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DRILLING PLAN FOR REGIONAL AQUIFER WELL R-56





Prepared by TPMC for the Environmental Programs Directorate

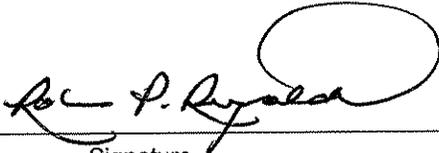
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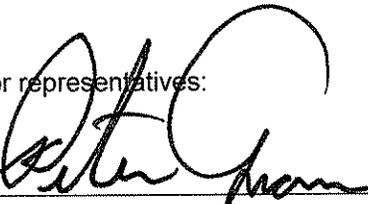
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ACRONYM LIST

APS	Accelerator Porosity Sonde
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BMP	Best management practices
CD	Compact disc
CMR	Combinable Magnetic Resonance
DOE	Department of Energy
EES	Earth & Environment Science Division
EP-WES	Environmental Programs Waste and Environmental Services
ER-SOP	Environment and Remediation Standard Operating Procedure
ES&H	Environment, Safety and Health
FMI	Formation Microimager
ft	Feet
FTL	Field Team Leader
FOD	Facility Operations Director
gal	Gallons
gpm	Gallons per minute
HP	Horsepower
ID	Inside diameter
IDW	Investigation Derived Waste
in	inch
IWD	Integrated Work Document
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security
MDA	Material Disposal Area
NMED	New Mexico Environment Department
NTU	Nephelometric turbidity units
OD	Outside diameter
OM	Operations Manager
PIC	Person in charge
PM	Project manager
ppm	Parts per million
PR-ID	Project Review and Requirements Identification
PVC	Polyvinyl chloride
RCT	Radiological control technician
RLM	Responsible Line Manager

RP-1/ RP-3	Radiological protection group(s)
SMO	Sample management office
SOM	Shift Operations Manager
SOW	Statement of Work
STR	Subcontract Technical Representative
SWPPP	Storm Water Pollution Prevention Plan
TD	Total Depth
TOC	Total organic carbon
TPMC	TerranearPMC
WCSF	Waste Characterization Strategy Form

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1.0 INTRODUCTION

1.1 Background

TerranearPMC has been contracted to install a regional aquifer monitoring well by Los Alamos National Security (LANS) Environmental Programs (EP) Directorate. The regional aquifer well (designated as R-56) will be located between Material Disposal Area (MDA) L and MDA G within Los Alamos National Laboratory (LANL) Technical Area (TA) 54 in Los Alamos County, New Mexico (Figure 1). All work will be performed under the statement of work (SOW) and in accordance with the Compliance Order on Consent (2005) between the New Mexico Environment Department (NMED) and the United States Department of Energy (DOE)/LANL, and the Drilling Work Plan for Regional Monitoring Well Aquifer Well R-56 (LA-UR-10-0426).

Regional aquifer monitoring well R-56 will be installed as part of the Environmental Programs TA-54 monitoring network. The R-56 well will be installed at a depth of approximately 1100 feet (ft) below ground surface (bgs). R-56 will be drilled approximately 180-ft into the regional aquifer and will be a dual screen completion. The screen intervals for R-56 will likely be installed in the Cerros del Rio basalt near the top of the regional aquifer and in the uppermost transmissive zone within the Puye Formation. Final well design will be determined based on conditions found during drilling and geophysical logging and will incorporate discussions with NMED.

This Drilling Plan provides guidance for drilling, sampling, borehole geophysics, well installation, well development, sampling system installation, and site restoration activities. Project staff, health and safety, waste management, security, schedules, and required permits are also discussed in this document.

1.2 Objectives

The R-56 monitoring well is intended to provide hydrogeologic and groundwater quality data to achieve specific data quality objectives consistent with the Groundwater Protection Program for the Laboratory and the Compliance Order on Consent (March 2005) and the NMED approved workplan. Specifically, R-56 is being installed to satisfy a requirement by the NMED to install a monitoring well between MDAs L and G. The primary purpose of R-56 is to monitor regional groundwater east of MDA L and to provide baseline data from groundwater flowing eastward toward MDA G.

Secondary objectives are to establish water levels in the regional aquifer, collect drill-cutting samples, borehole geophysical data, and sample potential perched groundwater zones, if present.

The end-users of the data collected from this project will be LANL, DOE, NMED, and the general public.

2.0 ORGANIZATIONAL STRUCTURE

This project is being performed for LANS. The LANL Environmental Programs Drilling Subcontract Technical Representative (STR) will assist with obtaining the necessary LANL-required permits and assist with scheduling and logistical issues.

An organizational chart is presented in Table 1.

2.1 TerranearPMC Project Management Team

The TerranearPMC Management Team consists of the Program Manager, Project Manager (PM), Drilling Superintendent, Environment, Safety and Health (ES&H) Representative, and Quality Assurance (QA) Manager. The Management Team will review all task order work plans, ensure compliance with QA, ES&H plans, and perform project audits of ongoing work.

The Management Team will also provide technical assistance to the Field Team. In addition, they will provide health and safety oversight and quality control guidance for well-construction and procedure compliance.

