



Watershed and Groundwater  
Modeling Solutions

# Setting up the GSSHA Green & Ampt Infiltration Model





# Green and Ampt Parameters

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- Derived from soil texture index map or combination soil texture land use index map
- Assigned with mapping table
- Initial values can be taken as average values from Rawls et al. 1983
- Calibrated values are constrained within limits from Rawls et al. 1983





# GSSHA Infiltration Setup

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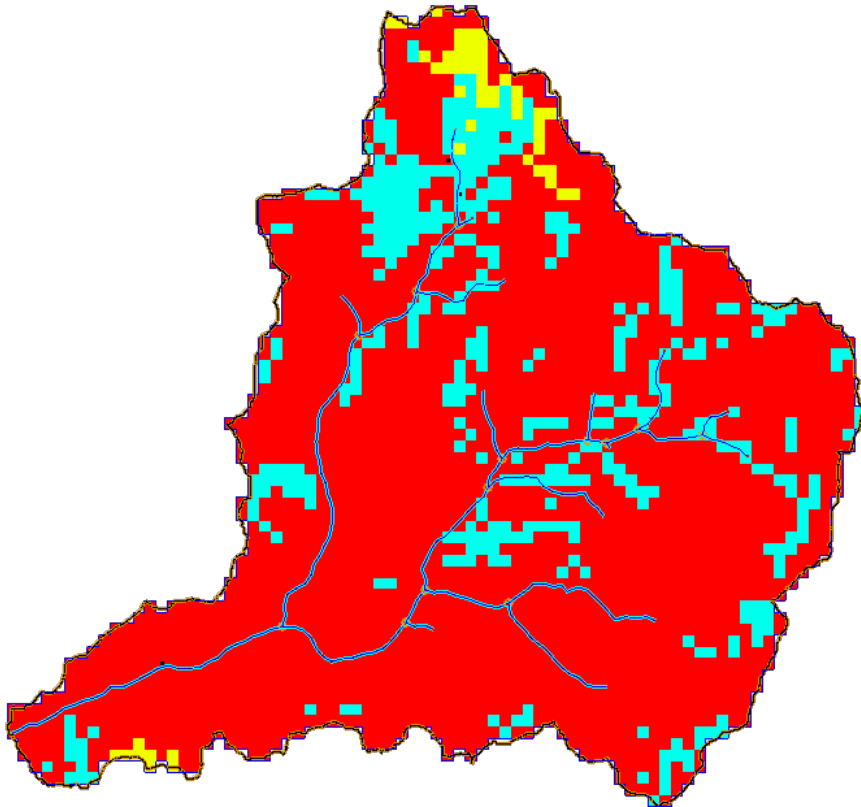
- Generate Index Maps
  - Soil or
  - Soil and Land Use Combination
- Define mapping table properties
- Establish initial conditions
- Turn on Green & Ampt simulation
- Save and run
- Visualize the results



