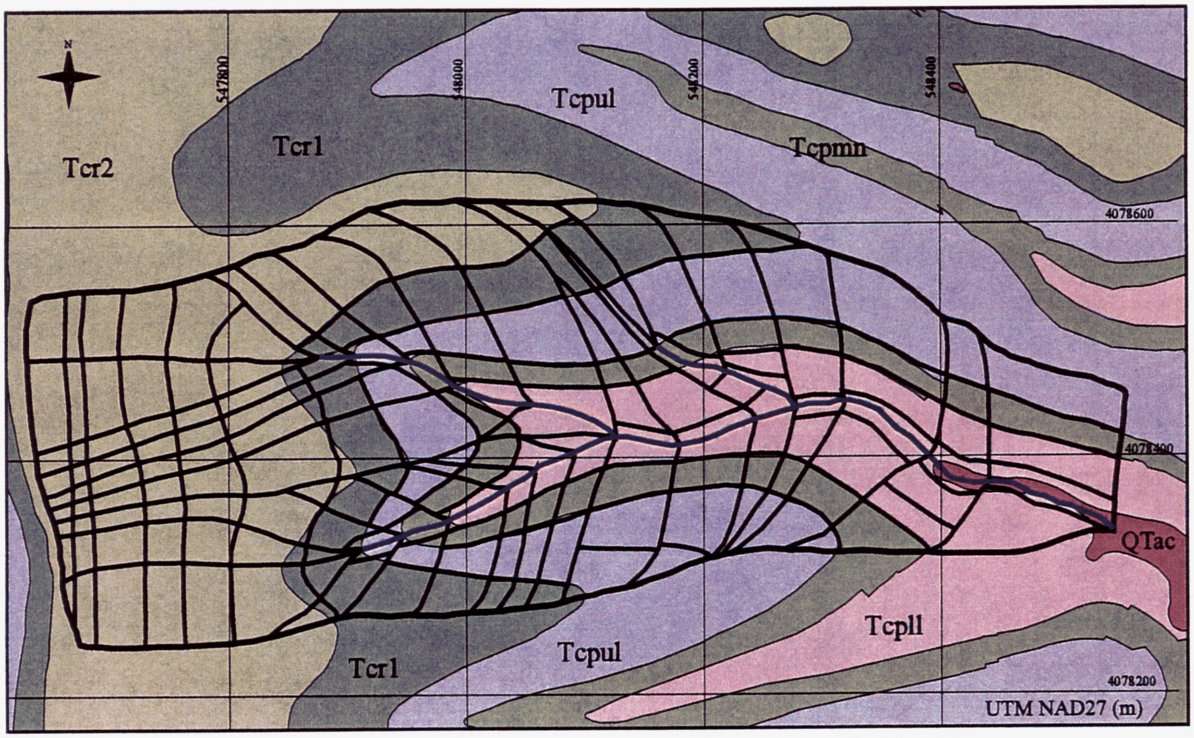
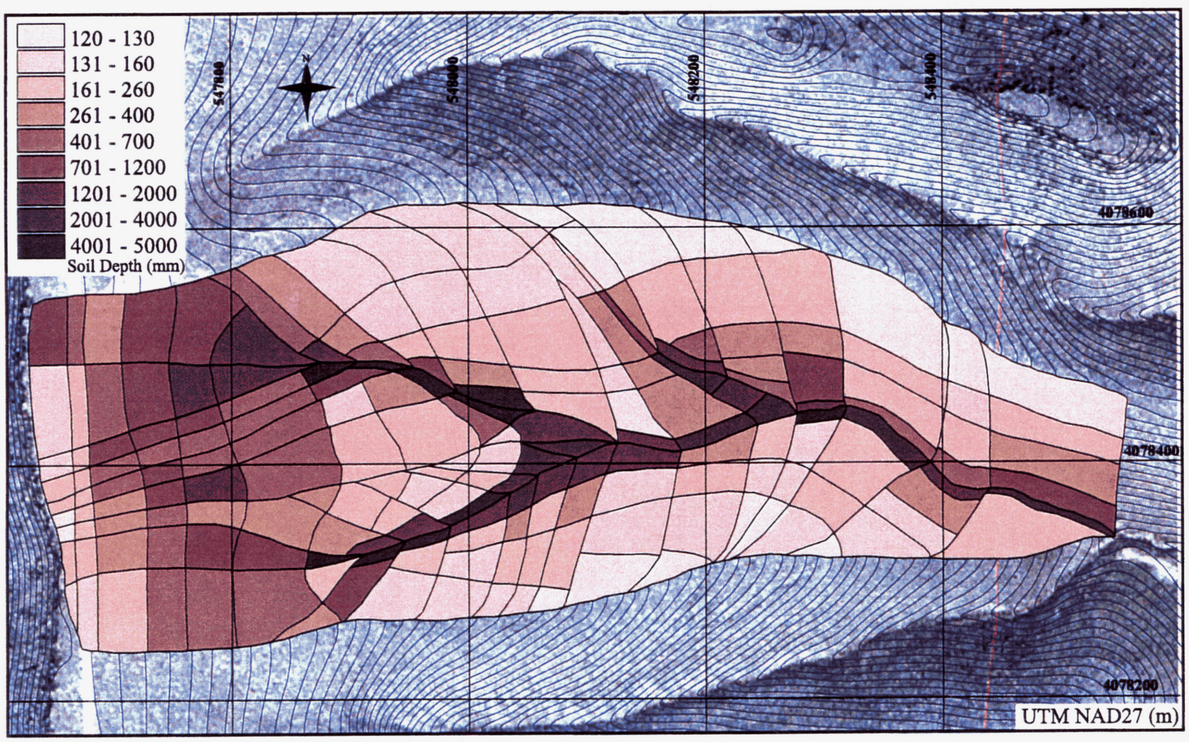