The ES&H Representative will provide health and safety related technical assistance and senior review of all project specific safety plans. He will also conduct daily project site safety inspections. The TPMC and LANS Management Team key personnel and their respective roles are detailed in Table 2.

2.2 Field Team

TerranearPMC's field team personnel and their respective roles are shown in Table 2. Additional qualified staff may be added as necessary to ensure all project requirements are met. These staff will be identified and their roles assigned before work begins.

During the drilling operations, there will be two onsite TerranearPMC personnel. One geologist will be onsite full time as the Field Team Leader (FTL)/Person in Charge (PIC) and lead site geologist. The other TerranearPMC team member will assist the geologist as needed. The field geologists will maintain field notes detailing daily site activities, compile and submit daily field reports, document down-hole tools, collect samples, conduct lithologic logging, document wastes generated, and conduct daily safety meetings and equipment inspections. The FTL/PIC will be the main point of contact at the site.

Field operations will run 12-hours a day, seven days per week and shifts will be 12-hours per day throughout the duration of the project. Shift timing is yet to be determined. TerranearPMC staff will rotate shifts on a regular basis. TerranearPMC field team members will be interchangeable and their exact scheduling is expected to be flexible.

2.3 Drilling Subcontractor

Boart Longyear will be the drilling subcontractor supporting the drilling, well installation, and development of R-56. The drilling subcontractor will be responsible for site safety, consistent and adequate sample recovery, ensuring that equipment is appropriate for the goals of the drilling project and in proper working order, and that daily drilling logs are maintained.

The Boart Longyear drilling staff will rotate on a 14-day schedule. Continuous operations will require two crews. One crew will start the job and will work 14 consecutive days before the relief crew arrives. The relief crew will work 7 consecutive days, giving the primary crew a 7-day break.

3.0 FIELD ACTIVITIES

Field activities will include well drilling, sample collection, down-hole geophysical characterization, well installation, well development, aquifer testing, permanent sampling system installation, surface completion, and site restoration. The Drilling Work Plan for Regional Monitoring Well

Aquifer Well R-56 (LA-UR-10-0992) will be used to guide field operations and ensure all objectives are met. A tentative schedule for project field activities is presented in Table 3.

3.1 Well Drilling

Drilling equipment and supplies for the completion of the project will be staged around the work site in an organized and secure manner. Surplus and/or inactive equipment and supplies may be stored at the LANL drilling project laydown yard located at the northwest corner of Pajarito Road and New Mexico State Road 4. Access to the laydown yard is through a locked gate. The FTL will control the gate key.

3.1.1 Mobilization

Mobilization will consist of transporting and setting up equipment at the location. Mobilization will include the following:

- Mobilize drill rig, trailers, support vehicles, drilling tools and materials, and well construction materials to the drill site.
- Stage alternative drilling tools and construction materials at the laydown yard.
- Entrance radiological screening of all equipment and tooling by RP-1.
- Set up drill rig, trailers, support vehicles and tools at the location.
- Review scope of work and project-specific health and safety issues with crew.
- Complete all required training for all personnel.
- Obtain Facility Operations Director (FOD) Work Authorization, including rig inspection and Integrated Work Document (IWD) review.

The R-56 site will be accessed through the TA-54 access control center.

3.1.2 Drilling Methods

The borehole for R-56 will be drilled using a Foremost DR-24 HD drill rig. Specifications for this machine may be found at Foremost's website (<http://www.foremostmobile.com/index.php>). The potential presence of intermediate-depth groundwater (potentially present above or within the lavas of the Cerros del Rio basalt) and the condition of the lavas will impact drilling method choices for the R-56 borehole. Intermediate-depth groundwater may be present at the R-56 location.

The primary drilling methods will be conventional dual-rotary casing-advance and open-hole drilling. Several different sizes of casing will be available. The casing diameters will be sufficient to allow smaller casing to telescope through larger casing with the smallest diameter casing allowing a minimum 2-in annular filter pack thickness. All casings will be standard wall, A53 grade B welded casing and the anticipated sizes for R-56 are 18-in, 16-in, and 12-in.

Figure 2 illustrates the predicted stratigraphy and proposed well design for R-56. The discussion of drilling methods that follows refers to the stratigraphic contacts shown in Figure 2.

Retractable 18-in and 16-in casing strings will be advanced with fluid-assisted air-rotary methods into and through the Tschirege member of the Bandelier Tuff, the Cerro Toledo Interval, the Otowi member of the Bandelier Tuff, the Guaje Pumice Bed, and any underlying Puye Formation sediments to the top of the Cerros del Rio basalt at an estimated depth of 397 ft bgs. Observations of potential perched water production will be made while drilling in the Cerro Toledo interval (264 – 304 ft bgs), the Guaje Pumice Bed (382 – 397 ft bgs), any Puye Formation sediments above the Cerros del Rio basalt, and in the upper portion of the Cerros del Rio basalt (397 ft bgs – base of basalt and/or top of regional aquifer).

