KEY TO INDIVIDUALS AND ENTITIES WHO PROVIDED COMMENTS
REVIEW TEAM AND PUBLIC COMMENTS

DRAFT, Groundwater Pollution Prevention, Monitoring and Response Action Plan

Pinedale Anticline Project Area, Sublette County, Wyoming (December 2014)

Key	Comments from:
JB	Janet Bellis (Bureau of Land Management)
DLD	Dennis Doncaster (Bureau of Land Management)
GN	Greg Noble (Bureau of Land Management)
DH	Deb Harris (Wyoming Department of Environmental Quality)
AS-JS	Andrew Schmidt and John Stover (U.S. Environmental Protection Agency, Region VIII)
KH	Kate Helm (Wyoming Oil and Gas Conservation Commission)
U-Q	Ultra Resources, Inc. and QEP Energy Company
JH	John Harju (Wyoming State Engineer's Office)
BJ	Bob Johnson
SCCD	Sublette County Conservation District
SK	Susan Kramer
CK	Carmel Kail
DB	Dottie Bently
IR	Isabel Rucker
MLW	Mary Lynn Worl
EC	Elaine Crumpley
EG	Elizabeth Greenwood
MC	Mindi Crabb
PKB	Peggy K. Bryant
RGW	Ronald G. Worl
CURED	Citizens United for Responsible Energy Development
MW for CURED	Mike Wireman for CURED/Wyoming Outdoor Council
KC	Kent Connelly, Coalition of Local Governments
MJK	Michael J. Kramer
LB	Linda Baker, , Upper Green River Alliance
SS	Sue Ann Spencer
TG	Tony Gosar

Reviewer	Section Number	Page Number	Line Number	Comment
KH				I think personally, I just want to be sure to enable the well owners in the area the peace of mind and confidence that their water supplies are safe. Something that I am confident that the public comment is addressing as well.
U-Q				Operator has identified some concerns with specific wells being proposed as monitoring wells in the northern portion of the Anticline. At a minimum, it should be noted at this time, that the specific well locations as identified may not ultimately be the wells that are used for the monitoring study, but that the general approach, spacing and number of wells on the northern portion of the anticline appears to be acceptable. The Operator recommends a meeting, or series of meetings, to work through the logistics of the wells, as proposed, to ensure that the proposed wells meet the WOGCC and State Engineers Office's requirements for continued monitoring.
BJ				Your Pollution Plan looks pretty good at face value. The data that have been collected seems to be quite extensive and thorough and good to keep as reference. As I read the plan they(the data collection group) will be monitoring water wells that are predominately in the lower Wasatch where particle movement is calculated at about 44 ft per year, such that any contaminints would take 9 to 10 years to move away significantly from its source .. I see no map that shows clearly how far or close the monitoring wells are from any potential point sources, such that any leak my take quite a long time to show up.
MW for CURED				The proposed groundwater monitoring plan only includes four wells in the alluvial aquifer along the New Fork River and all 4 are proposed to be located on the north side of the New Fork River along a 9000 ft. line adjacent to the river. Because these wells are so close to the river they will not serve as early warning wells. This does not provide adequate coverage for monitoring the alluvial aquifer. Additional alluvial monitoring wells are needed south of the river and away from the river towards the margins of the aquifer. Why didn't Newfields use VSP Version 7.0 to help determine wells needed in alluvial HSU?
SK	2.2	2-3	(O2.5)	Monitoring locations in environmentally sensitive areas is a stated goal.
MJK	2.2	2-3	(O2.5)	Again, the stated goal here is to establish monitoring locations in areas of greatest environmental sensitivity and all the proposed monitoring sites are miles up above the river and surrounding wetlands. The plan is flagrantly violating it's stated goal with exclusion of monitoring sites in this area.
SK	4.2.2	4-2	12-22	The nature of the soils near the surface are porus thus surface contamination and spread of plumes more likley than that of deep wells. It would be prudent to add shallow wells near possible contamination sites.
SK	4.2.3.1	4-4	12-38	Monitoring wells should be place at all identified potential receptors.
U-Q	4.2.3	4-3	General	This monitoring well network design includes a recommendation that 20 new water monitoring wells are installed throughout the Anticline. In March of 2013, WOGCC began implementing a new groundwater baseline sampling, analysis and monitoring rule. This rule reflects a comprehensive set of measures intended to ensure that groundwater is protected by sampling existing water wells within 1/2 mile of a proposed gas well 3 times. This approach reflects a rigorous and transparent process, with input from several agencies, as well as the public. The WOGCC Baseline rule does not mandate installation of new monitoring wells, but rather relies on existing wells where they are available. While we recognizes the importance of the groundwater resource beneath the Pinedale Anticline, it is important to recall that the LLPHC determined that there were no widespread impacts due to oil and gas activities. The installation of an additional 20 water monitoring wells is not warranted based on years of rigorous study to characterize the groundwater system. Furthermore, this plan includes a Pollution Prevention Plan, which presents a set of best management practices, including a number of voluntary measures, that the Operators have agreed to implement to ensure the continued protection of the groundwater resources. There is also a response action plan, which allows for rapid evaluation and response should a threshold be exceeded, the hydrogeologic conceptual model need revision or a BMP was determined to be insufficient or missing. This 3-part plan is a comprehensive approach to groundwater protection and all parts of the plan should be considered with respect to overall groundwaer protection. While we agree in general with the process used to select optimal well locations, credible/suitable existing wells should be used to form the monitoring network, rather than requiring installation of new groundwater monitoring wells.

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AS-JS	4.2.3.3	4-7	11+	It is unclear how this step incorporated the position of the well downgradient (in terms of groundwater flow). EPA recommends that the Plan describe the well elimination process more thoroughly.
AS-JS	4.2.3.4	4-8	1-3	EPA recommends that the Plan provide the rationale for increasing the hotspot radius from 4400 to 4421 feet.
SCCD	4-1			Under step 7, "Alluvial HSU monitoring…." this statement isn't entirely true based on the proposed design of the plan as it excludes any monitoring wells for the alluvial south of the New Fork River which is down-gradient from near-by E&P activities. Monitoring wells for the alluvial located on the north side of the river would not adequately capture contaminants from the activities south of the river.
SCCD		4A-2	2	What is the driving factor for a design with the "minimum number of monitoring locations needed? Since there is a level of unknown, minimizing the number of monitoring points may not allow for early detection. See lines 19-20 ("Optimization was based on an *assumed* area of potential degradation…")
AS-JS	RCE and Figure 4A-3	4A-4	1-2+	Most of the RCE wells are proposed to be screened in the Wasatch formation. Based on the hydrogeologic CSM and the groundwater flow model, if releases occur at the surface in the RCE, are the best detection monitoring points in the Wasatch, or in the alluvium? In other words, would a release really travel to the Wasatch and then into the alluvium, or would it be more likely to simply migrate through the alluvium? EPA recommends that consideration be given to the placement of more monitoring wells in the alluvium in the RCE to ensure the protection of receptors.
AS-JS	4A-3			Based on the figure, it appears that there are no monitoring wells downgradient of three pads located on the north side of the new fork river in between proposed monitoring wells RCE-05 and RCE-06. EPA recommends that the Appendix address this potential gap in monitoring.

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KH				As far as the plan and the comments to be made, I think that Mark from DEQ nailed our potential discrepancy in our baseline water quality rule and the field wide plan. While our rule is to protect individual well owners this field plan may exclude those individuals who wish for the sampling by the WOGCC rules. As you are clearly aware of the stance that SCCD has on this topic, I think that some consideration should be made for those well owners that we might be slighting.
MW for CURED				Mesa Spring should be included in the monitoring plan. This is a natural groundwater discharge point and a good location to build a baseline.
MJK	4.2.3.1	4-4	37	Potential Receptors were identified along the New Fork floodplain yet no monitoring wells were placed in these environmentally sensitive areas in the North section yet it was felt necessary to place multiple monitoring wells along the river in the river corridor. This does not appear to be a consistent plan.
AS-JS	4.2.3.3	4-6	9+	The monitoring plan does not mention or consider monitoring the Mesa Spring. Springs are surface expressions of groundwater and are one potential pathway to receptors. EPA recommends that sampling the Mesa Spring be included in the monitoring plan.
AS-JS	4.2.3.4	4-7	28+	The monitoring plan does not mention or consider monitoring the Antelope Spring. Springs are surface expressions of groundwater and are one potential pathway to receptors. EPA recommends that sampling the Antelope Spring be included in the monitoring plan.
JB	4.2.4	4-8	22-23	New paragraph. Not sure if this is the correct place for it, but add a paragraph somewhere that describes why the HDG study wells installed are not in the network.
MJK	4-7			This shows NO monitoring wells along the river which is one of the most environmentally sensitive areas and an area where contamination of domestic water sources would pose the greates risk to public health.
JB	4.9	4-18	31-33	Why is only one of the HDG's study wells included in the network and not the others? I am not sure this has been fully explained.
JB	4.9	4-19	3-8	Again, why did other HDG study wells not meet criteria?
JB		4A-16	1-7	I am still not sure why the HDG study wells or SCCD wells were not included, maybe add a paragraph describing that these wells do not meet the criteria.

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AS-JS				In general, EPA recommends that the plan needs to have more discussion regarding the hydrogeologic CSM, potential sources of groundwater contamination, and the monitoring approach. The plan does not have enough detail regarding the vertical aspect of monitoring, including what interval Newfields proposes to be monitored as the best indicator of a release, and more specifically, how wells will be screened. The discussion should include monitoring well locations, proposed screened intervals and preexisting screened intervals. Use of monitoring wells with very long screens (>100') is not appropriate for groundwater monitoring purposes, especially when paired with wells with screens ~20' in length. In addition, given the uncertainties associated with the CSM proposed in the LLPHC, verification of the hydrogeologic CSM needs to be considered with regards to overall monitoring approach. See specific comments for examples of areas recommended for clarification or modification.
MW for CURED				The 12 existing wells proposed for the Wasatch HSU in the North monitoring area, range in depth from 772 to 1120 ft. (11 of the 12 are greater than 900 feet deep). The proposed new well is anticipated to be 200-300 ft deep. This proposed monitoring scheme will not provide monitoring for the shallow Wasatch ground water flow system which is hydraulically connected to the alluvium along the New Fork River. Since the most likely sources of contaminants are from surface or shallow subsurface facilities, it is critical to construct monitoring wells that are screened in the shallow flow system.
MW for CURED				For the south monitoring area it is also important that wells be constructed to monitor the shallow flow system in the Wasatch HSU.
AS-JS	4.2.2	4-2	12+	One scenario that the current technical approach does not consider is the possibility of casing and/or cement failure of gas wells at depth. EPA recommends that the monitoring plan incorporate interspersed deeper screens in the form of nested well clusters to allow for the detection of a release at depth. The addition of deeper screens would also allow for the continued confirmation of the hydrogeologic CSM and the theory that the current detections of low levels of volatiles is a result of upward migration from the gas deposit. It may be possible to accomplish this by including some of the wells included in the current SCCD monitoring network or some of the study wells installed as part of the hydrogeologic data gaps study.
AS-JS	4.2.3.1	4-5	27+	Little or no discussion is provided regarding the proposed screened intervals of monitoring wells. The text states that the monitoring wells will target the uppermost portion of continuously saturated Wasatch formation, and later on that each new RCE well will be completed in a saturated sandstone unit in the uppermost portion of the Wasatch formation with an estimated thickness of 20-40 feet. EPA recommends that the plan be more specific about the screened intervals of proposed monitoring wells.
AS-JS	4.2.3.3	4-7	24-25	The monitoring plan indicates that the new well in the north zone will be installed to a depth of 250-300 feet and will be completed in a sandstone unit that has an estimated thickness of 20-40 feet. Is the new well proposed to be screened across the first fully saturated sandstone in the Wasatch, similar to the RCE? Is the well proposed to be screened across one, or multiple, sandstone units? How are the preexisting wells in the north zone screened and do those screens meet our criteria of looking at the first saturated sandstone interval in the Wasatch? See comment regarding Appendix 4C. Wells with screens over 100' long are not appropriate for use as monitoring wells. EPA recommends that the text have a more robust discussion regarding screened intervals and how preexisting and proposed screened intervals meet data quality objectives.
SCCD	4.2.3.3	4-7	23-24	The target depth for new monitoring wells within the northern zone does not coincide with the other existing wells. Although this is ideally a better target depth for contamination plumes that may be traveling downward, it would cause a gap in the spatial distribution for any deep (gas well) contamination source.
SCCD	4.2.3.4	4-8	10-11	Comment ID 25 may apply for the proposed new wells in the south zone as well.
AS-JS	4.2.3.4	4-8	9-13	See comments/recommendations regarding screened intervals in the RCE and north area above.
SCCD		4A-2	9-10	By targeting the first saturated layer, potential deep sources (injections wells, shut-in wells…) are not being adequately monitored for.
SCCD		4A-2	32-33	When removing wells for spatial purposes, were considerations also made as to the design of the wells (depths, perforation zones, well integrity…)?
SCCD	3.3	4C-7	14-15	By targeting the uppermost saturated zones of the Wasatch, potential deep sources (injections wells, shut-in wells…) are not being adequately monitored for, nor would that be consistent with other wells being retained for monitoring points.
AS-JS	Methods	4A-2	10-11	The Appendix states that alluvial wells will be drilled "into the water table." EPA recommends that the Appendix clarify what that means in terms of screened intervals. Monitoring wells screened in the alluvium, should be screened across the water table with a screen length not to exceed 15 feet unless fluctuations in the water table dictate a longer screen. A shallow screen across the water table would allow for the interception of LNAPLs (if present due to a release) and would allow for better assessment of risks to surface receptors.

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AS-JS	North and South Zones	4A-3	24-25	The discussion of the well selection process does not include any discussion of the screened intervals of preexisting wells. Both the lateral and the vertical position of wells needs to be considered in the selection process. EPA recommends that a more robust discussion be included in the Appendix that addresses monitoring groundwater with depth in the Pinedale Anticline.
AS-JS	4C-1	MS 11-21 and all preexisting monitoring wells in north and south zones.		The reported depth to water is 400' and the screened interval is reported as 750 to 910'. Was MS 11-21 screened across first encountered groundwater? A screened interval of 160' is not acceptable for a monitoring well. Generally, a screened interval of <20' should be utilized. A high degree of dilution may occur in a 160' well screen. EPA recommends that preexisting wells with long screens be removed from the proposed monitoring network and replaced with more specifically designed monitoring wells. This applies for all preexisting wells that are proposed for use as monitoring wells.

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AS-JS				In general, appendices would benefit from providing additional detail and rationale regarding methods or procedures employed, or to be employed. In addition, the appendices would benefit from presenting more information in tabular format for clarity. For example, more detail needs to be provided regarding the calculation of threshold values. See specific comments for further recommendations.
SCCD				There are some issues with the Data Quality Objectives regarding formulation ofthresholds and the abandonment of existing baseline data for use in future trend analysis. The existing dataset includes a decade or more of water quality measurements of many parameters. To abandon that baseline is to abandon the statistical power needed to develop accurate thresholds which,if exceeded, signal an anomaly in trend. Without the ability to statistically quantify natural variability and estimate ambient levels, it is impossible to develop meaningful appropriate thresholds. Well defined (even individualized for each well) thresholds, developed on actual historical data, ensure earliest possible detection of a possible change in water quality. The development of "field-wide" thresholds ignores not only the potential to individualize trend detection by well afforded by the existing dataset, but ignores the natural variability in many water quality parameters depending upon depth of the water source.
SCCD				Comments from 02.2 apply and are repeated here: The existing dataset includes a decade or more of water quality measurements of many parameters. To abandon that baseline is to abandon the statistical power needed to develop accurate thresholds which, if exceeded, signal an anomaly in trend. Without the ability to statistically quantify natural variability and estimates of ambient levels, it is impossible to develop meaningful thresholds. Well defined, perhaps even individualized thresholds, developed on actual historical data, ensure earliest possible detection of a possible change in water quality.
MW for CURED				BLM should evaluate whether the same set of threshold values should be applied to alluvial HSU wells and Wasatch HSU wells -or whether it is better to have HSU specific threshold values. This also applies to the shallow vs deep portions of the Wasatch HSU.
MW for CURED				Establishing threshold values that are approximately 50% of the applicable standard is arbitrary, but common. It should be noted that an increase in concentration from 50 % of a standard to the Standard value can happen relatively quickly under contamination scenarios -so immediate follow-up sampling is critical as is implementation of the response / mitigation
KC	2.3	2-3	1-6	This section illustrates the flawed reasoning of the previous sections. The goal of the Response Action Plan is to develop a program that "specifies responses to exceedences of established thresholds." Responding to exceedences, however, depends entirely on the data and threshold that has been exceeded. The intent of SCCD's monitoring program was to have baseline, historic groundwater data throughout the entire oil and gas field to protect all groundwater sources and the individuals who use them. SCCD monitored and collected data from over 200 groundwater sources for the past decade to establish a baseline for the future. This is consistent with the intent of the 2008 ROD (See Sections 3.5, 4.2). To abandon the SCCDs baseline is to abandon the statistical power needed to develop accurate thresholds which, if exceeded, signal an anomaly in trend. Without the ability to statistically quantify natural variability and estimates of ambient levels, it is impossible to develop meaningful thresholds. Well defined, perhaps even individualized thresholds, developed on actual historical data, ensure earliest possible detection of a possible change in water quality. Without the SCCD's data, exceedences are little more than speculation at this point.
MJK	4.4	4-11	14-22	Confusing if threshold absolute values will be used as a triggering event or a statistically significant increasing trend or both. If TDS doubles from one year to the next, would it trigger an event even if both values are below 500 mg/L??

