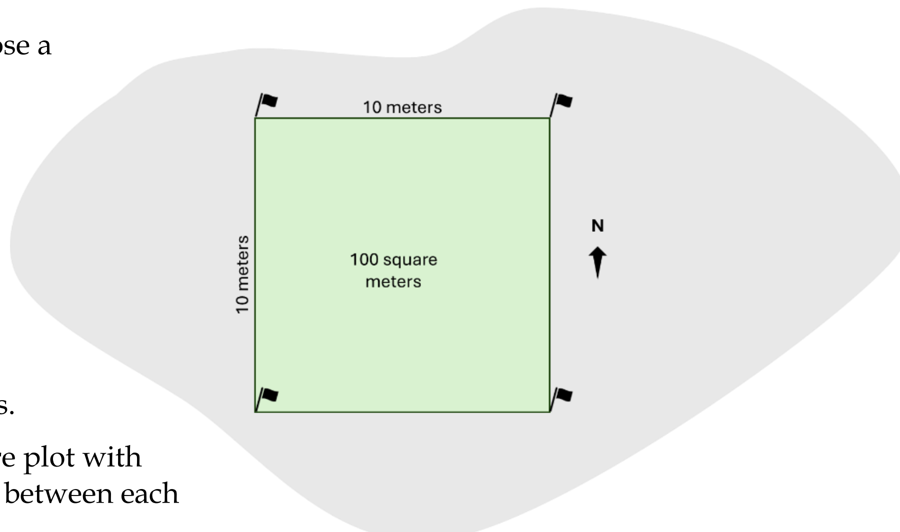
Appendix H: Sampling Procedures

Establishing the $10m^2$ Plot

Basal area and tree stem density is documented at every Vegetated Wetland Sub-Unit within a $10m^2$ plot. The location of the $10m^2$ plot should be established randomly but must be entirely within the Sub-Unit and should be representative of the vegetation in that Sub-Unit.

> NOTE: It may not be necessary to establish a $10m^2$ plot in some Sub-Units classified as Emergent if there are no trees present.

1) Randomly select a starting point within the Sub-Unit and place a flag (or other marker) at that location.
2) From the starting point, choose a random direction and run a measuring tape or line 10m. Place a flag at the second corner.
3) Reorient yourself 90° and run the measuring tape 10m. Place a flag at the third location.
4) Repeat step 3 two more times.
5) There should now be a square plot with flags in each corner and 10m between each flag.

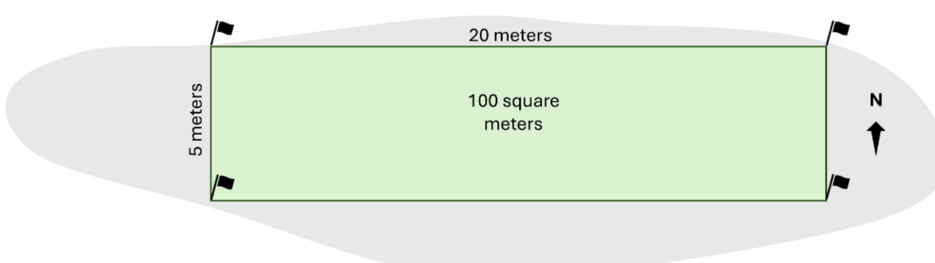


6) Double check that the $10m^2$ plot is representative of the Sub-Unit.

If the shape and size of the Sub-Unit do not allow for the placement of a square $10m^2$ plot use one of the following alternate scenarios.

<u>Linear Sub-Unit</u>

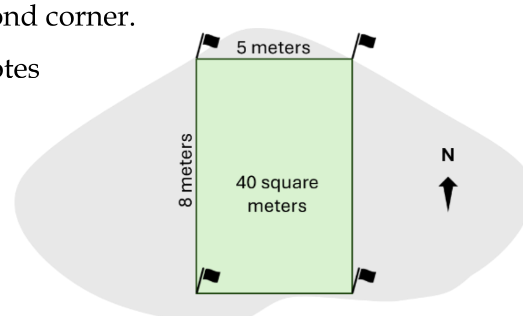
1) Randomly select a starting point within the Sub-Unit and place a flag (or other marker) at that location.
2) From the starting point, choose a random direction and run a measuring tape or line 10m **<u>OR until</u>** <u>you reach the edge of the Sub-Unit</u>. Place a flag at the second corner.
   - Record the distance between Flags 1 and 2 in the notes section of Part C.
   - Calculate the length required so that the finished plot will have an area of 100 square meters.



