

In this tutorial you will learn about:

- The design criteria for ditches.
- How to model a conveyance ditch.
- An introduction to reaches and nodes.
- How to include infiltration in the ditch design.
- How to use the calculator to estimate a ditch size.

Ditch Example

You have been asked to determine if the 'V' bottom ditch running parallel to the road is adequate to convey the runoff from both the road and back slopes. Figure 4-1 and 4-2 shows the plan and cross section view of the example project and details are noted below:

- The pervious area from the back slopes contributing to and including the ditch is **1.0 acre**.
- The SCS soil type is **Type C** and the ground cover is primarily **forest in fair conditions**.
- The average slope of the ground is **1%**.
- The calculated time of concentration for the forested condition will be **50 ft** of sheet flow and **900 ft** of shallow concentrated flow to the beginning of the ditch.
- The **20' x 900'** (**0.413ac**) roadway, without curbing, contributes to the ditch with a cross slope of **2%**.
- The ditch is **900'** long and has a longitudinal slope of **1%**, with a ground cover as **nearly bare ground**, very little grass. The side slopes are **3:1**.

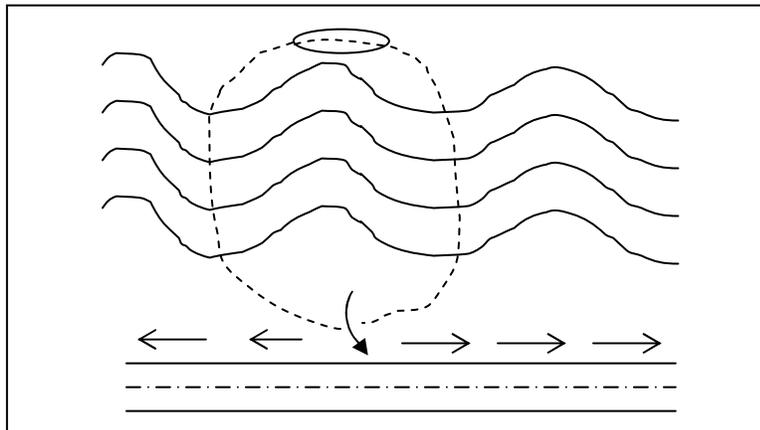


Figure 4-1. Plan View

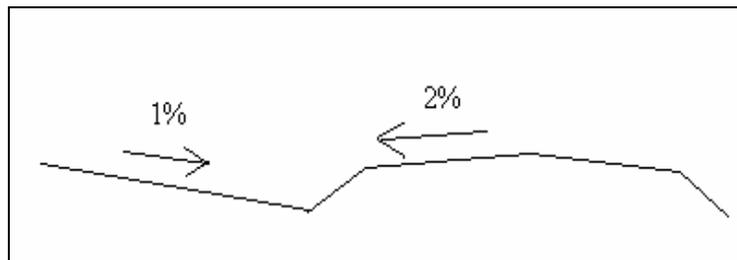


Figure 4-2 Cross Section

Design Criteria

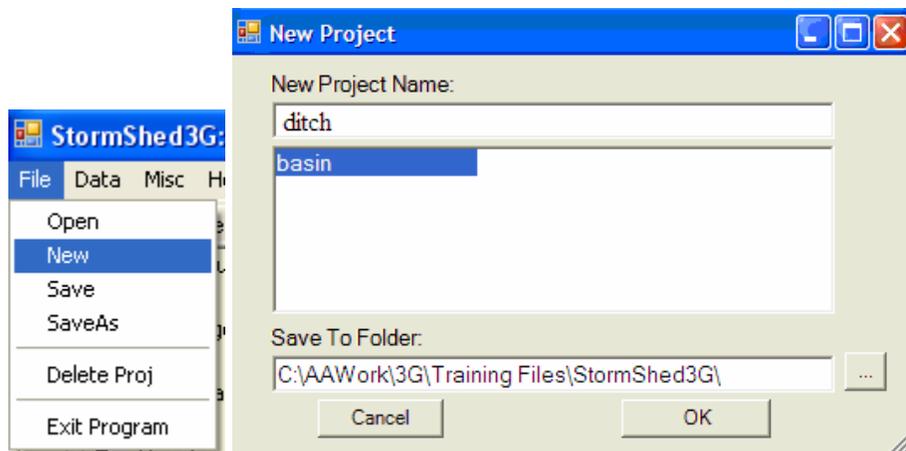
Roadside ditches are generally located alongside uncurbed roadways with the primary purpose of conveying runoff away from the roadway. This is different than a bioinfiltration or biofiltration swale (or bioswale), in that a ditch only conveys drainage runoff where as a bioswale both conveys runoff and provides runoff treatment by filtering the runoff through vegetation. Also the recommended shape of a bioswale is a trapezoid, not a 'V' ditch.

The design criteria for ditches are in located in Section 4-3 of the Hydraulics Manual. In short the following is required:

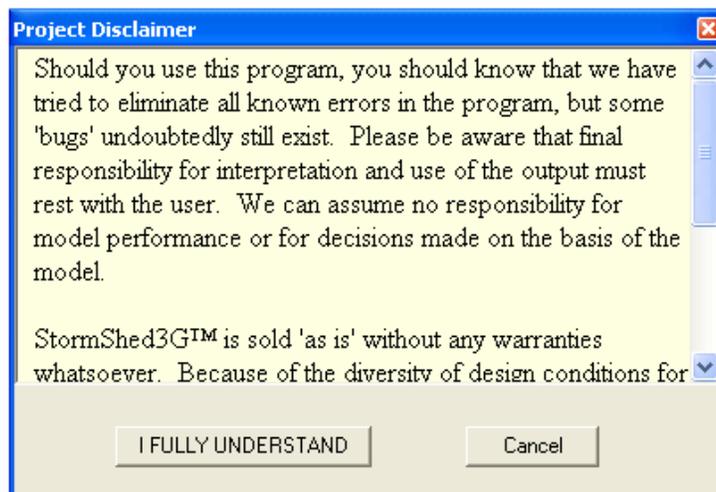
- The design storm is the 10 year recurrence interval.
- The maximum depth of water in the ditch is 0.5' below the bottom of sub-grade.
- Velocities in the ditch should not exceed 5 ft/sec and the ditch slope should be less than 6%.

Creating a New File

Select **File>New** and input: **ditch**. Then click on Ok.

