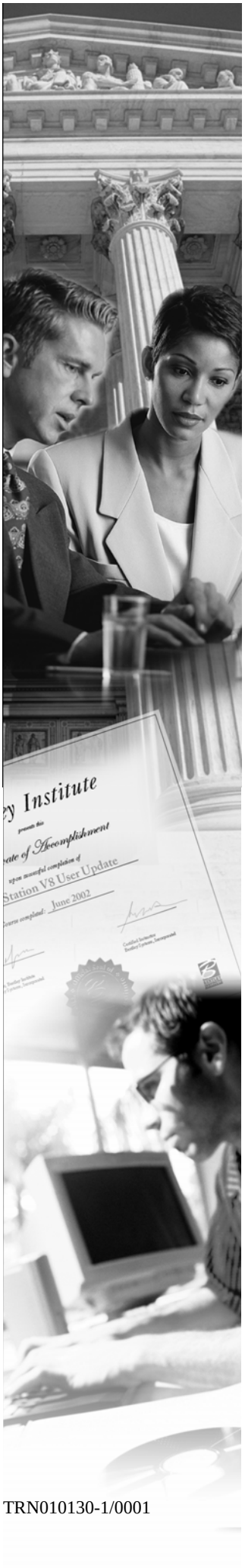

W13

Storm Drainage Layout with InRoads Storm & Sanitary

XM Edition

Bentley Institute

TRN010130-1/0001

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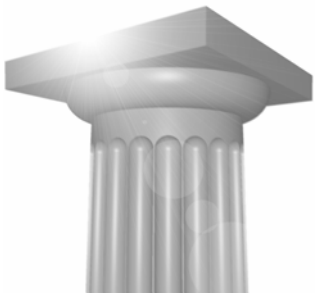


Storm Drainage Layout with InRoads Storm & Sanitary

Module Overview

This workshop demonstrates the tools available in InRoads Storm and Sanitary for precision placement of drainage structures in a design model, and the tools available for automating the design and analysis of storm drainage networks.

Module Prerequisites

- Knowledge of basic InRoads functionality
- Basic knowledge of InRoads alignments
- Basic knowledge of InRoads surfaces

Modules Objectives

After completing this module, you will be able to:

- Define standard structures
- Lay out storm structures
- Create drainage profiles
- Design networks
- Annotate drainage networks
- Edit and update drainage networks
- Annotate and report design data

Introductory Knowledge

Before you being this module, let’s define what you already know.

Questions

1. What is the purpose of Project Defaults?
2. How are Feature Styles used?

Answers

1. What is the purpose of Project Defaults?

   Answer: Use this command to set the default directory locations for opening/saving files. You can also set up preference files to be opened when InRoads is started.

2. How are Feature Styles used?

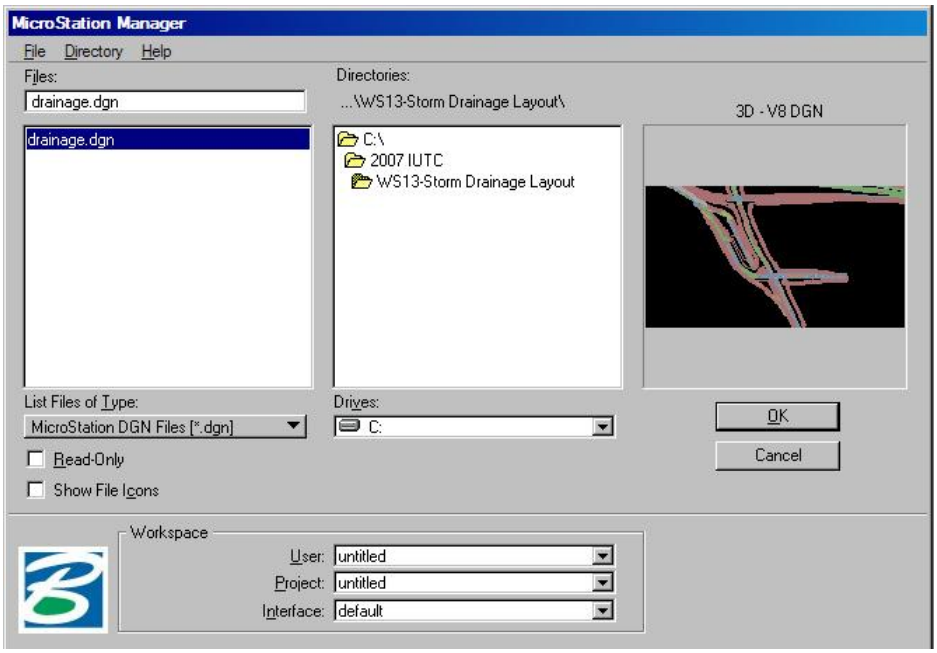
   Answer: Feature Styles are used to determine in which view (plan, profile, cross section) features may be displayed. They are also used to specify which Named Symbology will be used to set the feature's symbology, such as Level, Color, Line Style and Weight.

Starting InRoads Storm & Sanitary

Demonstrates how to open InRoads Storm & Sanitary, set project defaults, and open data files.

➔ **Exercise: In this exercise you will open InRoads Storm & Sanitary, set project defaults, and identify and open project data files.**

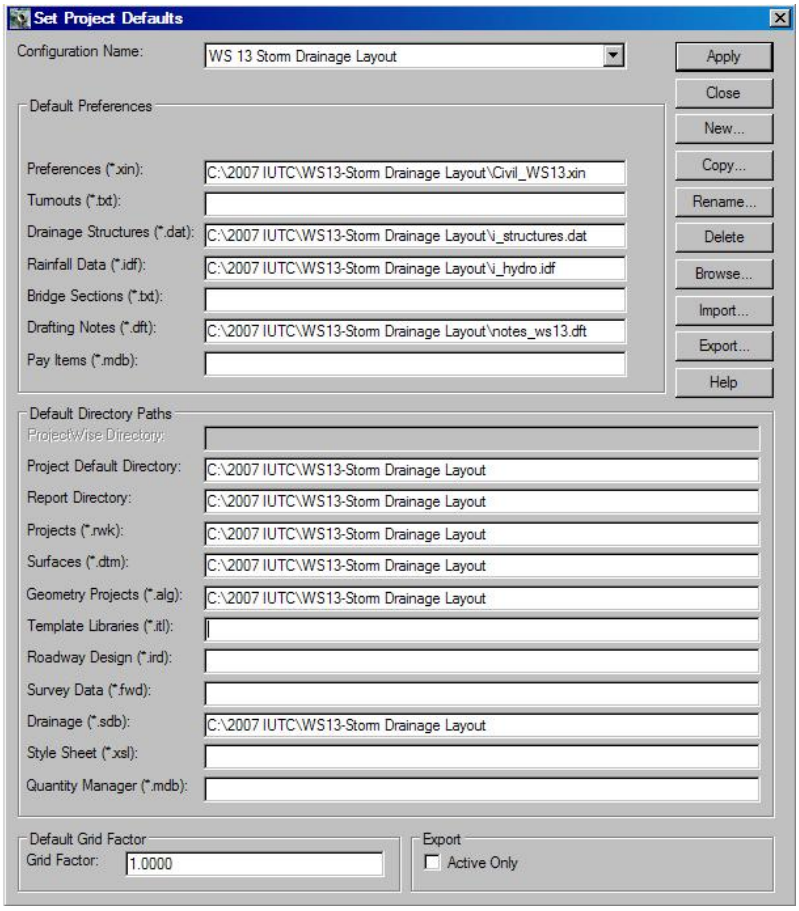
1. Select Start > All Programs > Bentley > InRoads Group > InRoads Storm & Sanitary.
2. On the *MicroStation Manager* dialog, select the file **C:\2007 IUTC\WS13-Storm Drainage Layout\drainage.dgn**.



After MicroStation and InRoads have started, load the Project Defaults for this workshop.

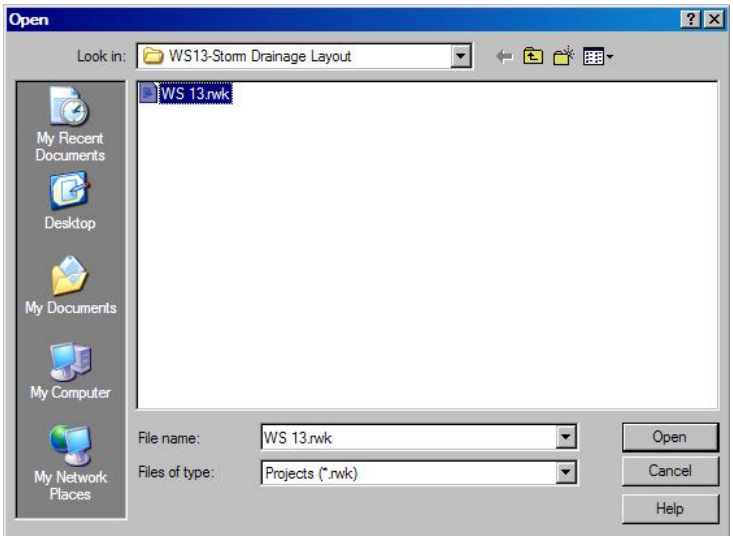
3. Select **File > Project Defaults**.

4. On the Set Project Defaults dialog, select WS 13-Storm Drainage Layout from the Configuration Name list box.



5. Select **Apply** and then **Close**. The parameter files are loaded and the directory paths are set as defined in the WS 13-Storm Drainage Layout project default.

6. Select **File > Open**. On the *Open* dialog, set the **Files of type** to **Projects(*.rwk)** and then select the file **C:\2007 IUTC\WS 13-Storm Drainage Layout\WS13.rwk**.



7. Select **Open** and then **Cancel**. The following data files are opened:

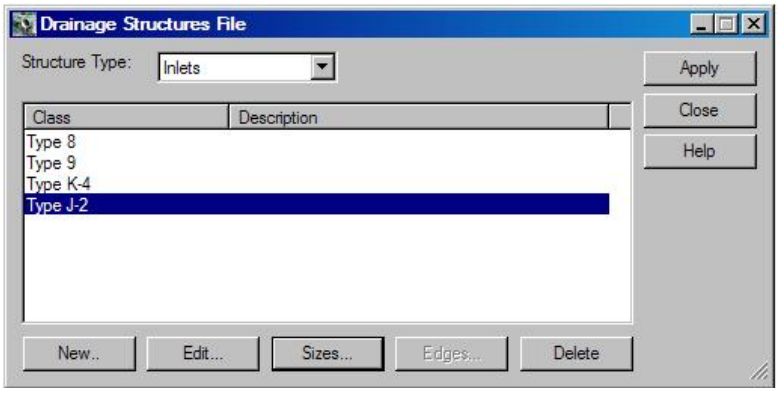
   i90mrgol.dtm
   Existing I-90.alg
   I90 Drain.sdb

Adding a Structure to the Structure.dat File

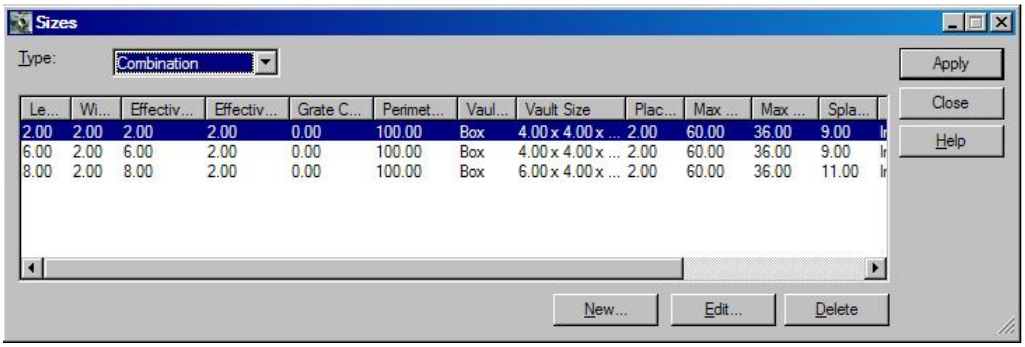
Demonstrates how to add a new inlet to the standard structure file.

➔ **Exercise: In this exercise, you will add a new inlet to the standard structures file. After the structures are created in the structures.dat file, they are available to be placed into the network.**

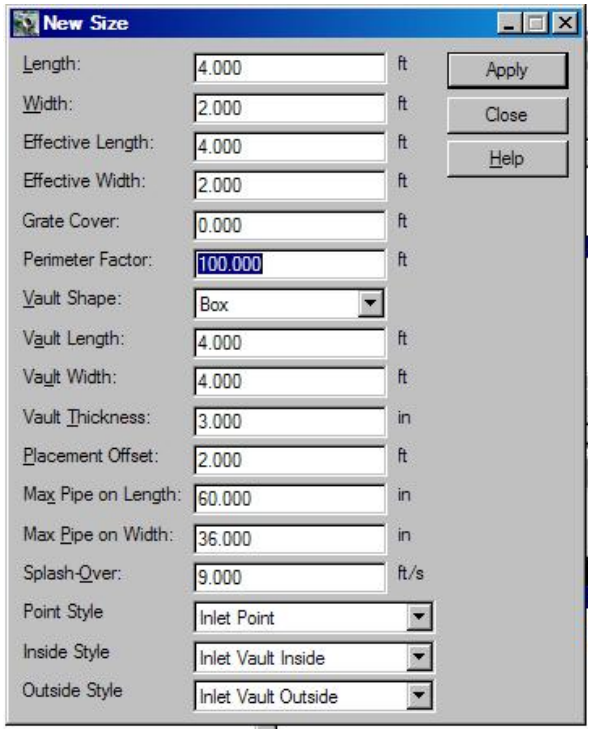
1. Select **Tools** > **Drainage** > **Structures File**.
2. On the *Drainage Structures File* dialog, change the **Structure** to **Inlets**.
3. Highlight class **Type J-2** and click the **Sizes** button.



