

HI-RUN version 2.0

A Step-by-Step Example

Project Identification and Location

State Route 13 Widening, Milepost 15.5
TDA 1 to be analyzed in this example
Located west of Olympia, WA

Existing roadway area: 24.8 acres

Proposed roadway area: 31.1 acres (6.3 additional acres)

Note: This is a hypothetical example; it does not reference a real highway project.

Project Example

Existing treatment

Biofiltration swale (sized for 4.3 acres)

Proposed treatment

Media filter drain (previously referred to as ecology embankments) sized for 6.3 new acres.

Existing biofiltration swale remains (sized for 4.3 acres).

Outfall

All runoff in the TDA discharges through a single outfall (only one subbasin).

Detention

Detention is planned for this TDA to meet the *Highway Runoff Manual* flow control requirements

Incidental Infiltration:

Due to sufficient separation between the base of the media filter drain and the seasonal high water table elevation, the media filter drains will achieve approximately 60 percent infiltration on an annual runoff volume basis.

The biofiltration swale is not expected to have substantial incidental infiltration.

Project Example

Receiving Water Information – Chinook Creek

ESA-listed fish species present in the project receiving water includes Puget Sound Chinook salmon. An analysis will be performed to evaluate the potential water quality effects of highway runoff on rearing Chinook salmon in the months of August and September.

Background water quality data from a site upstream of the project outfall is available from a previous watershed assessment effort. The median values for DCu and DZn are 0.002 and 0.003 mg/L, respectively.

Receiving water quality indicators are properly functioning.

Note: This is a hypothetical example; it does not reference a real receiving water.

Project Example

Translating Project Information into HI-RUN

The project information described in slides 2-4 is summarized in the *ESA Stormwater Design Checklist* – which is completed by the project designer and provided to the project biologist to use for inputs to the HI-RUN model. The checklist is available on the WSDOT BA Stormwater Guidance Web page:

<http://www.wsdot.wa.gov/Environment/Biology/BA/BAGuidance.htm#Stormwater>

Endangered Species Act Stormwater Design Checklist

For Western Washington

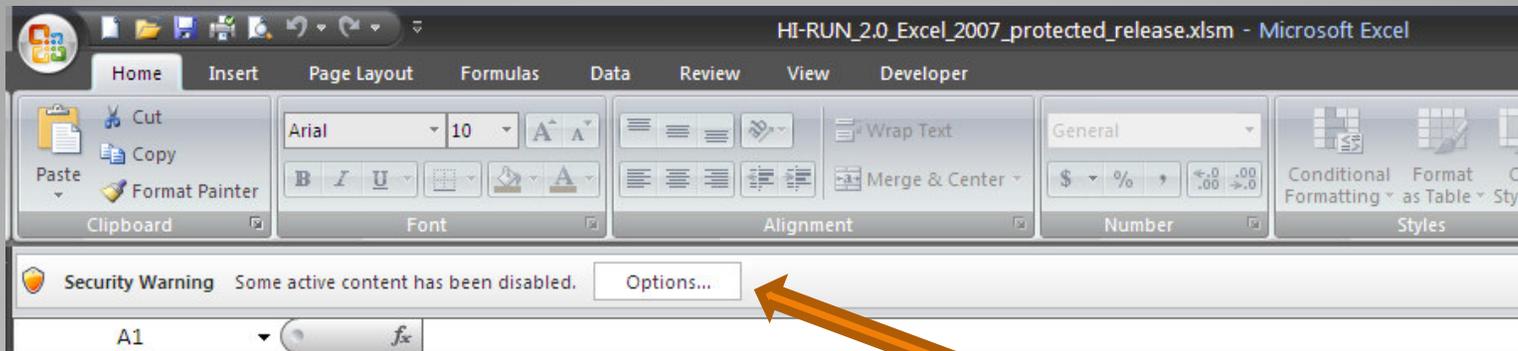
Inputs for HI-RUN Model End-of-Pipe Loading Subroutine

Baseline (i.e., Pre-Project) Stormwater Facilities

| Treatment Type | Level of Infiltration ^a | Subbasin 1 Impervious Area (acres) | Subbasin 2 Impervious Area (acres) | Subbasin 3 Impervious Area (acres) | Subbasin 4 Impervious Area (acres) | Subbasin 5 Impervious Area (acres) |
|---|------------------------------------|--|--|--|--|--|
| <input type="checkbox"/> Basic OR <input type="checkbox"/> Phosphorus (Check one) | 0% | | | | | |
| | 20% | | | | | |
| | 40% | | | | | |
| | 60% | | | | | |
| | 80% | | | | | |
| Enhanced | 0% | | | | | |
| | 20% | | | | | |
| | 40% | | | | | |
| | 60% | | | | | |
| | 80% | | | | | |
| None | | | | | | |
| Infiltration BMP | 100% | | | | | |

^aLevel of infiltration relates to the amount of incidental infiltration that can be expected, expressed as a percentage of annual average annual precipitation. If no incidental infiltration can be assumed, enter area in the row corresponding to "0%".

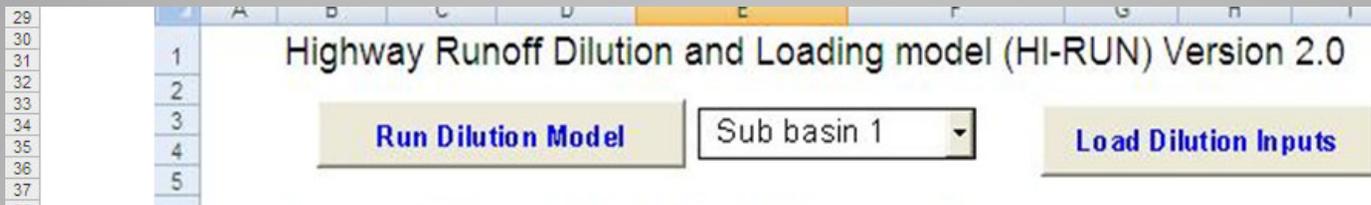
Project Example



If macros are disabled on your computer, you will not be able to enter input values or run the HI-RUN model.

To enable macros, click the "Options" button on the Security Warning banner at the top of the sheet. Then select "Enable this content" in the Microsoft Office Security Options window.

Starting HI-RUN



2. After clicking the options button, the window below will appear. Click on **Enable this content**.
You will need to do this every time you open HI-RUN unless you choose to enable macros by default.



