ADVANCED RULE DEMO

Introduction

This hands-on demonstration will help students learn how to use HEC-RAS to enter and edit advanced rules to control the gate operations at an inline structure.

Problem

For this demonstration a project file (RuleDemo.prj) with the title "Advanced Rule Demonstration" has been loaded on your workshop computers. The initial gate information (opening rate, max opening, initial opening, etc.) has already been entered.

The rules will be used to open the gate on a lateral structure (RS 42.6) and fill a small storage area until the SA water surface reaches 5 feet. As class time permits, the flow being diverted will be limited to 20% of the flow going over the inline structure overflow weir (RS 41.75). Finally, additional logic will be added to keep the water surface in the SA from "overshooting" the 5 foot target.



The default plan ("No Rules") models the lateral structure gates with 0-opening time series. To create rules, select this boundary condition and press the "Rules" button.

∑ Unsteady Flow Data - No Rules - □ ×						×	
File Options Help							
Description:					÷.	Apply	y Data
Boundary Convitions In	itial Conditions	Meteorologi	cal Data 🛛	Observed Data	1		
	B	oundary Cor	ndition Type	s			
Stage Hydrograph	Flow Hydro	ograph	Stage/Flow Hydr, Rating Curve				
Normal Depth	Lateral Inflo	w Hydr,	Uniform Lateral Inflow Groundwater Interfl			flow	
T.S. Gate Openings	Elev Controll	ed Gates	Naviga	ition Dams	IB S	itage/Flow	
Rules	Precipita	ition					
	Add I	Boundary Co	ondition Loca	ation			
Add RS Add SA	/2D Flow Area	. Add (Ionn ,	Add Pump St	a Ad	dd Pipe Nod	le
Se	elect Location in t	able then se	lect Bounda	ry Condition Ty	pe		
River R	each	RS	Boundar	y Condition			
1 Nittany River W	/eir Reach	60.1	Flow Hydr	ograph			
2 Nittany River W	/eir Reach	42.6 LS	T.S. Gate	Openings			
3 Nittany River W	/eir Reach	36.85	Rating Cu	rve			

This will open the Rules Editor. The first step, before entering any rules, involves parameterizing the gate parameters. These five variables (open rate, close rate, max and min opening and initial opening) will provide critical gate information unless the rules override them. Then press **Enter/Edit Rules Operations...**

Rule Operat	ions				
Description:	Open the gates on the I not divert more than 20 reduce the gate opening	LS and divert flow until 1% of the flow. When g so as to not oversho	the storage are the water surfac ot the 5 foot targ	a gets to an elev e in the SA gets get	vation of 5 feet. Do above 4 feet,
		Gate Para	meters		
Location 1 Gate #1	Open Rate (ft/min)	Close Rate (ft/min) 0.1	Max Opening 10	Min Opening 0	Initial Opening 0
		Summary of Variab	e Initializations:		
User Varia	ble	Descript	ion		Initial Value
		Rule Oper	ations		
row	Operation				True False
,		Enter/Edit Rule C	Operations.		OK Cancel

Press the <u>Comment</u> button to write a comment ! Rules Demo for Class Click on line number two to start the code there.

Click on the **Get Sim Value** Get Sim Value button to select a RAS result and name it as a Variable.

Operation Rule	es									
			Rule Based Op	eration	s			Rule Font Size:	10 -	Bold Font
row (Operation								-	True Ea
	Rule Demo for I	Class		N						0
2	=	01033		43						
-										
J	aratian						Current Colection C			
Insert New Op		Cat Circ Value	Cot On and Kanal Dava	. 1	Describ (15(Ting)	Table		Nanges	Disable	Copy description
Comment		Get Sim Value	Set Operational Para	m	Branch (IT/Eise) Math	Table	<u>a</u> 😐 🖻		Disable	
Get Simulation	Value									
Assign Resu	lt	Simulation Variable	e				Value at current	time step		-
C Existing	Variable	H-Time	5				I value at current	une step		<u> </u>
New Vari	iable	Bolution								
		B-Cross Sections								
		B. Inline Structure	S							
		B-Lateral Structur	es							
		B-Storage Areas								
		B-Storage Area C	onnections							
		Pump Stations								
		BC Lines		~	(Simulation variables	in bold are only a	available for the o	urrent struct	ure)	
L		j u. veterence l ine		_	-	· · ·			-	
						Check Rule Set .			OK	Cancel

Select the storage area WS Elevation and assign the result to a new variable called SAwatersurface as shown in the green circle below.