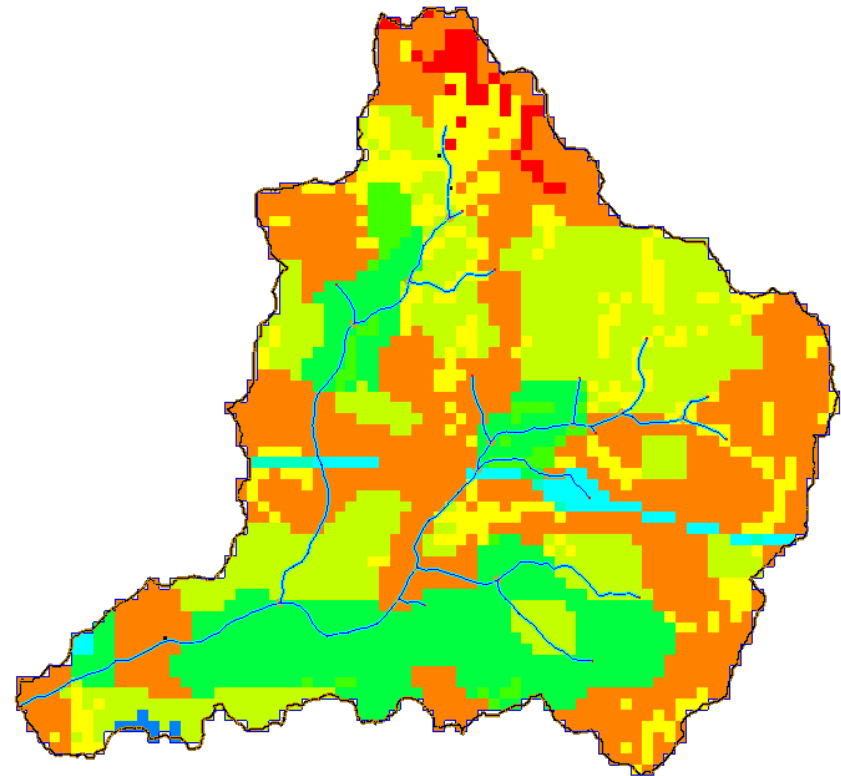


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# Generate Index Maps



Soils



Land Use





# Define Mapping Table Properties

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**GSSHA Map Table Editor**

Roughness Interception Retention Evapotranspiration **Infiltration** Initial Moisture Soil Erosion Contaminants Nutrients Continuous Maps

Using index map: NewCombined

Generate IDs Add ID Delete ID

Infiltration											
ID	1	2	3	4	5	6	7	8	9	10	11
Description1	coarse sand...	sand ...	fine sand ...	very fine sa...	loamy coars...	loamy sand ...	loamy fine s...	loamy very fi...	sandy loams...	coarse sand...	sandy loam ...
Description2	Cropland an...	Cropland an...	Cropland an...	Residential ...	Residential ...	Deciduous ...	Deciduous ...	Transportati...	Transportati...	Mixed Urba...	...
Hydraulic conductivity (cm/hr)	23.560000	23.560000	23.560000	2.000000	2.000000	23.560000	5.980000	0.500000	0.500000	0.500000	2.180000
Capillary head (cm)	4.950000	4.950000	4.950000	4.950000	6.130000	6.130000	6.130000	6.130000	11.010000	11.010000	11.010000
Porosity (m <sup>3</sup> /m <sup>3</sup> )	0.437000	0.437000	0.437000	0.100000	0.100000	0.437000	0.437000	0.100000	0.100000	0.100000	0.453000
Pore distribution index (cm/cm)	0.694000	0.694000	0.694000	0.694000	0.553000	0.553000	0.553000	0.553000	0.378000	0.378000	0.378000
Residual saturation (m <sup>3</sup> /m <sup>3</sup> )	0.020000	0.020000	0.020000	0.020000	0.035000	0.035000	0.035000	0.035000	0.041000	0.041000	0.041000
Field capacity (m <sup>3</sup> /m <sup>3</sup> )	0.091000	0.091000	0.091000	0.091000	0.125000	0.125000	0.125000	0.125000	0.207000	0.207000	0.207000

Help Import Table... Export Table... Job Control Done

# Table of Green and Ampt Values (Rawls et al, 1983)

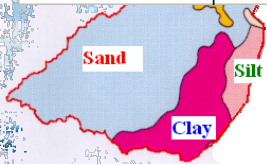
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## Loamy Sand