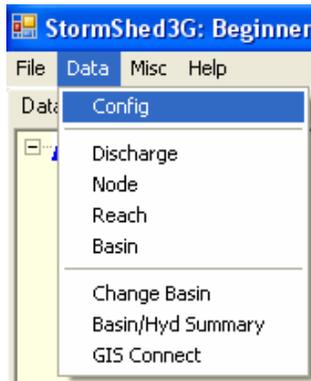


The 3G project disclaimer dialog will appear as shown below. Select **I Fully Understand** and the box will close.

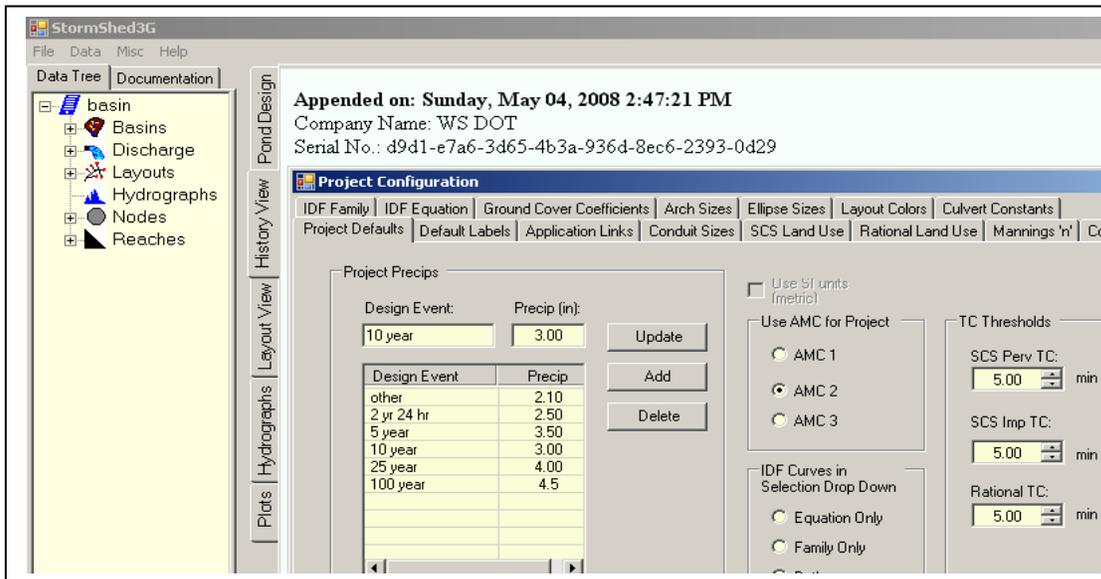


Set Project Defaults

Select **Data>Config**.

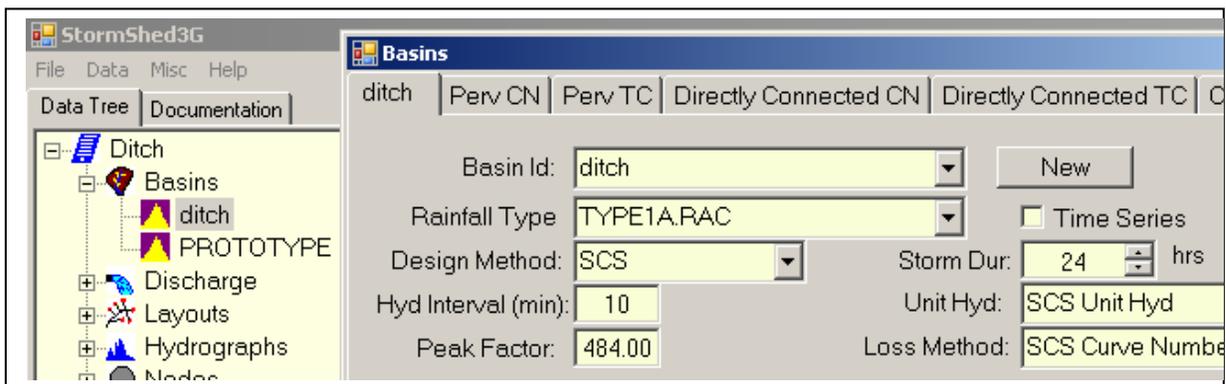


The Project Configuration box will open as shown below.

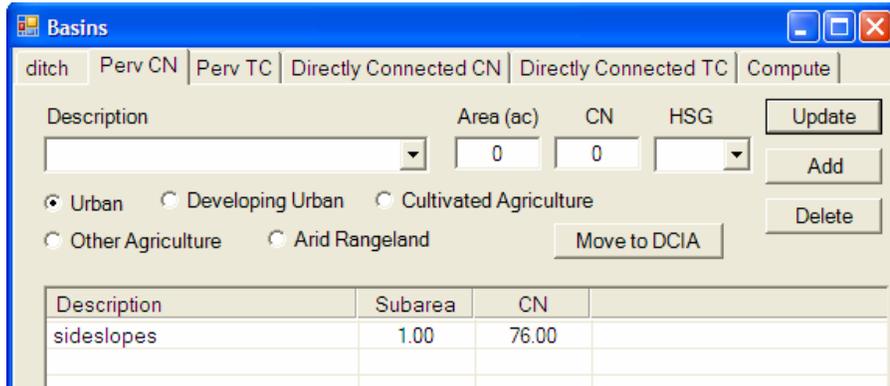


Create Basin

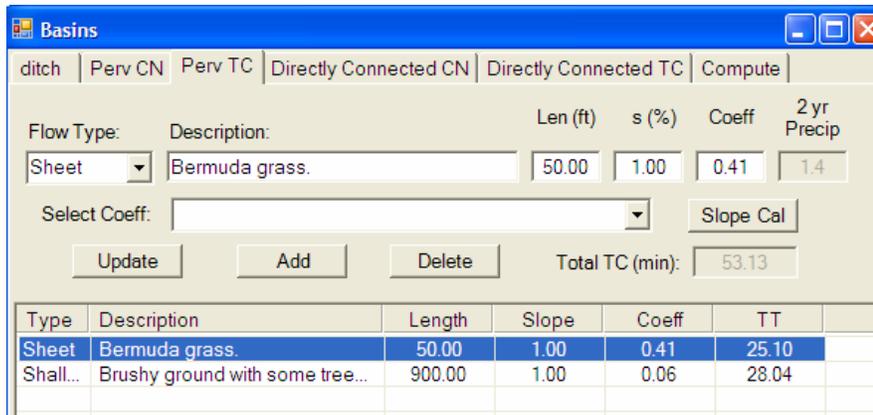
- Create a new basin named 'Ditch'.



