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Appendices

Figures

1.0 Introduction

1.1 General

The purpose of this report is to develop a conceptual stormwater management system for controlling the increase in stormwater runoff generated by the proposed build out of the Medicine Valley Industrial Park, in Lacombe County bordering on the north boundary of the Town of Eckville. This report focuses on drainage pattern impact, stormwater quantity changes and stormwater management issues for the subject area.

1.2 Background

The proposed development is approximately 23.9 ha (59 acres) located in the S.E. ¼ Section 21-39-3-W5M, as shown in Figure 1.1. The proposed development is located in Lacombe County, bordering the north boundary of the Town of Eckville, west of Secondary Highway 766. The project is to be developed in three phases. Phase 1 and 2 are proposed for commercial and light industrial use. Lot sizes range from 0.4 to 1.6 acres. Phase 3 of the Medicine Valley Industrial park is proposed for residential use.

For the purposes of this study, analysis will exclude the third phase as it is slated for future development. The stormwater management of Phase 3 is assumed to be controlled separately within the residential development, due to the fact it drains to the southwest away from Phases 1 and 2. Note, the developable area of Phase 1 and 2 comprises a total of 18.3 ha.

The land is presently used for agriculture. The development will be made up of several commercial/light industrial lots. The type of development and relatively flat topography will allow for minimal changes in the drainage patterns in the area. Proposed roadway construction will change the drainage patterns within the development, by diverting storm runoff along the roadways. However, the ultimate stormwater discharge location of the area remains roughly the same, though flows will be released at a singular point to the northeast rather than overland over a larger general area.

Topographical information for the development was obtained. This information was used to develop the contour plan of the site, as shown in Figure 1.2.

2.0 Design Guidelines / Modeling Parameters

2.1 Design Guidelines

The following sources were used in determining design guidelines and modeling parameters for this report:

- The City of Red Deer Design Guidelines – Section 10 - Stormwater Management Drainage Systems – City of Red Deer – 2006
- Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems – Alberta Environment – 2006
- Stormwater Management Guidelines for the Province of Alberta – Alberta Environmental Protection – 1999
- Hidden Springs Area Structure Plan – Engineering Support Study – ISL Engineering and Land Services Ltd. – 2005
- Energy Business Park – Stormwater Management Plan – ISL Engineering and Land Services Ltd. – 2008

From these sources, the following guidelines were determined:

- Post-development runoff rates to adjacent areas will not exceed pre-development rates.
- Quality of post-development runoff must be sufficient so as not to degrade the quality of surface water or groundwater in the area as per Alberta Environment. This requires 85% removal of particles 75 microns and larger.
- A pre-development flow rate of 3.6 L/s/ha
- Storm sewers conveying pond outlet flows will be sized based on the post development rate to control flows to acceptable levels.
- Storm pond sized for the 1:100 year event.
- Dry Pond design specifications as follows:
  - 1.5m maximum storage depth during the 1:100 year event.
  - Pond volume determined by the 1:100 year Chicago Storm.
  - Grading details as per the City of Red Deer Design Guidelines.
  - Minimum freeboard of 0.6 m and Maximum interior slopes of 5:1, as per City of Red Deer Stormwater Management Drainage Systems.

2.2 Runoff Modeling Parameters

In determining the runoff from the catchments in this development, the hydrologic "Runoff" component of the software XP-SWMM was used. For this model, several criteria needed to be identified.

Impervious percentages for land-use types were used as follows (note that for XP-SWMM modeling using the Runoff Method, runoff occurs from 100% pervious areas):

- Undeveloped 20%
- Gravel Streets 65%
- Commercial / Light Industrial 80%
- Storm Pond 100%

The following infiltration parameters were used:

- Initial Infiltration Rate $F_0 =$ 75 mm/hr
- Asymptotic Infiltration Rate (Final) $F_C =$ 7.5 mm/hr
- Infiltration Decay Rate $k =$ 0.00115 s^{-1}

The following parameters pertaining to depression storage were used:

- Pervious Area Depression Storage 3.2 mm
- Impervious Area Depression Storage 1.6 mm

Additionally, Manning's "n" values of 0.016 and 0.25 were used for pervious areas and impervious areas respectively. Catchment slopes were determined from topographic information and catchment widths were estimated from a map of the area.

3.0 Existing Drainage System

3.1 Existing Drainage Patterns

Drainage patterns for the site have been determined using contour information. These drainage patterns are shown in Figure 3.1. Sub drainage areas are described as follows:

- Area 1 drains to the southwest.
- Area 2 drains northeast away from higher land in the south and west.
- Area 3 drains generally to the northeast towards Medicine River.
- Area 4 drains slightly to the southeast corner of the area away from higher land in the north.

Ultimately, runoff from the entire development drains into Medicine River northeast of the development area. Based on topographical information and existing roads, it is assumed that there is no offsite drainage incorporated into this stormwater management plan.

3.2 Existing Catchment Areas

Under existing pre-development conditions, the development area naturally drains to Medicine River in the northeast.

4.0 Post-Development Drainage System

4.1 Post-Development Drainage Patterns

The development area is assumed to utilize a Stormwater Management Facility (SWMF) to control the post development storm flows. The development area is graded to convey flows to the SWMF. Overall discharge will be maintained through a surface drainage system (ditch and culvert) that will convey the storm flows from the development area and discharges into the proposed SWMF. It should be noted the SWMF within the project area ultimately discharges to Medicine River via the ditch along Secondary Highway 766.

4.2 Post-Development Catchment Areas

The catchment area delineation was assumed for modeling purposes, with drainage to the proposed pond location in the absence of a grading plan. Post-development drainage patterns assumed are shown in Figure 4.1.

5.0 Runoff Calculations

5.1 Pre-Development Runoff Rate

ISL completed an analysis of the Medicine River hydrology data and utilizing comparative basin formula to calculate a release rate of 1.88 L/s/ha whereas the Waskasoo Creek near Red Deer delivered a rate of 7.87 L/s/ha. Due to inconsistency in stream flow analysis, additional documentation was reviewed. These included:

1) Hidden Springs Area Structure Plan – Engineering Support Study, ISL 2005 - The pre-development rate of 3.3 L/s/ha with SCS modeling.
2) Energy Business Park - Stormwater Management Plan, ISL 2008 – The pre-development rate of 3.6 L/s/ha with SCS modeling.
3) The City of Red Deer Standards - The pre-development rate of 3.6 L/s/ha.

Based on the reviewed documentation, ISL concluded that using a release rate of 3.6L/s/ha would be considered reasonable.

5.2 Post-Development Runoff Calculations

XP-SWMM 2009, a sophisticated hydrologic/hydraulic computer model, was employed to determine the post-development runoff peak rate as well as total runoff expected from the development. Based on modeling results, the post-development peak runoff rate was estimated for each area. The modeled post-development runoff rate for the project area is 145 L/s/ha (Roughly 40 times the prescribed release rate). This post development release rate forms the justification for the conveyance of stormwater and the stormwater management system plan detailed below.

6.0 Stormwater Management Plan

6.1 Conveyance System Design

The layout of the proposed conveyance system is shown in Figure 6.1. The SWMF controls the storm flow rates leaving the development area. Flows from the project area are conveyed, by means of surface drainage system (ditches and culverts), to the proposed SWMF in the northeast. The SWMF restricts the storm flows to the pre-development release rate before flows discharge to the Medicine River through downstream overland conveyance elements.

The conceptual stormwater management network was modeled using XP-SWMM 2009 for the 18.26 ha development area. Storm flows are proposed to be conveyed to the SWMF through roadside ditches. In the absence of a grading plan ditch grades are assumed range from 0.6% - 1.5%.

Ditch and culvert sizing is based on the following:

- The 1:100 year flows along each roadway drain into ditches, which then convey the flows to the SWMF.
- Ditch geometry based on an assumed cross section of 3:1 and 5:1 side slopes, 1 m ditch bottom. Cross section geometry is based on the City of Red Deer Rural Service Road Drawing 5.13.
- Culverts are utilized to convey flows under roadways. Culvert diameters range from 900 -1500 mm in diameter (Only major roadway crossing culverts were sized as part of this analysis).

6.2 Stormwater Management Facility Design

Managing the increased flow rates from the development area, and maintaining stormwater quality control will be achieved through a proposed dry pond and oil and grit separator. The dry pond was selected as the desired SWMF because it will easily incorporate into a potential park area, will not have standing water, should require less maintenance, and will require less surface area than a wet pond, as desired by the Iron Horse Holdings.

The dry pond will outfall to the Medicine River via a naturalized drainage outlet. Stormwater quality will be managed through extended drawdown times as well as the provision of the forebay. This should ensure that stormwater quality will meet Alberta Environment requirements on discharge.

The stormwater management facility design details determined from model results are as follows:

SWMF (Dry pond)

- Catchment Area of 18.3 ha
- Required Storage volume of 8,600 m^3
- Peak outlet rate of 58.2 L/s (orifice plate size of 0.029 m^2 – diameter of 192 mm)
- Maximum depth of 1.16 m
- Side slopes of 5:1
- Requires oil/grit separator for quality control, sized to provide the Alberta Environment requirement of 85% of particles 75 microns or larger on an annual basis.

Figure 6.2 shows the pond location and footprint as modeled.

7.0 Closure

This report was prepared for the proposed Medicine Valley Industrial Park in Lacombe County, adjacent to the Town of Eckville, for the purpose of conceptually designing the stormwater management system for the initial development Phases of the proposed development.

8.0 References

Alberta Environment. 2006. Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems.

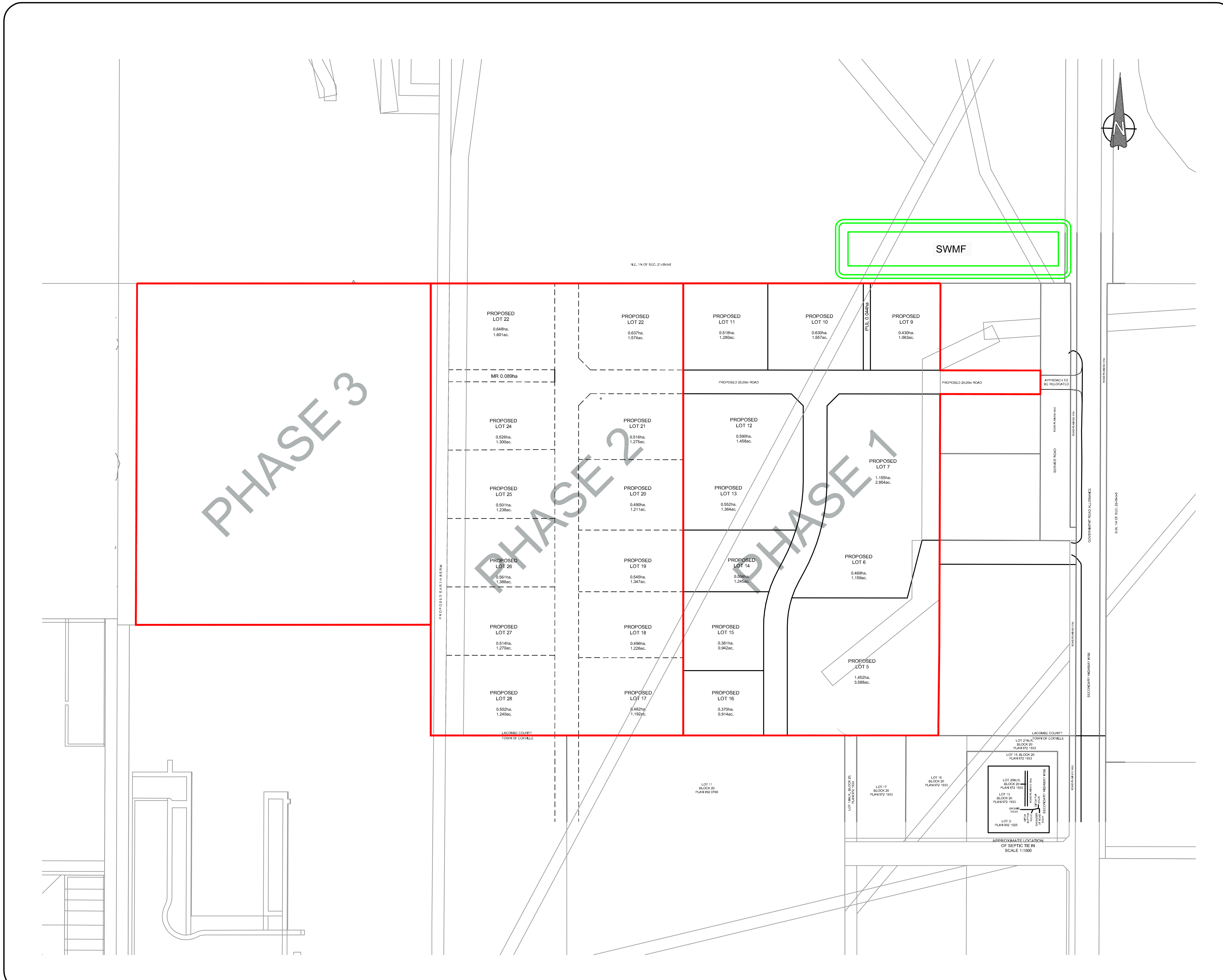
Alberta Environmental Protection. 1999. Stormwater Management Guidelines for the Province of Alberta.

City of City of Red Deer. 2006. Design Guidelines – Section 10 – Stormwater Design Standards.

ISL Engineering and Land Services Ltd. 2005. Hidden Springs Area Structure Plan – Engineering Support Study.

ISL Engineering and Land Services Ltd. 2008. Energy Business Park – Stormwater Management Plan.

Figure 1.1



Legend

- PROPOSED SWMF
- PROJECT AREA

IRON HORSE HOLDINGS
Medicine Valley Industrial Park
Stormwater Management Plan

PROPOSED LAYOUT

ISL Engineering and Land Services

Garnet Dawes July, 2009 N:\12000\12851 – Medicine Valley Industrial Park\04_Reports\04a_ISLReports\Figures\FIG.dwg

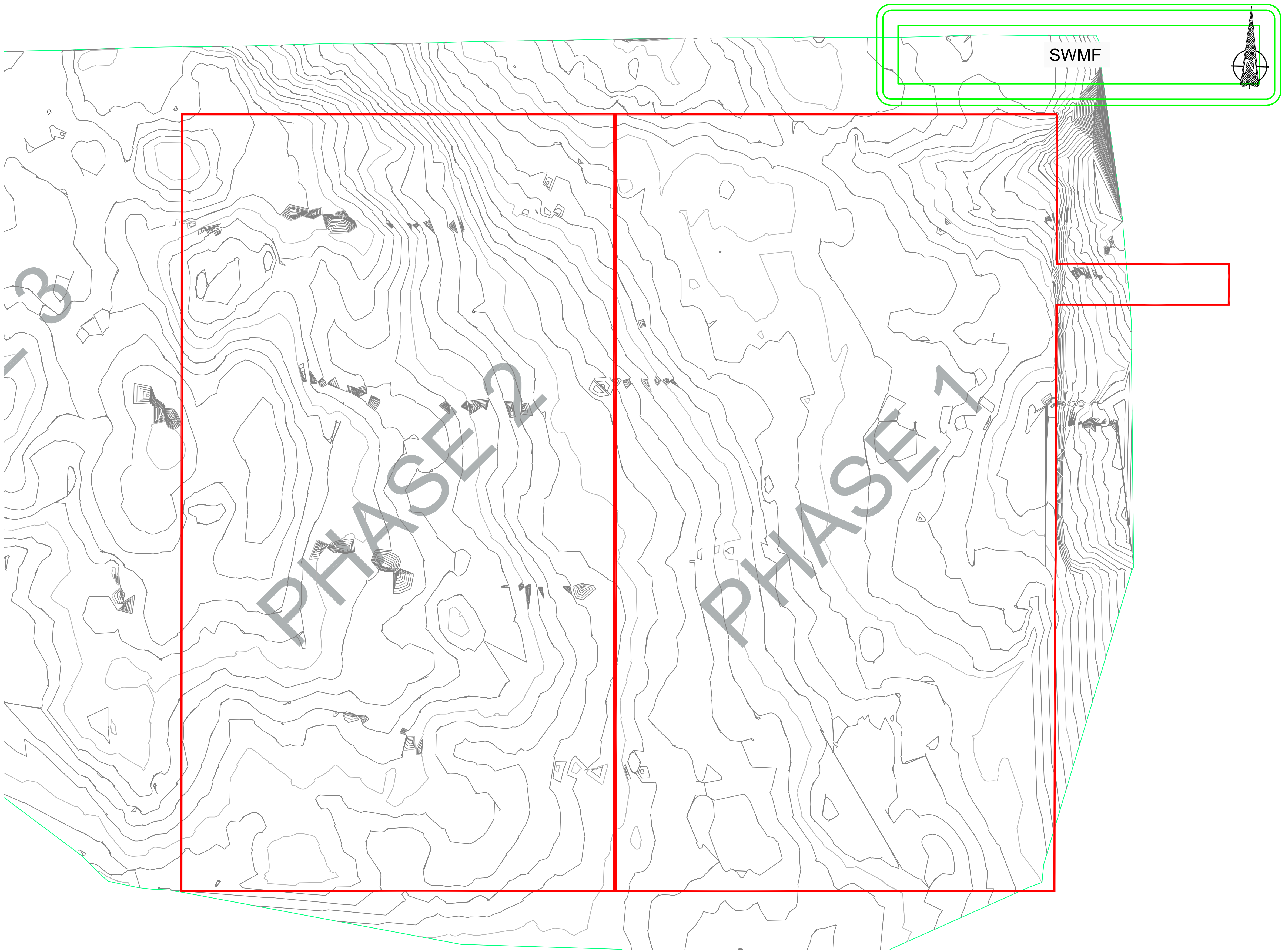


Figure 1.2

Legend

- PROPOSED SWMF
- PROJECT AREA

IRON HORSE HOLDINGS
Medicine Valley Industrial Park
Stormwater Management Plan

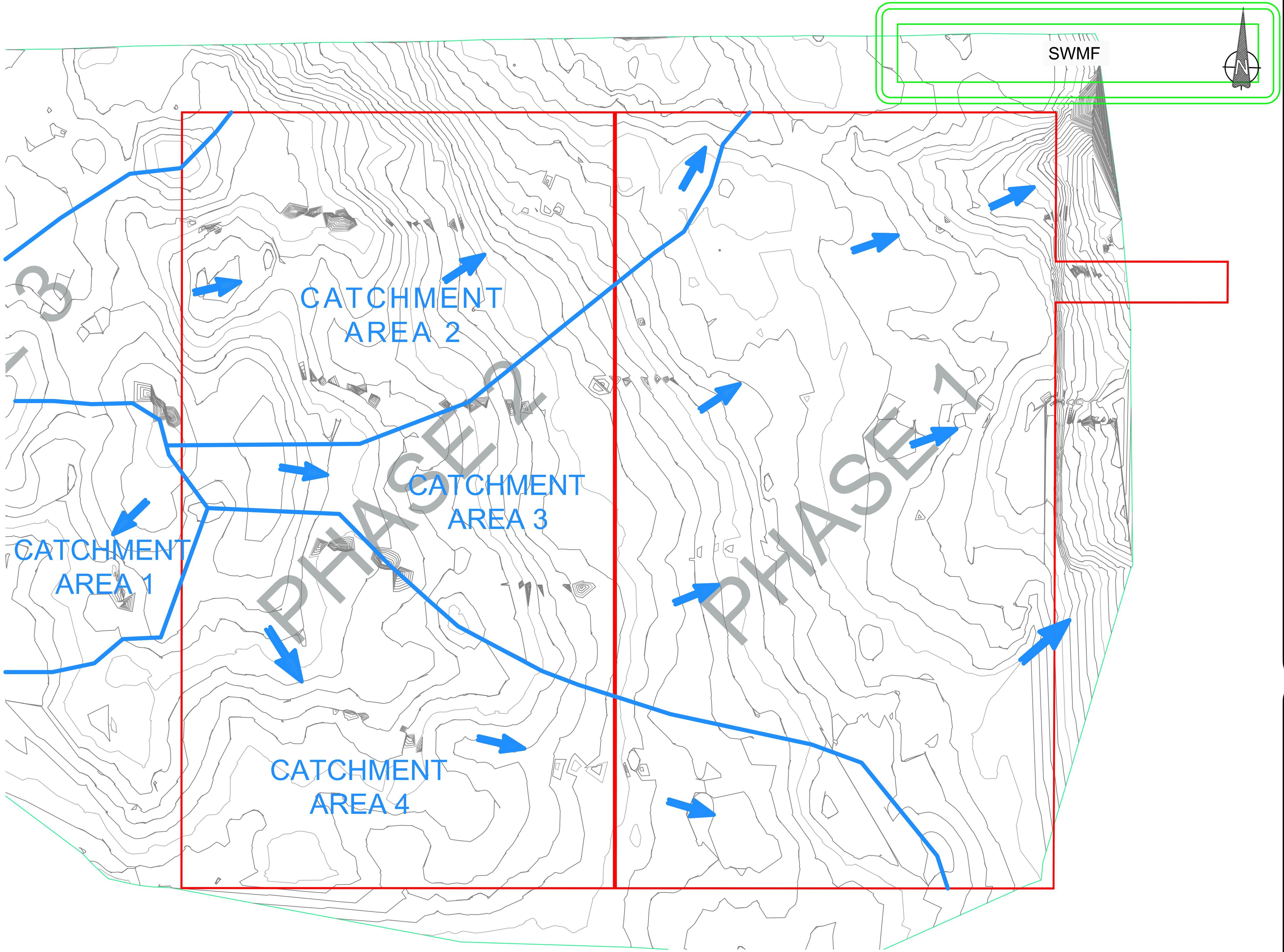
EXISTING TOPOGRAPHY

1: 2000 — 0 20 40 60 80

ISL Engineering and Land Services

Garnet Dawes July, 2009 N:\12000\12851 – Medicine Valley Industrial Park\04_Reports\04a_ISLReports\Figures\FIG.dwg

