Attachment A

Pavillion 2014 Groundwater Investigation (Project) Phase 1 Sampling Expert Scope of Work

The Consultant shall provide assistance to the Wyoming Department of Environmental Quality (WDEQ) Water Quality Division (WQD) to fulfill the requirements of the June 20, 2013 framework document (Attachment A) by completing the tasks detailed in this Scope of Work (SOW). The 2014 Pavillion, WY Groundwater Investigation will be conducted in two phases. The major tasks to be accomplished during Phase 1 of this Project include collecting water samples from thirteen (13) domestic water supply wells (to be determined by WDEQ/WQD) in the Pavillion area prior to or shortly after the start of the irrigation season in late April, and again after the end of the irrigation season in late July; analysis of domestic water well and quality assurance/quality control samples by an approved laboratory; conducting downhole video recording (pre-pumping and pumping) of each domestic well sampled; and conducting a site-survey. All work shall be performed in accordance with plans, schedules, and procedures developed by the Consultant and approved by WDEQ/WQD. An additional Scope of Work will be developed for Phase 2 of the Project and will define the tasks, deliverables and schedules for that phase.

Phase 1 tasks and deliverables will be completed according to the project schedule included as Attachment B. A description of the tasks related to Phase 1 include:

(Task numbers in parentheses are related to AME's draft Budget Summary spreadsheet (Attachment C))

- TASK 1 - Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) (TASK 1s)

  The Consultant shall provide a SAP and QAPP for well sampling and laboratory analysis that conforms to the WDEQ/WQD Groundwater Section QAPP and includes well sampling and laboratory analysis procedures and a Health and Safety Plan (HASP), among other things. The HASP shall comply with the Occupational Safety and Health Administration (OSHA) requirements. The QAPP may incorporate by reference existing industry and/or government standard procedures (e.g. ASTM, USGS, EPA) to the extent practicable. The Consultant shall have laboratory analyses performed by American Association for Laboratory Accreditation (A2LA) laboratory(ies), National Environmental Laboratory Accreditation Program (NELAP) laboratory(ies), or other WDEQ/WQD-approved nationally recognized laboratory(ies) for those analytes and analytical methods specified in Attachment D. Validation of laboratory data shall be conducted by a third party in accordance with the United States Environmental Protection Agency (US EPA) *Guidance on Environmental Data Verification and Data Validation (G-8), November 2002.* The

Consultant shall provide the SAPQAPPand HASP to WDEQ/WQD for review and approval prior to sample collection.

Task 1 deliverables include the following:

- Sampling and Analysis Plan
- Quality Assurance Project Plan
- Health and Safety Plan

- TASK 2 – Project Kickoff Meeting (Task 2s)
  The Consultant's Principal or Senior Project Manager shall attend a one day kick-off meeting in Cheyenne, Wyoming with the WDEQ prior to commencing on-site activities. The project kick-off meeting will be conducted by the WDEQ in order to review the project tasks, objectives and other relevant information with the consultant. There are no deliverables for this task.

- TASK 3 – Site Reconnaissance and Ancillary Data Acquisition and Compilation (TASKS 3s and 4s)
  The Consultant shall perform site reconnaissance of each well site, accompanied by WDEQ personnel, prior to sampling. This task includes: assessing each site for well access and sampling points, collecting GPS location data of the well head and proposed sampling point, and assessing land use. A site reconnaissance template included as part of the approved QAPP will be used to document site information. The data collected as part of this task will be evaluated to determine site needs for sample collection, including but not limited to identification of sample collection points and purge water discharge locations. Data collected as part of the site reconnaissance will be included in Preliminary Report No. 1-First Sampling Event and Preliminary Report No. 3-First and Second Sampling Events (TASK 6) to be submitted to the WDEQ. Ancillary data acquisition and compilation involves the review of the publicly available information on the thirteen (13) domestic water supply wells.. Data collected as part of this review will be included in Preliminary Report No. 1-First Sampling Event and Preliminary Report No. 3-First and Second Sampling Events (TASK 6) to be submitted to the WDEQ.

  Task 3 deliverables include the following:

  - Site reconnaissance templates

- TASK 4 – Sampling Preparations, Sample Collection, Data Validation and Electronic Data Entry (TASKS 5s and 6s)

- The Consultant shall conduct two sampling events on up to 13 private water wells ranging in depth from 30'-750'. The first sampling event shall occur in April, or as otherwise approved in writing by WDEQ/WQD, prior to the start of irrigation season, typically on or around May 1st. The second sampling event shall occur in July, or as otherwise approved in writing by WDEQ/WQD, after the irrigation season. Water samples will be collected from sampling points associated with wells identified in Task 3 and analyzed for those analytes listed in Appendix D in accordance with the SAP portion of the QAPP. Quality assurance/quality control (QA/QC) samples (e.g trip blanks, equipment blanks, duplicates, etc.) will be collected during each sampling event in accordance with the approved QAPP. Analytical data will be evaluated for usability according to the QAPP. All analytical data shall be provided in both hard copy laboratory sample reports and in electronic format as determined by WDEQ/WQD. Data collected and evaluated as part of the first sampling event will be included with Preliminary Report No. 1-First Sampling Event (TASK 6). All data collected and evaluated as part of this task will also be included with and discussed in Preliminary Report No. 3-First and Second Sampling Events, Downhole Video, and Well Owner Interviews (Task 6e and 11s). The database will be delivered in electronic format to WDEQ at the same time as Preliminary Report No. 3-First and Second Sampling Events, Downhole Video, and Well Owner Interviews.