3) Reorient yourself 90º and run the measuring tape the required length of the second side. Place a flag at the third location.
    - Record the distance between Flags 2 and 3 in the notes section of Part C.
4) Reorient yourself another 90º and run the measuring tape the length of the first side. Place a flag at the fourth location.
5) Check that the distance between the fourth flag and the first flag is the same as the distance between the second and the third flags.
6) There should now be a rectangular plot with flags in each corner and a total area of 100 m^2.
7) Double check that the plot is representative of the Sub-Unit.

Small Sub-Unit

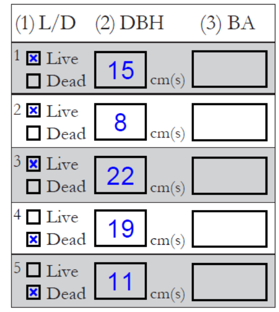
1) Randomly select a starting point within the Sub-Unit and place a flag (or other marker) at that location.
2) From the starting point, choose a random direction and run a measuring tape or line 10m **OR until you reach the edge of the Sub-Unit**. Place a flag at the second corner.
    - Record the distance between Flags 1 and 2 in the notes section of Part C.



3) Reorient yourself 90º and run the measuring tape 10m **OR until you reach the edge of the Sub-Unit**. Place a flag at the third location.
    - Record the distance between Flags 2 and 3 in the notes section of Part C.
4) Reorient yourself another 90º and run the measuring tape the length of the first side. Place a flag at the fourth location.
5) Check that the distance between the fourth flag and the first flag is the same as the distance between the second and the third flags.
6) There should now be a rectangular plot with flags in each corner.
    - **Calculate the area of the plot**. Data collected in the plot will be weighted to account for the difference in size compared to the other 10m^2 plots.
7) Double check that the plot is representative of the Sub-Unit.

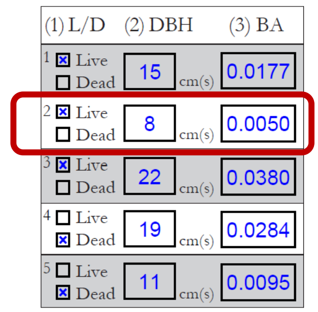
Converting DBH to Basal Area

1) The DBH of every tree rooted in the 10m² plot is measured and recorded in column (2) of Section C-2a.

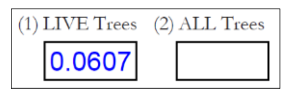


2) Use the table below to convert DBH (in cm) to Basal Area (in m²) for each tree recorded in column (2) of section C-2a and record the BA in column (3).
3) For any tree where DBH < 10cm **OR** DBH > 100cm, apply the equation.

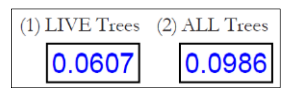
$$\boxed{BA = 0.0007854 \times DBH^2}$$



4) Calculate the **LIVE BA** by finding the sum of the values recorded in column (3) for trees marked Live only and record the total in column (1) of section C-2b.

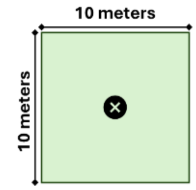


5) Calculate the **TOTAL BA** by finding the sum of ALL values recorded in column (3) and record the total in column (2) of section C-2b.



