



Bingham, S. N., C. C. Young, J. L. Haack-Gaynor , L. W. Morrison, and G. A. Rowell. 2016. Wetland monitoring protocol for Cuyahoga Valley National Park: Narrative. Natural Resource Report NPS/HTLN/NRR—2016/ 1336. National Park Service, Fort Collins, Colorado.

Standard Operation Procedure 10: Soil Stratigraphic Analysis

Version 1.00 (12/27/2016)

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

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Standard Operation Procedure 10: Soil Stratigraphic Analysis

Overview

Installing monitoring wells requires soils to be augured at a width of 7.62 cm (3 inches), to a depth of nearly 1 to 2.0 m below the ground surface. This soil profile provides an opportunity for stratigraphic analysis. The soils data is used to qualitatively examine the geologic and hydrologic histories of the site and confirmation of a site as wetland.

The analysis is a classification of conditions in soil layers, particularly soil colors and textures. Color serves as an indicator of the chemical transformations that occur in wetland soils when water is present for an extended time. For example, redoximorphic features like mottles are most likely to occur in soils that cycle between anaerobic (reduced) and aerobic (oxidized) conditions (Environmental Laboratory 1987) from alternating wet and dry conditions. By contrast, strongly gleyed soils suggest water is present for extended periods, resulting in prolonged anaerobic conditions.

Soil Color Analysis

Use a moist Munsell® chart (Gretag/Macbeth 2000) for the soil color analysis in natural light. Examine soil colors immediately within 5 to 30 minutes of sample collection as ferrous iron can oxidize rapidly (Environmental Laboratory 2012). If the soil is too saturated, however, it may be difficult to see redox features. Moist soil is recommended. The following procedures are used in each soil layer encountered.

1. Cleanly break off a representative block of soil
2. Hold the soil up to the Munsell charts to find the Munsell chip that most closely matches 1) the predominant soil matrix color and 2) the color of any mottles present in the block (Figure 10.1). The system has three components: hue (a specific color), value (lightness and darkness), and chroma (color intensity) that are arranged in books of color chips. A color's hue, value and chroma are combined in a numerical expression to form a designation for each color chip. For example, a color chip having a designation of 10 YR 4/2 has a hue of 10 YR, a value of 4, and a chroma of 2.
3. Write the correct Munsell soil designation in the Soil Characteristics Column of the Well Deployment Form (Attachment 7.1, Figure 10.3).
4. The presence of mottles, or areas of contrasting color (Figure 10.2), mottle color and percentage of mottle is noted directly below the matrix color in the Soil Characteristics column.
5. Soil texture is also recorded in the same column, immediately under the soil designation. For soil texture, grab a small soil sample that fits in the palm of your hand. Moisten the sample with water and work it into the soil for about 1-2 minutes until just before it becomes sticky. We use the Soil Texture Triangle to determine soil texture in our work (Attachment 10.1). The Soil Texture Flowchart can also be used.
(http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311).

6. Finally, the presence of oxidized roots or other redox features and hydric condition (i.e., inundated, saturated, moist, or dry), are recorded in the Comments column of the Well Deployment Form.



Figure 10.1. Using a Munsell® soil chart, determine the matrix and mottle colors of a soil sample.



Figure 10.2. a) An example of a sandy, reduced soil with a gray (gleyed) matrix with orange and black streaking (mottles). b) A mineral soil with a gleyed matrix and oxidized roots (USACE Midwest Regional Supplement 2010).

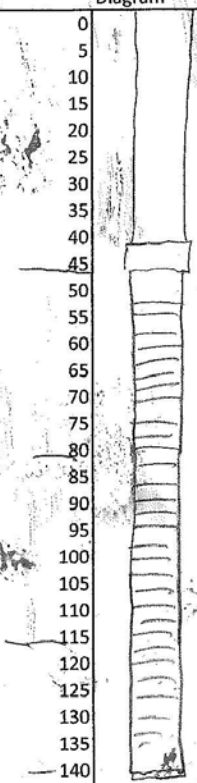
References

Environmental Laboratory. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, Version 2.0 (Regional Supplement)

USDA Natural resources Conservation Service. Soil Education. Guide to Texture by Feel. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311 (accessed 8 March 2016).

Well Deployment Log
Cuyahoga Valley National Park

Wetland ID 43 Tract ID 116-29/116-05 Well # 1
 Mapped Soil _____ Monitoring Period _____
 Monitoring Depths 190cm
 Method to measure water levels hydrolevel Frequency _____
 Height above surface 992cm
 Coordinate System: UTM zone 17N N/S _____ E/W _____

Depths (cm)	Diagram	Backfill	Soil characteristics	Comments
0		Bentonite	5Y 5/1 10YR 5/8 G/F	Oxidized roots very stinky odor (not sulfidic) clay
5				
10				
15				
20				
25		SAND		
30				
35				
40				
45				
50			6EY 1 5/10 10YR 3/6 F/F	clay
55				
60				
65				
70				
75				
80				
85			6EY 1 4/10 5Y 5/2 G/F 10YR 7/6 F/F	clay
90				
95				
100				
105				
110				
115				
120				
125			2.5Y 5/1 2.5Y 5/3 10YR 4/6	silty clay loam
130				
135				
140				
145				
150				

Bore hole diameter 3.5"
 Well stock ID 39 OD 41
 Material of well stock Sch 40 PVC
 Slot width #008
 Manufacturer Johnson Well Equip

Maintenance History		
Type	Date	Initials
Deployed	Aug 2, 2012	SB

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Figure 10.3. Completed well deployment form (blank available as Attachment 7.1) showing the soil mottles, redoximorphic features, Munsell color, and texture. The form also shows total well depth and location of backfill materials.

Attachment 10.1: Soil Textural Triangle

Soil Textural Triangle