Figure 3.1



Legend

- PROPOSED SWMF
- PROJECT AREA
- GENERAL FLOW DIRECTION
- EXISTING CATCHMENTS

IRON HORSE HOLDINGS
Medicine Valley Industrial Park
Stormwater Management Plan

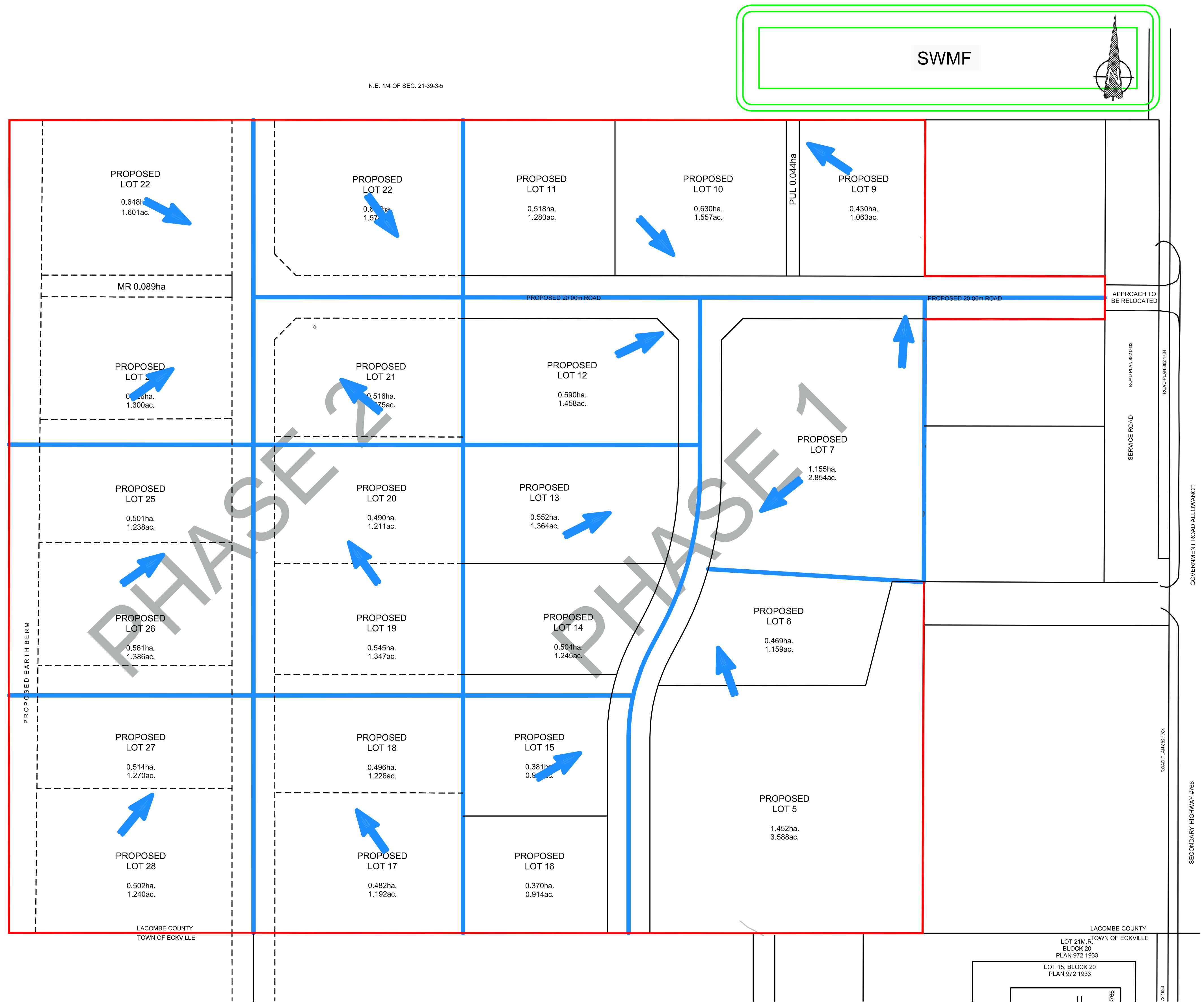
EXISTING DRAINAGE PATTERNS

1: 2000 0 20 40 60 80

ISL Engineering and Land Services

Garnet Dawes July, 2009 N:\12000\12851 – Medicine Valley Industrial Park\04_Reports\04a_ISLReports\Figures\FIG.dwg

Figure 4.1



Legend

- PROPOSED SWMF
- PROJECT AREA
- GENERAL FLOW DIRECTION
- CATCHMENT AREA

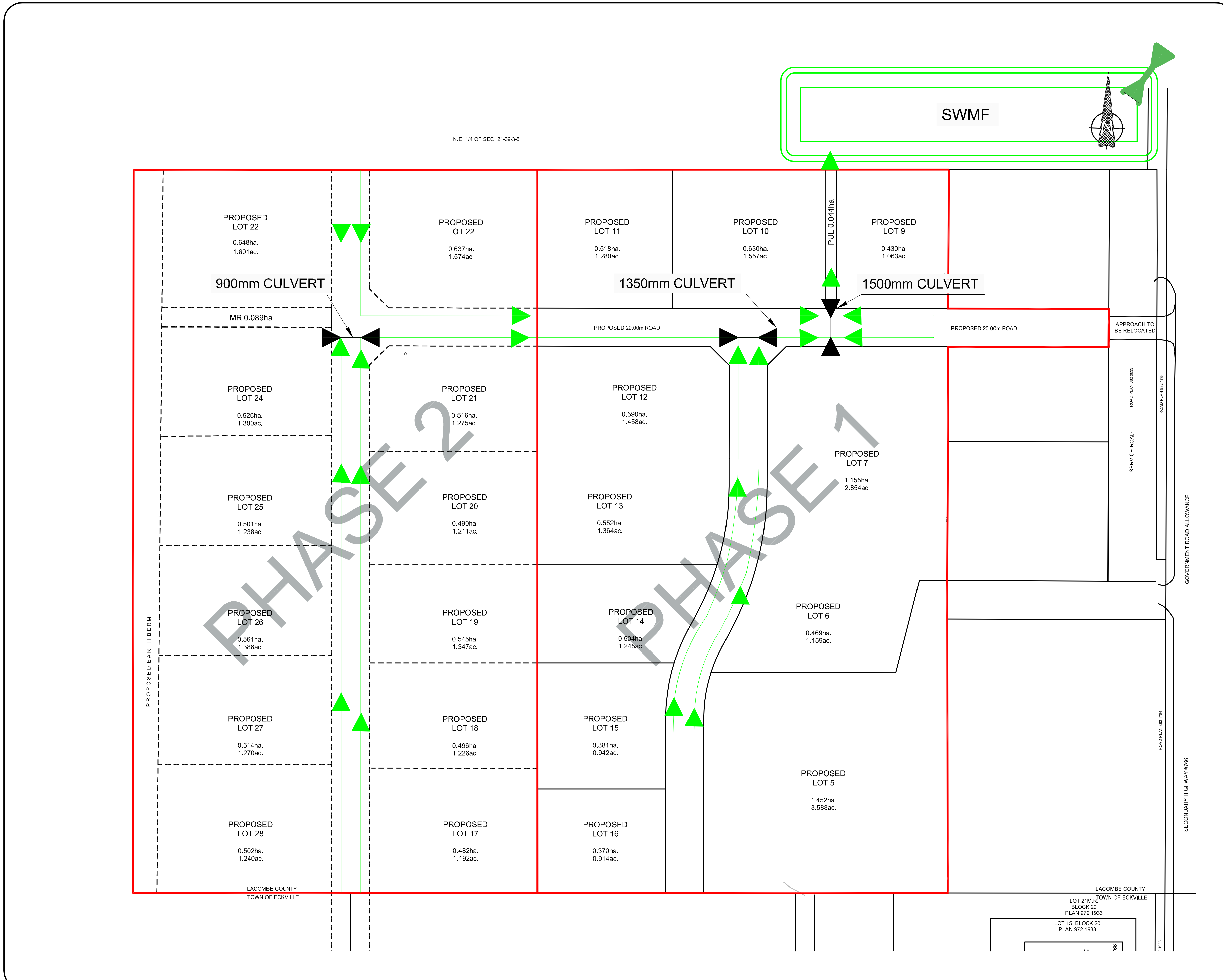
IRON HORSE HOLDINGS
Medicine Valley Industrial Park
Stormwater Management Plan

PROPOSED CATCHMENT AREAS

1: 2000 — 0 20 40 60 80

ISL Engineering and Land Services

Garnet Dawes July, 2009 N:\12000\12851 – Medicine Valley Industrial Park\04_Reports\04a_ISLReports\Figures\FIG.dwg



Legend

- PROPOSED SWMF
- PROJECT AREA
- PROPOSED DITCH CONVEYANCE
- PROPOSED SWMF
- PROPOSED CULVERT
- PROPOSED OUTLET

IRON HORSE HOLDINGS
Medicine Valley Industrial Park
Stormwater Management Plan

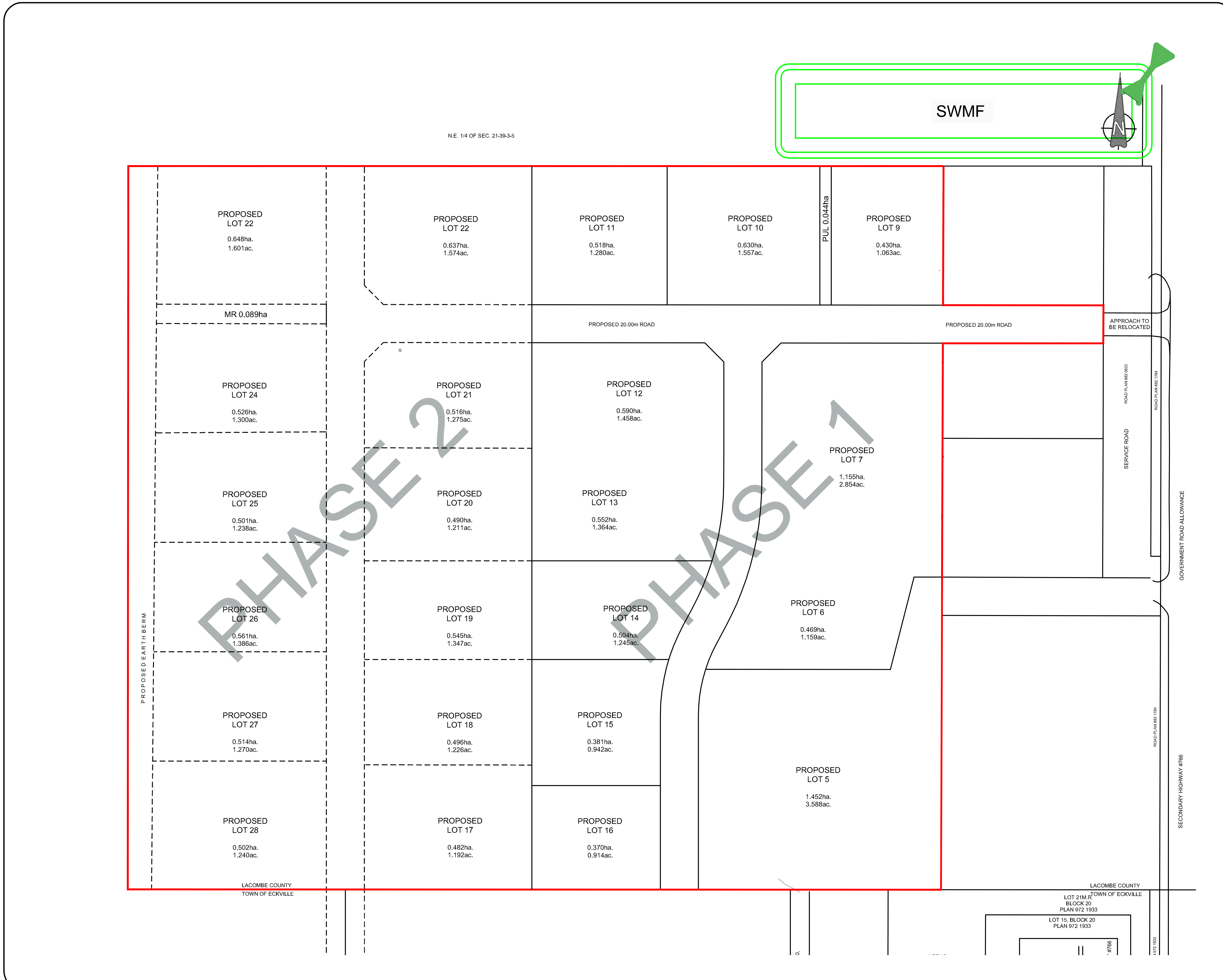
STORMWATER CONVEYANCE SYSTEM

1: 2000 — 0 20 40 60 80

ISL Engineering and Land Services

Garnet Dawes July, 2009 N:\12000\12851 – Medicine Valley Industrial Park\04_Reports\04a_ISLReports\Figures\FIG.dwg

Figure 6.2



Legend

- PROPOSED SWMF
- PROJECT AREA
- PROPOSED OUTLET

IRON HORSE HOLDINGS
Medicine Valley Industrial Park
Stormwater Management Plan

STORMWATER MANAGEMENT FACILITY

1: 2000 — 0 20 40 60 80

ISL Engineering and Land Services

Garnet Dawes July, 2009 N:\12000\12851 – Medicine Valley Industrial Park\04_Reports\04a_ISLReports\Figures\FIG.dwg

