

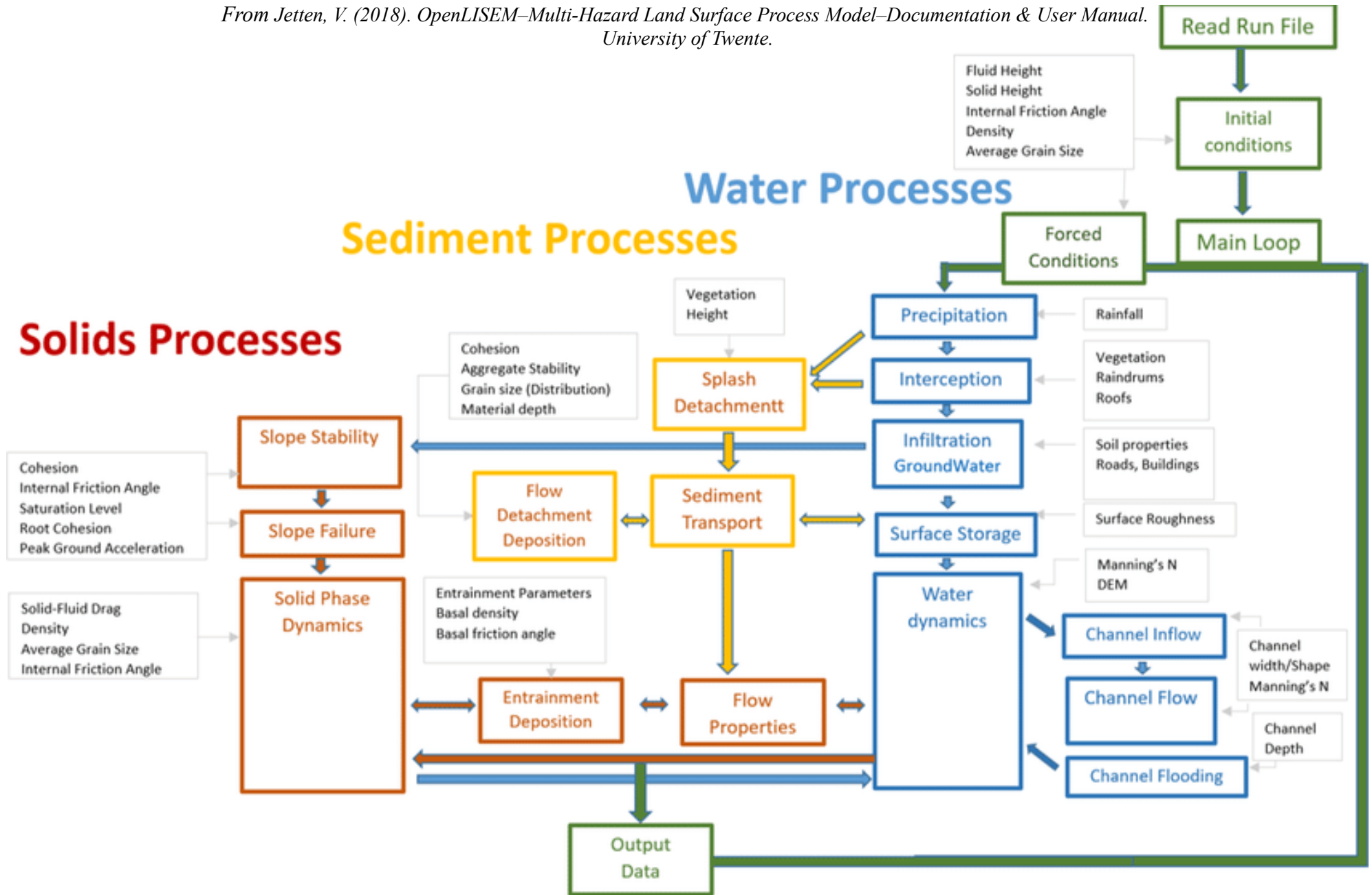
# APPENDIX 5

## Supporting materials

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### LISEM Flow chart

From Jetten, V. (2018). *OpenLISEM–Multi-Hazard Land Surface Process Model–Documentation & User Manual*. University of Twente.



## Lookup tables from the LISEM documentation and user manual

Lisem Documentation & Manual

Second Draft

ITC

### Appendix

#### Appendix A Land Use/Soil Tables

Land use and soil properties for several land use types.

