North Carolina Department Of Transportation



# Instruction Manual For Geopak Drainage

3/12/09

# **Open Project**

- 1. Open the Microstation design file *Path*
- 2. Activate the **GEOPAK Drainage** tools within the Microstation file

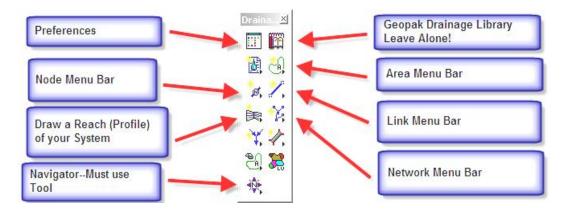
*Path*: Applications > GEOPAK Drainage > Drainage

3. Open the **GEOPAK DRAINAGE FILE** (GDF) from within the Microstation file.

*Path*: Drainage > Project > Open >

Note: You must remember to open your drainage project every time. If you don't you will lose that information.

# Open the Drainage Toolbar



# **Set Preferences**

When you start a new Geopak Drainage project, the first thing you have to do is set your **Preferences**. Preferences can be found on the main Drainage toolbox (upper left box) or under **Drainage> Project> Preferences**.

Once you have opened the Preferences, you need to:

## Select your units:

Preferences - Units		_ 🗆 X
Options         Units         Project Components         Rainfall Parameters         Land Use Options         Frequency Options         Intensity Option         Junction Losses         Inlet Options         Node Options         Link Options         Profile Options         Plan Symbology         Updates         Save Options	<ul> <li>English</li> <li>Drainage Area = Acres</li> <li>Length = Feet</li> <li>Dimension = Feet</li> <li>Depth = Feet</li> <li>Discharge = Cubic Feet per Second</li> <li>Velocity = Feet per Second</li> <li>Intensity = Inches per Hour</li> </ul>	● Metric Drainage Area = Hectares Length = Meters Dimension = Meters Depth = Meters Discharge = Cubic Meters per Second Velocity = Meters per Second Intensity = Millimeters per Hour

# Fill in your project components:

SPreferences - Project Co	omponents	_ 🗆 🗙
Options	Drainage Library File (DLB): c:\ncdot_v8_workspace\hydraulics_	Q
Units Desired Company and	GPK Job Number: 101 Q Road Prefere	nces
Project Components Rainfall Parameters	Drainage Cell Library: C:\NCDOT_V8_WORKSPACE\hydr	Q
Land Use Options	Criteria Directory:	Q
Frequency Options Intensity Option	GEOPAK DDB:	Q.
Junction Losses	Water and Sewer Project:	Q
Inlet Options Node Options		Q
Link Options	Superelevation Shapes File: u2702_rdy_shp_lshp.dgn	
Profile Options Plan Symbology	GEOPAK Site Project:	<u>م</u>
Updates Save Options	TIN File W:\V8_test_area\U2702Test\dtm\u	۹
	Design Surface	
OK Cancel		۹

The path to the Drainage Library file is: C:\NCDOT\_V8\_WORKSPACE\hydraulics\_STDS\English \gepak\dlb\englib.dlb

The path to the correct cell library is: C:\NCDOT\_V8\_WORKSPACE\hydraulics\_STDS\Standards\cell \Hydraulics.cel

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Make sure you pick the RDY gpk file.

You can pick the shape file, but roadway tends to make multiple shape files, one for each chain. Also, I haven't had much luck with shape files anyway.

## **Rainfall Parameters:**

<mark>8</mark> Preferences - Rainfall P	arameters	
<u>Fi</u> le		
Options         Units         Project Components         Rainfall Parameters         Land Use Options         Frequency Options         Intensity Option         Junction Losses         Inlet Options         Vode Options         Profile Options         Plan Symbology         Updates         Save Options	Rational Method Rainfall Source: Mecklenburg SCS Method Rainfall Source: None Available Antecedent Moisture Condition I Antecedent Moisture Condition II Antecedent Moisture Condition III Hydrograph Time Interval: 0.000	

#### Rational Method:

We created an IDF curve data for each of county using data from the NOAA website.

SCS Method:

## Land Use Options:

🔗 Preferences - Land Use Op	tions	_ 🗆 X
Options Units Project Components	Rational Method     Single Land Use Item: Sample Land Use     Multiple Land Use Item:	_
Rainfall Parameters Land Use Options	Land Use Item Level Color Weigh Style	
Frequency Options Intensity Option Junction Losses Inlet Options	Sample Land Use Symbology:	
Node Options Link Options	SCS Method Single Land Use Item: Sample Land Use	
Profile Options	O Multiple Land Use Item:	_
Plan Symbology Updates Save Options	Land Use Item Level Color Weigh Style	]
OK Cancel	Sample Land Use Symbology:	

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I have added a NCDOT landuse option. Mike has put landuse levels on the toolbar with the other drainage areas. You have to draw your main drainage area, then if you choose use the landuse shapes to create your composite C value.

