

## DRAINAGE DESIGN MANAGEMENT SYSTEM FOR WINDOWS VERSION 6.0.5

# TUTORIAL # 4 UPDATING NSTPS VALUES FOR CHANNEL ROUTING



## UPDATING NSTPS VALUES FOR CHANNEL ROUTING

## TABLE OF CONTENTS

## No. Section

#### Page

1.0	INTRODUCTION	1
2.0	OPEN THE PROJECT	2
3.0	ENTER INITIAL NSTPS VALUES	3
4.0	Update the Model	4
5.0	EXECUTE PROGRAM TO EVALUATE NSTPS VALUES	5
6.0	Run the Model	6
7.0	Notes	8

## UPDATING NSTPS VALUES FOR CHANNEL ROUTING <u>Date Updated</u>: April 20, 2022 <u>Tutorial Time</u>: 30 minutes

#### **1.0** INTRODUCTION

This tutorial document is developed to guide users in evaluating the NSTPS parameter (HEC-1 RS card's first field) for channel flow routing in HEC-1 using DDMSW. The input data file is an existing HEC-1 input file where normal-depth storage routing methodology is used. The implemented tool within the DDMSW program creates an updated HEC-1 input file that includes a refined set of NSTPS values updated from two successive model runs.

NSTPS is normally evaluated from flow and reach characteristics of the project area. It is usually estimated by the following relation (HEC, 1998).

NSTPS = [Channel Reach Length / Average Flow Velocity] / Time Interval ..... (1)

It can also be estimated by:

Normally, the determination of the refined values of NSTPS can be made from several runs of the HEC-1 model, until the values converge. There are rare occasions, however, when NSTPS do not converge (i.e., values swing back and forth between iterations). In these cases, the modeler should look into the matter and use engineering judgment to select appropriate values of NSTPS adequate for his/her modeling purposes. One possible solution is to manually use Manning's equation to estimate the channel flow velocity and then estimate NSTPS by Equation (1) above. The manually estimated NSTPS can then be entered into an HEC-1 input file for the channel routings whose NSTPS values do not converge, users can execute the tool within DDMSW twice (i.e., three (3) model iterative runs in each execution). Here, the second-time model execution (i.e., three more iterative model runs) provides refined NSTPS values for the HEC-1 input file. This process of executing the model twice will shed light if there is any instability in the NSTPS values.

The program is based on two assumptions. The first assumption is that normaldepth channel routings are defined by RS cards with FLOW as a keyword in Field 2. It should be mentioned that there might be some exceptions to this assumption due to many combinations of routing parameters though this assumption is valid for most cases. Users should check to make sure that the intended channel routings are defined by RS card with FLOW as a keyword in Field 2. The second assumption is that all ID's in KK cards are unique. Users should check to make sure that there are no duplicate (ID's in) KK cards. It is the users' responsibility to check and accept the final results.

For purposes of illustration, this tutorial will use KVLEXAMPLE1.DAT. After completing the tutorial, the user should test the tool using his or her project data.

## **2.0 OPEN THE PROJECT**

After launching the DDMSW program, open an existing project ('File => Select **Project**'). Select **KVLExAMPLE1** from the project list. Press 'OK' to close the **SELECT PROJECT** form. [Note: Please use the DDMSW project file 'KVLExample1.zip' that is bundled along with the tutorial document for this tutorial. To use the attached project data, delete first the 'KVLExample1' project in DDMSW and once it is deleted, to import the 'KVLExample1.zip' into DDMSW (File → Project Management→Import].

