RF **12/27/02**

SOIL DEPTH ANALYSIS

Preparation of soil depth model for Advances in Water Resources journal article, Pinder Volume, with Stuart Stothoff as the lead author. Soil is the most important net infiltration parameter after precipitation for estimating net infiltration. Areas with thin soils are particularly important zones for high net infiltration. Thick unconsolidated sediment cover (>5m) likely leads to negligible net infiltration because vegetation would be particularly successful in grabbing all water for most storm events (infiltration depths are mostly less than the rooting depths of plants, particularly creosote). USGS used an empirical model with equations for different categories of soil depths. We plan to compare Stu's model results to the USGS results and to our field measurements (see SciNtbk255). Stothoff is developing the model and parameter estimates, with periodic consultation with me and Woolhiser. I will also be looking into the topographic basemap for Stu to use. In particular, producing finer resolution digital elevation maps for Stu to check on soil model sensitivity to topographic grid resolution. We've observed that the 30m DEM from the USGS, and the contour maps (10-ft contours), both miss features of the site; e.g., compared against qualitative field observations in the upper Split Wash. Plus Stu has always had to manually fix depression artifacts that lead to routing difficulties.

Computer work done on bubo (WinNT box in my office) and on Spock (Sun, UNIX machine).

Elevation map comparison between the one we use in TPA 4.2/5.0 and the USGS merged map.
USGS elevations taken from:
bubo: D:\AMR-PMR_Rev00\Infil-Inputs-USGS\GS000308311221.006-mergedDEM\30m-elev.asc
USGS soil depths taken from all the spreadsheets (divided by watershed) in:
bubo: D:\AMR-PMR_Rev00\Infil-Inputs-USGS\GS000308311221.004-GeoSpatial\INFILTRATION*

Note that the coordinate system used by USGS and that used by Stothoff differ; i.e, the SW corner of USGS grid differs from SW corner of TPA, and they do not differ by a multiple of 30 m (thus, the pixels are offset between the two grids).
What are the offsets? (i.e., Offset by XX meter east-west and YY meters north-south.). In the comparison, we'll have to chose what to do:
1. We'll have to re-grid the results in order to compare with the USGS soil depths.
2. We'll have to use the USGS grid.

RF 1/14/03

Refining the Grid

The 30-m pixel dem is not resolved enough for Stothoff's soil depth modeling. We have the 10 ft contour map used in the Day et al., 1998 geologic map of Yucca Mountain (the central block map, Misc. Invest. Series I-2601). An option would be to obtain the vertices of the contours and then re-grid the data to whatever resolution we want. This of course will be somewhat artificial (e.g., problems at ridgetops and channels) but shouldn't lead to significant errors.

The obvious approach would be to obtain the digital data (DEM) from whence the contours were created. This was extensively explored through the Las Vegas Onsite Office to no avail. YMP staff couldn't find the photos in their archival warehouse. Similarly, the DEM files could not be found. Hence, on with getting the vertices of the contours from the 10-ft topo map.

Steps:

On SGI (Io), /data2/rfedors/arcview/DEMfromUSGScontours/*
On bubo, D:\Randy\Stothoff\SoilModel-Dec2002\code*

1. Convert shape file to .arcinfo file using ERDAS Imagine 8.5 using topo10.shp, .shx, .dbf shape files.

2. Then, also using ERDAS, rasterize the contours. Vector → Vector to Raster
   input file = topo10.arcinfo
   output file = topo2.img
   set input coverage = line
   subset definition = 547399.75, 549600.25, 4077399.75, 4078800.25 (UTM NAD27 meters)
   unsigned 32-bit, continuous, no data compression, no pyramiding
   pixel size = 0.5 m
   item pixel value = ELEV (what value to use for each pixel)
   this creates a raster image that is 4402 by 2802 rows and columns.

An alternative approach in ERDAS was to use Image Interpreter → Utilities →Vector to Raster, however, this was extremely slow.

3. Write pixel values to ascii file in ERDAS: Utilities → Convert Pixel to ASCII
   This creates a 3-column file of easting, northing, elevation with lots of the locations being 0 (between contours); file is called topo2.asc.

4. Filter out the zero locations using fortran code asc.for (Lahey-Fujitsu Fortran 95), see code below. Produces topo2.ascii

5. Use ENVI 3.5 to interpolate the irregular grid of points to create the image topo1.tif, .tfw.
   Rasterize Point Data using gridding options: 1-m pixel output, linear gridding, data type=double precision, and exporting as a geotif format leading to the file called topo1.tif, .tw that has 2201 by 1401 resolution. Need to use main menu to save geotif; the viewer save as image did not work properly.

6. Use ERDAS to convert topo1.tif,tfw (geotif file) to topo1.img file, then Utilities→Convert to ASCII
   Called this file topo1.asc

7. Reformat topo1.asc to TPA format (row major starting at NW corner, just a single column of elevations)
   Use the fortran script (Lahey Fortran 95) called stothoff.exe to create topo-sw.dat and add headers. This file is 1-m pixel resolution, with 2201 columns and 1401 rows with the SW corner being 547400m, 4077400 m.

asc.for script:
This script is in .\SoilModel_Dec2002\code\. ; script also in UNIX\rfedors\Topo-USGS2002\

```
C    Last change:  RWF  14 Jan 2003    1:32 pm
      program asc
c23456789 123456789 123456789 123456789 123456789 123456789 123456789 12
c filters out null points in gridded ascii file of contour shape file
      integer  mx, i
      parameter  (mx=12334404)
      real*8 elev, x, y
      character*60 junk

      open(unit=7,file='topo2.asc')
      open(unit=8,file='topo2.ascii')
c      read(7,*) junk
      read(7,*) junk
      read(7,*) junk
      read(7,*) junk

      do i = 1,mx
       read(7,*) x, y, elev
       if(elev.gt.3950) write(8,*) x, y, elev
      end do

      stop
      end
```

RF 3/12/03

The stothoff.for script:

```
C    Last change:  RWF  12 Mar 2003   5:40 pm
     program stothoff
c Reformats ERDAS pixel to ascii format from x,y,elev to
c  row major from from NW corner, single column listing of elevations;
c Note that the SW corner is used in TPA for UTM coordinates in TPA.
c23456789 123456789 123456789 123456789 123456789 123456789 123456789 12
     integer  mx, i
     parameter  (mx=3083601)
     real*8  elev, x, y
     character*60  junk

c ncols=2201, nrows=1401

     open(unit=7,file='db4.asc')
     open(unit=8,file='db4.dat',form='formatted')
c      read(7,*) junk
c      print*, junk
     read(7,*) junk
c      print*, junk
     read(7,*) junk
c      print*, junk
     read(7,*) junk
c      print*, junk
     read(7,*) x, y, elev
c      print*, x,y,elev
     write(8,*)  x
     write(8,*)  y
c convert elevation to meters for split wash, not for wren wash
c     write(8,'(f10.4)') elev * 0.3048
     write(8,'(f10.4)') elev
     do i = 2,mx
       read(7,*)   x, y, elev
c        write(8,'(f10.4)')   elev * 0.3048
     write(8,'(f10.4)')   elev
     end do

     stop
     end
```

RF 3/19/03

<u>Reducing Resolution of base photo for figure 1 of soil depth report</u>.

E:\AVData\Doq\bbnw5m*
and original source file .\bustedbnwp54424073.mos.img from DOE

Note that I could not convert the .\AVData\Doq\airfoto_nw27.bil file (and associated header files) that Ron Martin had created. It appears that only ArcView can read it properly. ERDAS and ENVI both could not load data or could not load the coordinate/projection info.

bbnw5m.* files were created using ERDAS Imagine 8.5 on the Io computer (SGI).

Reprojected bustedbnwp54424073.mos.img and aggregated to 5 m pixel; then exported resulting *.img file to geotiff and SUN raster formats.

bustedbnwp54424073.mos.img was obtained by Ron Martin from the Yucca Mountain Characterization Project; cdrom is dated Dec 04, 1994 and labeled Busted Butte Image Files.

All four quads are contained on the cdrom, I only did the northwest quad.

Split Wash Coordinates for Stothoff

Stothoff's coordinates for his box surrounding a portion of Split Wash are;

[547485 548600] and [4078070 4078660] UTM NAD27 meters (as usual)

In addition, I sent him the vertices from the portion of Split Wash he is modeling that I digitized in ArcView. I just edited the shape file and then used the getvertices extension to get a table of the x,y locations of all the vertices. I used the air photo and the 10-ft contours to help delineate the watershed.

E:\AVData\Soils\SplitWashOutline\sw-soil2.*

I sent the file called sw-table.txt (the split wash watershed outline) to Stothoff for him to overlay on his simulated soil depth maps. This is a comma-delimited file with points for the outline of our Split Wash watershed model for KINEROS2 in UTM NAD27 projection (meters).

Extracting USGS Soil Depth Data to Compare with Stothoff Estimate

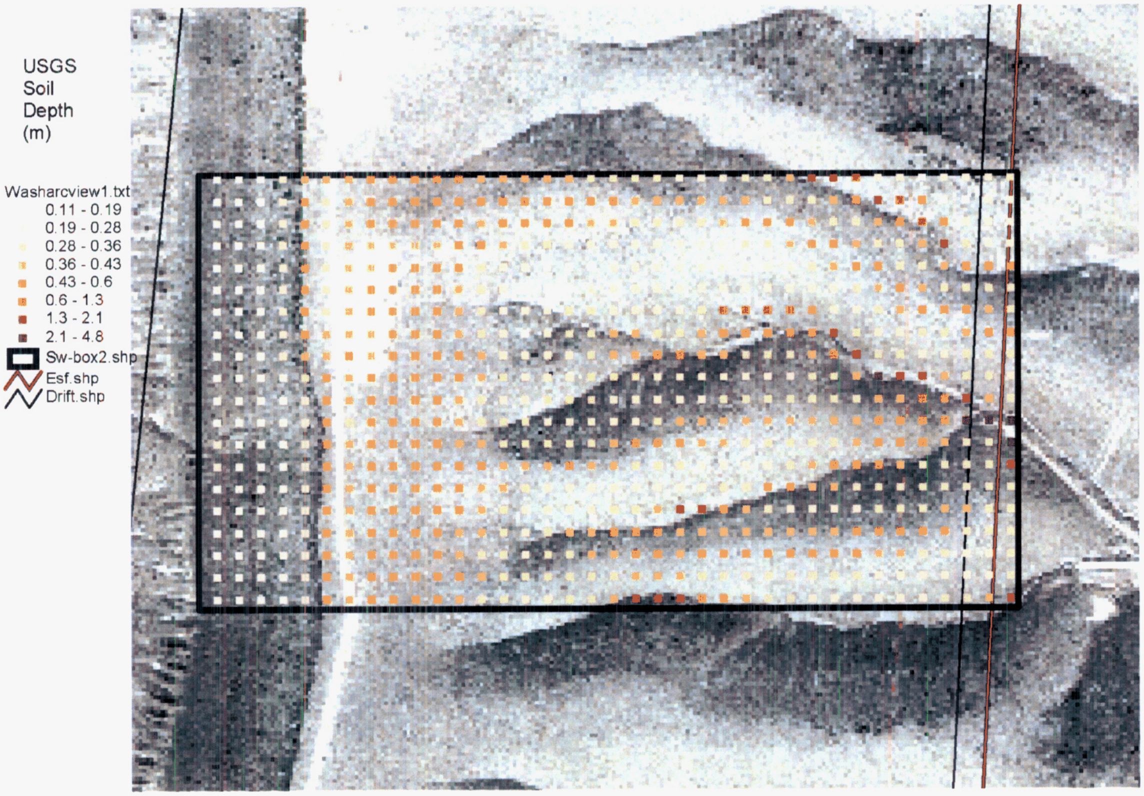
Using the usgs.for code to extract soil depths from the data in the USGS spreadsheets.

Inputs (spreadsheets) for soil from:
bubo: D:\AMR-PMR_Rev_00\Infil-Inputs-USGS\GS000308311221.004-Geospatial\INFILTRATION\
Work is in:
D:\Randy\Stothoff\SoilModel-Dec2002\USGS-Soil\code\usgs.for and sw_soil.dat

Sent Stothoff sw_soil.dat and splitwash.jpg (exported from ArcView 3.2). splitwash.jpg is an ArcView plot of USGS data for split wash area sw_soil.dem soil depth data in Stothoff dem format. The sw_soil.dat file came from washarcview.txt imported into Excel, sorted to remove duplicates and then sorted to row-major ordering from NW corner.

Saved usgs geospatial data from spreadsheets as a comma-delimited files with the same basename as the original files. Before doing so, I deleted 36 blocking angle columns, packed all spreadsheets (from different watersheds) together in 1 worksheet that was then sorted to be row-based starting from NW corner. The comma-delimited files were read in by usgs.for, which was created from June 24, 2000 extract.f script.

The image splitwash.jpg is included below (color image needed to decipher).



The usgs.for script (problem with search implementation for footprint, commented out since not needed):

```
=========================================
C     Last change:  RWF   5 Feb 2003    12:03 pm
      program usgs
c Reads in USGS geospatial data used in net infiltration model.
c Includes script for determining if a point lies within the watershed,
c   or any other odd-shaped outline; developed from extract.f (June 14, 2000).
c RFedors  Dec 11, 2002, Feb 4, 2003
c  laptop Lahey Fortran 95 / bubo (NTbox) Lahey Fortran 95
c23456789 123456789 123456789 123456789 123456789 123456789 123456789 12
      integer  mx, mxx, i, j, k, ii, jj, mcols, icols, ntotal,mrow,mcol
      integer  ioread, iowrit, iowrit2
      integer  ndrift, i_max, i_min, ict, lf_rt, nrow, ncol, irow, icol
      integer  ndrill, ndune, njet1, njet2, njet3, nplug
      integer  nsol1, nsol2, nsol3, nyucca
      parameter (mx=1000, mxx=300000, mcols=25)
      real*8  ymax, ytop, xbot, xpos, ypos, sum1, sum2, trow, tcol
      real*8  avg, stdev, avg_t, stdev_t, xsegment, ax, ay
      real*8  drift(mx,2), segments(mx,2)
      real*8  array(mxx,mcols), soil(mx,mx), east(mx,mx), north(mx,mx)
      real*8  washsoil(mxx), wash(mxx,4)
      real*8  wash_east(mx), wash_north(mx), wash_soil(mx,mx)
      character*9  flagside(mx), junk
      character*25  columns(mcols), header
```

```
c set input and output unit numbers
     ioread = 7
     iowrit = 8
     iowrit2 = 9

c read in drift coords file, 1st line comment line, 2nd line # of points
c account for repeated entry of first point as last entry.
c     open(unit = ioread, file = 'drift1.txt', form = 'formatted')
     open(unit = ioread, file = 'swbox.txt', form = 'formatted')
     read(ioread,'(a60)') header
     read(ioread,'(i5)') ndrift
     do i = 1, ndrift
       read(ioread,'(2f10.2)') drift(i,1), drift(i,2)
     enddo
     close(ioread)

c  set up usage of drift coordinates; checking to right or left of segment;
c  find min and max y-coord, then assign left/right to line segments
     ymax = 0.d0
     ymin = 4.d10
     do i = 1, ndrift-1
       if(drift(i,2).ge.ymax) then
         ymax = drift(i,2)
         i_max = i
       endif
       if(drift(i,2).le.ymin) then
         ymin = drift(i,2)
         i_min = i
       endif
     enddo

     if(i_max.lt.i_min) then
        do i = 1, ndrift-1
          flagside(i) = 'left'
        enddo
        do i = i_max, i_min-1
          flagside(i) = 'right'
        enddo
      else
        do i = 1, ndrift-1
          flagside(i) = 'right'
        enddo
        do i = i_min, i_max-1
          flagside(i) = 'left'
        enddo
     endif

c calculate line segment equations going counter-clockwise;
c segment(i,1)=slope; segment(i,2)=intercept; for horizontal lines,
c set flagside to avoid checking either side of the segment and
c then set denominator to any number just to avoid blowout;
c for vertical lines (xbot=0), set numerator of slope to a small number.

     do i = 1, ndrift-1
      ytop = drift(i+1,2) - drift(i,2)
      xbot = drift(i+1,1) - drift(i,1)
```

```
      if(dabs(ytop).lt.1.d-9) then
        flagside(i)='neither'
        segments(i,1) = 1.d0
        segments(i,2) = 1.d0
       elseif(dabs(xbot).lt.1.d-10) then
        segments(i,1) = 1.d0
        segments(i,2) = 0.d0
       else
        segments(i,1) = ytop / xbot
        segments(i,2) = drift(i,2) - (segments(i,1)*drift(i,1))
      endif
    enddo
    do i = 1, ndrift-1
      print*, segments(i,1), segments(i,2)
    enddo

c Read in usgs file that has 17 columns.
c ordering of data is row-major starting from the northwest corner.
c Since I'm doing this on the NTbox, I cannot use system calls to get
c the number of records in each file.
    icols = 17
    ndrill= 45859
    ndune = 20671
    njet1 = 5418
    njet2 = 1027
    njet3 = 606
    nplug = 7921
    nsol1 = 14095
    nsol2 = 494
    nsol3 = 1223
    nyucca= 46716
    ntotal = ndrill + ndune + njet1 + njet2 + njet3 + nplug
   &          + nsol1 + nsol2 + nsol3 + nyucca

    open(unit = ioread, file = 'drillhole.csv', form = 'formatted')
    read(ioread,*)  ( columns(j), j = 1, icols )
    do i = 1, ndrill
      read(ioread,*)  ( array(i,j), j = 1, icols )
    enddo
    close(ioread)
     print*, 1
    open(unit = ioread, file = 'dunewash.csv', form = 'formatted')
    read(ioread,*)  junk
    do i = ndrill+1, ndrill+ndune
      read(ioread,*)  ( array(i,j), j = 1, icols )
    enddo
    close(ioread)
      print*, 2
    open(unit = ioread, file = 'jetridge1.csv', form = 'formatted')
    read(ioread,*)  junk
    do i = ndrill+ndune+1, ndrill+ndune+njet1
      read(ioread,*)  ( array(i,j), j = 1, icols )
    enddo
    close(ioread)
      print*, 3
    open(unit = ioread, file = 'jetridge2.csv', form = 'formatted')
```

```
read(ioread,*) junk
do i = ndrill+ndune+njet1+1, ndrill+ndune+njet1+njet2
  read(ioread,*) ( array(i,j), j = 1, icols )
enddo
close(ioread)
    print*, 4
open(unit = ioread, file = 'jetridge3.csv', form = 'formatted')
read(ioread,*) junk
ii = ndrill+ndune+njet1+njet2+1
jj = ndrill+ndune+njet1+njet2+njet3
do i = ii, jj
  read(ioread,*) ( array(i,j), j = 1, icols )
enddo
close(ioread)
    print*, 5
open(unit = ioread, file = 'plughill.csv', form = 'formatted')
read(ioread,*) junk
ii = ii + njet3
jj = jj + nplug
do i = ii, jj
  read(ioread,*) ( array(i,j), j = 1, icols )
enddo
close(ioread)
    print*, 6
open(unit = ioread, file = 'solitario1.csv', form = 'formatted')
read(ioread,*) junk
ii = ii + nplug
jj = jj + nsol1
do i = ii, jj
  read(ioread,*) ( array(i,j), j = 1, icols )
enddo
close(ioread)
    print*, 7
open(unit = ioread, file = 'solitario2.csv', form = 'formatted')
read(ioread,*) junk
ii = ii + nsol1
jj = jj + nsol2
do i = ii, jj
  read(ioread,*) ( array(i,j), j = 1, icols )
enddo
close(ioread)
    print*, 8
open(unit = ioread, file = 'solitario3.csv', form = 'formatted')
read(ioread,*) junk
ii = ii + nsol2
jj = jj + nsol3
do i = ii, jj
  read(ioread,*) ( array(i,j), j = 1, icols )
enddo
close(ioread)
    print*, 9
open(unit = ioread, file = 'yuccawash.csv', form = 'formatted')
read(ioread,*) junk
ii = ii + nsol3
jj = jj + nyucca
do i = ii, jj
```

```
      read(ioread,*)  ( array(i,j), j = 1, icols )
     enddo
     close(ioread)
          print*, 10
     ntotal = 45859+20670+5417+1026+605+7920+14094+493+1222+46715
     nrow = 570
     ncol = 334

c sort array to row-major from NW corner; max rows=570, columns=334;
c some of cells do not have soil depth (irregular boundary), thus
c the matrices have to be initialized with a nodata value.
      do j = 1, ncol
        do i = 1, nrow
          east(i,j) = -999.
          north(i,j) = -999.
          soil(i,j) = -999.
        end do
     end do

     do i = 1, ntotal
       east(array(i,6),array(i,7)) = array(i,2)
       north(array(i,6),array(i,7)) = array(i,3)
       soil(array(i,6),array(i,7)) = array(i,15)
     end do

c check to see if current position is within watershed outline
c output of wash() array will need to be sorted in Excel for Stothoff.
c First, need to setup the counters for determining the position
c of drift() within in entire domain.
c      mrow = mxx
c      mcol = mxx
c      lf_rt = 0
c      ict = 0
c      do i = 1, ntotal
c        ay = array(i,3)
c        ax = array(i,2)
c        do m = 1, ndrift-1
c          if(ay.le.drift(m,2).and.ay.gt.drift(m+1,2).or.
c     &          ay.ge.drift(m,2).and.ay.lt.drift(m+1,2)) then
c            xsegment = (ay-segments(m,2)) / segments(m,1)
c            if(dabs(segments(m,2)).le.1.d-10) xsegment = drift(m,1)
c            if(flagside(m).eq.'right'.and.ax.ge.xsegment) lf_rt= lf_rt+ 1
c            if(flagside(m).eq.'left'.and.ax.le.xsegment) lf_rt= lf_rt + 1
c          endif
c          if(lf_rt.eq.2) then
c              ict = ict + 1
c              washsoil(ict) = soil(i,15)
c              wash(ict,1) = array(i,2)
c              wash(ict,2) = array(i,3)
c              wash(ict,3) = array(i,15)
c              wash(ict,4) = array(i,1)
c              wash_east(array(i,6)) = array(i,2)
c              wash_north(array(i,7)) = array(i,3)
c              wash_soil(array(i,6),array(i,7)) = array(i,15)
c              mrow = min(mrow,array(i,7))
c              mcol = min(mcol,array(i,6))
```

```
c           lf_rt = 0
c         endif
c       enddo
c       lf_rt = 0
c     enddo
c USGS column and row numbers increase starting from NW corner
      print*, mrow,mcol,wash_east(mrow),wash_soil(mrow,mcol)

c calculate the number of rows and columns in the small area; this
c is meaningful only for rectangular areas for Stothoff.
c Assume counter-clockwise starting at NW corner in drift().
c     trow = ( drift(1,2) - drift(2,2) ) / 30.
c     tcol = ( drift(3,1) - drift(1,1) ) / 30.
c     irow = int(trow)
c     icol = int(tcol)
c     print*, irow, icol
c write out summary statistics and Split Wash domain pixel values.
c     open(unit=iowrit, file='soil_summary.dat', form='formatted')
c     sum1 = 0.d0
c     do i = 1, ict
c       sum1 = sum1 + washsoil(i)
c     enddo
c     avg = sum1 / dfloat(ict)

c     sum1 = 0.d0
c     do i = 1, ict
c       sum1 = sum1 + dabs(washsoil(i) - avg)
c     enddo
c     stdev = dsqrt(sum1/dfloat(ict-1))

c     sum1 = 0.d0
c    do i = 1, ntotal
c       sum1 = sum1 + array(i,15)
c     enddo
c     avg_t = sum1 / dfloat(ntotal)

c     sum1 = 0.d0
c     do i = 1, ntotal
c       sum1 = sum1 + dabs(array(i,15) - avg_t)
c     enddo
c      stdev_t = dsqrt(sum1/dfloat(ntotal-1))

c     write(iowrit,*) 'Number in Watershed = ', ict
c     write(iowrit,*) 'Average = ', avg
c     write(iowrit,*) 'Std Dev = ', stdev
c     write(iowrit,*) 'Number in Modeling Domain = ', ntotal
c     write(iowrit,*) 'Average = ', avg_t
c     write(iowrit,*) 'Std Dev = ', stdev_t
c     close(iowrit)

      open(unit=iowrit, file='wash.txt', form='formatted')
      do i = 1, ict
        write(iowrit,500)  ( wash(i,j), j = 1,4 )
      enddo
 500  format(f10.2,f11.2,f7.2,f8.0)
      close(iowrit)
```

```
    open(unit=iowrit, file='all.txt', form='formatted')
    do i = 1, ntotal
     write(iowrit,520) (array(i,j), j=1,3), array(i,15)
    enddo
 520 format(f8.0,f10.2,f11.2,f7.2)
    close(iowrit)

c output for Stothoff and for ArcView, column major order from NW corner
    open(unit=iowrit, file='sw-soil.dem', form='formatted')
c    write(iowrit,*) 'stothof headers'
    write(iowrit,*) 'XLLCORNER ', drift(2,1)
    write(iowrit,*) 'YLLCORNER ', drift(2,2)
    open(unit=iowrit2, file='sw-soil.txt', form='formatted')
    write(iowrit2,*) 'easting, northing, soildep'
    do i = mrow, mrow+irow
     do j = mcol, mcol+icol
      write(iowrit,'(f7.2)') wash_soil(i,j)
      write(iowrit2,540) wash_east(j), wash_north(i), wash_soil(i,j)
     enddo
    enddo
 540 format(f8.0,',',f10.2,',',f11.2,',',f7.2)
    close(iowrit)

    stop
    end
==============================================
```