Appendix A

Post Development Model

```
 Current Directory:   C:\XPS\XPSWMM~3
 Engine Name: C:\XPS\XPSWMM~3\SWMMEN~1.EXE




 Input File : C:\_models\12851_Medicine V\12851_Storm Model.XP

          *=================================================*
          |                    xpswmm                       |
          |      Storm and Wastewater Management Model      |
          |          Developed by XP Software Inc.          |
          |=================================================|
          |                                                 |
          | Last Update      : January, 2009                |
          | Interface Version: 11.0                         |
          | Engine Version   : 2009.0                       |
          | Data File Version: 12.1                         |
          | Serial Number    :                              |
          |                                                 |
          *=================================================*

Engine Name: C:\XPS\XPSWMM~3\SWMMEN~1.EXE




*=====================================================*
|       Input and Output file names by Layer          |
*=====================================================*

 Input File  to Layer #     1 JIN.US


 Output File to Layer #     1 C:\_models\12851_Medicine V\12851_Storm Model.int


 Input File  to Layer #     2 C:\_models\12851_Medicine V\12851_Storm Model.int


 Output File to Layer #     2 JOT.US



*============================================================*
|   Special command line arguments in XP-SWMM2000. This      |
|   now includes program defaults. $Keywords are the program|
|   defaults.  Other Keywords are from the SWMMCOM.CFG file.|
|   or the command line or any cfg file on the command line.|
|   Examples include these in the file xpswm.bat under the  |
|   section :solve or in the windows version XPSWMM32 in the|
|   file solve.bat                                          |
|                                                            |
|   Note: the cfg file should be in the subdirectory swmxp  |
|         or defined by the set variable in the xpswm.bat   |
|         file.  Some examples of the command lines possible|
```

```
|         are shown below:                                        |
|                                                                 |
|   swmmd swmmcom.cfg                                             |
|   swmmd my.cfg                                                  |
|   swmmd nokeys nconv5 perv extranwq                             |
*=================================================================*

 $powerstation                         0.0000        1         2
 $perv                                 0.0000        0         4
 $oldegg                               0.0000        0         7
 $as                                   0.0000        0        11
 $noflat                               0.0000        0        21
 $oldomega                             0.0000        0        24
 $oldvol                               0.0000        1        28
 $implicit                             0.0000        1        29
 $oldhot                               0.0000        1        31
 $oldscs                               0.0000        0        33
 $flood                                0.0000        1        40
 $nokeys                               0.0000        0        42
 $pzero                                0.0000        0        55
 $oldvol2                              0.0000        2        59
 $storage2                             0.0000        3        62
 $oldhot1                              0.0000        1        63
 $pumpwt                               0.0000        1        70
 $ecloss                               0.0000        1        77
 $exout                                0.0000        0        97
 $spatial = 0.90                       0.9000        5       124
 $djref = -1.0                        -0.1000        3       143
 $weirlen = 50                        50.0000        1       153
 $oldbnd                               0.0000        1       154
 $nogrelev                             0.0000        1       161
 $ncmid                                0.0000        0       164
 $new_nl_97                            0.0000        2       290
 $best97                               0.0000        1       294
 $newbound                             0.0000        1       295
 $q_tol = 0.01                         0.0001        1       316
 $new_storage                          0.0000        1       322
 $old_iteration                        0.0000        1       333
 $minlen=10.0                         10.0000        1       346
 $review_elevation                     0.0000        1       383
 $use_half_volume                      0.0000        1       385
 VERT_WALLS=ON                         0.0000        1       389
 $min_ts = 1.0                         1.0000        1       407
 $design_restart = on                  0.0000        1       412
 $zero_value=1.e-05                    0.0000        1       415
 $relax_depth = on                     0.0000        1       427
 $saveallpts = on                      0.0000        1       434

 *================================================================*
 | Parameter Values on the Tapes Common Block.These are the       |
 | values read from the data file and dynamically allocated       |
 | by the model for this simulation.                              |
 *================================================================*

  Number of Subcatchments in the Runoff Block (NW)....    12
  Number of Channel/Pipes in the Runoff Block (NG)....     0
  Runoff Water quality constituents (NRQ).............     0
  Runoff Land Uses per Subcatchment (NLU).............     0
  Number of Elements in the Transport Block (NET).....     0
  Number of Storage Junctions in Transport (NTSE).....     0
  Number of Input Hydrographs in Transport (NTH)......     0
  Number of Elements in the Extran Block (NEE)........    21
  Number of Groundwater Subcatchments in Runoff (NGW).     0
```

```
 Number of Interface locations for all Blocks (NIE)..    21
 Number of Pumps in Extran (NEP)....................     0
 Number of Orifices in Extran (NEO).................     1
 Number of Tide Gates/Free Outfalls in Extran (NTG)..    1
 Number of Extran Weirs (NEW).......................     0
 Number of scs hydrograph points.................... 1729
 Number of Extran printout locations (NPO)...........    0
 Number of Tide elements in Extran (NTE).............    1
 Number of Natural channels (NNC)...................     0
 Number of Storage junctions in Extran (NVSE)........    1
 Number of Time history data points in Extran(NTVAL).    0
 Number of Variable storage elements in Extran (NVST)   21
 Number of Input Hydrographs in Extran (NEH).........    0
 Number of Particle sizes in Transport Block (NPS)...    0
 Number of User defined conduits (NHW)..............    12
 Number of Connecting conduits in Extran (NECC)......   20
 Number of Upstream elements in Transport (NTCC).....   10
 Number of Storage/treatment plants (NSTU)...........    1
 Number of Values for R1 lines in Transport (NR1)....    0
 Number of Nodes to be allowed for (NNOD)............   21
 Number of Plugs in a Storage Treatment Unit.........    1

 #######################################################
 #    Entry made to the Runoff Layer(Block) of SWMM    #
 #    Last Updated January,2009 by XP Software         #

 *===========================================================*
 |          RUNOFF TABLES IN THE OUTPUT FILE.                |
 |  These are the more important tables in the output file.  |
 |  You can use your editor to find the table numbers,       |
 |  for example: search for Table R3 to check continuity.    |
 |  This output file can be imported into a Word Processor   |
 |  and printed on US letter or A4 paper using portrait      |
 |  mode, courier font, a size of 8 pt. and margins of 0.75  |
 |                                                           |
 | Table R1  - Physical Hydrology Data                       |
 | Table R2  - Infiltration data                             |
 | Table R3  - Raingage and Infiltration Database Names      |
 | Table R4  - Groundwater Data                              |
 | Table R5  - Continuity Check for Surface Water            |
 | Table R6  - Continuity Check for Channels/Pipes           |
 | Table R7  - Continuity Check for Subsurface Water         |
 | Table R8  - Infiltration/Inflow Continuity Check          |
 | Table R9  - Summary Statistics for Subcatchments          |
 | Table R10 - Sensitivity anlysis for Subcatchments         |
 *===========================================================*

                    Red Deer Base


 ###########################################
 #              RUNOFF JOB CONTROL         #
 ###########################################

 Snowmelt parameter - ISNOW......................          0
 Number of rain gages - NRGAG....................          1
 Quality is not simulated - KWALTY...............          0
 Default evaporation rate used - IVAP............          0
 Hour of day at start of storm - NHR.............          0
 Minute of hour at start of storm - NMN..........          0
 Time TZERO at start of storm (hours)............      0.000
```

```
 Use Metric units for I/O - METRIC...............          1
  ===> Ft-sec units used in all internal computations
 Runoff input print control...                             0
 Runoff graph plot control....                             1
 Runoff output print control..                             0
 Limit number of groundwater convergence messages to   10000

 Print headers every 50 lines - NOHEAD (0=yes, 1=no)       0

 Print land use load percentages -LANDUPR (0=no, 1=yes)    0
 Month, day, year of start of storm is:            9/24/2007
 Wet time step length (seconds).......                  60.0
 Dry time step length (seconds).......               86400.0
 Wet/Dry time step length (seconds)...                  60.0
 Simulation length is......                             24.0 Hours

 If Horton infiltration model is being used
 A mixture of infiltration options may be used in
 XP-SWMM2000 as a watershed specific option.
 Rate for regeneration of infiltration = REGEN * DECAY
 Decay is read in for each subcatchment
 REGEN = ............................................  0.01000


 Raingage #..............................         1
 KTYPE  - Rainfall input type............         0
 NHISTO - Total number of rainfall values..     288
 KINC   - Rainfall values(pairs) per line..      10
 KPRINT - Print rainfall(0-Yes,1-No).......       0
 KTIME  - Precipitation time units
 0 --> Minutes  1 --> Hours................       0
 KPREP  - Precipitation unit type
 0 --> Intensity  1 --> Volume.............       0
 KTHIS - Variable rainfall intervals
 0 --> No, > 1 --> Yes.....................       0
 THISTO - Rainfall time interval...........    5.00
 TZRAIN - Starting time(KTIME units).......    0.00


######################################
# Rainfall input summary from Runoff #
######################################

 Total rainfall for gage #     1 is  110.1133 mm

   #############################
   #        Data Group F1      #
   # Evaporation Rate (mm/day) #
   #############################

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000


  ###################################################
  #  Table R1.  S U B C A T C H M E N T  D A T A    #
  #             Physical Hydrology Data             #
  ###################################################


   Deprs Deprs Prcnt
                                                                        Per-
```

```
  -sion -sion  Zero
       Subcatchment           Channel      Width    Area      cent  Slope  "n"
"n"  Storge Strge Deten
  Number          Name        or inlet      (m)     (Ha)     Imperv ft/ft Imprv
Perv Imprv  Perv -tion
  ====== =============== ================ ======== ========   ====== ===== =====
===== ===== ===== =====
      1          MH 1a#1          MH 1a 125.00    1.3940     70.80 0.001 0.016
0.250 1.600 3.200  0.00
      2          MH 1b#1          MH 1b 177.63    1.9560     72.90 0.001 0.016
0.250 1.600 3.200  0.00
      3          MH 1d#1          MH 1d 77.726    .84700     71.40 0.014 0.016
0.250 1.600 3.200  0.00
      4          MH 1h#1          MH 1h 98.070    .81200     76.70 0.023 0.016
0.250 1.600 3.200  0.00
      5           MH 2#1           MH 2 154.35    1.2810     77.30 0.006 0.016
0.250 1.600 3.200  0.00
      6          MH 3d#1          MH 3d 164.24    2.2240     75.90 0.009 0.016
0.250 1.600 3.200  0.00
      7          MH 3e#1          MH 3e 123.23    1.4720     76.80 0.001 0.016
0.250 1.600 3.200  0.00
      8          MH 1e#1          MH 1e 121.02    1.1870     74.50 0.006 0.016
0.250 1.600 3.200  0.00
      9          MH 1f#1          MH 1f 176.71    1.7320     77.70 0.004 0.016
0.250 1.600 3.200  0.00
     10          MH 3a#1          MH 3a 172.96    1.4330     74.70 0.003 0.016
0.250 1.600 3.200  0.00
     11          MH 3b#1          MH 3b 114.61    1.3730     77.50 0.002 0.016
0.250 1.600 3.200  0.00
     12          MH 4b#1          MH 4b 61.990    .59800     74.50 0.022 0.016
0.250 1.600 3.200  0.00


#################################################################################
###################
#          Table R2.  SUBCATCHMENT  DATA
                 #
#                    Infiltration or Time of Concentration Data
                 #
#
                 #
# Infiltration Type      Infl #1(#5)       Infl #2(#6)          Infl #3(#7)
    Infl #4(#8)  #
# SCS                  ->   Comp CN          Time Conc          Shape Factor
Depth or Fraction  #
# SBUH                 ->   Comp CN          Time Conc                   N/A
            N/A  #
# Green Ampt           ->   Suction          Hydr Cond            Initial MD
            N/A  #
# Horton               ->  Max Rate           Min Rate   Decay Rate (1/sec)
Max. Infilt. Volume  #
# Proportional         ->  Constant                N/A                   N/A
            N/A  #
# Initial/Cont Loss    ->   Initial         Continuing                   N/A
            N/A  #
# Initial/Proportional ->   Initial           Constant                   N/A
            N/A  #
# Laurenson Parameters ->   B Value       Pervious "n"      Impervious Cont
       Exponent  #
# Rational Formula     -> Tc Method   Flow Path Length      Flow Path Slope
Roughness or Retardance  #
#                               (#1 - #4 is Impervious Data / #5 - #8 is Pervious
Data)              #
```

```
#                          Rational Formula Tc Method: 1 = Constant
                 #
#                                                      2 = Friend's Equation
                 #
#                                                      3 = Kinematic Wave
                 #
#                                                      4 = Alameda Method
                 #
#                                                      5 = Izzard's Formula
                 #
#                                                      6 = Kerby's Equation
                 #
#                                                      7 = Kirpich's Equation
                 #
#                                                      8 = Bransby Williams Equation
                 #
#                                                      9 = Federal Aviation Authority
Equation            #
####################################################################################
###################
```

Subcatchment Number	Subcatchment Name	Infl # 1	Infl # 2	Infl # 3	Infl # 4	Infl # 5	Infl # 6	Infl # 7	Infl # 8
1	MH 1a#1	75.0000	7.5000	0.0011	0.0000				
2	MH 1b#1	75.0000	7.5000	0.0011	0.0000				
3	MH 1d#1	75.0000	7.5000	0.0011	0.0000				
4	MH 1h#1	75.0000	7.5000	0.0011	0.0000				
5	MH 2#1	75.0000	7.5000	0.0011	0.0000				
6	MH 3d#1	75.0000	7.5000	0.0011	0.0000				
7	MH 3e#1	75.0000	7.5000	0.0011	0.0000				
8	MH 1e#1	75.0000	7.5000	0.0011	0.0000				
9	MH 1f#1	75.0000	7.5000	0.0011	0.0000				
10	MH 3a#1	75.0000	7.5000	0.0011	0.0000				
11	MH 3b#1	75.0000	7.5000	0.0011	0.0000				
12	MH 4b#1	75.0000	7.5000	0.0011	0.0000				

```
############################################################
#     Table R3.  SUBCATCHMENT  DATA                        #
#                Rainfall and Infiltration Database Names  #
############################################################
```

Subcatchment Number	Subcatchment Name	Gage No	Infiltration Type	Routing Type	Rainfall Database Name	Infiltration Database Name

```
=================== ===================
     1          MH 1a#1      1       Horton  Non-linear reservoir
     2          MH 1b#1      1       Horton  Non-linear reservoir
     3          MH 1d#1      1       Horton  Non-linear reservoir
     4          MH 1h#1      1       Horton  Non-linear reservoir
     5           MH 2#1      1       Horton  Non-linear reservoir
     6          MH 3d#1      1       Horton  Non-linear reservoir
     7          MH 3e#1      1       Horton  Non-linear reservoir
     8          MH 1e#1      1       Horton  Non-linear reservoir
     9          MH 1f#1      1       Horton  Non-linear reservoir
    10          MH 3a#1      1       Horton  Non-linear reservoir
    11          MH 3b#1      1       Horton  Non-linear reservoir
    12          MH 4b#1      1       Horton  Non-linear reservoir

 Total Number of Subcatchments...           12
 Total Tributary Area (hectares).        16.31
 Impervious Area (hectares)......        12.26
 Pervious Area (hectares)........         4.05
 Total Width (metres)............      1567.53
 Impervious Area (%).............        75.17


  ###################################################
  #          S U B C A T C H M E N T   D A T A      #
  #   Default, Ratio values for subcatchment data   #
  #   Used with the calibrate node in the runoff.   #
  # 1 - width     2 - area      3 - impervious %    #
  # 4 - slope     5 - imp "n"   6 - perv "n"        #
  # 7 - imp ds    8 - perv ds   9 - 1st infil       #
  #10 - 2nd infil              11 - 3rd infil       #
  ###################################################

 Column          1         2         3         4         5         6         7
   8        9        10        11
 Default     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0.0000    0.0000    0.0000    0.0000
 Ratio       1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
1.0000    1.0000    1.0000    1.0000

 *********************************************************
 *     Arrangement of Subcatchments and Channel/Pipes    *
 *********************************************************


    Inlet
 MH 1a          No Tributary Channel/Pipes
                Tributary Subareas........ MH 1a#1
 MH 1b          No Tributary Channel/Pipes
                Tributary Subareas........ MH 1b#1
 MH 1d          No Tributary Channel/Pipes
                Tributary Subareas........ MH 1d#1
 MH 1h          No Tributary Channel/Pipes
                Tributary Subareas........ MH 1h#1
 MH 2           No Tributary Channel/Pipes
                Tributary Subareas........ MH 2#1
 MH 3d          No Tributary Channel/Pipes
                Tributary Subareas........ MH 3d#1
 MH 3e          No Tributary Channel/Pipes
                Tributary Subareas........ MH 3e#1
 MH 1e          No Tributary Channel/Pipes
                Tributary Subareas........ MH 1e#1
 MH 1f          No Tributary Channel/Pipes
                Tributary Subareas........ MH 1f#1
```

```
MH 3a          No Tributary Channel/Pipes
               Tributary Subareas........ MH 3a#1
MH 3b          No Tributary Channel/Pipes
               Tributary Subareas........ MH 3b#1
MH 4b          No Tributary Channel/Pipes
               Tributary Subareas........ MH 4b#1


***********************************************************
* Hydrographs will be stored for the following  12 INLETS *
***********************************************************
MH 1a     MH 1b     MH 1d     MH 1h     MH 2      MH 3d
MH 3e     MH 1e     MH 1f     MH 3a     MH 3b     MH 4b


************************************************
*  Quality Simulation not included in this run *
************************************************




***************************************************
*  Precipitation Interface File Summary           *
*  Number of precipitation station....        1   *
***************************************************

Location Station Number
-------- --------------
       1.             1


************************************************
*      End of time step DO-loop in Runoff      *
************************************************

Final Date (Mo/Day/Year)   =            9/25/2007
Total number of time steps =                 1440
Final Julian Date          =              2007268
Final time of day          =                   0. seconds.
Final time of day          =                 0.00   hours.
Final running time         =              24.0000   hours.
Final running time         =               1.0000    days.

****************************************************
*     Extrapolation Summary for Watersheds         *
* Explains the number of time steps and iterations *
* used in the solution of the subcatchments.       *
* # Steps ==> Total Number of Extrapolated Steps   *
* # Calls ==> Total Number of OVERLND Calls        *
****************************************************

Subcatchment   # Steps   # Calls Subcatchment   # Steps   # Calls
-------------  -------  -------- -------------  -------  --------
MH 1a#1           4905      1627 MH 1b#1           4885      1619 MH 1d#1
5728      1560
MH 1h#1           8411      1537 MH 2#1            5211      1557 MH 3d#1
4966      1570
MH 3e#1           4857      1615 MH 1e#1           5072      1568 MH 1f#1
4906      1570
MH 3a#1           4949      1575 MH 3b#1           4840      1596 MH 4b#1
7136      1544
```

```
##########################################################
# Rainfall input summary from Runoff Continuity Check   #
##########################################################

 Total rainfall read for gage #         1 is       110.11 mm
 Total rainfall duration for gage #     1 is      1440.00 minutes

 *************************************************************
 * Table R5. CONTINUITY CHECK FOR SURFACE WATER              *
 *       Any continuity error can be fixed by lowering the   *
 *       wet and transition time step. The transition time   *
 *       should not be much greater than the wet time step. *
 *************************************************************
                                                                              Millimeters
over
                                                             cubic meters  Total Basin
 Total Precipitation (Rain plus Snow)                       1.795838E+04    110.113
 Total Infiltration                                         3.864181E+03     23.694
 Total Evaporation                                          4.892784E+02      3.000
 Surface Runoff from Watersheds                             1.326310E+04     81.324
 Total Water remaining in Surface Storage                   3.454069E+02      2.118
 Infiltration over the Pervious Area...                     3.864181E+03     95.418
                                --------
 Infiltration + Evaporation +
 Surface Runoff + Snow removal +
 Water remaining in Surface Storage +
 Water remaining in Snow Cover.........                     1.796196E+04    110.135
 Total Precipitation + Initial Storage.                     1.795838E+04    110.113


 The error in continuity is calculated as
 ***************************************
 * Precipitation + Initial Snow Cover  *
 *      - Infiltration -               *
 *Evaporation - Snow removal -         *
 *Surface Runoff from Watersheds -     *
 *Water in Surface Storage -           *
 *Water remaining in Snow Cover        *
 *-------------------------------------*
 * Precipitation + Initial Snow Cover  *
 ***************************************
 Percent Continuity Error...............                                      -0.0199


 *****************************************************
 * Table R6. Continuity Check for Channel/Pipes     *
 *           You should have zero continuity error  *
 *           if you are not using runoff hydraulics *
 *****************************************************
                                                                              Millimeters
over
                                                             cubic meters  Total Basin
 Initial Channel/Pipe Storage................               0.000000E+00      0.000
 Final Channel/Pipe Storage..................               0.000000E+00      0.000
 Surface Runoff from Watersheds..............               1.326310E+04     81.324
 Groundwater Subsurface Inflow or Diversion..               0.000000E+00      0.000
 Evaporation Loss from Channels..............               0.000000E+00      0.000
 Groundwater Flow Diverted Out of Network....               0.000000E+00      0.000
 Channel/Pipe/Inlet Outflow..................               1.326310E+04     81.324
 Initial Storage + Inflow....................               1.326310E+04     81.324
 Final Storage + Outflow + Diverted GW.......               1.326310E+04     81.324
 *********************************************
```

```
 * Final Storage + Outflow + Evaporation  - *
 * Watershed Runoff - Groundwater Inflow  - *
 *     Initial Channel/Pipe Storage         *
 *     ---------------------------------    *
 *  Final Storage + Outflow  + Evaporation  *
 ********************************************
 Percent Continuity Error...................                        0.0000
```

```
        #################################################
        # Table R9. Summary Statistics for Subcatchments #
        #################################################
```

Note: Total Runoff Depth includes pervious & impervious areas.
Pervious and Impervious Runoff Depth is only the runoff from those two areas.
Subcatchments #1*, #2*, #3*, #4* and #5* are the fractions of Subcatchments #1, #2, #3, #4 and #5,
respectively, those have been redirected to another Subcatchment.

Subcatchment...........	MH 1a#1	MH 1b#1	MH 1d#1	MH 1h#1	MH 2#1	MH 3d#1
Area (hectares)........	1.39403	1.95604	0.84702	0.81202	1.28103	2.22405
Percent Impervious.....	70.80000	72.90000	71.40000	76.70000	77.30000	75.90000
Total Rainfall (mm)....	110.11333	110.11333	110.11333	110.11333	110.11333	110.11333
Max Intensity (mm/hr)..	100.18000	100.18000	100.18000	100.18000	100.18000	100.18000
Pervious Area						
Total Runoff Depth (mm)	9.90109	10.27336	12.67575	13.34154	12.76930	12.31868
Peak Runoff Rate (cms).	0.00660	0.00947	0.01035	0.01478	0.01315	0.01896
Total Impervious Area						
Total Runoff Depth (mm)	103.79403	103.83187	104.79223	104.97698	104.67747	104.52279
Peak Runoff Rate (cms).	0.13714	0.20129	0.13708	0.15502	0.21108	0.33129
Impervious Area with depression storage						
Total Runoff Depth (mm)	103.79403	103.83187	104.79223	104.97698	104.67747	104.52279
Peak Runoff Rate (cms).	0.13714	0.20129	0.13708	0.15502	0.21108	0.33129
Impervious Area without depression storage						
Total Runoff Depth (mm)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Peak Runoff Rate (cms).	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total Area						
Total Runoff Depth (mm)	76.37729	78.47751	78.44691	83.62593	83.81431	82.30160
Peak Runoff Rate (cms).	0.14166	0.20803	0.14729			

```
0.16981          0.22423          0.34902

 Rational Formula
 ----------------
 Pervious Tc. (mins)....          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Perv. Intensity (mm/hr)          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Pervious C ............          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Impervious Tc. (mins)..          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Imp. Intensity (mm/hr).          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Impervious C ..........          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Partial Area (Ha)......          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Partial Area Tc........          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Partial Area Intensity.          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000


 Subcatchment...........          MH 3e#1          MH 1e#1          MH 1f#1
MH 3a#1          MH 3b#1          MH 4b#1
 Area (hectares)........          1.47203          1.18703          1.73204
1.43303          1.37303          0.59801
 Percent Impervious.....         76.80000         74.50000         77.70000
74.70000         77.50000         74.50000
 Total Rainfall (mm)....        110.11333        110.11333        110.11333
110.11333        110.11333        110.11333
 Max Intensity (mm/hr)..        100.18000        100.18000        100.18000
100.18000        100.18000        100.18000

 Pervious Area
 -------------
 Total Runoff Depth (mm)         10.46203         12.40977         12.31184
12.15592         11.32337         13.14403
 Peak Runoff Rate (cms).          0.00642          0.01122          0.01362
0.01185          0.00746          0.00959

 Total Impervious Area
 ---------------------
 Total Runoff Depth (mm)        103.68772        104.60556        104.45487
104.49624        104.02822        104.92238
 Peak Runoff Rate (cms).          0.15043          0.18137          0.25487
0.20716          0.16366          0.10800

 Impervious Area with depression storage
 ---------------------------------------
 Total Runoff Depth (mm)        103.68772        104.60556        104.45487
104.49624        104.02822        104.92238
 Peak Runoff Rate (cms).          0.15043          0.18137          0.25487
0.20716          0.16366          0.10800

 Impervious Area without depression storage
 ------------------------------------------
 Total Runoff Depth (mm)          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Peak Runoff Rate (cms).          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
```

```
 Total Area
 ----------
 Total Runoff Depth (mm)         82.05936         81.09563         83.90697
81.13414         83.16963         81.51890
 Peak Runoff Rate (cms).          0.15510          0.19198          0.26759
0.21804          0.16970          0.11760

 Rational Formula
 ----------------
 Pervious Tc. (mins)....          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Perv. Intensity (mm/hr)          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Pervious C ............          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Impervious Tc. (mins)..          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Imp. Intensity (mm/hr).          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Impervious C ..........          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Partial Area (Ha)......          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Partial Area Tc........          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000
 Partial Area Intensity.          0.00000          0.00000          0.00000
0.00000          0.00000          0.00000

1
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          0.000
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                 0.0        1.0        2.0        3.0        4.0        5.0        6.0
7.0        8.0        9.0       10.0

                  LOCATION NO. : 1                   TIME IN HOURS


                   RAINFALL HYETOGRAPH

1
         10.000
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          6.000 = #             ###
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  RAINFALL      | #                    ##
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     IN         | #                         ###
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    MM/HR       | #                               ####
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          4.000 = #                                           ######
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                | #
              #                        |
          0.000
|=#=======|=========|=========|=========|=========|=========|=========|=========|==#
======|=========|
               8.0       9.0       10.0       11.0       12.0       13.0       14.0
15.0      16.0      17.0      18.0

                 LOCATION NO. : 1                   TIME IN HOURS
```

RAINFALL HYETOGRAPH

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          4.000
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          3.200 =
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    MM/HR       |   #
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     1.600 =   #
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     0.800 =   #
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     0.000
|===#=====|=========|=========|=========|=========|=========|=========|=========|===
======|=========#
              16.0      16.8      17.6      18.4      19.2      20.0      20.8
21.6      22.4      23.2      24.0

                 LOCATION NO. : 1                   TIME IN HOURS

                  RAINFALL HYETOGRAPH

 RANGE AND SCALE ARE ZERO ON PLOT ATTEMPT FOR LOCATION: FLOW SUM

 RANGE AND SCALE ARE ZERO ON PLOT ATTEMPT FOR LOCATION: INFILTRA

 ===> Runoff simulation ended normally.