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AS-JS	General			Typically, the main body of the document (Sections 1 thru 5) is used to discuss and summarize the Plan/Study. The Appendices are then used to provide details and expand on the development of the Plan to provide a better understanding of the background and approach. EPA recommends that Appendix 4B be expanded to explain, in greater detail; the rationale, methods, and procedures used to compute the proposed water quality thresholds. This would include the identification and removal of outliers (see comment below). Examples of additional topics that could be expanded in the Appendices are 1) Bromide is listed as having a threshold value calculated using background statistical techniques, in Fig 4-13. However, on Page 4B-2; First Paragraph and the remainder of the Appendix; Bromide is not included with no explanation why in the text. EPA recommends explaining why bromide is excluded. A partial explanation is found in a Table 4-4 footnote; 2) Page 4B-13, Line 15: Why does the "Presence of multiple populations exclude the use of background threshold value calculation procedures recommended by EPA (2013)." Did NewFields consult the 2014 EPA paper by Singh, A., Frederick, T., and N. Rios-Jafolla? If so, were any key points were incorporated into the Plan?; 3) Why was VSP Version 7.0 selected for the Plan? EPA recommends that the Appendix provide details regarding NewFields' approach and use of VSP, Version 7.0 software (PNNL 2014); 4) How are BLM's requirements under 43 CFR 3162.5-2(d) October 1, 2012 incorporated into the Plan and water quality thresholds? EPA recommends that the other Appendices be expanded as needed. Another example is expanding discussions in Appendix 4A about screened intervals of preexisting wells, and downgradient monitoring of pads between wells RCE-05 and RCE-06.
AS-JS	Methods	4B-1	19	Why weren't well-specific thresholds calculated given the large area covered by the field? EPA recommends that well-specific threshold values be considered given the range of analyte values to provide a greater level of protection to receptors.
AS-JS	Methods	4B-2	18-19	EPA recommends that sample results from outside the monitoring areas be considered for background purposes. The assumption that those wells may provide undue bias or distortion may suggest that oil and gas activities have impacted groundwater along the anticline.
AS-JS	Methods	4B-3	2+	It appears that the iterative Q-Q plots may not have been properly utilized and the analysis did not follow previous recommendations provided by Anita Singh dated October 20, 2014 (attached). It is not clear how ND values were treated during the creation of the Q-Q plots; and the iterative process does not appear to have been properly followed. Please see the attached memorandum provided by Anita Singh dated January 23, 2015 for specific comments and recommendations regarding a more transparent background extraction process.
AS-JS	Population Partitioning Analysis	4B-14	12-19	The Appendix states that data that were not detected below the MRL were removed from the dataset because the objective of the analysis was to identify the highest background subpopulations. If non detect (ND) values are present in the dataset, the BTVs calculated may not be correct. A method that can handle NDs should be utilized to determine the BTVs. Please see more specific comments provided by Anita Singh dated January 23, 2015 (attached).

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AS-JS				The plan should incorporation better discussion, analysis and description of sampling methodologies. The sampling methodology is critical to obtaining analytical results that are representative of groundwater in the PAPA. For example, if the pump and/or sampling method is not appropriate for VOCs then results will likely be biased low and data will not be representative. See specific comments for further recommendations.
RGW				My only comment relating to the sampling procedure is to question why samples are only collected during the summer.
SCCD	SOP-1			NewFields employees are referenced twice within this SOP….. The contractor has not been determined yet?
SCCD	SOP-3			Newfields is referenced twice within the SOP
AS-JS	3.3	4C-7	4-12	EPA recommends that the Appendix specify that all new borings be logged continuously for lithology in accordance with USCS classifications.
AS-JS	3.3	4C-7	13-14	EPA recommends that monitoring well screen lengths should be minimized to the extent possible. Screens should ideally be <20' in length.
AS-JS	3.4	4C-8	16	EPA recommends that the text be modified to specify that any water added during the drilling process be accounted for and removed during development in addition to the required 10 casing volumes.
SCCD	SOP-12	page 1		First paragraph, starting with "Always sequence…" does not apply to this plan or the wells that will be sampled as part of this plan therefor should be removed. Sampling From Temporary Boreholes should also be removed as it is non applicable.
AS-JS	3.6.7	4C-19	35-37	If well materials appear to have oily or other residue, EPA recommends that all decon waters be containerized until proper disposal can be determined.
SCCD	SOP-12	page 2		Since this plan is calling for pumps to be installed in all wells, the method of bailing a well to purge should be removed.
SCCD	SOP-15			Newfields personnel is referenced within the SOP
SCCD	SOP-15			Ninth bullet: soil sampling (SOP-14) is not part of this plan.
SCCD	SOP-24			"With the exception of…" ms/msd samples should be added as they are to be done by the lab as part of this plan.
AS-JS	4C-1	SOP-11	1 of 1	EPA recommends that more detail be provided to this SOP.
AS-JS	4C-1	SOP-12	2 of 4	The groundwater sampling SOP only addresses purging via the well volume method. The SOP should also include low-flow or low-stress sampling as per Appendix 4C. The groundwater sampling SOP, including parameter stabilization requirements are recommended to more closely resemble those presented in Yeskis and Zavala (2002) http://www.epa.gov/superfund/remedytech/tsp/download/gw_sampling_guide.pdf
AS-JS	4C-1	SOP-15	1 of 2	The SOP states: "drilling mud or drilling solutions of any kind are not to be used during drilling activities in conjunction with monitoring well construction." EPA recommends that this be made consistent with the Appendix, main text of the FGMP, and if eliminated, needs to be adequately supported with why deviating from industry practice is acceptable in this instance.
SCCD	SOP-40			Newfields is referenced throughout the SOP
AS-JS	4C-1	SOP-18	1 of 2	EPA recommends that the volume of water removed should include any fluid lost to the formation or water added during the drilling of the boring.
AS-JS	4C-1	SOP-18	1 of 2	It should be noted that purging a well using compressed air may change the geochemistry of the groundwater in the surrounding formation.
AS-JS	4C-1	SOP-25		EPA recommends that all groundwater purge water be containerized until analytical results are received and proper disposal can be determined.
AS-JS	2.1	4D-3	27	Based on this bullet, is the SAP going to be developed in greater detail? EPA recommends that this be clarified, and if the SAP will be developed in greater detail, that specifics are provided on what portions will be expanded.
AS-JS	4.1	4D-24	7+	EPA recommends that assessment or checks of activities should be conducted by an individual that is not in the same organization as the completing party.
SCCD	2.5.1	4D-8	30	The field forms attached in Annex 4C-2 are specific to NewFields.
SCCD	SOP-9			Third paragraph: "Place probe the directly into the stream or well…" should be replaced with "Place the probe directly into the well" - surface water monitoring is not addressed within this plan therefor the reference to streams should be removed.
SCCD	SOP-11			Third bullet: surface water monitoring is not addressed within this plan therefor the reference to streams should be removed.

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SCCD	SOP-11			The 6th and 7th bullets should be removed, as they do not directly relate to sample filtration. They should be included in SOP-12.

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U-Q				The BLM definition of useable groundwater seems to be in question? QEP's understanding is that this has always been <10,000 ppm consistent with WOGCC requirements, and the FGMP and not >1,000 ppm as stated in several BLM comments throughout this process? 43 CFR 3162.5-2(d) states operators will "isolate fresh water-bearing and other useable water containing 5,000 ppm or less of dissolved solids..."
PKB				Surface spills and other PHC contamination mixtures can be assumed to be possible and reasonable sources to the shallow groundwater we all draw from for domestic and livestock wells.
RGW				My guess is that any serious contamination and impact will result from unforeseen circumstances. I have not seen in the plan any discussions or contingency plans concerning other scenarios that might happen.
DB	1.6.2.5	1-17	29	The proposed model states that *"Natural gas activities in the PAPA will not affect groundwater in or around the town of Pinedale."* Below is a partial quote by Dawn Ballou of Pinedale Online: (Original post, 11/10/14, http://www.pinedaleonline.com/news/2014/11/Leakcleanupcontinues.htm) "On Sunday, October 26th, a leak was reported seeping up from an underground pipeline corridor on the Mesa approximately two miles southwest of Pinedale." How does the Plan assure protection of groundwater in these events? This is very close to residential subdivisions. This was a relatively small surface incident, and theoretically these residents are "upgradient". Provide detailed geologic maps and structural cross sections (using well data) to assure these residents that they are protected from groundwater contaminants.
CK		3-1	2	**Please state here whether any practices are made enforceable <u>solely</u>** via approval of this Plan -- Is this section only a reference document / current compendium?
SCCD		3-6	15-17	SCCD staff have noticed numerous industrial water well heads that are equipped in a way to lock, but are not sealed. This is noticed for wells with and without pumps in place. This has been documented and reported on through field data log sheets, photos and annual reporting as required by the BLM. SCCD would strongly encourage that a more detailed BMP requirement be implemented to address this concern.
JB	3.5.1	3-7	4-14	Make sure all definitions are correct. Fresh water as defined by BLM <1,000 ppm, by WOGCC <10,000 mg/L. May want to clarify.
SCCD		3-6	22-24	It is unnecessary to require that sampling equipment (other than industrial-use dedicated pumps) be steam cleaned prior to installation as requirements set fourth in sec 4 adequately address proper cleaning of sampling equipment.
SCCD		3-6	34-37	Can there be discussion added about the sensitivity of the sensors of these systems? The LGS leak in the northern portion of the PAPA (2014) shows that a slower leak can occur undetected.
AS-JS	3.5.1	3-7	15-22	The depth at which waters >5,000 or 10,000 ppm TDS should be fairly well known given the number of wells drilled in the anticline. Are any waters below 2,500' bgs of "fresh water quality?" If so, why are oil-based muds allowed in those circumstances? EPA recommends that more universal casing requirements be set for the anticline and be explicitly detailed in the Plan.
MW for CURED	3.5.1			How does an operator determine: "beneath the depth of usable water" or the "depth below interval of fresh water"?
CK		3-9	3	**Please explicate "voluntary" here.** E.g., Regarding the Voluntary BMPs listed in Appendix 3-B, <u>all</u> operators <u>always</u> (voluntarily) follow these, as of --- date.
MW for CURED	3.6			It states here that produced water with low total dissolved solids can be applied to roads for dust suppression. Is there a specific TDS value that must be\ demonstrated?
SCCD	3-2	2.19, 2.1, 2.2	operator practice, operator mitigation measure	So does this mean that the BLM is going to require that any new water supply well (industrial) will be tested once completed and again after a pump is installed. Further does it mean that "Provide basis for continued water quality." imply that the well will undergo future sampling? if so, why is this not addressed within Plan?

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SCCD	3-2	2.26	operator practice	The term "bailer" implies the use of a specific sampling collection device that the district would recommend not be used for future sampling. Replacing with "device" would be better. (SAP does not address the sampling procedures of wells without dedicated pumps - it assumed all well have pumps in place.)
SCCD	3-3	3.6	operator practice, operator mitigation measure	Specification is needed on the type of sampling and documentation (soil samples?)
SCCD	10	2.1, 2.2	operator practice	See related comment IDs
SCCD	10	2.3	operator practice	Surface water could be effected before groundwater in this instance.
SCCD	11	2.6	operator practice	Surface water could be effected before groundwater in this instance.
SCCD	11	2.10	applicable rules/ reg language	See related comment IDs
SCCD	14	2.26	operator practice	See related comment ID
U-Q	3.7	3-12	17	There is no concluding section on this section? It just sort of ends?
AS-JS	3-1	1.20	Operator Practice	EPA recommends that the SPCC Plan provide information and procedures to enable an onsite person report a discharge. A copy of the reporting information and procedures with up to date phone numbers should be readily accessible onsite.
AS-JS	3-2	2.13	Operator Practice	EPA recommends that the plan detail the installation of double liners, the thickness of the liners, and the installation of leak detection systems.
U-Q	3-3	3.2 & 3.24	Operator Mitigation Measure	Minimize/avoid on-site storage of oil-based drilling mud. This isn't possible. Oil-based drilling mud is used to drill well sand will be present on site in quantities appropriate to use. Please reword this mitigation measure.
JB	3-3	3.3	OMM	Add a row that says 'Ensure placement of all casings and cement isolate or protect (usable or fresh??) groundwater?? Note: when we say GW, do we mean only usable GW or all GW, may need to specify what GW we need to protect so that we are not protecting all GW regardless of depth or quality.
JB	3-3	3.14	OMM	See above discussion on GW, are we referring to usable GW or all GW, of all GW or better quality?
U-Q	3-3	3.17	Operator Practice	"Remove oil-based fluids with vacuum truck." It is unclear why oil-based fluids would be in the mouse hole? This is an odd practice/statement and should be removed or reworded based on actual practice.
JB	3-3	3.21	OP	What do we mean by fresh water here?
AS-JS	3-3	3.24	Operator Practice	EPA recommends that the table define semi-closed and closed loop drilling systems.
AS-JS	3-3	3.21	Operator Practice	EPA recommends that the plan detail the use fresh or recycled water that meets applicable standards and is of equal to, or higher quality, than the water encountered during drilling.
U-Q	3-3	4.15	Operator Practice	"Produced water will be disposed of in a closed storage system…" - it is unclear what a closed storage system means here? Produced water should go to the LGS system. Please clarify.
U-Q	3-3	5.2	Operator Practice	Comply with SEO requirements for plugging and abandoning water wells prior to pit closure. Water wells are not likely to be abandoned in relation to pit closure. This statement is unclear as water well P&A's are not related to pit closures?
JB	15	3.3	OP	We may need to change this based on the OBM report and management decisions. Make sure all definitions are correct. Fresh water as defined by BLM <1,000 ppm, by WOGCC <10,000 mg/L. May want to clarify.

Reviewer	Section Number	Page Number	Line Number	Comment
JB				All screen shots make the dots bigger as they cannot be seen.
SCCD				There is very little discussion regarding water level data and specifically how the the data will be reviewed and ultimately used.
U-Q				QEP is not sure that this report adequately specifies who will manage the data? Is this the operator's responsibility?
JB	TOC	1-i	10 &12	U.S.' Bureau of Reclamation and Environmental Protection Agency to be consistent
U-Q	APD	1-v	NA	APD states Application for Permits to Drill, permits should not be plural
U-Q	WOGCC	1-vi	NA	WOGCC acronym is listed in the acronym table twice
U-Q	TOC	1-iii	40	The word Supplemental is misspelled in the list of tables for Table 4-4
JB	1.1	1-1	35-38	See above, do want to say that other operators will have to follow this document as part of the ROD?
U-Q	1.2	1-2	24	"Plan is organized" should be "Plan *are* organized"
DB	1.3.2	1-3	28-33	This paragraph states that "*Some recharge to the Wasatch Formation may occur in the PAPA".* Explain how this will affect the PAPA. The term "some" is not quantitative. The Plan should include discussion of how contaminants will be caught. Is it safe to presume that contaminants will be contained in small sand lenses or travel over time through shales?
JB	1.3.2	1-3	32	Check document to make sure Figures and Sections are bolded.
SCCD		1-4	5	The language of "drinking water sources" within the 2008 ROD implies that this is a factor that should be accounted for through the plan. Drinking water is also not adequately addressed within goals & objective even though its discussed in the ROD.
SCCD		1-4 / 1-5	40 / 7	Two different BLM documents defines usable water…. One says 1,000 ppm (1-4 line 40), the other 10,000 ppm (1-5 line7). Is this correct?
JB	1.4	1-4	16	Culminated' instead of culminating?
U-Q	1.4	1-4	16	culminating should be culminated
MW for CURED	1.4.2			This section should also include the Safe Drinking Water Act as a federal law that WDEQ enforces.
JB	1.4.2	1-5	29	authority' vs authorities?
U-Q	1.4.2	1-6	29	discharge should be discharging
MW for CURED	1.4.3			This section states that "EPA has given WDEQ primacy for regulating drinking water". I do not think that WY has primacy for the PWS Drinking Water Program.
JB	1.4.4	1-8	19	minimum' construction of water wells?
U-Q	1.4.5	1-8	37	In the following - "admission of polluting materials into and underground…" the word *and* should probably be the word "an"
U-Q	1.4.5	1-9	8	"application filed in accordance **with** WOGCC rules"
U-Q	1.4.5	1-9	9	two commas used after Section 1.0
JB	1.4.5	1-9	9	two commas after Section 1.0
U-Q	1.4.5	1-10	4	"shall be responsible **for** permitting"
U-Q	1.4.6.1	1-9	40	"polluting materials into and (any?) underground water supply"
MW for CURED	1.4.6.2			It should be stated that the USEPA must approve all aquifer exemptions.
JB	1.5	1-11	4-7	Do we want to include a reference to the amendment to the first admin plan?
U-Q	1.5.1	1-11	29	are should be were
AS-JS	1.6	1-12	30	It was EPA's understanding that the numerical model was not a requirement, but rather was a tool that the operators and contractor wanted to develop to assist with various aspects of the project. If this was the case, the Numerical Groundwater Modeling Report was not a document that fulfilled, or was required by, the ROD.
AS-JS	1.6	1-12		The EPA recommends that the March 2008 Hydrogeologic Conceptual Model (HCM) be included in the list of Previous Studies in Section 1.6. Also, EPA recommends that a brief summary of the general groundwater chemistry discussion (found in Section 7.5 of the HCM) be included somewhere in Section 1.6.