No more effort put into this work. RF 10/16/07

RF 10/16/07

HYDRAULIC PROPERTIES BASED ON INFILTRATION (INJECTION) MEASUREMENTS AT YUCCA MOUNTAIN

The purpose of this entry is to collect observations related to hydraulic properties of surficial material at Yucca Mountain in preparation for writing a memo listing these observations. The memo is slated to be cited in the response to public comments for the proposed Part 63 rev.

During site visits to Yucca Mountain in 1997 and 1998, Dani Or, Randy Fedors, Stuart Stothoff, Jim Winterle, David Groeneveld, and others (not participating in measurements) made measurements (injection-based; not natural/ambient) of infiltration using various approaches. Some of the data were directly recorded in scientific notebooks of Fedors (#255), Stothoff (#175), and Winterle (#217), and other data was recorded by Dani Or in electronic files. For the data recorded by Dani Or, he provided the data and results either as spreadsheets and/or memorandum to CNWRA staff. It is the memos and spreadsheets of Dani Or that are captured in this section of the scientific notebook. In addition, Winterle's Guelph measurements are organized and tabulated.

The base path for files is:
.\UZ1\SoilHydraulicProp_Memo* [working files]
.\UZ1\SoilHydraulicProp_Memo\FieldSoilBedrock* [files from Dani Or]
Tabulation and consistency check amongst sources are contained in the file:
DataFromSciNtbk_Sept07.xls

Three site visits to Yucca Mountain were made 1997 and 1998, which included measurements of infiltration rates from injection tests

- March 26-28, 1997
- June 5-9, 1997
- May 14-18, 1998

Trip on March 26-28, 1997

A trip report by Stothoff and Winterle ("Trip to Yucca Mountain for Hydrology Field Work (20-5708-861)" dated April 9, 1997; ML033580481) and the scientific notebooks of Stothoff (#175) and Winterle (#217, pages 1-31) describe locations, approaches, and data. Winterle performed the measurements in alluvium of Solitario Canyon. Dani Or led the measurements on the hillslopes (memos & spreadsheets from Dani Or are included below – page 24 & 26-34).

Alluvial Measurements March 26-28, 1997

Measurements in alluvial sediments of Solitario Canyon were made by Jim Winterle using a Guelph Permeameter (SciNtbk#217, pages 1-31). Based on descriptions from the scientific notebook and comparision with ArcView displays of satellite photos (e.g., channel locations), it was determined that UTM NAD27 coordinates were recorded (the sci notebook did not specify if NAD27 or NAD83 was used). The table (modified from file: DataFromSciNtbk_Sept07.xls) on the following page tabulates info from SciNtbk#217 and recalculates the estimates of hydraulic conductivity as a check. In a comparison the values put into the trip report (Stothoff and WInterle, 1997), (i) they averaged the estimates from sites 1-1 and 1-2, (ii) used the 10th station (rough estimate), and (iii) otherwise the comparisons are close (within rounding errors). The values in the trip report should be the ones used.

Taken from file: DataFromSciNtbk_Sept07.xls	Kfs(cm/s)= 0.145 R2 - 0.191 R1; R1, R2 in units of cm/s
Guelph Permeameter	Locations are averages (if more than one reading), no differential (+-10m per SciNtbk)
R1 for head=5cm, R2 for head=10cm	R1, R2 calculated with time for 2cm drop in water supply bore

Used raw time data; this explains why some Ks results are slightly different from those calculated in sci ntbk; not all sites had calculated Ks in the sci ntbk

Where original charts are not readable, calculated result from notebook was used

		UTM NAD27					Time in seconds, avgs from chart							Jim's summary SciNtbk 217, page 16		
Page #	Site	Location Comment	Easting, m	Northing, m	Drop 1, cm	Drop 2, cm	Time, drop 1	Time, drop 2	R1	R2	Kfs, cm/s	Material		R1	R2	Kfs, cm/s
2	1.1	50 m east of UZN89&90	546637	4077467	5	5	9.067	4.430	0.5515	1.1287	0.0583	gravel and silty sand, side channel alluvium to Solitario Canyon up Jet Ridge	must be an error, chart was legible	0.644	1.13	0.042
2	1.2	50 m east of UZN89&90	546637	4077467	5	5	8.603	5.007	0.5812	0.9987	0.0338	gravel and silty sand, side channel alluvium to Solitario Canyon up Jet Ridge		0.551	1	0.04
5	2	further up side canyon	546517	4077632							0.0230	coarse gravel with fine silts, side channel to Solitario up Jet Ridge	use sci ntbk calc result	0.028	0.179	0.023
8	3	Just N of NTS/BLM border	546795	4077389	5	5	16.660	5.905	0.3001	0.8467	0.0655	pea-sized gravel and coarse sand; channel		0.3	0.85	0.067
10	4	300 m north site 3	546826	4077651	5	5	19.640	7.545	0.2546	0.6627	0.0475	well-sorted pea gravel, channel		0.24	0.67	0.051
12	5	300 m south site 3	546772	4077250	3	3	39.115	25.555	0.0767	0.1174	0.0024	gravel and silt with large cobbles, channel		0.077	0.117	0.0023
14	6	100 m upstream UZN89&90	546667	4077103	2	2	35.045	16.625	0.0571	0.1203	0.0065	fine gravel with silty sand, few large cobbles; channel		0.057	0.12	0.0066
18	7	50 m east of UZN89&90	546612	4076972	2	2	67.970	36.135	0.0294	0.0553	0.0024	angular cobbles, silt supported, channel				
20	8	200 m south UZN89&90	546593	4076710	5	5	45.345	22.280	0.1103	0.2244	0.0115	main channel, sandy gravel with cobbles				
22	9	700 m south UZN89&90	546597	4076410	3	3	19.697	8.540	0.1523	0.3513	0.0218	gravel at top, silty below; channel				
24	10	problem with auger hole for 10cm readings, 0.1 cm/s should be considered rough estimate										coarse gravel with sand; channel; likely error in Ks	questionable reading			
26	11	400 m south site 10	547135	4078848	5	5	5.230	3.293	0.9560	1.5182	0.0375	pea-sized gravel and coarse sand; channel				
28	12	400 m south site 11	547121	4078681	5	5	4.327	3.155	1.1556	1.5848	0.0091	pea-sized gravel from channel				
30	13	450 m south site 12	547021	4078283	2	2	43.533	27.310	0.0459	0.0732	0.0018	overbank silty sediments				

Converting the values of hydraulic conductivity in the Trip Report (Stothoff and Winterle, 1997) from cm/s to cm/hr for the memo on hydraulic properties of soils at YM led to a significant digits question (converting rounded-off values versus converting calculated values then rounding off). It was decided to roundoff the values calculated directly by Winterle in Sci Ntbk #217 for sites 1 to 6 (he didn't record the remainder in SciNtbk #217). For sites 7 to 13 (except site 10), I converted the values I calculated from the raw data in Winterle's sci ntbk #217. For site 10, I just converted Jim's estimated value of 0.1 cm/s. Thus, in the memo, these conversions (sites 1 to 6 directly from Jim, and sites 7 to 13 from raw data) are reflected in 6th column of the table below. The 5th column below is the conversion of the rounded-off data taken from the Stothoff and Winterle (1997) trip report. Note that for uncertainty when analyzing Guelph Permeameter data, it doesn't matter whether column 5 or 6 is used for the final estimate (i.e., the differences fall within the uncertainty of measurement technique). However, for traceability, both are included here.

Table extracted from spreadsheet DataFromSciNtbk_Sep07.xls

Table from Trip Report, modified to convert Ks from cm/s to cm/hr					convert from	Equation → Ks (cm/s)=C_2 R_2 + C_1 R_1
			Ks, cm/s	Ks cm/hr	column L and Q	Coefficient values in Winterle's SciNtbk #217: C_2=0.145, C_1=0.191
Site	Easting, m	Northing, m	Hydraulic Conductivity	convert column V	Ks, cm/hr	Notes
1	546637	4077467	0.04	144	147.6	silty coarse gravels with many large cobbles
2	546517	4077632	0.02	72	82.8	coarse gravel with fine silty sand
3	546794	4077389	0.07	252	241.2	sandy coarse gravel
4	546826	4077651	0.05	180	183.6	well-sorted, pea-sized gravel
5	546772	4077250	0.002	7.2	8.3	silty, sandy gravel with large cobbles
6	546667	4077103	0.007	25.2	23.8	silty, sandy gravel with a few large cobbles
7	546612	4076972	0.002	7.2	8.7	silty coarse gravel
8	546593	4076710	0.012	43.2	41.3	sandy gravel with a few large cobbles
9	546597	4076410	0.02	72	78.6	sandy gravel
10	547186	4079275	0.1	360	360.0	coarse sand and gravel
11	547135	4078848	0.04	144	135.1	well-sorted pea-gravel with coarse sand
12	547121	4078681	0.01	36	32.7	well-sorted pea-gravel with coarse sand
13	547021	4078283	0.002	7.2	6.6	silty overbank sediments (stream channel is well sorted pea-gravel)

----START 18Aug2008 RF---- Citation for Guelph Permeameter equation: Soilmoisture Equipment Corp. 1986. 2800KI Operating Instructions. Operating brochure for Guelph Permeameter. Santa Barbara, CA. See http://www.soilmoisture.com for current manual (2006 version), 2800K1 Guelph Permeameter. The Guelph User Manual cites Reynolds et al. 1986 Groundwater Monitoring Review Volume 6, No. 1, pp.84-95. I looked this up: Reynolds, W.D., and D.E. Elrick. 1986. A method for simultaneous in-situ measurements in the vadose zone of field saturated hydraulic conductivity, sorptivity, and the conductivity pressure head relationship. Ground Water Monit. Rev. 6:84-89.
Note that this appears to be the same Guelph Permeameter that I used for the measurements at Bishop (PTn Analog Site); Serial Number 10645. The coefficients include the shape factors from the User Manual (G_2=0.0041, G_1=0.0054) and the calibrated reservoir constant of 35.37 for this specific permeameter (Serial Number 10645); thus, C_2=G_2 * 35.37 and C_1 = G_1 * 35.37. Because these work out to the C_1 and C_2 values that Winterle used, I am sure that this was the exact same permeameter that I used at Bishop. **----END 18Aug2008** RF----

Hillslope and Ridge Measurements March 26-28, 1997

Stothoff's scientific notebook (#175) has locations and rough estimates of permeability of soil for 4 locations. The general location is south of the potential repository footprint on YM crest. The first 3 of 4 locations from Stothoff's scientific notebook (#175) are included in Dani Or's memo and spreadsheet. Data sheets were recorded in the field and put into the spreadsheet (infil1.wb3). The 4th location (Highway Ridge) is not included in Dani's memo or spreadsheet. In summary, Stothoff's SciNtbk #175 has the locations and site descriptions, and Dani Or's spreadsheet and memo have the data points and analyzed results.

Table derived from SciNbk #175: Locations and rough conductivity estimates

Page	Site	Location Comment	Easting, m	Northing, m	Ks, cm/s	Ks*kr, cm/s	Method
18	Transect 1-1	Shoulder of YM crest, ~310 m NNE of Borehole G-3; avg of 3 GPS readings	547665	4074905	0.0039		Ponded head permeameter
18	Transect 1-2		547665	4074905	0.0082		Ponded head permeameter
18	Transect 1		547665	4074905		0.0013	Tension head infiltrometer
18	Transect 1		547665	4074905		0.00072	Tension head infiltrometer
19	Transect 2	YM crest, ~365 m SSE of Borehole G-3; Average of 2 GPS readings	547477	4074256	6.6E-04		Ponded head permeameter
							Stu's notes did not have a tension reading, Dani's spreadsheet did
21	Transect 3	YM crest, east of road; NNE ~15m from UZN-62	547649	4075367	0.0023		Ponded head permeameter
						0.0027	Tension per Stu's notes
23	4	Highway Ridge sideslope, 30 m from road, random stop			0.0062		Ponded head permeameter, , rough estimate of reservoir drop rate
	4				0.0049		

As for the memo and spreadsheet referred to above, Dani Or provided a summary of the measurements and a spreadsheet detailing the analyses. Both are reproduced in this subsection. Additional explanation is provided here to clarify the Dani's calculations in the spreadsheet. The files from Dani Or are:

.\FieldSoilBedrock\infilmem1.wpd WordPerfect file (inserted on following page)
.\FieldSoilBedrock\infil1.wb3 Quattro spreadsheet file (follows memo)

Note that Transect 3 from Dani's spreadsheet and memo had 2 ponded tests. SciNtbk 175 page 21 notes a ponded and tension test. I take Dani's recorded readings as correct, since Stu (SciNtbk #175) was only jotting down brief notes on the tests.

Note also that Transect 2 from Stu's notes (page 19 of SciNtbk#175) only had a ponded test. Dani Or's spreadsheet had a ponded and tension test at Transect 2.

Note also that the tension settings differ between Dani's memo and his spreadsheet. I will take the spreadsheet as correct and assume the memo had a typo. The differences will not lead to significantly different results; e.g., tension setting of -11 cm in memo versus -10 in spreadsheet.

The "infilmem1.wpd file is the memo from Dani Or; the contents are:
== beginning of memo ===

Interoffice MEMORANDUM

To: Dr. Stu Stothoff - CNWRA

Dr. David Groeneveld - Resource Management

From: Dani Or - USU

Subject: Infiltration Data

Date: April 6, 1997

Dear Stu and David,

I completed a preliminary analysis of the infiltration data for Yucca Mountain collected during our last sampling campaign. The results are remarkably stable and repeatable for this type of measurement. The soil was identified by the "feel method" as sandy loam. Because the average porosity should be about n=0.42, we considered the near-surface change in water content to be about $\Delta\theta$=0.4 m^3 m^{-3} during the infiltration process.

Table 1: Infiltration Data for Yucca Mountain Loamy Sand Soil (Crest and Slopes)

Site	Ks or K(h) [cm/s]	α [cm^{-1}]†	Sorptivity [cm $s^{1/2}$]	Method
Trans. #1	0.00486	0.167	0.145	Ponded
	0.00293	0.371	0076	Ponded
	0.00069 (h=-5cm) 0.000166 (h=-11 cm)	0.293 0.146	0.058	Tension Tension
Trans. #2	0.00123	0.149	0.077	Ponded
	0.001 (h=-11 cm)	0.074	0.099	Tension
Trans. #3	0.00450	0.246	0.115	Ponded
	0.00394	0.331	0.093	Ponded

† The α parameter is for the Gardner (1958) conductivity model: $K(h)=K_s \exp(\alpha h)$.