An attempt will be made to advance a 15-in open borehole with fluid-assisted air-rotary methods and down-hole hammer through the lavas (an estimated minimum depth of 1035 ft bgs). The Cerros del Rio basalt is expected to provide difficult drilling conditions at the R-56 location. Intervals containing cinders, sediments, and thin lava flows may be encountered. The primary strategy for managing unstable borehole conditions will be to advance the open borehole as far as possible, cement problematic intervals, and then redrill the cemented interval(s). If unstable conditions are encountered within 100-ft of the predicted top of the regional aquifer (at an estimated depth of 922-ft bgs), drilling operations will switch to casing advance methods using 12-in casing and an under-reaming hammer bit to avoid introducing cement within 100-ft of the aquifer. Similarly, if perched groundwater is present, the primary strategy will be to cement the perched interval in order to seal the borehole and redrill the cemented interval. If perched groundwater is encountered within 100-ft of the predicted top of the regional aquifer, the borehole will be cased with 12-in casing and temporarily sealed with bentonite to isolate the perched water.

Drilling conditions and requirements in the volcanoclastic river deposits will be evaluated when the formation is encountered. It is anticipated that a 15-in open hole will only be able to be established partially into the basaltic lava sequence. Then 12-in casing and dual rotary methods will be used to advance the borehole through the lavas, into the Puye Formation sediments, and on to TD. It is possible, given the projected TD of R-56, that 12-in casing may not reach the entire depth to TD. If that should be the case, 10-in casing will be available and will be employed to reach TD.

All casing strings installed in the R-56 borehole will use welded drive shoes on the bottom of the string to protect the leading edge of the casing and to assist in cutting the borehole. The drive shoes will be cut off the casing strings using a pneumatic casing cutter on drill rods before casing extraction. Larger casing strings and the attached drive shoes will be cut prior to installing smaller casing strings. Short sections of each string of casing and the attached drive shoes will remain in the borehole and will be isolated in bentonite during well construction.

The DR24-HD drill rig will move off the R-56 borehole after the deepest casing drive shoe has been cut. All well construction, development, and similar activities will be carried out by a work-over (pump hoist) rig.

3.1.3 Proposed Alternative Drilling Methods

Drilling conditions may require converting to alternative methods. Consultation with the LANL STR will precede any deviations from the above referenced drilling methods. Conventional dual-rotary and casing advance will be the primary drilling methods employed at the R-56 borehole.

3.1.4 Drilling Additives

Potable water from a municipal source will be used to cool the drilling tools, help evacuate cuttings from the borehole and suppress dust from the discharge of dry returns. Filtered compressed air will be the primary circulation 'fluid' for returning cuttings to the surface. Drilling foam will be used as needed and will be terminated approximately 100 ft above the top of the regional aquifer. Descriptions of potential drilling foaming agents are as follows.

- AQF-2®: Added at a rate of 0.5 to 2.0% by volume. AQF-2 is an anionic surfactant that is added to fresh water for air/foam, air/gel-foam, or mist drilling applications. AQF-2 is the newest foaming agent in the Baroid line and is the preferred foaming agent for environmental drilling applications.
- Quik Foam®: Added at a rate of 0.5 to 1.0% by volume. Quik Foam provides the surfactant necessary for foam formation.

Portland Type I/II cement with either no aggregate or a small amount of sand may be used for sealing perched groundwater intervals or managing unstable borehole conditions in the basaltic lavas. Hydrated bentonite chips may be used for sealing perched groundwater intervals within 100-ft of the predicted top of the regional aquifer. The LANL STR will be contacted for approval before any perched groundwater zone is sealed off.

3.1.5 Decontamination

Decontamination of the drill rig and tools will be performed by hot water/steam pressure washing before arriving onsite prior to the start of drilling activities and before leaving the site. Decontamination water will be containerized in 55-gallon drums, properly labeled and stored onsite. Decontamination of sample tools will be performed with a wire brush followed by spraying with Fantastik® and wiping clean with paper towels. Bailers will be washed with LiquiNox® detergent and potable water and rinsed with deionized water prior to sample collection.

3.1.6 Demobilization

Demobilization activities will include:

- Final decontamination and screening for radioactivity by RP-1 of the drill rig, tools, and support equipment.
- Loading and removal of the drilling tools, including alternative tools, from the site.
- Removal of the drill rig and support vehicles from the site.
- Staging and securing of investigation derived wastes (IDW) for future disposition.
- Removal of municipal waste (e.g. materials packaging).
- Final site cleanup.

The LANL STR will inspect the site prior to final demobilization of the drill crew. Final demobilization of the drill crew will not be permitted until the condition of the site is acceptable to the STR.

3.2 Groundwater Detection

The primary indicator for perched water will be driller's observations. If the driller notes any indication of groundwater, drilling will stop, the drilling tools will be removed from the borehole and the presence of water will be verified using a water level meter. Alternatively, if the drill tools employed allow, the presence of water may be verified through the tooling without removal from the borehole. If water exists in the borehole the tools will either be pulled from the borehole or remain out of the hole to allow the field team to check for accumulation of water in the borehole and collect a sample for analysis. The LANL STR will be notified within four hours of perched groundwater detection or by 10 AM of the following day if detection was made during the night shift.

3.3 Sample Collection Procedures

All samples will be collected by the TPMC field team and transported to the SMO and/or EES-14 laboratory, as appropriate. A 'samples collected' table will be maintained electronically and submitted to the STR at the conclusion of each phase of the project.

