

EarthFax
Engineering, Inc.
Engineers/Scientists



September 19, 1986

RECEIVED
SEP 19 1986

Mr. Rick P. Summers
State of Utah Natural Resources
Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

**DIVISION OF
OIL, GAS & MINING**

Dear Rick,

Enclosed please find our proposed responses to your comments. As you will note each of your comments has been addressed as to how the question will be answered.

EarthFax would like to propose a meeting between yourself, Lowell Braxton and other pertinent members of your staff to discuss our approach. Such a meeting should allow us to work out any discrepancies with our own interpretation of the contract and the methodologies used to complete the report.

We would suggest that the meeting be held on either Monday, September 22 or Tuesday, September 23, 1986.

Sincerely,

Randolph B. Gainer
Principal Engineering Geologist

RBG:vb

Enclosures

cc: Ken May
Lowell P. Braxton
Susan Linner
Dave Cline
Jim Leatherwood
Dave Darby

RESPONSE TO DOGM COMMENTS
ON THE DRAFT SOAP REPORT
BY EARTHFAX ENGINEERING, INC.

Summary

The draft copy of the above referenced report was reviewed by myself, Dave Cline, Dave Darby, and James Leatherwood of the technical staff pursuant to the conditions of the original contract (number 587504) in order to determine if the contractor has completely met the obligations outlined in that contract. As a result of this review, it has been determined that the final report is not complete and the contractor will be required to conduct further investigations and analysis in order to complete the final phase of the report. The contract is still considered to be in the initial draft phase and at this time the contract should still be considered deficient by one report (see memo of April 23, 1986).

Although a letter was sent to EarthFax by Rick Summers dated April 25, 1986 that refers to a memo commenting on the initial draft report, the memo was not enclosed. EarthFax subsequently contacted Mr. Summers and informed him that the memo was not included. He indicated that the important items included in the memo had been discussed with EarthFax and that a copy of the memo was, therefore, not needed.

It is the opinion of EarthFax that the contract should not be considered deficient by one report. Page 21 of the contract specifically states (in reference to the initial draft report) that "results and conclusions do not have to be submitted at this time . . ." Discussions between EarthFax and Mr. Dave Hooper of the Division prior to submittal of both the proposal and the initial draft report also indicated that the initial draft report did not have to contain results or conclusions. Rather, this report was designed to provide a discussion of methodologies used in the study.

Although not required by the contract, results and conclusions were included in the initial draft report with respect to overburden investigations. This was done since data were considered complete in those areas. Hydrologic data were still being collected at the time the initial draft report was submitted, however. Thus, as allowed by the contract, only methodologies were discussed in the hydrologic sections. Although sufficient data existed to provide a discussion of some results and conclusions regarding the hydrologic investigations, it was decided that these would not be presented in the initial draft report since the conclusions were subject to change as the additional data were interpreted. Since this decision was supported by the contract, the contract should not be considered deficient by one report.

The following comments need clarification:

Exhibit D, Section D.1.1 Surface Water Baseline Information

The report must state the details used to obtain the curve number values for the site. This information must include vegetation type and cover, land condition, and hydrologic soil group (including references used for determination).

This information can be provided in the final report.

The report should contain a map of the stream channels and man made diversions located in the permit area and within one (1) square mile of the boundaries of the permit area. The channels must be delineated on this map as ephemeral, intermittent, or perennial.

Locations of stream channels are shown on Plate 4-1. Locations of man-made diversions are shown on Plate 4-3.

Designation of every ephemeral stream channel directly on the plate will make Plate 4-1 (or any other map) very cumbersome. The contract states that streams are to be classified but does not require that this classification be done on a map.

Page 53 of the draft report indicates that four perennial watersheds are present in the vicinity of the mine site (Huff Creek, Josh Hollow, Morby Creek, and Chalk Creek). The wording will be altered to indicate that these are the only perennial streams in the area. All other streams are considered ephemeral except for small reaches (such as WS-4) where the streams are locally fed by springs for at least a portion of the year.

