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Date: OCT 25 2011
Refer To: EP2011-0344

John Kieling, Acting Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Rationale to Plug and Abandon Borehole SCI-3

Dear Mr. Kieling:

The purpose of this letter is to document the rationale to plug and abandon (P&A) borehole SCI-3. This recommendation to P&A this borehole was agreed to by the New Mexico Environment Department (NMED) on October 7, 2011, in an email following review and discussion of information obtained during drilling. The principal reason Los Alamos National Laboratory (the Laboratory) recommended P&A is that no significant water-bearing zones that would support a monitoring well were identified in the borehole. The following discussion provides additional detail of the observations.

Original Well Objectives

Borehole SCI-3 was planned to penetrate through the Cerros del Rio volcanic series (Tb4) in the vicinity of existing perched-intermediate aquifer wells SCI-1 and SCI-2, which have screens in the perched interval above and within the Tb4, respectively. The screen placement for SCI-3 was to be within the deeper perched interval, at a horizon within the lower Cerros del Rio comparable with that at perched-intermediate well SCI-2 to the southeast. The objective at SCI-3 was to investigate the nature and extent of perched-intermediate groundwater and associated contaminants. The well was planned as a single-screen completion.

Drilling Observations at SCI-3

The proposed total depth (TD) of borehole at SCI-3 was to be 685 ft below ground surface (bgs). The actual depth reached was 711 ft bgs and the goal of penetrating Tb4 was attained. At SCI-3, preliminary lithologic contacts from visual examination of cuttings, gamma logging, and video logs identified the following geologic contacts in descending stratigraphic order: alluvium (Qal) at 0–60 ft bgs; Cerro Toledo interval (Qct) at 60–95 ft bgs; Otowi Member ash flows of the Bandelier Tuff (Qbo) at 95–316 ft bgs; Guaje Pumice Bed of the Otowi Member (Qbog) at 316–336 ft bgs,

upper Puye Formation (Tpf) at 336–398 ft bgs, Tb4 at 398–619 ft bgs, and lower Puye Formation (Tpf) from 619 ft bgs to TD at 711 ft bgs.

The 12-in. drill casing was landed at 410.6 ft bgs, 12.6 ft into the top of Tb4, before gamma, induction, and video logs were collected. Two sets of all three logs were collected, the first on October 5, 2011, when the hole had sloughed up to 650 ft bgs and again on October 6 after the hole had been redrilled to a depth of 711 ft and logs could be collected to a depth of 708 ft. The gamma logs confirmed contacts for Qbog and Tb4. Induction logs through Tb4 and lower Tpf indicated discrete intervals of elevated conductivity above 535 ft bgs; these higher conductivity intervals within Tb4 correlated well with rubble zones between lavas of the upper section. The lower section of Tb4 had a uniformly higher gamma signature, characteristic of alkalic lava, but poorer conductivity throughout that appears to be related to lack of interflow zones capable of higher saturation than the lava flows. Video logs confirm the lower Tb4 consists of massive lava, with no indication of interflow zones; from 535 ft bgs to the base of Tb4 at 619 ft bgs.

Video logs showed small amounts of water entering the borehole from the upper perched zone, above Tb4, leaking from behind the 12-in. casing at 410.6 ft bgs. The only other indication of water entering the borehole was minor inflow at approximately 530–534 ft bgs where possible entry of water was observed in the first video log; this possible flow from the rubble zone at the inferred contact between upper and lower portions of Tb4 was not present in the second video log. There was no indication of water flow along the borehole wall in either video from 534 ft bgs to the deepest video record at 649 ft bgs, 30 ft below Tb4, and into Tpf sediments that included multiple horizons of fine silt and light-colored fine-grained layers.

Water levels observed in video logging were initially at 615 ft bgs on October 5 but had dropped to 649 ft bgs on October 6 after the borehole was air-lifted dry. All indications are that no production of water from Tb4 can be expected below 534 ft bgs. The depth of 534 ft bgs is at an elevation roughly equivalent to the water levels observed at perched-intermediate well SCI-2 to the southeast (6204 ft).

Comparison of the Tb4 in SCI-2 and SCI-3 shows the lowermost massive lava is much thicker at SCI-3 (Figure 1). Thickness variations within lava flows are common in Tb4 series and reflect substantial paleotopography during volcanism. Rubble zones are important components of porous media hosting the perched–groundwater zone at SCI-2; these rubble zones are apparently absent at similar elevations in SCI-3, but are present at the base of Tb4 at SCI-3. Therefore, it appears that hydrogeologic conditions favored the accumulation of perched water at SCI-2, but not at SCI-3.