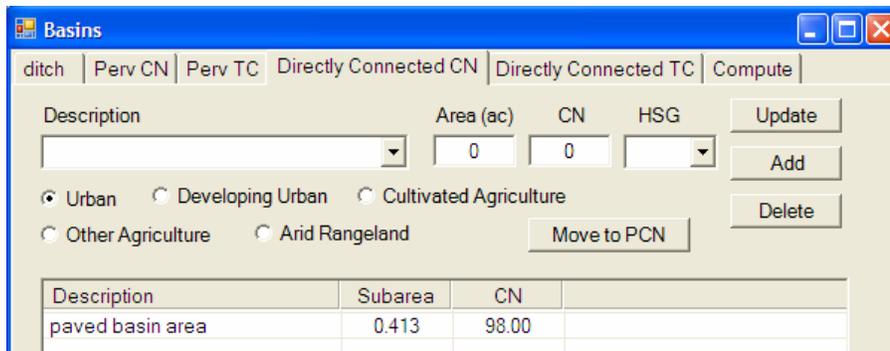
- Then define the pervious area site conditions in the *Perv CN* tab using the ditch example description on the previous page and input the values shown below.



- Next, select the *Perv TC* tab and define the pervious surface side slope area.



- Define the impervious basin area (roadway draining toward the ditch) in the *Directly Connected CN* tab.



- Finally, define the flow path from the roadway, into the ditch in the *Directly Connected TC*.

Type	Description	Length	Slope	Coeff	TT
Sheet	Smooth Surfaces.	20.00	2.00	0.011	0.51

Finally, estimate the flow rate of the runoff by using Compute button.

- Select **10 year** from the pull down menu.
- LMB click on the **Compute** button and the results should match as shown below.
- To save and close the basin dialog box, select the **Close** button.

Appended on: Monday, May 05, 2008 4:35:37 PM
 Company Name: WS DOT
 Serial No.: d9d1-e7a6-3d65-4b3a-936d-8ec6-2393-0d29

Select Design Event: 10 year [Compute]

AMC for this Computation:
 AMC1 AMC2 AMC3 Project AMC: 2

Results
 Peak Rate: 0.3536 cfs
 Time to Peak: 480.70 min / (8.01 hrs) from start.
 Hydrograph Vn1: 7850.81 cfs / 0.18023 acft

Create a Reach

Next, we need to create a Reach that will represent the ditch.

- In the **Data Tree View**, click on the “+” symbol next to the Reaches node.
- Double click on “**PROTOTYPE**” under the Reaches node.
- Click on the **New** button in the Reach Definition dialog.
- Override the default label with **D-001** and Click **OK**.

- After the reach has been named, the next step is to define the “*Section Shape*” or the type of reach. For this application, select **Ditch**.
- Change the “*Routing Method*” to **TT Shift**.

The ‘*Routing Method*’ box contains 4 hydrologic routing methods and the Travel Time Shift. The hydrologic methods actually route the hydrograph through the reach taking advantage of the storage that is available in the reach. The TT shift uses the Manning’s equation to compute the hydraulic parameters based on the peak flow rate and assumes a constant depth. Of the 5 options presented, the Muskingum-Cunge and TT shift are used the most. For most applications the **TT shift** should be used, however there are applications where this method is conservative. For long reaches with flat slopes, the Muskingum-Cunge method provides a more representative analysis because it allows the flow to spread out producing a lower peak.

- In the “*Uniform Flow Method*” box, there are only two available options available for ditches (or cross sections). Select the Manning’s equation, this is the one most commonly used in the United States. The Manning’s value can either be input manually, or selected from a table by clicking on the ‘...’ box to the right as shown below. *All the values provided in the table are the average values from the Hydraulics Manual Appendix 4-1, Manning’s Roughness Coefficients.*

Channel Category	Manning
annels, Excavated (Straight Alignment, Natural Lining)	0.017

Description	Manning
Open Channels, Excavated (Straight A...	
Earth, Uniform Section	
Clean, recently completed	0.017
Clean, after weathering	0.0245
With short grass, few weeds	0.0245
In gravelly soil, uniform section, clean	0.0235
Earth, fairly uniform section	0.0235
No vegetation	0.0235
Grass, some weeds	0.0275
Dense weeds or aquatic plants in d...	0.0325
Sides clean, gravel bottom	0.0275
Sides clean, cobble bottom	0.035
Dragline excavated or dredged	
No vegetation	0.0305
Light brush on banks	0.0425
Rock	
Based on design section (riprap)	0.035
Based on actual mean section	
Smooth and uniform	0.0375
jagged and irregular	0.0425
Channels not maintained, weeds an...	
Dense weeds, high as flow depth	0.1
Clean bottom, brush on sides	0.065
Clean bottom, brush on sides, high...	0.0405
Dense brush, high stage	0.12

Using the pull-down menu, select '**Open channels, Excavated (Straight Alignment, Natural Lining)**'. From that table, the closest match is **No vegetation** under the category '**Earth, fairly uniform section**'. LMB click on **No vegetation** and the *Manning Lookup Form* will close and the Mannings value of 0.0235 will automatically be input into the Mannings 'n' input box.

The following bullets apply to the lower options on the **reach dialog** box.

- Notice the “*Node Data*” boxes are blank. They remain blank until the up and down reaches are either defined in the layout view or manually attached.
- The “*Contrib Discharge*” option only applies when the reach is immediately down stream of a detention system. Using the pull down menu, the discharge structure that is coming through the reach can be identified.
- Only check the “*Save Route Hyd*” box, if you would like to see a hydrograph created from runoff going through this reach.

Next, select the **Geometry** tab. Notice the “Size” and “Entrance Losses” option are not available; these options only apply to pipes.

Reaches

D-001 | Geometry | Constraints

Size: 12 in Diam

Entrance Losses
Circular Conc: Groove End w/Headwall

Specific Geometry

Length (ft): 900.00
Slope (%): 1.00
Bottom Width (ft): 0.00
Top of Bank (ft): 1.00
Up IE (ft): 224.00
Dn IE (ft): 215.00

ss1 (h:1v): 3.00
ss2 (h:1v): 3.00

Vertical Orientation

- Input the Ditch “*Specific Geometry*” values as shown above.