Operation F	Rules		
	Rule Based Operations	Rule Font Size:	10 💌 🗖 Bold Font
1	Operation I Rule Demo for Class		True Fa 0
2	SAwatersunace = Storage Areas:vvS Elevation(Value at Jurrent time step)		
Commen	Operation Current S tt New Variable Get Sim Value Set Operational Param Branch (If/Else) Math Table #	election Changes	Disable Copy description
Get Simulati	ion Value		
Assign Re	esult B-Cross Sections A Ing Variable B-Inline Structures B-Lateral Structures	at current time step	•
SAwaters	E-Storage Areas WS Elevation -Net Inflow - Total Inflow - Total Outflow - Area Storage Supply		

Even though there is only one storage area, the storage area must still be selected by clicking on it as shown below. The name of the SA should then show up in the rule (green circle).

Operation Rules			
Rule Based Operations	Rule Font Size:	10 💌	🕅 Bold Font
row Operation			True F
1 ! Rule Demo for Class			C
2 'SAwatersurface' = Storage Areas:WS Elevation(Storage Sup	ply,Value at current time step)		
<			>
Insert New Operation Comment New Variable Get Sim Value Set Operational Param Bit	anon (If/Else) Math Table	Enable Di	sable Copy (
Get Simulation Value			
Assign Result	Value at current time st	ep	-
C Existing Variable	,		
New Variable He Lateral Structures			
😑 Storage Areas	a later in		
SAwatersurface	Set SA Location		
	Storade Subbiv		
- Total Outflow			
Area			
Volume			
B. Storage Area Connections ♥ (Simulation variables in bold are only available for the curren	t structure))
	Check Rule Set	ОК	Cancel

Click on line 3 Create an If/Then rule by clicking on the **Branch** button Branch (If/Else).

Operation R	ules					
	Rule Based Operations	Rule Font Size:	10	▼ Bold Font		
row	Operation					
1 2 - 3	1 ! Rule Demo for Class 2 'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply,Value at current time step) - 3 If ([not set] [not set]) Then					
Edit Rule Exp	ression					
Coefficien Current Expr Clear Exp	t Variable Exponent Coef * Exponent		+	Constant Cancel		
Branching O Branching I	eration (If/Else/ElseIf/Else/Endif) ine Type: Then And/Or () Then () Then () And/Or () Then					

And then click on the left most **Edit** button to bring up the Expression editor.

Click on the pull down menu under the **Variable** field and select the SAwatersurface variable and then click ok.

Edit Rule Expression				
	nt Coef \star	Exponent Variable)	
Coefficient Variable	1		+	Constant
Current Expression:				
Clear Expresion			ОК	Cancel

From the operator pull down, select "<" (less than). Select the second Expression and enter "5" in the constant field.

Operation Rules	
Rule Based Operations Rule Font Size: 10 🔽 🗖 Bold Font	
row Operation 1 ! Rule Demo for Class 2 'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply,Value at current time step) - 3 If ('SAwatersurface' [not set]) Then	
Edit Rule Expression	
(Exponent Coef * Exponent Variable)	
Coefficient Variable Constan	ht
Current Expression: P Insert Con Con Con Con Con Con Con Con	:el
Branching Operation (If/Else/ElseIf/Else/Endif) Branching Line Type: If () Then If () And/Or () Then Edit X Awatersurfac ElseIf () And/Or () Then Else Else End If Branching Line Type: Expression Edit X Awatersurfac Edit X Second Second Secon	
Check Rule Set OK Cancel	

The next step is to add a rule to open the gate. Click on Line 4 The gate opening will be set to the maximum gate opening of <u>10 feet</u>. However, because the gate opening rate is limited to 0.1 feet/minute (as entered on the main Rule Operations Editor) and the time step is one minute duration, the gate opening will only increase by 0.1 feet per time step.

