# DRAINAGE CALCULATIONS

Rational Method

Given Input Data:

Description ..... Loogootee Drainage Study - 2 yr flood and 25 yr flood under state highways

| Area Description | Area mi2 | Coef | Tc hrs | Intensity in/hr | Flow cfs |
|---|---|---|---|---|---|
| Area I | 0.0410 | 0.6000 | 0.4000 | 2.5000 | 39.3600 |
| Area II | 0.0670 | 0.6000 | 0.4000 | 2.5000 | 64.3200 |
| Area III | 0.0860 | 0.6000 | 0.5000 | 2.3000 | 75.9552 |
| Area IV | 0.1300 | 0.6000 | 0.6000 | 3.0000 | 149.7600 |
| Area V | 0.2500 | 0.5000 | 0.6000 | 2.1000 | 168.0000 |
| Area VI | 0.2780 | 0.5000 | 0.7000 | 2.0000 | 177.9200 |
| Area VII | 0.9280 | 0.4000 | 1.2000 | 1.4000 | 332.5952 |
| Area VIII | 1.0580 | 0.4000 | 1.3000 | 1.3000 | 352.1024 |
| Area IX | 1.2880 | 0.5000 | 1.6000 | 1.2000 | 494.5920 |
| Area X | 1.3880 | 0.5000 | 1.6000 | 2.0000 | 888.3200 |

Support Data:

# Ditch 1

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 40.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0200 |
| Height | 18.0000 in |
| Bottom width | 12.0000 in |
| Left slope | 4.0000 ft/ft |
| Right slope | 4.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 14.1123 in |
| Velocity | 5.9629 fps |
| Flow area | 6.7082 ft2 |
| Flow perimeter | 128.3733 in |
| Hydraulic radius | 7.5248 in |
| Top width | 124.8987 in |
| Area | 10.5000 ft2 |
| Perimeter | 160.4318 in |
| Percent full | 78.4019 % |

### Critical Information

| | |
|---|---|
| Critical depth | 15.8715 in |
| Critical slope | 0.0068 ft/ft |
| Critical velocity | 4.8077 fps |
| Critical area | 8.3199 ft2 |
| Critical perimeter | 142.8794 in |
| Critical hydraulic radius | 8.3852 in |
| Critical top width | 138.9717 in |
| Specific energy | 1.7286 ft |
| Minimum energy | 1.9839 ft |
| Froude number | 1.3094 |
| Flow condition | Supercritical |

Area I

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Elliptical |
| Solving for | Depth of Flow |
| Minor axis | 24.0000 in |
| Major axis | 38.0000 in |
| Flowrate | 40.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0150 |

Computed Results:

| | |
|---|---|
| Depth | 19.7147 in |
| Area | 4.9742 ft2 |
| Wetted Area | 4.3724 ft2 |
| Wetted Perimeter | 67.7893 in |
| Perimeter | 98.6348 in |
| Velocity | 9.1484 fps |
| Hydraulic Radius | 9.2879 in |
| Percent Full | 82.1448 % |
| Full flow Flowrate | 38.6209 cfs |
| Full flow velocity | 7.7643 fps |

# Ditch 2

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 64.0000 cfs |
| Slope | 0.0090 ft/ft |
| Manning's n | 0.0200 |
| Height | 24.0000 in |
| Bottom width | 12.0000 in |
| Left slope | 4.0000 ft/ft |
| Right slope | 4.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 18.1145 in |
| Velocity | 6.0239 fps |
| Flow area | 10.6244 ft2 |
| Flow perimeter | 161.3761 in |
| Hydraulic radius | 9.4804 in |
| Top width | 156.9161 in |
| Area | 18.0000 ft2 |
| Perimeter | 209.9091 in |
| Percent full | 75.4771 % |

### Critical Information

| | |
|---|---|
| Critical depth | 19.4351 in |
| Critical slope | 0.0063 ft/ft |
| Critical velocity | 5.2841 fps |
| Critical area | 12.1119 ft2 |
| Critical perimeter | 172.2661 in |
| Critical hydraulic radius | 10.1245 in |
| Critical top width | 167.4809 in |
| Specific energy | 2.0735 ft |
| Minimum energy | 2.4294 ft |
| Froude number | 1.1782 |
| Flow condition | Supercritical |

