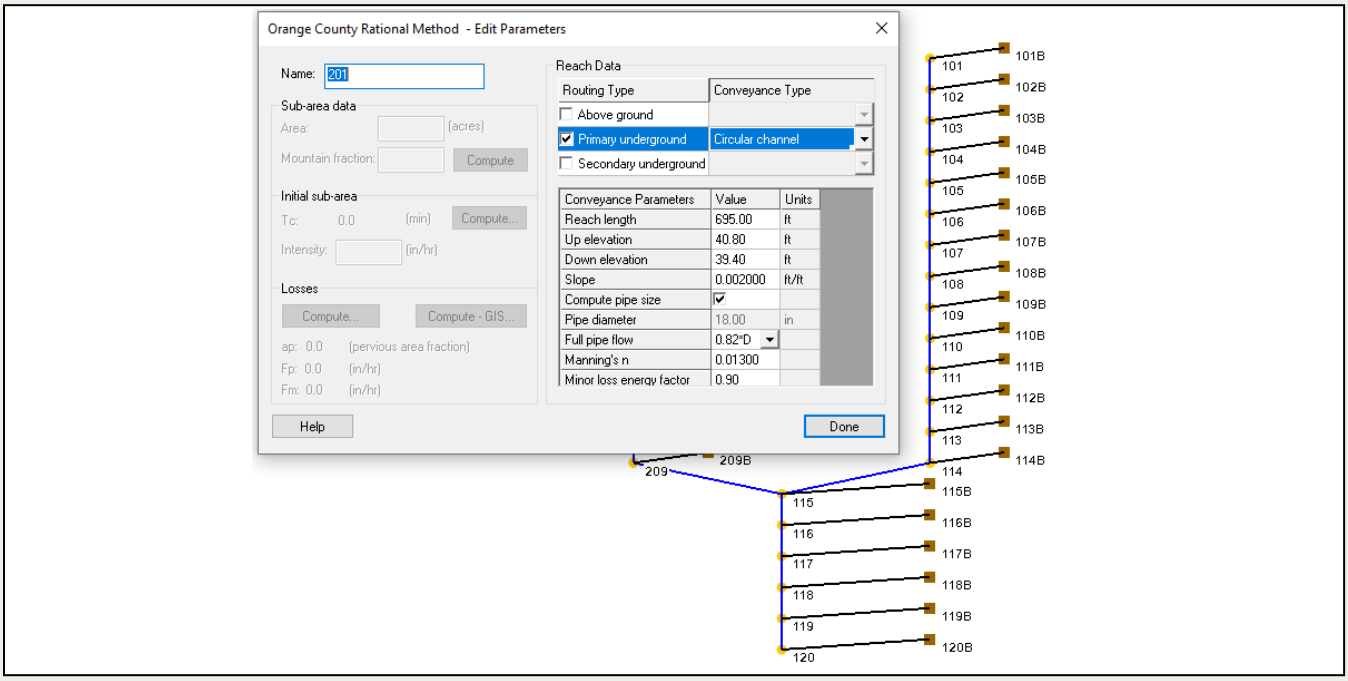
WMS 11.2 Tutorial

Orange County Rational Method

Build and run a hydrograph based on methods in the Orange County (California) hydrology manual



Objectives

This tutorial demonstrates how to run an Orange County rational method analysis and design and explore options for printing results and saving report files. The first example is based on the example problem on page D-16 of the Orange County Hydrology Manual.

Prerequisite Tutorials

- Introduction to WMS

Required Components

- WMS Core
- OC Rational Model

Time

- 20–40 minutes

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1 Introduction

It is possible to run Orange County rational analyses in either analysis mode or design mode, which automatically computes required pipe sizes. This tutorial demonstrates the analysis mode of the Orange County rational method by opening a WMS project file that contains data for the example problem on page D-16 of the Orange County Hydrology Manual. It then goes through running the Orange County rational analysis and saving files. An example of running the Orange County rational method in design mode is also provided.

2 Orange County Hydrology Manual Example

2.1 Open WMS Project File

1. Open WMS. If WMS is already open, select *File* **| New**, then click **Don't Save** if prompted to save changes.
2. Switch to the **Hydrologic Modeling Module** .
3. Select *File* **| Open** to bring up the *Open* dialog.
4. Locate the *data files* folder in the files for this tutorial and select the "OCHMRational.wms" file.
5. Click **Open** to import the project.