Reviewer	Section Number	Page Number	Line Number	Comment
U-Q	1.6	1-12	19	well at the beginning of this line should be plural "wells"
U-Q	1.6	1-12	24	Step 2 is *a* characterization - add the word "a" as in italics here
U-Q	1.6	1-12	25	Step 3 is *a* modification - add the word "a" as in italics here
U-Q	1.6.1	1-14	38	become should be became
AS-JS	1.6.1	1-14	27+	EPA recommends that groundwater budget statements be prefaced by stating that they are derived from the numerical model and thus are estimates.
U-Q	1.6.2.4	1-16	38	Replace "saltwater" with "produced water"
JB	1.6.3	1-19	5	documented' vs documents?
LB		1-20	20-22	The nature of the high-level detections, as well as the potential sources of the high-level detections, are not the focus of this report. Comment: The title of this report is, "Draft Groundwater Pollution Prevention, Monitoring and Response Action Plan." ALL LEVELS OF HUMAN-CAUSED POLLUTION ARE IMPORTANT TO THE WATERS AND WATER USERS OF the State of WYOMING. It would be completely irresponsible, contradictory, and more importantly illegal for BLM to exclude the reasons for, and responses to, existing, high levels of groundwater pollution on BLM-administered lands and BLM-approved leases. BLM must comply with the provisions of Section 313 of the Clean Water Act. This fact should be included in Section 1.4.1. **We strongly suggest that all instances of high-level water well hydrocarbon contamination within the BLM-approved Pinedale Anticline Natural Gas Field be identified, potential sources discussed, and a response plan be finalized.**
AS-JS	1.6.3.3	1-20	21-22	EPA recommends that this sentence be reworded; it appears to have been lifted from another report.
U-Q	1.6.3.6	1-21	25-26	Sentence that starts with "It is unknown why the chemical signature" does not make sense? Is some language or word missing? Line 26 states groundwater to change relative to the natural gas…?
LB		1-21	25-26	"It is unknown why the chemical signature of gas present in groundwater to change relative to the natural gas produced in the PAPA." Comment: This sentence makes no sense. **Please correct the syntax in this sentence.**
JB	1.6.3.6	1-21	25-26	Missing a word in this sentence: groundwater 'causes it' (?) to change?
SCCD		1-26 / 1-27	19-36 / 1-4	SCCD's dataset being lumped with independent data is not appropriate. Although the SAP that the district has been required to use does not include adequate directions for quality assurance, all effort is taken to ensure upmost accuracy of the data collected and managed by SCCD through in-house verification procedures that are documented. These associated documents are filed with other annual documents related to the program. Also, procedures specific to data collection protocol has been followed to the best of staff ability. Due to inadequacies of the current SAP, SCCD has made a number of attempts to have it amended to better address sampling protocol. These requests have been turned down which led SCCD to maintain an in-house sampling protocol manual that has been strictly followed by SCCD staff when possible. It would be beneficial to include language explaining the limitations associated with the SAP as it relates to the data rather than just the data its self. There is a high level of consistency with the SCCD dataset which should add to reason for use during future design making considerations.
JB	1.7.3	1-27	5-11	Is this still true based on the letter from DEQ that we should use the WOGCC RBDMS?
U-Q	1.7	1-27	10	UQ would prefer to simply state that a geodatabase that is importable into WOGCC's and WDEQ's databases will be used. The specifics of this database can be discussed in an implementation plan at a later date.
U-Q	1.7	1-27	12	UQ was not aware of an October 6, 2014 letter requesting that a geodatabase system be used. In discussions on January 15th, we now understand that this letter will be recinded. While UQ agrees that a geodatabase should be used, we would like to keep the language in this report generic, so that once a database is decided upon by WOGCC (that is in conformance with WDEQ) the Operators can decide on an appropriate database for their internal systems that will easily and appropriately upload data.
U-Q	Fig.1-2			Include the PAPA boundary on the State inset map
AS-JS	1-2	n/a	n/a	EPA recommends that major towns/cities be added to the location map.

Reviewer	Section Number	Page Number	Line Number	Comment
AS-JS	1-2 &1-3	n/a	n/a	These figures are not referenced in Section 1.
JB	1-4			Take Mark Thiesse's name off of the Review Team chart, he is no longer on the team
AS-JS	1-4			EPA recommends that a date be added to the Figure. Example: Current as of 1/6/2015
U-Q	Fig. 1-4			UQ feels that names should be left in this section, but questions whether this is forward looking or is to highlight contributors? If it is forward looking, titles may be more appropriate, but if it is intended to highlight contributors to this report and process, then names should be used. If names remain, replace "Ron LePlatt" with "Christy Woodward".
JB	2	2-1	2	Response 'Action' Plan
U-Q	2	2-1	24-26	Should this be a third bullet point?
JB		2-2	15	O2.2 Onshore Order #2 says ppm not mg/L so we might consider changing.
SCCD		2-2	15 (O2.2)	10,000 or 1,000?
AS-JS	3.2	3-2	40-42	Is the additional column added by Newfields the "project phase" column? EPA recommends that the Plan specifically identify the column by name.
JB	3.4	3-5	17	Some of the multi-well pads are 28-30 acres may want to check with operators on maximum size
AS-JS	3.7	3-11	36	Should *standards* be regulations?
U-Q	3.4	3-4	28	The SWPPP is then provided to BLM should state upon request. These documents can be provided to the BLM at any time if requested, but they are not automatically provided.
U-Q	3.4	3-5	17	Should update here from 20 to 30 acres.
U-Q	3.4	3-5	26	Remove the word *directed* from the following: "slight grade to provide for ~~directed~~ stormwater drainage."
U-Q	3.4	3-6	6	"Operators can shut-down pipeline *construction* at…."- the word construction should be changed to pipeline "*operation*".
U-Q	3.5.3	3-9	32	"disposed in permitted *deep* injection wells" - remove the word deep and just state "disposed of in permitted injection wells".
AS-JS	3-2	2.20	Operator Practice	Restrict grades 8-9%.....is this meant to read restrict grades to 8-9%?
JB	3-2	2.20	OP	Restrict grades 'to' 8-9%
U-Q	3-3	3.7	Operator Mitigation Measure	Provides both secondary containment for incidental leak or spill from fuel tank. The word "both" in this sentence doesn't make any sense.
U-Q	TOC	4-ii	7	The word Supplemental is misspelled in the list of tables for Table 4-4
JB	4.0	4-1	11	serves' rather than will serve?
JB	4.0	4-1	16-17	refer to Appendices rather than appended to this section if someone decides to print it out.
JB	4.2.1	4-2	5	What is involved in development? Are we just talking about drilling all the wells or something else?
JB	4.2.3	4-4	2	Put VSP and other model acronyms into acronyms table up front
CK	4.2.3.1	4-4	24	**Please clarify here whether the term "potential"** (sources or receptors) includes facilities, wells etc. which are **not yet built.**
JB	4.2.3.1	4-4	31-33	Explain why chloride was used or refer to numerical model as reference.
SCCD	4.2.3.1	4-5	1	Replace "White Horse" with "Wild Horse"

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD	4.2.3.2	4-5	35-40	The possibility of surface contamination from nearby well pads on the south side of the river (through vadose zone into alluvial) is not recognized as a potential source even though this would be a likely scenario. Locations chosen for the four monitoring wells RCE-08 through RCE-12 would also be suited for target depths where alluvial groundwater flow may be occurring. Contamination scenarios near these points (at the surface) could affect alluvial flow prior to affecting the deeper Wasatch HSU. A cost comparison could be done to determine the installation of two wells (one targeting alluvial - est 75 feet, and one targeting Wasatch - est 200) vs. installing one well with the capability of collecting samples from two different zones. The likelihood that a deeper target depth would result in artesian conditions, may lead to cost factors involved with the two different cost comparisons (typically it's much more cost effective to have one well vs. two, even with the additional components that would allow multiple independent sampling zones from within one casing.) Also see pg 4.8, line 16-17 for further argument.
AS-JS	4.2.3.3	4-6	6	The monitoring plan indicates that the four preexisting alluvial wells range in depth from 13 to 18 feet. EPA recommends that the plan present how the wells are screened, how the screened intervals compare to the depth to water and the thickness of the alluvium, and how those wells are appropriate give the data quality objectives.
U-Q	4.2.3.3	4-7	24	delete "is"
DH	4.2.3.4	4-7	31	state whether T-3 well/s are on WB 7-15 pad or not.
JB	4.3.1	4-9	8-10	fix spacing
JB	4.3.1	4-10	14-19	Are all of these wells simply monitoring wells or will they be constructed to ue used as water wells? If monitoring wells, say monitoring wells rather than just wells to identify. Not: it is very confusing to use the term 'wells'. Wells generally refers to gas wells not water or monitoring wells.
AS-JS	4.3.1	4-10	21-23	The section describes how all wells will be analyzed for core parameters, and a subset will be analyzed for both core and supplemental parameters. The section and Plan should be very explicit about which wells will be analyzed for what parameters and why. EPA recommends that a table be included that identifies each well and what groundwater will be analyzed for at each location. The same, or greater specificity should also be inserted into the SAP.
U-Q	4.3.2	4-11	2	Add sentence: According to the variance, the interim monitoring program performed by the SCCD serves as a Master Groundwater Monitoring Plan for the PAPA.
JB	4.4.1	4-12	2-3	Are you giving bromide as an example? If so, preface the statement with 'for example' or similar.
SCCD	4.4.1	4-11 thru 4-13	whole section	Using one absolute value for all the monitoring points does not allow for an appropriate "trigger action that is designed to prevent undesirable change" nor does it provide "for early detection of potential impacts". An example of this: the proposed threshold value is 214 mg/L for chloride. One of the particular water wells we have collected annual data from for 10 years has had chloride levels of either 1 or 2 mg/L. If the chloride level where to jump up to, say, 50 mg/L something is going on! But if the action level is set at 214, according to protocol, no notification is made and the well is just scheduled for annual sampling as usual the following year. There is historical data for 17 of the proposed sample points that "are representative of background conditions" (page 4-12, lines 10-11) - the use of developing a statistically significant trend for these wells from this data would allow for a quicker action to take place if needed.
SCCD	4.4.2	4-13	whole section	If SCCD collected data was used to help determine the absolute value thresholds (page 4-12, lines 10-11), then why can't the data set be used in determining statistically significant trend? This would allow for "early detection of potential impact". Also see Table 4-10, upper left box, 2nd paragraph.
SCCD	4.4.2	4-13	19-20	Table 4-1 states 4 sample rather than 6 - there needs to be consistancy through the plan.
U-Q	4.4.2	4-13	20	For future trend analysis, the six most recent data points will be used. Table 4-1, Step 3 column states that at least *four* samples have been collected then data will be statistically evaluated using the Mann-Kendal Method. Is it 6 samples or 4 samples? QEP would prefer 6 or more samples be used.
U-Q	4.6.1	4-15	8	QEP was not aware that data would be stored in the EDMS System? Can we get clarification on the database proposed for use? Is it readily available and in place? And who will manage the database? Operators?
U-Q	4.6.1	4-15	9	Operator's should be Operators'
U-Q	4.7	4-17	5	revised to read: "…prepared by the Operators' contractor for submittal…"

Reviewer	Section Number	Page Number	Line Number	Comment
AS-JS	4.7	4-17	8-24	EPA recommends that the Annual Summary Reports also include the following information or sections: Project background and CSM, monitoring network and schedule, a discussion of *graphical displays of parameter concentration vs. time for each well* in the text, plots of groundwater elevation vs. time, trend analyses and statistics calculations for analytes (discussion and plots) and boring logs for any wells installed and/or abandoned for *Supporting information appended to the report* .
JB	4.7	4-17	25-27	Is this still true based on the letter from DEQ that we should use the WOGCC RBDMS?
JB	4-1			On Figure 4-1 of the Plan, it might be useful to add groundwater flow directional arrows as shown on the HDG powerpoint. That might alleviate a lot of confusion about GW flow direction.
AS-JS	4-10		Box #2	(i.e., EPA, MCL) should read (i.e., EPA MCL) with no comma in between EPA and MCL.
JB	4-10			It seems like we need another box at the top above the reference for Table 1, Appendix K, that says 'constituent' on all these flow charts.
JB	4-10			After #3 Criteria NOT met, what happens next?
JB	4-11			It seems like we need another box at the top above the reference for Table 1, Appendix K, that says 'constituent' on all these flow charts.
JB	4-13			it seems like we need another box at the top above the reference for Table 1, Appendix K, that says 'constituent' on all these flow charts.
JB	4-1			Incorrect title
JB	4-1	Step 1		Do we need to state that the MP needs to be implemented in 2015 or that it will be implemented in 2015
JB	4-2			Title: 'Water' wells
GN	4-2			Under ownership surface management, 'County road ROW does not mean that the county owns the land or manages'.
AS-JS	4-2			EPA recommends that Table 4-2 contain well construction details. Well construction details would include information such as diameter of the casing, screened interval, and screen slot size. In addition, EPA recommends that the groundwater monitoring Plan include boring logs for wells included in the monitoring network. The inclusion of boring logs would allow for analysis of screened interval vs. depth to water and transmissive units. Such analysis may be necessary for future assessment of the hydrogeologic CSM, appropriateness of sample methodology, and depth discrete groundwater sample collection.
U-Q	4-4			The notes at the bottom are too small
AS-JS	4A-1			Critical well construction details are missing. For example, well diameter, screened interval, screen slot size, etc. EPA recommends that more well construction details be added to the table (See comment regarding Table 4-2).
AS-JS	4A-3			EPA recommends that water level contours be presented on the figure. In addition, EPA recommends that the Appendix present similar figures for both the north and south zones.
JB		4A-4	1-20	Describe or reference why chloride was used.
JB		4A-5-12		Screen Shots - would these more clear if numbered as figures or explanation for what was done.
U-Q		4A-5-12		I don't really understand these screenshots
JB		4A-13-16		Screen Shots - would these more clear if numbered as figures or explanation for what was done.
SCCD		4B-2	8-10	See related comment IDs
SCCD		4B-9	9-11	Wouldn't this be an adequate reason to use multiple thresholds, even individual thresholds for wells included in the plan?
JB	Outlier	4B-3	4-6	This sentence is confusing. Why are they parameters of concern (see p. 4B-2, lines 4-6). Not clear
U-Q		4B-6		Potassium, Re-plotted - remove "s" on 1 Outliers Remain
AS-JS	Results	4B-15 through 17	all	The y-axis should show the contaminant of concern.
U-Q		4B-15-17		The plot dots need to be larger
GN	4-C1			Under ownership surface management, 'County road ROW does not mean that the county owns the land or manages'.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD	4C-1			Of the 17 industrial well being retained, 5 of them did not have pumps in place the last time SCCD collected samples (2014). If pumps are going to be installed (page 4C-11), are depths going to be used as indicated within this table (presumably based on well completion logs?) Pump depths within this table are not necessarily ideal for collecting samples for monitoring purposes (at the bottom of screened section rather than at depths conducive of monitoring constituents. Two pump depths (Mesa 15-20 & Boulder 14-2) are below a screen portion of the casing (up to 300 ft below). See section 3.6.1 of the SAP, purging method 1 & SOP-12, page 3 ("The pump intake should be placed at the midpoint....")
SCCD	4C-2			Suggestion to change 6 deg C to <6 deg C or between 2 deg C and 6 deg C (water is most stable at 4 deg C)
AS-JS	4C-2	Well lithologic and completion log		EPA recommends that a field screening column be added to the boring log section (e.g. PID, sheen test, etc.).
U-Q	2.1	4C-2	27	"Groundwater encountered in three **of** the study wells"
DH	3.3	4c-6	31-35	state why casings are different.
SCCD	3.3	4C-6	33, 35	The proposed screen slot size may not be the best suited for the formation in which the wells will be located (same size being proposed for all new wells). Typically formations closest to river corridors will have courser material than those farther away which would effect the proper filter pack and screen size choices. (see SOP-15, page 2)
U-Q	3.3	4C-8	14	This sentence discusses meeting the safety requirements of the operators, but should also meet the requirements of the BLM and/or the surface owner(s)
SCCD	3.6	4C-11	26-27	WOGCC's SAP states that field personnel shall be "under the supervision of a state-licensed Professional Engineer or Professional Geologist *or other qualified professionals upon approval by the supervisor based on training and knowledge of standard industry practices* ." The secondary stipulation should also be included in this plan.
SCCD	3.6.1	4C-12	27-30	If the well owner would allow, it would make since to move the pump depth so that it is mid-point within the screen interval.
SCCD	3.6.2	4C-14	36-38	Some of the industrial-use wells included in the plan currently do not have a sample port and the rate of flow can not be controlled. Will operators be required to have a sample port installed?
SCCD	3.6.2	4C-14 / 4C-15	39 / 1	The presence of holding tanks, pressure tanks….aerators is highly unlikely for the wells proposed to be included in the plan.
SCCD	3.6.2	4C-15	20-22	More emphasis should be made for procedures to ensure no cross-contamination occurs. Saying gloves will be changed between sampling locations is not enough! This discussion could greatly be expanded on.
AS-JS	3.6.2	4C-15	5-7	Groundwater analyte sampling order should be VOCs, followed by SVOC compounds and then inorganics.
AS-JS	3.6.3	4C-16	26	In general, samples must be </= 4degrees C (the text it is also not consistent with SOP-4, which also states that sampled must be chilled to 4deg. C). EPA recommends that all text in the Plan and associated attachments be made consistent.
SCCD	3.6.3	4C-16	26-27	Include an option for an alternative to double bagged ice as long as temperature of samples can be maintained at <6. (SCCD has been successful using a combination of bagged ice with "ice blankets" that can be washed so they are re-usable.)
SCCD	3.6.6	4C-19	2-3	End-of-the-day calibration checks should be done regardless of whether or not calibration was done in the office or field.
AS-JS	3.6.8	4C-20	13	*Water source* should probably be monitoring well.
AS-JS	3.6.8	4C-20	19-21	EPA recommends that the SAP state that drill cuttings can be spread at the surface unless impacts are observed during the drilling process.
AS-JS	3.7.1	4C-21	5-27	EPA recommends that the text in the SAP and in other portions of the document be clarified regarding the frequency of trip blanks and the number of bottles collected per trip blank. The text may want to remove discussion regarding the number of bottles to avoid the impression that there will be two trip blank sets per shipment per day.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD	3.7.1	4C-21	15-16	If the sample collection time is labeled identical to the investigative sample, then it no longer becomes a "blind" sample. SCCD has had success using 00:00 or putting a line through the area used for writing the time down. (There are typically more than one actual sample set sent to the laboratory on a given day) This is dependent on the lab's data capabilities. Actual collection time is recorded on the field sampling sheets. When the lab data is entered into the database, the actual sample collection time is entered.
U-Q	3.7.1	4C-21	25-26	"Two trip blank vials per each daily set" but Table 4C-4 says "One trip blank bottle per daily set"
SCCD	3.7.1	4C-21	19-27	Trip blanks should be inspected to ensure there no head space within the vials. Trip blanks with head space should not be used.
SCCD	3.7.1	4C-21	33	There is no indication as to what parameters are to be analyzed for.
SCCD	3.7.1	4C-22	2-4	See related comment ID
SCCD	SOP-2			Direction of the decontamination area set up should be dependent on the location of potential for windborne contamination. Upwind may not always be the best choice.
SCCD	SOP-2			Last paragraph, dissolved water should be replaced with distilled water
SCCD	SOP-3			Language within this SAP does not apply to this specific plan (For example, the sample P3-TPI-SB-12, indicates the sample was collected in Pond 3 (P#), test pit number 1 (TP1), it was a subsurface soil sample (SB), and that was collected at 12 feet below ground).
SCCD	SOP-4			"4 C or less" is not consistent with requirements noted within the plan (<6 C).
SCCD	SOP-4			See related comment ID
U-Q	4C-1	SOP-4	1	4th bullet, 1st sentence is missing a word
AS-JS	4C-1	SOP-5	1 of 1	EPA recommends that double measurement be specified….i.e. once one reading has been noted, the probe should be lowered back into the water to ensure that the first measurement was within 0.01' of the second measurement.
SCCD	SOP-7			Instrument Calibration: the same language should be used as in section 3.6.6 of the SAP (pg 4C-18). There could be more than one sample event per day. Calibration can be done at the beginning of the day, and as needed during the day, with a calibration check at the end of the day.
SCCD	SOP-7			Field Measurement Procedure: along with rinsing the container or flow-through cell with sample water, the probe should also be rinse with sample water prior to inserting it into the sample water, not with distilled.
SCCD	SOP-7			Add the bullet point from SOP-8: "Note any problems…"
SCCD	SOP-7			Add "decontamination supplies (as necessary)" to the Equipment Needs
SCCD	SOP-8			Instrument Calibration: the same language should be used as in section 3.6.6 of the SAP (pg 4C-18). There could be more than one sample event per day. Calibration can be done at the beginning of the day, and as needed during the day, with a calibration check at the end of the day. Also, the field data generated from this plan will likely range between 6.5 and 10.5 therefore a two point calibration using 7.0 and 10.0 is sufficient.
SCCD	SOP-8			Field Measurement Procedure: along with rinsing the container or flow-through cell with sample water, the probe should also be rinse with sample water prior to inserting it into the sample water, not with distilled.
SCCD	SOP-8			Add "decontamination supplies (as necessary)" to the Equipment Needs
SCCD	SOP-8			Insert reference to SOP-2 in the last bullet point.
SCCD	SOP-9			When inspecting the membrane cap, it should also be verified that there are no bubbles present under the membrane. Also, "(does not apply if measurement uses and optical DO probe)" should be replaced with "does not apply if meter uses an optical DO probe)"
SCCD	SOP-9			Third paragraph: "Does not measure DO…" should be replaced with "Do not measure DO…"
SCCD	SOP-9			Add "decontamination supplies (as necessary)" to the Equipment Needs
SCCD	SOP-9			Add decontamination steps and the reference to SOP-2
U-Q	4C-1	SOP-9	1	3rd paragraph, 1st sentence, remove first "the"