## **Frequency Options:**

Options	
Units       Drainage Library (DLB):\english\geopak\dlb\englib.dlb         Project Components       Rational Frequency Options         Land Use Options       Computation         Intensity Option       10 Year         Junction Losses       10 Year         Inlet Options       SCS Frequency Options         Link Options       Cumulative         Profile Options       Cumulative         Profile Options       1.0000         Plan Symbology       1.0000         Updates       Save Options	
OK Cancel	

Most times you will select the 10 year for the **Computational Frequency**. You will design the network or system with the 10 year. If you want to check for a different frequency storm, but don't want to change the pipe size, you can do that.

# **Intensity Options:**

😤 Preferences - Intensity	Option
<u>Fi</u> le	
Options Units Project Components Rainfall Parameters Land Use Options Frequency Options Intensity Option Junction Losses Inlet Options Node Options Link Options Profile Options Plan Symbology Updates Save Options OK Cancel	Drainage Library (DLB):\english\geopak\dlb\englib.dlb         Minimum Time of Concentration:       10.0000         Accumulate Pipe Flow Time by:       Full Flow Velocity         Intensity Options       Intensity Options            © Compute Intensity from Library Rainfall Data Source       Absolute Intensity:            Weight Time of Concentration          Inlet Computation Only            M Absolute Intensity:            Absolute Intensity:

• Per our **Guidelines**, you will use a minimum time of concentration of **10 minutes**.

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- You should get your pipe time by: Full Flow Velocity.
- Use the **Compute Intensity from Library Rainfall Data Source** for the Intensity Option.
- Inlet computation should be checked on and use 4 in/hr.

## **Junction Losses:**

Use **Method 2** for your Junction Loss computations. (Bend, Simple & Complex)

SPreferences - Junction	losses			
Options	🗖 Disable	e All Junction Loss Comput	tations	
Units Project Components	Loss Ve	elocity: Actual 💌		
Rainfall Parameters		Description	Loss Coefficient - K	
Land Use Options Frequency Options		Pressure Expansio	on: 0.3000	
Intensity Option Junction Losses	+	Free Surface Expansion	on: 0.1000	
Inlet Options	÷	Pressure Contraction	on: 0.5000	
Node Options Link Options	‡≓	Free Surface Contraction	on: 0.3000	
Profile Options Plan Symbology	\$#	Bend Lo	ss: Method 2 💌	
Updates Save Options		Terminal Inlet/Junction	on: 1.0000	
	÷	Simple Junctio	on: Method 2 💌	
OK Cancel	¥ <u></u> Ţ=	Complex Junctio	on: Method 2 💌	

- Method 1 is Modern Sewer Design
- Method 2 is AASHTO

# **Inlet Options**

😤 Preferences - Inlet Opti	ons
Options Units Project Components Rainfall Parameters Land Use Options Frequency Options Intensity Option Junction Losses Intel Options Inlet Options Link Options Profile Options Plan Symbology Updates Save Options	Inlet By Pass Options: By Pass as Total Discharge  Link By Pass Flow Options: Do Not Allow Inlet By Pass in Link Discharges  Default Spread n Value: 0.0150 Extend Superelevation Shapes to Inlet at Shape Slope
OK Cancel	

- Per our **Guidelines**, Inlet By Pass should be treated as the **"Total Discharge"**.
- The Link By Pass Flow should be set as **"Do Not Allow Inlet By Pass in Link Discharges"**

# **Node Options:**

<b>8</b> Preferences - Node Opti	ons	
Eile		
Options		
Units	Default Node ID Prefix:	
Project Components Rainfall Parameters	Scale Node Cells Scale Factor: 1.0000	
Land Use Options	Minimum Freeboard: 0.5000	
Frequency Options Intensity Option		
Junction Losses		
Inlet Options		
Node Options		
Link Options Profile Options		
Plan Symbology		
Updates		
Save Options		
OK Cancel		

Set you Minimum Freeboard to 0.5 per our Guidelines.