Once you have enabled the macros, you're ready to start running the model. Select the "Loading" tab at the bottom of the screen to start the End-of-Pipe Loading Subroutine

Starting HI-RUN

End-of-Pipe Loading Subroutine

A Step-by-Step Example

| | A | B | C | D | E | F | G | H | I | J | K |
|----|---|---|--|--|---|---|--|---|---|---|---|
| 1 | Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007 | | | | | | | | | | |
| 2 | This model is for stormwater analysis associated with biological assessments, and is not a design tool. | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | <input type="button" value="Run Loading Model"/> | | | <input type="button" value="Load Inputs"/> | | | <input type="button" value="Save Inputs"/> | | | <input type="button" value="Clear TDA Inputs"/> | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | Data Inputs - End-of-Pipe Loading Subroutine | | | | | | | | | | |
| 8 | Description: This model provides risk-based predictions of stormwater quality at the outfall and Threshold Discharge Area (TDA) scale. The Highway Runoff Manual provides a thorough discussion of TDA delineation specific to transportation drainage systems. The analysis of water quality concentrations is conducted at a subbasin scale, with subbasins being divisions of TDAs that have discrete discharge points in the receiving water. If a TDA has only one discharge point, data need only be entered under Subbasin 1. The analysis of pollutant loadings is done at the TDA scale only. Water quality parameters analyzed by this tool are Total Suspended Solids (TSS), Total Copper (TCu), Dissolved Copper (DCu), Total Zinc (TZn), and Dissolved Zinc (DZn). | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | Project/TDA ID: | | <input type="text" value="SR 13, MP 15.5, TDA 1"/> | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | Precipitation Timeseries: | | <input type="text" value="Montesano"/> | | | <input type="button" value="ViewRegion Map"/> | | | | | |

Enter identifying information about the project and threshold discharge area that you are analyzing. Highway number, milepost, and TDA identifier are sufficient.

Step 1 – Project TDA/ID

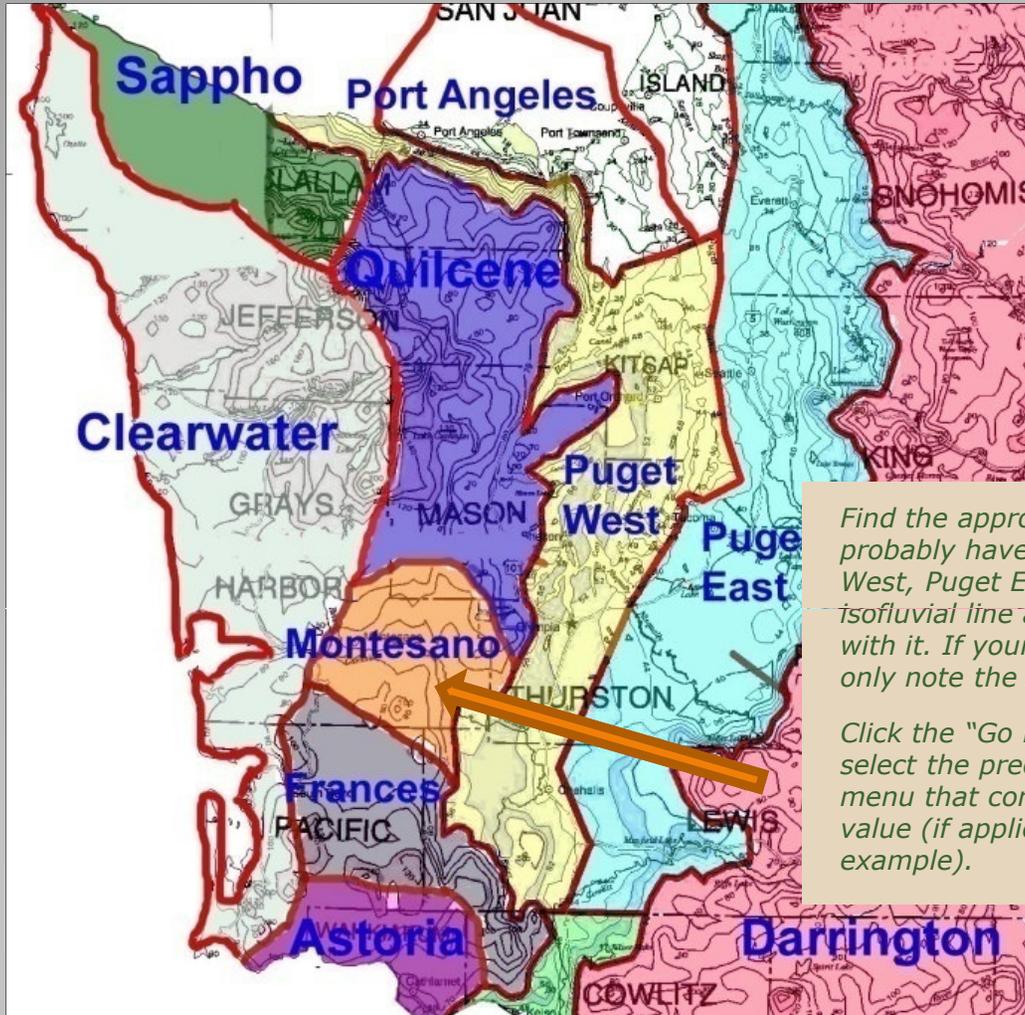
End-of-Pipe Loading Subroutine

| | A | B | C | D | E | F | G | H | I | J | K |
|----|---|---|-----------------------|-------------|---|----------------|-------------|---|---|------------------|---|
| 1 | Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007 | | | | | | | | | | |
| 2 | This model is for stormwater analysis associated with biological assessments, and is not a design tool. | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | Run Loading Model | | | Load Inputs | | | Save Inputs | | | Clear TDA Inputs | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | Data Inputs - End-of-Pipe Loading Subroutine | | | | | | | | | | |
| 8 | Description: This model provides risk-based predictions of stormwater quality at the outfall and Threshold Discharge Area (TDA) scale. The Highway Runoff Manual provides a thorough discussion of TDA delineation specific to transportation drainage systems. The analysis of water quality concentrations is conducted at a subbasin scale, with subbasins being divisions of TDAs that have discrete discharge points in the receiving water. If a TDA has only one discharge point, data need only be entered under Subbasin 1. The analysis of pollutant loadings is done at the TDA scale only. Water quality parameters analyzed by this tool are Total Suspended Solids (TSS), Total Copper (TCu), Dissolved Copper (DCu), Total Zinc (TZn), and Dissolved Zinc (DZn). | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | Project/TDA ID: | | SR 13, MP 15.5, TDA 1 | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | Precipitation Timeseries: | | Montesano | | | ViewRegion Map | | | | | |

Select the precipitation time series associated with your site from the dropdown menu. If you do not know which time series is appropriate, click the "View Region Map" button.

Step 2 – Precipitation Time Series

End-of-Pipe Loading Subroutine



Find the approximate project location on the map (you'll probably have to zoom in). If your project is in the Puget West, Puget East, or Vancouver zones, find the closest isofluvial line and note the precipitation value associated with it. If your site lies outside of those zones, you need only note the zone that it is located in.