This file, shown in Figure 1, contains a basic schematic model, which is made up of topologic tree nodes that represent the connectivity of sub-areas and concentration points and store their respective data.

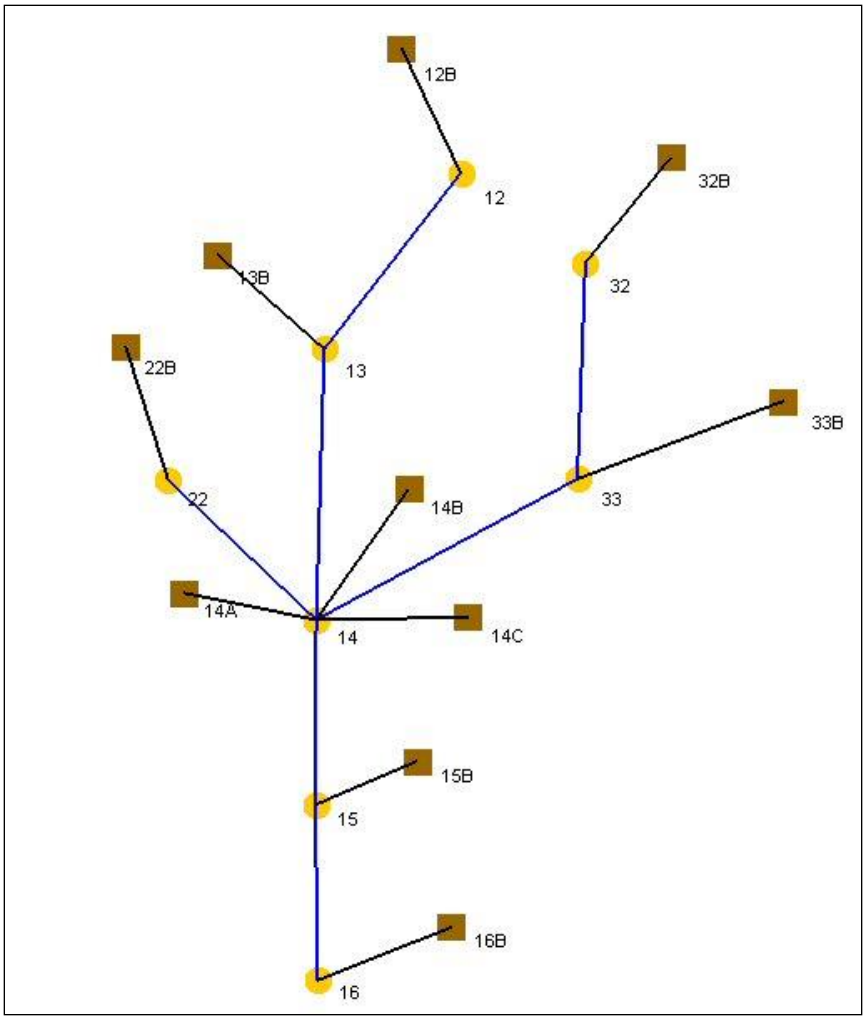


Figure 1 Schematic representation of example problem

2.2 View Data

Start with viewing the hydrologic tree data.

1. Using the **Select outlet** tool, select any of the hydrologic tree nodes by clicking once.
2. Select *OC Rational* **| Edit Parameters..** to open the *Orange County Rational Method – Edit Parameters* dialog.

Reach data are displayed if the selected hydrologic tree node is a concentration point and sub-area data (including initial sub-area parameters and losses) are displayed for hydrologic tree nodes representing sub-areas.

3. Select another hydrologic tree node on the screen without closing the dialog window and notice that the data in the *Orange County Rational Method – Edit Parameters* dialog is updated.
4. Select **Done** to close the *Orange County Rational Method – Edit Parameters* dialog.

2.3 Tree Mapping

Concentration points are mapped to their associated downstream sub-areas in order to use the correct areas for performing travel time calculations. WMS automatically maps sub-areas to concentration points if there is only one confluence point upstream from a concentration point. In this model, all concentration points are automatically mapped except for those labeled 22, 13, and 33, which are directly upstream of the confluence point labeled 14 (see Figure 1).