 #######################################################
 #    Entry made to the HYDRAULIC Layer(Block) of SWMM #
 #    Last Updated in January, 2009 by XP Software     #
```

Red Deer Base

```
*==========================================================*
|        HYDRAULICS TABLES IN THE OUTPUT FILE              |
|  These are the more important tables in the output file. |
|  You can use your editor to find the table numbers,      |
|  for example: search for Table E20 to check continuity.  |
|  This output file can be imported into a Word Processor  |
|  and printed on US letter or A4 paper using portrait     |
|  mode, courier font, a size of 8 pt. and margins of 0.75 |
|                                                          |
| Table E1   - Basic Conduit Data                          |
| Table E2   - Conduit Factor Data                         |
| Table E3a  - Junction Data                               |
| Table E3b  - Junction Data                               |
| Table E4   - Conduit Connectivity Data                   |
| Table E4a  - Dry Weather Flow Data                       |
| Table E4b  - Real Time Control Data                      |
| Table E5   - Junction Time Step Limitation Summary       |
| Table E5a  - Conduit Explicit Condition Summary          |
| Table E6   - Final Model Condition                       |
| Table E7   - Iteration Summary                           |
| Table E8   - Junction Time Step Limitation Summary       |
| Table E9   - Junction  Summary  Statistics               |
| Table E10  - Conduit   Summary  Statistics               |
| Table E11  - Area assumptions used in the analysis       |
| Table E12  - Mean conduit information                    |
| Table E13  - Channel losses(H) and culvert info          |
| Table E13a - Culvert Analysis Classification             |
| Table E14  - Natural Channel Overbank Flow Information   |
| Table E14a - Natural Channel Encroachment Information    |
| Table E14b - Floodplain Mapping                          |
| Table E15  - Spreadsheet Info List                       |
| Table E15a - Spreadsheet Reach List                      |
| Table E16  - New Conduit Output Section                  |
| Table E17  - Pump Operation                              |
| Table E18  - Junction Continuity Error                   |
| Table E19  - Junction Inflow & Outflow Listing           |
| Table E20  - Junction Flooding and Volume List           |
| Table E21  - Continuity balance at simulation end        |
| Table E22  - Model Judgement Section                     |
*=========================================================*

Time Control from Hydraulics Job Control
Year.........    2007 Month.......      9
Day..........      24 Hour........      0
Minute.......       0 Second......      0


Control information for simulation
----------------------------------

Integration cycles.................      2880
Length of integration step is......     30.00 seconds
Simulation length..................     24.00 hours
Do not create equiv. pipes(NEQUAL).         0
Use metric units for I/O...........         1
Printing starts in cycle...........         1
```

```
Intermediate printout intervals of.       500 cycles
Intermediate printout intervals of.    250.00 minutes
Summary printout intervals of......       500 cycles
Summary printout time interval of..    250.00 minutes
Hot start file parameter (REDO)....        0
Initial time.......................      0.00 hours

Iteration variables: Flow Tolerance.   0.00010
                     Head Tolerance.   0.00005
    Minimum depth (m or ft).........   0.00001
    Underrelaxation parameter.......   0.85000
    Time weighting parameter........   0.85000
    Conduit roughness factor........   1.00000
    Flow adjustment factor..........   1.00000
    Initial Condition Smoothing.....         0
    Courant Time Step Factor........   1.00000
    Default Expansion/Contraction K.   0.00000
    Default Entrance/Exit K.........   0.00000
    Routing Method..................   Dynamic Wave
Default surface area of junctions...      1.22 square meters.
Minimum Junction/Conduit Depth......   0.00001 meter.
Ponding Area Coefficient............   5000.00
Ponding Area Exponent...............    1.0000
Minimum Orifice Length..............      1.00 meters.
NJSW input hydrograph junctions.....     0
     or user defined hydrographs....

*==================================================*
|          Table E1 - Conduit Data                 |
*==================================================*
```

Inp Num	Conduit Name	Length (m)	Conduit Class	Area (m^2)	Manning Coef.	Max Width (m)	Depth (m)	Trapezoid Side Slopes	
1	P4a-4c	16.1110	Circular	1.7671	0.0130	1.5000	1.5000		
2	P3f-4a	35.4150	Trapezoid	1.4200	0.0130	2.3500	0.4000	3.0000	3.0000
3	P3e-3f	119.2310	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
4	P3d-3e	172.2360	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
5	P3c-3f	16.3990	Circular	1.4314	0.0130	1.3500	1.3500		
6	P2-4c	154.2870	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
7	P1h-2	89.7280	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
8	P1g-3c	192.5690	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
9	P1f-1g	168.3010	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
10	P1e-1f	120.9960	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000
11	P1c-1h	16.6120	Circular	0.6362	0.0130	0.9000	0.9000		
12	P1b-1c	181.0080	Trapezoid	1.0400	0.0130	1.0000	0.4000	3.0000	5.0000

```
  13          P1a-1b   125.1050  Trapezoid    1.0400     0.0130     1.0000
0.4000     3.0000     5.0000
  14          P3b-3c   116.7390  Trapezoid    1.0400     0.0130     1.0000
0.4000     3.0000     5.0000
  15          P3a-3b   175.0930  Trapezoid    1.0400     0.0130     1.0000
0.4000     3.0000     5.0000
  16          P4c-4d    75.0300  Trapezoid    1.2800     0.0130     2.0000
0.4000     3.0000     3.0000
  17          P1d-1c    74.3500  Trapezoid    1.0400     0.0130     1.0000
0.4000     3.0000     5.0000
  18          P4b-4c    61.7880  Trapezoid    1.0400     0.0130     1.0000
0.4000     3.0000     5.0000
  19          Link25    10.0000   Circular    3.1416     0.0140     2.0000
2.0000
 Total length of all conduits ....      1920.9980 meters

 *=====================================================*
 | If there are messages about (sqrt(g*d)*dt/dx), or |
 | the sqrt(wave celerity)*time step/conduit length  |
 | in the output file all it means is that the        |
 | program will lower the internal time step to       |
 | satisfy this condition (explicit condition).       |
 | You control the actual internal time step by       |
 | using the minimum courant time step factor in the |
 | HYDRAULICS job control.  The message put in words |
 | states that the smallest conduit with the fastest |
 | velocity will control the time step selection.     |
 | You have further control by using the modify       |
 | conduit option in the HYDRAULICS Job Control.      |
 *=====================================================*


        Conduit     Courant
           Name       Ratio
 ----------------   ---------
         P4a-4c        7.14  ===> Warning ! (sqrt(wave celerity)*time step/conduit
length)
         P3f-4a        1.45  ===> Warning ! (sqrt(wave celerity)*time step/conduit
length)
         P3e-3f        0.39
         P3d-3e        0.27
         P3c-3f        6.66  ===> Warning ! (sqrt(wave celerity)*time step/conduit
length)
          P2-4c        0.30
          P1h-2        0.52
         P1g-3c        0.24
         P1f-1g        0.28
         P1e-1f        0.39
         P1c-1h        5.36  ===> Warning ! (sqrt(wave celerity)*time step/conduit
length)
         P1b-1c        0.26
         P1a-1b        0.37
         P3b-3c        0.40
         P3a-3b        0.27
         P4c-4d        0.68
         P1d-1c        0.63
         P4b-4c        0.76
         Link25       13.29  ===> Warning ! (sqrt(wave celerity)*time step/conduit
length)

 *==================*
 |  Conduit Volume  |
 *==================*
```

Full pipe or full open conduit volume
Input full depth volume............ 2.0617E+03 cubic meters

==
| Table E3a - Junction Data |
==

Inp Num	Junction Name	Ground Elevation	Crown Elevation	Invert Elevation	Qinst cms	Initial Depth-m	Interface Flow (%)
1	MH 1a	938.9150	938.9150	938.5150	0.0000	0.0000	100.0000
2	MH 1e	938.9140	938.9140	938.5140	0.0000	0.0000	100.0000
3	MH 1f	938.1880	938.1880	937.7720	0.0000	0.0000	100.0000
4	MH 1b	938.1780	938.1780	937.7780	0.0000	0.0000	100.0000
5	MH 1d	937.6230	937.6230	937.2230	0.0000	0.0000	100.0000
6	MH 1c	937.4700	937.3140	936.4140	0.0000	0.0000	100.0000
7	MH 1g	937.1620	937.1620	936.5100	0.0000	0.0000	100.0000
8	MH 1h	937.2500	936.9620	936.0620	0.0000	0.0000	100.0000
9	MH 3a	935.7190	935.7190	935.3190	0.0000	0.0000	100.0000
10	MH 3d	935.6950	935.6950	935.2950	0.0000	0.0000	100.0000
11	MH 2	935.1400	935.1400	934.4470	0.0000	0.0000	100.0000
12	MH 3b	934.6770	934.6770	934.2770	0.0000	0.0000	100.0000
13	MH 3e	934.6610	934.6610	934.2610	0.0000	0.0000	100.0000
14	MH 4b	934.0260	934.0260	933.6260	0.0000	0.0000	100.0000
15	MH 3f	933.9510	933.9510	932.5190	0.0000	0.0000	100.0000
16	MH 3c	934.2600	934.0270	932.6590	0.0000	0.0000	100.0000
17	MH 4a	933.9500	933.8170	932.3120	0.0000	0.0000	100.0000
18	MH 4c	933.9500	933.7360	932.2360	0.0000	0.0000	100.0000
19	MH 4d	932.6000	932.4220	930.5000	0.0000	0.0000	100.0000
20	Orifice	932.6000	932.5000	930.5000	0.0000	0.0000	100.0000
21	Node22	932.0000	927.5000	925.5000	0.0000	0.0000	100.0000

==
| Table E3b - Junction Data |
==

Inp Num	Pavement Junction Name	X Coord.	Y Coord.	Type of Manhole	Type of Inlet	Maximum Capacity

```
  Shape   Slope
---  ----------------    -----------    ----------- ---------- ------------   --------
-------- -------
  1            MH 1a          0.0000         0.0000       No P       Normal
       0   0.0000
  2            MH 1e          0.0000         0.0000       No P       Normal
       0   0.0000
  3            MH 1f          0.0000         0.0000       No P       Normal
       0   0.0000
  4            MH 1b          0.0000         0.0000       No P       Normal
       0   0.0000
  5            MH 1d          0.0000         0.0000       No P       Normal
       0   0.0000
  6            MH 1c          0.0000         0.0000       No P       Normal
       0   0.0000
  7            MH 1g          0.0000         0.0000       No P       Normal
       0   0.0000
  8            MH 1h          0.0000         0.0000       No P       Normal
       0   0.0000
  9            MH 3a          0.0000         0.0000       No P       Normal
       0   0.0000
 10            MH 3d          0.0000         0.0000       No P       Normal
       0   0.0000
 11             MH 2          0.0000         0.0000       No P       Normal
       0   0.0000
 12            MH 3b          0.0000         0.0000       No P       Normal
       0   0.0000
 13            MH 3e          0.0000         0.0000       No P       Normal
       0   0.0000
 14            MH 4b          0.0000         0.0000       No P       Normal
       0   0.0000
 15            MH 3f          0.0000         0.0000       No P       Normal
       0   0.0000
 16            MH 3c          0.0000         0.0000       No P       Normal
       0   0.0000
 17            MH 4a          0.0000         0.0000       No P       Normal
       0   0.0000
 18            MH 4c          0.0000         0.0000       No P       Normal
       0   0.0000
 19            MH 4d          0.0000         0.0000       No P       Normal
       0   0.0000
 20          Orifice          0.0000         0.0000       No P       Normal
       0   0.0000
 21           Node22          0.0000         0.0000       No P       Normal
       0   0.0000


 *====================================================*
 |           Table E4 - Conduit Connectivity          |
 *====================================================*

 Input          Conduit          Upstream        Downstream     Upstream  Downstream
Number             Name              Node              Node    Elevation   Elevation
====== ================   ==============  ===============    =========   =========
     1            P4a-4c             MH 4a             MH 4c     932.3170    932.2360
No Design
     2            P3f-4a             MH 3f             MH 4a     932.5240    932.3120
No Design
     3            P3e-3f             MH 3e             MH 3f     934.2610    933.5510
No Design
     4            P3d-3e             MH 3d             MH 3e     935.2950    934.2610
No Design
     5            P3c-3f             MH 3c             MH 3f     932.6770    932.5190
```

```
No Design
     6            P2-4c              MH 2            MH 4c      934.4470    932.4410
No Design
     7            P1h-2              MH 1h            MH 2      936.0810    934.7400
No Design
     8            P1g-3c             MH 1g           MH 3c      936.5100    932.6590
No Design
     9            P1f-1g             MH 1f           MH 1g      937.7720    936.7620
No Design
    10            P1e-1f             MH 1e           MH 1f      938.5140    937.7880
No Design
    11            P1c-1h             MH 1c           MH 1h      936.4140    936.0620
No Design
    12            P1b-1c             MH 1b           MH 1c      937.7780    936.7880
No Design
    13            P1a-1b             MH 1a           MH 1b      938.5150    937.7780
No Design
    14            P3b-3c             MH 3b           MH 3c      934.2770    933.5730
No Design
    15            P3a-3b             MH 3a           MH 3b      935.3190    934.2770
No Design
    16            P4c-4d             MH 4c           MH 4d      932.2410    932.0220
No Design
    17            P1d-1c             MH 1d           MH 1c      937.2230    936.6900
No Design
    18            P4b-4c             MH 4b           MH 4c      933.6260    933.2660
No Design
    19            Link25           Orifice          Node22      930.5000    925.5000
No Design


 *===========================================*
 |          Storage Junction Data            |
 *===========================================*

                                 MAXIMUM OR       PEAK OR      CROWN      DEPTH
 STORAGE JUNCTION   JUNCTION  CONSTANT SURFACE  CONSTANT VOLUME  ELEVATION   STARTS
   NUMBER OR NAME       TYPE     AREA   (M2)     (CUBIC MET.)      (M)       FROM
   --------------   --------  ----------------  ---------------  ---------
-----------
           MH 4d Stage/Area       10720.5400       17987.4015    932.6000 Node
Invert

       *==================================*
       |   Variable storage data for node |MH 4d
       *==================================*
        Data     Elevation     Depth          Area          Volume
        Point      meters     meters           m^2             m^3
        =====    =========    ======    ===========    ============
          1       930.5000    0.0000      2533.1200          0.0000