Land Use/Cover	nr	Random Roughness cm	Manning's n -	Plant Height m	Cover -
	0	1	2	3	4
Densely Vegetated Farming	1	1.0	0.03	1.0	0.8
Eroded Agricultural Land	2	0.7	0.03	0.5	0.5
Flatland Intensive Farming	3	1.0	0.03	1.0	0.8
Grasslands	4	0.5	0.10	0.2	1.0
Grasslands and Open Wood	5	0.5	0.10	0.2	1.0
Intensive Farming (25% Forest)	6	1.0	0.05	1.0	0.8
Mangrove	7	1.0	0.10	5.0	0.9
Mixed Farming	8	1.0	0.10	5.0	0.9
Natural Tropical Forest	9	1.0	0.10	5.0	0.9
Plantation Forest	10	1.0	0.10	5.0	8.0
Rock and Exposed Soil	11	0.5	0.01	0.0	0.0
Rural Settlement	12	0.5	0.05	5.0	0.1
Scrub Forest	13	1.0	0.10	5.0	0.9
Urban Settlement	14	0.5	0.05	5.0	0.1
Water	15	0.1	0.05	5.0	0.9

Soil Type (Saxtion et al., 2005)	ksat mm/h	porosity cm <sup>3</sup> /cm <sup>3</sup>	psi cm	
text class	0	1	2	3
C	1	2.5	0.5	50.0
CL	2	4.2	0.5	50.0
L	3	18.5	0.5	40.0
S	4	112.0	0.5	20.0
SaCL	5	7.0	0.4	35.0
SaL	6	80.0	0.5	40.0
Si	7	42.0	0.5	40.0
SiC	8	13.0	0.6	40.0
SiCL	9	25.0	0.5	40.0
SiL	10	17.4	0.5	40.0
Water (W)	20	0.0	0.0	0.0
Urban (A)	21	0.0	0.2	40.0
Salt pans (m)	22	0.0	0.4	40.0
Rock/outcrops	23	0.0	0.1	40.0

Soil type	Grain size (U.S. SCS, 1975)
Very coarse sand	2.0-1.0 mm
Coarse sand	1.0-0.5 mm
Medium sand	0.5-0.25 mm
Fine sand	0.25-0.10 mm
Very fine sand	0.10-0.05 mm
Silt	0.05-0.002 mm
Clay	<0.002 mm

## Lookup tables from the LISEM documentation and user manual

### Appendix B Manning's N Values

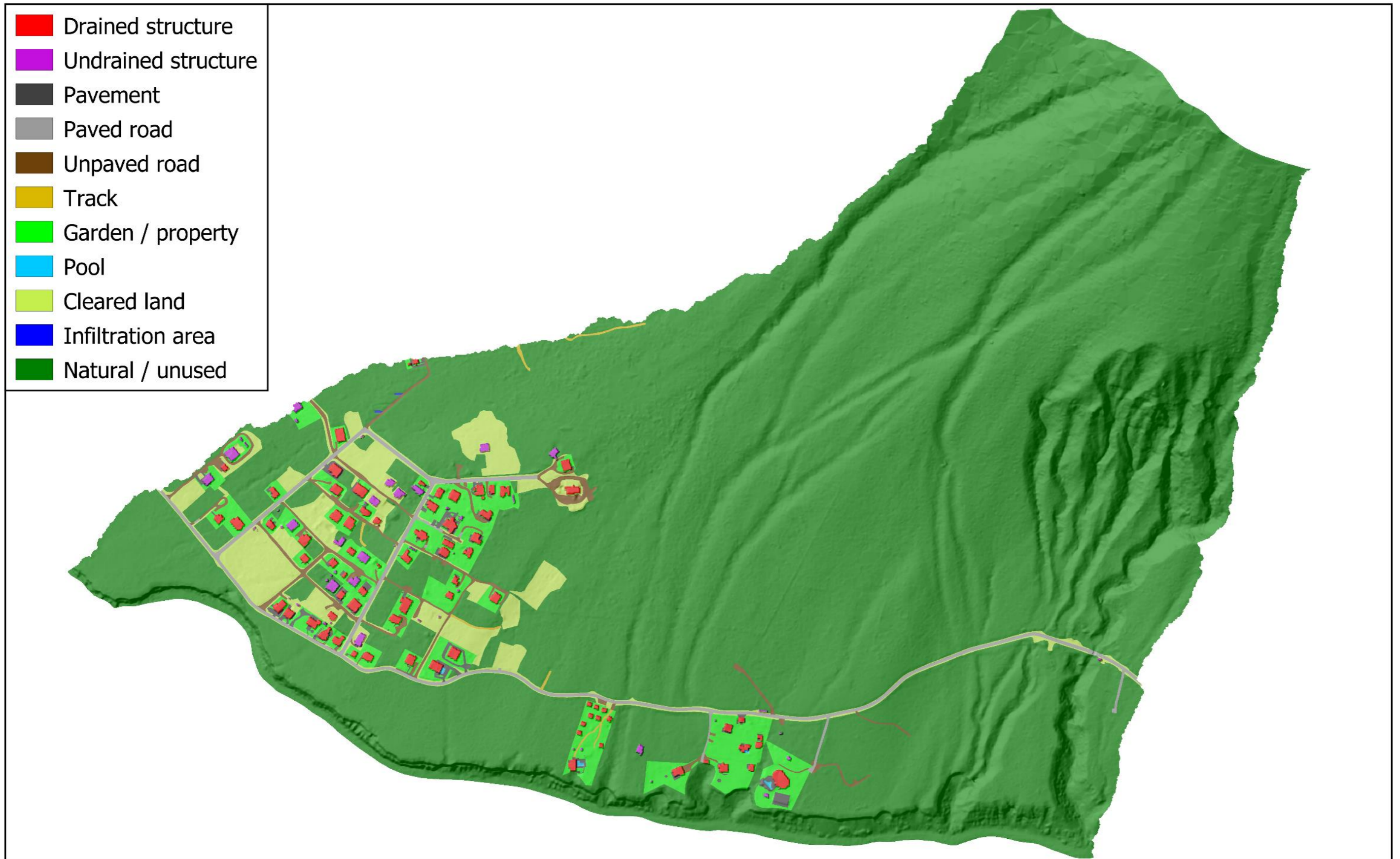
#### Manning's N values for different land covers

