

# W13

# Storm Drainage Layout with InRoads Storm & Sanitary

XM Edition



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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.
- On the *MicroStation Manager* dialog, select the file C:\2007 IUTC\WS13-Storm Drainage Layout\drainage.dgn.

MicroStation Manager		
<u>File Directory H</u> elp		
Files:	Directories:	
drainage.dgn	\WS13-Storm Drainage Layout\	3D - V8 DGN
drainage.dgn	C:\ 2007 IUTC WS13-Storm Drainage Layout	
List Files of <u>Type</u> : MicroStation DGN Files [*.dgn] <u>Bead-Only</u> Show File <u>Leons</u>	Drives:	<u>Q</u> K Cancel
Workspace User Broject Interface	: Junitled The second sec	

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.

oninguration reame.	WS 13 Stom Drainage Layout	Apply
D.(		Close
Delaul Freierences		New
Preferences (*xin):	C:\2007 IUTC\WS13-Storm Drainage Layout\Civil WS13.xin	Copy
Tumouts (*.txt):		Rename
Drainage Structures (*.dat):	C:\2007 IUTC\WS13-Storm Drainage Layout\i_structures.dat	Delete
Rainfall Data (*.idf):	C:\2007 IUTC\WS13-Storm Drainage Layout\i_hydro.idf	Browse
Bridge Sections (*.bd):		Import
Drafting Notes (*.dft):	C:\2007 IUTC\WS13-Storm Drainage Layout\notes_ws13.dft	
Pay Items (*.mdb):		Export
		Help
Default Directory Paths	r	
Project Default Directory:	CA2007 ILITC\WS12 Stern Designed Laws 4	
Report Directory:	C:\2007 IUTC\WS13-Storm Drainage Layout	
	C. 2007 TO TO WO TO Storin Drainage Layour	
Projects (*.rwk):	C:\2007 II ITC\WS12-Storm Drainage Lavout	
Projects (*.rwk): Surfaces (*.dtm):	C:\2007 IUTC\WS13-Storm Drainage Layout	
Projects (*.rwk): Surfaces (*.dtm): Geometry Projects (*.alg.):	C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout	
Projects (*.rwk): Surfaces (*.dtm): Geometry Projects (*.alg): Temolate Libraries (*.itl):	C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout	
Projects (*.rwk): Surfaces (*.dtm): Geometry Projects (*.alg): Template Libraries (*.itl): Roadway Design (*.ird):	C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout	
Projects (*.rwk): Surfaces (*.dtm): Geometry Projects (*.alg): Template Libraries (*.tl): Roadway Design (*.ird): Survey Data (*.fwd):	C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout	
Projects (*.rwk): Surfaces (*.dtm): Geometry Projects (*.alg): Template Libraries (*.itl): Roadway Design (*.ird): Survey Data (*.fwd): Drainage (*.sdb):	C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout	
Projects (*.rwk): Surfaces (*.dtm): Geometry Projects (*.alg): Template Libraries (*.itl): Roadway Design (*.ird): Survey Data (*.fwd): Drainage (*.sdb): Style Sheet (*.ssl):	C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout C:\2007 IUTC\WS13-Storm Drainage Layout	

- 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.

Open					?×
Look in:	C WS13-Storm	Drainage Layout	•	+ 🗈 📸 🖬	
My Recent Documents Desktop	WS 13.rwk				
My Documents My Computer					
My Network Places	File name: Files of type:	WS 13.rwk Projects (*.rwk)		•	Open Cancel Help

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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.

👷 Drainage Structu	res File	
Structure Type:	ets 💌	Apply
Class	Description	Close
Туре 8 Туре 9 Туре К-4 Туре J-2		Help
New	Edit Sizes Edges	Delete

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

ype:		Combination										Apply
Le	Wi	Effectiv	Effectiv	Grate C	Perimet	Vaul	Vault Size	Plac	Max	Max	Spla	Close
2.00	2.00	2.00	2.00	0.00	100.00	Box	4.00 x 4.00 x	2.00	60.00	36.00	9.00 lr	Help
8.00	2.00	8.00	2.00	0.00	100.00	Box	4.00 x 4.00 x 6.00 x 4.00 x	2.00	60.00	36.00	11.00 lr	
•											F	

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.