4. On the *Sizes* dialog, set the **Type** to **Combination** and select the **New** button.



5. On the *New Size* dialog, enter a new 4’ x 2’ Combination inlet with a 4’ x 4’ vault and 2’ placement offset as shown below.



Note: Make the Effective Length and the Effective Width equal to the Length and Width.

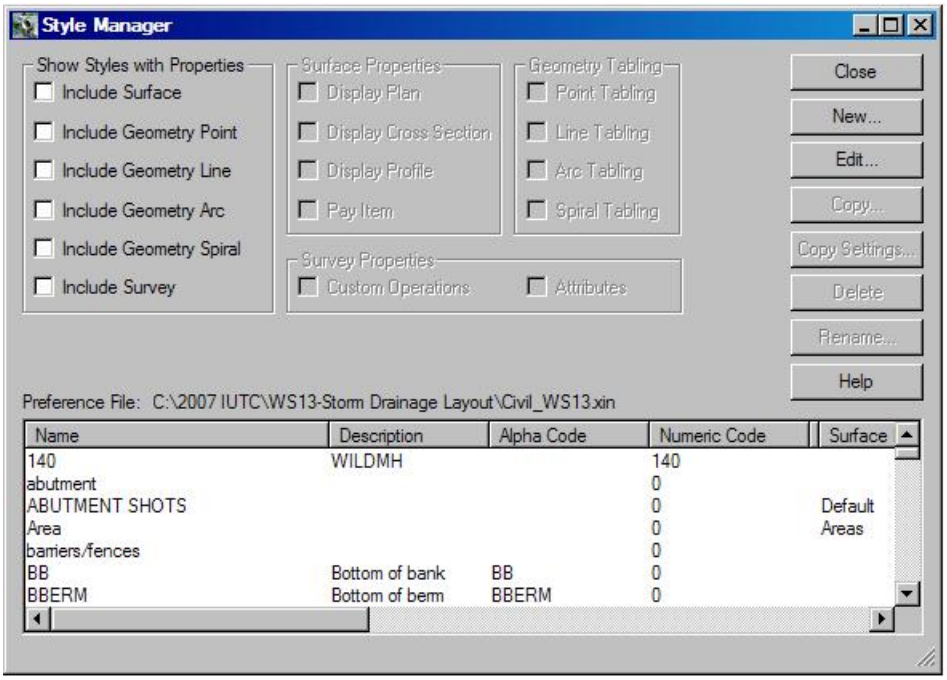
6. On the *New Size* dialog, select **Apply**.
7. On the *Sizes* dialog, select **Apply**.
8. On the *Drainage Structures File* dialog, select **Apply** and **Close**.

Creating a New Style

Demonstrates how to create a new style to display pipe centerlines in plan and profile views.

➔ **Exercise: In this exercise you will create a new style that will tell the program how to display pipe centerlines in plan and profiles views. The new style will use a Named Symbology that has already been created, and is stored in the Civil_WS13.xin file.**

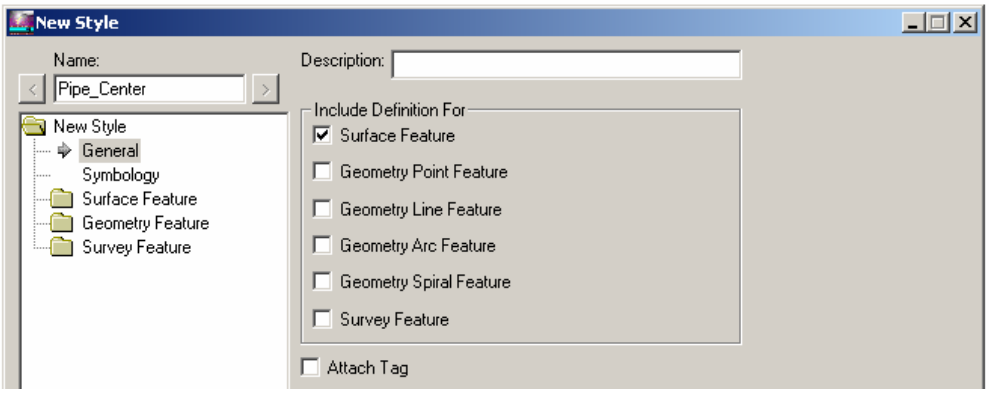
1. Select **Tools > Style Manager**, and select the **New** button.



2. On the New Style dialog, select the General leaf and make the following settings:

   Name: **Pipe_Center**

   Surface Feature: **On**



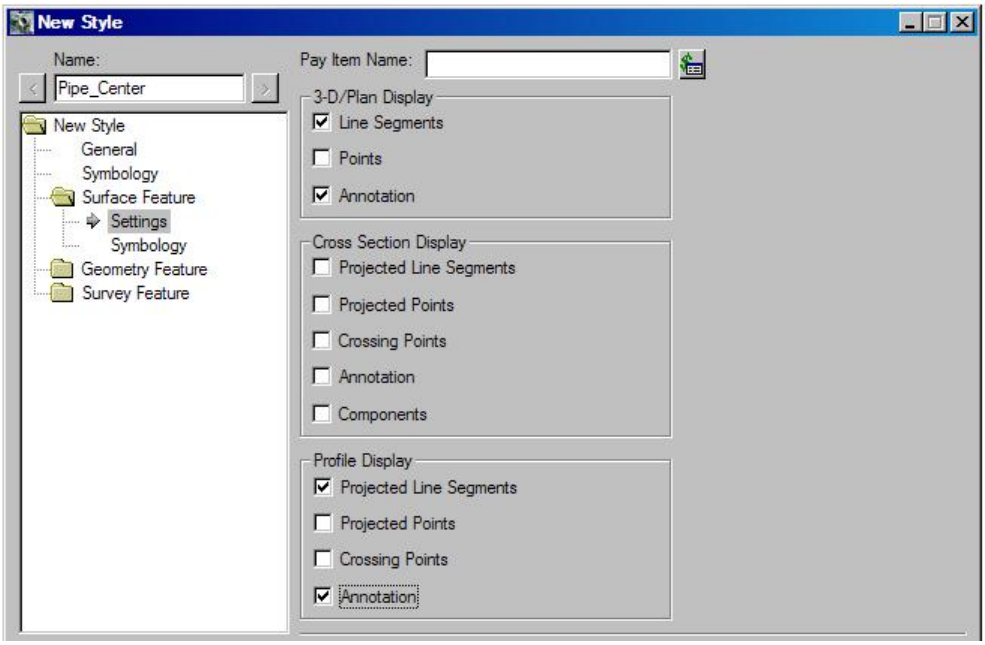
3. Select the Surface Feature > Settings leaf, and make the following settings:

   3-D Plan display: Line Segments: **On**

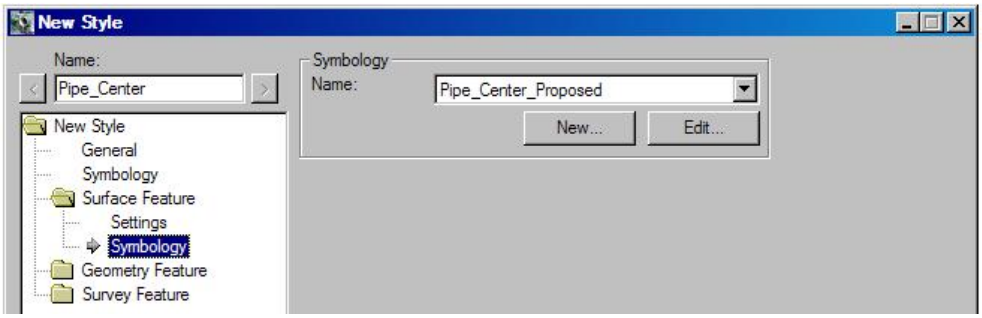
   Annotation: **On**

   Profile Display: Projected Line Segments: **On**

   Annotation: **On**



4. Select the **Surface Feature > Symbology** leaf, click in the **Symbology Name** field and select **Pipe_Center_Proposed** from the pull-down list.



Note: This assigns the named symbolgy Pipe_Center_Proposed to the style Pipe_Center. The named symbology Pipe_Center_Proposed was previously created and provided in the Civil_WS13.xin file.

5. Select **Apply** and then **Close** to create and save the new style.

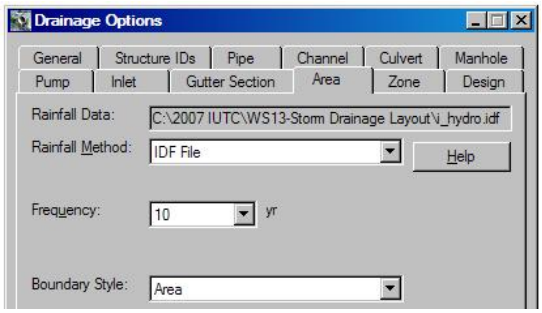
6. On the *Style Manager* dialog, select **Close**.

Assigning Styles and Setting Layout Defaults

Demonstrates how to assign a style when Areas are created.

➔ **Exercise: In this exercise, you will assign the style to be used when Areas are created. The active styles for drainage structures are set when you choose which structures from the structures.dat file the program will default to during layout.**

1. Select **Tools > Drainage > Options** and click on the **Area** tab. Set the following style for Areas: Boundary Style: **Area**.



2. On the *Drainage Options* dialog, click on the **Inlet** tab and set the following:

   Structure Type: **Combination**

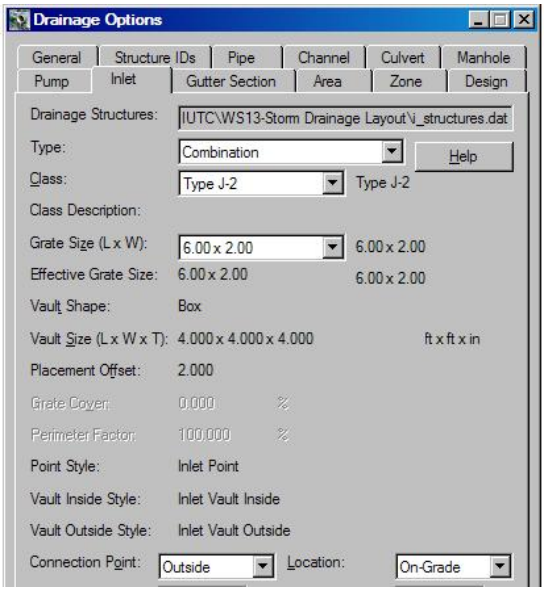
   Class: **Type J-2**

   Grate Size: **6.0 x 2.0** defaults to vault size 4.0 x 4.0 x 4.0

   Placement Offset: **2**

   Location: **On Grade**

   Connection Point: **Outside**



3. On the *Drainage Options* dialog, click on the **Gutter Section** tab and verify or set the following settings:

   Type: **Composite**

   Gutter Width: **1.50**

   Side Slope: **5.00%**

   Longitudinal Slope: **Compute from DTM**

   Transverse Slope: **User Value: 3.00%**

   Roughness: **0.012000**

   Maximum Spread: **5.00**

4. Select **Apply** to set the defined parameters.
5. Select the **Preferences** button and select **Save** to store your changes to the "Default" preference.
6. Select **Close** on the *Preferences* and *Drainage Options* dialogs.

Note: The options set in Drainage Options are used as defaults when laying out structures. These can be changed at the time of layout by clicking on the Options button, and they can be changed for each individual structure by using the Edit/Review or Query commands.

