Introduction

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EPA Point of Contact for SWMM

Worked on Green Infrastructure since 2010

Disclaimer

The U.S. EPA, through its Office of Research and Development, funded and collaborated in the research described in this presentation. It has been subjected to the agency's administrative review and has been approved for external publication. Opinions expressed in this presentation are those of the author and do not necessarily reflect the views of the agency; therefore, no official endorsement should be inferred.

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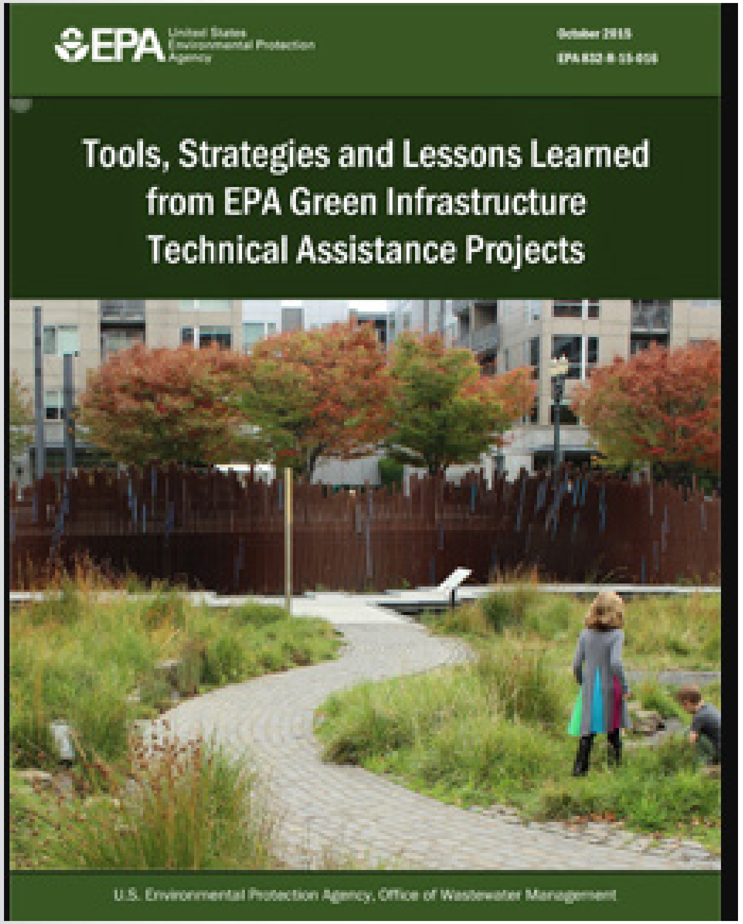
Recent Updates to SWMM 5.1

Michelle Simon, Ph.D., P.E.
United States Environmental Protection Agency

Villanova University Seminar

March 23, 2021

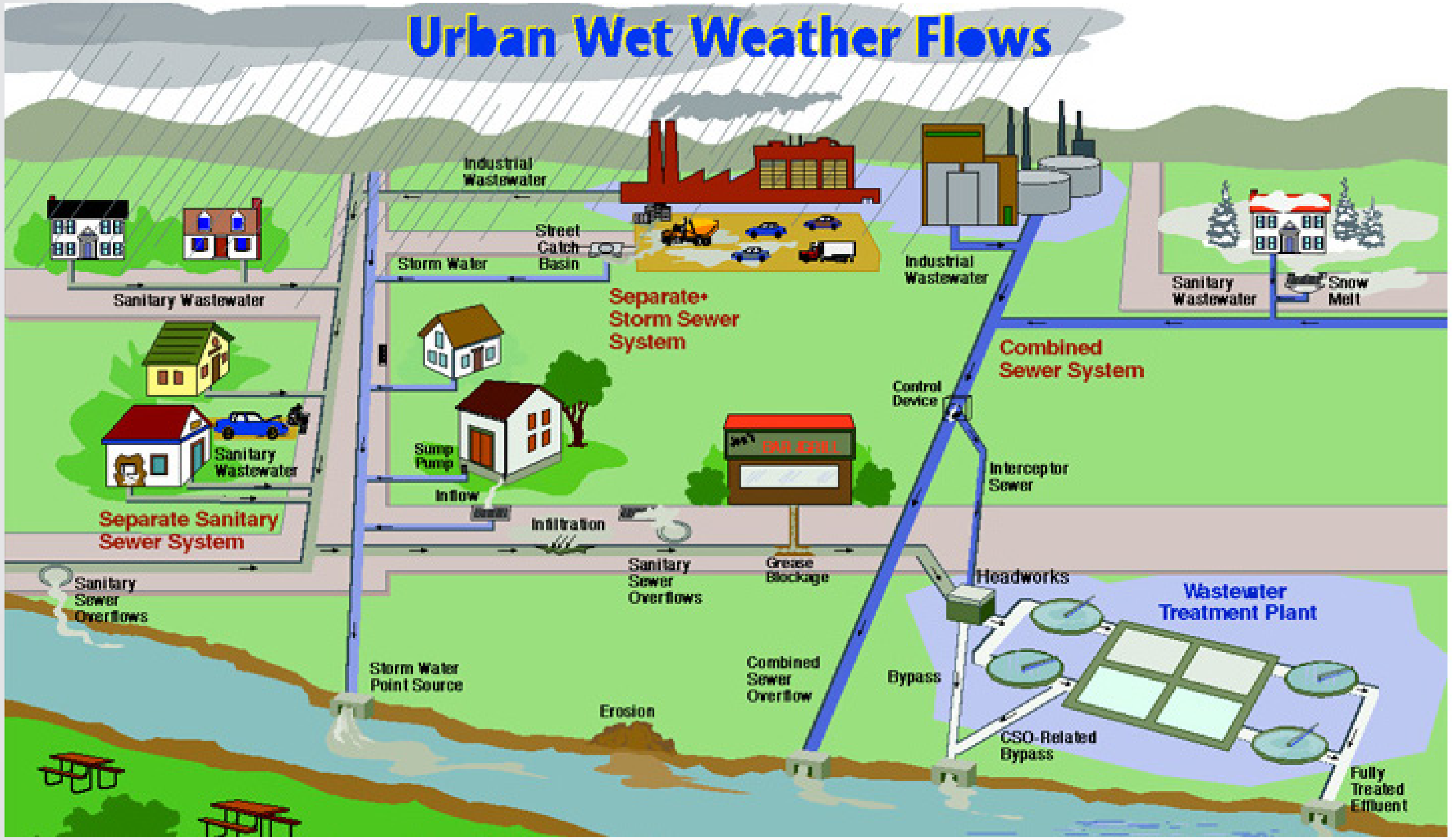
Talk Outline – kudos to Lew Rossman



- Introduction
- EPA's Stormwater Management Model (SWMM)
- SWMM 5.1.013
- SWMM 5.1.014
- SWMM 5.1.015
- SWMM 5.1.016 - beta version
- Summary

What is SWMM?

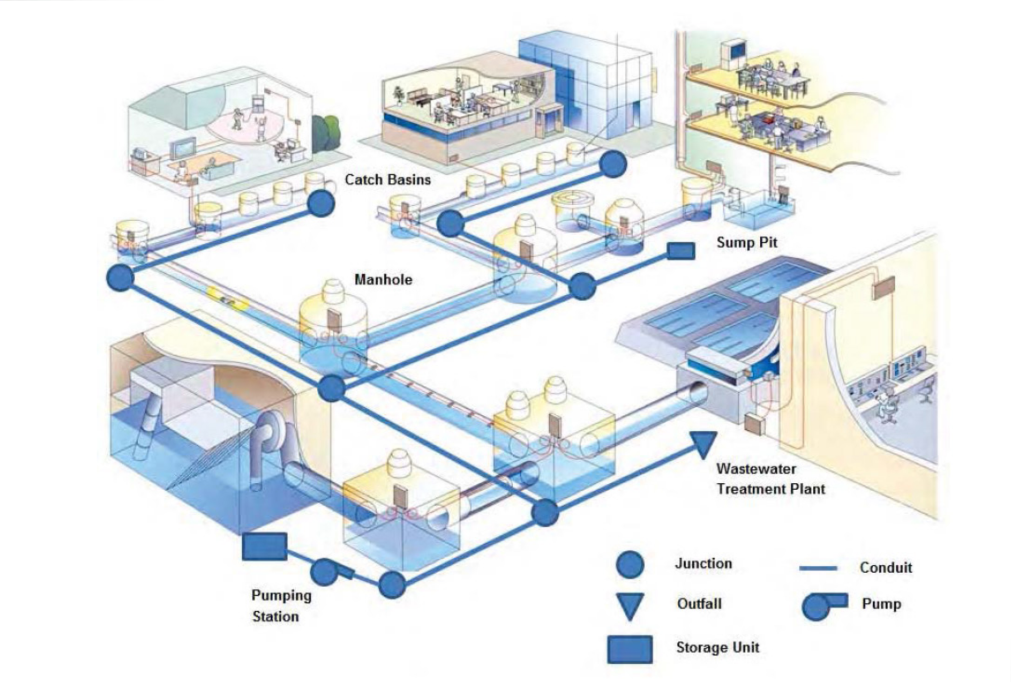
https://www.epa.gov/water-research/storm-water-management-model-swmm



SWMM is a public domain, distributed, dynamic hydrologic - hydraulic - water quality model used for simulation of runoff quantity and quality from primarily urban areas.

EPA Stormwater Management Model

https://www.epa.gov/water-research/storm-water-management-model-swmm

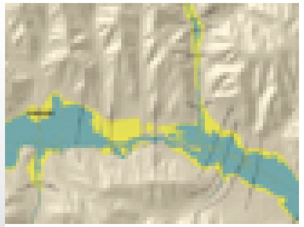


Why EPA needs SWMM (CSO, MS4, TMDL, NPDES)

Design and sizing of drainage system.

Control of combined and sanitary sewer overflows.

Modeling Inflow & Infiltration in sanitary sewer systems.

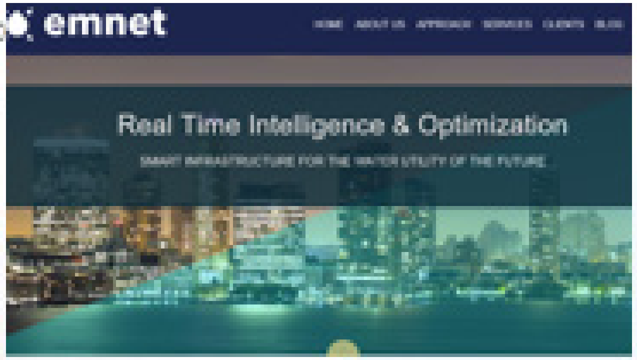


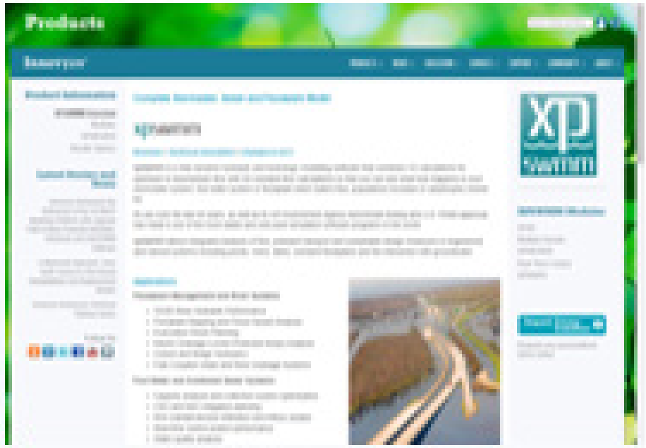
Generating non-point source pollutant loadings for waste load allocation studies.

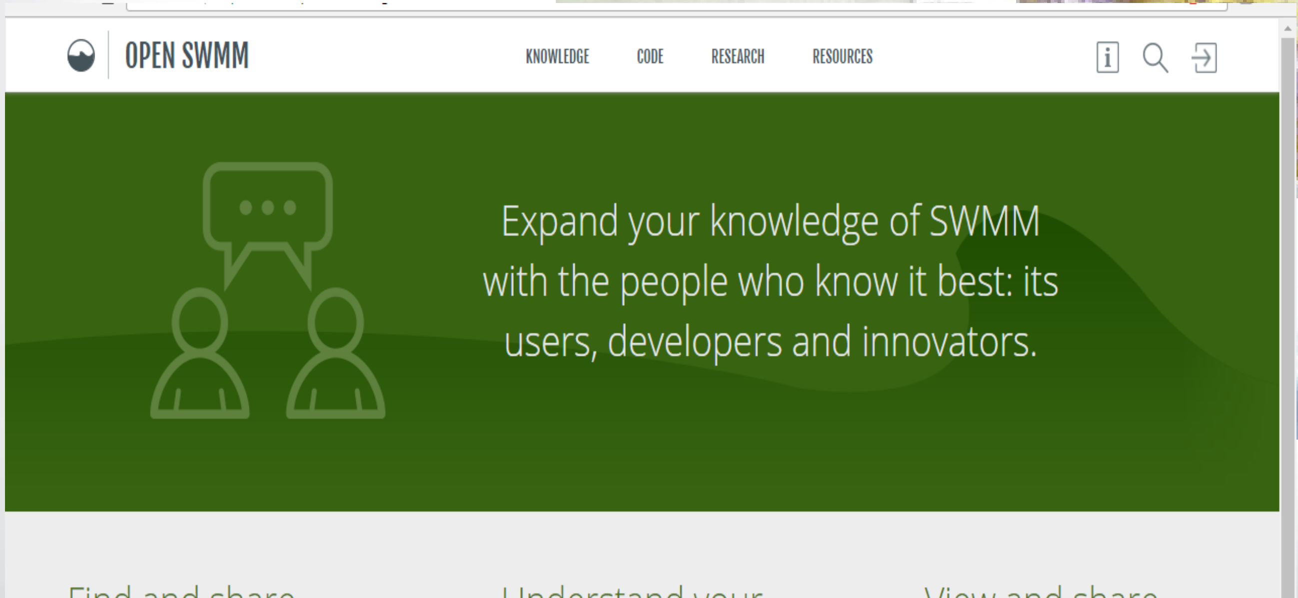
Evaluating green infrastructure.

SWMM – Many stakeholders

Downloaded >30,000 annually





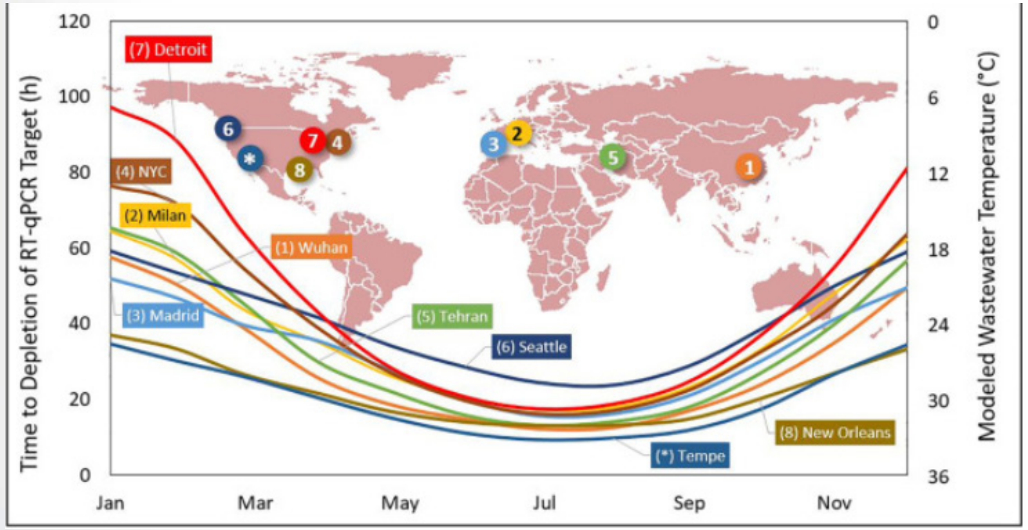


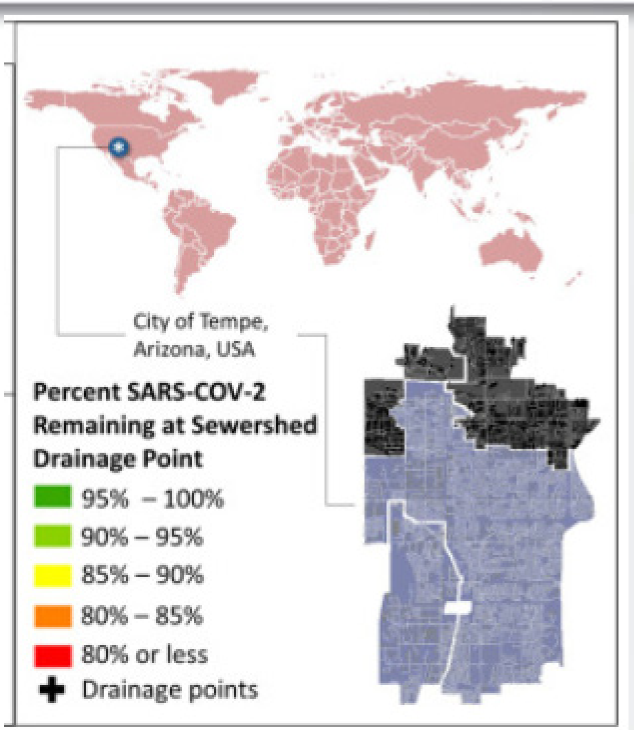
Regulators
Communities,
Utilities,
Private industry,
Consultants,
Academia

Jay Garland, Nichole Brinkman, Greater Cincinnati Water Works

Using SWMM to calculate COVID detection

Estimated kinetic parameters of SAR-CoV-2 attenuation in wastewater at ambient temperature			
Time to 99.9% reduction (hours)	Half-Life, $t_{1/2}$ (hours)	Mean Lifetime, τ (hours)	Decay constant, λ
48	4.82	6.95	0.143
72	7.22	10.4	0.096





Brinkman.Nichole@epa.gov

https://www.epa.gov/water-research/water-research-webinar-series

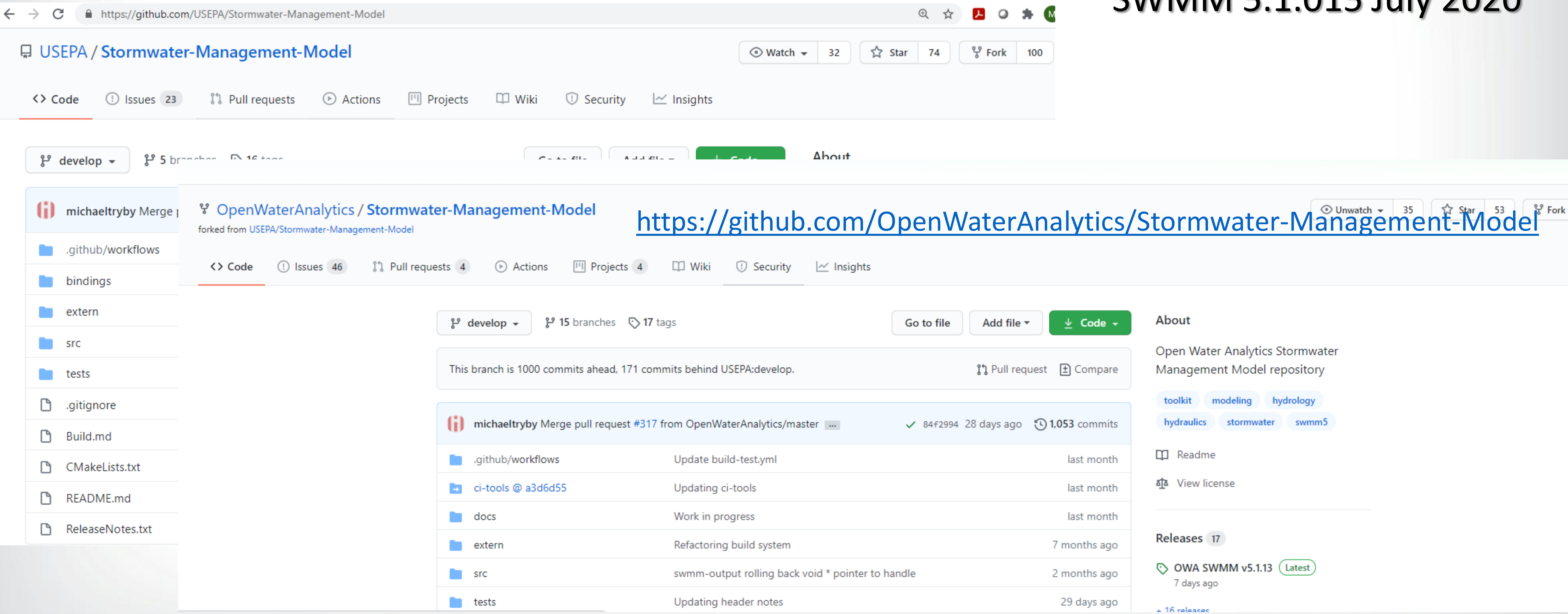
https://www.epa.gov/healthresearch/research-covid-19-environment