Area II

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Elliptical |
| Solving for | Depth of Flow |
| Minor axis | 29.0000 in |
| Major axis | 45.0000 in |
| Flowrate | 64.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0150 |

Computed Results:

| | |
|---|---|
| Depth | 23.5957 in |
| Area | 7.1177 ft2 |
| Wetted Area | 6.2019 ft2 |
| Wetted Perimeter | 80.2605 in |
| Perimeter | 117.6015 in |
| Velocity | 10.3194 fps |
| Hydraulic Radius | 11.1272 in |
| Percent Full | 81.3646 % |
| Full flow Flowrate | 62.4109 cfs |
| Full flow velocity | 8.7684 fps |

# Ditch 3

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 80.0000 cfs |
| Slope | 0.0150 ft/ft |
| Manning's n | 0.0200 |
| Height | 24.0000 in |
| Bottom width | 12.0000 in |
| Left slope | 4.0000 ft/ft |
| Right slope | 4.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 17.8802 in |
| Velocity | 7.7141 fps |
| Flow area | 10.3706 ft2 |
| Flow perimeter | 159.4438 in |
| Hydraulic radius | 9.3661 in |
| Top width | 155.0415 in |
| Area | 18.0000 ft2 |
| Perimeter | 209.9091 in |
| Percent full | 74.5008 % |

### Critical Information

| | |
|---|---|
| Critical depth | 21.3781 in |
| Critical slope | 0.0062 ft/ft |
| Critical velocity | 5.5261 fps |
| Critical area | 14.4767 ft2 |
| Critical perimeter | 188.2887 in |
| Critical hydraulic radius | 11.0715 in |
| Critical top width | 183.0252 in |
| Specific energy | 2.4148 ft |
| Minimum energy | 2.6723 ft |
| Froude number | 1.5180 |
| Flow condition | Supercritical |

Area III

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Elliptical |
| Solving for | Depth of Flow |
| Minor axis | 24.0000 in |
| Major axis | 38.0000 in |
| Flowrate | 38.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0150 |

Computed Results:

| | |
|---|---|
| Depth | 18.7088 in |
| Area | 4.9742 ft2 |
| Wetted Area | 4.1603 ft2 |
| Wetted Perimeter | 64.6556 in |
| Perimeter | 98.6348 in |
| Velocity | 9.1339 fps |
| Hydraulic Radius | 9.2659 in |
| Percent Full | 77.9532 % |
| Full flow Flowrate | 38.6209 cfs |
| Full flow velocity | 7.7643 fps |

# Ditch 4

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 150.0000 cfs |
| Slope | 0.0100 ft/ft |
| Manning's n | 0.0200 |
| Height | 36.0000 in |
| Bottom width | 12.0000 in |
| Left slope | 4.0000 ft/ft |
| Right slope | 4.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 24.9279 in |
| Velocity | 7.7566 fps |
| Flow area | 19.3384 ft2 |
| Flow perimeter | 217.5606 in |
| Hydraulic radius | 12.7998 in |
| Top width | 211.4231 in |
| Area | 39.0000 ft2 |
| Perimeter | 308.8636 in |
| Percent full | 69.2441 % |

### Critical Information

| | |
|---|---|
| Critical depth | 27.8886 in |
| Critical slope | 0.0057 ft/ft |
| Critical velocity | 6.2686 fps |
| Critical area | 23.9288 ft2 |
| Critical perimeter | 241.9750 in |
| Critical hydraulic radius | 14.2401 in |
| Critical top width | 235.1086 in |
| Specific energy | 3.0123 ft |
| Minimum energy | 3.4861 ft |
| Froude number | 1.3052 |
| Flow condition | Supercritical |

Area IV

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Rectangular |
| Solving for | Depth of Flow |
| Height | 48.0000 in |
| Width | 36.0000 in |
| Flowrate | 150.0000 cfs |
| Slope | 0.0150 ft/ft |
| Manning's n | 0.0120 |

Computed Results:

| | |
|---|---|
| Depth | 38.9024 in |
| Area | 12.0000 ft2 |
| Wetted Area | 9.7256 ft2 |
| Wetted Perimeter | 113.8048 in |
| Perimeter | 168.0000 in |
| Velocity | 15.4232 fps |
| Hydraulic Radius | 12.3060 in |
| Percent Full | 81.0467 % |
| Full flow Flowrate | 164.2227 cfs |
| Full flow velocity | 13.6852 fps |