Task 4 deliverables include the following:

- Preliminary Report No. 1-First Sampling Event
- Preliminary Report No. 3-First and Second Sampling Events, Downhole Video, and Well Owner Interviews
- Electronic Database

- <u>TASK 5 - Downhole Video Workplan, Video-recording of Water Wells, Interview Well Owners, (TASKS 7s, 8s and 9s)</u>
  - The Consultant shall provide a Downhole Video Workplan to WDEQ/WQD for review and approval prior to conducting the video survey. The Downhole Video Workplan shall address how the wells will be accessed, include a description of the type(s) of equipment to be used, discuss decontamination and disinfection procedures, discuss documentation of the field operations, and any other applicable requirements. The downhole video of the sampled domestic water wells will be conducted after the first sampling event. Video will be performed under pumping and non-pumping conditions. WDEQ cannot approve pump removal, therefore not all wells may be able to be video-recorded due to space or other limitations. The Consultant will provide video electronic files on DVDs or other WDEQ/WQD-

approved media along with a written interpretation of the well construction and water conditions observed in each well. In addition, the Consultant, accompanied by personnel from the WDEQ/WQD, shall conduct an interview with each well owner regarding the maintenance history, operational issues or events, and any surface issues that may affect the well, or water quality within the well, in accordance with the WDEQ/WQD approved interview questions developed by the Consultant. Video recordings will be evaluated for well depth, screened interval, well integrity, material type and condition of the casing, color and clarity of the water, presence of scaling, sediment, bacteria and other similar information that may relate to potential water quality issues and sources as discussed in Preliminary Report No. 2- Downhole Video and Well Owner Interviews (Task 10s). The data and evaluation will also be included in Preliminary Report No. 3-First and Second Sampling Events, Downhole Video, and Well Owner Interviews (Task 6e).

Task 5 deliverables include the following:

- Well Owner Interview Questionnaire
- Downhole Video Workplan Addendum
- Preliminary Report No. 2-Downhole Video and Well Owner Interviews

- TASK 6 – Project Reports (TASKS 10s and 11s)

The Consultant shall provide the following three documents in Phase 1 of the Project: 1) Preliminary Report No. 1-First Sampling Event, 2) Preliminary Report No. 2-Downhole Video and Well Owner Interviews, and 3) Preliminary Report No. 3- First and Second Sampling Events, Downhole Video, and Well Owner Interviews.

Preliminary Report No. 1-First Sampling Event will be submitted to WDEQ/WQD within six (6) weeks of the completion of the first sampling field event to provide WDEQ with data to facilitate decision analysis regarding water quality and to assist with planning of the second sampling event. This report shall include but not be limited to the following: a summary of analytical data with comparisons to toxicity, taste, odor and color water quality standards as developed by WDEQ/WQD with the assistance of the Consultant, a vicinity/location map, a map illustrating sampling locations and constituents and concentrations detected , laboratory sample reports, tables presenting analytical data, and recommendations for sampling and analysis to be implemented during the second sampling event, etc.

Preliminary Report No. 2-Downhole Video and Well Owner Interviews will be submitted to WDEQ/WQD within six (6) weeks of the completion of downhole video and well owner interview field activities to assist in the planning of the second sampling event. This report

shall include but not be limited to the following: video electronic files on DVDs or other WDEQ/WQD-approved media along with a written discussion and description of well depths, screened intervals, well integrity, material types and condition of the casing, color and clarity of the water, presence of scaling, sediment, bacteria and other similar information.

Preliminary Report No. 3-First and Second Sampling Events, Downhole Video, and Well Owner Interviews will be submitted to WDEQ/WQD within twelve (12) weeks of the completion of the second sampling field event to provide WDEQ with data to facilitate decision analysis regarding water quality. This report shall include but not be limited to the following: a summary of analytical data with comparisons to toxicity, taste, odor and color water quality standards as developed by WDEQ/WQD with the assistance of the Consultant, a vicinity/location map, a map illustrating sampling locations and constituents and concentrations detected , laboratory sample reports, tables presenting analytical data. In addition, the report shall include but not be limited to the following: video electronic files on DVDs or other WDEQ/WQD-approved media along with a written discussion and description of well depths, screened intervals, well integrity, material types and condition of the casing, color and clarity of the water, presence of scaling, sediment, bacteria and other similar information, and how those factors may relate to potential water quality issues and sources. The electronic database will be delivered at the same time as this report.

The information presented in the aforementioned three preliminary reports will be included in the Final Report that documents work conducted in Phases I and II. Task 6 deliverables include the following:

- Preliminary Report No. 1-First Sampling Event
- Preliminary Report No. 2-Downhole Video and Well Owner Interviews
- Preliminary Report No. 3-First and Second Sampling Events, Downhole Video, and Well Owner Interviews
- Electronic Database

- <u>TASK 7 – Progress Reporting (TASK 12s)</u>

  The Consultant shall provide periodic, timely communication with the WDEQ/WQD for project updates and approvals. These include weekly project status conference calls with WDEQ/WQD, monthly schedule updates using Gantt-type time management tools, and monthly financial spreadsheet updates.