Click the "Go Back to Data Input Sheet" button and select the precipitation time series from the dropdown menu that corresponds to the zone and precipitation value (if applicable) from the map (Montesano in this example).

Step 2 – Precipitation Time Series

End-of-Pipe Loading Subroutine

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Data Inputs - End-of-Pipe Loading Subroutine

Description: This model provides risk-based predictions of stormwater quality at the outfall and Threshold Discharge Area (TDA) scale. The Highway Runoff Manual provides a thorough discussion of TDA delineation specific to transportation drainage systems. The analysis of water quality concentrations is conducted at a subbasin scale, with subbasins being divisions of TDAs that have discrete discharge points in the receiving water. If a TDA has only one discharge point, data need only be entered under Subbasin 1. The analysis of pollutant loadings is done at the TDA scale only. Water quality parameters analyzed by this tool are Total Suspended Solids (TSS), Total Copper (TCu), Dissolved Copper (DCu), Total Zinc (TZn), and Dissolved Zinc (DZn).

Project/TDA ID:

Precipitation Timeseries:

Water Quality Parameters
 All
 TSS
 Copper - Total
 Copper -Dissolved
 Zinc - Total
 Zinc - Dissolved

Month
 January
 February
 March
 April
 May
 June
 July
 August
 September
 October
 November
 December

Select the water quality parameters you would like to analyze. You can select multiple parameters by using the Ctrl or Shift keys while selecting parameters from the list.



HI-RUN won't let you select a parameter?

If you've already made sure that macros are enabled, try switching sheets (click on "Dilution" tab, then back on "Loading" tab). You should then be able to select a parameter from the list.

Step 3 – Water Quality Parameters

End-of-Pipe Loading Subroutine

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Data Inputs - End-of-Pipe Loading Subroutine

Description: This model provides risk-based predictions of stormwater quality at the outfall and Threshold Discharge Area (TDA) scale. The Highway Runoff Manual provides a thorough discussion of TDA delineation specific to transportation drainage systems. The analysis of water quality concentrations is conducted at a subbasin scale, with subbasins being divisions of TDAs that have discrete discharge points in the receiving water. If a TDA has only one discharge point, data need only be entered under Subbasin 1. The analysis of pollutant loadings is done at the TDA scale only. Water quality parameters analyzed by this tool are Total Suspended Solids (TSS), Total Copper (TCu), Dissolved Copper (DCu), Total Zinc (TZn), and Dissolved Zinc (DZn).

Project/TDA ID:

Precipitation Timeseries:

| Water Quality Parameters | Month |
|--------------------------|-----------|
| All | January |
| TSS | February |
| Copper - Total | March |
| Copper -Dissolved | April |
| Zinc - Total | May |
| Zinc - Dissolved | June |
| | July |
| | August |
| | September |
| | October |
| | November |
| | December |

Select the month(s) of interest. You can select multiple months by using the Ctrl or Shift keys while selecting months from the list.

NOTE: This selection only affects the monthly end-of-pipe concentration results. Select only one month for a faster model run unless you are interested in the monthly concentration results .

HI-RUN won't let you select a month?

If you've already made sure that macros are enabled, try switching sheets (click on "Dilution" tab, then back on "Loading" tab). You should then be able to select a month from the list.

Step 4 – Months

End-of-Pipe Loading Subroutine

Incidental infiltration is the estimated portion of annual runoff volume that is infiltrated during the runoff treatment process.

Enter impervious drainage area that is applied in the **pre-project** condition.

HI-RUN can evaluate up to 5 subbasins within a given TDA (areas with different discharge points)

| TDA Information - Baseline Conditions | | | | | | | |
|---------------------------------------|--------------------------------------|-----------------------|----------|----------|----------|----------|-----------------------------|
| Treatment Type | Level of Incidental Infiltration (%) | Subbasin Area (acres) | | | | | TDA Impervious Area (acres) |
| | | 1 | 2 | 3 | 4 | 5 | |
| Basic | 0 | 4.3 | | | | | 4.3 |
| | 20 | | | | | | 0 |
| | 40 | | | | | | 0 |
| | 60 | | | | | | 0 |
| | 80 | | | | | | 0 |
| Enhanced | 0 | | | | | | 0 |
| | 20 | | | | | | 0 |
| | 40 | | | | | | 0 |
| | 60 | | | | | | 0 |
| Infiltration BMP | 100 | | | | | | 0 |
| | None | 20.5 | | | | | 20.5 |
| Total | | 24.8 | 0 | 0 | 0 | 0 | 24.8 |

Runoff from 4.3 acres of the project area impervious surface is treated with a basic treatment BMP (as defined in the Highway Runoff Manual).

Infiltration BMP indicates infiltration ponds, trenches, etc. that are designed to infiltrate all or most runoff routed to them.

Runoff from 20.5 acres of the project area impervious surface is discharged with no treatment.

Step 5 – Baseline Conditions

End-of-Pipe Loading Subroutine

Enter impervious drainage area, separated by the kind of runoff treatment that will be applied in the **post-project** condition.

Runoff from 4.3 acres of the project area impervious surface is treated with a basic treatment BMP (as defined in the Highway Runoff Manual) .

| TDA Information - Proposed Conditions | | | | | | | |
|---------------------------------------|--------------------------------------|-----------------------|----------|----------|----------|----------|-----------------------------|
| | | Subbasin Area (acres) | | | | | TDA Impervious Area (acres) |
| Treatment Type | Level of Incidental Infiltration (%) | 1 | 2 | 3 | 4 | 5 | |
| Basic | 0 | 4.3 | | | | | 4.3 |
| | 20 | | | | | | 0 |
| | 40 | | | | | | 0 |
| | 60 | | | | | | 0 |
| | 80 | | | | | | 0 |
| Enhanced | 0 | | | | | | 0 |
| | 20 | | | | | | 0 |
| | 40 | | | | | | 0 |
| | 60 | 6.3 | | | | | 6.3 |
| | 80 | | | | | | 0 |
| Infiltration BMP | 100 | | | | | | 0 |
| None | 0 | 20.5 | | | | | 20.5 |
| Total | | 31.1 | 0 | 0 | 0 | 0 | 31.1 |

Runoff from 20.5 acres of the project area impervious surface is discharged with no treatment.

Runoff from 6.3 acres of the project area impervious surface is treated with an enhanced treatment BMP (as defined in the Highway Runoff Manual). This BMP also infiltrates approximately 60% of the annual runoff volume.