Land use or cover		low	mean	high	
Bare soil: roughness depth	< 25 mm	0.010	0.020	0.030	
	25-50 mm	0.014	0.025	0.033	
	50-100 mm	0.023	0.030	0.038	
	> 100 mm	0.045	0.047	0.049	
Bermuda grass: sparse to good cover	> 50 mm	0.015	0.023	0.040	
	very short grass				
	short grass	50-100 mm	0.030	0.046	0.060
	medium grass	150-200 mm	0.030	0.074	0.085
	long grass	250-600 mm	0.040	0.100	0.150
	very long grass	> 600 mm	0.060	0.150	0.200
Bermuda grass: dense cover		0.300	0.410	0.480	
Other dense sod forming grasses		0.390	0.450	0.630	
Dense bunch grasses			0.150		
Annual grasses (e.g. Sudan grass)			0.200		
Kudzu		0.070	0.150	0.230	
Lespedeza (legumes)			0.100		
Natural rangeland		0.100	0.130	0.320	
Clipped range		0.020	0.150	0.240	
Wheat straw mulch	2.5 t/ha	0.050	0.055	0.080	
	5.0 t/ha	0.075	0.100	0.150	
	7.5 t/ha	0.100	0.150	0.200	
	10.0 t/ha	0.130	0.180	0.250	
Chopped maize stalks	2.5 t/ha	0.012	0.020	0.050	
	5.0 t/ha	0.020	0.040	0.075	
	10.0 t/ha	0.023	0.070	0.130	
Cotton		0.070	0.080	0.090	
Wheat		0.100	0.125	0.300	
Sorghum		0.040	0.090	0.110	
Mouldboard plough		0.020	0.060	0.100	
Chisel plough; residue rate	< 0.6 t/ha	0.010	0.070	0.170	
	0.6-2.5 t/ha	0.070	0.180	0.340	
	2.5-7.5 t/ha	0.190	0.300	0.470	
	> 7.5 t/ha	0.340	0.400	0.460	
	< 0.6 t/ha	0.010	0.080	0.410	
Disc/harrow residue rate	0.6-2.5 t/ha	0.100	0.160	0.250	
	2.5-7.5 t/ha	0.140	0.250	0.530	
	> 7.5 t/ha		0.300		
No tillage: residue rate	< 0.6 t/ha	0.030	0.040	0.070	
	0.6-2.5 t/ha	0.010	0.070	0.130	
	2.5-7.5 t/ha	0.160	0.300	0.470	
Coulter		0.050	0.100	0.130	