Task 7 deliverables include the following:

Electronic delivery of project Gantt-type time and financial management spreadsheets and/or tracking information.

The Consultant, in consultation with the WDEQ, is responsible for identifying needed additional resources, experts, etc. to ensure the project timeline, budget, and scientific goals and integrity are met. If the Consultant determines that a third party is required to assist with fulfilling this scope of work, the Consultant shall be responsible for subcontracting, and managing subcontractors to ensure timely project completion. The Consultant shall provide vetting information of suggested sub-contractors to WDEQ/WQD for screening and approval. The WDEQ/WQD retains final approval authority for all subcontractors.

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Well Bore Integrity – Final Report

The Wyoming Oil and Gas Conservation Commission (WOGCC or Commission) will develop a report that includes its technical and regulatory analysis along with assumptions and recommendations concerning the integrity of all oil and natural gas exploration and production wells within 1320 feet of the fourteen (14) domestic wells evaluated for water quality and palatability concerns. In developing its report, the WOGCC will solicit additional, relevant data from the WDEQ, SEO, EPA, USGS, BLM, Tribes, and the operator in order to complete its technical and regulatory analysis.

The WOGCC will contract with an expert or experts to review and comment on the Commission's analysis of well bore integrity in those wells. Specifically, the WOGCC will determine if records and test results demonstrate that wellbore construction is adequate to protect those water supply wells within 1320 feet of the oil and natural gas wellbores.

The report will consist of a comprehensive review of the following, if available:

- location (Q/Q, STR);
- distance to water well;
- lease type (fee, tribal);
- API #;
- date completed;
- operator;
- surface casing and cement;
- mud system;
- total depth;
- production casing and cement;
- cement bond log results;
- bradenhead test results;
- mechanical integrity tests;
- gas analysis from bradenhead and tubing;
- subsequent remedial work; and
- other data in the WOGCC records that are deemed pertinent.

Of particular interest is whether the available bradenhead test results for the Pavillion Field confirm hydraulic isolation, consistent with the June 2, 2011 "Pavillion Bradenhead Testing Procedure," approved by WOGCC sundry.

The expert or experts will assist the WOGCC staff in preparation of a final report that summarizes the results of the well bore integrity review and, specifically, includes an evaluation of the available data and addresses compliance with WOGCC regulatory requirements. The WOGCC and expert or experts may identify data gaps, including the need for additional testing and analysis and/or investigation. If the WOGCC and expert or experts identify data gaps, then, to the extent feasible and consistent with applicable law, the WOGCC will work with the well operator to obtain the

additional information in advance of issuance of the WOGCC's final report. This information and work will be summarized in WOGCC's final report. Any recommended work which cannot be completed in a reasonable timeframe will be identified in the WOGCC's final report, including a scope of work.

WOGCC will consider the following criteria in the selection of expert or experts:

- Expertise in petroleum engineering and hydrogeology.
- Individual(s) with both industry and academic experience.
- Professional Engineer preferable.
- Regional expertise (geologic, etc.).
- No conflicts with (financial or other) with State, EPA or Encana.

WOGCC will solicit and consider candidate expert or experts submitted by the EPA and Encana. EPA and Encana will be provided an opportunity to review the WOGCC's draft final report and provide comment prior to issuing its report. WOGCC plans to finalize this report no later than December 31, 2013.

The WOGCC reserves its rights to require any action consistent with its authorities under existing statutes, rules and regulations.

Pits – Final Report

The WOGCC will develop a report that includes its technical and regulatory analysis along with assumptions and recommendations concerning the status and reclamation of pits in the Pavillion Field. In developing its report, the WOGCC will solicit additional, relevant data from the WDEQ, EPA, BLM, Tribes, and the operator, in order to complete its technical and regulatory analysis. The report will summarize the results of records evaluated, identify historical pit locations, and outline site investigations and/or reclamation of pits conducted to date. The WOGCC will determine if the site investigations and/or reclamation was sufficient to protect those water supply wells within 1320 feet of the pit locations.

The WOGCC will contract with an expert or experts to assist in its review and analysis of the current body of information available for pits in the Pavillion Field. The expert or experts will be selected using the same process and have similar expertise as that identified for the Domestic Water Wells – Final Report and Palatability Study (see below).

WOGCC staff may identify data gaps, including the need for additional testing and analysis and/or site investigations and/or reclamation. If the WOGCC identifies data gaps, then, to the extent feasible and consistent with applicable law, the WOGCC will work with the well operator to obtain the additional information in advance of issuance of the WOGCC's final report. This information and work will be summarized in WOGCC's final report. Any recommended work which cannot be completed in a reasonable timeframe will be identified in the WOGCC's final report, including a scope of work.

EPA and Encana will be provided an opportunity to review the WOGCC's draft final report and provide comment prior to issuing its report. WOGCC plans to finalize this report no later than December 31, 2013.

The WOGCC reserves its rights to require any action consistent with its authorities under existing statutes, rules, and regulations.