# Ditch 5

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 168.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 48.0000 in |
| Bottom width | 24.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 31.3522 in |
| Velocity | 6.5360 fps |
| Flow area | 25.7037 ft2 |
| Flow perimeter | 222.2887 in |
| Hydraulic radius | 16.6510 in |
| Top width | 212.1132 in |
| Area | 56.0000 ft2 |
| Perimeter | 327.5787 in |
| Percent full | 65.3171 % |

### Critical Information

| | |
|---|---|
| Critical depth | 30.7250 in |
| Critical slope | 0.0055 ft/ft |
| Critical velocity | 6.7775 fps |
| Critical area | 24.7880 ft2 |
| Critical perimeter | 218.3219 in |
| Critical hydraulic radius | 16.3496 in |
| Critical top width | 208.3500 in |
| Specific energy | 3.2766 ft |
| Minimum energy | 3.8406 ft |
| Froude number | 0.9556 |
| Flow condition | Subcritical |

Area V

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Circular |
| Solving for | Depth of Flow |
| Diameter | 84.0000 in |
| Flowrate | 200.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |

Computed Results:

| | |
|---|---|
| Depth | 50.8569 in |
| Area | 38.4845 ft2 |
| Wetted Area | 24.3702 ft2 |
| Wetted Perimeter | 149.7947 in |
| Perimeter | 263.8938 in |
| Velocity | 8.2067 fps |
| Hydraulic Radius | 23.4275 in |
| Percent Full | 60.5440 % |
| Full flow Flowrate | 293.6197 cfs |
| Full flow velocity | 7.6296 fps |

Critical Information

| | |
|---|---|
| Critical depth | 44.2748 in |
| Critical slope | 0.0078 ft/ft |
| Critical velocity | 9.7233 fps |
| Critical area | 20.5692 ft2 |
| Critical perimeter | 136.4965 in |
| Critical hydraulic radius | 21.7000 in |
| Critical top width | 84.0000 in |
| Specific energy | 5.2780 ft |
| Minimum energy | 5.5343 ft |
| Froude number | 0.7765 |
| Flow condition | Subcritical |

Dicth 6

Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 179.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 48.0000 in |
| Bottom width | 24.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 32.1909 in |
| Velocity | 6.6410 fps |
| Flow area | 26.9537 ft2 |
| Flow perimeter | 227.5928 in |
| Hydraulic radius | 17.0538 in |
| Top width | 217.1451 in |
| Area | 56.0000 ft2 |
| Perimeter | 327.5787 in |
| Percent full | 67.0643 % |

Critical Information

| | |
|---|---|
| Critical depth | 31.6032 in |
| Critical slope | 0.0055 ft/ft |
| Critical velocity | 6.8649 fps |
| Critical area | 26.0747 ft2 |
| Critical perimeter | 223.8762 in |
| Critical hydraulic radius | 16.7716 in |
| Critical top width | 213.6192 in |
| Specific energy | 3.3680 ft |
| Minimum energy | 3.9504 ft |
| Froude number | 0.9593 |
| Flow condition | Subcritical |

Area VI

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Circular |
| Solving for | Depth of Flow |
| Diameter | 96.0000 in |
| Flowrate | 178.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0220 |

Computed Results:

| | |
|---|---|
| Depth | 36.1493 in |
| Area | 50.2655 ft2 |
| Wetted Area | 17.3133 ft2 |
| Wetted Perimeter | 126.8475 in |
| Perimeter | 301.5929 in |
| Velocity | 10.2811 fps |
| Hydraulic Radius | 19.6544 in |
| Percent Full | 37.6556 % |
| Full flow Flowrate | 590.3958 cfs |
| Full flow velocity | 11.7456 fps |

Critical Information

| | |
|---|---|
| Critical depth | 39.9693 in |
| Critical slope | 0.0083 ft/ft |
| Critical velocity | 8.9881 fps |
| Critical area | 19.8040 ft2 |
| Critical perimeter | 134.6591 in |
| Critical hydraulic radius | 21.1778 in |
| Critical top width | 94.6469 in |
| Specific energy | 4.6551 ft |
| Minimum energy | 4.9962 ft |
| Froude number | 1.2129 |
| Flow condition | Supercritical |

