

# LECTURE #8

## WATERSHED SEGMENTATION



# MODELING STRATEGY

- Processes, constituents, and sources to be modeled
- Watershed segmentation (spatial and temporal data)
- Channel segmentation and tributary area
- Human impacts
- Alternatives to be analyzed

# WATERSHED SEGMENTATION DEFINITIONS

Segmentation –

Division of watershed into discrete land and channel segments to analyze watershed behavior

Land Segment -

Portions of the watershed that demonstrate similar hydrologic and water quality response

PLS = pervious land segment

ILS = impervious land segment

Channel Segment -

Sections of a stream channel with similar morphology and hydraulic behavior

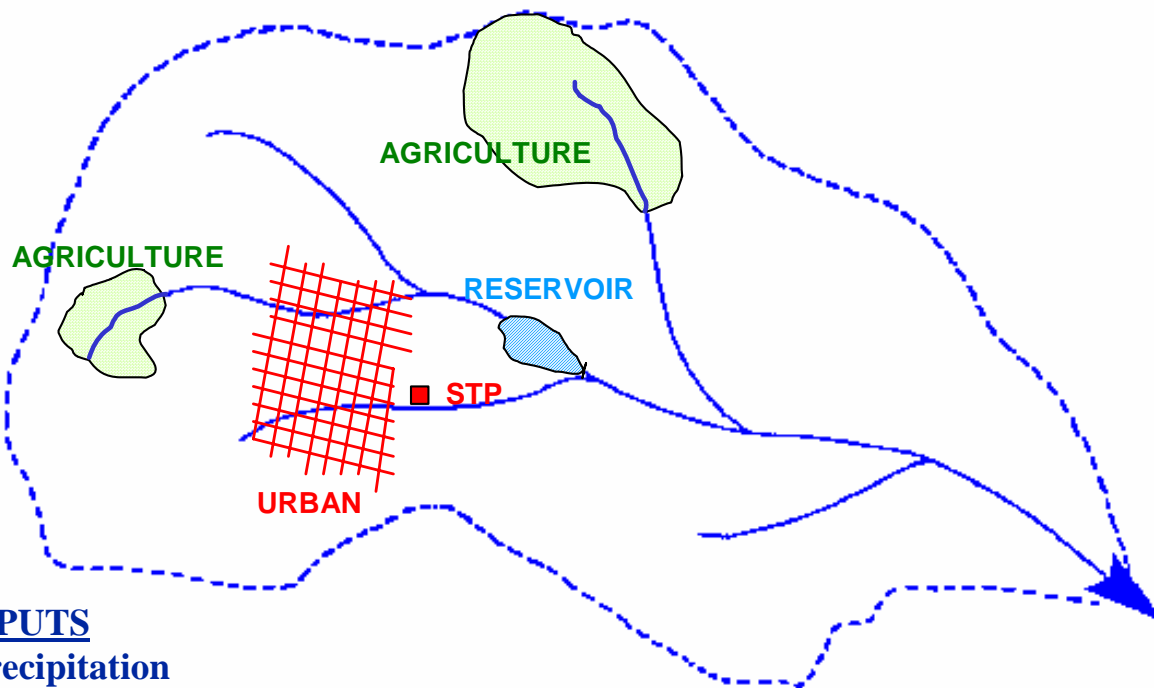
RCHRES = channel segment

# WATERSHED SEGMENTATION CONSIDERATIONS

	<u>Land segments</u>	<u>Channel segments</u>
<b>Inputs</b>	<p>Meteorologic (Precip., ET, Other)</p> <p>Man-made (Irrigation, Chemicals)</p>	<p>Point discharges</p> <p>Diversions</p>
<b>Physical characteristics</b>	<p>Topography/drainage</p> <p>Land use</p> <p>Soils</p>	<p>Slope</p> <p>Roughness</p> <p>Morphology Obstructions (e.g., Dams)</p>
<b>Outputs</b>	<p>Land Use/management alternatives</p> <p>Cropping</p>	<p>Gage/data locations</p> <p>Management alternatives</p>

# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #1 - Overview



### INPUTS

Precipitation  
Temperature  
Other Met. Data  
Atmos. Deposition  
STP Inflows  
Chemical App. etc.

### PHYSICAL CHARACTERISTICS

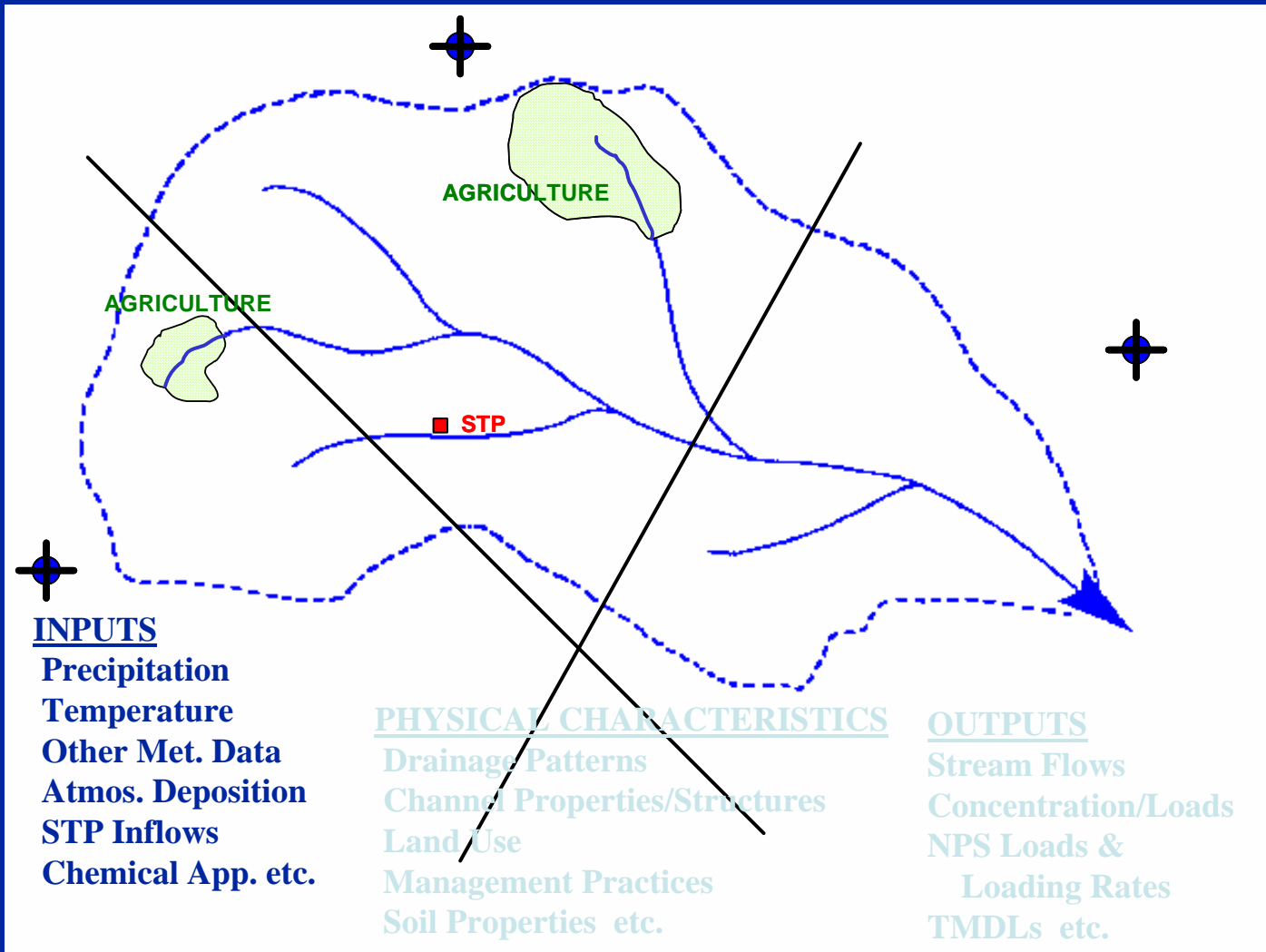
Drainage Patterns  
Channel Properties/Structures  
Land Use  
Management Practices  
Soil Properties etc.

### OUTPUTS

Stream Flows  
Concentration/Loads  
NPS Loads &  
Loading Rates  
TMDLs etc.