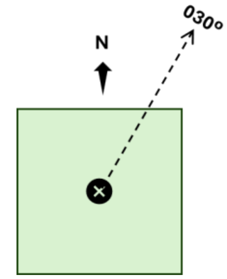
DBH (cm)	Basal Area (m²)	DBH (cm)	Basal Area (m²)	DBH (cm)	Basal Area (m²)	DBH (cm)	Basal Area (m²)	DBH (cm)	Basal Area (m²)
10	0.0079	30	0.0707	50	0.1964	70	0.3848	90	0.6362
11	0.0095	31	0.0755	51	0.2043	71	0.3959	91	0.6504
12	0.0113	32	0.0804	52	0.2124	72	0.4072	92	0.6648
13	0.0133	33	0.0855	53	0.2206	73	0.4185	93	0.6793
14	0.0154	34	0.0908	54	0.2290	74	0.4301	94	0.6940
15	0.0177	35	0.0962	55	0.2376	75	0.4418	95	0.7088
16	0.0201	36	0.1018	56	0.2463	76	0.4536	96	0.7238
17	0.0227	37	0.1075	57	0.2552	77	0.4657	97	0.7390
18	0.0254	38	0.1134	58	0.2642	78	0.4778	98	0.7543
19	0.0284	39	0.1195	59	0.2734	79	0.4902	99	0.7698
20	0.0314	40	0.1257	60	0.2827	80	0.5027	100	0.7854
21	0.0346	41	0.1320	61	0.2922	81	0.5153		
22	0.0380	42	0.1385	62	0.3019	82	0.5281		
23	0.0415	43	0.1452	63	0.3117	83	0.5411		
24	0.0452	44	0.1521	64	0.3217	84	0.5542		
25	0.0491	45	0.1590	65	0.3318	85	0.5675		
26	0.0531	46	0.1662	66	0.3421	86	0.5809		
27	0.0573	47	0.1735	67	0.3526	87	0.5945		
28	0.0616	48	0.1810	68	0.3632	88	0.6082		
29	0.0661	49	0.1886	69	0.3739	89	0.6221		

Microfeature Transects



1) Identify a point in the approximate center of the 10m2 plot.
2) From the center point, identify a random direction to run the first transect. This may be done by using a random numbers table to generate a random compass direction, tossing a pencil or other linear object to point in a random direction, or any other ecologically accepted transect randomization method.
   - Record the direction in the first box on line 1 in Section C-3a.

	(1) Direction	(2) CWM	+	(3) BDS	+	(4) MTC	=	(5) Total
1	030°		+		+		=	



3) Use a tape to lay out a 30 meter transect in that direction. If a tape is not available, pacing is acceptable as long as the same individual paces all three transects in EVERY sub-unit.
4) Walk the transect and note each time the transect intersects a microfeature.
   - Document the count for each microfeature category in boxes 2, 3 and 4 on line 1 in Section C-3a.

	(1) Direction	(2) CWM	+	(3) BDS	+	(4) MTC	=	(5) Total
1	030°	2	+	5	+	3	=	

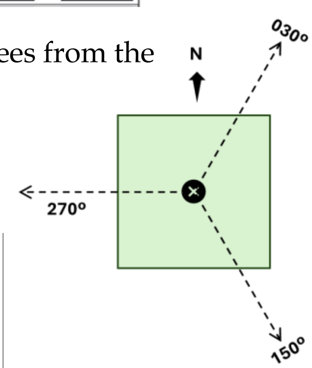
   - Calculate the total number of microfeatures along the first transect.

	(1) Direction	(2) CWM	+	(3) BDS	+	(4) MTC	=	(5) Total
1	030°	2	+	5	+	3	=	10

5) Return to the center point and lay out a second 30 meter transect at a 120 degree angle from the first transect, record the direction and count microfeatures along this transect.
   - Document the direction and count for each microfeature along the second transect on line 2 in Section C-3a.

	(1) Direction	(2) CWM	+	(3) BDS	+	(4) MTC	=	(5) Total
1	030°	2	+	5	+	3	=	10
2	150°	3	+	1	+	0	=	4

6) Return to the center point and lay out the third 30 meter transect 120 degrees from the other two, record and count microfeatures along the third transect.
   - Document the direction and count for each microfeature along the third transect on line e in Section C-3a.