Step 6 – Proposed Conditions

End-of-Pipe Loading Subroutine

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Run Loading Model **Load Inputs** **Save Inputs** **Clear TDA Inputs**

Data Inputs - End-of-Pipe Loading Subroutine

Description: This model provides risk-based predictions of stormwater quality at the outfall and Threshold Discharge Area (TDA) scale. The Highway Runoff Manual provides a thorough discussion of TDA delineation specific to transportation drainage systems. The analysis of water quality concentrations is conducted at a subbasin scale, with subbasins being divisions of TDAs that have discrete discharge points in the receiving water. If a TDA has only one discharge point, data need only be entered under Subbasin 1. The analysis of pollutant loadings is done at the TDA scale only. Water quality parameters analyzed by this tool are Total Suspended Solids (TSS), Total Copper (TCu), Dissolved Copper (DCu), Total Zinc (TZn), and Dissolved Zinc (DZn).

Project/TDA ID:

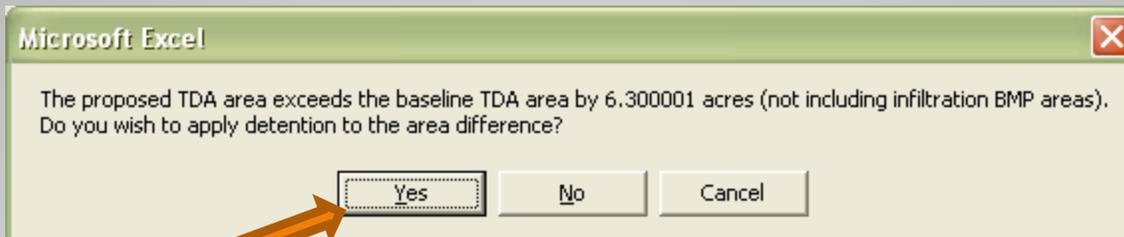
Precipitation Timeseries:

Click this button when your inputs have been entered.

You can also save your inputs for future model runs.

Step 7 – Run End-of-Pipe Loading Subroutine

End-of-Pipe Loading Subroutine



Indicate here whether the project will implement detention to control flows from increased impervious area.

Note: Detention does not affect the annual pollutant load estimates in the End-of-Pipe Loading Subroutine, but it does affect the pollutant concentration results.

Step 7 – Run End-of-Pipe Loading Subroutine

End-of-Pipe Loading Subroutine

Confirm Input Parameters

Outfall ID: SR 13, MP 15.5, TDA 1 Water Quality Parameters: All
 Rain Gauge: Montesano
 Months: All

| TDA Baseline Conditions | TDA Proposed Conditions |
|--|--|
| None Treatment 0% - 20.5 ac | None Treatment 0% - 20.5 ac |
| Basic Treatment 0% - 4.3 ac | Basic Treatment 0% - 4.3 ac |
| Enhanced Treatment no drainage area | Enhanced Treatment 60% - 6.3 ac |
| Total Area: 24.8 ac | Total Area: 31.1 ac Detention Area: 6.3 ac Applied to subbasin 1 |

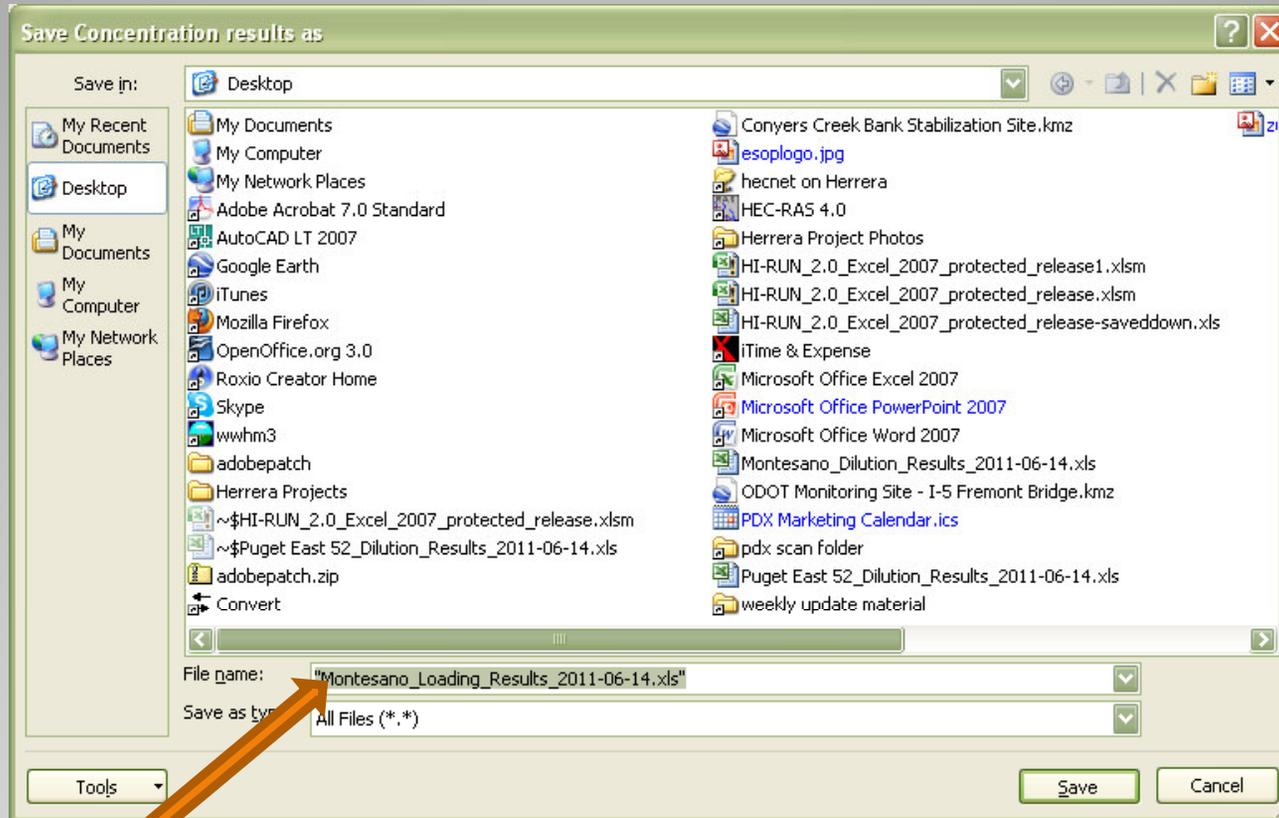
Enter Descriptive text for simulation

Enter notes regarding the model run for documentation in the Results file.

Click here to run the end-of-pipe loading subroutine. You will see the Results file being assembled as the model runs.

Step 7 – Run End-of-Pipe Loading Subroutine

End-of-Pipe Loading Subroutine



Save your results for your records.