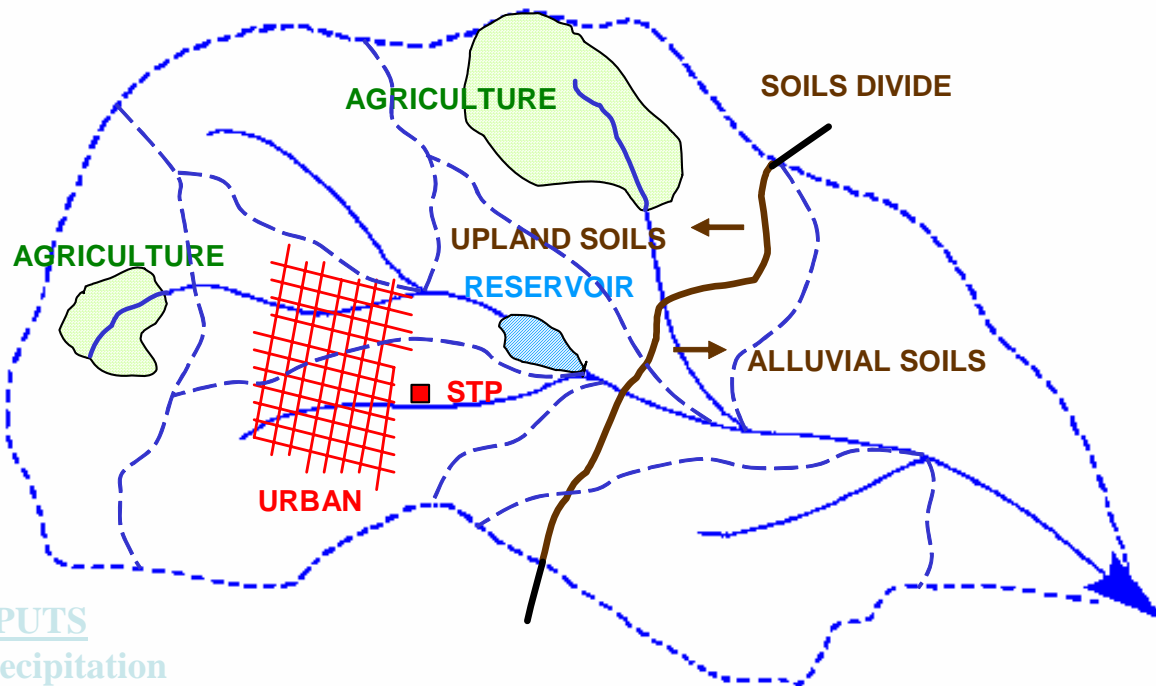
# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #2 - Inputs



# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #3 - Physical Characteristics



### INPUTS

Precipitation  
Temperature  
Other Met. Data  
Atmos. Deposition  
STP Inflows  
Chemical App. etc.

### PHYSICAL CHARACTERISTICS

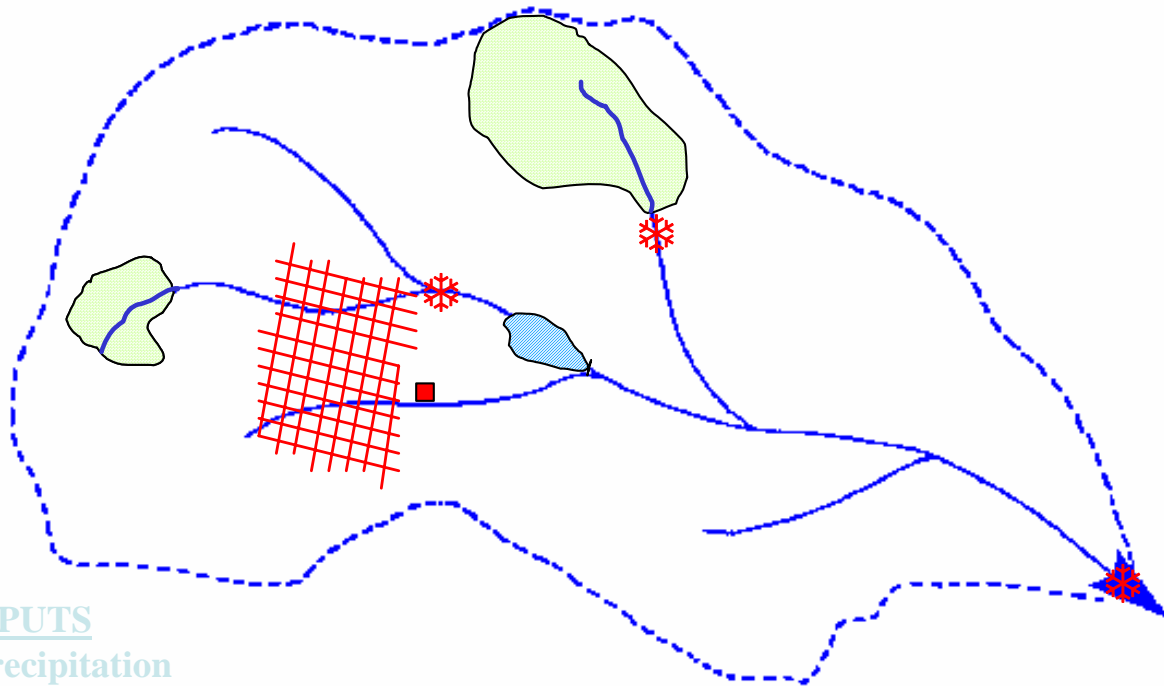
Drainage Patterns  
Channel Properties/Structures  
Land Use  
Management Practices  
Soil Properties etc.

### OUTPUTS

Stream Flows  
Concentration/Loads  
NPS Loads &  
Loading Rates  
TMDLs etc.

# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #4 - Outputs



### INPUTS

Precipitation  
Temperature  
Other Met. Data  
Atmos. Deposition  
STP Inflows  
Chemical App. etc.

### PHYSICAL CHARACTERISTICS

Drainage Patterns  
Channel Properties/Structures  
Land Use  
Management Practices  
Soil Properties etc.

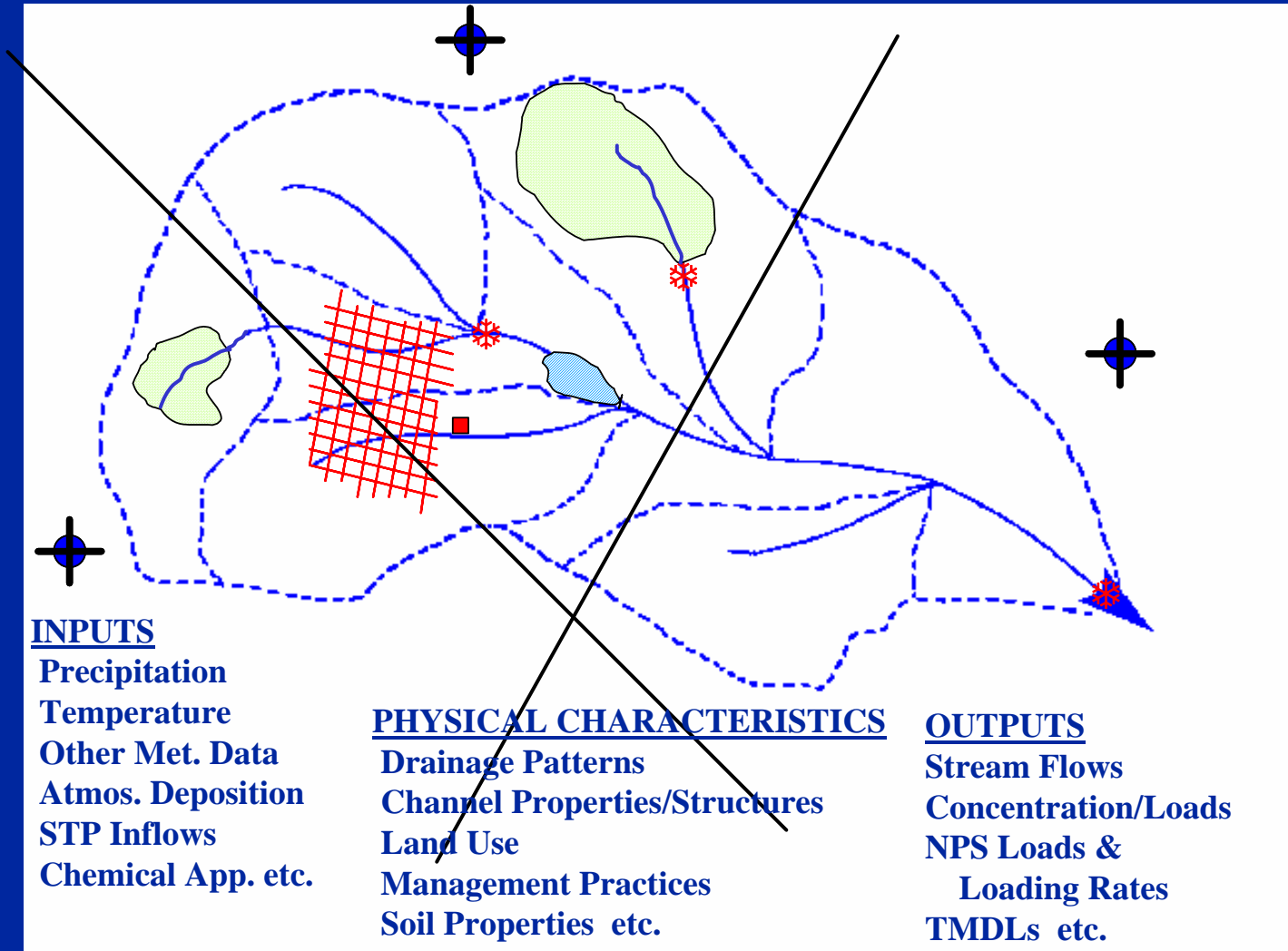
### OUTPUTS

Stream Flows  
Concentration/Loads  
NPS Loads &  
Loading Rates  
TMDLs etc.