Olga E. Hart, Rolf U. Halden, 2020 Computational analysis of SARS-CoV-2/COVID-19 surveillance by wastewater-based epidemiology locally and globally: Feasibility, economy, opportunities and challenges, Science of The Total Environment, Volume 730, 2020
https://doi.org/10.1016/j.scitotenv.2020.138875

Community Development

https://github.com/USEPA/Stormwater-Management-Model

SWMM 5.1.015 July 2020



https://github.com/OpenWaterAnalytics/Stormwater-Management-Model

EPA_updates.txt 2018-2021

Preissmann Slot

Individual Subcatchment Infiltration

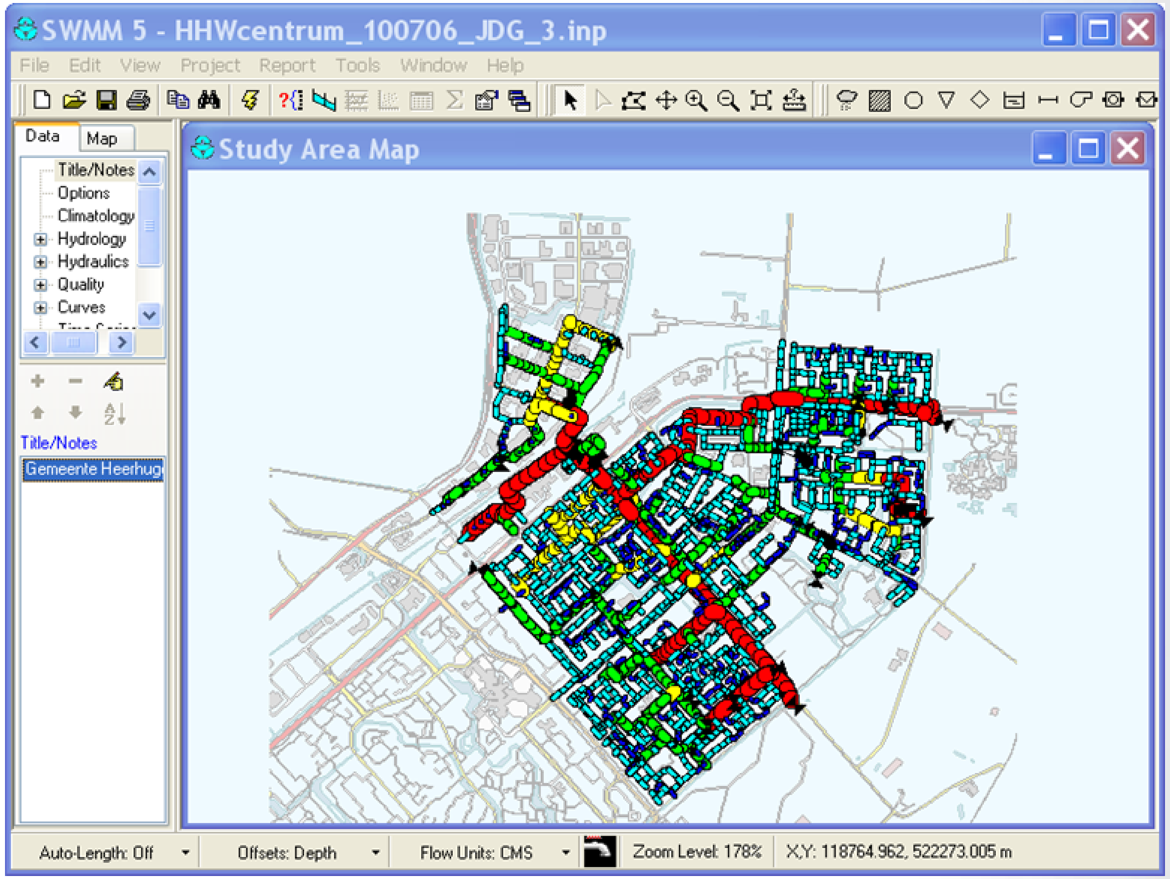
Dual Drainage

Storage Unit Shapes

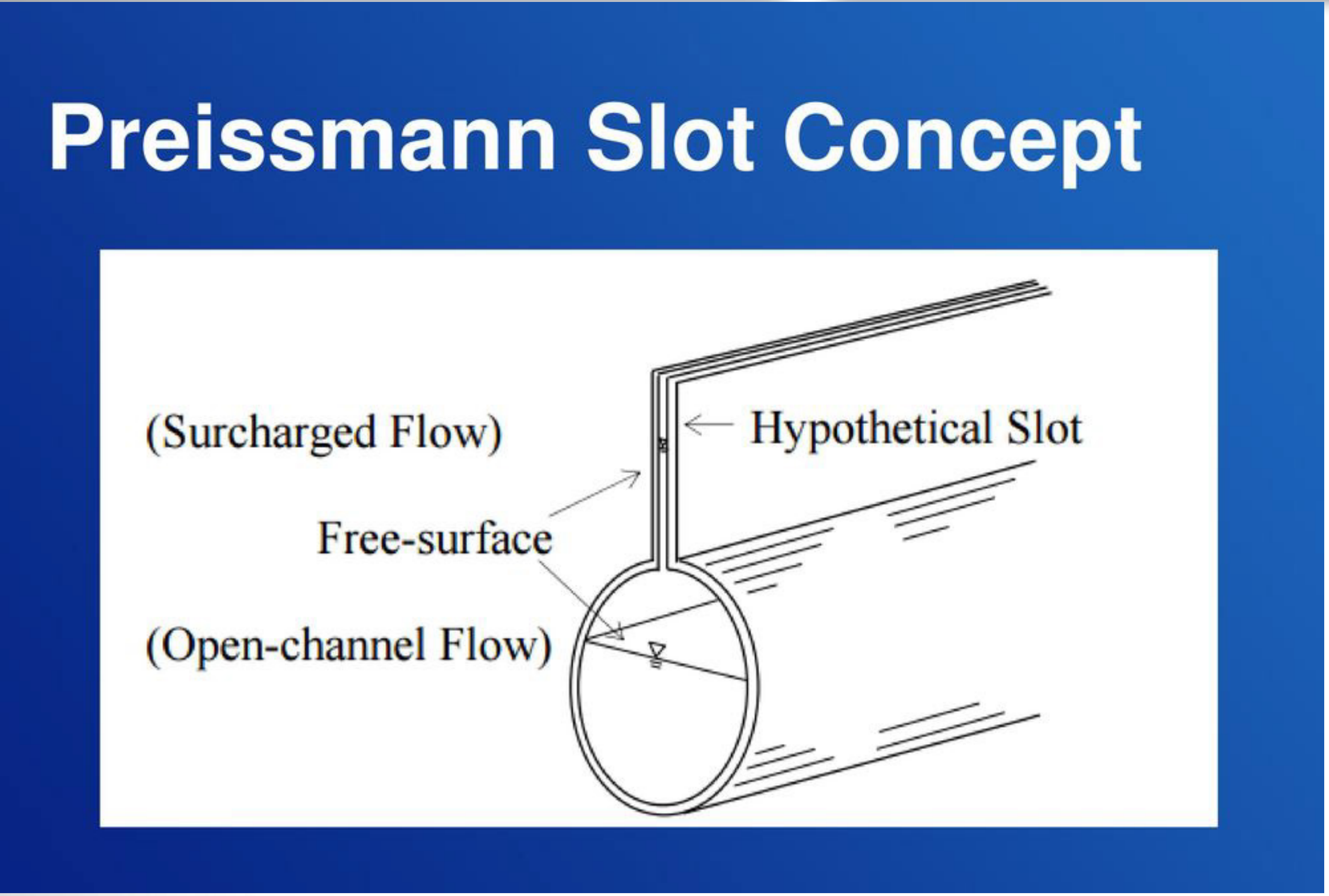
Variable Speed Pumps

New Control Rule Features

GIS Import - World Coordinates



Preissmann Slot



$$w_{slot} = gA/c^2$$

$$w_{slot}/W_{max} = 0.5423\,\exp\left(-\left(Y/Y_{full}\right)^{2.4}\right)$$

EPA SWMM 5.1.013

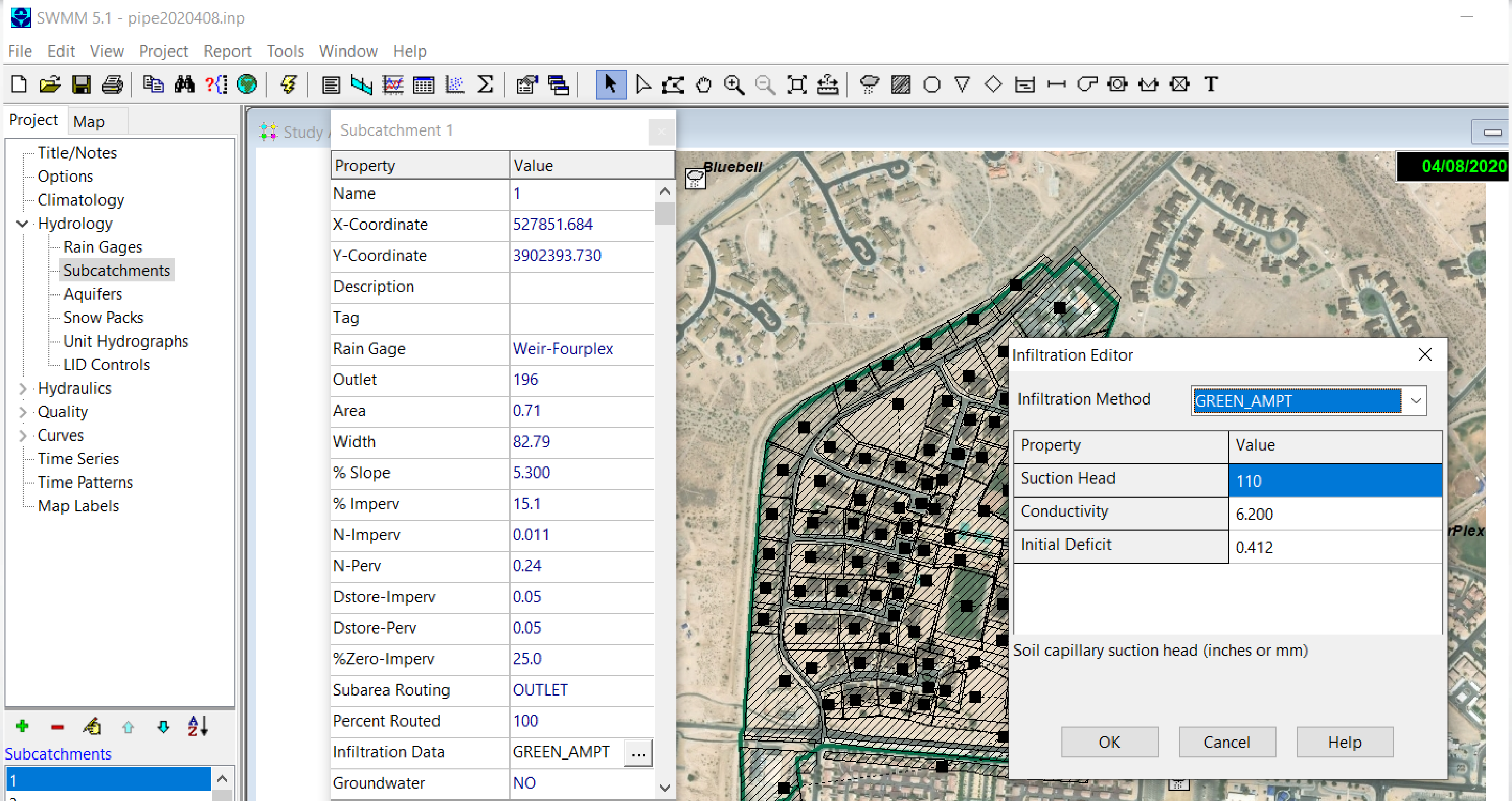
getSlotWidth

```
////  New function added to release 5.1.013.  ////                    //(5.1.013)

double getSlotWidth(TXsect* xsect, double y)
{
   double yNorm = y / xsect->yFull;

   // --- return 0.0 if slot surcharge method not used
   if (SurchargeMethod != SLOT || xsect_isOpen(xsect->type) ||
   yNorm < CrownCutoff) return 0.0;

   // --- for depth > 1.78 * pipe depth, slot width = 1% of max. width
   if (yNorm > 1.78) return 0.01 * xsect->wMax;

   // --- otherwise use the Sjoberg formula
   return xsect->wMax * 0.5423 * exp(-pow(yNorm, 2.4));
}
```

Original reference (Cunge and Wegner, 1964
modified version of a formula proposed by Sjőberg (1982))

Photo credit
https://www.google.com/search?rlz=1C1SQJL_enUS938US938&source=univ&tbm=isch&q=images+for+the+preissman+slot&sa=X&ved=2ahUKEwij5bHizKbvAhVrGVkFHYUWDOsQ7Al6BAgFEBA&biw=2000&bih=986#imgrc=N_6wsL9eiqeztM

Mix of Infiltration Methods



HEC-22 Inlet Analysis

Inlets convey runoff from street pavements into below ground storm sewers.

Inlet type, sizing and spacing chosen to meet limits on spread & depth of water on pavement.

FHWA "Urban Drainage Design Manual" (HEC-22) is the de facto standard for inlet analysis.

Factors Affecting Inlet Flow Capture

On-Grade Grates:

- Approach flow rate, velocity & spread
- Street cross slope & curb depression
- Grate width & length

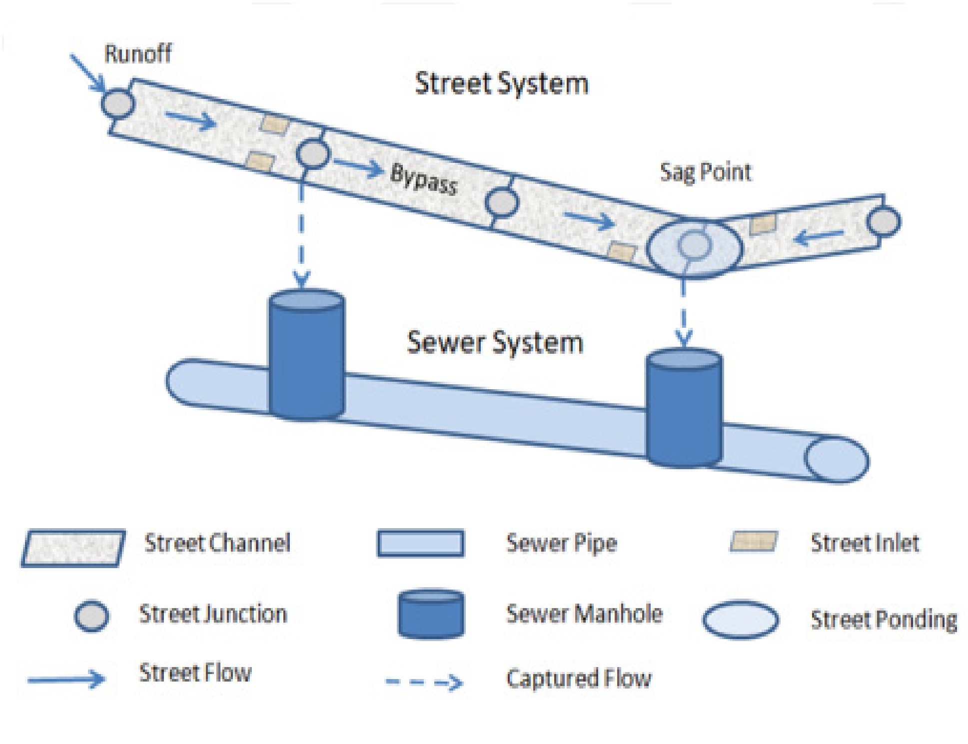
On-Grade Curb Openings:

- Approach flow rate
- Street slope, cross slope, roughness & curb depression
- Opening length

On-Sag Inlets:

- Depth of water at curb
- Grate width, length & area of openings
- Curb opening length & height

Modeling a Dual Drainage System



Methods for Modeling

Dual Drainage Systems

Flow divider nodes

Shared nodes with offset

Orifice or outlet links

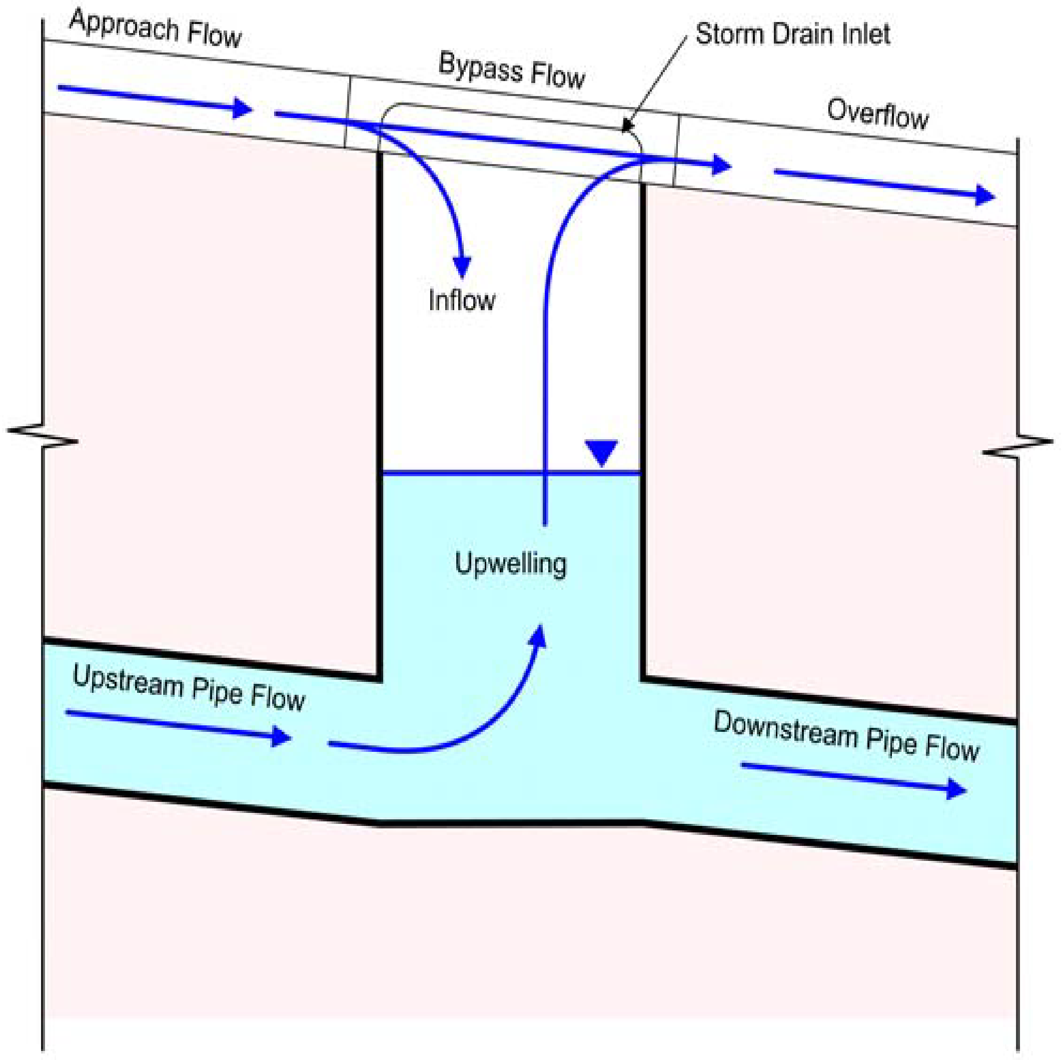
Lateral Flow Adjustment

Original Source: FHWA "Urban Drainage Design Manual" (HEC-22)