3.3.1 Groundwater Screening and Groundwater Characterization Sample Collection

Sample collection and handling procedures will be conducted in accordance with TPMC procedures equivalent to ENV-DO-306, SOP-5057, and SOP-5058 (LANL 2001b, LANL 2000, LANL 2002). See Table 4 for analytical suites, container size, and preservation.

Groundwater screening samples will be collected if significant perched groundwater is encountered, at the first productive interval within the regional aquifer, and at the TD of the borehole. Screening samples will be analyzed for tritium and volatile organic compounds (VOCs) by offsite laboratories and for dissolved cations/metals and anions by the LANL Earth and Environmental Sciences Division (Group EES-14) chemistry laboratory. Samples will also be collected from the well screen interval(s) at the end of well development and during aquifer pump testing. Development and aquifer testing samples will be analyzed for total organic carbon (TOC) only by the EES-14 laboratory.

Groundwater characterization samples will be collected from the completed well between 10 and 60 days after well development in accordance with the Consent Order. If the well is completed with two screens, the initial characterization samples will be collected at the end of the aquifer tests through stainless steel discharge pipe. A groundwater sampling team will assist in sample collection. The samples will be analyzed for the full suite of constituents including: radioactive elements, metals/cations, general inorganic chemicals, volatile and semi-volatile organic compounds, and stable isotopes of hydrogen, nitrogen, and oxygen. This sampling event will be performed by others and is not a part of this drilling plan.

3.3.2 Cuttings Samples

Cuttings will be collected from the discharge line at 5-ft intervals. The cuttings will be examined to determine lithologic characteristics and will be used to prepare lithologic logs. Portions of the cuttings will be wet sieved (using #10 and #35 mesh) and placed in chip trays along with unsieved cuttings. The sieved fractions in chip trays will be submitted to the LANL archive. Lost circulation zones with no cuttings returns will be indicated by empty chip trays and cuttings-loss markers (core boxes) labeled 'no returns'. The remaining bulk cuttings will be sealed in Ziploc® bags, labeled, and archived in core boxes. The core boxes and chip trays will be delivered to the

LANL archive at the conclusion of drilling activities. A summary of cuttings sampling is presented in Table 5.

3.4 Down-Hole Geophysics

The R-56 borehole may be logged with LANL-owned geophysical tools as requested during drilling. It is anticipated that LANL geophysical runs will be coordinated with specific drilling targets (e.g. upon reaching TD or before hanging a casing string in an open portion of the borehole). Additionally, the LANL-owned down-hole video camera may be used to evaluate and remedy adverse conditions.

Subcontract geophysical logging may be performed in the R-56 borehole by Schlumberger Water Services. If requested, Schlumberger will log the entire borehole after TD is reached. The following cased-hole Schlumberger geophysical suite may be run in the R-56 borehole:

- Natural and Spectral Gamma Logs
- Elemental Capture Sonde (ECS)
- Accelerator Porosity Sonde (APS)
- Triple Litho Density

In the event that the borehole is open, the following open-hole Schlumberger geophysical suite will be performed:

- Natural and Spectral Gamma Logs
- Accelerator Porosity Sonde (APS)
- Formation Microimager (FMI); can only be operated below the water table
- Array Induction
- Combinable Magnetic Resonance (CMR)

The logs will be used to characterize the hydraulic properties of saturated rocks within the regional aquifer and to help select the well screen interval. The geophysical logging operation will consist of one mobilization after reaching the total depth for R-56. Personnel from RP-3 will perform radiological screening and documentation of Schlumberger's down-hole radioactive source tool(s) upon arrival and prior to departure. If logging is conducted in an open hole, no radioactive sources will be used; however, RP-3 will be notified. A TPMC field crewmember will be present during logging operations to oversee logging runs and calibration checks.

Schlumberger will process the geophysical logs and provide a preliminary interpretation within 24 hours of completion. Five copies of the raw field geophysical logs and a compact disc (CD) containing the field logs (in .las format) will be provided to LANL immediately after completion of logging. Final logs, electronic files, and montages will be provided in the well completion report.

The drilling subcontractor shall assist in hanging a sheave from the rig mast or tophead for wireline access to the borehole during all geophysical logging operations.

3.5 Well Installation and Completion

Two well screens will be placed in the most productive intervals identified within the upper 180 ft of the regional aquifer. Data from screening samples and the lithologic, geophysical, and video logs will be used to determine the exact placement of the screened intervals of the well. The well will be designed in accordance with TPMC's procedure equivalent to LANL ER SOP-5032. LANL will provide an approved well design to TPMC prior to the start of well installation. Final well design will be based on data review and discussions between TPMC, EP-WSP, DOE and NMED.

The total well screen length and well construction details will be based upon site-specific conditions and will be approved by the LANL STR in writing before the start of well construction. NMED will approve the design prior to well construction.