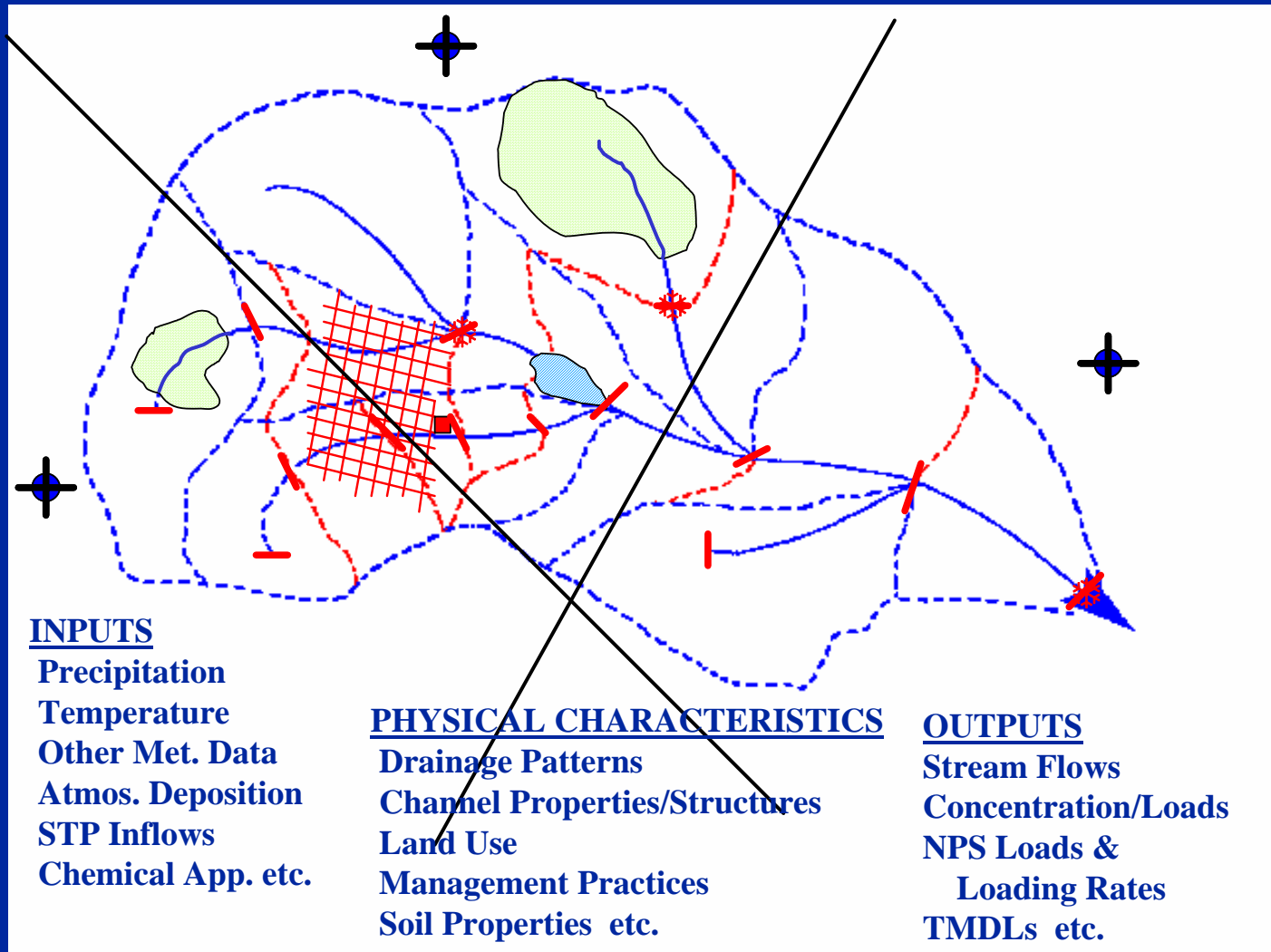
# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #5 - Integration/Overlay of Data Layers



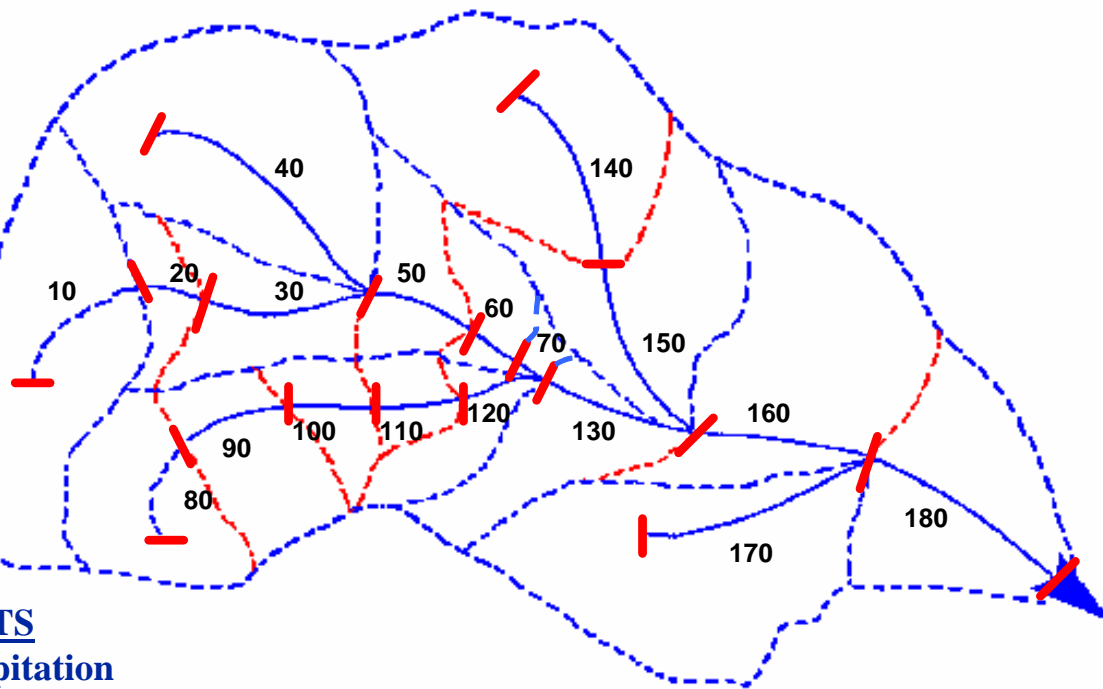
# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #6 - Adjustment/Extension of Drainage Areas; Initial Reach Boundaries



# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #7 - Reach Extension Numbering and Network



### INPUTS

Precipitation  
Temperature  
Other Met. Data  
Atmos. Deposition  
STP Inflows  
Chemical App. etc.

### PHYSICAL CHARACTERISTICS

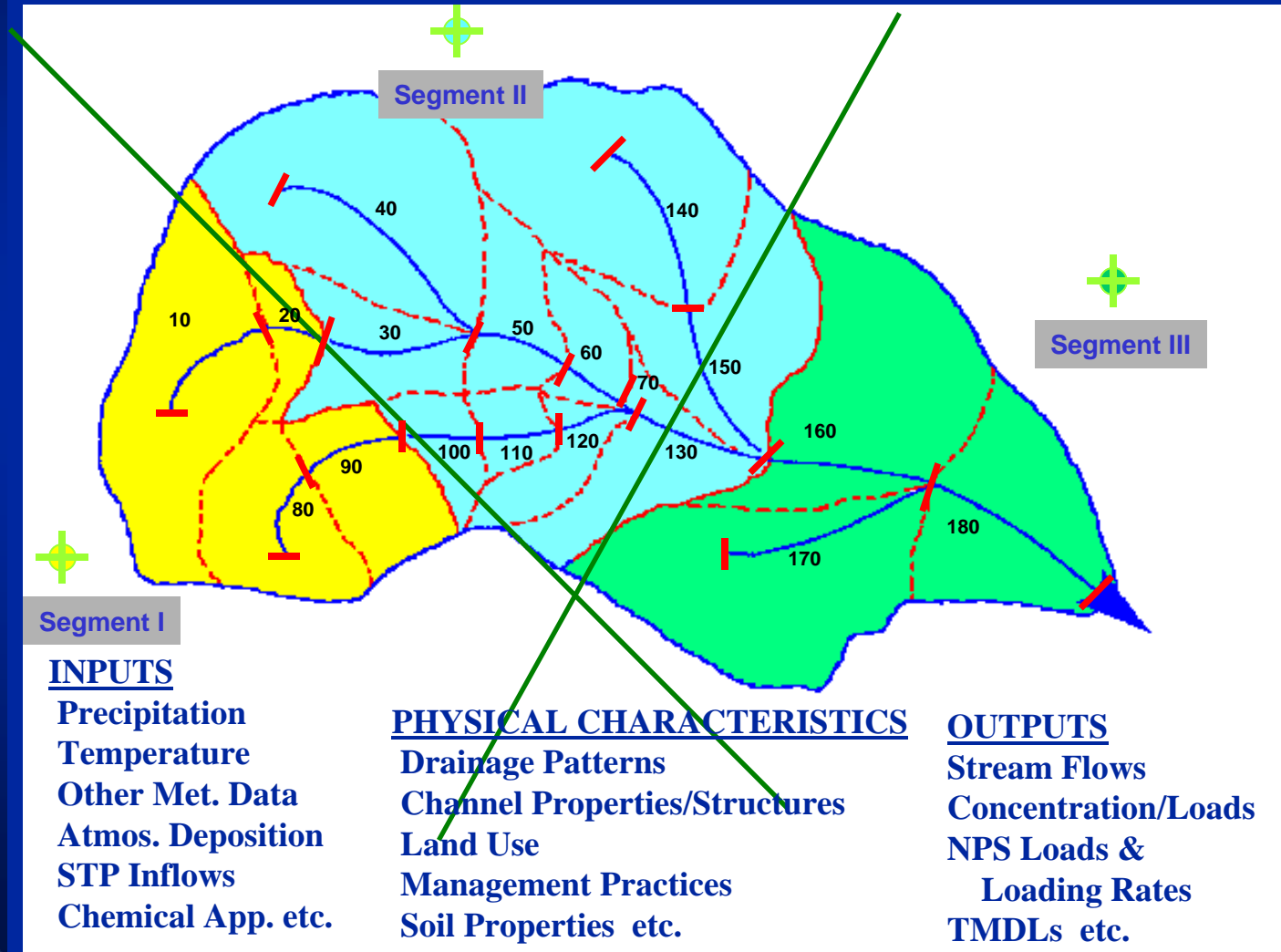
Drainage Patterns  
Channel Properties/Structures  
Land Use  
Management Practices  
Soil Properties etc.