          2       930.5125    0.0125      3031.3950         34.7316

          3       930.5250    0.0250      3529.6700         75.6988

          4       930.5375    0.0375      4027.9450        122.8997

          5       930.5500    0.0500      4526.2200        176.3329

          6       930.5625    0.0625      5024.4950        235.9978

          7       930.5750    0.0750      5522.7700        301.8937
```

8	930.5875	0.0875	6021.0450	374.0201
9	930.6000	0.1000	6519.3200	452.3768
10	930.6125	0.1125	6546.8312	534.0401
11	930.6250	0.1250	6574.3425	616.0474
12	930.6375	0.1375	6601.8537	698.3986
13	930.6500	0.1500	6629.3650	781.0936
14	930.6625	0.1625	6656.8763	864.1326
15	930.6750	0.1750	6684.3875	947.5154
16	930.6875	0.1875	6711.8988	1031.2422
17	930.7000	0.2000	6739.4100	1115.3128
18	930.7125	0.2125	6767.1175	1199.7285
19	930.7250	0.2250	6794.8250	1284.4906
20	930.7375	0.2375	6822.5325	1369.5990
21	930.7500	0.2500	6850.2400	1455.0538
22	930.7625	0.2625	6877.9475	1540.8549
23	930.7750	0.2750	6905.6550	1627.0024
24	930.7875	0.2875	6933.3625	1713.4962
25	930.8000	0.3000	6961.0700	1800.3363
26	930.8125	0.3125	6988.9725	1887.5240
27	930.8250	0.3250	7016.8750	1975.0605
28	930.8375	0.3375	7044.7775	2062.9458
29	930.8500	0.3500	7072.6800	2151.1798
30	930.8625	0.3625	7100.5825	2239.7627
31	930.8750	0.3750	7128.4850	2328.6943
32	930.8875	0.3875	7156.3875	2417.9747
33	930.9000	0.4000	7184.2900	2507.6039
34	930.9125	0.4125	7212.3887	2597.5830
35	930.9250	0.4250	7240.4875	2687.9135
36	930.9375	0.4375	7268.5862	2778.5951
37	930.9500	0.4500	7296.6850	2869.6280
38	930.9625	0.4625	7324.7838	2961.0121
39	930.9750	0.4750	7352.8825	3052.7475

40	930.9875	0.4875	7380.9813	3144.8341
41	931.0000	0.5000	7409.0800	3237.2719
42	931.0125	0.5125	7437.3750	3330.0622
43	931.0250	0.5250	7465.6700	3423.2062
44	931.0375	0.5375	7493.9650	3516.7038
45	931.0500	0.5500	7522.2600	3610.5552
46	931.0625	0.5625	7550.5550	3704.7602
47	931.0750	0.5750	7578.8500	3799.3189
48	931.0875	0.5875	7607.1450	3894.2314
49	931.1000	0.6000	7635.4400	3989.4975
50	931.1125	0.6125	7663.9300	4085.1185
51	931.1250	0.6250	7692.4200	4181.0956
52	931.1375	0.6375	7720.9100	4277.4289
53	931.1500	0.6500	7749.4000	4374.1182
54	931.1625	0.6625	7777.8900	4471.1638
55	931.1750	0.6750	7806.3800	4568.5654
56	931.1875	0.6875	7834.8700	4666.3231
57	931.2000	0.7000	7863.3600	4764.4370
58	931.2125	0.7125	7892.0463	4862.9083
59	931.2250	0.7250	7920.7325	4961.7381
60	931.2375	0.7375	7949.4187	5060.9265
61	931.2500	0.7500	7978.1050	5160.4734
62	931.2625	0.7625	8006.7913	5260.3790
63	931.2750	0.7750	8035.4775	5360.6431
64	931.2875	0.7875	8064.1638	5461.2658
65	931.3000	0.8000	8092.8500	5562.2471
66	931.3125	0.8125	8121.7313	5663.5882
67	931.3250	0.8250	8150.6125	5765.2903
68	931.3375	0.8375	8179.4937	5867.3534
69	931.3500	0.8500	8208.3750	5969.7775
70	931.3625	0.8625	8237.2563	6072.5627

71	931.3750	0.8750	8266.1375	6175.7088
72	931.3875	0.8875	8295.0187	6279.2160
73	931.4000	0.9000	8323.9000	6383.0842
74	931.4125	0.9125	8352.9775	6487.3146
75	931.4250	0.9250	8382.0550	6591.9085
76	931.4375	0.9375	8411.1325	6696.8659
77	931.4500	0.9500	8440.2100	6802.1867
78	931.4625	0.9625	8469.2875	6907.8710
79	931.4750	0.9750	8498.3650	7013.9188
80	931.4875	0.9875	8527.4425	7120.3300
81	931.5000	1.0000	8556.5200	7227.1048
82	931.5125	1.0125	8585.7925	7334.2442
83	931.5250	1.0250	8615.0650	7441.7495
84	931.5375	1.0375	8644.3375	7549.6207
85	931.5500	1.0500	8673.6100	7657.8578
86	931.5625	1.0625	8702.8825	7766.4608
87	931.5750	1.0750	8732.1550	7875.4298
88	931.5875	1.0875	8761.4275	7984.7646
89	931.6000	1.1000	8790.7000	8094.4653
90	931.6125	1.1125	8820.1688	8204.5332
91	931.6250	1.1250	8849.6375	8314.9695
92	931.6375	1.1375	8879.1063	8425.7741
93	931.6500	1.1500	8908.5750	8536.9470
94	931.6625	1.1625	8938.0438	8648.4883
95	931.6750	1.1750	8967.5125	8760.3980
96	931.6875	1.1875	8996.9813	8872.6760
97	931.7000	1.2000	9026.4500	8985.3224
98	931.7125	1.2125	9056.1150	9098.3384
99	931.7250	1.2250	9085.7800	9211.7252
100	931.7375	1.2375	9115.4450	9325.4828
101	931.7500	1.2500	9145.1100	9439.6112
102	931.7625	1.2625	9174.7750	9554.1105

103	931.7750	1.2750	9204.4400	9668.9805
104	931.7875	1.2875	9234.1050	9784.2214
105	931.8000	1.3000	9263.7700	9899.8330
106	931.8125	1.3125	9293.6300	10015.8167
107	931.8250	1.3250	9323.4900	10132.1737
108	931.8375	1.3375	9353.3500	10248.9039
109	931.8500	1.3500	9383.2100	10366.0073
110	931.8625	1.3625	9413.0700	10483.4840
111	931.8750	1.3750	9442.9300	10601.3340
112	931.8875	1.3875	9472.7900	10719.5572
113	931.9000	1.4000	9502.6500	10838.1536
114	931.9125	1.4125	9532.7063	10957.1246
115	931.9250	1.4250	9562.7625	11076.4712
116	931.9375	1.4375	9592.8188	11196.1935
117	931.9500	1.4500	9622.8750	11316.2916
118	931.9625	1.4625	9652.9312	11436.7653
119	931.9750	1.4750	9682.9875	11557.6148
120	931.9875	1.4875	9713.0438	11678.8399
121	932.0000	1.5000	9743.1000	11800.4408
122	932.0125	1.5125	9767.2850	11922.3806
123	932.0250	1.5250	9791.4700	12044.6228
124	932.0375	1.5375	9815.6550	12167.1673
125	932.0500	1.5500	9839.8400	12290.0141
126	932.0625	1.5625	9864.0250	12413.1633
127	932.0750	1.5750	9888.2100	12536.6147
128	932.0875	1.5875	9912.3950	12660.3684
129	932.1000	1.6000	9936.5800	12784.4245
130	932.1125	1.6125	9960.8913	12908.7837
131	932.1250	1.6250	9985.2025	13033.4467
132	932.1375	1.6375	10009.5138	13158.4137
133	932.1500	1.6500	10033.8250	13283.6845

134	932.1625	1.6625	10058.1362	13409.2592
135	932.1750	1.6750	10082.4475	13535.1379
136	932.1875	1.6875	10106.7588	13661.3204
137	932.2000	1.7000	10131.0700	13787.8068
138	932.2125	1.7125	10155.5062	13914.5978
139	932.2250	1.7250	10179.9425	14041.6944
140	932.2375	1.7375	10204.3787	14169.0963
141	932.2500	1.7500	10228.8150	14296.8038
142	932.2625	1.7625	10253.2512	14424.8166
143	932.2750	1.7750	10277.6875	14553.1350
144	932.2875	1.7875	10302.1238	14681.7588
145	932.3000	1.8000	10326.5600	14810.6880
146	932.3125	1.8125	10351.1213	14939.9235
147	932.3250	1.8250	10375.6825	15069.4660
148	932.3375	1.8375	10400.2437	15199.3155
149	932.3500	1.8500	10424.8050	15329.4720
150	932.3625	1.8625	10449.3663	15459.9356
151	932.3750	1.8750	10473.9275	15590.7061
152	932.3875	1.8875	10498.4888	15721.7837
153	932.4000	1.9000	10523.0500	15853.1683
154	932.4125	1.9125	10547.7363	15984.8607
155	932.4250	1.9250	10572.4225	16116.8616
156	932.4375	1.9375	10597.1087	16249.1712
157	932.4500	1.9500	10621.7950	16381.7893
158	932.4625	1.9625	10646.4813	16514.7160
159	932.4750	1.9750	10671.1675	16647.9513
160	932.4875	1.9875	10695.8538	16781.4951
161	932.5000	2.0000	10720.5400	16915.3475
162	932.6000	2.1000	10720.5400	17987.4015

```
*==========================================*
|             Orifice Data                 |
*==========================================*
```

```
          Orifice            From              To                Area     Depth
Discharge   Height Above
             Name        Junction        Junction      Type      (m2)      (m)
Coefficient  Junction  (m)
 ---------------- --------------- ---------------      ----     -----     -----
-----------  -------------
       Orifice_1           MH 4d         Orifice Circ Side      0.03      0.00
    0.600          0.000

 ====> EQUIVALENT PIPE INFORMATION FOR ORIFICE              1
       CONDUIT NAME..........................       Orifice_1
       Upstream node..........................          MH 4d
       Downstream node........................        Orifice
       PIPE DIAMETER.......................              0.19
       PIPE LENGTH.........................            300.00
       MANNINGS ROUGHNESS..................            0.0029
       INVERT ELEVATION AT UPSTREAM END.....         930.5000
       INVERT ELEVATION AT DOWNSTREAM END...         930.4970

 Note: For a Bottom-outlet orifice the invert elevation of the downstream node will
be
       adjusted to accomodate the equivalent conduit.  Conduit grades are not
affected.


 *================================================*
 |          FREE OUTFALL DATA (DATA GROUP I1)     |
 |         BOUNDARY CONDITION ON DATA GROUP J1    |
 *================================================*

 Outfall at Junction....Node22          has boundary condition number...         1


 *================================================*
 |        INTERNAL CONNECTIVITY INFORMATION       |
 *================================================*

          CONDUIT         JUNCTION         JUNCTION
 ---------------- ---------------- ----------------
       Orifice_1            MH 4d          Orifice
        FREE # 1           Node22         BOUNDARY

 *===================================================*
 |        Boundary Condition Information             |
 |                 Data Groups J1-J4                 |
 *===================================================*


 BC NUMBER..         1 has no control water surface.


 ###########################################
 # Header information from interface file: #
 ###########################################

 Title from first computational layer:
 Red Deer Base


 Title from immediately preceding computational layer
 Red Deer Base
```

```
 Name of preceding layer:................        Runoff Layer
 Initial Julian date (IDATEZ).....................   2007267
 Initial time of day in seconds (TZERO)...........       0.0
 No. Transfered input locations...................        12
 No. Transfered pollutants........................         0
 Size of total catchment area (acres).............     40.30

 #################################################
 # Element numbers of interface inlet locations: #
 #################################################

 MH 1a            MH 1b            MH 1d            MH 1h            MH 2
 MH 3d            MH 3e
 MH 1e            MH 1f            MH 3a            MH 3b            MH 4b


 Conversion factor to cfs for flow units on interface file.  Multiply by:
35.31467

######## Important Information ########
 Interface file start: 2007/09/24  00:00:00
 Simulation start:     2007/09/24  00:00:00
Same date/time found in interface file and model

 *=====================================================*
 |              XP Note Field Summary                  |
 *=====================================================*



 *==================================*
 |   Conduit Convergence Criteria   |
 *==================================*
```

Conduit Name	Full Flow	Conduit Slope
P4a-4c	5.0122	0.0050
P3f-4a	3.7112	0.0060
P3e-3f	2.3948	0.0060
P3d-3e	2.4045	0.0060
P3c-3f	5.2390	0.0096
P2-4c	3.5386	0.0130
P1h-2	3.7938	0.0149
P1g-3c	4.3886	0.0200
P1f-1g	2.4041	0.0060
P1e-1f	2.4039	0.0060
P1c-1h	2.6352	0.0212
P1b-1c	2.2951	0.0055

```
           P1a-1b      2.3819      0.0059

           P3b-3c      2.4099      0.0060

           P3a-3b      2.3940      0.0060

           P4c-4d      2.2906      0.0029

           P1d-1c      2.6276      0.0072

           P4b-4c      2.3688      0.0058

           Link25     99.9586      0.5000

        Orifice_1      0.0338      0.0000


 *=================================*
 |    Initial Model Condition      |
 | Initial Time =      0.01 hours  |
 *=================================*

       Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.00 /   938.51           MH 1e/   0.00 /   938.51
MH 1f/   0.00 /   937.77
           MH 1b/   0.00 /   937.78           MH 1d/   0.00 /   937.22
MH 1c/   0.00 /   936.41
           MH 1g/   0.00 /   936.51           MH 1h/   0.00 /   936.06
MH 3a/   0.00 /   935.32
           MH 3d/   0.00 /   935.29            MH 2/   0.00 /   934.45
MH 3b/   0.00 /   934.28
           MH 3e/   0.00 /   934.26           MH 4b/   0.00 /   933.63
MH 3f/   0.00 /   932.52
           MH 3c/   0.00 /   932.66           MH 4a/   0.00 /   932.31
MH 4c/   0.00 /   932.24
           MH 4d/   0.00 /   930.50         Orifice/   0.00 /   930.50
Node22/   0.00 /   925.50

         Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
          P4a-4c/       0.00            P3f-4a/       0.00            P3e-3f/
0.00
          P3d-3e/       0.00            P3c-3f/       0.00             P2-4c/
0.00
           P1h-2/       0.00            P1g-3c/       0.00            P1f-1g/
0.00
          P1e-1f/       0.00            P1c-1h/       0.00            P1b-1c/
0.00
          P1a-1b/       0.00            P3b-3c/       0.00            P3a-3b/
0.00
          P4c-4d/       0.00            P1d-1c/       0.00            P4b-4c/
0.00
          Link25/       0.00         Orifice_1/       0.00          FREE # 1/
0.00

         Conduit/   Velocity
          P4a-4c/       0.00            P3f-4a/       0.00            P3e-3f/
0.00
          P3d-3e/       0.00            P3c-3f/       0.00             P2-4c/
0.00
           P1h-2/       0.00            P1g-3c/       0.00            P1f-1g/
0.00
          P1e-1f/       0.00            P1c-1h/       0.00            P1b-1c/
0.00
```

```
          P1a-1b/       0.00          P3b-3c/       0.00          P3a-3b/
0.00
          P4c-4d/       0.00          P1d-1c/       0.00          P4b-4c/
0.00
          Link25/       0.00       Orifice_1/       0.00

         Conduit/ Cross Sectional Area
          P4a-4c/       0.00          P3f-4a/       0.00          P3e-3f/
0.00
          P3d-3e/       0.00          P3c-3f/       0.00           P2-4c/
0.00
           P1h-2/       0.00          P1g-3c/       0.00          P1f-1g/
0.00
          P1e-1f/       0.00          P1c-1h/       0.00          P1b-1c/
0.00
          P1a-1b/       0.00          P3b-3c/       0.00          P3a-3b/
0.00
          P4c-4d/       0.00          P1d-1c/       0.00          P4b-4c/
0.00
          Link25/       0.00       Orifice_1/       0.00

         Conduit/ Hydraulic Radius
          P4a-4c/       0.00          P3f-4a/       0.00          P3e-3f/
0.00
          P3d-3e/       0.00          P3c-3f/       0.00           P2-4c/
0.00
           P1h-2/       0.00          P1g-3c/       0.00          P1f-1g/
0.00
          P1e-1f/       0.00          P1c-1h/       0.00          P1b-1c/
0.00
          P1a-1b/       0.00          P3b-3c/       0.00          P3a-3b/
0.00
          P4c-4d/       0.00          P1d-1c/       0.00          P4b-4c/
0.00
          Link25/       0.00       Orifice_1/       0.00

         Conduit/ Upstream/ Downstream Elevation
          P4a-4c/   932.24/   932.24         P3f-4a/   932.31/   932.31
P3e-3f/   932.52/   932.52
          P3d-3e/   934.26/   934.26         P3c-3f/   932.52/   932.52
P2-4c/   932.24/   932.24
           P1h-2/   934.45/   934.45         P1g-3c/   932.66/   932.66
P1f-1g/   936.51/   936.51
          P1e-1f/   937.77/   937.77         P1c-1h/   936.06/   936.06
P1b-1c/   936.41/   936.41
          P1a-1b/   937.78/   937.78         P3b-3c/   932.66/   932.66
P3a-3b/   934.28/   934.28
          P4c-4d/   930.50/   930.50         P1d-1c/   936.41/   936.41
P4b-4c/   932.24/   932.24
          Link25/   925.50/   925.50      Orifice_1/   930.50/   930.50

 ===> System inflows (file) at     4.17 hours (  Junction / Inflow, cu m/s)

 MH 1a     / 8.57E-03 MH 1b     / 1.24E-02 MH 1d     / 5.44E-03 MH 1h     / 5.64E-03
MH 2     / 8.87E-03 MH 3d     / 1.50E-02
 MH 3e     / 9.78E-03 MH 1e     / 7.90E-03 MH 1f     / 1.20E-02 MH 3a     / 9.53E-03
MH 3b     / 9.32E-03 MH 4b     / 4.03E-03

 Cycle        500      Time          4 Hrs - 10.00 Min

       Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.02 /   938.53           MH 1e/   0.02 /   938.53
MH 1f/   0.03 /   937.80
```

```
           MH 1b/   0.03 /   937.81            MH 1d/   0.01 /   937.24
MH 1c/   0.07 /   936.48
           MH 1g/   0.02 /   936.53            MH 1h/   0.05 /   936.11
MH 3a/   0.02 /   935.34
           MH 3d/   0.03 /   935.32             MH 2/   0.04 /   934.49
MH 3b/   0.03 /   934.31
           MH 3e/   0.04 /   934.30            MH 4b/   0.01 /   933.64
MH 3f/   0.04 /   932.56
           MH 3c/   0.11 /   932.76            MH 4a/   0.12 /   932.44
MH 4c/   0.08 /   932.32
           MH 4d/   0.13 /   930.63          Orifice/   0.02 /   930.51
Node22/   0.00 /   925.50

         Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
          P4a-4c/       0.06             P3f-4a/       0.06*          P3e-3f/
0.02           P3d-3e/       0.01*
          P3c-3f/       0.04              P2-4c/       0.04            P1h-2/
0.03           P1g-3c/       0.02*
          P1f-1g/       0.02             P1e-1f/       0.01           P1c-1h/
0.03           P1b-1c/       0.02
          P1a-1b/       0.01*            P3b-3c/       0.02           P3a-3b/
0.01*          P4c-4d/       0.11
          P1d-1c/       0.01             P4b-4c/       0.00           Link25/
0.01        Orifice_1/       0.01
        FREE # 1/       0.01

 ===> System inflows (file) at     8.33 hours (  Junction / Inflow, cu m/s)

 MH 1a     / 3.42E-02 MH 1b     / 4.87E-02 MH 1d     / 1.89E-02 MH 1h     / 1.79E-02
MH 2      / 2.97E-02 MH 3d     / 5.25E-02
 MH 3e     / 3.83E-02 MH 1e     / 2.75E-02 MH 1f     / 4.16E-02 MH 3a     / 3.38E-02
MH 3b     / 3.47E-02 MH 4b     / 1.32E-02

 Cycle       1000      Time          8 Hrs - 20.00 Min

        Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.04 /   938.56            MH 1e/   0.04 /   938.55
MH 1f/   0.07 /   937.84
           MH 1b/   0.08 /   937.85            MH 1d/   0.03 /   937.25
MH 1c/   0.13 /   936.55
           MH 1g/   0.05 /   936.56            MH 1h/   0.09 /   936.15
MH 3a/   0.04 /   935.36
           MH 3d/   0.06 /   935.35             MH 2/   0.08 /   934.53
MH 3b/   0.07 /   934.34
           MH 3e/   0.08 /   934.34            MH 4b/   0.03 /   933.65
MH 3f/   0.10 /   932.61
           MH 3c/   0.18 /   932.84            MH 4a/   0.22 /   932.53
MH 4c/   0.17 /   932.40
           MH 4d/   0.74 /   931.24          Orifice/   0.03 /   930.53
Node22/   0.01 /   925.51

         Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
          P4a-4c/       0.25             P3f-4a/       0.25           P3e-3f/
0.10           P3d-3e/       0.05*
          P3c-3f/       0.15              P2-4c/       0.16            P1h-2/
0.13           P1g-3c/       0.07*
          P1f-1g/       0.07             P1e-1f/       0.03*          P1c-1h/
0.11           P1b-1c/       0.09
          P1a-1b/       0.03*            P3b-3c/       0.07           P3a-3b/
0.03*          P4c-4d/       0.42
          P1d-1c/       0.02             P4b-4c/       0.01           Link25/
0.05        Orifice_1/       0.05
        FREE # 1/       0.05
```

```
 ===> System inflows (file) at    12.50 hours (  Junction / Inflow, cu m/s)

 MH 1a     / 1.12E-02 MH 1b     / 1.62E-02 MH 1d     / 6.71E-03 MH 1h     / 6.89E-03
MH 2      / 1.10E-02 MH 3d     / 1.89E-02
 MH 3e     / 1.29E-02 MH 1e     / 9.86E-03 MH 1f     / 1.51E-02 MH 3a     / 1.20E-02
MH 3b     / 1.20E-02 MH 4b     / 4.93E-03

 Cycle       1500      Time         12 Hrs - 30.00 Min

       Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.02 /   938.54            MH 1e/   0.02 /   938.54
MH 1f/   0.04 /   937.81
           MH 1b/   0.04 /   937.82            MH 1d/   0.02 /   937.24
MH 1c/   0.08 /   936.49
           MH 1g/   0.03 /   936.54            MH 1h/   0.06 /   936.12
MH 3a/   0.02 /   935.34
           MH 3d/   0.03 /   935.33             MH 2/   0.04 /   934.49
MH 3b/   0.04 /   934.31
           MH 3e/   0.04 /   934.30            MH 4b/   0.02 /   933.64
MH 3f/   0.05 /   932.57
           MH 3c/   0.12 /   932.78            MH 4a/   0.14 /   932.45
MH 4c/   0.09 /   932.33
           MH 4d/   0.99 /   931.49          Orifice/   0.04 /   930.53
Node22/   0.01 /   925.51

         Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
          P4a-4c/       0.08          P3f-4a/       0.08          P3e-3f/
0.03           P3d-3e/       0.02*
          P3c-3f/       0.05           P2-4c/       0.05           P1h-2/
0.04           P1g-3c/       0.03*
          P1f-1g/       0.03          P1e-1f/       0.01          P1c-1h/
0.03           P1b-1c/       0.03
          P1a-1b/       0.01*         P3b-3c/       0.02          P3a-3b/
0.01*          P4c-4d/       0.14
          P1d-1c/       0.01          P4b-4c/       0.00          Link25/
0.05        Orifice_1/       0.05
        FREE # 1/       0.05