Step 7 – Run End-of-Pipe Loading Subroutine

End-of-Pipe Loading Subroutine

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0
End of Pipe Loading Subroutine Report
 This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 6/14/11 13:43
 Outlet ID: SR 10, MP 15.5, TDA 1
 Rain Gauge: Montecano
 Description: Case Study #2 - MB

Discharge Areas

Subbasin 1 - Baseline Conditions - 24.8 acres
 basic treatment - 0% infiltration - 4.3 acres
 no treatment - 0% infiltration - 20.5 acres

Subbasin 1 - Proposed Conditions - 31.1 acres
 basic treatment - 0% infiltration - 4.3 acres
 enhanced treatment - 60% infiltration - 6.3 acres
 no treatment - 0% infiltration - 20.5 acres

Load Analysis

| | TSS Load (lb/yr) | | Total Copper Load (lb/yr) | | Dissolved Copper Load (lb/yr) | | Total Zinc Load (lb/yr) | | Dissolved Zinc Load (lb/yr) | |
|-----------------|------------------|----------|---------------------------|----------|-------------------------------|----------|-------------------------|----------|-----------------------------|----------|
| | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed |
| Max | 2846930 | 1808645 | 232 | 169 | 49.9 | 33 | 1079 | 1063 | 407 | 634 |
| 75th Percentile | 35783 | 35787 | 8.09 | 8.2 | 2.03 | 2.1 | 49.2 | 50 | 15.8 | 16 |
| Median | 17630 | 17667 | 4.62 | 4.7 | 1.22 | 1.3 | 27.9 | 28 | 8.63 | 8.9 |
| 25th Percentile | 8766 | 8849 | 2.67 | 2.8 | 0.746 | 0.8 | 16 | 16 | 4.89 | 5.2 |
| Min | 163 | 174 | 0.018 | 0.029 | 0.009 | 0.022 | 0.146 | 0.4 | 0.049 | 0.064 |
| P (exceed) | | 0.503 | | 0.507 | | 0.52 | | 0.506 | | 0.514 |

Concentration Analysis

| Subbasin 1 | TSS Conc (mg/L) | | Total Copper Conc (mg/L) | | Dissolved Copper Conc (mg/L) | | Total Zinc Conc (mg/L) | | Dissolved Zinc Conc (mg/L) | |
|-----------------|-----------------|----------|--------------------------|----------|------------------------------|----------|------------------------|----------|----------------------------|----------|
| | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed |
| Max | 6953.54 | 5510.38 | 0.714 | 0.324 | 0.089 | 0.094 | 2.066 | 3 | 1.38 | 1.825 |
| 75th Percentile | 105.123 | 96.396 | 0.023 | 0.022 | 0.006 | 0.006 | 0.143 | 0.133 | 0.046 | 0.044 |
| Median | 53.215 | 49.223 | 0.014 | 0.013 | 0.004 | 0.004 | 0.084 | 0.079 | 0.026 | 0.025 |
| 25th Percentile | 27.188 | 25.576 | 0.008 | 0.008 | 0.002 | 0.002 | 0.05 | 0.048 | 0.015 | 0.016 |
| Min | 1.056 | 1.339 | 0.001 | 0.001 | 0 | 0 | 0.004 | 0.006 | 0.002 | 0.002 |
| P (exceed) | | 0.48 | | 0.483 | | 0.504 | | 0.479 | | 0.498 |

This box summarizes the inputs that were used.

This box summarizes load statistics

This box summarizes concentration statistics.

Step 8 - Interpreting End-of-Pipe Loading Subroutine Results

End-of-Pipe Loading Subroutine

30 **Load Analysis**

| | TSS Load (lb/yr) | | Total Copper Load (lb/yr) | | Dissolved Copper Load (lb/yr) | | Total Zinc Load (lb/yr) | | Dissolved Zinc Load (lb/yr) | |
|------------------------|------------------|--------------|---------------------------|--------------|-------------------------------|-------------|-------------------------|--------------|-----------------------------|--------------|
| | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed |
| Max | 2846930 | 1808645 | 232 | 169 | 49.9 | 33 | 1078 | 1063 | 407 | 634 |
| 75th Percentile | 35783 | 35787 | 8.09 | 8.2 | 2.03 | 2.1 | 49.2 | 50 | 15.8 | 16 |
| Median | 17630 | 17667 | 4.62 | 4.7 | 1.22 | 1.3 | 27.9 | 28 | 8.63 | 8.9 |
| 25th Percentile | 8766 | 8849 | 2.67 | 2.8 | 0.746 | 0.8 | 16 | 16 | 4.89 | 5.2 |
| Min | 163 | 174 | 0.018 | 0.029 | 0.009 | 0.022 | 0.146 | 0.4 | 0.049 | 0.064 |
| P (exceed) | | 0.503 | | 0.507 | | 0.52 | | 0.506 | | 0.514 |

Annual Load statistics: Max, Min, Median, 25th and 75th percentiles for proposed and baseline and P(exceed).

These tables summarize annual pollutant loads and concentrations at the project outfall.

45 **Concentration Analysis**

| Subbasin 1 | TSS Conc (mg/L) | | Total Copper Conc (mg/L) | | Dissolved Copper Conc (mg/L) | | Total Zinc Conc (mg/L) | | Dissolved Zinc Conc (mg/L) | |
|------------------------|-----------------|----------|--------------------------|----------|------------------------------|----------|------------------------|----------|----------------------------|----------|
| | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed | Baseline | Proposed |
| Max | 6953.54 | 5510.98 | 0.714 | 0.324 | 0.089 | 0.094 | 2.066 | 3 | 1.38 | 1.825 |
| 75th Percentile | 105.123 | 96.396 | 0.023 | 0.022 | 0.006 | 0.006 | 0.143 | 0.133 | 0.046 | 0.044 |
| Median | 53.215 | 49.223 | 0.014 | 0.013 | 0.004 | 0.004 | 0.084 | 0.079 | 0.026 | 0.025 |
| 25th Percentile | 27.188 | 25.576 | 0.008 | 0.008 | 0.002 | 0.002 | 0.05 | 0.048 | 0.015 | 0.016 |
| Min | 1.056 | 1.339 | 0.001 | 0.001 | 0 | 0 | 0.004 | 0.006 | 0.002 | 0.002 |
| P (exceed) | | 0.48 | | 0.483 | | 0.504 | | 0.479 | | 0.498 |

Concentration statistics: Max, Min, Median, 25th and 75th percentiles for proposed and baseline and P(exceed).

The key data point to note here is the P(exceed) value for dissolved zinc load (0.514).

| Dissolved Zinc Load (lb/yr) | |
|-----------------------------|--------------|
| Baseline | Proposed |
| 407 | 634 |
| 15.8 | 16 |
| 8.63 | 8.9 |
| 4.89 | 5.2 |
| 0.049 | 0.064 |
| | 0.514 |

Step 8 – Interpreting End-of-Pipe Loading Subroutine Results

End-of-Pipe Loading Subroutine

| Dissolved Zinc Load (lb/gr) | |
|-----------------------------|--------------|
| Baseline | Proposed |
| 407 | 634 |
| 15.8 | 16 |
| 8.63 | 8.9 |
| 4.89 | 5.2 |
| 0.049 | 0.064 |
| | 0.514 |

What does the *P(exceed)* value mean?