Inlet Analysis Using Lateral Flow Adjustment

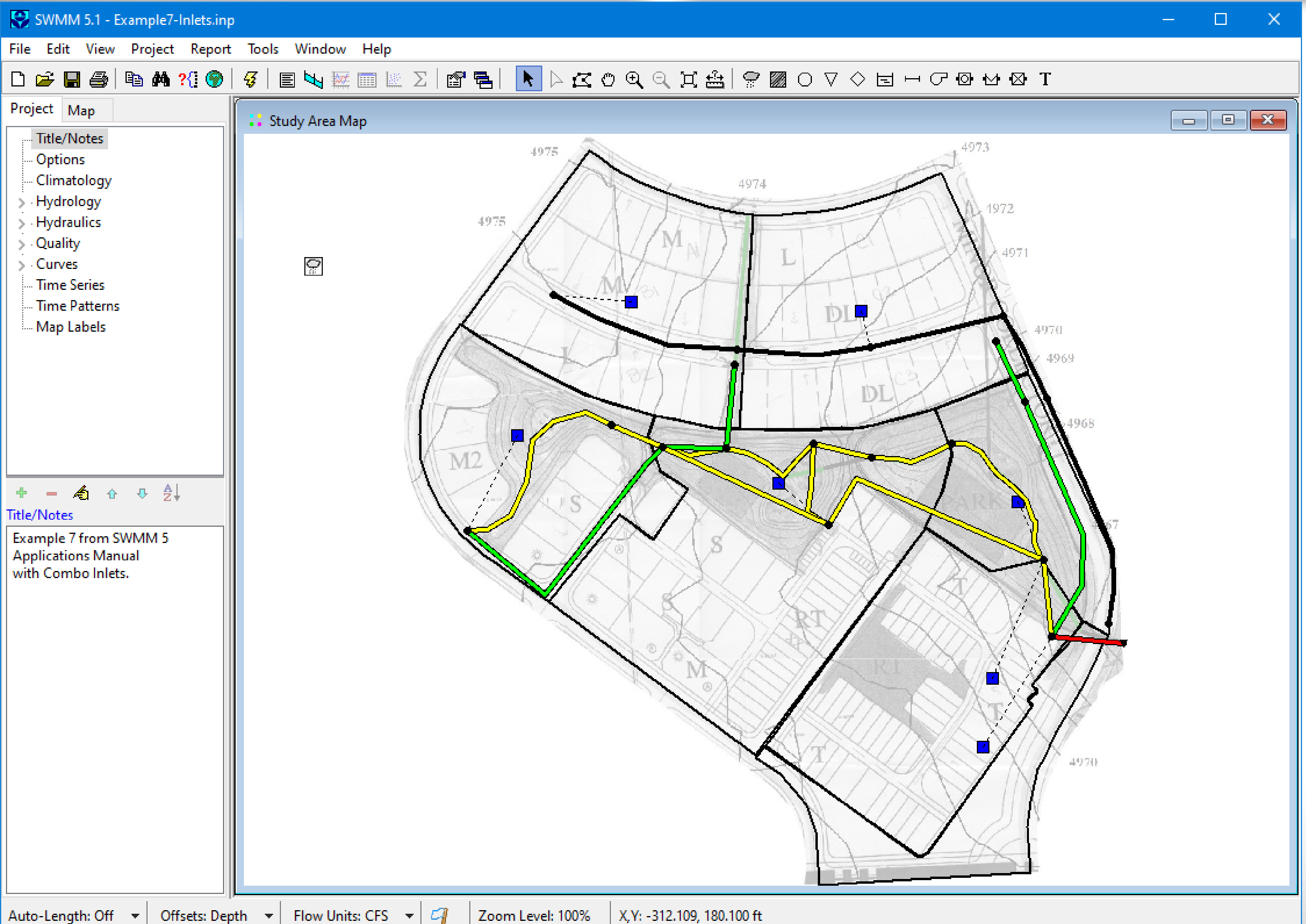
At each flow routing time step:

- Compute each inlet's flow capture (Qc) using HEC-22 methods
- Add Qc to sewer node's lateral inflow
- Subtract Qc from lateral inflow to inlet's street node
- Add any sewer node overflow to street node's lateral inflow
- Apply usual flow routing procedure

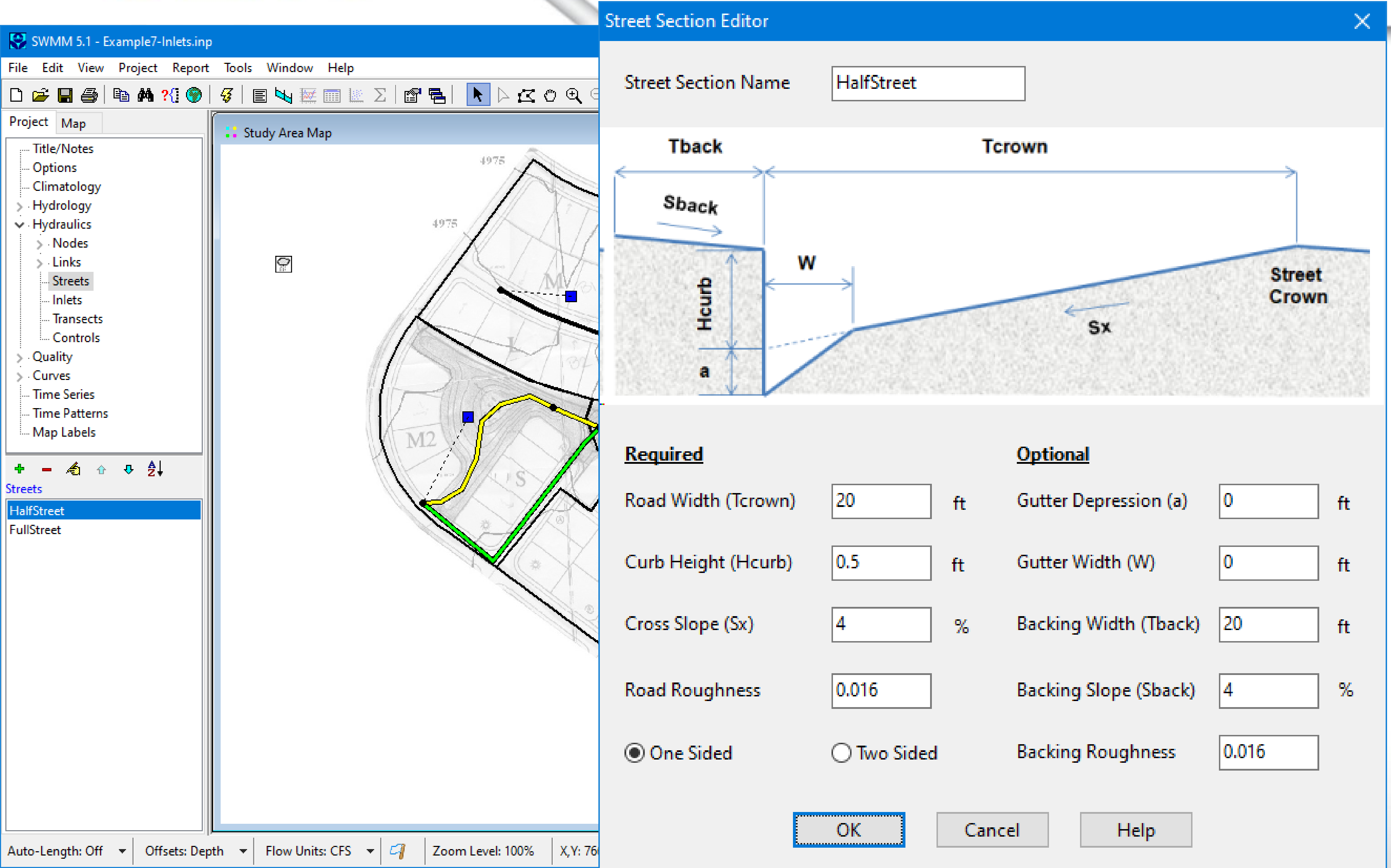


Original Source: FHWA "Urban Drainage Design Manual" (HEC-22)

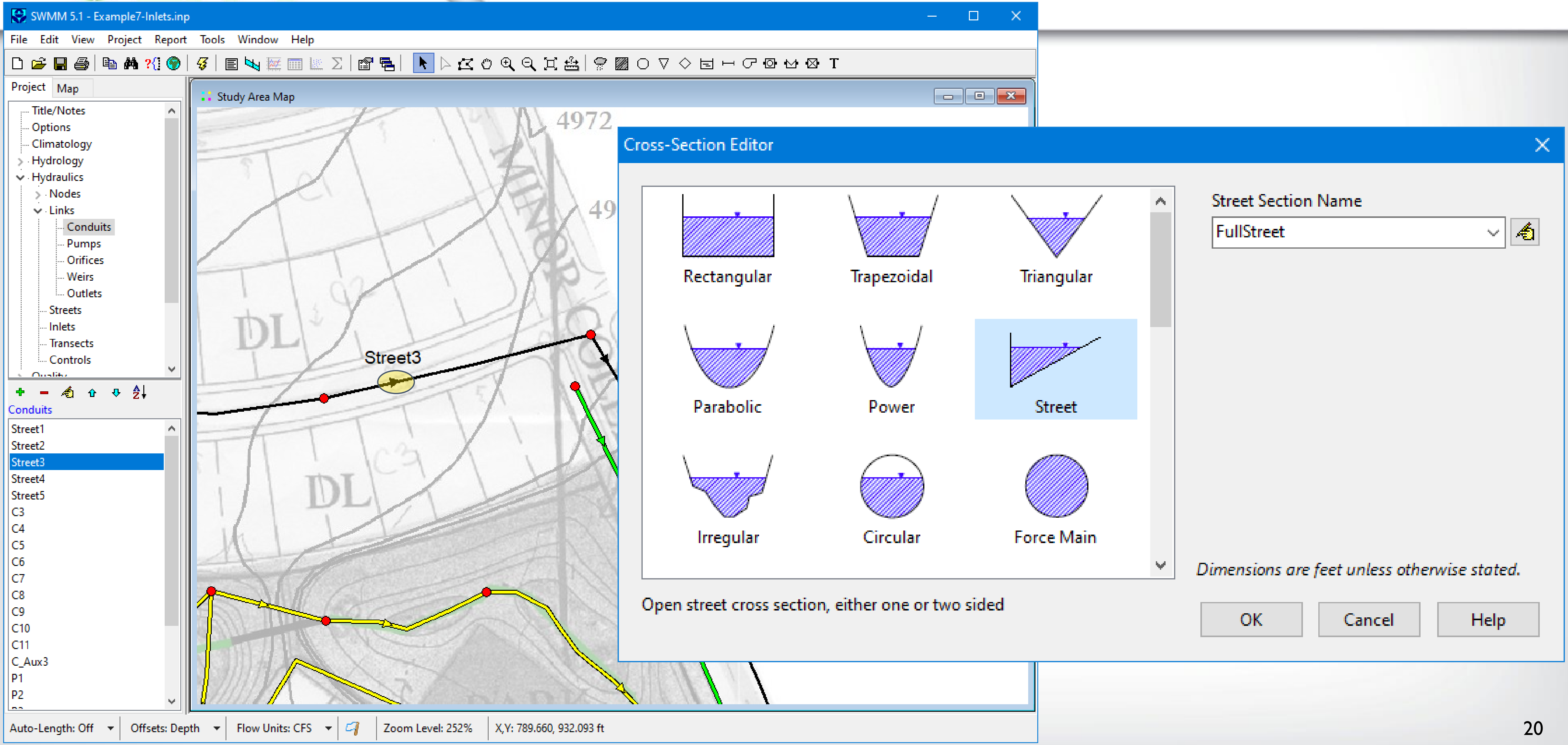
Step 1 - Layout the street and sewer networks



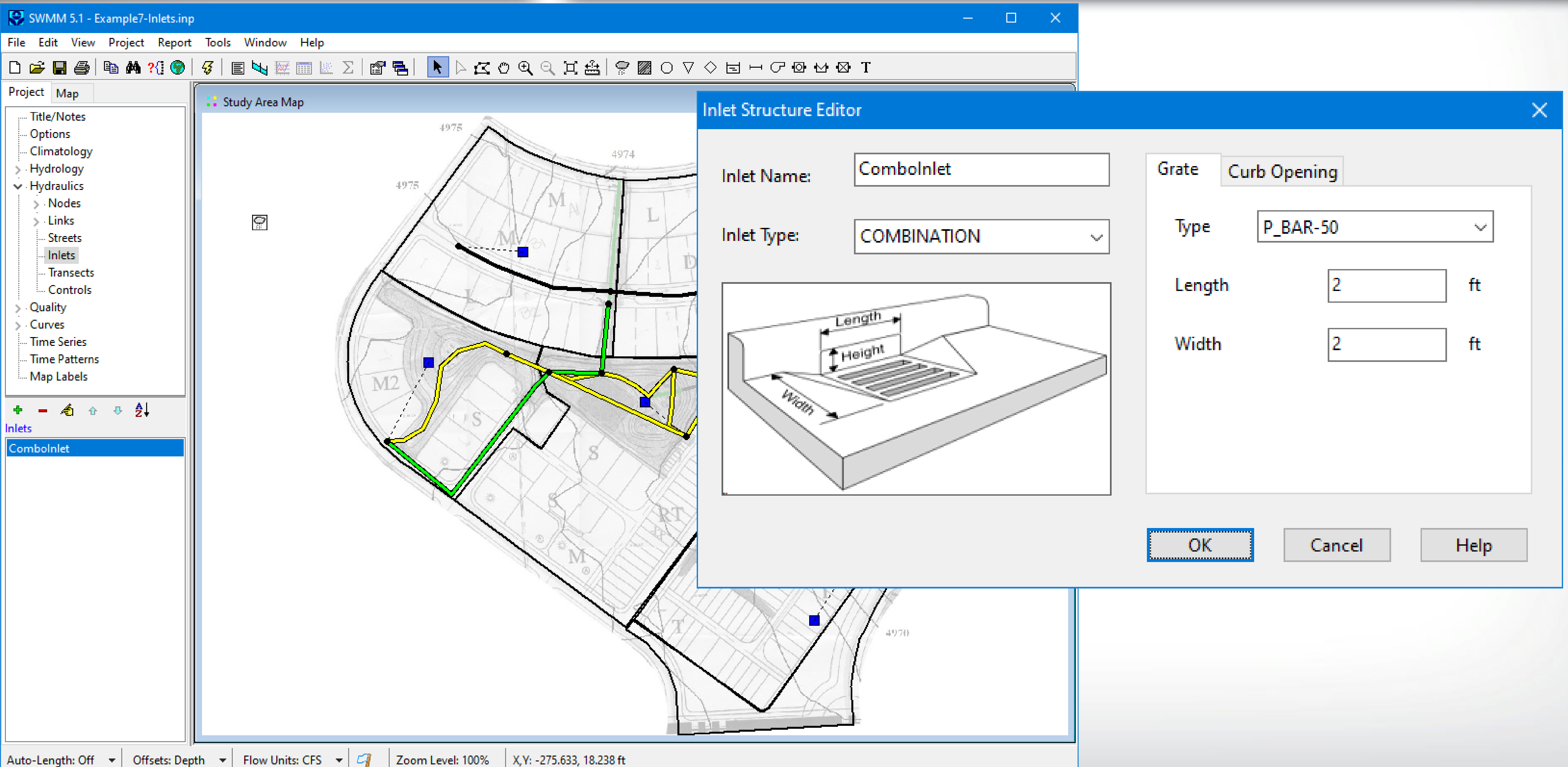
Step 2 - Create a collection of Street cross-sections