Reviewer	Section Number	Page Number	Line Number	Comment
U-Q	4C-1	SOP-9	1	3rd paragraph, 2nd sentence, "Does" should be "Do"
U-Q	4C-1	SOP-10	1	4th bullet, remove "it"
SCCD	SOP-10			Instrument Calibration: the same language should be used as in section 3.6.6 of the SAP (pg 4C-18). There could be more than one sample event per day. Calibration can be done at the beginning of the day, and as needed during the day, with a calibration check at the end of the day.
SCCD	SOP-10			Take out 4th bullet point as its addressed in the last bullet point.
SCCD	SOP-10			Along with rinsing the container or flow-through cell with sample water, the probe should also be rinse with sample water prior to inserting it into the sample water, not with distilled.
SCCD	SOP-10			Add "decontamination supplies (as necessary)" to the Equipment Needs
SCCD	SOP-11			Eighth bullet: specify the reference of SOP-2
SCCD	SOP-11			Add "decontamination supplies (as necessary)" to the Equipment Needs
SCCD	SOP-12	page 1		There should be discussion about the use of gloves through the site visit. They should be changed as often as necessary to avoid any transfer of contamination.
SCCD	SOP-12	page 1		Well Purging, second paragraph, beginning with "If sampling…free product..." should be removed as it is non applicable to the wells being sampled as part of this plan. Also, remove "oil-interface probe from the Equipment Needs list.
SCCD	SOP-12	page 2		"The radius should be the radius of the well borehole…." is not consistent with language used in section 3.6.1 of the SAP (page 4C-13), nor is it consistent with WOGCC's monitoring requirements
SCCD	SOP-12	page 2		"To obtain a representative sample…" is not consistent with purging requirements described within section 3.6.1 of the SAP.
SCCD	SOP-12	page 2		Stabilization criteria is not consistent with language within section 3.6.1 of this plan.
SCCD	SOP-12	page 2		Ideally, water level should be monitored (and kept within a % minimal drawdown) throughout the purging procedure to ensure a well is not compromised by over purging. If this is done, there is no need to discuss the what-if of running a well dry. Also see page 3, 2nd paragraph ("Obtain the sample...")
SCCD	SOP-12	page 2		Collecting Groundwater Quality Samples: labeling requirements need to be consistent (see section 3.6.3 of SAP).
SCCD	SOP-12	page 3		"Obtain the sample from…" this language should be consistent with the Plan which does not include the use of bailers or hydrosleves.
SCCD	SOP-12	page 3		"When sampling a monitoring well..." Its not always possible to have pre-preserved bottles when sampling from industrial use wells as the pressure is sometimes too much causing over-fill of the bottles. This can also present an issue with the rate at which the VOA vials are filled.
SCCD	SOP-12	page 3		"When sampling a domestic well…" is not applicable with the currant proposed plan as none are included. If they were to be included, samples should never be collected from a hose. Also, the time of purging should be dependent on the individual well, rate of flow and field parameter reading rather than a 60 minute time for all.
SCCD	SOP-12			The table on this page needs to be consistent with Table 4C-2 (page 4C-9).
U-Q	4C-1	SOP-12	4	"in accorandance **with** SOP-04"
AS-JS	4C-1	SOP-12	3 of 4	As per the comment above, EPA recommends that the SOP more closely follow EPA guidance and recommend an analyte sampling order.
SCCD	SOP-15			Fifth bullet: language needs to be consistent with section 3.3 of the SAP (page 4C-7).
SCCD	SOP-15			seventh bullet: ??????????
U-Q	4C-1	SOP-15	1	4th bullet, "safety equipment required **for** drilling"
SCCD	SOP-18			A turbidity meter needs to be added to the Equipment Needs
SCCD	SOP-18			There should be discussion about not over developing the well (too much air pressure or force using surging techniques can cause damage to the filter pack and even the screens which could compromise the future use of the well's purpose.
SCCD	SOP-24			Second paragraph, last sentence: "…during transport to the lab." should be changed to "during transport to and from the lab."
SCCD	SOP-24			Within the table Most Common QC Samples, Field Blanks are not part of the SAP and should be removed.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD	SOP-24			"Typical CQ sample collection… Consult the SAP..." this just needs be consistent with the SAP.
SCCD	SOP-24			"Typical CQ sample collection…" replace "Each field crew leader" with "Each field team leader" to be consistent with language used within the plan.
SCCD	SOP-24			The table on page 2 needs to be consistent with Table 4C-4 within section 3.7.1 of the SAP (page 4C-21) - Equipment blanks, 1 per 20 rather than 1 per sampling event; Field blanks are not part of the SAP; Trip blanks should be 1 set per shipment as there could be more than one sample set within a cooler.
SCCD	SOP-25			Soil: much of this is not applicable to this plan ("Whenever possible… excavated" "Alternatively, project …. anticipated contaminate concentrations.")
SCCD	SOP-25			Groundwater: "A drum should be dedicated to each well sampled…" is not necessary as the wells being included in this plan are not anticipated to have contaminants that cannot be discharged onto the surface.
SCCD	SOP-41	page 1		First paragraph, last sentence: this isn't applicable to this plan.
SCCD	SOP-41	page 1		Collect Sample For Dissolved Gases, first sentence is not necessary to include (also not necessary to include SOP-12 under Equipment Needs)
SCCD	SOP-41	page 1		"Submerge the … Monitor the time…." remove "Monitor the time to" unless one is going to calculate the time it actually would take to flush the container. This action is really at the discretion of the sampler as onc can't actually see when the container has been flushed.
SCCD	SOP-41	page 1		"Slowly remove …" the cap should be placed on the sample bottle quickly. The longer the bottle is held under water without the cap (after the tube is taken out) the more that interaction can take place with the sample and the water within the bucket.
SCCD	SOP-41	page 2		"Label each sample…." again, this needs to be consistent with language within the SAP and other SOPs.
SCCD	SOP-42	page 1		Much of the language within this SOP is not applicable to this plan (collecting gas samples, sampling a well with a bailer or other grab sampler).
SCCD	SOP-42	page 1		The Goal and Objective is for SOP-41, replace with appropriate goal and objective
SCCD	SOP-42	page 2		There is little discussion about procedures for discharging nitrogen or other inert gases - this should be elaborated on or there should be a separate SOP dedicated to these procedures. This can also be taken out entirely as its not a likely procedure if all wells are to have pumps in place.
SCCD	SOP-42	page 2		Depth to water measurements shouldn't be taken after a well is sampled….. Is there a safety issue with using a sonic water level meter when combustible gasses are present?
SCCD	4D-3			<6 C rather than 6 C
SCCD	2.1	4D-5	32-33	replacing "Operators, BLM and the Project QA Officer" with "Project Manager" would make more sense.
SCCD	2.5.1	4D-8	29	Insert "with" in accordance the SAP.
SCCD	2.5.1	4D-8	34	Replace "field team's lead investigator" with "field team leader"
SCCD	3.4	4D-13 / 4D-16	29-36 / 1-8	Paragraph is repeated
SCCD	3.5.1.2	4D-18	9	Use same language as 3.7.1 (4C-20)
AS-JS	3.5.1.3	4D-18	28-29	EPA recommends that language regarding trip blanks be consistent across the Plan sections, appendices, and attachments.
SCCD	3.7	4D-21	17	Language should be consistent with 3.6.6 (4C-19). A calibration check at the end of the day is appropriate rather than actual calibration.
SCCD	3.9.1.2	4D-22	29-30	Any manually entered transcriptions should be 100% verified not 10%.
SCCD	3.9.1.4	4D-23	whole section	Forms for the documentation process should be included within the plan.
SCCD	5.1	4D-27	13	20 percent is high….. A better target would be 10 or even 5. (duplicate results from energy labs are rarely over 5). Labs typically shoot for better than 10.
DLD	Fig D-1			This is a good graphic to show the structure. However, given the likely length of time that this document will be active and the potential number of personnel changes, is this the place to have specific names in a graphic or would titles and a regularly reviewed sub appendix that references the titles in text format be more efficient?
SCCD	needed			There needs to be a SOP dedicated to collecting a turbidity measurement.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD	all SOPs			use just one term: "deionized" or "distilled" water throughout SOPs
DH	5	general	several	Provide more info on who makes up TEAMS, Review Team, Working Group.
U-Q	5.1			Consistent with previous comments, well owner should hold responsibility for notification of DEQ of a well with an exceedance of a groundwater standard. Revise accordingly.
JB	5.2.1	5-2	11-2	Will members remain the same or just agency representatives?
U-Q	5.2.4	5-4	26-28	revise to read: "…"If the Review Team determines that an existing BMP needs to be revised, or suggests a new BMP is required, and the revision or addition of the BMP is scientifically justified and within the confines of regulatory requirements, a working Group will be established. Once the Review Team collaboratively determines that such revision or addition is scientifically justified, the Operators will lead the change effort by preparing a work plan (**Figure 5-1**)."
U-Q	5.2.5	5-4	39	Well owners should be held respondible for notifying DEQ in the case that there is an exceedence of a groundwater standard in their well. Sentence should therefore be revised to read: "…notify the well owner, who will notify DEQ of the occurence. The well owner will also inform the BLM Project Lead that DEQ has been notified." Note that this change will also require of the table on page 5-6, and Figure 5.1.
U-Q	5.3	5-5	21	Break bullet into two separate bullets. 1st bullet: Changes to operators. 2nd bullet: Changes to natural gas operations in the PAPA, including current and future development status of resource.
AS-JS	5.3	5-6	1	The table does not appear to agree with Figure 5-1. For example, for condition #1, the table indicates that the working group will prepare a work Plan to investigate cause of threshold exceedance and that the operators will review and accept work plan. In contrast, figure 5-1 says the operators prepare work Plan for working group review; BLM and DEQ approve work Plan. The later case should be the correct order/procedure. EPA recommends that the tables and figures be made consistent.
U-Q	5.3	5-6	Table	Move table to end of section (just prior to references).
U-Q	5.3	5-6	Table Line 2	Per the previous comment, the well owner should be the "Responsible Party." "Who Notified" should be the BLM Project Lead, DEQ and Review Team.
U-Q	5.3	5-6	Table, Condition #3, Line item #1	Revise to read: "Prepare Work Plan to Revise Groundwater Pollution Prevention Practices in response to scientifically justified evidence."
U-Q	5.3	5-7	14	Will we be using EDMS? If not, how will data be collected and monitored?
SCCD	3.9	4D-21	29-30	Data gathered during previous monitoring is already in the EDMS right?

Reviewer	Section Number	Page Number	Line Number	Comment
JH				I don't think I have any questions regarding the plan, nor do I plan to provide any comments relative to the overall draft GW Monitoring Plan. I think everyone involved should be proud of the product that has been assembled.
SCCD				There is little emphisis on disposal facilities.
MLW				I know projects need funding. However, when I look at the cover sheet for this document and see the logos of gas companies a red flag goes off in my head, and I wonder if my interests as an ordinary citizen are being best served.
MLW				The issue of dissolved methane appears to not be addressed in the plan.
PKB				The entire PAPA project has suffered from the fact that NO predevelopment baseline information was collected. The project to protect water is already starting late, after the field development began.
PKB				A major concern of mine is the potential for surface waters to be polluted and then entered into the ground water sources over time. Sublette County has been in a drought for the past decade at least so surface to ground water perculation has been probably slow. Recent drought conditions since the main development of the field since 2000 may hide or mask the normal long-term trends in ground water recharge that will occur over decades in the future.
PKB				What are the impacts of natural gas PHC sources that are airborne on the field in the potential for their accumulation on the surface soils in the PAPA and then movement into surface water run-off and groundwater infiltration?
RGW				I do not see any mention of what happens during periods of heavy runoff of surface water from sudden snow melt or flash floods. Much of the water would immediately rush down the drainages, some of which are partially sealed by fine grained clay deposits, but a lot would move laterally through Holocene and Quaternary gravels along and on top of silt lenses and caliche caps. It would also move in the upper parts of the Wasatch along the impervious beds before filtering downward to the saturation zone. All of this water movement would follow the topography
MW for CURED				A map that depicts the major potential sources of contaminants of concern, including liquidgathering facilities, natural gas pads, pipelines, wastewater disposal facilities and pre-1984 gas wells, should be included as a Figure.
MW for CURED				There is no discussion in this report re: construction and development of proposed new monitoring wells. A section should be added {or referenced if found in another document) that provides details on well construction (drilling method, well diameter, screened interval lengths, casing material, annulus cementing, etc).
MW for CURED				All new monitoring wells should be sampled and analyzed for stable water isotopes (deuterium, 180, tritium) and carbon isotopes of methane.
TG				I would prefer to continue the program of subsurface water analysis on the Pinedale Resource Area for one more year until the PRMA has the blessing of the EPA release of their Air Quality Program (attainment) it would seem premature to decrease the program at this time. Quantity and Quality of both air and water both have their health consequences. Operators are not financially hurt with low prices since most have probably dated contracts. Other areas are looking to Pinedale for oversight.
JB	1	1-1	19-24	Do we want to say anything about Linn's involvement?
AS-JS	1.3	1-3	28+	A more detailed discussion of depositional environment is recommended to support the range of GW velocities.
KC	1.4			Sublette County Conservation District is not identified in this section as an agency involved in protecting groundwater resources despite being the primary source of the data provided for in this Draft Plan. Wyoming Conservation Districts have the broad statutory authority to assist, promote, and protect public lands and natural resources, soil, water, and wildlife resources, to develop water and to prevent floods, and to provide for the public safety, health, and welfare of its citizens. Wyo. Stat. §11- 16-103. Consistent with this authority, one of SCCD's policies in its Land Use Plan is: "The quality and quantity of water shall not be reduced below current levels." SCCD has been involved with monitoring the groundwater since 2004 and the data it has collected has been relied upon by BLM in its hydrogeologic characterization studies and in preparing this Draft Plan. Please revise Section 1.4 to include SCCD.