Because opening the gate is an "Operation" set it with the **Set Operational Param** button <u>Set Operational Param</u>.

Then Scroll down and select "Gate.Opening". Even though there is only one gate group, it still needs to be selected (green circle).

Operation Rules			
Rule Based Operations Rule	Font Size:	10	💌 🥅 Bold Font
row Operation 1 ! Rule Demo for Class 2 'SAwatersurface' = Storage Areas:WS Elevation(Storage S - 3 If ('SAwatersurface' < 5) Then	Supply,Val	ue at c	urrent time step)
Insert New Operation			>
Comment New Variable Get Sim Value Set Operational Param	Branch (If,	/Else)	Math Table
Set Operational Parameter (i.e. gate opening) Gate.Flow Maximum Gate.Copening Gate.Opening Gate.Coefficient.Discharge Gate.Coefficient.Discharge Gate.Coefficient.Opening Exponent Select Gate Group Gate: Gate #1			
Gate opening height for the gate group. Check Rule Set		ОК	Cancel

Operation F	Rules			
	Rule Based Operations Rule Font	Size:	10	▼ Bold Font
row	Operation			
1	! Rule Demo for Class			
2	'SAwatersurface' = Storage Areas:WS Elevation(Storage Suppl	y,Val	ue at (current time step)
- 3	If ('SAwatersurface' < 5) Then			
4	Gate.Opening(Gate #1) - [not set]			
Edit Rule Exp	pression			
	Exponent Coef Exponent Variable	-)		
Coefficien	t Variable		+	Constant 10
Current Expr	ession: 10			
Clear Exp	resion		ок	Cancel
-Set Operati	onal Parameter (i.e. gate opening)			
Gate.Flow Gate.Flow Gate.Oper Gate.Cost Gate.Cost Gate.Cost Gate.Cost	Maximum Minimum ning Rate ng Rate ng Rate ficient.Discharge ficient.Opening Exponent ficient.Opening Exponent			
Gate:	ate #1			
Gate opening	height for the gate group. Check Rule Set		OK	Cancel

Select the gate group and Edit the Expression and set it to a constant of ten.

When the SA water surface gets to 5 feet, the gate needs to be closed. A new If/Then test could be created for this. However, it is simpler to just add an "Else" statement to the existing test.

Click on line 5.

The "Else" is created by first clicking on the **Branch** button and then selecting the Else radial button.

Operation I	Rules
	Rule Based Operations Rule Font Size: 10 💌 🗖 Bold Font
row	Operation
1	! Rule Demo for Class
2	'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply, Value at current time step)
- 3	If ('SAwatersurface' < 5) Then
4	Gate.Opening(Gate #1) = 10
5	Else
<	>
- Insert New	Operation
Commen	nt New Variable Get Sim Value Set Operational Param Branch (If/Else) Math Table
Branching C	Dperation (If/Else/ElseIf/Else/Endif)
Branching	Line Type: Then
O If ()	And/Or () Then
C ElseIf	() Then
C ElseIf	() And/Or () Then
C Else	

The next rule needs to close the gate by setting the opening to "0". A rule could be created from scratch just like the rule shown in row 4. However, it is much quicker to copy and paste rule 4 and then change the value of the expression.

Highlight row 4 by clicking on it and then click the **Copy** button (or use **Ctrl+C** on the keyboard).

