# MAPSS method for onsite assignment of Hydrologic Soil Group (HSG).\*

This is a proposed method for assigning Hydrologic Soil Groups (HSG) to sites or High Intensity Soil Survey (HISS) map unit components based on observed soil properties of Representative Pedons.

#### **Abbreviations:**

HSG Hydrologic Soil Group
RP Representative Pedon
HISS High Intensity Soil Survey
SHWT Seasonal High Water Table

NEH CH7 National Engineering Handbook, Part 630 Hydrology, CHapter 7

https://www.wcc.nrcs.usda.gov/ftpref/wntsc/H&H/NEHhydrology/ch7.pdf

#### Background and proposal:

- 1. HSG is assigned using Chapter 7 of the NRCS National Engineering Handbook (NEH), Part 630. It uses depth to water impermeable layer, depth to seasonal high water table (SHWT), and Ksat of the least transmissive layer above the water impermeable layer to determine HSG.
- 2. Soil series' HSG assignments are based on a single pedon by NRCS, 1 HSG per series.
- 3. But soil series' ranges in depths to water impermeable layers and SHWT mean that HSG can vary.
- 4. HSG is arguably the single most sought-after soil attribute from soils consultants.
- 5. HSG assignment based on actual site characteristics would add significant accuracy and value to that product.
- 6. Two methods have been explored:
  - A. The Rhode Island Triangle
  - B. Using CH7 NEH
- 7. The triangle method cannot be defensibly promoted due to issues with separation of SHWT depths, and using inexact groups of soil textures as proxies for Ksat.
- 8. The MAPSS Technical Committee is proposing a method using the NEH CH7 method.

<sup>\*</sup>If you are not experienced in using this methodology, or do not have a representative pedon description for your site or map unit component, then stop here.

### What is a "water impermeable layer"?

See Footnote 1/ below **Table 7.1**, p. 7-4. The various diagnostic horizons are defined in *Keys to Soil Taxonomy*, USDA (Chapter 3).

"Fragipan" is equivalent to the Cd-horizon in lodgement till.

"Densic materials have, at their upper boundary, a densic contact if they have NO CRACKS or if the spacing of the cracks that roots can enter is 10 CM OR MORE."

"An impermeable layer has a Ksat < 0.01 micro-meters/second\*

\*micro-meter = micron = 0.001 mm

SAND 0.050 microns
SILT 0.002microns
CLAY

## What is "Depth to high water table"?

See Footnote 2/ below **Table 7.1**, p. 7-4. This is the Seasonal High Water Table (SHWT)

## What is "Ksat of least transmissive layer in depth range"?

This is the layer or horizon with that will be least transmissive ABOVE THE WATER IMPERMEABLE LAYER.