Mean K_s=0.0035 (σ_{Ks}=0.00145) [cm/s] ....Ponded Only

Mean α = 0.222 (σ_α=0.1) [cm^{-1}] .... Ponded+Tension

Our results are comparable with data based on statistical analyses of many sandy loam soil samples (McCuen et al., 1981, WRR 17:1004-1013) — Mean K_S=0.005 cm/s. I am confident we will learn more on the hydraulic properties once the soil samples are analyzed. I am looking forward for your input and comments (hardcopies of the worksheet graphs will be sent by mail).
=== end of memo ====

Some explanation is needed to help understand Dani's memo and spreadsheet calculations. The collected data and the analysis of the data are contained in the spreadsheet "infil1.wb3" For each of the worksheets in this spreadsheet, *r* is the radius (reservoir or base), *A* is the area, *K(h)*, or *K* alone, is the effective conductivity at the specified tension head, alpha (α) is the coefficient of the Gardner equation, *i* is the infiltration rate, *I* is the cumulative infiltration, and *S* is the sorptivity. The change in water content is assumed to be 0.4 for all calculations, which is reasonable considering the silty to fine sand loam sediments and the dry in situ conditions.

The analysis follows

- White, I., M.J. Sully, and K.M. Perroux. 1992. Measurement of surface-soil hydraulic properties: Disk permeameters, tension infiltrometers, and other techniques. In (G.C. Topp, W.D. Reynolds, and R.E. Green, eds.) Advances in Measurement of Soil Physical Properties: Bringing Theory in to Practice. Soil Sci. Soc. Amer., Inc., Madison, Wisconsin, USA.

The effective conductivity at some tension head is

$$K(h) = Q - \frac{4\,b\,S^2}{(\Delta\theta)\pi\, r_{base}}$$

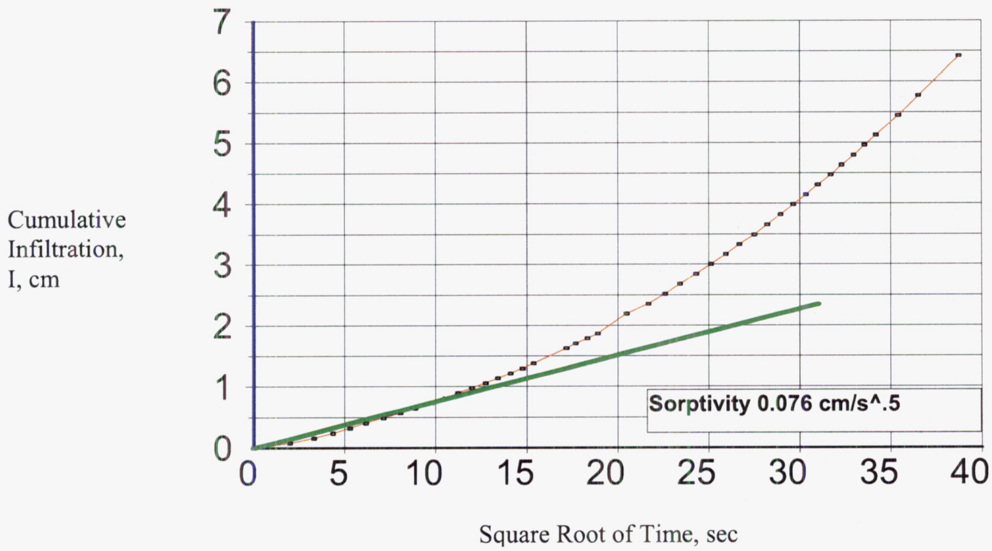
where Q is some average flux at late times (recorded in the field from reservoir level readings), and *b* is a shape factor that is taken as 0.55 in the analyses in the spreadsheet. The value of 0.55 is widely used. The shape factor b ranges from 0.5 to $\pi/4$; b is stated as an average in Everett, et al. (1999, Soil Hydraulic Conductivity and Retention Curves from Tension Infiltrometer and Laboratory Data; in van Genuchten, Leij, and Wu (eds), Proc. Int. Workshop Characterization and Measurement of Hydraulic Properties of Unsaturated Porous Media; pages 541-551; Univ of Calif-Riverside). Note that it was White and Sully (1987, Water Res Res 23:1514-1522) who originally derived the range for *b* values, and suggested that *b*=0.55 was representative. To estimate Q, an average infiltration, "i(f)", is calculated at some late time when the rate is stable. Note that for the tension infiltrometer, *K(h)* is the effective conductivity for some tension head (setting parameter on tension infiltrometer). For the ponded head permeameter, *h*=0 cm, thus a saturated conductivity is obtained using the same equation above.

Average Sorptivity "(Sbar)" (in infil1.wb3) is estimated using regression as the slope of the early time cumulative infiltration data as a function of the square root of time. At early times, capillarity is assumed dominant compared to gravity, thus sorptivity can be estimated from the ratio of cumulative infiltration to the square root of time.

$$S = \frac{I(t)}{\sqrt{t}}$$

Infiltration rate, *i*, is calculated as the change in reservoir height times the reservoir area divided by the area of the base then divided by the change in time. Cumulative infiltration amount, *I(t)*, is calculated taking the previous infiltration amount plus the infiltration amount for that time step calculated as the change in reservoir water height multiplied by the ratio of reservoir and base areas.

It is acknowledged that there is some subjectivity to estimating sorptivity from the slope of early-time data. The slope is changing over time. Also, the selection of which times to put into the linear regression is subjective. The following figure for a ponded head permeameter data set illustrates the sorptivity estimation approach:



And finally, alpha, α, is calculated as

$$\alpha = \frac{\Delta\theta\,\Delta K}{b\,S^2}$$

Where the average sorptivity is used, $\Delta\theta$ is assumed to be 0.4, and $\Delta K = K(h) - K_{initial}$ where $K_{initial}$ is << $K_{saturated}$ or $K(h)$ and thus is assumed negligible.

The following tables are taken from the infil1.wb3 worksheet sent by Dani Or after the field trip and along with the memo (included above). Note that extra decimal places were carried through as a consequence of the cut and paste from the spreadsheet, and are not intended to infer an increased level of preciseness. A couple of significant figures are probably adequate.

"pond1r2" worksheet:

Infiltration on Yucca Mountain, NV							
3/27-28/1997							
Ponded		A [cm^2]					
r(res)=[cm]	2.85	25.5175863287831		Ks	0.00485607682817625	[cm/s]	
r(base)=	10	314.16		Alpha	0.166815467192057	1/cm	
	Transect #1-run2			i(f)	0.00856253711868852	cm/s	
	dTheta	0.4	[cm^3/cm^3]	S(bar)	0.145503442130453	cm/s^.5	
	Ponded						
	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	5		0	18		0	
	6.5		26	26	0.015229651886449	0.121837215091592	
	7		46	46	0.00203062025152654	0.162449620122123	0.022622367262043
	8		53	53	0.0116035442944374	0.243674430183185	0.0307761583140375
	9	1	0	60	0.0116035442944374	0.324899240244246	0.0376172498265747
	10	1	9	69	0.00902497889567351	0.406124050305308	0.0428379357992
	11	1	18	78	0.00902497889567351	0.487348860366369	0.0473022961536172

	12	1	26	86	0.0101531012576327	0.568573670427431	0.0514826865830817
	14	1	42	102	0.0101531012576327	0.731023290549554	0.0585061454008603
	15	1	50	110	0.0101531012576327	0.812248100610615	0.0615007111305303
	16	1	59	119	0.00902497889567351	0.893472910671677	0.0639525339676552
	17	2	7	127	0.0101531012576327	0.974697720732739	0.0664496995797479
	18	2	17	137	0.00812248100610616	1.0559225307938	0.0682428964485034
	19	2	25	145	0.0101531012576327	1.13714734085486	0.0703786637055878
	20	2	35	155	0.00812248100610616	1.21837215091592	0.0718928958808136
	21	2	44	164	0.00902497889567351	1.29959696097698	0.0735266536917789
	22	2	52	172	0.0101531012576327	1.38082177103805	0.0752703430714967
	23	3	2	182	0.00812248100610616	1.46204658109911	0.0764821722051622
	24	3	11	191	0.00902497889567351	1.54327139116017	0.0778257421157085
	25	3	20	200	0.00902497889567351	1.62449620122123	0.0790917812997443
	26	3	28	208	0.0101531012576327	1.70572101128229	0.0804804689871058
	27	3	38	218	0.00812248100610616	1.78694582134335	0.0814199385806219
	28	3	47	227	0.00902497889567351	1.86817063140442	0.0824941172981709
	29	3	56	236	0.00902497889567351	1.94939544146548	0.0835151767850579
	30	4	5	245	0.00902497889567351	2.03062025152654	0.0844874772245454
	31	4	14	254	0.00902497889567351	2.1118450615876	0.0854148850870568
	32	4	24	264	0.00812248100610616	2.19306987164866	0.0861372399849247
	33	4	33	273	0.00902497889567351	2.27429468170972	0.0869886723963791
	34	4	42	282	0.00902497889567351	2.35551949177079	0.0878043140827141
	35	4	52	292	0.00812248100610616	2.43674430183185	0.0884348456650534
	36	5	1	301	0.00902497889567351	2.51796911189291	0.0891894591920583
	37	5	12	312	0.00738407364191469	2.59919392195397	0.0896262907396295
	39	5	30	330	0.00902497889567351	2.76164354207609	0.091008788133527
	41	5	49	349	0.00854998000642753	2.92409316219822	0.0921619012201045
	42	6	0	360	0.00738407364191469	3.00531797225928	0.0925161591603233
	43	6	9	369	0.00902497889567351	3.08654278232034	0.0931128252957145
	45	6	28	388	0.00854998000642753	3.24899240244246	0.0941274666197071
	47	6	47	407	0.00854998000642753	3.41144202256458	0.0950810860363001
	49	7	4	424	0.00955586000718371	3.57389164268671	0.096205812176431
	52	7	35	455	0.00786046548978015	3.81756607286989	0.0971823115914912
	54	7	54	474	0.00854998000642753	3.98001569299202	0.0979665437207427
	56	8	14	494	0.00812248100610616	4.14246531311414	0.0986112320448616
	58	8	34	514	0.00812248100610616	4.30491493323626	0.0992259403363671
	60	8	53	533	0.00854998000642753	4.46736455335839	0.0999065678729738
	62	9	13	553	0.00812248100610616	4.62981417348051	0.100465125387335
	64	9	32	572	0.00854998000642753	4.79226379360263	0.101088359315467
	66	9	52	592	0.00812248100610616	4.95471341372475	0.101598877699873
	68	10	13	613	0.00773569619629158	5.11716303384688	0.102005813411723
	70	10	31	631	0.00902497889567351	5.279612653969	0.102641653418769
	74	11	10	670	0.00833074974985247	5.60451189421325	0.103605246394171
	80	12	11	731	0.00798932557977655	6.09186075457962	0.104743441797106

"pond1r1" worksheet:

Infiltration on Yucca Mountain, NV							
3/27-28/1997							
Ponded		A [cm^2]					
r(res)=[cm]	2.85	25.5175863287831		Ks	0.0029296543677884	[cm/s]	
r(base)=	10	314.16		Alpha	0.371311278053778	1/cm	
	Transect #1 - run1			i(f)	0.00393424324346862	cm/s	
	d‾heta	0.4	[cm^3/cm^3]	S(bar)	0.0757508959648783	cm/s^.5	
	Ponded						Long-term
	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	7		0	0		0	
	8		4	4	0.0203062025152654	0.0812248100610616	
	9		11	11	0.0116035442944374	0.162449620122123	0.0462615970961806
	10		19	19	0.0101531012576327	0.243674430183185	0.0514014702791186
	11	0	28	28	0.00902497889567351	0.324899240244246	0.0550660152748161
	12	0	38	38	0.00812248100610616	0.406124050305308	0.057724646588695
	13	0	51	51	0.00624806231238935	0.487348860366369	0.0584984603902566
	14	1	5	65	0.00580177214721868	0.568573670427431	0.059218001879862
	15	1	19	79	0.00580177214721868	0.649798480488492	0.0602004384919797
	16	1	35	95	0.00507655062881635	0.731023290549554	0.0606233273727804
	17	1	51	111	0.00507655062881635	0.812248100610615	0.0612230541317774
	18	2	6	126	0.0054149873374041	0.893472910671677	0.0621506915198095
	19	2	24	144	0.00451248944783675	0.974697720732739	0.0624041735899665
	20	2	42	162	0.00451248944783675	1.0559225307938	0.0627567186629073
	21	3	0	180	0.00451248944783675	1.13714734085486	0.0631667838267477
	22	3	19	199	0.00427499000321377	1.21837215091592	0.0634490740320772
	23	3	38	218	0.00427499000321377	1.29959696097698	0.0637732394666054
	24	3	56	236	0.00451248944783675	1.38082177103805	0.0642587269654949
	27	4	55	295	0.00413007508785059	1.62449620122123	0.0651231421240786
	28	5	13	313	0.00451248944783675	1.70572101128229	0.0656069724919952
	29	5	36	336	0.00353151348091572	1.78694582134335	0.0655827130166771
	30	5	57	357	0.00386784809814579	1.86817063140442	0.0657812013124
	34	7	0	420	0.00515713079752772	2.19306987164866	0.0682917544633426
	36	7	50	470	0.00324899240244246	2.35551949177079	0.0680129292335035
	38	8	31	511	0.00396218585663715	2.51796911189291	0.0684520294116431
	40	9	9	549	0.00427499000321377	2.68041873201503	0.0690717525448448
	42	9	51	591	0.00386784809814579	2.84286835213715	0.0694224143829539
	44	10	31	631	0.00406124050305308	3.00531797225928	0.0698802041948964
	46	11	13	673	0.00386784809814579	3.1677675923814	0.0702153430641433
	48	11	52	712	0.00416537487492623	3.33021721250352	0.0706923676103928
	50	12	37	757	0.0036099915582694	3.49266683262565	0.0708648453001165
	52	13	16	796	0.00416537487492623	3.65511645274777	0.0713115524259607

	54	13	58	838	0.00386784809814579	3.81756607286989	0.0716095449635987
	56	14	39	879	0.00396218585663715	3.98001569299202	0.0719403455657954
	58	15	21	921	0.00386784809814579	4.14246531311414	0.0722204257381566
	60	16	1	961	0.00406124050305308	4.30491493323626	0.07256798914114
	62	16	45	1005	0.00369203682095734	4.46736455335839	0.0727569715119985
	64	17	24	1044	0.00416537487492623	4.62981417348051	0.0731185628843617
	66	18	8	1088	0.00369203682095734	4.79226379360263	0.0732967493772116
	68	18	47	1127	0.00416537487492623	4.95471341372475	0.0736355959353462
	70	19	29	1169	0.00386784809814579	5.11716303384688	0.073866565241878
	74	20	55	1255	0.00377789814237496	5.44206227409112	0.0742502913521484
	78	22	15	1335	0.00406124050305308	5.76696151433537	0.0747846111135411
	86	25	2	1502	0.00389100886520055	6.41675999482386	0.0755776557942563

"Tension 1" worksheet. [Note that data for tension head set to -4.5 is changed to tension = -10 cm at approximately 2335 seconds. Thus, *K(-4.5cm)* uses data from 896 sec to 2156 sec, and *K(-10 cm)* uses infiltration data from the times of 2791 sec to 5386 sec.]

Infiltration on Yucca Mountain, NV							
3/27-28/1997							
		A [cm^2]		K(-10cm)	0.000165736423896587		
r(res)=[cm]	2.54	20.27		K(-4.5cm)	0.000689777223131219	[cm/s]	
r(base)=	10	314.16		Alpha	0.146391599203411	1/cm	
	Transect #1			i(f)	0.00128971030831321	cm/s	
	dTheta	0.4		S(bar)	0.0585389594132629	cm/s^.5	
	H=-4.5 cm						
	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	4.3		0	22		0	
	5		14	24	0.0225824420677362	0.0451648841354724	
	7		20	30	0.0215070876835583	0.174207410236822	0.0299199164877725
	8		29	39	0.00716902922785276	0.238728673287497	0.0352045967770347
	9		40	50	0.00586556936824317	0.303249936338172	0.0387116932936044
	10		55	65	0.00430141753671165	0.367771199388846	0.0404028333994615
	11	1	14	84	0.00339585595003552	0.432292462439521	0.0410305222690758
	12	1	36	106	0.00293278468412158	0.496813725490196	0.0412628306310093
	13	2	3	133	0.00238967640928425	0.561334988540871	0.0409448065741832
	14	2	30	160	0.00238967640928425	0.625856251591546	0.0409736924096461
	14.5	2	43	173	0.00248158704041057	0.658116883116883	0.0411215883655751
	15	2	59	189	0.00201628947033359	0.690377514642221	0.0409648378993624
	15.5	3	15	205	0.00201628947033359	0.722638146167558	0.040872241840277
	16	3	29	219	0.00230433082323839	0.754898777692895	0.0410148330827879
	16.5	3	49	239	0.00161303157626687	0.787159409218233	0.040652393186401
	17	4	7	257	0.00179225730696319	0.81942004074357	0.0405290569516275

	17.5	4	22	272	0.00215070876835583	0.851680672268908	0.0406702424168307
	18	4	40	290	0.00179225730696319	0.883941303794245	0.0406086538095977
	18.5	4	59	309	0.00169792797501776	0.916201935319583	0.0405103270111833
	19	5	18	328	0.00169792797501776	0.94846256684492	0.0404431281717328
	19.5	5	38	348	0.00161303157626687	0.980723198370257	0.0403433840468431
	20	5	58	368	0.00161303157626687	1.01298382989559	0.0402710414919711
	20.5	6	18	388	0.00161303157626687	1.04524446142093	0.0402214963825522
	21	6	36	406	0.00179225730696319	1.07750509294627	0.0402899027970706
	21.5	6	57	427	0.00153622054882559	1.10976572447161	0.0402236361466583
	22	7	16	446	0.00169792797501776	1.14202635599694	0.0402657467166439
	22.5	7	36	466	0.00161303157626687	1.17428698752228	0.0402725617569388
	23.5	8	20	510	0.00146639234206079	1.23880825057296	0.0401566529999587
	24.5	9	4	554	0.00146639234206079	1.30332951362363	0.0400946202717037
	25.5	9	48	598	0.00146639234206079	1.36785077667431	0.0400730889958477
	26.5	10	31	641	0.00150049448955058	1.43237203972498	0.0401136153422234
	27.5	11	13	683	0.00153622054882559	1.49689330277566	0.0402032747011639
	28.5	12	0	730	0.00137279283086542	1.56141456582633	0.0401664257404604
	30	13	9	799	0.00140263615327554	1.65819646040234	0.0401929820010454
	32	14	46	896	0.00133033532063247	1.78723898650369	0.0401660002194454
	34	16	22	992	0.00134419298022239	1.91628151260504	0.0402184128032393
	36	18	5	1095	0.0012528400592364	2.04532403870639	0.0401778058999183
	38.5	20	10	1220	0.0012904252610135	2.20662719633308	0.0402507641371306
	41	22	16	1346	0.00128018379068799	2.36793035395977	0.0403436731945844
	45	25	40	1550	0.00126512280491519	2.62601540616247	0.0405083933933391
	50	29	53	1803	0.00127512377570504	2.94862172141584	0.0407879308916081
	57	35	46	2156	0.0012794584740927	3.40027056277056	0.0412170988189969
	59	37	43	2273	0.00110292757351581	3.52931308887191	0.0411923528992899
	59.5	38	45	2335	0.0005203327665377	3.56157372039725	0.040898268578482
	60	39	37	2387	0.000620396760102642	3.59383435192259	0.0407030238643452
	61	40	54	2464	0.000837938481177595	3.65835561497326	0.0405565561160831
	62	42	15	2545	0.000796558803094751	3.72287687802394	0.040388903590735
	63	43	37	2627	0.000786844671349693	3.78739814107461	0.0402253903122813
	64	44	58	2708	0.000796558803094751	3.85191940412529	0.0400805561456678
	65	46	21	2791	0.000777364615068371	3.91644066717596	0.0399312364693916
	66	47	40	2870	0.000816724848742719	3.98096193022664	0.0398195569925182
	67	49	0	2950	0.000806515788133435	4.04548319327731	0.0397085685625431
	69	51	48	3118	0.000768110274412795	4.17452571937866	0.0394569953496083
	71	54	36	3286	0.000768110274412795	4.30356824548001	0.0392356773919574
	72.5	56	51	3421	0.000716902922785276	4.40035014005602	0.0390354303454066
	94	89	36	5386	0.000705957839994661	5.78755729564553	0.0373192377631499