# **Link Options:**

SPreferences - Link Optic	ons	_ 🗆 >
Options Units	Default Link ID Prefix:	
Project Components Rainfall Parameters	Design Optimization: Minimize Depth of Cover	
Land Use Options Frequency Options	Elevation Option:at Hydraulic Center	
Intensity Option Junction Losses Inlet Options	<ul> <li>Design for Maximum Capacity</li> <li>Design for Full Capacity</li> </ul>	
Node Options Link Options	Design Partial Capacity (d/D) Ratio: 1.0000     Design Partial Capacity (q/Q) Ratio: 1.0000	
Profile Options Plan Symbology Updates	Link Slope Decimal: 3	
Save Options	Link Criteria File	
OK Cancel	Hydraulic GradeLine Options Hydraulic Gradeline Basis: Equal Hydraulic Gradeline 💌	

- We want to design pipe by using the "Minimize Depth of Cover" option
- Set the Elevation Option to "at Hydraulic Center"
- Choose the Link Design Option of **"Design for Full** Capacity"
- This option agrees with the design criteria in our Guidelines

# **Profile Options:**

Options         Units       Default Profile ID Prefix:         Project Components       Create Cogo Chains and Profiles         Rainfall Parameters       Enter Cogo Chains and Profiles	Preferences - Profile Op	tions	_ 🗆 ×
Land Use Options Frequency Options Intensity Option Junction Losses Inlet Options Node Options Link Options Profile Options Plan Symbology Updates Save Options OK Cancel	Units Project Components Rainfall Parameters Land Use Options Frequency Options Intensity Option Junction Losses Inlet Options Node Options Link Options Profile Options Plan Symbology Updates Save Options		

• Leave boxes unchecked

# **Plan Symbology:**

🔗 Preferences - Plan Sym	bology				_ 🗆 🗙
<u>Fi</u> le					
Options		Plan View Par	ameters		
Units	Component	Linear	Text	Label	
Project Components Rainfall Parameters	Areas:		Sample		
Land Use Options	Pipes:		Sample		
Frequency Options Intensity Option	Ditches:		Sample		
Junction Losses	Culverts:		Sample		
Inlet Options Node Options Link Options	Nodes —	Set Node	Cell Symbology		1
Profile Options	Inlets:		Sample	V	
Plan Symbology Updates	Junctions:		Sample	◄	
Save Options	Outlets:		Sample	$\checkmark$	
	Other:		Sample	<b>v</b>	
OK Cancel	Headwall:		Sangle		

• Set the pipes to the default level, color 9, line style 0, and you can choose the line weight.

# Updates :

Options		
Options Units Project Components Rainfall Parameters Land Use Options Frequency Options Intensity Option Junction Losses Inlet Options Link Options Profile Options Plan Symbology Updates Save Options OK Cancel	<ul> <li>Automatic Link Updates on Node Relocations</li> <li>Automatic Update Area data on Network Design</li> <li>Automatic Update Node data on Network Design</li> <li>Automatic Update Link data on Network Design</li> <li>Automatic Update Profiles on Network Design</li> <li>Automatic Update Network on Profile Edit</li> </ul>	

• All the updates should be turned on

# **Save Options:**

SPreferences - Save Options	;	
Options		
Units	Automatically Save Drainage Updates	
Project Components	Automatic Backup	
Rainfall Parameters Land Use Options		
Frequency Options	🗖 Automatic Save: <u>5 Minute</u> 🔽	
Intensity Option		
Junction Losses		
Inlet Options Node Options		
Link Options		
Profile Options		
Plan Symbology		
Updates Save Options		
Save options		
OK Cancel		

Turn on the "Automatically Save Drainage Updates" option.

# NODES

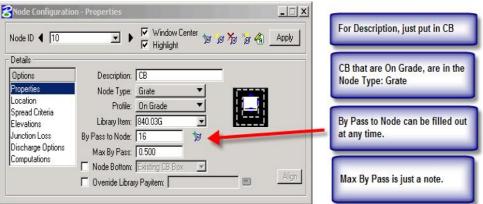
## **Placing Nodes:**

1. Open the **Navigator** tool (Drainage: Utilities > Navigator) ----You can also reach most tools from the Main Drainage Toolbar

<b>8</b> Navigator	
View Tools	
$\mathbf{X}$	📀 🤟 💆 🖊 🛤 🥢
ID	Description 🔺
1	
2	Open End □ □ DI11 □ JB 12 □ DI13 ↓
2 3 4 5 6	JB 12 🗸 🗸
4	DIVIS
5	DI100 D
6	CB14
7	OPEN END15 📃
🔲 Highlight	🗌 Window Center 🛛 🔲 Query
	Draina $\boxtimes$ Image: Second symptotic symptot symptotic symptotic symptotic symptot symptotic symptotic sympto

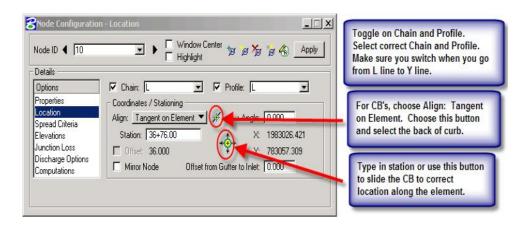
- 2. Click on the Node button from short-cut tools at the top of the Navigator.
- 3. Click Add Item (right side of the list box)
- 4. Enter the Properties Information

For a Catch Basin.