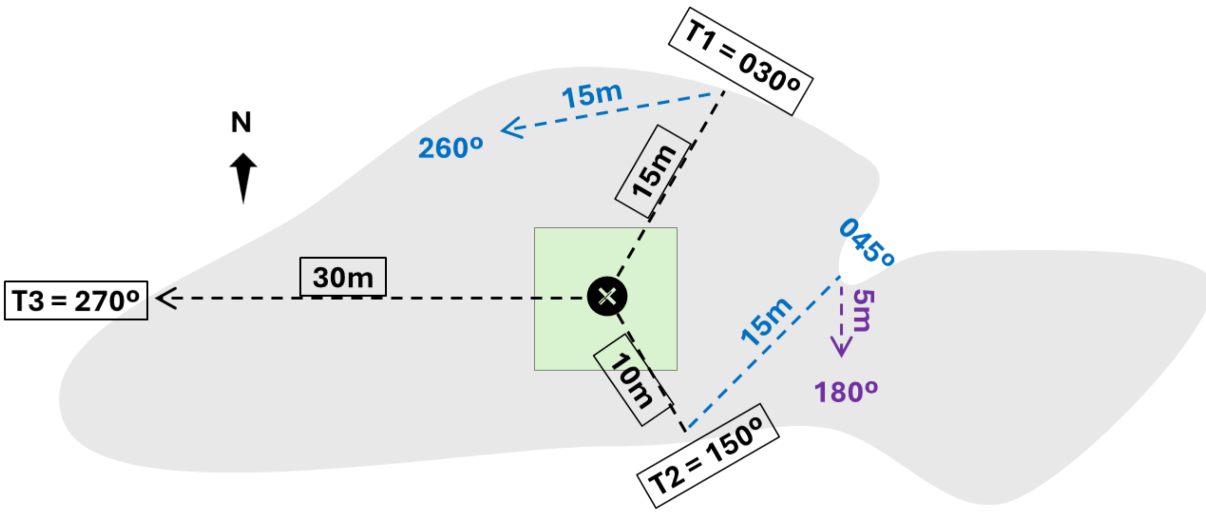


7) Use the values in column (5) to calculate the average number of microfeatures per 30m.
   - Record the average in the box in Section C-3b.

	(1) Direction	(2) CWM	+	(3) BDS	+	(4) MTC	=	(5) Total
1	030°	2	+	5	+	3	=	10
2	150°	4	+	1	+	0	=	5
3	270°	0	+	8	+	1	=	9
	Average:	8						

8) If any transects reach Sub-Unit or AU boundary before extending the full 30 meters, the line is then bent back into the Sub-Unit at a randomly-selected angle until 30 meters is reached.
9) For small Sub-Units, the boundary may be intersected multiple times and the transect would be set a new trajectory each time. See example below

Example: Narrow Sub-Unit – Microfeature Transects



1) Transect 1 begins at the centerpoint and extends in the direction 030º for 15m before intersecting the Sub-Unit boundary. The transect is then bent and extended in the direction 260º for the remaining 15m.
   - Record the direction 030º in the data sheet and add a note describing the direction change.
2) Transect 2 begins at the centerpoint and extends in the direction 150º for 10m before intersecting the Sub-Unit boundary. The transect is then bent and extended in the direction 045º for 15m before it intersects the boundary a second time. The transect is then bent again and extended in the direction 180º for the remaining 5m.
   - Record the direction 150º in the data sheet and add a note describing the direction change.
3) Transect 3 begins at the centerpoint and extends in the direction 270º for 30m.

a. MICROFEATURE COUNT	**NOTE: See User Guide for modification of transect location in narrow Sub-Units.**					
Record # of microfeatures along three 30m transects starting from the center of the 10m² plot (spaced 120° apart).		(1) Direction	(2) CWM +	(3) BDS +	(4) MTC =	(5) Total
MICROFEATURE KEY: CWM = Coarse Woody Material (≥ 0.9 m length/≥ 10 cm diameter) BDS = Boulders (≥ 25 cm diameter) MTC = Microtopographic Changes (> 10 cm height/depth)	1	030°	2	5	3	10
	2	150°	4	1	0	5
	3	270°	0	8	1	9

b. AVERAGE # of MICROFEATURES (per 30m): Average: 8

NOTES: T1 - Direction 030 for 15m, Direction 260 for 15m
T2 - Direction 150 for 10m, Direction 045 for 15m, Direction 180 for 5m
T3 - Direction 270 for 30m

Soil Sampling

Documenting the Soil Profile - Example

In order to examine the soil, pits should be hand dug to a minimum of 70 cm. Soil augers may be used for examining deeper soil layers. Starting at the soil surface indicate the depth in centimeters of each layer (e.g. 0-8 cm, 8-14 cm, etc.). Start a new layer anytime there is a color change, texture change or a change in redoximorphic features or root presence.

