Meeting Record

Purpose: DQO Meeting to Recommend Characterization Activities for Well R-29, Two Mile Canyon	Meeting Date: 1/28/03

Background Information:

The Hydrogeologic Workplan rationale for R-29 was to provide information about the depth to the regional aquifer in a poorly-characterized area, and the water-level data used to optimize placement of down-gradient monitoring wells along the eastern Laboratory boundary. The DQOs for the R-29 are described below.

Geology –

Cerros del Rio lavas are reasonably well constrained by outcrop data and R-31, but it is uncertain whether the underlying stratigraphy would be dominated by Puye fanglomerates, river gravels, or (less likely) Santa Fe Group sediments. Are the Tb2 lavas found to the south at river level in White Rock Canyon present here? In R-16 there was no Tb2, but there is in R-22. This would be a good opportunity to capture the geophysical signature of the Santa Fe Group if it is present in this area.

Hydrology –

Vadose zone: R-29 is upstream of Spring AA (more like a seep), so perched intermediate zones may be present. Perched zones should be looked for during drilling.

Regional aquifer: Regional saturation is expected at a depth of about 520 ft. The most important data for the saturated zone is the permeability of the Santa Fe and/or Tb2 lavas, if they are present under the Cerros del Rio. This would also be a good location to evaluate the degree of confined aquifer characteristics by drilling slowly enough to see the top of the regional aquifer. Tb2 lavas are not present in Buckman well field, but they are quite close by, so having a second permeability measurement (there is a Tb2 screened interval in R-22) in Tb2 would be helpful.

Geochemistry-

Water from the regional aquifer should be analyzed for the standard suite of analyses and plutonium.

Recommendations:

Based on discussions at the R-29 DQO meeting, a recommendation is made that R-29 be sited in lower Water Canyon on the flat spot above the notch. R-29 would be used to characterize regional aquifer characteristics in an area where geologic units that have been too deep to access may be present at much shallower depths. This goal is consistent with the original criteria for siting this well in the Hydrogeologic Workplan.

The R-29 lower Water Canyon site is designed to address the following data needs:

- To determine if the Tb2 lavas are present, to determine the presence and character of the Santa Fe Group. These data are needed to refine the 3-D geologic model, which is critical for identifying geologic controls on groundwater pathways.
- To measure the water table elevation in the regional aquifer; this data is important to constraining the water level map and are part of the general characterization of groundwater conditions beneath the Laboratory and support ongoing efforts to

improve the hydrogeologic conceptual model.

- To provide aquifer characteristics in geologic units that have not been tested yet, and chemistry data for improving the regional flow and transport model.

The R-29 well should be drilled to penetrate the Tb2 lavas, expected to be about 500 feet below the top of the regional aquifer, to approximately 1100 ft. The well should be completed with two screens in the regional aquifer, one in the Santa Fe Group and one in Tb2 lavas. The screens will provide access to groundwater in these geologic units so that the permeability of the units at this location can be estimated by hydrologic testing. Hydraulic testing is planned to determine the conductivity of geologic unit at the well screen. Testing will consist of injection tests or aquifer pumping tests.

It is recommended that R-29 be drilled as an open borehole, using air with minimal fluids. The open hole will facilitate the use of borehole geophysics, which can be used to characterize moisture distribution and identify perched groundwater in the vadose zone. Open-hole geophysics will also provide data to characterize the hydraulic properties of saturated rocks in the regional aquifer as well as provide key information for the selection of well screen depth.

The desire for open-hole characterization data will be balanced against the potential for creating a groundwater pathway to the regional aquifer. If perched groundwater is encountered during drilling, borehole water samples shall be collected and submitted for rapid turn-around analyses for non-sorbing potential contaminants (e.g. ClO_4, NO_3); these screening analyses will be used to evaluate whether contaminants in perched water zones should be isolated with drill casing before the regional aquifer is penetrated.

Cuttings will be collected every 5 feet by the subcontractor to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization. These data will be used to prepare a lithologic log of the borehole.

A summary of the data needs and data collection is shown in the following table:

Data Needed	**Data Collection**
Stratigraphy	Core, cuttings, and geophysical logs
Perched zone identification	Driller observations, borehole video, drill with minimal fluids
Perched zone water chemistry	Borehole screening sample, if perched water is encountered
Regional aquifer water level	Measure water level in borehole and well
Regional aquifer water chemistry	Collect water samples from well

Regional aquifer water chemistry	Collect water samples from well
Regional aquifer hydraulic characteristics	Hydrologic testing

Action Items:	**Action Assigned To:**
1. Propose R-29 location to NMED and get concurrence	Nylander
2. Update cost estimates based on approved R-29 work scope.	McCann
3. Brief NMED on work scope and location for R-29	Nylander McCann/Pearson/
4. Finalize R-29 well site location	Broxton
5. Prepare FIP for R-29	Broxton