Figure 3-4. Geology of Upper Split Wash with detailed grid



Figured 3-5. Soil thickness for each plane element in detailed grid

Table 3-1. Characteristics of plane and channel elements for the Upper Split Wash watershed

	S-Model	D-Model (& later versions F, L)
Plane Elements		
Mean Area (m^2)	2,429	1,310
Mean Length (m)	53.8	41.9
Mean Slope	0.339	0.333
Maximum Slope	0.688	0.612
Minimum Slope	0.047	0.027
Channel Elements		
Mean length (m)	53.9	54.7
Mean slope	0.22	0.239
Maximum slope	0.572	0.503
Minimum slope	0.102	0.100

3.2.1 Parameters and Initial Conditions—Plane Elements

The parameters required for plane elements include soil depth, K_s for both soil and bedrock, net capillary drive, coefficient of variation of K_s, porosity, rock fraction, microtopographic spacing and relief, initial water content, and Manning's n. This section discusses the bases for the values of these parameters for use in the watershed model.

Soil depths for each plane element were estimated visually from a contour map of soil depths derived from values used in Mohanty et al. (2000). The CDFs calculated for the alternative models are shown in figure 3-7. There is very little difference between the two functions for the S-model and the D-model, so there is likely little difference between the watershed areas saturated after major low-intensity storms. There is also very good agreement between the CDFs for visually determined soil depths and the CDF obtained from the mass balance approach in Mohanty et al. (2000).