A description of the channels in the area should be included. Channel length, general configuration, morphology patterns, and a statement of losing or gaining reaches should be addressed.

A description of stream channel characteristics is provided in Section 4.2.3.2. Specifically, channel length and general configuration are shown on Figures 4-6 through 4-12 and discussed on pages 49, 53, and 60.

The contract requires that the geomorphic characteristics of Chalk Creek and the intermittent stream be evaluated. A discussion of these characteristics (as indexed by erosional stability of the channels) is provided on pages 53, 60, and 74 of the draft report.

EarthFax is unaware of a requirement in the contract to identify losing or gaining reaches in streams in the vicinity of the mine. If required, EarthFax is willing to collect the necessary data to determine these characteristics.

Average annual high and low flow values should be determined and presented for Chalk Creek.

This information will be determined for Chalk Creek at the U.S. Geological Survey station at Coalville and provided in the final report.

The report should discuss the status of the lack of data for SS-1, SS-2, and SS-3 (i.e. no runoff events).

Wording to that effect will be added to the final report.

A reference map depicting the station numbers for the stream gradient profiles must be supplied. Station numbers should be labeled on the x-axis for each profile.

Plate 4-1 will be altered to show the starting point for each of the gradient profiles. Placement of additional station numbers on the map will be cumbersome and of little value. Station numbers will be added to the x-axis of the figures showing the profiles.

The report must include a map depicting the sampling points used to determine the stream bed and bank material characteristics.

Locations of the sampling points are referenced in Attachment E. Wording will be added to the narrative of the final report to place this information in the main body of the report.

The report must contain a description of the riparian communities for Chalk Creek and the intermittent stream.

This information will be added to the final report.

A discussion of the geomorphic characteristics for Chalk Creek and the intermittent stream must be supplied.

Both the comment and the contract are vague with reference to information required in a discussion of the "geomorphic characteristics" of Chalk Creek and the intermittent stream. EarthFax provided a discussion of what was felt to be the salient features of the geomorphology of the two streams by discussing stream gradients and profiles (page 49, Figures 4-7 and 4-9), cross sections (page 53, Figures 4-11 and 4-12), and erosional stability (pages 53, 60, and 74). If more information is required to understand geomorphic features of the stream channels that are of importance, please provide a list of those features.

As discussed on Sept. 2, 1986, the report should contain calculations for the 100 yr. - 24 hr. and 10 yr.- 24 hr. events using the SCS curve number methodology.

As noted by EarthFax during the referenced conversation, this information is not required by the contract. The contract refers only to return periods of specific flow events, making no mention of a rainfall event. Thus, the information requested in this comment is not required by the contract. However, EarthFax is willing to provide the information in the final report.

Figures 4-11 and 4-12 should be labeled for the stage level and discharge value for each event.

The stage level on these figures is arbitrary and, therefore, of little value. The peak flows are provided in the discussion on pages 72 through 74 of the draft report. Reproducing the values on Figures 4-11 and 4-12 will not provide information of value in understanding the figures and should, therefore, not be included.

Cross-sections for the channel configuration for the 100 yr - 24 hr. event should be supplied for Chalk Creek. A channel configuration for the 10 yr. - 24 hr. event should be supplied for the intermediate station on Chalk Creek.

As is noted on Figure 4-12, the stages of the referenced flows are above bankfull stage. The contract specifically states that cross section information is to be provided for the channels, with no information requested on adjacent flood plains. What is important on the cross sections is not the precise flood stage on the flood plain but the fact that the river will flood at least once each 100 years at SS-5 and SS-6 and at least once each 10 years at the intermediate station.

Since the stages of the referenced flows are above bankfull stage, the flood plains will need to be surveyed. Although EarthFax considers this beyond the scope of the contract, we are willing to collect the information. We suggest, however, that future contracts of this nature include wording to the effect that flood plain data are to be collected.