Water-Retention properties classified by soil texture

USDA Textural Classification	Total Porosity cm <sup>3</sup> /cm <sup>3</sup> ( $\theta_s$ )	Residual water content cm <sup>3</sup> /cm <sup>3</sup> ( $\theta_r$ )	Effective Porosity cm <sup>3</sup> /cm <sup>3</sup> ( $\theta_e$ )	Bubbling Pressure Geometric mean, cm (pb)	Pore size distribution Arithmetic Mean ( $\lambda$ )	Field Capacity (Water Retained at .33kPa) cm <sup>3</sup> /cm <sup>3</sup>	Wilting Point (Water Retained at - 1500 kPa) cm <sup>3</sup> /cm <sup>3</sup>	Hydraulic Conductivity, cmh <sup>-1</sup> ( $K_s$ )	$\psi_f$ (cm)
Sand	0.437	0.02	0.417	7.26	0.694	0.091	0.033	4.95	4.95
	(0.374 - 0.500)	(0.001 - 0.039)	(0.354 - 0.480)	(136 - 38.74)	(0.298 - 1.090)	(0.018 - 0.164)	(0.007 - 0.059)		
Loamy sand	0.437	0.035	0.401	8.69	0.553	0.125	0.055	6.13	6.13
	(0.368 - 0.506)	(0.003 - 0.067)	(0.329 - 0.473)	(1.80 - 41.85)	(0.234 - 0.872)	(0.060 - 0.190)	(0.019 - 0.091)		
Sandy loam	0.453	0.041	0.412	14.66	0.378	0.207	0.095	11.01	11.01
	(0.351 - 0.555)	- 0.024 - 0.106	(0.283 - 0.541)	(3.45 - 62.24)	(0.140 - 0.616)	(0.126 - 0.288)	(0.031 - 0.159)		
Loam	0.463	0.027	0.434	11.15	0.252	0.27	0.117	8.89	8.89
	(0.375 - 0.551)	- 0.020 - 0.074	(0.334 - 0.534)	(1.63 - 76.40)	(0.086 - 0.418)	(0.195 - 0.345)	(0.069 - 0.165)		
Silt loam	0.501	0.015	0.486	20.76	0.234	0.33	0.133	16.68	16.68
	(0.420 - 0.582)	- 0.028 - 0.056	(0.394 - 0.578)	(3.58 - 120.4)	(0.105 - 0.363)	(0.258 - 0.402)	(0.078 - 0.188)		
Sandy clay loam	0.398	0.068	0.33	28.08	0.319	0.255	0.148	21.85	21.85
	(0.332 - 0.464)	- 0.001 - 0.137	(0.235 - 0.425)	(5.57 - 141.5)	(0.079 - 0.559)	(0.186 - 0.324)	(0.085 - 0.211)		
Clay loam	0.464	0.075	0.39	25.89	0.242	0.318	0.197	20.88	20.88
	(0.409 - 0.519)	- 0.024 - 0.174	(0.279 - 0.501)	(5.80 - 115.7)	(0.070 - 0.414)	(0.250 - 0.386)	(0.115 - 0.279)		
Silty clay loam	0.471	0.04	0.432	32.56	0.177	0.366	0.208	27.30	27.30
	(0.418 - 0.524)	- 0.038 - 0.116	(0.347 - 0.517)	(6.68 - 158.7)	(0.039 - 0.315)	(0.304 - 0.428)	(0.138 - 0.278)		
Sandy clay	0.43	0.109	0.321	29.17	0.223	0.339	0.239	23.90	23.90
	(0.370 - 0.490)	(0.013 - 0.205)	(0.207 - 0.435)	(4.96 - 171.6)	(0.048 - 0.398)	(0.245 - 0.433)	(0.162 - 0.316)		
Silty clay	0.479	0.056	0.423	34.19	0.15	0.387	0.25	29.22	29.22
	(0.425 - 0.533)	- 0.024 - 0.136	(0.334 - 0.512)	(7.04 - 166.2)	(0.040 - 0.260)	(0.332 - 0.442)	(0.193 - 0.307)		
Clay	0.475	0.09	0.385	37.3	0.165	0.396	0.272	31.63	31.63
	(0.427 - 0.523)	- 0.015 - 0.195	(0.269 - 0.501)	(7.43 - 187.2)	(0.037 - 0.293)	(0.326 - 0.466)	(0.208 - 0.336)		

First Line is the mean value, second line is  $\pm$  one standard deviation about the mean