3.5.1 Well Construction

The well will be constructed of 5.0-in. inside diameter (ID)/ 5.56-in outside diameter (OD), type A304, stainless steel casing fabricated to ASTM A312 standards provided by LANS. The screened interval of the well will consist of nominal 11-ft length(s) of 5.3-in OD, 0.020-in slot, rod-based wire wrapped well screen. Each well screen segment has an effective screen length of 10 ft. Stainless-steel casing will be installed below the bottom-most well screen to provide up to a 20 ft sump with a threaded end cap. External couplings, also of type A304 stainless steel fabricated to ASTM A312 standards, will be used to connect individual casing and screen joints. Alternatively, beveled (unthreaded) stainless steel well casing may be used with casing segments joined by welding. All well screen and casing will be thoroughly washed/ decontaminated before use and wrapped in plastic if staged after washing. Centralizers will be placed 2-ft above and below the well screen. A secure cap will be welded or threaded onto the top of the well casing to prevent backfill materials from entering the well during construction.

Due to observations made at other dual screen well constructions, a temporary isolation packer will be set inside the well between the well screens in order to eliminate potential cross flow of introduced water within the well. If the screen intervals should be located in zones of drastically different permeabilities, annular fill materials, especially bentonite, can be forced up into the drill casing under the influence of introduced water flowing into the upper screen and out the lower screen. The packer will be a liquid-inflated, mechanically-set bridge plug.

A tremie pipe will be used during well construction to gravity feed the annular fill materials below the regional aquifer water table. The bottom of the borehole will be tagged at the beginning of well installation and bentonite chips will be placed from the bottom of the borehole to within 5 ft of the bottom of the screened interval. The well shall be supported from the top at all times during construction.

The primary filter pack of the screened interval will consist of 10/20 sand and will be placed approximately 5 ft above and below the screened interval. The primary filter pack material and interval will be based on site-specific data. After placement, the screened interval will be swabbed to promote settling and compaction of the primary filter pack. A two to five foot thick collar of finer-grained (20/40) sand will be placed above the primary filter pack.

A bentonite seal consisting of 100 percent bentonite chips or pellets will be placed above the fine sand collar. Potable water will be used to transport the materials down-hole.

Backfill material will consist of bentonite chips to fill the borehole annulus to within 100 ft of the ground surface. Neat cement, or other approved mix, will be used to fill the remainder of the borehole annulus. The depth to annular material will be measured periodically to determine that the materials are settling properly.

3.5.2 Well Development

Development of R-56 will begin no sooner than 24-hrs after the well has been cemented to ground surface. The primary objective of well development is to develop the filter pack and remove suspended sediment from the well until water turbidity is less than 5 nephelometric turbidity units (NTUs) for three consecutive samples collected at 30-minute intervals. Additional water quality parameters to be measured during development include pH, temperature, specific conductance, dissolved oxygen, and total organic carbon (TOC). If the turbidity standard is not attainable, an alternate standard of stabilization of pH, temperature, conductivity, and a TOC level of less than 2.0 parts per million (ppm) must be achieved before termination of development procedures. Water will be collected daily in 40-ml septum vials and transferred to the LANL EES-14 laboratory for analysis. Samples will be submitted unfiltered and without preservatives.

Development of the well will begin by bailing and swabbing the screened intervals and sump to remove any backfill and/or formation materials that have been introduced into the well during drilling and well construction and clean the filter pack. Bailing will continue until water clarity visibly improves.

The screened intervals will be swabbed using a surge block to enhance filter pack development. The surge block will consist of a 4.75-in. OD, 1-in. thick nylon (or similar) disc attached to a weighted static rod operated on a wireline. The swabbing tool will be lowered into the well and drawn repeatedly across the screened interval for approximately 1 hour. Water turbidity will not be measured during the bailing and swabbing process.

A 4-in. diameter submersible pump with an appropriately sized pump motor will be used for the final stage of the well development. The submersible pump used during development will be a larger unit, capable of moving larger volumes (20+ gallons per minute), than the pump to be installed for the dedicated sampling system. The pump intake will be set at multiple depths within the screened intervals and in the sump to remove as much suspended sediment as possible until the desired results (parameters) are achieved. The screen intervals will be isolated with an inflatable packer for the final pumping stage of well development. Water quality parameters collected during pumping will be discrete.

3.5.3 Aquifer Testing

Aquifer pump testing will be conducted for each well screen at R-56. Aquifer tests will be designed and implemented at the direction of David Schafer and Associates. An isolation packer will be installed between the two screens to eliminate communication between the two zones if the well is inactive for more than 24 hrs at a time.

3.5.4 Sampling System Installation

The dedicated sampling system will be custom-designed based on hydrogeologic data gathered during the aquifer tests. The system's plumbing and inflatable packer will be manufactured by Baski, Inc. in Denver, Colorado. It is anticipated that the system will implement a shrouded 4-in, Grundfos® submersible pump (environmentally retrofitted with Teflon®) with a 4-in, 3-phase, 460-

volt, Viton fitted Franklin Electric® submersible motor. The pump size (horsepower) will be specified after well screen interval specific capacity observations are made during aquifer testing. The pump will draw water from discrete intervals via pneumatically actuated access port valves. Inflatable Viton covered packers will be supplied as components of the dedicated systems.