Domestic Water Wells – Final Report and Palatability Study

The Wyoming Department of Environmental Quality (WDEQ) will contract with an expert or experts to assist the WDEQ in its review of the current body of information available for the domestic water wells in the Pavillion Field. This review will consist of an evaluation of the data, conclusions and recommendations developed from the well bore integrity and pits final reports and a comparison of currently available analytical results for each domestic water well in the Pavillion Field to U.S. Environmental Protection Agency (EPA) primary maximum contaminant levels (MCLs) and secondary maximum contaminant levels (SMCLs), and WDEQ Water Quality Rules and Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters. The review will evaluate, in particular, the domestic water wells commonly labeled as PGDW05, PGDW14, PGDW20, PGDW21, PGDW23, PGDW30, PGDW32, PGDW33, PGDW41, PGDW42, PGDW44, PGDW45, PGDW49, and LD02. Water quality in these wells exceeds standards for one or more constituents. In its review, the WDEQ will solicit additional, relevant data from the SEO, WOGCC, EPA, USGS, BLM, Tribes, and the operator, in order to complete its evaluation. Based on its review, the WDEQ may identify domestic water wells where additional testing and analysis is necessary. For these wells, WDEQ will undertake two (2) additional rounds of water quality sampling (pre- and post- irrigation season within a twelve (12) month period) to determine domestic well water quality and identify other parameters that might cause palatability or toxicity issues. Each domestic well also will be evaluated for well construction and integrity issues (including down-hole video), maintenance history and other proximate and pertinent features (e.g., septic systems).

The following standards and protocols will be used to guide the sampling efforts:

- The domestic well sampling will follow the WDEQ, Water Quality Division, Guideline for Sampling and Testing Well Water Quality (Exhibit 2) consisting of testing for Tier I, II, and III constituents.
    - The Tier III constituents will include analyzing for "indicator" chemical compounds, including bacteria, and other microbial activity, as appropriate. Note that some of these indicator type compounds do not have water quality standards, but may be useful in evaluating palatability issues, along with many of the Tier I and II constituents.
    - All laboratory analysis will be conducted by well-respected, appropriately certified (e.g., NELAC) commercial laboratories chosen by WDEQ and in accordance with WDEQ Water Quality Rules and Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters, Section 7 and in accordance with an approved Quality Assurance Project Plan (QAPP);
    - Constituent detection limits used by commercial laboratories will be as specified in the analytical methods utilized and as defined by WDEQ Water Quality Rules and

Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters, Section 8 and as defined by an approved QAPP; and

- Data qualifiers, blank contamination, and other QA/QC related issues will be handled in accordance with established US EPA National Functional Guidelines (2009).

WDEQ and the expert or experts will work with each individual landowner that allows sampling to determine the causes and sources of palatability issues and/or well contamination. In the event that the WDEQ is denied access to a well by the landowner, sampling and palatability consultation will be withdrawn and not included in this study.

- EPA MCLs, SMCLs, and Quality Standards for Wyoming Groundwaters are similar and largely overlap, but all of these standards will be utilized to ensure a comprehensive evaluation. Exceedence of standards, plus other palatability-related data, will be used to guide the investigation as to the palatability issues for that well.
- Oil and natural gas activities will be further investigated as a possible source of domestic water well palatability if oil and gas related volatile/semi-volatile organic constituents, including VOCs and SVOCs in DRO and GRO ranges, exceed MCLs, SMCLs or Quality Standards for Wyoming Groundwaters.
- If domestic well analytical results exceed standards for constituents determined by WDEQ to be associated with sources of contamination other than oil and gas activities or determined to be natural in derivation, then WDEQ will determine next steps with the landowner or as otherwise required in accordance with Wyoming law.

The expert or experts will assist the WDEQ in preparation of a final report that summarizes the analytical results relative to standards and, specifically, include a discussion of impacts on palatability associated with constituents and sources identified and appropriate responses. The WDEQ and expert or experts may identify data gaps, including the need for additional testing and analysis and/or investigation. The WDEQ will determine which wells may benefit from further evaluation using exceedances of the standards listed above as a trigger for evaluation and testing. Further work may or may not include additional sampling of domestic wells and/or construction of groundwater monitoring wells, as appropriate. Any recommended work will be conducted consistent with WDEQ standard procedures. This information and work will be summarized in WDEQ's final report. Any recommended work which cannot be completed in a reasonable timeframe will be identified in the WDEQ's final report, including a scope of work. In its final report, the WDEQ will summarize its rationale and criteria used in the selection of domestic water wells for further testing and analysis and also include its rationale and criteria for any determinations made regarding additional testing and analysis and/or investigation.

WDEQ will consider the following criteria in the selection of an expert or experts:

- Expertise in hydrogeology, geochemistry, and toxicology.
- Individual(s) with both industry and academic experience.
- Regional expertise (geologic, etc.).
- No conflicts with (financial or other) with State, EPA or Encana.

WDEQ will solicit and consider candidate expert or experts submitted by the EPA and Encana. EPA and Encana will be provided an opportunity to review the WDEQ's draft final report and provide comment prior to issuing its report. WDEQ plans to finalize this report no later than September 30, 2014.

The WDEQ reserves the right to require any action consistent with its authorities under existing statues, rules, and regulations.

