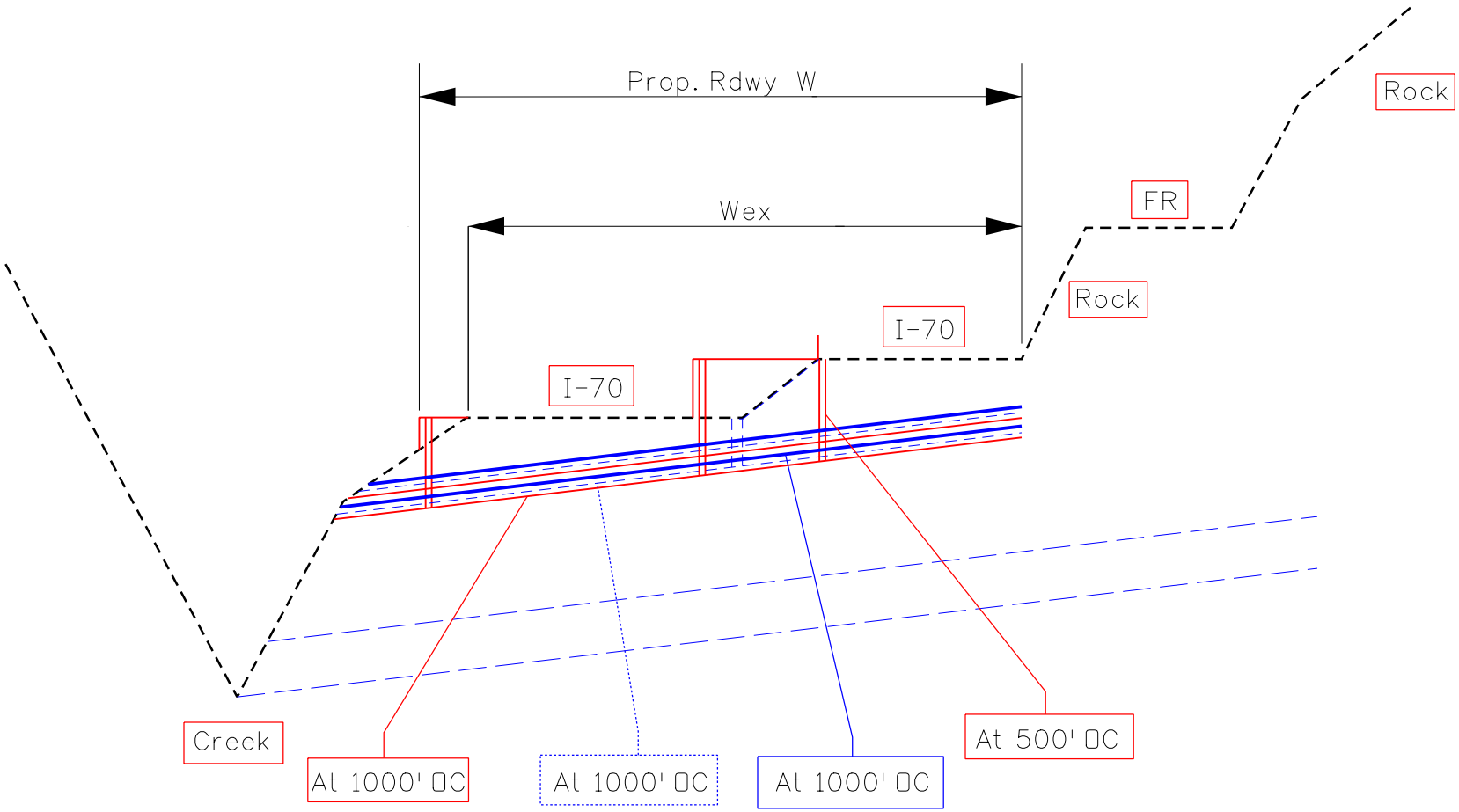
**I-70 Mountain**
**Drainage & Water Quality**

| Alternative | Option | 2 - ML 65 | 3 - ML 65 | GP 65 | GP 55 | ML Viaduct | EJMT Bore | Hard Shoulder Running | Minimum Program | Maximum Program |
|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 01 | x | | | x | x | | | | |
| | 02 | x | | x | | | | | | |
| 02 | 01 | | x | | x | x | | | | |
| | 02 | | x | x | | | | | | |
| 03 | 01 | | | | x | | x | | x | |
| | 02 | | | x | | | x | | x | |
| | 03 | | | | x | | | | x | |
| | 04 | | | x | | | | | x | |
| 04 | 01 | | | | x | | | | | x |
| | 02 | | | x | | | | | | x |
| 05 | 01 | | | | | | | x | | |
| | 02 | | | | | | | x | | |
| 06 | 01 | | | | | | | WB | | |
| | 02 | | | | | | | EB | | |

| Segment | Begin | End |
|---|---|---|
| 1 | Dillon | EJMT (W) |
| 2 | EJMT (W) | EJMT (E) |
| 3 | EJMT (E) | Empire Pass |
| 4 | Empire Pass | Idaho Springs |
| 5 | Idaho Springs | Floyd Hill |
| 6 | Floyd Hill | C470 |

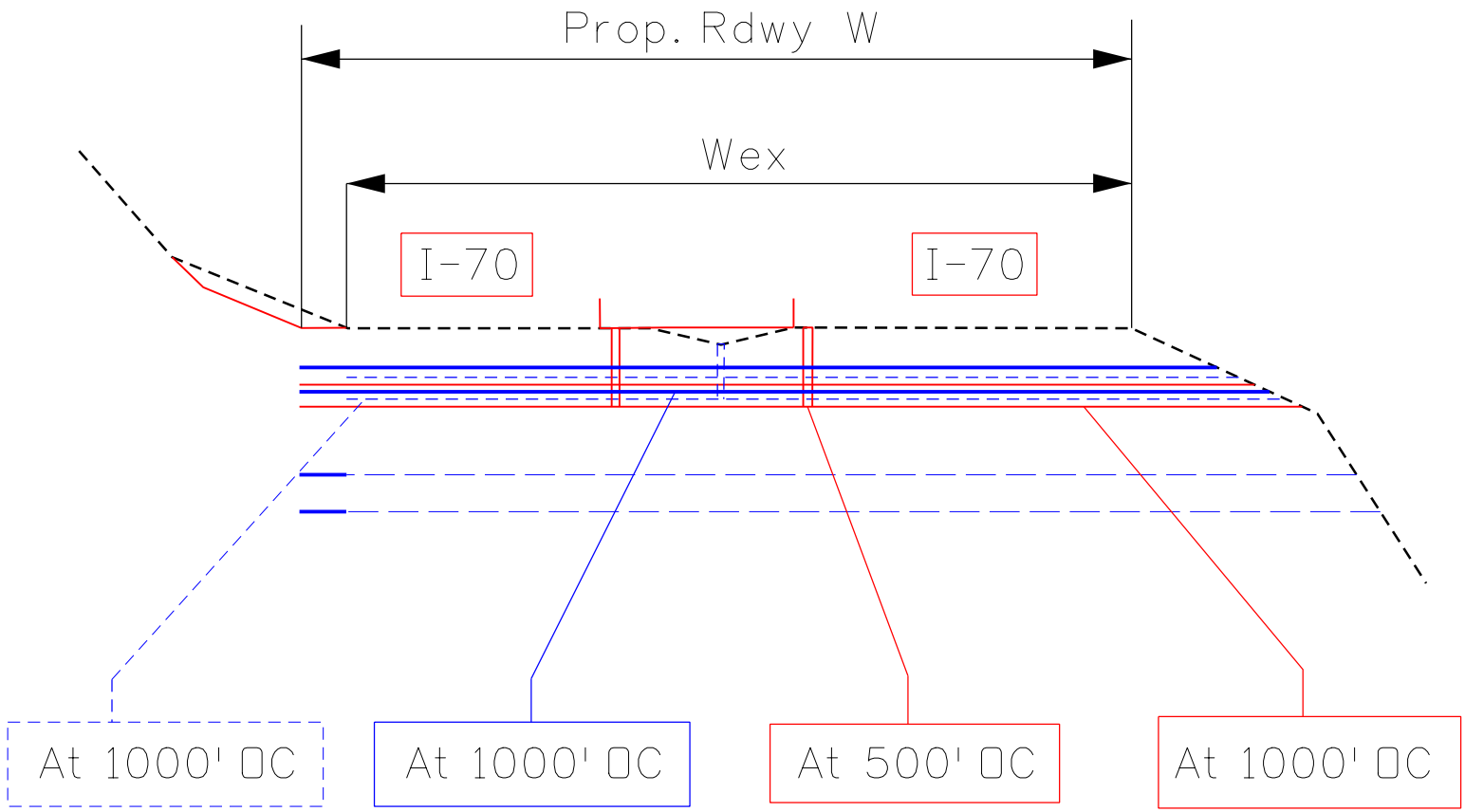
DRAINAGE TYPICAL SECTION 1

HOGBACK TO MT. VERNON (2.5 MI) Wex = 140'



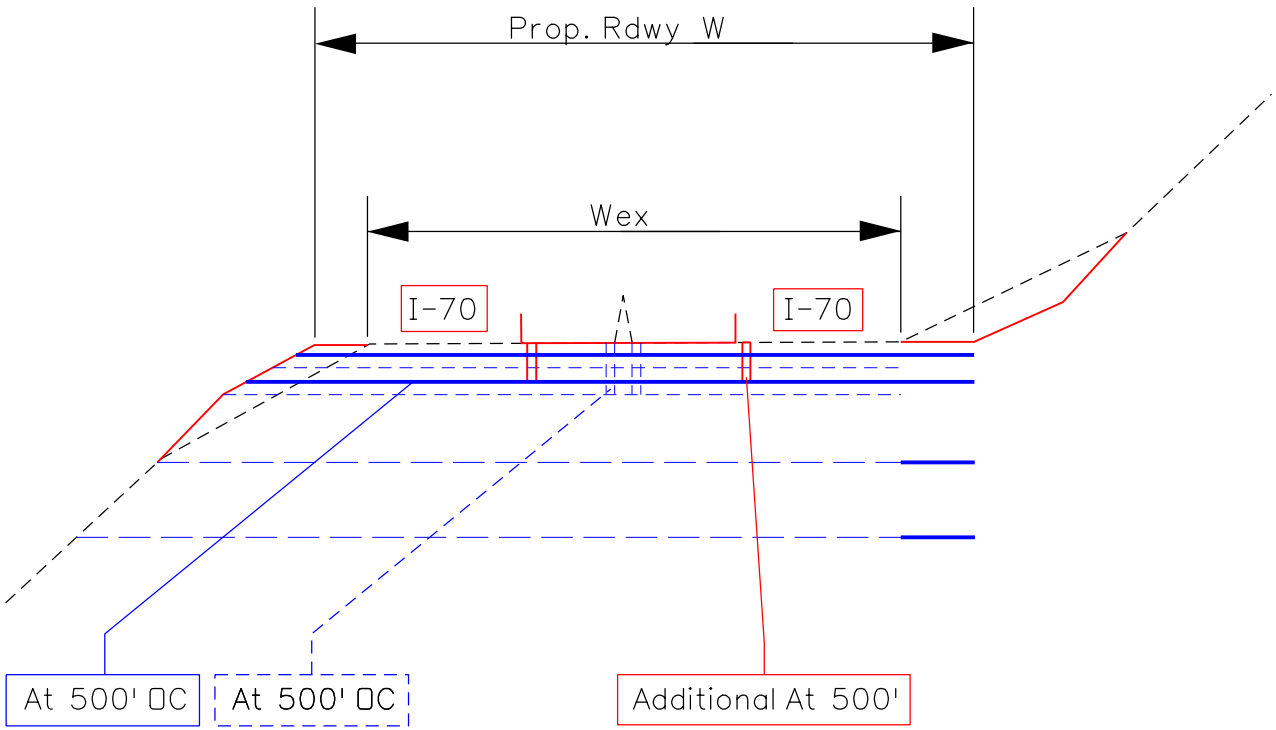
DRAINAGE TYPICAL SECTION 2

MT. VERNON TO CHIEF HOSA (3.5 MI) Wex = 140'
EVERGREEN TO FLOYD HILL (5 MI) Wex = 140'



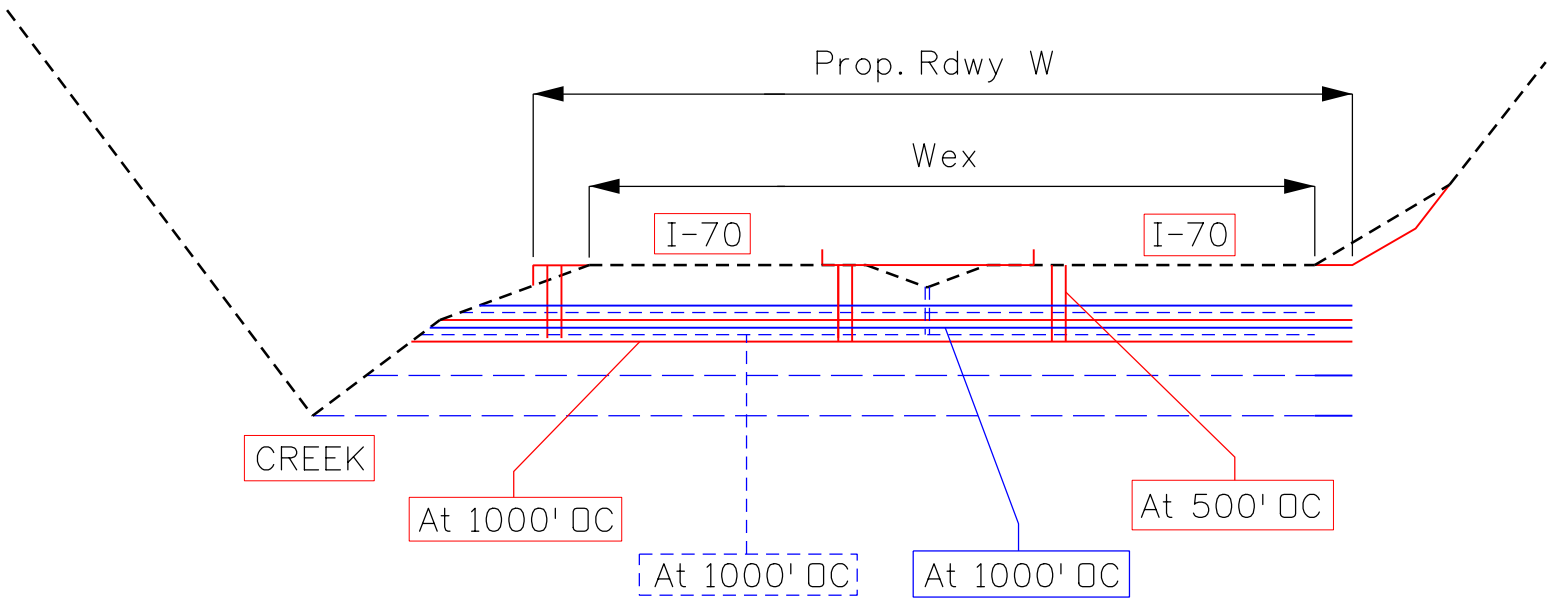
DRAINAGE TYPICAL SECTION 3

CHIEF HOSA TO EVERGREEN 91 MI) Wex = 150'
FLOYD HILL TO US 6 (2.5 MI) Wex = 95'
TUNNEL TO IDAHO SPRINGS (3 MI) Wex = 80'
GEORGETOWN TO SILVER PLUME (3 MI) Wex = 80'
LOVELAND SKI TO DILLON INTERCHANGE (7.5 MIO Wex = 100'



