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Plugging and Abandonment of Wells for 2014

Prepared by the Environmental Programs Directorate

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Plugging and Abandonment of Wells for 2014

October 2013

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1.0 INTRODUCTION

This report contains information and work plans for the plugging and abandonment of eight wells and boreholes at Los Alamos National Laboratory (LANL or the Laboratory) and is part of the Laboratory's ongoing efforts to plug and abandon legacy wells and boreholes.

The work plans describe plugging and abandonment procedures that comply with Section X.D, Well Abandonment, of the Compliance Order on Consent for the Laboratory as well as the New Mexico Office of the State Engineer (NMOSE) well or borehole abandonment regulations. Additionally, the plugging and abandonment procedures used comply with 19.27.4 New Mexico Administrative Code Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells. The work plans will be submitted to NMOSE before abandonment.

This report includes eight stand-alone work plans and associated figures as listed in Table 1.0-1. References for the work plans are provided at the end of this report.

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Organization of Work Plans**

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2.0 BACKGROUND INFORMATION AND RATIONALE

The Laboratory has researched the status of a number of legacy wells and boreholes and has identified those included in this document to be proposed for abandonment in fiscal year 2014. Prioritization of wells and boreholes to be abandoned is based on criteria that determine their potential for providing a pathway for contaminants to reach the regional aquifer. These criteria include the depth of the well, its location (canyon bottom versus mesa top), whether the hole is wet or dry, its proximity to known sources of contamination, the age of the well, the construction of the well, and its accessibility to the public. In addition, recent experience from work performed in 2011, 2012, and 2013 has added some practical criteria to maximize cost savings and stay within allotted budgets. These criteria include grouping wells and boreholes within a given location to minimize mobilization costs and required permitting, and combining difficult and thus expensive wells with less difficult ones. The information available about legacy boreholes can be incorrect, and unexpected conditions may be encountered. Field reconnaissance will be conducted at the wells and boreholes on this list to check for the presence of water, possible obstructions, ease of site access, condition of the surface well pad, surface casing and well head security, verification of total well depth, depth of groundwater (if present), location of any potential obstructions, and other issues that may hamper the abandonment work plan.

The locations of wells and boreholes to be abandoned are shown in Figure 2.0-1. The Mortandad Canyon watershed has received a variety of contaminants released during Laboratory operations that have impacted intermediate and regional groundwater. Consequently, Mortandad Canyon has been prioritized as the focus of the work this year. Additional rationale for plugging and abandoning each hole is provided below.

Intermediate Well MCOI-1

Groundwater monitoring well MCOI-1 was drilled as a corehole and completed as a well in January 2005 (Kleinfelder 2006, 092494). The corehole was drilled to 843.2 ft below ground surface (bgs). A single screen well was installed from 815 to 825.5 ft bgs. This well has been dry since it was installed. Soundings for water in 2006 and 2007 encountered sand at a total depth of only 814 ft bgs, suggesting the 10-ft-long screen may have been damaged. This well is located in a canyon bottom and was drilled to determine if contaminant releases from the TA-50 outfall have impacted intermediate perched water in upper Mortandad Canyon. The location and condition of this well make it a priority for plugging and abandonment.

Intermediate Well MCOI-8

Intermediate well MCOI-8 was drilled using fluid-assisted (QUIK-FOAM) air-rotary drilling methods in January, 2005 (Kleinfelder 2006, 092494). The borehole was drilled to 745 ft bgs. A single screen well was installed from 665 to 675 ft bgs. Water was encountered at 676.06 ft bgs. Since well completion, the water level has been in the sump, rendering the well unusable for collecting groundwater samples. The depth of this well and its location along a potential contaminant pathway within a canyon bottom make it a priority for plugging and abandonment.

Alluvial Well MCA-9

Alluvial well MCA-9 was drilled to a depth of 115 ft in lower Mortandad Canyon in December 2004 (Kleinfelder 2006, 092486). Slight moisture was observed during drilling; however, no water was present when well development was attempted in April 2005. Water was present only in the sump until November 2007 when monitoring was discontinued (Koch and Schmeer 2009, 105181). The lack of water to monitor in this well, together with its location within a canyon bottom along a potential contaminant pathway, makes this well a priority for plugging and abandonment.

Alluvial Well MCO-7.2

Alluvial well MCO-7.2 was installed in middle Mortandad Canyon near the confluence with Ten Site Canyon in December 1998 (Gray 2001, 073307). This well is 95 ft deep with groundwater encountered at 42.5 ft bgs. This well was installed to investigate the possible hydrologic connection between alluvium and the Cerro Toledo Formation in the subsurface. The depth of this well and its location along a potential contaminant pathway within a canyon bottom make it a priority for plugging and abandonment.

Alluvial Well MCO-12

Alluvial well MCO-12 was installed at a depth of 108 ft in lower Mortandad Canyon in June 1971 (Purtymun 1995, 045344) as part of an effort to better understand the hydrogeologic setting of Mortandad Canyon, the major release area for treated radioactive effluent at the Laboratory. The depth of this well and its location along a potential contaminant pathway within a canyon bottom make it a priority for plugging and abandonment.

Alluvial Well MCO-13

Alluvial well MCO-13 was installed in lower Mortandad Canyon in July 1970 (Purtymun 1995, 045344) as part of an effort to better understand the hydrogeologic setting of Mortandad Canyon. It was drilled to a depth of 112 ft, and a well was installed to a depth of 107 ft. Mortandad Canyon was the major release area for treated radioactive effluent at the Laboratory. The depth of this well and its location along a potential contaminant pathway within a canyon bottom make it a priority for plugging and abandonment.

Test Wells SIMO and SIMO-1

These two test wells were drilled on San Ildefonso Pueblo in Mortandad Canyon south of the Laboratory boundary in cooperation with San Ildefonso Pueblo and the Bureau of Indian Affairs (BIA). Test well SIMO was completed in September 1990 to a depth of 104 ft (Stoker et al. 1991, 007530). The information on test well SIMO-1 is limited. According to Purtymun (1995, 045344), this well was drilled in September 1992. The geologic log for this well continues to a depth of 163 ft. However, in a table later in his report, Purtymun lists the total depth as 116 ft (1995, 045344). Perhaps the well was completed to this depth. It is located ~50 ft north of test well SIMO. Both holes were dry. Mortandad Canyon was the major release area for treated radioactive effluent at the Laboratory. The depths of these wells and their locations along a potential contaminant pathway within a canyon bottom make them a priority for plugging and abandonment. In addition, the fact that these wells are not located on Laboratory property heightens the need to properly abandon them.