Reaches

D-001 | Geometry | Constraints

Constraints affecting up and down inverts

Min Vel (ft): 2.00
Max Vel (ft): 15.00
Min Slope (%): 0.50
Max Slope (%): 2.00
Drop across MH (ft): 0.00
Min Cov (ft): 3.00
(Applied at downstream node)

Exfiltration/Infiltration

Ex/Infil Rate (in/hr): 0.00 Use Discharge Structure

(A negative number denotes exfiltration while a positive number denotes infiltration.)

(Use of Discharge structure assumes exfiltration.)

- The **Constraints** tab applies mostly to pipes and will be discussed further in the Network Tutorial. The only option that applies to ditches is *infiltration/exfiltration*, which represents flow into and out of the reach. In this case, infiltration is when water is entering a reach (high water table and a perforated pipe) and it is represented by a positive value. Exfiltration is water exiting or leaving a reach (due to a ditch that infiltrates runoff into the soil or a reach with joints not properly sealed) and is represented by a negative value. Right now leave this value at 0, we will repeat the example using this option.
- Click on the **Close** button to close the dialog box.

Create Nodes

A node is required for every transition in a reach, even if there is no structure present. In this tutorial, a **Dummy Node** must be defined to represent the ends of the reach so StormSHED 3G can perform the calculations.

- Open the “PROTOTYPE” node in the Nodes section of the *Data Tree View*.
- Click on the **New Node** button.
- Rename the default node ID to **dummy1**.

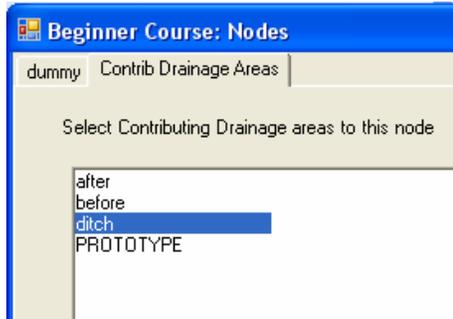
The screenshot shows the 'Nodes' dialog box with the following fields and values:

- Node Type:** Radio buttons for MH/CB type, Vault, Trap Pond, Underground Pipe, Stg-Storage, Detention Pond, **Dummy Node** (selected), and Compound.
- Node ID:** dummy (dropdown menu)
- Description:** upstream node (text box)
- Start EL(ft):** 224.00 (text box)
- Max EL(ft):** 225.00 (text box)
- Contrib Area:** ditch (dropdown menu)
- Contrib Hyd:** (empty dropdown menu)
- North (ft):** 0.00 (text box)
- East (ft):** 0.00 (text box)
- Increment for rating curves:** 0.10 (text box)
- Void Ratio (%):** 100 (text box)

- For the “*Description*” type ‘**upstream point of ditch**’. For larger projects it maybe beneficial to provide more information in the description so when the report is read it is easy to determine the use of the node.
- The “*Node Type*” box is where the application of the node is defined. For the “*Node Type*”, select **Dummy Node**. Once the Dummy Node radio button is selected, notice the third tab disappears as there is no structure to define.
- The “*Start EL*” refers to the outlet elevation or in this case the bottom of the ditch elevation or **224**. The “*Max EL*” is the top of the bank for a ditch or the rim elevation of the catch basin or manhole. In the case of trap pond or vault this would be the ground elevation. For this example input the “*Max EL*” **225**.
- The “*Contributing Area*” is the name of the basin that is attached to this node. Once it is selected from the *Contributing Drainage Areas* tab, it will be shown in gray on this tab.
- The “*Contrib Hyd*” pull down menu allows the designer to create a Hydrograph and apply that Hydrograph to the node. For this example, leave it blank.
- Generally the “*North*” and “*East*” boxes are left at zero, inputting a value here only affects the location of the node in the layout view. If no value is entered, StormShed 3G will use the approximate location in the layout view when computing.
- The “*Increment for rating curve*” option, only applies to the number of points plotted on the rating curve. For computing, the program will use as many points as needed to run the analysis.

- All nodes support a “*void ratio*” for the inside of the node. Generally this is left as 100% voids. This could be helpful if the structure is filled with rock for example, the program will compute the correct volume of available in the structure based on the void ratio.

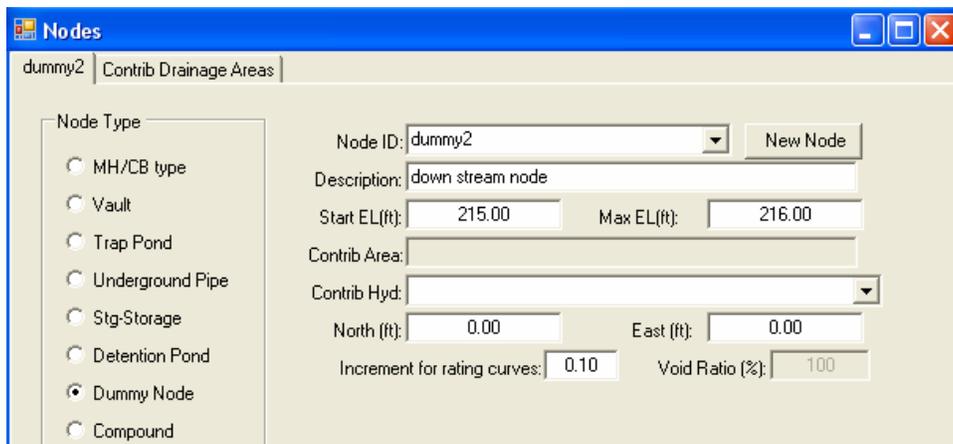
Select the ***Contributing Drainage Area*** tab and choose the basin that is contributing runoff to the node, in this case use the area we just created, **ditch**.



- Click on the **OK** button to close the dialog box.

Next create the downstream node.