Laying Out the Drainage Network

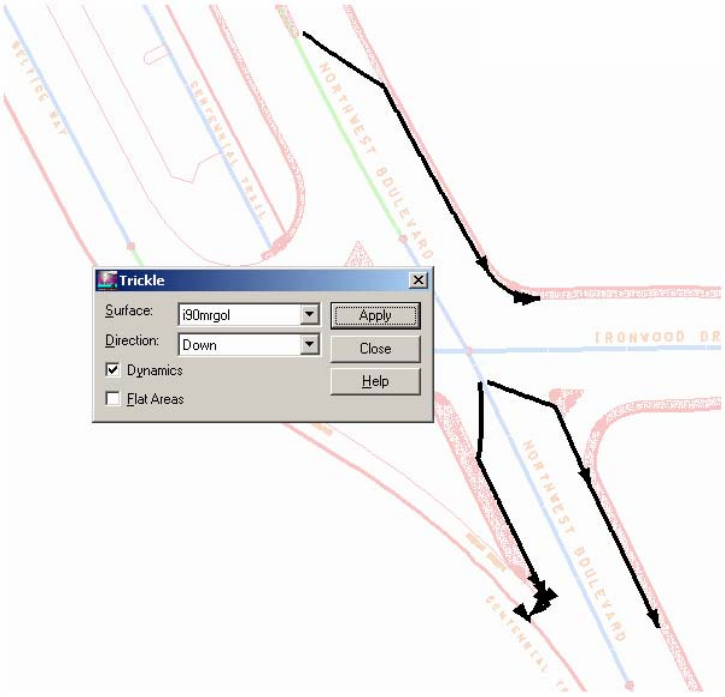
Demonstrates how to lay out a drainage network using the Multiple junctions layout command.

➔ **Exercise: In this exercise, you will lay out a drainage network using the Multiple Junctions layout command, and by laying out individual structures.**

1. **Zoom In** on the southern portion of Northwest Boulevard.
2. Select **Evaluation > Hydrology and Hydraulics > Trickle** and verify or set the **Surface** to **i90mrgol** and **Direction** to **Down**.

   If you do not find Hydrology and Hydraulics under Evaluation, select Tools > Application Add-Ins and turn on the Hydrology and Hydraulics Add-in.

3. On the *Trickle* dialog, select **Apply** and move the cursor over Northwest Boulevard. A dynamic line will display in the design file representing the flow path from the current position of the cursor. Pressing the **<D>** button on the mouse will place a graphic in the design file with the current MicroStation settings. Move the mouse to several areas in order to gain an understanding of where the rainfall runoff will go, and where inlets need to be placed. <R> to exit command.



Note: As you can see from the Trickle command, most of the runoff will flow to the right side of Northwest Blvd. as it is superelevated. Near the southern-most portion of the roadway, the road returns to normal crown and will need inlets on both sides of the roadway.

4. When through evaluating the surface drainage, select **Close** on the *Trickle* dialog.
5. Verify that **Style** lock is *On* and leave it on for this entire workflow.

6. Select **Drainage > Layout**, and then click on the **Multiple Junctions** tab.
7. On the *Multiple Junctions* tab, verify or set the following settings:

   Junction Type: **Inlet**

   Alignment: **Northwest Blvd K**

   Upstream Station: **0+00.00**

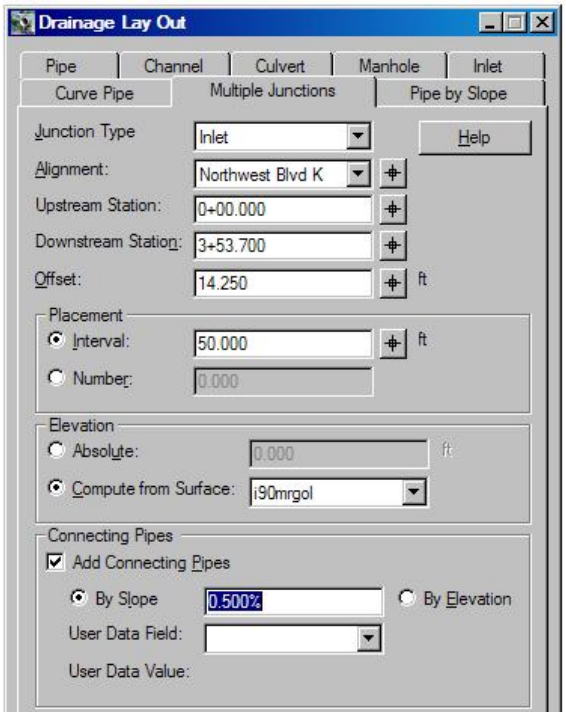
   Downstream Station: **3+53.7**

   Offset: **14.25**

   Placement Interval: **50**

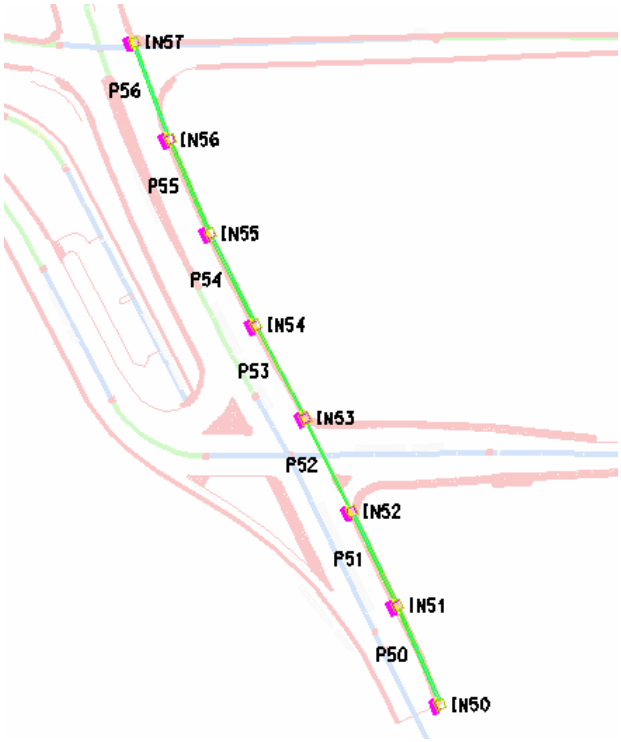
   Compute Elevation from Surface: **i90 mrgol**

   Add Connecting Pipes by Slope: **0.50%**



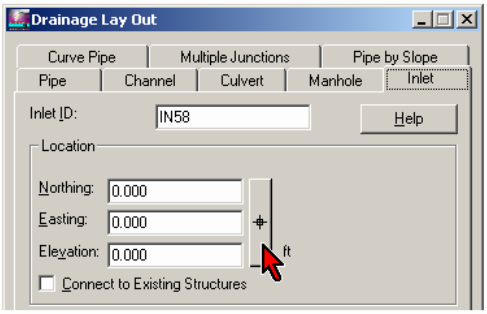
8. Select the **Options** button at the bottom of the *Drainage Lay Out* dialog and notice that the settings entered in the previous exercise are active and will be the structure type placed. This is where you can change the type of structure to be placed.
9. Select **Close** on the *Drainage Options* dialog.

10. On the Drainage Lay Out dialog, select Apply. This creates Inlets 50 – 57 and Pipes 50 – 56.



11. On the *Drainage Lay Out* dialog, select the **Inlet** tab.

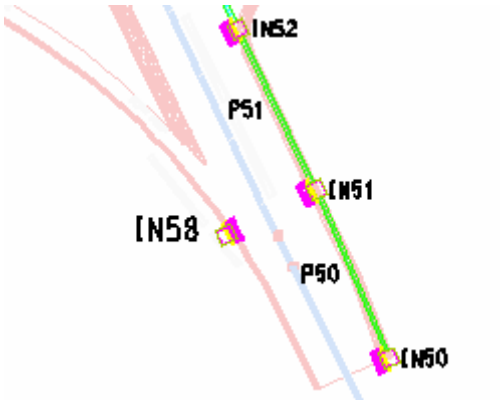
12. **Click** on the **Northing/Easting/Elevation locate button** to the right of the data fields.



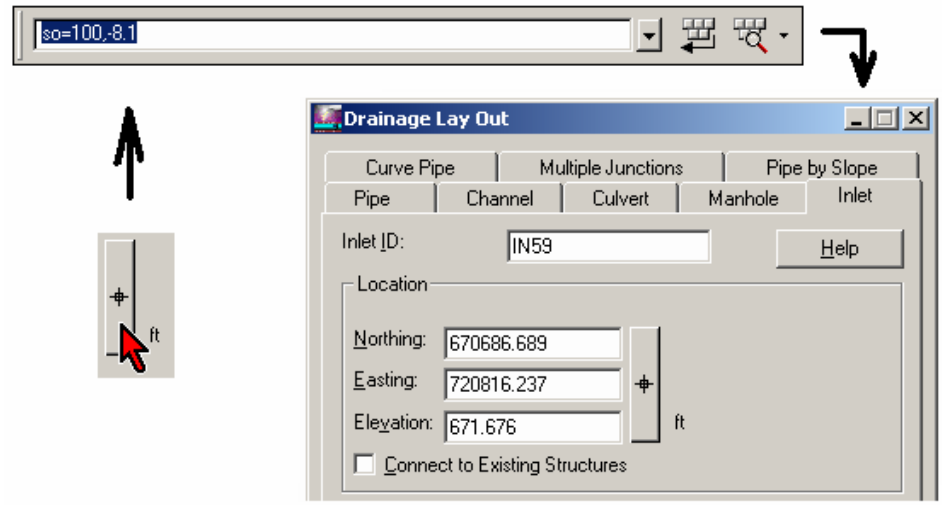
13. In the *MicroStation key-in* dialog, key in **so=49.6,-10** and hit the **Enter** key.

Note: This populates the Northing, Easting, and Elevations fields with the coordinates of the point at station 0+49.6 that is ten feet left of the alignment. It also reads the DTM for the longitudinal slope and transverse slope at that point.

14. Select **Apply** to layout that inlet, IN58.



15. To layout the next inlet, use the **locate** button again and key in **so=100,-8.1**.



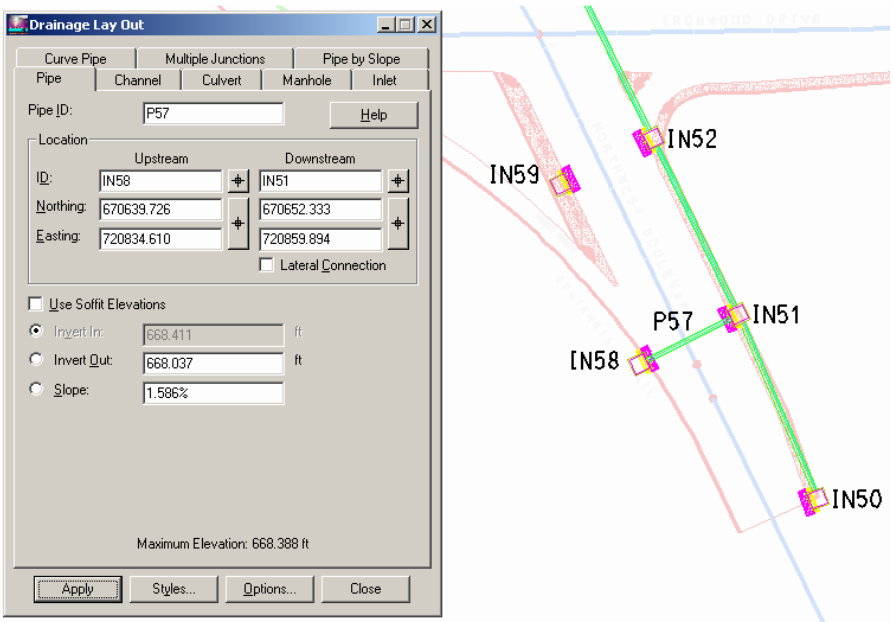
16. Select **Apply** to create **IN59** and add it to the database.

17. Select the **Pipe** tab and zoom in on the southern portion of the network.

18. Lay out the following pipe, named **P57** (see picture below):

    Upstream ID: **IN58** (Keyin the ID or use the Locate button to select IN58)

    Downstream ID: **IN51**



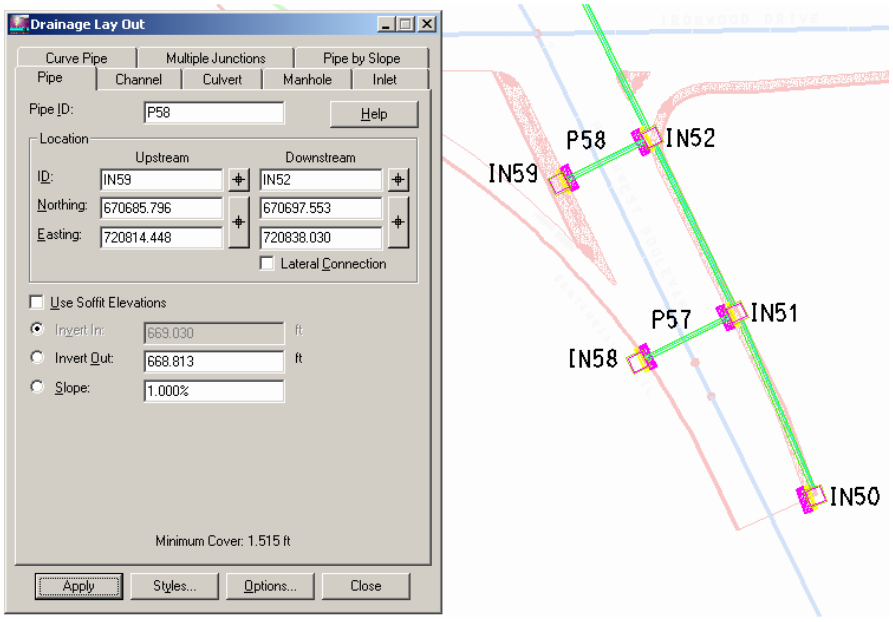
19. Select **Apply** to create **P57** and add it to the database.