All materials that contact the groundwater will be constructed of either stainless steel, Teflon, Viton, or PVC. All components of the pump column will be new. The pump column will be constructed of 1-in threaded/coupled passivated stainless steel pipe with check valves installed in the pipe string every 200 ft. The exact composition and pedigree of the 1-in. stainless pump column will be documented in the field logbook, in the sample system receipt inspection, and in the final well completion report. A weep hole will be installed at the bottom of the uppermost pipe joint to protect the pump column from freezing. To measure water levels in the well, two 1-in inside diameter (ID) schedule 80 polyvinyl chloride (PVC) pipes will be installed to sufficient depths to set dedicated transducers below the measured static water levels. The upper screen interval PVC transducer tube will be equipped with a 6-in section of 0.010-in slot screen with a threaded end cap at the bottom of the tube. The lower screen interval PVC transducer tube will be equipped with a flexible nylon tube that will extend from a threaded end cap at the bottom of the PVC tube through the isolation packer to measure water levels in the lower screen interval. A LANL-standardized weather-resistant pump control box will be installed next to the wellhead.

A design drawing or memorandum describing the system in detail will be submitted to LANL for approval prior to placing the order with Baski. While the sampling system is designed and fabricated an isolation packer (either detachable or inflatable) will be kept between the two screens.

3.5.5 Surface Completion

The wellhead surface completion will include a 16-in. steel outer protective casing to protect the stainless steel monitoring well. The protective casing will extend below ground surface to approximately 3-ft. The wellhead completion will be a 'stick-up' with an overall height, including riser cap, of 3-ft, 6-in. A weep-hole will be installed to prevent water build-up inside the protective casing. The top of the protective casing will be fitted with a LANL supplied tamper-proof well cover plate and will be set in a 10-ft by 10-ft by 6-in.-thick reinforced concrete pad. A brass survey monument, imprinted with well identification information, will be placed in the northwest corner of the pad. A total of four bollards, painted yellow for visibility, will be set at the outside edges of the pad to protect the well from traffic. All four bollards will be designed for easy removal to allow access to the well.

Southwest Mountain Surveys, a New Mexico licensed professional land surveyor, will survey the well location and elevation. Survey points will include: ground surface elevation near the concrete pad, the top of the brass pin in the concrete pad, the top of the well casing, and the top of the protective casing. The accuracy of the survey data will be in accordance with NMED Regulations and LANL procedure. Survey data will be supplied to the LANL STR and will also be provided in the completion report.

3.6 Investigation Derived Waste

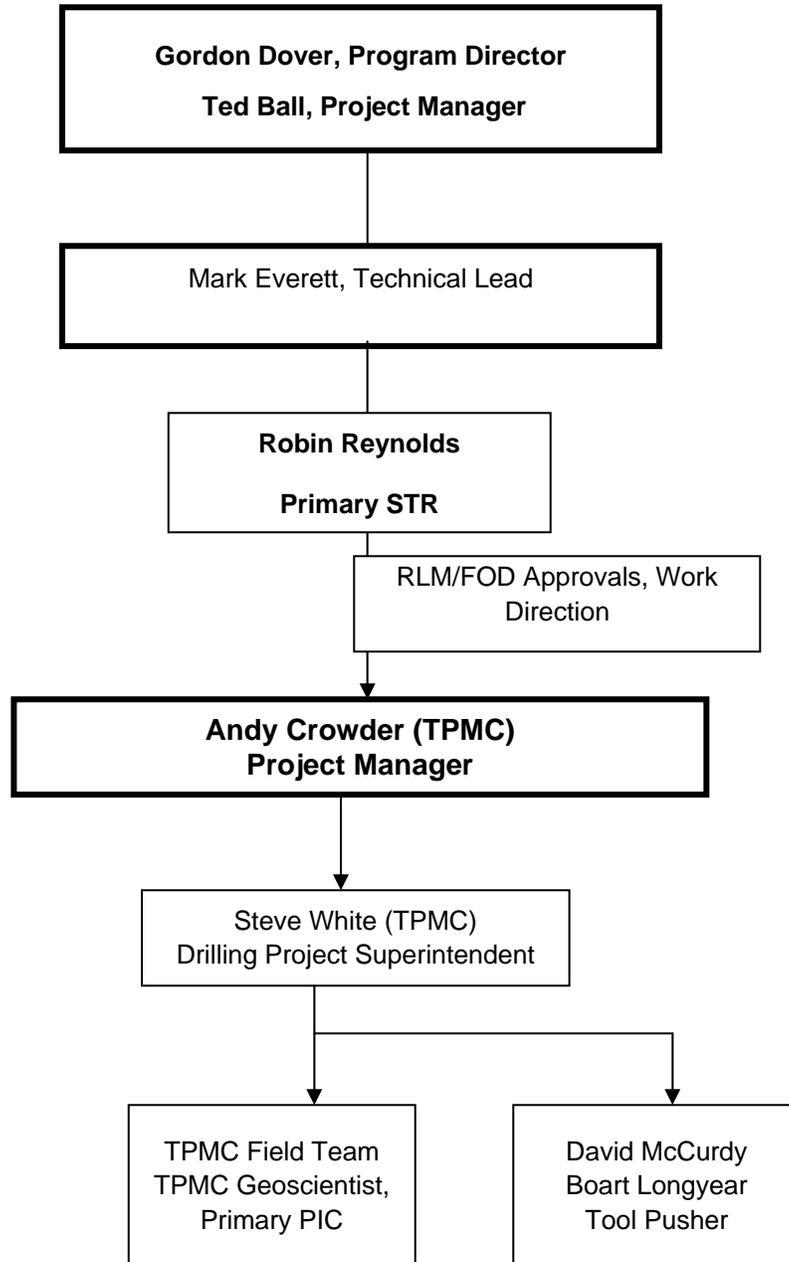
All IDW generated during implementation of this work plan will be managed in accordance with applicable Environmental Programs—Waste and Environmental Services (EP-WES) and Environmental Protection Water Quality and Resource Conservation Recovery Group (ENV-RCRA) SOPs. These SOPs incorporate the requirements of all applicable U.S. Environmental