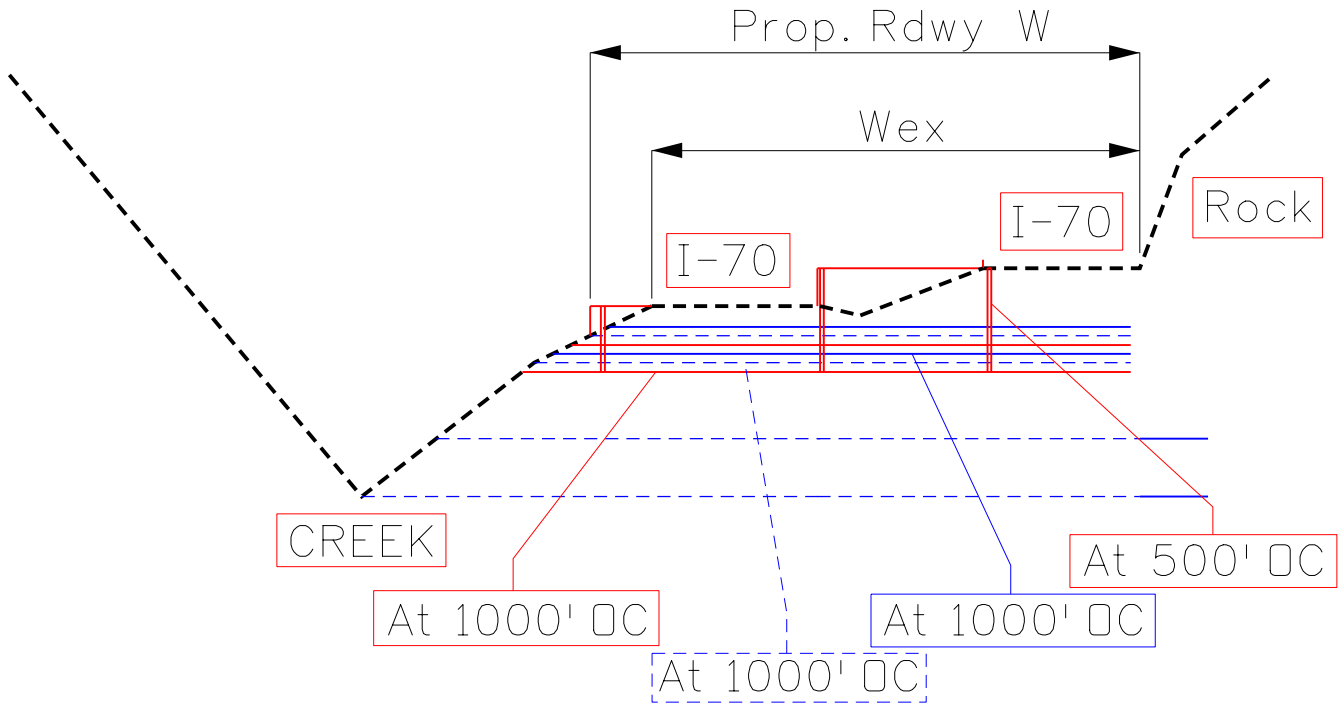
# DRAINAGE TYPICAL SECTION 4

US 6 TO TUNNEL (2 MI) WEX = 100'
DUMONT TO EMPIRE PASS (5 MI) WEX = 100'
SILVER PLUME TO LOVELAND SKI (8 MI) WEX = 100'

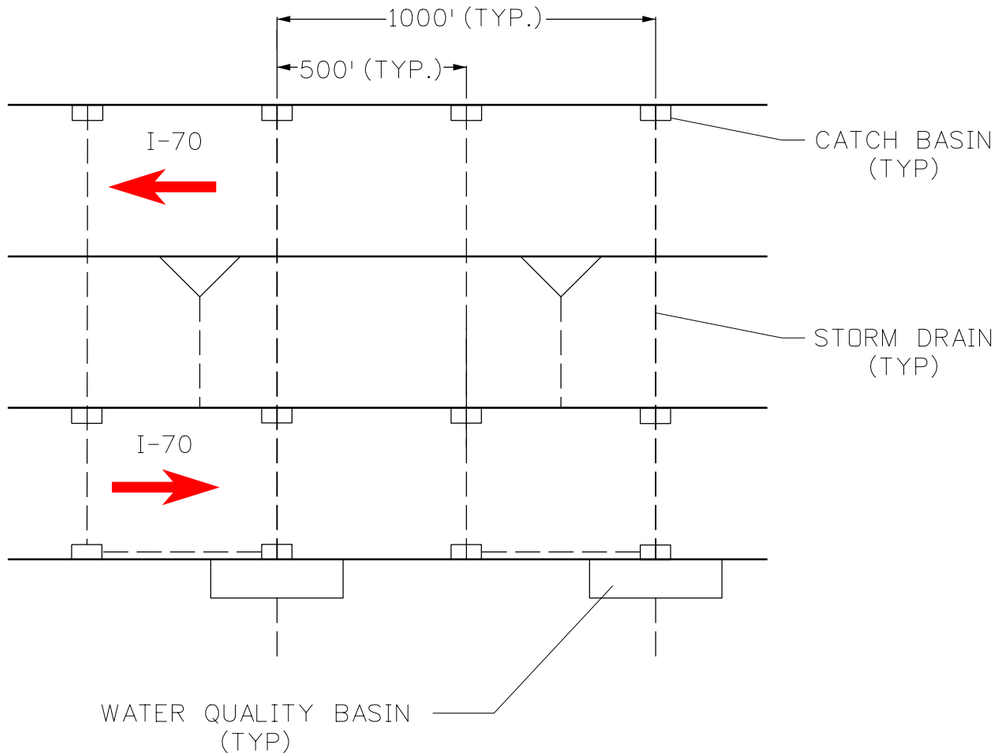


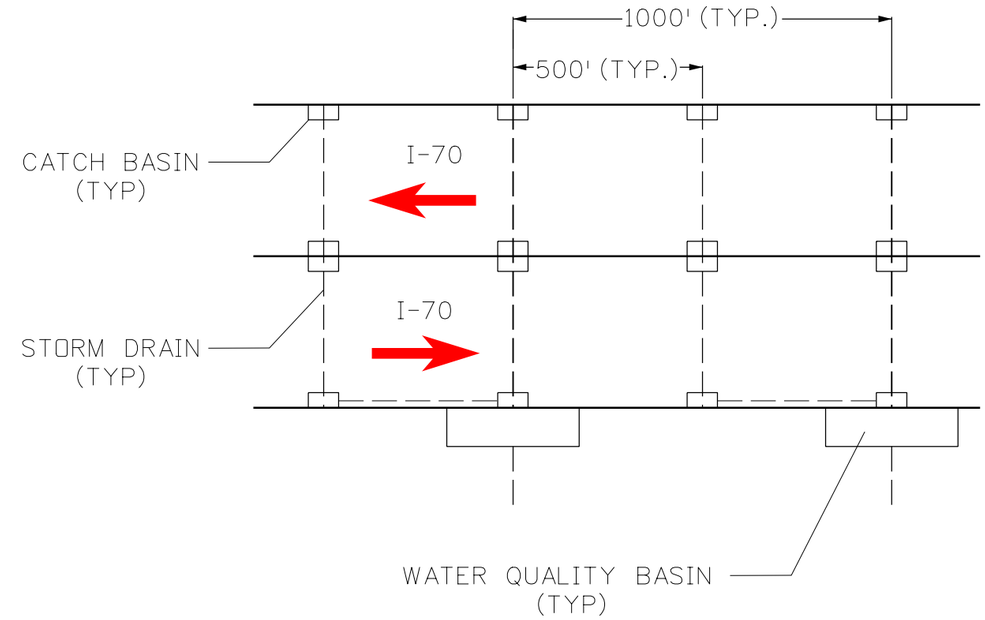
DRAINAGE TYPICAL SECTION 5

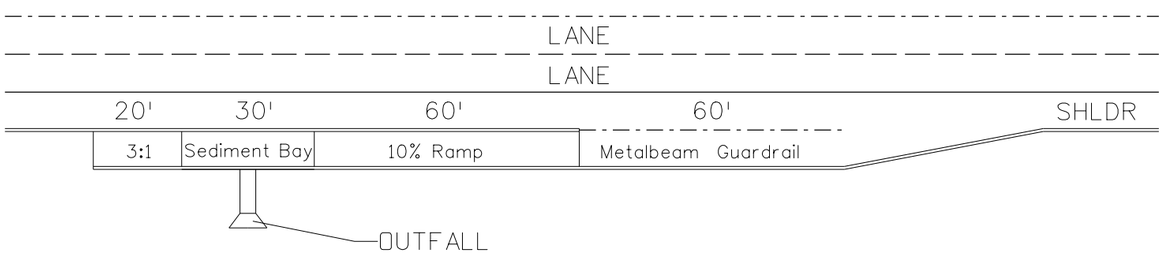
IDAHO SPRINGS TO DUMONT (4 MI) Wex = 100'
EMPIRE PASS TO GEORGETOWN (2 MI) Wex = 105'



# WATER QUALITY BASIN DETAIL




WATER QUALITY BASIN

**CDOT 2012 Cost Data**

**RCP**

| Size (in) | Item | Item No. | Qty | Unit | $/Unit | $/in dia | Qty-$/in dia | | USE $ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 24 | RCP | 603-01245 | 4621 | LF | $ 57.75 | $ 2.41 | $ 11,119 | | $ 59 | LF |
| 30 | RCP | 603-01305 | 4956 | LF | $ 77.26 | $ 2.58 | $ 12,763 | | $ 73 | LF |
| 36 | RCP | 603-01365 | 2339 | LF | $ 79.00 | $ 2.19 | $ 5,133 | | $ 88 | LF |
| 42 | RCP | 603-01425 | 626 | LF | $ 88.27 | $ 2.10 | $ 1,316 | | $ 102 | LF |
| 48 | RCP | 603-01485 | 1568 | LF | $ 120.00 | $ 2.50 | $ 3,920 | | $ 117 | LF |
| | | | **14110** | | | **$ 2.43** | **$ 34,251** | | | |
| | | | | | | | | | | |
| 54 | RCP | | | LF | | | | | $ 132 | LF |
| 60 | RCP | | | LF | | | | | $ 146 | LF |
| 66 | RCP | | | LF | | | | | $ 161 | LF |
| 72 | RCP | | | LF | | | | | $ 175 | LF |
| 78 | RCP | | | LF | | | | | $ 190 | LF |
| 84 | RCP | | | LF | | | | | $ 204 | LF |
| 90 | RCP | | | LF | | | | | $ 219 | LF |

**Grout & Inlets**

| Size (in) | Item | Item No. | Qty | Unit | $/Unit | | | | USE $ | | $/in. dia/ft |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annular Space Grout | | 603-00001 | 119 | CY | $ 299 | | | | $ 300 | CY | $ 0.73 |
| | | | | | | | | | | | |
| Inlet Ty C (5 ft) | | 604-00305 | 36 | EA | $ 2,163 | | | | $ 2,200 | EA | |
| | | | | | | | | | | | |
| Inlet Ty D (5 ft) | | 604-00505 | 4 | EA | $ 2,944 | | | | $ 3,000 | EA | |

**RCB**

| Size (ftxft) | | Item | Item No. | Qty | Unit | $/LF | $/sf | Qty-$/sf | USE $ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 6 | 7 | CBC | 603-70607 | 72 | LF | $ 660 | $ 15.71 | $ 1,131 | | |
| 12 | 6 | CBC | 603-71206 | 72 | LF | $ 1,117 | $ 15.51 | $ 1,117 | | |
| 16 | 6 | CBC | 603-71606 | 110 | LF | $ 2,900 | $ 30.21 | | | |
| 16 | 8 | CBC | 603-71608 | 55 | LF | $ 1,980 | $ 15.47 | $ 851 | | |
| | | | | **199** | | | **$ 15.57** | **$ 3,099** | | |
| | | | | | | | | | | |
| 5 | 4 | CBC | 603-70504 | | LF | | | | $ 320 | LF |
| 6 | 5 | CBC | 603-70605 | | LF | | | | $ 470 | LF |
| 6 | 6 | CBC | 603-70606 | | LF | | | | $ 570 | LF |
| 8 | 4 | CBC | 603-70804 | | LF | | | | $ 500 | LF |
| 8 | 6 | CBC | 603-70806 | | LF | | | | $ 750 | LF |
| 8 | 8 | CBC | 603-70808 | | LF | | | | $ 1,000 | LF |
| 10 | 8 | CBC | 603-71008 | | LF | | | | $ 1,250 | LF |