3.0 WORK PLANS FOR PLUGGING AND ABANDONMENT

3.1 Work Plan to Plug and Abandon Intermediate Well MCOI-1

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for intermediate well MCOI-1 (also known as I-1), located in Technical Area 35 (TA-35) in Mortandad Canyon. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Groundwater monitoring well MCOI-1 was drilled as a corehole using a track-mounted rig and completed as a well in January 2005 (Kleinfelder 2006, 092494). The corehole was advanced using air-rotary techniques with no drilling fluids. The hole was dry when drilled and has been continuously dry since. The corehole was drilled to 843.2 ft bgs. A single-screen well was installed from 815 to 825.5 ft bgs. Slough fills the hole from 828.5 to 843.2 ft bgs, and bentonite chips were used between 826.5 and 828.5 ft bgs. The diameter of the borehole is as follows (Figure 3.1-1):</p> <ul style="list-style-type: none"> • 7.375 in. from 0–220 ft bgs • 6.0 in. from 220–260 ft bgs • 4.38 in. from 260–517.5 ft bgs • 3.895 in. from 517.5–843.2 ft bgs <p>A well was installed using nominal 1-in.–outside diameter (O.D.) stainless-steel casing. A 10-ft screen fabricated from two coupled 5-ft perforated wire-wrapped screens with 0.010-in. slot size is located at 815 to 825.5 ft bgs. The annular space consists of the following (Figure 3.1-1):</p> <ul style="list-style-type: none"> • Grout from 1–77 ft bgs • 3/8-in. bentonite chips from 77–265 and 495–807 ft bgs • Formation collapse from 265–495 ft bgs • Filter pack 20/40 silica sand from 807–826.5 ft bgs • 3/8-in. bentonite chips from 826.5–828.5 ft bgs • Formation slough from 828.5–843.2 ft bgs
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. Access to this well will be difficult because there is no road to the site. The well is too small in diameter to be video surveyed. Because of the small diameter, the casing cannot be perforated. The well will be pressure grouted from 825.5 to 10 ft bgs. Neat-cement slurry will be emplaced from 10 ft bgs to the ground surface. The well casing will be cut off at the surface. A schematic diagram of well abandonment is shown in Figure 3.1-1.
Surface Completion	A neat-cement mound with a survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A waste characterization strategy form (WCSF) will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.2 Work Plan to Plug and Abandon Intermediate Well MCOI-8

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for intermediate well MCOI -8 (also known as I-8), located in TA-05 in Mortandad Canyon. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Groundwater monitoring well MCOI-8 was drilled using fluid-assisted (QUIK-FOAM) air-rotary drilling methods in January, 2005 (Kleinfelder 2006, 092494). The borehole was drilled to 745 ft bgs. A single-screen well was installed to 678.6 ft bgs. Slough fills the hole from 744.5 to 745 ft bgs, and bentonite chips were used between 678.5 and 744.5 ft bgs. Groundwater was encountered at 676.06 ft bgs. The diameter of the borehole is as follows (Figure 3.2-1):</p> <ul style="list-style-type: none"> • 13.375 in. from 0–78.7 ft bgs • 12.25 in. from 78.7–745 ft bgs <p>The single-screen well is constructed as follows (Figure 3.2-1):</p> <ul style="list-style-type: none"> • 5-in.-O.D. stainless-steel from –3 ft to 678.6 ft bgs <p>A 10-ft 5.27-in.-O.D. stainless-steel screen (0.020 slot size) is installed from 665 to 675 ft bgs.</p> <p>The annular space consists of the following (Figure 3.2-1):</p> <ul style="list-style-type: none"> • Concrete from 1–66 ft bgs • Formation collapse from 66–85 ft bgs • 3/8-in. bentonite chips from 85–648 ft bgs • Fine sand collar 20/40 silica sand from 648–650 ft bgs • Filter pack 10/20 silica sand from 650–678.6 ft bgs • Bentonite from 678.6–744.5 ft bgs • Formation slough from 744.5–745 ft bgs
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The well will be video and gamma surveyed to document preabandonment conditions. The casing will be perforated from 648 to 664 ft bgs, and the screen will be ripped from 665 to 675 ft bgs. The casing will then be pressure grouted from 678.6 to 10 ft bgs. Neat-cement slurry will be emplaced from 10 ft bgs to the surface. The well casing will be cut off at ground surface. A schematic diagram of well abandonment is shown in Figure 3.2-1.
Surface Completion	A neat-cement mound with survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.3 Work Plan to Plug and Abandon Alluvial Well MCA-9

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for alluvial well MCA-9, located in lower Mortandad Canyon. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Groundwater monitoring well MCA-9 was drilled with a hollow stem auger to a depth of 115 ft bgs in December 2004 (Kleinfelder 2006, 092486). The well was dry.</p> <p>The single screen well is constructed in an 8-in.-diameter hole as follows (Figure 3.3-1):</p> <ul style="list-style-type: none"> • 113 ft of 2.4-in.-O.D. polyvinyl chloride (PVC) pipe <p>A 15-ft 2.8-in.-O.D. prepacked screen (0.010-in. slot size) is located from 92.8 to 107.8 ft bgs.</p> <p>The annular space consists of the following (Figure 3.3-1):</p> <ul style="list-style-type: none"> • Cement from 1–5 ft bgs • Bentonite chips from 5–90.1 ft bgs • Filter pack 20/40 silica sand from 90.1–108.5 ft bgs • Bentonite chips from 108.5–113 ft bgs • Formation slough from 113–115 ft bgs
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The casing will be pressure grouted from 113 to 10 ft bgs, and the well will be drilled out to a minimum of 10 ft bgs. Neat-cement slurry will be emplaced in that boring from 10 ft bgs to the ground surface. The well casing will be cut off at the surface. A schematic diagram of well abandonment is shown in Figure 3.3-1.
Surface Completion	A neat-cement mound with survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.4 Work Plan to Plug and Abandon Alluvial Well MCO-7.2

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for alluvial well MCO-7.2, located in middle Mortandad Canyon. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Groundwater monitoring well MCO-7.2 was drilled with a hollow-stem auger to a depth of 132.5 ft bgs on December 3, 1998 (Gray 2001, 073307). Water was encountered at 42.5 ft bgs. The borehole diameter is as follows (Figure 3.4-1):</p> <ul style="list-style-type: none"> • 12.25 in. from 0–65 ft bgs • 8.0 in. from 65.0–132.5 ft bgs <p>The single-screen well is constructed as follows (Figure 3.4-1):</p> <ul style="list-style-type: none"> • 10-in.-diameter threaded steel surface casing cemented in place from 0–64 ft bgs • 2-in. schedule 40 PVC casing from 0–95.35 ft bgs <p>The 20-ft-long screen is made from two 10-ft lengths of 2-in. factory-slotted PVC (0.020-in. slot size). It is coupled with 0.5-ft coupling and prepacked with 16/40-grade silica sand and is located between 72 and 92.5 ft bgs.</p> <p>The annular space consists of the following (Figure 3.4-1):</p> <ul style="list-style-type: none"> • Grout (Portland cement with 5% bentonite) from 1–10 ft bgs • Hydrated bentonite chips from 10–70.8 ft bgs • 30/70 silica sand from 71–72 ft bgs • 16/40 silica sand from 72–95.35 ft bgs • 3/8-in. hydrated bentonite chips from 95.35–110.6 ft bgs • Formation slough from 115–132.5 ft bgs
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The PVC casing will be pressure grouted from 95.35 to 10 ft bgs, and the well will be drilled out to a minimum of 10 ft bgs. The cemented steel surface casing will remain in place. Neat-cement slurry will be emplaced in that boring from 10 ft bgs to the ground surface. The well casing will be cut off at the surface. A schematic diagram of well abandonment is shown in Figure 3.4-1.
Surface Completion	A neat cement mound with survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.5 Work Plan to Plug and Abandon Alluvial Well MCO-12