1. Select *OC Rational* **| Tree Mapping…** to access the *Orange County Rational Method – Tree Mapping* dialog.

This dialog contains a list of unmapped concentration points in the upper left-hand box. As a list item is selected, a list of unmapped sub-areas that are downstream of the selected concentration point will appear in the lower left-hand box. Simply select the appropriate pair to map and click the  button.

2. Select concentration point “22”.
3. Select sub-area “14A”.
4. Click on the **Map** () button.
5. Repeat steps 2–4 to map concentration point “13” and sub-area “14B”.
6. Repeat steps 2–4 to map concentration point “33” and sub-area “14C”.
7. Select **OK** to close the *Orange County Rational Method – Tree Mapping* dialog.

3 Running the Simulation

Since the model has already been built, the model run can be performed, and the output reviewed.

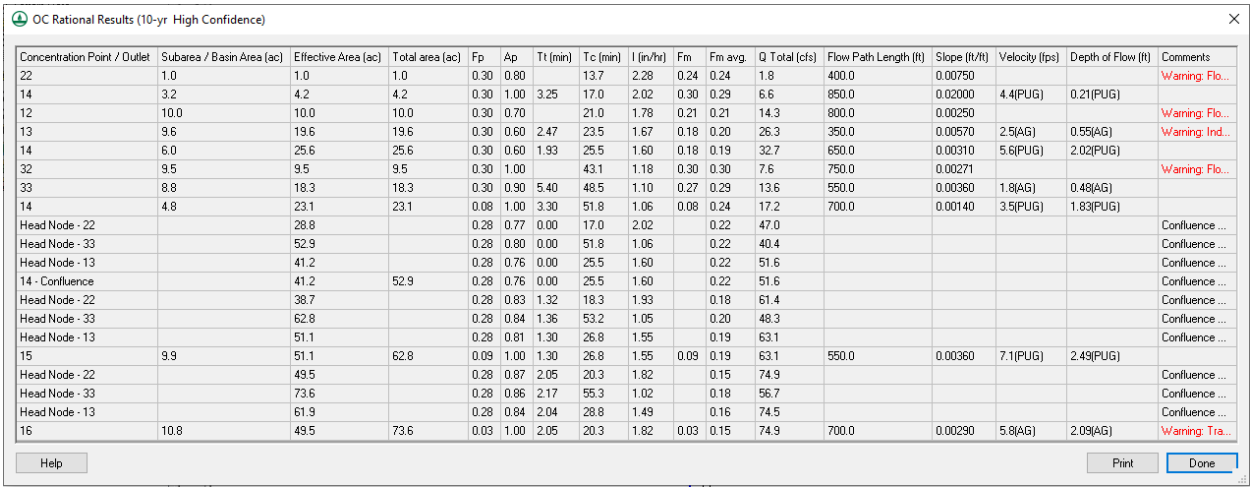
3.1 Running the Model

Once all the concentration points have been mapped, the model can be run.

1. Deselect all concentration points by clicking somewhere on the screen
2. Select *OC Rational* **| Run Simulation…** to open the *Select Orange County Rational details output filename* dialog.
3. For the *File name* enter “OCHMRational1.txt”.
4. Click **Save** to run the Orange County rational analysis and open the *OC Rational Results (10-yr High Confidence)* dialog.

The *OC Rational Results (10-yr High Confidence)* dialog (shown in Figure 2) displays the results of the completed analysis.