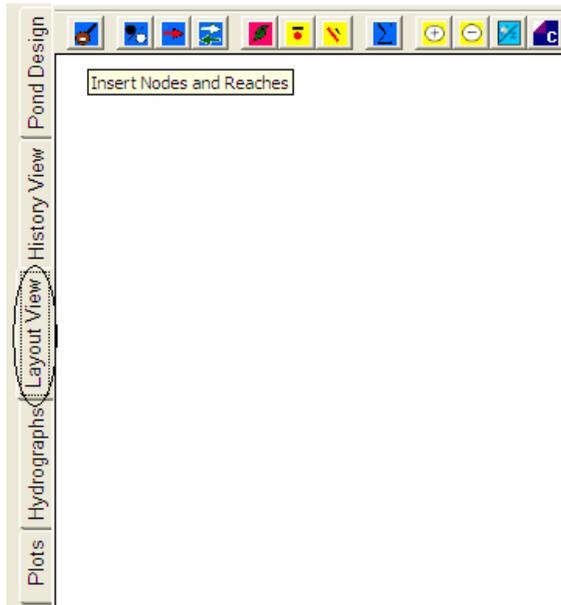
- Re-open the node named dummy instead of the PROTOYPE node and select the New Node button. Name the node **dummy2** and hit OK. By doing this all the values entered in the original node (except the name) are carried over into the new node (including the contributing drainage area).
- Change the “*Start*” and “*Max El*” as shown below.
- The select the ***Contributing Drainage Area*** tab and unselect the basin.
- Finally close the dialog box.



Create a New Layout.

Next create a layout to represent the ditch.

- In the Layout View, click on the **Layout View** Tab and select the 'Insert Nodes and Reaches' button in the upper left corner.

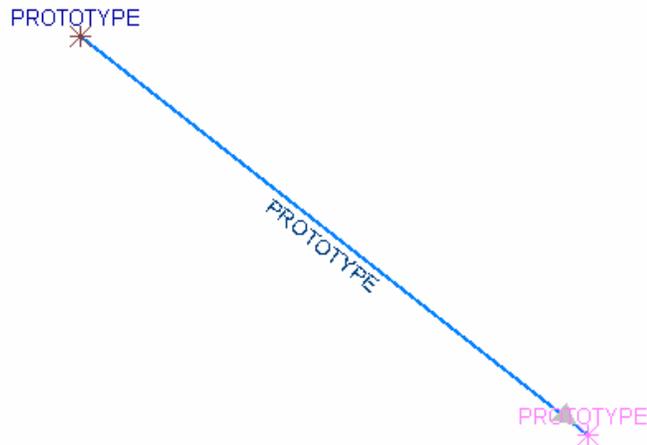


- Before any nodes or reaches can be placed, the program will prompt you to name the layout. Since some projects can have multiple layouts, it is recommended that the name of the layout be meaningful to the area being designed. For this example use '**ditch**'.



- Select **OK** after inputting the layout name.

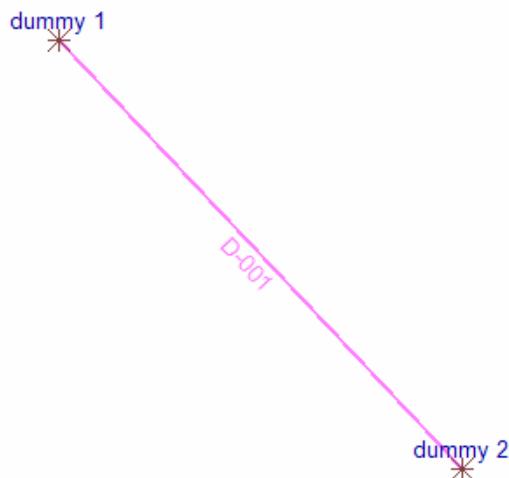
- Next select the approximate locations of the up and down nodes as shown below. Since the nodes and reaches have not been defined, the names default to the *PROTOTYPE* record.



- Next we will define the nodes and reaches. Double LMB click on the upper node. Use the pull down menu to select **dummy 1** for the Node ID.

Node ID:	dummy 1	New Node
Description:	dummy 1	
Start EL(ft):	PROTOTYPE	225.00

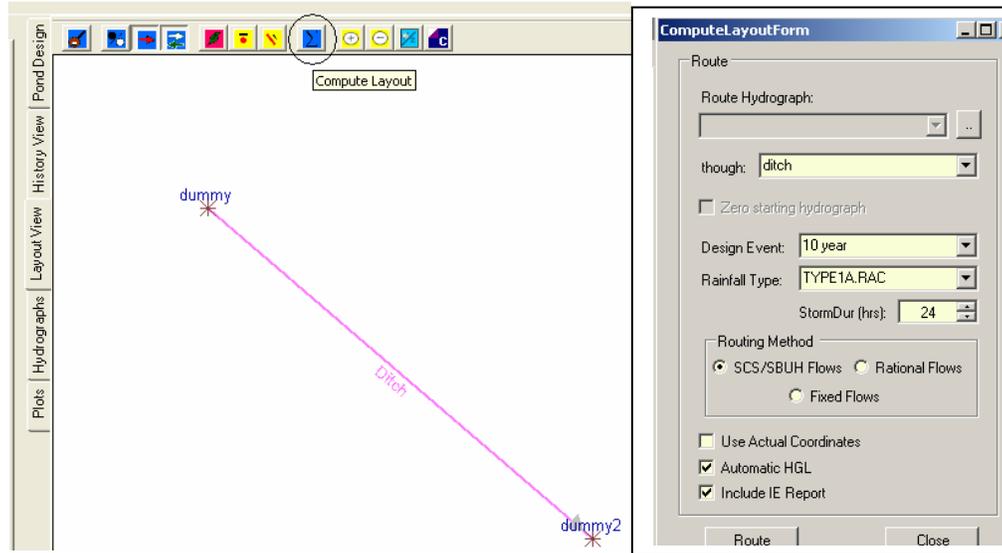
- Repeat this process to define the reach and down stream node. When finished the layout should appear as shown in the next view.



- If the names are not shown, use the *'Toggle Node Label'* and *'Toggle Reach Label'* buttons until the node and reach name are shown.



- To route the design storm through layout, select the compute layout button.



- In the “*through*” box, use the pull down menu to select the name of the layout to run the design storm through. In this case select **ditch**.
- Use the pull down menu to define the **Design Event** as the **10 year** and **Rainfall Type** as the **Type IA** for WWA. For the **Storm Duration**; input **24 hrs** for WWA. Note that while these options were set when defining the basin, the values entered in the compute command **override** those settings.
- “*Use Actual Coordinates*” – this would only apply if the “*North*” and “*East*” values were input when the nodes were created. For WSDOT projects this option is generally not used.
- “*Route as Rational Network*” – selecting this option would allow the designer to use the Rational Method to analyze the layout. Again this would override whatever design event and rainfall type was input into each basin, for just the compute command (the actual values input in the basin do not change). *Notice when this option is selected the pull-down menu choices change for the Design Event and the Rainfall Type.*
- “*Automatic HGL*” – if this option is selected the HGL analysis will be sent to the History View along with the Conduit Notes. If this box is not marked, only the Gravity Analysis will be sent to the History View. **For this example check this box.**
- “*Include IE Report*” – when this box is selected, a report will be included in the history view of the invert elevations for the reaches and nodes. This option allows the designer to verify the location of the inverts. **For this example check this box.**

- Finally, select the **Route** button to route the design storm through the layout and then select the close button to **Close** the dialog box.