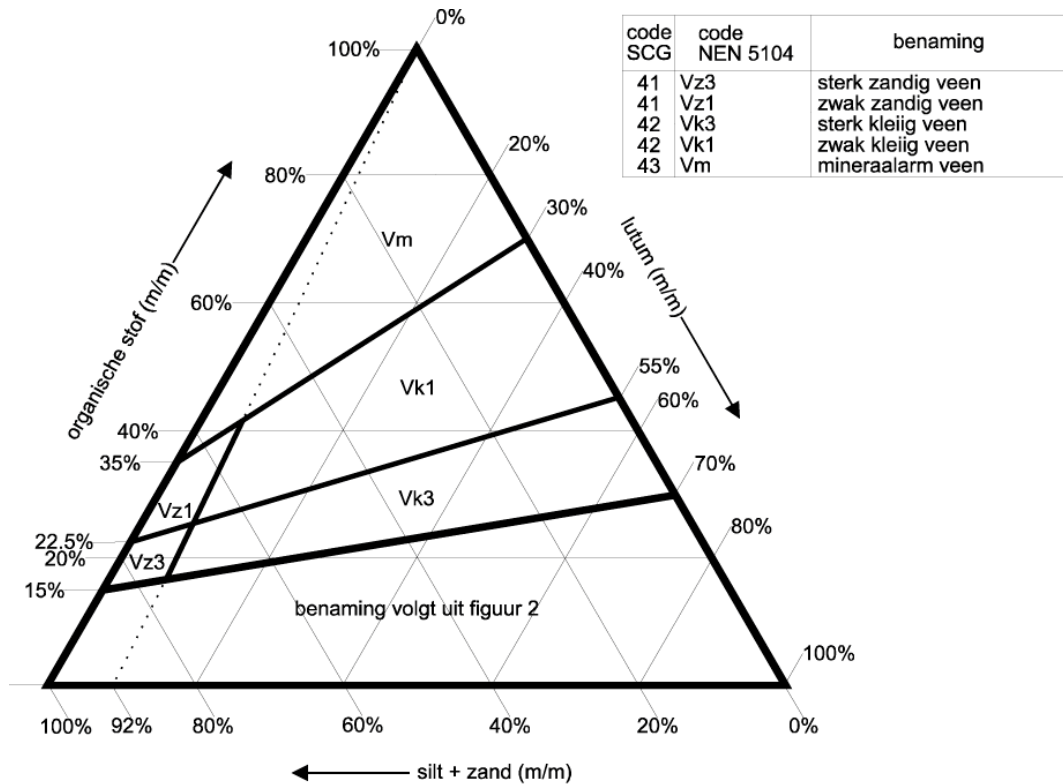
After Petryk and Bosmajian (1975), Temple (1982) and Engman (1986)