It should be noted that the channel configuration of Chalk Creek has changed since the draft report was printed due to erosion during spring runoff. Thus, the data collected by the new survey will be different than that obtained from the past survey.

Survey data for the channel cross-sections must be supplied in the Appendix.

EarthFax is unaware of a stipulation in the contract that indicates that the survey data "must be provided in an appendix. However, the data will be provided in an appendix of the final report.

Watershed maps used in the determination of the flows for Chalk Creek should be supplied.

A map showing the watershed boundaries used in the flow determinations will be included in the final report.

It appears that SS-1 and SS-2 sample drainage from the watershed labeled WS-3. Additional watershed boundaries should be drawn to define the watershed that each station is designed to sample.

SS-1 and SS-2 do, in fact, monitor subwatersheds within the same larger watershed. These stations were placed as directed by the Division during the initial site visit. While subwatersheds can be indicated on Plate 4-1 to show the contributing areas to each station, this is not considered necessary for the following reasons:

- o The contributing area to SS-1 is relatively small, with many other subwatersheds in WS-1 through WS-4 of similar size. If designating the subwatershed contributing to SS-1, other subwatersheds should also be designated to maintain consistency.
- o As noted especially this summer during a thunderstorm that occurred in the area, the potential for flows to occur at SS-1 is very small compared with other adjacent stations. Thus, specially designating the watershed contributing to SS-1 makes little hydrologic sense.
- o Due to the lack of runoff at SS-1, Mr. Summers has suggested that it might be appropriate to move SS-1. Thus, designating this subwatershed makes no long-term sense.

D.1.2. Ground Water Baseline Information

Information obtain at the minesite from mining personnel indicate that there several seeps (or springs) exist in the lower reaches of WS-4. These should be included in the seep and spring inventory and depicted on Plate 4-2.

EarthFax is unaware of any seeps or springs in the vicinity of the mine site other than the seepage immediately upstream from SS-4 (i.e., the source of flow at SS-4). This seepage (inadvertently left off of Plate 4-2) will be added to the plate in the final report. In any case, EarthFax is unaware of other seepage within WS-4 since this watershed was thoroughly investigated during the seep and spring inventories.

The report should correlate all water rights with the spring number identified on the inventory on Plate 4-2 and on Tables 4-19 and 4-20.

Wording to this effect will be added to the narrative in Section 4.2.5.2. This affects only SP-15, SP-16, and SP-17.

Springs SP-6 through SP-8 should be depicted on Plate 4-2.

These springs are outside of the boundary of the map. The contract requires that the seep and spring inventory be conducted within one mile of the permit boundary. The survey in the area of SP-6, SP-7, and SP-8 was inadvertently conducted outside of this radius. Rather than change the base map or change the spring numbering system, the springs were included in the draft report for informational purposes but were not precisely located on the map due to their location outside of the required survey area.

The Morbey well must be added to Figure 4-22 and Table 4-15.

The Morby well is not included on Figure 4-22 or Table 4-15 since (as noted on page 33) a log is not available for this well. Thus, the well will not be included in Figure 4-22 or Table 4-15.

An estimate of the average flow for the wells in the area was not presented. It is recognized that this data may not be available at this stage of the investigation. In that case, the data will be collected and analyzed during the upcoming year of investigation.

The average yield of wells in the area will be included in Table 4-15 as obtained from the well logs currently provided in Attachment C. No other information will be collected.

A discussion of oil wells and production in the area should be supplied.

Oil wells and production in the vicinity of the mine were considered prior to writing the draft report. However, due to the steep dip in the vicinity of the mine, an examination of oil wells and production in the area will provide no information that will be useful in understanding local hydrologic or overburden conditions. Thus, this information will not be included in the final report. It is also considered superfluous to provide a discussion in the final report of why no mention of local oil wells is provided (since such a discussion is of no concern to the outside reader).