"Pond2r1" worksheet:

Infiltration on Yucca Mountain, NV							
3/27-28/1997							
Ponded		A [cm^2]					
r(res)=[cm]	2.85	25.5175863287831		Ks	0.00123315455902873	[cm/s]	
r(base)=	10	314.16		Alpha	0.149439950074919	1/cm	
	Transect #2 – run1			i(f)	0.00228381146070642	cm/s	
	dTheta	0.4	[cm^3/cm^3]	S(bar)	0.0774683044131192	Cm/s^.5	
	Ponded						Long-Term
	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	8		0	7		0	
	9		14	14	0.0116035442944374	0.0812248100610616	
	10		21	21	0.0116035442944374	0.162449620122123	0.0334816858430758
	11		31	31	0.00812248100610616	0.243674430183185	0.0402412530228208
	12		43	43	0.00676873417175513	0.324899240244246	0.0444353329637827
	13	1	0	60	0.00477793000359186	0.406124050305308	0.0459385682740204
	14	1	18	78	0.00451248944783675	0.487348860366369	0.0473022961536172
	15	1	40	100	0.00369203682095734	0.568573670427431	0.0477430794494675
	16	2	3	123	0.00353151348091572	0.649798480488492	0.0482459257958473
	17	2	28	148	0.00324899240244246	0.731023290549554	0.0485702919896454
	18	2	52	172	0.00338436708587757	0.812248100610615	0.0491826875413388
	19	3	19	199	0.00300832629855784	0.893472910671677	0.0494543729364626
	20	3	49	229	0.00270749366870205	0.974697720732739	0.0494854063851337
	21	4	16	256	0.00300832629855784	1.0559225307938	0.0499226639980029
	22	4	47	287	0.00262015516326005	1.13714734085486	0.0500246512131669
	23	5	15	315	0.00290088607360934	1.21837215091592	0.0504308803768835
	24	5	46	346	0.00262015516326005	1.29959696097698	0.050620761685431
	25	6	15	375	0.00280085551934695	1.38082177103805	0.0509767900631739
	26	6	47	407	0.00253827531440817	1.46204658109911	0.0511444724682364
	28	7	51	471	0.00253827531440817	1.62449620122123	0.0515389897103928
	30	8	54	534	0.00257856539876386	1.78694582134335	0.0520221609877294
	32	10	1	601	0.00242462119585258	1.94939544146548	0.0523340289427179
	34	11	9	669	0.00238896500179593	2.1118450615876	0.0526304835734545
	36	12	10	730	0.00266310852659218	2.27429468170972	0.0531964432738692
	38	13	19	799	0.00235434232061048	2.43674430183185	0.0534615392021684
	40	14	23	863	0.00253827531440817	2.59919392195397	0.0538898931250072
	42	15	27	927	0.00253827531440817	2.76164354207609	0.0543000755996259
	44	17	19	1039	0.00145044303680467	2.92409316219822	0.0534141553257436
	48.5	18	45	1125	0.00425013541017183	3.28960480747299	0.0557598971407708
	50.5	19	57	1197	0.00225624472391838	3.45205442759512	0.055899935171675
	54.5	22	16	1336	0.00233740460607371	3.77695366783936	0.0562994571478193
	59	25	3	1503	0.00218869248667531	4.14246531311414	0.0565340851983574
	62.5	27	10	1630	0.00223847901743083	4.42675214832786	0.0567796630953254
	67.5	30	5	1805	0.00232070885888747	4.83287619863316	0.0572277826486627
	72	32	48	1968	0.0022424027317471	5.19838784390794	0.0575271853365216

	76.5	35	44	2144	0.00207677071178851	5.56389948918272	0.0576411322634254
	80.5	37	57	2277	0.00244285143040787	5.88879872942696	0.0580506340053118
	84	39	53	2393	0.00245074857942858	6.17308556464068	0.0583921415877482

"Tension 2" worksheet:

	Infiltration on Yucca Mountain, NV						
3/27-28/1997							
		A [cm^2]					
r(res)=[cm]	2.54	20.27		K(-11cm)	0.00100260470106487	[cm/s]	
r(base)=	10	314.16		Alpha	0.0745227296839405	1/cm	
	Transect #2			i(f)	0.00271558000208671	cm/s	
	dTheta	0.4		S(bar)	0.0989165913233879	cm/s^.5	
	H=-11 cm						
	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	2		0	6		0	
	4		8	18	0.0107535438417791	0.12904252610135	
	6		20	30	0.0107535438417791	0.258085052202699	0.0431287497188607
	7		28	38	0.00806515788133435	0.322606315253374	0.0469667491219579
	8		36	46	0.00806515788133435	0.387127578304049	0.0502780101988988
	9		45	55	0.00716902922785276	0.451648841354724	0.0527006753728201
	10		55	65	0.00645212630506748	0.516170104405399	0.0544736065802632
	11	1	7	77	0.00537677192088957	0.580691367456073	0.0554023673445559
	12	1	19	89	0.00537677192088957	0.645212630506748	0.0563780291151359
	13	1	32	102	0.00496317408082114	0.709733893557423	0.0570743441473278
	14	1	49	119	0.00379536841474558	0.774255156608098	0.0568259779228338
	15	2	2	132	0.00496317408082114	0.838776419658773	0.0576519715924003
	16	2	16	146	0.00460866164647677	0.903297682709448	0.0582557150569936
	17	2	31	161	0.00430141753671165	0.967818945760123	0.0586799331968841
	18	2	47	177	0.00403257894066718	1.0323402088108	0.0589590601129331
	19	3	4	194	0.00379536841474558	1.09686147186147	0.0591208263331257
	20	3	22	212	0.00358451461392638	1.16138273491215	0.0591875794580935
	21	3	39	229	0.00379536841474558	1.22590399796282	0.0594352141487842
	22	3	55	245	0.00403257894066718	1.2904252610135	0.0598241174083886
	23	4	13	263	0.00358451461392638	1.35494652406417	0.0599823355293587
	24	4	31	281	0.00358451461392638	1.41946778711485	0.0601627735513211
	25	4	51	301	0.00322606315253374	1.48398905016552	0.060158395516422
	26	5	10	320	0.00339585595003552	1.5485103132162	0.0602825938311781
	28	5	48	358	0.00339585595003552	1.67755283931755	0.0605766247518846
	30	6	28	398	0.00322606315253374	1.8065953654189	0.0607556384791166
	32	7	10	440	0.00307244109765118	1.93563789152025	0.0608423667469974
	34	7	53	483	0.00300098897910115	2.0646804176216	0.0609175763315307
	36	8	37	527	0.00293278468412158	2.19372294372294	0.0609792937069738
	38	9	18	568	0.00314737868539877	2.32276546982429	0.0612412633870043
	40	10	2	612	0.00293278468412158	2.45180799592564	0.0613585105752246
	44	11	38	708	0.00268838596044478	2.70989304812834	0.0613004789364867
	48	13	8	798	0.0028676116911411	2.96797810033104	0.061593616952642

	52	14	43	893	0.00271668476002841	3.22606315253374	0.0617386200086043
	56	16	18	988	0.00271668476002841	3.48414820473644	0.0619249548541667
	60	17	54	1084	0.00268838596044478	3.74223325693914	0.0621067740643787
	66	20	22	1232	0.00261572688043276	4.12936083524319	0.0623089030122537

"pond3" worksheet:

Infiltration on Yucca Mountain, NV							
3/27-28/1997							
Ponded		A [cm^2]					
r(res)=[cm]	2.85	25.517586		Ks	0.00450318000381978	[cm/s]	
r(base)=	10	314.16		Alpha	0.246286132833745	1/cm	
	Transect #3 - run1		(Slope)	i(f)	0.00683121479487902	cm/s	
	dTheta	0.4	[cm^3/cm^3]	S(bar)	0.115315669493417	cm/s^.5	
	Ponded						Long-Term
	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	12		0	0		0	
	13		6	6	0.0135374683435103	0.0812248100610616	
	14		13	13	0.0116035442944374	0.162449620122123	0.0425544800360331
	15		21	21	0.0101531012576327	0.243674430183185	0.0488925506986626
	16		29	29	0.0101531012576327	0.324899240244246	0.0541082723839499
	18		44	44	0.0108299746748082	0.487348860366369	0.0629800768045577
	20	1	3	63	0.00854998000642753	0.649798480488492	0.0674128868533078
	22	1	23	83	0.00812248100610616	0.812248100610615	0.0708006808261206
	24	1	46	106	0.00706302696183144	0.974697720732739	0.0727347498720276
	26	2	6	126	0.00812248100610616	1.13714734085486	0.0754987471893699
	28	2	28	148	0.00738407364191469	1.29959696097698	0.0773990922719909
	30	2	54	174	0.00624806231238935	1.46204658109911	0.0782206253876483
	31.5	3	12	192	0.00676873417175513	1.5838837961907	0.0791799376510672
	34	3	38	218	0.00781007789048669	1.78694582134335	0.0814199385806219
	36	4	4	244	0.00624806231238935	1.94939544146548	0.082134665556716
	38	4	29	269	0.00649798480488493	2.1118450615876	0.0829992712599916
	40	4	53	293	0.00676873417175513	2.27429468170972	0.0839673053389203

Infiltration on Yucca Mountain, NV							
3/27-28/1997							
Ponded		A [cm^2]					
r(res)=[cm]	2.85	25.517586		Ks	0.00393731519444433	[cm/s]	
r(base)=	10	314.16		Alpha	0.331601051372804	1/cm	
	Transect #3 - run2		(Slope)	i(f)	0.00544911540885833	cm/s	
	dTheta	0.4	[cm^3/cm^3]	S(bar)	0.0929267595015119	cm/s^.5	
	Ponded						Long-Term
	H(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	15		0	7		0	
	16		9	9	0.0406124050305308	0.0812248100610616	
	17		19	19	0.00812248100610616	0.162449620122123	0.0351997974162702

	18		29	29	0.00812248100610616	0.243674430183185	0.0416057488527094
	20		52	52	0.00706302696183144	0.406124050305308	0.0493459380496531
	21	1	4	64	0.00676873417175513	0.487348860366369	0.0522203210071208
	22	1	19	79	0.0054149873374041	0.568573670427431	0.0537151610415458
	23	1	32	92	0.00624806231238935	0.649798480488492	0.0557852375258965
	24	1	47	107	0.0054149873374041	0.731023290549554	0.0571228257784559
	25	2	0	120	0.00624806231238935	0.812248100610615	0.0588824479826616
	26	2	16	136	0.00507655062881635	0.893472910671677	0.0598221177807471
	27	2	30	150	0.00580177214721868	0.974697720732739	0.0611433532461935
	28	2	45	165	0.0054149873374041	1.0559225307938	0.0621835859394812
	29	2	59	179	0.00580177214721868	1.13714734085486	0.0633429816134349
	30	3	16	196	0.00477793000359186	1.21837215091592	0.0639328096803419
	31	3	30	210	0.00580177214721868	1.29959696097698	0.0649766142440482
	32	3	49	229	0.00427499000321377	1.38082177103805	0.0652334545245849
	34	4	17	257	0.00580177214721868	1.54327139116017	0.0670924100490097
	35	4	33	273	0.00507655062881635	1.62449620122123	0.067696315357208
	36	4	50	290	0.00477793000359186	1.70572101128229	0.0681589932534516
	37	5	7	307	0.00477793000359186	1.78694582134335	0.0686103807605002
	38	5	23	323	0.00507655062881635	1.86817063140442	0.0691567614261642
	39	5	40	340	0.00477793000359186	1.94939544146548	0.0695796032023694
	40	5	56	356	0.00507655062881635	2.03062025152654	0.0700890842232663
	41	6	13	373	0.00477793000359186	2.1118450615876	0.0704848862735364
	42	6	31	391	0.00451248944783675	2.19306987164866	0.0707790186234939
	43	6	47	407	0.00507655062881635	2.27429468170972	0.0712437583145226
	44	7	4	424	0.00477793000359186	2.35551949177079	0.0716073299711489

Trip on June 5-9, 1997

Primary information sources: (i) Spreadsheet from Dani Or named infil697.wb3
(ii) Field Notebook #175 (Stothoff) pages 25-37, especially pages 34-36.
On June 8, 1997, measurements were made at three locations, 2 near the Ghost Dance Fault exposure and 1 at a scree location (based on description in SciNtbk 175, this is a talus pile that was excavated, not a scree slope. Inspection of Dani Or's spreadsheet entries for depth and time at the 3 tests show that these match the entries in Stothoff's SciNtbk pages 34, 35, and 36.

Dani's worksheet	Stothoff's SciNtbk	Location	Stothoff estimate of K, cm/s	Dani's estimates		
				K, cm/s	Gardner α, cm^{-1}	Sorptivity, $cm/s^{0.5}$
GD1	34	WT-2 Wash, upslope of Ghost Dance Fault exposure; GD2 is 4 m east from GD1	0.0054	0.00446	0.552	0.767
GD2	35		0.0038	0.00268	0.136	0.120
Scree1	36	N 36° 49.532, W 116° 27.515	0.0072	0.00609	0.510	0.093

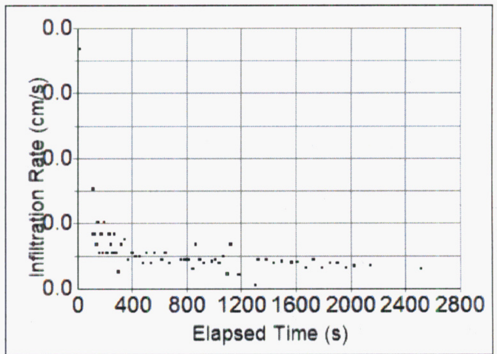
Dani Or's spreadsheet are included in the following tables. The ponded permeameter had a 10 cm radius base, and the change in water content (initial versus saturated) was assumed to be 0.4 for the calculations. The Quattro spreadsheet file infil697.wb3 has 3 worksheets labeled "GD1," "GD2," and "Scree1"; these files are on the next three pages:

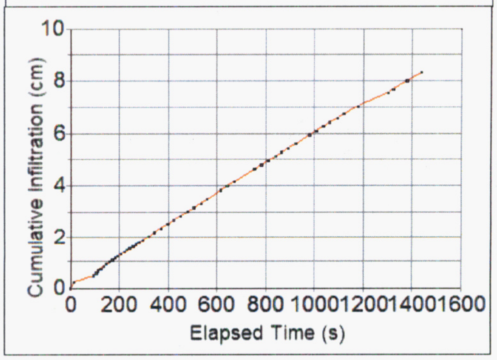
Infiltration on Yucca Mountain, NV — Ghost Dance Fault #1

06/08/97

Ponded		A [cm^2]			
r(res)=[cm]	2.85	25.5175863	Ks	0.00446382	[cm/s]
r(base)=	10	314.16	Alpha	0.5523245	1/cm
Ghost Dance Fault #1			i(f)	0.00549284	cm/s
dTheta	0.4	[cm^3/cm^3]	S(bar)	0.07666637	cm/s^.5
Ponded			S(bar1)	0.08343215	

	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
	3			0		0	
	6		13	13	0.01874	0.24367	
	9	1	34	94	0.00301	0.48735	0.04309
	10	1	45	105	0.00738	0.56857	0.04659
	11	1	53	113	0.01015	0.64980	0.05034
	12	2	4	124	0.00738	0.73102	0.05306
	13	2	16	136	0.00677	0.81225	0.05531
	14	2	26	146	0.00812	0.89347	0.05774
	15	2	39	159	0.00625	0.97470	0.05939
	16	2	50	170	0.00738	1.05592	0.06126
	17	3	3	183	0.00625	1.13715	0.06265
	18	3	13	193	0.00812	1.21837	0.06443
	19	3	26	206	0.00625	1.29960	0.06560
	20	3	39	219	0.00625	1.38082	0.06671
	21	3	50	230	0.00738	1.46205	0.06803
	22	4	2	242	0.00677	1.54327	0.06914
	23	4	15	255	0.00625	1.62450	0.07004
	24	4	26	266	0.00738	1.70572	0.07117
	25	4	39	279	0.00625	1.78695	0.07197
	26	4	55	295	0.00508	1.86817	0.07236
	28	5	19	319	0.00677	2.03062	0.07404
	30	5	42	342	0.00706	2.19307	0.07568
	32	6	10	370	0.00580	2.35552	0.07665
	34	6	36	396	0.00625	2.51797	0.07776
	36	7	3	423	0.00602	2.68042	0.07869
	38	7	30	450	0.00602	2.84287	0.07956
	40	7	59	479	0.00560	3.00532	0.08020
	42	8	25	505	0.00625	3.16777	0.08106
	44	8	54	534	0.00560	3.33022	0.08163
	46	9	20	560	0.00625	3.49267	0.08239
	50	10	16	616	0.00580	3.81757	0.08352
	52	10	42	642	0.00625	3.98002	0.08418
	54	11	11	671	0.00560	4.14247	0.08461
	60	12	35	755	0.00580	4.62981	0.08598
	62	13	3	783	0.00580	4.79226	0.08640
	64	13	31	811	0.00580	4.95471	0.08680
	66	14	2	842	0.00524	5.11716	0.08704
	68	14	26	866	0.00677	5.27961	0.08762
	70	14	54	894	0.00580	5.44206	0.08797
	72	15	23	923	0.00560	5.60451	0.08827
	76	16	20	980	0.00570	5.92941	0.08888
	78	16	48	1008	0.00580	6.09186	0.08920
	80	17	17	1037	0.00560	6.25431	0.08946
	82	17	44	1064	0.00602	6.41676	0.08980
	84	18	17	1097	0.00492	6.57921	0.08988
	86	18	41	1121	0.00677	6.74166	0.09032
	89.5	19	39	1179	0.00490	7.02595	0.09044
6.5	96	21	43	1303	0.00426	7.55391	0.09010
8	97.5	22	4	1324	0.00580	7.67574	0.09030
12	101.5	23	0	1380	0.00580	8.00064	0.09080
16	105.5	23	58	1438	0.00560	8.32554	0.09122
20	109.5	24	55	1495	0.00570	8.65044	0.09164
25	114.5	26	7	1567	0.00564	9.05657	0.09212
28	117.5	26	50	1610	0.00567	9.30024	0.09241
32	121.5	27	51	1671	0.00533	9.62514	0.09266
36	125.5	28	47	1727	0.00580	9.95004	0.09305
40	129.5	29	48	1788	0.00533	10.27494	0.09329
44	133.5	30	46	1846	0.00560	10.59984	0.09359
48	137.5	31	44	1904	0.00560	10.92474	0.09388
52	141.5	32	45	1965	0.00533	11.24964	0.09409
56	145.5	33	45	2025	0.00541	11.57454	0.09432
64	153.5	35	44	2144	0.00546	12.22433	0.09477
88	177.5	41	55	2515	0.00525	14.17373	0.09570





Regression Output:

Constant		-0.10362506
Std Err of Y Est		0.09344747
R Squared		0.84761152
No. of Observations		7
Degrees of Freedom		5
X Coefficient(s)	0.06990058	
Std Err of Coef.	0.01325481	