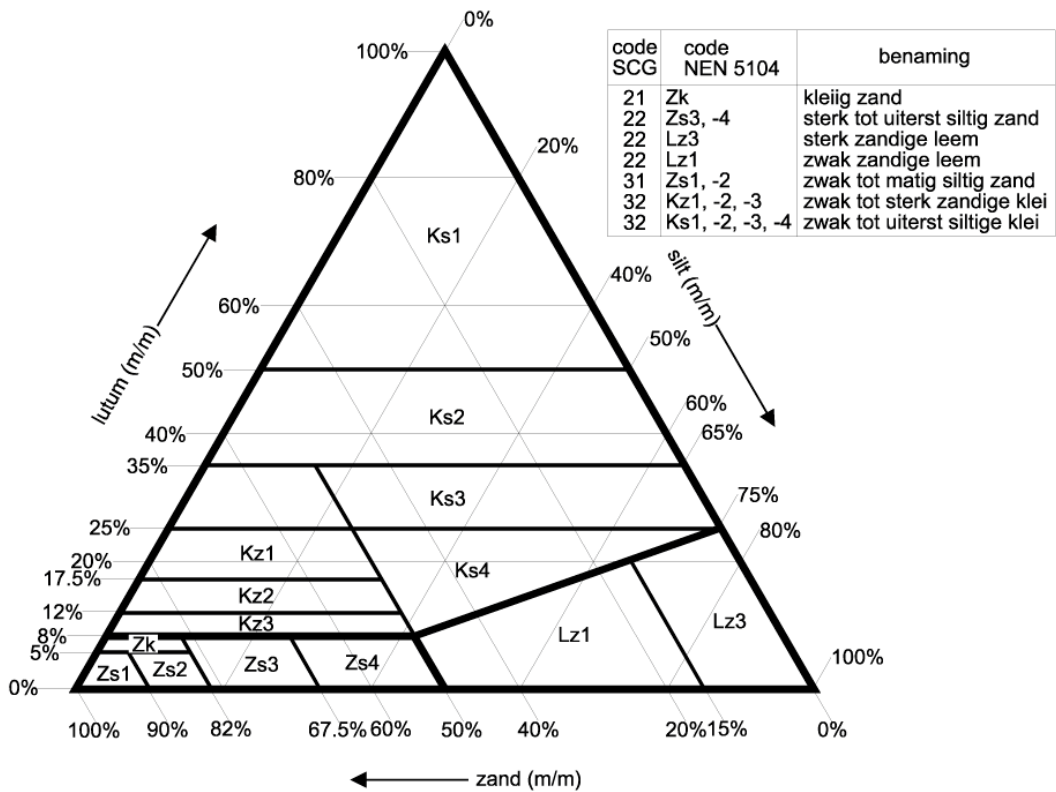
### Land use / land cover map



### NEN 5104 soil triangles

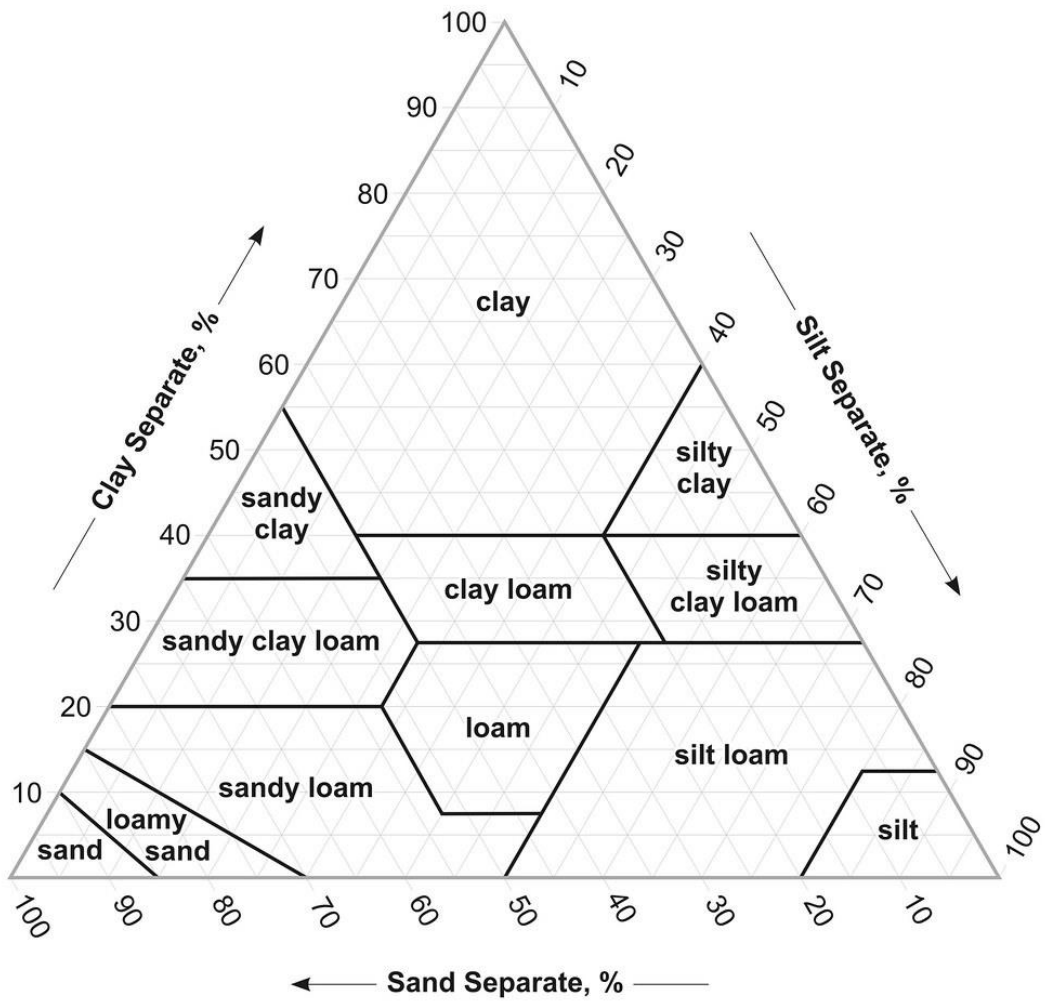


**Figuur 1:** Indeling en benaming van grondsoorten naar de gehalten aan organische stof, lutum en silt + zand conform NEN 5104



**Figuur 2:** Indeling en benaming van grondsoorten naar de gehalten aan lutum, silt en zand conform NEN 5104

### Soil Textural Triangle



### White Wall – Sugar Loaf stratigraphic column

From Roobol, M. J., & Smith, A. L. (2004). *Volcanology of Saba and St. Eustatius, Northern Lesser Antilles*. Koninklijke nederlandse Akademie van wetenschappen.