Table 7-1

			ı	able 7-1		
		Depth to water impermeable layer 1/	Depth to high water table 2/	$ m K_{sat}$ of least transmissive layer in depth range	$ m K_{sat}$ depth range	HSG 3/
		<50 cm [<20 in]	_	_	_	D
	"how to	o" example		>40.0 μm/s (>5.67 in/h)	0 to 60 cm [0 to 24 in]	A/D
nmn			<60 cm	>10.0 to ≤40.0 µm/s (>1.42 to ≤5.67 in/h)	0 to 60 cm [0 to 24 in]	B/D
Start here in this column		<b></b>	[<24 in]	>1.0 to ≤10.0 µm/s (>0.14 to ≤1.42 in/h)	0 to 60 cm [0 to 24 in]	C/D
re in		50 to 100 cm		≤1.0 μm/s (≤0.14 in/h)	0 to 60 cm [0 to 24 in]	D
tart he		[20 to 40 in]		>40.0 μm/s (>5.67 in/h)	0 to 50 cm [0 to 20 in]	A
Ś				>10.0 to ≤40.0 µm/s (>1.42 to ≤5.67 in/h)	0 to 50 cm [0 to 20 in]	В
			≥60 cm [≥24 in]	>1.0 to ≤10.0 µm/s (>0.14 to ≤1.42 in/h)	0 to 50 cm [0 to 20 in]	С
	_			≤1.0 µm/s (≤0.14 in/h)	0 to 50 cm [0 to 20 in]	D
tart here in this column				>10.0 µm/s (>1.42 in/h)	0 to 100 cm [0 to 40 in]	A/D
re in thi		<b>—</b>	<60 cm	>4.0 to ≤10.0 µm/s (>0.57 to ≤1.42 in/h)	0 to 100 cm [0 to 40 in]	B/D
			[<24 in]	>0.40 to ≤4.0 µm/s (>0.06 to ≤0.57 in/h)	0 to 100 cm [0 to 40 in]	C/D
S		>100 cm		≤0.40 µm/s (≤0.06 in/h)	0 to 100 cm [0 to 40 in]	D
		[>40 in]		>40.0 µm/s (>5.67 in/h)	0 to 50 cm [0 to 20 in]	A
			60 to 100 cm	>10.0 to ≤40.0 µm/s (>1.42 to ≤5.67 in/h)	0 to 50 cm [0 to 20 in]	В
			[24 to 40 in]	>1.0 to ≤10.0 µm/s (>0.14 to ≤1.42 in/h)	0 to 50 cm [0 to 20 in]	C
	_			≤1.0 μm/s (≤0.14 in/h)	0 to 50 cm [0 to 20 in]	D
column				>10.0 µm/s (>1.42 in/h)	0 to 100 cm [0 to 40 in]	A
Start here in this column		<b></b>	>100 cm	$>4.0 \text{ to} \le 10.0 \ \mu\text{m/s}$ (>0.57 to $\le$ 1.42 in/h)	0 to 100 cm [0 to 40 in]	В
art here			[>40 in]	>0.40 to ≤4.0 µm/s (>0.06 to ≤0.57 in/h)	0 to 100 cm [0 to 40 in]	С
St	_			≤0.40 μm/s (≤0.06 in/h)	0 to 100 cm [0 to 40 in]	D

#### Method:

Using the included HSG worksheet or equivalent:

**1.** From your site and/or HISS: use the pedon description information for the map unit component **Representative Pedon (RP)**.

For each RP; identify 1) the depth to water impermeable layer, 2) depth to seasonal highwater table, and 3) least transmissive layer above the water impermeable layer.

**2.** Using Web Soil Survey (download PDF instructions from MAPSS website if needed): Identify the analogous soil series (component) used in the most relevant published soil survey. Identify the appropriate layer from that NRCS pedon to use for your RP least transmissive layer.

Note: the NRCS pedon layer should be the least transmissive layer above any impermeable layers in most cases.

Use the Ksat data for the NRCS layer to attribute to your RP least transmissive layer.

Record the **H**igh, **L**ow and **R**epresentative **V**alue (RV) for the Ksat of the NRCS pedon least transmissive layer.

Either: Use the RV for Ksat for that layer and go to (3).

or: Deviate from the NRCS RV value based on RP properties, using the guidance in (2A).

**2A**. Deviating from the NRCS pedon layer RV for Ksat.

1. If RP layer **R**ock **F**ragment **(RF)** % exceeds NRCS reference pedon layer, then the RP Ksat RV may be increased or decreased by the percentage deviation from the NRCS layer RF %, to a maximum of 20 percent.

Example: NRCS reference pedon layer has 5% RF, RP layer has 15% RF, and NRCS Ksat RV is 10, then it may be increased to 11 for your RP layer.

2. If the fine earth texture is one class or more different than the NRCS reference layer, then the Ksat may be adjusted up to 10% (up for a coarser RP, down for a finer RP).

Example: NRCS reference pedon layer is L, RP layer is CL, and Ksat RV is 10, then it may be decreased to 9 for your RP layer.

3. If the NRCS reference layer consistence *and* structure are at least one class different from the RP layer, then the Ksat may be adjusted up to 10% from the NRCS layer.

Example A: NRCS reference pedon layer is firm and weak, RP layer is friable and strong, and Ksat RV is 10, then it may be increased to 11 for your RP layer.