 ===> System inflows (file) at    16.67 hours (  Junction / Inflow, cu m/s)

 MH 1a     / 8.12E-03 MH 1b     / 1.17E-02 MH 1d     / 4.90E-03 MH 1h     / 5.04E-03
MH 2      / 8.04E-03 MH 3d     / 1.37E-02
 MH 3e     / 9.31E-03 MH 1e     / 7.19E-03 MH 1f     / 1.10E-02 MH 3a     / 8.71E-03
MH 3b     / 8.72E-03 MH 4b     / 3.61E-03

 Cycle       2000      Time         16 Hrs - 40.00 Min

       Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.02 /   938.53            MH 1e/   0.02 /   938.53
MH 1f/   0.03 /   937.80
           MH 1b/   0.03 /   937.81            MH 1d/   0.01 /   937.24
MH 1c/   0.07 /   936.48
           MH 1g/   0.02 /   936.53            MH 1h/   0.05 /   936.11
MH 3a/   0.02 /   935.34
           MH 3d/   0.03 /   935.32             MH 2/   0.04 /   934.48
MH 3b/   0.03 /   934.31
           MH 3e/   0.04 /   934.30            MH 4b/   0.01 /   933.64
MH 3f/   0.04 /   932.56
           MH 3c/   0.10 /   932.76            MH 4a/   0.12 /   932.43
MH 4c/   0.08 /   932.31
           MH 4d/   1.09 /   931.59          Orifice/   0.04 /   930.53
Node22/   0.02 /   925.52
```

```
        Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
         P4a-4c/       0.06            P3f-4a/       0.06           P3e-3f/
0.02          P3d-3e/       0.01*
         P3c-3f/       0.04             P2-4c/       0.04            P1h-2/
0.03          P1g-3c/       0.02*
         P1f-1g/       0.02            P1e-1f/       0.01           P1c-1h/
0.02          P1b-1c/       0.02
         P1a-1b/       0.01*           P3b-3c/       0.02           P3a-3b/
0.01*         P4c-4d/       0.10
         P1d-1c/       0.00            P4b-4c/       0.00           Link25/
0.06       Orifice_1/       0.06
       FREE # 1/       0.06

 ===> System inflows (file) at    20.83 hours (  Junction / Inflow, cu m/s)

 MH 1a     / 6.63E-03 MH 1b     / 9.58E-03 MH 1d     / 4.02E-03 MH 1h     / 4.13E-03
MH 2      / 6.59E-03 MH 3d     / 1.13E-02
 MH 3e     / 7.61E-03 MH 1e     / 5.89E-03 MH 1f     / 8.98E-03 MH 3a     / 7.14E-03
MH 3b     / 7.13E-03 MH 4b     / 2.96E-03

 Cycle       2500      Time         20 Hrs - 50.00 Min

       Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.02 /   938.53            MH 1e/   0.02 /   938.53
MH 1f/   0.03 /   937.80
           MH 1b/   0.03 /   937.81            MH 1d/   0.01 /   937.24
MH 1c/   0.06 /   936.47
           MH 1g/   0.02 /   936.53            MH 1h/   0.05 /   936.11
MH 3a/   0.02 /   935.34
           MH 3d/   0.02 /   935.32             MH 2/   0.03 /   934.48
MH 3b/   0.03 /   934.30
           MH 3e/   0.03 /   934.29            MH 4b/   0.01 /   933.64
MH 3f/   0.03 /   932.55
           MH 3c/   0.10 /   932.76            MH 4a/   0.11 /   932.42
MH 4c/   0.07 /   932.31
           MH 4d/   1.14 /   931.64          Orifice/   0.04 /   930.53
Node22/   0.02 /   925.52

        Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
         P4a-4c/       0.05            P3f-4a/       0.05           P3e-3f/
0.02          P3d-3e/       0.01*
         P3c-3f/       0.03             P2-4c/       0.03            P1h-2/
0.02          P1g-3c/       0.01*
         P1f-1g/       0.01            P1e-1f/       0.01           P1c-1h/
0.02          P1b-1c/       0.02
         P1a-1b/       0.01*           P3b-3c/       0.01           P3a-3b/
0.01*         P4c-4d/       0.08
         P1d-1c/       0.00            P4b-4c/       0.00           Link25/
0.06       Orifice_1/       0.06
       FREE # 1/       0.06


 *=====================================================*
 | Table E5 - Junction Time Limitation Summary         |
 |             (0.10 or 0.25)* Depth * Area            |
 | Time step = ------------------------------          |
 |                 Sum of Flow                         |
 *=====================================================*
 |  The time this junction was the limiting junction   |
 |               is listed in the third column.        |
 *=====================================================*
```

Junction	Time(.10)	Time(.25)	Time(sec)
MH 1a	136.6583	300.0000	86400.0000
MH 1e	86.1453	215.3633	0.0000
MH 1f	120.8225	300.0000	0.0000
MH 1b	156.0578	300.0000	0.0000
MH 1d	102.8907	257.2268	0.0000
MH 1c	81.4178	203.5446	0.0000
MH 1g	138.9497	300.0000	0.0000
MH 1h	69.0029	172.5073	0.0000
MH 3a	98.1646	245.4115	0.0000
MH 3d	69.3183	173.2957	0.0000
MH 2	87.3497	218.3741	0.0000
MH 3b	157.4511	300.0000	0.0000
MH 3e	135.3980	300.0000	0.0000
MH 4b	101.2339	253.0848	0.0000
MH 3f	59.1920	147.9801	0.0000
MH 3c	205.2361	300.0000	0.0000
MH 4a	239.5276	300.0000	0.0000
MH 4c	57.7826	144.4564	0.0000
MH 4d	122.8629	300.0000	0.0000
Orifice	300.0000	300.0000	0.0000
Node22	300.0000	300.0000	0.0000

The junction requiring the smallest time step was...MH 1a

```
 *==========================================================*
 |       Table E5a - Conduit Explicit Condition Summary     |
 |       Courant   =         Conduit Length                 |
 |       Time step = --------------------------------       |
 |                      Velocity + sqrt(g*depth)            |
 |                                                          |
 |                  Conduit Implicit Condition Summary      |
 |       Courant   =         Conduit Length                 |
 |       Time step = --------------------------------       |
 |                             Velocity                     |
 *==========================================================*
 |  The 3rd column is the Explicit time step times the      |
 |      minimum courant time step factor                    |
 |                                                          |
 |  Minimum Conduit Time Step in seconds in the 4th column  |
 |  in the list. Maximum possible is 10 * maximum time step |
```

The 5th column is the maximum change at any time step during the simulation. The 6th column is the wobble value which is an indicator of the flow stability.

You should use this section to find those conduits that are slowing your model down. Use modify conduits to alter the length of the slow conduits to make your simulation faster, or change the conduit name to "CHME?????" where ????? are any characters, this will lengthen the conduit based on the model time step, not the value listed in modify conduits.

Conduit	Time(exp)	Expl*Cmin	Time(imp)	Time(min)	Max Qchange	Wobble	Type of Soln
P4a-4c	3.3992	3.3992	5.9945	66.0000	0.0090	0.4299	Normal Soln
P3f-4a	12.8589	12.8589	26.9941	0.0000	0.0088	0.5793	Normal Soln
P3e-3f	46.5663	46.5663	81.7188	0.0000	0.0036	0.3552	Normal Soln
P3d-3e	72.5542	72.5542	129.4840	0.0000	0.0027	0.2730	Normal Soln
P3c-3f	3.6853	3.6853	6.1363	0.0000	0.0056	0.2544	Normal Soln
P2-4c	46.2228	46.2228	69.7125	0.0000	0.0056	0.3910	Normal Soln
P1h-2	28.2110	28.2110	41.9021	0.0000	0.0043	0.2725	Normal Soln
P1g-3c	72.8184	72.8184	119.8762	0.0000	0.0028	0.1685	Normal Soln
P1f-1g	67.7630	67.7630	119.2115	0.0000	0.0033	0.3126	Normal Soln
P1e-1f	59.9510	59.9510	110.3844	0.0000	0.0015	0.1509	Normal Soln
P1c-1h	3.7215	3.7215	5.7405	37.0000	0.0031	0.2991	Normal Soln
P1b-1c	78.8208	78.8208	142.4345	0.0000	0.0022	0.2528	Normal Soln
P1a-1b	68.0564	68.0564	129.2609	0.0000	-0.0006	0.1103	Normal Soln
P3b-3c	48.8774	48.8774	86.3334	0.0000	0.0027	0.2660	Normal Soln
P3a-3b	84.5281	84.5281	155.0304	0.0000	0.0016	0.1658	Normal Soln
P4c-4d	22.8419	22.8419	44.6601	0.0000	0.0144	1.5627	Normal Soln
P1d-1c	37.9039	37.9039	66.2418	0.0000	0.0012	0.1055	Normal Soln
P4b-4c	34.4619	34.4619	63.1620	0.0000	0.0010	0.0942	Normal Soln
Link25	1.3707	1.3707	1.3756	1337.0000	0.0002	0.0006	Normal Soln
Orifice_1	54.5453	54.5453	140.7233	0.0000	0.0000	1.7885	Normal Soln

The conduit with the smallest time step limitation was..Link25
The conduit with the largest wobble was.................Orifice_1
The conduit with the largest flow change in any
consecutive time step..................................P4c-4d

```
 *==============================================*
 * Hydraulic design routine final results.      *
 *==============================================*

                  <-------- Original --------> <---------- Designed -------->
    Conduit Name    Height     Width    Barrels    Height     Width    Barrels
          P1c-1h    0.9000    0.9000    1.0000    0.9000    0.9000    1.0000

 *===================================================*
 |  Table E6. Final Model Condition                  |
 |           This table is used for steady state     |
 |           flow comparison and is the information|
 |           saved to the hot-restart file.          |
 |           Final Time =    24.008 hours            |
 *===================================================*

 Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
           MH 1a/   0.02 /   938.53/          MH 1e/   0.02 /   938.53/
MH 1f/   0.03 /   937.80/
           MH 1b/   0.03 /   937.81/          MH 1d/   0.01 /   937.24/
MH 1c/   0.06 /   936.47/
           MH 1g/   0.02 /   936.53/          MH 1h/   0.05 /   936.11/
MH 3a/   0.02 /   935.34/
           MH 3d/   0.02 /   935.32/           MH 2/   0.03 /   934.48/
MH 3b/   0.03 /   934.30/
           MH 3e/   0.03 /   934.29/          MH 4b/   0.01 /   933.64/
MH 3f/   0.03 /   932.55/
           MH 3c/   0.09 /   932.75/          MH 4a/   0.11 /   932.42/
MH 4c/   0.07 /   932.30/
           MH 4d/   1.16 /   931.66/        Orifice/   0.04 /   930.53/
Node22/   0.02 /   925.52/

   Conduit/       Flow   ===> "*" Conduit uses the normal flow option.
          P4a-4c/       0.04 /          P3f-4a/       0.04 /          P3e-3f/
0.02 /
          P3d-3e/       0.01*/          P3c-3f/       0.03 /           P2-4c/
0.03 /
           P1h-2/       0.02 /          P1g-3c/       0.01*/          P1f-1g/
0.01 /
          P1e-1f/       0.01 /          P1c-1h/       0.02 /          P1b-1c/
0.01 /
          P1a-1b/       0.01*/          P3b-3c/       0.01 /          P3a-3b/
0.01*/
          P4c-4d/       0.07 /          P1d-1c/       0.00 /          P4b-4c/
0.00 /
          Link25/       0.06 /      Orifice_1/       0.06 /        FREE # 1/
0.06 /

         Conduit/   Velocity
          P4a-4c/       0.87 /          P3f-4a/       0.50 /          P3e-3f/
0.52 /
          P3d-3e/       0.42 /          P3c-3f/       0.87 /           P2-4c/
0.80 /
           P1h-2/       0.76 /          P1g-3c/       0.45 /          P1f-1g/
0.47 /
          P1e-1f/       0.33 /          P1c-1h/       1.11 /          P1b-1c/
0.47 /
          P1a-1b/       0.33 /          P3b-3c/       0.47 /          P3a-3b/
0.35 /
          P4c-4d/       0.56 /          P1d-1c/       0.29 /          P4b-4c/
0.24 /
          Link25/       3.47 /      Orifice_1/       2.13 /
```

```
          Conduit/       Width
           P4a-4c/        0.73 /          P3f-4a/       2.56 /            P3e-3f/
1.23 /
           P3d-3e/        1.18 /          P3c-3f/       0.60 /             P2-4c/
1.25 /
            P1h-2/        1.21 /          P1g-3c/       1.20 /            P1f-1g/
1.20 /
           P1e-1f/        1.12 /          P1c-1h/       0.42 /            P1b-1c/
1.22 /
           P1a-1b/        1.14 /          P3b-3c/       1.20 /            P3a-3b/
1.14 /
           P4c-4d/        2.36 /          P1d-1c/       1.10 /            P4b-4c/
1.09 /
           Link25/        0.78 /       Orifice_1/       0.02 /

         Junction/         EGL
            MH 1a/        0.02 /           MH 1e/       0.02 /             MH 1f/
0.03 /
            MH 1b/        0.03 /           MH 1d/       0.01 /             MH 1c/
0.41 /
            MH 1g/        0.29 /           MH 1h/       0.11 /             MH 3a/
0.02 /
            MH 3d/        0.02 /            MH 2/       0.35 /             MH 3b/
0.03 /
            MH 3e/        0.04 /           MH 4b/       0.01 /             MH 3f/
1.07 /
            MH 3c/        0.95 /           MH 4a/       0.12 /             MH 4c/
1.04 /
            MH 4d/        1.59 /         Orifice/       0.27 /            Node22/
0.63 /

         Junction/  Freeboard
            MH 1a/        0.38 /           MH 1e/       0.38 /             MH 1f/
0.39 /
            MH 1b/        0.37 /           MH 1d/       0.39 /             MH 1c/
1.00 /
            MH 1g/        0.63 /           MH 1h/       1.14 /             MH 3a/
0.38 /
            MH 3d/        0.38 /            MH 2/       0.66 /             MH 3b/
0.37 /
            MH 3e/        0.37 /           MH 4b/       0.39 /             MH 3f/
1.40 /
            MH 3c/        1.51 /           MH 4a/       1.53 /             MH 4c/
1.65 /
            MH 4d/        0.94 /         Orifice/       2.07 /            Node22/
6.48 /

         Junction/ Max Volume
            MH 1a/        0.11 /           MH 1e/       0.14 /             MH 1f/
0.20 /
            MH 1b/        0.18 /           MH 1d/       0.11 /             MH 1c/
0.31 /
            MH 1g/        0.14 /           MH 1h/       0.21 /             MH 3a/
0.14 /
            MH 3d/        0.19 /            MH 2/       0.22 /             MH 3b/
0.18 /
            MH 3e/        0.21 /           MH 4b/       0.11 /             MH 3f/
0.30 /
            MH 3c/        0.42 /           MH 4a/       0.53 /             MH 4c/
0.44 /
            MH 4d/     8598.90 /         Orifice/       0.04 /            Node22/
0.02 /
```

```
        Junction/Total Fldng
          MH 1a/        0.00 /            MH 1e/        0.00 /            MH 1f/
0.00 /
          MH 1b/        0.00 /            MH 1d/        0.00 /            MH 1c/
0.00 /
          MH 1g/        0.00 /            MH 1h/        0.00 /            MH 3a/
0.00 /
          MH 3d/        0.00 /             MH 2/        0.00 /            MH 3b/
0.00 /
          MH 3e/        0.00 /            MH 4b/        0.00 /            MH 3f/
0.00 /
          MH 3c/        0.00 /            MH 4a/        0.00 /            MH 4c/
0.00 /
          MH 4d/        0.00 /          Orifice/        0.00 /           Node22/
0.00 /

         Conduit/ Cross Sectional Area
         P4a-4c/        0.05 /           P3f-4a/        0.09 /           P3e-3f/
0.03 /
         P3d-3e/        0.02 /           P3c-3f/        0.03 /            P2-4c/
0.03 /
          P1h-2/        0.03 /           P1g-3c/        0.03 /           P1f-1g/
0.03 /
         P1e-1f/        0.02 /           P1c-1h/        0.02 /           P1b-1c/
0.03 /
         P1a-1b/        0.02 /           P3b-3c/        0.03 /           P3a-3b/
0.02 /
         P4c-4d/        0.13 /           P1d-1c/        0.01 /           P4b-4c/
0.01 /
         Link25/        0.02 /        Orifice_1/        0.03 /

         Conduit/  Final Volume
         P4a-4c/        0.80 /           P3f-4a/        3.06 /           P3e-3f/
3.89 /
         P3d-3e/        4.15 /           P3c-3f/        0.49 /            P2-4c/
5.36 /
          P1h-2/        2.59 /           P1g-3c/        5.71 /           P1f-1g/
4.74 /
         P1e-1f/        1.95 /           P1c-1h/        0.27 /           P1b-1c/
5.55 /
         P1a-1b/        2.26 /           P3b-3c/        3.20 /           P3a-3b/
3.23 /
         P4c-4d/        9.78 /           P1d-1c/        0.93 /           P4b-4c/
0.70 /
         Link25/        0.17 /        Orifice_1/        8.20 /

         Conduit/ Hydraulic Radius
         P4a-4c/        0.06 /           P3f-4a/        0.03 /           P3e-3f/
0.03 /
         P3d-3e/        0.02 /           P3c-3f/        0.05 /            P2-4c/
0.03 /
          P1h-2/        0.02 /           P1g-3c/        0.02 /           P1f-1g/
0.02 /
         P1e-1f/        0.01 /           P1c-1h/        0.04 /           P1b-1c/
0.02 /
         P1a-1b/        0.02 /           P3b-3c/        0.02 /           P3a-3b/
0.02 /
         P4c-4d/        0.05 /           P1d-1c/        0.01 /           P4b-4c/
0.01 /
         Link25/        0.02 /        Orifice_1/        0.05 /

         Conduit/ Upstream/ Downstream Elevation
```

```
         P4a-4c/   932.42/   932.30          P3f-4a/   932.55/   932.42
P3e-3f/  934.29/   933.58/
         P3d-3e/   935.32/   934.29          P3c-3f/   932.75/   932.55
P2-4c/   934.48/   932.47/
          P1h-2/   936.11/   934.76          P1g-3c/   936.53/   932.75
P1f-1g/  937.80/   936.79/
         P1e-1f/   938.53/   937.80          P1c-1h/   936.47/   936.11
P1b-1c/  937.81/   936.81/
         P1a-1b/   938.53/   937.81          P3b-3c/   934.30/   933.60
P3a-3b/  935.34/   934.30/
         P4c-4d/   932.30/   932.07          P1d-1c/   937.24/   936.70
P4b-4c/  933.64/   933.27/
         Link25/   930.53/   925.52       Orifice_1/   931.66/   930.53
```

```
 *===========================================================*
 |         Table E7 -  Iteration Summary                     |
 *===========================================================*

 Total number of time steps simulated............       2880
 Total number of passes in the simulation........      30490
 Total number of time steps during simulation....      30484
 Ratio of actual # of time steps / NTCYC.........     10.585
 Average number of iterations per time step......      1.000
 Average  time step size(seconds)................      2.834
 Smallest time step size(seconds)................      1.364
 Largest  time step size(seconds)................     30.000
 Average minimum Conduit Courant time step (sec).      4.372
 Average minimum implicit time step (sec)........      2.891
 Average minimum junction time step (sec)........      2.891
 Average Courant Factor Tf.......................      2.891
 Number of times omega reduced...................        272
```