New Size			
Length:	4.000	ft	Apply
<u>W</u> idth:	2.000	ft	Close
Effective Length:	4.000	ft	Help
Effective Width:	2.000	ft	
Grate Cover:	0.000	ft	
Perimeter Factor:	100.000	ft	
<u>V</u> ault Shape:	Box	-	
V <u>a</u> ult Length:	4.000	ft	
Va <u>u</u> lt Width:	4.000	ft	
Vault <u>T</u> hickness:	3.000	in	
Placement Offset:	2.000	ft	
Ma <u>x</u> Pipe on Length:	60.000	in	
Max <u>P</u> ipe on Width:	36.000	in	
Splash- <u>O</u> ver:	9.000	ft/s	
Point Style	Inlet Point	-	
Inside Style	Inlet Vault Inside	•	
Outside Style	Inlet Vault Outside	-	

**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.

Show Styles with Properties	Surface Properties		abling	Close
			ung	New
Include Geometry Point	Display Cross Section	Line Tab	ling	Edit
I Include Geometry Line	Display Profile	Arc Tabl	ing	
Include Geometry Arc	Pay Item	🗖 Spiral Ta	bling	Сору
				Conv Setting
Include Geometry Spiral	- Survey Properties			a sept second
Include Geometry Spiral	Survey Properties	L Attribute:	5	Delete
	CWS13-Storm Decinace Lavort		5	Delete Rename Help
eference File: C:\2007 IUT	C\WS13-Storm Drainage Layout	Civil_WS13.xin	S Numeric Code	Delete Rename Help
eference File: C:\2007 IUT	C\WS13-Storm Drainage Layout	Civil_WS13.xin Alpha Code	S Numeric Code	Delete Rename Help
eference File: C:\2007 IUT Name UTMENT SHOTS	CVWS13-Storm Drainage Layout Description WILDMH	Civil_WS13.xin Apha Code	S Numeric Code	Delete Hename Help
eference File: C:\2007 IUT Name 40 BUTMENT SHOTS rea	C\WS13-Stom Drainage Layout Description WILDMH	Civil_WS13.xin	S Numeric Code 140 0 0 0	Delete Rename Help Usurface Default Areas
eference File: C:\2007 IUT Name 40 butment BUTMENT SHOTS rea aniers/fences	C\WS13-Storm Drainage Layout Description WILDMH	Civil_WS13.xin	S Numeric Code 140 0 0 0 0	Delete Hename Help Surface Default Areas

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

Name: Pipe\_Center

Surface Feature: On

🌉 New Style		
Name: Pipe_Center	Description: Include Definition For Surface Feature Geometry Point Feature Geometry Line Feature Geometry Arc Feature Geometry Spiral Feature Survey Feature Attach Tag	

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** 

New Style		
Name: Pipe_Center New Style Symbology Surface Feature Symbology Geometry Feature Survey Feature	Pay Item Name:         3-D/Plan Display         Image: Points         Points         Image: Projected Line Segments         Projected Points         Crossing Points         Annotation         Crossing Points         Projected Line Segments         Projected Points         Projected Line Segments         Crossing Points         Projected Line Segments         Components         Projected Line Segments         Projected Line Segments         Crossing Points         Crossing Points         Projected Points         Crossing Points         Projected Points         Projected Ine Segments         Projected Ine Segments         Projected Ine Segments         Projected Ine Segments	

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

New Style			
Name: Pipe_Center	Symbology Name:	Pipe_Center_Proposed	
New Style General Symbology Surface Feature Settings Symbology Geometry Feature Survey Feature		New Ec	<u></u>

- **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**.