# Establish Initial Conditions

**GSSHA Map Table Editor**

Soil Erosion    Contaminants    Nutrients    Continuous Maps  
Roughness    Interception    Retention    Evapotranspiration    Infiltration    **Initial Moisture**

Using index map: Soil

Initial Moisture			
ID	1	2	3
Description1	Soil moisture...	Soil moisture...	Soil moisture...
Description2		...	...
Initial moisture	0.150000	0.150000	0.150000



# Turn on Green & Ampt Simulation

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**GSSHA Job Control Parameters**

**Computation parameters**

Total time (min): 2000

Time step (sec): 10

**Overland flow**

Computation method: Explicit

☐ Interception

☐ Initial depth

☐ Retention depth

☐ Area reduction depth

**Initialize GSSHA** **Delete GSSHA Data**

**Outlet information**

Column: 1

Row: 64

Slope: 0.00100

**Evapotranspiration**

☒ No evaporation

☐ Deardorff method

☐ Penman method

☐ Seasonal resist.

**Infiltration**

☐ No infiltration

☐ Green + Ampt

☒ Green + Ampt with soil moisture redistribution

**Channel routing computation scheme**

☐ No routing

☒ Diffusive wave

☐ MESH

**Groundwater** **Soil erosion** **Long term simulation** **Contaminant transport** **Nutrients** **Storm/tile drain** **Stochastic** **Link CE-QUAL-W2 ...** **Manage files**

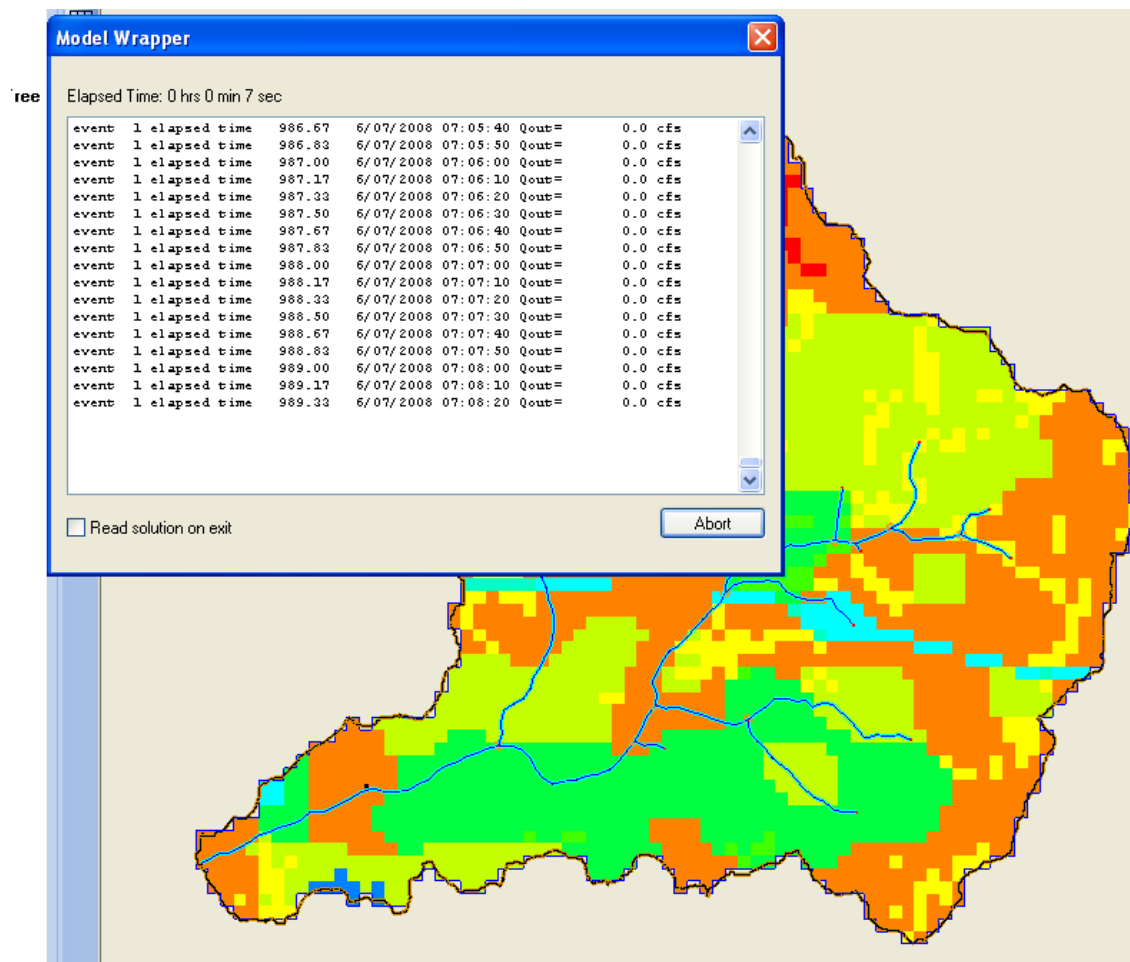
**Help** **Output Control...** **OK** **Cancel**