It is the estimated probability that the parameter (annual load of zinc in the dissolved phase in this example) will be greater with the proposed project than in the baseline condition.

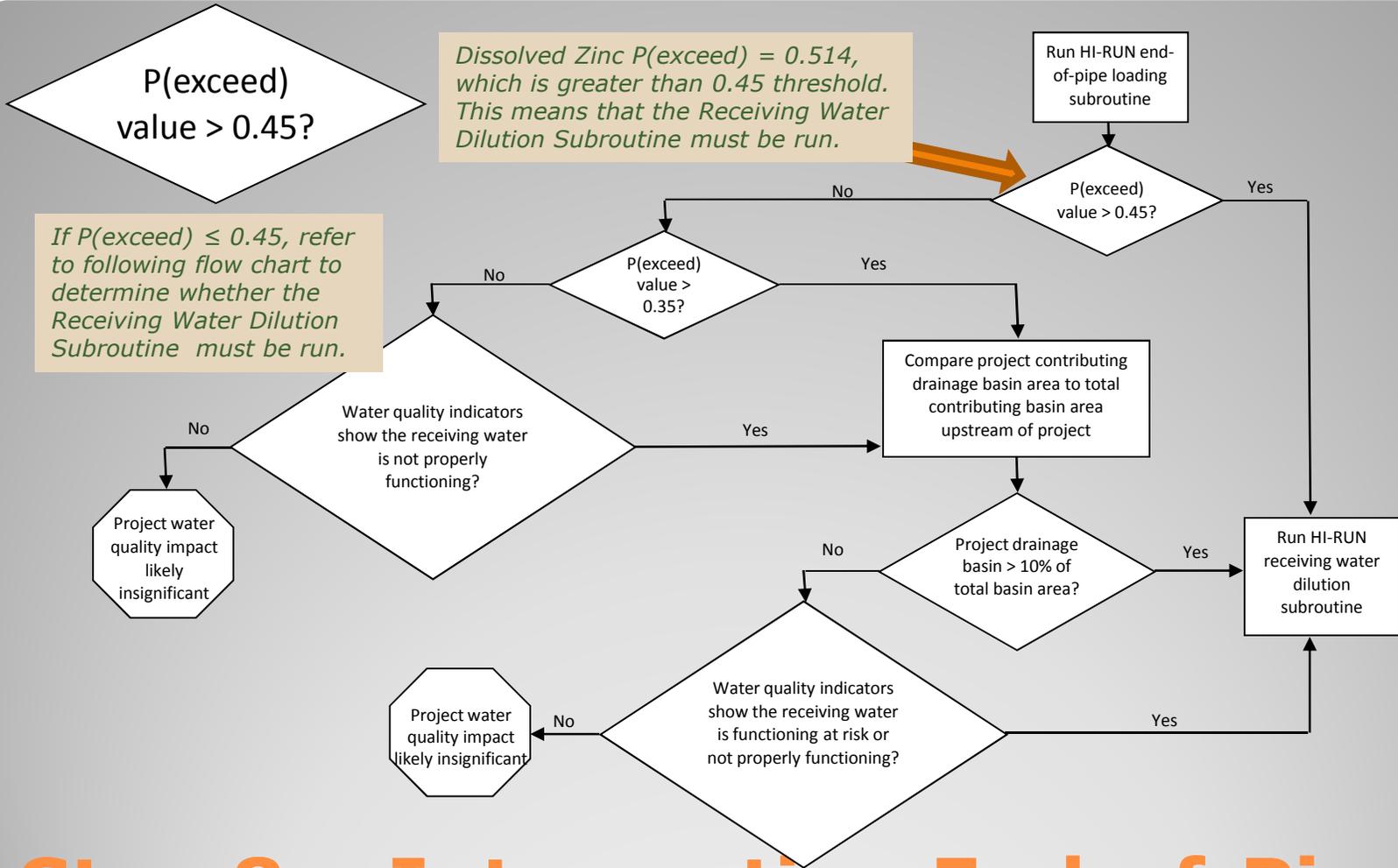
If a TDA has a *P(exceed)* value of 0.5, there is a 50% probability that the load with the proposed project will be greater than in the baseline condition (an increase in pollutant loading) and a 50% probability that it will be less (a decrease in pollutant loading).

If a TDA has a *P(exceed)* value < 0.5 , there is a **greater chance that pollutant loading will decrease** with the proposed project.

If a TDA has a *P(exceed)* value > 0.5 , there is a **greater chance that pollutant loading will increase** with the proposed project.

Step 8 – Interpreting End-of-Pipe Loading Subroutine Results

End-of-Pipe Loading Subroutine



Step 8 – Interpreting End-of-Pipe Loading Subroutine Results

End-of-Pipe Loading Subroutine

Receiving Water Dilution Subroutine

A Step-by-Step Example

| Treatment Type | Level of Incidental Infiltration (%) | Subbasin Area (acres) | | | | | TDA Impervious Area (acres) |
|------------------|--------------------------------------|-----------------------|----------|----------|----------|----------|-----------------------------|
| | | 1 | 2 | 3 | 4 | 5 | |
| Basic | 0 | 4.3 | | | | | 4.3 |
| | 20 | | | | | | 0 |
| | 40 | | | | | | 0 |
| | 60 | | | | | | 0 |
| | 80 | | | | | | 0 |
| Enhanced | 0 | | | | | | 0 |
| | 20 | | | | | | 0 |
| | 40 | | | | | | 0 |
| | 60 | 6.3 | | | | | 6.3 |
| | 80 | | | | | | 0 |
| Infiltration BMP | 100 | | | | | | 0 |
| None | 0 | 20.5 | | | | | 20.5 |
| Total | | 31.1 | 0 | 0 | 0 | 0 | 31.1 |

Last Revision Date: May 27, 2011



To begin running the Receiving Water Dilution Subroutine, click on the "Dilution" tab at the bottom of the sheet

Running the Receiving Water Dilution Subroutine

Receiving Water Dilution Subroutine

HI-RUN_2.0_Excel_2007_protected_release.xlsm - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Developer

Cut Copy Paste Format Painter Clipboard Font Alignment Number Styles

O18 0.5

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007

Run Dilution Model Sub basin 1 Load Dilution Inputs Save Dilution Inputs Clear Inputs

Inputs for Receiving Water Dilution Subroutine

Dilution subroutine analysis is only conducted on pollutants that have an established biological effects threshold (dissolved copper and zinc)

Subbasin 1

| | Background Concentration (mg/L) | Enter short description of simulation (optional) |
|-------------------|---------------------------------|--|
| TSS | | |
| Copper - Total | | |
| Zinc - Total | | |
| Copper -Dissolved | 0.002 | |
| Zinc - Dissolved | 0.003 | |

Related to the subbasin columns in the "Loading" sheet

Enter receiving water background concentrations for dissolved copper and dissolved zinc.