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for alluvial well MCO-12, located in Mortandad Canyon. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Groundwater monitoring well MCO-12 was augered with a 4.5-in.-diameter bit to a depth of 112 ft bgs in June 1971 (Purtymun 1995, 045344). The well was dry.</p> <p>The single-screen well is constructed as follows (Figure 3.5-1):</p> <ul style="list-style-type: none"> • 108 ft of 2-in.-diameter plastic pipe • The lower 20 ft of pipe was perforated with a 0.25-in. drill bit to form the screen <p>The annular space was filled with cuttings from the hole.</p>
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The casing will be pressure grouted from 108 to 10 ft bgs, and the well will be drilled out to a minimum of 10 ft bgs. Neat-cement slurry will be emplaced in that boring from 10 ft bgs to the ground surface. A schematic diagram of well abandonment is shown in Figure 3.5-1.
Surface Completion	A neat-cement mound with survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.6 Work Plan to Plug and Abandon Alluvial Well MCO-13

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for alluvial well MCO-13, located in Mortandad Canyon. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Groundwater monitoring well MCO-13 was augered with a 4.5-in.-diameter bit to a depth of 112 ft bgs in July 1970 (Purtymun 1995, 045344). The well was dry.</p> <p>The single screen well is constructed as follows (Figure 3.6-1):</p> <ul style="list-style-type: none"> • 107 ft of 2-in.-diameter plastic pipe • The lower 20 ft of pipe was perforated with a 0.25-in. drill bit to form the screen <p>The annular space was filled with cuttings from the hole.</p>
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The casing will be pressure grouted from 107 to 10 ft bgs. The well will be drilled out to a minimum of 10 ft bgs. Neat-cement slurry will be emplaced in that boring from 10 ft bgs to the ground surface. A schematic diagram of well abandonment is shown in Figure 3.6-1.
Surface Completion	A neat-cement mound with survey marker will be installed at ground surface over the well. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.7 Work Plan to Plug and Abandon Test Well SIMO

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for test well SIMO, located in lower Mortandad Canyon on San Ildefonso Pueblo land. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Test well SIMO was drilled with a 3.50-in. hollow-stem auger in September 1990 to a depth of 104 ft (Stoker et al. 1991, 007530). The hole was dry. The top was sealed with cement and a BIA steel security cover was installed.</p> <p>The well is constructed as follows (Figure 3.7-1):</p> <ul style="list-style-type: none"> • 104 ft of 2-in.-inside diameter schedule 40 PVC • 10-ft sections of the pipe located between 50 and 60 ft bgs and 80 and 90 ft bgs were perforated with a 0.25-in. drill bit to form two screens <p>The annular space consists of the following (Figure 3.7-1):</p> <ul style="list-style-type: none"> • Cement from 0–5 ft bgs • Bentonite from 5–8 ft bgs • Cuttings from 8–53 ft bgs • Sand from 53–57 ft bgs • Cuttings from 57–66 ft bgs • Bentonite from 66–69 ft bgs • Cuttings from 69–81 ft bgs • Sand from 81–84 ft bgs • Cuttings from 84–104 ft bgs <p>The cuttings in construction are tuff from the hole and silts, sands, and gravels.</p>
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The casing will be pressure grouted from 104 to 10 ft bgs. The well will be drilled out to a minimum of 10 ft bgs. Neat-cement slurry will be emplaced in that boring from 10 ft bgs to the ground surface. A schematic diagram of well abandonment is shown in Figure 3.7-1.
Surface Completion	A neat-cement mound with survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. No waste samples will be collected. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.8 Work Plan to Plug and Abandon Test Well SIMO-1

Primary Purpose	This work plan summarizes the plugging and abandonment methods the Laboratory proposes for test well SIMO-1, located in lower Mortandad Canyon on San Ildefonso Pueblo land. The well is located ~50 ft north of test well SIMO. Well abandonment will be consistent with Section X.D, Well Abandonment, of the Consent Order and with NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	<p>Test well SIMO-1 was drilled with an auger in September 1992 to a depth of 163 ft bgs (Purtymun 1995, 045344). The hole was dry.</p> <p>No construction information about this well is available other than a description by Purtymun (1995, 045344) in which he states its construction is similar to that of test well SIMO and it contains screens at various depths (Figure 3.8-1). Thus, it can be assumed this well includes between 116 and 163 ft of 2-in.-diameter schedule 40 PVC with several slotted sections. Likewise, the annular space should consist of a mix of bentonite, cuttings, and sand. The upper 5 ft likely contains cement. It is assumed a BIA steel security cover is emplaced at the surface.</p>
Abandonment Methods	All surface and subsurface appurtenances will be removed from the well before abandonment. The casing will be pressure grouted from total depth to 10 ft bgs. The well will be drilled out to a minimum of 10 ft bgs. Neat cement will be emplaced in the boring from 10 ft bgs to the ground surface. A schematic diagram of well abandonment is shown in Figure 3.8-1.
Surface Completion	A neat-cement mound with survey marker will be installed over the well at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ± 0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. No waste samples will be collected. Materials removed from the borehole will be reused or recycled if possible. Nonrecyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

4.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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Kleinfelder, April 2006. "Final I Wells Completion Report, 2004-05 Mortandad Canyon Drilling Program," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092494)

Kleinfelder, May 2006. "Final MCA Wells, MCB Boreholes, and MCRES Boreholes Completion Report 2004-05 Mortandad Canyon Drilling Program," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092486)

Koch, R.J., and S. Schmeer, March 2009. "Groundwater Level Status Report for 2008, Los Alamos National Laboratory," Los Alamos National Laboratory report LA-14397-PR, Los Alamos, New Mexico. (Koch and Schmeer 2009, 105181)