Ghost Dance Fault #2

Infiltration on Yucca Mountain, NV
06/08/97

Ponded		A [cm^2]
r(res)=[cm]	2.85	25.51759
r(base)=	10	314.16

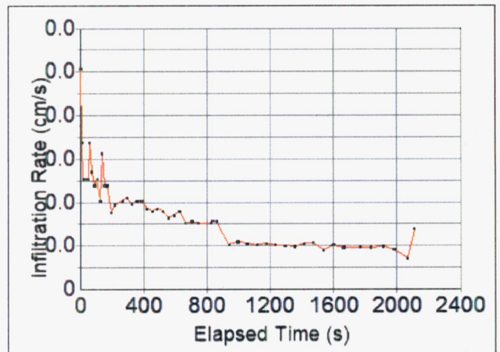
Ks	0.00268	[cm/s]
Alpha	0.13619	1/cm
i(f)	0.00518	cm/s
S(bar)	0.11962	cm/s^.5
S(bar1)	0.07567	

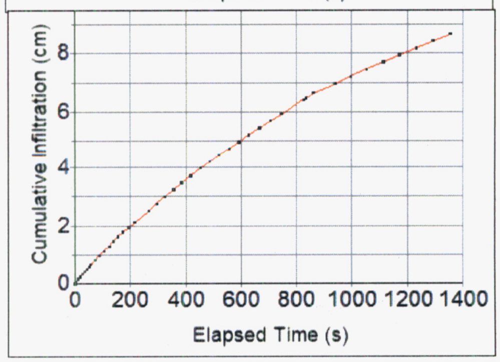
Ghost Dance Fault #2
dTheta 0.4 [cm^3/cm^3]
Ponded

	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	Long-term S [cm/s^.5]
	14		0	0	0	0	
	14.5		30	2	0.02031	0.04061	0.02836
	16		41	11	0.01354	0.16245	0.04626
	17		49	19	0.01015	0.24367	0.05140
	18	0	57	27	0.01015	0.32490	0.05608
	19	1	5	35	0.01015	0.40612	0.06015
	20	1	13	43	0.01015	0.48735	0.06371
	21	1	21	51	0.01015	0.56857	0.06685
	22	1	27	57	0.01354	0.64980	0.07087
	24	1	42	72	0.01083	0.81225	0.07602
	26	1	59	89	0.00956	0.97470	0.07938
	28	2	15	105	0.01015	1.13715	0.08270
	30	2	35	125	0.00812	1.29960	0.08422
	32	2	48	138	0.01250	1.46205	0.08783
	34	3	5	155	0.00956	1.62450	0.08984
	36	3	22	172	0.00956	1.78695	0.09166
	38	3	45	195	0.00706	1.94940	0.09188
	40	4	6	216	0.00774	2.11185	0.09262
	45	4	56	266	0.00812	2.51797	0.09488
	48	5	25	295	0.00840	2.76164	0.09626
	51	5	56	326	0.00786	3.00532	0.09722
	54	6	26	356	0.00812	3.24899	0.09827
	57	6	56	386	0.00812	3.49267	0.09924
	60	7	29	419	0.00738	3.73634	0.09979
	63	8	3	453	0.00717	3.98002	0.10021
	66	8	36	486	0.00738	4.22369	0.10074
	69	9	10	520	0.00717	4.46736	0.10115
	72	9	47	557	0.00659	4.71104	0.10128
	75	10	23	593	0.00677	4.95471	0.10151
	78	10	57	627	0.00717	5.19839	0.10192
	81	11	37	667	0.00609	5.44206	0.10185
	84	12	16	706	0.00625	5.68574	0.10189
	87	12	56	746	0.00609	5.92941	0.10187
19.3	93	14	16	826	0.00609	6.41676	0.10192
20	93.7	14	25	835	0.00632	6.47362	0.10194
22	95.7	14	51	861	0.00625	6.63607	0.10201
26	99.7	16	10	940	0.00411	6.96097	0.10068
29	102.7	17	6	996	0.00435	7.20464	0.09999
32	105.7	18	4	1054	0.00420	7.44832	0.09929
35	108.7	19	4	1114	0.00406	7.69199	0.09857
38	111.7	20	2	1172	0.00420	7.93566	0.09802
41	114.7	21	2	1232	0.00406	8.17934	0.09745
44	117.7	22	3	1293	0.00399	8.42301	0.09690
47	120.7	23	5	1355	0.00393	8.66669	0.09638
50	123.7	24	3	1413	0.00420	8.91036	0.09603
53	126.7	25		1470	0.00427	9.15404	0.09575
56	129.7	26	8	1538	0.00358	9.39771	0.09516
59	132.7	27	8	1598	0.00406	9.64138	0.09486
62	135.7	28	12	1662	0.00381	9.88506	0.09447
67	140.7	29	57	1767	0.00387	10.29118	0.09393
70	143.7	31	1	1831	0.00381	10.53486	0.09362
74	147.7	32	24	1914	0.00391	10.85976	0.09329
77	150.7	33	31	1981	0.00364	11.10343	0.09296
80	153.7	34	57	2067	0.00283	11.34711	0.09223
83	156.7	35	41	2111	0.00554	11.59078	0.09246

Regression Output:

	Regression Output:	
Constant		-0.19674321
Std Err of Y Est		0.10967356
R Squared		0.93537112
No. of Observations		13
Degrees of Freedom		11
Degrees of Freedom		3
X Coefficient(s)	0.11961837	
Std Err of Coef.	0.00948032	





Infiltration on Yucca Mountain, NV
06/08/97

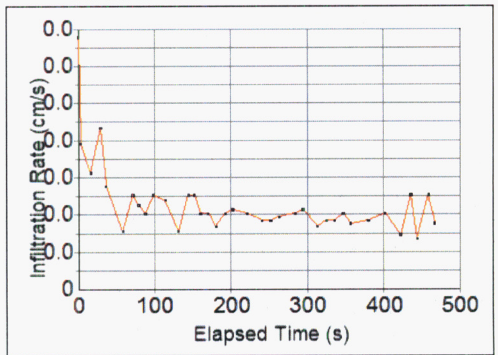
Ponded		A [cm^2]
r(res)=[cm	2.85	25.51759
r(base)=	10	314.16

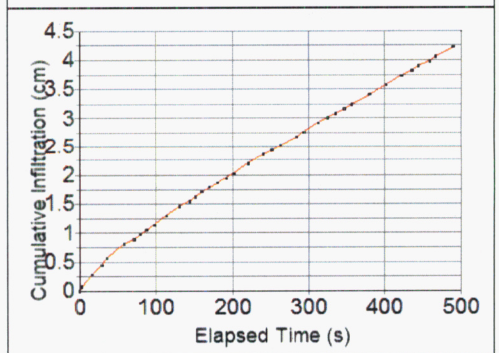
Ks	0.00609 [cm/s]
Alpha	0.50984 1/cm
i(f)	0.00761 cm/s
S(bar)	0.09322 cm/s^.5
S(bar1)	0.09363

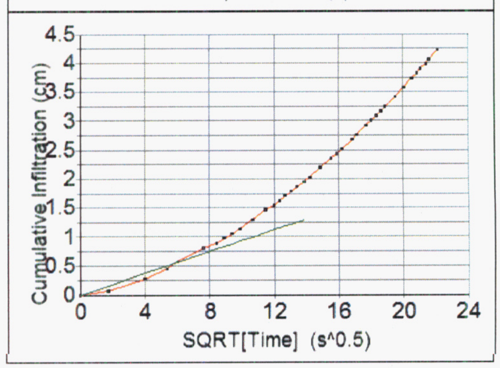
Regression Output:		
Constant		-0.04298
Std Err of Y Est		0.052266
R Squared		0.964202
No. of Observations		5
Degrees of Freedom		3
Degrees of Freedom		3
X Coefficient(s)	0.093222	
Std Err of Coef.	0.010371	
Std Err of Coef.	0.005774	

Scree #1
dTheta 0.4 [cm^3/cm^3]
Ponded

h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	Long-Term S [cm/s^.5]
2	9	0	0		0	
3		3	3	0.02707	0.08122	
5.5		16	16	0.01562	0.28429	0.06453
7.5		29	29	0.01250	0.44674	0.07188
9		36	36	0.01741	0.56857	0.07957
12		58	58	0.01108	0.81225	0.08470
13	1	11	71	0.00625	0.89347	0.08279
14	1	19	79	0.01015	0.97470	0.08425
15	1	28	88	0.00902	1.05592	0.08515
16	1	38	98	0.00812	1.13715	0.08561
18	1	54	114	0.01015	1.29960	0.08819
20	2	11	131	0.00956	1.46205	0.09015
21	2	24	144	0.00625	1.54327	0.08963
22	2	32	152	0.01015	1.62450	0.09072
23	2	40	160	0.01015	1.70572	0.09176
24	2	50	170	0.00812	1.78695	0.09220
25	3	0	180	0.00812	1.86817	0.09264
26	3	12	192	0.00677	1.94940	0.09259
27	3	22	202	0.00812	2.03062	0.09305
29	3	41	221	0.00855	2.19307	0.09414
31	4	1	241	0.00812	2.35552	0.09498
32	4	12	252	0.00738	2.43674	0.09520
33	4	23	263	0.00738	2.51797	0.09542
35	4	44	284	0.00774	2.68042	0.09603
36	4	54	294	0.00812	2.76164	0.09642
38	5	13	313	0.00855	2.92409	0.09732
39	5	25	325	0.00677	3.00532	0.09737
40	5	36	336	0.00738	3.08654	0.09758
41	5	47	347	0.00738	3.16777	0.09779
42	5	57	357	0.00812	3.24899	0.09813
44	6	20	380	0.00706	3.41144	0.09840
46	6	42	402	0.00738	3.57389	0.09880
48	7	2	422	0.00812	3.73634	0.09943
49	7	16	436	0.00580	3.81757	0.09928
50	7	24	444	0.01015	3.89879	0.09981
51	7	39	459	0.00541	3.98002	0.09955
52	7	47	467	0.01015	4.06124	0.10007
54	8	10	490	0.00706	4.22369	0.10033
56	8	32	512	0.00738	4.38614	0.10068
58	8	56	536	0.00677	4.54859	0.10084
60	9	18	558	0.00738	4.71104	0.10119
62	9	41	581	0.00706	4.87349	0.10143
64	10	2	602	0.00774	5.03594	0.10185
66	10	25	625	0.00706	5.19839	0.10208
68	10	47	647	0.00738	5.36084	0.10239







Trip on May 14-18, 1998

Primary information sources:

Memo and spreadsheet from Dani Or (tripreport5_20_98.wpd and infil598.wb3)
Field Notebook #255 (Fedors) pages 42-88, especially pages 43 and 84-87.
Field Notebook #175 (Stothoff) pages 56-67, especially page 61.

Staff included myself, Dani Or, Stu Stothoff, and David Groenveld. Most of the tests are documented in Dani Or's memo and spreadsheet. For the measurements on bedrock, 4 are mentioned in Dani's memo with additional details in SciNtbk #255, and 2 other measurements are listed SciNtbk #255, and 1 additional measurement in SciNtk#175.

Memo from Dani Or (file name tripreport5_20_98.wpd):

==beginning of memo =====

June 2, 1998

Subject: Field campaign to Yucca Mountain to characterize a small watershed for subsequent detailed studies.
Date: May 15 through 18, 1998
Author: Dani Or

Background and objectives:
A significant proportion of the proposed repository footprint in Yucca Mountain (YM) is comprised of steep sloping surfaces (typical slope angle in the range of 20° to 26°). Several aspects of infiltration processes on hillslopes are different than infiltration behavior on flat surfaces. The role of hillslope processes was limited by over-simplifications required for watershed-scale models on the one hand, and by 1-D modeling of detailed infiltration on the other. To improve deep infiltration predictions for YM, a better coupling between detailed hydrological processes on hillslopes and watershed overland flow models is needed. The primary objective of this field campaign was to identify and characterize the hydraulic properties of a small watershed for subsequent detailed studies. This effort would help elucidate interactions between surface cover (soil, talus, bedrock), position in the landscape (wash bottom, lower slope) and the potential for higher than average infiltration at a location (i.e., "hot spot").

Field measurements
Infiltration on exposed bedrock and cracks - An important parameter for watershed-scale overland flow modeling is the infiltration rate at the bottom of channels and washes. Of particular interest was the infiltration rate into sections of exposed bedrock through cracks and fissures. To measure infiltration rates into exposed bedrock we used rectangular plastic boxes (with an area of approx. 1700 cm^2) attached to the bedrock with silicon cement. An alternate method was based on ponding water in large cracks and measuring infiltration rates directly.

Table 1: Infiltration into exposed bedrock and cracks.

Location	Meas. type	Average flux (cm/h)	Crack flux (cm/h)	
(1) Lower confluence	infiltrometer	0.124	1.25	Est. crack area - 10%
(2) North wash	infiltrometer	2.64	21.19	Measured crack area - 12.4%

(3) North wash	direct ponding	NA	1.93	
(4) North wash (5m downslope)	direct ponding	NA	4.62	
	Mean	1.4	7.25	

The results summarized in Table 1 show that (i) the infiltration rate into the bedrock matrix is negligibly small; and (ii) the average flux into the cracks is of the same order as infiltration into soils. In fact, virtually all the cracks and fissures were filled with other porous material (either soil or calcite).

Infiltration on slopes and terraces - We used disc infiltrometers to characterize infiltration on various landforms (mostly slopes and terraces). The relatively wet conditions induced by recent rainfall events interfered with the measurement of infiltration transient behavior required for estimation of sorptivity and the parameter α (also known as the sorptive length parameter, is used in the Gardner (1958) conductivity model: $K(h)=K_s \exp(\alpha h)$). A limited number of soil water content measurements indicated that the gravimetric soil water content was between 0.1 and 0.15 kg/kg (or by assuming a bulk density of 1.35 kg/m^3 , the volumetric water content was between 0.135 and 0.2 m^3/m^3). Because of these relatively wet conditions, the values of the parameter α and sorptivity are uncertain, and only the value of Ks which is less sensitive to wet conditions is estimated with some confidence. The results are summarized in Table 2 below.

Table 2: Infiltration Data for Watershed Study (YM)

Site		**Ks [cm/h]**	**α [cm^{-1}]**	**Sorptivity† [cm s$^{1/2}$]**
Middle Terrace #1		*12.52*	0.301	0.043
Middle Terrace #2		*60.00*	0.787	0.063
Western Terrace #1		*8.68*	0.121	0.070
Western Terrace #2		*17.42*	0.402	0.050
Western Terrace #3		*15.56*	0.419	0.049
Western Terrace #4		*23.77*	0.510	0.056
NF Slope #1		*5.78*	0.718	0.017
NF Slope #2		*20.35*	0.446	0.048
SF Slope #1		*22.54*	0.683	0.057
SF Slope #2		*39.34*	0.625	0.0784
Top Watershed #1		*17.50*	0.578	0.0366
	Mean	**22.1**	0.508	0.052

† Initial water content was relatively high, $\theta v \approx 0.2\ m^3/m^3$.

The variability in Ks data is relatively small considering the diversity of the landforms. This narrow range suggests that the saturated conductivity on YM is controlled by the fine aeolian soil material which covers all the slopes and surfaces.

Criteria for potential infiltration "hot-spots"

A discussion was initiated on developing semi-quantitative criteria for potential sites with enhanced infiltration into underlying bedrock (i.e., "hot spots"). The general conditions for enhanced infiltration under present climatic scenario may be attributed to evaporation shelters (such as talus piles), the presence of densely fractured bedrock, and the potential for lateral diversion of surface fluxes. With these considerations in mind we identify areas with a combination of such conditions as potential "hot spots". For example:

(1) Talus piles on lower portion of a hillslope coupled with fine aeolian material at the base of the pile (for storage), overlaying densely fractured bedrock.

(2) Soil cover over densely fractured bedrock at lower portion of a slope or on wash bottom.

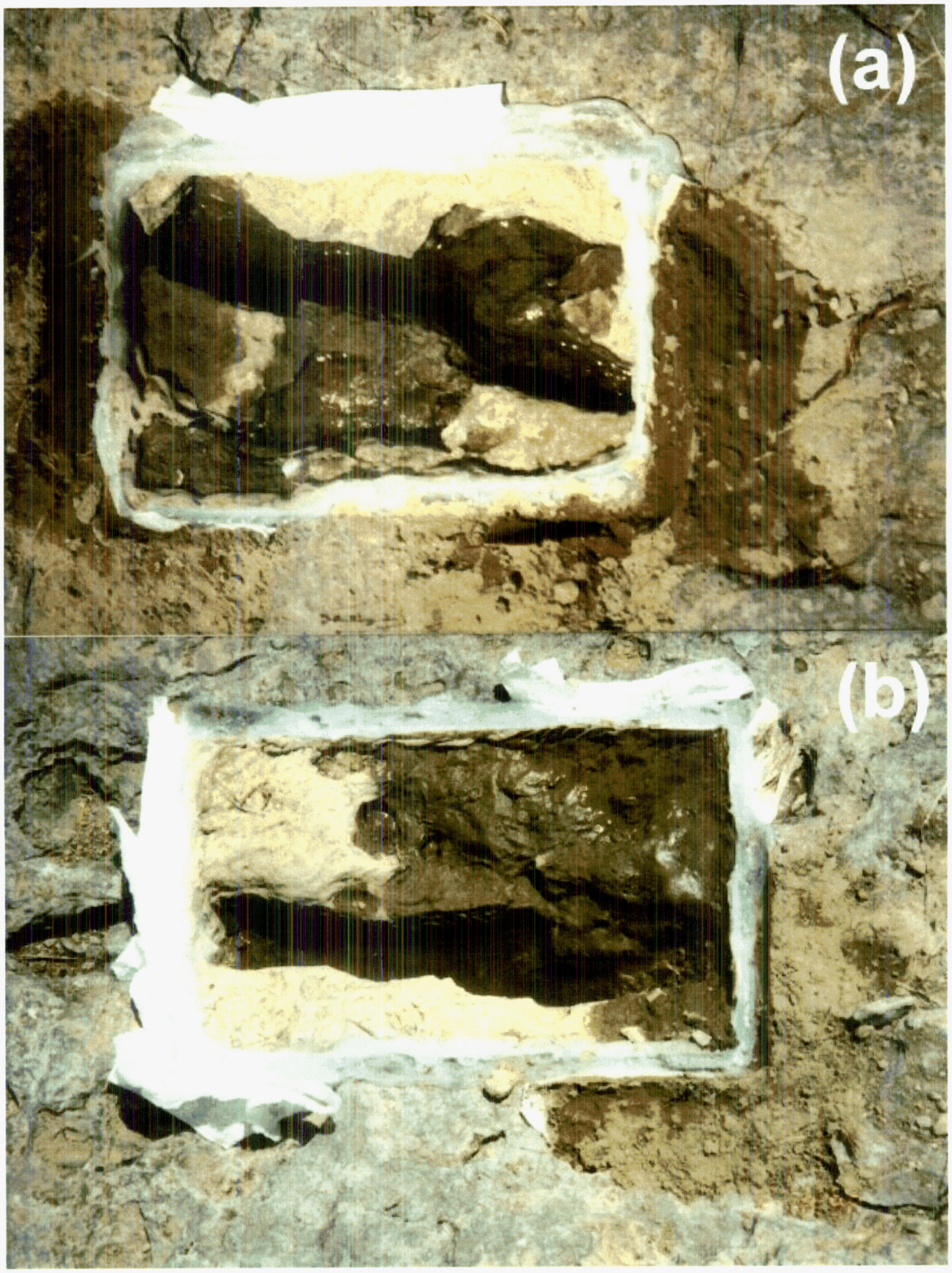
Checkerboard model for hillslopes on YM

Heterogeneous surface covers on YM hillslopes are likely to affect many surface hydrological processes ranging from energy balance to infiltration and overland flow. We propose to investigate the effect of different surface covers on infiltration and lateral flow processes using cascading 1-D modeling approach. The basic steps in the proposed modeling effort include: (1) Definition of a few characteristic cover types such as: exposed bedrock, soil or colluvium cover, talus or scree piles; and relation to hillslope position and bedrock fracture characteristics (density, aperture, filling, and patterns; proportion and sequence on the hillslope); (2) Develop approximations for lateral exchange processes that are compatible with a cascading 1-D model; and (3) Testing the approximations with a full 2-D model (including an overland flow component?). A detailed outline for this modeling effort will be developed in the next month.