Ŀ	ist		Details						
Look for									
Reference 🔶	Date	ID	Title						
BANKPROTECTIONFCD	01/01/2012	00049	River Mechanics Example - Bank Protection	_					
BRIDGEPIERFCD	01/01/2012	00053	River Mechanics Example - Bridge Pier						
DUMMY1	03/16/2018	00048							
XAMPLE1	01/01/2010	00054	Clark, Green Ampt, Single, 6 Hour						
EXAMPLE1_TEST	03/16/2018	00077	Clark, Green Ampt, Single, 6 Hour						
XAMPLE2	01/01/2010	00055	S-Graph, Green-Ampt, Single, 24 Hour						
EXAMPLE3	01/01/2010	00056	S-Graph, Green-Ampt, Multiple, 6 Hour						
EXAMPLE3_TEST	03/19/2018	00084	S-Graph, Green-Ampt, Mulitple, 6 Hour						
EXAMPLE4	01/01/2010	00057	Clark, Init and Uniform, Single, 6 Hour						
	01/01/2011	00088	Example 1 HEC-1 tutorial project						
VLEXAMPLE12	01/10/2014	00070	Street Drainage Example						
VLEXAMPLE2	04/11/2018	00086	Example 2 Using Shape Files and NOAA 14						
VLEXAMPLE3	01/01/2011	00061	Example 3 Rational Method tutorial project						
(VLEXAMPLE3A	04/13/2018	00087	Example Project of the Rational Method Tutorial						
VLEXAMPLE5	01/01/2011	00063	HEC-1 Tutorial - Clark Unit Hydrograph						
VLEXAMPLE5_TEST	03/26/2018	00083	HEC-1 Tutorial - Clark Unit Hydrograph						
•	III			Þ.					

## **3.0 ENTER INITIAL NSTPS VALUES**

Go to the Routing Menu ('Hydrology  $\rightarrow$  HEC-1  $\rightarrow$  Routing'). On the HEC-1 ROUTING DATA form, check the custom check boxes to the right of the 'Steps' field for all the return periods. This allows you to enter an initial step value into the current routing card. Enter initial step values into the 'Steps' field. Now, uncheck the custom check boxes and press 'Save'. Repeat for every routing card or record. When finished, press 'OK' to close the HEC-1 ROUTING DATA form.

HEC-1 Routing Data - MB: 01									
Look for	⊤ Route								
ID A Type A 010105 Normal Depth 010110 Normal Depth	Major E	asin ID 0 coute ID 0 Type N							
	Normal	Depth —	NSTPS Model N	ISTPS C	ustom				
	LOB N	0.035	1.	510.0	99.70	2 Year 🗹	8		
	Chan N	0.038	2.	1510.0	94.10	5 Year 🗹	6		
	ROB N	0.035	LB	1585.0	93.60	10 Year 🗹	6		
	Length	4224.0	4.	1596.0	92.20	25 Year 🗹	5		
	Slope	0.0012	5.	1600.0	92.20	50 Year 🗹	5		
^	Max Elev	99.70	RB	1612.0	93.60	100 Year 🗹	5		
			7.	1662.0	94.90	Custom 🗌			
~	8. 2262.0 99.70					Update NSTPS from HEC-1			
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## 4.0 UPDATE THE MODEL

On the **HEC-1 DATA** form (*'Hydrology* → *HEC-1* → *Data'*), press the *'Update'* button.

🚮 н	EC-1 Data	a - MB: 01								Þ			x
			<u>L</u> ist				Dețalis						
Fin	d Nex	t											
F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	Sort	Special Code ID	^
ID		KVL Cons	ultants.	Inc.							10	Code ID	
ID		VLEXAMP	LE1-Ex	ample 1	HEC-1 tu	torial p	roject				20		1
ID		2 YEAR									30		t I
ID		6 Hour	Storm								40		t I
ID		Unit Hyd	rograph:	Clark							50		T I
ID		Storm: M	ultiple								60		
ID		04/25/20	18								70		II
*D	IAGRAM										80		
IT	5	1JAN99	0	2000							90		
10	5										100		
IN	15										110		
*											120		
JD	1.180	0.0001									130		1
PC	0.000	0.008	0.016	0.025	0.033	0.041	0.050	0.058	0.066	0.074	140		1
PC	0.087	0.099	0.118	0.138	0.216	0.377	0.834	0.911	0.931	0.950	150		1
PC	0.962	0.972	0.983	0.991	1.000						160	I .	~
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On the UPDATE HEC-1 DATA form, press 'Yes' to continue.



Select a return period. Press the **'OK'** button for DDMSW to update the HEC-1 model with the latest parameters from the data entry menus, including the initial routing NSTPS values. Press **'OK'** to close the **HEC-1 DATA** form.