```
 *===========================================================*
 |     Table E8 - Junction Time Step Limitation Summary      |
 *===========================================================*
 |   Not Convr = Number of times this junction did not       |
 |               converge during the simulation.             |
 |   Avg Convr = Average junction iterations.                |
 |   Conv err  = Mean convergence error.                     |
 |   Omega Cng = Change of omega during iterations           |
 |   Max Itern = Maximum number of iterations                |
 *===========================================================*
        Junction Not Convr Avg Convr Total Itt Omega Cng  Max Itern  Ittrn >10
Ittrn >25  Ittrn >40
   -------------- --------- --------- ---------  --------  ---------  ---------
---------  ---------
          MH 1a         0      1.01     30863         0          4          0
 0         0
          MH 1e         0      1.02     31013         0          4          0
 0         0
          MH 1f         0      1.04     31824         6          7          0
 0         0
          MH 1b         0      1.04     31651         0          6          0
 0         0
          MH 1d         0      1.01     30877         0          6          0
 0         0
          MH 1c         0      1.09     33088       133          8          0
 0         0
          MH 1g         0      1.06     32202         0          7          0
 0         0
          MH 1h         0      1.08     32802         0          6          0
```

							0	0
MH 3a	0	1.02	31095	0	4	0	0	0
MH 3d	0	1.03	31282	0	5	0	0	0
MH 2	0	1.10	33511	10	13	2	0	0
MH 3b	0	1.04	31705	0	6	0	0	0
MH 3e	0	1.05	31992	3	7	0	0	0
MH 4b	0	1.01	30824	0	6	0	0	0
MH 3f	0	1.12	34152	0	7	0	0	0
MH 3c	0	1.09	33128	0	7	0	0	0
MH 4a	0	1.10	33405	0	5	0	0	0
MH 4c	0	1.18	35916	83	8	0	0	0
MH 4d	0	1.11	33916	37	8	0	0	0
Orifice	0	1.00	30491	0	3	0	0	0
Node22	0	1.00	30502	0	6	0	0	0

Total number of iterations for all junctions.. 676239

Minimum number of possible iterations......... 640164

Efficiency of the simulation.................. 1.06

Good Efficiency

```
*===========================================================*
| Extran Efficiency is an indicator of the efficiency of    |
| the simulation.  Ideal efficiency is one iteration per    |
| time step.  Altering the underrelaxation parameter,       |
| lowering the time step, increasing the flow and head      |
| tolerance are good ways of improving the efficiency,      |
| another is lowering the internal time step. The lower the|
```

```
| efficiency generally the faster your model will run.     |
| If your efficiency is less than 1.5 then you may try     |
| increasing your time step so that your overall simulation|
| is faster.  Ideal efficiency would be around 2.0         |
|                                                          |
| Good Efficiency      < 1.5          mean iterations      |
| Excellent Efficiency < 2.5 and > 1.5 mean iterations     |
| Good      Efficiency < 4.0 and > 2.5 mean iterations     |
| Fair      Efficiency < 7.5 and > 4.0 mean iterations     |
| Poor Efficiency      > 7.5          mean iterations      |
*==========================================================*
```

```
*=====================================================*
|        Table E9 - JUNCTION SUMMARY STATISTICS       |
| The Maximum area is only the area of the node, it   |
| does not include the area of the surrounding conduits|
*=====================================================*
```

Junction Name	Ground Elevation meters	Uppermost PipeCrown Elevation meters	Maximum Junction Elevation meters	Time of Occurence Hr.	Min.	Meters of Surcharge at Max Elevation	Freeboard of node meters	Maximum Junction Area m^2	Maximum Gutter Depth meters	Maximum Gutter Width meters	Maximum Gutter Velocity m/s
MH 1a	938.9150	938.9150	938.6092	7	21	0.0000	0.3058	1.2200	0.0000	0.0000	0.0000
MH 1e	938.9140	938.9140	938.6251	7	21	0.0000	0.2889	1.2200	0.0000	0.0000	0.0000
MH 1f	938.1880	938.1880	937.9362	7	22	0.0000	0.2518	1.2200	0.0000	0.0000	0.0000
MH 1b	938.1780	938.1780	937.9254	7	24	0.0000	0.2526	1.2200	0.0000	0.0000	0.0000
MH 1d	937.6230	937.6230	937.3152	7	21	0.0000	0.3078	1.2200	0.0000	0.0000	0.0000
MH 1c	937.4700	937.3140	936.6654	7	22	0.0000	0.8046	1.2200	0.0000	0.0000	0.0000
MH 1g	937.1620	937.1620	936.6284	7	23	0.0000	0.5336	1.2200	0.0000	0.0000	0.0000
MH 1h	937.2500	936.9620	936.2338	7	21	0.0000	1.0162	1.2200	0.0000	0.0000	0.0000
MH 3a	935.7190	935.7190	935.4360	7	21	0.0000	0.2830	1.2200	0.0000	0.0000	0.0000
MH 3d	935.6950	935.6950	935.4475	7	21	0.0000	0.2475	1.2200	0.0000	0.0000	0.0000
MH 2	935.1400	935.1400	934.6311	7	22	0.0000	0.5089	1.2200	0.0000	0.0000	0.0000
MH 3b	934.6770	934.6770	934.4281	7	23	0.0000	0.2489	1.2200	0.0000	0.0000	0.0000
MH 3e	934.6610	934.6610	934.4363	7	22	0.0000	0.2247	1.2200	0.0000	0.0000	0.0000
MH 4b	934.0260	934.0260	933.7126	7	21	0.0000	0.3134	1.2200	0.0000	0.0000	0.0000
MH 3f	933.9510	933.9510	932.7683	7	24	0.0000	1.1827	1.2200	0.0000	0.0000	0.0000
MH 3c	934.2600	934.0270	932.9997	7	24	0.0000	1.2603	1.2200	0.0000	0.0000	0.0000
MH 4a	933.9500	933.8170	932.7475	7	24	0.0000	1.2025	1.2200	0.0000	0.0000	0.0000

MH 4c	933.9500	933.7360	932.5975	7	24	0.0000	1.3525	1.2200	0.0000	0.0000	0.0000
MH 4d	932.6000	932.4220	931.6570	24	0	0.0000	0.9430	8924.9553	0.0000	0.0000	0.0000
Orifice	932.6000	932.5000	930.5337	24	0	0.0000	2.0663	1.2200	0.0000	0.0000	0.0000
Node22	932.0000	927.5000	925.5157	24	0	0.0000	6.4843	1.2200	0.0000	0.0000	0.0000

```
*=====================================================*
|        Table E10 - CONDUIT SUMMARY STATISTICS       |
| Note: The peak flow may be less than the design flow |
| and the conduit may still surcharge because of the  |
| downstream boundary conditions.                     |
|                                                     |
| * denotes an open conduit that has been overtopped  |
|   this is a potential source of severe errors       |
*=====================================================*
```

Conduit Name	Design Flow (cms)	Design Velocity (m/s)	Conduit Vertical Depth (mm)	Maximum Computed Flow (cms)	Time of Occurence Hr.	Min.	Maximum Computed Velocity (m/s)	Time of Occurence Hr.	Min.	Ratio of Max. to Design Flow	Maximum Water Elev at Pipe Ends Upstream (m)	Dwnstrm (m)	Ratio d/D US	DS
P4a-4c	5.0122	2.8363	1500.000	1.0988	7	24	2.6896	7	25	0.2192	932.7475	932.5975	0.287	0.241
P3f-4a	3.7112	2.6135	435.5191	1.0956	7	24	1.3120	7	25	0.2952	932.7683	932.7475	0.561	1.000 *
P3e-3f	2.3948	2.3027	400.0000	0.4336	7	23	1.4607	7	23	0.1811	934.4363	933.7260	0.438	0.437
P3d-3e	2.4045	2.3120	400.0000	0.3327	7	21	1.3385	7	21	0.1384	935.4475	934.4363	0.381	0.438
P3c-3f	5.2390	3.6601	1350.000	0.6793	7	24	2.6734	7	25	0.1297	932.9997	932.7683	0.239	0.185
P2-4c	3.5386	3.4025	400.0000	0.7053	7	22	2.2150	7	22	0.1993	934.6311	932.6246	0.460	0.459
P1h-2	3.7938	3.6479	400.0000	0.5254	7	22	2.1439	7	22	0.1385	936.2338	934.8922	0.382	0.381
P1g-3c	4.3886	4.2198	400.0000	0.3763	7	23	1.6087	7	22	0.0857	936.6284	932.9997	0.296	0.852
P1f-1g	2.4041	2.3116	400.0000	0.3823	7	22	1.4138	7	23	0.1590	937.9362	936.9256	0.410	0.409
P1e-1f	2.4039	2.3114	400.0000	0.1830	7	21	1.0981	7	21	0.0761	938.6251	937.9362	0.278	0.370
P1c-1h	2.6352	4.1423	900.0000	0.4028	7	22	2.8956	7	23	0.1528	936.6654	936.2338	0.279	0.191
P1b-1c	2.2951	2.2068	400.0000	0.2972	7	24	1.2713	7	24	0.1295	937.9254	936.9351	0.368	0.368
P1a-1b	2.3819	2.2903	400.0000	0.1338	7	21	0.9695	7	21	0.0562	938.6092	937.9254	0.236	0.368
P3b-3c	2.4099	2.3173	400.0000	0.3269	7	23	1.3542	7	23	0.1356	934.4281	933.7236	0.378	0.376
P3a-3b	2.3940	2.3019	400.0000	0.2007	7	21	1.1336	7	21	0.0838	935.4360	934.4281	0.293	0.378
P4c-4d	2.2906	1.7896	400.0000	1.8263	7	24	1.6802	7	25	0.7973	932.5975	932.3771	0.891	0.888
P1d-1c	2.6276	2.5265	400.0000	0.1402	7	21	1.1273	7	21	0.0534	937.3152	936.7814	0.231	0.228

P4b-4c	2.3688	2.2777	400.0000	0.1127	7	21	0.9835	7	21	0.0476	933.7126	933.3518	0.217	0.214
Link25	99.9586	31.8178	2000.000	0.0582	24	0	7.2694	1	42	0.0006	930.5337	925.5157	0.017	.0078
Orifice_1	0.0338	0.1467	192.1561	0.0582	24	0	2.1319	24	0	1.7244	931.6570	930.5337	6.021	0.191
FREE # 1	Undefnd	Undefnd	Undefn	0.0582	24	0								

```
*===================================================*
| Table E11.  Area assumptions used in the analysis|
| Subcritical and Critical flow assumptions from   |
| Subroutine Head. See manual for more information.|
*===================================================*
```

Conduit Name	Duration of Dry Flow(min)	Duration of Sub-Critical Flow(min)	Durat. of Upstream Critical Flow(min)	Durat. of Downstream Critical Flow(min)	Maximum Hydraulic Radius-m	Maximum X-Sect Area(m^2)	Maximum Vel*D (m^2/s)
P4a-4c	69.6667	1370.3333	0.0000	0.0000	0.2436	0.4103	1.0588
P3f-4a	59.0000	1381.0000	0.0000	0.0000	0.2052	0.8370	0.4449
P3e-3f	46.0000	0.0000	0.0000	1394.0000	0.1218	0.2981	0.2548
P3d-3e	45.0000	1395.0000	0.0000	0.0000	0.1094	0.2486	0.2132
P3c-3f	73.8333	1366.1667	0.0000	0.0000	0.1865	0.2545	0.7620
P2-4c	45.0000	0.0000	0.0000	1395.0000	0.1268	0.3196	0.4063
P1h-2	51.0000	0.0000	0.0000	1389.0000	0.1088	0.2459	0.3259
P1g-3c	46.0000	1394.0000	0.0000	0.0000	0.1003	0.2363	0.3622
P1f-1g	46.0000	0.0000	0.0000	1394.0000	0.1154	0.2718	0.2308
P1e-1f	45.0000	463.1111	0.0000	931.8889	0.0856	0.1669	0.1385
P1c-1h	50.0000	1390.0000	0.0000	0.0000	0.1408	0.1392	0.6105
P1b-1c	46.0000	0.0000	0.0000	1394.0000	0.1056	0.2342	0.1869
P1a-1b	45.0000	1395.0000	0.0000	0.0000	0.0759	0.1391	0.1136
P3b-3c	46.0000	0.0000	0.0000	1394.0000	0.1078	0.2422	0.2037
P3a-3b	45.0000	1395.0000	0.0000	0.0000	0.0890	0.1774	0.1480
P4c-4d	45.0000	0.0000	0.0000	1395.0000	0.2571	1.0934	0.5951
P1d-1c	45.0000	0.0000	0.0000	1395.0000	0.0716	0.1260	0.1021
P4b-4c	45.0000	0.0000	0.0000	1395.0000	0.0679	0.1165	0.0831
Link25	102.3750	1337.6250	0.0000	0.0000	0.0239	0.0168	0.0856
Orifice_1	61.0000	1379.0000	0.0000	0.0000	0.0538	0.0276	

1.2724

==
| Table E12. Mean Conduit Flow Information |
==

Conduit Name	Mean Flow (cms)	Total Flow (m^3)	Mean Percent Change	Low Flow Weightng	Mean Froude Number	Mean Hydraulic Radius	Mean Cross Area	Mean Conduit Roughness
P4a-4c	0.0894	7720.3393	0.0000	0.9942	1.1332	0.0815	0.0767	0.0130
P3f-4a	0.0894	7726.0601	0.0000	0.9957	0.9392	0.0485	0.1386	0.0130
P3e-3f	0.0351	3030.8882	0.0000	0.9969	1.0081	0.0362	0.0510	0.0130
P3d-3e	0.0212	1828.1732	0.0000	0.9969	0.9466	0.0285	0.0376	0.0130
P3c-3f	0.0544	4696.1797	0.0000	0.9934	1.5729	0.0602	0.0467	0.0130
P2-4c	0.0579	5000.5206	0.0000	0.9969	1.5015	0.0383	0.0549	0.0130
P1h-2	0.0455	3932.0568	0.0000	0.9966	1.5771	0.0328	0.0448	0.0130
P1g-3c	0.0279	2410.1509	0.0000	0.9969	1.1572	0.0297	0.0440	0.0130
P1f-1g	0.0279	2411.1793	0.0000	0.9969	0.9997	0.0321	0.0436	0.0130
P1e-1f	0.0111	960.2296	0.0000	0.9969	0.9403	0.0200	0.0243	0.0130
P1c-1h	0.0377	3254.4150	0.0000	0.9968	1.7711	0.0475	0.0266	0.0130
P1b-1c	0.0300	2591.3238	0.0000	0.9969	0.9607	0.0343	0.0476	0.0130
P1a-1b	0.0123	1063.3792	0.0000	0.9969	0.8713	0.0223	0.0280	0.0130

P3b-3c	0.0266	2298.3885	0.0000	0.9969	0.9983	0.0314	0.0424	0.0130
P3a-3b	0.0134	1160.9923	0.0000	0.9969	0.9014	0.0228	0.0285	0.0130
P4c-4d	0.1528	13198.645	0.0000	0.9969	0.8250	0.0758	0.2002	0.0130
P1d-1c	0.0077	663.2812	0.0000	0.9969	1.0106	0.0156	0.0182	0.0130
P4b-4c	0.0056	486.6271	0.0000	0.9969	0.9243	0.0142	0.0164	0.0130
Link25	0.0412	3556.4134	0.0000	0.9872	9.5364	0.0210	0.0143	0.0140
Orifice_1	0.0412	3557.2720	0.0000	0.9949	3.0694	0.0447	0.0257	0.0029
FREE # 1	0.0412	3556.3142						

==
| Table E13. Channel losses(H), headwater depth (HW), tailwater |
| depth (TW), critical and normal depth (Yc and Yn). |
| Use this section for culvert comparisons |
==

Conduit Name	Maximum Flow	Head Loss	Friction Loss	Critical Depth	Normal Depth	HW Elevat	TW Elevat	
P4a-4c	1.0980	0.0000	0.1297	0.5313	0.4769	932.7464	932.5946	Max Flow
P3f-4a	1.0916	0.0000	0.0856	0.2503	0.2045	932.7670	932.7464	Max Flow
P3e-3f	0.4330	0.0000	0.7045	0.2033	0.1748	934.4363	933.7258	Max Flow
P3d-3e	0.3250	0.0000	0.9782	0.1740	0.1503	935.4466	934.4235	Max Flow
P3c-3f	0.6792	0.0000	0.1858	0.4275	0.3280	932.9995	932.7670	Max Flow
P2-4c	0.7000	0.0000	1.9763	0.2620	0.1829	934.6309	932.6239	Max Flow
P1h-2	0.5252	0.0000	1.3370	0.2254	0.1522	936.2336	934.8922	Max Flow
P1g-3c	0.3735	0.0000	1.7533	0.1877	0.1177	936.6280	932.9977	Max Flow

P1f-1g	0.3818	0.0000	1.0133	0.1900	0.1635	937.9355	936.9255	Max Flow
P1e-1f	0.1814	0.0000	0.6556	0.1255	0.1105	938.6246	937.9284	Max Flow
P1c-1h	0.4018	0.0000	0.3211	0.3672	0.2370	936.6652	936.2312	Max Flow
P1b-1c	0.2965	0.0000	0.9833	0.1654	0.1469	937.9253	936.9349	Max Flow
P1a-1b	0.1337	0.0000	0.6092	0.1051	0.0941	938.6092	937.9199	Max Flow
P3b-3c	0.3258	0.0000	0.6966	0.1743	0.1503	934.4280	933.7233	Max Flow
P3a-3b	0.1971	0.0000	0.9627	0.1316	0.1157	935.4349	934.4170	Max Flow
P4c-4d	1.8185	0.0000	0.2208	0.3629	0.3543	932.5946	932.3763	Max Flow
P1d-1c	0.1375	0.0000	0.5126	0.1069	0.0904	937.3148	936.7804	Max Flow
P4b-4c	0.1112	0.0000	0.3476	0.0945	0.0851	933.7124	933.3511	Max Flow
Link25	0.0582	0.0000	3.4296	0.1045	0.0157	930.5337	925.5157	Max Flow
Orifice_1	0.0582	0.0000	0.6929	0.2003	0.1922	931.6570	930.5337	Max Flow

===

| Table E13a. CULVERT ANALYSIS CLASSIFICATION, and the time the culvert was in a particular classification during the simulation. The time is in minutes. The Dynamic Wave Equation is used for all conduit analysis but the culvert flow classification condition is based on the HW and TW depths. |

===

Conduit Name	Mild Slope Critical D Outlet Control	Mild Slope TW Control Outlet Control	Steep Slope TW Insignf Entrance Control	Slug Flow Outlet/ Entrance Control	Mild Slope TW > D Outlet Control	Mild Slope TW <= D Outlet Control	Outlet Control	Inlet Control	Inlet Configuration
P4a-4c	0.0000	0.0000	778.0000	0.0000	0.0000	0.0000	662.0000	0.0000	None
P3f-4a	0.0000	30.0000	1330.0000	0.0000	0.0000	0.0000	80.0000	0.0000	None
P3e-3f	26.0000	15.0000	1399.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P3d-3e	25.0000	43.0000	1372.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P3c-3f	0.0000	0.0000	1420.0000	0.0000	0.0000	0.0000	20.0000	0.0000	None
P2-4c	0.0000	0.0000	1440.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P1h-2	0.0000	0.0000	1440.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P1g-3c	0.0000	0.0000	1440.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P1f-1g	28.0000	13.0000	1399.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P1e-1f	251.0000	734.0000	455.0000	0.0000	0.0000	0.0000			

							0.0000	0.0000	None
P1c-1h	0.0000	0.0000	1440.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P1b-1c	147.0000	394.0000	899.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P1a-1b	1.0000	969.0000	470.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P3b-3c	22.0000	28.0000	1390.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P3a-3b	2.0000	846.0000	592.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P4c-4d	378.0000	1000.0000	45.0000	0.0000	0.0000	0.0000	17.0000	0.0000	None
P1d-1c	0.0000	0.0000	1440.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
P4b-4c	329.0000	971.0000	140.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
Link25	0.0000	0.0000	1440.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
Orifice_1	347.0000	0.0000	65.0000	0.0000	0.0000	0.0000	1028.0000	0.0000	None

=====================================
| Kinematic Wave Approximations |
| Time in Minutes for Each Condition |
=====================================

Conduit Name	Duration of Normal Flow	Slope Criteria	Super-Critical	Roll Waves
P4a-4c	7.3333	9.3333	1350.0000	0.0000
P3f-4a	339.6833	1365.3333	10.5000	0.0000
P3e-3f	0.7841	0.8295	1082.0000	0.0000
P3d-3e	1341.4000	1369.0000	101.1833	0.0000
P3c-3f	3.3333	4.6667	1364.3333	0.0000
P2-4c	1.5136	7.5136	1395.0000	0.0000
P1h-2	1.2000	3.2000	1388.5000	0.0000
P1g-3c	1372.0000	1394.0000	1394.0000	0.0000
P1f-1g	0.3682	0.3682	1010.7500	0.0000
P1e-1f	294.7500	347.5000	62.1000	0.0000
P1c-1h	31.6667	41.5000	1384.5000	0.0000
P1b-1c	0.3182	0.3182	1054.8000	0.0000
P1a-1b	1336.3000	1395.0000	61.0500	0.0000
P3b-3c	0.6909	0.6909	1037.0500	0.0000
P3a-3b	1341.9500	1369.5000	37.0591	0.0000
P4c-4d	1.6182	11.1182	18.0000	0.0000
P1d-1c	0.1455	5.1455	1145.5000	0.0000
P4b-4c	0.0955	9.5955	39.9045	0.0000
Link25	0.0000	0.1477	1337.6250	0.0000
Orifice_1	0.0000	0.0000	254.6500	0.0000

===
| Table E15 - SPREADSHEET INFO LIST |
| Conduit Flow and Junction Depth Information for use in |
| spreadsheets. The maximum values in this table are the |
| true maximum values because they sample every time step.|
| The values in the review results may only be the |
| maximum of a subset of all the time steps in the run. |
| Note: These flows are only the flows in a single barrel.|
===

Conduit Maximum Total Maximum Maximum ##
Junction Invert Maximum

Name	Flow (cms)	Flow (m^3)	Velocity (m/s)	Volume (m^3)	##	Name	Elevation (m)	Elevation (m)
P4a-4c	1.0988	7720.3393	2.6896	5.9985	##	MH 1a	938.5150	938.6092
P3f-4a	1.0956	7726.0601	1.3120	40.6093	##	MH 1e	938.5140	938.6251
P3e-3f	0.4336	3030.8882	1.4607	8.7386	##	MH 1f	937.7720	937.9362
P3d-3e	0.3327	1828.1732	1.3385	7.6675	##	MH 1b	937.7780	937.9254
P3c-3f	0.6793	4696.1797	2.6734	3.6251	##	MH 1d	937.2230	937.3152
P2-4c	0.7053	5000.5206	2.2150	4.4947	##	MH 1c	936.4140	936.6654
P1h-2	0.5254	3932.0568	2.1439	2.4980	##	MH 1g	936.5100	936.6284
P1g-3c	0.3763	2410.1509	1.6087	7.6456	##	MH 1h	936.0620	936.2338
P1f-1g	0.3823	2411.1793	1.4138	7.3829	##	MH 3a	935.3190	935.4360
P1e-1f	0.1830	960.2296	1.0981	4.7365	##	MH 3d	935.2950	935.4475
P1c-1h	0.4028	3254.4150	2.8956	0.9166	##	MH 2	934.4470	934.6311
P1b-1c	0.2972	2591.3238	1.2713	6.2882	##	MH 3b	934.2770	934.4281
P1a-1b	0.1338	1063.3792	0.9695	4.4061	##	MH 3e	934.2610	934.4363
P3b-3c	0.3269	2298.3885	1.3542	6.0283	##	MH 4b	933.6260	933.7126
P3a-3b	0.2007	1160.9923	1.1336	5.1117	##			