Reviewer	Section Number	Page Number	Line Number	Comment
JB	1.6.2.1	1-15	18-35	Repetition of discussion under 1.6.1, p. 1-13, lines 31-38
KC	1.6.3.8	1-22 / 1-23	37-39 / 30-32	These two statements appear to be inconsistent. On the one hand SCCD data is not consistent, and then on the other, it is consistent. Both statements reference organic constituents and yet the Draft Plan appears to draw a starkly different conclusion between statements. Please clarify and revise.
MJK	1.6.3.9	1-24	30 & 31	Ongoing Ground water monitoring will help identify potential changes to ground water conditions in the future. A very important concept to keep in mind when establishing the goal of the Groundwater Monitoring Progam described in Section 2.0
AS-JS	1-1	n/a	n/a	The flow diagram presented in the figure is not intuitive. EPA recommends that a more traditional box-type flow diagram be used.
DLD	Fig. 1-1			Consider briefly refferencing later chapters and/or flow charts from this graphic as more detailed explanations. This is a good general conceptual model of the procedure that could be used to guide readers into the depths of the document.
DLD	Fig 1-1			The statment, "BLM Review Team Determines Next Step, " makes a rather abrupt end to the process. Consider changing this to, 'BLM Review Team adjusts Pollution Prevention and Groundwater Monitoring plans to address issues,' or something similar and adding a split arrow back to both programs.
JB	1-2			Use black font in pink PAPA, hard to read the white lettering
DH	1 2			E. Fork River not shown on Fig. 1-2.
SCCD		1-25	26-28	Didn't the geodatabase that was created by AMEC beginning in 2009 also include data gathered by third party contractors as part of DEQ requirements? See page 1-26, line18.
KC		1-26 / 1-27	28-36 / 1	This statement is entirely unjustified. SCCD developed its current monitoring plan in close coordination with a BLM task group representing public interests, operators, and agencies as well as Wyoming Department of Environmental Quality. Thus, any real or manufactured uncertainty as to procedures, reliability, or methodology regarding development of the data should be resolved in favor of the SCCD and its partners in developing the data. Even though steps to "verify" the data are not needed, those steps are ultimately the responsibility of the authors of this report. It is also unclear why the Draft Plan draws issue with Method 8021 when the 2013 SCCD Annual Groundwater Report plainly states that both Method 8021 and 8260 were used. See 2013 Annual Report, at 6. Finally, the 2008 Record of Decision Final Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project explicitly states that groundwater monitoring and mitigation is the responsibility of BLM and the Operators and who have contracted with SCCD to provide monitoring data, see 2008 ROD at 29, and this data will be "augmented by results obtained from the activities described below." Id. Thus, by the controlling ROD, the Draft Plan may not summarily discard the resource management plan for the PAPA. See 43 C.F.R. §1610.5-3; 43 U.S.C. §1732(a); Norton v. S. Utah Wilderness Alliance, 542 U.S. 55, 67-72 (2004). As such, we request that this paragraph be removed entirely from the Draft Plan and the authors comply with the 2008 PAPA ROD.
AS-JS	2.0	2-1	8	Based on the lack of reference in Section 1, Figure 1-4 may be better suited to Section 2 (i.e. Figure 2-*).
LB	2	2-2	10-14	"The GMP has 10 specific objectives", none of which consider groundwater quantity impacts from oil and gas activities. Yet, groundwater quantity is currently one of the most discussed and alarming subjects among all states in the Colorado River Compact. BLM, and other state and federal agencies, have failed to correctly analyze and predict the actual amount of water that was considered necessary to develop the PA, the amount of which will continue to increase as natural gas and oil development continues. **We strongly suggest that all agencies re-consider the amount of water that was analyzed and approved in the EIS ROD, and compare that to what has actually been used, per BLM, operators' and WOGCC records and reports, including fresh well water and produced groundwater. (See Illustration 4: to be updated)**

Reviewer	Section Number	Page Number	Line Number	Comment
LB				**Illustration 4 (to be updated)** Upper Green River Alliance P.O. Box 994 Pinedale, Wyoming * 82941 307-367-3670 * linda@uppergreen.org www.uppergreen.org **Comparison of Projected vs. Actual Impacts to Water Quantity & Water Quality in the Pinedale Anticline Natural Gas Field, Sublette County, Wyoming** **Water Quantity** Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Projected quantity of "produced" water that would be withdrawn from aquifers — Unknown / not analyzed Actual Impacts — Actual quantity of "produced" water withdrawn on the Anticline thru 1/14[i] — **5,716,668,888** gallons Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Projected quantity of fresh water required for PA development analyzed in EIS[ii] — 20,000-40,000 bbls per gas well Actual Impacts — Actual quantity fresh water used in 2012 by Anticline operators Ultra, Shell, and QEP[iii] — **232,316** bbls per gas well Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Projected quantity of "produced" water that would be injected into aquifers — Unknown / not analyzed Actual Impacts — Actual quantity of "produced" water injected into aquifers beneath the Anticline as of 1/14[iv] — **3,015,437,922** gallons Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Projected number of injection wells analyzed in Anticline EIS[v] — 5 Actual Impacts — Actual Number of Anticline injection wells in 2013[vi] — **21** Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Projected annual quantity of groundwater use analyzed in Anticline EIS[vii] — 100 acre-feet Actual Impacts — Actual annual quantity groundwater used in Anticline ('05-'13) — **1,837** acre-feet Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Estimated quantity of water contained in the Wasatch aquifer (ibid) — >10,000 acre-feet Actual Impacts — Actual quantity produced and fresh water withdrawn from Wasatch & other aquifers — **17,536** total ac.ft. "produced" water; **566** ac.ft. fresh (2011-2012 only). **Total Acre Feet: 18,102** 1 **Water Quality** Pinedale Anticline Environmental Impact Statement Analyzed Impacts — Projected number of water supply wells analyzed in PA EIS that would potentially be impacted by hydrocarbon contamination — Unknown / not analyzed Actual Impacts — Actual number of water supply wells impacted by hydrocarbon contamination in the Anticline — **88+** Pinedale Anticline Environmental Impact Statement Analyzed Impacts — SEIS analysis of groundwater quality in the Wasatch aquifer[viii] — Class I (suitable for domestic use) to Class III (suitable for stock use) Actual Impacts — Current analysis of groundwater quality in the Wasatch aquifer — ? [i] http://wogcc.state.wy.us/ Choose: (Field); (Click "Wyoming Cowboy" to Search); (In "Enter Field Name" type "Pinedale", click on "Pinedale"); (Go Find); (Display Field Production) [ii] http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/anticline/feis_Par.86060.File.dat/06chap3.pdf and http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/anticline/feis_Par.64415.File.dat/08App07.pdf [iii] http://www.blm.gov/pgdata/etc/medialib/blm/wy/field-offices/pinedale/papadocs/apm_air_water_socio.Par.31221.File.dat/USQWater.pdf [iv] Source: http://wogcc.state.wy.us/ Click on "Injection"; Click on cowboy next to "All Disposal Wells"; Magnify window to 200% to see locations. Click on red dots to see disposal wells at each location; Click on API number to see well records; Click on "Production/Injection". Click on "Table" to see injection totals by year (not summed). [v] http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/anticline/feis_Par.86060.File.dat/06chap3.pdf p.3-104 [vi] www.wogcc.state.wy.us [vii] http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/anticline/feis_Par.93246.File.dat/20App19.pdf p.19-5 [viii] http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/anticline/feis_Par.86060.File.dat/06chap3.pdf p.3-86 2
JB	3.5.1	3-7	24-29	Can we definitely say that OBMs are not in contact with fresh groundwater? We may need to alter this sentence.
AS-JS	3.5.2	3-8	3-6	EPA recommends that the Plan clarify whether cement is forced from the base of intermediate casing to the bottom of the surface casing.
AS-JS	3.5.3	3-9	28+	EPA recommends that the Plan provide more detail regarding how the "Flowback fluid" is collected and recovered.
AS-JS	3.7	3-12	10	Is there any process/procedure to more thoroughly clean out pipelines? It seems like residual oil or gas might be left in place if the pipeline isn't flushed. Residual materials left in low points might eventually leak out due to corrosion and impact soil and/or groundwater. EPA recommends that the process be more thoroughly detailed to ensure that future leaks due to corrosion and residual oil leaks are eliminated.
JB		AECOM Memo		There are two references to the FGMP in memo, may want to footnote the name change.
CK	4.2.3.1	4-4	23	**Please add here / reference a new Figure** depicting 1) the 41 proposed monitoring wells, 2) the potentiometric topo lines, and 3) all identified potential "sources" including well pads and facilities, centralized liquid gathering system (LGS) facilities, LGS pipelines, and injection wells.
U-Q	4.2.3.4	4-7	General	The South Zone is different from the North Zone in some key ways that are not accounted for is this approach. In addition to differences in the topography, subsurface characteristics and aquifer prioritization, this area has some key differences from a development perspective. It contains a less-dense network of gas wells, due in part in differences in WOGCC spacing requirements (5 acre spacing in the north and spacing as high as 40 acre spacing in the south). A monitoring well network should be developed for the south zone in consideration of these factors, and it is likely that the south zone network will be less dense than the network currently proposed.
KC	4.4.1	4-12	9-13	The Coalition appreciates the use of data collected by the SCCD over the past decade under the current monitoring plan to determine the absolute value thresholds. See Appendix 4-B, Technical Memorandum at 2. This baseline data is invaluable in developing a threshold value for the groundwater quality in the PAPA. The use of this historical data to define the threshold will ensure the earliest possible detection of any change in the water quality. This data should also be used to determine the statistically significant trend.

Reviewer	Section Number	Page Number	Line Number	Comment
AS-JS	4.4.1	4-11 to 4-12	39-2	EPA recommends that EPA's Regional Screening Levels for residential tap water (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm) also be considered when applicable in the determination or selection of absolute value thresholds for those constituents that do not have a MCL, DEQ groundwater standard, VRP cleanup level, or WOGCC action and notification level. Regional Screening Levels (RSLs) are a purely risk-based number and would ensure the use of a trigger that is protective of human health.
JB	4.4.2	4-13	12-23	Can we mention that Singh reviewed the process and we concurred or was that simply a review/comment issue?
JB	4.4.2	4-13	19-23	I remember this discussion at Sep 25th meeting, do these 6 samples have to be taken at the regularly scheduled annual sampling or can they include resampling?
SCCD	4-1			Under step 5, 2nd & 3rd bullet. Who's to say the second sample is correct over the first? Also, is the whole core list analyzed for of just the parameter in question? If there is a discrepancy between the first and second sample, a third should be taken (of just the parameter of concern) for final confirmation.
JB	4.7	4-16	26-33	When you speak of interactive web application, are you referencing the RBDMS? I was not aware that an interactive web site would be part of this MP.
SCCD	4.9	4-18 / 4-19	34-35 / 1-2	Does this apply to industrial use wells being used as monitoring points for this plan? Currently they are not secured with watertight caps.
MJK	4-6			This shows several Monitoring wells along the river near the wetlands in the River Corridor Envelope
JB	4-1			Yellow for the DA-1 through DA-5 is hard to see against the background (fix figures in appendices as well)
JB	4-2			See above
SCCD	4-10			Upper right hand box: what is the reasoning for not including WOGCC bacterial testing? The included 17 industrial wells could have some level of bacterial impacts that could impact a well integrity.
AS-JS	4-10		Final box	Based on this figure, if a State or Federal standard is exceeded, but that constituent is not considered to travel conservatively with respect to groundwater velocity, then no further action will be taken. EPA recommends that the figure be clarified (i.e. if a state or federal standard is exceeded, action should be taken).
JB	4-10			The white lettering is hard to read against some of the backgrounds, especially the light gray on all these flow charts
JB	4-10			On the first NO, what happens after this box?
JB	4-11			See comments above on layout and colors, again hard to read white lettering, esp on light gray background unless it is bolded.
JB	4-11			Last box, do you mean that there is no sampling required for the list below?
DLD	Fig 4-12			"After sampling, has one of the following Thresholds been reached? in the document. Consider referencing back to specific sections of the text at appropriate locations in this and other charts e.g. Actual concentration value exceeds standards (section 4.4.1, Appendix 4B) Statistically significant increase (section 4.4.2).
JB	4-12			Again, white lettering hard to read, esp against light gray
JB	4-13			See previous comments on white lettering and layout
DH	4 13			chloride & TDS have WDEQ, WQ, Chapter 8 MCL; note why not included.
JB	4-1			would it help to number the paragraphs within each step?
JB	4-1	Step 5	3	Again, I am questioning how much effort we put into investigating the cause of an exceedence. We got into trouble with the ROD by saying that we would investigate all potential sources of contamination. What is our limit or will this be established by the RAP?
DH	4-4			Strontium 90 (total) in Chapter 8 WDEQ, WQ, Chapter 8 = 8 pCi/L; should you include it too.
AS-JS	n/a	4A-1	2-20	EPA recommends that there be a discussion regarding verification of the general hydrogeologic and contaminant transport CSM.
JB	Spatial	4B-13	1-9	I am confused as to where these data area coming from.
SCCD	4C-1			The format of the northing & easting coordinates are not a common format.
SCCD	4C-1			Within the "reported depth to water" and "screen interval" column, there are a number of "NA" entries that should likely be UNK as these would be depths unknown because they will be decided on in the field as the well is being installed.

Reviewer	Section Number	Page Number	Line Number	Comment
JB	3.3	4C-6	21-27	Are these to be drilled strictly as monitoring wells or can they be completed as water supply wells to be used after the moratorium is lifted? If they are completed as water supply wells, the construction must meet minimum SEO standards and p. 11 of the operator practices matrices under construction of water supply wells.
AS-JS	3.3	4C-6 to 7	28 to 3	EPA recommends that the Appendix include a table that details each new monitoring well and its proposed well construction details.
AS-JS	3.6	4C-12	3	EPA recommends that the core parameters should be included in the notification scheme.
JB	4C-1			White lettering difficult to read on anticline, add cities and highways
AS-JS	4C-1		GMPN-01	The casing type for the new monitoring well in the north zone is identified as steel. Casing should be stainless steel to avoid oxidation.
AS-JS	4C-3	Well completion logs		EPA recommends that well construction details be added to the Annex.
SCCD	3.6.1	4C-13	2	Minimal drawdown is best to monitor based on a percentage (screen columnd depth / water column depth) rather than a given "<.3 foot" for all wells approach.
SCCD	3.6.1	4C-13	24-29	Based on SCCD field staff experience the stabilization criteria proposed is not necessarily adequate. Temperature and specific conductance criteria are very loose compared to the pH criteria. Both the temperature and specific conductance typically are within 1 to 3 percent by the time pH is within +/- .2 units. Also, within SCCD's dataset there are numerous sample events that have indicated to staff that even after field parameters have stabilized and at least 3 casing volumes have been purged, water being extracted may not be 100% representative of formation water. Example 1) When sampling industrial wells in particular, stabilization can occur within 15 minuets (3 minute intervals) and stay stabilized for 2 to 4 more readings (3 casing volumes (water column) sometimes are also purged within or shortly after 15 minutes). Then the field parameters will indicate a change, presumably at this point, indicating the likelihood that a higher % of formation water is being pumped and the stagnate casing water has been purged. Example 2) See SCCD bi-annual report, 2010 that includes data collected during the 2009 field season. Within the summary is a short field explanation for well, AD238. Field data and subsequent lab analysis indicated that both volume and field parameter stabilization criteria were not effective for determining when a well was sufficiently purged.
SCCD	3.6.3	4C-16	40-41	Many labs are using temperature guns to record the receiving temperature of samples. Are temperature blanks really necessary?
SCCD	SOP-1			A GPS unit should be added to the equipment needs, as well as 'equipment as is appropriate for the purpose of the site visit'
SCCD	SOP-2			Rinsing with dilute nitric acids or methanol should be as appropriate and not necessarily all the time.
SCCD	SOP-5			SOP-6 (measuring thickness of free product in the well) is not included within this plan / non applicable
SCCD	2.1	4D-3	27-30	The first two responsibilities have already been done by NewFields
SCCD	2.1	4D-3…	whole section	Can the same person fill more than one role. Total workload for 41 wells does not justify staffing as shown in figure 4D-1 (depending on the contractor; a small scale contractor could not afford this….. Unless operators are willing to pay more).
JB	5.2.2	5-2	19-23	See comment #63 on the 6 sampling events (annual or will resampling count towards the 6?)
U-Q	5.2.2	5-3	1	States that four quarters of monitoring will be used with the absolute value threshold for dissolved methane. QEP would suggest making this 6 quarters of monitoring to be consistent with the Mann-Kendal test if appropriate?
JB	5.2.2	5-3	1-5	Again, how far do we go in determining the cause?
JB	5.2.4	5-4	3-10	See above, what if the exact cause cannot be determined? How much effort is put into finding it?
U-Q	5.3	5-6	1	For Condition No. 1 it states that threshold exceedances will be confirmed by quarterly monitoring, can we state here that it will be 6 quarters?
JB	5-1			There seem to be arrows missing going to the left and right columns below the green stripe.
DLD	Fig 5-1			As with the figures in Chapter 4, consider refferencing back to sections within the text.

Reviewer	Section Number	Page Number	Line Number	Comment
AS-JS				The plan contains little or no discussion of groundwater or solute transport velocities in relation to monitoring frequency. This is of greatest concern in the RCE, where groundwater velocities have the potential to be very high. Monitoring must be frequent enough to catch potential releases before they reach receptors. In addition, it may be beneficial to include additional analytes to provide early warning of changes in groundwater chemistry that may indicate a release. See specific comments for further recommendations.
AS-JS	4.2.3.2	4-5	35+	Significant areas of high priority aquifers are located in the RCE along the New Fork and East New Fork Rivers as shown in Figure 4-2. There potentially could be rapid changes in alluvial ground water due to ground water or surface water impacts. Given the alluvial wells shallow depth and higher conductivity, consideration should be given to sampling the alluvial wells more frequently than annually if groundwater velocities suggest that spills in the alluvium might reach receptors more quickly than 365 days. Another recommendation is to consider collecting common water chemistry parameters (major ions) to identify shifts in water quality like mixing of saline and potable water. Trilinear/Piper or Stiff diagrams are good visual tools to show changes in relative concentrations of major ions of TDS composition. Diagrams could be used as environmental indicators for rapid screening or early identification of ionic changes and possible mixing of waters. One response action maybe to increase sampling frequency and add monitoring wells to area.
AS-JS	4.3.2	4-11	6-12	The discussion/consideration of monitoring frequency should also take into account the potential time a release may take to reach receptors. EPA recommends that the section discuss potential groundwater and solute travel times in the RCE and north and south areas in relation to monitoring frequency to ensure that the monitoring frequency is adequate to protect receptors in case of a release

Reviewer	Section Number	Page Number	Line Number	Comment
AS-JS	3-2	2.26	Operator Practice	EPA recommends that the table provide enough detail to ensure that the sampling method is applicable to length of screen, lithology/hydrogeology, and analytes of interest. In general, bailers should not be used to sample groundwater for VOCs.
AS-JS	3.6	4C-11	13	EPA recommends that the Appendix identify what kind of pumps are used in the industrial water supply wells. It is likely that pumps used for water supply wells will not be acceptable for the collection of VOCs.
AS-JS	3.6	4C-11	22	EPA recommends that the Appendix detail that the intake of the well should be at the middle of the screened interval, or opposite the zone most likely to be contaminated by a release.
AS-JS	3.6	4C-11	17	Any electric submersible pumps used need to be acceptable for sampling VOCs.
AS-JS	4C-1	SOP-12	2 of 4	EPA recommends that groundwater sampling pumps proposed for use in the anticline be assessed to ensure that they do not affect the geochemistry, physical parameters, or increase turbidity (see Yeskis and Zavala above).

Reviewer	Section Number	Page Number	Line Number	Comment
U-Q				Generally speaking, it would be beneficial to include an end statement to the monitoring on the PAPA. For example, once drilling ceases and the field is in production - if 5 years of sampling have been conducted with no detection of constituents of concern, can monitoring cease? Can specific parameters be dropped from the sampling regime if they are ND for a number of years?
AS-JS	4.9	4-19	9-12	EPA recommends that the study wells not be abandoned. Study wells provide valuable potentiometric data and also can provide data to support the current hydrogeologic CSM. Wells should be able to be properly secured; minimizing the risk of wells serving as a contaminant vector.