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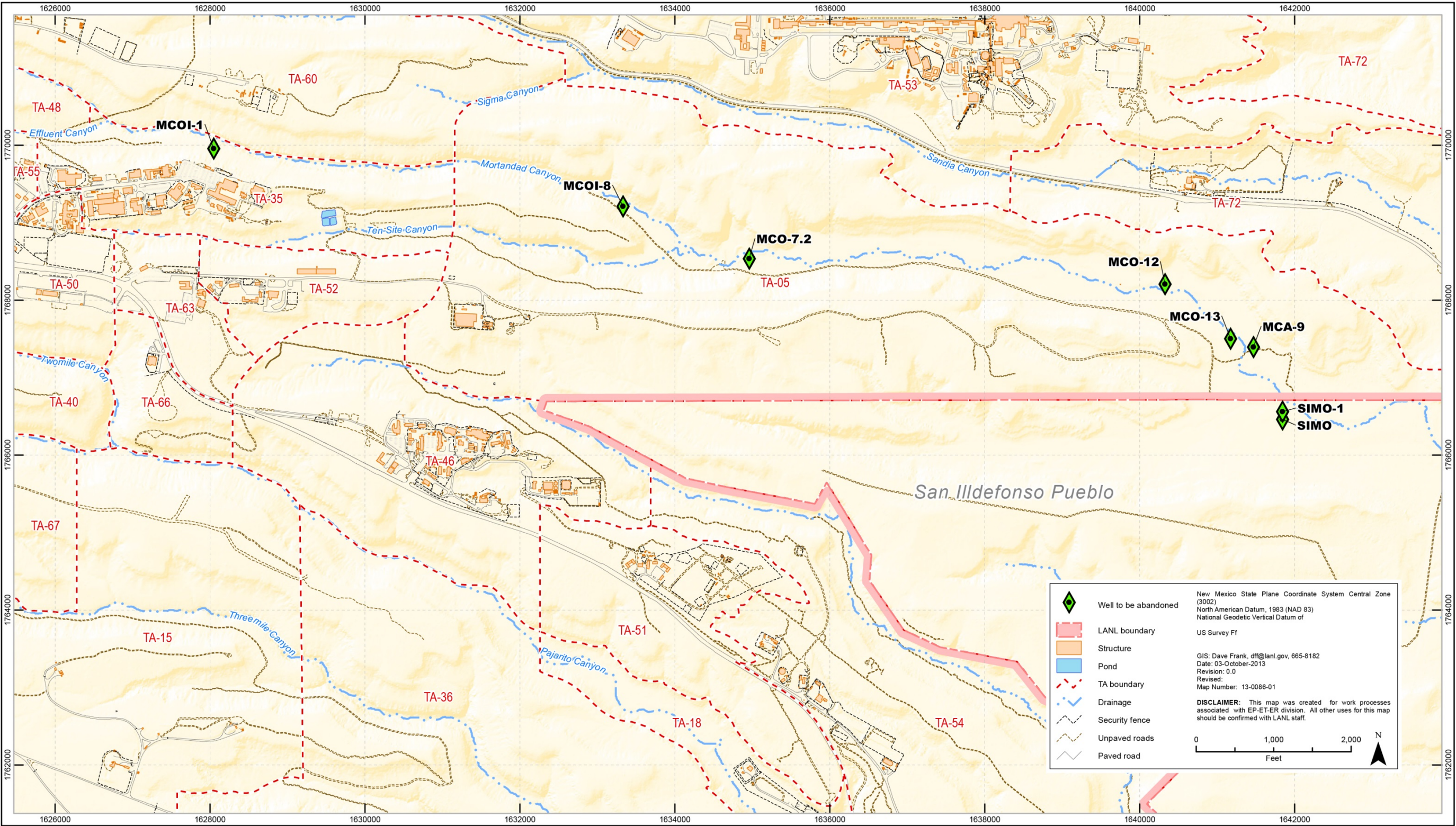