Step 3 - Assign Street cross-sections to street conduits

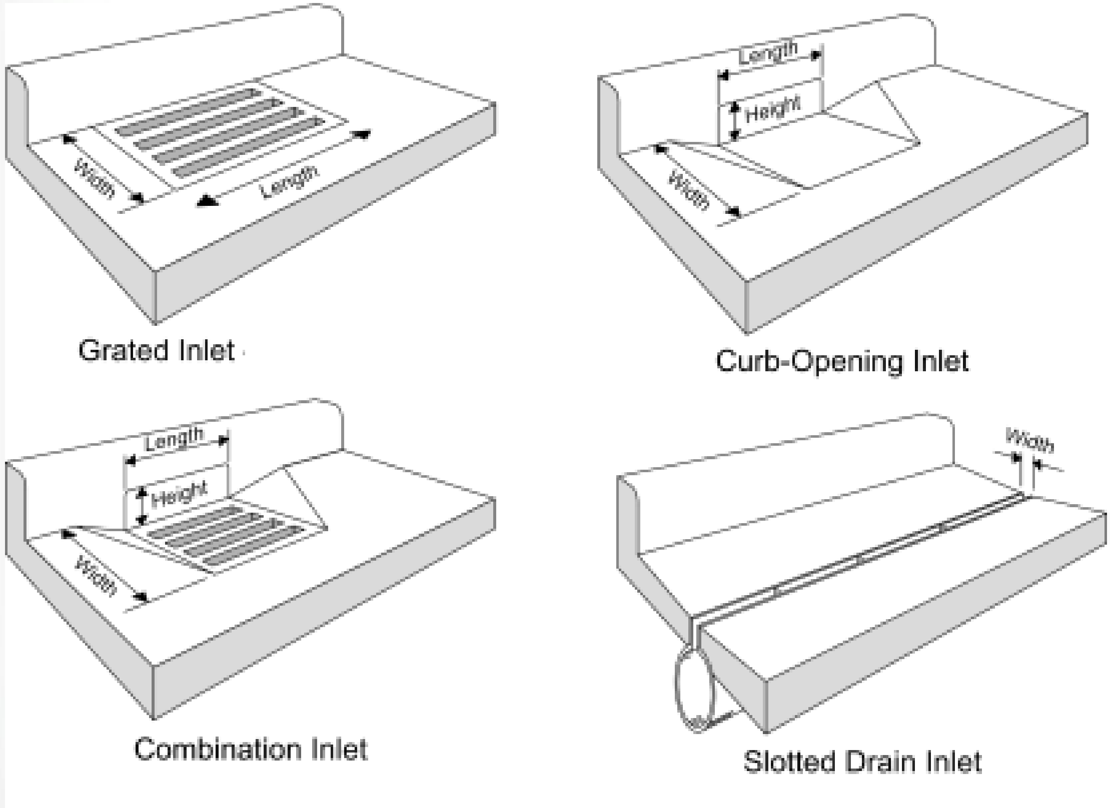


Step 4 - Create a collection of Inlet designs

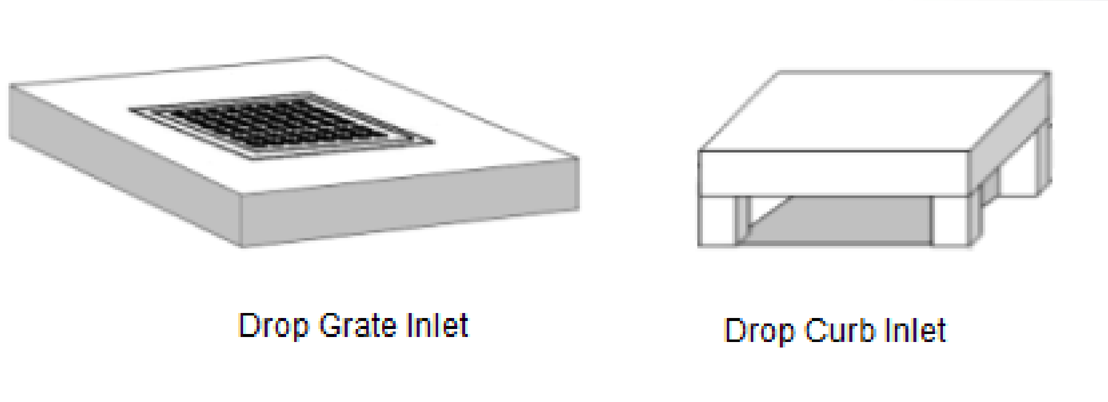


Supported Inlet Types

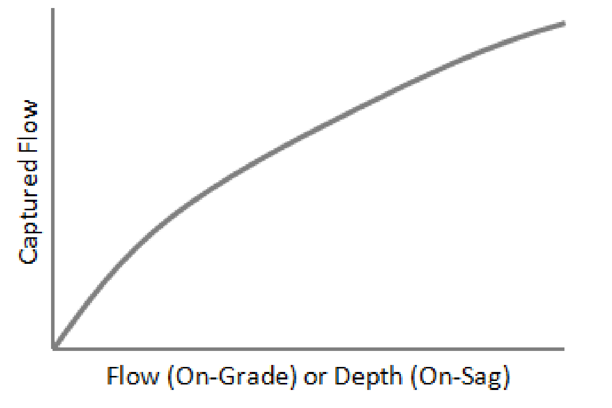
Curb & Gutter Inlets



Drop Inlets

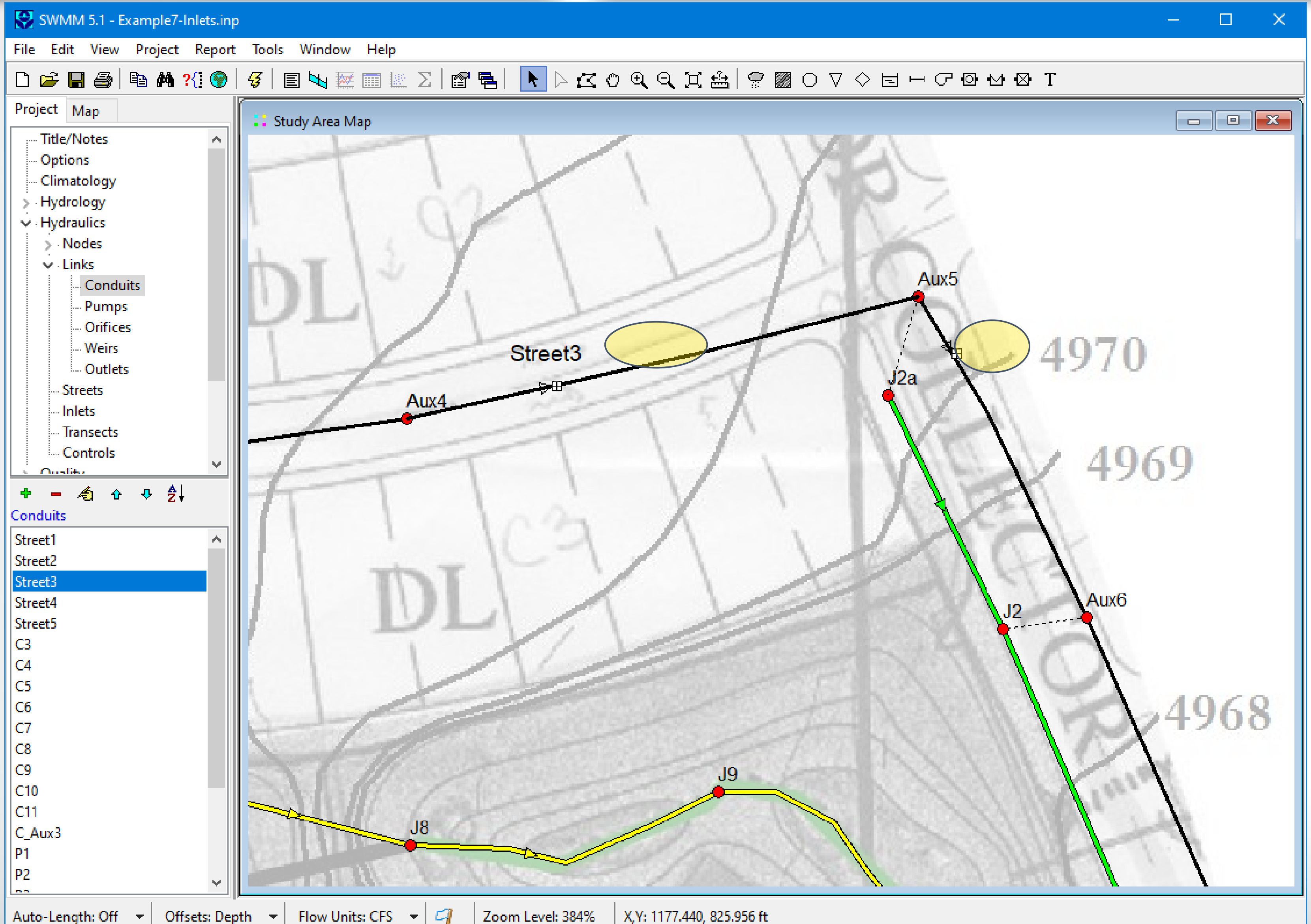


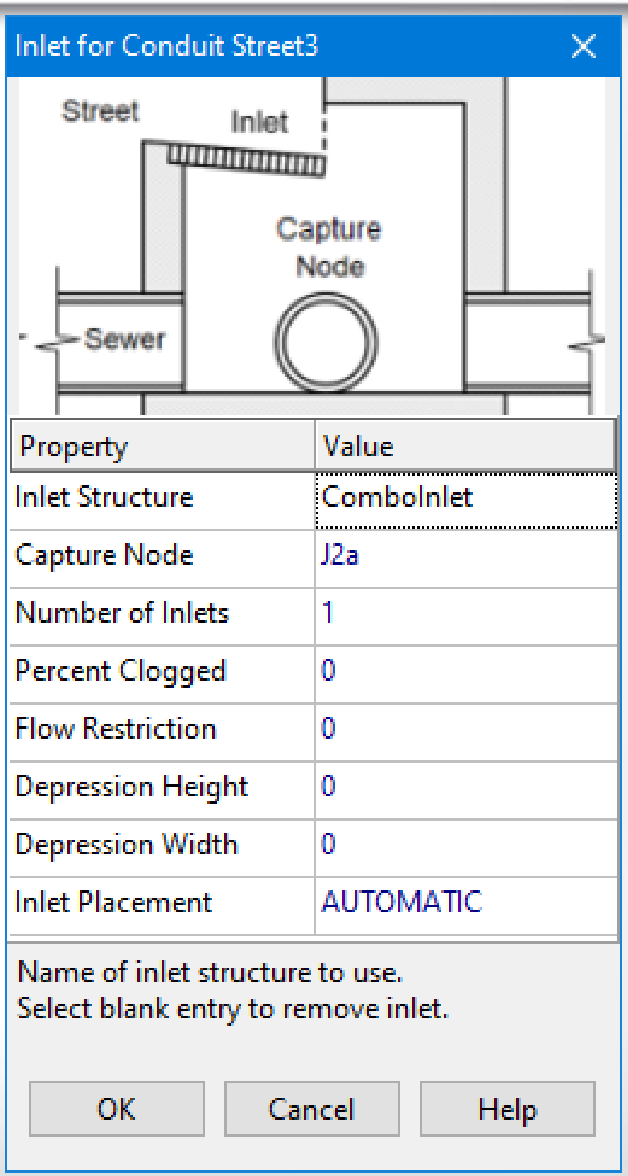
Custom Inlet



Original Source: FHWA "Urban Drainage Design Manual" (HEC-22)

Step 5 - Assign Inlet designs to streets



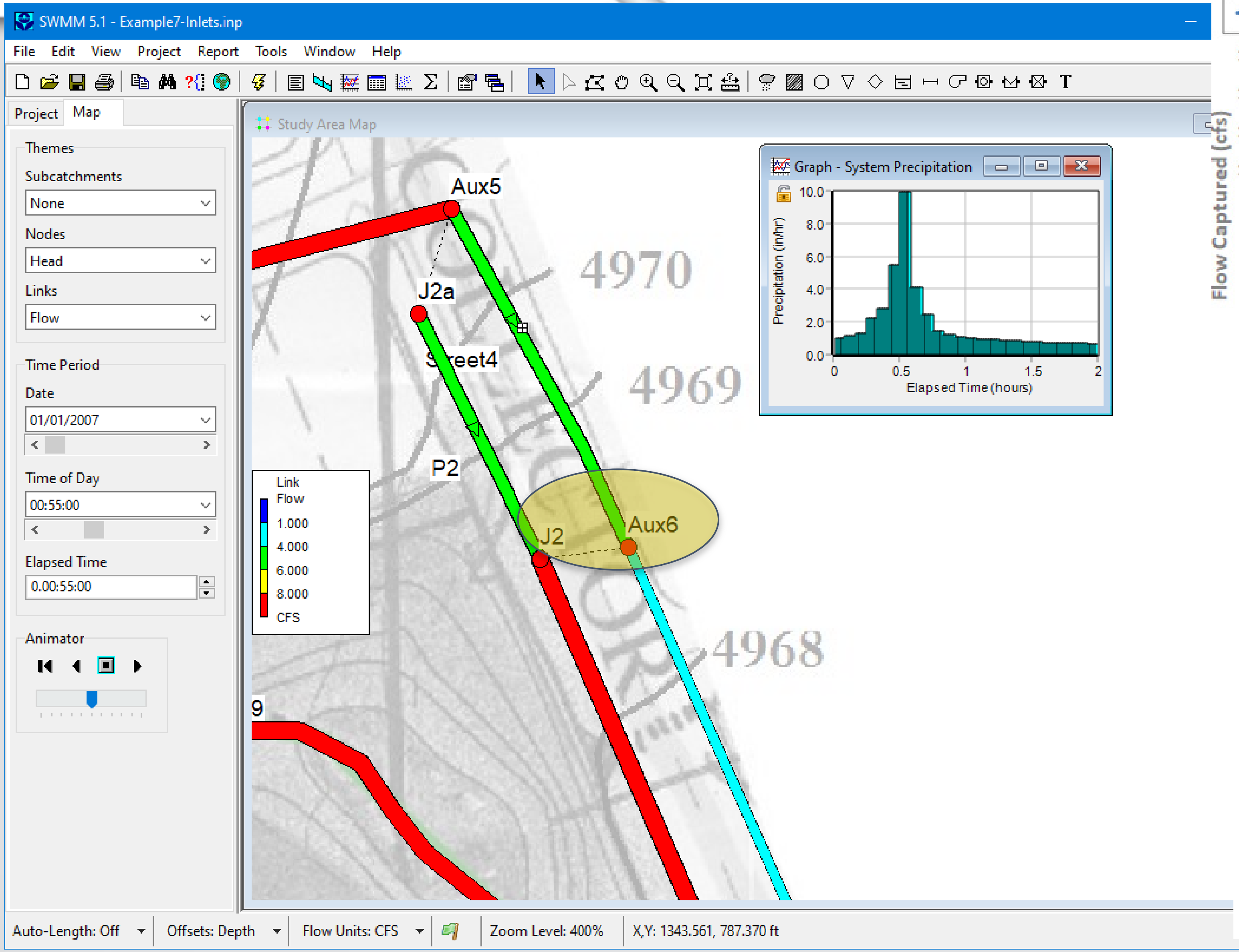


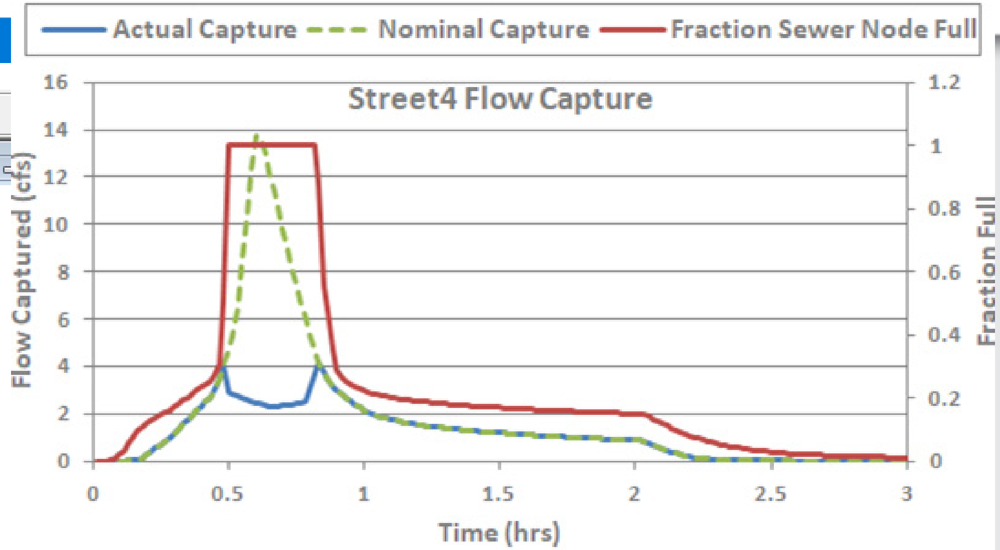
Step 6 - Run an analysis and view the Street Flow Summary Report

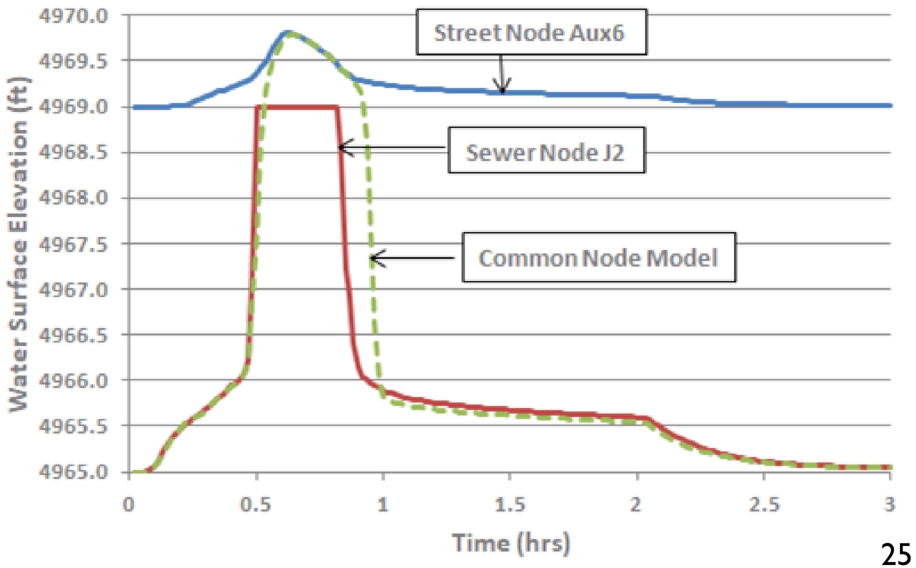
Topic: Street Flow — Click a column header to sort the column.

Street Conduit	Peak Flow CFS	Maximum Spread ft	Maximum Depth ft	Inlet Structure	Peak Flow Capture %	Average Capture %	Bypass Frequency %	Backflow Frequency %
Street1	37.33	19.99	0.65	ComboInlet	17.06	67.86	88.77	0.00
Street2	25.79	23.32	0.72					
Street3	59.91	28.22	0.83	ComboInlet	14.85	62.93	90.10	0.00
Street4	49.36	28.11	0.82	ComboInlet	4.94	64.30	86.82	0.00
Street5	45.02	30.73	0.93	ComboInlet	70.65	92.04	22.96	0.00

Reduced Capture Due to Full Manhole







Control Rule Enhancements

Control rule premise clauses expanded to include:

additional control parameters

- rain gage current rainfall & next rainfall
- node full depth, volume, head
- conduit length, slope, full depth, full flow, velocity

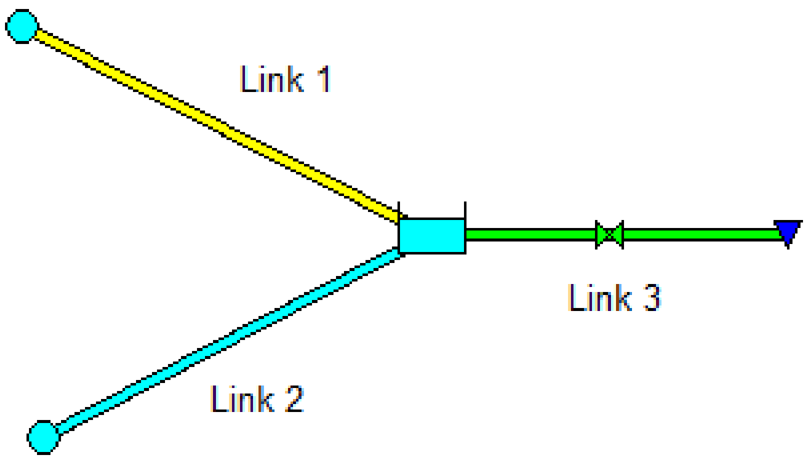
named variables as aliases for Object - ID - Property

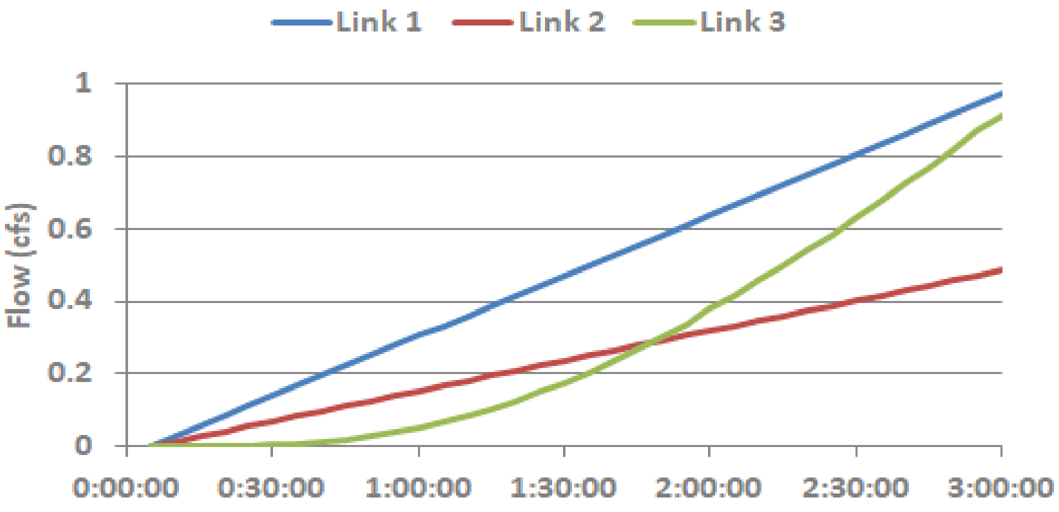
```
Variable N23 = Node 23 Depth
```

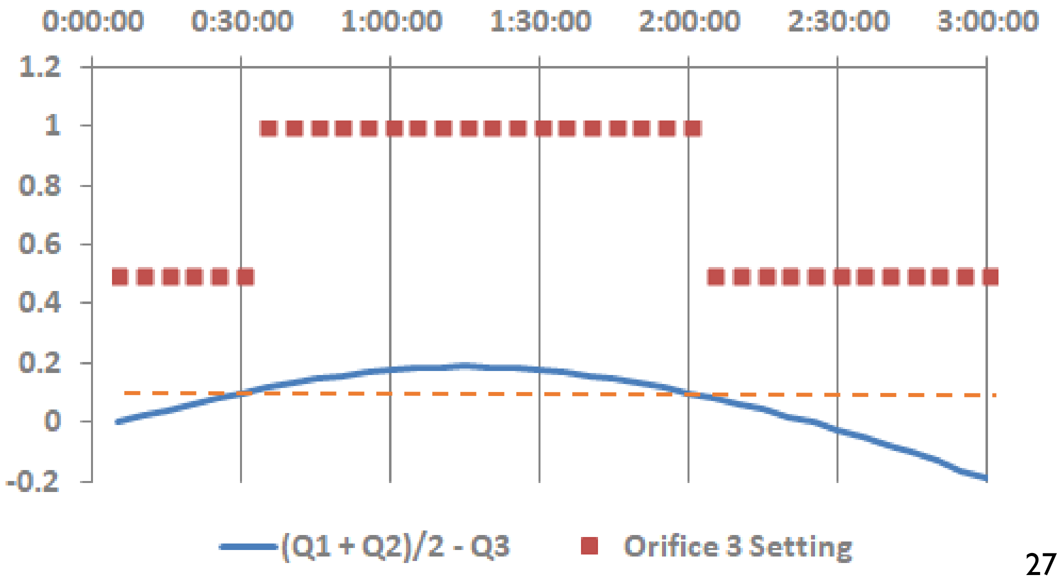
math expressions containing named variables

```
Expression HGL = abs(H23.1-H23.2)/L23
```