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EXHIBIT 2

Wyoming Department of Environmental Quality
Water Quality Division

Guideline for Sampling and Testing Well Water Quality

The Wyoming Department of Environmental Quality (WDEQ) has developed this Guideline to provide basic information to well owners interested in evaluating water well quality for domestic use. Well owners may find the information in this guideline useful in understanding how and when to collect water well samples, what to sample for, and laboratories that perform water quality analyses. The information presented in this guideline is intended to assist well owners in making informed decisions, but well owners are also encouraged to seek professional advice and assistance related to their specific situation or concern.

Potential Sources of Groundwater Contamination

Virtually all types of land use activities have the potential to impact water supplies. Common land use activities that are known to have impacted water supplies include: agricultural, residential, government, commercial, and industrial (including mining and oil and gas development). Water wells can also be impacted by naturally occurring sources of contamination (e.g. arsenic, selenium, fluoride, radium, etc.) at levels that may cause health concerns. Well owners should become familiar with the various types of land use activities within their area in order to understand the types of chemical constituents that are often associated with them and that may impact groundwater. Please refer to the table of potential sources and contaminants available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp that further describes potential sources of contamination and the types of materials and chemical constituents that are commonly associated with them.

Establishing 'Baseline' Quality of Well Water

DEQ recommends that all domestic wells be initially sampled and analyzed for **Tier 1** (with the exception of disinfection by-products and disinfectants), **Tier 2 and Tier 3** constituents as described below:

Tier 1 (Safe Drinking Water) constituents include those potential drinking water contaminants for which the US EPA has established safe drinking water levels (*National Primary Drinking Water Standards*), and levels that ensure the aesthetic (taste, odor, etc.) quality of drinking water (Secondary Drinking Water Standards). These include certain microorganisms, metals, inorganic minerals and chemical compounds, organic chemicals, and radionuclides known to be potentially harmful or otherwise affect the aesthetic quality of drinking water. A copy is available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. A Tier 1 analysis is very expensive and may cost upwards of a few thousand dollars to complete.

Tier 2 and Tier 3 ('Indicators') constituents are a limited set of potential contaminants that can be used to indicate changes in well water quality, and possibly detect the presence of water well contamination. They typically consist of several minerals and metals that occur naturally in ground water, physical parameters (e.g. pH), and one or more chemical constituents usually associated with potential sources of contamination in the area of the well. Different 'indicators' recommended by other agencies and laboratories may be equally suitable for establishing baseline water well quality and monitoring for potential contamination over time. The more comprehensive the list of constituents, the better, when determining whether well water is suitable for domestic use or has been impacted by a potential source of contamination.

Tier 2 constituents include: conductivity, pH, Total Dissolved Solids (TDS), alkalinity, barium, calcium, magnesium, sodium, chloride, sulfate, fluoride, nitrate, lead, arsenic, iron, and total organic carbon. A Tier 2 analysis is relatively inexpensive and will likely cost less than a couple hundred dollars to complete.

Tier 3 constituents are 'indicator' chemical compounds often associated with a potential source of contamination. A Tier 3 analysis can cost between a couple hundred to several thousand dollars to complete, depending upon the type and number of constituents to be analyzed by the laboratory.

Sampling Frequency

Upon completion of **Tier 1, Tier 2 and Tier 3** analyses to establish 'baseline' conditions, it is important to continue to periodically collect samples from the well in order to evaluate whether well water quality has changed over time, or not. Ideally, follow up samples should be analyzed for **Tier 1** constituents on a schedule similar to that required for public water systems, or more frequently if there is a noticeable change in the taste, color, or odor of well water. Generally, for groundwater-supplied public water systems EPA requires sampling and analyses for inorganic and synthetic organic contaminants and radionuclides every three years; volatile organic contaminants every 5 years (or annually if detected in prior samples); and nitrate and nitrite annually. Well owners may consider eliminating the need to analyze for constituents associated with sources of contamination which they believe pose little, if any threat to their water supply.

Unfortunately, the cost for Tier 1 analysis can be very expensive. Alternatively, less expensive sampling and lab analyses can be a useful way to periodically screen for changes in water well quality provided that the well owner understands the limitations of not completing a Tier 1 analyses on schedule. One alternative may be to rotate the sampling schedule by completing a Tier 1 analysis as scheduled in order to evaluate the safety of the well water for drinking water purposes, then complete less expensive Tier 2 and Ties 3 'indicator' sampling during Year 2 and annually or bi-annually thereafter in order to evaluate 'indicators' of potential contamination.

Well owners may wish to consider negotiating water well testing, both pre-and post-drilling, as a condition to their mineral lease, or surface use agreement. Obtaining baseline water well quality and periodic sampling and analysis may be beneficial to both parties.

Sample Collection and Laboratory Analysis

Water well testing should be arranged through a certified water testing laboratory and water well samples should be collected by an unbiased professional. This could be an employee of the water testing laboratory. Doing so can add significantly to the cost of water well testing but may be vital to the admissibility of the sample results if a legal action related to pollution of the water well ensues. It is unlikely that test results from water samples collected by the water well owner will be recognized in legal proceedings, however, well owners are encouraged to consult their own attorneys for professional advice.

It is also important to request laboratory methods that achieve a low detection limit in order to detect the presence of contaminants at low levels. Generally, the lower the detection limit, the more expensive the water quality analysis.