Layer/Horizon: The uppermost layer (Layer 1) consists of **organic material**, in the least decomposed state (**fibric**). The designation for **Organic (Fibric) is Oi** and recorded in column (1).

(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1. Oi			%		%	

Depth: Layer depth is recorded starting at the soil surface and measuring down. **Layer 1 begins at 0** and goes **down to 38 cm** below the soil surface.

(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1. Oi	0-38		%		%	

Matrix Color: The color of the layer is evaluated using a color book (e.g. Munsell or Earth Colors) to determine the Hue, Value, and Chroma.

This layer matches the colors on the **Hue = 2.5Y** page, **Value = 4** and **Chroma = 3**.

- This is recorded as **2.5Y 4/3** in column (3)

(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1. Oi	0-38	2.5Y 4/3	%		%	

Matrix Percent: Layer 1 is the same color throughout and does not contain any redox features. The **matrix percent is 100%** and is recorded in column (4).

(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1. Oi	0-38	2.5Y 4/3	100 %		%	

Redox (redoximorphic) Color/Percent: Because there are no redox features in Layer 1, the box in column (5) is left empty and 0% redox is recorded in column (6).

(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1. Oi	0-38	2.5Y 4/3	100 %		0 %	

Texture: Layer 1 consists of slightly decomposed organic material. This **texture is fibric (or peat)** and should be recorded in column (7).

(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1. Oi	0-38	2.5Y 4/3	100 %		0 %	peat

Start a new layer anytime there is a color change, texture change or a change in redoximorphic features presence/color.

Layer 2 – Depth: Layer 2 is measured starting at the bottom of layer 1 (38 cm below the soil surface). It is 18 cm thick which means it extends to a depth of 56 cm below the soil surface.

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-38	2.5Y 4/3	100 %		0 %	fibric
2.	Oe	38-56		%		%	

Layer 2 – Color and Texture: The matrix of layer 2 is slightly redder in hue than layer 1 and has a color of 10YR 4/3. There are no redox features, and the texture is moderately decomposed organic material or hemic (mucky peat).

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-38	2.5Y 4/3	100 %		0 %	fibric
2.	Oe	38-56	10YR 4/3	100 %		0 %	hemic

Layer 3: Consists of highly decomposed organic material and extends to a depth of 100 cm.

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-38	2.5Y 4/3	100 %		0 %	fibric
2.	Oe	38-56	10YR 4/3	100 %		0 %	hemic
3.	Oa	56-100	2.5YR 2.5/1	100 %		0 %	sapric

Layer 4 – Redox Color and Percent: The first layer to contain redox features. Layer 4 is 80% matrix, and the remaining 20% is redox. The color of the redox features is recorded in column (5) and the percent is recorded in column (6).

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-38	2.5Y 4/3	100 %		0 %	fibric
2.	Oe	38-56	10YR 4/3	100 %		0 %	hemic
3.	Oa	56-100	2.5YR 2.5/1	100 %		0 %	sapric
4.	Cg1	100-115	2.5Y 4/1	80 %	2.5Y 4/4	20 %	

Layer 4 – Mineral Soil Texture: This layer is also the first mineral soil layer in this profile. The texture is fine sandy loam texture which is recorded in column (7) as fsl. The abbreviations for mineral soil textures are found in the table below.

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-38	2.5Y 4/3	100 %		0 %	fibric
2.	Oe	38-56	10YR 4/3	100 %		0 %	hemic
3.	Oa	56-100	2.5YR 2.5/1	100 %		0 %	sapric
4.	Cg1	100-115	2.5Y 4/1	80 %	2.5Y 4/4	20 %	fsl

NOTE: Some layers may have more than one matrix or redox color. In that case, record the second color and percent on the line below. The total percent should = 100% for each layer. Example:

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture	
1.	Oi	0-9	10YR 3/3	100 %		0 %	peat	
2.	A	9-19	10YR 4/2	100 %		0 %	sil	
3.	Bg	19-28	10YR 4/2	55 %	10YR 5/2	35 %	sil	= 100%
4.				%	7.5YR 5/8	10 %		
5.	Cg	28+	7.5YR 5/4	58 %	5YR 5/8	40 %	fsl	= 100%
6.				%	5YR 6/2	2 %		

Layer 5: This is the last layer in the soil profile. It is only 5cm thick and has no redox features. The texture is slightly coarser, sandy loam (or sl).