Groundwater data obtained is does not meet the conditions of the contract or the intent of a baseline monitoring period. The diameter, total depth, perforated intervals, static water levels, rights and lithology were not supplied for the Morbey well. Monthly water levels were not obtained for the wells. Water quality samples were to be collected quarterly. No single monitoring point meets this requirement. Water levels were to be obtained for each sample. Five of the six samples had cation-anion balances that exceeded five (5) percent. Based on the problems noted above it has been determined that the data does not meet the requirements to define the baseline hydrologic regime for either the SOAP program nor the permitting requirements. It is the Division's current opinion that this data be utilized simply for approximate site characterization, and the groundwater sampling program for baseline requirements begin with the contract currently being processed in this office.

As noted previously, information on the diameter, total depth, perforated intervals, static water levels, rights, and lithology were not provided on the Morby well because a well log does not exist for this well (see page 33). This information will, therefore, also not be provided in the final report.

Monthly water-level data were not collected for the following reasons:

- o The well heads on the Morby and Boyer wells make access difficult for water-level measurements. The Morby well is sealed in such a manner that the seals would need to be broken before water levels could be obtained. This would compromise the integrity of the well. Numerous attempts were made to collect water-level measurements in the Boyer well. However, electrical wires leading to the submersible motor prohibit the probe on the water-level indicator from reaching the water surface.
- o Permission was not obtained from Mrs. Boyer for monitoring of the Old Well until November 1985. The pump was then pulled from the well to allow access. Water-level measurements were subsequently collected from the well. These data will be provided in the final report.

Quarterly water-quality samples were not obtained from the wells for the following reasons:

- o Mr. Hooper indicated that the Division would be initially responsible for obtaining permission to sample the private wells. This was being done in the hopes of obtaining a more cordial response from the well owners. Due to difficulties in contacting the well owners, he could not obtain permission early during the contract. Mr. Hooper then asked EarthFax in July 1985 to contact the well owners directly. This was done and the Boyer and Morby wells were sampled in August 1985. Since these wells service summer homes (which are occupied only

intermittently), samples could be obtained only through October 1985. The homes had not yet opened for the 1986 season prior to submission of the draft report. Hence, later samples could not be collected.

- o As noted previously, permission was not obtained from Mrs. Boyer for sampling of the Old Well until November 1985. This was due to the fact that an old pump was still installed in the well and her concern over use of the well even though the Division of Water Rights considered it abandoned. Once permission was obtained, the well was sampled in December 1985 and again in April 1986.

EarthFax recognizes that problems occurred with the charge balances on the groundwater samples. However, these problems are not considered as serious as the Division's comments suggest. Although five of the six analyses had charge balance errors that exceeded 5 percent, only two of the six had errors in excess of 8 percent. The 5 percent cutoff point is somewhat arbitrary (having neither a contractual nor an absolute technical basis) and should not be considered a compelling factor in rejecting the results (e.g., the Division's comments suggest that the sample that had an error of 5.3 percent should be rejected as quickly as the sample with an error of 14.7 percent).

EarthFax finds no redeeming value in rejecting the water-quality data. One of the main purposes of a charge balance analysis is to determine not whether a sample should be rejected but whether a sample should be re-analyzed. In this case, all of the samples with "large" charge balance errors were re-analyzed. In some cases, the errors remained large, suggesting possible interferences with the analytical methods. Since the errors did not appear to be ion-specific, general laboratory problems apparently did not exist.

It should be noted that EarthFax has decided to change laboratories for any future water-quality analyses. Future analyses will be performed by Chemtech of Orem, Utah. However, the past samples should not be rejected. No set of data is without problems, indicating that all data must be accepted at face value. EarthFax considers the present data set of sufficient value to aid in determining long-term trends and baseline conditions.