5. Select **Done** to close the *OC Rational Results* dialog.



Concentration Point / Outlet	Subarea / Basin Area (ac)	Effective Area (ac)	Total area (ac)	Fp	Ap	Tt (min)	Tc (min)	I (in/hr)	Fm	Fm avg.	Q Total (cfs)	Flow Path Length (ft)	Slope (ft/ft)	Velocity (fps)	Depth of Flow (ft)	Comments
22	1.0	1.0	1.0	0.30	0.80		13.7	2.28	0.24	0.24	1.8	400.0	0.00750			Warning: Flo...
14	3.2	4.2	4.2	0.30	1.00	3.25	17.0	2.02	0.30	0.29	6.6	850.0	0.02000	4.4(PUG)	0.21(PUG)	
12	10.0	10.0	10.0	0.30	0.70		21.0	1.78	0.21	0.21	14.3	800.0	0.00250			Warning: Flo...
13	9.6	19.6	19.6	0.30	0.60	2.47	23.5	1.67	0.18	0.20	26.3	350.0	0.00570	2.5(AG)	0.55(AG)	Warning: Ind...
14	6.0	25.6	25.6	0.30	0.60	1.93	25.5	1.60	0.18	0.19	32.7	650.0	0.00310	5.6(PUG)	2.02(PUG)	
32	9.5	9.5	9.5	0.30	1.00		43.1	1.18	0.30	0.30	7.6	750.0	0.00271			Warning: Flo...
33	8.8	18.3	18.3	0.30	0.90	5.40	48.5	1.10	0.27	0.29	13.6	550.0	0.00360	1.8(AG)	0.48(AG)	
14	4.8	23.1	23.1	0.08	1.00	3.30	51.8	1.06	0.08	0.24	17.2	700.0	0.00140	3.5(PUG)	1.83(PUG)	
Head Node - 22		28.8		0.28	0.77	0.00	17.0	2.02		0.22	47.0					Confluence ...
Head Node - 33		52.9		0.28	0.80	0.00	51.8	1.06		0.22	40.4					Confluence ...
Head Node - 13		41.2		0.28	0.76	0.00	25.5	1.60		0.22	51.6					Confluence ...
14 - Confluence		41.2	52.9	0.28	0.76	0.00	25.5	1.60		0.22	51.6					Confluence ...
Head Node - 22		38.7		0.28	0.83	1.32	18.3	1.93		0.18	61.4					Confluence ...
Head Node - 33		62.8		0.28	0.84	1.36	53.2	1.05		0.20	48.3					Confluence ...
Head Node - 13		51.1		0.28	0.81	1.30	26.8	1.55		0.19	63.1					Confluence ...
15	9.9	51.1	62.8	0.09	1.00	1.30	26.8	1.55	0.09	0.19	63.1	550.0	0.00360	7.1(PUG)	2.49(PUG)	
Head Node - 22		49.5		0.28	0.87	2.05	20.3	1.82		0.15	74.9					Confluence ...
Head Node - 33		73.6		0.28	0.86	2.17	55.3	1.02		0.18	56.7					Confluence ...
Head Node - 13		61.9		0.28	0.84	2.04	28.8	1.49		0.16	74.5					Confluence ...
16	10.8	49.5	73.6	0.03	1.00	2.05	20.3	1.82	0.03	0.15	74.9	700.0	0.00290	5.8(AG)	2.09(AG)	Warning: Tra...

Figure 2 OC Rational Results dialog, complete analysis

3.2 Viewing Detailed Output

1. Select *File* **| Edit File…** to bring up an *Open* dialog.
2. Select the file "OCHMRational1.txt" and click Open.
3. If the *View Data File* dialog appears, select **OK** to view the file in Notepad.
4. Review the file data, then close the file when done.

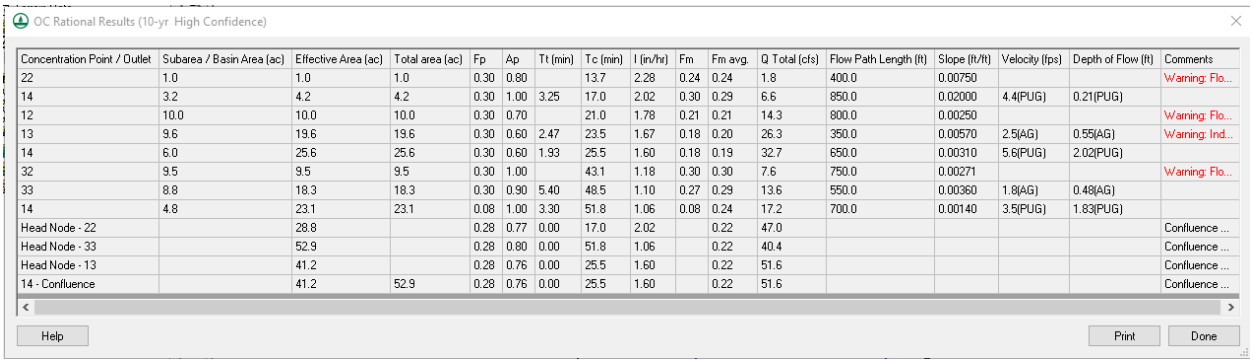
3.3 Running the Model up to a Selected Concentration Point

There is also the option of terminating all calculations downstream of a selected concentration point in the model.