Move the control below row 5, as would normally be done for a new rule, and click on the **Paste** button (or **Ctrl+V**).

ro	w	Operation
	1	! Rule Demo for Class
	2	'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply, Value at current time step)
-	3	If ('SAwatersurface' < 5) Then 🛛 😓
	4	Gate.Opening(Gate #1) = 10
	5	Else
	6	Gate.Opening(Gate #1) = 10
		CTRL-V
<		> · · · · · · · · · · · · · · · · · · ·

fter pasting the new rule, the row may look highlighted by the blue line but the bottom half of the Rule Editor is blank (as shown below). This can be fixed by moving the blue line up a row and then back down. (The highlighted blue line can be moved by using the up and down arrows on the keyboard.)

Operation Rules			
Rule Based Operations	Rule Font Size:	10	Bold Font
row Operation			
1 ! Rule Demo for Class			
2 'SAwatersurface' = Storage Areas:WS Elevation(Storage)	age Supply.Va	lue at	current time step)
- 3 If ('SAwatersurface' < 5) Then	5 11 5		
4 Gate.Opening(Gate #1) = 10			
5 Else			
6 Gate.Opening(Gate #1) = 10			
Edit Rule Expression			
Coefficient	t Variable	+	Constant 0
Current Expression: P			1
Clear Expresion		OK	Cancel
Set Operational Parameter (i.e. gate opening)			
Gate.Flow Maximum Gate.Flow Minimum Gate.Opening Gate.Opening Rate Gate.Coefficient.Discharge Gate.Coefficient.Trunnion Exponent Gate.Coefficient.Opening Exponent Select Gate Group Gate: Gate #1			
Gate opening height for the gate group. Check Rule Set		ОК	Cancel

Click on the **Edit** button and change the constant from "10" to "0" to close the gate.

Every If/Then rule must have a corresponding End If. Create a new Branch rule Branch (If/Else) and set it to End If.

At this point, the editor could be closed, the data saved, and the model run. However, it is useful to check the rules for bugs while the editor is still open. Click on the **Check Rule Set** button and RAS will pop up a window that will list the bugs, if any.

Operation	Rules							
	Rule Bas	ed Operations		Rule Font Size:	10	•	Bold Font	
row	Operation					True	Fa /	~
1 2 - 3 4 5	! Rule Demo for C 'SAwatersurface' = If ('SAwatersurface Gate.Opening(Else	:lass : Storage Area: :' < 5) Then Gate #1) = 10	s:WS Elevation(S	Storage Supply,Va	lue a	2 3 4 7 6	2 3 5 7 6	
6 7	Gate.Opening(End If	Gate #1) = 0				7 0	7	-
Commer Branching () Branching O If () O If () C ElseIf O ElseIf O Else O End If	New Variable Operation (If/Else/ElseIf/ Line Type: Then And/Or () Then () And/Or () Then () And/Or () Then	Get Sim Value Else/Endif) RAS No	Set Operational	Param Branch (I re found in the curre	f/Else)	Math ×		
		Check Rule	Set		OK		Cancel	

Fix any bugs, run the data set, and look at the lateral structure hydrographs.