# Ditch 7

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 333.0000 cfs |
| Slope | 0.0060 ft/ft |
| Manning's n | 0.0200 |
| Height | 72.0000 in |
| Bottom width | 24.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 40.0424 in |
| Velocity | 8.3088 fps |
| Flow area | 40.0778 ft2 |
| Flow perimeter | 277.2506 in |
| Hydraulic radius | 20.8159 in |
| Top width | 264.2547 in |
| Area | 120.0000 ft2 |
| Perimeter | 479.3680 in |
| Percent full | 55.6145 % |

### Critical Information

| | |
|---|---|
| Critical depth | 41.5027 in |
| Critical slope | 0.0050 ft/ft |
| Critical velocity | 7.7800 fps |
| Critical area | 42.8019 ft2 |
| Critical perimeter | 286.4859 in |
| Critical hydraulic radius | 21.5141 in |
| Critical top width | 273.0160 in |
| Specific energy | 4.4097 ft |
| Minimum energy | 5.1878 ft |
| Froude number | 1.0858 |
| Flow condition | Supercritical |

Area VII

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Rectangular |
| Solving for | Depth of Flow |
| Height | 90.0000 in |
| Width | 84.0000 in |
| Flowrate | 333.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0220 |

Computed Results:

| | |
|---|---|
| Depth | 50.1950 in |
| Area | 52.5000 ft2 |
| Wetted Area | 29.2804 ft2 |
| Wetted Perimeter | 184.3899 in |
| Perimeter | 348.0000 in |
| Velocity | 11.3728 fps |
| Hydraulic Radius | 22.8666 in |
| Percent Full | 55.7722 % |
| Full flow Flowrate | 577.0148 cfs |
| Full flow velocity | 10.9908 fps |

Critical Information

| | |
|---|---|
| Critical depth | 49.5348 in |
| Critical slope | 0.0124 ft/ft |
| Critical velocity | 11.5244 fps |
| Critical area | 28.8953 ft2 |
| Critical perimeter | 183.0696 in |
| Critical hydraulic radius | 22.7286 in |
| Critical top width | 84.0000 in |
| Specific energy | 6.1929 ft |
| Minimum energy | 6.1918 ft |
| Froude number | 0.9803 |
| Flow condition | Subcritical |

# Ditch 8

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 352.0000 cfs |
| Slope | 0.0060 ft/ft |
| Manning's n | 0.0200 |
| Height | 96.0000 in |
| Bottom width | 36.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 39.2114 in |
| Velocity | 8.4140 fps |
| Flow area | 41.8349 ft2 |
| Flow perimeter | 283.9950 in |
| Hydraulic radius | 21.2124 in |
| Top width | 271.2687 in |
| Area | 216.0000 ft2 |
| Perimeter | 643.1573 in |
| Percent full | 40.8453 % |

### Critical Information

| | |
|---|---|
| Critical depth | 40.7712 in |
| Critical slope | 0.0050 ft/ft |
| Critical velocity | 7.8530 fps |
| Critical area | 44.8239 ft2 |
| Critical perimeter | 293.8599 in |
| Critical hydraulic radius | 21.9650 in |
| Critical top width | 280.6273 in |
| Specific energy | 4.3678 ft |
| Minimum energy | 5.0964 ft |
| Froude number | 1.0904 |
| Flow condition | Supercritical |

Area VIII

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Rectangular |
| Solving for | Depth of Flow |
| Height | 76.0000 in |
| Width | 101.0000 in |
| Flowrate | 352.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0220 |

Computed Results:

| | |
|---|---|
| Depth | 43.4946 in |
| Area | 53.3056 ft2 |
| Wetted Area | 30.5066 ft2 |
| Wetted Perimeter | 187.9892 in |
| Perimeter | 354.0000 in |
| Velocity | 11.5385 fps |
| Hydraulic Radius | 23.3681 in |
| Percent Full | 57.2297 % |
| Full flow Flowrate | 585.1397 cfs |
| Full flow velocity | 10.9771 fps |

Critical Information

| | |
|---|---|
| Critical depth | 45.4584 in |
| Critical slope | 0.0106 ft/ft |
| Critical velocity | 11.0400 fps |
| Critical area | 31.8840 ft2 |
| Critical perimeter | 191.9169 in |
| Critical hydraulic radius | 23.9234 in |
| Critical top width | 101.0000 in |
| Specific energy | 5.6936 ft |
| Minimum energy | 5.6823 ft |
| Froude number | 1.0685 |
| Flow condition | Supercritical |