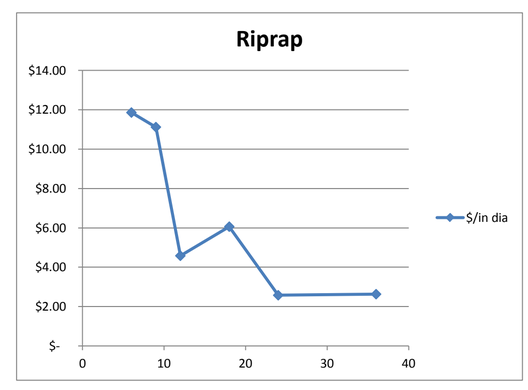
**Riprap**

Depth = 2 x Size

| Size (in) | Item | Item No. | Qty | Unit | $/Unit | $/in dia | Qty-$/in dia | $/in dia | USE $ | | $/sf | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| 6 | Riprap | 506-00206 | 2657 | CY | $ 71.15 | $ 11.86 | $ 31,508 | 11.86 | $ 71 | CY | $ 2.64 | SF |
| 9 | Riprap | 506-00209 | 225 | CY | $ 100.07 | $ 11.12 | $ 2,502 | 10.55 | $ 95 | CY | $ 5.27 | SF |
| 12 | Riprap | 506-00212 | 2058 | CY | $ 54.98 | $ 4.58 | $ 9,429 | 9.24 | $ 111 | CY | $ 8.21 | SF |
| 18 | Riprap | 506-00218 | 1471 | CY | $ 109.08 | $ 6.06 | $ 8,914 | 6.62 | $ 119 | CY | $ 13.24 | SF |
| 24 | Riprap | 506-00224 | 12 | CY | $ 61.81 | $ 2.58 | $ 31 | 4.00 | $ 96 | CY | $ 14.22 | SF |
| 36 | Riprap | 506-00236 | 90 | CY | $ 94.71 | $ 2.63 | $ 237 | 2.63 | $ 95 | CY | $ 21.04 | SF |
| | | | **6513** | | | **$ 8.08** | **$ 52,620** | | | | | |

| Size (in) | $/in dia | Equation |
|---|---|---|
| 6 | $ 11.86 | 11.86 |
| 9 | $ 11.12 | |
| 12 | $ 4.58 | |
| 18 | $ 6.06 | |
| 24 | $ 2.58 | 4 |
| 36 | $ 2.63 | 2.63 |

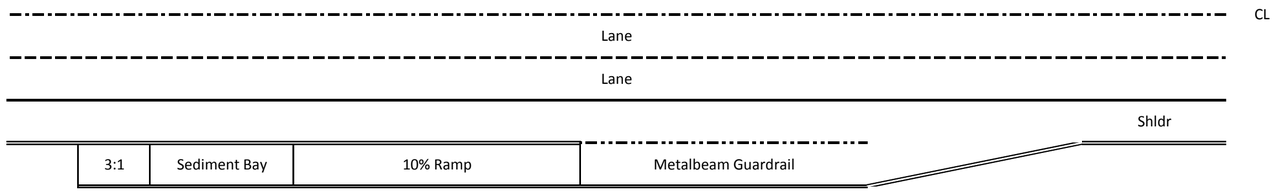
$/in dia = 11.86+(4.00-11.86)/(24-6)RipRap




**Metal Beam Guardrail**

| Item | Item No. | Qty | Unit | $/Unit | | | | USE $ | |
|---|---|---|---|---|---|---|---|---|---|
| End Anchor Non-flared | 606-02003 | 227 | EA | $ 1,965 | | | | $ 2,000 | |
| Bridge Rail Ty 3 | 606-10305 | 86 | LF | $ 102 | | | | $ 110 | |
| Guardrail ty 3 | 606-00301 | 111179 | LF | $ 15 | | | | $ 20 | |
| | | | | | | | | | |

**Roadside Sediment Bay**




| | * 50% | 603-70806 | * 50% of 603-70806 | Br rail | Gdrl Ty 3 | Anchor |
|---|---|---|---|---|---|---|
| Length (ft) | 20 | 30 | 60 | 110 | 60 | 1 |
| Unit Cost | $375 | $750 | $375 | $110 | $20 | $2,000 |
| Cost | $7,500 | $22,500 | $22,500 | $12,100 | $1,200 | $2,000 |
| **Total Cost** | | | **$67,800** | | | |

**ENTER_ROAD_NAME_HERE**

| | | | |
|---|---|---|---|
| PROJECT: | **I-70 EJMT Fire Protection Deluge Flow (2 Zone)** | SHEET: _____ OF _____ | |
| | | BY: | DATE: 01/08/14 |
| SUBJECT: | FLOODED WIDTH | CK: | DATE: _____ |

PURPOSE: This spreadsheet calculates runoff volume, spread width, inlet interception/bypass volume.

APPROACH: Runoff volume is computed between stations based on width of paved and natural areas. Rainfall intensity and runoff coefficient for paved areas are entered for the inlets 1, 2 & 3. Rainfall intensity and runoff coefficient for unpaved areas are entered for the natural area. Inlet grate parameters are entered for N, W, L, CF & $V_o$.
Tmax is used in the column labeled CK. This column verifies spread width does not exceed shoulder width. If spread exceeds shoulder width, an * appears in the column.

Columns labeled from INLET, $R_f$, $E_o$, $R_s$, E, $Q_{int}$, and $Q_{by}$ are used in the inlet interception analysis. By placing the letter "I" or "Inlet" in the INLET column the spreadsheet performs the inlet interception analysis at the corresponding station using the cumulative Qtotal at that point.

The base spreadsheet is setup with and an "Inlet 1" a every station. If an "Inlet 2" or "Inlet 3" is required, the corresponding row of information for that inlet type must be copied down from above the column titles.

If an inlet is not needed the word "Inlet 1" can be deleted from the column and interception analysis will not be performed until "I" or "Inlet" is placed in the INLET column. **A word of caution: if you place "I" or "Inlet" in the INLET column the corresponding information from above the column titles must be copied down in order to perform the inlet analysis using the corresponding/correct parameters.**

RESULTS: Inlet spacing for inlets on grade is analyzed with flooded widths, interception capacities and bypass capacities computed.

INPUT: Input is required in the cells shown as:

**I-70 3Rd Bore and New Tunnels**
**Options**

| Alternative | Option | 3RD Tunnel | | | | Drainage & Seep System Cost | Water Treatment Plant |
|---|---|---|---|---|---|---|---|
| | | EJMT | | Twin | | | |
| | | Rdwy Width | Length | Rdwy Width | Length | | |
| | | | | | | | |
| 01 | 2-Lane Reversable | 47 | 8700 | 47 | 1300 | $ 4,140,120 | $ 5,747,000 |
| 02 | 3-Lane Reversable | 59 | 8700 | 56 | 1650 | $ 4,643,553 | $ 5,948,000 |
| 03 | 01 | 63 | 8700 | | | $ 4,021,197 | $ 5,000,000 |
| | 02 | 63 | 8700 | | | $ 4,021,197 | $ 5,000,000 |
| 04 | 01 | 63 | 8700 | | | $ 4,021,197 | $ 5,000,000 |
| | 02 | 63 | 8700 | | | $ 4,021,197 | $ 5,000,000 |
| 05 | 2-Way Traffic | 55 | 8700 | | | $ 3,816,429 | $ 5,000,000 |
| | | | | | | | |

| Alternative | Option | New Tunnels | | | | | | Drainage & Seep System Cost | Water Treatment Plant |
|---|---|---|---|---|---|---|---|---|---|
| | | Hidden Valley EB | | Hidden Valley WB | | US-6 | | | |
| | | Rdwy Width | Length | Rdwy Width | Length | Rdwy Width | Length | | |
| | | | | | | | | | |
| 03 | 02 | 75 | 1070 | 63 | 980 | 75 | 1650 | $ 1,857,474 | $ 2,126,000 |
| | 04 | 75 | 1070 | 63 | 980 | 75 | 1650 | $ 1,857,474 | $ 2,126,000 |
| 04 | 02 | 75 | 1070 | 63 | 980 | 75 | 1650 | $ 1,857,474 | $ 2,126,000 |
| | | | | | | | | | |

| Alternative | Option | Tunnel Drainage, Seepage & Treatment Total Cost | Low | High |
|---|---|---|---|---|
| | | | | |
| 01 | 2-Lane Reversable | $ 9,887,120 | $ 6,140,120 | $ 15,634,120 |
| 02 | 3-Lane Reversable | $ 10,591,553 | $ 6,643,553 | $ 16,539,553 |
| 03 | 01 | $ 9,021,197 | $ 6,021,197 | $ 14,021,197 |
| | 02 | $ 13,004,671 | $ 7,878,671 | $ 20,130,671 |
| | 04 | $ 3,983,474 | $ 1,857,474 | $ 6,109,474 |
| 04 | 01 | $ 9,021,197 | $ 6,021,197 | $ 14,021,197 |
| | 02 | $ 13,004,671 | $ 7,878,671 | $ 20,130,671 |
| 05 | 2-Way Traffic | $ 8,816,429 | $ 5,816,429 | $ 13,816,429 |
| | | | | |

**I-70 3Rd Bore and New Tunnels**
**Drainage System Costs**

| Manholes | | Inlets | | Drainage Pipe | | | | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 15-inch | | 12-inch | | 8-inch | | 6-inch | | |
| (EA) | | (EA) | | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | |
| 70 | $ 2,400 | 140 | $ 2,700 | | | 10000 | $ 54.00 | 3290 | $ 36.00 | | | $ 1,204,440 |
| 73 | $ 2,400 | 146 | $ 2,700 | | | 10350 | $ 54.00 | 4268 | $ 36.00 | | | $ 1,281,948 |
| 62 | $ 2,400 | 124 | $ 2,700 | | | 8700 | $ 54.00 | 3780 | $ 36.00 | | | $ 1,089,480 |
| 62 | $ 2,400 | 124 | $ 2,700 | | | 8700 | $ 54.00 | 3780 | $ 36.00 | | | $ 1,089,480 |
| 62 | $ 2,400 | 124 | $ 2,700 | | | 8700 | $ 54.00 | 3780 | $ 36.00 | | | $ 1,089,480 |
| 62 | $ 2,400 | 124 | $ 2,700 | | | 8700 | $ 54.00 | 3780 | $ 36.00 | | | $ 1,089,480 |
| 62 | $ 2,400 | 124 | $ 2,700 | | | 8700 | $ 54.00 | 3300 | $ 36.00 | | | $ 1,072,200 |

| Manholes | | Inlets | | Drainage Pipe | | | | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 15-inch | | 12-inch | | 8-inch | | 6-inch | | |
| (EA) | | (EA) | | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | |
| 27 | $ 2,400 | 54 | $ 2,700 | 3700 | $ 67.50 | | | | | 2154 | $ 27.00 | $ 518,508 |
| 27 | $ 2,400 | 54 | $ 2,700 | 3700 | $ 67.50 | | | | | 2154 | $ 27.00 | $ 518,508 |
| 27 | $ 2,400 | 54 | $ 2,700 | 3700 | $ 67.50 | | | | | 2154 | $ 27.00 | $ 518,508 |

**CDOT 2012 Cost Data**

| | | Unit | Ave Cost | $/in dia |
|---|---|---|---|---|
| 603-50004 | 4-inch Plastic Pipe | LF | $ 12.80 | $ 3.20 |
| 603-50008 | 8-inch Plastic Pipe | LF | $ 48.98 | $ 6.12 |
| 603-50012 | 12-inch Plastic Pipe | LF | $ 50.63 | $ 4.22 |
| 603-50015 | 15-inch Plastic Pipe | LF | $ 55.00 | $ 3.67 |
| 603-50018 | 18-inch Plastic Pipe | LF | $ 42.35 | $ 5.29 |
| | | | | **$ 4.50 Ave** |
| 605-25005 | e grate Inlet (5 ft) | EA | $ 2,672 | |
| | MH Slab Base (5 ft) | EA | $ 2,404 | |

**I-70 3Rd Bore and New Tunnels**
**Seep System Costs**

| Manholes | | | | Seep Pipe | | | | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 12-inch | | 4-inch (Invert) | | 4-inch (Soffit) | | 2-inch (Soffit) | | |
| (EA) | | | | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | |
| | | | | | | | | | | | | |
| 70 | $ 2,400 | | | 20000 | $ 54.00 | 20329 | $ 18.00 | 11890 | $ 18.00 | 123082 | $ 9.00 | $ 2,935,680 |
| 73 | $ 2,400 | | | 20700 | $ 54.00 | 23281 | $ 18.00 | 12321 | $ 18.00 | 158641 | $ 9.00 | $ 3,361,605 |
| 62 | $ 2,400 | | | 17400 | $ 54.00 | 20290 | $ 18.00 | 10374 | $ 18.00 | 143485 | $ 9.00 | $ 2,931,717 |
| 62 | $ 2,400 | | | 17400 | $ 54.00 | 20290 | $ 18.00 | 10374 | $ 18.00 | 143485 | $ 9.00 | $ 2,931,717 |
| 62 | $ 2,400 | | | 17400 | $ 54.00 | 20290 | $ 18.00 | 10374 | $ 18.00 | 143485 | $ 9.00 | $ 2,931,717 |
| 62 | $ 2,400 | | | 17400 | $ 54.00 | 20290 | $ 18.00 | 10374 | $ 18.00 | 143485 | $ 9.00 | $ 2,931,717 |
| 62 | $ 2,400 | | | 17400 | $ 54.00 | 18984 | $ 18.00 | 10374 | $ 18.00 | 125265 | $ 9.00 | $ 2,744,229 |
| | | | | | | | | | | | | |

| Manholes | | | | Seep Pipe | | | | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 12-inch | | 4-inch (Invert) | | 4-inch (Soffit) | | 2-inch (Soffit) | | |
| (EA) | | | | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | (LF) | Unit Cost | |
| | | | | | | | | | | | | |
| 27 | $ 2,400 | | | 7400 | $ 54.00 | 9279 | $ 18.00 | 4429 | $ 18.00 | 69758 | $ 9.00 | $ 1,338,966 |
| 27 | $ 2,400 | | | 7400 | $ 54.00 | 9279 | $ 18.00 | 4429 | $ 18.00 | 69758 | $ 9.00 | $ 1,338,966 |
| 27 | $ 2,400 | | | 7400 | $ 54.00 | 9279 | $ 18.00 | 4429 | $ 18.00 | 69758 | $ 9.00 | $ 1,338,966 |
| | | | | | | | | | | | | |

**Deluge Flow**

**47 Ft Roadway-Tunnel Width**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 0.16 | gpm/sf | | | |
| Duration: | 60 | min | | | |
| Active zones: | 2 | ea | | | |
| Zone Length | 100 | ft | One Zone Area | 4700 | sf |
| Tunnel Width | 47.0 | ft | | | |
| | | | Two Zone Area | 9400 | sf |
| Two Zone flow Volume: | 90240 | gal/hr | | | |
| | 12064 | cf/hr | | 33.5 | cfs |
| Flow Volume: | 15.4 | in/hr | | | |

**Mist Flow**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 871 | gpm | 3300 | L/min | |
| Duration: | 60 | min | | | |
| Active zones: | 3 | ea | | | |
| Zone Length | 82 | ft | One Zone Area | 3855 | sf |
| Tunnel Width | 47.0 | ft | | | |
| | | | Three Zone | 11565 | sf |
| Three Zone flow Volume: | 52272 | gal/hr | | | |
| | 6988 | cf/hr | | | |
| Flow Volume: | 7.3 | in/hr | | | |

**55 Ft Roadway-Tunnel Width**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 0.16 | gpm/sf | | | |
| Duration: | 60 | min | | | |
| Active zones: | 2 | ea | | | |
| Zone Length | 100 | ft | One Zone Area | 5500 | sf |
| Tunnel Width | 55.0 | ft | | | |
| | | | Two Zone Area | 11000 | sf |
| Two Zone flow Volume: | 105600 | gal/hr | | | |
| | 14118 | cf/hr | | 39.2 | cfs |
| Flow Volume: | 15.4 | in/hr | | | |