ы 🛃	HEC-1 Data - MB: 01												
			<u>L</u> ist				Dețails						
Fin	d Nex	t											
F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	Sort	Special Code ID	^
ID		KVL Cons	ultants.	Inc.							10		
ID		VLEXAMP	LE1 - Ex	ample 1	HEC-1 tu	torial p	roject				20		1
ID		2 YEAR									30		t I
ID		6 Hour	Storm								40		†
ID		Unit Hyd	rograph:	Clark							50		Ī
ID		Storm: M	ultiple								60		Ī
ID		04/25/20	18								70		II
*D	IAGRAM										80		
IT	5	1JAN99	0	2000							90		
10	5										100		
IN	15										110		
*											120		
JD	1.180	0.0001									130		
PC	0.000	0.008	0.016	0.025	0.033	0.041	0.050	0.058	0.066	0.074	140		
PC	0.087	0.099	0.118	0.138	0.216	0.377	0.834	0.911	0.931	0.950	150		
PC	0.962	0.972	0.983	0.991	1.000						160		T 🗸 🛛
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			2	Info E	oport Re	e <u>S</u> ort	P <u>r</u> int	<u>D</u> elete	<u>A</u> dd	MB	Update	<u>о</u> к	

## 5.0 EXECUTE PROGRAM TO EVALUATE NSTPS VALUES

On the **HEC-1 ROUTING DATA** form ('Hydrology → HEC-1 → Routing'), click the "Update NSTPS from HEC-1' button.

HEC-1 Rou	🚽 HEC-1 Routing Data - MB: 01										
Look	for		Route					3			
ID 🔺	Туре	^	Major F	Major Basin ID 01							
010105	Normal Depth				10406						
010110	Normal Depth	-					õ				
		-		Type 1	URM/	ALDEPTH					
		-			Char	nel Loss					
		-	<b>⊳Normal</b>	Depth —				NSTPS			
		-				Station	Elevation	Model	NSTPS C	ustom	
			LOB N	0.035	1.	510.0	99.70	2 Year 🗹	8		
		-	Chan N	0.038	2.	1510.0	94.10	5 Year 🗹	6		
		-	ROB N	0.035	LB	1585.0	93.60	10 Year 🗹	6		
		-	Length	4224.0	4.	1596.0	92.20	25 Year 🗹	5		
		- <b>•</b>	Slope	0.0012	5.	1600.0	92.20	50 Year 🗹	5		
		^	Max Elev	99.70	RB	1612.0	93.60	100 Year 🗹	5		
					7.	1662.0	94.90	Custom 🗌			
					8.	2262.0	99.70	Lindate NCT	DS from H	EC 1	
		~				Update NSTPS from HEC-1					
				o Cop	Y	P <u>r</u> int	<u>D</u> elete	<u>A</u> dd MB		<u>о</u> к	

A pop-up message will appear stating that HEC-1 will run 3 times for each of the

selected return periods. This will update the NSTPS routing values, only if the custom checkbox is unchecked. Press '**Yes'** to continue.



After the last HEC-1 run is completed, the NSTPS values for the routing cards will be updated. Press **'OK'** to close the **HEC-1 ROUTING DATA** form.

HEC-1 Ro	uting Data - MB: 01										
Look for			Route	Route							
010105	Normal Depth Normal Depth		Major B R	asin ID 0 <sup>.</sup> oute ID 0	1 10105						
		=		Type N	ORMA	L DEPTH					
		-			Chan						
		=									
		-	_ Normal I	Depth —	NSTPS						
			-			Station	Elevation	Model	NSTPS C	Custom	
			LOB N	0.035	1.	510.0	99.70	2 Year 📝	8		
		- 1	Chan N	0.038	2.	1510.0	94.10	5 Year 🔽	6		
		-	ROB N	0.035	LB	1585.0	93.60	10 Year 📝	6		
		-	Length	4224.0	4.	1596.0	92.20	25 Year 📝	5		
			Slope	0.0012	5.	1600.0	92.20	50 Year 📝	5		
		^	Max Elev	99.70	RB	1612.0	93.60	100 Year 📝	5		
					7.	1662.0	94.90	Custom 🔳			
		-			8.	Update NST	'PS from H	EC-1			
			@ <u>I</u> nfo	Cop	Y [	P <u>r</u> int	Delete	Add MB		<u>о</u> к	

#### 6.0 RUN THE MODEL

After all the NSTPS values have been determined and accepted, you can run the HEC-1 model to obtain your model results.