Before selecting a lab it may be prudent to check the laboratory's certifications. Preferred labs are certified by US EPA. Consult the 'Environmental' or 'Water Testing' sections of your local Yellow Pages for a list of laboratories within your area.

The Wyoming Department of Agriculture laboratory in Laramie also provides some analytical services and is EPA certified. For more information, contact the lab at 307-742-2984 or visit them online at: http://wyagric.state.wy.us/images/stories/pdf/forms/aslab/labfees.pdf.

Evaluating Sample Results

Tier 1 sample results should be compared to the safe drinking water levels listed on US EPA's Primary Drinking Water Standards table available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. If a sample result for any "primary" constituent exceeds its safe drinking water level (Maximum Contaminant Level (MCL)) listed on the table, the US EPA considers the water not safe for drinking water purposes. In these situations, well owners should discontinue use of the well until an assessment of water treatment alternatives has been completed. The cause may, or may not be associated with man-made contamination. For instance, some areas in Wyoming have naturally occurring constituents in ground water (e.g. arsenic, selenium, fluoride, radium, etc.) that exceed the safe drinking water level. If the cause of contamination is suspected to be a result of some type of human activity, well owners are encouraged to contact DEQ's Spill and Complaint hotline at 307-777-7781 or provide information online at DEQ's website (http://deq.state.wy.us/) by clicking on the link *"Got a Spill?"*.

Tier 1 sample results should also be compared to the aesthetic drinking water levels listed on US EPA's Secondary Drinking Water Standards table available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. If a sample result for any "secondary" constituent exceeds its aesthetic drinking water level (Secondary Standard) listed on the table, the water may be safe for drinking water purposes, but may have problems with taste, appearance, or odor. Again, the cause may, or may not be associated with manmade contamination. Well owners should contact their local health department or county conservation district office, or visit DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp for further information on water treatment.

Usually one sees only minor fluctuations in **Tier 2** water quality results over time. Tier 2 sample results should also be compared to US EPA's Primary and Secondary Drinking Water Standards table as described above. If Tier 2 sample results illustrate an increasing trend in constituent concentration over time (i.e. over several sampling periods) the well owner is encouraged to consult with the local DEQ Water Quality Division office in Cheyenne, Sheridan, Lander, or Casper.

Tier 3 sample results should be compared to US EPA's latest edition of "*Drinking Water Standards and Health Advisories*" available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. If a sample result for any constituent exceeds its safe drinking water level (Maximum Contaminant Level (MCL)) or its drinking water equivalent level (DWEL) listed on the table, the US EPA considers the water to be not safe for drinking water purposes. In these situations, well owners should discontinue use of the well until an assessment of water treatment alternatives has been completed. The cause may, or may not be associated with man-made contamination. If the cause of contamination is suspected to be a result of some type of human activity, well owners are encouraged to contact DEQ's Spill and Complaint hotline at 307-777-7781 or provide information online at DEQ's website (http://deq.state.wy.us/) by clicking on the link *"Got a Spill?"*.

For Further Information:

Wyoming Department of Environmental Quality
Water Quality Division
122 W. 25th St. – 4W
Cheyenne, WY 82002
307-777-7781

EXHIBIT 3 - ANALYTE LIST

Analyete	Symbol	CAS Number	Analytical Method	Inclusion Rational
Field Parameters				
Specific Conductivity	SpC	--		Water Chemistry
Total Dissolved Solids (calc. from SPC)	TDS	--	EPA 2540C	WDEQ WQRR Ch8 Table 1
Dissolved Oxygen	DO	--		Water Chemistry
pH	pH	--		WDEQ WQRR Ch8 Table 1
Oxidation/Reduction Potential	ORP	--		Water Chemistry
Ferrous Iron	Fe^{2+}	7439-89-6		Water Chemistry
Hydrogen Sulfide	H_2S	7783-06-4	A4500 5-D	WDEQ WQRR Ch8 Table 1
Turbidity	Turb	--		Water Chemistry
Inorganics (totals)				
Silver	Ag	7440-22-4	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Aluminum	Al	7429-90-5	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Arsenic	As	7440-38-2	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Boron	B	7440-42-8	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Barium	Ba	7440-39-3	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Beryllium	Be	7440-41-7	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Cadmium	Cd	7440-43-9	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Cobalt	Co	7440-48-4	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Chromium	Cr	7440-47-3	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Copper	Cu	7440-50-8	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Iron	Fe	7436-89-6	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Mercury	Hg	7439-97-6	SW-846 7470 (Hg)	WDEQ WQRR Ch8 Table 1
Lithium	Li	7436-93-2	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Manganese	Mn	7439-96-5	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Sodium	Na	7440-23-5	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Nickel	Ni	7440-02-0	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Lead	Pb	7439-92-1	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Antimony	Sb	7440-36-0	SW-846 6010B and 620	EPA MCL
Selenium	Se	7782-49-2	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Thallium	Tl	7440-28-0	SW-846 6010B and 620	EPA MCL
Uranium	U	7440-61-1	SW-846 6010B and 620	EPA MCL
Vanadium	V	7440-62-2	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Zinc	Zn	7440-66-6	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Cyanide	Cn	57-12-5	SW-846 6010B and 620	WDEQ WQRR Ch8 Table 1
Molybdenum	Mo	7439-98-7	SW-846 6010B and 620	EPA DWEL
Strontium	Sr	7440-24-6	SW-846 6010B and 620	EPA DWEL