== end of memo ====

No more entries this page.

Photographs of the cracks in Case 3 and 4 of Dani's memo are shown below (a and b). Scale: the width of the supply area in Case 3 (photo a) is 42 cm, and in Case 4 is 36 cm.



Dani Or's spreadsheet (infil598.wb3) with the recorded readings of depth and time for each test are included as tables below.

Infil598.wb3 file has three worksheets: "Slopes," "Terraces," and "cracks."

Cracks worksheet:

Infiltration into Fissured Bedrock on Wash Bottom (5/18/97)

DPG(5/17) - lower confluence bedrock

	Case 1	Green box	A=	1622.4	cm^2	Crack area=10%		
		Time (min)	h(cm)	av. flux (cm/h)		crack flux	(cm/h)	
-1	03:08 AM	8	4.4	0.12465		1.2465		
	05:40 AM	160	4.1					

DPG(5/17) - lower confluence bedrock south wash bedrock This was measured! (see case 4)

	Case 2	Clear Box	A=	1734 cm^2	Crack area=	0.124567
	Time (min)	h(cm)	Flux(cm/min)	0.95		
-2	13	52.35				
	34	51.2	0.05764	av. flux (cm/h)	crack flux (cm/h)	
	50	51	0.013157	2.63972	21.19112	
	66	50.07	0.061184			

Infiltration into Fissures (5/18/97) (no infiltrometer)

North wash upper confluence

	Case 3	Crack area	240	cm^2	
-3	Time (min)	h(cm)	Flux(cm/h)		
	54	29.8			
	63.5	29.5	1.89473	avg Flux(cm/h)	
	80.5	29	1.76470	1.925697	
	97.5	28.4	2.11764		

5m downslope

	Case 4	Crack area	216	cm^2	
	Time (min)	h(cm)	Flux(cm/h)		
-4	6	69.9			
	19.75	68.7	5.23636	avg Flux(cm/h)	
	28	68.1	4.363636	4.62857	
	35	67.6	4.28571		

Cases 3 and 4 are also described in SciNtbk #255, pages 84-85. Two other tests were recorded in SciNtbk #255, but not mentioned in Dani's memo or spreadsheet. The data and descriptions are found in SciNtbk #255 pages 86-87. The next table below summarizes all available data and compares the overlapping entries for Dani's Cases 3 & 4 and SciNtbk#255 pages 84-85. One other measurement was found, Stothoff SciNtbk #175 page 61 recorded a test on fractured bedrock.

Page					UTM NAD27						Fedors'	Dani's Values	
Fedors,255	Dani	Location	Dani	Fedors'	See NOTE below		Rate 1	Rate 2	Rate 3	Rate 4	K estimate	bulk K	Crack only K
Stothoff,175	Number		Description	Description	Easting, m	Northing, m	cm/min	cm/min	cm/min	cm/min	cm/hr	cm/hr	cm/hr
#255, p.84	Case 3	Near flag at 500 m, in channel bedrock, near confluence of upper north and south channels	5/18/98; fissure in north wash, upper confluence, crack area 240 cm2	soil-filled fractures in lithophysal tuff, bulk permeab.	548170	4078412	0.030	0.030	0.035		1.90	n/a	1.926
#255, p.85	Case 4	5m from flag at 500m, in channel bedrock, near confluence of upper north and south channels	5/18/98; 5 m downslope from Case 3, crack area 36*6 = 216 cm2	soil-filled fractures in lithophysal tuff, ponded only in fracture	548170	4078412	0.087	0.073	0.071		4.29	n/a	4.629
#255, p.86		North upper channel, just below steep nonlith headwall (i.e., just east of contact with nonlith)		small-aperture fractures in lithophysal tuff, bulk permeab.	548020	4078450	0.075	0.100	0.089	0.055	3.27		
#255, p.87		North upper channel, just below steep nonlith headwall (i.e., just east of contact with nonlith)		small-aperture fractures in lithophysal tuff, bulk permeab.	548020	4078450	0.033	0.010	0.007		0.43		
	Case 1	Estimated from ArcView view, noting proximity to lower confluence (just upslope from confluence in north channel)	5/17/98, lower confluence bedrock, soil or caliche-filled fractures, green box, crack area10%		see Dani's infil598.wb3 file, "cracks" worksheet; estimated location 548,420 m and 4,078,384 m UTM NAD27 is approximate, location is +/- 50 m in the channel							0.12465	1.2465
	Case 2	Estimated from ArcView view, noting proximity to lower confluence (just upslope from confluence in south channel)	5/17/98, south wash bedrock, soil or caliche filled fractures, clear box, crack area =12.46%		see Dani's infil598.wb3 file, "cracks" worksheet; confluence is at 548,550 m and 4,078,337 m UTM NAD27, south channel starts here, measurement location is upstream from here a short (unspecified) distance							2.6397	21.19
[#175, p.61]		channel fractures, natural depression ~49cm x 49cm, 15+ m south of confluence					0.0286	0.0200	0.0280	0.0180	1.275		
								stothoff sci ntbk p. 61					
Matched times and depths between Fedors SciNtbk 255 with entries in Dani's spreadsheet (infil598.wb3)							time, minutes	depth, cm	rate, cm/min				
							1.5	8					
NOTE:							5	7.9					
Easting and Northing approximated in 2007, usnig maps and descriptions in scientific notebooks							10	7.8					
Easting and Northing of upper confluence in north branch of Split Wash							35	7.1					
548130 m & 4078418 m							85	6.2					
							no crack area recorded, just ~49cmx49cm						

Locating approximate locations of tests on bedrock fractures and joints was done with the aid of ArcView (except for airphotos from Groeneveld's plane) and the following files. All the files were originally in subdirectories of .\E_Drive.\AVData* but were consolidated to .\SplitWash* for archiving of the supporting files of this scientific notebook. Note that ArcView will need to recreate the project using these file (path locations are impt). These files are in UTM NAD27 (m) except one of the IKONOS images as noted below.

.\WatershedGrid\Grids-Save\channels1.shp
.\WatershedGrid\AlongContacts\geo_contacts.shp
.\WatershedGrid\Grids-Save\outline1.shp
.\Topo-YM-ci10\top10ci (arc)
.\Soils\IKONOS\po_94511_red_0000000.bil (UTM NAD83, note shift with NAD27)
.\Soils\IKONOS\sw_jun2002red.bil
.\DOQ\airfoto_nw27.bip
.\WDay\CB\geol_utm.shp
.\Groen\Photos\splitwash-wash.pdf (not geo-referenced, for qualitative inspection only)
Composite of Groeneveld's photos from his plane (flighth1.tif, flighth2.tif, flighti1.tif and flighti2.tif)

Dani's other measurements during this trip included permeameter measurements on various ridges and sideslopes. The results of these tests and their geomorphic position are included in his memo (included above). Here (below), the calculations, including the readings from the field, are included from his spreadsheet infil598.wbs, worksheets "Slopes" and "Terraces."

All these measurements are from the work in upper Split Wash. The "Terrace" locations are on the terrace deposits next to the channel from the lower confluence and upwards toward the northern upper confluence; i.e., from the lower confluence (548,550 m and 4,078,337 m UTM NAD27) up to approximately 548,392 m and 4,078,400 m. The "Slopes" locations are from various north- and south-facing hillslope locations in upper Split Wash, and one location on the broadslope of the YM crest.

Calculations of permeability, sorptivity (S), and Gardner alpha (α) in the infil598.wb3 spreadsheet are the same as described on volume VI pages 25-26 of this SciNtbk (#432), except that the final sorptivity value reported is an average of two approaches. The first approach is the same as described earlier. The second approach calculates sorptivity as

$$S = \frac{r_{base}\,\Delta\theta^2}{1.31\sqrt{t}}\left(\frac{1+2.63\,I}{r_{base}\,\Delta\theta^2}\right)^{-1/2}$$

This equation for sorptivity is calculated at each time step. The representative value recorded for this approach is the average for intermediate to long times (exclude first few data points). The resulting representative value is smaller than the value calculated using the slope of the cumulative infiltration data (as a function of the square root of time).

Also, the change in water content in the calculations was varied according to the measurements referred to Dani's memo of June 2, 1998 (include several pages back). The value of $\Delta\theta$ used for the north-facing slopes was 0.1025, for south-facing slopes was 0.1935 (makes sense that south-facing is drier), and for terrace and caprock area was 0.135.

First, the data from the "Slopes" worksheet, followed by the worksheets from the "Terraces" worksheet:

North Facing Slope #1

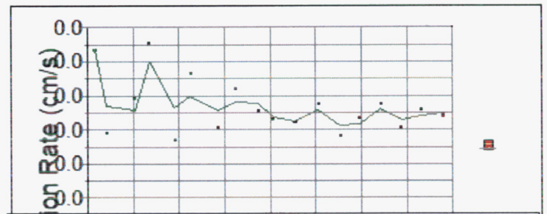
`(small colluvial lobe)

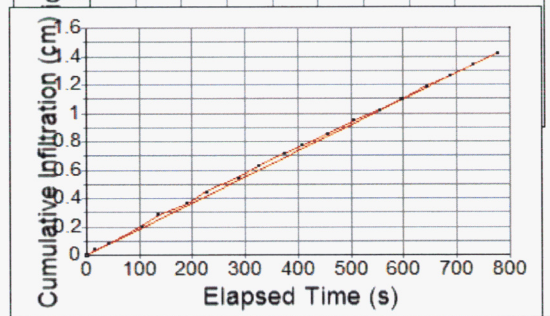
Infiltration on Yucca Mountain, NV
05/17/98

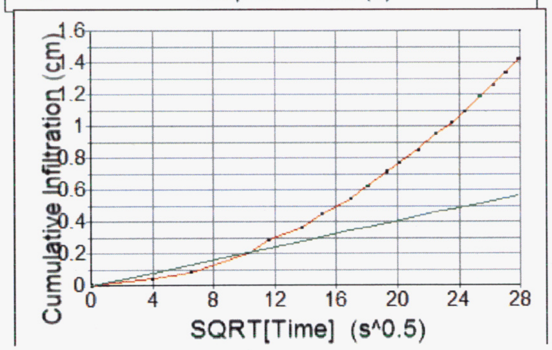
	Ponded			A [cm^2]				Ks(cm/h)	
	r(res)=[cm		2.85	25.51759	Ks	0.001605	[cm/s]	5.778693	
	r(base)=		10	314.16	Alpha	0.717886	1/cm		
tgrav	r(base)=		10	314.16					
161.7256		Thetas		0.33	i(f)	0.001733	cm/s	Mean S	
tg (s)		**Thetai**		0.2275	S(bar)	0.020413	cm/s^.5	0.017158	
3568.774		dTheta		0.1025 [cm^3/cm^3]	S(bar1)	0.013902			

Constant	0
Std Err of Y Est	0.040427
R Squared	0.883423
No. of Observations	5
Degrees of Freedom	4
X Coefficient(s)	0.020413
Std Err of Coef.	0.002346

Sqrt(time)	Model	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
0	0	1.5	0	0	0		0	
4	0.081654	2	0	16	16	0.002538	0.040612	
6.480741	0.132294	2.5	0	42	42	0.001562	0.081225	0.009178
10.19804	0.208177	4	1	44	104	0.001965	0.203062	0.011532
11.61895	0.237183	5	2	15	135	0.00262	0.284287	0.012762
13.78405	0.28138	6	3	10	190	0.001477	0.365512	0.012718
15.0333	0.306881	7	3	46	226	0.002256	0.446736	0.013286
16.91153	0.345223	8.2	4	46	286	0.001624	0.544206	0.013392
18.02776	0.368009	9.2	5	25	325	0.002083	0.625431	0.013707
19.33908	0.394777	10.3	6	14	374	0.001823	0.714778	0.013879
20.17424	0.411826	11	6	47	407	0.001723	0.771636	0.013943
21.33073	0.435434	12	7	35	455	0.001692	0.852861	0.014015
22.49444	0.459189	13.2	8	26	506	0.001911	0.95033	0.014186
23.5372	0.480476	14.1	9	14	554	0.001523	1.023433	0.014173
24.41311	0.498356	15	9	56	596	0.001741	1.096535	0.014237
25.35744	0.517633	16.1	10	43	643	0.001901	1.185882	0.014357
26.22975	0.53544	17	11	28	688	0.001624	1.258985	0.014378
27.0555	0.552296	18	12	12	732	0.001846	1.340209	0.014459
27.89265	0.569385	19	12	58	778	0.001766	1.421434	0.014516







North Facing Slope #2

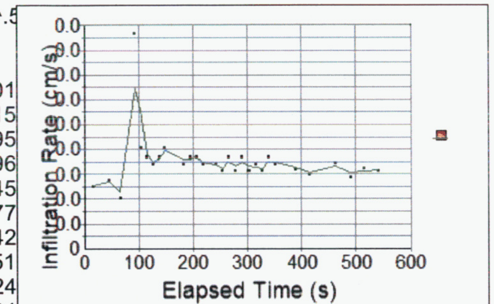
Infiltration on Yucca Mountain, NV
05/18/98
Ponded

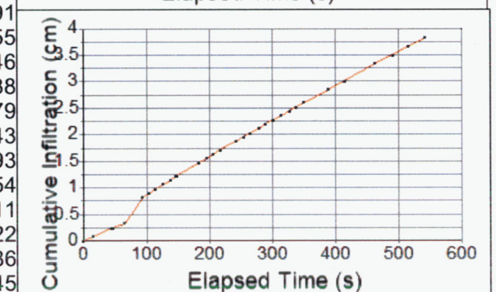
			A [cm^2]				Ks(cm/h)
	r(res)=[cm	2.85	25.51759	Ks	0.005653 [cm/s]		20.35216
	r(base)=	10	314.16	Alpha	0.446463 1/cm		
tgrav	r(base)=	10	314.16				
139.2291	Thetas		0.33	i(f)	0.00638 cm/s		Mean S
tg (s)	**Thetai**		0.2275	S(bar)	0.066707 cm/s^.5		0.048578
445.2093	dTheta		0.1025 [cm^3/cm^3]	S(bar1)	0.030449		

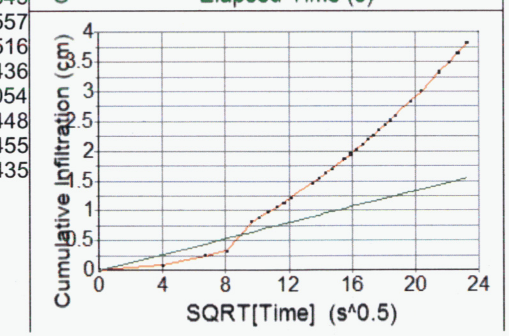
Regression Output:

Constant	0
Std Err of Y Est	0.198354
R Squared	0.720896
No. of Observations	6
Degrees of Freedom	5
X Coefficient(s)	0.066707
Std Err of Coef.	0.011054

Sqrt(time)	Model	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5
0	0	7	0	0	0		0	
4	0.266829	8	0	16	16	0.005077	0.081225	
6.708204	0.447486	10	0	45	45	0.005602	0.243674	0.019901
8.062258	0.537811	11	1	5	65	0.004061	0.324899	0.020115
9.643651	0.643301	17	1	33	93	0.017405	0.812248	0.030095
10.14889	0.677005	18	1	43	103	0.008122	0.893473	0.030296
10.67708	0.712239	19	1	54	114	0.007384	0.974698	0.030345
11.22497	0.748787	20	2	6	126	0.006769	1.055923	0.030277
11.7047	0.780788	21	2	17	137	0.007384	1.137147	0.030342
12.12436	0.808782	22	2	27	147	0.008122	1.218372	0.03051
13.52775	0.902399	25	3	3	183	0.006769	1.462047	0.030424
13.92839	0.929125	26	3	14	194	0.007384	1.543271	0.030491
14.31782	0.955102	27	3	25	205	0.007384	1.624496	0.030555
14.73092	0.982659	28	3	37	217	0.006769	1.705721	0.030546
15.52417	1.035575	30	4	1	241	0.006769	1.868171	0.030538
15.93738	1.063139	31	4	14	254	0.006248	1.949395	0.030479
16.27882	1.085915	32	4	25	265	0.007384	2.03062	0.030543
16.67333	1.112232	33	4	38	278	0.006248	2.111845	0.030493
17	1.134023	34	4	49	289	0.007384	2.19307	0.030554
17.37815	1.159248	35	5	2	302	0.006248	2.274295	0.030511
17.72005	1.182056	36	5	14	314	0.006769	2.355519	0.030522
18.08314	1.206277	37	5	27	327	0.006248	2.436744	0.030486
18.38478	1.226398	38	5	38	338	0.007384	2.517969	0.030545
18.70829	1.247978	39	5	50	350	0.006769	2.599194	0.030557
19.69772	1.31398	42	6	28	388	0.006412	2.842868	0.030516
20.37155	1.35893	44	6	55	415	0.006017	3.005318	0.030436
21.49419	1.433818	48	7	42	462	0.006913	3.330217	0.03054
22.13594	1.476628	50	8	10	490	0.005802	3.492667	0.030448
22.69361	1.513828	52	8	35	515	0.006498	3.655116	0.030455
23.25941	1.551571	54	9	1	541	0.006248	3.817566	0.030435







South Facing Slope #1

Infiltration on Yucca Mountain, NV
05/18/98
Ponded

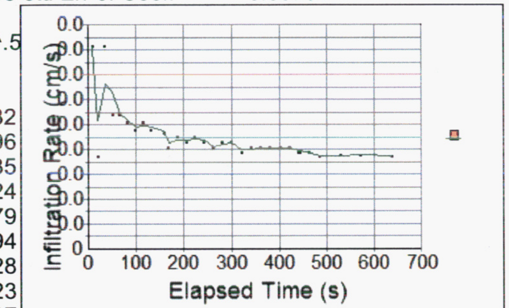
			A [cm^2]	
	r(res)=[cm	2.85	25.51759	
	r(base)=	10	314.16	
tgrav	r(base)=	10	314.16	
154.9022		Thetas	0.33	
tg (s)		**Thetai**	0.1365	
1161.85		dTheta	0.1935	[cm^3/cm^3]

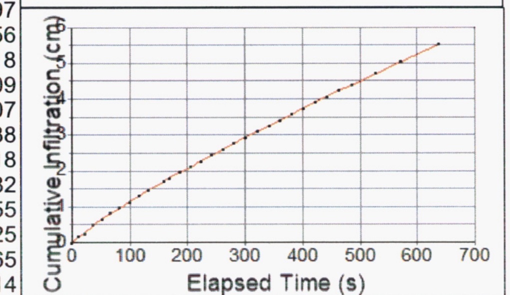
		Ks(cm/h)
Ks	0.006261 [cm/s]	22.53933
Alpha	0.68351 1/cm	
i(f)	0.007914 cm/s	Mean S
S(bar)	0.077923 cm/s^.5	0.056768
S(bar1)	0.035613	

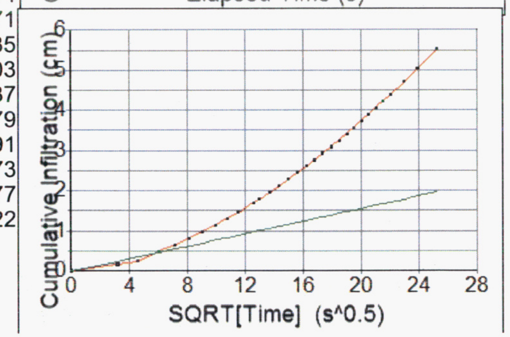
Regression Output:

Constant		0
Std Err of Y Est		0.085166
R Squared		0.892215
No. of Observations		5
Degrees of Freedom		4
X Coefficient(s)	0.077923	
Std Err of Coef.	0.00784	

Sqrt(time)	Model	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5
0	0	10	0	0	0		0	
3.162278	0.246415	12	0	10	10	0.016245	0.16245	
4.582576	0.357089	13	0	21	21	0.007384	0.243674	0.029132
6	0.46754	16	0	36	36	0.016245	0.487349	0.035196
7.141428	0.556484	18	0	51	51	0.01083	0.649798	0.035435
8.124038	0.633052	20	1	6	66	0.01083	0.812248	0.035724
9.055385	0.705626	22	1	22	82	0.010153	0.974698	0.035779
9.949874	0.775327	24	1	39	99	0.009556	1.137147	0.035694
10.72381	0.835634	26	1	55	115	0.010153	1.299597	0.035828
11.48913	0.895271	28	2	12	132	0.009556	1.462047	0.035823
12.56981	0.979481	31	2	38	158	0.009372	1.705721	0.035797
12.96148	1.010001	32	2	48	168	0.008122	1.786946	0.035656
13.63818	1.062732	34	3	6	186	0.009025	1.949395	0.035618
14.31782	1.115692	36	3	25	205	0.00855	2.111845	0.035509
14.93318	1.163643	38	3	43	223	0.009025	2.274295	0.035507
15.55635	1.212202	40	4	2	242	0.00855	2.436744	0.035438
16.18641	1.261299	42	4	22	262	0.008122	2.599194	0.035318
16.76305	1.306233	44	4	41	281	0.00855	2.761644	0.035282
17.32051	1.349671	46	5	0	300	0.00855	2.924093	0.035255
17.91647	1.396111	48	5	21	321	0.007736	3.086543	0.035125
18.46619	1.438946	50	5	41	341	0.008122	3.248992	0.035065
19	1.480543	52	6	1	361	0.008122	3.411442	0.035014
19.51922	1.521002	54	6	21	381	0.008122	3.573892	0.034971
20.02498	1.560413	56	6	41	401	0.008122	3.736341	0.034935
20.51828	1.598853	58	7	1	421	0.008122	3.898791	0.034903
21.0238	1.638244	60	7	22	442	0.007736	4.061241	0.034837
21.51743	1.67671	62	7	43	463	0.007736	4.22369	0.034779
22.02272	1.716083	64	8	5	485	0.007384	4.38614	0.034691
22.97825	1.790541	68	8	48	528	0.007556	4.711039	0.034573
23.89561	1.862025	72	9	31	571	0.007556	5.035938	0.034477
25.23886	1.966695	78	10	37	637	0.007384	5.523287	0.034322







South Facing Slope #2

Infiltration on Yucca Mountain, NV
05/18/98

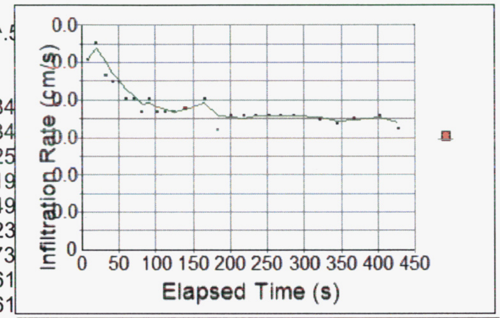
	Ponded			A [cm^2]			
	r(res)=[cm		2.85	25.51759	Ks	0.010929 [cm/s]	
	r(base)=		10	314.16	Alpha	0.62522 1/cm	
tgrav	r(base)=		10	314.16			
103.2797		Thetas		0.33	i(f)	0.014084 cm/s	
tg (s)		**Thetai**		0.1365	S(bar)	0.111065 cm/s^.5	
608.8471		dTheta		0.1935 [cm^3/cm^3]	S(bar1)	0.045775	

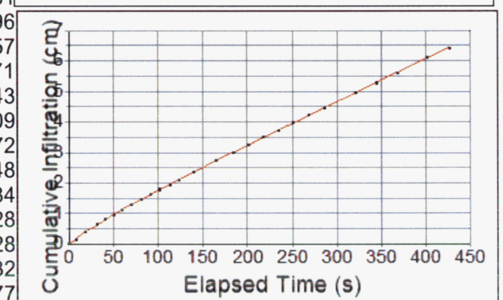
Ks(cm/h)	Mean S
39.34333	0.07842

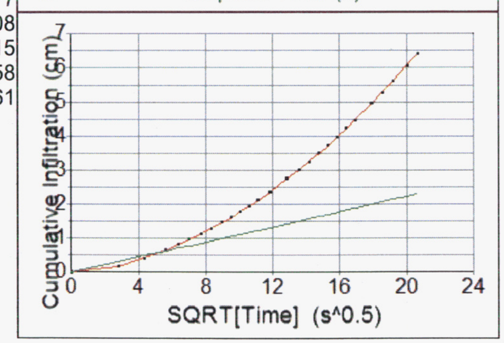
Regression Output:

Constant		0
Std Err of Y Est		0.099718
R Squared		0.911342
No. of Observations		5
Degrees of Freedom		4
X Coefficient(s)	0.111065	
Std Err of Coef.	0.009972	

Sqrt(time)	Model	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5
0	0	3	0	0	0		0	
2.828427	0.314138	5	0	8	8	0.020306	0.16245	
4.358899	0.48412	8	0	19	19	0.022152	0.406124	0.043084
5.656854	0.628277	11	0	32	32	0.018744	0.649798	0.044734
6.403124	0.711161	13	0	41	41	0.01805	0.812248	0.045325
7.071068	0.785346	15	0	50	50	0.01805	0.974698	0.045819
7.745967	0.860304	17	1	0	60	0.016245	1.137147	0.045849
8.3666	0.929234	19	1	10	70	0.016245	1.299597	0.045923
9	0.999582	21	1	21	81	0.014768	1.462047	0.04573
9.539392	1.05949	23	1	31	91	0.016245	1.624496	0.045861
10.0995	1.121699	25	1	42	102	0.014768	1.786946	0.045761
10.63015	1.180634	27	1	53	113	0.014768	1.949395	0.045696
11.13553	1.236764	29	2	4	124	0.014768	2.111845	0.045657
11.83216	1.314135	32	2	20	140	0.01523	2.355519	0.04571
12.84523	1.426652	37	2	45	165	0.016245	2.761644	0.046043
13.56466	1.506555	40	3	4	184	0.012825	3.005318	0.045709
14.17745	1.574614	43	3	21	201	0.014334	3.248992	0.045672
14.76482	1.639851	46	3	38	218	0.014334	3.492667	0.045648
15.32971	1.70259	49	3	55	235	0.014334	3.736341	0.045634
15.87451	1.763098	52	4	12	252	0.014334	3.980016	0.045628
16.40122	1.821597	55	4	29	269	0.014334	4.22369	0.045628
16.91153	1.878275	58	4	46	286	0.014334	4.467365	0.045632
17.91647	1.989888	64	5	21	321	0.013924	4.954713	0.045577
18.57418	2.062936	68	5	45	345	0.013537	5.279613	0.045508
19.18333	2.130591	72	6	8	368	0.014126	5.604512	0.045515
20.04994	2.226841	78	6	42	402	0.014334	6.091861	0.045558
20.66398	2.295039	82	7	7	427	0.012996	6.41676	0.045461







Lower caprock /Top of the Watershed #1

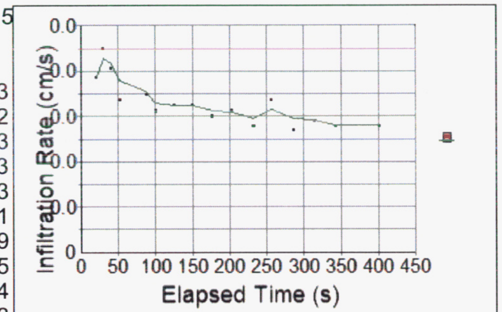
Infiltration on Yucca Mountain, NV
05/18/98

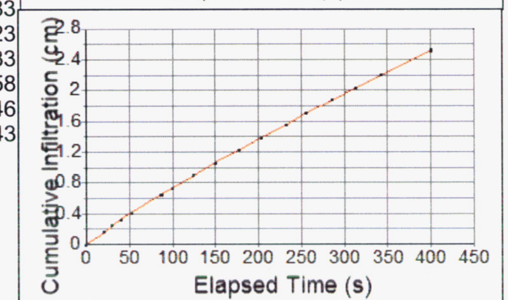
	Ponded		A [cm^2]			Ks(cm/h)	
	r(res)=[cm	2.85	25.51759	Ks	0.004861 [cm/s]	17.49816	
	r(base)=	10	314.16	Alpha	0.578116 1/cm		
tgrav	r(base)=	10	314.16				
87.35065	Thetas		0.33	i(f)	0.005602 cm/s	Mean S	
tg (s)	**Thetai**		0.195	S(bar)	0.045428 cm/s^.5	0.036611	
1359.716	dTheta		0.135 [cm^3/cm^3]	S(bar1)	0.027794		

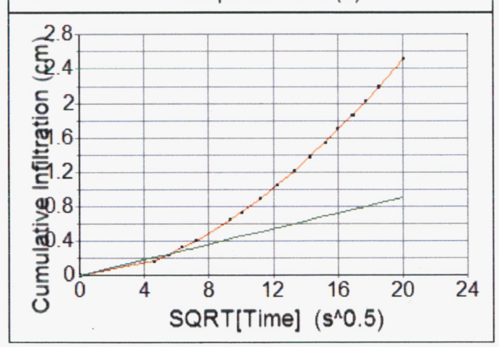
Regression Output:

Constant		0
Std Err of Y Est		0.034304
R Squared		0.938846
No. of Observations		4
Degrees of Freedom		3
X Coefficient(s)	0.045428	
Std Err of Coef.	0.003596	

Sqrt(time)	Model	h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5
0	0	21	0	0	0		0	
4.582576	0.208177	23	0	21	21	0.007736	0.16245	
5.477226	0.248819	24	0	30	30	0.009025	0.243674	0.024373
6.324555	0.287311	25	0	40	40	0.008122	0.324899	0.025642
7.211103	0.327585	26	0	52	52	0.006769	0.406124	0.026043
9.327379	0.423723	29	1	27	87	0.006962	0.649798	0.02713
10	0.454279	30	1	40	100	0.006248	0.731023	0.027213
11.18034	0.5079	32	2	5	125	0.006498	0.893473	0.027501
12.24745	0.556376	34	2	30	150	0.006498	1.055923	0.027749
13.30413	0.604379	36	2	57	177	0.006017	1.218372	0.027805
14.24781	0.647248	38	3	23	203	0.006248	1.380822	0.02794
15.23155	0.691937	40	3	52	232	0.005602	1.543271	0.027883
16	0.726847	42	4	16	256	0.006769	1.705721	0.028123
16.91153	0.768256	44	4	46	286	0.005415	1.868171	0.028033
17.72005	0.804985	46	5	14	314	0.005802	2.03062	0.028058
18.52026	0.841337	48	5	43	343	0.005602	2.19307	0.028046
20.02498	0.909693	52	6	41	401	0.005602	2.517969	0.028043







Middle Terrace - Site #1

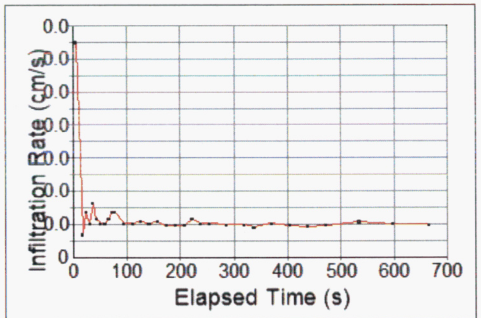
Infiltration on Yucca Mountain, NV
05/15/98

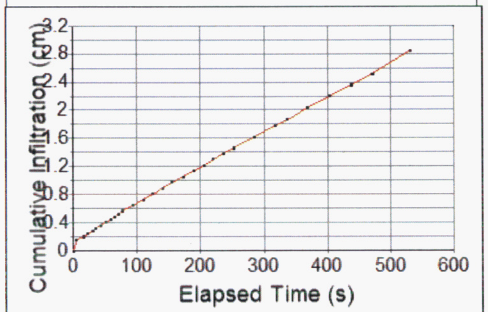
	Ponded		A [cm^2]			
	r(res)=[cm	2.85	25.51759	Ks	0.003479 [cm/s]	12.52344 cm/h
tgrav	r(base)=	10	314.16	Alpha	0.301463 1/cm	
234.05373	Thetas		0.33			
tg (s)	**Thetai**		0.195	i(f)	0.004948 cm/s	Mean S
643.44245	dTheta		0.135 [cm^3/cm^3]	S(bar)	0.05322 cm/s^.5	0.043158
	Ponded			S(bar1)	0.033096 cm/s^.5	Long-term

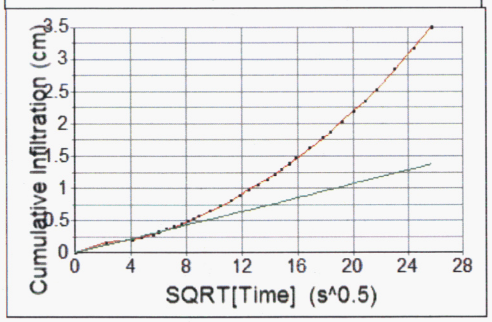
Regression Output:

Constant	Regression Output:	0.006454
Std Err of Y Est		0.02267
R Squared		0.973622
No. of Observations		8
Degrees of Freedom		6
Degrees of Freedom		3
X Coefficient(s)	0.05322	
Std Err of Coef.	0.003576	
Std Err of Coef.	0.005774	

Sqrt(time)		h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
		0		0	0	0	0	
0	0.006454	0	46	20	0	ERR	0	ERR
2.236068	0.125458	2	46	25	5	0.03249	0.16245	0.051562
4.1231056	0.225888	2.5	46	37	17	0.003384	0.203062	0.033152
4.7958315	0.26169	3	46	43	23	0.006769	0.243674	0.03264
5.5677644	0.302773	3.5	46	51	31	0.005077	0.284287	0.031455
6	0.325777	4	46	56	36	0.008122	0.324899	0.032116
6.5574385	0.355444	4.5	47	3	43	0.005802	0.365512	0.031928
7.1414284	0.386524	5	47	11	51	0.005077	0.406124	0.031545
7.6811457	0.415248	5.5	47	19	59	0.005077	0.446736	0.031314
8.1240384	0.438819	6	47	26	66	0.005802	0.487349	0.031411
8.4852814	0.458045	6.5	47	32	72	0.006769	0.527961	0.031739
8.8317609	0.476484	7	47	38	78	0.006769	0.568574	0.03204
9.6953597	0.522446	8	47	54	94	0.005077	0.649798	0.031875
10.488088	0.564635	9	48	10	110	0.005077	0.731023	0.031814
11.18034	0.601477	10	48	25	125	0.005415	0.812248	0.031939
11.874342	0.638412	11	48	41	141	0.005077	0.893473	0.031955
12.489996	0.671178	12	48	56	156	0.005415	0.974698	0.032095
13.152946	0.70646	13	49	13	173	0.004778	1.055923	0.032045
13.784049	0.740048	14	49	30	190	0.004778	1.137147	0.03202
14.387495	0.772163	15	49	47	207	0.004778	1.218372	0.032013
14.866069	0.797633	16	50	1	221	0.005802	1.299597	0.032235
15.394804	0.825773	17	50	17	237	0.005077	1.380822	0.032303
15.905974	0.852978	18	50	33	253	0.005077	1.462047	0.03237
16.911535	0.906494	20	51	6	286	0.004923	1.624496	0.032445
17.860571	0.957002	22	51	39	319	0.004923	1.786946	0.032525
18.35756	0.983452	23	51	57	337	0.004512	1.868171	0.032494
19.209373	1.028786	25	52	29	369	0.005077	2.03062	0.032626
20.07486	1.074848	27	53	3	403	0.004778	2.19307	0.032667
20.92845	1.120276	29	53	38	438	0.004641	2.355519	0.032675
21.725561	1.162699	31	54	12	472	0.004778	2.517969	0.032725
23.086793	1.235144	35	55	13	533	0.005326	2.842868	0.033039
24.454039	1.30791	39	56	18	598	0.004998	3.167768	0.033194
25.768197	1.37785	43	57	24	664	0.004923	3.492667	0.033309







Middle Terrace - Site #2

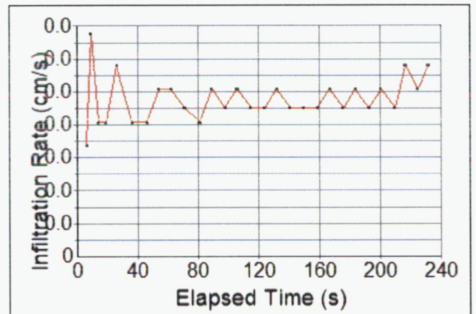
Infiltration on Yucca Mountain, NV
05/15/98

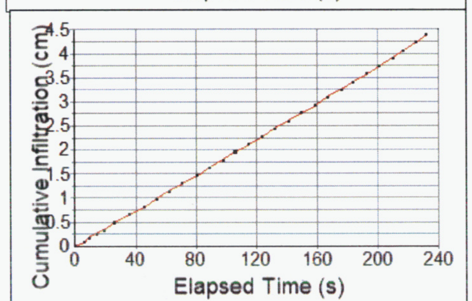
	Ponded		A [cm^2]	Ks	0.016664 [cm/s]	59.99171 cm/h		
	r(res)=[cm	2.85	25.51759	Alpha	0.787187 1/cm			
tgrav	r(base)=	10	314.16					
18.711327	Thetas		0.33					
tg (s)	**Thetai**		0.195	i(f)	0.01936 cm/s	Mean S		
350.74011	dTheta		0.135 [cm^3/cm^3]	S(bar)	0.072084 cm/s^.5	0.062927		
	Ponded			S(bar1)	0.053769 cm/s^.5	Long-term		

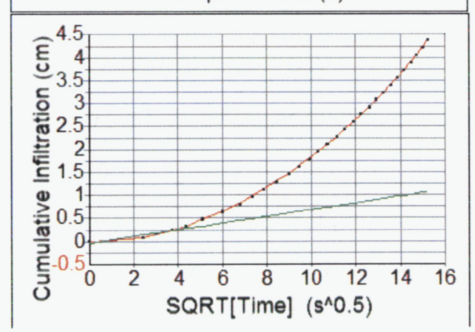
Regression Output:

Constant	Regression Output:	-0.0329
Std Err of Y Est		0.049551
R Squared		0.888352
No. of Observations		5
Degrees of Freedom		3
Degrees of Freedom		3
X Coefficient(s)	0.072084	
Std Err of Coef.	0.014754	
Std Err of Coef.	0.005774	