20. Lay out the following pipe, named **P58**:

    Upstream ID: **IN59**

    Downstream ID: **IN52**

    Slope: **1.0%**

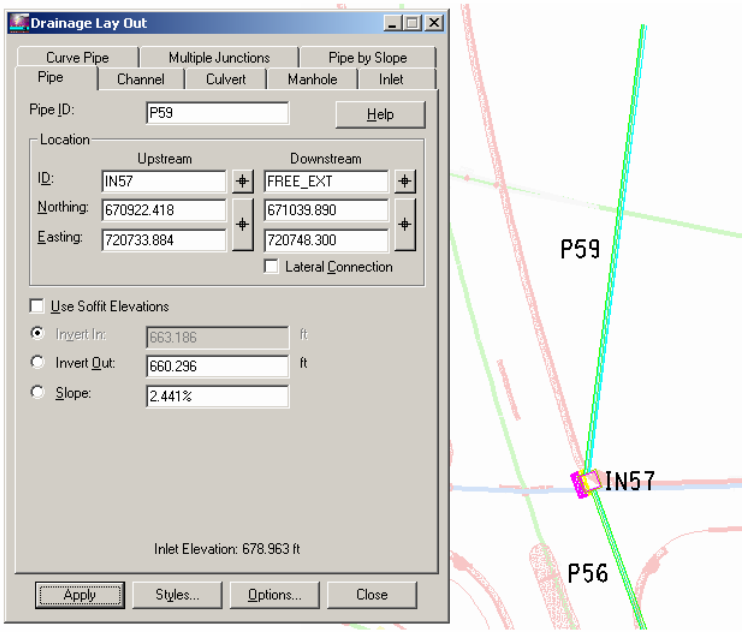


21. Select **Apply** to create **P58** and add it to the database.
22. **Window Area** to the northern end of the network around IN57.
23. Finally, lay out an outfall pipe, **P59**, from IN57 to specified coordinates as follows:

    Upstream ID: **IN57**

    Downstream: Northing: **671039.89**

    Easting: **720748.30**



24. Select **Apply** to create **P59** and add it to the database.

    Notice that this placed a free-exit outfall pipe from Inlet 57 up to the northeast gore area of the intersection

25. On the *Drainage Lay Out* dialog, select **Close**.

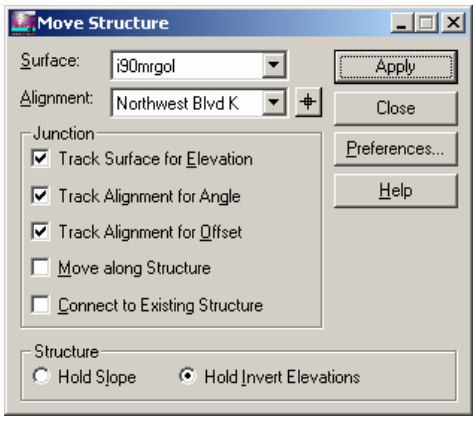
Moving Drainage Structures

Demonstrates how to check for any interference with existing utilities and check for proper locaton of inlets near intersections.

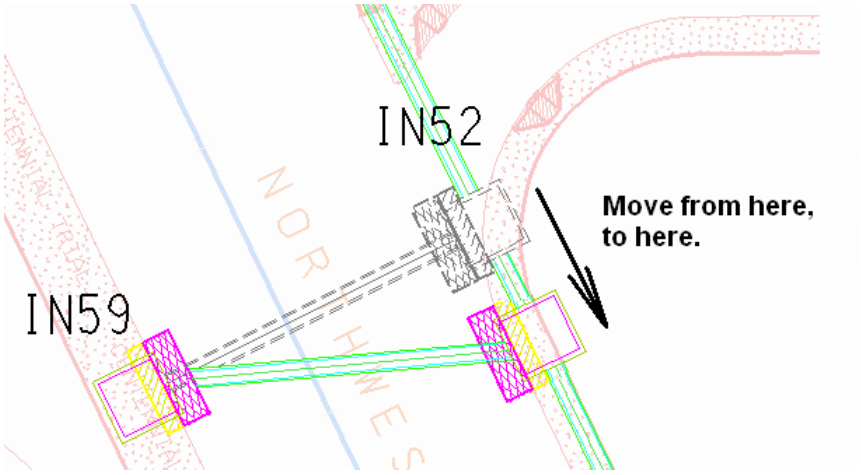
➔ **Exercise: In this exercise, now that we have quickly laid out the structures on our site, we need to go back and "fine tune" the locations of some of the structures.**

If you zoom in to the intersection of Ironwood Dr. and Northwest Blvd., you will see that the inlets placed by the multiple junction layout command are close, but need to be moved to a better location along the curb.

1. Select **Drainage > Structure > Move**, and set the following settings:



2. Select **Apply** and move **IN52** to a location along the curb before the intersection begins.



3. Continue the same process with inlet **IN53** on the north side of the intersection, and move it away from the intersection.
4. Move the most northern inlet in the network, **IN57**, back away from the intersection.
5. Select **Close** on the *Move Structure* dialog.

Creating a Drainage Profile

Demonstrates how to create a profile along the drainage network.

➔ **Exercise: In this exercise, you will create a profile along the drainage network to evaluate the system and look for potential problems.**

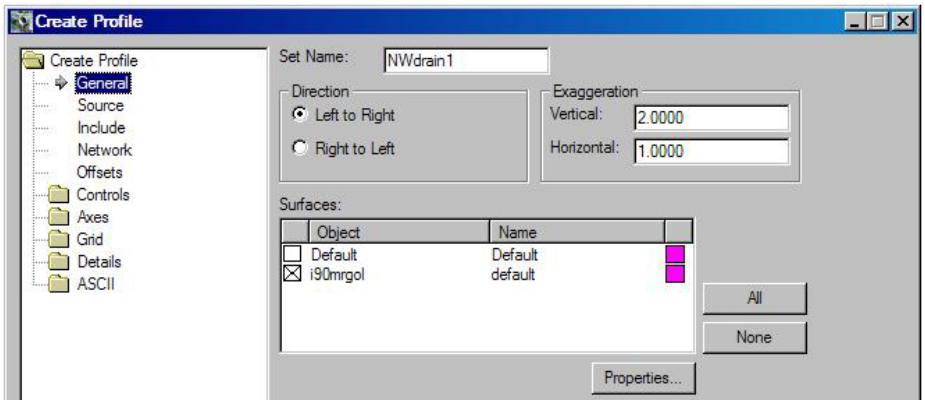
1. **Zoom Out** in your drawing file so that you can see the entire network that has been placed.
2. Select **Evaluation > Profile > Create Profile**, on the **General** leaf, verify the following:

   Set Name: **NWdrain1**

   Direction: **Left to Right**

   Vertical Exaggeration: **2.0**

   Surface Object: **i90mrgol**



3. Select the **Source** leaf, and verify or set the following settings:

   Create: **Network**

   Alignment: **NWdrain1**

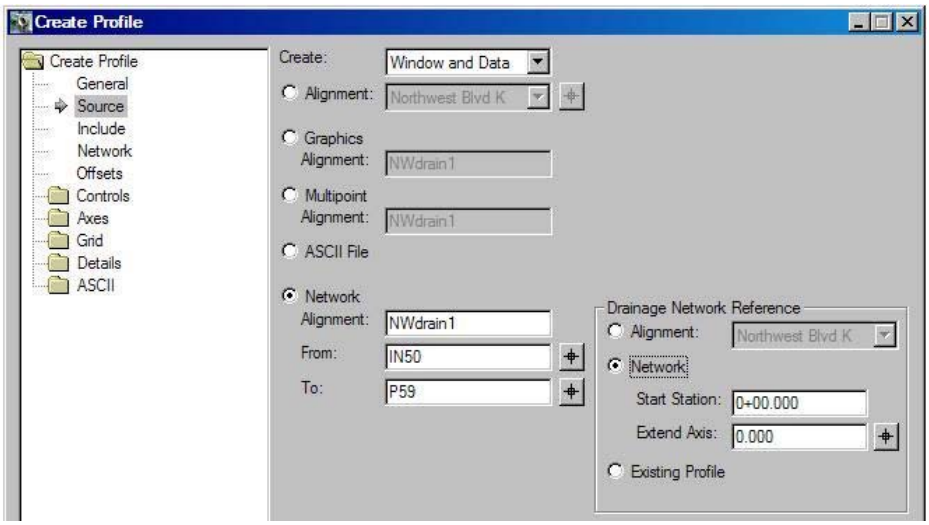
   From: **IN50**

   To: **P59**

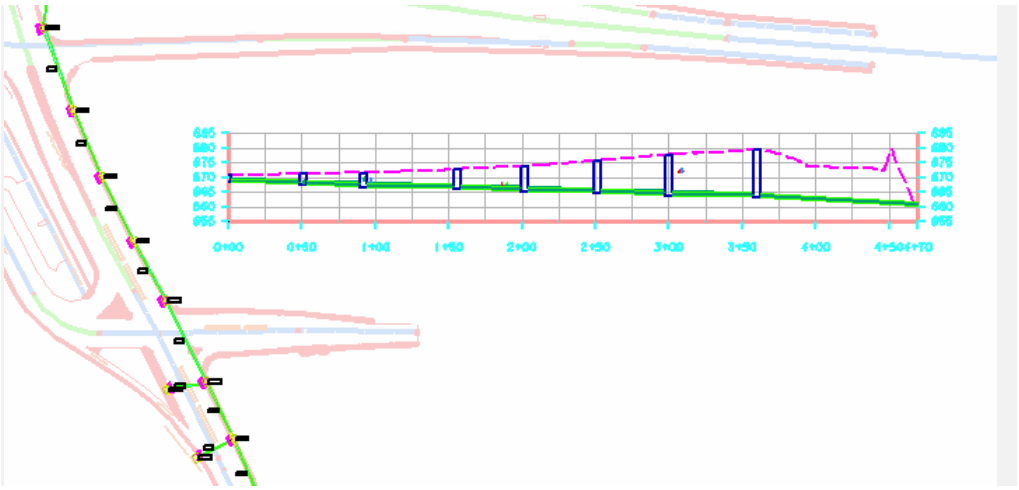
   Drainage Network Reference: **Network**

   Start Station: **0.00**

   Extend Axis: **0.00**



4. Select **Apply** and place a **<D>** point in the design file to locate the lower left corner of the profile window. Place the profile such that it is near the drainage network, but away from the existing graphics.



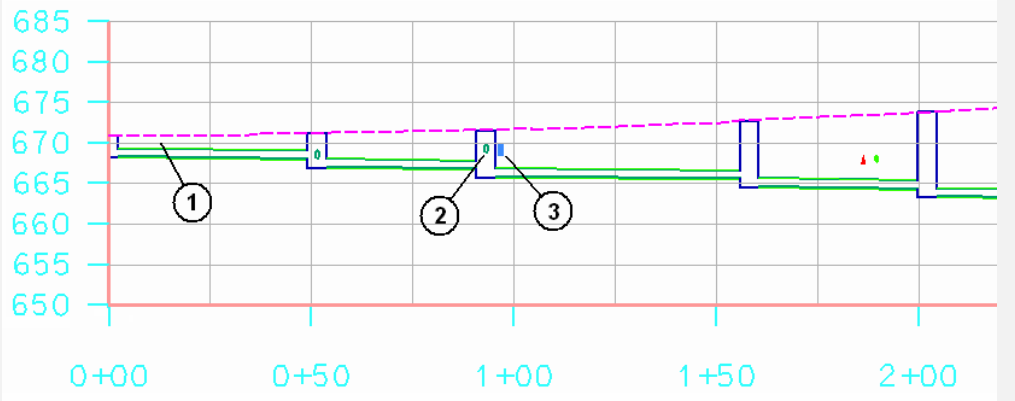
5. On the *Create Profile* dialog, select **Close**.

Evaluating the Profile and Making Changes

Demonstrates how to evaluate the profile and identify and correct problems.

➔ **Exercise: In this exercise, you will evaluate the profile, identify potential problems, and correct the problems.**

1. **Zoom In** on the profile window and **review** the results.
2. **Window Area** to the **left end** of the profile window such that you can see at least the first three inlets, and toggle the **Graphic Group lock** *Off*.