Drainag	e Option	S			
General Pump	Structu	ure IDs Pipe   Gutter Section	Channel Area	Culvert Zone	Manhole Design
Rainfall Di Rainfall <u>M</u>	ata: [( ethod: [	C:\2007 IUTC\WS13 IDF File	3-Storm Drain	age Layout\	i_hydro.idf Help
Frequency	r: [	10 💌 уг			
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

General Structure Pump Inlet	IDs Pipe Channel Cul Gutter Section Area Z	vert Manhole one Design
Drainage Structures:	IUTC\WS13-Storm Drainage Layou	t\i_structures.dat
Туре:	Combination	Help
<u>C</u> lass:	Type J-2 Type J-	2
Class Description:		
Grate Si <u>z</u> e (L <mark>x</mark> W):	6.00 x 2.00 • 6.00 x 2	2.00
Effective Grate Size:	6.00 x 2.00 6.00 x 2	2.00
Vaul <u>t</u> Shape:	Box	
Vault <u>S</u> ize (L x W x T):	4.000 x 4.000 x 4.000	ft x ft x in
Placement Offset:	2.000	
Grate Co⊻er;		
Perimeter Factor:	100.000 %	
Point Style:	Inlet Point	
Vault Inside Style:	Inlet Vault Inside	
Vault Outside Style:	Inlet Vault Outside	

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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%

Pipe Chann	el Culvert Multiple Iupotions	lanhole   Inlet
Curve Pipe	Multiple Junctions	Pipe by Slope
Junction Type	Inlet	Help
Alignment:	Northwest Blvd K	] +
Upstream Station:	0+00.000	+
Downstream Statio <u>n</u> :	3+53.700	+
<u>O</u> ffset:	14.250	ft
Placement		
	50.000	_ <b>⊕</b> ft
C Numbe <u>r</u> :	0.000	
Elevation		
C Absol <u>u</u> te:	0.000	ft
• Compute from St	urface: i90mrgol	•
Connecting Pipes -		
Add Connecting	<u>P</u> ipes	
By Slope	0.500%	C By Elevation
User Data Field:		न
	-	

- 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.

Drainage	Lay Out						x
Curve Pij	be	Mult	iple June	ctions	Pi	pe by Slope	1
Pipe	Chanr	nel	Culve	rt	Manhole	Inlet	
Inlet <u>I</u> D:	ſ	IN58				<u>H</u> elp	1
- Location-							
<u>N</u> orthing:	0.000			1			
<u>E</u> asting:	0.000		_	₽-			
Ele <u>v</u> ation:	0.000			ft.			
Conne	ct to Exis	ting Stru	ictures				

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**.

so=100,-8.1	- 野 現・	7
λ	💭 Drainage Lay Out	
T	Curve Pipe   Multiple Junctions   Pipe b Pipe   Channel   Culvert   Manhole	ySlope   Inlet
<del>+</del>	Inlet ID: IN59	Help
- <b>\</b> t	Northing: 670686.689	
	Elevation: 671.676 ft	

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

💭 Drainage Lay Out	
Curve Pipe   Multiple Junctions   Pipe by Slop Pipe   Channel Culvert   Manhole   Inle	
Pipe ID: P57 Help	
Upstream         Downstream           ID:         IN58         ♦           Notthing:         E70652.333	+] IN59
Easting: 720834.610	
Use Soffit Elevations	P57 SIN51
Invertin: 668.037     Invert Qut: 668.037     It	[N58
○ <u>S</u> lope: 1.586%	
Maximum Elevation: 668.388 ft	
Apply Styles Dptions Close	

- 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%

🔄 Drainage Lay Out	
Curve Pipe   Multiple Junctions   Pipe by Sl Pipe   Channel   Culvert   Manhole   Ir	
Pipe ID: P58 Hel	P58 1N52
Upstream         Downstream           ID:         IN59         IN52           Northing:         670685.796         670697.553	+ IN59
Easting: 720814.448	
<u>Use Sofit Elevations</u> Invert In: 669.030     ft	P57 \$1N51
O         Invert <u>0</u> ut:         668.813         ft           O         Slope:         1.000%         1.000%	[N58
	\$IN50
Minimum Cover: 1.515 ft	
Apply Styles Options Close	