### OUTPUTS

Stream Flows  
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TMDLs etc.

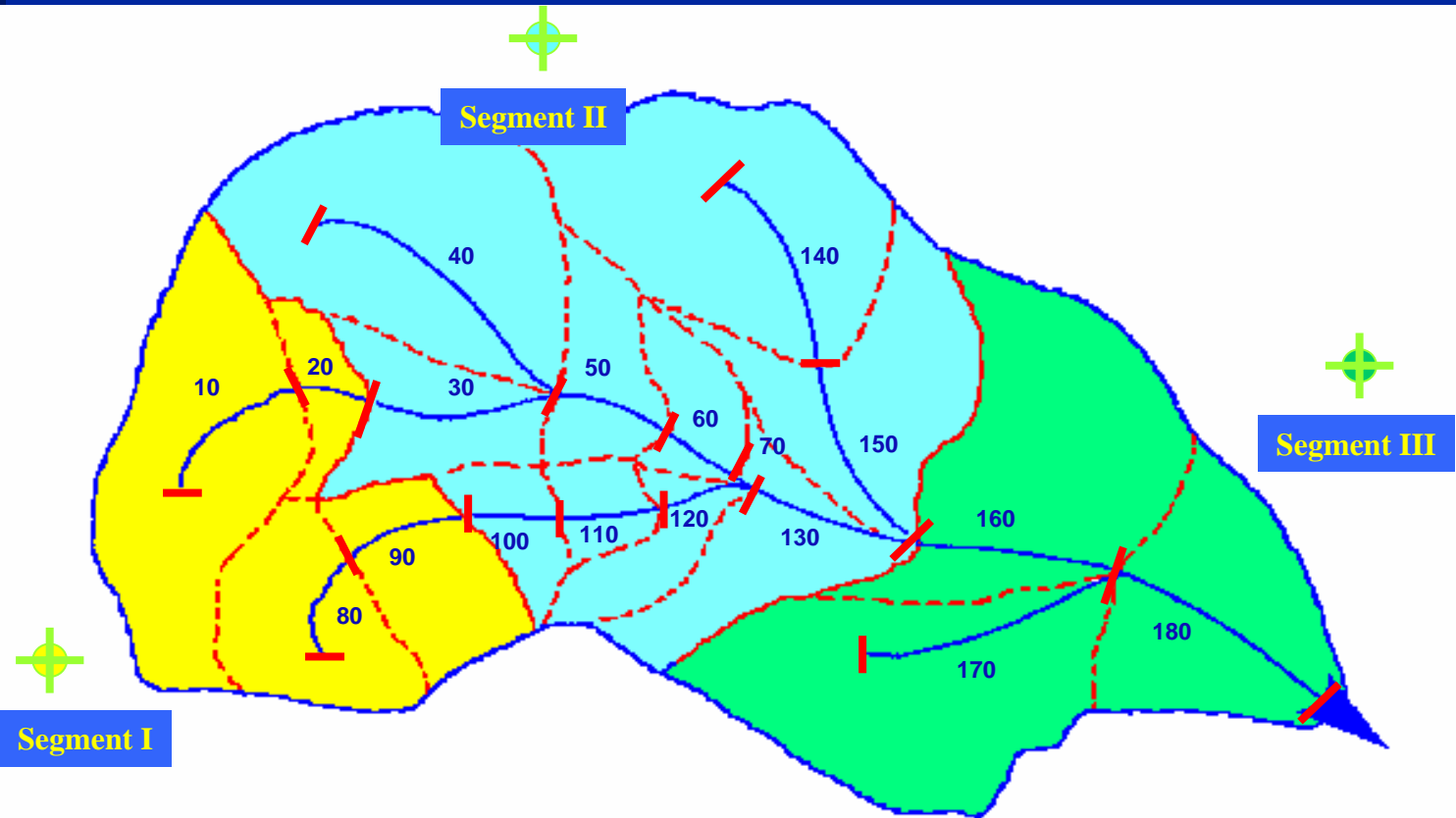
# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

## #8 - Adjustment of Meteorologic Segment Boundaries



# SEGMENTATION OF COMPLEX WATERSHEDS FOR MODELING

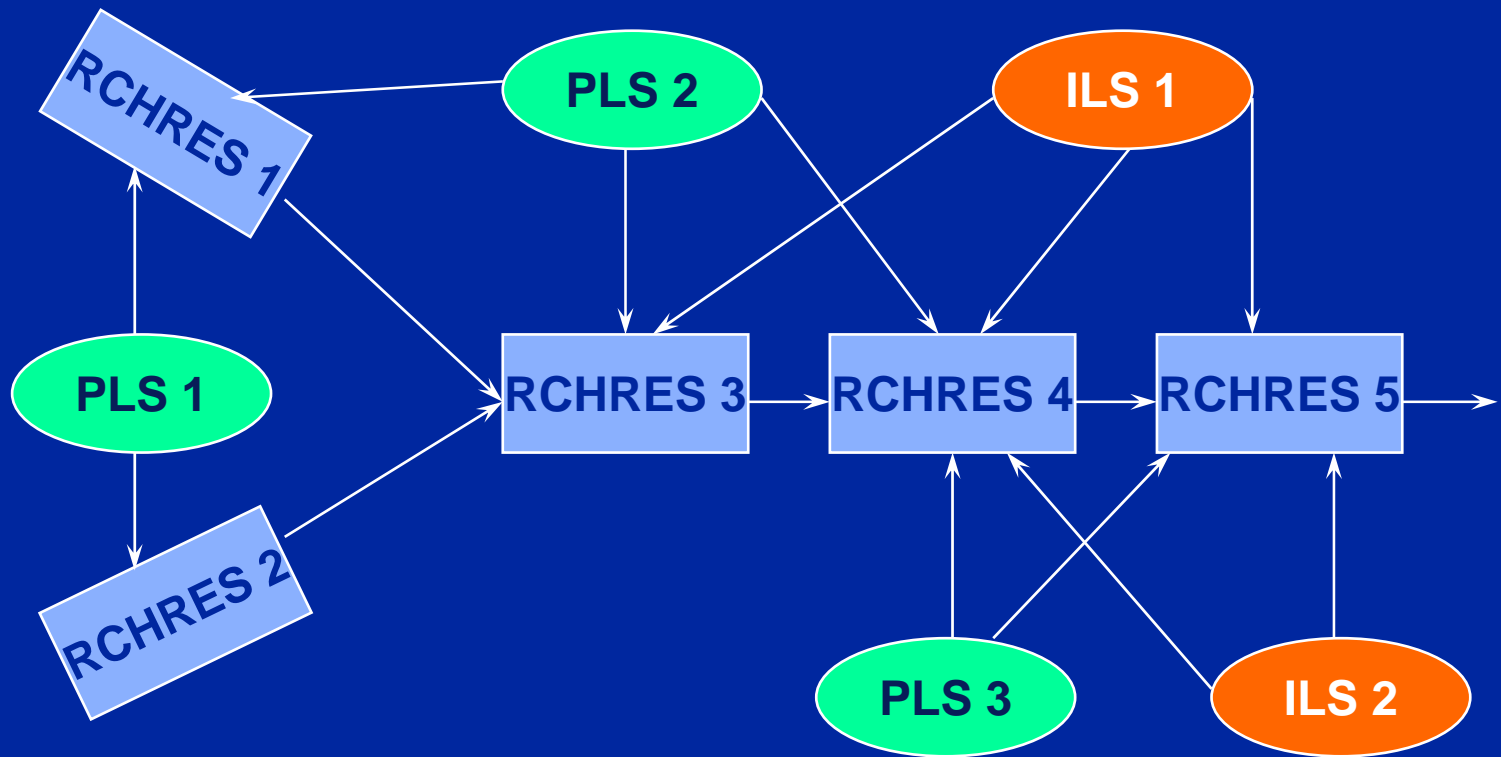
## #9 - Final Segmentation



### FINAL TASKS -

1. Tabulate land use categories tributary to each reach.
2. Aggregate, as needed, to define PLSs and ILSs.
3. Evaluate & assign parameter values based on conditions (soils, topography, cropping, management, etc.) in each segment.

# SCHEMATIC OF EXAMPLE PLS/ILS & RCHRES CONNECTIONS



PLS - Pervious Land Segment  
ILS - Impervious Land Segment  
RCHRES - Stream Channel Segment

A vertical photograph of a waterfall cascading over dark rocks, with water splashing and creating white foam at the bottom. The image is positioned on the left side of the slide.