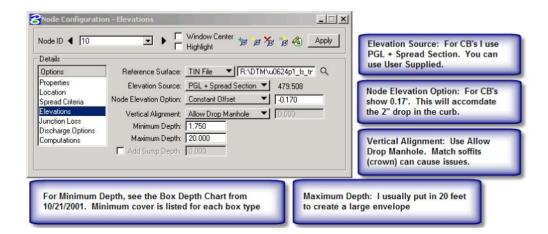


## **Catch Basins on Grade**

After you get several nodes placed you can start filling in the "By Pass to Node" box. Select or input the box that this box (in this case Box 10) will bypass to. If the CB happens to be the last one in line then there will not be a box for it to bypass to. This will give you a warning message when you run your system. It is not an error, it is just a message.



Node ID 4 10	n - Spread Criteria for On Grade	In most cases, Reference PGL is the best choice. Make sure you have the right Profile
Details Options Properties Location Spread Criteria Elevations	Longitudinal Slope Source:       Reference PGL ▼ 5.345         Spread Cross Section       Spread Source:         Width % Slope Roughness       Maximum         2.000       6.000       0.015         34.000       2.000       0.015	Spread Source: You can use the library I built to get started. Then go back to User Supplied to modify the widths. You build from curb face to the Center line.
Junction Loss Discharge Options Computations	34.000 2.000 0.015 Pond Depth: 0.500 26.000 2.000 0.015 Pond Width: 25.000	Pond Depth and Pond width are used as checks. They do not control the design.

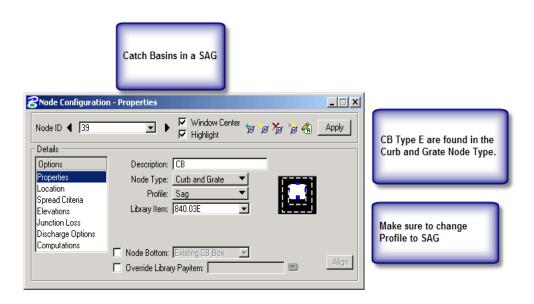


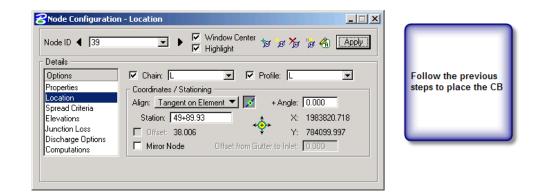
Before going to Computation "page", add your drainage area.

8Node Configuration - J	unction Loss	
Node ID  TO Totails  Details  Properties Location Spread Criteria Elevations Junction Loss Discharge Options Computations	Window Center Highlight Defined Equations Equations x Loss Reduction: Absolute Loss: Supplied K - Outlet Velocity: Supplied K - Change in Velocity: None	Add your Drainage area to your CB Node before going to computions.

8Node Configuration	n - Computations
Node ID ┥ 🔟	▼ ► Vindow Center 10 10 70 10 4 Apply
Details	
Options Properties Location Spread Criteria Elevations Junction Loss Discharge Options Computations	Discharge = 1.5649 Spread Width from Gutter = 4.8767 Total Ponded Width = 4.8767 Ponded Depth = 0.1775 Spread Left Intercept = 0.0000 Spread Right Intercept = 4.8767 Grate Length = 3.0000 Grate Vidth = 2.0000 Grate Capacity = 1.2703 ByPass Flow = 0.2940 Efficiency = 0.8121



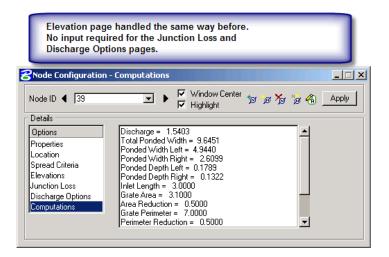




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Node ID ┥ 39	<u>_</u>	v ♥ H ♥	√indow Center Iighlight	to 1	ø 🎢 🝺 🏟 🛛 Apply	Set the % Slope Left and Right Generally we will use 0.3%
Details	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Slope Left:	4.000 F	Right:	0.300	
Options				101703000	A CONTRACT OF A	
Properties Location	C Spread Cro	charge Left:   ss Section: urce: <u>User S</u>		Right:	10.000	Estimate the % Discharge Lef
Properties Location Spread Criteria	C Spread Cro	ss Section: -		Right:	Maximum	Estimate the % Discharge Lef and Right
Properties Location Spread Criteria Elevations	- Spread Cro Spread Sou	ss Section: – urce: <u>User S</u>	Supplied	Right:		
Properties Location Spread Criteria Elevations Junction Loss Discharge Options	Spread Cro Spread Sou Width	ss Section: – urce: <u>User 9</u> % Slope	Supplied Roughness	_ _	Maximum	



## DI's and 2GI's

DI's and 2GI's are handled just like CB's. DI's and 2GI's that are against curbs or island will have similar spread criteria as a CB. The DI's and 2GI's will also have bypass if on a grade.