Analyete	Symbol	CAS Number	Analytical Method	Inclusion Rational
Miscellaneous				
Acrylamide	--	79-06-1	EPA 8032A or 8316	EPA DWEL
Dissolved Organic Carbon	DOC	--	SW-846 9060A	Water Chemistry
Dissolved Inorganic Carbon	DIC	--	SW-846 9060A	Water Chemistry
Methylene Blue Activated Substances	MBAS	--	425.1	EPA SMCL
Isotopes and Dissolved Gases				
Helium	He	7440-59-7	Isotech Laboratories	Indicator/Water Chemistry
Hydrogen	H_2	1333-74-0	Isotech Laboratories	Indicator/Water Chemistry
Argon	Ar	7440-37-1	Isotech Laboratories	Indicator/Water Chemistry
Oxygen	O_2	7782-44-7	Isotech Laboratories	Indicator/Water Chemistry
Carbon dioxide	CO_2	124-38-9	Isotech Laboratories	Indicator/Water Chemistry
Nitrogen	N_2	7727-37-9	Isotech Laboratories	Indicator/Water Chemistry
Carbon monoxide	CO	630-08-0	Isotech Laboratories	Indicator/Water Chemistry
Methane	C_1	74-82-8	Isotech Laboratories	Indicator/Water Chemistry
Ethane	C_2	74-84-0	Isotech Laboratories	Indicator/Water Chemistry
Ethene	C_2H_4	74-85-1	Isotech Laboratories	Indicator/Water Chemistry
Propane	C_3	74-98-6	Isotech Laboratories	Indicator/Water Chemistry
Propylene	C_3H_6	115-07-1	Isotech Laboratories	Indicator/Water Chemistry
Isobutane	iC_4	75-28-5	Isotech Laboratories	Indicator/Water Chemistry
Normal Butane	nC_4	106-97-8	Isotech Laboratories	Indicator/Water Chemistry
Isopentane	iC_5	78-78-4	Isotech Laboratories	Indicator/Water Chemistry
Normal Pentane	nC_5	109-66-0	Isotech Laboratories	Indicator/Water Chemistry
Hexane Plus	C_6+	110-54-3	Isotech Laboratories	Indicator/Water Chemistry
[($^{13}C/^{12}C$) Sample/($^{13}C/^{12}C$) Standard]*1000	$\delta^{13}C_1$	--	Isotech Laboratories	Indicator/Water Chemistry
[($^{2}H/H$) Sample/($^{2}H/H$) Standard]*1000	δDC_1	--	Isotech Laboratories	Indicator/Water Chemistry
[($^{13}C/^{12}C$) Sample/($^{13}C/^{12}C$) Standard]*1000	$\delta^{13}C_2$	--	Isotech Laboratories	Indicator/Water Chemistry
[($^{13}C/^{12}C$) Sample/($^{13}C/^{12}C$) Standard]*1000	$\delta^{13}C$ DIC	--	Isotech Laboratories	Indicator/Water Chemistry
Nitrogen isotopes	$\delta^{15}N_{(nitrate)}$ and $\delta^{18}O_{(nitrate)}$	--	Isotech Laboratories	Indicator/Water Chemistry

Analyete	Symbol	CAS Number	Analytical Method	Inclusion Rational
Dissolved Gases				
Methane	C_1	74-82-8	RSKSOP175	Indicator
Ethane	C_2	74-84-0	RSKSOP175	Indicator
Propane	C_3	74-98-6	RSKSOP175	Indicator
Butane	C_4	106-97-8	RSKSOP175	Indicator
Low Molecular Weight Acids				
Lactate	--	50-21-5	RSKSOP112v6	Previously detected in DWW
Formate	--	64-18-6	RSKSOP112v6	Previously detected in DWW
Acetate	--	64-19-7	RSKSOP112v6	Previously detected in DWW
Propionate	--	79-09-4	RSKSOP112v6	Previously detected in DWW
Butyrate	--	107-92-6	RSKSOP112v6	Previously detected in DWW
Petroleum Hydrocarbons				
Diesel Range Organics	DRO	--	SW-846 8015D	Indicator
Gasoline Range Organics	GRO	--	SW-846 8015D	Indicator
Oil and Grease	O&G	--	EPA 1664A	Indicator
Bacteria				
Sulfate Reducing Bacteria	SRB	--		Indicator
Iron Reducing Bacteria	IRB	--		Indicator
Total Coliform		--	P/A test, 9221 or 9222	EPA MCL
E. Coli		--		EPA MCL
Radionucleides				
Radium 226 and 228		--	EPA 903.1; EPA 904.0	WDEQ WQRR Ch8 Table 1
Total Strontium 90		--		WDEQ WQRR Ch8 Table 1
Gross Alpha Partcile radioactivity (including Radium 226 but not Radon and Uranium)		--		WDEQ WQRR Ch8 Table 1
Radon		10043-92-2	LC 1369	EPA MCL
Glycols				
2-butoxyethanol		111-76-2	SW-846 8015B	Indicator
Diethylene glycol		111-46-6	SW-846 8015B	Indicator
Triethylene glycol		112-27-6	SW-846 8015B	Indicator
Tetraethylene glycol		112-60-7	SW-846 8015B	Indicator

