

Identifier: **EP-ERSS-SOP-5033**  
(was SOP-05.02)

Revision: 0.0



Effective Date: **02/09/07**

# Environment & Remediation Support Services

## Standard Operating Procedure

for **WELL DEVELOPMENT**

**APPROVAL SIGNATURES:**

<b>Subject Matter Expert:</b> <i>Mark Everette</i> <del>Mark Everette</del>	<b>Organization</b> LWSP	<b>Signature</b> <i>Mark Everette</i>	<b>Date</b> 1/26/07
<b>Quality Assurance Specialist:</b> Phil Noll	<b>Organization</b> QA-IQ	<b>Signature</b> <i>Phil Noll</i>	<b>Date</b> 12/22/06
<b>Responsible Line Manager:</b> Dwain Farley	<b>Organization</b> ERSS	<b>Signature</b> <i>Dwain Farley</i>	<b>Date</b> 12/22/06

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**1.0 PURPOSE AND SCOPE**

The purpose of this procedure is to describe the responsibilities and processes for development of monitor wells subsequent to drilling and installation for the Los Alamos National Laboratory (LANL or Laboratory) Environment & Remediation Support Services (ERSS).

**2.0 BACKGROUND AND PRECAUTIONS**

**2.1 Background**

This procedure is used in conjunction with an approved Integrated Work Document (IWD). Also, consult the IWD for information on and use of all PPE.

All well drilling and installation procedures create a skin, or filter cake, on the borehole wall. During well development, the fine particulate matter is removed from the well or saturated formation near the screen. A secondary function of development is to settle the annular fill to a stable position.

The following factors influence the success of well development: 1) the drilling method employed in the well construction; 2) the design and completion of the well; and 3) the type and gradation of geologic material surrounding the screen. Because of the small size of weathering products from the volcanic tuff, in some of the alluvial canyon aquifers in the region, it is virtually impossible to eliminate turbidity while developing the well.

There are various techniques that may be effective in developing wells depending on the hydrogeologic conditions encountered in the aquifer, drilling method used, and well design. Since hydrogeologic conditions may be complex and unpredictable, a single procedure can not be developed that will apply to all possible situations. Refer to the site-specific work plan for more information on the scope of work activities for determining the most appropriate method to be used for existing conditions.

**2.2 Precautions**

None.

**3.0 EQUIPMENT AND TOOLS**

<ul style="list-style-type: none"> <li>• Water Level Meter</li> <li>• Specific Conductance/Temperature/pH</li> <li>• Distilled Water</li> <li>• Stop Watch</li> <li>• Plastic Sheet</li> <li>• Wire Brush Assembly</li> <li>• Bailer</li> <li>• Pump</li> </ul>	<ul style="list-style-type: none"> <li>• Surge Block</li> <li>• Turbidity Meter (with range of 0-400 NTU)</li> <li>• Photo-ionization Detector (PID)</li> <li>• Equipment and Supplies listed in SOP-05-0029</li> <li>• Borehole/Well Completion Information Form</li> <li>• Any Personal Protective Equipment listed or required in the SSHASP</li> <li>• Any additional supplies listed in associated procedures, as needed</li> </ul>
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## 4.0 STEP-BY-STEP PROCESS DESCRIPTION

### 4.1 Pre-Operational Activities

Field Team Leader	1.	Coordinate efforts for on-site staging of water that is produced during development.
	2.	Assemble containers for temporary water storage.
	3.	Ensure containers are structurally sound, decontaminated, compatible with anticipated contaminants, and field manageable.
	4.	Containerize all development water until it can be discharged in accordance with an NMED-approved Notice of Intent (NOI) or other appropriate disposal method.
	5.	Clearly label each container with the location ID, date, and time.
	6.	Ensure labels are placed on the side of the containers and covered with clear tape to ensure their permanence.
	7.	Decontaminate all equipment that will enter the well or come into contact with the development water before developing each well according to procedure EP-ERSS-SOP-5061, Field Decontamination of Drilling and Sampling Equipment.
	8.	Assemble equipment on a plastic sheet in an area that is beyond the range of splashing development water activities.
	9.	Begin well development as soon as is practical after the well is installed, but no sooner than 48 hours after grouting is completed.
	10.	Do not use any dispersing agents, acids, or disinfectants to enhance the development of the well unless specifically instructed in writing by the Project Leader.
Site Geologist	11.	If problems or unusual conditions arise that require the addition of water to aide development, coordinate with the Project Leader as soon as possible.  [NOTE: In the installation of some monitoring wells in perched alluvial aquifers at Los Alamos, partial development is desirable before emplacing the bentonite seal and cement grout because of settling that commonly occurs.]

### 4.2 Well Development Activities

EP Project Personnel	1.	Open the surface protective casing and remove the well cap (if applicable).
	2.	Monitor air quality at the top of the casing and in the breathing zone using a PID or other suitable monitoring instrument.