**Mist Flow**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 871 | gpm | 3300 | L/min | |
| Duration: | 60 | min | | | |
| Active zones: | 3 | ea | | | |
| Zone Length | 82 | ft | One Zone Area | 4511 | sf |
| Tunnel Width | 55.0 | ft | | | |
| | | | Three Zone | 13533 | sf |
| Three Zone flow Volume: | 52272 | gal/hr | | | |
| | 6988 | cf/hr | | | |
| Flow Volume: | 6.2 | in/hr | | | |

**56 Ft Roadway-Tunnel Width**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 0.16 | gpm/sf | | | |
| Duration: | 60 | min | | | |
| Active zones: | 2 | ea | | | |
| Zone Length | 100 | ft | One Zone Area | 5600 | sf |
| Tunnel Width | 56.0 | ft | | | |
| | | | Two Zone Area | 11200 | sf |
| Two Zone flow Volume: | 107520 | gal/hr | | | |
| | 14374 | cf/hr | | 39.9 | cfs |
| Flow Volume: | 15.4 | in/hr | | | |

**Mist Flow**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 871 | gpm | 3300 | L/min | |
| Duration: | 60 | min | | | |
| Active zones: | 3 | ea | | | |
| Zone Length | 82 | ft | One Zone Area | 4593 | sf |
| Tunnel Width | 56.0 | ft | | | |
| | | | Three Zone | 13780 | sf |
| Three Zone flow Volume: | 52272 | gal/hr | | | |
| | 6988 | cf/hr | | | |
| Flow Volume: | 6.1 | in/hr | | | |

## 59 Ft Roadway-Tunnel Width

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 0.16 | gpm/sf | | | |
| Duration: | 60 | min | | | |
| Active zones: | 2 | ea | | | |
| Zone Length | 100 | ft | One Zone Area | 5900 | sf |
| Tunnel Width | 59.0 | ft | | | |
| | | | Two Zone Area | 11800 | sf |
| Two Zone flow Volume: | 113280 | gal/hr | | | |
| | 15144 | cf/hr | | 42.1 | cfs |
| Flow Volume: | 15.4 | in/hr | | | |

**Mist Flow**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 871 | gpm | | 3300 | L/min |
| Duration: | 60 | min | | | |
| Active zones: | 3 | ea | | | |
| Zone Length | 82 | ft | One Zone Area | 4839 | sf |
| Tunnel Width | 59.0 | ft | | | |
| | | | Three Zone | 14518 | sf |
| Three Zone flow Volume: | 52272 | gal/hr | | | |
| | 6988 | cf/hr | | | |
| Flow Volume: | 5.8 | in/hr | | | |

## 63 Ft Roadway-Tunnel Width

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 0.16 | gpm/sf | | | |
| Duration: | 60 | min | | | |
| Active zones: | 2 | ea | | | |
| Zone Length | 100 | ft | One Zone Area | 6300 | sf |
| Tunnel Width | 63.0 | ft | | | |
| | | | Two Zone Area | 12600 | sf |
| Two Zone flow Volume: | 120960 | gal/hr | | | |
| | 16171 | cf/hr | | 44.9 | cfs |
| Flow Volume: | 15.4 | in/hr | | | |

**Mist Flow**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 871 | gpm | | 3300 | L/min |
| Duration: | 60 | min | | | |
| Active zones: | 3 | ea | | | |
| Zone Length | 82 | ft | One Zone Area | 5167 | sf |
| Tunnel Width | 63.0 | ft | | | |
| | | | Three Zone | 15502 | sf |
| Three Zone flow Volume: | 52272 | gal/hr | | | |
| | 6988 | cf/hr | | | |
| Flow Volume: | 5.4 | in/hr | | | |

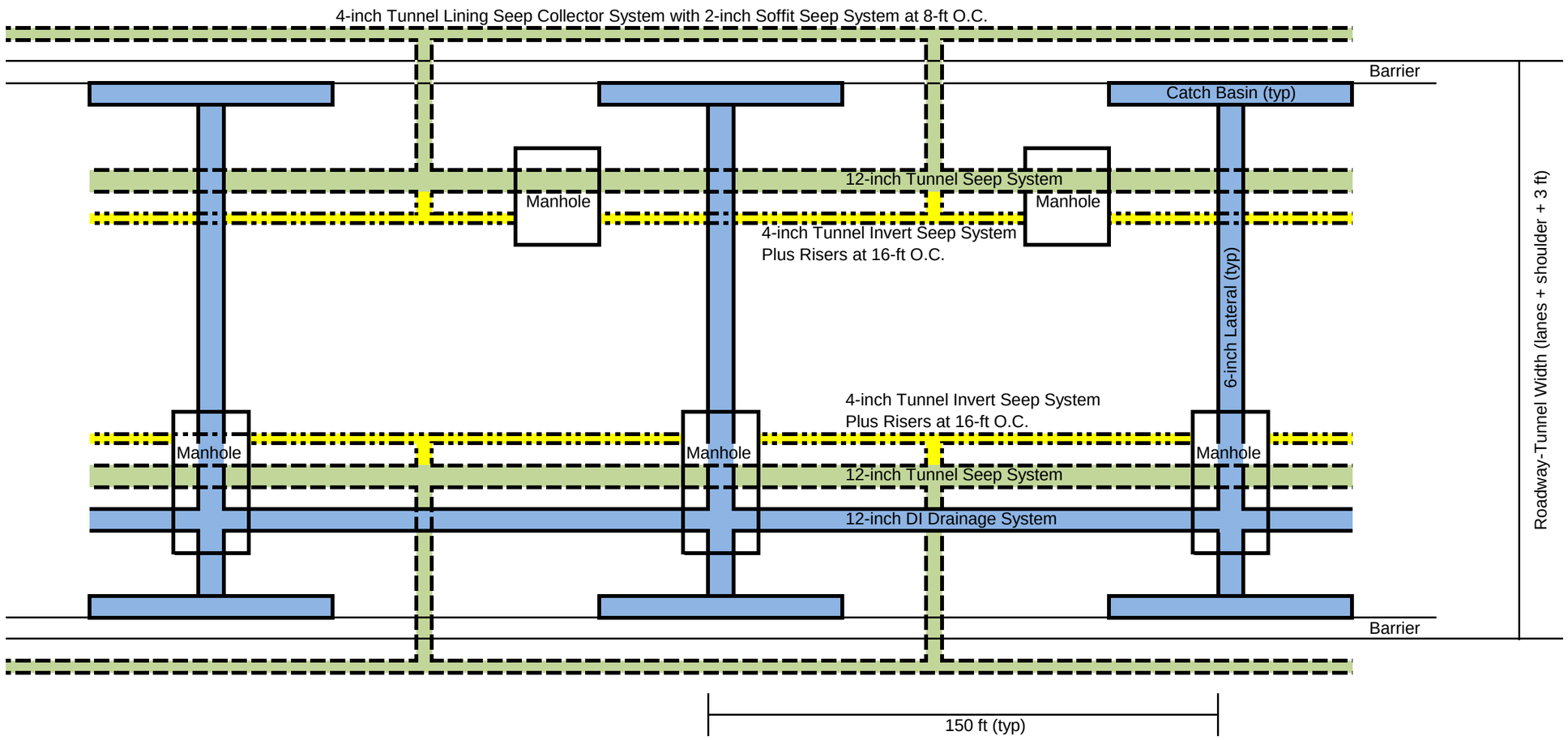
## 75 Ft Roadway-Tunnel Width

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 0.16 | gpm/sf | | | |
| Duration: | 60 | min | | | |
| Active zones: | 2 | ea | | | |
| Zone Length | 100 | ft | One Zone Area | 7500 | sf |
| Tunnel Width | 75.0 | ft | | | |
| | | | Two Zone Area | 15000 | sf |
| Two Zone flow Volume: | 144000 | gal/hr | | | |
| | 19251 | cf/hr | | 53.5 | cfs |
| Flow Volume: | 15.4 | in/hr | | | |

**Mist Flow**

| | | | | | |
|---|---|---|---|---|---|
| Water application rate: | 871 | gpm | | 3300 | L/min |
| Duration: | 60 | min | | | |
| Active zones: | 3 | ea | | | |
| Zone Length | 82 | ft | One Zone Area | 6152 | sf |
| Tunnel Width | 75.0 | ft | | | |
| | | | Three Zone | 18455 | sf |
| Three Zone flow Volume: | 52272 | gal/hr | | | |
| | 6988 | cf/hr | | | |
| Flow Volume: | 4.5 | in/hr | | | |

**I-70 New Tunnels**
**Drainage & Seep Systems**



PROJECT: PROJECT: **I-70 EJMT Fire Protection Deluge Flow (2 Zone)**

SUBJECT: FLOODED WIDTH (ENGLISH UNITS) **GRATE INLET**

SECTION:

TRUNK: XXXXXX

SHEET: _____ OF _____

BY: C. Rogers DATE: __ 1/8/2014

CK: DATE: _____

| DESIGN PARAMETERS | INLET 1 | INLET 2 | INLET 3 | Natural | SOURCE |
|---|---|---|---|---|---|
| Rational "C" = | 1.00 | 1.00 | 1.00 | 0.50 | Coefficient for new pavement |
| Rainfall intensity, I (inch/hr) = | 15.40 | 15.40 | 15.40 | 15.40 | Deluge Fire Suppression even |
| Manning's "n" = | 0.016 | 0.016 | 0.016 | N/A | HEC-12 standard value for paved shldr |
| Grate Width, Wg (feet) = | 0.98 | 0.98 | 1.48 | N/A | Standard grate + 0.0 ft offset from wall |
| Grate Length, Lg (feet) = | 2.21 | 4.42 | 2.27 | N/A | Standard grate length |
| Clogging Factor, CF ( % ) = | 25% | 25% | 25% | N/A | Standard value for grate inlet |
| Effective Length, Le (feet) = | 1.66 | 3.31 | 1.70 | N/A | Effective "unclogged" length of grate |
| Splash over velocity, Vo (fps) = | 4.20 | 6.90 | 6.20 | N/A | From HEC-12, Page 55, Chart 7 |
| Cross slope, Sx (%) = | Varies | Varies | Varies | N/A | See plans |
| Gutter slope, Sl ( % ) = | Varies | Varies | Varies | N/A | See plans |
| Drainage Width, W ft) = | Varies | Varies | Varies | N/A | See plans |
| Allowable Flooded Width, Tmax (ft) = | 12.00 | 12.00 | 12.00 | N/A | From Plans |

| EQUATIONS: | | SOURCE |
|---|---|---|
| A = (Sta2 - Sta1) x (W1 + W2) / 2 | | Area in square meters |
| Qro = C x Ap x I + C x An X I | | Rational equation (ENGLISH UNITS) |
| Qtotal = Qro + Qby (from upstream section) | | |
| T = ( Q x n / 0.56 / Sx^1.67 / Sl^0.5 )^0.375 | | HEC-12 , Page 22, Eq. 4 |
| Rf = 1 - 0.09 x max ( 0, ( V - Vo)) | **English** | HEC-12 , Page 54, Eq. 9 |
| Eo = 1-(1-@min( 1, Wg/T))^2.67 | | HEC-12 , Page 54, Eq. 7 |
| Rs = 1 / ( 1 + 0.15 x V^1.8 / Sx / Le^2.3 ) | | HEC-12 , Page 56, Eq. 10 |
| Le = L x (1 - CF) | | Clogging reduces length |
| E = Rf x Eo + Rs x (1-Eo) | | HEC-12 , Page 56, Eq. 11 |
| Qint = E x Qtotal | | HEC-12 , Page 56, Eq. 12 |
| Qby = Qtotal - Qint | | Bypass flow to next inlet |
| CK = "OK" if T<= Tmax, else "*" Explain | | Spread criteria RFP ___ |

| | | | | | |
|---|---|---|---|---|---|
| INLET 1 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Single Inlet (longitudinal) |
| INLET 2 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Double Inlet (longitudinal) |
| INLET 3 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | CDOT Vane Grate Inlet |