Reviewer	Section Number	Page Number	Line Number	Comment
U-Q	5.3	5-5	25	Public participation in the future is not clearly defined in this section. In the unlikely event that changes are needed in the future, they will be made based on best operating practices at the time, and a detailed scientific approach from the review team. In the event that the hydrogeological groundwater model and groundwater pollution prevention matrices are revised as identified in the Responsibilities table on page 5-6, it should be stated that the plans will be released to the public for informational purposes only.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD				In our opinion,this draft has abandoned a number of very important advantages that the existing program offers. Here is what the plan gives up: • The first opportunity to discover aquifer contamination via water well bores. (Water well bores are very probably the most likely route of contamination of the Wasatch. Periodic sampling is a Best Management Practice which this plan ignores.) • The well sampling density afforded by the current sampling network. (Density of sampling points directly affects time-to-detection.) • These yield the first, best, and most logical Best Management Practice to protect aquifers. (Early detection is key to minimizing damage from a contamination event.) • The opportunity to detect and act upon small changes or trends in water quality. (The plan prescribes wildly generic water quality thresholds, rather than deriving and putting to use source-specific statistical analysis on data existing on all existing water sources to set source- specific thresholds.)
SCCD				Contrary to assertions, this plan represents neither a continuation of nor an augmentation of the existing groundwater monitoring effort- a point very explicitly made in the 2008 Record of Decision. Unless the effort to continue sampling existing water sources in the PAPA area is continued, the future water quality of a substantial portion ofthe county is imperiled.
SCCD				In the 2000 and 2008 BLM Records of Decision,the first, most logical practice- sampling the existing water sources- has created the sampling program we have today. All that we've learned from the studies doesn't change the fundamental wisdom of sampling from those water sources,particularly industrial sources, penetrating the aquifers. It continues to be the first and best management practice to protect the water into the future.
SCCD				There are two general aquifer waterbodies of concern: 1. A shallow aquifer which communicates with the New Fork River. This aquifer is generally less than 100 feet deep, in relatively porous (often gravely) formations and thus allow fairly quick movement of water. {100 to 700 times faster than the Wasatch aquifer). It is this aquifer from which most domestic and stock water is drawn and the source of springs and other New Fork river water gains. 2. The aquifer of the Wasatch formation is deep, between 100ft. to perhaps thousands (deepest water well source "'1200 feet). The waterbearing geologic formation is relatively non-porous (transport rates ranging from 0.011 to 40ft/year through sandstone, siltstone, and shales). The vast majority of industrial wells draw from this aquifer.
SCCD				The deeper Wasatch formation aquifer is very unlikely to be vulnerable to such an event. The two likely scenarios for contamination of that deep aquifer are: 1) An wellhead event in which contaminant is introduced down a water well casing, or 2) An event associated with a gas well bore/casing failure.
SCCD				To detect the contamination in scenario #1, it is obvious that periodic sampling of that water well is the first and best avenue of detection and speedy remediation. Periodic sampling of water wells, particularly industrial water wells, should be considered a best management practice affording the earliest detection and most rapid response.
SCCD				To detect the contamination in scenario #2, we must rely on passage of time, direction, and speed of flow through the aquifer's host geological formation from the compromised wellbore for the contaminant plume to be intercepted by a sampling effort. Speed of detection, in this scenario, becomes a matter of density of the sampling network. Again, routine monitoring ofwater wells decreases the amount of time passing from the event to time of detection. It is simply a matter of sampling density. The existing program, composed of a network of over 200 sample sites (including "'80 industrial wells currently sampled rather than the 17 proposed) affords that density. As a best management practice, there is no better way to initiate an early detection/rapid response system than to sample from those wells which may be the source of aquifer contamination. It could only be bettered by constructing monitoring wells next to every gas well bore.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD				There are arguments that the existing wells have not been constructed to the standard of "monitoring wells", sometime have unknown screen depths, etc. However, the simple fact that the subjects of the existing program penetrate the aquifer and afford the opportunity to sample the aquifer at a key point of aquifer vulnerability, are compelling reasons to preserve the existing monitoring network. The information learned from recent studies is being used to argue that many "upstream" existing water sources are irrelevant because they are believed to be "upstream". However,the only certainty is that suggested in a model. What we are certain of is that the current program has a decade of baseline data reporting a tremendous array of physical and chemical parameters. This baseline is invaluable in detecting changes in the groundwater and is discarded in the proposed plan. While the information we have recently learned may help augment the groundwater monitoring strategy,it does not justify discarding the utility of the existing water quality dataset.
SCCD				The District therefore strongly recommends that the existing groundwater quality monitoring program be preserved, and the operators employ the information from recent studies be used to augment the existing program's ability to detect issues, rather than discard the existing programs compelling strengths.
SCCD				The goal and objective set is absolutely supported by the Sublette County Conservation District as it responds directly to our mandate and specific land use policies. Our issue with the plan is that it overlooks the first and most logical BMP for preventing or minimizing potential future groundwater impacts from Oil and Gas activities. That Best Management Practice is to periodically sample water well sources! Sampling those sources is the first and best way to detect pollution introduced into the groundwater through the water well itself. (Perhaps the aquifer's highest vulnerability) Second, the increased sampling density afforded by a periodic sampling of existing and proposed water wells BMP is invaluable given the slow transport rates within the geologic formation.
SCCD				Early detection is key! As noted earlier, there is no strategy affording better early detection of potential impacts than the existing monitoring network, augmented by strategically located sampling points employing newly developed information. The proposed plan augments sampling density in areas of environmental sensitivity. That is positive. However, the proposed plan discards much ability to detect, at the earliest time, potential impacts originating away from the environmentally sensitive areas. Also at issue is lost ability to specifically tailor thresholds as discussed in reponse to 02.2. In the plan presented, the scheme relies on the passage of 4 or 6 years to establish trend- trend which is already readily quantifiable in the existing dataset.
SCCD				As noted earlier,there is no strategy affording better spatial coverage than the existing monitoring network,augmented by a few new,strategically located sampling points using newly developed information. Ifthere were to be a systematic reduction in the number of currently sampled wells, the strongest arguments for retention are made for the industrial wells. The weakest, from a standpoint of detecting a oil/gas contamination event at the first opportunity,might be the domestic wells.
SCCD				Issues regarding compliance with the 2008 ROD • Failure to comply with the intent of the ROD intent as described in Section 3.5 (Drinking Water concerns)
SCCD				• Failure to maintain existing water quality monitoring as required in Section 4.2
SCCD				• Failure to augment existing water quality monitoring as required in Section 4.2
SCCD				• Failure to comply with the promise to develop a program consistent with the BLM's Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development. (http:ljwww.blm.gov/style/medlalib/blm/wy/field- offfces/plneda le/papadocs/water.Par.82963.File.dat/RF-WaterResMonitorlng.pdfl Interestingly, the ROD characterizes the Framework as a 3-step process, while the Framework presents a 7-step process. See the Regional Framework document (uri above)- page 4.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD				Due to the level of uncertainty of the model (sec 1.6.2.6, page 1-18) which the plan is based on, the district would like to recommend at a minimum the continued sampling of a select number of domestic wells, strategically located north of core development as well as those within the development area. Locations of wells to retain could be based on spatial and physical criterial (well depth, water baring zones, integrity...).
SK				The use of fracking to release natural gas may cause unknow consequenses. Using this plan to augment the existing monitoring would be beneficial.
IR				I am concerned about the proposal to remove the currently monitored domestic water wells from the groundwater monitoring plan. The main reasons for my concern are: -The gas field drilling is slated to continue coming north towards Pinedale, bringing further activity closer to the domestic wells. -10 years of data that has been collected so far provides a baseline and it can't be understated that 10 years of data collection is valuable and takes time. It would be a waste to restart with different wells. -Companies drilling here should be ensuring citizen safety through projects like the groundwater monitoring program. Citizen health is extremely important.
IR				All water wells that have had any indication of contaminants should continue to be included in the program. I am very concerned by the lack of inclusion of these certain wells in this draft proposal. It is important to continue to keep data on these wells. Isn't this one of the main reasons for the groundwater monitoring to detect and monitor contaminated water?
IR				Adding dedicated monitoring wells to the program is a good idea. I did not see any in the domestic areas proposed; perhaps add dedicated monitoring wells to domestic areas and near populated areas.
IR				Will dropping so many wells and adding new ones merely just give a 'clean slate'? We just got to the 10-year mark where baseline data can begin to happen and I would hate to see that thrown out in exchange for a new set of water wells.
MLW				Eliminating the testing of the wells located on the fringe of Pinedale which have been tested for 10 years and have provided baseline data is very disconcerting to the owners of the wells and difficult to understand why by many of us.
EC				There needs to be a greater understanding of the alluvial aquifer along the New Fork River. Many people live along that area, yet those wells are no longer within the monitoring Plan.
EC				My last concern is that this Plan would discard a decade's worth of invaluable baseline data in detecting changes in the groundwater.The first sentence in the proposed Plan says, "Fundamentally, this Plan was developed to protect groundwater resources from potential impacts associated with natural gas exploration and production (E&P) activities in the PAPA." I do not see this new Plan able to carry this statement forward as it stands today. I strongly recommend the existing groundwater monitoring system needs to stay in place until all the information from recent studies are better understood and all the public comments are taken into consideration.
EG				I live right on the New Fork River which would seem to me to be a pretty important water shed and one that should continue to be monitored in our area due to the proximity of the gas production to our homes, wells, live stock, and all water sources. I object strenuously to the elimination of the testing in our area.
MC				Removing groundwater well sampling sites that the Sublette County Conservation District has been monitoring and doing water quality analysis on for nearly a decade is wasteful and irresponsible. The recommendation to ignore the value of professionally collected data in an area with ongoing potential for safety impact makes no sense scientifically. Please work with the local water experts at the Sublette County Conservation District and devise a plan that truly protects our water quality legacy.

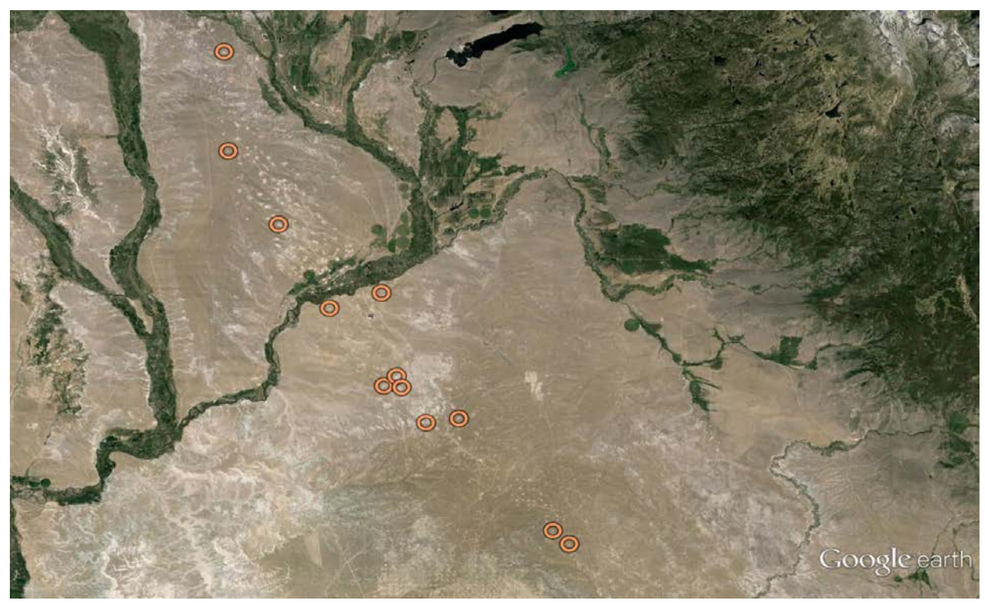
Reviewer	Section Number	Page Number	Line Number	Comment
SK	1.0	1-1	2-	A monitoring plan was developed as stated in the 2000ROD. Historical data has been collected under the current monitoring plan. While additional data has been collected regarding the geological characterization of the PAPA, not continuting with the existing plan would mean a loss of valuable data for the future. There is a viable monitoring plan in use, it would be advantageous to augment the existing plan with parts of this plan.
SCCD		1-19	17-18	Finding from the LLPHC study indicated likely sources including "… the introduction into water wells during drilling, installation and operation of the well". This is another compelling reason to continue sampling existing water wells, especially the industrial-use water wells that are located within the core development area. At a minimum, any new water well should be sampled once completed and include some level of follow-up testing to ensure BMPs are being as prescribed (flow-back prevention devices...) (this also relates to section 3)
KC	2.1	2-2	1-7	First, this goal and objective mirrors the goals and objectives of the Sublette County Conservation District Long Range Plan, id. at 10, as well as the Sublette County Conservation District Land Use Policies regarding monitoring groundwater. Id. at 13. Second, the goal of determining BMPs to reduce the potential for groundwater impacts from oil and gas activities is nearly undone by the Pollution Prevention Program itself. As stated earlier, the SCCD's data for the PAPA was gathered and analyzed pursuant to the PAPA ROD and spans more than a decade of sampling efforts. SCCD periodically gathered groundwater samples from more than 200 groundwater sources in the PAPA. This sampling and monitoring effort taps directly into the aquifer's most vulnerable points across the broadest possible area. Thus, operators and agencies do not need to wait for the contaminant plume to reach a potentially distant monitoring point because the potential source of the contaminant would already be near a monitoring site. The decade of baseline data is invaluable in detecting future changes in the groundwater and such data cannot now be placed aside. In contrast, the proposed monitoring plan would reduce this exhaustive monitoring scheme to 41 wells based on nothing more than analytical models. The assumption of the proposed plan being that some existing wells are upstream while all 41 wells are more likely to collect contamination plumes. However, as practice has shown, the density of the SCCD's existing monitoring scheme has caught contamination events which precipitated several of the BMP's put in place and described in this plan. In essence, monitoring under the SCCD's existing scheme is pollution prevention – the proposed plan is more akin to pollution reaction.
KC	2.2	2-2 / 2-3	8-15	Our comment above continues with equal force here. The Draft Plan appears to reject the SCCD's existing data set, developed over the course of more than a decade, and establishes an entirely new monitoring program. This reasoning is fundamentally flawed and provides immediate cause for concern. Without the existing data set, there is no other data baseline by which to judge any management action. Without any baseline, there can be no statistical certainty in the new data developed by a new monitoring plan. Nor could the new monitoring plan indicate an anomaly in trend. Without the ability to statistically quantify natural variability and estimate ambient levels, it is impossible to develop meaningful thresholds. In essence, the Draft Plan commits the operators and the BLM to an arbitrary course of action before the Draft Plan can even be implemented. Removing or replacing the SCCD's monitoring plan is tantamount to removing a baseline data set that informs management actions and justifies rational decision making, and therefore could lead to arbitrary actions. See Neighbors of Cuddy Mountain v. U.S. Forest Serv., 141 F.3d 1177 (9th Cir. 1998) (discarding reliable and comprehensive data may be arbitrary and capricious); See also American Tunabout Ass'n v. Baldrige, 738 F.2d 1013, 1017 (9th Cir.1984). SCCD's data is clearly defined, developed over the course of several years, and is often specific to a certain well. With this baseline, and only with this baseline, can operators and the BLM immediately establish a trend, and therefore, properly evaluate new data against that trend. Put simply, without the SCCD's data, variables or anomalous data points will be impossible to detect until the new monitoring plan develops enough data to establish a new trend (likely years). Thus, instead of abandoning an entire developed data set, the Draft Plan should seek to fill any holes or gaps in data with a complimentary monitoring framework.
MJK	2.2	2-2	14	The goal that was established for the GMP clearly states that the monitoring sites chosen should ALSO include sites that are "most hazardous to public health and the environment". The exclusion of any monitoring sites in the Region of the Highest Aquifer Prioritization according the Figure 4-2 near the New Fork River where domestic wells have been identified as "Potential Receptors" in the event of chemical migrations from above appears to be in violation of your stated goal.
SK	2.2	2-2	14	Excluding monitoring sites that are identified as" Potential Receptors" is contradictory to the existing GMProgram.

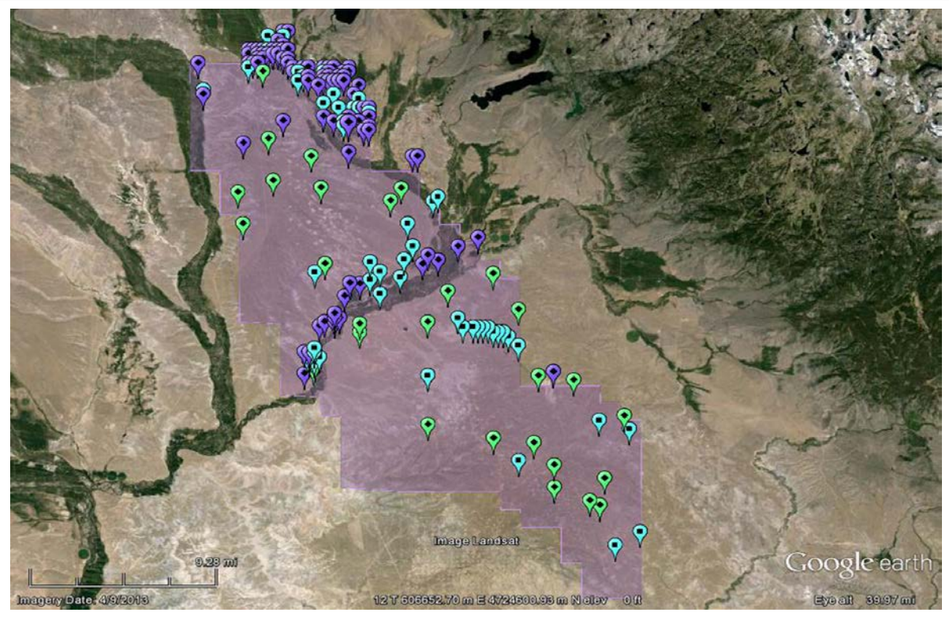
Reviewer	Section Number	Page Number	Line Number	Comment
MJK	2.2	2-2	15 (O2.3)	02.3 Clearly states that monitoring locations should be based on risk and proximity to natural gas development. There are no proposed monitoring sites in the area of my subdivision where there are multiple wells within 2 miles, uphill from our subdivision where multiple domestic wells are in use daily
SCCD	4.2.3.3	4-6	34-36	If the scenario is use of tracing particles from an industrial-use well, then this should lead to reasons for sampling all of the industrial-use wells?
KC	4.2.4	4-8	23-25	The SCCD's monitoring program included taking samples from over 200 water sources (domestic, industrial, and stock). To detect contamination at the earliest time, periodic sampling at every water well is the best option. By only monitoring 41 wells, there is the risk that contamination at other water wells will not be detected at the earliest possible time and that the contamination would spread. The more widespread the monitoring is, the quicker and more effective the response will be to potential groundwater contamination.
SK	4-2			Map indicates my residence is in a high Prioritzation category. No plans to place moniroting wells there and to stop testing domestic water wells already in existence. Heath and Safety should be a top priority.
MJK	4-2			This map places my subdivision in a high Prioritization category yet there are no plans to place any monitoring wells there and to stop testing the domestic water wells already in existence that have been tested since 2004.
MJK	4-2			Only existig industrial wells will remain in the monitoring network. There is not one domestic well.
SCCD		4A-3	16-17 & 19-20	The short reasoning for removing the domestic and stock wells leaves a lot of room for questioning. There also appears to be no monitoring point upgradient from a number of domestic wells within the Wild Horse Subdivision (see 4A-13 & 4A-15). Plus there are a number of wells within this subdivision that are placed out of RCE area although they are in an area of likely similar recharge/flow rates as others within the RCE.
MJK		4A-3	16-20	While removing Domestic Wells that are potential receptors from the testing program and replacing them with what the computer models believe are early warning sites satisfies GMP objective 02.5, it is in direct violation of objective 02.4 which recommends that constituents that are most hazardous to public health and the environment be included. It appears that this plan is selectively choosing which objectives to stress and which ones it would like to ignore. The public has the right to ask WHY and deserves a truthful answer. This is not a reassuring approach for those of us who drink and shower with water from wells that have been identified as a "Potential Receptor".
MJK	4A-2			Figure 4A-2 shows all Domestic wells in close proximity to the New Fork River, in the highest Prioritization zone being removed from the testing program. The very wells that pose the greatest risk to humans are being dropped from the testing program based on a software program that thinks it can predict the earliest warning to contamination of an aquifer. This is in direct violation of the goals set forth in the GMP, 02-Section2 Page 2-2, that is supposed to implement a plan that includes monitoring sites that are "most hazardous to public health and the environment".