Select the *History View* tab to see the routed information, as shown below.

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[ROUTEHYD \[\] THRU \[ditch\] USING \[10 year\] AND \[TYPE1A.RAC\] NOTZERO RELATIVE SCS/SBUH](#)

Gravity Analysis using 24 hr duration storm

Reach ID	Area (ac)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Depth ratio	Size	nVel (ft/s)	fVel (ft/s)	Infil Vol (cf)	CBasin / Hyd
D-001	1.413	0.3536	----	0.00	0.2705	----	Ditch	1.6108	-----	0.00	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							215.2705
dummy1	dummy2	224.2422	--na--	--na--	--na--	224.2422	225.0000

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
D-001	0.2422	na	0.3536	0.2705	0.2422	0.2705	Direct Step Backwater Calc

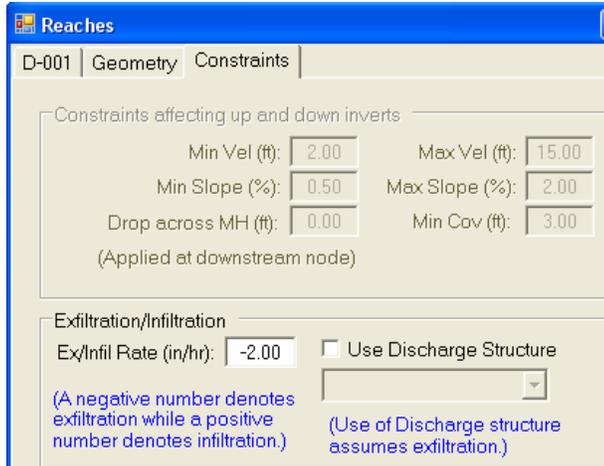
Node and Reach invert report

Node and Reach invert report				
Node	dummy1		Out ie	224.00 ft
	Reach	D-001	I.E. Out	224.00 ft

Exfiltration (Create Reach D-002)

Now we will apply Exfiltration to the reach to see how it affects flow in the ditch.

- In the *Layout View*, double LMB on the reach and select the *Constraints* tab.
- Type '**-2**' into the Exfiltration/Infiltration box. This represents water leaving the reach at a rate of 2 in/hr.



- **Close** the Reach dialog box.
- Select the **Compute** button and route the **10 year storm** through the layout.
- **Close** the Compute Layout Form dialog box and select the **History View** tab.

Note the Flow has decreased in the reach from **0.353 to 0.282 cfs**. Using the Exfiltration/Infiltration option will decrease the flow rate Q and Volume, which would decrease the size of a detention facility down stream.

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[ROUTEHYD \[\] THRU \[ditch\] USING \[10 year\] AND \[TYPE1A.RAC\] NOTZERO RELATIVE SCS/SBUH](#)

Gravity Analysis using 24 hr duration storm

Reach ID	Area (ac)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Depth ratio	Size	nVel (ft/s)	fVel (ft/s)	Infil Vol (cf)	CBasin / Hyd
D-001	1.413	0.2823	----	0.00	0.2485	----	Ditch	1.5236	-----	3509.75	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							215.2485
dummy1	dummy2	224.2188	--na--	--na--	--na--	224.2188	225.0000

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
D-001	0.2188	na	0.2823	0.2485	0.2188	0.2485	Direct Step Backwater Calc

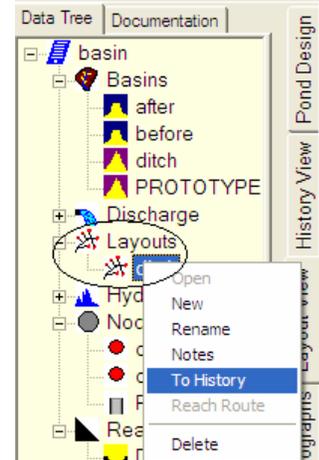
Node and Reach invert report

Node and Reach invert report				
Node	dummy1		Out ie	224.00 ft
	Reach	D-001	I.E. Out	224.00 ft

Creating a Report

There is no report command in StormSHED 3G, instead data must be copied from the History View and pasted into a word document. The information in the history view is not cumulative, so it is important to copy the data before sending anything else to the history view.

To copy the basin/node/reach information into a report go to the *Data Tree View* and **RMB click** on the **layout name**, then **LMB click** and select **To History**. Select the *History View* tab, highlight the data, and copy the data by selecting **Ctrl C**. Use **Ctrl V** to paste into a word document.



The data shown below was copied from the *History View*.

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Layout Report: ditch

Event	Precip (in)
other	2.10
2 yr 24 hr	2.50
10 year	3.00
5 year	3.50
25 year	4.00
100 year	4.50

Reach Records

[Record Id: D-001](#)

Section Shape:	Ditch		
Uniform Flow Method:	Manning's	Coefficient:	0.0235
Routing Method:	Travel Time Shift	Contributing Hyd	
Length	900.00 ft	Slope	1.00%
Bottom Width	0.00 ft	Top of Bank	1.00 ft
SS1	3.00v:1h	SS2	3.00v:1h
Up Invert	224.00 ft	Dn Invert	215.00 ft

Node Records

[Record Id: dummy1](#)

Descrip:	upstream node	Increment	0.10 ft
Start El.	224.00 ft	Max El.	225.00 ft
Void Ratio	100.00		

Dummy Type Node

Contributing Drainage Areas

Record Id: ditch

Design Method	SCS	Rainfall type	TYPE1A.RAC
Hyd Intv	10.00 min	Peaking Factor	484.00
Storm Duration	24.00 hrs	Abstraction Coeff	0.20
Pervious Area	1.00 ac	DCIA	0.413 ac
Pervious CN	76.00	DC CN	98.00
Pervious TC	46.8159 min	DC TC	5.00 min