1. Use the **Select outlet** tool to select the concentration point labeled 14.
2. Select *OC Rational* **| Run Simulation…** to open the *Select Orange County Rational details output filename* dialog.
3. Enter "OCHMRational2.txt" for the *File name*.
4. Click **Save** to run the Orange County rational analysis and open the *OC Rational Results* dialog.

The *OC Rational Results (10-yr High Confidence)* dialog is now only showing results from the simulation up until the selected concentration point (Figure 3).

6. Select **Done** to close the *OC Rational Results* dialog.



Concentration Point / Outlet	Subarea / Basin Area (ac)	Effective Area (ac)	Total area (ac)	Fp	Ap	Tt (min)	Tc (min)	I (in/hr)	Fm	Fm avg.	Q Total (cfs)	Flow Path Length (ft)	Slope (ft/ft)	Velocity (fps)	Depth of Flow (ft)	Comments
22	1.0	1.0	1.0	0.30	0.80		13.7	2.28	0.24	0.24	1.8	400.0	0.00750			Warning: Flo...
14	3.2	4.2	4.2	0.30	1.00	3.25	17.0	2.02	0.30	0.29	6.6	850.0	0.02000	4.4(PUG)	0.21(PUG)	
12	10.0	10.0	10.0	0.30	0.70		21.0	1.78	0.21	0.21	14.3	800.0	0.00250			Warning: Flo...
13	9.6	19.6	19.6	0.30	0.60	2.47	23.5	1.67	0.18	0.20	26.3	350.0	0.00570	2.5(AG)	0.55(AG)	Warning: Ind...
14	6.0	25.6	25.6	0.30	0.60	1.93	25.5	1.60	0.18	0.19	32.7	650.0	0.00310	5.6(PUG)	2.02(PUG)	
32	9.5	9.5	9.5	0.30	1.00		43.1	1.18	0.30	0.30	7.6	750.0	0.00271			Warning: Flo...
33	8.8	18.3	18.3	0.30	0.90	5.40	48.5	1.10	0.27	0.29	13.6	550.0	0.00360	1.8(AG)	0.48(AG)	
14	4.8	23.1	23.1	0.08	1.00	3.30	51.8	1.06	0.08	0.24	17.2	700.0	0.00140	3.5(PUG)	1.83(PUG)	
Head Node - 22		28.8		0.28	0.77	0.00	17.0	2.02		0.22	47.0					Confluence ...
Head Node - 33		52.9		0.28	0.80	0.00	51.8	1.06		0.22	40.4					Confluence ...
Head Node - 13		41.2		0.28	0.76	0.00	25.5	1.60		0.22	51.6					Confluence ...
14 - Confluence		41.2	52.9	0.28	0.76	0.00	25.5	1.60		0.22	51.6					Confluence ...

Figure 3 OC Rational Results dialog, partial analysis

4 Saving/Reading an Orange County Project File

Now to save the Orange County rational method simulation:

1. Select *OC Rational* **| Save Simulation…** to open the *Select Orange County Rational file name* dialog.
2. Enter “OCHMSimulation.ocr” for the *File name* and click **Save**.

NOTE: The file will have an “.ocr” extension signifying that it is an Orange County Rational method file.

To read an Orange County file into WMS, select *OC Rational* **| Read Simulation…**. In this case there is no need to open a file since one was just created.

5 Newland Storm Channel Pipe Design Example

This section looks at a different Orange County rational method model example. This example uses the design mode.