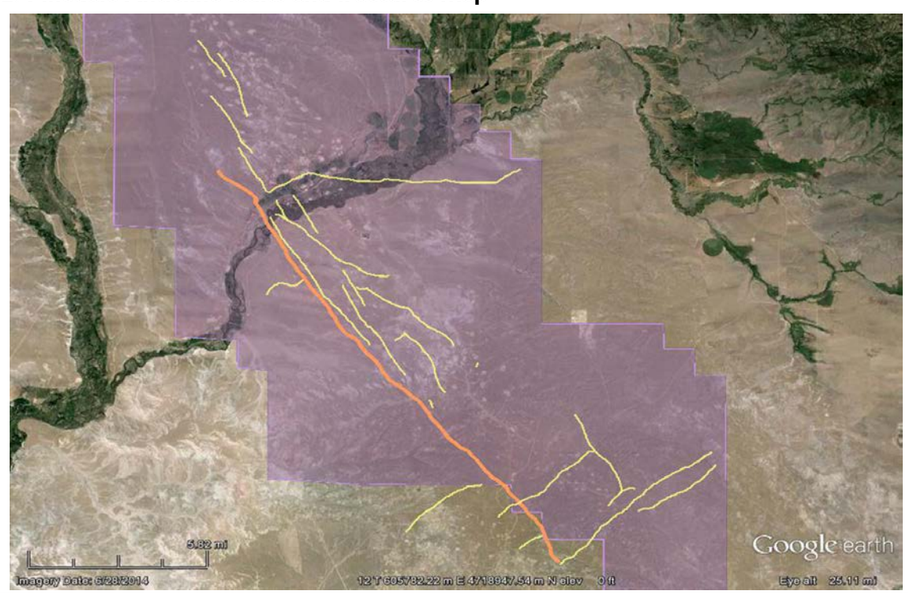
Reviewer	Section Number	Page Number	Line Number	Comment
SCCD				Instead, the draft plan adopts a "line of last defense" posture by pulling monitoring back from likely contamination sources; relying on the hope modeling is correct in predicting a contamination event's pollution plume might be detected sometime in the next century. In a field with a projected life of something less than 50 years,the modeling effort misses the scale oftime meaningful to protecting groundwaters.
SK	Appencix A 9			The use of artifical algorithms to develop the models may be acceptable only until actual data (readings) can be used.
CK				GENERAL COMMENT Please require data-based augmentation and refinement of the Groundwater Model, to be completed over the next several years. The current Monitoring Plan is based on too little geo-hydrological field data and too much simulation. For a resource as important as human drinking water, a much greater level of site-specific geo-hydrological knowledge / mapping detail is warranted.
DB				The Plan makes minimal reference to structural features such as faults, fissures and joints in the shallow upper Wasatch water bearing zones, and overlying alluvium. The Plan should include a subsurface geologic map and cross sections. The New Fork River is following a fault zone. More information is needed on how that area will be protected. Though the simulated groundwater model may be sound, explain how these structures would change this model. Include maps that show production and groundwater monitor wells in relation to geologic structures.
MLW				I have had no background with the techniques used to formulate the model for this plan. However, I have had extensive classes in statistics and understand how modeling mistakes can occur. To me, there seems to be a lot of uncertainties and unknowns regarding aquifers and groundwater systems in the Pinedale Anticline. In addition, I know you have received input from experts regarding concerns with the plan's model
EC				My main concern with the proposed plan is that I question the quality of the hydrological conceptual model used to define the monitoring plan. The Plan does not take into account structural features such as faults in the shallow, upper Wasatch water bearing zones and overlying alluvium. The New Fork River follows a fault zone. Groundwater in this region flows towards the New Fork River. Groundwater modeling should be done appropriate to this flow system.
PKB				Do we know how long the recharge time is for the groundwater aquifer? Most of the surficial geology is glacial till with a high permeability so that water moves through the soil and substrate quickly if it is not evaporated quickly into an alkali surface. Is this fact accounted in the proposed plans?
RGW				What is not mentioned are fracture zones (faults), always a major factor in the flow of groundwater. There are fractures that penetrate the Wasatch, and in some areas even younger sediments (something that Gerry Richmond was working on). I am sure that the companies have details on fracture systems in the Lance field and maybe even in the Wasatch.
RGW				Four of the five Hypothetical release scenarios are surface releases, but only transport in the hypothetical groundwater system are modeled with no consideration to immediate surface runoff or of near surface temporary perched water tables or impervious barriers to the water flow.
MW for CURED				There needs to be a better discussion I description of the alluvial aquifer along the New Fork River. Data from only 6 wells was used to characterize the hydrology of this aquifer - which does not provide adequate spatial coverage. The discussion in Amec, 2102(see above) indicates that the alluvium is a high permeability aquifer that is hydraulically connected to the New Fork River. A separate map should be generated for this aquifer (in addition to Figure 9 in Amec, 2012) showing thickness and location of all alluvial water wells within the PAPA.

Reviewer	Section Number	Page Number	Line Number	Comment
MW for CURED			Hydrogeologic Conceptual Model	The scale of modeling is not appropriate. Groundwater flow occurs at multiple flow system scales and the primary risk to the Wasatch HSU is to shallow flow systems which occur within the permeable lithologic units in the very upper part of the Wasatch formation. Groundwater in this upper system flows toward and discharges to the New Fork River. Groundwater recharge that moves vertically below this flow system flows southward towards the center of the Green River basin and does not discharge to the New Fork River. Groundwater modeling should be done at a scale that is appropriate for the groundwater flow system at risk and estimated contaminant transport distances.
MW for CURED			Hydrogeologic Conceptual Model	It is not appropriate to treat the entire Wasatch formation as a single HSU. The significant lithologic heterogeneity results in very complicated, multi-scale groundwater flow. However the Wasatch should be divided into at least two HSUs -a shallow HSU that is hydraulically connected to major perennial streams and the underlying Wasatch formation where groundwater flow is more regional and not significantly connected to most streams.
MW for CURED			Hydrogeologic Conceptual Model	The proposed groundwater monitoring plan does not consider the effect on groundwater flow due to preferential flowpaths related to fractures, joints and faults. While it is recognized that delineation and characterization of these structures is difficult -it must also be recognized that groundwater flow and contaminant transport can occur at velocities much greater than estimated by the flow model used by Amec and in directions not anticipated by a porous media flow model. There should be some effort to identify areas where there is significant fracturing within the Wasatch HSU. Faulting associated with the formation of the Pinedale anticline occurred primarily in the late Cretaceous and early Tertiary. Some discussion should be included about the extent of faulting, folding and fracturing in the power part of the Wasatch HSU.
MW for CURED				The data limitations and uncertainties in the transport model are so great that results are not useful. In section 1.6.2.6 the report states that the transport model "*has not been calibrated*" and "*the predictive capabilities of the transport model have not been evaluated*". These limitations result in very large error bars on the transport velocities and distances used to design the groundwater monitoring network.
MW for CURED				The report indicates that a "few" water wells in the PAPA contain high levels of organic constituents. A section in this report should provide information about these wells – what\ organic constituents were detected? What was the source? How far did the contaminants migrate? Why aren't some or all of these locations included in the GWMP? Just because these sites are in the VRP should not disqualify them from inclusion in the GWMP.
MW for CURED				A key conclusion is that the occurrence of LLPHC in the upper Wasatch comes from naturally occurring organic matter. What is this organic matter? Are there any data regarding type and concentration of organic matter?
MW for CURED	1.6.1			Please provide a citation for the statement that 3% of precipitation goes to groundwater recharge.
DB	1.6.1	1-13	1-38	In lines 18-25, data are described that were used to evaluate ground water seeps. There is no consideration of faulting in this model. Though this is a groundwater model, the omission of any commentary on geologic structure is glaring. This conceptual model, in turn, forms the basis for the numerical groundwater flow model. Describe how the Plan deals with geologic structures.
DB	1.6.1	1-13	29-30	Industry well information is abundant. Use it to interpret the structure that causes well depths in the north PAPA to be 910-1,200 feet. In the New Fork corridor, the well depths jump to very shallow, 13-20. In the southern PAPA, well depths are 550-800 feet. There are obviously some geologic structures in the PAPA that are not considered in this report. Include figures that show the public the geologic complexity of the PAPA. Include figures that clearly show faulting between the Wind River and Pinedale thrust faults. The New Fork River trends NW-SE in the north, then changes to a NE-SW trend because it is following a zone of structural weakness. To ignore the complexity of the faulting between these two major thrust faults (the very reason that we have gas and oil deposits) is problematic. Describe how the Plan will deal with zones of increased permeability.
DB	1.6.1	1-13	35-36	*"Sandstone and siltstone/shale are interbedded, laterally discontinuous on a scale of 1,000 feet".* Are existing and proposed water monitoring wells spaced adequately to catch contaminants if these sand lenses are that small?
SK	1.6.1	1-14	25	Basing conclusions on the estimated rate of flow on model is not factual.
MJK	1.6.1	1-14	25	The use of the word "may" means conclusion is a best guess or a computer model conclusion, not fact

Reviewer	Section Number	Page Number	Line Number	Comment
SK	1.6.2.1	1-15	35	A model developed from actual testing if possible would be more accurate.
MJK	1.6.2.1	1-15	35	the use of the word "Likely" means the conclusion is computer model generated or an educated opinion
LB	1	1-16	37	"Potential sources of groundwater contamination associated with natural gas operations and potential receptors of concern in and around the PAPA were identified. Potential sources include shut-in pre-1984 natural gas wells, liquid-gathering facilities, natural gas pads, pipelines, roads, and saltwater disposal facilities." Comment: This list of potential contamination sources is incomplete and should include additional sources that are deemed viable contamination pathways by the USGS[1], Duke University scientists[2], and the American Petroleum Institute[3]. **We request that this study also consider other potential contamination sources including but not limited to: water well drilling practices, water well casing installation, leaks during or following hydraulic fracturing, failed casing seals post-installation, faulty cementing post-installation, deep-well disposal of flowback or produced wastewater, and induced subsurface migration pathways.**
DB	1.6.2.3	1-16	9	*"Model layers were defined by lithologic modelling incorporating data from 243 wells…"* Use those logs to create a clear picture of the geology of the PAPA.
DB	1.6.2.3	1-16	25-26	*"Qualitative and quantitative evaluation of results indicates the model is well calibrated."* Though I cannot comment on the mix of qualitative and quantitative data, the above statement is vague. Further clarification of calibration is warranted.
MW for CURED	1.6.2.4			Should identify which solute transport model was used.
SS	1.6.2.4	1-16	37	One of the potential sources included in the modeling was pre-1984 shut-in gas wells. Based on studies, older shut-in gas wells are commonly affected by sustained casing pressure (SCP) which can indicate that there is communication within the annulus of a gas well from a sustainable pressure source caused by inadequate zonal isolation due to poor well construction, i.e. not enough cement in the well between the production zone and the surface casing, a poor cement seal, or aging cement that has been compromised. Researchers report that by the time a well is 15 years old, there is a 50% probability that it will have measurable SCP in its casing annulus. A well that is influenced by SCP may create a positive hydraulic gradient between the annulus and the overlying zones of fresh water causing contaminants in the annulus to flow outward and upward into the zone of fresh groundwater if a permeability pathway exists This source was eliminated as a potential contaminant source in the model because it was treated as a "leaking well" under ambient conditions. Because the contaminants are under pressure in an SCP well, the rate of movement would be orders of magnitude higher than the ambient modeled flow rate of used in the model. If this source were modeled using SCP conditions the outcome would probably have been much different. In some instances reported in the literature, natural gas from an overpressured annulus travelled to household water wells located more than 4,000 feet from the gas well.
MJK	1.6.2.4	1-16	41	"assumptions" were used to reach their conclusions on the following page
DB	1.6.2.4	1-17	7-15	This paragraph and list of five scenarios describes what the Plan considers *"most susceptible to groundwater quality impacts to assess fate and transport of certain petroleum hydrocarbon compounds…".* There is no mention of potential failed well completion in deep production wells as a source of potential contamination. The list shown focuses on surface contamination, but does not consider production wells as potential Wasatch contaminators. The Plan should include scenarios where contamination could occur from faulty production and injection wells
LB		1-17	11-15	Comment: Previous incidents that resulted in contamination over DEQ/EPA standards included water wells at the Falcon Compressor Station; the Halliburton facility at Sand Draw Industrial Park; Shell's North Mesa 4-7-32-109; Shell's North Pinedale 14-8; Ultra Resources' Warbonnet 7-15D; Ultra Resources' Riverside 15-12; Ultra Resources' Riverside 11-14; Ultra Resources Riverside 11-34; Ultra Resources' Riverside 1-4; Ultra Resources Rainbow 13-30; and Ultra Resources' Mesa 10-33. (Also, in the Jonah, Ultra's Stud Horse Butte UN 9-21) These serious contamination incidents occured for reasons other than those considered in the solute transport modeling. **We request that BLM also list and consider hypothetical release scenarios that include the types of incidents that have already occurred at the above-mentioned compressor and produced water sites on the Pinedale Anticline and at related facilities. In addition, we request that BLM investigate and correct the reasons why Ultra Resources, in particular, has contaminated most of the Anticline industrial water wells that have been entered into the VRP.**

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD		1-17	16-19	What about slow releases (such as the slow leak of the LGS pipe in the northern portion of the PAPA, 2014)? Explanation should be given as to the reasoning for determining scenario outcomes based on "worst case"
LB	1	1-17	29	"Natural gas activities in the PAPA will not affect groundwater in or around the town of Pinedale." The Town of Pinedale and its source waters are outside of the boundaries of the Pinedale Anticline Project Area. This statement should not be considered a "key finding", is beyond the scope of analysis in this document, and cannot be considered relevant. **We request that this statement be struck from the final document.**
LB	1	1-18	1-3	"The area most susceptible to groundwater quality impacts...from natural gas activities is the New Fork River valley between Boulder Creek and the downstream PAPA boundary." This is incorrect. Industrial water wells that exceeded DEQ/EPA standards for BTEX, but were not entered into the VRP and were subsequently plugged, span the length of the PA. Neither were these wells considered "LLPHC", so contamination sources were not discovered, analyzed or remediated by either BLM or DEQ. **We request that BLM re-define areas most susceptible to groundwater quality impacts based on the locations of these hydrocarbon-contaminated wells (see Illustration 3). We also request that SEO cease the practice of allowing industrial water wells to be permitted as "temporary" so that if/when contamination occurs monitoring can be continued and contamination remediated rather than "swept under the rug." These include: Antelope 1-16: AMI187. 6/8/07: Benzene 25 ug/L; Blue Rim State #2: AMI 149. 11/5/07: Benzene 5.2 ug/L, Toluene 13 ug/L; Boulder 14-32: AMI 280. 11/13/06: Toluene 12 ug/L; DRO 3.9 ug/L; Boulder 15D-7D: AMI 252. 1/16/07: Toluene 110 ug/L, GRO 4 ug/L; Highway Federal #7: AMI182.12/6/06: Benzene 5.9 ug/L. LEL; Mesa 12-28-32-109: AMI160.11/13/06: Toluene 69 ug/L; DRO 7.4 ug/L; North Mesa 4-7-32-109: AMI 140. 9/7/06: Benzene 290; Toluene 4400; Ethylbenzene 1200; m+p xyl. 16000; o-xyl. 3000; xylene 19000; GRO 46; North Pinedale 14-8: AMI 188. 11/17/06: Benzene 6.6 ug/L; Riverside 11-34: AMI 190 DRO 7.6 - 1/16/07; Warbonnet 13-11: AMI 147. 1/19/07: Toluene 43 ug/L; DRO: 230 ug/L; Warbonnet 7-5: AMI 285.10/30/07: Benzene 28 ug/L. Toluene 25 ug/L; Warbonnet 8-6: AMI 186. 11/6/07: Toluene 45 ug/L, DRO 1.8 ug/L.**
LB				**Illustration 3: Water wells on the PA with BTEX levels above DEQ/EPA standards that were not entered into the VRP and were plugged** 

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD		1-18	8-14	Language such as "Since *most* of the potential receptors …" and "… impacts related to petroleum hydrocarbons would be *unlikely* to reach *most* of these receptors." indicate that there is some level of unknown. Because there are known limitations to the model that is directing the Plan, it would be best to continue sampling privately owned wells, especially those in the river corridor envelope. Also, see page 1-24, lines 28-31. There is also discussion relating to the unknowns about the layering within the Wasatch on pages 1-13 and 1-15.
DB	1.6.2.5	1-18	11-14	The text states that potential receptors in this area are >150 away from simulated sources. *"If a major release to groundwater were to occur, impacts would not reach the receptors."* This is very unclear to the average reader. Is it not desirable to reach the receptor? The Plan should clarify.
CK		1-18	14	*"unlikely to reach".* **Please define/quantify "unlikely" here, expressing confidence level if possible and cite source/page.**
CK		1-18	14	*"most".* **Please define/quantify "most" here.** (e.g., 51% of receptors on a particular map?) Express confidence level if possible and cite source document/page.
CK		1-18	16	*"unlikely to impact".* **Please define "unlikely"** here, expressing confidence level if possible and cite source/page. If usage is same as line 14, please so state.
CK		1-18	16	*"large"* **Please quantify "large" here, such as in acres.** (E.g., an unknown total comprised of areas each no more than 300 ft in radius / 0.65 ac in size).
LB	1	1-18	24	"There is a scarcity of groundwater elevation data outside the development area of the Pinedale Anticline." Comment: This is incorrect. The State Engineer's Office (SEO) maintains water well depth and static water depth information on all water wells in Wyoming, offering an estimate of area groundwater elevation data. **We request that BLM include SEO water well depth and static water depth information for all domestic, domestic stock, BLM stock, and industrial water wells within Pinedale Anticline boundaries in the final analysis. (See Illustration 1: locations of all domestic, domestic stock and BLM stock water wells within the boundaries of the Pinedale Anticline. Note: for clarity, this illustration doesn't include industrial water wells.)**
LB				**Illustration 1** 
MJK	1.6.2.6	1-18	26 & 29	"increased model uncertainty" & "conservative assumptions" raise doubt regarding conclusions
SK	1.6.2.6	1-18	27&28	If stating that contaminants are not known, why? These contaminants could find a fracture and migrate down.