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- 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

Drainage Lay Out	×
Curve Pipe Multiple Junctions Pipe by Slope	
Pipe ID: P59 Help	
Upstream Downstream	
Notthing: 670922.418 671038.890 720733.884 720748.300 +	P59
Lateral <u>C</u> onnection	
Use Soffit Elevations	
C Invertin: 663.186 r.	
C Slope: 2.441%	01N57
Inlet Elevation: 678.963 ft	P56
Apply Styles Options Close	

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:

Move Structure	_ 🗆 X				
Surface: i90mrgol	Apply				
Alignment: Northwest Blvd K 💌 🛨	Close				
Junction Track Surface for <u>E</u> levation	Preferences				
Track Alignment for Angle	<u>H</u> elp				
✓ Track Alignment for <u>O</u> ffset					
Move along Structure					
Connect to Existing Structure					
Structure C Hold Sjope    Hold Invert Elevat	ions				

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

reate Profile	Set Name: NWdrain	11		
General	Direction	- Exagge	eration	
Source	Left to Right	Vertical	2.0000	
Network	C Right to Left	Horizon	tal: 1.0000	
Controls	Surfaces:			
Grid	Object	Name		
Details	Default i90mraol	Default default		
ASCII			All	
			None	

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

Create Profile				
Create Profile	Create:	Window and Data	-	
General	C Alignment:	Northwest Blvd K	* +	
Include Network	C Graphics	-		
Offsets	C Making internet	NVVdrain 1		
Axes	Alignment:	NWdrain1		
Grid Details	C ASCII File			
ASCII	Network			- Drainage Network Reference
	Alignment:	NWdrain1		C Alignment: Northwest Blvd K
	From:	IN50	+	Network
	To:	P59	+	Start Station: 0+00.000
				Extend Axis: 0.000
				C Existing Profile

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.

Eneck Pipe Cover	_ 🗆 X
Profile Set:	Apply
NWdrain1 💌 🕈	
🔽 Generate Report	Llose
🔽 List All Pipes	Help
Cover along Pipe	
Interval: 10	
🔽 Surface Elevation	
Elevation at Bottom of Pipe	
Elevation at Top of Pipe	

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.

urrent minim	mum cover for pipes: 1.500	(ft)				Save As
urface: i9	Omrgol					Append
Pipe ID	Distance Down Pipe (ft)	Top of Pipe (ft)	Surface Elevation (ft)	Cover (ft)		Display
						Print
(P50)	0.000	669.417	670.839	1.422	*Minimum not met	Help
	20.000	669 317	670.885	1.498	*Minimum not met	
	30.000	669.267	670.957	1.690		
	40.000	669.217	671.203	1.986		
	46.768	669.183	671.224	2.041		
P51	0.000	668.683	671.252	2.569	*Least amount of	
	10.000	668.620	671.337	2.716		
	20.000	668.558	671.424	2.867		
	30.000	668.495 660 AFE	6/1.524	3.029		

- 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  $\langle \mathbf{D} \rangle$  point to locate the new position, and then  $\langle \mathbf{R} \rangle$  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**

- 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.

Pipe Length:	23.509	ft
Invert In:	669.030	ft
O Invert Out:	668.300	ft
C Slope:	3.106%	

- **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.

<unnamed></unnamed>	named> 💌 🐮 🧐 📎 🏏 🎢 🔤 🛶					
	= ID	Utility Name	X Dimension	Y Dimension	Shape	Reference Po
- Pipes -	↓ U1	Electrical	12.000	12.000	Triangle	Тор
🖌 Channels	<b>U</b> 2	Phone	15.000	15.000	Rectangle	Тор
Culverts	<b>U</b> 3	Electrical	12.000	12.000	Triangle	Тор
Manholes	<b>1</b> U4	Gas	10.000	10.000	Circle	Тор
- 🔁 Inlets	<b>U</b> 5	Electrical	12.000	12.000	Triangle	Top
Pumps 	∕ U6	Phone	15.000	15.000	Rectangle	Тор
Preferences 🗊 Drainage 🚺	- - -					