Rationale to P&A

Driller's observations and video logs indicate perched saturation within Tb4 at SCI-3 is not sufficient to install a well. The upper perched zone, above Tb4, is already sampled effectively by the adjacent well SCI-1. For these reasons any perched-intermediate well design for SCI-3 would not be warranted, and therefore, the Laboratory recommends the P&A of borehole SCI-3, as shown in Figure 2.

If you have any questions, please contact Ted Ball at (505) 665-3996 (tedball@lanl.gov) or Woody Woodworth at (505) 665-5820 (lance.woodworth@nnsa.doe.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

George J. Rael, Assistant Manager
Environmental Projects Office
Los Alamos Site Office

MG/GR/CD/TB:vt

Attachment: Figure 1: Correlation of Tb4 and groundwater occurrences in well SCI-2 and borehole SCI-3 (LA-UR-11-11802)
Figure 2: The stratigraphic sequence, lithologic types, and contacts for SCI-3, along with P&A bentonite and cement placements (LA-UR-11-11802)

Cy: (w/att.)
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Steve Yanicak, NMED-DOE-OB, MS M894
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RPF, MS M707 (electronic copy)
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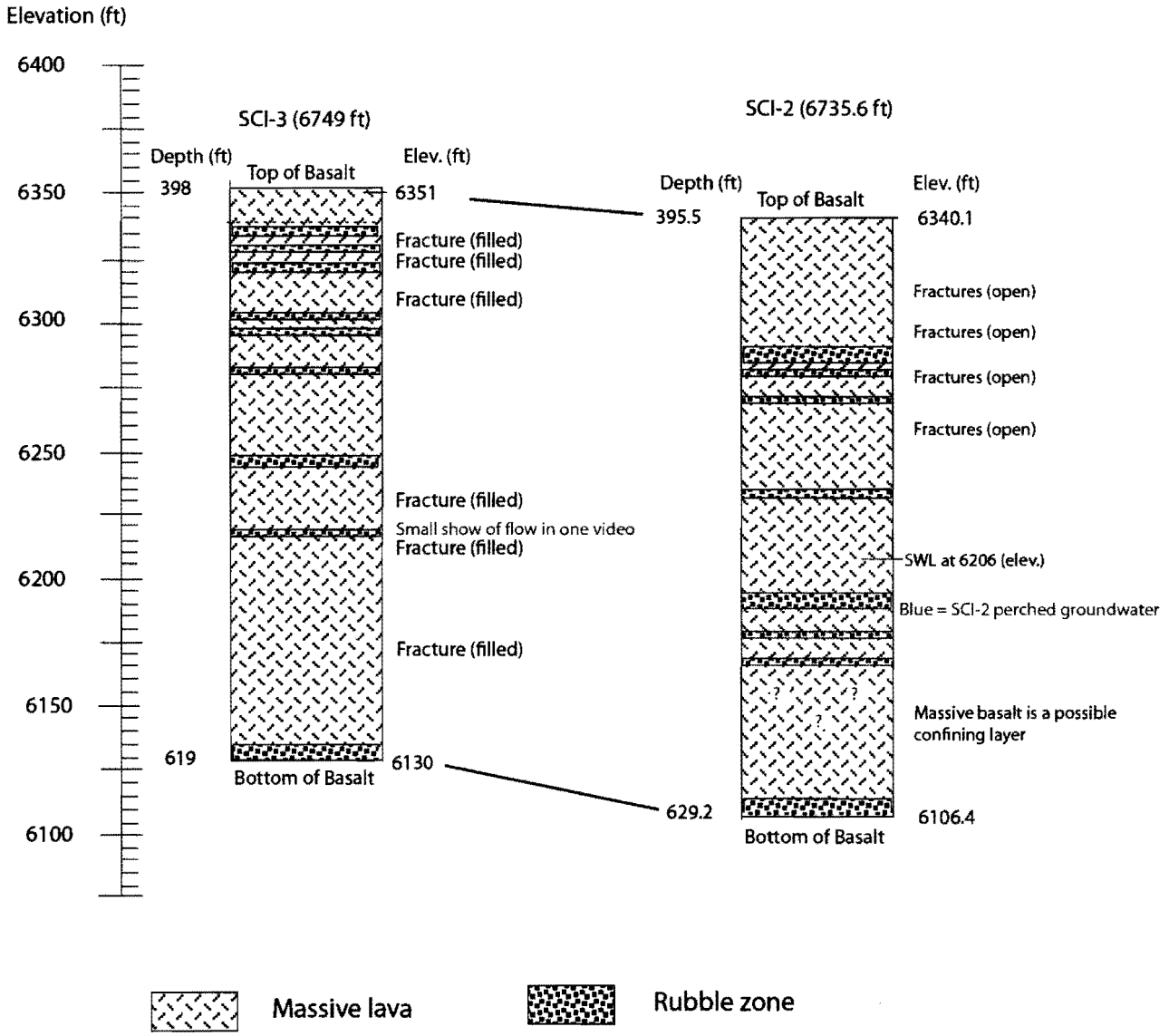

