APPENDIX 2: FLOOD WAVE ASSUMPTION

The interaction between the overland flow and the Green-Ampt (G-A) model is based on the assumption that the flood wave from the field will supply enough water to sustain maximum infiltration as dictated by the G-A model. A check for flooding at the surface is made to determine when the field inflow covers the surface of the buffer to switch infiltration to the maximum rate. By default, the hydrology model checks the first and last nodes of the buffer while running G-A following the regular procedure at the beginning of the simulation. When runoff is detected (h>0) at the first (x=0) and last node (x=L), the infiltration is changed to the maximum infiltration capacity for the last rainfall period when the flood was detected. This assumption could cause problems for the case of soils with high infiltration capacity, where a significant amount of water could be infiltrated before the flood wave reaches the last node of the system. An analysis of sensitivity was performed on 3 soils. The first soil is the Cecil Sandy Loam from our experimental field, the second is a Portsmouth Loamy-Sand and the last one is a hypothetical sand with an extreme infiltration rate (Table 1).

Table 1: Soil parameters used in study

[1]Layer (cm)	Texture	K_{sv} (cm/h)	K_{sh} (cm/h)	θ_s (cm^3/cm^3)	θ_r (cm^3/cm^3)	S_{av} (cm)	θ_i (cm^3/cm^3)
			Cecil Sandy Loam				
[2]Ap 0-23	SL	**6.02**	7.85	0.311	0.090	35.7	0.20
			Portsmouth Fine Sandy Loam				
[2]Ap 0-30	SL	**7.48**	14.97	0.365	0.12	2.0	0.20
			Hypothetical Sandy				
[2]Ap 0-30	SL	**41.18**	82.40	0.365	0.12	2.0	0.20

[1]Nomenclature: K_{sv} = Vertical saturated Conductivity; K_{sh} = Horizontal saturated Conductivity; θ_s,θ_r = Sat. and residual water contents; S_{av} = Average suction at the wetting front; S,C,L = Sand, Clay, Loam; θ_i= initial water content

[2]The Ap layer was the only one considered active for infiltration calculations

The rainfall distribution inflow boundary and other field parameters were taken from the event on 06/30/91. The procedure followed consists on moving the downslope node were the check for flooding is made (*nchk*), starting from the upper edge (*nchk*=1) to the last node of the FE mesh (*nchk*=*N*). Results are summarized on table 2.

Table 2. Analysis of sensitivity for the flooding hypothesis

Node	X (m)	Vol_out (m3)	Vol_inf (m3)	td (s)	tp (s)	Qp (m3/s)	tend (s)
			CECIL SANDY LOAM (L=4.39 m)				
1	0.00	1.088	0.658	1186	1653	2.064e-03	2263
3	0.31	1.088	0.658	1186	1653	2.064e-03	2263
6	0.78	1.088	0.658	862	1653	2.064e-03	2227
9	1.26	1.088	0.658	862	1653	2.064e-03	2227
12	1.73	1.088	0.658	862	1653	2.064e-03	2227
15	2.20	1.087	0.658	862	1653	2.064e-03	2227
17	2.51	1.087	0.658	862	1653	2.064e-03	2227
20	2.98	1.087	0.658	862	1653	2.064e-03	2227
23	3.45	1.088	0.658	862	1653	2.064e-03	2227
26	3.92	1.087	0.658	862	1653	2.064e-03	2227
29	4.39	1.087	0.659	862	1653	2.064e-03	2227
			PORTSMOUTH FINE SANDY LOAM (L=8.66 m)				
1	0.00	0.919	1.248	1295	1690	1.948e-03	2230
6	0.77	0.919	1.248	863	1690	1.948e-03	2194
11	1.55	0.919	1.248	863	1690	1.948e-03	2194
17	2.47	0.922	1.246	863	1690	1.947e-03	2194
23	3.40	0.921	1.246	863	1690	1.947e-03	2194
29	4.33	0.921	1.247	863	1690	1.947e-03	2194
34	5.10	0.916	1.251	863	1690	1.948e-03	2194
40	6.03	0.920	1.248	863	1690	1.947e-03	2194
46	6.95	0.923	1.245	863	1690	1.947e-03	2194
51	7.73	0.921	1.247	863	1690	1.947e-03	2194
57	8.66	0.920	1.248	863	1690	1.948e-03	2194
			HYPOTHETICAL SANDY (L=8.66 m)				
1	0.00	0.000e+00	2.167	0	0	0.000e+00	0
6	0.77	5.118e-45	2.167	863	863	1.423e-46	899
11	1.55	1.747e-44	2.167	863	935	3.436e-46	935
17	2.47	1.747e-44	2.167	863	935	3.436e-46	935
23	3.40	9.743e-37	2.167	863	1079	2.709e-38	1079
29	4.33	4.772e-31	2.167	863	1115	1.327e-32	1115
34	5.10	4.772e-31	2.167	863	1115	1.327e-32	1115
40	6.03	6.527e-26	2.167	863	1151	1.815e-27	1151
46	6.95	4.567e-20	2.167	863	1187	1.270e-21	1187
51	7.73	4.567e-20	2.167	863	1187	1.270e-21	1187
57	8.66	4.567e-20	2.167	863	1187	1.270e-21	1187

This analysis shows that the assumption has little bearing on the model results for the first two soils but significantly affects the predictions for a very sandy soil.

In view of these results, an additional model input, *schk*, is added to the 'soil.in' file in the computer model. this new parameter is the relative distance from the upper filter edge where the check for flooding will be made (i.e. *schk*=1.0, end of the filter;*schk*=0.5 mid filter point; *schk*=0.0, beginning of the filter). A default value of 1 is suggested but some experimentation is suggesting when using soils with very high conductivity values.