If the DI's and 2GI's are in a yard, I usually say that the box is in a sag. This way I don't have to worry about bypass. I build a ditch here with a steep front slope and a flat back slope. This is for a rough estimate only. These ideas are up for discussion.

## Remember to add your drainage areas.

# For DI's and 2GI's in a ditch

If the ditch has a false sump in it, then choose the Profile: Sag option. If you are going to use false sumps then you will want to enter the By Pass to Node data.

Node ID ┥ 200	Vindow Center 📁 🖉 🍃 🦓 Apply	Used the Library Item as the spread source and chose the 5:1 ditch option. If you need to modif
Details	Longitudinal Slope Source: Reference PGL 💙 5.058	the ditch dimensions, toggle it
Options	Spread Cross Section	back to User Supplied.
Properties Location	Spread Source: Library Item	
Spread Criteria	Width % Slope Roughness	
Elevations	20.000 -20.000 0.045 Maximum	Notice how the ditch has both
Junction Loss	20.000 20.000 0.045 Pond Depth 0.500	a positive and negative
Discharge Options Computations	26.000 2.000 0.015 Pond Width: 25.000	slopes to create the ditch.

<b>8</b> Node Configuration	n - Elevations		_ 🗆 🗙	
Node ID ┥ 200		Window Center 🍗 🍺 🏂 Highlight	r 🝺 🍓 🛛 Apply	Elevation Source: Choose the User Supplied option for
Details				the top of box elevation.
Options	Reference Surface:	TIN File 🔻 R:\DTM\u	10624p1_ls_tr 🔍 👘	
Properties Location	Elevation Source:	PGL + Spread Section 🔻	490.834	
Spread Criteria	Node Elevation Option:	Same as Source 🔹 💌	490.834	
Elevations	Vertical Alignment:	Allow Drop Manhole 🛛 💌	0.000	Minimum cover is different
Junction Loss Discharge Options	Minimum Depth:	1.920		for each type of 2GI and for both types of DI's.
Computations	Maximum Depth:	20.000		for bour types of bils.
ľ	🔲 Add Sump Depth:	0.000		

# SAGS INLETS in GEOPAK DRAINAGE

Geopak Drainage handles inlets in a sag a little different than Flowmaster.

Flowmaster asks for a % clogged. We usually use 50%.

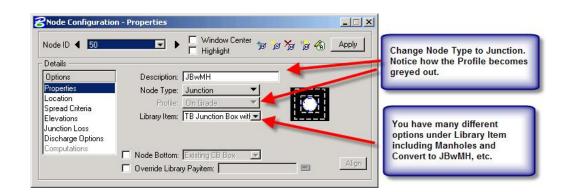
Geopak Drainage asks for an area reduction and a perimeter reduction. This was tested against Flowmaster. The area and perimeter reductions were adjusted to match the results found in Flowmaster.

Geopak Drainage Definitions

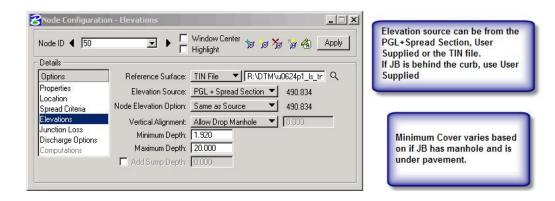
Ponded Width Right: Pnded Depth Left:	Spread calculated just before the inlet on the left side Spread calculated just before the inlet on the right side Depth calculated just before the inlet on the left side Depth calculated just before the inlet on the right side
Total Ponded Width:	Spread Calculated at the inlet based on the depth. The depth is determined by weir or orfice equation,

whichever is greater.

# Junction Boxes and Manholes



Node Configuration - Spread Criteria for On Grade     Image: Configuration - Spread Criteria for On Grade       Node ID     50     Image: Configuration - Spread Criteria for On Grade       Highlight     Image: Configuration - Spread Criteria for On Grade     Image: Configuration - Spread Criteria for On Grade	
Details       Longitudinal Slope Source:       Reference PGL ▼ 5.068         Options       Spread Cross Section         Properties       Spread Cross Section         Location       Spread Cross Section         Spread Criteria       Spread Cross Section         Elevations       Width % Slope         Junction Loss       Discharge Options         Computations       26.000       0.015         Pond Width:       25.000	Making sure you have the Reference PGL selected and filling out the Spread Criteria will help you find you top elevation.