## **SEGMENTATION EXAMPLE -**

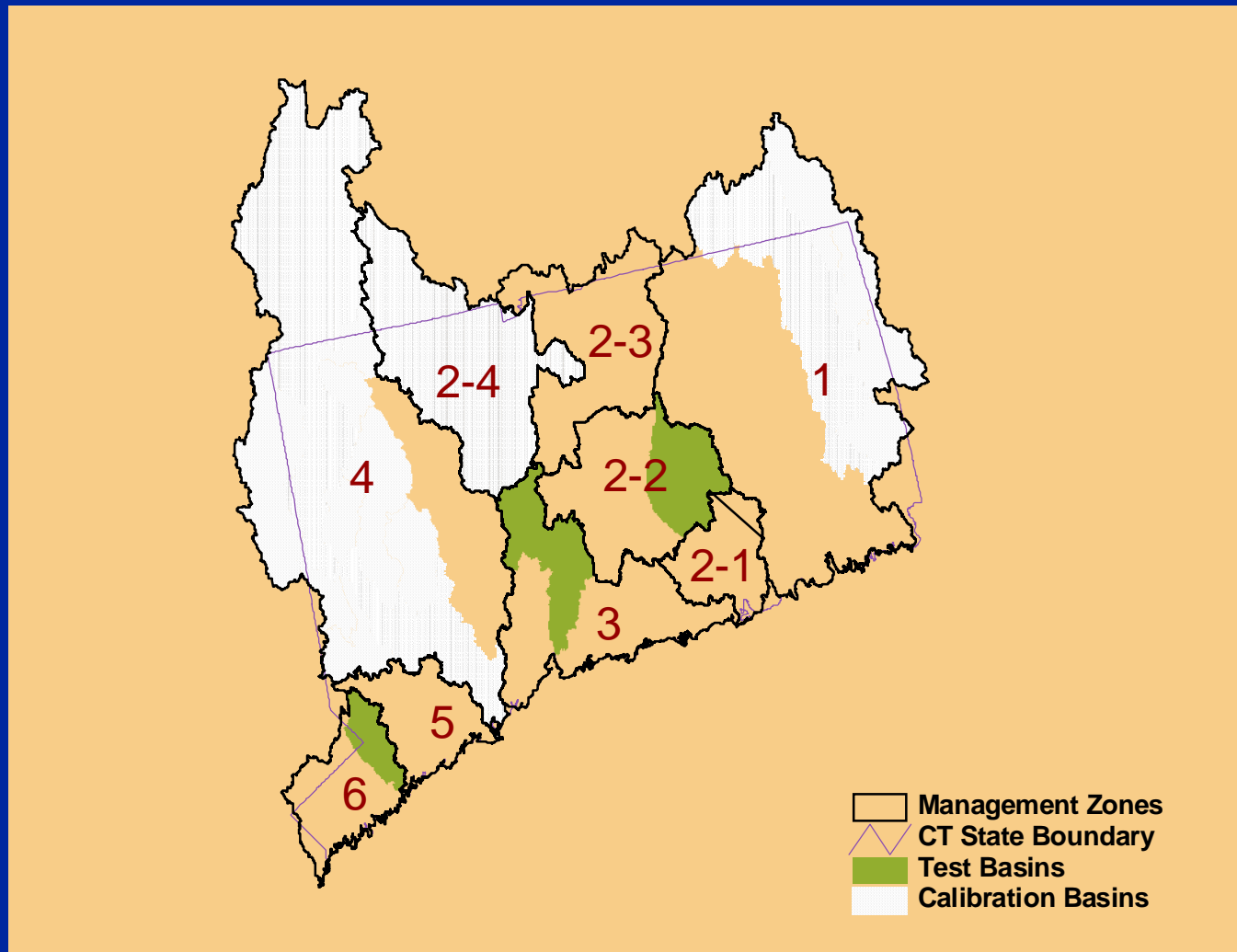
## **NUTRIENT LOADS TO LONG ISLAND SOUND FROM CONNECTICUT WATERSHEDS**

# STUDY OBJECTIVES

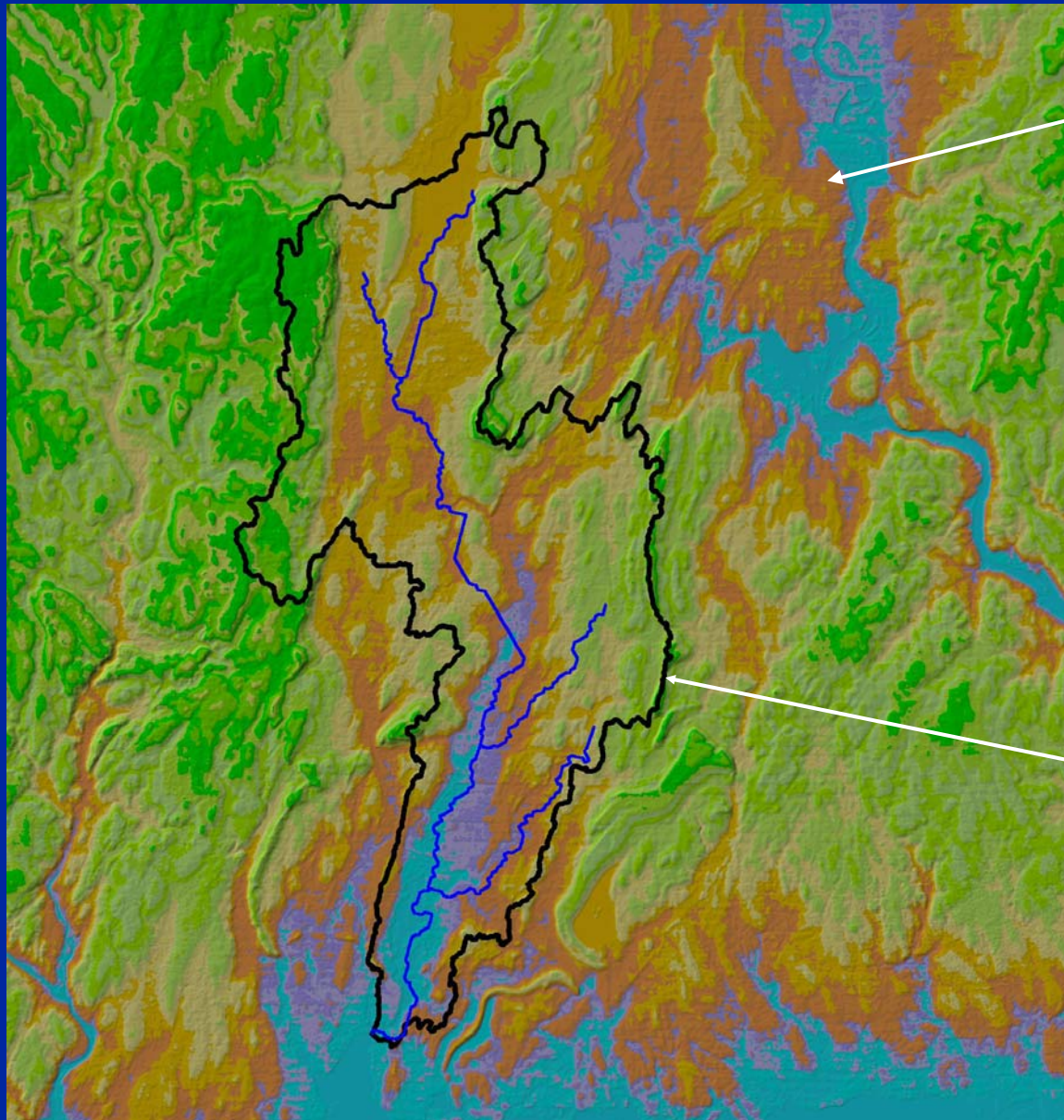
- **Develop a watershed model as a framework for quantifying nutrient sources and loadings to LIS from Connecticut watersheds**
- **Evaluate the potential for nutrient load reduction from various BMP implementation levels under both current and future growth scenarios**
- **Provide a spreadsheet compilation of nutrient loads to LIS and modeled scenarios as a simplified planning tool**