<u>م</u>	tage an	nd Flow Hydro	graphs										_ 0
File	Туре	Options I	Help										
Rive	r: Nitta	any River	<u> </u>				Time Series Maximu HW US Stage 12.	um Time at	Max Volun	ne(acre-ft)	1		Reload
Read	th: Wei	r Reach	•	River Sta.: 42.6	LS _		HW DS Stage 12.	30 09Apr 199	9 0000		_		
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Sta	age Flow	Table Rat	ing Curve 0	ate Openings									
					Plan	Rules Riv	er: Nittany River R	each: Weir	Reach RS	: 42.6			
	14	1	T			· · · · · · · · · · · · · · · · · · ·		1					Legend
	12-												Stage HW US
	10-												Stage HW DS
		/											Stage TW
	8-		-										
			🔂 Stag	ge and Flow Hydrog	graphs								
₽	6-		File	Type Options H	elp								
ll E	4-		Divers	Nittanu Diver				— IT	Time Series	laximum Ti	me at Max Volume(ac	re-ft)	Reload Data
Star			River:	INILIARIY RIVER		n an I			W US Stage	12.30 09A	pr 1999 0000	_	
	2-		Reach:	weir Reach		River Sta.: 14	2.6 LS	Ů_ 2 H	W DS Stage	12.30 09A	pr 1999 0000		
			Plo	t Stage 🔽 Plot Flow	Obs Stage	Obs Flow	Use Ref Stage	3 T\	N Stage	10.75 08A	pr 1999 0238	-	
	0-		Stage	Flow Table Ratin	ng Curve Gate	e Openings							
	-2-				Stage HW US	Stage HW DS	Stage TW	Flow HW US	Flow HW DS	Flow Leaving	Gate Flow - Gate #1	Gate Open - Gate #1	
	-	/		Date	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	
	-4 -	1			FEET	FEET	FEET	CFS	CFS	CFS	CFS	FEET	
	1		/0	08Apr 1999 0115	11.91696	11.91694	4.07508	3555 75000	1867.63500	1755 19100	1752, 15600	7.50	000
	-6-	00	78	08Apr 1999 0117	11.91414	11.91331	4.56177	3576.61400	1865.74500	1778.20100	1778,20100	7.70	000
		I	79	08Apr 1999 0118	11.91272	11.91270	4,80987	3597.52100	1863.85500	1801.21900	1801.21900	7.80	000
1			80	08Apr 1999 0119	11.91130	11.91128	5.06114	3618.46300	1861.97500	1824.23500	1824.23500	7.90	000
			81	08Apr 1999 0120	11.91046	11.91044	5.30923	\$630.33200	1868.55000	1801.09900	1801.09900	7.80	000
			82	08Apr 1999 0121	11.90996	11.90995	5.55413	8636.55000	1876.94200	1777.98200	1777.98200	7.70	000
			83	08Apr 1999 0122	11.90975	11.90975	5.7958	3637.83000	1884.06600	1754.88000	1754.88000	7.60	000
			84	08Apr1999-0123	11.90983	11.90984	6.03439	3634.20800	1889.39700	1709 72000	1/31./9400	7.50	000
			85	08Apr 1999 0124	11.91010	11.91018	6,50193	3614.35800	1896.30700	1607.31300	1607,31300	7.30	000
			87	08Apr 1999 0126	11.91315	11.91319	6.70905	3572.44400	1920.10600	1504.23700	1504.23700	7.20	000

Since the lateral structure is connected to the storage area, the Stage TW of the lateral structure is the same as the water surface in the SA. The lateral structure is diverting flow into the SA and when the target water surface reaches 5 feet, the gate starts closing (although the target is dramatically exceeded by the time the gate gets fully closed).

The next step is to limit the diversion to no more than 20% of flow that is going over the dam.

Add two more Get Sim Value rules Get Sim Value. One that gets the total flow in the inline structure (there is only a single inline structure at 41.75) and a second that gets the total flow for the lateral structure. New variable names will have to be entered (green circle). Note also that these rules must come before the If/Then test rule.

Click on Line 3 to add.

row	Operation	True	Fa
1	! Rule Demo for Class	2	2
2	'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply, Value a	3	3
3	LSFlow' = Lateral Structures:Structure.Total Flow(Nittany River,Weir Re	4	4
- 4	If ('SAwatersurface' < 5) Then	5	6
5	Gate.Opening(Gate #1) = 10	8	8
6	Else	7	7
7	Gate.Opening(Gate #1) = 0	8	8
8	End If		0



row	Operation	True	Fa	^					
1	! Rule Demo for Class	2	2						
2	3	3							
vg 3	4	4							
4	5	5							
- 5	6	7							
6	Gate.Opening(Gate #1) = 10	9	9						
7	Else	8	8						
8	Gate.Opening(Gate #1) = 0		0						
9	End If		0	4					
_Insert Cor	New Operation mment New Variable Get Sim Value Set Operational Param Branch (If/Else)	Math	Tab	le					
-Get Sin	nulation Value								
Assi	ign Result Structure. Total Flow	۱ <u> </u>							
	Existing Variable Structure.Stage (Fixed) River: Nittany F	River		-					
•	© New Variable Weir.Flow Reach: Weir Rea								
Flow	FlowInline Weir, Flow Maximum RS: 41.75 IS								
-	Piowinine Weir.Flow Minimum RS: 41.75 IS								