While it is true that a year of baseline data were not collected from the water wells, the reasons outlined above indicate that problems associated with the collection process were largely beyond the control of EarthFax. Many of these problems will continue in the future (e.g., inability to measure water-levels due to well access problems, wells not operating during the non-summer months, etc.). Thus rather than rejecting the past data and writing them off as an "approximate site characterization", the data should be considered a valid indicator of local conditions, to be supplemented by future sampling.

D.1.4. Results and Conclusions

Graphs of the average monthly flows for Chalk Creek and the intermittent stream must be supplied.

This information will be included in the final report.

The report should contain a correlation between all runoff events to precipitation amounts.

A discussion to this effect will be included in the final report.

An estimate of the soil erosion and soil loss should be conducted using the methodology outlined by PSIAC.

This estimate will be provided in the final report.

Graphs of seasonal variations for all constituents at each sampling site should be supplied.

This information can be included in the final report. However, the Division may want to reconsider the requirement to include graphs depicting the concentrations of all constituents for which analyses were performed. Surface-water samples were analyzed for 34 constituents and groundwater samples were analyzed for 31 constituents. Field analyses were performed for three additional constituents in both cases. Thus (assuming surface-water stations can be combined and wells can be combined), approximately 70 graphs will be required. Providing this many graphs would be unwieldy. Important aspects of local water quality could probably be as easily identified using graphs developed from selected key constituents (i.e., TSS, TDS, etc.).

High and low water levels were not supplied for each well. A graph of monthly average water levels for each well was not supplied. Again, it is recognized that this data may have not been collected and may not be available at this stage of the investigation. This data may be obtained during the upcoming year of investigation.

Difficulties in obtaining water-level measurements were discussed previously in this response. Due to the lack of data, graphs of monthly water levels were not considered appropriate for the report.

Problems experienced with the pumping test indicate the test may be invalid. These concerns are as follows:

1. The current condition of the well (i.e. severely incrustated, unknown well efficiency, extent of perforated zone) results in questionable data and conclusions.
2. The duration of the test was relatively short (128 minutes). It is questionable that the test data was of sufficient quantity to define the transmissivity value T_2 as defined by Schafer (1978).
3. Recovery measurements are questionable due to problems with rust sticking a valve allowing water to drain from the discharge pipe. Conclusions based upon this data should be limited.
4. The formation of well completion is not stated.

Based upon these concerns and discussions held between our office and your representatives, it has been determined that this data should only be used with caution and the limitations of the test and conclusions be clearly explained in the report. Additionally, it has been agreed that another test be conducted on this well. This test should be either a recovery test as outlined by Schafer (1980) or a slug (recovery) test as discussed on September 2, 1986.

Even though the pumping test conducted in the Old Well was of less than textbook quality, the data collected from the test should not be considered invalid. As explained during the referenced telephone conversation on September 2, 1986, the following problems exist at the Old Well that make it difficult to obtain better data:

- o The hydraulic conductivity of the aquifer at the well is sufficiently low that the well yield is limited. This makes flow regulation difficult when pumping at a rate of 1.5 to 2.0 gpm for extended periods of time.
- o Incrustation in the well has resulted in the formation of a significant amount of rust. This rust clogs the pump, further making flow-rate regulation difficult and affecting the operation of the check valve.

These problems were certainly of sufficient magnitude to make the data questionable. However, no alternatives existed since this was the only well near the mine site in which a pumping test could be conducted. Even though the drawdown and recovery data were of questionable quality, the results compared favorably. The results obtained from the Old Well also compared favorably with estimates calculated for the Boyer well. Thus, the data are not considered invalid but are considered an adequate estimate of hydraulic conditions in unfractured bedrock in the mine vicinity.

Information on the formation in which the Old Well is completed was not provided due to the sparsity of data obtained from the well log. A conjecture will be made in the final report.

EarthFax has agreed, as noted, to conduct a slug test in the Old Well to verify the data obtained from the pumping test. However, it should be remembered that many of the same problems that affected the pumping test will also plague a slug test (i.e., incrustation, unknown extent of the perforated zone, etc.). Thus, although the test will probably be performed with fewer hitches, the results may be open to just as many questions.