# Ditch 9

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 495.0000 cfs |
| Slope | 0.0030 ft/ft |
| Manning's n | 0.0200 |
| Height | 96.0000 in |
| Bottom width | 48.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 50.5445 in |
| Velocity | 7.0642 fps |
| Flow area | 70.0721 ft2 |
| Flow perimeter | 367.6715 in |
| Hydraulic radius | 27.4440 in |
| Top width | 351.2671 in |
| Area | 224.0000 ft2 |
| Perimeter | 655.1573 in |
| Percent full | 52.6505 % |

### Critical Information

| | |
|---|---|
| Critical depth | 45.7908 in |
| Critical slope | 0.0048 ft/ft |
| Critical velocity | 8.3974 fps |
| Critical area | 58.9469 ft2 |
| Critical perimeter | 337.6066 in |
| Critical hydraulic radius | 25.1427 in |
| Critical top width | 322.7449 in |
| Specific energy | 4.9875 ft |
| Minimum energy | 5.7239 ft |
| Froude number | 0.8049 |
| Flow condition | Subcritical |

# Area IX

## Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Rectangular |
| Solving for | Depth of Flow |
| Height | 82.0000 in |
| Width | 168.0000 in |
| Flowrate | 495.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0220 |

Computed Results:

| | |
|---|---|
| Depth | 35.2931 in |
| Area | 95.6667 ft2 |
| Wetted Area | 41.1753 ft2 |
| Wetted Perimeter | 238.5862 in |
| Perimeter | 500.0000 in |
| Velocity | 12.0218 fps |
| Hydraulic Radius | 24.8516 in |
| Percent Full | 43.0404 % |
| Full flow Flowrate | 1231.9563 cfs |
| Full flow velocity | 12.8776 fps |

### Critical Information

| | |
|---|---|
| Critical depth | 40.6441 in |
| Critical slope | 0.0079 ft/ft |
| Critical velocity | 10.4390 fps |
| Critical area | 47.4181 ft2 |
| Critical perimeter | 249.2882 in |
| Critical hydraulic radius | 27.3908 in |
| Critical top width | 168.0000 in |
| Specific energy | 5.1871 ft |
| Minimum energy | 5.0805 ft |
| Froude number | 1.2358 |
| Flow condition | Supercritical |

# Ditch 10

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 888.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 96.0000 in |
| Bottom width | 48.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 58.0765 in |
| Velocity | 9.9077 fps |
| Flow area | 89.6270 ft2 |
| Flow perimeter | 415.3077 in |
| Hydraulic radius | 31.0765 in |
| Top width | 396.4587 in |
| Area | 224.0000 ft2 |
| Perimeter | 655.1573 in |
| Percent full | 60.4963 % |

### Critical Information

| | |
|---|---|
| Critical depth | 59.6201 in |
| Critical slope | 0.0044 ft/ft |
| Critical velocity | 9.4542 fps |
| Critical area | 93.9267 ft2 |
| Critical perimeter | 425.0707 in |
| Critical hydraulic radius | 31.8193 in |
| Critical top width | 405.7207 in |
| Specific energy | 6.3652 ft |
| Minimum energy | 7.4525 ft |
| Froude number | 1.0605 |
| Flow condition | Supercritical |

# Area III A

## Manning Pipe Calculator

**Given Input Data:**

| | |
|---|---|
| Shape | Circular |
| Solving for | Depth of Flow |
| Diameter | 18.0000 in |
| Flowrate | 12.0000 cfs |
| Slope | 0.0200 ft/ft |
| Manning's n | 0.0150 |

**Computed Results:**

| | |
|---|---|
| Depth | 13.7622 in |
| Area | 1.7671 ft2 |
| Wetted Area | 1.4498 ft2 |
| Wetted Perimeter | 38.3108 in |
| Perimeter | 56.5487 in |
| Velocity | 8.2772 fps |
| Hydraulic Radius | 5.4493 in |
| Percent Full | 76.4568 % |
| Full flow Flowrate | 12.8747 cfs |
| Full flow velocity | 7.2856 fps |

### Critical Information

| | |
|---|---|
| Critical depth | 17.0232 in |
| Critical slope | 0.0101 ft/ft |
| Critical velocity | 6.3611 fps |
| Critical area | 1.8865 ft2 |
| Critical perimeter | 44.3207 in |
| Critical hydraulic radius | 6.1292 in |
| Critical top width | 18.0000 in |
| Specific energy | 2.2086 ft |
| Minimum energy | 2.1279 ft |
| Froude number | 1.5152 |
| Flow condition | Supercritical |