There are multiple options for how the 20% limit could be added. In this example, the If/Then test is going to be changed to a compound test that has the 20% built into the same row.

Highlight the If/Then test in row 5 and change the Branching Operation to a compound test. The rule for opening the gate is going to be changed so that it only opens if the SA water surface is less than 5 *and* the diverted flow is less than 20%. The "And" operator comes up by default (green circle). Since the check requires that both parts of the test

must be True in order to open the gate, the And is correct. (The other choice is an Or operator which would be used to check if either test is true.)

row	Operation	True	Fa	
1	! Rule Demo for Class	2	2	
2	'FlowInline' = Inline Structures:Structure.Total Flow(Nittany River,Weir Re	3	3	
3	'LSFlow' = Lateral Structures:Structure.Total Flow(Nittany River,Weir Re	4	4	
4	'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply, Value a	5	5	
5	If ('SAwatersurface' < 5) And ([not set] [not set]) Then	6	7	
6	Gate.Opening(Gate #1) = 10	9	9	
7	Else	8	8	
8	Gate.Opening(Gate #1) = 0		0	
9	End If		0	
Insert New Commen Branching O Branching () G If () C If () C ElseIf	Operation Get Sim Value Set Operational Param Branch (If/Else) peration (If/Else/ElseIf/Else/Endif) Line Type: Expression Then And/Or () Then () Then Edit X Awatersurfac Family and the set of the	Math ression	Tab	Expression Edit X [not set]
C ElseIf C Else C End If	() And/Or () Then			

For the third expression select the lateral structure flow and set the second test to "<" (less than).

Operation Rules			
Rule Base	d Operations	Rule Font Size:	10 💌 🗖 Bold Font
row Edit Rule Expression			
1 2 3	Exponent Coef Exponent Variable	<u> </u>	
Coefficient Variat		+	Constant
8 Current Expression: I [[] FlowInline 9 Clear Expression SAwatersurface	<u>.</u>	ок	Cancel
Insert New Operation Comment New Variable Get Sim Val	ue Set Operational Param Branch (If/Els	se) Math Tab	le
- Branching Operation (If/Else/ElseIf/Else/Endif) Branching Line Type: Expression Expressi			
C If () Then Edit		Edit X	Edit X
C ElseIf () Then Awatersu	rfac 5	[not set]	[not set]
C ElseIf () And/Or () Then			
C Else			
C End If			
	Check Rule Set		OK Cancel

For the final Expression, select the variable for the flow over the inline structure. Since the test for the lateral structure flow is limited to 20% of the inline flow, a coefficient of 0.2 should be added.



The final If/Then test is shown below.

1	! Rule Demo for Class
⁷⁵ 2	'FlowInline' = Inline Structures:Structure.Total Flow(Nittany River,Weir Reach,41.75,Value at current time step)
3	'LSFlow' = Lateral Structures:Structure.Total Flow(Nittany River,Weir Reach,42.6,Value at current time step)
4	'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply,Value at current time step)
5	If ('SAwatersurface' < 5) And ('LSFlow' < 0.2 * 'FlowInline') Then
6	Gate.Opening(Gate #1) = 10
7	Else
8	Gate.Opening(Gate #1) = 0
9	End If

With the additional test, the SA fills more slowly and the overshoot of the target is considerably reduced. Once the flow gets up to the 20% limit, the structure is oscillating between opening and closing the gate every other time step. Although this is not shown in this demo, more rules could be added to limit how frequently the gate is adjusted.