You can put in a drainage area for JB's if you are tying into an existing drainage system. It just won't have computations.

## **Other Drainage Structure or Nodes**

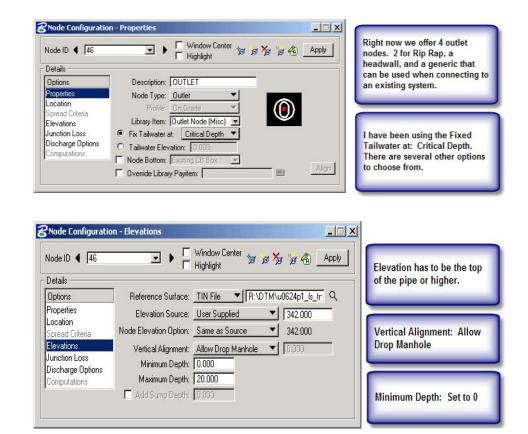
Most other drainage structures have been added to the drainage library and follow a similar pattern.

OTCB are located under the **Curb** Node Type. I set it up for the number of sides you could have open.

Under the **Other** Node Type you have collars, open end pipes, etc. The tops of these nodes should either at least the top of the pipe. You can control the invert in the links for these items.

## Outlets

The way Geopak handles an outlet is awkward. Because the outlet is a node, you have to put in a top elevation. We would rather put in the invert out elevation. So, you have to estimate the pipe size add at least a couple of inches to it and run it. You can adjust the final elevation in the **Link Conditions**.



# AREAS

Area ID: ┥ 🔽		Window Center 🐁 を	🖌 🔒 🗛	Draw a Drainage Area
Details Options Definition	Description:	To Node	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Use Select Shape Option to choose the drainage area
Subareas Computation	Drainage Area: 2.948 Base C Value: 0.900 Time of Conc.: 12.711	- Area Selection / Crea Select Shape	Create DTM Shape	Pick your base C value. I usually use 0.9
Hydro. Method Rational SCS	Compute TC	Pick Boundary Elements	DP Create Shape	Time of C: I usually put in 5 min for a CB. For off site "Compute TC" works good.

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# COMPUTE TC

**Compute TC** seems to work pretty well. The better your tin files are the better results you will get. Most of us will not have proposed DTM so this option will not as well for CB as it will for DI's picking offsite drainage. You can also use this tool any time you need a time of concentration as long as you have DTM coverage.

Concentration	
Drainage Area ID: 200	Choose your TIN file
Define Path ID - Segments	Use ID - Segments. Left click to ID the segment. Right click if you don't want to use an option
Sheet Flow	like Concentrated flow.
Method: FHA Length: 168.240	
n Value: 0.150 Slope: 2.498	
Shallow Flow	Make sure the boxes are check for the flows you want to use. The coefficients can
Inter. K: 0.150 Slope: 1.847	be found in the tables below.
Concentrated Flow	
Method: Continuity V Length: 0.000	
Velocity: 0.000	You will need to solve for your ditch velocity to solve
Accum. Distance: 293.521	concentrated flow.
Accum. Avg. Slope: 2.220	
Tc= 12.711 Compute Apply	Hit compute and Apply

Choose your TIN file.

I like to use the **ID-Segments** option so that I can control things more, but the **TRACE** option may work better for you. Use the tables below for HEC-22 to get your "n values" and "intercept K". Right now use another program to determine your velocity for concentrated flow.

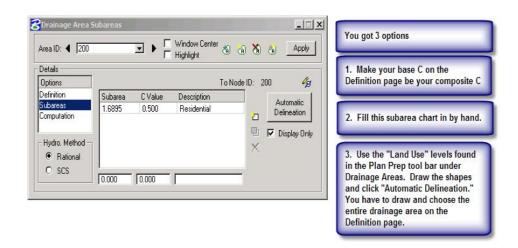
Hit compute and apply.