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.

```
Move Structure
                                                _ 🗆 🗙
<u>S</u>urface:
           i90mrgol
                                              Apply
                                •
Alignment: Northwest Blvd K
                               • +
                                              Close
 -Junction
                                          Preferences.
 ☑ Track Surface for <u>E</u>levation
                                                                                       IN52
                                              <u>H</u>elp
 ▼ Track Alignment for Angle
 ✓ Track Alignment for Offset
                                                                                                                    э –
    Move along Structure
 Connect to Existing Structure
 Structure

    Hold Invert Elevations

  O Hold Slope
```

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.

Misplay Source Areas		×
Surface: i90mrgol	•	Apply
Process Ponds		Close
		<u>H</u> elp

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**.
- 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.

IT I	Compute Flow		
	Modified Rational SCS Un	it Hydrograph	
	Area I <u>D</u> :	A50	Help
	Drainage <u>A</u> rea :	0.031	🕂 ac
IN57	<u>R</u> unoff Coefficient:	0.90	Compute
	• Time of <u>C</u> oncentration:	5.00	Compute min
	○ Intensity:	6.960	in/h
A LINES	Peak Flow:	0.196	cfs
	Attach <u>T</u> o:	IN53	+
P55			
00055			
16 MM			
P54			
INS4			
P63 [W53			
	Apply	Dptions	llose

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.

<unnamed></unnamed>	Ta 📚 🚳	💊 🏏 🗾	E					
		Attached To	Method	С	Intensity	Area	Peak Flow	Time o
- Pipes -	A50	IN53	Mod. Rational	0.900	6.960	0.031	0.192	5.000
	A51	IN54	Mod. Rational	0.900	6.960	0.037	0.232	5.000
	3 A52	IN55	Mod. Rational	0.900	6.960	0.037	0.231	5.000
	3 A53	IN56	Mod. Rational	0.900	6.960	0.037	0.231	5.000
	A54	IN57	Mod. Rational	0.900	6.960	0.041	0.257	5.000
Pumps								
	22							
Zones								
Utilities								

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.
- 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.

IN59	Attach To:         IN50         #           Storm Flow:         0.200         cfs	_ X
P57 [N51 [N58	Symbology Display Object Name Text	Preferences
IN50		<u>E</u> dit

- 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.

<unnamed></unnamed>	1 💐 🚳	🔨 🎽 💆 ·				
	= ID	Inlet Type	Inlet Class	Length	Width	Flow From
🗐 Drainage - 190 Drain	<ul> <li>IN50</li> </ul>	Combination	Type J-2	6.000	2.000	Injected Storm
Pipes	🚟 IN51	Combination	Type J-2	6.000	2.000	Injected Storm
Channels	🚟 IN52	Combination	Type J-2	6.000	2.000	Injected Storm
- Quiverts	🛋 IN53	Combination	Type J-2	6.000	2.000	Area
- B Manholes	🛋 IN54	Combination	Type J-2	6.000	2.000	Area
and the second s	🛋 IN55	Combination	Type J-2	6.000	2.000	Area
Pumps	🛋 IN56	Combination	Type J-2	6.000	2.000	Area
	IN57	Combination	Type J-2	6.000	2.000	Area
Zones	I IN58	Combination	Type J-2	6.000	2.000	Injected Storm
Utilities	IN59	Combination	Type J-2	6,000	2.000	Injected Storm

### **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

Design Network	>
Structures	Apply
C Upstream From:	
O Downstream From:	+ Ciose
Tree <u>N</u> etwork Containing: P50	+
	<u>H</u> elp
🗹 <u>G</u> enerate Design Log	
Enable Time of Concentration	
Assign Inlet Bypass Flows	
Capture all flow to Inlet, ignoring Inlet capaci	ty calculations
Use Depth to Height Ratios	
Generate HGL and EGL	
Outfall Water Level	Trunk Line Path
Use Water Depth	Greatest <u>Flow</u>
C Water Level: 0.000	C Longest Path
	C Least <u>B</u> end

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.