Pervious CN Calc

Description	SubArea	Sub cn
side slopes	1.00 ac	76.00
Pervious Compositd CN (AMC 2)		76.00

Pervious TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Bermuda grass.	50.00 ft	1.0%	0.41	0.00 in	18.7794 min
Shallow	Brushy ground with some trees (n=0.060)	900.00 ft	1.0%	0.06		28.0364 min
Pervious TC						46.8159 min

DCI - CN Calc

Description	SubArea	Sub cn
paved basin area	0.413 ac	98.00
DC Compositd CN (AMC 2)		98.00

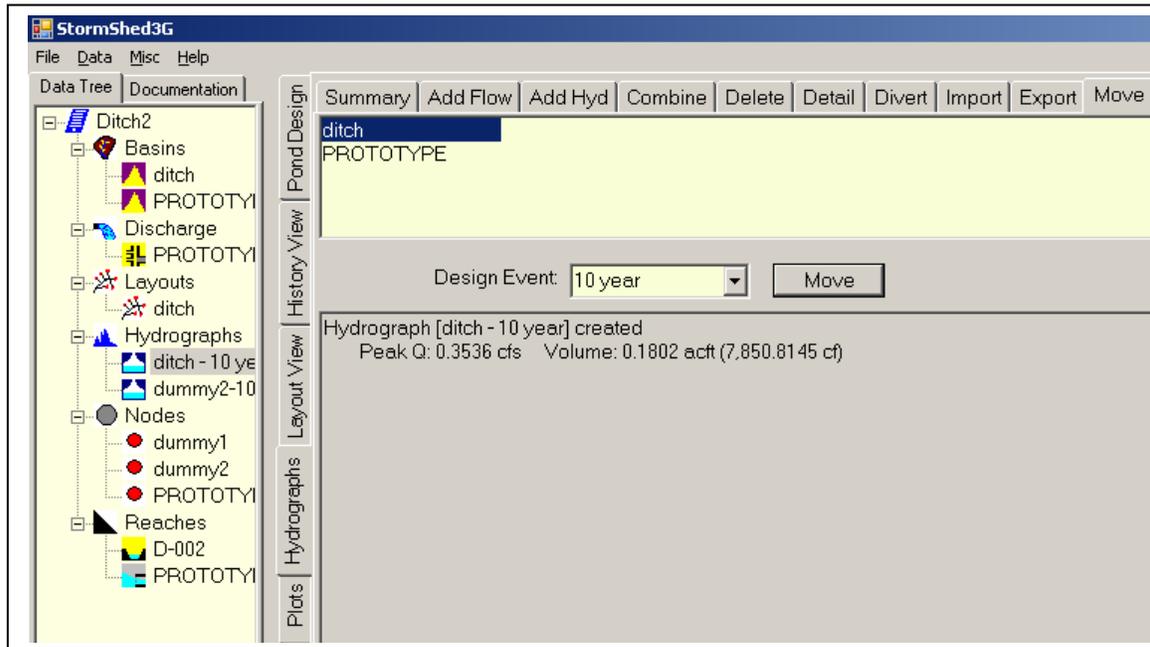
DCI - TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Smooth Surfaces.	20.00 ft	2.0%	0.011	0.00 in	0.3783 min
Pervious TC						0.3783 min

Move Hydrograph Option

The **Compute** option also allows a hydrograph to be routed through a reach. We are going to use the **Move Hydrograph** option to generate a hydrograph from the basin we created. The **Move Hydrograph** option allows as many basins as desired to be moved into one hydrograph based on a specified design event. The benefit of this option is it

allows the designer to manipulate the final hydrograph before routing it through the layout.



- Select the **Hydrograph** tab and then select the **Move** tab.
- The previously defined basins are shown in the top box, select the basin(s) to be moved. For this example select **ditch**.
- Next select a **Design Event** of **10 year** and then hit the **Move** button.
- After the **Move** button has been pressed, a new hydrograph will be created. The summary data is visible in the lower portion of the **Hydrograph** tab as shown above.
- To view the Hydrograph, select the **Plots** tab.
- Select the **ditch 10 year** hydrograph as shown below.
- For the “Type of Plot”, select the **Hydrograph** radio button.
- The “Hydrograph/Basin List” instructs the program to list just the hydrographs, just the basins, or both in the box to the left. For this example, select the List Both radio button.
- The “Design Event” pull-down menu allows the designer to select which design event is run through a basin to generate a hydrograph. This option only applies to basins. Since we have already assigned a design event to our hydrograph, changing the event will not change our plot.
- If the “Plot as points” button were selected, the plot would appear as a series of points instead of line. For this example, **leave the box blank**.