# CTWWM, NUTRIENT MANAGEMENT ZONES, AND CALIBRATION SITES



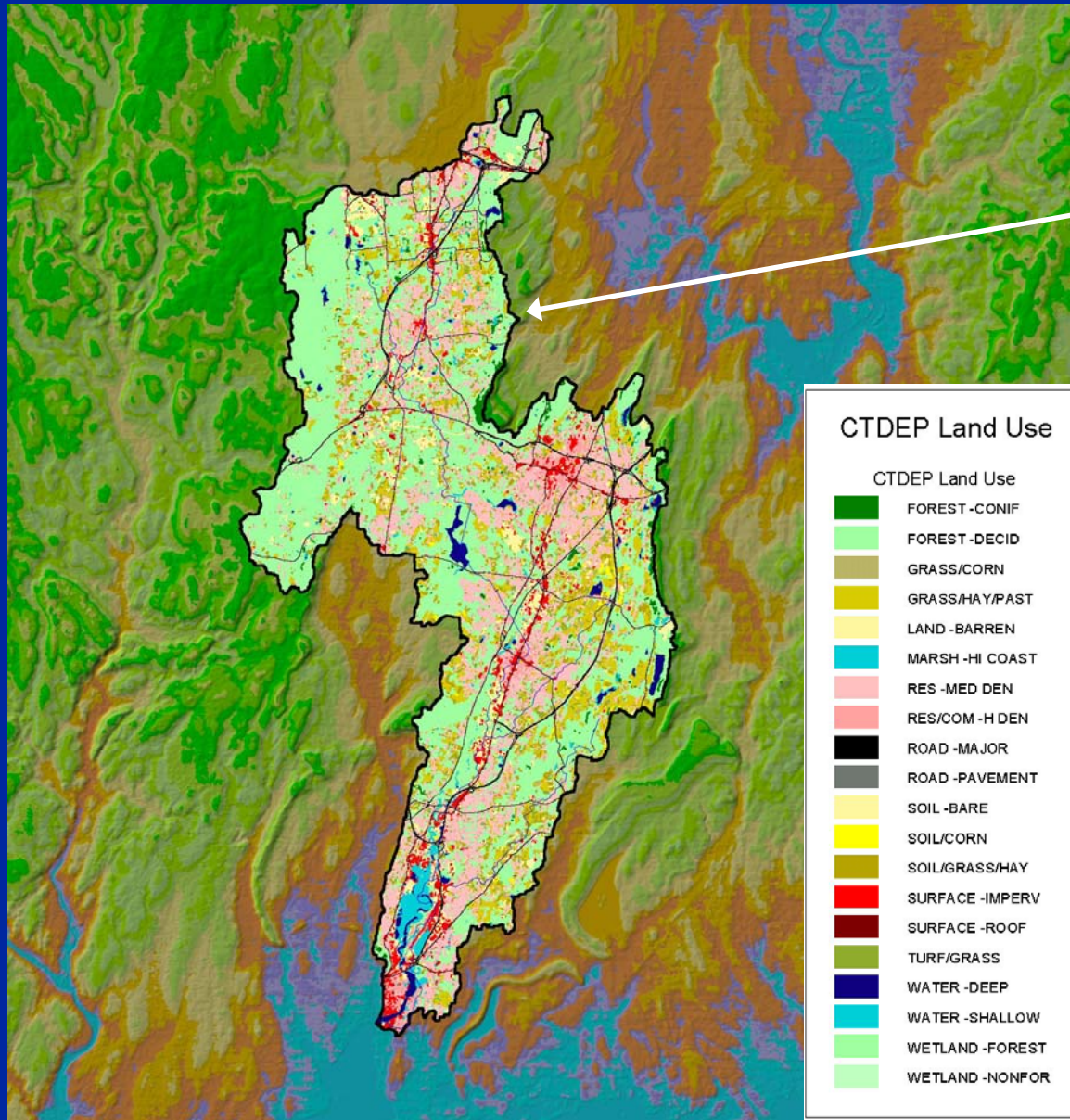
# QUINNIPIAC WATERSHED - DEM



DEM

Quinnipiac  
Watershed

# QUINNIPIAC WATERSHED – LAND USE

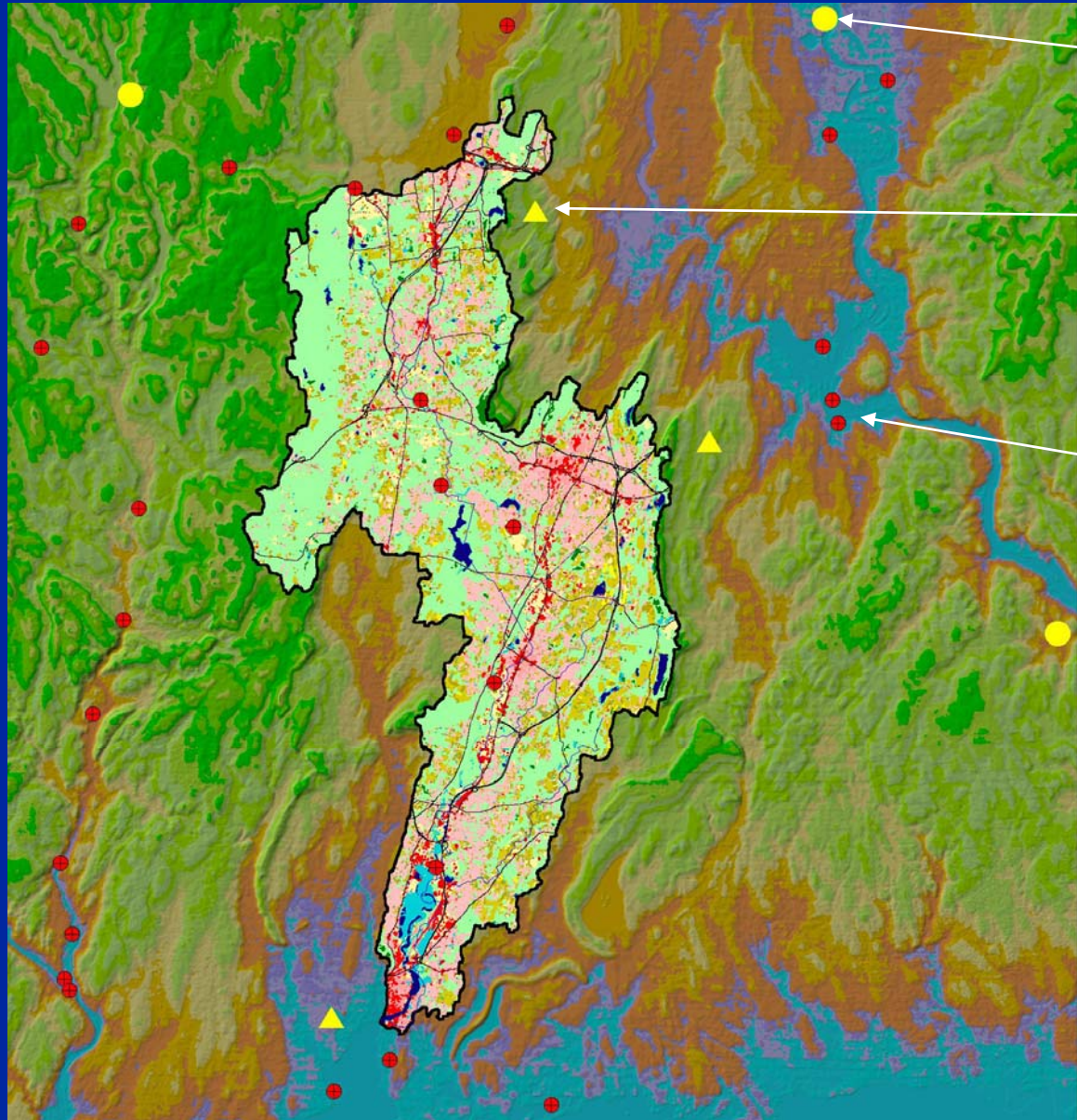


Land Use

## CTDEP Land Use

CTDEP Land Use	
	FOREST - CONIF
	FOREST - DECID
	GRASS/CORN
	GRASS/HAY/PAST
	LAND - BARREN
	MARSH - HI COAST
	RES - MED DEN
	RES/COM - H DEN
	ROAD - MAJOR
	ROAD - PAVEMENT
	SOIL - BARE
	SOIL/CORN
	SOIL/GRASS/HAY
	SURFACE - IMPERV
	SURFACE - ROOF
	TURF/GRASS
	WATER - DEEP
	WATER - SHALLOW
	WETLAND - FOREST
	WETLAND - NONFOR