To run the model, open the RUN HEC-1 MODEL form ('*Hydrology* → HEC-1 → *Model*') and check the following checkboxes: All the events in the '*Return Period*', the '*Update HEC-1*' checkbox, and the '*Delete Prior Results*' checkbox. Finally, click the '*Run Model*' button to execute the program.

Run HEC-1 Model - MB: 01	
Return Period   ✓ 2 Year   ✓ 5 Year   ✓ 10 Year   ✓ 25 Year   ✓ 50 Year   ✓ 100 Year	Options Multiple Basins Major Basin 01 Update HEC-1 V Delete Prior Results Select Custom Folder Update Conveyance Flows
Info Schematic Output	Storage Results Run Model OK

Click 'Yes' twice to continue.

Run HEC-	1 Model	$\times$						
1	This will run the HEC-1 model for the selected Major Basin(s) and Return Period(s).							
	If Update HEC-1 is checked, all parameters for the model will be updated from the appropriate tables							
	If Delete Prior Results is checked, all prior model results for all return periods will be deleted for the modeled Major Basin.							
	If Select Custom Folder is checked, the model input and output files will be placed in the selected folder rather than the default folder.							
	If Update Conveyance Flows is selected, the resultant discharges will be placed in the appropriate Conveyance Facilities records.							
	Do you want to continue?							
	Yes No							

Afterwards, you can view the model results by clicking the '*Results*' button on the Run HEC-1 Model form. Alternatively, you can also view the results from '*Hydrology*  $\rightarrow$  *HEC-1*  $\rightarrow$  *Flow Summary*'.

HEC-11	Flow Sumr	mary - FLOWS -	MB: 01				45				x
L	ook for										
ID	Sort 📤	Туре	Area	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr		^
010105	10	Hydrograph	6.69	1742	3314	4520	6166	7445	8650		
DT0105	20	Diversion	6.69	610	1160	1582	2158	2606	3028		
010105	30	Hydrograph	6.69	1132	2154	2938	4008	4839	5623		
010105	40	Routed	6.69	957	1939	2634	3618	4423	5077		
010110	50	Hydrograph	5.70	2631	4025	5051	6465	7569	8621		
010105	60	Hydrograph	6.69	610	1160	1582	2158	2606	3028		
010105	70	Combined	12.39	2929	4896	6667	9098	11003	12855		
010110	80	Routed	12.39	2644	4676	6277	8433	10227	12126		
HYD001	90	Hydrograph	3.76	1941	2718	3883	5047	5824	7765		
HYD001	100	Combined	16.15	2642	4675	6277	8433	10218	12126		
ST0115	110	Routed	16.15	937	1252	1552	1939	2237	2635		
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				_ <b>⊘</b> Info	<u>E</u> xpor	t P <u>r</u> int	More R	esults I	MB	<u>0</u> K	

## **7.0** Notes

- A. When you check the 'Custom' checkbox (3<sup>rd</sup> column) next to the 'Steps' field on the HEC-1 ROUTING DATA form ('Hydrology → HEC-1 → Routing'), the program will lock the entered values so they could not be changed even when the 'Update Steps from HEC-1' button is pressed. Only the ones that are unchecked will be updated by the program.
- B. If you receive 'Output file not found' messages after pressing the 'Update Steps from HEC-1' button, while on the HEC-1 ROUTING DATA form, check the model runs path ('File → Project Paths → Model Runs Path') to ensure that you have set the path for the project; otherwise, define the Model Runs Path by using the ellipse (...) button on the right side of the Model Runs Path textbox.
- C. To ensure that NSTPS values have reached stability, the tool may have to be executed more than once. To run the tool for the second or the third time, press the 'Update Steps from HEC-1' button after the first or second execution.
- D. Selecting the **'Custom'** checkbox, under the **'Model'** column (1<sup>st</sup> column) in the '*Steps*' data group, will default the tool to run only for the '**100 Year'** event.