The K_s of surface soil and bedrock are critical parameters in partitioning rainfall between Hortonian overland flow, infiltration into the soil, and percolation into bedrock. Woolhiser et al. (1998) discuss procedures for estimating K_s for surface soils. For the Solitario Canyon watershed, west of YM, they used K_s values determined by an analysis of rainfall simulator data from plots near Mercury, Nevada, on the Nevada Test Site (NTS). Procedures for the rainfall simulator studies are described by Simanton et al. (1986) and a summary of the data collected was published by Lane (1986; Appendix C). Detailed rainfall and run-off data for the plots were obtained from Roger Simanton of the ARS-USDA. In our study, K_s values for natural surfaces were the same as those used by Woolhiser et al. (1998), specifically 22.25 mm/hr for the period December through June and 11.25 mm/hr for July through November. This strong seasonal variation, with

(a)

(b)

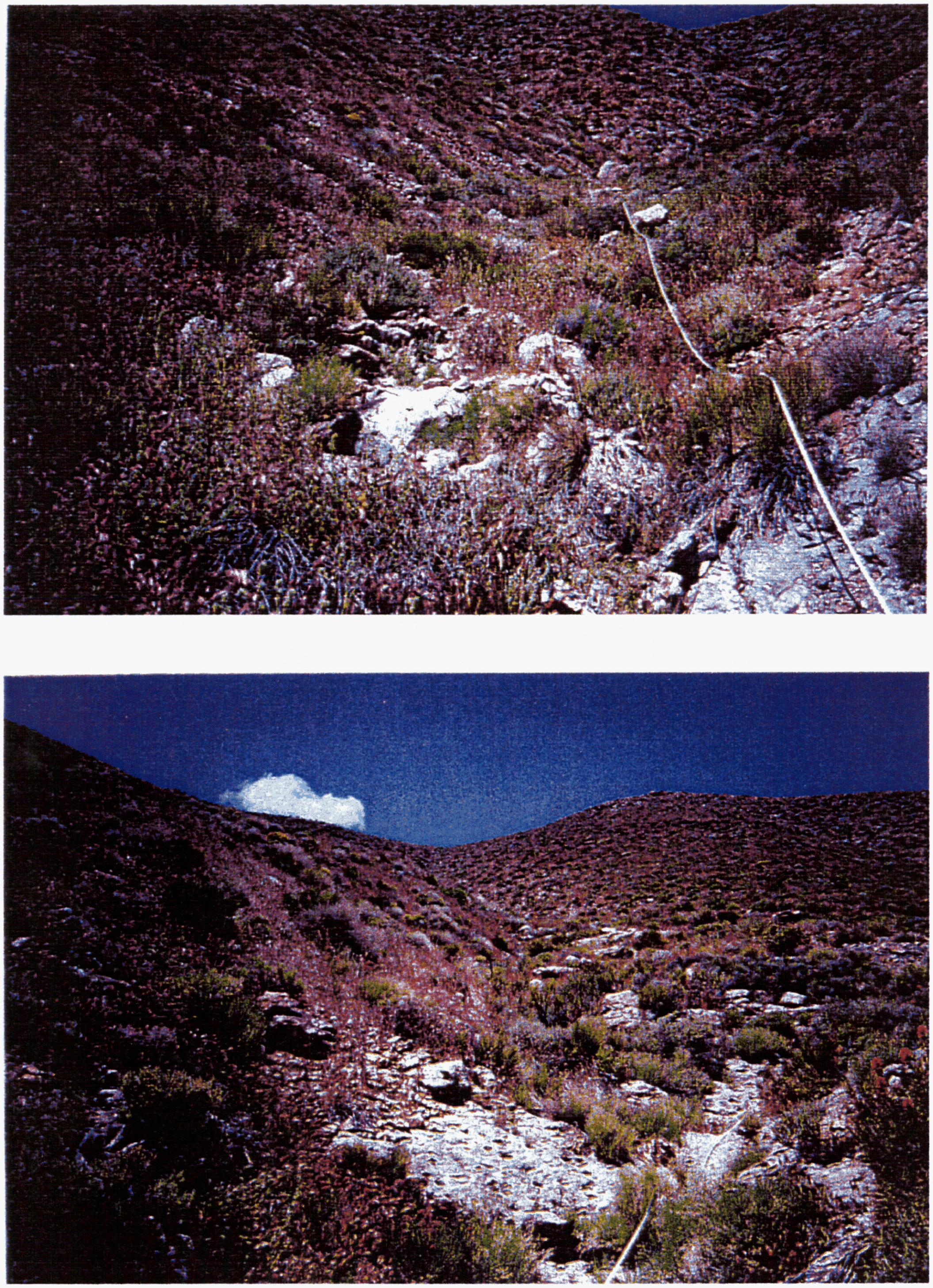


Figure 3-6. Photograph of upstream view of (a) channel reach 72 and (b) channel reach 137 from channel 46 of the detailed model