A discussion of the recharge characteristics of the area must be supplied.

Recharge characteristics are implied in Figure 4-22. A discussion of these characteristics will be provided in the final report.

A discussion of probable sediment pond locations must be supplied.

It was the opinion of EarthFax that this was a mute point since the sedimentation pond had already been constructed at the site. Unless the Division is of a different opinion, this item will not be included in the final report.

A discussion of suggested water monitoring locations must be supplied.

This will be provided in the final report.

All figures, tables and raw data should be clearly labeled with dates of data collection, sites numbers, legends, titles, etc. All material must be clear and legible. All raw data should be supplied to the Division in the form of an Appendix with a table of contents.

A table of contents for the appendices will be provided in the final report. Please provide specific details of figures, tables, or raw data that are not clear.

Ten of the seventeen water analysis samples submitted had cation-anion balances that were in excess of five (5) percent. This makes conclusions based upon the data questionable, these limitations should be clearly outlined in the report. Additionally, questions have arisen concerning the water quality analysis data in Attachment II. Several values were changed. Was this the result of re-analysis? Changes in the analysis results located in Attachment II should be supplied by the lab conducting the analysis.

The referenced attachment is Attachment G, not Attachment II. The changes are the result of reruns. Changes were made immediately prior to printing of the draft report and, thus, could not be supplied by the laboratory. Updated copies of these sheets can be included in the final report.

A discussion of charge balance errors was provided previously in this response. A similar discussion will be provided in the final report.

General comments relative to the contract and the Proposal.

The report should contain a list of the EPA standards discussed on Page 78 for reader reference.

The only standards that were exceeded are provided in the discussion on page 78. A list of other standards can be provided in the final report but are not considered germane to the report since (as noted) the standards are not exceeded.

The report must contain the original pump test data.

These data were inadvertently left out of the draft supplied to the Division. The data were subsequently supplied by EarthFax to Mr. Summers. Please inform EarthFax if the data are still missing.

Dissolved oxygen analysis for SS-5 and SS-4 was not supplied.

This omission will be corrected in the final report.

A copy of the data used to develop Figure 2-1 should be supplied.

These data are provided in Table 4-3.

Locations of points of diversion (if different than water right location) should be depicted on Plate 4-3.

These locations are the same.

The report should include the items discussed on page 10, paragraph 5 and page 11, section 2.2.2 of the proposal dated April 30, 1985.

To the extent allowed by the pre-existing data base and local site conditions, a discussion was provided of the items included on page 10 , paragraph 5 of the proposal. Items included in Section 2.2.2 of the proposal will be included in the final report.

Page 9; paragraph 6 - An old slump scarp is present uphill from the new slump that occurred in the spring of 1986. Therefore, at least one slump has occurred in the point boundary.

Unless we are speaking of different areas, the "old slump" referred to in the Division comments is an old road cut and, therefore is not appropriately included in the discussion on page 9 of the draft report. The "new slump" occurred after the draft report was finalized as a result of construction activities (undercutting of the toe of a slope). A brief mention of this slump will be made in the final report.

Page 12; paragraph 7 - Figure 2-3 shows a fault in the permit area northwest of the western boundary. Additionally, the eastern fault should be located on Figure 2-3.

The figure will be changed accordingly.

Figure 2-4; There is no reference for this Figure. What source did the cross-section come from? Where is this cross-section located on Figure 2-3?

This information will be included in the final report.

Page 15; paragraph 1 - This section should describe the aquifer in terms of confined, or unconfined, thickness, gradient, and estimate of transmissivity.

The only information available from the published literature has been provided. More detailed information is not available. Therefore, this information cannot be provided as requested.

Page 15; A discussion of any hydraulic connection between the Frontier Formation and the alluvium should be included.