Figure 2.0-1 Locations of wells to be abandoned

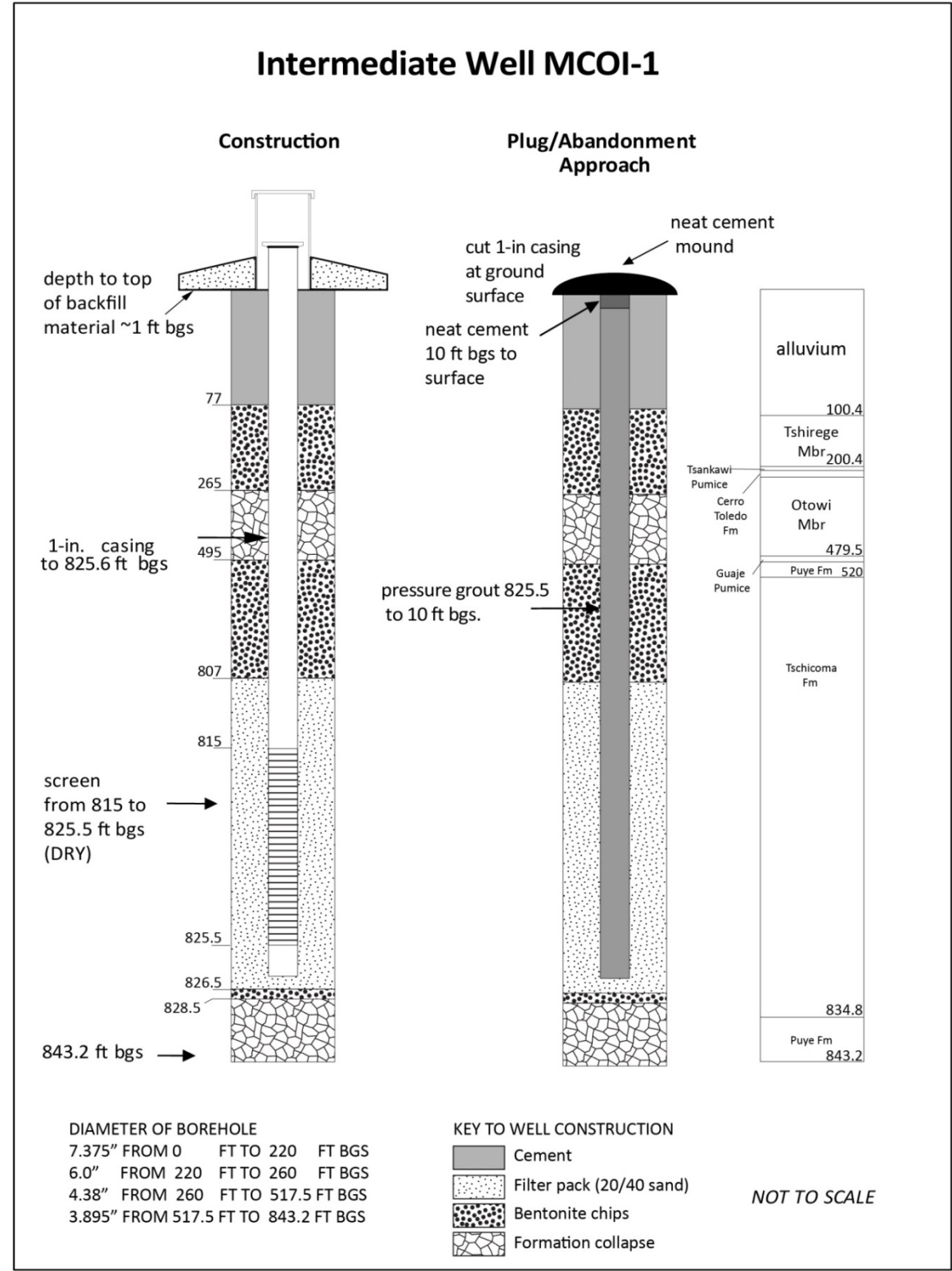


Figure 3.1-1 MCOI-1 abandonment schematic

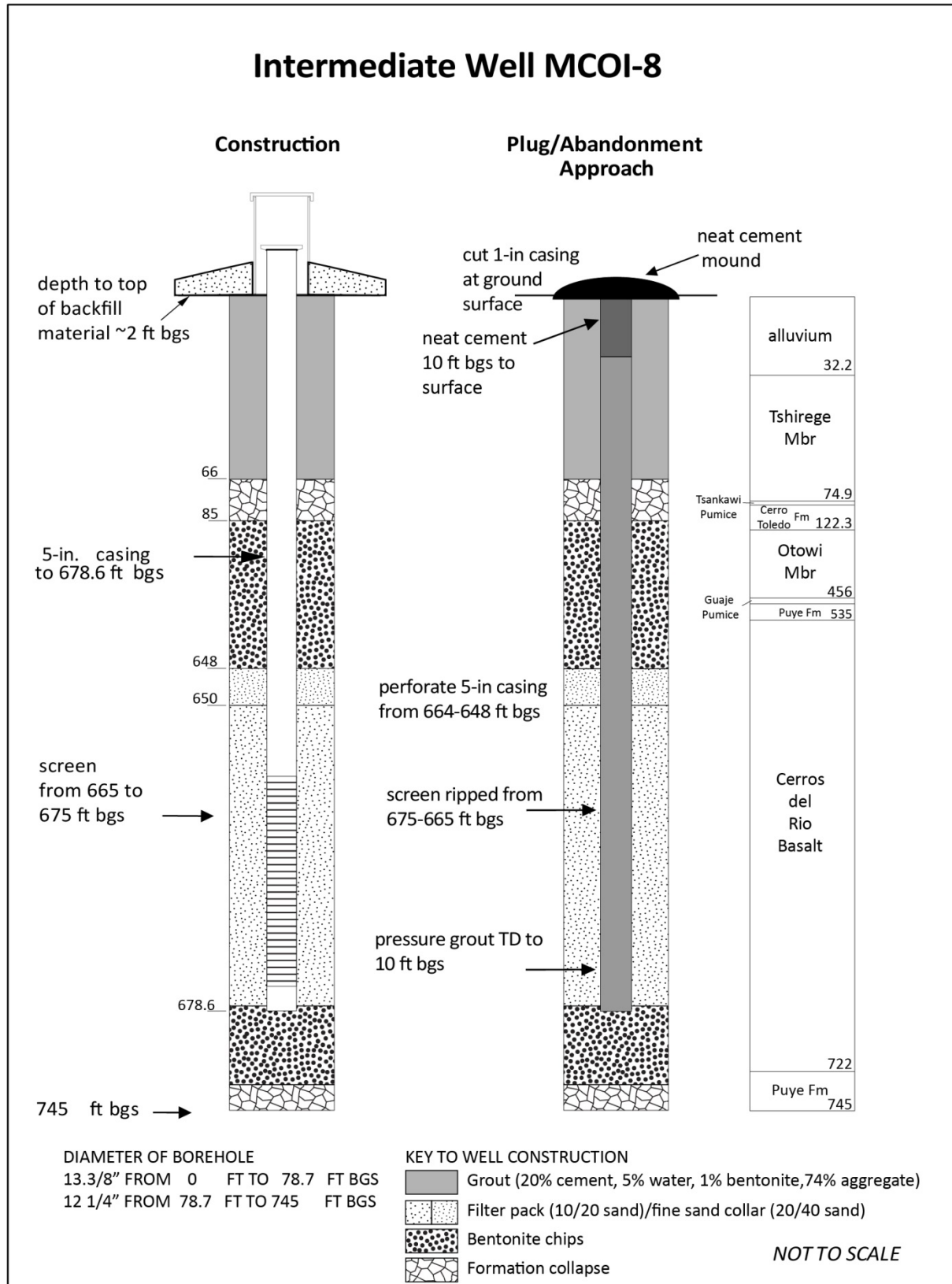