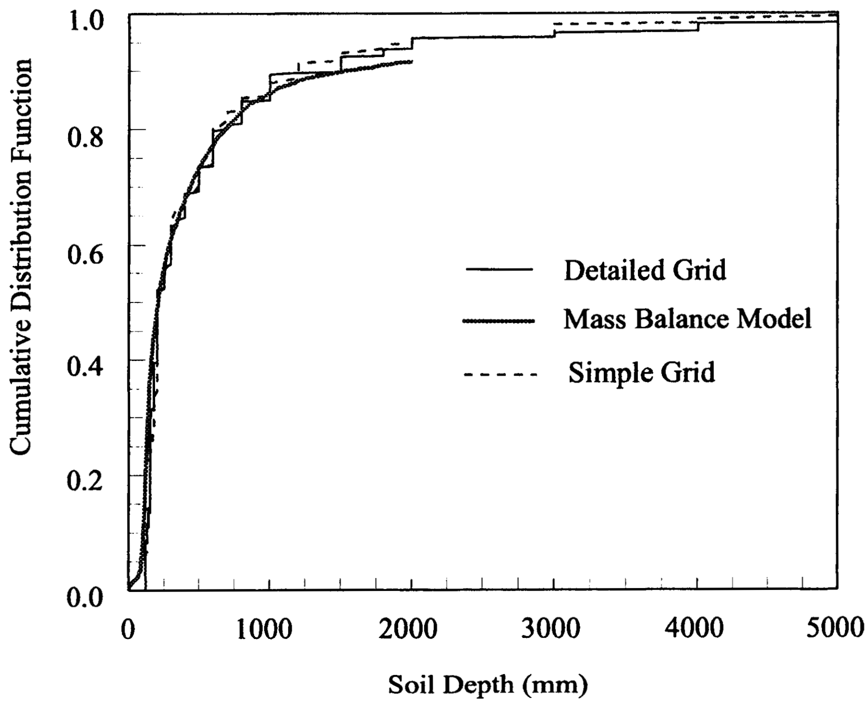


Figure 3-7. Cumulative distribution functions of soil depth

lower K_s values in the fall, was apparent in the data and has been noted by Simanton and Renard (1986) at the Walnut Gulch Experimental Watershed in Arizona. The specific seasonal variations used here were based on the hypothesis that the variations were caused by winter freeze-thaw processes and the subsequent compaction by summer rains.

The detailed representation of Upper Split Wash has a resolution that requires K_s values for areas disturbed by roads and other activities. In these areas, near the YM crest, the vegetation has been removed and the soil has been compacted by traffic. The rainfall simulator studies (Simanton et al., 1986) included experiments on bare plots, where the vegetation and surface rock had been removed. This treatment resulted in substantial reductions of K_s as compared with undisturbed surfaces and was adopted as a reasonable analog for road surfaces. The rainfall/run-off data for Mercury, Nevada, plots 9 and 12 were analyzed using KINEROS2 and manually adjusting K_s and the net capillary drive term, G, until a satisfactory fit was obtained between observed and computed run-off for the dry, wet, and very wet runs for the spring and fall seasons (an example is shown in figure 3-8). Although seasonal differences were noted for these plots, as they were for the plots analyzed by Woolhiser et al. (1998), a constant value of 1.9 mm/hr was chosen and was first assigned to the 1.8 percent of the watershed identified as roads (planes 3,4,16,27,40,55,74,81, and 88) of the D-Model. This quantity is consistent with K_s values obtained for the fall simulations and is smaller than values obtained for the spring. It will result in increased run-off from the road areas and increased of infiltration at downstream elements. Field observations and an aerial photograph (figure 3-1 or 3-2) of the watershed shows