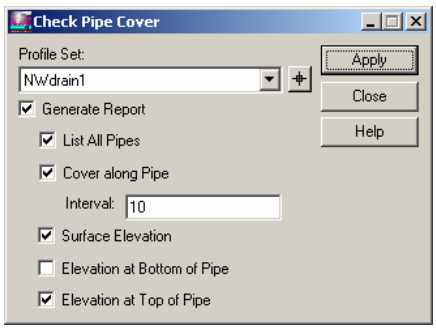


Looking at the profile, you can see three potential problems:

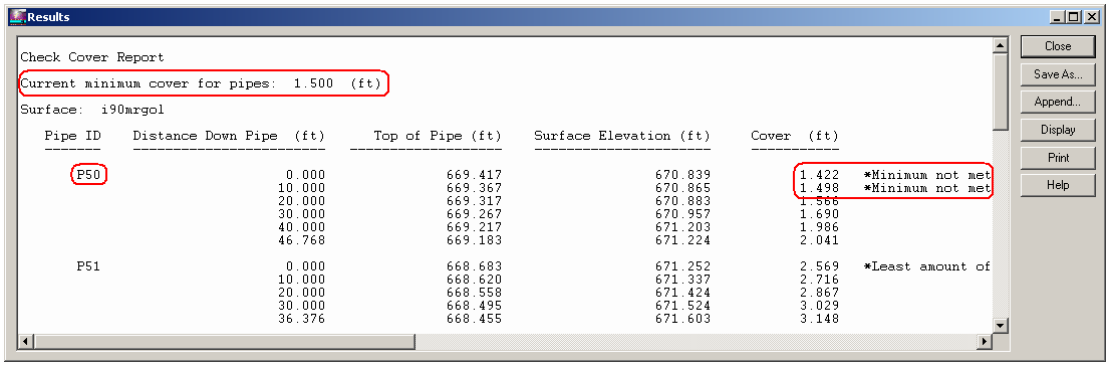
1. The ground cover over the first pipe may be too shallow.
2. The invert elevation of the second cross drain pipe may be too high.
3. The third inlet, IN52, may be too close to an existing underground utility.

Resolving Problem 1

3. Select **Evaluation** > **Profile** > **Check Pipe Cover**, and set the following settings.



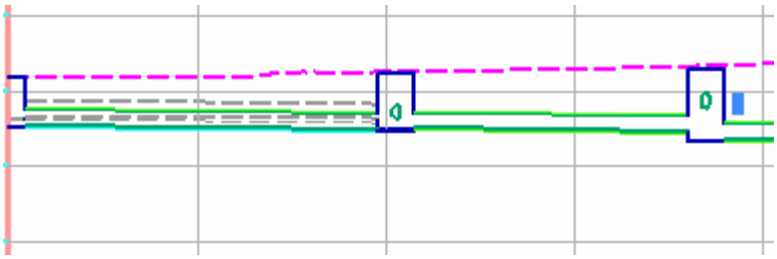
4. Select **Apply**. The *Results* dialog is displayed with the report data. Review the report and note that the Minimum Pipe Cover is 1.5 ft and that the first pipe, P50, does not meet minimum cover.



5. **Close** the *Results* and the *Check Pipe Cover* dialoges.

6. Select **Drainage > Structure > Move in Profile**. When prompted to Identify structure, select the **middle** of the first pipe in the profile and move it down about one/half the pipe diameter, but not lower than the invert in of the next downstream pipe.

7. Place a **<D>** point to locate the new position, and then **<R>** to exit the command.

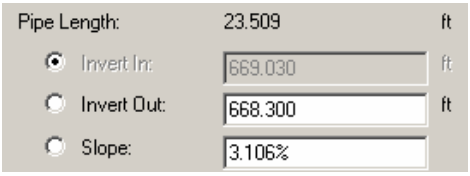


8. Run the **Check Pipe Cover** command again and verify that the cover is now sufficient for that pipe.

Resolving Problem 2

9. Select **Drainage > Edit/Review** and **<D>** point on the **end of the cross drain pipe** in IN52 and then **<D>** to Accept when it highlights. The *Edit/Review Pipe* dialog is displayed for P58.

10. In the *Edit/Review Pipe* dialog, note that the slope of pipe P58 is 0.9%. You can either enter a new Invert Out elevation or enter a new Slope for the pipe. Click in the **Invert Out** field, enter **668.30** and **Tab** out of the field. When you tab out, the Slope value is automatically calculated and updated.



Note: Your Pipe Length and Slope Values will be different from the values shown due to moving IN52 earlier in the workshop.

11. Select **Apply** to save the changes to the database, and then **Close** the dialog.

12. Select **Evaluation > Profile > Update Drainage Profile** and select **Apply**. The new elevation of the cross drain pipe will be displayed in the profile.

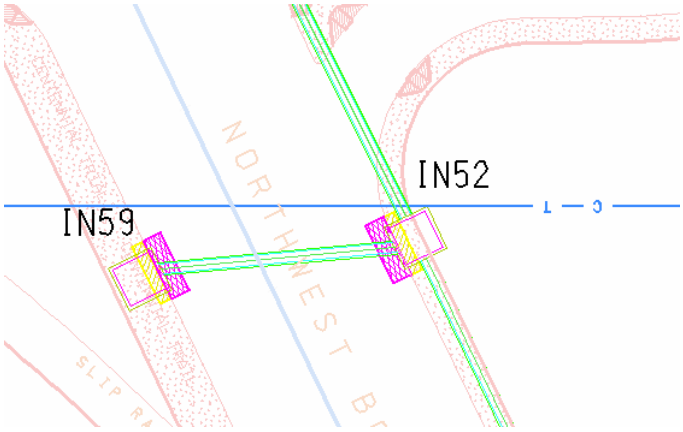
13. Select **Close** to dismiss the *Update Drainage Profile* dialog.

Resolving Problem 3

14. **Zoom Out** until the plan view of the network is visible.
15. In the InRoads Storm & Sanitary **Explorer** window, click on the **Drainage** tab to display the drainage database Text.
16. Click on the **Utilities** leaf to display the utilities in the active database. The utilities are displayed in the right-side of the Explorer window.

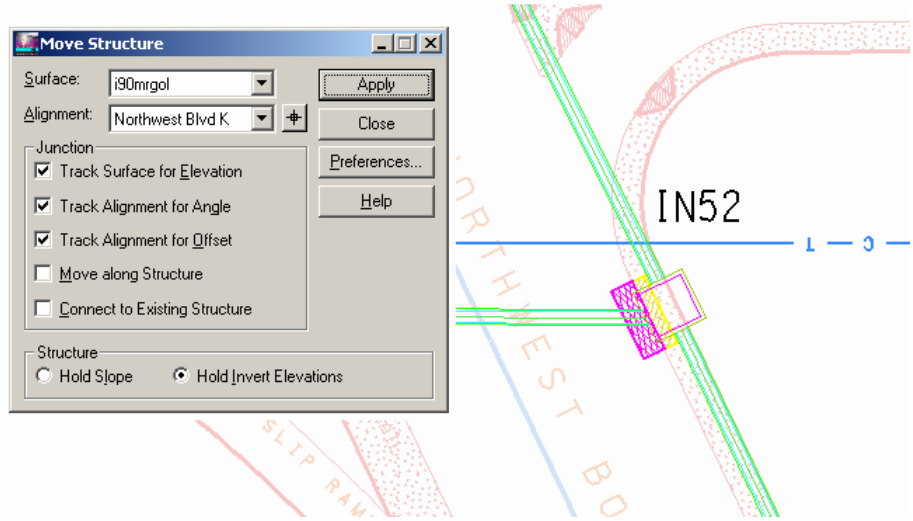
Note the different utilities and their associated shapes.

17. Select **Drainage > Utilities > View**, and then select **Apply** to display the existing utilities into the drawing file.
18. **Window Area** around **IN52** and note the position of the inlet in relation to the existing telephone/cable line.

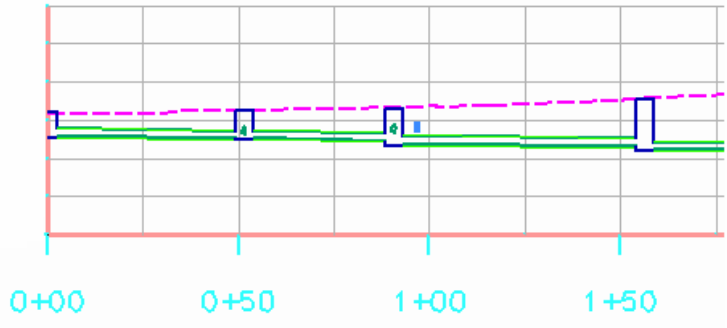


19. Select **Drainage > Structure > Move** and slide the inlet away from the phone line.

Note: Be sure to set the **Alignment** to **Northwest Blvd K**.



20. Select **Evaluation > Profile > Update Drainage Profile** and select **Apply**. The new location of the inlet will be displayed in the profile.

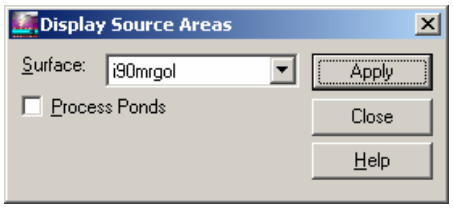


Computing Flows Into the Network

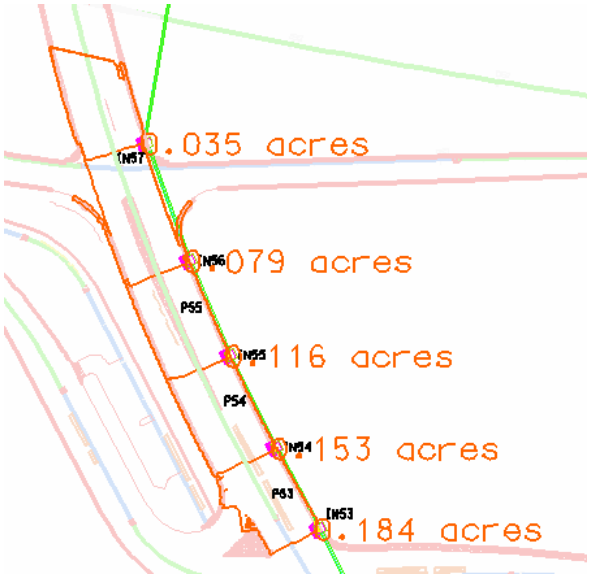
Demonstrates how to analyze the DTM and automatically delineate drainage areas.

➔ **Exercise: In this section, we will use the Display Source Areas command to analyze the DTM and automatically delineate drainage areas. We will then attach those drainage areas to inlets and we will also inject flow directly in some inlets**.

1. **Zoom In** on the five northern most inlets in the network.
2. In the **MicroStation Key-in** field, enter **tx=0.5** and press the **Enter** key. The **Display Source Areas** command uses the active MicroStation settings, you may also want to set your active color, linestyle, and lineweight.
3. Select **Evaluation > Hydrology and Hydraulics > Display Source Areas** and verify that surface **i90mrgo**l is selected.
4. Select **Apply**. When prompted to Identify Point, **snap** to the origin of the cell for these five inlets and **<D>** point to place the source area.



Hint: Make sure the active MicroStation snap is set to Origin Snap.



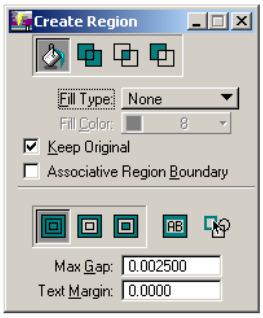
The area created by the Display Source Areas command outlines the entire area of the surface that drains to the selected point. Since we have multiple inlets accepting flow, we need to subdivide the areas drawn by the Display Source Areas command. To do this, we will use the Create Region - Flood command in MicroStation

5. On the *Display Source Area* dialog, select **Close**.

6. In MicroStation, use the **PowerSelector** and select the text next to each of the five areas created in the previous steps. 

7. In MicroStation, invoke the **Create Region** command either by keying –in create region flood, or by selecting the Create Region icon off of the Groups toolbox.

8. Set the method to **Flood**, and make sure **Keep Original** is selected.



9. At the prompt Create Region From Area Enclosing Point, **<D>** point **inside** each of the five areas and **<D>** to **Accept**.

10. With the five original areas still selected, select the **Delete Element** command in MicroStation to delete the original areas created by the Display Source Areas command. **Refresh** the view, and only the new areas will display.