Figure 3.2-1 MCOI-8 abandonment schematic

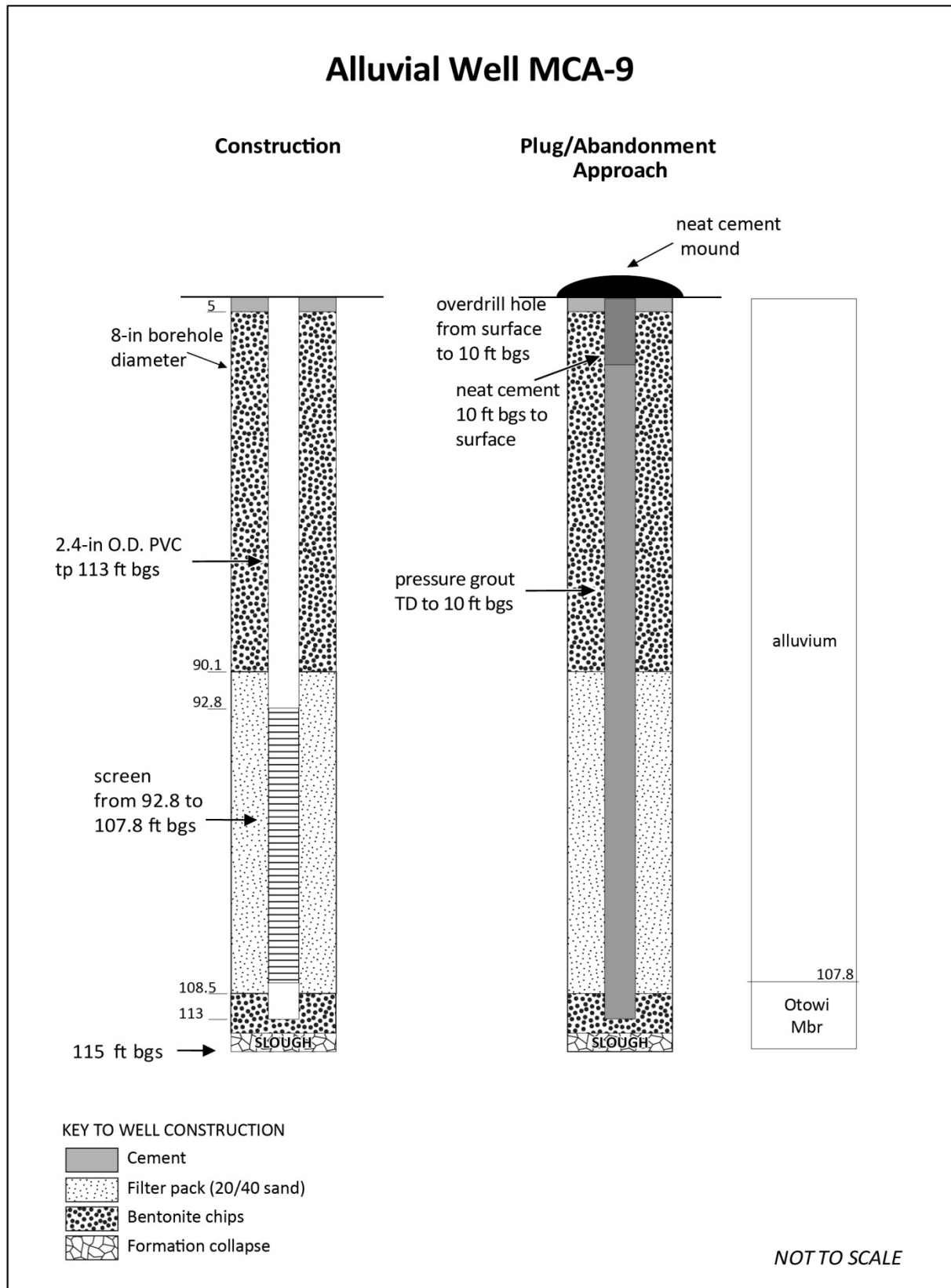


Figure 3.3-1 MCA-9 abandonment schematic

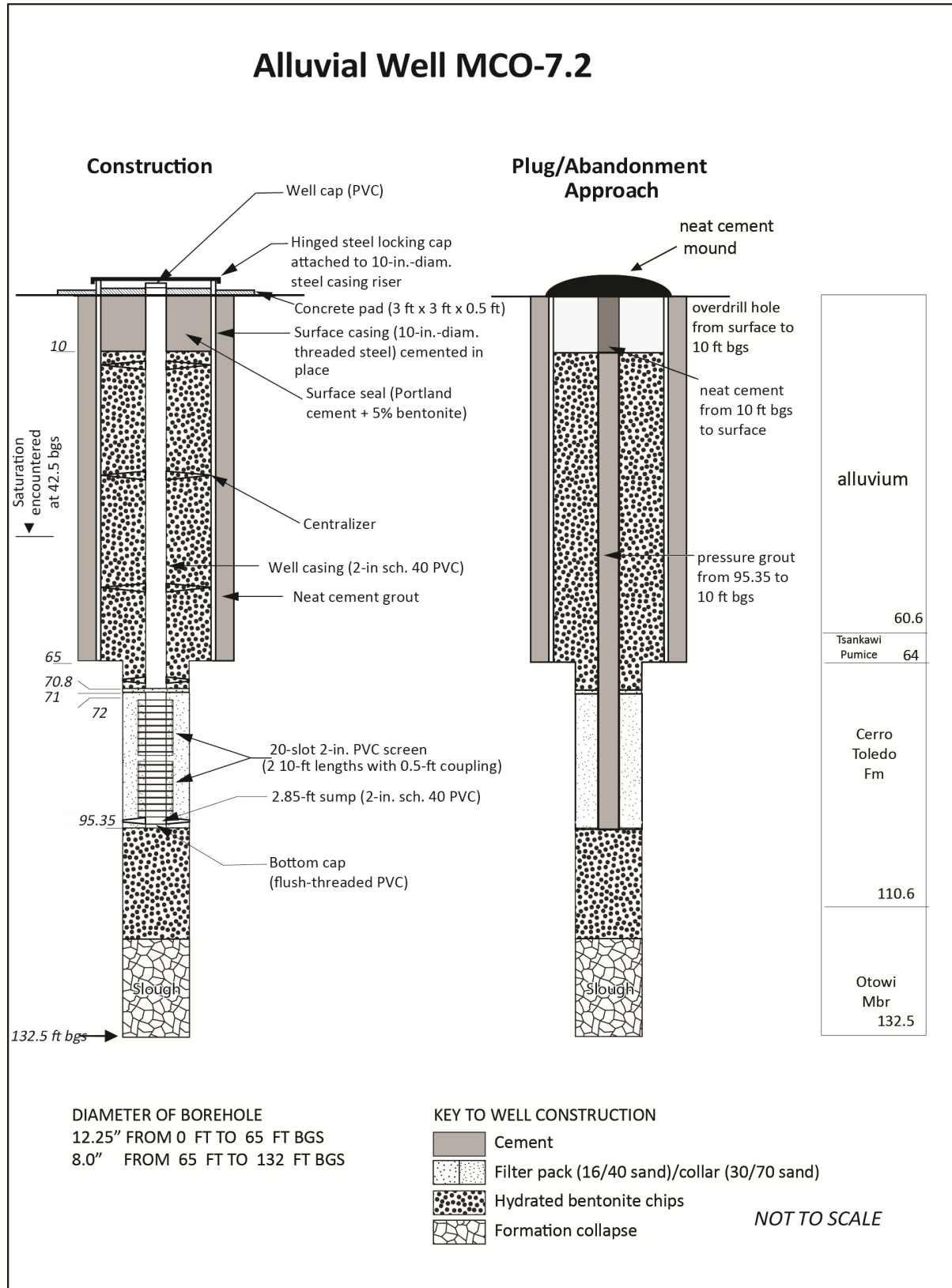