Note: the receiving water dilution subroutine will analyze only dissolved copper and zinc, regardless of parameters selected on the "Loading" sheet.

Step 1 – Background Concentrations

Receiving Water Dilution Subroutine

6 **Inputs for Receiving Water Dilution Subroutine**

7 Dilution subroutine analysis is only conducted on pollutants that have an established biological effects threshold (dissolved copper and zinc)

8 **Subbasin 1**

9 Background Concentration (mg/L)

10 TSS

11 Copper - Total

12 Zinc - Total

13 Copper -Dissolved 0.002

14 Zinc - Dissolved 0.003

15 Enter short description of simulation (optional)

| | January | February | March | April | May | June | July | August | September | October | November | December |
|--|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|
| Stream Depth (ft) | | | | | | | | 1.55 | 1.5 | | | |
| Stream Velocity (fps) | | | | | | | | 0.53 | 0.5 | | | |
| Channel Width (ft) | | | | | | | | 10.5 | 10 | | | |
| Slope | | | | | | | | 0.004 | 0.004 | | | |
| Discharge Distance into Water Body From Nearest Shoreline (ft) | | | | | | | | 0 | 0 | | | |

Enter depth, velocity, width, slope (or channel roughness), for each month of interest, and the outfall distance from the bank.

Note: The receiving water dilution subroutine will analyze all months with characteristic data entered, NOT the months selected in the "Loading" sheet.

Steps 2-6 – Receiving Water Characteristics

Receiving Water Dilution Subroutine

HI-RUN_2.0_Excel_2007_protected_release.xlsm - Microsoft Excel

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Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0 For Excel 2007

Run Dilution Model Sub basin 1 Load Dilution Inputs Save Dilution Inputs Clear Inputs

Inputs for Receiving Water Dilution Subroutine

Dilution subroutine analysis is only conducted on pollutants that have an established biological effects threshold (dissolved copper and zinc)

Subbasin 1

Background Concentration (mg/L)

TSS
Copper - Total
Zinc - Total
Copper - Dissolved 0.002
Zinc - Dissolved 0.003

Enter short description of simulation (optional)

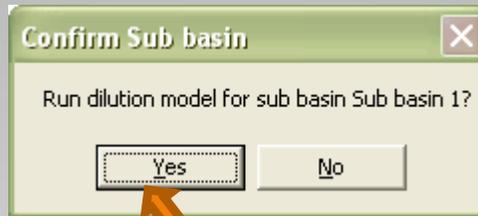
| | January | February | March | April | May | June | July | August | September | October | November | December |
|--|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|
| Stream Depth (ft) | | | | | | | | 1.55 | 1.5 | | | |
| Stream Velocity (fps) | | | | | | | | 0.53 | 0.5 | | | |
| Channel Width (ft) | | | | | | | | 10.5 | 10 | | | |
| Slope | | | | | | | | 0.004 | 0.004 | | | |
| Discharge Distance into Water Body From Nearest Shoreline (ft) | | | | | | | | 0 | 0 | | | |

You can also save your inputs for future model runs.

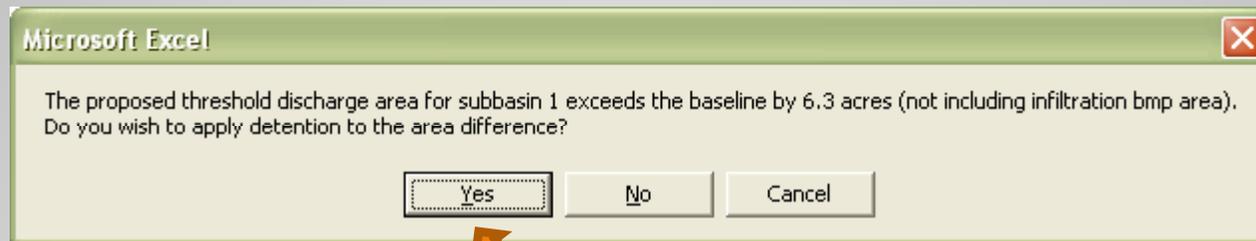
Click "Run Dilution Model" button when data input is complete.

Step 7 – Run Receiving Water Dilution Subroutine

Receiving Water Dilution Subroutine



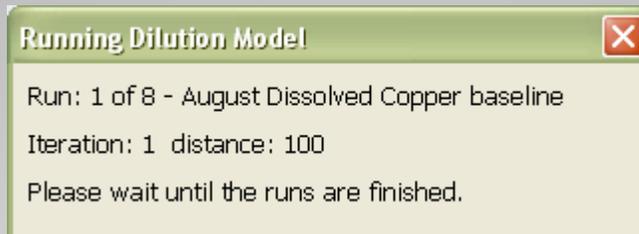
Click to confirm the subbasin to be analyzed.



Indicate here whether the project will implement detention to control flows from increased impervious area.