Participants:

Bruce Robinson
Elizabeth Keating
Bruce Gallaher
Brent Newman
David Vaniman
Tom Whitacre
Bob Enz
Steve McLin
David Broxton
Kelly Bitner
Phil Wardwell

Meeting Record Prepared By	**Date:**
Kelly Bitner	1/31/03

Meeting Record

Purpose: DQO Meeting to Recommend Characterization Activities for Well R-17, Two Mile Canyon	Meeting Date: 1/28/03

Background Information:

The Hydrogeologic Workplan rationale for R-17 was to provide information on perched and regional aquifer groundwater in the poorly-characterized west-central part of the Lab. It is located down stream of release sites in TAs-3, -6, -58, -59, -62, and –69 in a major tributary to Pajarito Canyon. The DQOs for the R-17 are described below.

Geology – Located in the poorly-characterized western part of the Laboratory. Unknown nature of Cerro Toledo (is it present?). Uncertain thickness, welding, and alteration of the Otowi Member of the Bandelier Tuff. Unknown lithologies beneath the Bandelier Tuff (possible occurrence of Puye Formation, Totavi, pumiceous deposits, and/or Tschicoma lavas). The R-17 location is near H-19. In boring H-19, the stratigraphy encountered was: dacite, Tschicoma dacite, Puye Formation fanglomerates, more Tschicoma dacite, Totavi, and a deeper Tschicoma dacite. This is a surprising stratigraphy because Totavi river gravels are interspersed between dacitic lavas . It is important to know if the Totavi, a transmissive unit, really extends that far west. Confirming the presence of the Totavi that far west is important in structural basin development. There is poor control on the Tschicoma and Cerros del Rio basalts, which overlap in time and composition, and potentially older dacites of Keres age. The distribution of dacite has significant impact on the 3-D geologic model and the ages of the dacites will be necessary to know where in the stratigraphic column the dacites belong. The 3-D model currently assumes thick dacite flows, but if they are thinner and more laterally extensive, that will make a difference in 3D structure of lavas for the model. In the location of R-17 the unit underlying the Bandelier could be Puye Formation as in R-25 or it could be Tschicoma as in R-19.

Hydrology –

Vadose zone: R-17 is in an area that is not known to have vadose zone contamination. It is unknown whether perched zones are present. Perched zones should be looked for during drilling.

Regional aquifer: Regional saturation is expected at a depth of about 1250 ft. There is not a need to measure vertical gradients at this location, because the vertical gradient will be measured in R-6. There were no large liquid release sites upgradient from this location that would tend to move contaminants down to the regional aquifer. This location is important for constraining the water table map. There is a big gap on the map with no data in this area. This information is critical in determining which way HE would be transported from the HE production areas.

Geochemistry-

There are contaminated springs in Pajarito Canyon and the probable source of contaminants is TA-15. However, it is unlikely we would see the contaminants from TA-15 in R-17, unless the water table map is not accurate in this location. R-17 may be a useful location for background regional aquifer quality.

Recommendations:

Based on discussions at the R-17 DQO meeting, a recommendation is made that R-17 be sited in Two Mile Canyon, about 500 feet south of where it is shown on the Hydrogeologic Workplan map. The original location is in a very narrow part of t he canyon and cannot be accessed. R-17 would be used to characterize groundwater in the intermediate-depth perched groundwater (if present) and regional groundwater down gradient from several Laboratory areas. ·This goal is consistent with the original criteria for siting this well in the Hydrogeologic Workplan.

The R-17 Two Mile Canyon site is designed to address the following data needs:

- To determine if the Totavi is present, to determine the presence and character of the lavas, and the thickness and character of the Puye Formation. These data are needed to refine the 3-D geologic model, which is critical for identifying geologic controls on groundwater pathways.
- To identify the presence of perched intermediate saturated zones in order to evaluate groundwater pathways and interconnections between the surface and deep groundwater recharge in Two Mile Canyon.
- To measure the water table elevation in the regional aquifer; this data is important to constraining the water level map and are part of the general characterization of groundwater conditions beneath the Laboratory and support ongoing efforts to improve the hydrogeologic conceptual model.
- To provide aquifer characteristics, and chemistry data for improving the regional flow and transport model.

The R-17 well should be drilled to 200 feet below the top of the regional aquifer, to approximately 1500 ft, to try and penetrate the Tschicoma. If the drilling conditions are too difficult to reach this depth, the borehole should be drilled to far enough below the water table to install a single screen. The well should be completed with a single screen in the regional aquifer, placed near the regional aquifer water table. The screens will provide access to groundwater in the Puye Formation so that the permeability of the Puye at this location can be estimated by hydrologic testing. Hydraulic testing is planned to determine the conductivity of geologic unit at the well screen. Testing will consist of injection tests or aquifer pumping tests.