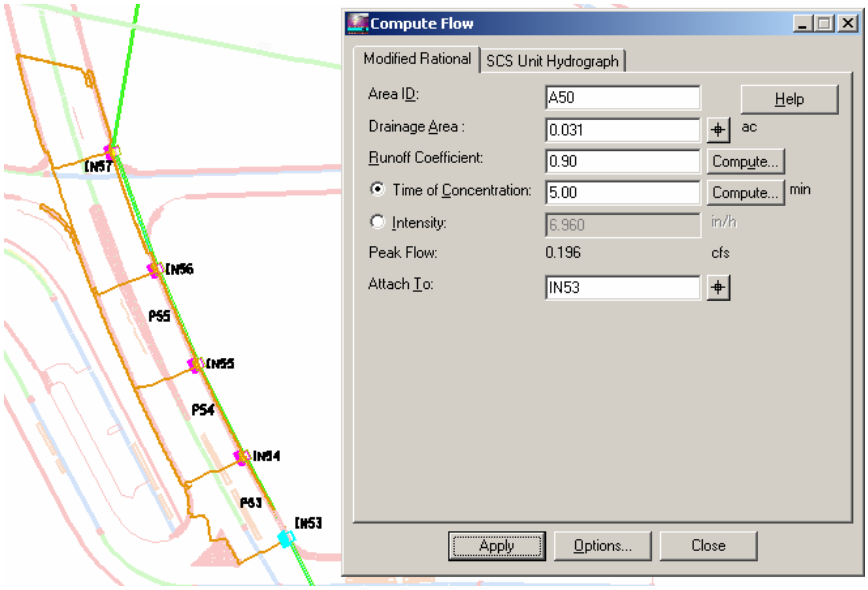
11. In InRoads, select **Drainage > Flows > Compute Flow** and set the following settings:

    Runoff Coefficient: **0.90**

    Time of Concentration: **5.0**

12. Click on the **locate button** next to **Drainage Area** and place a **<D>** point to identify the **graphic** representing the drainage area for the first inlet. Once accepted, the Drainage Area field is automatically filled updated with the calculated area.

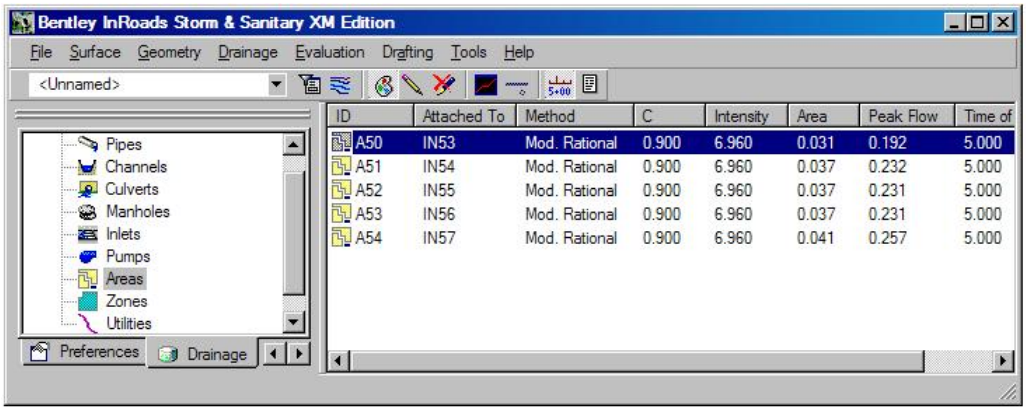
13. Click on the locate button next to Attach To and place a <D> point to pick the corresponding inlet.



14. Select **Apply** to add the Area/Inlet combination and the areas to the drainage database.

15. Repeat this process for the remaining four inlets, then **Close** the dialog.

16. In the InRoads Storm & Sanitary **Explorer** window, click on the **Drainage** tab, and then click on the **Areas** leaf to list all the Areas in the database. Verify that you have created all five areas and attached them to their corresponding inlet.

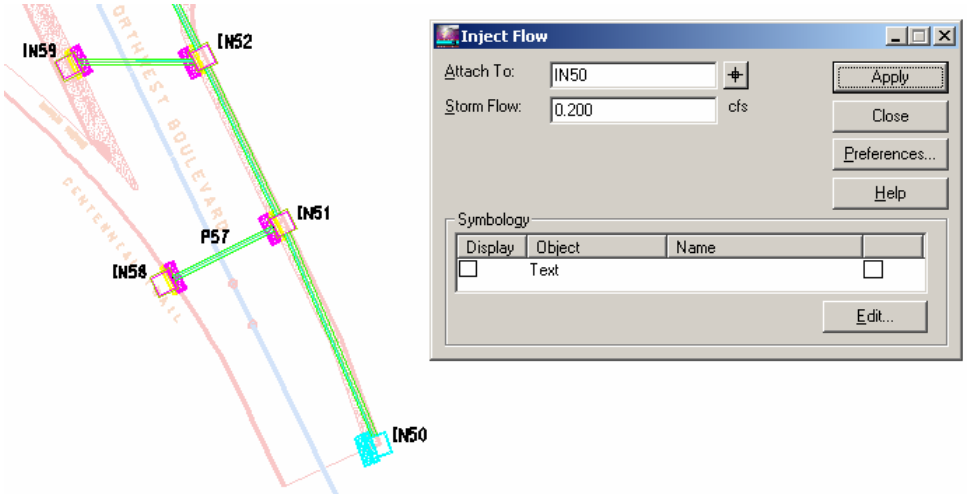


For the remaining five inlets on the southern end of the network, we will inject 0.2 cfs of flow directly into each inlet.

17. **Window Area** to the southern end of the network.

18. Select **Drainage > Flows > Inject Flow**, click on the Attach To **locate button** and **<D>** point on **IN50**.

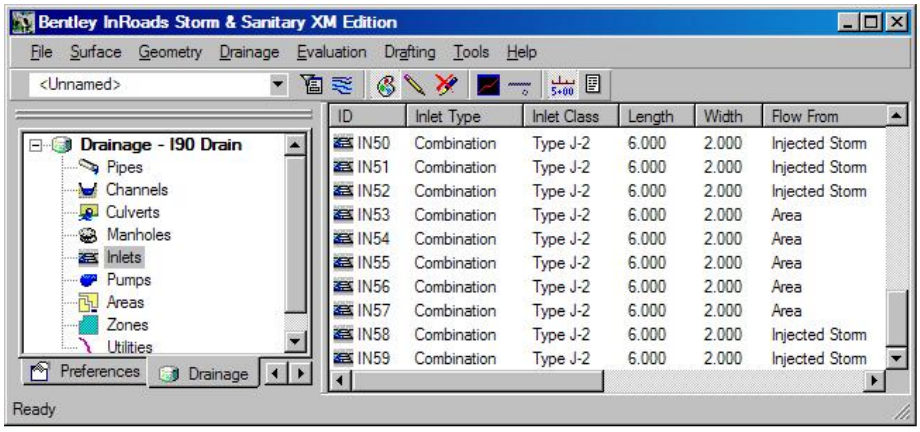
19. Click in the Storm Flow field, enter 0.200, and select Apply. The injected storm flow is attached to the inlet and stored in the database.



20. Repeat the above process for the four remaining inlets.

21. Select **Close** on the *Inject Flow* dialog.

22. On the **Drainage** tab of the Explorer window, select the **Inlets** leaf. **Scroll down** until inlets IN50 – IN59 are visible. **Verify** that all the inlets display **Area** or **Injected Storm** in the **Flow From** column.



Designing the Network

Demonstrates how to design the network.

➔ **Exercise: After flows have been attached to the network, you can design the network. When the design network command is run, the program begins at the most upstream structure and travels downstream. The capacity of each structure is analyzed, and the appropriate size is selected from the structures file to handle the amount of flow specified. After the structures are sized, the program begins at the network outfall and calculates the HGL and EGL by adding each structure's losses to the one below it**.

1. Select **Drainage > Network > Design** and verify or set the following settings:

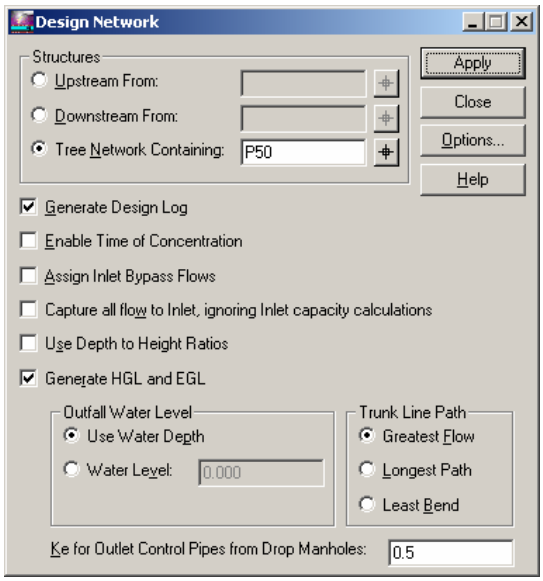
   Tree Network Containing: **Select any structure in the network**

   Generate Design Log: **On**

   Generate HGL and EGL: **On**

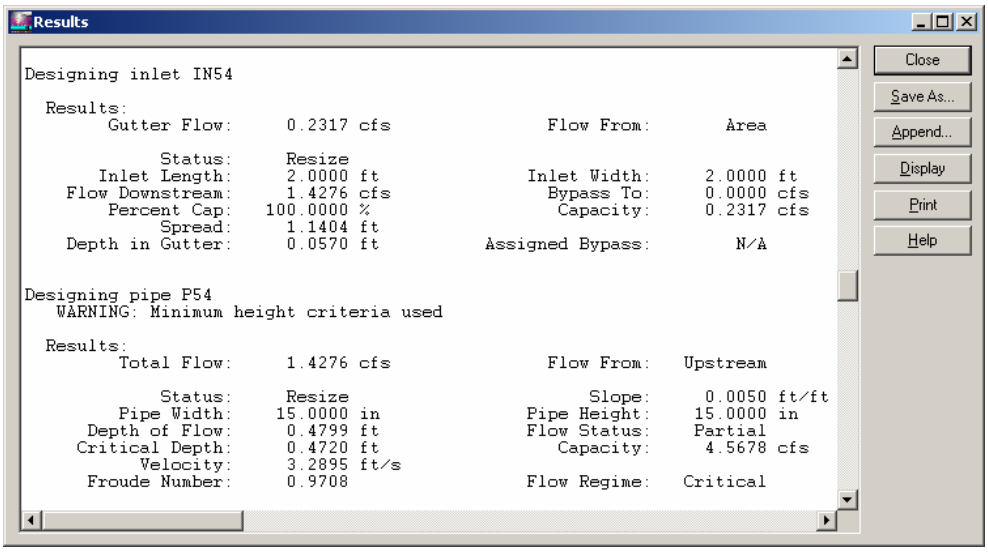
   Outfall Water Level: **Use Water Depth**

   Trunk Line Path: **Greatest Flow**



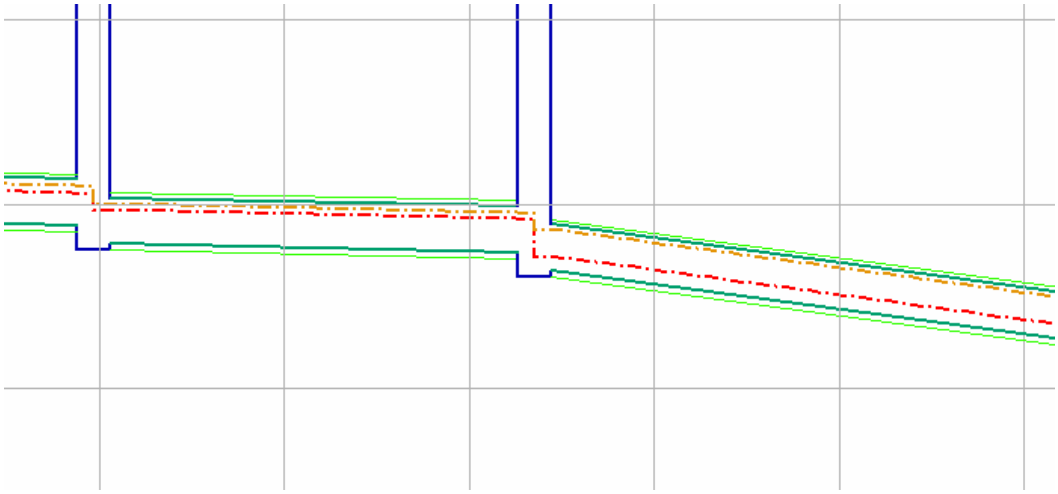
2. Select **Apply**. The network is designed, and the *Results* dialog displays the design log.

3. Review the design log to see the results, and to look for warnings.



4. Select **Close** on the *Results* and the *Design Network* dialogs.

5. Select **Evaluation > Profile > Create Profile** and create a new profile that will show the results of the design. All the settings should still be active from earlier, if not, go back to the section “Creating a Drainage Profile” for instructions.



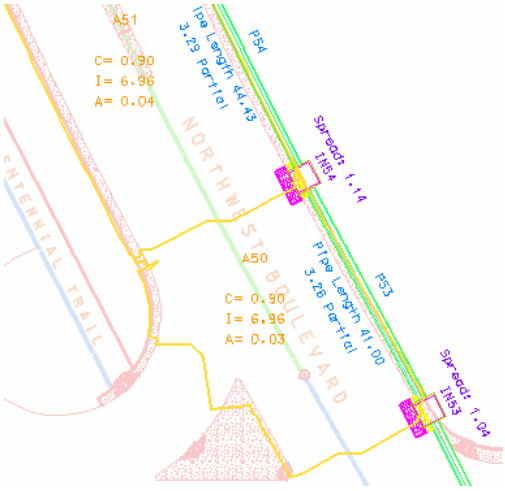
Note: This profile example was generated with a verticasl exaggeration of 5.