Tab	<ol> <li>Dementiale</li> </ol>	A-NHI-01-021	imental Accession No.	3. Recipient's Catalog No.
	s 4. Title and Subtitle			5. Report Date
	c			July 2001
	C Urban Draina	ge Design Manual		6. Performing Organization Code
		ineering Circular 22, Secon	d Edition	6. Performing organization code
	۷			I
	Cast iron	0.015		
	Corrugated metal pipe	0.024		
	Cement rubble surface	0.024		
	Fallow (no residue)	0.05		
	Cultivated soils		A	Publication No. PARK MILLI POI
	🗕 <mark>ट</mark> Drainage Area Subar	eas	- IX	Very and 2 sections
	Area ID: 4 200	I I Window Center	a 🗞 💩 🗛 Apply	You got 3 options
	Details	1 rigingix		1. Make your base C on the
		T - N-	de ID: 200 🦓	Definition page be your composite C
	Options		de ID: 200 💋	bennition page be your composite c
	V SIL	barea CValue Description	Automatic	
	Computation	6895 0.500 Residential	Delineation	2. Fill this subarea chart in by hand.
	-			2. This subured chart in by hund.
	+ Hvdro. Method -		🖳 🔽 Display Only	
			×	3. Use the "Land Use" levels found
	( 🖲 Rational			in the Plan Prep tool bar under
		00 0.000	-	Drainage Areas. Draw the shapes
	10.0	00 10.000 1		and click "Automatic Delineation."
Tab			S.	You have to draw and choose the
Tab.				entire drainage area on the
				Definition page.
	F(			
	Ti cropped; woodland (overla	and flow)		
	Short grass pasture (overl	-	0.213	
	Cultivated straight row (ov	,	0.274	
		verland flow); alluvial fans in western	0.305	
	mountain regions			
	Grassed waterway (shallo	1	0.457	
	Unpaved (shallow concent		0.491	
	Paved area (shallow conc	entrated flow); small upland gullies	0.619	
1. Report No. FH\		2. Governmental Accession No.	3. Recipient's (	Catalog No.
FH/	WA-NHI-01-021			-
HE	C-22			

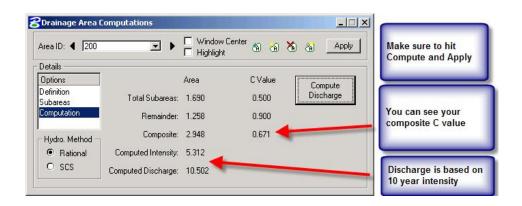
4. Title and Subtitle

Urban Drainage Design Manual Hydraulic Engineering Circular 22, Second Edition 5. Report Date July 2001

6. Performing Organization Code



Finally, click on the **Computation** tab. Click on the **Compute Discharge** button and choose **Apply**.



Close the "Drainage Area Computations" box.

Now that the drainage area has been entered, return to the Node dialogue box and click on **Computations**. Go to page ? in the Nodes handout.

# LINKS

Links are pipes and ditches. For now we will only design pipes.

This is where you will create your system, by connecting **nodes** with **links**.

You will not get any computations until you have created a **Network** (next section), but you will create a path for program to follow.

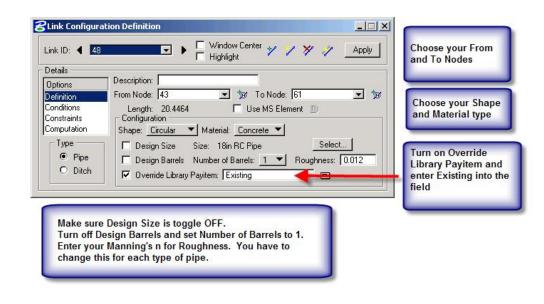
Pipes are designed by slope capacity only. If discharge exceeds the maximum allowable inlet capacity, the <u>pipe size must be changed</u> <u>manually</u>. At this time the program does not check for inlet control of a pipe based on our STORM DRAIN PIPE MAXIMUM CAPACITY TABLE.

!Don't hit Add or Update until you have completed all options!

On your **Navigator**, click the **LINK** button. Then choose the **Add Link** option. (Note that the program defaults to the next available link number.)

tails	Description:	Choose your From Node and To
finition nditions nstraints	From Node: 3 💽 🎾 To Node: 1 💽 🏂 Length: 54.4466 🔽 Use MS Element 🕦	Node. All boxes have pipe connection points on each side.
mputation	Shape: Circular 🔻 Material: Concrete 💌	
Type Pipe Ditch	✓ Design Size     Size:     15in RC Pipe     Select       ✓ Design Barrels     Number of Barrels:     1     ▼     Roughness:     0.012       ✓ Override Library Payltem:	Choose your Shape and your Material type

If the pipe is an existing pipe, check the "override library payitem" and type in "existing". When you run the Payitem Utility at the end of the project, the application will move existing pipes to a scratch level that will not plot and have a 0 line weight.



Go to Conditions

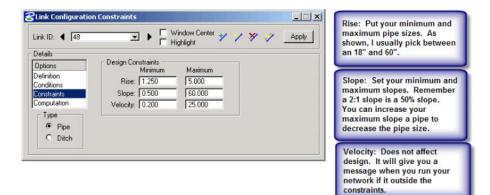
## Conditions

-Unless you want to hold an elevation, no change is required here. For this workshop, no entries are required.

-Note: If you need to hold an elevation at either end of the Link (pipe) (for example tying to an existing system) check the Invert "from Node" or "To Node" box you want hold and enter the invert elevation.