| INLET (#) | STA. (ft) | SIDE (Lt/Rt) | RUN (ft) | PAVED WIDTH (meter) | PAVED AREA (acre) | NATURAL WIDTH (ft) | NATURAL AREA (acre) | Qro (cfs) | Qtotal (cfs) | Sx (%) | Sl (%) | T (feet) | T (meter) | CK (OK/*) | VEL (fps) | INLET | Rf (frac) | Eo (frac) | Rs (frac) | E (frac) | Qint (cfs) | Qby (cfs) | REMARKS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALT01-EJMT** | 0+00.0 | Rt | | 47.0 | | 0.0 | | | 0.00 | 4.50% | 1.70% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge | |
| | | | 100.0 | | 0.11 | | 0.00 | 1.66 | | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 47.0 | | 0.0 | | | 1.66 | 4.50% | 1.70% | 4.77 | 1.46 | OK | 3.24 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.66 | | |
| | | | 50.0 | | 0.05 | | 0.00 | 0.83 | | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 47.0 | | 0.0 | | | 2.49 | 4.50% | 1.70% | 5.56 | 1.69 | OK | 3.59 | INLET 3 | 1.00 | 0.56 | 0.09 | 0.60 | 1.50 | 0.99 | | |
| | | | 50.0 | | 0.05 | | 0.00 | 0.83 | | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 47.0 | | 0.0 | | | 1.82 | 4.50% | 1.70% | 4.94 | 1.51 | OK | 3.31 | INLET 3 | 1.00 | 0.61 | 0.11 | 0.65 | 1.19 | 0.63 | End Deluge | |
| | | | 100.0 | | 0.05 | | 0.00 | | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.63 | 4.50% | 1.70% | 3.32 | 1.01 | OK | 2.54 | INLET 3 | 1.00 | 0.79 | 0.16 | 0.83 | 0.52 | 0.11 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.11 | 4.50% | 1.70% | 1.72 | 0.52 | OK | 1.64 | INLET 3 | 1.00 | 0.99 | 0.30 | 1.00 | 0.11 | 0.00 | 100% interception by inlets | |
| | | | | | | | | | | | | | | | | | | | | | | | **3.32** | **cfs** |
| **ALT01-TWIN** | 0+00.0 | Rt | | 47.0 | | 0.0 | | | 0.00 | 4.50% | 1.30% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge | |
| | | | 100.0 | | 0.11 | | 0.00 | 1.66 | | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 47.0 | | 0.0 | | | 1.66 | 4.50% | 1.30% | 5.02 | 1.53 | OK | 2.93 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.66 | | |
| | | | 50.0 | | 0.05 | | 0.00 | 0.83 | | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 47.0 | | 0.0 | | | 2.49 | 4.50% | 1.30% | 5.84 | 1.78 | OK | 3.24 | INLET 3 | 1.00 | 0.54 | 0.11 | 0.59 | 1.47 | 1.02 | | |
| | | | 50.0 | | 0.05 | | 0.00 | 0.83 | | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 47.0 | | 0.0 | | | 1.85 | 4.50% | 1.30% | 5.23 | 1.59 | OK | 3.01 | INLET 3 | 1.00 | 0.59 | 0.12 | 0.64 | 1.18 | 0.67 | End Deluge | |
| | | | 100.0 | | 0.05 | | 0.00 | | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.67 | 4.50% | 1.30% | 3.57 | 1.09 | OK | 2.33 | INLET 3 | 1.00 | 0.76 | 0.18 | 0.80 | 0.54 | 0.13 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.13 | 4.50% | 1.30% | 1.93 | 0.59 | OK | 1.55 | INLET 3 | 1.00 | 0.98 | 0.32 | 0.99 | 0.13 | 0.00 | 100% interception by inlets | |
| | | | | | | | | | | | | | | | | | | | | | | | **3.32** | **cfs** |
| **ALT02-EJMT** | 0+00.0 | Rt | | 59.0 | | 0.0 | | | 0.00 | 4.50% | 1.70% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge | |
| | | | 100.0 | | 0.14 | | 0.00 | 2.09 | | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 59.0 | | 0.0 | | | 2.09 | 4.50% | 1.70% | 5.20 | 1.58 | OK | 3.43 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.09 | | |
| | | | 50.0 | | 0.07 | | 0.00 | 1.04 | | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 59.0 | | 0.0 | | | 3.13 | 4.50% | 1.70% | 6.05 | 1.84 | OK | 3.80 | INLET 3 | 1.00 | 0.53 | 0.08 | 0.57 | 1.77 | 1.36 | | |
| | | | 50.0 | | 0.07 | | 0.00 | 1.04 | | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 59.0 | | 0.0 | | | 2.40 | 4.50% | 1.70% | 5.48 | 1.67 | OK | 3.55 | INLET 3 | 1.00 | 0.57 | 0.09 | 0.61 | 1.46 | 0.94 | End Deluge | |
| | | | 100.0 | | 0.07 | | 0.00 | | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.94 | 4.50% | 1.70% | 3.85 | 1.17 | OK | 2.81 | INLET 3 | 1.00 | 0.73 | 0.14 | 0.76 | 0.72 | 0.22 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.22 | 4.50% | 1.70% | 2.24 | 0.68 | OK | 1.96 | INLET 3 | 1.00 | 0.94 | 0.23 | 0.96 | 0.21 | 0.01 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.01 | 4.50% | 1.70% | 0.69 | 0.21 | OK | 0.89 | INLET 3 | 1.00 | 1.00 | 0.56 | 1.00 | 0.01 | 0.00 | 100% interception by inlets | |
| | | | | | | | | | | | | | | | | | | | | | | | **4.17** | **cfs** |

PROJECT: PROJECT: **I-70 EJMT Fire Protection Deluge Flow (2 Zone)**

SUBJECT: FLOODED WIDTH (ENGLISH UNITS) **GRATE INLET**

SECTION:

TRUNK: XXXXXX

SHEET: _____ OF _____

BY: C. Rogers DATE: __ 1/8/2014

CK: DATE: _____

| DESIGN PARAMETERS | INLET 1 | INLET 2 | INLET 3 | Natural | SOURCE |
|---|---|---|---|---|---|
| Rational "C" = | 1.00 | 1.00 | 1.00 | 0.50 | Coefficient for new pavement |
| Rainfall intensity, I (inch/hr) = | 15.40 | 15.40 | 15.40 | 15.40 | Deluge Fire Suppression even |
| Manning's "n" = | 0.016 | 0.016 | 0.016 | N/A | HEC-12 standard value for paved shldr |
| Grate Width, Wg (feet) = | 0.98 | 0.98 | 1.48 | N/A | Standard grate + 0.0 ft offset from wall |
| Grate Length, Lg (feet) = | 2.21 | 4.42 | 2.27 | N/A | Standard grate length |
| Clogging Factor, CF ( % ) = | 25% | 25% | 25% | N/A | Standard value for grate inlet |
| Effective Length, Le (feet) = | 1.66 | 3.31 | 1.70 | N/A | Effective "unclogged" length of grate |
| Splash over velocity, Vo (fps) = | 4.20 | 6.90 | 6.20 | N/A | From HEC-12, Page 55, Chart 7 |
| Cross slope, Sx (%) = | Varies | Varies | Varies | N/A | See plans |
| Gutter slope, Sl ( % ) = | Varies | Varies | Varies | N/A | See plans |
| Drainage Width, W ft) = | Varies | Varies | Varies | N/A | See plans |
| Allowable Flooded Width, Tmax (ft) = | 12.00 | 12.00 | 12.00 | N/A | From Plans |

| EQUATIONS: | | SOURCE |
|---|---|---|
| A = (Sta2 - Sta1) x (W1 + W2) / 2 | | Area in square meters |
| Qro = C x Ap x I + C x An X I | | Rational equation (ENGLISH UNITS) |
| Qtotal = Qro + Qby (from upstream section) | | |
| T = ( Q x n / 0.56 / Sx^1.67 / Sl^0.5 )^0.375 | | HEC-12 , Page 22, Eq. 4 |
| Rf = 1 - 0.09 x max ( 0, ( V - Vo)) | **English** | HEC-12 , Page 54, Eq. 9 |
| Eo = 1-(1-@min( 1, Wg/T))^2.67 | | HEC-12 , Page 54, Eq. 7 |
| Rs = 1 / ( 1 + 0.15 x V^1.8 / Sx / Le^2.3 ) | | HEC-12 , Page 56, Eq. 10 |
| Le = L x (1 - CF) | | Clogging reduces length |
| E = Rf x Eo + Rs x (1-Eo) | | HEC-12 , Page 56, Eq. 11 |
| Qint = E x Qtotal | | HEC-12 , Page 56, Eq. 12 |
| Qby = Qtotal - Qint | | Bypass flow to next inlet |
| CK = "OK" if T<= Tmax, else "*" Explain | | Spread criteria RFP ___ |

| | | | | | |
|---|---|---|---|---|---|
| INLET 1 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Single Inlet (longitudinal) |
| INLET 2 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Double Inlet (longitudinal) |
| INLET 3 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | CDOT Vane Grate Inlet |

| INLET (#) | STA. (ft) | SIDE (Lt/Rt) | RUN (ft) | PAVED WIDTH (meter) | PAVED AREA (acre) | NATURAL WIDTH (ft) | NATURAL AREA (acre) | Qro (cfs) | Qtotal (cfs) | Sx (%) | Sl (%) | T (feet) | T (meter) | CK (OK/*) | VEL (fps) | INLET | Rf (frac) | Eo (frac) | Rs (frac) | E (frac) | Qint (cfs) | Qby (cfs) | REMARKS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALT02-TWIN** | 0+00.0 | Rt | | 56.0 | | 0.0 | | | 0.00 | 4.50% | 1.30% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge | |
| | | | 100.0 | | 0.13 | | 0.00 | 1.98 | | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 56.0 | | 0.0 | | | 1.98 | 4.50% | 1.30% | 5.36 | 1.63 | OK | 3.06 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.98 | | |
| | | | 50.0 | | 0.06 | | 0.00 | 0.99 | | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 56.0 | | 0.0 | | | 2.97 | 4.50% | 1.30% | 6.24 | 1.90 | OK | 3.39 | INLET 3 | 1.00 | 0.51 | 0.10 | 0.56 | 1.67 | 1.30 | | |
| | | | 50.0 | | 0.06 | | 0.00 | 0.99 | | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 56.0 | | 0.0 | | | 2.29 | 4.50% | 1.30% | 5.66 | 1.72 | OK | 3.17 | INLET 3 | 1.00 | 0.55 | 0.11 | 0.61 | 1.38 | 0.90 | End Deluge | |
| | | | 100.0 | | 0.06 | | 0.00 | | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.90 | 4.50% | 1.30% | 3.99 | 1.22 | OK | 2.52 | INLET 3 | 1.00 | 0.71 | 0.16 | 0.76 | 0.68 | 0.22 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.22 | 4.50% | 1.30% | 2.35 | 0.72 | OK | 1.77 | INLET 3 | 1.00 | 0.93 | 0.27 | 0.95 | 0.21 | 0.01 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.01 | 4.50% | 1.30% | 0.77 | 0.24 | OK | 0.84 | INLET 3 | 1.00 | 1.00 | 0.58 | 1.00 | 0.01 | 0.00 | 100% interception by inlets | |
| | | | | | | | | | | | | | | | | | | | | | | | **3.96** | **cfs** |
| **ALT03-EJMT** | 0+00.0 | Rt | | 63.0 | | 0.0 | | | 0.00 | 4.50% | 1.70% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge | |
| | | | 100.0 | | 0.14 | | 0.00 | 2.23 | | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 63.0 | | 0.0 | | | 2.23 | 4.50% | 1.70% | 5.33 | 1.62 | OK | 3.49 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.23 | | |
| | | | 50.0 | | 0.07 | | 0.00 | 1.11 | | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 63.0 | | 0.0 | | | 3.34 | 4.50% | 1.70% | 6.20 | 1.89 | OK | 3.86 | INLET 3 | 1.00 | 0.52 | 0.08 | 0.56 | 1.86 | 1.48 | | |
| | | | 50.0 | | 0.07 | | 0.00 | 1.11 | | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 63.0 | | 0.0 | | | 2.59 | 4.50% | 1.70% | 5.64 | 1.72 | OK | 3.62 | INLET 3 | 1.00 | 0.56 | 0.09 | 0.60 | 1.55 | 1.05 | End Deluge | |
| | | | 100.0 | | 0.07 | | 0.00 | | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 1.05 | 4.50% | 1.70% | 4.01 | 1.22 | OK | 2.89 | INLET 3 | 1.00 | 0.71 | 0.13 | 0.75 | 0.78 | 0.27 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.27 | 4.50% | 1.70% | 2.40 | 0.73 | OK | 2.05 | INLET 3 | 1.00 | 0.92 | 0.22 | 0.94 | 0.25 | 0.02 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.02 | 4.50% | 1.70% | 0.84 | 0.26 | OK | 1.02 | INLET 3 | 1.00 | 1.00 | 0.50 | 1.00 | 0.02 | 0.00 | 100% interception by inlets | |
| | | | | | | | | | | | | | | | | | | | | | | | **4.45** | **cfs** |
| **ALT04-EJMT** | 0+00.0 | Rt | | 63.0 | | 0.0 | | | 0.00 | 4.50% | 1.70% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge | |
| | | | 100.0 | | 0.14 | | 0.00 | 2.23 | | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 63.0 | | 0.0 | | | 2.23 | 4.50% | 1.70% | 5.33 | 1.62 | OK | 3.49 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.23 | | |
| | | | 50.0 | | 0.07 | | 0.00 | 1.11 | | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 63.0 | | 0.0 | | | 3.34 | 4.50% | 1.70% | 6.20 | 1.89 | OK | 3.86 | INLET 3 | 1.00 | 0.52 | 0.08 | 0.56 | 1.86 | 1.48 | | |
| | | | 50.0 | | 0.07 | | 0.00 | 1.11 | | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 63.0 | | 0.0 | | | 2.59 | 4.50% | 1.70% | 5.64 | 1.72 | OK | 3.62 | INLET 3 | 1.00 | 0.56 | 0.09 | 0.60 | 1.55 | 1.05 | End Deluge | |
| | | | 100.0 | | 0.07 | | 0.00 | | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 1.05 | 4.50% | 1.70% | 4.01 | 1.22 | OK | 2.89 | INLET 3 | 1.00 | 0.71 | 0.13 | 0.75 | 0.78 | 0.27 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.27 | 4.50% | 1.70% | 2.40 | 0.73 | OK | 2.05 | INLET 3 | 1.00 | 0.92 | 0.22 | 0.94 | 0.25 | 0.02 | | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.02 | 4.50% | 1.70% | 0.84 | 0.26 | OK | 1.02 | INLET 3 | 1.00 | 1.00 | 0.50 | 1.00 | 0.02 | 0.00 | 100% interception by inlets | |
| | | | | | | | | | | | | | | | | | | | | | | | **4.45** | **cfs** |

PROJECT: PROJECT: **I-70 EJMT Fire Protection Deluge Flow (2 Zone)**

SUBJECT: FLOODED WIDTH (ENGLISH UNITS) **GRATE INLET**

SECTION:

TRUNK: XXXXXX

SHEET: _____ OF _____

BY: C. Rogers DATE: __ 1/8/2014

CK: DATE: _____

| DESIGN PARAMETERS | INLET 1 | INLET 2 | INLET 3 | Natural | SOURCE |
|---|---|---|---|---|---|
| Rational "C" = | 1.00 | 1.00 | 1.00 | 0.50 | Coefficient for new pavement |
| Rainfall intensity, I (inch/hr) = | 15.40 | 15.40 | 15.40 | 15.40 | Deluge Fire Suppression even |
| Manning's "n" = | 0.016 | 0.016 | 0.016 | N/A | HEC-12 standard value for paved shldr |
| Grate Width, Wg (feet) = | 0.98 | 0.98 | 1.48 | N/A | Standard grate + 0.0 ft offset from wall |
| Grate Length, Lg (feet) = | 2.21 | 4.42 | 2.27 | N/A | Standard grate length |
| Clogging Factor, CF ( % ) = | 25% | 25% | 25% | N/A | Standard value for grate inlet |
| Effective Length, Le (feet) = | 1.66 | 3.31 | 1.70 | N/A | Effective "unclogged" length of grate |
| Splash over velocity, Vo (fps) = | 4.20 | 6.90 | 6.20 | N/A | From HEC-12, Page 55, Chart 7 |
| Cross slope, Sx (%) = | Varies | Varies | Varies | N/A | See plans |
| Gutter slope, Sl ( % ) = | Varies | Varies | Varies | N/A | See plans |
| Drainage Width, W ft) = | Varies | Varies | Varies | N/A | See plans |
| Allowable Flooded Width, Tmax (ft) = | 12.00 | 12.00 | 12.00 | N/A | From Plans |

| EQUATIONS: | | SOURCE |
|---|---|---|
| A = (Sta2 - Sta1) x (W1 + W2) / 2 | | Area in square meters |
| Qro = C x Ap x I + C x An X I | | Rational equation (ENGLISH UNITS) |
| Qtotal = Qro + Qby (from upstream section) | | |
| T = ( Q x n / 0.56 / Sx^1.67 / Sl^0.5 )^0.375 | | HEC-12 , Page 22, Eq. 4 |
| Rf = 1 - 0.09 x max ( 0, ( V - Vo)) | **English** | HEC-12 , Page 54, Eq. 9 |
| Eo = 1-(1-@min( 1, Wg/T))^2.67 | | HEC-12 , Page 54, Eq. 7 |
| Rs = 1 / ( 1 + 0.15 x V^1.8 / Sx / Le^2.3 ) | | HEC-12 , Page 56, Eq. 10 |
| Le = L x (1 - CF) | | Clogging reduces length |
| E = Rf x Eo + Rs x (1-Eo) | | HEC-12 , Page 56, Eq. 11 |
| Qint = E x Qtotal | | HEC-12 , Page 56, Eq. 12 |
| Qby = Qtotal - Qint | | Bypass flow to next inlet |
| CK = "OK" if T<= Tmax, else "*" Explain | | Spread criteria RFP ___ |

| | | | | | |
|---|---|---|---|---|---|
| INLET 1 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Single Inlet (longitudinal) |
| INLET 2 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Double Inlet (longitudinal) |
| INLET 3 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | CDOT Vane Grate Inlet |

| INLET (#) | STA. (ft) | SIDE (Lt/Rt) | RUN (ft) | PAVED WIDTH (meter) | PAVED AREA (acre) | NATURAL WIDTH (ft) | NATURAL AREA (acre) | Qro (cfs) | Qtotal (cfs) | Sx (%) | Sl (%) | T (feet) | T (meter) | CK (OK/*) | VEL (fps) | INLET | Rf (frac) | Eo (frac) | Rs (frac) | E (frac) | Qint (cfs) | Qby (cfs) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALT05-EJMT** | 0+00.0 | Rt | | 55.0 | | 0.0 | | | 0.00 | 4.50% | 1.70% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge |
| | | | 100.0 | | 0.13 | | 0.00 | 1.94 | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 55.0 | | 0.0 | | | 1.94 | 4.50% | 1.70% | 5.06 | 1.54 | OK | 3.37 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.94 | |
| | | | 50.0 | | 0.06 | | 0.00 | 0.97 | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 55.0 | | 0.0 | | | 2.92 | 4.50% | 1.70% | 5.90 | 1.80 | OK | 3.73 | INLET 3 | 1.00 | 0.54 | 0.09 | 0.58 | 1.69 | 1.23 | |
| | | | 50.0 | | 0.06 | | 0.00 | 0.97 | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 55.0 | | 0.0 | | | 2.20 | 4.50% | 1.70% | 5.31 | 1.62 | OK | 3.48 | INLET 3 | 1.00 | 0.58 | 0.10 | 0.62 | 1.37 | 0.83 | End Deluge |
| | | | 100.0 | | 0.06 | | 0.00 | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.83 | 4.50% | 1.70% | 3.68 | 1.12 | OK | 2.72 | INLET 3 | 1.00 | 0.75 | 0.14 | 0.78 | 0.65 | 0.18 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.18 | 4.50% | 1.70% | 2.08 | 0.63 | OK | 1.86 | INLET 3 | 1.00 | 0.96 | 0.25 | 0.97 | 0.18 | 0.00 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.00 | 4.50% | 1.70% | 0.54 | 0.16 | OK | 0.75 | INLET 3 | 1.00 | 1.00 | 0.63 | 1.00 | 0.00 | 0.00 | 100% interception by inlets |
| | | | | | | | | | | | | | | | | | | | | | | | **3.89 cfs** |
| **ALT03/04-HV EB** | 0+00.0 | Rt | | 37.5 | | 0.0 | | | 0.00 | 2.00% | 1.30% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge |
| **75 ft Total Width** | | | 100.0 | | 0.09 | | 0.00 | 1.33 | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 37.5 | | 0.0 | | | 1.33 | 2.00% | 1.30% | 7.67 | 2.34 | OK | 2.26 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.33 | |
| | | | 50.0 | | 0.04 | | 0.00 | 0.66 | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 37.5 | | 0.0 | | | 1.99 | 2.00% | 1.30% | 8.92 | 2.72 | OK | 2.50 | INLET 3 | 1.00 | 0.38 | 0.08 | 0.43 | 0.86 | 1.13 | |
| | | | 50.0 | | 0.04 | | 0.00 | 0.66 | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 37.5 | | 0.0 | | | 1.79 | 2.00% | 1.30% | 8.58 | 2.61 | OK | 2.43 | INLET 3 | 1.00 | 0.40 | 0.08 | 0.45 | 0.80 | 0.99 | End Deluge |
| | | | 100.0 | | 0.04 | | 0.00 | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.99 | 2.00% | 1.30% | 6.87 | 2.09 | OK | 2.10 | INLET 3 | 1.00 | 0.48 | 0.11 | 0.53 | 0.53 | 0.46 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.46 | 2.00% | 1.30% | 5.16 | 1.57 | OK | 1.73 | INLET 3 | 1.00 | 0.59 | 0.14 | 0.65 | 0.30 | 0.16 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.16 | 2.00% | 1.30% | 3.47 | 1.06 | OK | 1.33 | INLET 3 | 1.00 | 0.77 | 0.21 | 0.82 | 0.13 | 0.03 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 7+50.0 | Rt | | 0.0 | | 0.0 | | | 0.03 | 2.00% | 1.30% | 1.82 | 0.56 | OK | 0.87 | INLET 3 | 1.00 | 0.99 | 0.37 | 0.99 | 0.03 | 0.00 | 100% interception by inlets |
| | | | | | | | | | | | | | | | | | | | | | | | **5.30 cfs** |
| **ALT03/04-HV WB** | 0+00.0 | Rt | | 31.5 | | 0.0 | | | 0.00 | 2.00% | 1.30% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge |
| **63 ft Total Width** | | | 100.0 | | 0.07 | | 0.00 | 1.11 | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 31.5 | | 0.0 | | | 1.11 | 2.00% | 1.30% | 7.18 | 2.19 | OK | 2.16 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.11 | |
| | | | 50.0 | | 0.04 | | 0.00 | 0.56 | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 31.5 | | 0.0 | | | 1.67 | 2.00% | 1.30% | 8.36 | 2.55 | OK | 2.39 | INLET 3 | 1.00 | 0.41 | 0.09 | 0.46 | 0.76 | 0.91 | |
| | | | 50.0 | | 0.04 | | 0.00 | 0.56 | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 31.5 | | 0.0 | | | 1.46 | 2.00% | 1.30% | 7.96 | 2.42 | OK | 2.31 | INLET 3 | 1.00 | 0.42 | 0.09 | 0.48 | 0.70 | 0.77 | End Deluge |
| | | | 100.0 | | 0.04 | | 0.00 | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 0.77 | 2.00% | 1.30% | 6.25 | 1.90 | OK | 1.97 | INLET 3 | 1.00 | 0.51 | 0.12 | 0.57 | 0.44 | 0.33 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.33 | 2.00% | 1.30% | 4.55 | 1.39 | OK | 1.59 | INLET 3 | 1.00 | 0.65 | 0.16 | 0.71 | 0.23 | 0.10 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.10 | 2.00% | 1.30% | 2.87 | 0.87 | OK | 1.17 | INLET 3 | 1.00 | 0.86 | 0.25 | 0.89 | 0.09 | 0.01 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 7+50.0 | Rt | | 0.0 | | 0.0 | | | 0.01 | 2.00% | 1.30% | 1.24 | 0.38 | OK | 0.67 | INLET 3 | 1.00 | 1.00 | 0.48 | 1.00 | 0.01 | 0.00 | 100% interception by inlets |
| | | | | | | | | | | | | | | | | | | | | | | | **4.45 cfs** |

PROJECT: PROJECT: **I-70 EJMT Fire Protection Deluge Flow (2 Zone)**

SUBJECT: FLOODED WIDTH (ENGLISH UNITS) **GRATE INLET**

SECTION:

TRUNK: XXXXXX

SHEET: _____ OF _____

BY: C. Rogers DATE: __ 1/8/2014

CK: DATE: _____

| DESIGN PARAMETERS | INLET 1 | INLET 2 | INLET 3 | Natural | SOURCE |
|---|---|---|---|---|---|
| Rational "C" = | 1.00 | 1.00 | 1.00 | 0.50 | Coefficient for new pavement |
| Rainfall intensity, I (inch/hr) = | 15.40 | 15.40 | 15.40 | 15.40 | Deluge Fire Suppression even |
| Manning's "n" = | 0.016 | 0.016 | 0.016 | N/A | HEC-12 standard value for paved shldr |
| Grate Width, Wg (feet) = | 0.98 | 0.98 | 1.48 | N/A | Standard grate + 0.0 ft offset from wall |
| Grate Length, Lg (feet) = | 2.21 | 4.42 | 2.27 | N/A | Standard grate length |
| Clogging Factor, CF ( % ) = | 25% | 25% | 25% | N/A | Standard value for grate inlet |
| Effective Length, Le (feet) = | 1.66 | 3.31 | 1.70 | N/A | Effective "unclogged" length of grate |
| Splash over velocity, Vo (fps) = | 4.20 | 6.90 | 6.20 | N/A | From HEC-12, Page 55, Chart 7 |
| Cross slope, Sx (%) = | Varies | Varies | Varies | N/A | See plans |
| Gutter slope, Sl ( % ) = | Varies | Varies | Varies | N/A | See plans |
| Drainage Width, W ft) = | Varies | Varies | Varies | N/A | See plans |
| Allowable Flooded Width, Tmax (ft) = | 12.00 | 12.00 | 12.00 | N/A | From Plans |

| EQUATIONS: | | SOURCE |
|---|---|---|
| A = (Sta2 - Sta1) x (W1 + W2) / 2 | | Area in square meters |
| Qro = C x Ap x I + C x An X I | | Rational equation (ENGLISH UNITS) |
| Qtotal = Qro + Qby (from upstream section) | | |
| T = ( Q x n / 0.56 / Sx^1.67 / Sl^0.5 )^0.375 | | HEC-12 , Page 22, Eq. 4 |
| Rf = 1 - 0.09 x max ( 0, ( V - Vo)) | **English** | HEC-12 , Page 54, Eq. 9 |
| Eo = 1-(1-@min( 1, Wg/T))^2.67 | | HEC-12 , Page 54, Eq. 7 |
| Rs = 1 / ( 1 + 0.15 x V^1.8 / Sx / Le^2.3 ) | | HEC-12 , Page 56, Eq. 10 |
| Le = L x (1 - CF) | | Clogging reduces length |
| E = Rf x Eo + Rs x (1-Eo) | | HEC-12 , Page 56, Eq. 11 |
| Qint = E x Qtotal | | HEC-12 , Page 56, Eq. 12 |
| Qby = Qtotal - Qint | | Bypass flow to next inlet |
| CK = "OK" if T<= Tmax, else "*" Explain | | Spread criteria RFP ___ |

| | | | | | |
|---|---|---|---|---|---|
| INLET 1 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Single Inlet (longitudinal) |
| INLET 2 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | Double Inlet (longitudinal) |
| INLET 3 | 1.00 | #DIV/0! | #DIV/0! | #DIV/0! | CDOT Vane Grate Inlet |

| INLET (#) | STA. (ft) | SIDE (Lt/Rt) | RUN (ft) | PAVED WIDTH (meter) | PAVED AREA (acre) | NATURAL WIDTH (ft) | NATURAL AREA (acre) | Qro (cfs) | Qtotal (cfs) | Sx (%) | Sl (%) | T (feet) | T (meter) | CK (OK/*) | VEL (fps) | INLET | Rf (frac) | Eo (frac) | Rs (frac) | E (frac) | Qint (cfs) | Qby (cfs) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALT03/04-US6** | 0+00.0 | Rt | | 37.5 | | 0.0 | | | 0.00 | 2.00% | 0.80% | 0.00 | 0.00 | OK | #DIV/0! | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bedin Deluge |
| **75 ft Total Width** | | | 100.0 | | 0.09 | | 0.00 | 1.33 | | | | | | | | | | | | | | | |
| | 1+00.0 | Rt | | 37.5 | | 0.0 | | | 1.33 | 2.00% | 0.80% | 8.40 | 2.56 | OK | 1.88 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.33 | |
| | | | 50.0 | | 0.04 | | 0.00 | 0.66 | | | | | | | | | | | | | | | |
| | 1+50.0 | Rt | | 37.5 | | 0.0 | | | 1.99 | 2.00% | 0.80% | 9.77 | 2.98 | OK | 2.08 | INLET 3 | 1.00 | 0.35 | 0.11 | 0.42 | 0.84 | 1.14 | |
| | | | 50.0 | | 0.04 | | 0.00 | 0.66 | | | | | | | | | | | | | | | |
| | 2+00.0 | Rt | | 37.5 | | 0.0 | | | 1.81 | 2.00% | 0.80% | 9.43 | 2.87 | OK | 2.03 | INLET 3 | 1.00 | 0.37 | 0.11 | 0.44 | 0.79 | 1.02 | End Deluge |
| | | | 100.0 | | 0.04 | | 0.00 | | | | | | | | | | | | | | | | |
| | 3+00.0 | Rt | | 0.0 | | 0.0 | | | 1.02 | 2.00% | 0.80% | 7.60 | 2.32 | OK | 1.76 | INLET 3 | 1.00 | 0.44 | 0.14 | 0.52 | 0.53 | 0.49 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 4+50.0 | Rt | | 0.0 | | 0.0 | | | 0.49 | 2.00% | 0.80% | 5.78 | 1.76 | OK | 1.47 | INLET 3 | 1.00 | 0.55 | 0.19 | 0.63 | 0.31 | 0.18 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 6+00.0 | Rt | | 0.0 | | 0.0 | | | 0.18 | 2.00% | 0.80% | 3.98 | 1.21 | OK | 1.14 | INLET 3 | 1.00 | 0.71 | 0.26 | 0.79 | 0.14 | 0.04 | |
| | | | 150.0 | | 0.00 | | 0.00 | 0.00 | | | | | | | | | | | | | | | |
| | 7+50.0 | Rt | | 0.0 | | 0.0 | | | 0.04 | 2.00% | 0.80% | 2.23 | 0.68 | OK | 0.78 | INLET 3 | 1.00 | 0.95 | 0.42 | 0.97 | 0.04 | 0.00 | |
| | | | | | | | | | | | | | | | | | | | | | | | **5.30** **cfs** |