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-38	2.5Y 4/3	100 %		0 %	fibric
2.	Oe	38-56	10YR 4/3	100 %		0 %	hemic
3.	Oa	56-100	2.5YR 2.5/1	100 %		0 %	sapric
4.	Cg1	100-115	2.5Y 4/1	80 %	2.5Y 4/4	20 %	fsl
5.	Cg2	115-120	2.5Y 4/1	100 %		0 %	sl

Documenting Texture Class

1) Identify the texture of the uppermost mineral soil layer in the soil profile. In the example above the uppermost mineral soil layer is layer 4 and the texture is Fine Sandy Loam.

   - Use the texture class key (see table below) to record the texture class of the uppermost mineral soil in section D-2b(1). The texture class for Fine Sandy Loam is Loamy (Coarse)

(1) Upper Mineral Layer

Record the texture class of the uppermost mineral soil layer.

☐ No mineral soil layers present

☐ Clayey
☐ Loamy (Fine) ☐ mucky
☐ Loamy (Med) ☐ mucky
☒ Loamy (Coarse) ☐ mucky
☐ Loamy Sand ☐ mucky
☐ Sandy ☐ mucky

2) Identify all organic soil textures in the soil profile. In the soil profile above, layers 1-3 are all organic: Fibric, Hemic, and Sapric textures.

   - Record all organic soil textures by checking the corresponding boxes in section D-2b(2).

3) Identify all mineral soil textures in the soil profile. In the soil profile above, layers 4 and 5 are mineral soils: layer 4 is Fine Sandy Loam and layer 5 is Sandy Loam.

4) Use the Mineral Soil Texture class key to determine the Texture Class(es) for the mineral soil textures documented.

   - Use the texture class key (see table below) to record the texture class(es) of the mineral soil layers in section D-2b(2), including the layer recorded in section D-2b(1).

(2) All Textures Present

Record ALL texture classes in the soil profile.

ORGANIC SOILS
☒ Fibric (Peat)
☒ Hemic (Mucky Peat)
☒ Sapric (Muck)

MINERAL SOILS
☐ Clayey
☐ Loamy (Fine) ☐ mucky
☐ Loamy (Med) ☐ mucky
☒ Loamy (Coarse) ☐ mucky
☐ Loamy Sand ☐ mucky
☐ Sandy ☐ mucky

NOTE: Check mucky modified box if applicable

   - Fine Sandy Loam and Sandy Loam are both in the Loamy (Coarse) texture class.

Organic Thickness

Organic thickness is the total thickness of all organic layers. In the example above layers 1-3 are all organic, starting at the soil surface and extending to 100cm.

- Record the organic thickness in section D-2c.

c. THICKNESS OF ORGANIC LAYERS	100	cm(s)	☐ Total thickness > 130 cm	☐ No organic layers

Example 2 – Deep Organic

The soil profile in this example consists of two organic layers and no mineral layers.

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	Oi	0-80	10YR 3/3	100 %		%	peat
2.	Oe	80-150	10YR 2/1	100 %		%	mucky peat

The texture for layer 1 is Peat (or Fibric) and the texture for layer 2 is Mucky Peat (or Hemic).

- Select the box labeled <u>no mineral soil layers present</u> in section D-2b(1).
- Select the boxes which correspond to the organic soil textures of the two layers in section D-2b(2).

(1) Upper Mineral Layer

Record the texture class of the uppermost mineral soil layer.

☒ No mineral soil layers present

☐ Clayey
☐ Loamy (Fine) ☐ mucky
☐ Loamy (Med) ☐ mucky
☐ Loamy (Coarse) ☐ mucky
☐ Loamy Sand ☐ mucky
☐ Sandy ☐ mucky

(2) All Textures Present

Record ALL texture classes in the soil profile.