Example of Enhanced Control Rule








```
[RULES]
variable  Q1 = LINK 1 FLOW
variable  Q2 = LINK 2 FLOW
variable  Q3 = LINK 3 FLOW
expression Net_Inflow = (Q1 + Q2)/2 - Q3

rule 1
if Net_Inflow > 0.1
then ORIFICE 3 Setting = 1
else ORIFICE 3 Setting = 0.5
```

Variable Pump Speeds

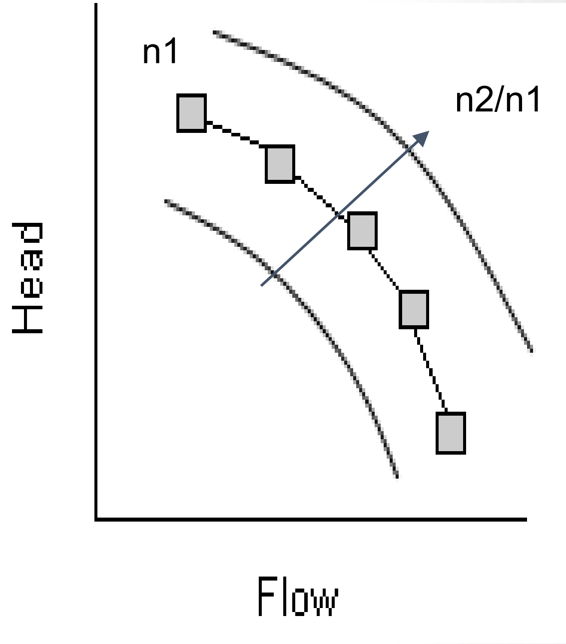
Requires a Head (H) v. Flow (Q) performance curve that obeys the pump affinity laws:

$Q2/Q1 = n2/n1 \quad H2/H1 = (n2/n1)^2$

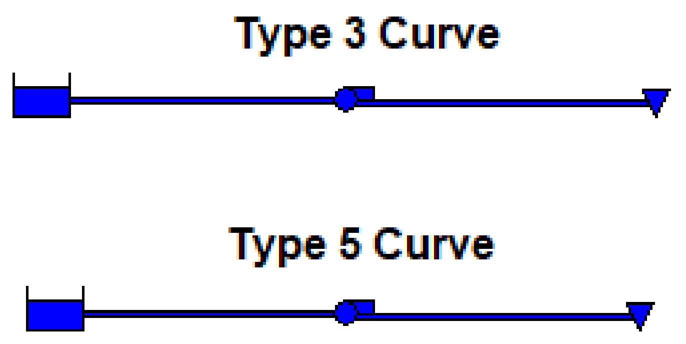
These determine how the curve shifts as impeller speed changes from a nominal value n1 to n2.

SWMM's Type 3 Pump uses a H-Q curve that only follows the flow affinity law as its speed setting is changed.

A new Type 5 pump has been introduced that obeys both affinity laws.



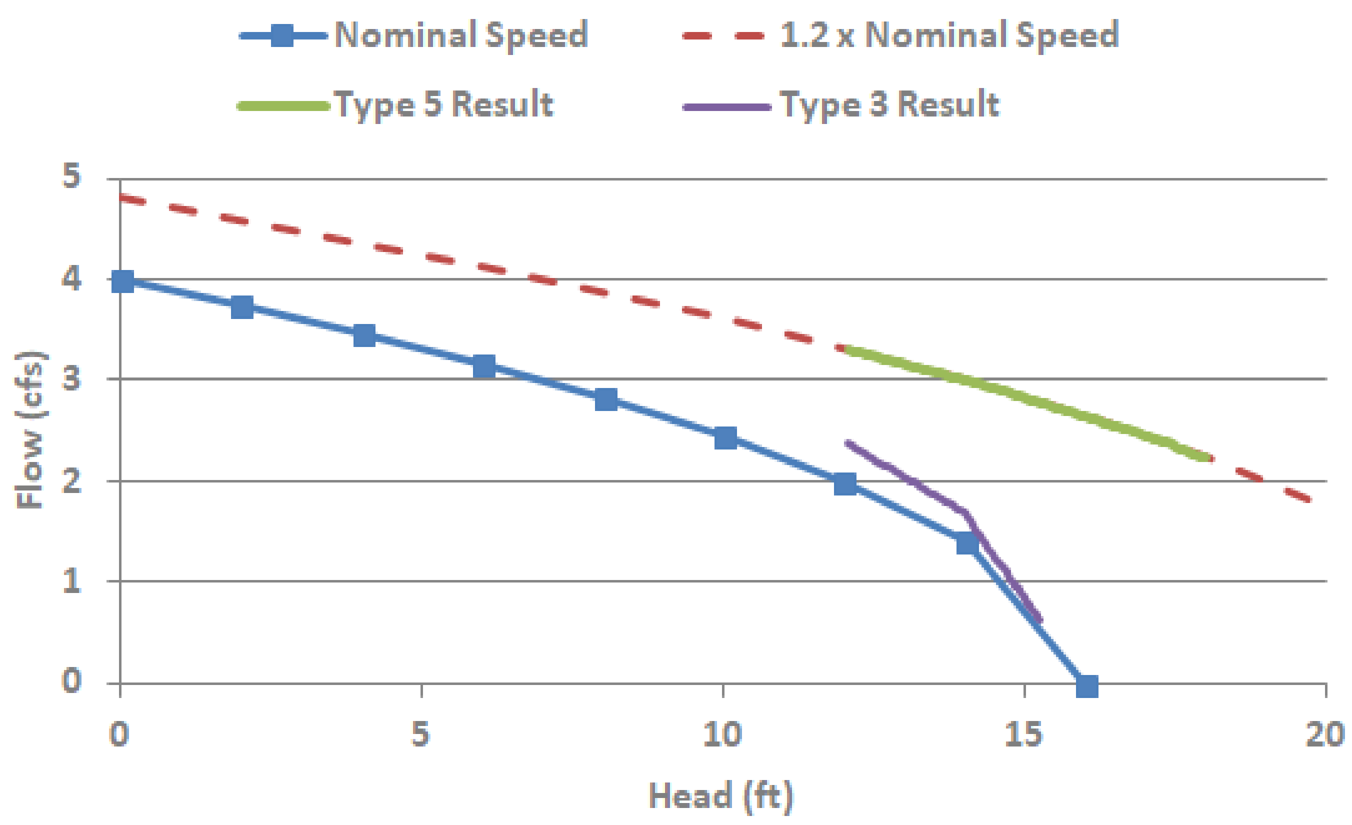
New Type 5 Pump Curve v. Existing Type 3 Curve



If Simulation Time = 0

Then Pump Type3 Setting = 1.2

And Pump Type5 Setting = 1.2



Storage Unit Curves

SWMM represents storage unit shapes with a surface area v. depth curve.

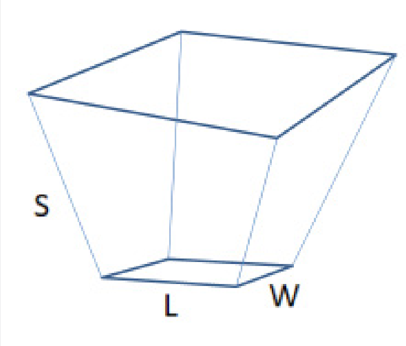
Either a tabular listing of area & depth points or a functional formula:

Area = A0 + A1 * Depth^A2

can be used.

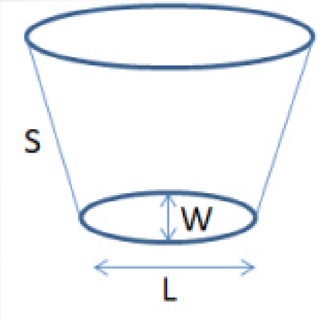
The functional option cannot represent common regular shapes where all sides are sloping (e.g., truncated pyramids).

New Functional Storage Curves Added



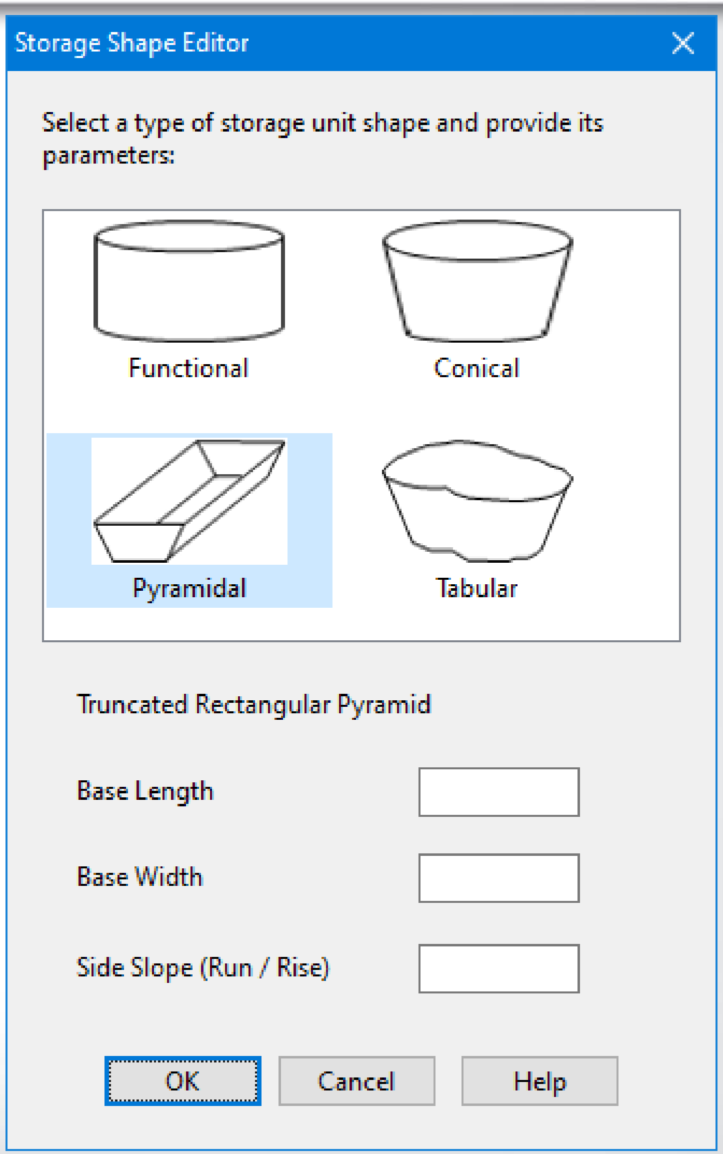
Truncated Rectangular Pyramid:

$$Area = L*W + 2*(L+W) * S*Depth + 4*(S*Depth)^2$$



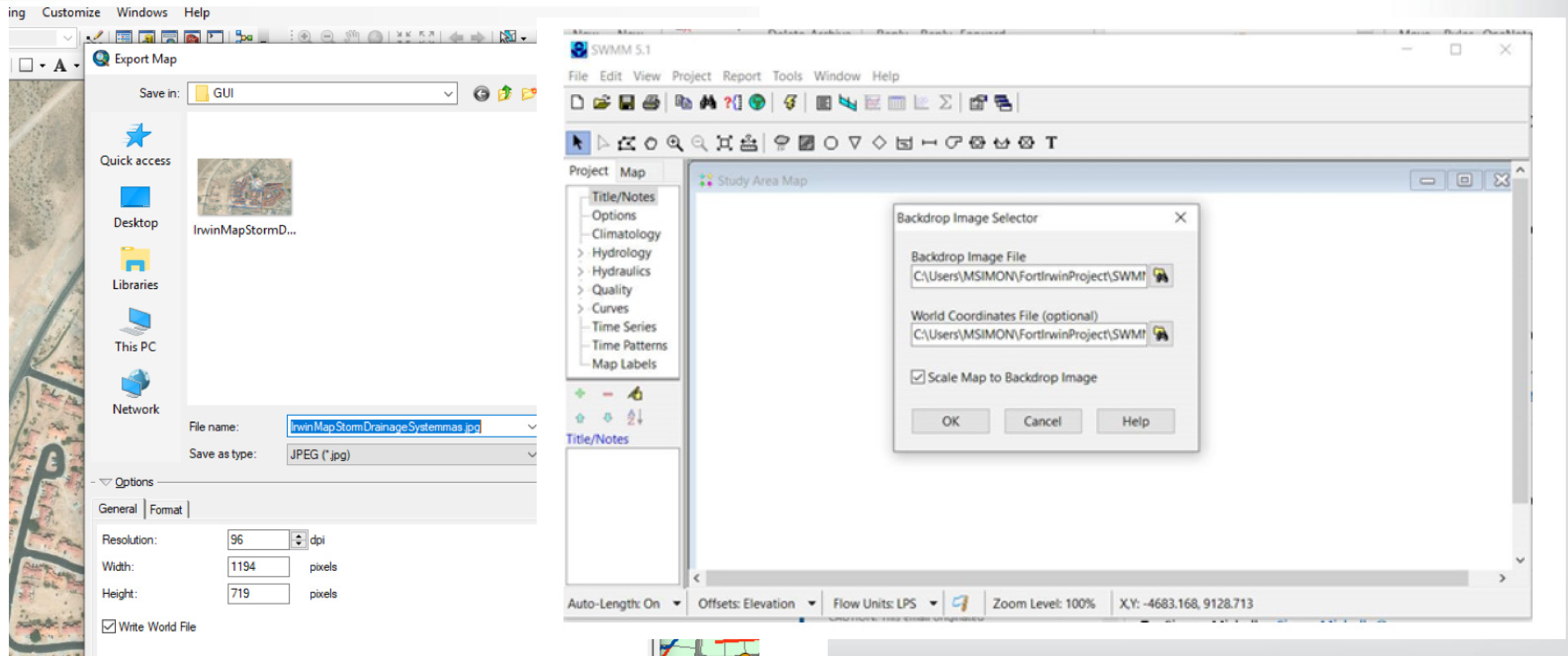
Truncated Elliptical Cone:

$$Area = PI * (L*W + 2*W*S*Depth + (W/L)(S*Depth)^2)$$



Import Geo Referenced Map

https://www.openswmm.org/Topic/27275/how-to-import-a-georeferenced-swmm-backdrop-with-world-coordinates-from-an-arcgis-map-into-swmm



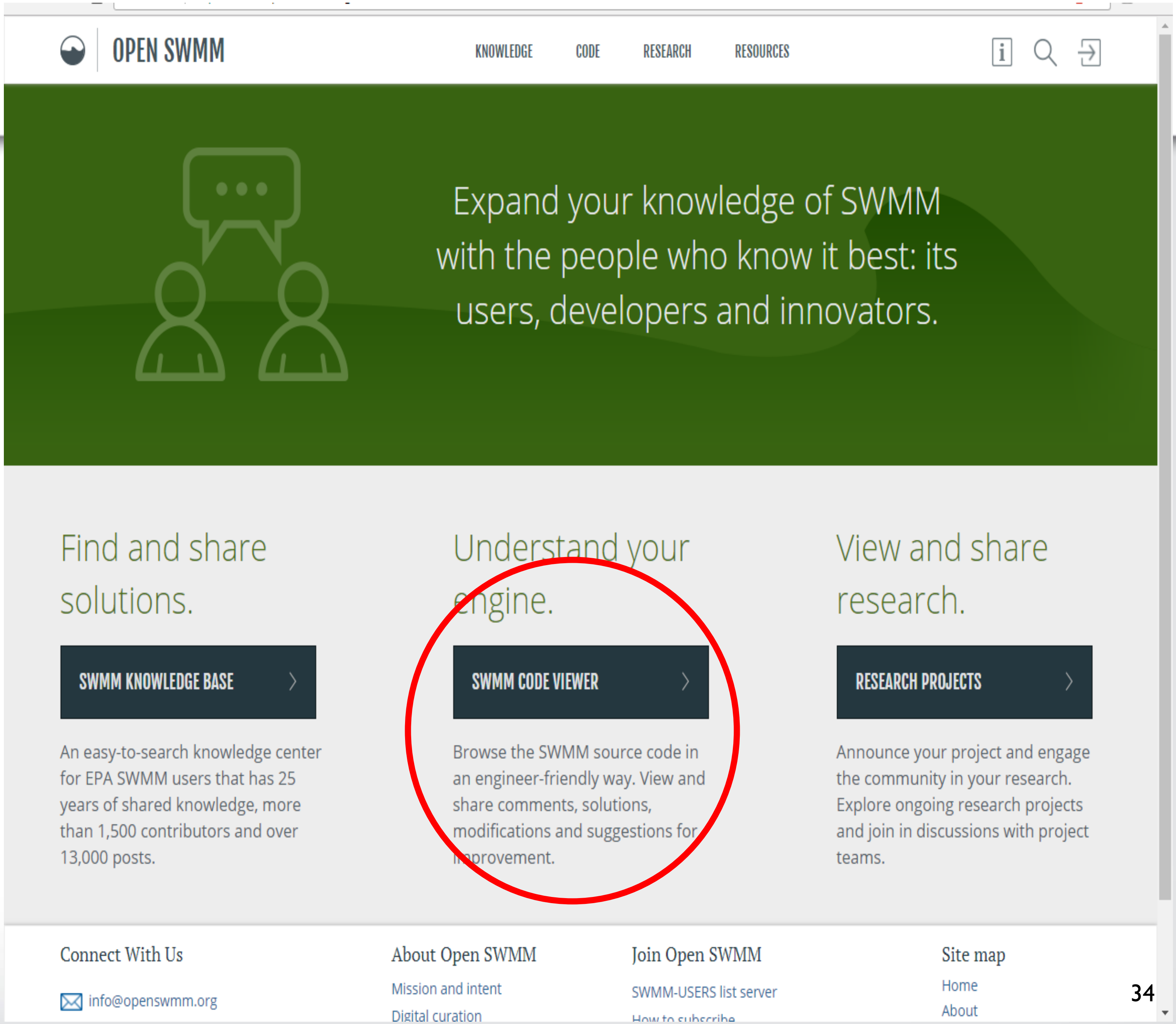
SWMM Reference Manuals

https://www.epa.gov/water-research/storm-water-management-model-swmm

Manuals and Guides

Date	Title
09/30/2015	SWMM 5.1 User's Manual
09/01/2014	SWMM-CAT User's Guide
09/07/2016	SWMM Applications Manual (ZIP) (7 MB)
01/18/2018	SWMM Modeling Methods for Simulating Green Infrastructure at a Suburban Headwatershed: User's Guide
03/19/2019	SWMM Reference Manuals Errata (Volumes I and II)
01/29/2016	SWMM Reference Manual Volume I—Hydrology
08/07/2017	SWMM Reference Manual Volume II—Hydraulics
09/08/2016	SWMM Reference Manual Volume III—Water Quality (Includes the LID Module references)

https://www.openswmm.org/



OPEN SWMM

KNOWLEDGE CODE RESEARCH RESOURCES

SWMM Code Viewer

Understand your engine.

