

## MODRET submittal guide

All MODRET submittals shall have at least the following information in one package:

- Test pit and boring logs, including actual elevations (not just relative elevations).
- Map showing location of test pits, borings and infiltration facility
- Wet season (October 1 to April 30) maximum water table elevation.
- If mottling or iron oxide staining is present, and that elevation does not reflect the wet season maximum water table elevation, include a detailed description of why.
- Description and documentation supporting all MODRET input parameters
- LS stamped letter documenting constructed volume, elevations, infiltration area (constructed facilities only)
- PE stamped letter documenting TIR volume, elevations and infiltration area (design reviews only)
- PE stamped letter (with input data) documenting rainfall data used in MODRET
- Rainfall data shall be the KCRTS reduced 8 water year record or data reflecting the peak volume and peak rate over a 30 day period, both one day increments
- Actual rainfall data used in MODRET runs (PRN file or manual input)
- MODRET run for reduced 8 water year record, or two runs (30 day peak volume and peak rate)
- MODRET safety factor of 2
- Geotechnical Engineer summary and conclusions
- Small scale infiltration test data (inches/hour) with calibration factor, then converted to Vertical Hydraulic Conductivity (feet/day)

Small Scale Test	Calibration factor
EPA	9:1
Double Ring	7:1
Large Ring (3')	2:1
Pilot Infiltration	1.5:1

- Horizontal Hydraulic Conductivity based on HHC:VHC ratio of 1.5:1 homogeneous soils
- Horizontal Hydraulic Conductivity based on HHC:VHC ratio of 3:1 for layered soils
- Geotechnical engineer documentation of why a particular HHC:VHC ratio is applicable

## How to review MODRET ground water mounding submittals

A review of a MODRET proposal is basically verifying that the input parameters are appropriate and applicable. The geotechnical firm must submit documentation for all input parameters and provide a conclusion based on their professional judgment.

The input parameters cover four major areas of concern:

- Rainfall data
- Drainage Facility volume, infiltration surface area and elevation
- Soils data, including high ground water
- Small scale infiltration test data

All areas must be thoroughly reviewed to ensure a complete permanent record for future research

### Rainfall data (generally KCTRS runoff time series data)

There are two methods:

1. Import complete reduced 8 year record into MODRET
2. Identify peak volume and peak rate data to be imported to MODRET manually.

### Complete 8 year KCTRS record

After the data is calculated by KCTRS (DOS version, windows doesn't work with XP), go to the extract hydrograph section of KCRS, select one day increments. The extract file is a .PRN extension displaying hours and cfs. Here is an example of a partial file:

Hydrograph from Time Series file

devw.tsf

Time Step is 1.00 days

Date	Hour	CFS
		+/- 0.00032
11/ 1/00	0:00	24.00 0.017
11/ 2/00	0:00	48.00 0.001
11/ 3/00	0:00	72.00 0.001
11/ 4/00	0:00	96.00 0.001
11/ 5/00	0:00	120.00 0.000
11/ 6/00	0:00	144.00 0.004
11/ 7/00	0:00	168.00 0.000
11/ 8/00	0:00	192.00 0.000
11/ 9/00	0:00	216.00 0.000
11/10/00	0:00	240.00 0.000
11/11/00	0:00	264.00 0.000
11/12/00	0:00	288.00 0.000
11/13/00	0:00	312.00 0.000
11/14/00	0:00	336.00 0.000
11/15/00	0:00	360.00 0.006
11/16/00	0:00	384.00 0.007

## How to review MODRET ground water mounding submittals

Geotechnical firm must provide a copy of the rainfall data used in MODRET. Increments should be 24 hours.

### **Peak volume and peak rate method (Manual Input)**

With the peak volume and peak rate method, two MODRET runs are needed to determine the worst case scenario. If this method is used, verify the MODRET, Runoff Data: Manual is consistent with the KCRTS data (stamped letter) submitted by the civil engineer. Must be 24 hour increments with volumes (Cubic Feet) are used rather than cfs.

### **Peak Rate**

KCTRS identifies the peak rate. Take that date and capture 30 days (one day increments) that represents the worst case. Generally 30 days of data with the peak in the last quarter of the data set will represent the worst case. Extract the hydrograph (PRN file) and convert to volumes. Manually input the volume (Cubic Feet) per 24 hours data into MODRET. MODRET is then run to determine the height of the groundwater mound.

### **Peak volume**

Peak volume must be determined by a manual review of the data (30 days, one day increments). The peak volume does not happen over the same date range as the peak rate. The peak volume is the cumulative peak volume over a 30 day period, not just a one day period. Once the peak volume period is identified, manually input the data (24 hour increments and CF) into MODRET. MODRET is then run to determine the height of the groundwater mound.

With either the reduced record or the peak volume/rate method, the ground water mound can not extend beyond the overflow elevation.

### **Volume, infiltration surface area and elevation confirmation (constructed facilities only)**

In accordance with the R/D In-Operation Public rule, the volume, infiltration surface area and elevations must be verified by a PLS. The MODRET package must include a stamped letter from a PLS stating what the actual constructed volume, infiltration surface area and elevations are. For design reviews, assume the facility has been constructed in accordance with the plans and TIR.

### **Soils data**

Review all soils information for accurate location, depth, groundwater, mottling or staining. Test pits or boring logs must be at the actual location of the infiltration facility. (Check existing condition contours to determine starting elevation of test pits or borings.) Verify that the maximum wet season (October 1 to April 30) water table was identified correctly. The maximum wet season water table is typically in January or February. The best way to determine the maximum wet season water table is to install monitoring wells for at least one full wet season.

The depth of the exploration determines some of the MODRET input parameters. If a test pit only extends three feet below the pond bottom, that elevation determines the assumed impermeable layer. Conversely, since MODRET will not accept a depth to impermeable layer of more than one pond width, exploration below that level is unnecessary. Any evidence of mottling or staining (potential high ground water indicators) will need to be reviewed by WLRD's hydro geologist for evaluation.

### **Small Scale Infiltration tests/Vertical Hydraulic Conductivity (VHC)**

This input parameter is determined by small scale infiltration tests, adjusted to match what a full scale test might reflect. There needs to be enough tests (usually three) to represent the infiltration surface. If the soil is not consistent within the facility, or the facility is large, additional tests will be needed.

There are several types of small scale tests; however, small scale to full pond calibration factors differs widely. Averaged measured tests must be converted from inches/hour to feet/day, then apply the appropriate calibration factor:

Small Scale Test	Calibration
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