Figure 1. Correlation of Tb4 and groundwater occurrences in well SCI-2 and borehole SCI-3

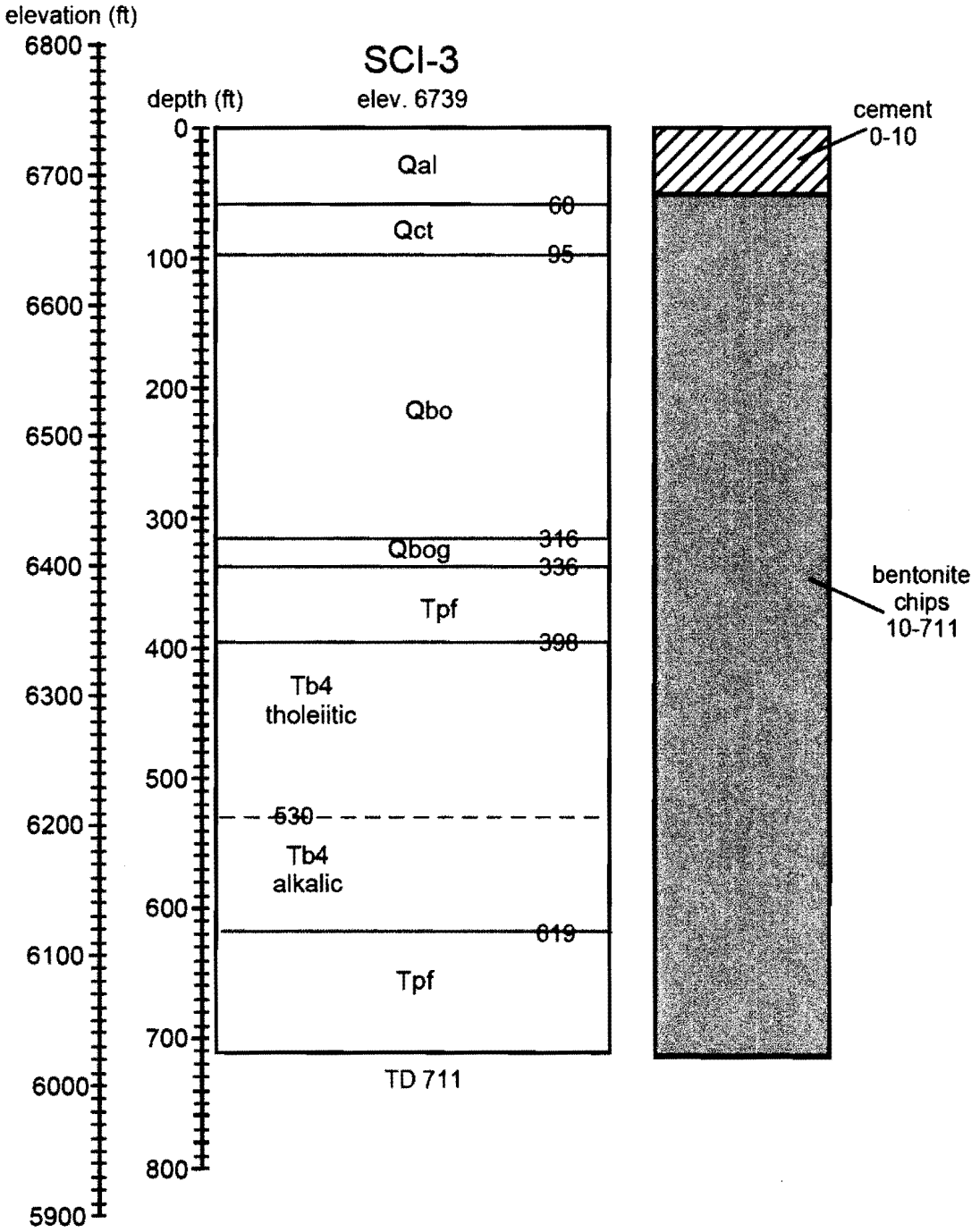

Figure 2. The stratigraphic sequence, lithologic types, and contacts for SCI-3, along with P&A bentonite and cement placements