EPA SWMM 5.1.015 vs EPA SWMM 5.1.013

EPA SWMM 5.1.015

vs. EPA SWMM 5.1.013

About this Engine

Code Roadmap

Visual Code Explorer

Search

- headers.h
- hotstart.c
- iface.c
- infil.c
  - curvenum_getInfil
  - curvenum_getState
  - curvenum_initState
  - curvenum_setParams
  - curvenum_setState
  - grnampt_getF2
  - grnampt_getInfil
  - grnampt_getParams +
  - grnampt_getSatInfil
  - grnampt_getState
  - grnampt_getUnsatInfil

Code comparison summary — Collapse all

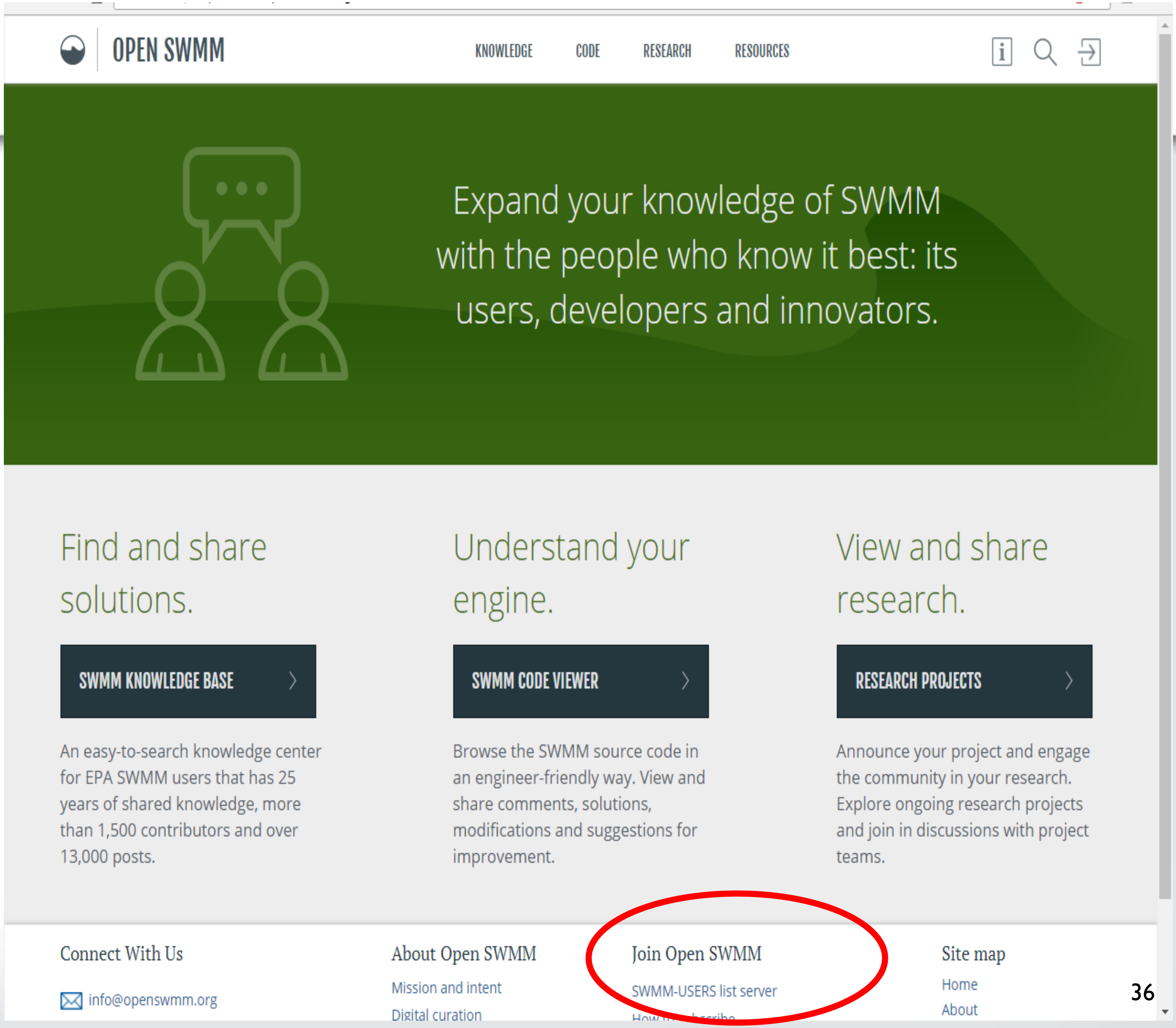
ADDED (2)

1. grnampt_getParams +
2. report_RouteStepFreq +

EDITED (96)

1. adjustSubareaParams
2. conduit_getLossRate
3. conduit_initState
4. consts.h
5. createObjects
6. datetime.h
7. dwflow.c
8. dwflow_findConduitFlow
9. dynwave.c
10. enums.h
11. error.c
12. error.h
13. execRouting
14. exfil.h

https://www.openswmm.org/



Open Swmm User's group

https://www.openswmm.org/Forum

OPEN SWMM

KNOWLEDGE CODE RESEARCH RESOURCES

SWMM Knowledge Base

Find and share solutions.

Search for a topic GO ›

Post a question

DISCUSSIONS

LID controls
15 Mar 2021 | Mariana de Lara

Permeable Pavers Infiltration: conductivity of joints
12 Mar 2021 | Jasmin Eggert, Lew Rossman

Modeling of SWALE on highway in SWMM
12 Mar 2021 | Rikin Patel

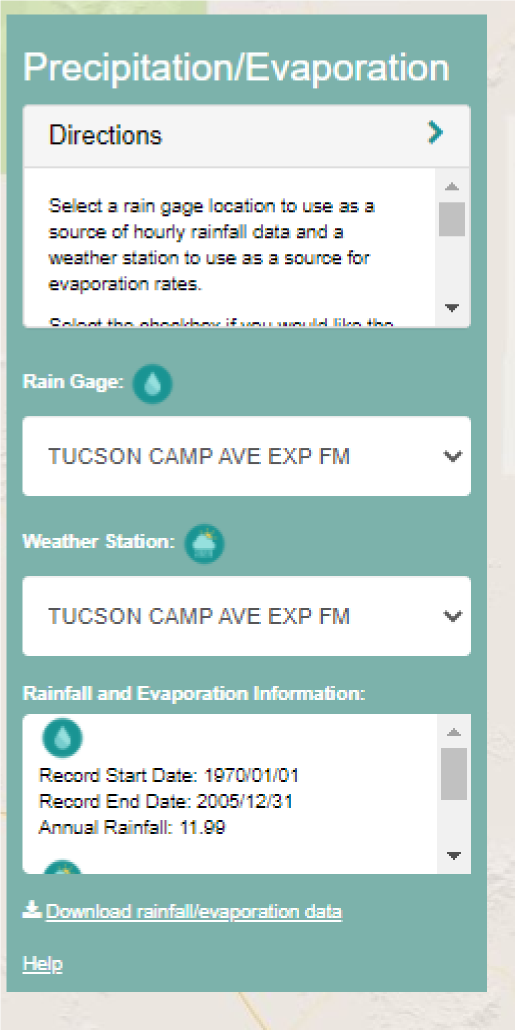
What shapefile layer do cross sections belong in
11 Mar 2021 | Elizabeth Fernandez

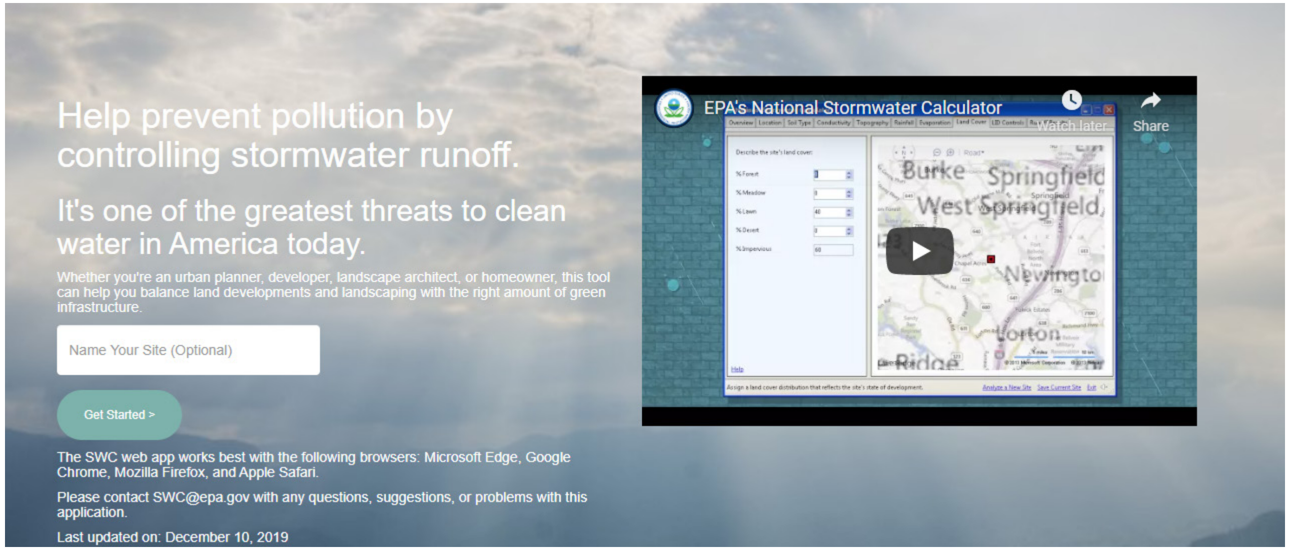
LID - no evaporation during times of surface infiltration

REFERENCE DOCUMENTATION
DISCUSSIONS
HOT TOPICS
DOCUMENTED BUGS
FEATURE REQUESTS
EXAMPLE MODELS

BE PART OF THE CONVERSATION:
To ask, add or contribute to the Knowledge Base, please join the SWMM-USERS email discussion group.

EPA SWC – Storm Water Calculator





BASINS Flat Files

1970-2006

SWMM is the engine for SWC

https://www.epa.gov/water-research/national-stormwater-calculator

EPA\ORISE Updated Historical Data – COOP and ISD 2006-2019 append 2020 later

barrc Add network to Station and other small changes — Latest commit 1be74d0 on Nov 24, 2020 — History

1 contributor

COOP: https://github.com/barrc/get_ncei/blob/master/src/coop_stations_to_use.csv

1860 lines (1860 sloc) | 185 KB

Raw | Blame

Search this file...

1	station_id	station_name	state	start_date	end_date	latitude	longitude	in_basins	break_with_basins	network
2	USC00010008	ABBEVILLE	AL	1948-06-01 00:00:00	2018-04-18 00:00:00	31.5702	-85.2482	True	False	coop
3	USC00010063	ADDISON	AL	1948-06-01 00:00:00	2020-08-06 00:00:00	34.2553	-87.1814	True	False	coop
4	USC00010140	ALBERTA	AL	1963-09-26 00:00:00	2020-08-01 00:00:00	32.2322	-87.4104	True	False	coop
5	USC00010252	ANDALUSIA 3 W	AL	1980-03-01 00:00:00	2018-02-05 00:00:00	31.3071	-86.5226	True	False	coop
6	USC00010369	ASHLAND 3 ENE	AL	1948-06-01 00:00:00	2013-08-04 00:00:00	33.2941	-85.7788	True	False	coop

barrc Don't use if station has < 1 year of new data (ex. 72582794190) — Latest commit 2be3881 Dec 7, 2020 — History

1 contributor

ISD: https://github.com/barrc/get_ncei/blob/master/src/isd_stations_to_use.csv

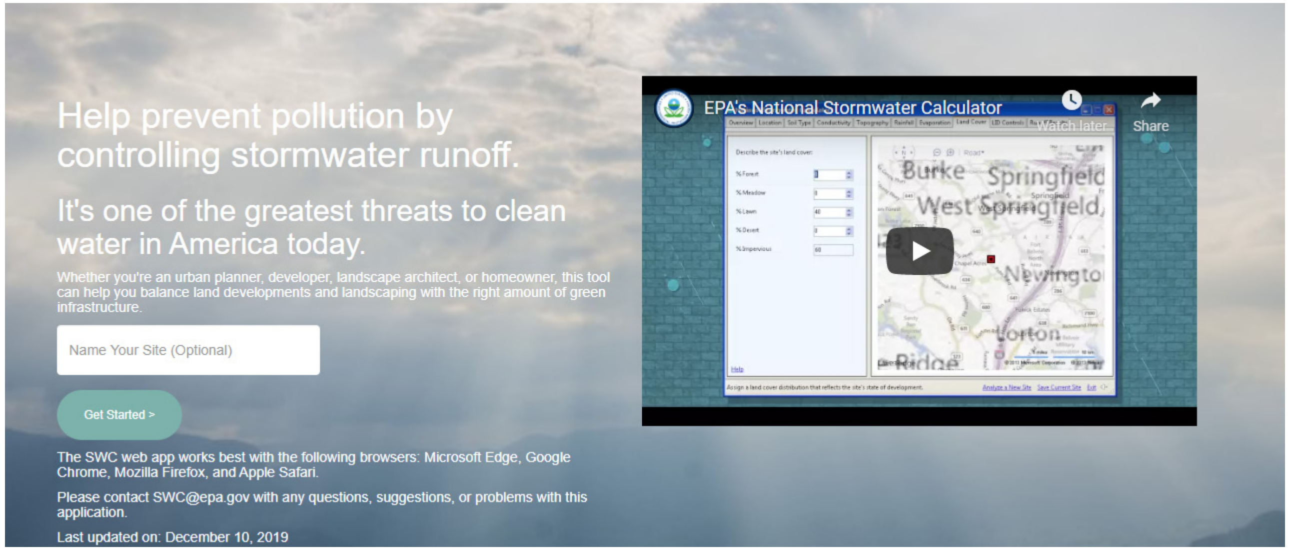
3295 lines (3295 sloc) | 349 KB

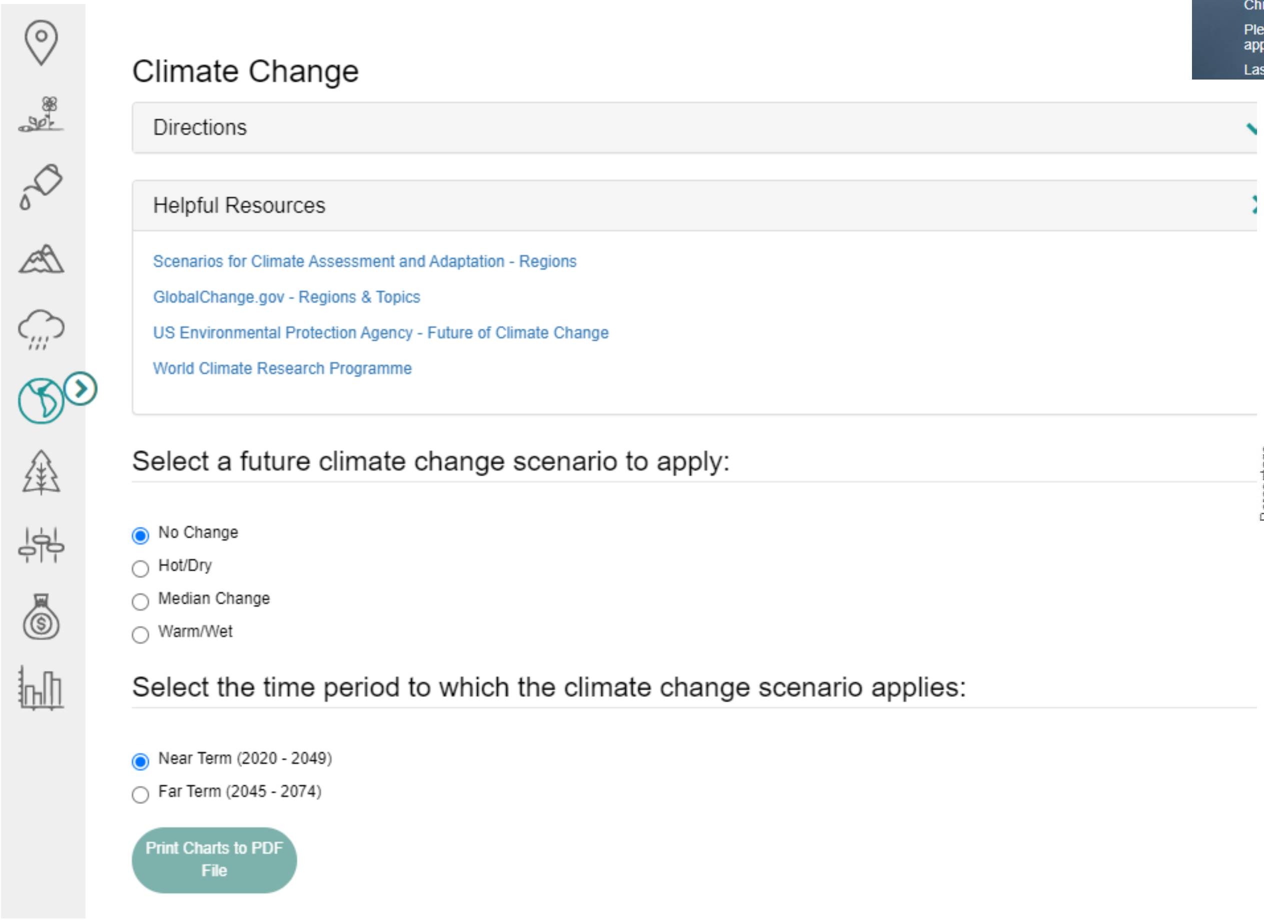
Raw | Blame

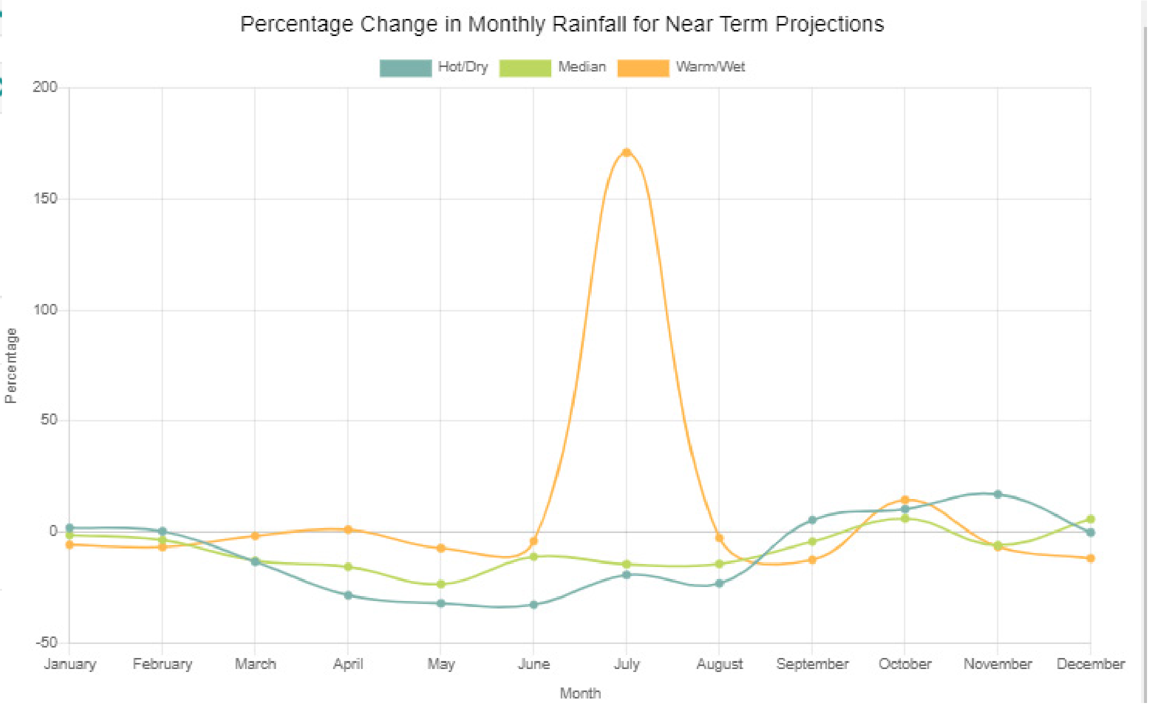
Search this file...