Figure 3.4-1 MCO-7.2 abandonment schematic

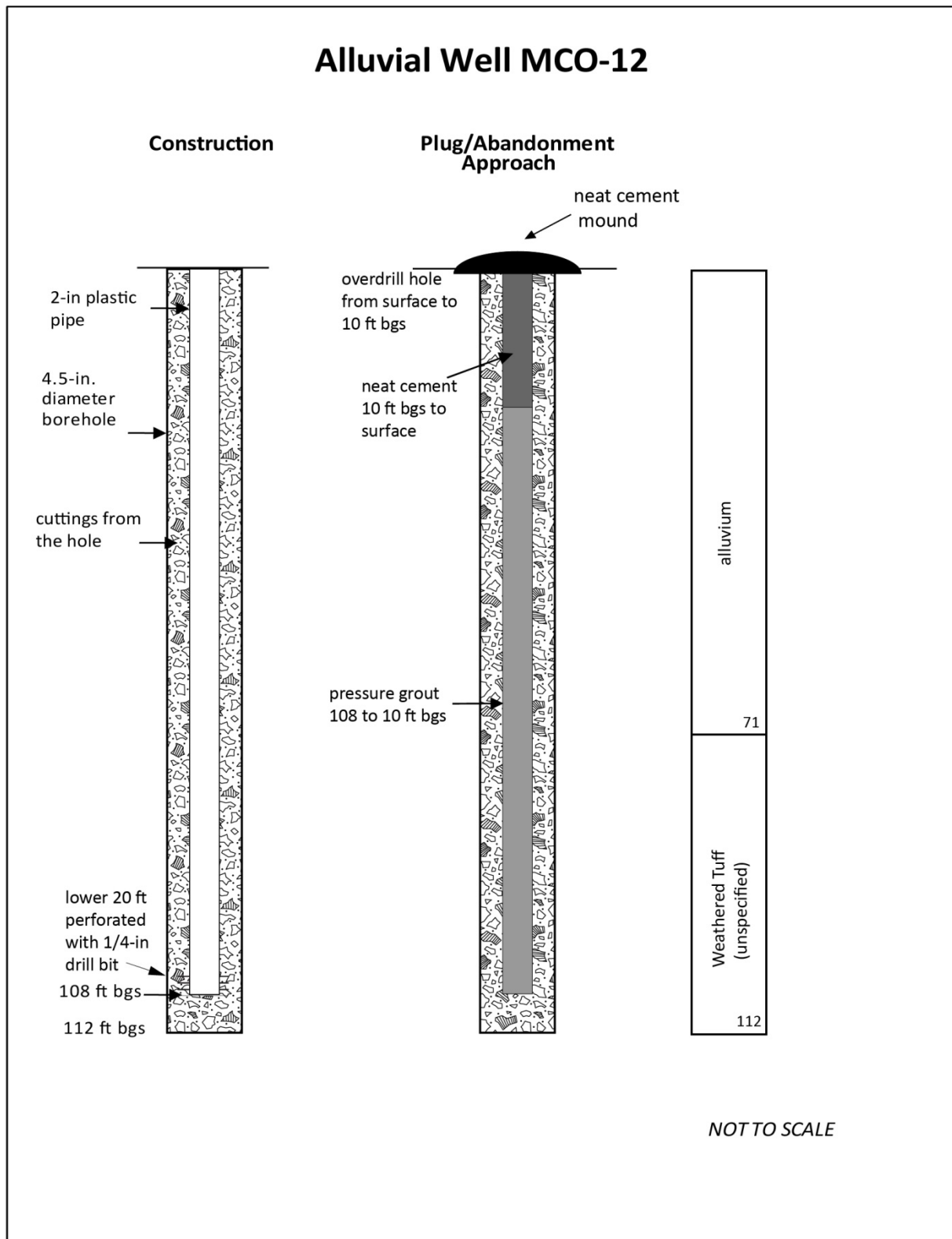


Figure 3.5.1 MCO-12 abandonment schematic

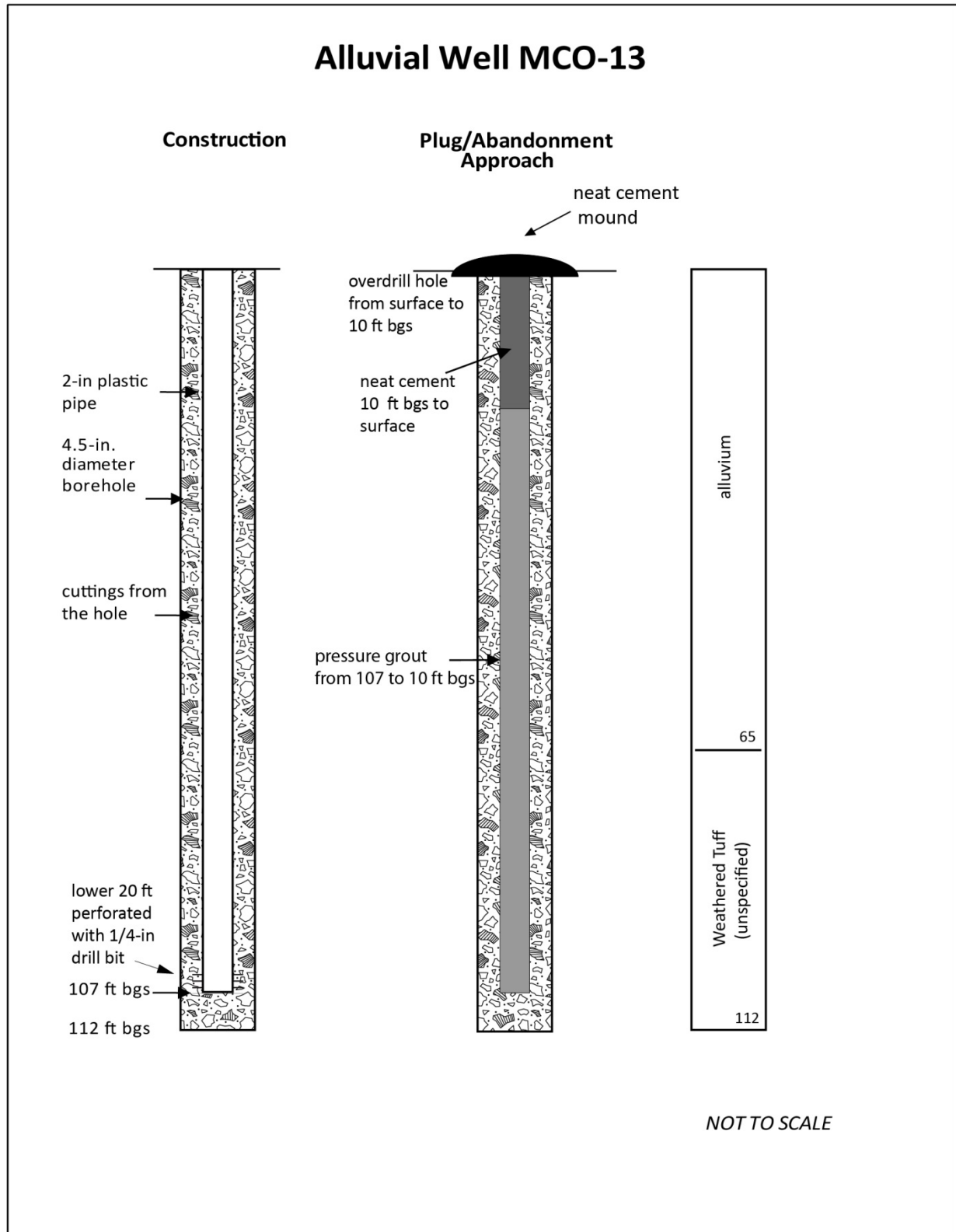


Figure 3.6.1 MCO-13 abandonment schematic