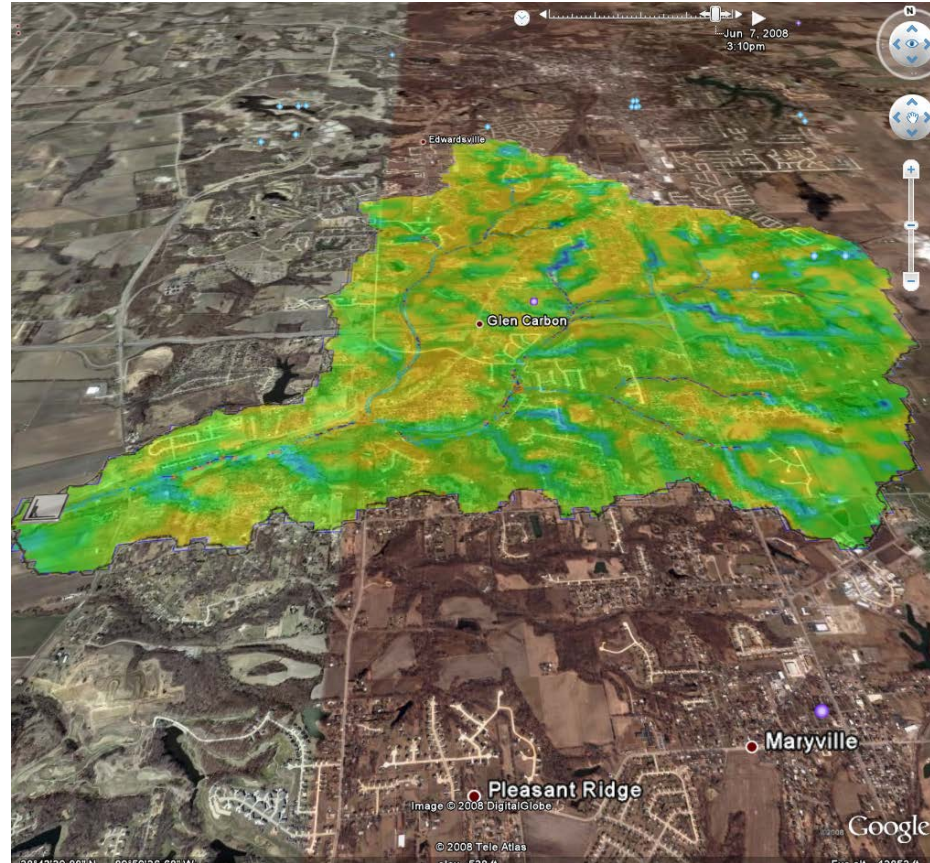
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# Save and Run





# Visualize the Infiltration Results





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# Demonstration





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# Workshop