ORGANIC SOILS
☒ Fibric (Peat)
☒ Hemic (Mucky Peat)
☐ Sapric (Muck)

MINERAL SOILS
☐ Clayey
☐ Loamy (Fine) ☐ mucky
☐ Loamy (Med) ☐ mucky
☐ Loamy (Coarse) ☐ mucky
☐ Loamy Sand ☐ mucky
☐ Sandy ☐ mucky

NOTE: Check mucky modified box if applicable

In this example, organic soil layers extend from the soil surface down to 150 cm.

- Record the thickness as 150cm in section D-2c.
- Check the box to indicate that the total thickness is > 130 cm. NOTE: When the SEA contains very deep organic soils, it is not necessary to measure beyond 130 cm – record the thickness as 131 and check the box.

c. THICKNESS OF ORGANIC LAYERS	150	cm(s)	☒ Total thickness > 130 cm	☐ No organic layers

Example 3 – Mucky Modified Mineral

	(1) Layer/ Horizon	(2) Depth (cm)	(3) Matrix Color	(4) Matrix Percent	(5) Redox Color	(6) Redox Percent	(7) Soil Texture
1.	A1	0-26	10YR 2/1	90 %	2.5YR 3/6	10 %	sil
2.	Ab2	26-40	10YR 2/1	100 %		0 %	mucky sil
3.	Bg	40-48	10YR 5/1	98% %	2.5YR 4/8	2 %	sil
4.	2Cg	48-71	7.5YR 5/2	100 %		0 %	Sand (gr)

The soil profile in this example consists of four mineral layers and no organic layers. Layers 1-3 are all Silt Loam, however layer 2 is mucky modified.

- The uppermost mineral layer is layer 1 which has a texture of Silt Loam. Check the box for the Loamy (Med) texture class in section D-2b(1).

(1) Upper Mineral Layer

Record the texture class of the uppermost mineral soil layer.

☐ No mineral soil layers present

☐ Clayey
☐ Loamy (Fine) ☐ mucky
☒ Loamy (Med) ☐ mucky
☐ Loamy (Coarse) ☐ mucky
☐ Loamy Sand ☐ mucky
☐ Sandy ☐ mucky

- Because layers 1-3 are all Silt Loam, the box for Loamy (Med) texture class should also be checked in section D-2b(2).
- In addition, to indicate that at least one of those layers is mucky modified, check the Mucky box on the same line.
- Check the box for the Sandy texture class to record the Gravelly Sand texture of layer 4.
- Check the box for No organic layers in section D-2c.

(2) All Textures Present

Record ALL texture classes in the soil profile.

ORGANIC SOILS
☐ Fibric (Peat)
☐ Hemic (Mucky Peat)
☐ Sapric (Muck)

MINERAL SOILS
☐ Clayey
☐ Loamy (Fine) ☐ mucky
☒ Loamy (Med) ☒ mucky
☐ Loamy (Coarse) ☐ mucky
☐ Loamy Sand ☐ mucky
☒ Sandy ☐ mucky

NOTE: Check mucky modified box if applicable

c. THICKNESS OF ORGANIC LAYERS ____ cm(s) ☐ Total thickness > 130 cm ☒ No organic layers

Table – Soil Texture Abbreviations and Texture Classes

Soil Texture	Code	Texture Class	Soil Texture	Code	Texture Class
Clay	C	CLAYEY	Fine Sandy Loam	FSL	LOAMY (COARSE)
Silty Clay	SIC		Sandy Loam	SL	
Sandy Clay	SC		Coarse Sandy Loam	COSL	
Clay Loam	CL	LOAMY (FINE)	Loamy Very Fine Sand	LVFS	LOAMY SAND
Silty Clay Loam	SICL		Loamy Fine Sand	LFS	
Sandy Clay Loam	SCL		Loamy Sand	LS	
Silt	SI	LOAMY (MED)	Loamy Coarse Sand	LCOS	
Silt Loam	SIL		Very Fine Sand	VFS	SANDY
Loam	L		Fine Sand	FS	
Very Fine Sandy Loam	VFSL		Sand	S	
			Coarse Sand	COS	