Annotating Structures and Drainage Profiles

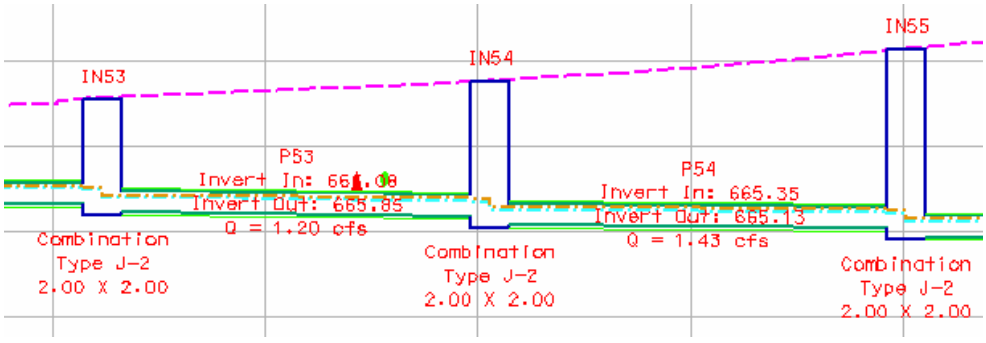
Demonstrates how to annotate structures and drainage profiles.

➔ **Exercise: With Style Lock turned on, every structure's annotation is controlled separately by the Style that is assigned to it. With Style Lock off, every structure is annotated as defined on the Annotate Structure dialog**.

1. For plan view annotation, select the **Drainage > View > Annotate Structures** command.
2. Set the **Structures for Annotation** to **Outfall** and use the locate button to identify the last structure in the network profile, **P59**.
3. Select **Apply** and the network structures in the plan view are annotated.



4. Select **Close** on the *Annotate Structures* dialog.
5. For profile annotation, select **Evaluation > Profile > Annotate Drainage Profile**.
6. On the *Annotate Drainage Profile* dialog, identify the profile to be annotated, select **Apply**, and then **Zoom In** to the profile to view the annotation.



7. Select **Close** on the *Annotate Drainage Profile* dialog.

Editing the Network

Demonstrates how to edit the network.

➔ **Exercise: If there are design changes to alignments or surfaces during the project that occur after the storm network has been placed, you can use the Move Network command to adjust the network to the new data. In this workshop, we are going to simulate a design change that necessitates lowering the roadway by a half a foot.**

1. Select **File > Open**, set the **Files of type** to **Surfaces (*.dtm)** and open the file **i90rev3.dtm**.

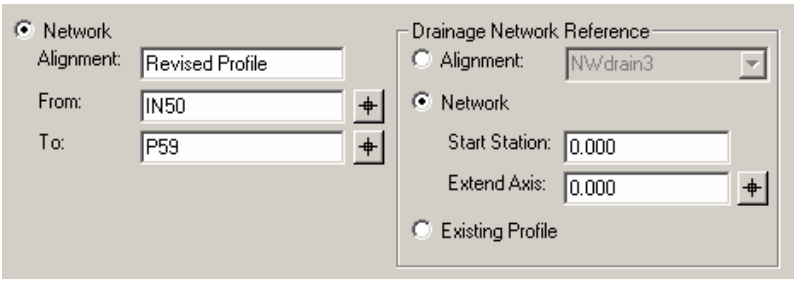
2. Select **Evaluation > Profile > Create Profile**, click on the **General** leaf and set the following settings:

   Set Name: **Revised Profile**

   Surface Object: **i90mrgol – On**

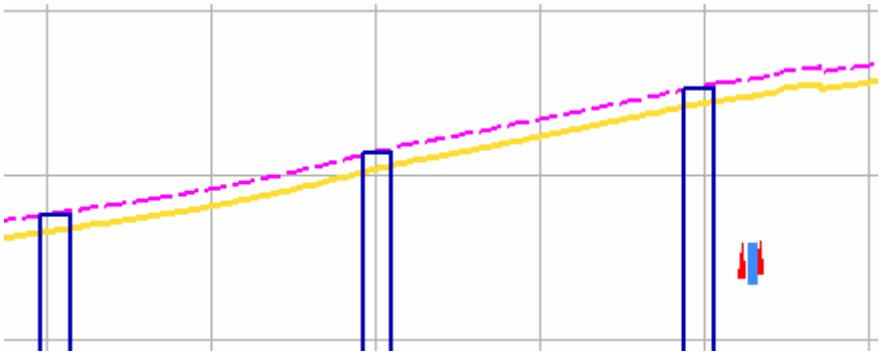
   i90rev3 - On

3. Click on the **Source** leaf, and verify or set the following settings:



4. Select **Apply** and create a new profile.

5. **Window Area** into the new profile. Notice that the rims of all the inlets need to be lowered to the new design surface.



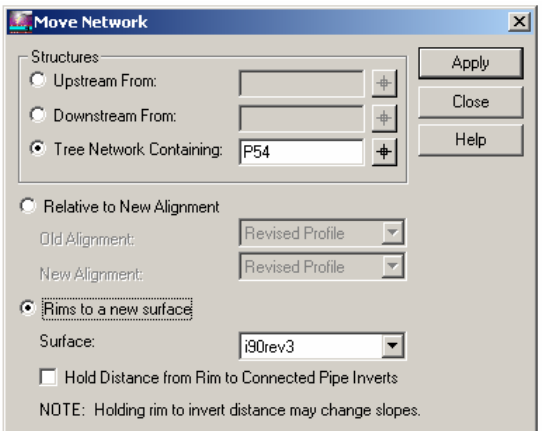
6. Select **Drainage > Network > Move**, and set the following settings:

   Structures: **Tree Network Containing**

   select any structure (from plan view)

   Rims to a new surface: **On**

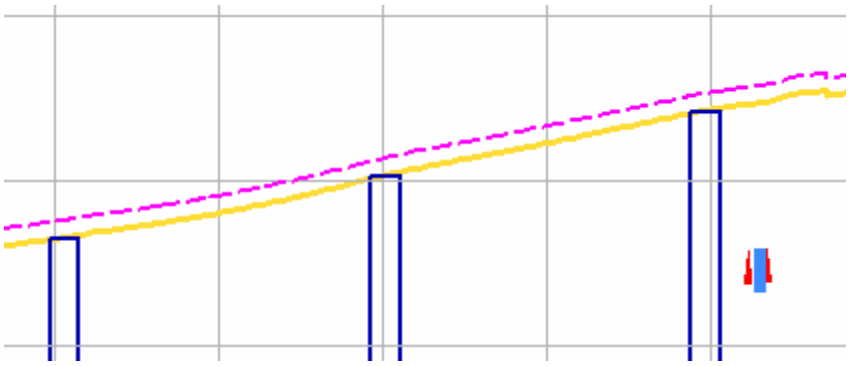
   Surface: **i90rev3**



Note: You have the option to move the pipe inverts down by the same distance as the rims by selecting the Hold Distance From Rim To Connected Pipe Inverts toggle. We won't do it in this exercise since we have no issues with our network violating minimum cover.

7. Select **Apply** and the elevations of the inlets are changed.

8. Run the **Evaluation > Profile > Update Drainage Profile** command. Make sure you select the **Revised Profile** set in the Profile Set list and select **Apply**.



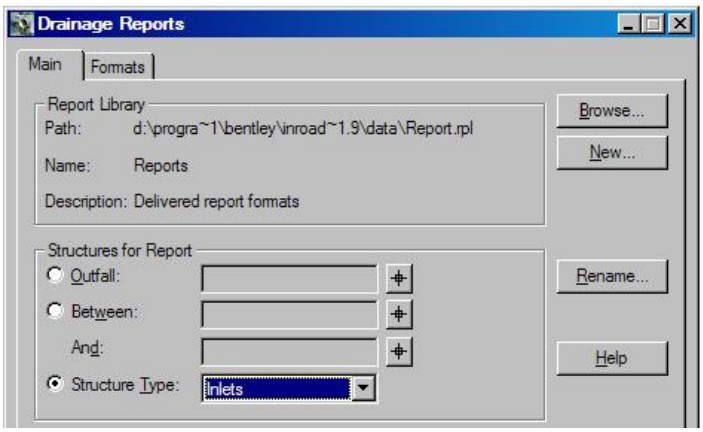
Notice all the inlet rims have now been adjusted to the new elevation.

Creating Custom Reports

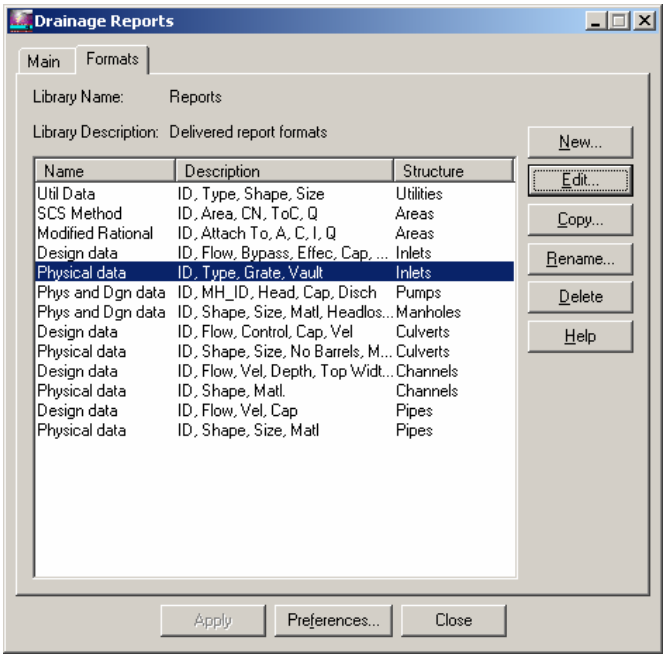
Demonstrates how to create custom reports.

➔ **Exercise: Working with the InRoads Storm & Sanitary Access database, we will easily create custom reports and queries on the database**.

1. Select **Tools > Drainage > Reports**.
2. On the *Drainage Reports* dialog, click the **Main** tab, click the **Structure Type** option and select **Inlets** from the pull-down list.



3. Click the **Formats** tab.
4. On the **Drainage Reports** dialog, from the list of report templates, under the **Structure** column, find **Inlets**. Select **Physical Data** and click **Edit**.



5. On the **Edit Report Format** dialog, in the upper portion of the **Report Data** section, set the following settings:

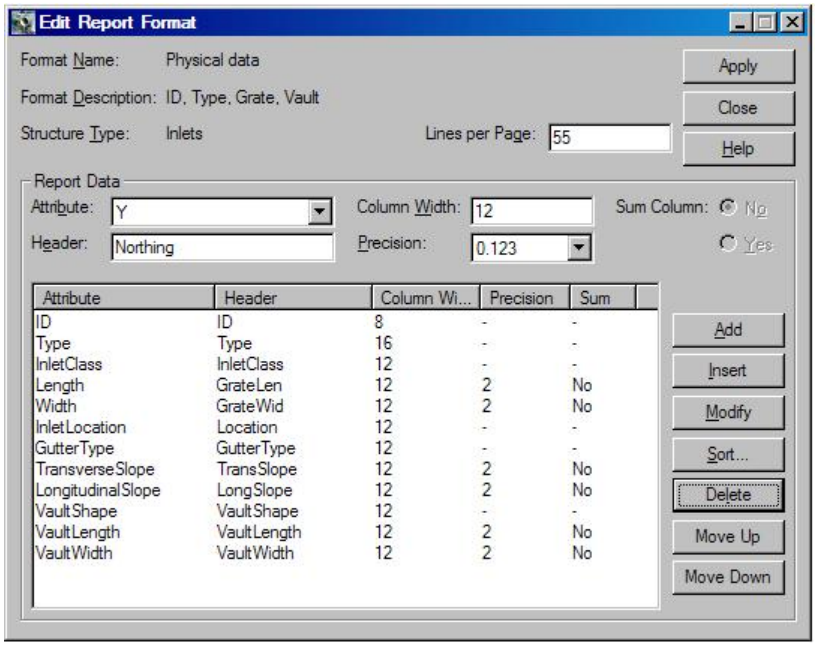
   Lines per Page: **55**

   Attribute: **Y**

   Header: **Northing**

   Column Width: **12**

   Precision: **0.123**



6. Select **Add** and scroll down to the bottom to see that attribute Y was added to the list of attributes to be included in the report.

7. Repeat the above with the following settings:

   Attribute: **X**

   Header: **Easting**

   Column Width: **12**

   Precision: **0.123**

8. Select **Add**.

9. Click the **Sort** button.

10. Highlight the **Y** attribute in the list view.

11. Click the **Move Up** button until the **Y** attribute is just below **ID**.

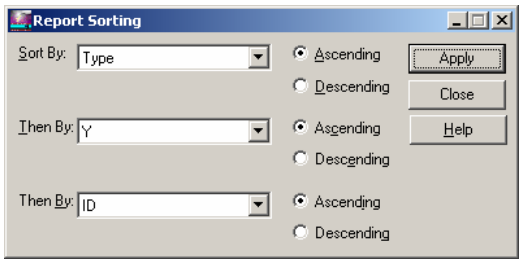
12. Do the same for the **X** attribute.