**Conveyance Factor (Flowing Full)**

K = (1.486/n)AR^(2/3)
Q=KS^(1/2)

n = 0.015

| | | |
|---|---|---|
| n = | 0.010 | HDPE |
| n = | 0.013 | RCP |
| n = | 0.015 | CI |

| Dia (in) | W (ft) | H (ft) | A (sf) | P (ft) | R | K |
|---|---|---|---|---|---|---|
| PIPE | | | | | | CI |
| 4 | | | 0.1 | 1.0 | 0.08 | 2 |
| 6 | | | 0.2 | 1.6 | 0.13 | 5 |
| 8 | | | 0.3 | 2.1 | 0.17 | 10 |
| 10 | | | 0.5 | 2.6 | 0.21 | 19 |
| 12 | | | 0.8 | 3.1 | 0.25 | 31 |
| 15 | | | 1.2 | 3.9 | 0.31 | 56 |

**EJMT 47**

Q = 3.32 S = 0.017 K = 25

12-inch CI Pipe needed for 3.32 cfs

Q = 0.83 S = 0.005 K = 12

>8-inch CI Pipe needed for Sf = 0.0050

**TWIN 47**

Q = 3.96 S = 0.013 K = 35

>12-inch CI Pipe needed for 3.96 cfs

Q = 0.99 S = 0.005 K = 14

>8-inch CI Pipe needed for Sf = 0.0050

**EJMT 59**

Q = 4.17 S = 0.017 K = 32

>12-inch CI Pipe needed for 4.17 cfs

Q = 0.83 S = 0.005 K = 12

>8-inch CI Pipe needed for Sf = 0.0050

**TWIN 56**

Q = 3.96 S = 0.013 K = 35

>12-inch CI Pipe needed for 3.96 cfs

Q = 0.79 S = 0.005 K = 11

>8-inch CI Pipe needed for Sf = 0.0050

**EJMT 63**

Q = 4.45 S = 0.017 K = 34

>12-inch CI Pipe needed for 4.45 cfs

Q = 0.89 S = 0.005 K = 13

>8-inch CI Pipe needed for Sf = 0.0050

**EJMT 55**

Q = 3.89 S = 0.017 K = 30

>12-inch CI Pipe needed for 3.89 cfs

Q = 0.78 S = 0.005 K = 11

>8-inch CI Pipe needed for Sf = 0.0050

**Conveyance Factor (Flowing Full)**

K = (1.486/n)AR^(2/3)
Q=KS^(1/2)

n = 0.015

| | | |
|---|---|---|
| n = | 0.010 | HDPE |
| n = | 0.013 | RCP |
| n = | 0.015 | CI |

| Dia (in) | W (ft) | H (ft) | A (sf) | P (ft) | R | K |
|---|---|---|---|---|---|---|
| PIPE | | | | | | CI |
| 4 | | | 0.1 | 1.0 | 0.08 | 2 |
| 6 | | | 0.2 | 1.6 | 0.13 | 5 |
| 8 | | | 0.3 | 2.1 | 0.17 | 10 |
| 10 | | | 0.5 | 2.6 | 0.21 | 19 |
| 12 | | | 0.8 | 3.1 | 0.25 | 31 |
| 15 | | | 1.2 | 3.9 | 0.31 | 56 |
| | | | | | | |

**HV EB 75**

Q = 5.3
S = 0.013
K = 46

Q = 0.44
S = 0.005
K = 6

>12-inch CI Pipe needed for 5.3 cfs

>6-inch CI Pipe needed for Sf = 0.0050

**HV WB 63**

Q = 4.45
S = 0.013
K = 39

Q = 0.37
S = 0.005
K = 5

>12-inch CI Pipe needed for 4.45 cfs

6-inch CI Pipe needed for Sf = 0.0050

**US6 75**

Q = 5.3
S = 0.008
K = 59

Q = 0.44
S = 0.005
K = 6

>15-inch CI Pipe needed for 5.3 cfs

>6-inch CI Pipe needed for Sf = 0.0050

## WW Flow

| MONTH | 2000 | 2001 | 2002 | 2003 | 2004 | MONTH | 2005 | 2006 | 2007 | 2008 | 2009 | MONTH | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 631,018 | 872,282 | 187,330 | 34,997 | 86,880 | January | 201,843 | 56,433 | 107,356 | 355,720 | 285,263 | January | 314,370 | 177,249 | 186,093 | | |
| February | 573,005 | 760,932 | 139,545 | 30,047 | 78,323 | February | 165,308 | 34,362 | 79,090 | 250,684 | 375,838 | February | 237,961 | 186,315 | 153,550 | | |
| March | 597,886 | 813,892 | 198,911 | 33,027 | 670,708 | March | 79,008 | 88,979 | 111,608 | 281,068 | 353,573 | March | 252,159 | 335,013 | 197,043 | | |
| April | 816,254 | 968,745 | 400,026 | 83,932 | 69,152 | April | 92,864 | 60,507 | 114,058 | 256,039 | 315,127 | April | 280,582 | 364,503 | 282,215 | | |
| May | 2,029,578 | 2,828,965 | 277,801 | 341,352 | 1,188,466 | May | 165,308 | 135,550 | 536,628 | 140,809 | 612,977 | May | 537,605 | 444,439 | 681,550 | | |
| June | 369,687 | 2,843,630 | 152,387 | 1,752,197 | 2,380,233 | June | 307,884 | 313,892 | 914,646 | 754,943 | 787,515 | June | 1,334,888 | 1,266,175 | 556,649 | | |
| July | 714,032 | 555,006 | 159,266 | 743,038 | 168,770 | July | 186,950 | 141,869 | 662,912 | 589,700 | 446,236 | July | 374,661 | 1,643,442 | 325,983 | | |
| August | 794,938 | 403,443 | 182,205 | 748,259 | 64,406 | August | 193,975 | 115,860 | 1,577,558 | 340,914 | 233,405 | August | 271,526 | 909,306 | | | |
| September | 827,525 | 385,110 | 223,433 | 1,044,252 | 49,610 | September | 193,112 | 65,472 | 354,735 | 326,268 | 195,005 | September | 332,361 | 566,237 | | | |
| October | 1,135,864 | 316,492 | 196,669 | 511,871 | 94,652 | October | 96,498 | 51,442 | 359,925 | 349,481 | 214,786 | October | 271,692 | 468,585 | | | |
| November | 1,020,000 | 262,596 | 52,813 | 164,313 | 178,865 | November | 73,541 | 41,682 | 290,557 | 327,152 | 374,733 | November | 274,197 | 318,187 | | | |
| December | 925,706 | 197,665 | 32,260 | 122,795 | 206,524 | December | 80,137 | 83,605 | 345,949 | 290,101 | 288,921 | December | 258,269 | 227,624 | | | |
| Total flow | 10,435,493 | 11,208,758 | 2,202,646 | 5,610,080 | 5,236,589 | Total flow | 1,836,428 | 1,189,653 | 5,455,022 | 4,262,879 | 4,483,379 | Total flow | 4,740,271 | 6,907,075 | 2,383,083 | 0 | 0 |
| Avg | 1,605,460 | 1,724,424 | 338,869 | 863,089 | 805,629 | Avg | 282,527 | 183,024 | 839,234 | 655,828 | 689,751 | Avg | 729,272 | 1,062,627 | 595,771 | 0 | 0 |

## Seepage $ WW Flow

| MONTH | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| January | | 5,093,100 | | | |
| February | | 4,017,700 | | | |
| March | | 5,469,700 | | | |
| April | | 6,778,202 | | | |
| May | | 13,506,630 | | | |
| June | | 16,554,140 | | | |
| July | | 6,950,751 | | | |
| August | | | | | |
| September | | | | | |
| October | 2,770,300 | | | | |
| November | 1,572,100 | | | | |
| December | 6,174,000 | | | | |
| Total flow | 10,516,400 | 58,370,223 | 0 | 0 | |
| Avg | 5,258,200 | 14,592,556 | 0 | 0 | #DIV/0! |

| MONTH | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| January | | | | | |
| February | | | | | |
| March | | | | | |
| April | | | | | |
| May | | | | | |
| June | | | | | |
| July | | | | | |
| August | | | | | |
| September | | | | | |
| October | | | | | |
| November | | | | | |
| December | | | | | |
| Total flow | 0 | 0 | 0 | 0 | 0 |
| Avg | 0 | 0 | 0 | 0 | 0 |

| MONTH | 2021 | 2022 | 2023 | 2024 | 2014 |
|---|---|---|---|---|---|
| January | | | | | |
| February | | | | | |
| March | | | | | |
| April | | | | | |
| May | | | | | |
| June | | | | | |
| July | | | | | |
| August | | | | | |
| September | | | | | |
| October | | | | | |
| November | | | | | |
| December | | | | | |
| Total flow | 0 | 0 | 0 | 0 | 0 |
| Avg | 0 | 0 | 0 | 0 | 0 |

## Drinking Water Usage

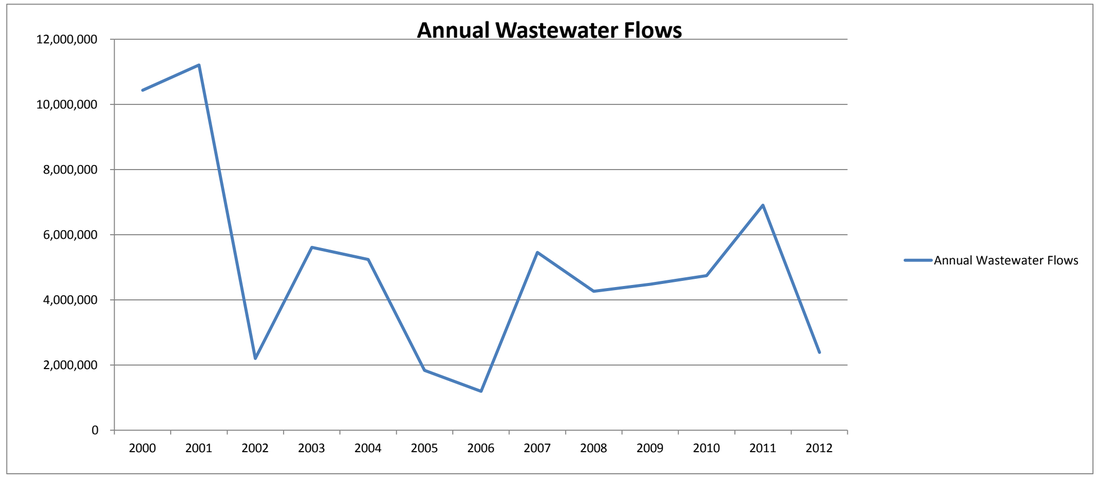
| MONTH | 2010 West WTP | 2010 East WTI | 2010 Total | | |
|---|---|---|---|---|---|
| January | 17,425 | 19,173 | 36,598 | | |
| February | 17,425 | 20,740 | 38,165 | | |
| March | 17,425 | 13,710 | 31,135 | | |
| April | 17,425 | 25,057 | 42,482 | | |
| May | 17,425 | 42,543 | 59,968 | | |
| June | 17,425 | 74,825 | 92,250 | | |
| July | 17,425 | 175,919 | 193,344 | | |
| August | 17,425 | 40,390 | 57,815 | | |
| September | 17,425 | 29,047 | 46,472 | | |
| October | 29,047 | 29,047 | 58,094 | | |
| November | 12,616 | 25,662 | 38,278 | | |
| December | 10,613 | 27,664 | 38,277 | | |
| Total flow | 209,101 | 523,777 | 732,878 | 0 | 0 |
| Avg | 32,169 | 80,581 | 112,750 | 0 | 0 |

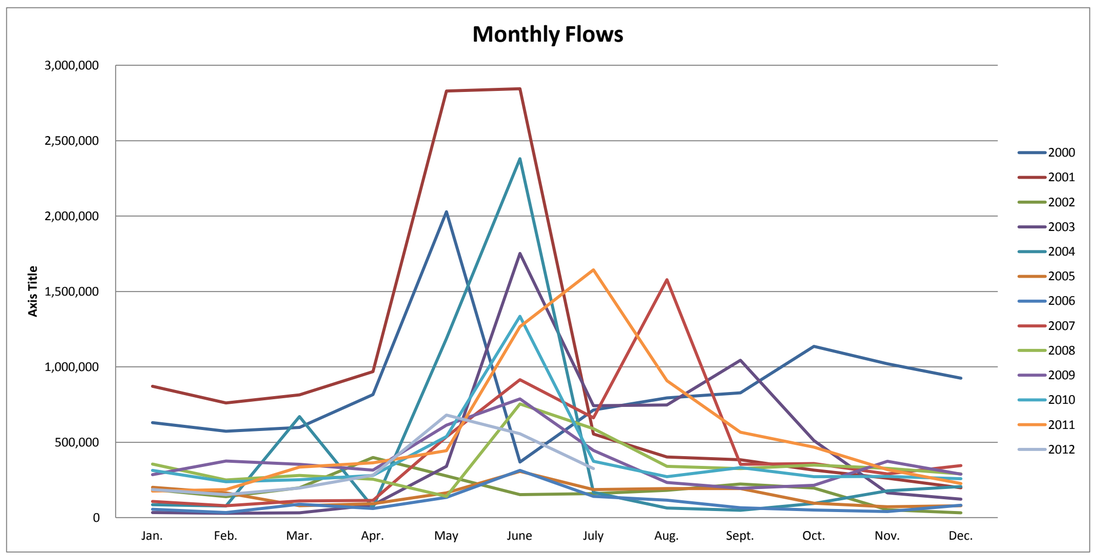
| MONTH | 2011 West WTP | 2011 East WTP | Total | | |
|---|---|---|---|---|---|
| January | 46,245 | 30,008 | 76,253 | | |
| February | 13,879 | 22,957 | 36,836 | | |
| March | 21,742 | 23,043 | 44,785 | | |
| April | 38,416 | 32,316 | 70,732 | | |
| May | 16,118 | 20,907 | 37,025 | | |
| June | 16,780 | 19,360 | 36,140 | | |
| July | 5,803 | 18,684 | 24,487 | | |
| August | 37,362 | 5,204 | 42,566 | | |
| September | 18,155 | 5,052 | 23,207 | | |
| October | 37,416 | 16,496 | 53,912 | | |
| November | 29,891 | 23,711 | 53,602 | | |
| December | 41,909 | 19,423 | 61,332 | | |
| Total flow | 323,716 | 237,161 | 560,877 | 0 | 0 |
| Avg | 49,802 | 36,486 | 86,289 | 0 | 0 |