Rational Method

Given Input Data:

Description ..... Loogootee Drainage Study - Area 5a & 5b

| Area Description | Area mi2 | Coef | Tc hrs | Intensity in/hr | Flow cfs |
|---|---|---|---|---|---|
| Area Vb (2 year) | 0.0600 | 0.5000 | 0.3500 | 2.6000 | 49.9200 |
| Area Va (2 year) | 0.0900 | 0.5000 | 0.4300 | 2.5000 | 72.0000 |
| Area Vb (25 year) | 0.0600 | 0.5000 | 0.3500 | 4.3000 | 82.5600 |

Support Data:

Area 5a

Manning Pipe Calculator

Given Input Data:

| | |
|---|---|
| Shape | Elliptical |
| Solving for | Depth of Flow |
| Minor axis | 36.0000 in |
| Major axis | 48.0000 in |
| Flowrate | 72.0000 cfs |
| Slope | 0.0120 ft/ft |
| Manning's n | 0.0200 |

Computed Results:

| | |
|---|---|
| Depth | 30.2897 in |
| Area | 9.4248 ft2 |
| Wetted Area | 8.4636 ft2 |
| Wetted Perimeter | 95.0461 in |
| Perimeter | 132.6210 in |
| Velocity | 8.5071 fps |
| Hydraulic Radius | 12.8227 in |
| Percent Full | 84.1381 % |
| Full flow Flowrate | 68.9833 cfs |
| Full flow velocity | 7.3194 fps |

# Ditch 5a

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 70.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 24.0000 in |
| Bottom width | 12.0000 in |
| Left slope | 4.0000 ft/ft |
| Right slope | 4.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 21.1293 in |
| Velocity | 4.9428 fps |
| Flow area | 14.1621 ft2 |
| Flow perimeter | 186.2369 in |
| Hydraulic radius | 10.9503 in |
| Top width | 181.0346 in |
| Area | 18.0000 ft2 |
| Perimeter | 209.9091 in |
| Percent full | 88.0389 % |

### Critical Information

| | |
|---|---|
| Critical depth | 20.1945 in |
| Critical slope | 0.0063 ft/ft |
| Critical velocity | 5.3800 fps |
| Critical area | 13.0112 ft2 |
| Critical perimeter | 178.5283 in |
| Critical hydraulic radius | 10.4947 in |
| Critical top width | 173.5562 in |
| Specific energy | 2.1404 ft |
| Minimum energy | 2.5243 ft |
| Froude number | 0.8994 |
| Flow condition | Subcritical |

# Ditch 5b

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 50.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 24.0000 in |
| Bottom width | 12.0000 in |
| Left slope | 4.0000 ft/ft |
| Right slope | 4.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 18.4612 in |
| Velocity | 4.5432 fps |
| Flow area | 11.0055 ft2 |
| Flow perimeter | 164.2350 in |
| Hydraulic radius | 9.6496 in |
| Top width | 159.6896 in |
| Area | 18.0000 ft2 |
| Perimeter | 209.9091 in |
| Percent full | 76.9217 % |

### Critical Information

| | |
|---|---|
| Critical depth | 17.4794 in |
| Critical slope | 0.0066 ft/ft |
| Critical velocity | 5.0284 fps |
| Critical area | 9.9436 ft2 |
| Critical perimeter | 156.1390 in |
| Critical hydraulic radius | 9.1705 in |
| Critical top width | 151.8354 in |
| Specific energy | 1.8592 ft |
| Minimum energy | 2.1849 ft |
| Froude number | 0.8807 |
| Flow condition | Subcritical |

# Ditch 11 A

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 40.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 36.0000 in |
| Bottom width | 48.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 14.2524 in |
| Velocity | 4.4530 fps |
| Flow area | 8.9827 ft2 |
| Flow perimeter | 138.1402 in |
| Hydraulic radius | 9.3637 in |
| Top width | 133.5145 in |
| Area | 39.0000 ft2 |
| Perimeter | 275.6840 in |
| Percent full | 39.5900 % |