Link ID: ┥ 48 Details		► Window		🗡 🧳 🔥 Apply	The first time through. Don't hold any elevations. After you run the Network once, then you
Options Definition	Profile Conditi	From Node	- Slope	To Node	can hold elevations.
Conditions Constraints Computation	Min Cover: Soffit: Invert:	492.710 492.710 □ 491.210 □	-11.500 0.500	495.176 492.602 🗖 491.102 🗖	To hold an invert, toggle on the
Type ● Pipe ● Ditch	Max Depth:	474.630	-2.548	475.176	invert of your choice and then enter the elevation.

# Constraints



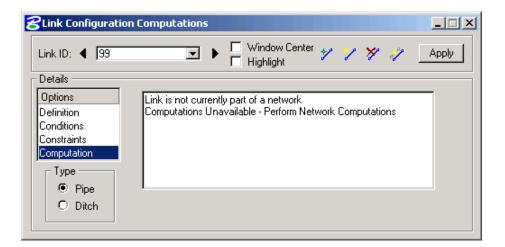
- Note: For this program, "Rise" is the diameter of the pipe.

# HIT APPLY

# **COMPUTATIONS**

-Will not show up until we have created and run a network.

Before the network is run.



Cink Configuratior	Computations	_ 🗆 🗙
Link ID: ┥ 48	🖃 🕨 🗖 Window Center 🦅 🏏 🎢 🧳	Apply
Details		
Options Definition Conditions Constraints Computation Type • Pipe	Flow is supercritical Discharge = 1.118 Capacity = 8.047 Rise = 1.500 Roughness = 0.012 Slope = 0.500 Friction Slope = 0.491 Critical Slope = 0.416	×
O Ditch		

After the Network has been run.

### **NETWORKS**

A NETWORK is your system. A GEOPAK Drainage Network is defined as a series of interconnected Nodes and Links draining to a single outlet. GEOPAK Drainage can maintain multiple Networks in a single project. The Network computations serve as the final calculation process in the design or analysis of a storm drain system. Drainage Areas and Inlets may be computed individually and are not dependent on any type of Network configuration. Pipes and Ditches, however, are dependent on the connectivity and Network characteristic and therefore, require a Network be defined and successfully built, in order to complete the hydraulic computations on these features.

To create or modify a network

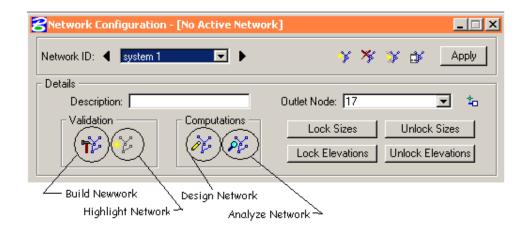
Go to the Microstation tool bar, click on "Drainage", "Network", "Add". (Note that Network Utilities are also available from the "Drainage Tool Box"). This will open the NETWORK dialog box.

-Give your Network a name in Network ID

Description: I have always put the Outlet Node number. The station may be better.	Add a New Network       Network ID:       Description:	I have always named by Networks as System 1, 2, etc. I am open to discussion, but would like to be somewhat uniform.
Again, up for discussion. I would like it to be standard.	Outlet Node:  46	Outlet Node: Pick your node.

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-Click **Build Network** in the Validation group box.

This process checks to make sure the network is correctly assembled. It should tell that the network was successfully built.

-Click OK on the dialog box

-Click Apply to add the network "System 1" to the project.

-Click the **Design Network** in the Computation group box to design the system.

-Click **OK** in the dialog box. There may (and probably will be) warnings in a dialog box. Not all warnings are errors.

-Close the Network Configuration dialog box.

-We need to make the Network Active.

-Select the Active Network tool (Drainage menu: Network > Active)

-Highlight System 1

-Click OK

# **GENERATING REPORTS-**

We have a brand new application to create your Storm Drain comp sheets. We have eliminated the "Hydraulics Gradeline Sheet" by combining it with the "Storm Drain Sheet."

The drn file has to be in the Drainage directory for this application to work.



Basic Excel Report Generator (B GDF File:	ERG ¥.2008.09.30)	<u>&gt;</u>
Report Criteria	Project Information	
C All Networks	Create Date	County
C Selected Network	Rev. Date	Designed By
	I.D. No.	Revd By
Number of Nodes:	Proj. No.	
Number of Links:	Description	
Generate Re	port	Close
Ready		

After opening the report generator, you will path to the GDF. Then fill out the Project Information.

Choose to either run all projects. This will put everything in one document. Or choose the system you want to run. Then select "Generate Report". Follow the directions and when the application is done, look for the spreadsheet in the Hdyraulics\Documents folder.

See VBA document to run the Pay Item Utility to ad hoc pay items and to get the pipes moved to the correct level