1	station_id	station_name	state	start_date	end_date	latitude	longitude	in_basins	break_with_basins	network
2	69015093121	TWENTY NINE PALMS	CA	1990-01-02 00:00:00	2020-10-15 00:00:00	+34.300	-116.167	False	False	isd
3	69017099999	IND SPRNG RANGE 63	NV	1980-05-14 00:00:00	2008-12-31 00:00:00	+36.533	-115.567	False	False	isd
4	69019013910	ABILENE DYESS AFB	TX	1943-12-01 00:00:00	2009-12-31 00:00:00	+32.433	-099.850	False	False	isd
5	69023024255	WHIDBEY ISLAND NAS	WA	1989-12-01 00:00:00	2009-06-02 00:00:00	+48.350	-122.667	False	False	isd
6	69026099999	CHEBOYGAN	MI	1980-06-11 00:00:00	2001-10-23 00:00:00	+45.650	-084.467	False	False	isd

0. EPA SWC-CAT
SWMM-CAT







CREAT 2.0 vs 3.0

CREAT 2.0, 9-models, 0.5 by 0.5 degree

Near Term (2020 - 2049) Far Term (2045 – 2074))

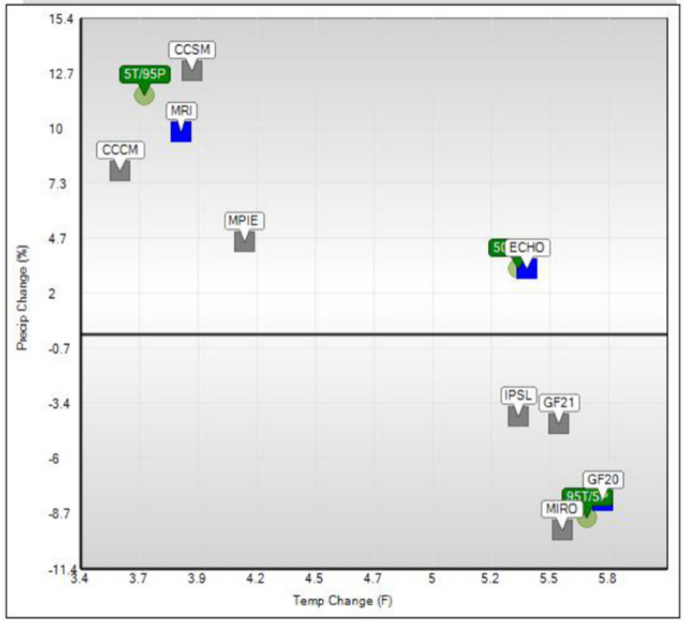


Figure 50. CMIP3 2060 projected changes in temperature and precipitation for Omaha, NE (EPA, 2012).

CREAT 3.0, 38-models, 0.5 by 0.5 degree

2035 (2025-2045) 2060 (2050-2070)

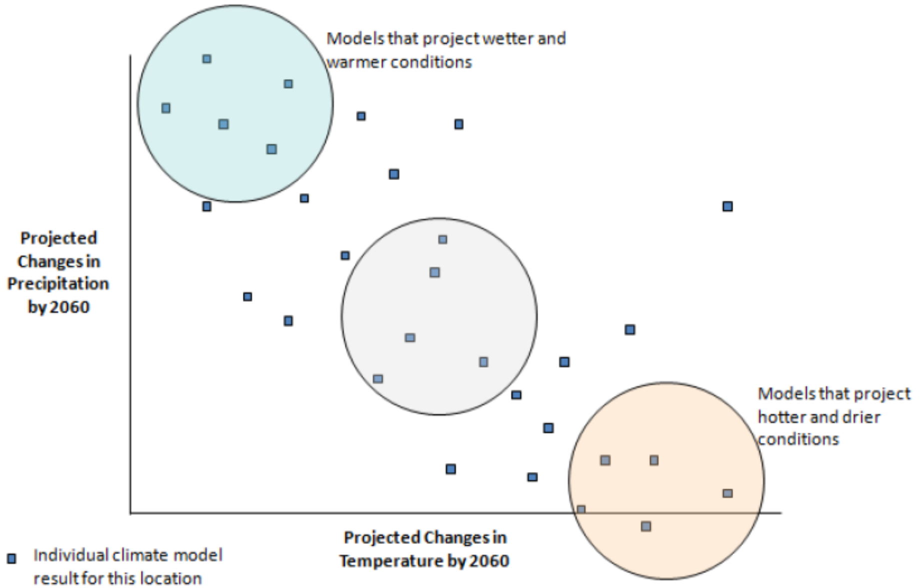


Figure 5. Illustration of Ensemble-informed Selection of Model Projections to Define Potential Future Conditions

- Warmer and wetter future conditions: average of five individual models that are nearest to the 95th percentile of precipitation and 5th percentile of temperature projections;
- Moderate future conditions: average of five individual models that are nearest to the median (50th percentile) of both precipitation and temperature projections; and
- Hotter and drier future conditions: average of five individual models that are nearest to the 5th percentile of precipitation and 95th percentile of temperature projections.

CREAT 3.0 Projected Extreme Events

- 22 of the 38 models
- Scalers from 5-year storms

https://www.epa.gov/crwu/creat-version-30-methodology-guide-water-utilities

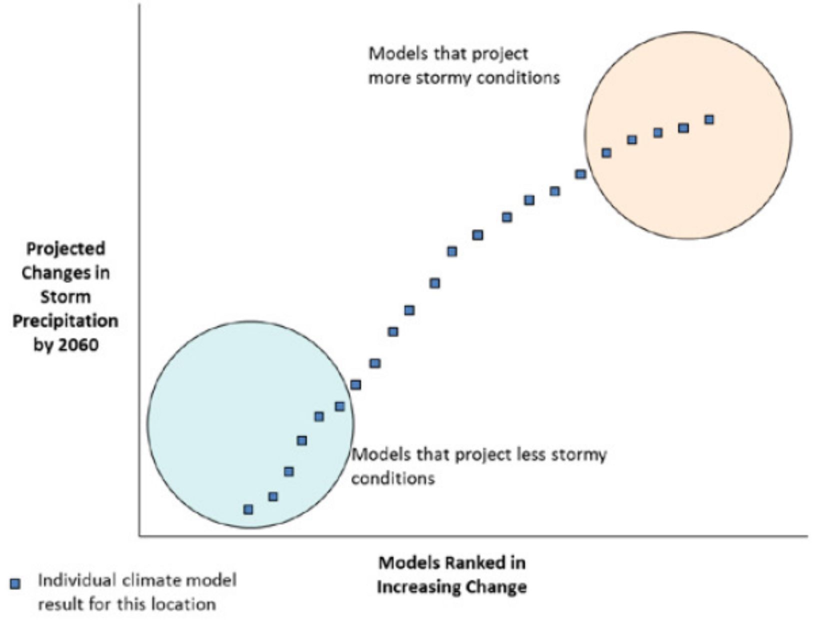


Figure 6. Illustration of Ensemble-informed Selection of Model Projections to Define Potential Future Storm Conditions

The selected models were used to provide ensemble average scalars for changes in precipitation per degree of warming for all the return intervals provided for historical data including 5-year, 10-year, 15-year, 30-year, 50-year and 100-year. Projected changes in event magnitudes were calculated using the scalars, generating a new GEV curve for each future time period, as follows:

$$Intense\ Precip(RI, Proj) = Intense\ Precip(RI, Hist) * \left(1 + \Delta Intense\ Precip(RI, Proj)\right), \text{ where}$$

$$\Delta Intense\ Precip(RI, Proj) = Scalar(RI, Proj) * \Delta Temp(Proj),$$

and ΔTemp is the change in global mean temperature from the same model.

Already Available Data from CREAT 3.0

OBJECTID	CREAT_ID	Longitude_Centroid	Latitude_Centroid	TEMP_2035_HOTDRY_ANNUAL_CHANGEF	TEMP_2035_CENTRAL_ANNUAL_CHANGEF	TEMP_2035_WETWARM_ANNUAL_CHANGEF	TEMP_2060_HOTDRY_ANNUAL_CHANGEF	TEMP_2060_CENTRAL_ANNUAL_CHANGEF	TEMP_2060_WETWARM_ANNUAL_CHANGEF	PRECIP_2035_HOTDRY_ANNUAL_CHANGEPCT	PRECIP_2035_CENTRAL_ANNUAL_CHANGEPCT	PRECIP_2035_WETWARM_ANNUAL_CHANGEPCT
1	9720	-67.25	17.75	1.66	1.55	1.35	3.24	3.04	2.65	-10.31	-7	-1.86
2	9721	-66.75	17.75	1.67	1.53	1.35	3.28	2.97	2.65	-9.35	-7.29	-2.14
3	9722	-66.25	17.75	1.67	1.51	1.42	3.26	2.93	2.79	-9.26	-6.99	-0.09
4	9723	-65.75	17.75	1.62	1.49	1.39	3.15	2.93	2.72	-9.89	-6.73	-0.96
5	9713	-67.75	18.25	1.73	1.55	1.44	3.35	3.02	2.81	-10.66	-5.81	0.55

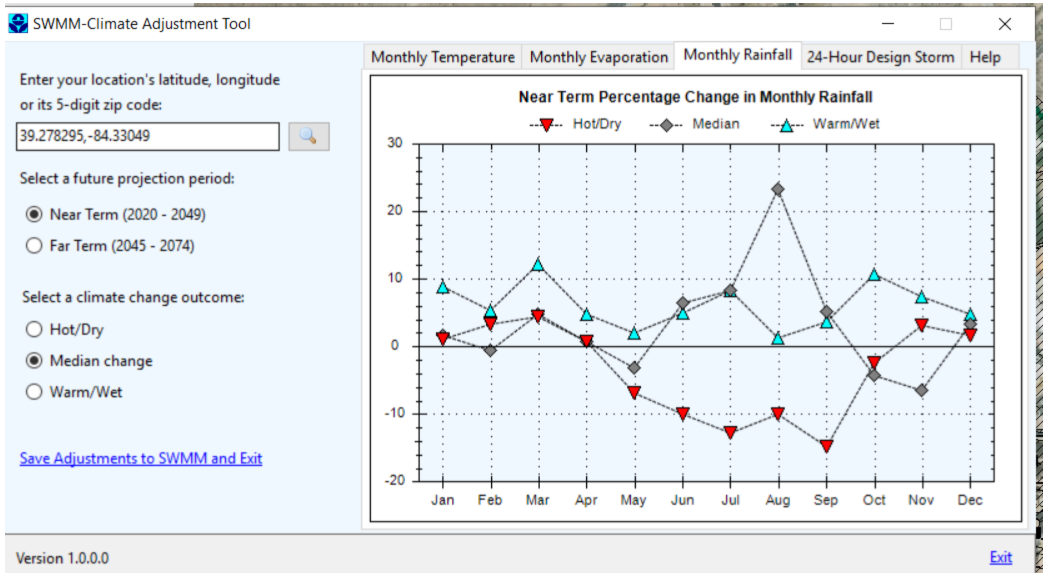
a. CREAT 3.0 Climate Projection Data and metadata
b. CREAT 3.0 Historic Gridded Weather Data and metadata
c. CREAT 3.0 Historic Weather Station Point Data and metadata

Available Data from CREAT 3.0

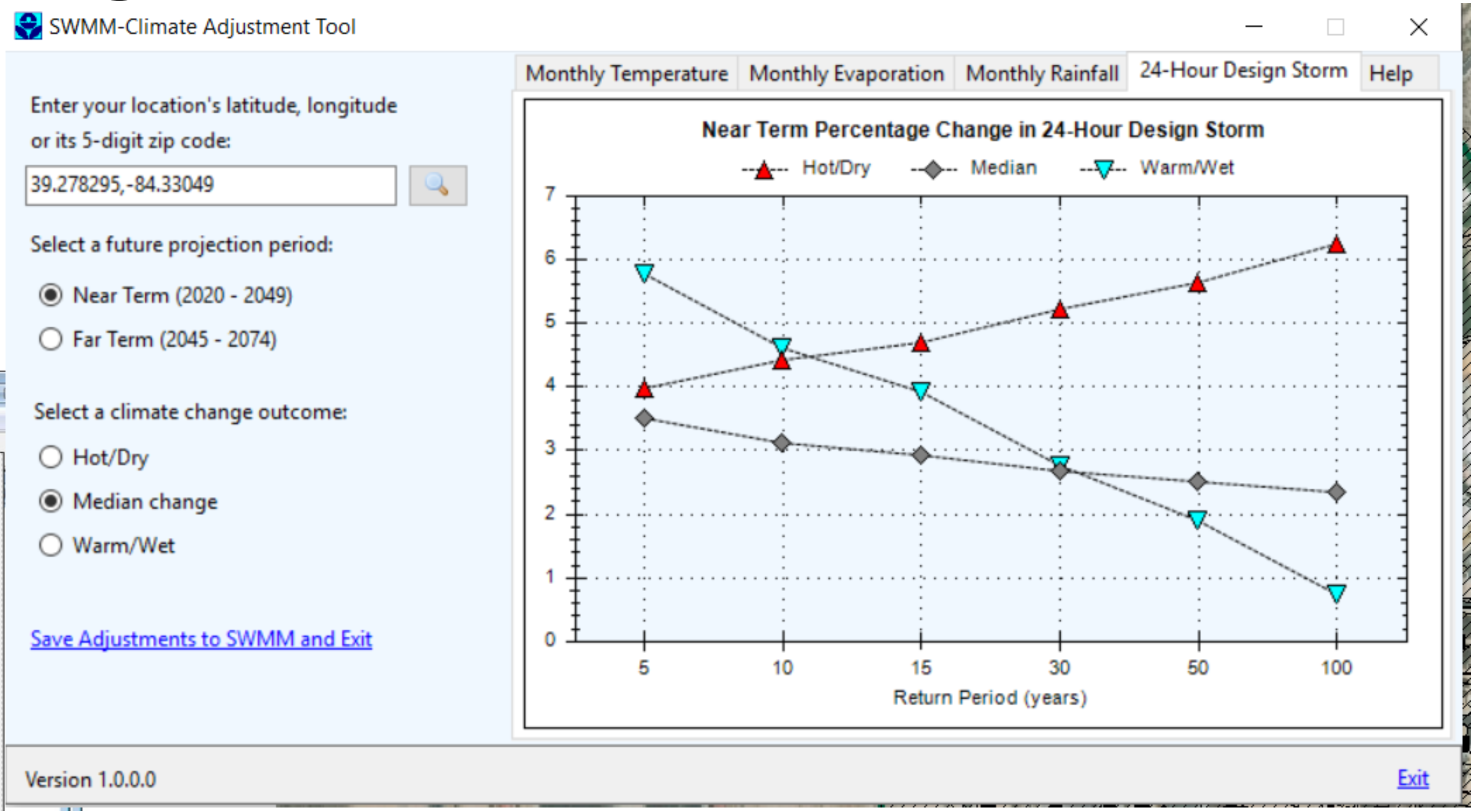
OBJECTID	CREAT_ID	Longitude_Centroid	Latitude_Centroid	TEMP_2035_HOTDRY_JAN_CHANGEF	TEMP_2035_CENTRAL_JAN_CHANGEF	TEMP_2035_WETWARM_JAN_CHANGEF	TEMP_2060_HOTDRY_JAN_CHANGEF	TEMP_2060_CENTRAL_JAN_CHANGEF	TEMP_2060_WETWARM_JAN_CHANGEF	PRECIP_2035_HOTDRY_JAN_CHANGEPCT
1	9720	-67.25	17.75	1.66	1.51	1.38	3.23	2.95	2.7	-4.08
2	9721	-66.75	17.75	1.68	1.51	1.38	3.27	2.94	2.69	-6.79
3	9722	-66.25	17.75	1.67	1.5	1.44	3.27	2.92	2.81	-7.09
4	9723	-65.75	17.75	1.59	1.5	1.4	3.11	2.92	2.74	-6.33
5	9713	-67.75	18.25	1.66	1.56	1.45	3.24	3.05	2.84	-2.98

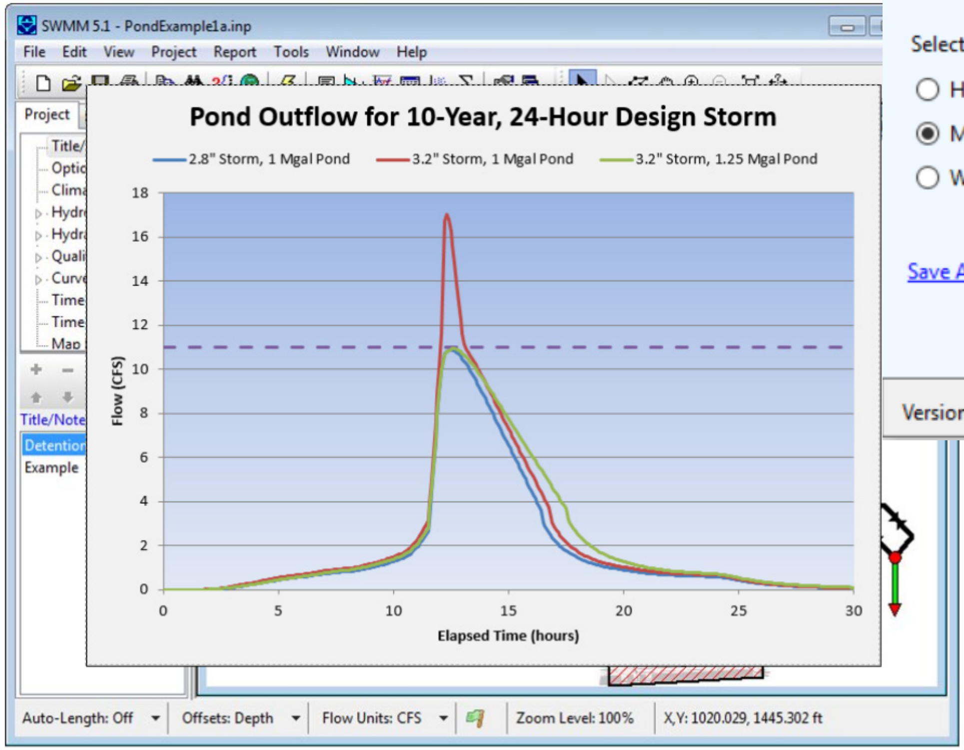
a. CREAT 3.0 Climate Projection Data and metadata
b. CREAT 3.0 Historic Gridded Weather Data and metadata
c. CREAT 3.0 Historic Weather Station Point Data and metadata