### Critical Information

| | |
|---|---|
| Critical depth | 13.2634 in |
| Critical slope | 0.0067 ft/ft |
| Critical velocity | 4.9468 fps |
| Critical area | 8.0861 ft2 |
| Critical perimeter | 131.8852 in |
| Critical hydraulic radius | 8.8289 in |
| Critical top width | 127.5805 in |
| Specific energy | 1.4959 ft |
| Minimum energy | 1.6579 ft |
| Froude number | 0.8737 |
| Flow condition | Subcritical |

# Ditch 11 B and Ditch 11 C

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 40.0000 cfs |
| Slope | 0.0050 ft/ft |
| Manning's n | 0.0200 |
| Height | 36.0000 in |
| Bottom width | 24.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 16.9343 in |
| Velocity | 4.5471 fps |
| Flow area | 8.7968 ft2 |
| Flow perimeter | 131.1018 in |
| Hydraulic radius | 9.6622 in |
| Top width | 125.6057 in |
| Area | 33.0000 ft2 |
| Perimeter | 251.6840 in |
| Percent full | 47.0397 % |

### Critical Information

| | |
|---|---|
| Critical depth | 15.8893 in |
| Critical slope | 0.0067 ft/ft |
| Critical velocity | 5.0581 fps |
| Critical area | 7.9080 ft2 |
| Critical perimeter | 124.4930 in |
| Critical hydraulic radius | 9.1472 in |
| Critical top width | 119.3360 in |
| Specific energy | 1.7325 ft |
| Minimum energy | 1.9862 ft |
| Froude number | 0.8745 |
| Flow condition | Subcritical |

Rational Method

Given Input Data:
Description ..... Loogootee Drainage Study - Secodary Drainage Way

| Area Description | Area mi2 | Coef | Tc hrs | Intensity in/hr | Flow cfs |
|---|---|---|---|---|---|
| Area XI | 0.1100 | 0.6000 | 0.3600 | 2.8000 | 118.2720 |
| Area XIII | 0.1400 | 0.6000 | 0.6200 | 2.0000 | 107.5200 |
| Area XIV | 0.2000 | 0.6000 | 0.8000 | 1.7000 | 130.5600 |

Support Data:

# Ditch 12 and Ditch 13

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 120.0000 cfs |
| Slope | 0.0100 ft/ft |
| Manning's n | 0.0200 |
| Height | 36.0000 in |
| Bottom width | 24.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 23.4980 in |
| Velocity | 7.7823 fps |
| Flow area | 15.4196 ft2 |
| Flow perimeter | 172.6147 in |
| Hydraulic radius | 12.8635 in |
| Top width | 164.9883 in |
| Area | 33.0000 ft2 |
| Perimeter | 251.6840 in |
| Percent full | 65.2723 % |

### Critical Information

| | |
|---|---|
| Critical depth | 26.4266 in |
| Critical slope | 0.0058 ft/ft |
| Critical velocity | 6.3312 fps |
| Critical area | 18.9537 ft2 |
| Critical perimeter | 191.1363 in |
| Critical hydraulic radius | 14.2795 in |
| Critical top width | 182.5595 in |
| Specific energy | 2.8994 ft |
| Minimum energy | 3.3033 ft |
| Froude number | 1.2955 |
| Flow condition | Supercritical |

# Ditch 14

## Channel Calculator

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 130.0000 cfs |
| Slope | 0.0060 ft/ft |
| Manning's n | 0.0200 |
| Height | 36.0000 in |
| Bottom width | 36.0000 in |
| Left slope | 3.0000 ft/ft |
| Right slope | 3.0000 ft/ft |

Computed Results:

| | |
|---|---|
| Depth | 25.4720 in |
| Velocity | 6.5375 fps |
| Flow area | 19.8851 ft2 |
| Flow perimeter | 197.0991 in |
| Hydraulic radius | 14.5280 in |
| Top width | 188.8320 in |
| Area | 36.0000 ft2 |
| Perimeter | 263.6840 in |
| Percent full | 70.7556 % |

### Critical Information

| | |
|---|---|
| Critical depth | 25.7743 in |
| Critical slope | 0.0057 ft/ft |
| Critical velocity | 6.4092 fps |
| Critical area | 20.2835 ft2 |
| Critical perimeter | 199.0111 in |
| Critical hydraulic radius | 14.6767 in |
| Critical top width | 190.6459 in |
| Specific energy | 2.7869 ft |
| Minimum energy | 3.2218 ft |
| Froude number | 1.0253 |
| Flow condition | Supercritical |