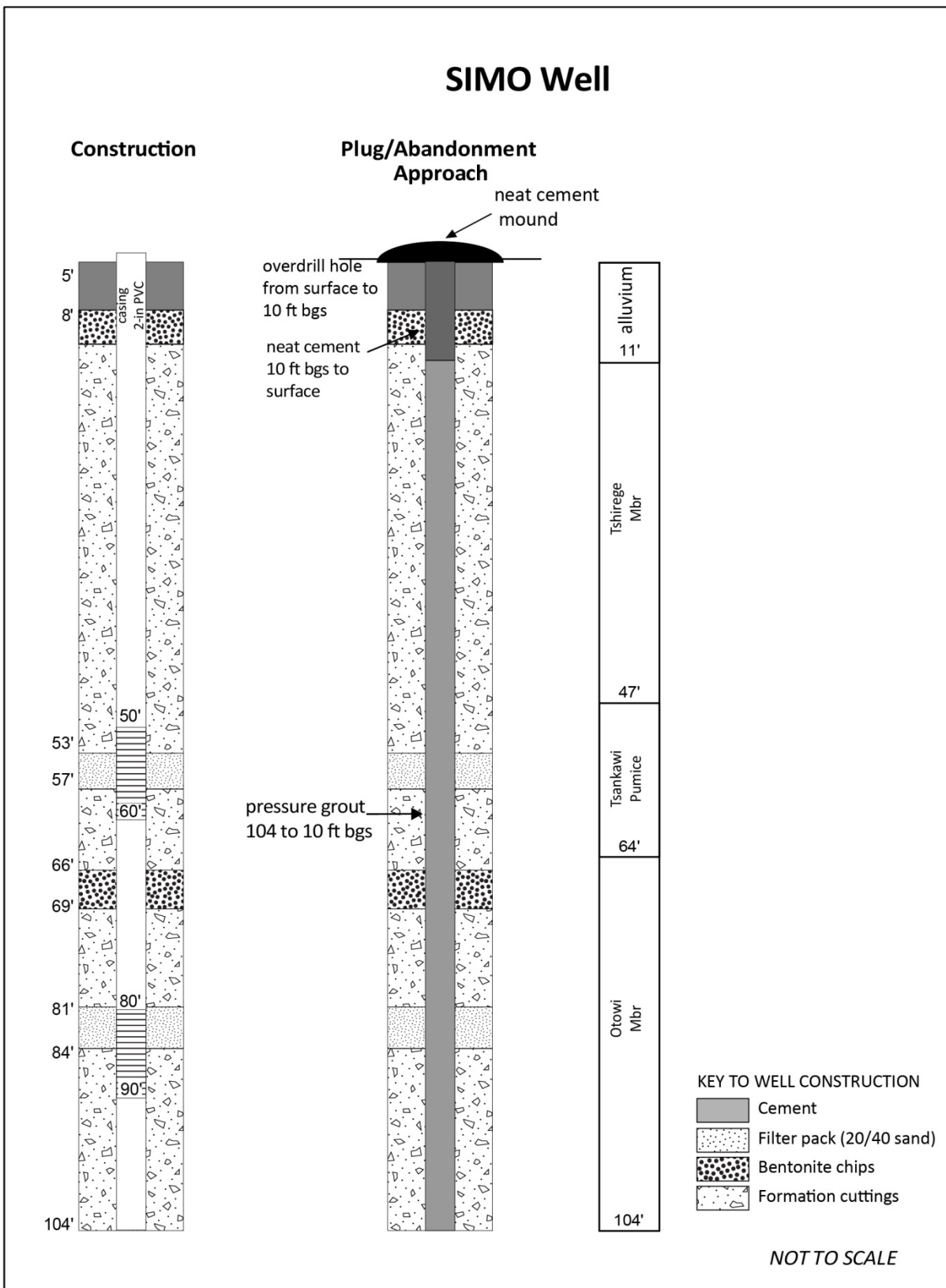


Figure 3.7-1 SIMO abandonment schematic

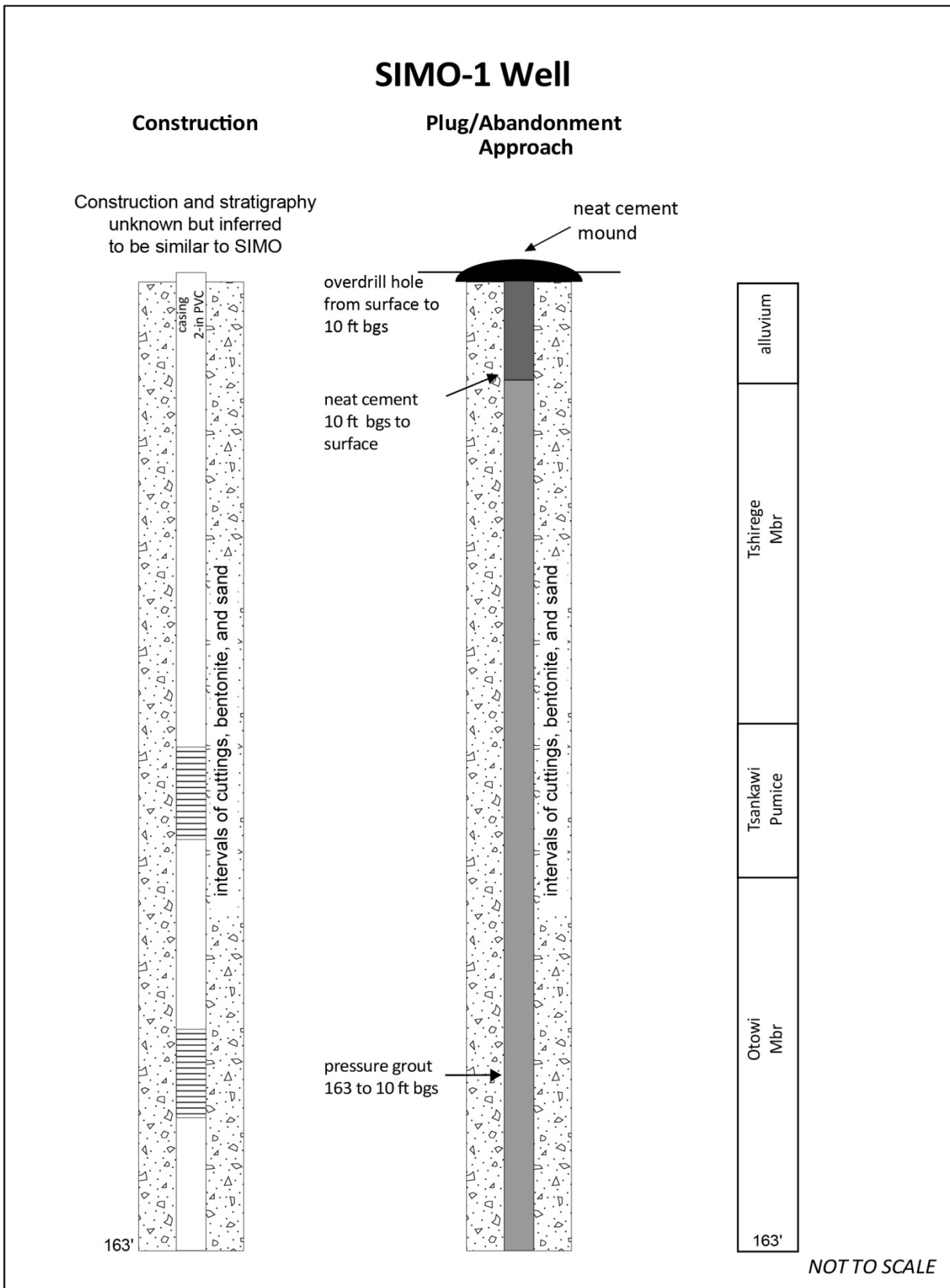


Figure 3.8-1 SIMO-1 abandonment schematic