Protection Agency (EPA) and NMED regulations, DOE orders, and Laboratory requirements. Documents applicable to the characterization and management of IDW are the following:

- SOP-5238, Characterization and Management of Environmental Program Waste (http://int.lanl.gov/environment/all/docs/qa/ep_qa/SOP-5238.pdf);
- the NMED-approved Notice of Intent (NOI) Decision Tree for Drilling, Development, Rehabilitation, and Sampling Purge Water; and
- the NMED-approved NOI decision Tree for IDW Solids from Construction of Wells and Boreholes.

A Waste Characterization Strategy Form (WCSF) will be prepared by LANS in accordance with SOP-5238 and will provide more detailed information on waste descriptions, quantities, handling, and disposition. All wastes generated during the R-56 project will be managed according to the WCSF.

Table 1
R-56 Project Organizational Chart



**Table 2
TerranearPMC Key Team Personnel Roles and Responsibilities**

Name	Role	Responsibilities
Peter Gram	Program Manager	Program Management
Andy Crowder	Project Manager, Alternate Person in Charge (PIC)	Project management, budget, resource commitments, and LANS interaction
Steve White	Drilling Superintendent, Principal Field Team Leader (FTL), Alternate PIC	Project and field management, LANS interaction, geology, and subcontractor coordination
Travis Costello	ES&H Representative	IWD and Health and Safety compliance
Al Whiteaker	Quality Assurance Manager	Quality assurance management oversight
Gary Stoopes	Environmental Professional	Regulatory compliance
Ryan McGuill	Field Geologist, FTL/ Alternate PIC	Field management, geology, and subcontractor coordination
Luana Rought	Field Geologist, FTL/ Alternate PIC	Field management, geology, and subcontractor coordination
Andy Miller	Field Geologist, FTL/ Alternate PIC	Field management, geology, and subcontractor coordination
Mickey Jojola	Field Geologist, FTL/ Alternate PIC	Field management, geology, and subcontractor coordination
Scott Muggleton	Field Geologist, FTL/ Alternate PIC	Field management, geology, and subcontractor coordination
Len Sabatino	Field Waste Management Technician	Management of waste and implementation of WCSF
Robert Stadeli	Boart Longyear Drilling Supervisor	Project and technical management oversight of drilling operations
David McCurdy	Boart Longyear Tool Pusher	Project and technical management oversight of drilling operations

**Table 2 (Continued)
LANS Key Team Personnel Roles and Responsibilities**

Name	Role	Responsibilities
Gordon Dover	Program Director	Responsible for the overall planning, coordination, approval, execution and closeout for this project. Authorizes and approves project work
Ted Ball	Project Manager	Responsible to the Program Director for the successful execution of the project.
Mike Alexander	Facility Ops Director (FOD)	Facility Operations and Security Management/Coordination; When delegated authorizes and approves project work
Mark Everett	Drilling Project Technical Lead	Responsible for all drilling projects technical planning, oversight, execution and closeout.
Terry Forrester	Procurement Specialist, (PS)	Responsible for solicitation, negotiation, award, and administration of subcontracts and has overall commercial responsibility for respective subcontracts; designated authority to direct subcontractor
Robin Reynolds, MTOA Task Order 7 Primary STR Dave Anderson, Secondary STR	Primary Point-of-Contact (POC), Subcontract Technical Representative (PSTR)	Responsible to the Project Manager for monitoring and documenting the subcontractor's day-to-day performance, providing day-to-day oversight, assuring work is performed in a safe manner. STR is the single Point-of-Contact for interaction between LANS and Subcontractor.

**Table 3
Tentative R-56 Drilling Schedule**

Activity	Start Date	Date of Completion
Drill Site Preparation	Complete	Complete
Driller Mobilization	4/8/10	4/9/10
R-56 Drilling	4/10/10	5/5/10
R-56 Geophysics	5/6/10	5/7/10
R-56 Well Construction	5/9/10	6/3/10
R-56 Development	6/4/10	6/11/10
R-56 Aquifer Testing	6/12/10	6/22/10
R-56 Pump Installation	TBD	TBD
IDW Analyses	TBD	TBD
Site Restoration	TBD	TBD

Notes: TBD = to be determined

Table 4
Analytical Suites, Sample Containers, Sample Volume, and Preferred Laboratories for
Groundwater Collection from Well R-56

Analytical Suite	Sample Container	Filtered (0.45 micron filter)	Sample Volume (L)	Preferred Laboratory
Groundwater Screening Samples				
Metals/cations (dissolved)	Poly	No	1.0	EES-14*
Anions (dissolved) [including perchlorate]	Poly	No	1.0	EES-14
Tritium	Poly	No	1.0	TBD^
VOCs	Amber glass	No	40 ml	TBD^
Total Organic Carbon (TOC)	Amber glass	No	40 ml	EES-14

Notes:

*EES-14: LANL Earth and Environmental Sciences-Hydrology, Geochemistry and Geology Group.