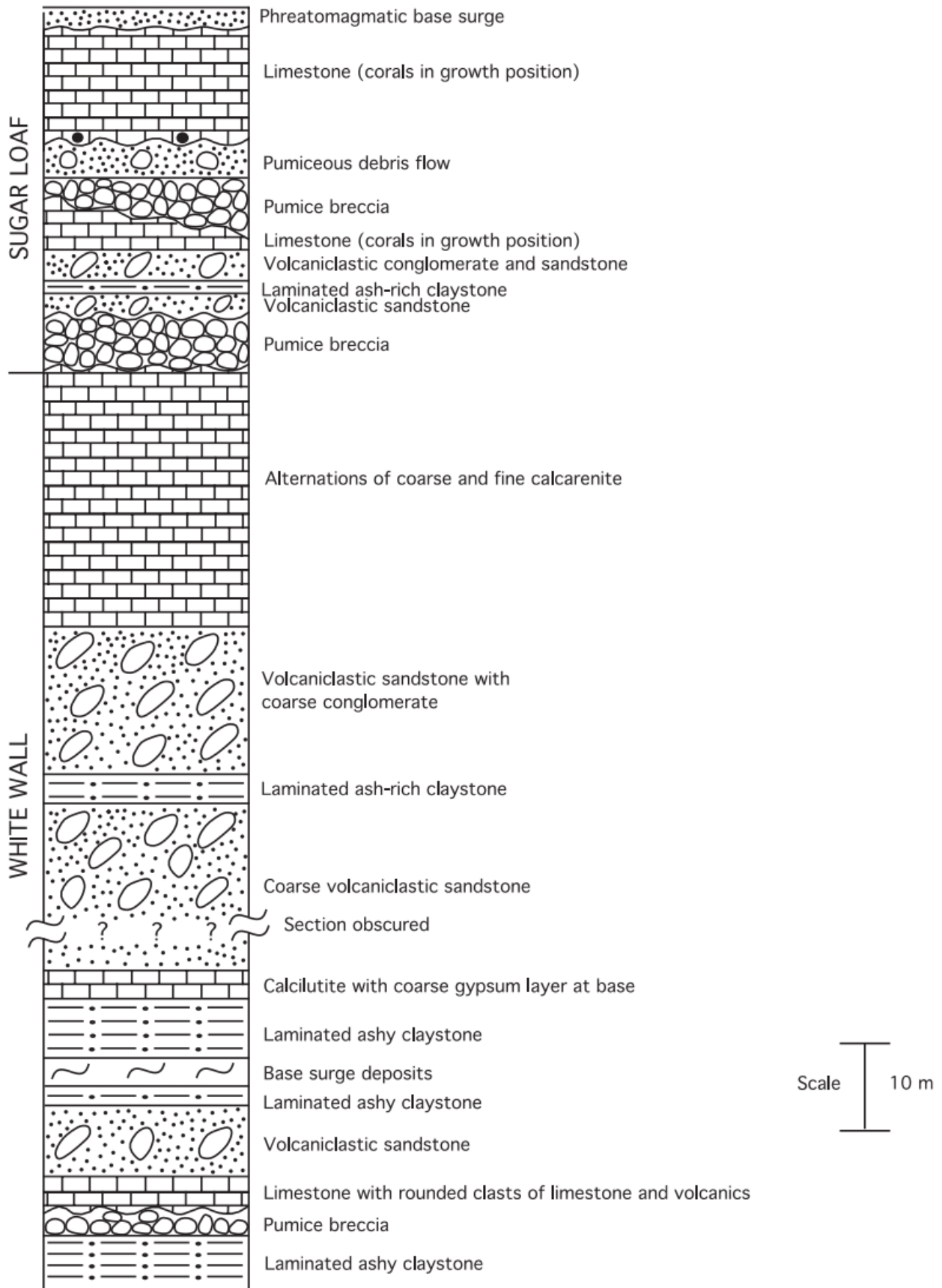


FIGURE 34. Stratigraphy of the White Wall-Sugar Loaf succession.