

Manual for PIPE (Copyright (c) Hunter Software, LLC)

This program is produced and manufactured by:

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GENERAL INFORMATION

The program is designed with relatively small windows, and to remain "on top" of other applications. This format will facilitate the identification of pipes, drainage areas, etc., in an underlying CAD display. The window may be minimized.

The modules in the program share information, so that any data on-screen in one module will be visible in the others.

MAIN MENU:

Notice that options for three types of operations - computing flow data, filing, and printing - are gathered in graphic frames on the screen. Pressing "OK" within the frame will begin the selected operation, and "Cancel" will unselect an operation. The "Exit Pipe" button at the bottom of the window closes the program.

COMPUTE PIPE DATA:

1. NORMAL DEPTH

Normal depth (the depth of flow measured perpendicularly to the pipe slope) is calculated by solving Manning's equation $Q = 1.486 n A r^{(2/3)} s^{.5}$. In this equation, Q is the rate of flow in CFS; 1.486, the conversion factor from SI units; n, Manning's coefficient for surface roughness; A, the cross sectional area of flow; r, the area divided by the wetted perimeter, and s, the pipe slope, in ft./ft.

Enter the requested data and click the "Compute" button.

If the pipe is flowing full, a message screen will appear asking the user to accept full flow or revise the input data.

The calculated values for normal depth and the velocity at normal depth are displayed in bold face type.

Because critical depth of flow is of interest in many situations, this value, in standard face type, is also shown. Critical depth is determined to be the depth of flow for which the expression $(Q^2T)/(gA^3)$ is equal to one. In this expression, Q is the flow in CFS; T, the top width of flow; g, the acceleration of gravity (32.17 ft./ft.), and A, the cross sectional area of flow.

The "Clear Input" button will clear the input values.

The "Add Pipe to List" button will open a window that will request upstream and downstream structure numbers to identify a pipe. Enter the information, press "OK", and the pipe will be entered into a list that will be displayed on-screen, and may be saved and printed from the Main Menu. The program sorts the list in ascending order, using the downstream ID as an index.

The "Remove Pipe from List" button works as the "Add" button does. Enter the upstream and downstream structure numbers and press "OK" to remove a pipe from the list.

The "Exit" button returns the user to the main menu.

2. INLET CONTROL

Headwater depth under inlet control is calculated by multiplying the diameter of the pipe by a fifth-order polynomial whose terms vary with the rate of flow, inlet geometry, pipe type and pipe size. The method was developed by the US Department of Transportation and published in 1979 as "Hydraulic Analysis of Culverts" (Program HY-6).

Select the inlet type for the appropriate pipe material by clicking on the

selection, enter the requested data, and click on the "Compute" button.

If subcritical or critical flow is found, a message will be displayed asking the user if he wants to proceed. This option is offered because M1 or M2 water surface calculations under outlet control will occasionally give a lower headwater depth than that calculated by inlet control.

The calculated headwater depth and outlet velocity (calculated from normal depth) are displayed in boldface type. Please note that the program assumes a clear outlet. If the tailwater depth could affect the headwater depth, other methods should be used.

The "Clear Input" button will clear the input values.

The "Add Pipe to List" button will open a window that will request upstream and downstream structure numbers to identify a pipe. Enter the information, press "OK", and the pipe will be entered into a list that will be displayed on-screen, and may be saved and printed from the Main Menu. The program sorts the list in descending order, using the downstream ID as an index.

The "Remove Pipe from List" button works as the "Add" button does. Enter the upstream and downstream structure numbers and press "OK" to remove a pipe from the list.

The "Exit" button returns the user to the main menu.

3. OUTLET CONTROL

Headwater depth under outlet control conditions is calculated for full flow by adding the entrance loss, the velocity head loss and the friction head loss to the tailwater depth, and subtracting the rise of the pipe (pipe slope times pipe length). If a tailwater depth less than critical depth is entered, the program assigns a tailwater depth equal to critical depth. If open channel flow is detected in the pipe, the program performs a (direct- step) water surface profile, beginning at the tailwater depth (entered or assigned), and adds the velocity and entrance head losses to the calculated normal depth of flow at the entrance to determine the headwater depth. The vertical component of the headwater depth is displayed.

Select the inlet type for the appropriate pipe material by clicking on the selection, enter the requested data and click on the "Compute" button.

If supercritical flow is found, a message will be displayed asking the user to use the "Inlet Control" option on the menu.

Otherwise, the calculated headwater depth and outlet velocity are displayed in boldface type.

The "Clear Input" button will clear the input values.

The "Add Pipe to List" button will open a window that will request upstream and downstream structure numbers to identify a pipe. Enter the information, press "OK", and the pipe will be entered into a list that will be displayed on-screen, and may be saved and printed from the Main Menu. The program sorts the list in ascending order, using the downstream ID as an index.

The "Remove Pipe from List" button works as the "Add" button does. Enter the upstream and downstream structure numbers and press "OK" to remove a pipe from the list.

The "Exit" button returns the user to the main menu.

FILE OPERATIONS:

The "Save" option saves the current list to a user-specified file. Any file extension, or none, may be used. Standard software will retrieve the data, but only this program will format the data.

When a file is opened, the opened list is displayed on-screen. If a file is opened when a list is present in the running program, the data in the current list will be lost.

PRINTING:

Selecting the "Print" option will generate a request for optional user input that will be printed as a page header. User input is limited to 85 characters.