Analyete	Symbol	CAS Number	Analytical Method	Inclusion Rational
Anions and Ammonia				
Bromide	Br^-	--	SW-846 6500	Indicator
Chloride	Cl^-	--	SW-846 6501	WDEQ WQRR Ch8 Table 1
Sulfate	SO_4^{2-}	--	SW-846 6502	WDEQ WQRR Ch8 Table 1
Fluoride	F^-	--	SW-846 6503	WDEQ WQRR Ch8 Table 1
Nitrate + Nitrite	$NO_3^- + NO_2^-$	--	EPA 350.1	WDEQ WQRR Ch8 Table 1
Ammonia	NH_3	7664-41-7	EPA 353.2	WDEQ WQRR Ch8 Table 1
Organic Compounds				
Volatile Organic Compounds	VOCs	Various	SW-846 8260B /5035	EPA MCL/SMCL/DWEL/Indicator
Semi-volatile Organic Compounds	SVOCs	Various	SW-846 8270C & 8270SIM	EPA MCL/SMCL/DWEL/Indicator
Pesticides, Herbicides, Fungicides	--	Various	EPA507 and 8270D	EPA MCL/SMCL/DWEL/Indicator

Attachment B

Billing Rates

Labor	Hourly Rate
Principal / Sr Technical Consultant	$120
Senior Consultant / Sr Proj Manager	$98
Consultant / Proj Manager	$90
Project Engineer/Geologist	$80
Staff Engineer/Geologist	$70
Sr Technician	$64
Technician	$48
Drafter / GIS Specialist / Visualization	$52
Editor / Administrator	$45
Other Charges	
Subcontractor and Other Direct Costs	Cost only

Attachment C - Schedule

Pavillion, WY 2014 Groundwater Investigation Phase 1: Sampling, Analysis and Downhole Video-recording of Water Wells

Phase I Sampling Schedule (Notice to Proceed = Day 1)	SOW Task	Budget Task		Project Task as related to AME draft Budget Summary Spreadsheet for Phase 1	Deliverable Date
Day 3	Tasks 1 and 3	Task 1s and 3s	HASP and Site Recon Template	Provide Health & Safety Plan to WQD and Site Reconnaissance Template	Day 3
Day 18	Task 1	Task 1s	SAP & QAPP	Provide SAP & QAPP to WQD	Day 18
Day 7	Task 2	Task 2s	Kickoff Meeting	Kickoff meeting in Cheyenne as requested by WDEQ.(AME project leader meet WDEQ upper level management, Gov.'s representative, etc.)	
Days 7 - 11	Task 3	Task 3s	Site Reconnaissance	Site Reconnaissance (establish site id's, photos, determine sampling point and access, GPS locations, misc.)	
Days 7 - 18	Task 3	Task 4s	Ancillary Data Acquisition and Compilation	Ancillary data acquisition and compilation	
Days 21 - 25	Task 4	Task 5s	Sampling Preparation	Sample preparations for first sampling event	
Days 28 - 41	Task 4	Task 5s	Sampling Collection	Sample collection, first sampling event, collection of groundwater quality samples during low water table conditions. Sample GW at up to 13 water wells.	
Day 38	Task 5	Task 7s	Downhole Video-recording Workplan Addendum and Well Owner Questionnaire	Downhole Video-recording Workplan Addendum and Well Owner Interview Questionnaire	Day 38
Days 29 - 154	Task 4	Task 6s	Data Validation and Electronic Data Entry	Data validation and database entry	

Pavillion, WY 2014 Groundwater Investigation Phase 1: Sampling, Analysis and Downhole Video-recording of Water Wells (continued)

Phase I Sampling Schedule (Notice to Proceed = Day 1)	SOW Task	Budget Task		Project Task as related to AME draft Budget Summary Spreadsheet for Phase 1	Deliverable Date
Days 56 - 62	Task 5	Task 8s	Downhole Video-recording	Downhole video-recording and interviews (perform downhole video-recording on up to 13 water wells and interview well owners in conjunction with video event)	
Days 56 - 62	Task 5	Task 9s	Interview Well Owners		
Day 85	Tasks 4 and 6	Task 10s	Project Reports	Preliminary Report No. 1 - First Sampling Event	Day 85
Day 87	Tasks 5 and 6	Task 10s	Project Reports	Preliminary Report No. 2 - Downhole Video and Well Owner Interview	Day 87
ongoing, ~ weekly & monthly	Task 7	Task 12s	Progress Reporting	Progress Reporting (provide weekly project status conference calls with WQD, monthly schedule updates using Gantt-type time management tools, and monthly financial spreadsheet updates.	
Days 105 - 112	Task 4	Task 5s	Sampling Preparation	Sample preparations for second sampling event	
Days 112 - 124	Task 4	Task 5s	Sampling Collection	Sample collection, second sampling event, collection of groundwater quality samples during low water table conditions. Sample GW at up to 13 water wells.	
Day 207	Tasks 4 and 6	Task 6s and 11s	Database	Deliver database to WDEQ with Preliminary Report No. 3	Day 207
Day 207	Tasks 4 and 6	Task 11s	Project Reports	Preliminary Report No. 3 - First and Second Sampling events, Downhole Video, and Well Owner Interviews	Day 207