^TBD: to be determined

Table 5
R-56 Sample Collection Activities for Drill Cuttings

Sample Description	Test	Sample Size	Container	Sample Frequency
Cuttings	Bulk cuttings systematically collected for archival purposes and for supplemental sample needs	500-700 ml	Plastic Ziploc™ bags	One sample every 5-ft.
Cuttings	Sieved cuttings for lithologic description and binocular microscope examination	Enough to partly fill trays	Plastic chip trays	One sample every cutting run (nominally every 5-ft.) Normally, an unseived sample, >10 mesh sample, and a >35 mesh sample every cuttings run.



Approximate NAD83 NM State Plane Coordinates:
Easting 1640449 ft, Northing 1759065 ft.

Figure 1 Proposed location of Regional Monitoring Well R-56

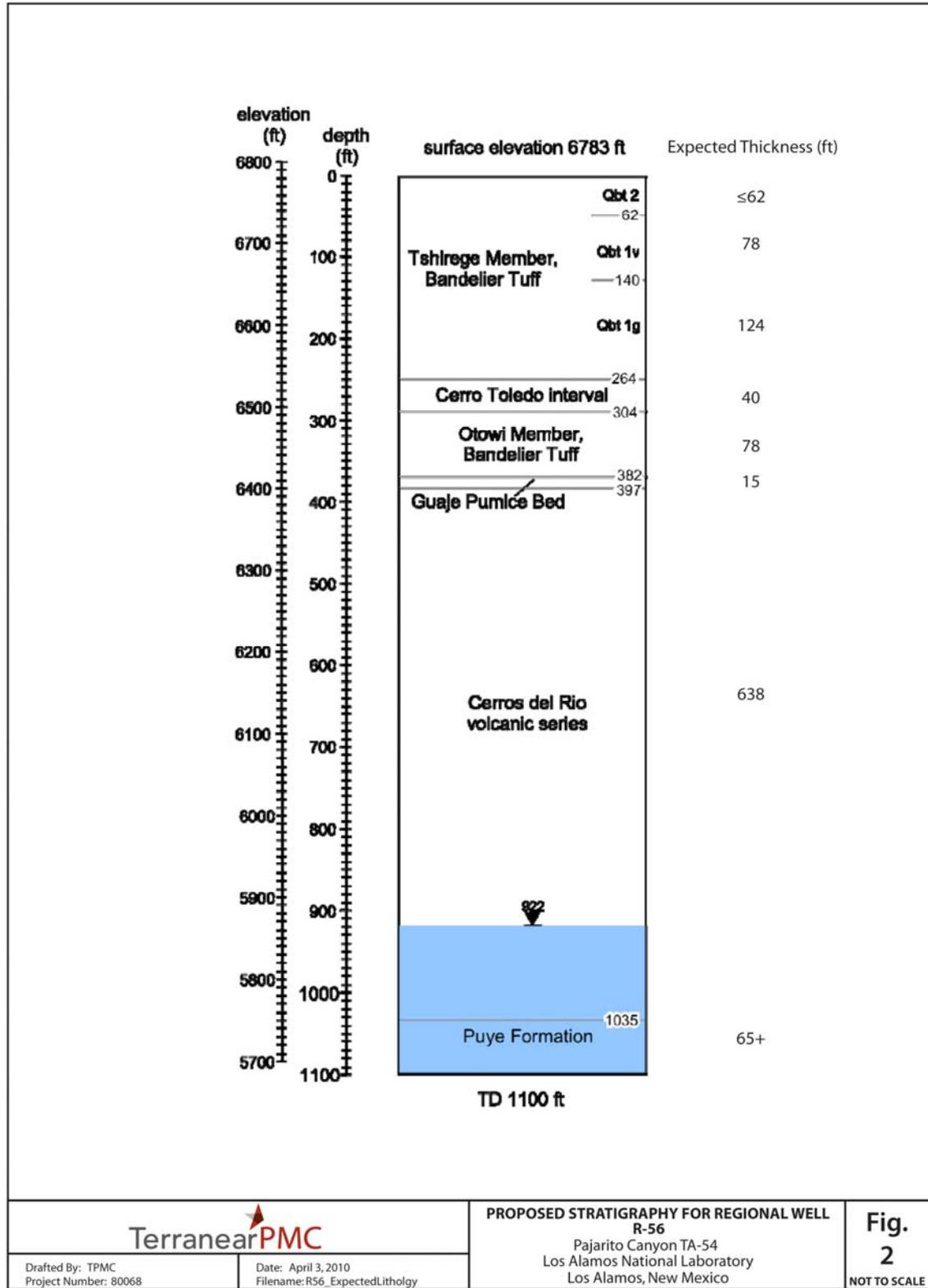


Figure 2 Predicted stratigraphy for Regional Monitoring Well R-56