Plot Control | Plot

after
before
ditch
ditch - 10 year
dummy 2-10 year
PROTOTYPE

Type of Plot

- Hydrographs
- Node Rating Curves
- Discharge Rating Curves
- Rainfall Types

Hydrograph/Basin List

- List Hydrographs
- List Basins
- List Both

Design Event
10 year

Elevation Range

From El: 100 ft

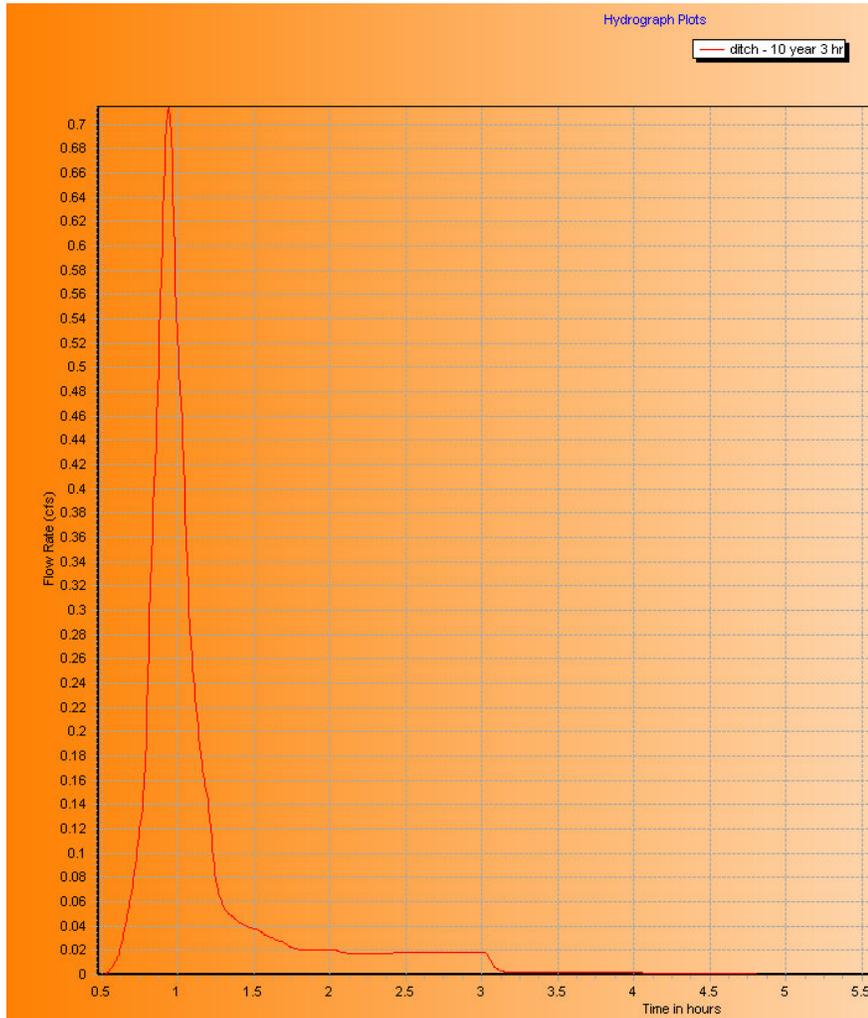
To El: 105 ft

At Every: 1 ft

Storage Structure
PROTOTYPE

Plot as points

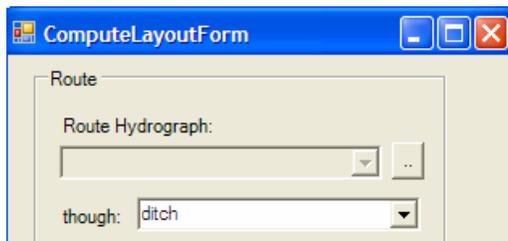
- Next select the *Plot* tab.



The Hydrograph above should appear.

Route Hydrograph Using Compute Command

In the *ComputeLayoutForm* dialog box, notice the “*Route Hydrograph*” option is not accessible.

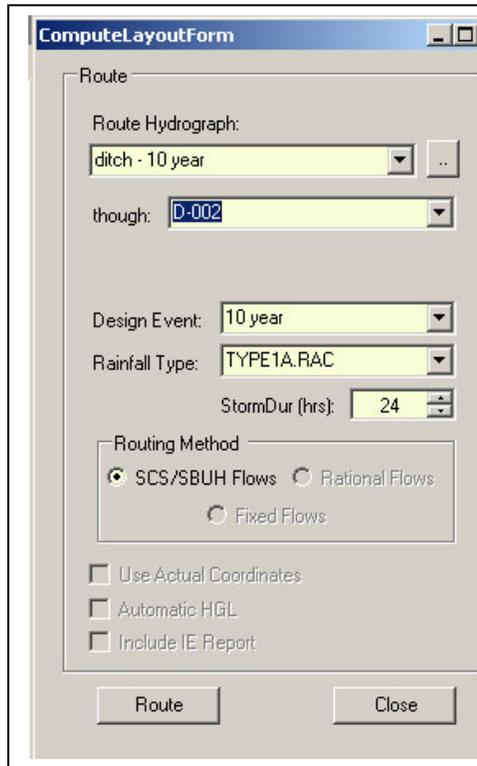


Close the Compute dialog box and got to the main tabs. Select:

Data>Reach Route

- The compute dialog box will automatically open and “*Route Hydrograph*” box will be accessible. Select **Ditch – 10 year** from the pull-down menu.

- In the “through” pull-down menu, notice only the reaches are available. Select the reach created in this example “**D-002**”.



- Before selecting the Compute button, go back to the upstream and unselect the basin. *Otherwise the hydrograph and the basin will both be routed through the reach.*
- Click on the **Route** button and then **Close** the dialog box.

Go to the *History View* tab and data should appear as shown below.

Appended on: Tuesday, May 13, 2008 7:17:16 AM

[ROUTEHYD \[\] THRU \[rchRoute\] USING \[10 year\] AND \[TYPE1A.RAC\] NOTZERO RELATIVE SCS/SBUH](#)

Gravity Analysis using 24 hr duration storm

Reach ID	Area (ac)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Depth ratio	Size	nVel (ft/s)	fVel (ft/s)	Infil Vol (cf)	CBasin / Hyd
Starting Hyd		ditch - 10 year	Peak Rate (cfs)		0.3536	Hyd Vol (acft)	0.1802	Time of Peak (min)	480.702		
D-002	1.413	0.2823	----	0.00	0.2485	----	Ditch	1.5236	-----	3509.75	

Calculators

Another tool available in StormSHED 3G is the calculator, which can be used to estimate the size of the ditch. From the main menu select:

Misc>Calculators.

- From the “*Select Reach*” pull-down menu, select the reach that was created in this example **D-002**. Notice all the values input into the reach dialog box are carried over to the white boxes in the calculator. The values in the white boxes can be modified and the gray boxes are calculated.
- Modify the “*Flow*” to match the flow rate in the history file and the gray values on the right should match the history file output.
- Try modifying other parameters to see how the key design criteria limits are affected (velocity, depth, and grade).

Appended on: Monday, May 05, 2008 5:35:17 PM

ROUTEHYD [] THRU [rchRoute] USING [10 year] AND [TYPE1A.RAC] NOT

Gravity Analysis using 24 hr duration storm

Calculators

Flow Profiles | Swale Calc | Pipe Calc

Select Reach: D-002 [Update Reach]

Length (ft)	Bottom Width (ft)	Area (sf)	Top Width (ft)	Wetted Perim
900.00	2.00	1.1491	4.2178	4.3377
Left SS (h:1v)	Right SS (h:1v)	Depth (ft)	Crit Depth (ft)	HRAD
3.0000	3.0000	0.3696	0.3442	0.2649
Slope (%)	Mannings n	Residence time (min)	Velocity (fps)	
1.0000	0.02350	5.7460	2.6107	
Flow (cfs)				

[Close]

This could be the starting place for a ditch design before a reach is created or it could be used to determine how to modify a reach if the history output exceeds the design criteria (ie the ditch is too large or too small).