It is recommended that R-17 be drilled as an open borehole, using air with minimal fluids. The open hole will facilitate the use of borehole geophysics, which can be used to characterize moisture distribution and identify perched groundwater in the vadose zone. Open-hole geophysics will also provide data to characterize the hydraulic properties of saturated rocks in the regional aquifer as well as provide key information for the selection of well screen depth.

The desire for open-hole characterization data will be balanced against the potential for creating a groundwater pathway to the regional aquifer. If perched groundwater is encountered during drilling, borehole water samples shall be collected and submitted for rapid turn-around analyses for non-sorbing potential contaminants (e.g. ClO_4, NO_3); these screening analyses will be used to evaluate whether contaminants in perched water zones should be isolated with drill casing before the regional aquifer is penetrated.

Cuttings will be collected every 5 feet by the subcontractor to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization. These data will be used to prepare a lithologic log of the borehole.

A summary of the data needs and data collection is shown in the following table:

Data Needed	Data Collection
Stratigraphy	Core, cuttings, and geophysical logs
Perched zone identification	Driller observations, borehole video, drill with minimal fluids
Perched zone water chemistry	Borehole screening sample, if perched water is encountered
Regional aquifer water level	Measure water level in borehole and well
Regional aquifer water chemistry	Collect water samples from well
Regional aquifer hydraulic characteristics	Hydrologic testing

Action Items:	Action Assigned To:
1. Propose R-17 location to NMED and get concurrence	Nylander
2. Update cost estimates based on approved R-17 work scope.	McCann
3. Brief NMED on work scope and location for R-17	Nylander
4. Finalize R-17 well site location	McCann/Pearson/ Broxton
5. Prepare FIP for R-17	Broxton

Participants:

Bruce Robinson

Elizabeth Keating

Bruce Gallaher

Brent Newman

David Vaniman

Tom Whitacre Bob Enz Steve McLin David Broxton Kelly Bitner Phil Wardwell	
Meeting Record Prepared By Kelly Bitner	**Date:** 1/31/03

Meeting Record

Purpose:	Meeting Date:
DQO Meeting to Recommend Characterization Activities for Well R-18, Potrillo Canyon	1/28/03

Background Information:

The Hydrogeologic Workplan rationale for R-18 was to provide information on perched and regional aquifer groundwater in the poorly-characterized west-central part of the Lab. The location of R-18 shown in the Hydrogeologic Workplan is inaccessible. Two other locations were suggested for R-18: 1) within TA-14 on the south rim of Pajarito Canyon, 8000 feet west of the confluence with Twomile Canyon and 3100 ft northeast of R-25 and 2) near the confluence with Threemile Canyon. The second location is too close to the 5 FY02 wells installed around TA-54 to offer new information. The DQO discussion focused on the TA-14 site. To fill in an area with little hydrogeologic data, R-18 would have to be further to the east, on Pajarito mesa. However, that is in the midst of firing sites and drilling is not allowed there. Based on discussions at the R-18 DQO meeting, there are no good reasons to drill R-18 in either of the locations that are accessible for the hydrogeologic characterization program. A recommendation is made that R-18 be sited in Portillo Canyon at the location originally planned for R-23 in the Hydrogeologic Workplan. The DQOs for the Potrillo Canyon site are described below.

Geology –

Hydrology –

Vadose zone: R-18 location is near a borehole put in by Naomi Becker and Bill Purtymun to investigate the hydrologic "sink" – an area where surface water infiltrates rapidly. There is also a geophysical anomaly in the high-resolution resistivity survey in this area, suggesting a shallow (<80 feet) low resistivity zone. It has been suggested that this is an area of rapid recharge down stream from firing sites. Brent Newman studied the chloride profile from the core collected in the Becker/Purtymun borehole. The borehole is about 200 feet deep. The chloride profile is not different than any other canyon and there is no suggestion of a high infiltration rate. However, the nitrate is higher than is typical in other canyons (e.g. R-9, R-12). The elevated nitrate is present down to about 70 – 80 feet in the core. Similarly elevated nitrate levels are also present in the core from R-31. There is historical information that prior to land acquisition by the Lab, Potrillo and Ancho canyons were used as wintering areas for sheep. This could possibly be a source of nitrate. Nitrogen isotopes would easily distinguish between nitrate from animals and nitrate from explosives.

Regional aquifer: Regional saturation is expected at a depth of 683 ft. There is a downward vertical gradient at R-22 and R-16 and a flat gradient at R-31. The downward gradient at R-22 and R-16 are unexpected. R-18 in this location is a good candidate for multiple completion well to measure the vertical gradient. This would help distinguish whether the downward gradients at R-22 or R-16 local or related to recharge; is this a broad regional characteristic of the aquifer or a local perturbation of the aquifer. Have we biased our water table measurements by installing wells in areas of higher recharge because those are the areas we are concerned about. It would also be useful in evaluating the influence of pumping on recharge in northern canyons.