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EP Project  
Personnel  
(Continued)

3. Measure and record depth to water and the total depth of the well according to procedure EP-ERSS-SOP-5037, Water Level Measurements.
4. Perform wire-brush procedures throughout the interior length of the well casing, screen(s), and sump.
5. Begin bailing to remove turbid water from the well and sediment from the sump.
6. Measure and record initial field chemical parameters (pH, electrical conductivity, and temperature) and turbidity.
7. Periodically measure field parameters as specified in the site-specific Work Plan.
8. Note and record volumes of water produced as bailing proceeds.
9. Continue bailing as prescribed by the Work Plan or as otherwise directed by the Project Leader.
10. Begin pump-development procedures, using the following general steps to develop each screen individually and in succession:
  - Install a submersible pump-and-packer assembly across the first screen to be developed;
  - Pumping is initiated at a sustainable rate that will not induce excessive drawdown;
  - A transducer and/or a bubble piezometer may be installed in the well to measure water levels during the pump-development phase;
  - When the pump has been turned on, collect a sample of the development water to measure and record initial field chemical parameters and turbidity;
  - Note the initial color, clarity, and any obvious odor of the water;
  - Periodically monitor water quality parameters throughout the pump-development phase as prescribed in the Work Plan;
  - Likewise, note and record flow measurements (flow rate and volume produced) as indicated by an in-line flow meter; and
  - Continue to record measurements until the screen interval has been fully developed.

[NOTE: For wells with multiple completions, each water-bearing zone is isolated using inflatable packers above and below the screen.]
11. Continue well development procedures for each screen interval until: 1) the development water becomes free of suspended sediment; 2) an appropriate volume of water has been purged; and 3) field parameters have stabilized.

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| EP Project Personnel<br>(Continued) | 12. | Continue until the turbidity readings stabilize at levels of less than 5 NTU or cannot be improved per the Hazardous and Solid Waste Amendments Permit (May, 1990).                                                                                                                                                                                            |
|                                     | 13. | If the well is not free of sediment after the required volume of water has been removed, continue pumping until twice that volume has been purged <u>or</u> approval to cease development activities is authorized by the Project Leader.                                                                                                                      |
|                                     | 14. | Be sure to document all turbidity measurements in the Daily Activity Log in accordance with procedure EP-ERSS-SOP-5058, Sample Control and Field Documentation.                                                                                                                                                                                                |
|                                     | 15. | For wells where borehole drilling was conducted without the use of drilling fluid (water, mud, or additives), purge a minimum of five casing volumes of water before stopping well development.<br><br>[NOTE: In situations where the groundwater flow from the screen interval is exceeded by the development pumping rate, the well may temporarily dry up.] |
|                                     | 16. | Contact the Project Leader when it is determined that five casing volumes can not be purged within a 24-hour period.                                                                                                                                                                                                                                           |
| Site Geologist                      | 17. | For completing well development, ensure field chemical parameters have stabilized over a series of monitoring measurements.                                                                                                                                                                                                                                    |
|                                     | 18. | If it is determined that one or more of the above criteria for well development cannot be met regardless of the amount of pumping, coordinate with the Focus Area Leader to select an alternate procedure for verifying that the well is adequately developed.                                                                                                 |

### 4.3 Documentation

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|----------------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EP Project Personnel | 1. | Record all manually measured data and procedural descriptions in a field notebook as required by procedure EP-ERSS-SOP-5009, Notebook Documentation for Environmental Restoration technical Activities. |
|                      | 2. | Complete the appropriate data entry requirements on the Borehole/Well Completion Information Form to document well development.                                                                         |
|                      | 3. | Record all well development activities on the Summary of Well Development Methods Form (see Attachment 1).                                                                                              |
|                      | 4. | Document all deviations from the Work Plan in accordance with procedure EP-ERSS-SOP-3001, Issues Management.                                                                                            |

#### 4.4 Post-Operation Activities

- Field Team Leader
1. Collect groundwater samples from the well in accordance with procedure EP-ERSS-SOP-5057, Handling, Packaging, and Shipping of Samples, early as 30 days after well development is complete, or as otherwise specified in project documents.
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2. Insure that all equipment is accounted for and decontaminated (see procedure EP-ERSS-SOP-5061, Field Decontamination of Equipment).

#### 4.5 Records

- Field Team Leader
1. Submit the following records generated from this procedure to the Records Processing Facility:
    - Completed Borehole/Well Completion Field Data Log;
    - Completed Daily Drilling Summary Log; and
    - Completed Summary of Well Development Form.

### 5.0 PROCESS FLOW CHART

Flow chart is to be included at a later date.

### 6.0 ATTACHMENTS

Attachment 1: 5033-1 Summary of Well Development Methods Form (1 page)


### 7.0 REVISION HISTORY

Author: Paula Schuh

Revision No. <i>[Enter current revision number, beginning with Rev.0]</i>	Effective Date <i>[DCC inserts effective date for revision]</i>	Description of Changes <i>[List specific changes made since the previous revision]</i>	Type of Change <i>[Technical (T) or Editorial (E)]</i>
0.0	02/09/07	Reformatted and renumbered, supersedes SOP-05.02	E

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**ATTACHMENT 1: SUMMARY OF WELL DEVELOPMENT METHODS FORM**

<b>5033-1</b>  <b>Summary of Well Development Methods Form</b>	Records Use only  
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<b>Well ID:</b>	<b>Date Development Began:</b>	<b>Date Development Ended:</b>
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<b>Screen No.:</b>	<b>Screen Interval (Perforations):</b> _____ <b>to</b> _____
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**Formation:**

Development Method	Final Development Criteria

<b>Screen No.:</b>	<b>Screen Interval (Perforations):</b> _____ <b>to</b> _____
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**Formation:**

Development Method	Final Development Criteria

<b>Screen No.:</b>	<b>Screen Interval (Perforations):</b> _____ <b>to</b> _____
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**Formation:**

Development Method	Final Development Criteria

<b>Screen No.:</b>	<b>Screen Interval (Perforations):</b> _____ <b>to</b> _____
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