Example B: NRCS reference pedon layer is firm and weak, RP layer is very firm and strong, then they offset and no deviation from the RV is allowed.

--these may be applied cumulatively for a maximum of 40% deviation from the NRCS pedon layer Ksat RV--

Establish Ksat and go to (3).

3. Use table 7.1 from the NEH CH7, Part 630 to attribute the HSG for your RP.

MAPSS Soil/Sit	te Hydrologic Gr	oup and (	Connotative Le	gend Worksheet							
					NRCS Component HSG reference dat						
	RP Water		Texture of			reference					
	<u>Impermeab</u>		<u>least</u>	NRCS Soil Survey	<u>NRCS</u>	<u>layer</u>					
	<u>le layer</u>	<u>SHWT</u>	<u>transmissi</u>	<u>reference</u>	series	(bottom	NRCS	<u>NRCS</u>	NRCS_	<u>RP</u>	
Rep Pedon	depth (cm)	<u>depth</u>	ve layer	component name	<u>HSG</u>	depth)	Ksat L	Ksat RV	Ksat H	<u>Ksat</u>	RP HSG
1/Elmwood	70	56	LFS	Elmwood	В	76	14.11	28.23	42.34	28.23	B/D
2/Nicholville	105	80	VFSL or FSL	Nicholville	С	102	1	15	99.9999	15	В
3/Peru	75	56	CBFSL	Peru	C/D	66	1	7.81	9.9999	7.81	C/D
4/Brayton	49	8	FSL	Brayton	D	58	1	7.8	9.9999	7.8	D
5/Peru	90	85	GRSL	Peru	C/D	66	1	7.81	9.9999	7.81	С
			Populate on	ly if deviation from NF	RCS Ksat RV is used						
		RP rock				NRCS rock	NRCS_	NRCS_			
		fragm	<u>RP</u>		<u>NRCS</u>	fragment	Structu	consist			
	RP texture	ent %	<u>Structure</u>	RP consistence	<u>texture</u>	<u>%</u>	<u>re</u>	<u>ence</u>	<b>RP HSG</b>		
Rep Pedon											

Example:							
Using CH7							
Representa	ative Pedon (RP):	Kennebec Ch	nesuncook (I	Dixmont)			
		Redoximor					
		phic		% Rock			
	Bottom depth	features	Texture	fragments.	Consistence	Structure	
Oa	5cm		sil	20	fr	1FGR	
E	10cm		sil	20	fr	1FPL	
Bs	45cm		sil	25	fr	2FMGR	
Bs2	75cm		l	30	fr	2FMSBK	
ВС	85cm	yes	I	40	fr	2FMSBK	
Cd							
Soil survey	BC horizon on to	op of pan Ksa	L at 1.41-14.1 	 1 um/sec, Rep 	l presentative \	<u> </u> /alue (RV) = 	7.76
Based on t	exture and RF%, I	use Ksat=10.0	09 (30% abo	ve RV) based	on rocks, text	ture.	
HSG = B							
Using Rho	 de Island Triangle	the HSG =	<u>C</u>				
Usingsoil s	urvey data, the H	ISG = C/D.					

<b>RP</b> =Representative	Pedon fro	m your te	est pit soil su Texture of least	rvey	N	RCS Compo	onent HSG r	eference da	<u>ta</u>		
<b>RP</b> =Representative	Pedon fro	m your te	Texture of	rvey							
			transmissiv								
	RP: Depth to water		e layer above above			reference					
	<u>Imperme</u>			NRCS Soil Survey		<u>layer</u>					
	able layer			reference component		(bottom	-	NRCS Ksat		1	
Rep Pedon	<u>(cm)</u>	<u>depth</u>	ble layer	<u>name</u>	series HSG	depth)	<u>Low</u>	RV	<u>High</u>	RP Ksat	RP HSG
			Populate o	nly if deviation from N	RCS Ksat RV	is propose	ed.				
		RP rock fragme				NRCS rock fragment		NRCS consistenc			
		nt %		RP consistence		%		e	RP HSG	Notes	
								=			