13. On the Report Sorting dialog, make the following settings.

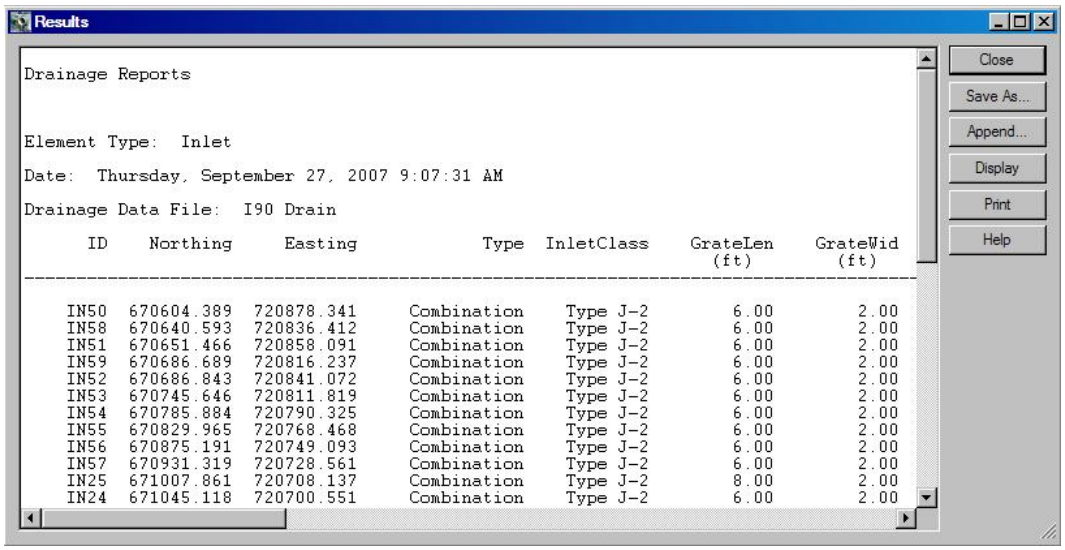
    Sort By: **Type** **Ascending**

    Then By: **Y** **Ascending**

    Then By: **ID** **Ascending**



14. Select **Apply**.
15. On the *Edit Report Format* dialog, select **Apply** and then **Close**.
16. Click the **Main** tab, make sure that the **Inlets** are set to **Physical data**. Select **Apply**.



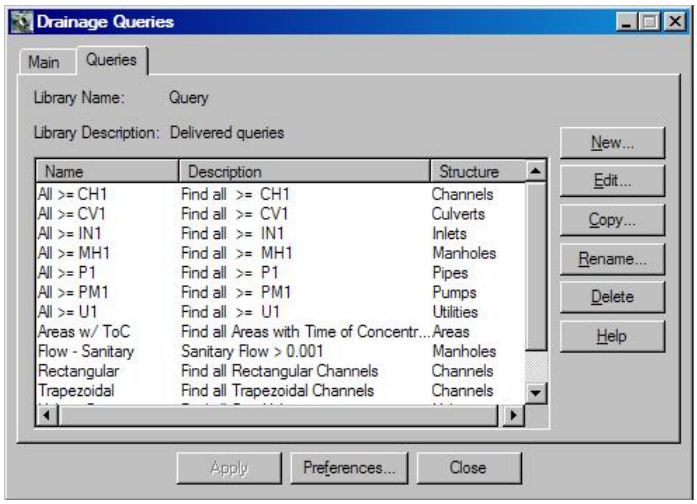
17. On the *Results* dialog, select **Save As** to save the report.
18. Click in the **File name** field and enter **inlet.txt**.
19. Select **Save**.
20. **Close** the *Results* and the *Drainage Reports* dialogs.

Executing Queries

Demonstrates how to execute queries to find structures that meet defined criteria.

➔ **Exercise: While working with a storm network, we will search the network to find structures that meet certain criteria. In this case, we want to highlight any pipes where the velocity is greater than 3 ft/sec.**

1. Select **Tools** > **Drainage** > **Queries**, and click the **Queries** tab.

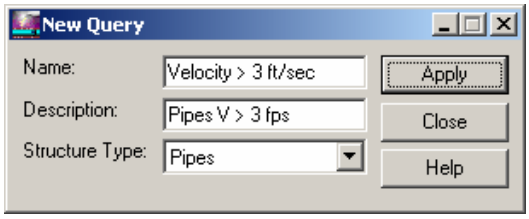


2. Click **New**, and set the following settings:

   Name: **Velocity > 3ft/sec**

   Description: **Pipes V > 3 fps**

   Structure Type: **Pipes**



3. Select **Apply**. The new query is entered into the list of existing queries.
4. Select the query **Velocity > 3 ft/sec** and select **Edit**.
5. On the *Edit Query* dialog, set the following settings:

   Attribute: **ID**

   Operator: >= (greater than or equal to)

   Value: **P1**

6. Click the **Add option** and then select the **Add button** to create the first entry in the query attribute list.

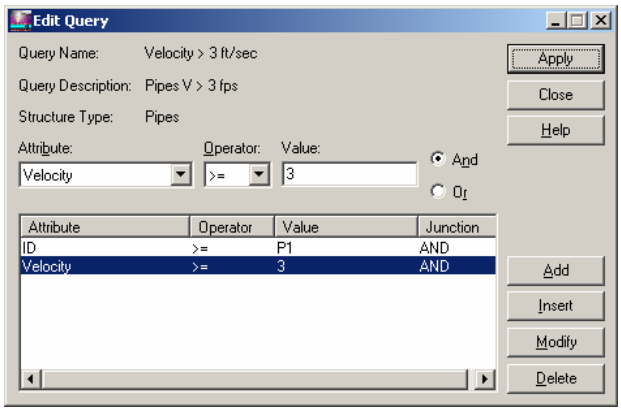
7. Create the second entry by setting the following values:

   Attribute: **Velocity**

   Operator: >= (greater than or equal to)

   Value: **3.0**

8. Click the **Add option** and then select the **Add button** to create the second entry.

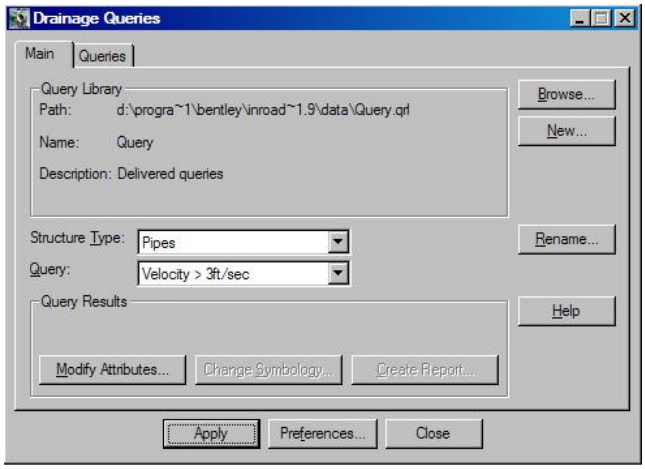


9. Select **Apply**, and then **Close**.

10. On the *Drainage Queries* dialog, click the **Main** tab, and make the following settings:

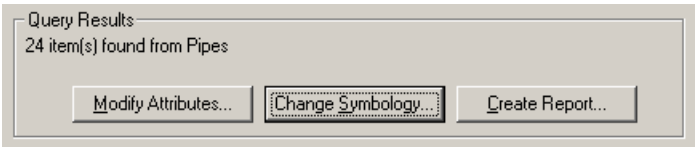
    Structure Type: **Pipes**

    Query: **Velocity > 3ft/sec**



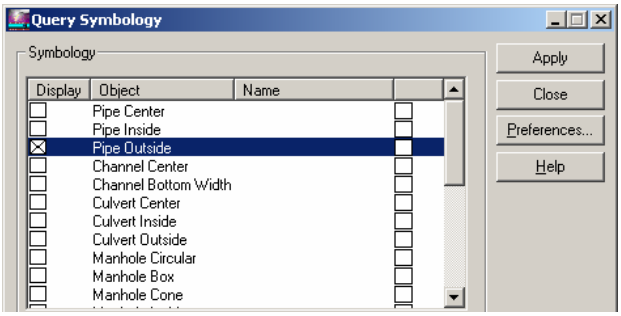
11. Select **Apply**.

12. In the **Query Results** section, the number of items that match the query is listed and the three buttons in that section become active.

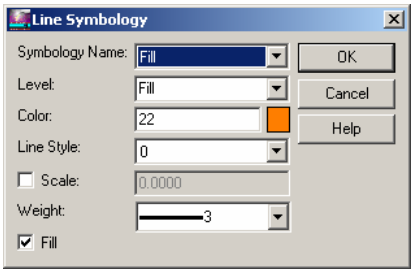


13. Select **Change Symbology**.

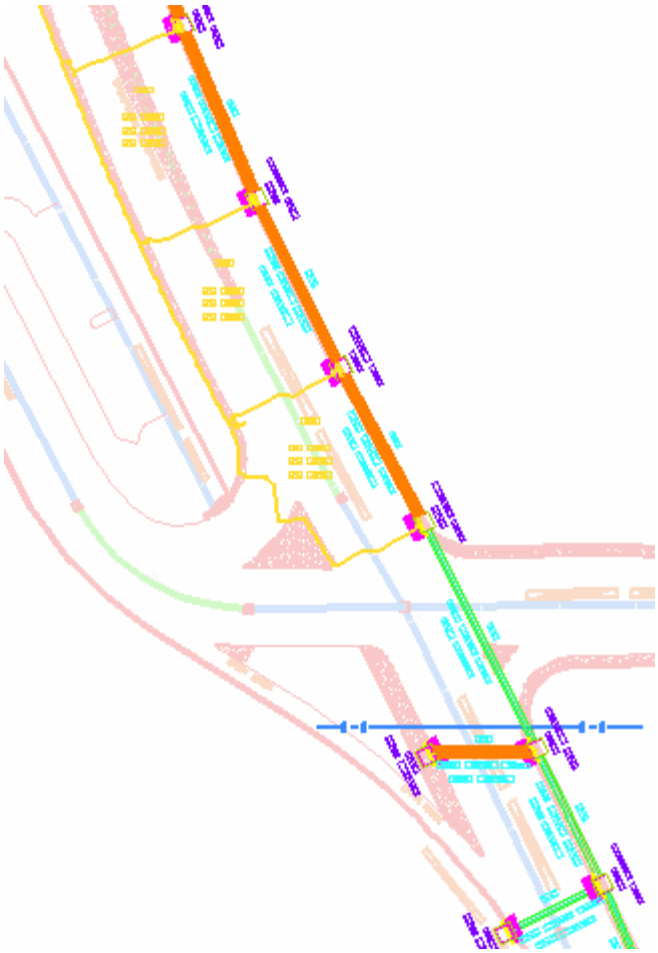
14. On the *Query Symbology* dialog, toggle everything *off*, toggle *on* **Pipe Outside**, double click on Pipe Outside to edit the symbology.



15. On the *Line symbology* dialog, click the **Symbology Name** pull-down and select **Fill** from the list. Select **OK**.



16. On the *Query Symbology* dialog, select **Apply** and then **Close**.



Notice that the pipes that have a velocity of 3 ft/sec or greater have a different symbology.

17. **Close** the *Drainage Queries* dialog.

Module Review

Now that you have completed this module, let's measure what you have learned.

Questions

1. Which command is used to define new standard structures?
2. When laying out a new structure like an inlet, manhole, or pipe, where does the user set the type of structure to be laid out?
3. The Trickle command displays a flow path on a surface from a cursor position. This command can be found under which pull-down menu?

   Surface
   Drainage
   Evaluation

4. Specifying the Northing, Easting, and Elevation of a new inlet can be accomplished only by placing a data point in the design file.

   True
   False

5. Plan annotation and profile annotation commands annotate only the highest invert into an inlet or manhole and the lowest invert out of the inlet or manhole.

   True
   False

Answers

1. Which command is used to define new standard structures?

   Answer: Tools>Drainage>Structures File

2. The Trickle command displays a flow path on a surface from a cursor position. This command can be found under which pull-down menu?

   Answer: Tools>Drainage>Options

3. The Trickle command displays a flow path on a surface from a cursor position. This command can be found under which pull-down menu?

   Answer: Evaluation

4. Specifying the Northing, Easting, and Elevation of a new inlet can be accomplished only by placing a data point in the design file.

   Answer: False, because you can also specify location by using the so= and xy= keyins in the MicroStation keyin window.

5. Plan annotation and profile annotation commands annotate only the highest invert into an inlet or manhole and the lowest invert out of the inlet or manhole.

   Answer: False, because these commands include a checkbox that allows you to annotate all the inverts at an inlet or manhole.

Module Summary

You are now able to:

- Define standard structures
- Lay out storm structures
- Create drainage profiles
- Design networks
- Annotate drainage networks
- Edit and update drainage networks
- Annotate and report design data