

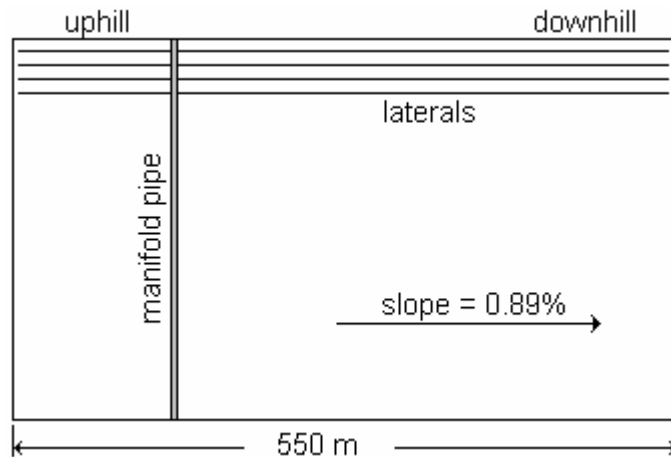
BIE 5110/6110
Sprinkle & Trickle Irrigation
Fall Semester, 2004

Assignment #9 (100 pts)
Trickle Manifold Location
Due: 3 Dec 04

Given:

A rectangular field of orchard trees, 550-m long in the direction of the PE laterals. The preliminary design data are as follows:

lateral ID = 17.8 mm	$q_a = 3.95$ lph
$S_e = 2.5$ m	$f_e = 0.10$ m
$S_p = 5.0$ m	$H_a = 13.0$ m
$x = 0.55$	$Q_s = 9.77$ lps



Required:

Determine the following using either: (1) the semi-graphical, non-dimensional, design procedure, or (2) a completely numerical design procedure:

1. Optimal manifold location
2. Required lateral inlet pressure head, H_l
3. Minimum lateral pressure head, H_n'

Show all of your work neatly, step by step. Adjust the manifold location uphill by as much as $0.75(S_p)$, or downhill by as much as $0.25(S_p)$ so that it is positioned midway between two plant rows.

1. How many trees on the uphill side?
2. How many trees on the downhill side?
3. Is H_n' the same on the uphill & downhill sides?

Solution:

- The solution can be obtained by different methods, as explained in class.
- The quickest and easiest solution is to use the *New and Improved* "OptManifold.exe" computer program, as shown below:

The screenshot shows a software window titled "Trickle Manifold Location" with a close button (X) in the top right corner. The window is divided into two main sections: "Data:" and "Results:".

Data:

Emitter discharge (lph)	Lateral length (m)	
3.950	550.000	
Emitter spacing (m)	Lateral ID (mm)	
2.500	17.800	
Emitter head (m)	Ground slope (m/m)	
13.000	0.00890	
Barb loss, fe (m)	Hazen-Williams C	
0.100	150	

Results:

Length of uphill lateral:	177.804	m
Length of downhill lateral:	372.196	m
Distance from manifold to minimum head	190.166	m
Required lateral inlet head:	12.160	m
Minimum head in downhill lateral:	10.044	m
Minimum head in uphill lateral:	10.572	m

- The *New and Improved* version of the program uses Hazen-Williams.
- Due to approximations and simplifying assumptions in the equations, the calculated value of H_n' is not exactly equal in the uphill and downhill parts of the lateral.
- The tree spacing is given as $S_p = 5.0$ m. Make the downhill lateral 375-m long, and the uphill lateral will be 175 m in length (a slight adjustment on the calculation results).
- This gives $175/5 = 35$ trees on the uphill side of the manifold, and $375/5 = 75$ trees on the downhill side.