1. Select *File* **| New** .
2. Select **Don’t Save** if prompted to save changes to the project.
3. Switch to the **Hydrologic Modeling Module** . Make sure “OC Rational” is selected in the *Model* drop-down box to the right of the modules.
4. Select *OC Rational* **| Read Simulation…** to bring up an *Open* dialog.
5. In the browser, select the file “NewlandDesign.ocr” and click **Open** to import the model.

The model should appear similar to Figure 4.

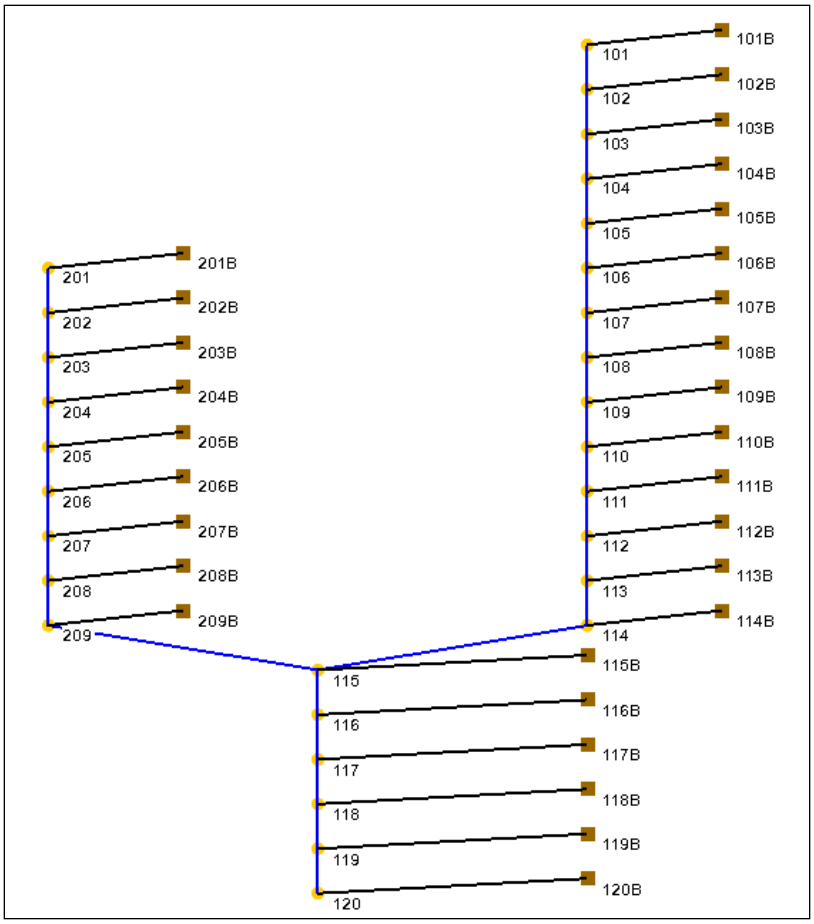


Figure 4 Design mode example project

6. Use the **Select outlet** tool to select the concentration point labeled 201.
7. Select *OC Rational* **| Edit Parameters…** to open the *Orange County Rational Method – Edit Parameters* dialog.

Notice the pipe diameter specified for this reach is “0.00” in and the *Compute pipe size* option is turned on.

8. Select **Done** to close the *Orange County Rational Method – Edit Parameters* dialog.
9. Deselect the concentration point by clicking somewhere on the screen.
10. Select *OC Rational* **| Run Simulation…** to open the *Select Orange County Rational details output filename* dialog.
11. Enter “NewlandDesign.txt” for the *File name*.
12. Click **Save** to run the Orange County rational analysis and open the *OC Rational Results (10-yr High Confidence)* dialog.
13. When finished reviewing the results, select **Done** to close the *OC Rational Results (10-yr High Confidence)* dialog.
14. Use the **Select outlet** tool to select the concentration point labeled 201.
15. Select *OC Rational* **| Edit Parameters…** to open the *Orange County Rational Method – Edit Parameters* dialog.

It is possible to view the standard pipe sizes that WMS computes at each design node.

16. When finished, select **Done** to close the *Orange County Rational Method – Edit Parameters* dialog.

6 Conclusion

This concludes the “Orange County Rational Method” tutorial. This tutorial demonstrated how to run an Orange County Rational Method analysis and design and explore options for printing results and saving report files.