TECHNICAL NOTES

October, 2014

SSR1- Technical Note Number 26 (3rd Revision)

This Technical note provides guidance on the entry of saturated hydraulic conductivity (Ksat) values in NASIS.

A discussion on saturated hydraulic conductivity (Ksat) is in Soil Survey Technical Note 6, posted December 2004 to the National Soils web site. Also, the NSSH has additional information regarding Ksat in part 618.88.

This guidance replaces the MO-1 technical note 26 (NASIS - Ksat Values) issued in November of 2006. The major change in this guidance is to move away from values that correspond to inches/hour associated with permeability classes. The previous guidance was to enter the low and high values corresponding to the class breaks while using an approximate mid-point as the representative value.

There are two main purposes for this new guidance. This update corresponds to an update in SSR1 Technical note 40 (DMU Data population guidance). Within the new DMU guidance when the use of class break values are suggested, the preference is to use metric class break values and not values based on English units converted to metric. The other reason for change is to suggest the use of more values, in addition to class breaks, in order to show better the relative differences in horizons.

Actual measured Ksat data is very scarce in SSR1 at this time. While this guide serves to estimate soil properties, the gathering of additional measurements is strongly encouraged. This guide is intended to be a starting point for developing more refined local guides dealing with particular parent materials, horizons, and other factors affecting pore size distribution and therefore Ksat.

Note- Ksat is a soil property that is used in many interpretations. It is recommended that you check some of the more important interpretations, such as T factor, for your area after you populate values.

SSR1 Ksat Guide, 2013	Values (um/sec)					
Soil Texture	Horizons with low Db or high porosity	Class Term	Horizons with medium Db or medium porosity	Class Term	Horizons with high Db or low porosity	Class Term
O horizons unsaturated	100-400-700					
O horizons saturated	5-15-25					
Cr or R horizon					Do Not Populate	
Any continuously indurated or very strongly cemented restrictive horizon (e.g., duripan)					0-0-0	Very Low
other restrictive horizons from non-cemented to strongly cemented (e.g., fragipan, densic)			1.0-0.5-0.1	Moderately Low	0.01-0.05-0.1	Low
COS	600-650-700	Very High	500-550-600	Very High	100-200-300	Very High
S	400-450-500	Very High	300-350-400	Very High	50-75-100	High
LS	200-250-300	Very High	100-150-200	Very High	10-25-50	High
coarse end of SL	75-125-150	Very High	10-50-100	High	5-10-25	High
fine end of SL	50-75-100	High	10-25-50	High	1-5-10	Moderately High
L	10-25-50	High	5-15-25	High	1-3-5	Moderately High
SIL, SI	5-15-25	High	5-8-10	Moderately High	0.1-0.5-1	Moderately Low
CL, SCL, SICL	1-5-10	Moderately High	1-3-5	Moderately High	0.1-0.3-0.5	Moderately Low
SC, SIC, C	0.5-0.8-1.0	Moderately Low	0.1-0.3-0.5	Moderately Low	0.01-0.05-0.1	Low

Notes: This is intended to be a starting place for developing your MLRA Guide. Adjustments should be made for soil properties that are likely to occur across the landscape. For example, having a fragment supported matrix with very coarse pores could have higher values than this guide would suggest. Some restrictive horizons that are not indurated or very strongly cemented might be considered very low (0-0-0) based on morphology. For subclasses of sands, loamy sands, and sandy loams, use texture that you feel most closely relates in terms of pores size distribution. For saturated O horizons the values provided are assumed mean values, which can be adjusted based on degree of organic matter decomposition, assuming less decomposition equates to higher Ksat. Db refers to 1/3 bar bulk density.

The following table is a guide to determine the bulk density category (low, medium, or high).

Generalized texure	low Db	medium Db	high Db
Sandy	<1.5	1.5-1.75	>1.75
Loamy	<1.2	1.2-1.6	>1.6
Clayey	<1.1	1.1-1.4	>1.4

Porosity:

The assumption made in developing this guide is that porosity and bulk density have an inverse relationship (high bulk density equates to low porosity). The pore size distribution should also be considered when choosing values. Note that there are three types of pores (matrix, nonmatrix, and interstructural). The pores normally described in pedons are nonmatrix. Matrix pores are usually smaller than nonmatrix pores and likely have less effect on Ksat, unless the texture is fairly coarse (e.g. LCOS). Interstructural pores are roughly the space between structural units and they can significantly influence Ksat. So in order to make the best Ksat value determination, take into account the structure of the horizon. Consideration should be made for horizons that have structural units that swell in a moist state and therefore decrease interstructural pores (e.g. strong prismatic structure described in a dry soil may appear to have large interstructural pores, but they may be significantly reduced upon wetting if the clay content is high and the type of clay is expansive).

The following are examples of Ksat values that might be derived using this guide. (units are um/sec)

Example 1. Silty Palouse soil with fragipan.

							old Ksat			new Ksat	
	texture	texture2	Db	structure	porosity	L	RV	H	L	RV	H
A	SIL		1.2	SBK	High	4	9	14	5	15	25
AB	SIL		1.3	SBK	High	4	9	14	5	15	25
Bw	SIL		1.4	SBK	Med	4.1	13.2	39.6	5	8	10
E	SIL	SI	1.5	M	Med/Low	0.43	4.8	13.8	1	3	5
Btxb1	SICL	SIL	1.65	PR	Low	0.01	0.07	0.42	0.01	0.05	0.1

Example 2. Soil formed in glacial sediments with densic material

							old Ksat			new Ksat	
	texture	texture2	Db	structure	porosity	L	RV	H	L	RV	H
A	L		1.25	SBK	High	4	7.5	14	10	25	50
E	SL	LS	1.7	SBK	Low	14	24	42	5	10	50
Bg1	LS	S	1.6	SBK	Med	42	77	141	100	200	400
Bg2	S	LS	1.6	SGR	Med	141	310	705	100	300	400
2Cd	L	SL	1.8	M	Low	0.01	0.1	0.42	0.01	0.05	0.1

Past guidance that is out of date now - included for information only

Permeability Class Terms (8)	Inches/Hour	µm/sec L (RV) H
very rapid	20-100	141 (423) 705
rapid	6-20	42 (92) 141
moderately rapid	2-6	14 (28) 42
moderate	0.6-2	4 (9) 14
moderately slow	0.2-0.6	1.4 (2.7) 4
slow	0.06-0.2	0.42 (.91) 1.4
very slow	0.0015-0.06	0.01 (.22) 0.42
impermeable	0.00-0.0015	0.0 (.005) 0.01

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K_{sat} Class			Permeability Class		
VERY HIGH	705.00	100.00	VERY RAPID	705.00	100.00
	100.00	14.17		141.14	20.00
HIGH			RAPID		
	10.00	1.417		42.34	6.00
MODERATELY HIGH			MODERATELY RAPID		
	1.00	0.1417		14.11	2.00
MODERATELY LOW			MODERATE		
	0.10	0.01417		4.23	0.60
LOW			MODERATELY SLOW		
	0.01	0.001417		1.41	0.20
VERY LOW			SLOW		
	0.00	0.00		0.42	0.06
µm/sec		in/hr	VERY SLOW		
				0.01	0.0015
			IMPERMEABLE		
				0.00	0.00
			µm/sec		in/hr

µm/sec x 0.1417 = in/hr in/hr x 7.0572 = µm/sec