Step 7 – Run Receiving Water Dilution Subroutine

Receiving Water Dilution Subroutine

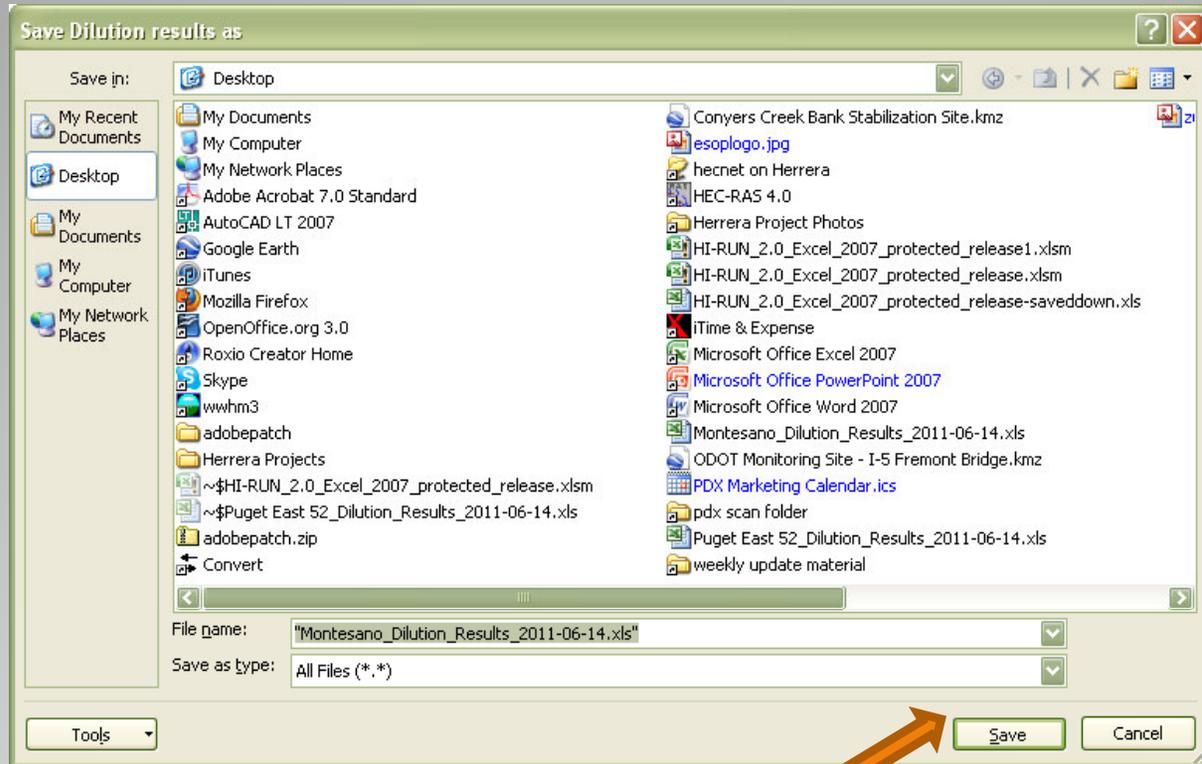


The receiving water dilution subroutine will conduct multiple iterations for each combination of baseline/proposed conditions and parameters.

This window shows progress as the Results file is generated in the background.

Step 7 – Run Receiving Water Dilution Subroutine

Receiving Water Dilution Subroutine



When the analysis is complete, you will be prompted to save your results.

Step 7 – Run Receiving Water Dilution Subroutine

Receiving Water Dilution Subroutine

Montesano_Dilution_Results_2011-06-14.xls [Compatibility Mode] - Microsoft Excel

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A1

1 Highway Runoff Dilution Summary Results

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3 Project SR 13, MP 15.5, TDA 1
 4 Precipitation Series: Montesano
 5 Description:

6 Background Concentrations (mg/L)
 7 Dissolved Copper: 0.002
 8 Dissolved Zinc: 0.003

9 Baseline Conditions: 24.8 acres
 10 Basic Treatment Infiltration 0% - 4.3 acres
 11 No Treatment Infiltration 0% - 20.5 acres

12 Proposed Conditions: 31.1 acres
 13 Enhanced Treatment Infiltration 60% - 6.3 acres with detention
 14 Basic Treatment Infiltration 0% - 0 acres with detention
 15 Basic Treatment Infiltration 0% - 4.3 acres
 16 No Treatment Infiltration 0% - 20.5 acres

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| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|
| Depth (ft) | | | | | | | | 1.55 | 1.5 | | | |
| Velocity (fps) | | | | | | | | 0.53 | 0.5 | | | |
| Width (ft) | | | | | | | | 10.5 | 10 | | | |
| Slope | | | | | | | | 0.004 | 0.004 | | | |
| Discharge | | | | | | | | 0 | 0 | | | |
| Distance (ft) | | | | | | | | | | | | |
| Distance Downstream in feet to Meet Biological Threshold | | | | | | | | | | | | |
| Dissolved Coppe | Baseline | | | | | | | <1 | <1 | | | |
| | Proposed | | | | | | | <1 | <1 | | | |
| Dissolved Zinc | Baseline | | | | | | | 7 | 18 | | | |
| | Proposed | | | | | | | 7 | 17 | | | |

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Dilution Results Summary Dilution Results Detailed

Ready 100%

Summary of receiving water background concentration inputs . This restates values entered on the "Dilution" sheet.

Summary of watershed inputs. This restates values entered on the "Loading" sheet.

Summary of receiving water inputs. This restates values entered on the "Dilution" sheet.

Receiving water dilution subroutine results. This is a summary of predicted downstream distances to meet biological effects thresholds.

Step 8 - Interpreting Receiving Water Dilution Subroutine Results

Receiving Water Dilution Subroutine

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| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|
| Depth (ft) | | | | | | | | | 1.55 | 1.5 | | | |
| Velocity (fps) | | | | | | | | | 0.53 | 0.5 | | | |
| Width (ft) | | | | | | | | | 10.5 | 10 | | | |
| Slope | | | | | | | | | 0.004 | 0.004 | | | |
| Discharge Distance (ft) | | | | | | | | | 0 | 0 | | | |
| Distance Downstream in feet to Meet Biological Threshold | | | | | | | | | | | | | |
| Dissolved Copper | Baseline | | | | | | | | <1 | <1 | | | |
| | Proposed | | | | | | | | <1 | <1 | | | |
| Dissolved Zinc | Baseline | | | | | | | | 7 | 18 | | | |
| | Proposed | | | | | | | | 7 | 17 | | | |

"<1" results indicate nearly instantaneous dilution to below the biological effects threshold upon discharge to the receiving water.

If a result of ">1,000" is generated, it suggests that the receiving water does not have the capacity to dilute project discharge to below the biological effects threshold.

Dissolved zinc results for September indicate the greatest distance from the outfall within which the biological effects threshold is predicted to be exceeded.

The lower value under proposed conditions (17 feet vs. 18 feet) suggests that the project will result in slightly reduced impacts (compared to the baseline [existing] condition).

| Threshold | | | |
|-----------|----|----|--|
| | <1 | <1 | |
| | <1 | <1 | |
| | 7 | 18 | |
| | 7 | 17 | |

Step 8 – Interpreting Receiving Water Dilution Subroutine Results

Receiving Water Dilution Subroutine

- What do these results mean for fish?

- Copper concentrations are diluted nearly instantaneously to background levels in both August and September under pre- and post project conditions.
- Project will result in no change in zinc levels in August
- Project will result in slight improvement in zinc levels in September.
- Fish within 0 to 7 feet (August) and 0 to 17 feet (September) of the outfall could be exposed to zinc concentrations exceeding the biological threshold.

| Threshold | | | |
|-----------|----|----|--|
| | <1 | <1 | |
| | <1 | <1 | |
| | 7 | 18 | |
| | 7 | 17 | |

Step 8 – Interpreting Receiving Water Dilution Subroutine Results

- Considerations for the BA
 - What species or life stages are potentially present in August and September?
 - What habitat is present between 0 and 17 feet of the outfall?
 - How would fish use habitat in this area during this time of year?
 - How frequently are discharges from storm events expected to occur during these months?

- Purpose of the BA
 - Identify the potential for exposure
 - Characterize what the exposure will be like and quantify the extent of exposure (duration, area, frequency, etc.)

Step 8 – Interpreting Receiving Water Dilution Subroutine Results