Results					_ 🗆 ×
Designing inlet IN54					Close
Recultor					Save As
Gutter Flow:	0.2317 cfs	Flow From:	Area		Append
Status: Inlet Length:	Resize 2.0000 ft	Inlet Width:	2.0000 ft		<u>D</u> isplay
Percent Cap:	1.4276 CIS 100.0000 %	Bypass IO: Capacity:	0.0000 crs 0.2317 cfs		<u>P</u> rint
Spread: Depth in Gutter:	1.1404 ft 0.0570 ft	Assigned Bypass:	N/A		<u>H</u> elp
Designing pipe P54 WARNING: Minimum he	eight criteria use	d			
Results: Total Flow:	1.4276 cfs	Flow From:	Upstream		
Status: Pipe Width: Depth of Flow: Critical Depth:	Resize 15.0000 in 0.4799 ft 0.4720 ft	Slope: Pipe Height: Flow Status: Capacity:	0.0050 ft/f 15.0000 in Partial 4.5678 cfs	t	
Velocity: Froude Number:	3.2895 ft/s 0.9708	Flow Regime:	Critical	-	
			<u> </u>		

- 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:

<ul> <li>Network Alignment:</li> </ul>	Revised Profile	- Drainage Network O Alignment:	Reference NWdrain3
From:	IN50 +	Network	
To:	P59 +	Start Station:	0.000
		Extend Axis:	0.000 +
		C Existing Profile	

- 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

Move Network			X
Structures C Upstream From: C Downstream From: Tree Network Containing:	 	+ + +	Apply Close Help
C Relative to New Alignment			
Old Alignment:	Revised Profile	7	
New Alignment:	Revised Profile	Ψ.	
Rims to a new surface			
Surface:	i90rev3	•	
🔲 Hold Distance from Rim to	o Connected Pipe Ir	nverts	
NOTE: Holding rim to invert	distance may chang	je slopes	

- **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.

Report Library	Browse
ath: d:\progra~1\bentley\inroad~1.9\data\Report.rpl	
ame: Reports	<u>N</u> ew
escription: Delivered report formats	
tructures for Report	
〕 <u>O</u> utfall:	<u>R</u> ename
Between:	

- 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

leport Format				
ame: Physical data				Apply
escription: ID, Type, Gra	te, Vault			Close
<u>T</u> ype: Inlets	L	ines per Pa <u>q</u> e	55	<u>H</u> elp
Data				
: Y	Column <u>W</u> i	dth: 12	Sun	n Column: 💿 Ng
Northing	Precision:	0.123	-	C Yes
te Head	ler Column	Wi Precis	ion Sum	_
ID	8	-	2	Add
Туре	16			
ss InletCl	ass 12	37-5		Insert
Gratel	en 12	2	No	
Grate	Nid 12	2	No	Modify
cation Locati	on 12	1.00		
ype Gutter	Type 12	-		<u>S</u> ort
erse Slope Trans	Slope 12	2	No	
dinalSlope LongS	hope 12	2	INO	<u>E Delete</u>
vaults vaults	onape 12	2	NIO	
idth VaultV	Width 12	2	No	Move Up
		2	140	Move Down
idth VaultV	Vidth 12	2	No	Mov

- 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

Report Sorting	
Sort By: Type	• Ascending Apply
	C Descending Close
<u>T</u> hen By: <mark>Y</mark> ▼	• Ascending <u>H</u> elp
	O Desc <u>e</u> nding
Then By:	Ascending
	O Descending

- 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.