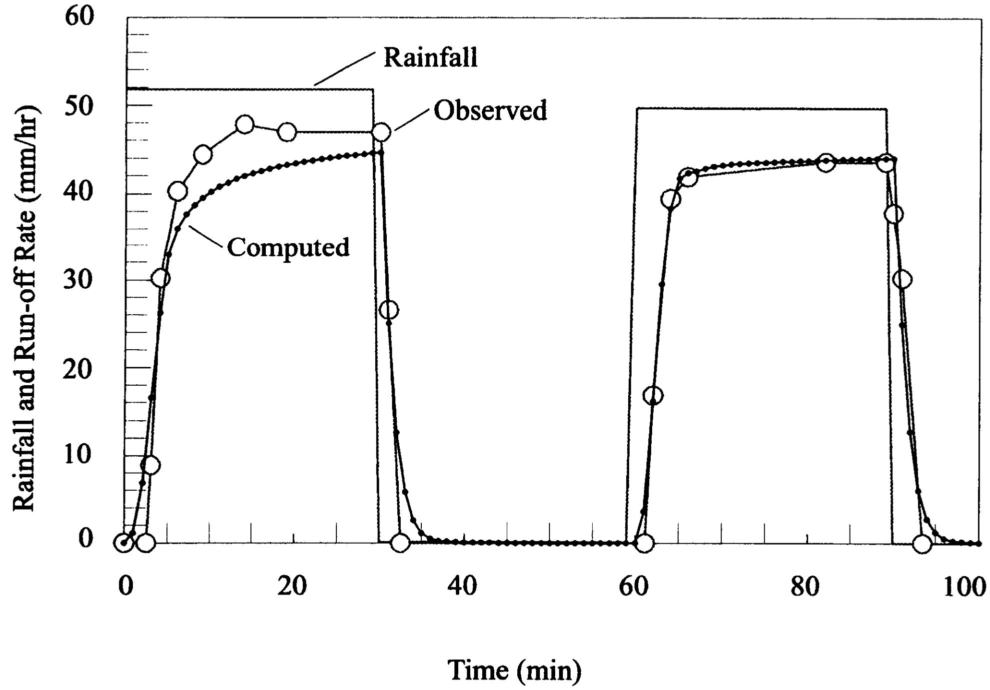


Figure 3-8. Observed and simulated run-off hydrographs, Mercury, Nevada bare plot

that there is a substantial disturbed area in the northwestern part of the watershed in addition to the road. Accordingly, new parameter files were created (referred to as the E-Model) wherein K_s was set to 1.9 mm/hr for planes 5, 6, 7, 8, 17, 18, 28, and 41 in addition to those in the D-Model (a total of 5.9 percent of the watershed area). This provided an opportunity to examine the model's sensitivity to additional disturbance by man's activities.

Values of K_s for the bedrock were based on estimates presented by Flint et al. (1996) and are shown in table 3-2. The plane elements in the D-model were chosen to conform with the bedrock lithostratigraphic units in addition to changes in soil depth and slope and hillslope convergence or divergence, so the K_s values shown in table 3-2 were readily assigned. For the S-model, the K_s values associated with the predominant lithologic formation was assigned to each plane. The K_s values for bedrock in channels were assigned in the same manner.

The value of G for undisturbed areas was set at 50 mm, the same value used by Woolhiser et al. (1998). For the roads in the D-Model (and the additional disturbed areas in the E-Model), it was set at 80 mm based on the rainfall simulator data for the bare plots at Mercury, Nevada. The values of G for the bedrock was set to 60 mm based on Woolhiser et al. (1998). Because both K_s and G were estimated from rainfall simulator data, the rock fraction was set to zero for all plane elements (Woolhiser et al., 1990).