Demo SWMM-CAT

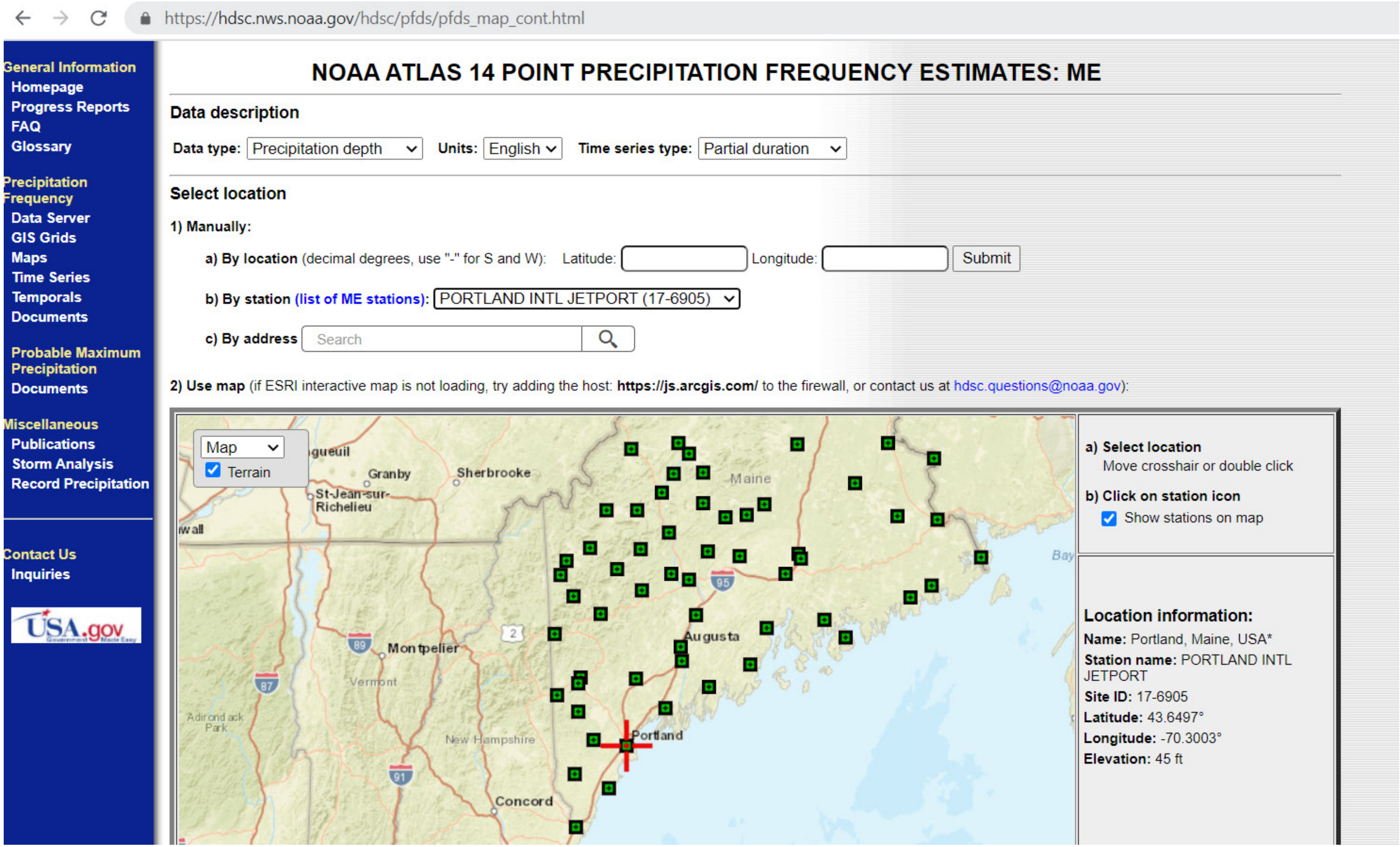


2. We also need to update extreme 24-Hour Design Storm disaggregations for various return periods





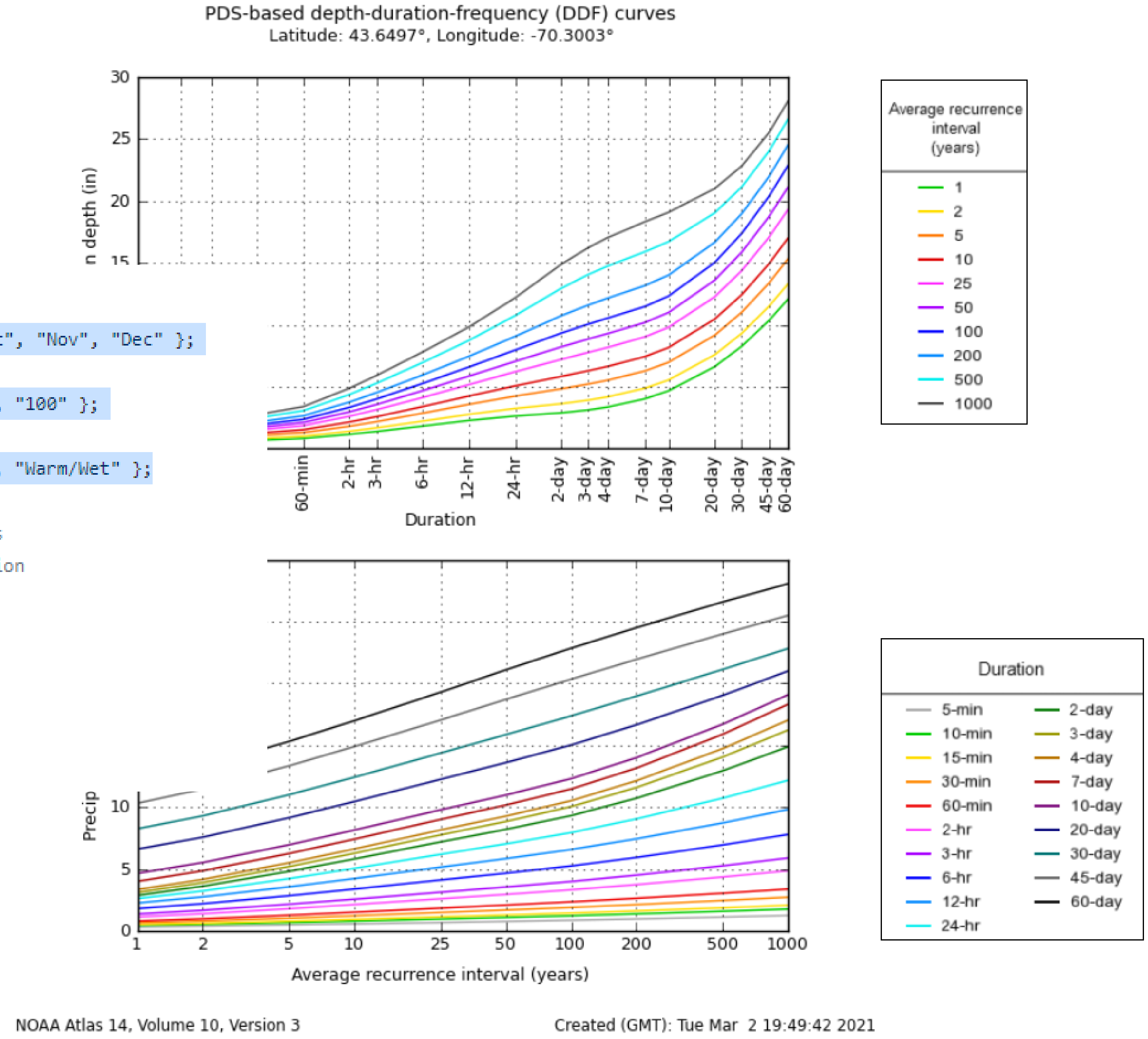
Precipitation Frequency Estimates - ME



PDS-Based depth-duration-frequency curves

Portland, ME

```
public static string[] monthLabels =
{ "Jan", "Feb", "Mar", "Apr", "May", "Jun", "Jul", "Aug", "Sep", "Oct", "Nov", "Dec" };

public static string[] returnPeriods = { "5", "10", "15", "30", "50", "100" };

public static string[] scenarioNames = { "None", "Hot/Dry", "Median", "Warm/Wet" };

// Updates the climate change adjustments displayed on the MainForm's
// Climate Change page when a new precip. station or climate projection
// year is selected.
public static void UpdateAdjustments()
{
    UpdateRainfallAdjustments();
    UpdateMaxRainAdjustments();
}
```



Currently SWC disaggregates extreme events data based on 1986 temporal rainfall distribution

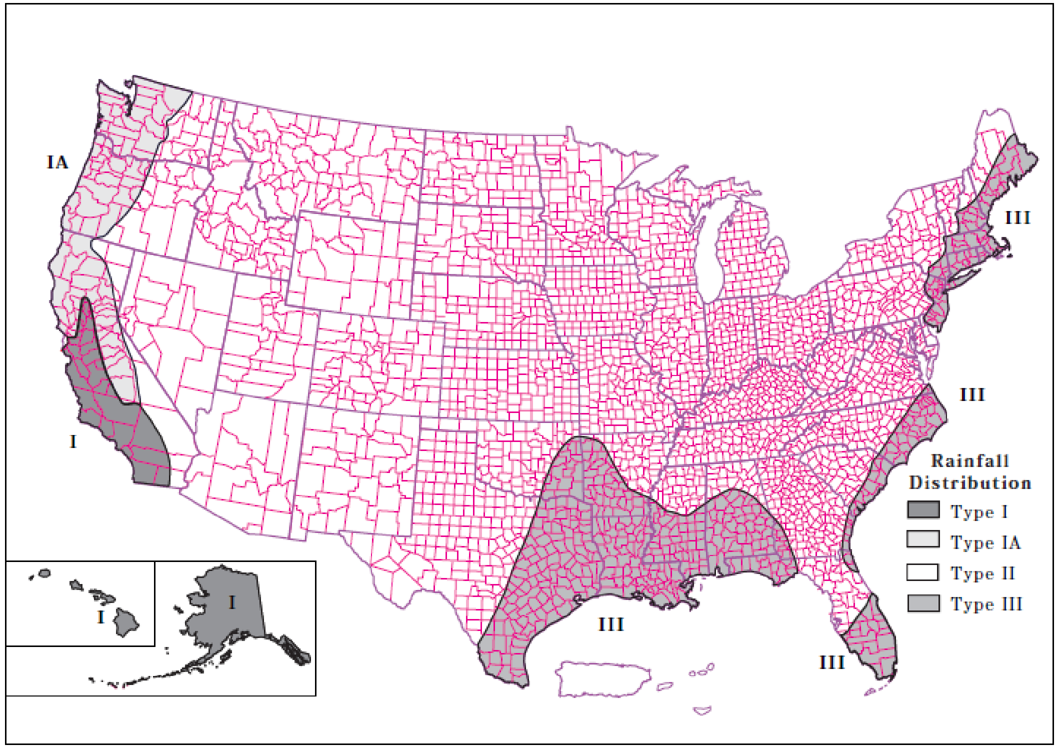


Figure 48. Geographic boundaries for the different NRCS (SCS) rainfall distributions (USDA, 1986).

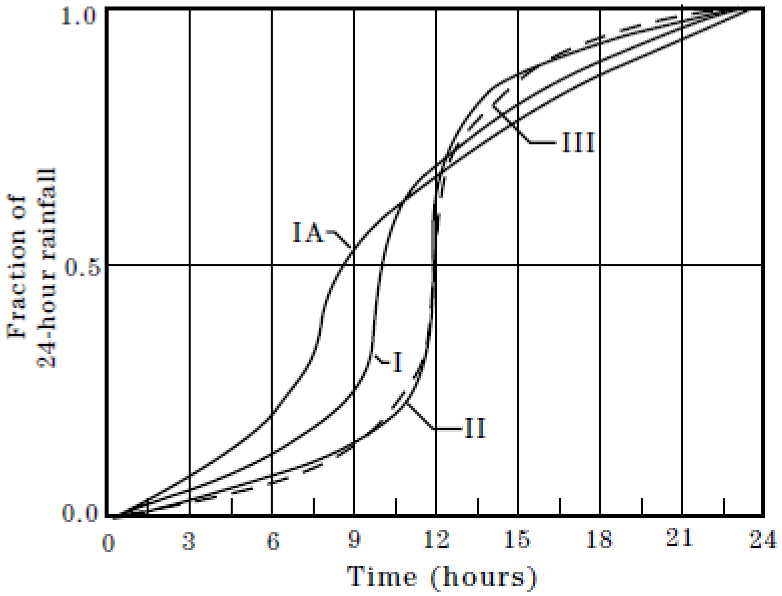
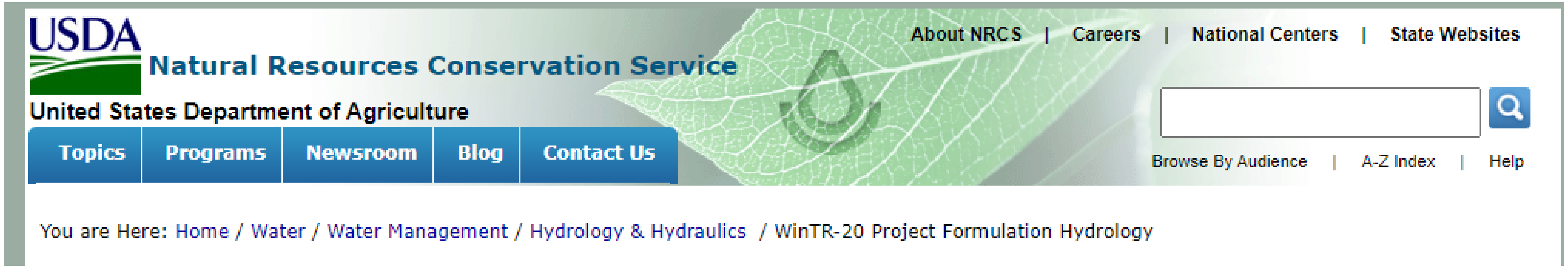


Figure 47. NRCS (SCS) 24-hour rainfall distributions (USDA, 1986).

New - NCRS Updated since 1986

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/manage/hydrology/?cid=stelprdb1042793 for 30 states



temporal_dist_file.txt

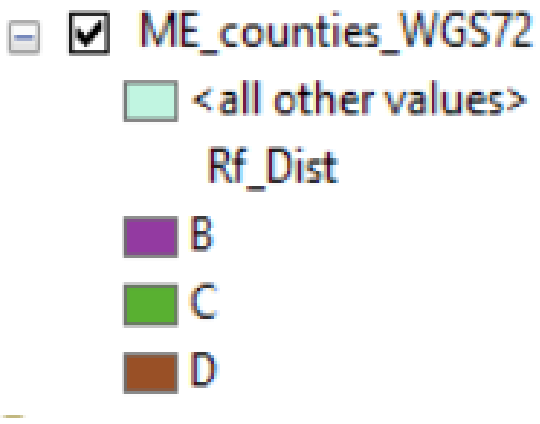
Time	NOAA_ A	NOAA_ B	NOAA_ C	NOAA_ D	NRCC_A	NRCC_B	NRCC_C	NRCC_D	NV_N	NV_S	NV_W	SCS_I	SCS_IA	SCS_II	SCS_III
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.1	0.00078	0.00101	0.00128	0.0011	0.00098	0.0012	0.00112	0.00146	0.0011	0.00084	0.0014	0.00174	0.00224	0.00101	0.001
0.2	0.00141	0.00182	0.00231	0.0022	0.00177	0.00217	0.00224	0.00287	0.0022	0.0017	0.0028	0.00348	0.00432	0.00202	0.002
0.3	0.00205	0.00265	0.00335	0.00332	0.00257	0.00315	0.00337	0.0043	0.0033	0.0025	0.0043	0.00522	0.00628	0.00305	0.003
0.4	0.0027	0.00348	0.00441	0.00445	0.00338	0.00414	0.00451	0.00573	0.0045	0.0034	0.0057	0.00697	0.00816	0.00408	0.004
0.5	0.00336	0.00433	0.00547	0.00559	0.0042	0.00514	0.00566	0.00718	0.0056	0.0043	0.0072	0.00871	0.01	0.00513	0.005
0.6	0.00403	0.00518	0.00654	0.00674	0.00503	0.00615	0.00683	0.00863	0.0067	0.0051	0.0087	0.01046	0.01184	0.00618	0.006
0.7	0.00471	0.00605	0.00763	0.0079	0.00587	0.00717	0.008	0.0101	0.0079	0.006	0.0101	0.0122	0.01372	0.00725	0.007
0.8	0.00539	0.00692	0.00872	0.00907	0.00671	0.0082	0.00919	0.01158	0.009	0.0069	0.0116	0.01395	0.01568	0.00832	0.008
0.9	0.00609	0.0078	0.00982	0.01025	0.00757	0.00924	0.01038	0.01306	0.0102	0.0078	0.0131	0.0157	0.01776	0.00941	0.009

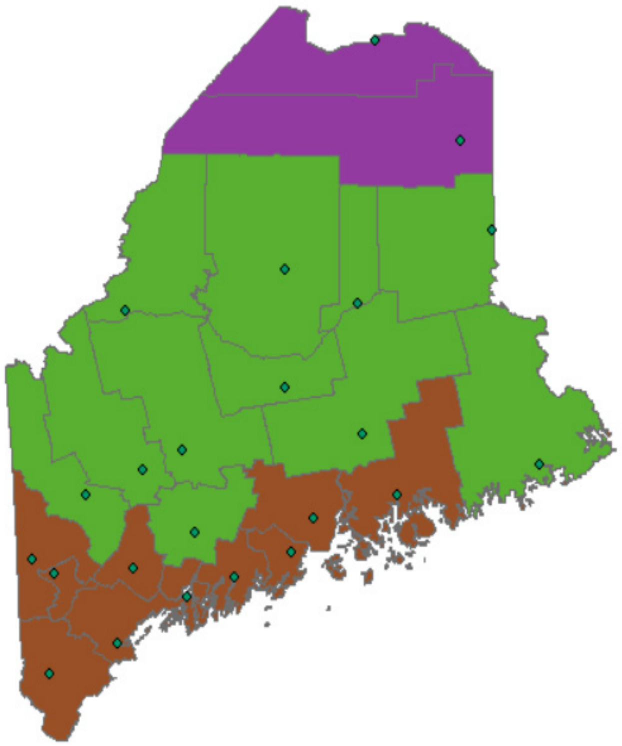
AL, AK, AR, CA, CO, CT, DE, FL, GA, IN, IA, KY, LA, ME, MD, MA, MN, NE, NV, NH, NJ, NY, OH, PA, RI, SC, TN, VT, VA, WV, Washington DC is in MD

The new temporal distributions are region-specific.

For example, NOAA_A – NOAA_D apply to the Mid-Atlantic states and NRCC_A – NRCC_D apply to New England.

For Maine, the shapefile ME_counties_WGS72.shp shows that Maine falls in temporal distributions B, C, and D:

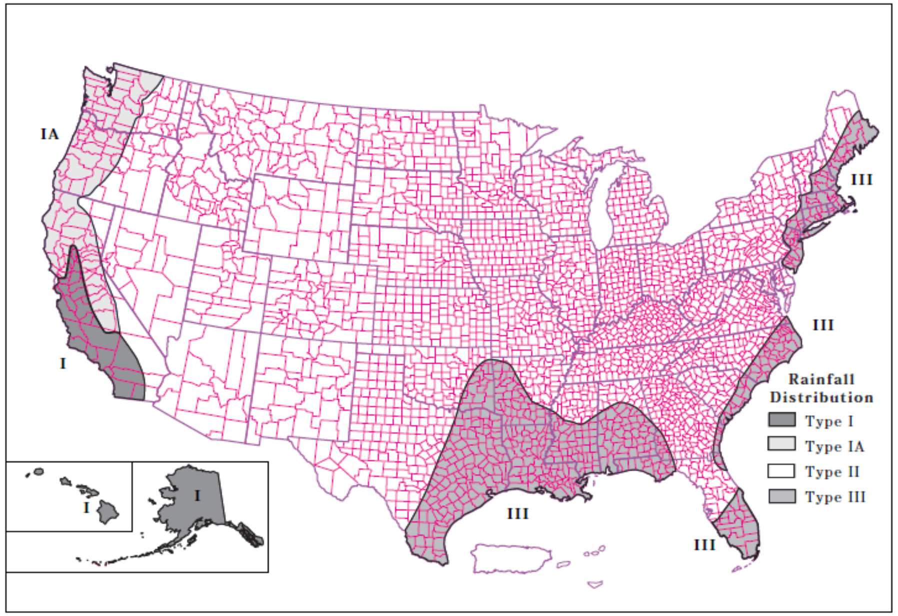


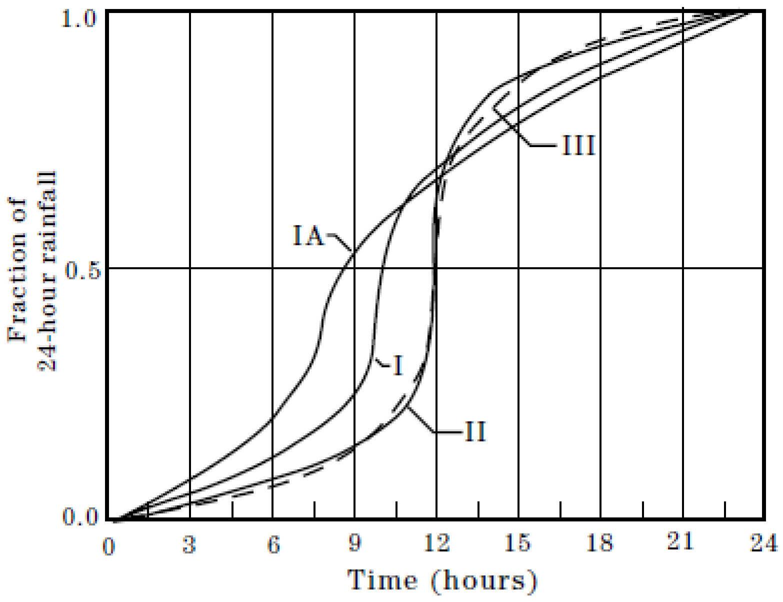


- This is shown in the attribute table by Rf_Dist.
- Maine uses the NRCC_ prefix.

Some states don't have new NRCS temporal distributions available.

AZ, HI, ID, IL, KS, MI, MS, MO, MT, NM, NC, ND, OK, OR, SD, TX, UT, WA, WI, WY





For those the data from ireg_zones.shp should be used. This shapefile represents the NRCS 1986 legacy rainfall distribution storm types that are currently used by the SWC.

Any questions

Contact: Simon.michelle@epa.gov