Geochemistry-

Considering the nitrate in the core from the Becker/Purtymun borehole and the location down stream from HE sites, core should be collected in the vadose zone and analyzed for HE suites, the special HE suite that identifies HE degradation products, nitrogen isotopes, stable isotopes, anion, depleted uranium, beryllium, and the top four contaminants in firing site runoff identified by Naomi Becker. The water in the regional aquifer should be analyzed for the same constituents. A plan for collecting C-14 data from the regional aquifer should be developed and it is likely that this well would be a good place for C-14 data.

Recommendations:

Based on discussions at the R-18 DQO meeting, a recommendation is made that R-18 be sited in Potrillo Canyon at the site of R-23 in the original Hydrogeologic Workplan in order to characterize groundwater in the intermediate-depth perched groundwater (if present) and regional groundwater down gradient of releases from firing sites and in an area suspected of high infiltration. This goal is revised from the original criteria for siting this well in the Hydrogeologic Workplan.

The R-18 Potrillo Canyon site is designed to address the following data needs:

- To measure the thickness of the Cerros del Rio basalts at this location, determine if the Totavi is present, and to determine the presence of older basalts and if Puye Formation or Santa Fe Group is below the Ceros del Rio basalts (or older lavas). These data are needed to refine the 3-D geologic model, which is critical for identifying geologic controls on groundwater pathways.
- To estimate the infiltration rate and understand the distribution of contaminants in the vadose zone in order to evaluate groundwater pathways and interconnections between the surface and deep groundwater recharge in Potrillo Canyon.
- To measure the water table elevation and vertical gradient in the regional aquifer; these data are part of the general characterization of groundwater conditions beneath the Laboratory and support ongoing efforts to improve the hydrogeologic conceptual model.
- To provide aquifer characteristics, and chemistry data for improving the regional flow and transport model.

Although the regional aquifer flow gradient in this area is expected to be horizontal, the gradient in nearby wells (R-22 and R-16) is downward. In order to measure the vertical gradient, the R-18 well should be drilled to 500 feet below the top of the regional aquifer and be completed with up to 4 screens in the regional aquifer, placed in different geologic units encountered. The screens will provide access to groundwater in different geologic units so that the permeability of the units can be estimated by hydrologic testing. Hydraulic testing is planned to determine the conductivity of geologic units at the well screen. Testing will consist of injection tests or aquifer pumping tests.

It is recommended that R-18 be drilled as an open borehole, using air with minimal fluids. The open hole will facilitate the use of borehole geophysics, which can be used to characterize moisture distribution and identify perched groundwater in the vadose zone. Open-hole geophysics will also provide data to characterize the hydraulic properties of saturated rocks in the regional aquifer as well as provide key information for the selection

of well screen depth.

The desire for open-hole characterization data will be balanced against the potential for creating a groundwater pathway to the regional aquifer. If perched groundwater is encountered during drilling, borehole water samples shall be collected and submitted for rapid turn-around analyses for non-sorbing potential contaminants (e.g. ClO_4, NO_3); these screening analyses will be used to evaluate whether contaminants in perched water zones should be isolated with drill casing before the regional aquifer is penetrated.

The upper portion of the boring will be cored in selected intervals in order to determine contaminant distribution, moisture, and anion/isotope profiles in the vadose zone. Cuttings will be collected every 5 feet by the subcontractor to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization. These data will be used to prepare a lithologic log of the borehole.

A summary of the data needs and data collection is shown in the following table:

Data Needed	**Data Collection**
Stratigraphy	Core, cuttings, and geophysical logs
Perched zone identification	Driller observations, borehole video, drill with minimal fluids
Perched zone water chemistry	Borehole screening sample, if perched water is encountered
Contaminant distribution in vadose zone	Core in upper portion; cuttings for sorbing species
Regional aquifer water level	Measure water level in borehole and well
Regional aquifer water chemistry	Collect water samples from well
Regional aquifer hydraulic characteristics	Hydrologic testing

Action Items:	**Action Assigned To:**
1. Propose R-18 location to NMED and get concurrence	Nylander

2. Upate cost estimates based on approved R-18 work scope. 3. Brief NMED on work scope and location for R-18 4. Finalize R-18 well site location 5. Prepare FIP for R-18	McCann Nylander McCann/Pearson/ Broxton Broxton
Participants: Bruce Robinson Elizabeth Keating Bruce Gallaher Brent Newman David Vaniman Tom Whitacre Bob Enz Steve McLin David Broxton Kelly Bitner Phil Wardwell	
Meeting Record Prepared By Kelly Bitner	**Date:** 1/31/03