Reviewer	Section Number	Page Number	Line Number	Comment
SS	1.6.2.6	1-18	37	Fracturing and faulting in the Wasatch Formation along the crest of the Pinedale Anticline is undoubtedly an important mechanism that influences the hydraulic flow regime in the study area. The crests of Wyoming foreland anticlines are typically characterized by extensive fracturing and because these fractures are tensional in nature they effectively act as conduits to groundwater flow. Therefore, to assume for the purposes of the model that there are no preferential flow paths or secondary permeability in the Wasatch Aquifer resulting from folding and faulting is not representative and undoubtedly has the effect of decreasing the travel time within the Wasatch aquifer.
MJK	1.6.2.6	1-18	37 - 40	While there is limited information about fractures and faults, the model assumes flow through a porous medium. Connection with a fault could speed transport to more superficial aquifers more quickly
DB	1.6.2.5	1-18 / 1-19	31-40 / 1-3	This section discusses limited information regarding faults and fissures in the Wasatch, then goes on to state that *"some preferential flow paths associated with the geologic structure and secondary porosity likely exist"* . Again, the hydrogeologic model addresses none of these structures.
LB	1	1-18 / 1-19	37-40 / 1-3	"Limited information is available regarding the location of fractures and faults in the Wasatch Formation." Comment: This is incorrect. AMEC mapped generalized locations of Anticline fractures and faults4. See Illustration 2 (below). While AMEC's model assumes that "no preferential flow occurs through...fractures in the Wasatch Formation", AMEC authors admit that, "In reality, some preferential flow paths associated with geolog1ic structure... likely exist; permeable fractures could affect groundwater flow directions and transport velocities." BLM offers no rationale to exclude the possibility of groundwater transport along faults & fractures. **We request that the final report be amended to account for the fact that water and any solutes therein can, indeed, flow along fractures and faults in the Anticline. We request that fracture and fault location information and their potential for contaminant transport be included in the final analysis.**
LB				**Illustration 2: Pinedale Anticline faults and fractures map** 

Reviewer	Section Number	Page Number	Line Number	Comment
LB	1	1-19	15	Comment: According to BLM, known or likely sources of hydrocarbon incursion into water wells include, "Upward seepage by natural processes of natural gas from deep, underlying gas reservoirs over time into overlying geologic layers where groundwater occurs. And, "naturally occurring organic matter in groundwater" is also considered a likely source. However, all but two incidences of hydrocarbon contamination occur exclusively in industrial water wells. If upward seepage by natural processes has occurred, much older, domestic wells would have also shown similar hydrocarbon detections. This has not been reported. **We request that BLM either explain this discrepancy, or exclude "natural processes" and "naturally occurring" from the list of potential reasons for hydrocarbon contamination.**
SS	1.6.3.	1-19	15	The conclusion that no sources associated with gas exploration and production is based on a model that doesn't represent the aquifer conditions along the crest of a fractured anticline. The obvious sources of low and high levels of contamination in the aquifer, surface spills and leaks as well as pre-1984 shut in gas wells, are conveniently dismissed based on a model using flawed assumptions in favor of three vague, unprovable sources that have nothing to do with the gas industry. There are numerous water supply wells completed in the Wasatch Aquifer throughout the state of Wyoming that have been sampled for VOCs and SVOCs, I have rarely seen a single hit for any VOC or SVOC contaminant. It is hard to believe that the source of low levels of these constituents in a large number of wells in the study area is a result of contaminants introduced into water wells during drilling and pump installation. If there is a widespread problem with contamination being introduced during construction of industrial water supply wells this problem is related to the gas industry and should be addressed. However, it is unlikely that all of the well installers in the area have caused similar problems since this problem does not seem to occur in other areas of the state. The conclusion that the low levels of VOC and SVOC contamination are a result of naturally occurring organic matter in the aquifer material is totally unsubstantiated. Why is it that numerous water supply wells completed in the Wasatch Aquifer in Green River Basin and throughout the state don't have this issue? There is no evidence to substantiate this ridiculous claim. Likewise, the conclusion that thermogenic methane present in many of the monitoring wells is a result of upward seepage by natural processes is totally unsubstantiated. If this process has actually occurred over "geologic time" why has it been accelerated over the past 20 years?
LB	1	1-19	25-27	"The sources of low-level organic constituents detected in some wells may be a combination of both organic material introduced into the wells and other organic material that occurs naturally. In many cases, it is impossible to differentiate between natural and man-made sources." Comment: There are many, man-made chemicals, such as biocides, foaming agents, and corrosion inhibitors introduced during various phases of natural gas well drilling and completion that are not naturally occurring. It is indeed possible to differentiate between the two. **We request that man-made chemicals be specifically identified and attempts made, through chemical tracing, to detect and report them in the final analysis.**
SS	1.6.3.3.	1-20	17	It is unreasonable to separate the wells with high levels of VOCs from the other wells with low level hits of VOCs and SVOCs at this point in the project because it is not abundantly clear that the two are not connected and will lead down the wrong track in the end. Just because the wells with high concentrations of contaminants are part of the VRP doesn't mean that they shouldn't be included as part of the conceptual model for this project. Further investigation of the whole system using a model that accurately represents the aquifer conditions should be done before any such conclusion is reached. Just because you don't understand the connection between the low levels of SVOCs and high levels of VOCs in these particular wells doesn't mean there is no relationship.
LB	1	1-20	17-20	A few water wells in the PAPA...contained high-levels of organic constituents...DEQ... is overseeing cleanup and/or further investigation of the few cases where high levels of organic constituents have been identified in water wells. This is absolutely false; there were more than "a few." **We strongly urge BLM/SEO/DEQ to investigate the reasons why BTEX-contaminated wells that were not entered into the VRP are/were plugged, with no fines or consequences to operators, and remediate all water wells with BTEX over DEQ/EPA standards (see comments for 1-18, 1-3 above).**
MW for CURED	1.6.3.7			This section should include a more thorough discussion of the occurrence of the semi-volatile organic constituents present in water wells. Which VOCs are present? What are potential sources? What is the basis for the conclusion that there is no relationship between semi-volatile organic compounds and the volatile organic compounds?

Reviewer	Section Number	Page Number	Line Number	Comment
LB		1-22	18-19	"This study did not produce any evidence of widespread impact to groundwater in the PAPA as a result of natural gas E&P operations…" Comment: There are two reasons to doubt this assertion: 1) the Wasatch hydrostratigraphic unit in the PAPA is likely a semi-confined aquifer, and 2) almost all low-and-high-level hydrocarbon contamination has occurred within the aquifer in industrial water wells. If an aquifer is considered semi-confined, and within that semi-confined aquifer over a hundred water wells have been contaminated, it is logical that groundwater contamination within that aquifer is more widespread than current monitoring suggests. **We request that BLM, SEO, and WOGCC disallow future plugging of water wells that have shown any level of hydrocarbon contamination so that future monitoring may be conducted and new information reported as it becomes available.**
SK	1.6.3.7	1-22	7	Any found chemical signatures should be categorically identified and defined .
MJK	1.6.3.7	1-22	7	signatures did not match "most" potential source materials used in the study. Does this mean it did match some, and were all chemicals utilized in all phases of drilling and production made available to the study so that they could be compared??
MW for CURED	1.6.3.8			It states here that the unsaturated zone in the Wasatch HSU is 200 -500 feet thick. It should be clarified that this cannot be the case where the Wasatch HSU discharges to the alluvium along the New Fork River.
DB	1.6.3.8	1-23	19	*"Assuming no preferential pathways exist in the Wasatch Formation, the volume of any spill or release would need to be substantial in order to reach the groundwater in the Wasatch in areas along the crest of the Pinedale Anticline".* This assumes there are no faults, fractures or other structures. See above paragraph, where the text states that *"some preferential flow paths associated with the geologic structure and secondary porosity likely exist".* The Plan makes a bold assumption. The Plan should address how preferential pathways such as fault zones will affect groundwater. Explain the contradictory nature of these statements.
MJK	1.6.3.9	1-24	20	The word "likely" again suggests conclusion is a best guess or an assumption, not fact and still uncertain
CK	4.2.3.3	4-6	31	*40 feet/year max advective velocity* . **Please express here the associated certainty level** and reference that source document / page.
MW for CURED	4-4			Figure 4-4- How were the "inferred groundwater elevations" determined?
MW for CURED	4-19			The potentiomentric surface map (Fig 4~19) presented for the Wasatch HSU is much too generalized. The potentiomentric surface map was generated for a 527 mi2 area and used to make well location decisions at a scale of a 1/2 mile or less
MW for CURED	4-19			The potentiometric map included as Fig 4-19 is not consistent with potentiometric data /maps presented on the WWDC Green River Basin Water Plan II (2007-2009)
SK		4A-3	16-20	It appears that this plan is selectively choosing which objectives receive priority. This is not reassuring as the plan is using models. Public health and the environment should be a priority.

Reviewer	Section Number	Page Number	Line Number	Comment
BJ				From my perspective, I would want to know where, when and how much leakage from a particular point source may have gotten into ground water zones in the upper Wasatch components, as noted in the data as having particle transport of 1000 to 4000 +/- ft per year. This data should be important to all users such that any pollution materials can be found rather quickly and be remediated before further degradation might occur. Consequently, any and all monitor wells should be used, such as the 43+ that are used by the Sublet County Conservation District, if available, and any new ones that may be necessary. As an end user I would want to know what may be coming oward my potable or stock water well a long time before a 10 year data point.
EC				Another concern is the use of the 110 year travel time/risk to catch contamination. Why is this factor being used? Is it to justify cutting the numbers of monitoring wells down to 41? How does that bode for someone who is in their 70's and living where they can see drill rigs out their kitchen window? How is this going to help their children and grandchildren that live here?
PKB				What in the plan will establish a timeline to monitor over time the potential for contaminated PHCs that can take years to move through the underground aquifer? What in the plan will avoid the situations similar to those on the Wind River Indian Reservation and in sites in Utah where containment of post-uranium field development materials are now found to be entering the watershed aquifers + 20 years after the fields were abandoned and that existing containment methods proved inadequate to prevent health-affecting pollution.
RGW				The 110 yrs is one of the poorest explained parts of the report. The 110 years is determined (used) in the model to simulate particle transport in the Wasatch, which would be at a max of 40ft/yr, from potential sources to receptors. I think they are saying that any contamination that enters the Wasatch will take at least 110 years to reach a receptor, namely the River Corridor. What they say in Section 4.2 is: "It (the River Corridor) is the zone enveloping potential sources with associated potential receptors over a 110-year travel time for contaminants in groundwater to move from potential source to potential receptor". This needs clarification, I cannot believe a technical reviewer let alone an editor did not jump on this. I think it is saying that it will take (on average?) 110 years for pollutants from a potential source (outside the River Corridor) to move through the Wasatch system to reach the River Corridor. They do state in Section 1.6.2.4 that the 110 yrs is twice the expected life of the field, but I do not think that is the reason for using that travel time.
LB		1-16	40	"For advective modeling, the following conservative assumptions were used: A travel time of 110 years…" <u>Comment:</u> This modeled travel time fails to distinquish between Wasatch Formation sandstone lenses, alluvial deposits along streams, and glacial deposits, the latter two of which host much faster travel times. **We request that a more realistic travel time for potential contaminants in alluvial and glacial deposits be modeled and analyzed in the final document.**
SS	1.6.2.5	1-17	all	A travel time of 110 years for advective modeling is used to substantiate the claim that contaminants could not possibly travel more that 150 feet within the portion of the Wasatch aquifer that is not within the streambed. As a result, all potential contaminant sources associated with gas development in the area have been eliminated from further consideration as the cause of widespread contamination of the groundwater with low levels of VOCs and SVOCs. This artificially low travel time was derived by eliminating potential conduits of flow and high secondary permeability from the model which is not representative of the actual aquifer conditions along the Pinedale anticline.
CK	4.2	4-2	0	*"early detection" in Table.* **Please define/quantify *"early detection"* (** such as in years or decades) in discussion below.
CK	4.2	4-2	3	**Please add section discussing temporal issues**, particularly the temporal goal(s) for areas not requiring "early" detection. The currently proposed monitoring network is "optimized" to detect contamination no-later-than 110 years from now. To my mind this capture period is far too long. Rather, the well network should be re-designed for much earlier detection.

Reviewer	Section Number	Page Number	Line Number	Comment
SCCD	4.2.2	4.2	15-22	Although aquifer sensitivity can be related to potential surface contamination, the plan does not address travel pathways through the vadose zones.
CK	4.2.3.3	4-6	37	**Please explicate here the formula implications of the 110-year target capture period which is utilized in network density determination.** E.g., if this factor (110 years) were halved, doubled, etc., the number of groundwater monitoring wells (41) would likewise be halved, doubled etc.
CK	4.2.3.3	4-7	18	**Please add a paragraph discussing rationale for the 110-year** target capture period utilized. E.g., Why was a 15-year period was not selected *(such as would allow for remediation if appropriate)* ??
SCCD	4.3.2	4-10 / 4-11	28-38 / 1-6	Flow rate should also be a determining factor for sampling frequency.
SCCD		4A-3	8-10	So, it could potentially take this plan 100+ years before a contamination plume would be detected? Early detection?

Reviewer	Section Number	Page Number	Line Number	Comment
DB				The timing of the release of the Plan was problematic. I request that the Plan be released as an Interim document.
DB				We, the public, have not had adequate time to review.
DB				A public forum would have indeed benefitted the public and their understanding of the Plan.
MLW				I appreciate the opportunity to submit my comments. However, I feel information conveyed to the public on such an important topic as safeguarding our water has been very lacking. This topic is too important to not educate the public in language they can understand regarding what the plan is to protect our water, and what is planned in case of an unforeseeable event.
PKB				I have been trying to read the plan that is available online as linked to Pinedaleonline.com but have found the document confusing and not reader-friendly in trying to decipher the details of the plan.
PKB				I think there should have been a public meeting to explain more of the draft Groundwater Pollution Prevention, Monitoring, and Response Action Plan or at least a series of articles on facts and common concerns in the paper or a poster board flowchart at the local libraries so citizens such as myself could decipher the pertinent parts of the plan that relate to our questions and concerns. Just having access to one copy of the text without appendices at one library is not adequate public notice and discussion.
CURED	5			We are concerned that Section 5: Response Action Program (RAP) lacks clarity with respect to: 1) transparency regarding data collected from monitoring wells, 2) public notification in the event the RAP is triggered, and 3) opportunities for public participation in the event the RAP process is triggered. We strongly believe the public should be included in the processes outlined in Section 5 of the plan, especially since the plan is intended to fulfill part of the Pinedale Anticline Project Area (PAPA) Environmental Impact Statement Record of Decision requirements, which is part of the National Environmental Policy Act (NEPA) process, as well as to serve as the master plan for the region under the state's baseline water testing rule. As part of the NEPA process, actions under the monitoring plan should provide opportunities for public involvement. Ensuring public participation is a hallmark of the NEPA process. See, e.g., 40 C.F.R. § 1506.6(a) (agencies shall "[m]ake diligent efforts to involve the public in preparing and implementing their NEPA procedures")(emphasis added). Additionally, the state's baseline water testing rule requires that any proposed master plan must "meet or exceed" the requirements of Chapter 3, Section 46 "Groundwater Baseline Sampling Analysis and Monitoring." Under the state's baseline water testing rule, data collected to satisfy the rule must be made available to the public (WOGCC Rules, Ch. 3, Section 46 (g)). We are concerned that sections 5.1, 5.2.5, and the chart on page 5-6 do not indicate there will be public notification other than to the individual well owner if the RAP is triggered. We believe public notice is crucial. Also, we are concerned that section 5.2.1 does not include an opportunity for the well owner or any qualified member of the public to participate in the working group assembled to address any trigger for the RAP. The working group should include appropriate members of the public. Further, we request that the plan clarify that the data from monitoring wells will be available to the public under Chapter 3, Section 46 (g) of the state's baseline water testing rule.
CK	5.2.1	5-2	11	**Please provide for "Receptor representatives"** whenever "Operator representatives" are included in the process. Receptor representatives could include, for example, nearby private waterwell owners, Trout Unlimited members, Stockgrowers staff, and local government representatives.
U-Q	5.3	5-5	25	Public participation in the future is not clearly defined in this section. In the unlikely event that changes are needed in the future, they will be made based on best operating practices at the time, and a detailed scientific approach from the review team. In the event that the hydrogeological groundwater model and groundwater pollution prevention matrices are revised as identified in the Responsibilities table on page 5-6, it should be stated that the plans will be released to the public for informational purposes only.