V	Stag	ge and Flow Hydrog	raphs								3 X
F	ile	Type Options H	elp								
R	iver:	Nittany River	- .				Time 9	Series Maxim	um Time at Max	Volume(acre-ft) A Re	eload Data
R	each:	Weir Reach	•	River Sta.: 4	2.6 LS	- J 1	HW US	Stage 12	.30 09Apr1999 0000		
		,					2 HW DS	Stage 12	.30 09Apr 1999 0000		
	✓ Plot Stage Plot Flow Obs Stage Obs Flow Use Ref Stage 3 TW Stage 5.39 08Apr 1999 0328										
ſ	Stage	Flow Table Ratin	g Curve Gat	e Openings							
			Stage HW US	Stage HW DS	Stage TW	Flow HW US	Flow HW DS	Flow Leaving	Gate Flow - Gate #1	Gate Open - Gate #1	· •
		Date	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	INST-VAL	
			FEET	FEET	FEET	CFS	CFS	CFS	CFS	FEET	
	13	08Apr 1999 0012	11.99976	11.99973	-4.78950	2173.94900	1979.01800	277.82290	277.8229	0 1.20	000
	14	08Apr 1999 0013	11.99850	11.99846	-4.75124	2194.31500	1977.07900	300.96370	300.963	0 1.30	000
	15	08Apr 1999 0014	11.99722	11.99719	-4.70979	2214.94600	1975.17500	324.10250	324, 1025	i0 1.40	000
	16	08Apr 1999 0015	11.99594	11.99590	-4.66514	2235.82500	1973.33000	347.23960	347.2396	0 1.50	000
	17	08Apr 1999 0016	11.99465	11.99461	-4.61732	2256.93100	1971.54700	370.37490	370.3749	0 1.60	000
	18	08Apr 1999 0017	11.99335	11.99332	-4.56630	2278.22300	1969.81400	393.50830	393.5083	0 1.70	000
	19	08Apr 1999 0018	11.99206	11.99202	-4.51210	2299.65300	1968.12800	416.64000	416.6400	0 1.80	000
	20	08Apr 1999 00 19	11.99076	11.99073	-4.45472	2321.17800	1966.46600	393.47830	393.4783	0 1.70	000
	21	08Apr 1999 0020	11.99005	11.99001	-4.40052	2333.58400	1973.30200	416.61530	416.6153	0 1.80	000
	22	08Apr 1999_0021	11 98910	11 98907	-4 34314	2349 44800	1973 46400	393 45910	393 459	170	000

A final option is to start closing the gate before the SA reaches the 5 foot target. This is done by closing the gate to 0.3 feet once the water surface gets above 4 feet.

Additionally, comments can be used to document and explain the rule data set.

	Rule Based Operations Rule Font Size: 14 🗾 🗸 Bold Font
row	Operation
1	! Rule Demo for Class
2	!
3	! Get LS flow and flow over dam and SA WSE.
4	1
5	'FlowInline' = Inline Structures:Structure.Total Flow(Nittany River,Weir Reach,41.75,Value at current time step)
6	'LSflow' = Lateral Structures:Structure.Total Flow(Nittany River,Weir Reach,42.6,Value at current time step)
7	'SAwatersurface' = Storage Areas:WS Elevation(Storage Supply,Value at current time step)
8	
9	I If SA WSE is less than 5 feet and flow diversion is no more than 20%
10	Then open gate (or keep it open). Otherwise close it (or keep it close).
11	
- 12	IT ('SAwatersurface' < 5) And ('LSflow' <= 0.2 * 'Flowinine') Then
13	i If (Convertere uniformation of A) There
14	II (SAWaterSurface < 4) Then
10	cate Opening = 10
17	
18	I SA is between 4 and 5 feet. Reduce opening to not
19	l overshoot 5 foot target
20	Gate Opening = 0.3
21	End If
22	
23	Else
24	Gate.Opening = 0
25	End If
Terret N	
Commen	operation