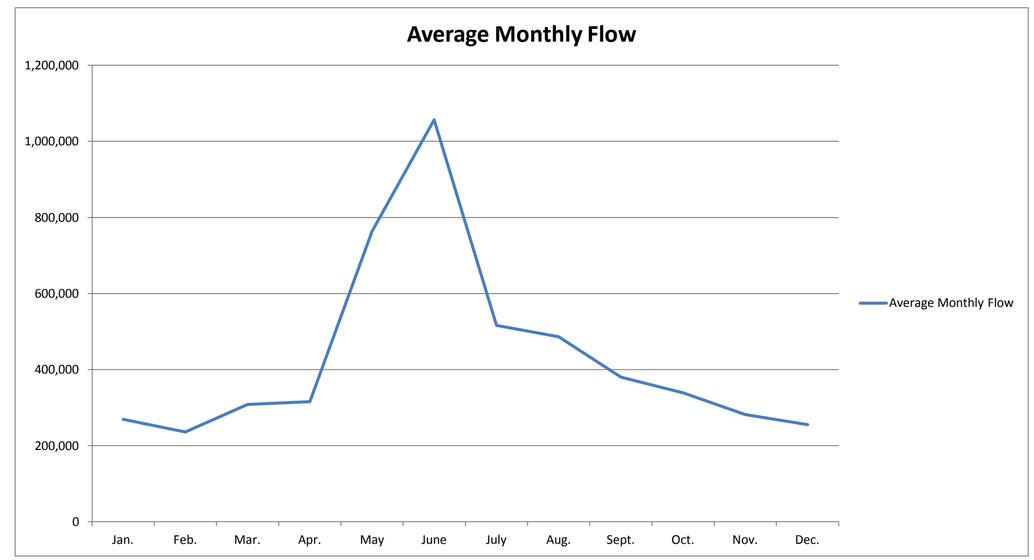
| MONTH | 2012 West WTP | 2012 East WTP | Total | | |
|---|---|---|---|---|---|
| January | 47,981 | 47,981 | 95,962 | | |
| February | 45,198 | 18,619 | 63,817 | | |
| March | 48,188 | 35,594 | 83,782 | | |
| April | 50,649 | 30,512 | 81,161 | | |
| May | 57,879 | 42,230 | 100,109 | | |
| June | 54,250 | 32,720 | 86,970 | | |
| July | 55,358 | 41,661 | 97,019 | | |
| August | | | | | |
| September | | | | | |
| October | | | | | |
| November | | | | | |
| December | | | | | |
| Total flow | 359,503 | 249,317 | 608,820 | 0 | 0 |
| Avg | 89,876 | 62,329 | 152,205 | 0 | 0 |

EJMT Wastewater Flows

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | total | avg | 2012 % of avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | | | | | | | | | | | | | | | | |
| Jan. | 631,018 | 872,282 | 187,330 | 34,997 | 86,880 | 201,843 | 56,433 | 107,356 | 355,720 | 285,263 | 314,370 | 177,249 | 186,093 | 3,496,834 | 268,987 | 69.2% |
| Feb. | 573,005 | 760,932 | 139,545 | 30,047 | 78,323 | 165,308 | 34,362 | 79,090 | 250,684 | 375,838 | 237,961 | 186,315 | 153,550 | 3,064,960 | 235,766 | 65.1% |
| Mar. | 597,886 | 813,892 | 198,911 | 33,027 | 670,708 | 79,008 | 88,979 | 111,608 | 281,068 | 353,573 | 252,159 | 335,013 | 197,043 | 4,012,875 | 308,683 | 63.8% |
| Apr. | 816,254 | 968,745 | 400,026 | 83,932 | 69,152 | 92,864 | 60,507 | 114,058 | 256,039 | 315,127 | 280,582 | 364,503 | 282,215 | 4,104,004 | 315,693 | 89.4% |
| May | 2,029,578 | 2,828,965 | 277,801 | 341,352 | 1,188,466 | 165,308 | 135,550 | 536,628 | 140,809 | 612,977 | 537,605 | 444,439 | 681,550 | 9,921,028 | 763,156 | 89.3% |
| June | 369,687 | 2,843,630 | 152,387 | 1,752,197 | 2,380,233 | 307,884 | 313,892 | 914,646 | 754,943 | 787,515 | 1,334,888 | 1,266,175 | 556,649 | 13,734,726 | 1,056,517 | 52.7% |
| July | 714,032 | 555,006 | 159,266 | 743,038 | 168,770 | 186,950 | 141,869 | 662,912 | 589,700 | 446,236 | 374,661 | 1,643,442 | 325,983 | 6,711,865 | 516,297 | 63.1% |
| Aug. | 794,938 | 403,443 | 182,205 | 748,259 | 64,406 | 193,975 | 115,860 | 1,577,558 | 340,914 | 233,405 | 271,526 | 909,306 | | 5,835,795 | 486,316 | |
| Sept. | 827,525 | 385,110 | 223,433 | 1,044,252 | 49,610 | 193,112 | 65,472 | 354,735 | 326,268 | 195,005 | 332,361 | 566,237 | | 4,563,120 | 380,260 | |
| Oct. | 1,135,864 | 316,492 | 196,669 | 511,871 | 94,652 | 96,498 | 51,442 | 359,925 | 349,481 | 214,786 | 271,692 | 468,585 | | 4,067,957 | 338,996 | |
| Nov. | 1,020,000 | 262,596 | 52,813 | 164,313 | 178,865 | 73,541 | 41,682 | 290,557 | 327,152 | 374,733 | 274,197 | 318,187 | | 3,378,636 | 281,553 | |
| Dec. | 925,706 | 197,665 | 32,260 | 122,795 | 206,524 | 80,137 | 83,605 | 345,949 | 290,101 | 288,921 | 258,269 | 227,624 | | 3,059,556 | 254,963 | |
| total | 10,435,493 | 11,208,758 | 2,202,646 | 5,610,080 | 5,236,589 | 1,836,428 | 1,189,653 | 5,455,022 | 4,262,879 | 4,483,379 | 4,740,271 | 6,907,075 | 2,383,083 | 63,568,273 | 5,297,356 | |
| | | | | | | | | | | | | | | | Jan-July | |
| | | | | | | | | | | | | | | | 3,465,099 | 68.8% |

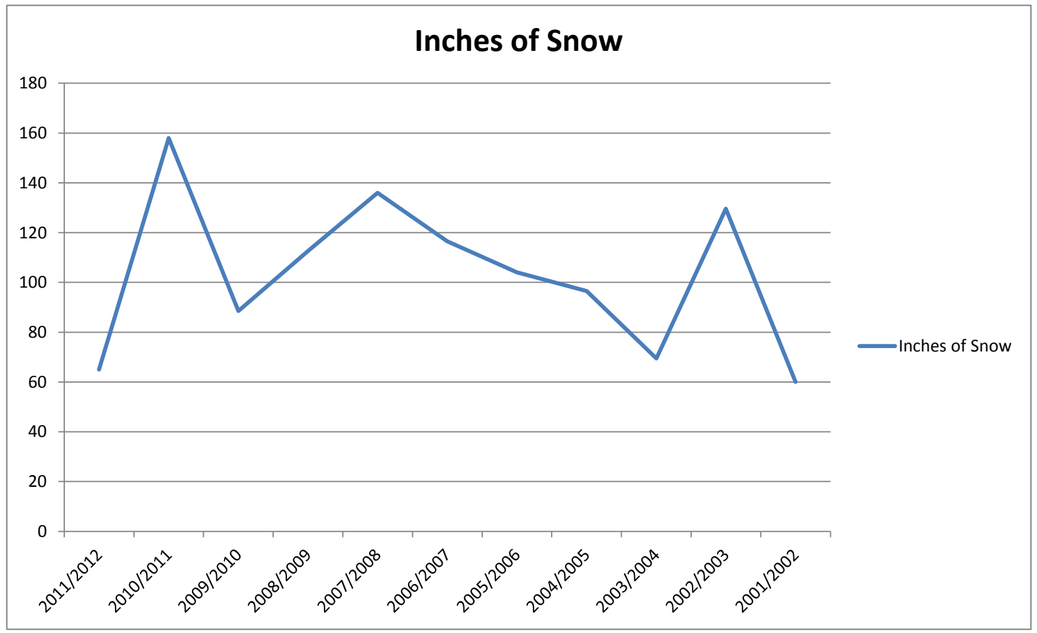

Annual Wastewater Flows
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Annual Wastewater Flows

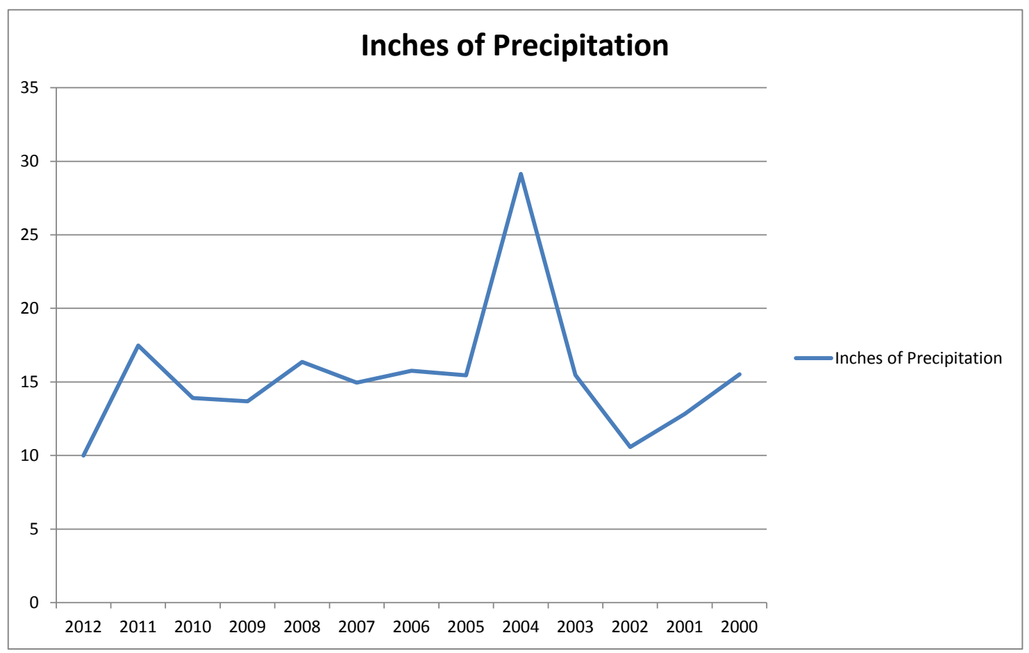

Monthly Flows
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Axis Title
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


Average Monthly Flow
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Average Monthly Flow

Dillon Coop Snowfall and Precipitation Data

| Snowfall Season | Amount | Precipitation Year | Amount |
|---|---|---|---|
| 2011/2012 | 65 | 2012 | 9.99 |
| 2010/2011 | 158 | 2011 | 17.48 |
| 2009/2010 | 88.5 | 2010 | 13.9 |
| 2008/2009 | 112.7 | 2009 | 13.68 |
| 2007/2008 | 136 | 2008 | 16.36 |
| 2006/2007 | 116.5 | 2007 | 14.96 |
| 2005/2006 | 104 | 2006 | 15.76 |
| 2004/2005 | 96.5 | 2005 | 15.45 |
| 2003/2004 | 69.5 | 2004 | 29.15 |
| 2002/2003 | 129.6 | 2003 | 15.46 |
| 2001/2002 | 60 | 2002 | 10.58 |
| | | 2001 | 12.82 |
| | | 2000 | 15.52 |
| average | 103.3 | | 15.47 |



COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL
WASTEWATER EFFLUENT FLOW
MONTH: April, 2008

| OPERATOR: | LOCATION: | DATE: | TIME: | METER READING: | GPD: |
|---|---|---|---|---|---|
| APRIL THOMAS | WATER ROOM | 01 | 08:00 AM | 7089875 | 9,179 |
| APRIL THOMAS | WATER ROOM | 02 | 08:00 AM | 7099054 | 17,624 |
| APRIL THOMAS | WATER ROOM | 03 | 08:00 AM | 7116678 | 7,704 |
| APRIL THOMAS | WATER ROOM | 04 | 08:00 AM | 7124382 | 9,973 |
| APRIL THOMAS | WATER ROOM | 05 | 08:00 AM | 7134355 | 9,973 |
| APRIL THOMAS | WATER ROOM | 06 | 08:00 AM | 7144328 | 5,290 |
| APRIL THOMAS | WATER ROOM | 07 | 08:00 AM | 7149618 | 8,897 |
| APRIL THOMAS | WATER ROOM | 08 | 08:00 AM | 718515 | 8,733 |
| APRIL THOMAS | WATER ROOM | 09 | 08:00 AM | 7167248 | 11,727 |
| APRIL THOMAS | WATER ROOM | 10 | 08:00 AM | 7178975 | 8,436 |
| APRIL THOMAS | WATER ROOM | 11 | 08:00 AM | 7187412 | 8,437 |
| APRIL THOMAS | WATER ROOM | 12 | 08:00 AM | 7195849 | 8,437 |
| APRIL THOMAS | WATER ROOM | 13 | 08:00 AM | 7204285 | 9,425 |
| APRIL THOMAS | WATER ROOM | 14 | 08:00 AM | 7213710 | 8,722 |
| APRIL THOMAS | WATER ROOM | 15 | 08:00 AM | 7222432 | 9,429 |
| APRIL THOMAS | WATER ROOM | 16 | 08:00 AM | 7231861 | 9,474 |
| APRIL THOMAS | WATER ROOM | 17 | 08:00 AM | 7241335 | 9,474 |
| APRIL THOMAS | WATER ROOM | 18 | 08:00 AM | 7250809 | 3,802 |
| APRIL THOMAS | WATER ROOM | 19 | 08:00 AM | 7254611 | 3,803 |
| APRIL THOMAS | WATER ROOM | 20 | 08:00 AM | 7258414 | 1,897 |
| APRIL THOMAS | WATER ROOM | 21 | 08:00 AM | 7260311 | 1,888 |
| APRIL THOMAS | WATER ROOM | 22 | 08:00 AM | 7262199 | 2,845 |
| APRIL THOMAS | WATER ROOM | 23 | 08:00 AM | 7265044 | 2,048 |
| APRIL THOMAS | WATER ROOM | 24 | 08:00 AM | 7267092 | 1,875 |
| APRIL THOMAS | WATER ROOM | 25 | 08:00 AM | 7268967 | 1,485 |
| APRIL THOMAS | WATER ROOM | 26 | 08:00 AM | 7270452 | 1,485 |
| APRIL THOMAS | WATER ROOM | 27 | 08:00 AM | 7271937 | 1,568 |
| APRIL THOMAS | WATER ROOM | 28 | 08:00 AM | 7273505 | 2,361 |
| APRIL THOMAS | WATER ROOM | 29 | 08:00 AM | 7275866 | 1,572 |
| APRIL THOMAS | WATER ROOM | 30 | 08:00 AM | 7277438 | 2,352 |
| APRIL THOMAS | WATER ROOM | 31 | 08:00 AM | | |

189,915