Sqrt(time)		h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
		0		0	0	0	0	
0	-0.0329	6	7	18	0	ERR	0	ERR
2.4494897	0.14367	7	7	24	6	0.013537	0.081225	0.026911
3	0.183353	8	7	27	9	0.027075	0.16245	0.038432
3.7416574	0.236815	9	7	32	14	0.016245	0.243674	0.041836
4.3588989	0.281309	10	7	37	19	0.016245	0.324899	0.044207
5.0990195	0.33466	12	7	44	26	0.023207	0.487349	0.050045
6	0.399607	14	7	54	36	0.016245	0.649798	0.051506
6.78233	0.456	16	8	4	46	0.016245	0.812248	0.052649
7.3484692	0.49681	18	8	12	54	0.020306	0.974698	0.054552
7.8740079	0.534693	20	8	20	62	0.020306	1.137147	0.056054
8.4261498	0.574494	22	8	29	71	0.01805	1.299597	0.056872
9	0.61586	24	8	39	81	0.016245	1.462047	0.057208
9.4339811	0.647143	26	8	47	89	0.020306	1.624496	0.058161
9.8994949	0.680699	28	8	56	98	0.01805	1.786946	0.058682
10.29563	0.709254	30	9	4	106	0.020306	1.949395	0.05942
10.723805	0.740119	32	9	13	115	0.01805	2.111845	0.05981
11.135529	0.769798	34	9	22	124	0.01805	2.274295	0.060162
11.489125	0.795287	36	9	30	132	0.020306	2.436744	0.06071
11.874342	0.823055	38	9	39	141	0.01805	2.599194	0.060989
12.247449	0.84995	40	9	48	150	0.01805	2.761644	0.061245
12.60952	0.87605	42	9	57	159	0.01805	2.924093	0.061481
12.922848	0.898636	44	10	5	167	0.020306	3.086543	0.061885
13.266499	0.923407	46	10	14	176	0.01805	3.248992	0.062081
13.56466	0.9449	48	10	22	184	0.020306	3.411442	0.062433
13.892444	0.968528	50	10	31	193	0.01805	3.573892	0.062597
14.177447	0.989073	52	10	39	201	0.020306	3.736341	0.062907
14.491377	1.011702	54	10	48	210	0.01805	3.898791	0.063047
14.73092	1.028969	56	10	55	217	0.023207	4.061241	0.06347
15	1.048366	58	11	3	225	0.020306	4.22369	0.063726
15.231546	1.065057	60	11	10	232	0.023207	4.38614	0.064105



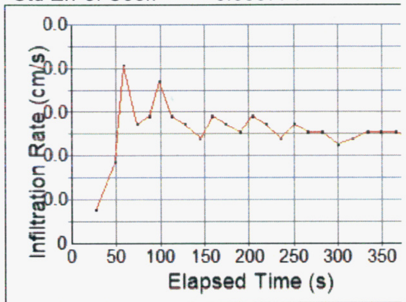


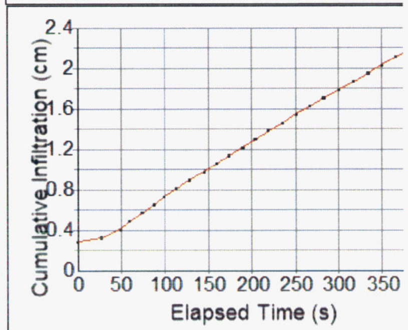


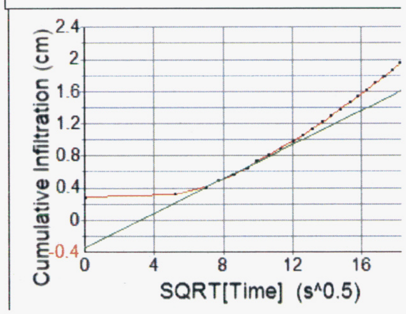
Western Terrace - Site #1

	Infiltration on Yucca Mountain, NV							
	05/17/98							
	Ponded		A [cm^2]					
	r(res)=[cm	2.85	25.51759		Ks	0.002411	[cm/s]	8.678842 cm/h
tgrav	r(base)=	10	314.16		Alpha	0.121003	1/cm	
1944.5076		Thetas	0.33					
tg (s)		**Thetai**	0.195		i(f)	0.004948	cm/s	Mean S
161.26469		dTheta	0.135	[cm^3/cm^3]	S(bar)	0.106308	cm/s^.5	0.069931
		Ponded			S(bar1)	0.033554	cm/s^.5	Long-term
Sqrt(time)		h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
		0		0	0	0	0	
0	-0.33747	3.5	2	0	0	ERR	0.284287	ERR
5.1961524	0.214922	4	2	27	27	0.001504	0.324899	0.037084
7	0.406685	5	2	49	49	0.003692	0.406124	0.032183
7.6811457	0.479096	6	2	59	59	0.008122	0.487349	0.033222
8.6023253	0.577024	7	3	14	74	0.005415	0.568574	0.032895
9.3808315	0.659785	8	3	28	88	0.005802	0.649798	0.032944
9.9498744	0.720279	9	3	39	99	0.007384	0.731023	0.033535
10.630146	0.792597	10	3	53	113	0.005802	0.812248	0.033592
11.313708	0.865265	11	4	8	128	0.005415	0.893473	0.033538
12.041595	0.942644	12	4	25	145	0.004778	0.974698	0.033291
12.60952	1.003019	13	4	39	159	0.005802	1.055923	0.033426
13.190906	1.064825	14	4	54	174	0.005415	1.137147	0.03346
13.784049	1.12788	15	5	10	190	0.005077	1.218372	0.033415
14.282857	1.180907	16	5	24	204	0.005802	1.299597	0.033552
14.798649	1.23574	17	5	39	219	0.005415	1.380822	0.033604
15.362291	1.29566	18	5	56	236	0.004778	1.462047	0.033516
15.84298	1.34676	19	6	11	251	0.005415	1.543271	0.033579
16.340135	1.399612	20	6	27	267	0.005077	1.624496	0.033579
16.822604	1.450902	21	6	43	283	0.005077	1.705721	0.033585
17.349352	1.506899	22	7	1	301	0.004512	1.786946	0.033484
17.832555	1.558267	23	7	18	318	0.004778	1.868171	0.03345
18.275667	1.605373	24	7	34	334	0.005077	1.949395	0.033474
18.708287	1.651364	25	7	50	350	0.005077	2.03062	0.0335
19.131126	1.696315	26	8	6	366	0.005077	2.111845	0.033526
19.570386	1.743012	27	8	23	383	0.004778	2.19307	0.03351
19.974984	1.786024	28	8	39	399	0.005077	2.274295	0.033539

Regression Output:		
Constant Regression Output:		-0.33747
Std Err of Y Est		0.010878
R Squared		0.994619
No. of Observations		5
Degrees of Freedom		3
Degrees of Freedom		3
X Coefficient(s)	0.106308	
Std Err of Coef.	0.004515	
Std Err of Coef.	0.005774	







Western Terrace - Site #2

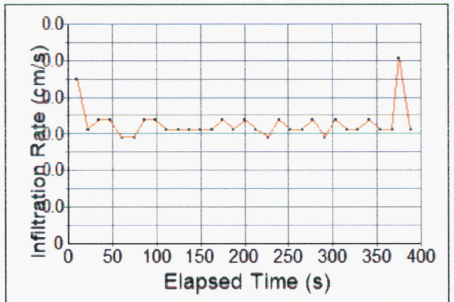
Infiltration on Yucca Mountain, NV
05/17/98

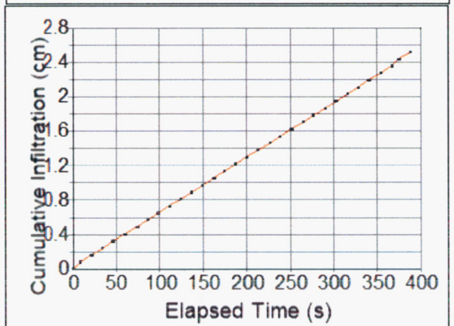
	Ponded		A [cm^2]					
	r(res)=[cm	2.85	25.51759	Ks	0.004839	[cm/s]	17.42029 cm/h	
tgrav	r(base)=	10	314.16	Alpha	0.402351	1/cm		
260.68898	Thetas		0.33					
tg (s)	**Thetai**		0.195	i(f)	0.00637	cm/s	MeanS	
298.5652	dTheta		0.135	[cm^3/cm^3] S(bar)	0.078129	cm/s^.5	0.054332	
	Ponded			S(bar1)	0.030536	cm/s^.5	Long-term	

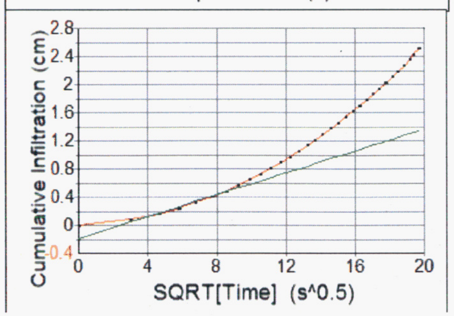
Regression Output:

Constant Regression Output:		-0.18769
Std Err of Y Est		0.026413
R Squared		0.981117
No. of Observations		7
Degrees of Freedom		5
Degrees of Freedom		3
X Coefficient(s)	0.078129	
Std Err of Coef.	0.004847	
Std Err of Coef.	0.005774	

Sqrt(time)		h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
		0		0	0	0	0	
0	-0.18769	2	0	8	0	ERR	0	ERR
3	0.046696	3	0	17	9	0.009025	0.081225	0.021973
4.6904158	0.178767	4	0	30	22	0.006248	0.16245	0.024581
5.8309519	0.267877	5	0	42	34	0.006769	0.243674	0.026846
6.78233	0.342207	6	0	54	46	0.006769	0.324899	0.028411
7.7459667	0.417495	7	1	8	60	0.005802	0.406124	0.029083
8.6023253	0.484402	8	1	22	74	0.005802	0.487349	0.029664
9.2736185	0.53685	9	1	34	86	0.006769	0.568574	0.030513
9.8994949	0.585749	10	1	46	98	0.006769	0.649798	0.031218
10.535654	0.635452	11	1	59	111	0.006248	0.731023	0.031671
11.135529	0.68232	12	2	12	124	0.006248	0.812248	0.032067
11.7047	0.726789	13	2	25	137	0.006248	0.893473	0.032418
12.247449	0.769193	14	2	38	150	0.006248	0.974698	0.032731
12.767145	0.809797	15	2	51	163	0.006248	1.055923	0.033013
13.228757	0.845862	16	3	3	175	0.006769	1.137147	0.033364
13.711309	0.883564	17	3	16	188	0.006248	1.218372	0.033592
14.142136	0.917224	18	3	28	200	0.006769	1.299597	0.033886
14.59452	0.952568	19	3	41	213	0.006248	1.380822	0.034074
15.066519	0.989445	20	3	55	227	0.005802	1.462047	0.034174
15.459625	1.020158	21	4	7	239	0.006769	1.543271	0.034412
15.874508	1.052573	22	4	20	252	0.006248	1.624496	0.034564
16.278821	1.084162	23	4	33	265	0.006248	1.705721	0.034707
16.643317	1.11264	24	4	45	277	0.006769	1.786946	0.034904
17.058722	1.145095	25	4	59	291	0.005802	1.868171	0.034968
17.406895	1.172297	26	5	11	303	0.006769	1.949395	0.035145
17.776389	1.201166	27	5	24	316	0.006248	2.03062	0.035256
18.138357	1.229446	28	5	37	329	0.006248	2.111845	0.035361
18.466185	1.255059	29	5	49	341	0.006769	2.19307	0.035513
18.814888	1.282303	30	6	2	354	0.006248	2.274295	0.035607
19.157244	1.309051	31	6	15	367	0.006248	2.355519	0.035696
19.364917	1.325276	32	6	23	375	0.010153	2.436744	0.036019
19.697716	1.351278	33	6	36	388	0.006248	2.517969	0.036094







Western Terrace - Site #3

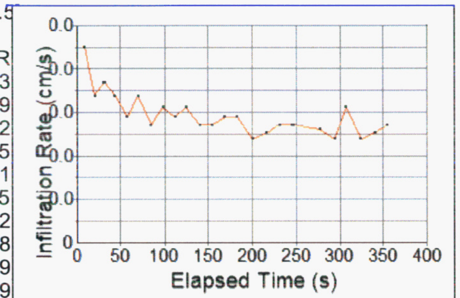
Infiltration on Yucca Mountain, NV
05/17/98

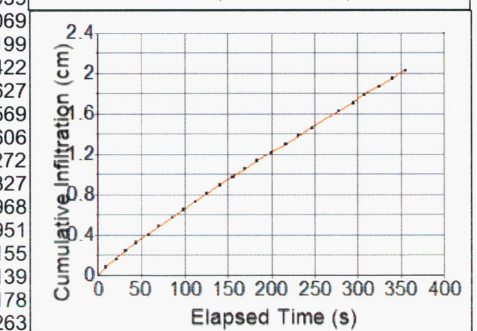
	Ponded		A [cm^2]					
	r(res)=[cm	2.85	25.51759	Ks	0.004044	[cm/s]	14.55871 cm/h	
tgrav	r(base)=	10	314.16	Alpha	0.419552	1/cm		
273.64649		Thetas	0.33					
tg (s)		**Thetai**	0.195	i(f)	0.005271	cm/s	MeanS	
407.22755		dTheta	0.135 [cm^3/cm^3]	S(bar)	0.066898	cm/s^.5	0.048641	
		Ponded		S(bar1)	0.030384	cm/s^.5	Long-term	

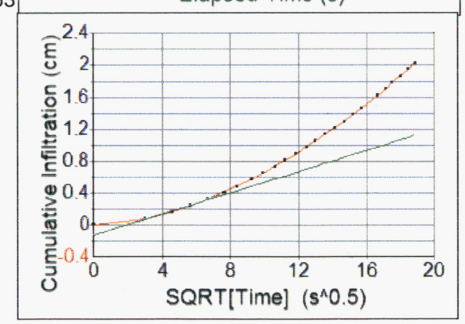
Regression Output:

Constant		-0.1293
Std Err of Y Est		0.015085
R Squared		0.986204
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	0.066898	
Std Err of Coef.	0.005595	

Sqrt(time)		h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
		0		0	0	0	0	
0	-0.1293	3	0	20	0	ERR	0	ERR
3	0.071395	4	0	29	9	0.009025	0.081225	0.021973
4.5825757	0.177266	5	0	41	21	0.006769	0.16245	0.025159
5.6568542	0.249134	6	0	52	32	0.007384	0.243674	0.027672
6.6332496	0.314453	7	1	4	44	0.006769	0.324899	0.02905
7.6157731	0.380182	8	1	18	58	0.005802	0.406124	0.029581
8.3666003	0.430411	9	1	30	70	0.006769	0.487349	0.0305
9.2195445	0.487472	10	1	45	85	0.005415	0.568574	0.030692
9.8994949	0.532959	11	1	58	98	0.006248	0.649798	0.031218
10.583005	0.578685	12	2	12	112	0.005802	0.731023	0.031529
11.18034	0.618646	13	2	25	125	0.006248	0.812248	0.031939
11.83216	0.662251	14	2	40	140	0.005415	0.893473	0.032069
12.4499	0.703577	15	2	55	155	0.005415	0.974698	0.032199
13	0.740378	16	3	9	169	0.005802	1.055923	0.032422
13.527749	0.775683	17	3	23	183	0.005802	1.137147	0.032627
14.142136	0.816785	18	3	40	200	0.004778	1.218372	0.032569
14.696938	0.8539	19	3	56	216	0.005077	1.299597	0.032606
15.198684	0.887466	20	4	11	231	0.005415	1.380822	0.03272
15.684387	0.919959	21	4	26	246	0.005415	1.462047	0.032827
16.643317	0.98411	23	4	57	277	0.00524	1.624496	0.032968
17.146428	1.017767	24	5	14	294	0.004778	1.705721	0.032951
17.521415	1.042853	25	5	27	307	0.006248	1.786946	0.033155
18	1.07487	26	5	44	324	0.004778	1.868171	0.033139
18.439089	1.104244	27	6	0	340	0.005077	1.949395	0.033178
18.841444	1.131161	28	6	15	355	0.005415	2.03062	0.033263







Western Terrace - Site #4

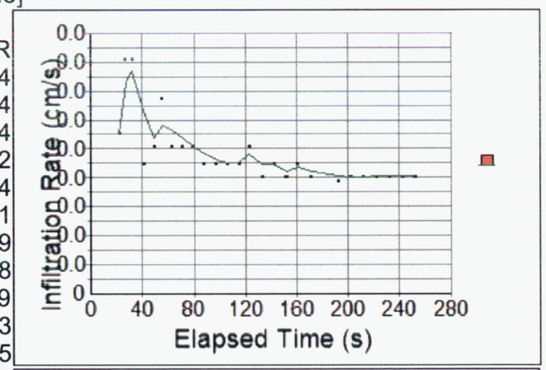
Infiltration on Yucca Mountain, NV
05/17/98
Ponded

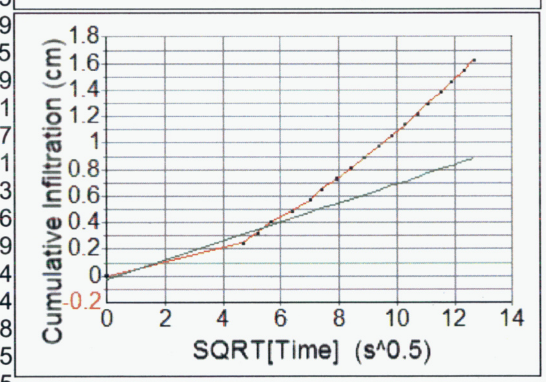
		A [cm^2]					
	r(res)=[cm	2.85	25.51759	Ks	0.006603	[cm/s]	23.77205 cm/h
tgrav	r(base)=	10	314.16	Alpha	0.510153	1/cm	
116.77425	Thetas		0.33				
tg (s)	**Thetai**		0.195	i(f)	0.008251	cm/s	MeanS
357.92524	dTheta		0.135 [cm^3/cm^3]	S(bar)	0.071357	cm/s^.5	0.056366
	Ponded			S(bar1)	0.041375	cm/s^.5	Long-term

Regression Output:

Constant		-0.0208
Std Err of Y Est		0.055256
R Squared		0.934512
No. of Observations		5
Degrees of Freedom		3
X Coefficient(s)	0.071357	
Std Err of Coef.	0.010906	

Sqrt(time)		h(cm)	t (sec)		time(s)	i(cm/s)	I (cm)	S [cm/s^.5]
		0		0	0	0	0	
0	-0.0208	1	0	0	0	ERR	0	ERR
4.6904158	0.313895	4	0	22	22	0.011076	0.243674	0.033374
5.1961524	0.349983	5	0	27	27	0.016245	0.324899	0.037084
5.6568542	0.382858	6	0	32	32	0.016245	0.406124	0.039824
6.4031242	0.436109	7	0	41	41	0.009025	0.487349	0.039852
7	0.478701	8	0	49	49	0.010153	0.568574	0.040424
7.4161985	0.5084	9	0	55	55	0.013537	0.649798	0.041671
7.9372539	0.545581	10	1	3	63	0.010153	0.731023	0.042039
8.4261498	0.580467	11	1	11	71	0.010153	0.812248	0.042378
8.8881944	0.613437	12	1	19	79	0.010153	0.893473	0.04269
9.3808315	0.64859	13	1	28	88	0.009025	0.974698	0.042733
9.8488578	0.681987	14	1	37	97	0.009025	1.055923	0.042795
10.29563	0.713868	15	1	46	106	0.009025	1.137147	0.042869
10.723805	0.744421	16	1	55	115	0.009025	1.218372	0.04295
11.090537	0.77059	17	2	3	123	0.010153	1.299597	0.043209
11.532563	0.802132	18	2	13	133	0.008122	1.380822	0.043121
11.916375	0.829519	19	2	22	142	0.009025	1.462047	0.043207
12.328828	0.858951	20	2	32	152	0.008122	1.543271	0.043151
12.688578	0.884622	21	2	41	161	0.009025	1.624496	0.043243
13.076697	0.912317	22	2	51	171	0.008122	1.705721	0.043206
13.856406	0.967955	24	3	12	192	0.007736	1.868171	0.043049
14.21267	0.993377	25	3	22	202	0.008122	1.949395	0.043044
14.56022	1.018177	26	3	32	212	0.008122	2.03062	0.043044
14.899664	1.042398	27	3	42	222	0.008122	2.111845	0.043048
15.231546	1.066081	28	3	52	232	0.008122	2.19307	0.043055
15.556349	1.089258	29	4	2	242	0.008122	2.274295	0.043065
15.874508	1.111961	30	4	12	252	0.008122	2.355519	0.043078





end 10/16/07 RF

Last entry this volume is the following declaration:

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Entries made into Scientific Notebook #432e for the period October 4, 2002, to August 18, 2008, have been made by Randall Fedors (August 18, 2008).

No original text or figures entered into this Scientific Notebook has been removed

RF 8/18/2008

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ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK NO. 432E

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