```
MH 3f   932.5190     932.7683


         P4c-4d      1.8263  13198.6452        1.6802       81.7615   ##
MH 3c   932.6590     932.9997


         P1d-1c      0.1402    663.2812        1.1273        1.5756   ##
MH 4a   932.3120     932.7475


         P4b-4c      0.1127    486.6271        0.9835        1.6830   ##
MH 4c   932.2360     932.5975


         Link25      0.0582   3556.4134        7.2694        0.0004   ##
MH 4d   930.5000     931.6570


      Orifice_1      0.0582   3557.2720        2.1319        4.4580   ##
Orifice   930.4970     930.5337


       FREE # 1      0.0582   3556.3142        0.0000        0.0000   ##
Node22   925.5000     925.5157
```

```
 *=====================================================*
 |     Table E15a - SPREADSHEET REACH LIST             |
 | Peak flow and Total Flow listed by Reach or those   |
 |      conduits or diversions having the same         |
 |      upstream and downstream nodes.                 |
 *=====================================================*
```

Upstream Node	Downstream Node	Maximum Flow (cms)	Total Flow (m^3)
MH 4a	MH 4c	1.0988	7720.3393
MH 3f	MH 4a	1.0956	7726.0601
MH 3e	MH 3f	0.4336	3030.8882
MH 3d	MH 3e	0.3327	1828.1732
MH 3c	MH 3f	0.6793	4696.1797
MH 2	MH 4c	0.7053	5000.5206

MH 1h	MH 2	0.5254	3932.0568
MH 1g	MH 3c	0.3763	2410.1509
MH 1f	MH 1g	0.3823	2411.1793
MH 1e	MH 1f	0.1830	960.2296
MH 1c	MH 1h	0.4028	3254.4150
MH 1b	MH 1c	0.2972	2591.3238
MH 1a	MH 1b	0.1338	1063.3792
MH 3b	MH 3c	0.3269	2298.3885
MH 3a	MH 3b	0.2007	1160.9923
MH 4c	MH 4d	1.8263	13198.6452
MH 1d	MH 1c	0.1402	663.2812
MH 4b	MH 4c	0.1127	486.6271
Orifice	Node22	0.0582	3556.4134
MH 4d	Orifice	0.0582	3557.2720

```
#########################################################
# Table E16. New Conduit Information Section            #
#            Conduit Invert (IE) Elevation and Conduit  #
#            Maximum Water Surface (WS) Elevations      #
#########################################################
```

Conduit Name	Upstream Node	Downstream Node	IE Up	IE Dn	WS Up	WS Dn	Conduit Type
P4a-4c	MH 4a	MH 4c	932.3170	932.2360	932.7475	932.5975	Circular
P3f-4a	MH 3f	MH 4a	932.5240	932.3120	932.7683	932.7475	Trapezoid
P3e-3f	MH 3e	MH 3f	934.2610	933.5510	934.4363	933.7260	Trapezoid
P3d-3e	MH 3d	MH 3e	935.2950	934.2610	935.4475	934.4363	Trapezoid
P3c-3f	MH 3c	MH 3f	932.6770	932.5190	932.9997	932.7683	Circular
P2-4c	MH 2	MH 4c	934.4470	932.4410	934.6311	932.6246	Trapezoid
P1h-2	MH 1h	MH 2	936.0810	934.7400	936.2338	934.8922	Trapezoid
P1g-3c	MH 1g	MH 3c	936.5100	932.6590	936.6284	932.9997	Trapezoid
P1f-1g	MH 1f	MH 1g	937.7720	936.7620	937.9362	936.9256	Trapezoid
P1e-1f	MH 1e	MH 1f	938.5140	937.7880	938.6251	937.9362	Trapezoid
P1c-1h	MH 1c	MH 1h	936.4140	936.0620	936.6654	936.2338	Circular
P1b-1c	MH 1b	MH 1c	937.7780	936.7880	937.9254	936.9351	Trapezoid
P1a-1b	MH 1a	MH 1b	938.5150	937.7780	938.6092	937.9254	Trapezoid
P3b-3c	MH 3b	MH 3c	934.2770	933.5730	934.4281	933.7236	Trapezoid
P3a-3b	MH 3a	MH 3b	935.3190	934.2770	935.4360	934.4281	Trapezoid

```
         P4c-4d           MH 4c            MH 4d  932.2410  932.0220  932.5975
932.3771 Trapezoid


         P1d-1c           MH 1d            MH 1c  937.2230  936.6900  937.3152
936.7814 Trapezoid


         P4b-4c           MH 4b            MH 4c  933.6260  933.2660  933.7126
933.3518 Trapezoid


         Link25         Orifice           Node22  930.5000  925.5000  930.5337
925.5157 Circular


      Orifice_1           MH 4d          Orifice  930.5000  930.4970  931.6570
930.5337 Circ Orif


 *=============================================================================*
 |    Table E18 - Junction Continuity Error.   Division by Volume added 11/96  |
 |                                                                             |
 |  Continuity Error = Net Flow + Beginning Volume - Ending Volume             |
 |                     ------------------------------------------------        |
 |                     Total Flow + (Beginning Volume + Ending Volume)/2       |
 |                                                                             |
 |  Net Flow   = Node Inflow - Node Outflow                                    |
 |  Total Flow = absolute (Inflow + Outflow)                                   |
 |  Intermediate column is a judgement on the node continuity error.           |
 |                                                                             |
 |  Excellent  < 1 percent    Great  1 to  2 percent  Good  2 to  5 percent    |
 |  Fair  5 to 10  percent    Poor  10 to 25 percent  Bad  25 to 50 percent    |
 |  Terrible > 50  percent                                                     |
 *=============================================================================*

        Junction    <------Continuity Error ------->   Remaining   Beginning    Net
Flow  Total Flow Failed to
            Name      Volume  % of Node  % of Inflow      Volume      Volume   Thru
Node   Thru Node  Converge
 ---------------    --------  ----------  ----------    --------  ----------
----------  ---------- ---------
          MH 1a     -0.6198     -0.0291      0.0047      1.4839      0.0000
0.8640   2127.6873         0


          MH 1e      1.0482      0.0545      0.0079      0.9240      0.0000
1.9723   1922.4998         0


          MH 1f     -1.2921     -0.0268      0.0097      3.2456      0.0000
1.9535   4824.1622         0


          MH 1b      2.3879      0.0460      0.0180      4.2000      0.0000
6.5879   5189.1587         0


          MH 1d      0.5475      0.0412      0.0041      0.4153      0.0000
0.9628   1327.5012         0
```

MH 1c	-3.0607	-0.0470	0.0231	3.2903	0.0000		
0.2297	6509.0199	0					
MH 1g	-7.6255	-0.1580	0.0575	8.5602	0.0000		
0.9347	4821.3302	0					
MH 1h	-0.1410	-0.0018	0.0011	1.4377	0.0000		
1.2967	7865.2866	0					
MH 3a	-0.7818	-0.0336	0.0059	1.9729	0.0000		
1.1911	2323.2359	0					
MH 3d	-0.9100	-0.0249	0.0069	2.4212	0.0000		
1.5112	3657.9174	0					
MH 2	1.0599	0.0106	0.0080	3.9653	0.0000		
5.0252	10005.8656	0					
MH 3b	0.6470	0.0141	0.0049	3.5405	0.0000		
4.1875	4600.8824	0					
MH 3e	0.5388	0.0089	0.0041	4.3490	0.0000		
4.8878	6066.5248	0					
MH 4b	0.4442	0.0456	0.0034	0.2944	0.0000		
0.7386	973.9463	0					
MH 3f	-3.9020	-0.0252	0.0294	4.9606	0.0000		
1.0585	15453.1280	0					
MH 3c	4.1904	0.0445	0.0316	8.0696	0.0000		
12.2599	9404.7192	0					
MH 4a	2.3222	0.0150	0.0175	3.2786	0.0000		
5.6008	15446.3993	0					
MH 4c	1.1385	0.0043	0.0086	7.8520	0.0000		
8.9905	26406.1322	0					
MH 4d	1034.7380	4.9134	7.8044	8607.0811	0.0000		
9641.8191	16755.9172	0					
Orifice	-1.4073	-0.0198	0.0106	2.3373	0.0000		
0.9299	7113.6853	0					
Node22	0.0232	0.0003	0.0002	0.0825	0.0000		
0.1057	7112.7276	0					

The total continuity error was 1029.3 cubic meters
The remaining total volume was 8673.8 cubic meters
Your mean node continuity error was Excellent
Your worst node continuity error was Fair

==
| Table E19 - Junction Inflow & Outflow Listing |
| Units are either ft^3 or m^3 |
| depending on the units in your model.|
==

Junction Name	Constant Inflow to Node	User Inflow to Node	Interface Inflow to Node	DWF Inlow to Node	Inflow through Outfall	RNF Layer Inflow to Node	Outflow from Node	Evaporation from Node	Inflow from 2D Layer
MH 1a	0.0000	0.0000	1064.3416	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
MH 1e	0.0000	0.0000	962.2870	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000
MH 1f	0.0000	0.0000	1452.7840	0.0000	0.0000	0.0000	-0.0122	0.0000	0.0000
MH 1b	0.0000	0.0000	1534.5034	0.0000	0.0000	0.0000	-0.0045	0.0000	0.0000
MH 1d	0.0000	0.0000	664.2282	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000
MH 1h	0.0000	0.0000	678.8192	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
MH 3a	0.0000	0.0000	1162.2667	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000
MH 3d	0.0000	0.0000	1829.7798	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
MH 2	0.0000	0.0000	1073.3054	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000
MH 3b	0.0000	0.0000	1141.5342	0.0000	0.0000	0.0000	-0.0094	0.0000	0.0000
MH 3e	0.0000	0.0000	1207.5036	0.0000	0.0000	0.0000	-0.0154	0.0000	0.0000

```
         MH 4b      0.0000       0.0000     487.3232       0.0000       0.0000
  0.0000       0.0004       0.0000       0.0000


        Node22      0.0000       0.0000       0.0000       0.0000       0.0000
  0.0000    3556.3142       0.0000       0.0000


   *=====================================================*
   | Table E20 - Junction Flooding and Volume Listing.    |
   |             The maximum volume is the total volume   |
   |             in the node including the volume in the |
   |             flooded storage area. This is the max    |
   |             volume at any time. The volume in the    |
   |             flooded storage area is the total volume|
   |             above the ground elevation, where the    |
   |             flooded pond storage area starts.        |
   | The fourth column is instantaneous, the fifth is the|
   | sum of the flooded volume over the entire simulation|
   | Units are either ft^3 or m^3 depending on the units.|
   *=====================================================*

                                                 Out of               Passed to 2D
cell
                                              1D-System               OR  Volume
Stored
        Junction    Surcharged   Flooded       (Flooded     Maximum    in allowed
Flood
            Name    Time (min)  Time(min)       Volume)      Volume   Pond of
1D-System
 ---------------    ----------  ---------     ---------   ---------
-----------------
         MH 1a          0.0000     0.0000        0.0000      0.1150
0.0000


         MH 1e          0.0000     0.0000        0.0000      0.1356
0.0000


         MH 1f          0.0000     0.0000        0.0000      0.2003
0.0000


         MH 1b          0.0000     0.0000        0.0000      0.1798
0.0000


         MH 1d          0.0000     0.0000        0.0000      0.1125
0.0000


         MH 1c          0.0000     0.0000        0.0000      0.3067
0.0000


         MH 1g          0.0000     0.0000        0.0000      0.1445
0.0000
```

```
             MH 1h         0.0000      0.0000        0.0000       0.2096
0.0000

             MH 3a         0.0000      0.0000        0.0000       0.1428
0.0000

             MH 3d         0.0000      0.0000        0.0000       0.1860
0.0000

              MH 2         0.0000      0.0000        0.0000       0.2246
0.0000

             MH 3b         0.0000      0.0000        0.0000       0.1843
0.0000

             MH 3e         0.0000      0.0000        0.0000       0.2139
0.0000

             MH 4b         0.0000      0.0000        0.0000       0.1057
0.0000

             MH 3f         0.0000      0.0000        0.0000       0.3041
0.0000

             MH 3c         0.0000      0.0000        0.0000       0.4156
0.0000

             MH 4a         0.0000      0.0000        0.0000       0.5313
0.0000

             MH 4c         0.0000      0.0000        0.0000       0.4410
0.0000

             MH 4d         0.0000      0.0000        0.0000    8598.9023
0.0000

           Orifice         0.0000      0.0000        0.0000       0.0448
0.0000

            Node22         0.0000      0.0000        0.0000       0.0191
0.0000


 *==================================*
 | Simulation Specific Information  |
 *==================================*
 Number of Input Conduits..........        19 Number of Simulated Conduits......
   21
 Number of Natural Channels........         0 Number of Junctions..............
```

```
  21
Number of Storage Junctions.......        1 Number of Weirs..................
   0
Number of Orifices................        1 Number of Pumps..................
   0
Number of Free Outfalls...........        1 Number of Tide Gate Outfalls......
   0


*=========================================================*
| Average % Change in Junction or Conduit is defined as:  |
| Conduit  % Change ==> 100.0 ( Q(n+1) - Q(n) ) / Qfull   |
| Junction % Change ==> 100.0 ( Y(n+1) - Y(n) ) / Yfull   |
*=========================================================*

The Conduit with the largest average change was..P4c-4d     with     0.000 percent
The Junction with the largest average change was.MH 4d      with     0.004 percent
The Conduit with the largest sinuosity was.......Orifice_1  with     1.788


*=====================================================================*
| Table E21. Continuity balance at the end of the simulation          |
|            Junction Inflow, Outflow or Street Flooding              |
| Error = Inflow  + Initial Volume - Outflow - Final   Volume         |
*=====================================================================*
```

Inflow Junction	Inflow Volume, m^3	Average Inflow, cms
MH 1a	1064.3081	0.0123
MH 1e	962.2702	0.0111
MH 1f	1452.7533	0.0168
MH 1b	1534.4557	0.0178
MH 1d	664.2200	0.0077
MH 1h	678.8148	0.0079
MH 3a	1162.2435	0.0135
MH 3d	1829.7441	0.0212
MH 2	1073.2882	0.0124

MH 3b	1141.5016	0.0132
MH 3e	1207.4634	0.0140
MH 4b	487.3192	0.0056
MH 1a	-0.0002	0.0000
MH 1e	-0.0004	0.0000
MH 1d	-0.0004	0.0000
MH 1h	-0.0007	0.0000
MH 3a	-0.0004	0.0000
MH 3d	-0.0007	0.0000
MH 2	-0.0006	0.0000
MH 4b	-0.0004	0.0000
Node22	-3556.3142	-0.0412

Outflow Junction	Outflow Volume m^3	Average Outflow, cms
MH 1a	0.0002	0.0000
MH 1e	0.0004	0.0000
MH 1d	0.0004	0.0000

```
          MH 1h       0.0007        0.0000

          MH 3a       0.0004        0.0000

          MH 3d       0.0007        0.0000

           MH 2       0.0006        0.0000

          MH 4b       0.0004        0.0000

         Node22    3556.3142        0.0412


*=======================================================*

| Initial system volume        =         0.0000 Cu M  |

| Total system inflow volume   =     13258.6762 Cu M  |

| Inflow + Initial volume      =     13258.6762 Cu M  |

*=======================================================*

| Total system outflow         =      3556.3181 Cu M  |

| Volume left (Final volume)   =      8673.7618 Cu M  |

| Evaporation                  =         0.0000 Cu M  |

| Outflow + Final Volume       =     12230.0799 Cu M  |
```

```
*===========================================================*



*================================================*
| Total Model Continuity Error                   |
| Error in Continuity, Percent =          7.7579 |
| Error in Continuity, m^3     =        1028.596 |
| + Error means a continuity loss, - a gain      |
*================================================*

###################################################
# Table E22. Numerical Model judgement section    #
###################################################

Overall error was (minimum of Table E18 & E21)              7.7579 percent



Worst nodal error was in node MH 4d            with         6.1751 percent



Of the total inflow this loss was                            7.8042 percent



Your overall continuity error was                    Fair



                                                    Excellent Efficiency



Efficiency of the simulation                         1.06



Most Number of Non Convergences at one Node          0.
```

Total Number Non Convergences at all Nodes 0.

Total Number of Nodes with Non Convergences 0.

===> Hydraulic model simulation ended normally.
===> XP-SWMM Simulation ended normally.

===> Your input file was named : C:_models\12851_Medicine V\12851_Storm Model.DAT

===> Your output file was named : C:_models\12851_Medicine V\12851_Storm Model.out

```
*=============================================================*
|             SWMM Simulation Date and Time Summary           |
*=============================================================*
| Starting Date... July       10, 2009  Time...   14: 8:49: 3  |
|   Ending Date... July       10, 2009  Time...   14: 8:57:56  |
|  Elapsed Time...    0.14217 minutes or      8.53000 seconds  |
*=============================================================*
```