Information concerning this connection is not available in the literature and con, therefore, not be provided as requested.

Page 20; paragraph 7 - This section conflicts with Section 204.4 that states no other faults other than the two already mentioned are present in the permit area. These faults should be located on a geologic map.

The faults discussed on page 20 are small scale (displacements of one foot or less) while those discussed in Section 2.4.4 have displacements of tens of feet. The wording in Section 2.4.4 will be altered to indicate that no other major faults exist within the permit area.

Figures 3-2 through 3-6; The formations that these logs represent should be labeled on the figures.

Formational names will be provided in the final report.

Page 37; paragraph 2 - The report should reference the seep and spring results in this section.

This section is a discussion of methodologies used to collect data, not a presentation of the results. EarthFax considers it more appropriate to keep the discussions of results in the same section as is currently done.

Page 83; paragraph 5 - This section should state what formation this well is completed in.

A formational name will be provided in the final report.

Page 96; paragraph 3 - An explanation of what lead has to do with the rust in steel casing should be provided.

A discussion of this will be provided in the final report.

Page 102; The possibility of the infiltration of coal leachate, oil and grease or other contaminants into the alluvial aquifer should be discussed.

This discussion will be provided in the final report.

A clear geologic map should be submitted with a scale of at least 1": 500' for the mine plan and adjacent area.

Figure 3-1 will be altered to include formational contacts, faults, etc.

The geologic map should depict the permit area and adjoining areas to 2000 ft. from the permit area. The coal outcrops should be shown. All faults, anticlinal and synclinal structures, attitudes of formations and structures, and cross-sectional information should be illustrated.

Does this comment refer to the same map mentioned in the previous comment (scale of 1"=500' of the mine plan and adjacent areas)? If so, EarthFax is unaware of a contractual requirement to provide a map of this scale showing areas within 2000 feet of the permit area. Please advise EarthFax if this is a contractual requirement so that maps can be appropriately altered.

Page 9, paragraph 1 states that numerous folds and faults are evident in the immediate area. These structures should be identified and shown on the geologic map.

The terminology "immediate area" will be modified as appropriate. Structures that are within the area included in Figure 2-3 will be included in that figure in the final report.

The faults described in paragraph 7, page 12 should be shown on the geologic map.

As discussed, these items will be included in the final report.

SAR values should be submitted for samples PBO, PBU, BC20, BC2U, BC3U.

These will be included in the final report.

The AWC presented in the report is based upon the subsoil. The report should clarify why the AWC is not based upon the entire soil.

The word "subsoil" should read soil. This will be changed in the final report.

In developing the water budget for the site, the report assumes that precipitation equals potential evapotranspiration ($Ppt = PET$). This should be clarified.

The report does not make this assumption. As noted in Table 4-3, PET and Ppt are not equal during any month.

The use of "pasture grasses" for the crop factor may not be representative of the area based on: 1) the high density of shrubs and trees, 2) the low density of grass cover, and 3) different grass species present at the site. Pasture grasses usually include a thick stand of orchard grass, kentucky bluegrass, etc. in high water supply (i.e. approximately 90 % cover). The grasses present at the site are short lived species that begin their growth early in the year (February-March) and end early in the year (August-September). The report uses a plant coefficient of 0 for March and April, thereby rendering the PET to be 0 for the same period. Even if the plants are not transpiring in this period, the soil is losing water through evaporation (accelerated by wind). The report should clarify these issues.

All analytical methods have their drawbacks. The use of "pasture grass" was determined the most appropriate alternative.

The use of a plant coefficient of 0 during the months of October through April is specified by the Blaney-Criddle method (i.e. during all months that the average monthly temperature is less than 45° F). Although it is recognized that ET continues to occur from the soil surface, the method ignores this component. The Blaney-Criddle method was selected due to its overall reliability (see the discussion on page 43 of the draft report). Thus, other PET computational methods are not considered necessary.