Results								
Drainage	Reports						-	Close
brainage	Nepor vs						Sa	ve As
Element T	Nope: Inlet						Ap	pend
Date: Th	nursday, Sept	ember 27, 2003	7 9:07:31 AM				0	)isplay
Drainage	Data File:	190 Drain						Print
ID	Northing	Easting	Туре	InletClass	GrateLen (ft)	GrateWid (ft)		Help
IN50	670604.389	720878.341	Combination	Type J-2	6.00	2.00		
IN58 IN51 IN59	670651.466 670686.689	720836.412 720858.091 720816.237	Combination Combination Combination	Type J-2 Type J-2 Type J-2	6.00 6.00 6.00	2.00 2.00 2.00		
IN52 IN53	670686.843 670745.646	720841.072 720811.819 720790.225	Combination Combination Combination	Type J-2 Type J-2 Type J-2	6.00 6.00	2.00 2.00		
IN55 IN56	670829.965 670875.191	720768.468 720749.093	Combination Combination	Type J-2 Type J-2 Type J-2	6.00 6.00	2.00 2.00 2.00		
IN57 IN25 IN24	670931.319 671007.861 671045.118	720728.561 720708.137 720700.551	Combination Combination Combination	Type J-2 Type J-2 Type J-2	6.00 8.00 6.00	2.00 2.00 2.00	<b>-</b>	
4				.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0.00	•		

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.

lain Queries			
Library Name:	Query		
Library Description	Delivered queries		<u>N</u> ew
Name	Description	Structure 🔺	Eda
All >= CH1	Find all >= CH1	Channels	<u></u>
All >= CV1	Find all >= CV1	Culverts	Copy
All >= IN1	Find all >= IN1	Inlets	<u></u>
All >= MH1	Find all >= MH1	Manholes	Rename
All >= P1	Find all >= P1	Pipes	
All >= PM1	Find all >= PM1	Pumps	Delete
All >= U1	Find all >= U1	Utilities	
Areas w/ ToC	Find all Areas with Time of Concentr	Areas	Help
Flow - Sanitary	Sanitary Flow > 0.001	Manholes	
Rectangular	Find all Rectangular Channels	Channels	
Trapezoidal	Find all Trapezoidal Channels	Channels 👻	

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

Name: Velocity > 3ft/sec

Description: **Pipes V > 3 fps** 

Structure Type: Pipes

🌆 New Query		_ 🗆 🗵
Name:	Velocity > 3 ft/sec	Apply
Description:	Pipes V > 3 fps	Close
Structure Type:	Pipes 💌	Help

- 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.

🔙 Edit Query			_ 🗆 ×
Query Name:	Velocity > 3 ft/sec		Apply
Query Description:	Pipes V > 3 fps		Close
Structure Type:	Pipes		
Attri <u>b</u> ute: Velocity	<u>O</u> perator: Value: ▼ >= ▼ 3	• And 0 • 0	<u> </u>
Attribute	Operator Value	Junction	
ID Velocity	>= P1 >= 3	AND AND	Add
			Insert
			<u>M</u> odify
•		F	<u>D</u> elete

- 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

eries	
\progra~1\bentley\inroad~1.9\data\Query.qrl uery elivered queries	<u>B</u> rowse <u>N</u> ew
Pipes	<u>R</u> ename
	Help
	heres  horogra~1\bentley\inroad~1.9\data\Query.qrl uery elivered queries  Pipes 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.

Query 24 iter	y Results m(s) found from Pipes			
	Modify Attributes	Change Symbology)	<u>C</u> reate Report	

- 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.

🧸 Query S	ymbology			
- Symbolog	y			Apply
Display	Object	Name	<b>_</b>	Close
	Pipe Center			
	Pipe Inside			Preferences
$\mathbf{X}$	Pipe Outside			
	Channel Center			<u>H</u> elp
	Channel Bottom Width			
	Culvert Center			
	Culvert Inside			
	Culvert Outside			
	Manhole Circular			
	Manhole Box			
	Manhole Cone		] -	

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

Line Symbolo	×	
Symbology Name:	Fil	ОК
Level:	Fill	Cancel
Color:	22	Help
Line Style:	0	
🔲 Scale:	0.0000	
Weight:	3	
🔽 Fill		





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