# QUINNIPIAC WATERSHED – MET GAGES

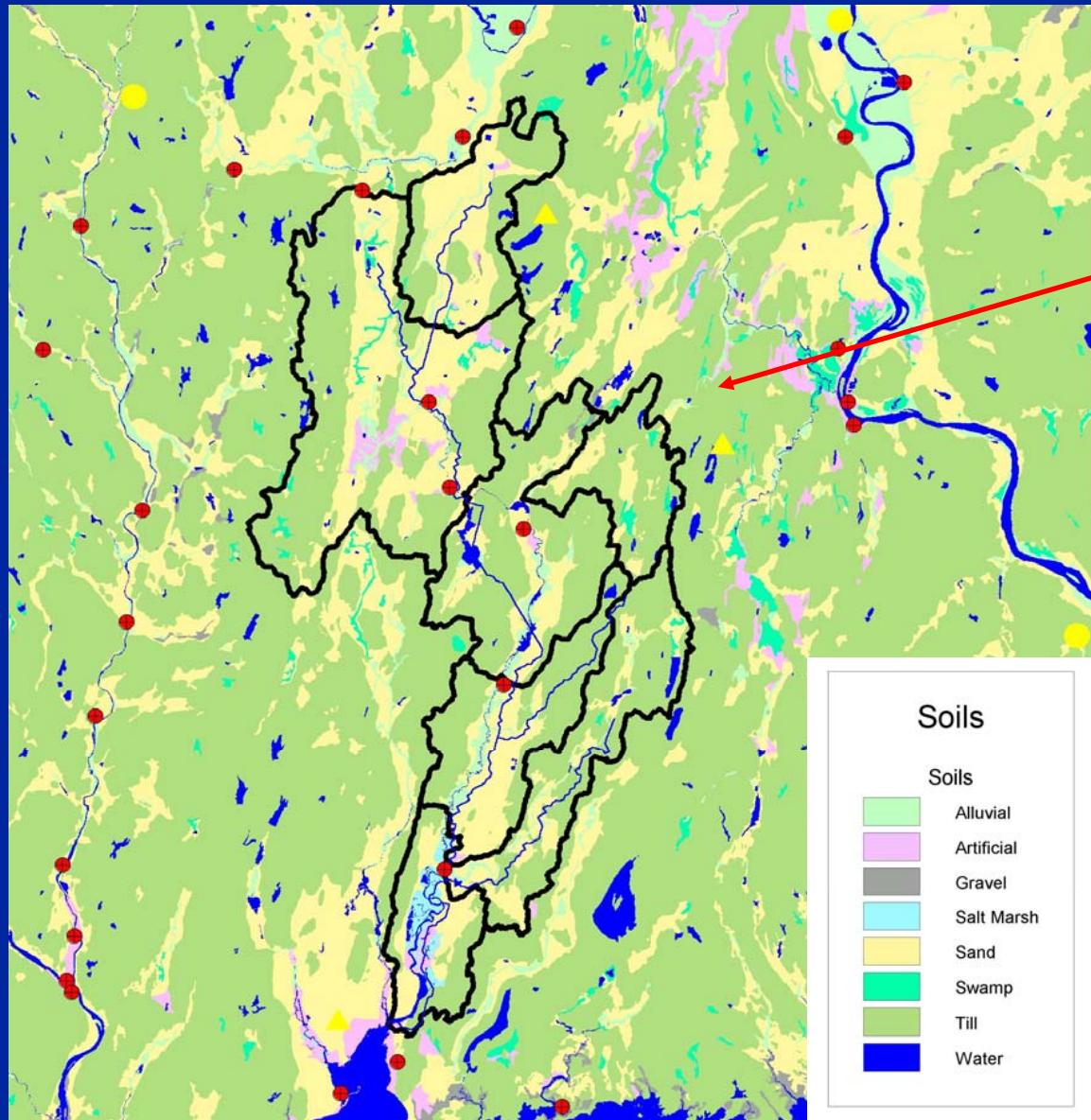


Hourly Met

Daily Met

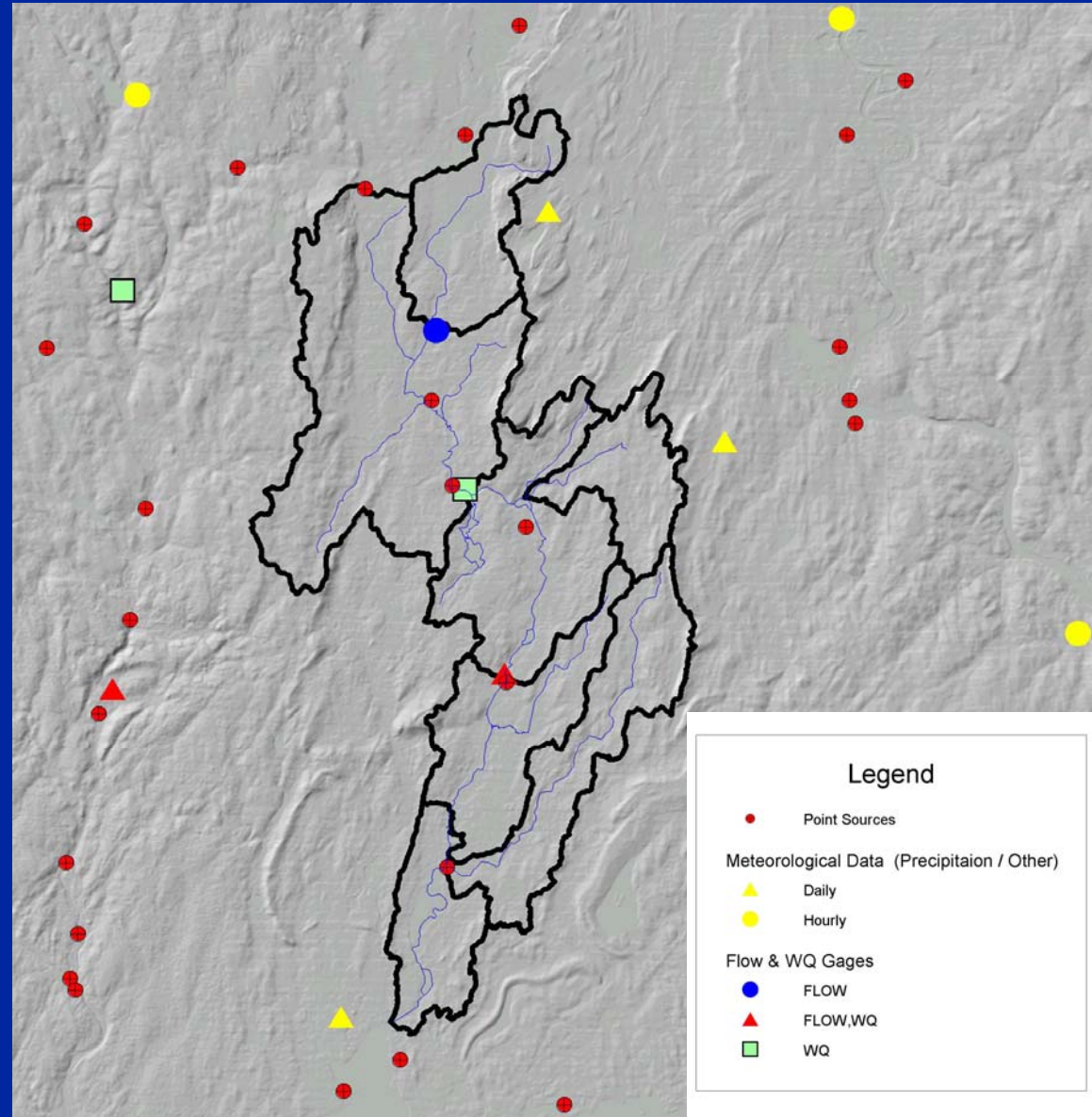
Point Source

# QUINNIPIAC WATERSHED – DRAINAGES & SOILS

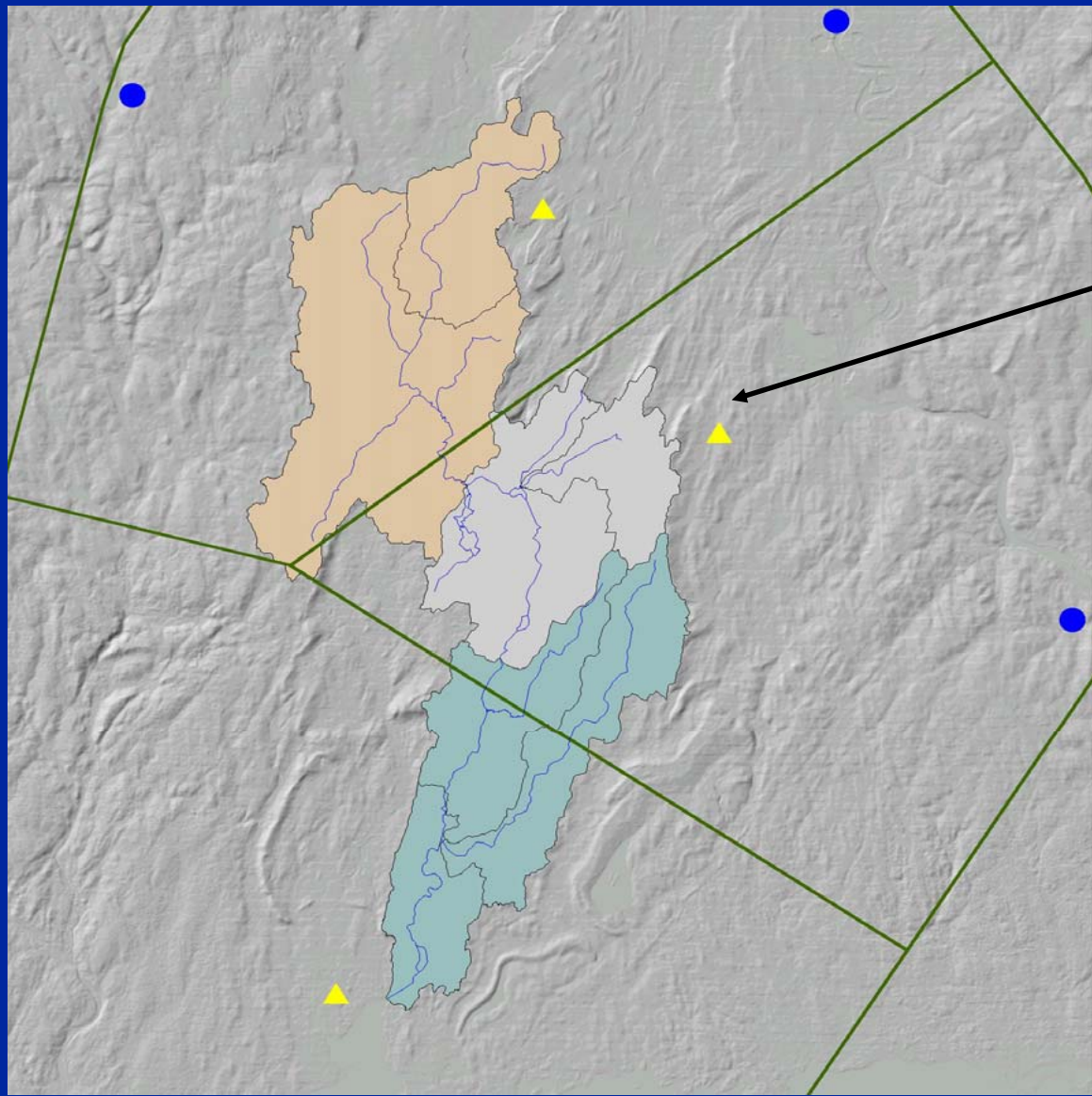


Soils

# QUINNIPIAC WATERSHED – FLOW & WQ GAGES



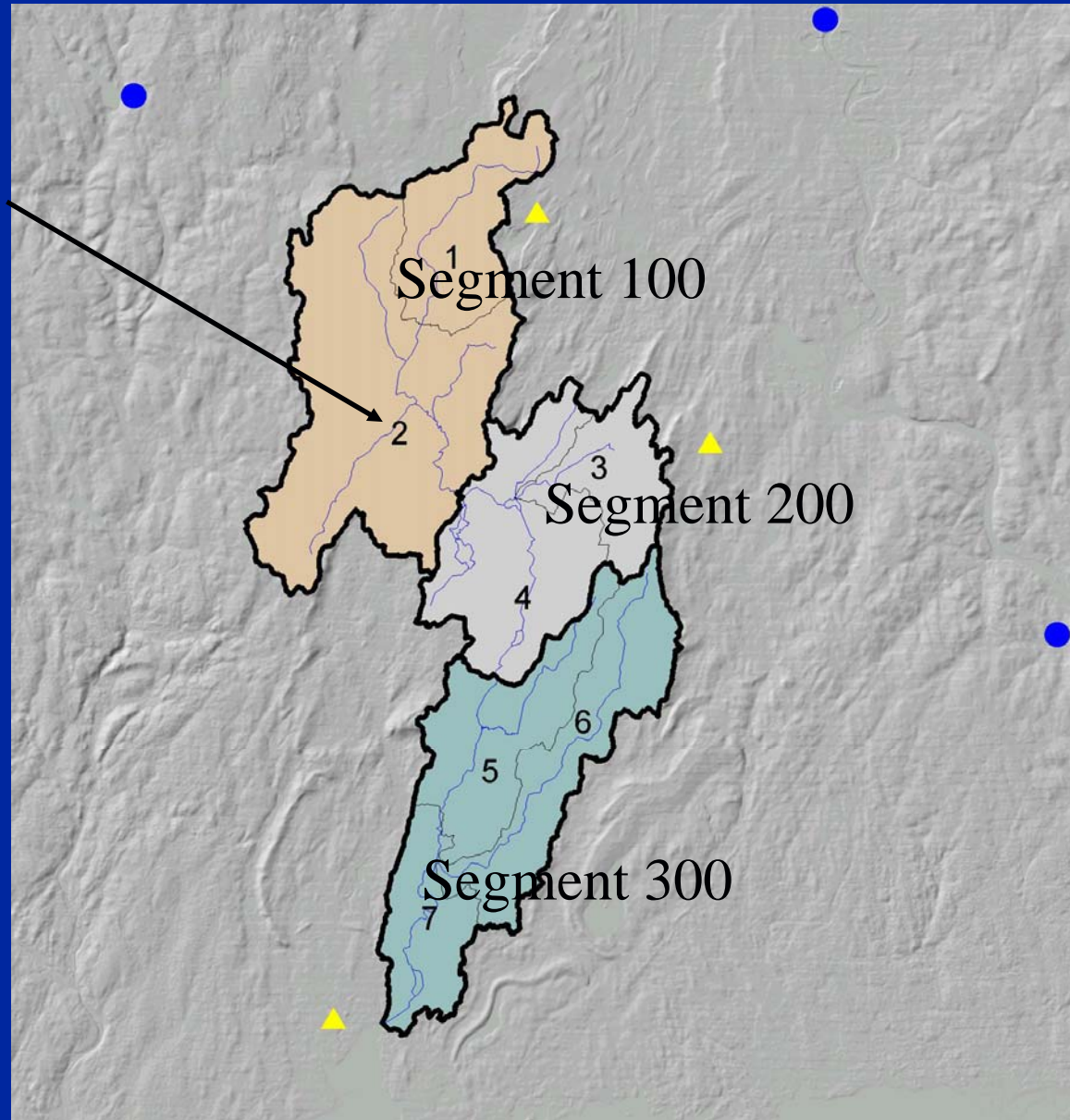
# QUINNIPIAC WATERSHED – MET SEGMENTS



Rain Gages

# QUINNIPIAC WATERSHED – FINAL SEGMENTATION

Reach #

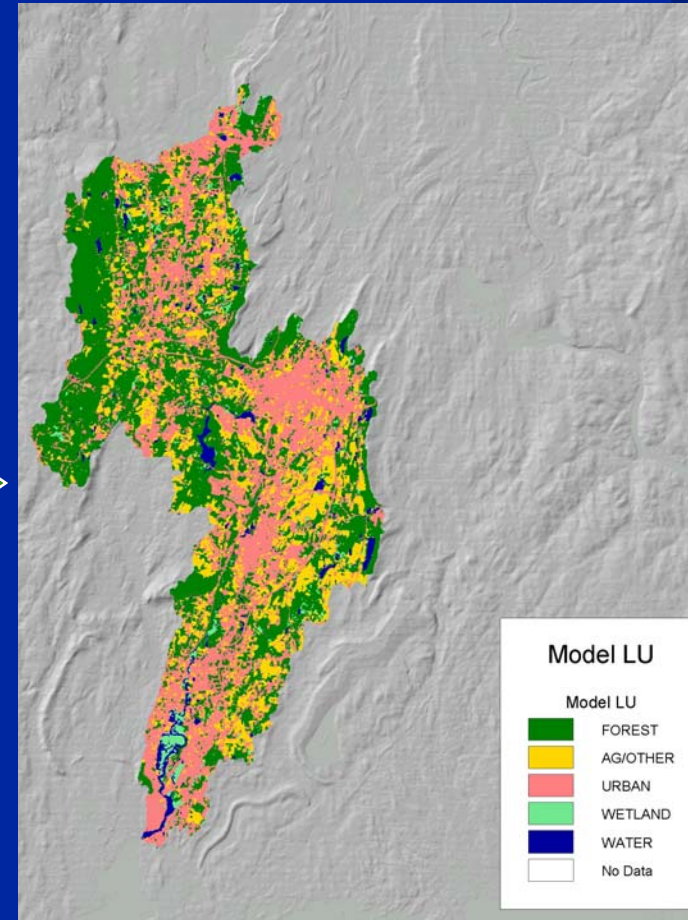
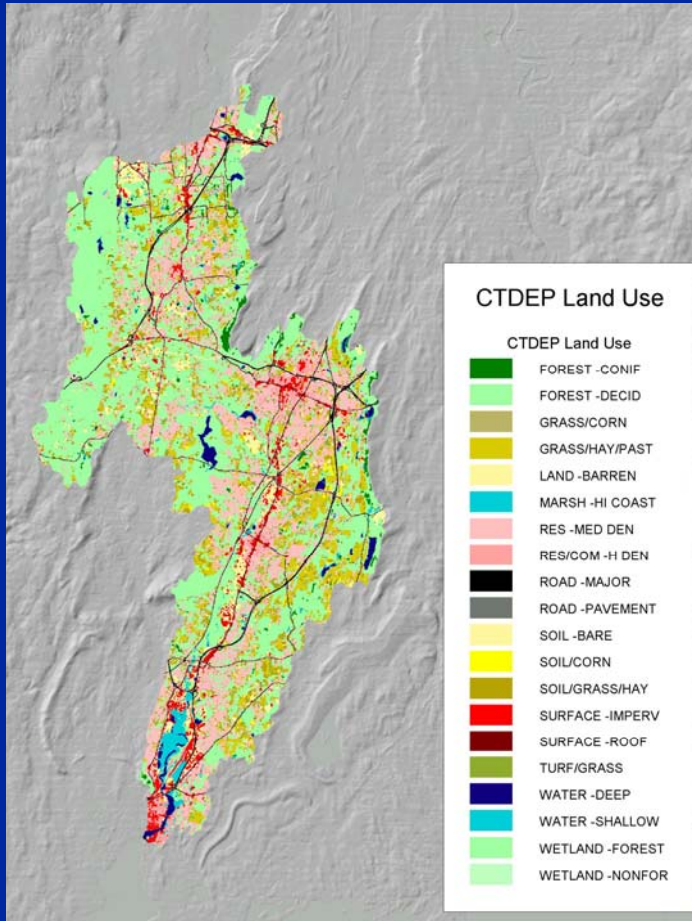




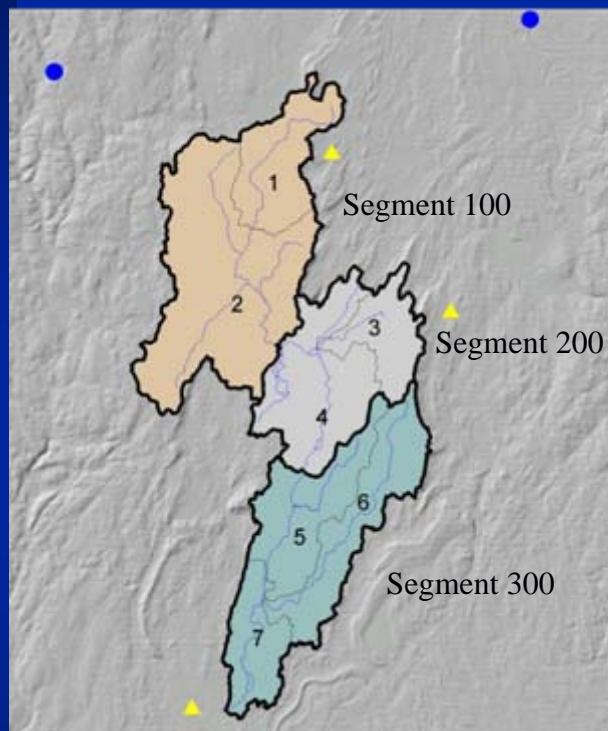
# QUINNIPIAC WATERSHED – CORRESPONDENCE BETWEEN MODEL LU AND CTDEP LU

Model Category	CT DEP Category
Forest	Deciduous Forest
	Coniferous Forest
Ag/Other	Turf Grass
	Soil/Grass/Hay
	Grass/Hay/Pasture
	Soil/Corn
	Grass/Corn
	Soil/Tobacco
	Grass/Tobacco
	Bare Soil
Urban (pervious and impervious)	Impervious Surface
	High Density Residential/Commercial
	Medium Density Residential
	Roof
	Pavement
	Major Road
	Barren Land
Wetland	Shallow Water
	Non-Forest Wetland
	Forest Wetland
	Low Coastal Marsh
	High Coastal Marsh

# QUINNIPIAC WATERSHED – CORRESPONDENCE BETWEEN MODEL LU AND CTDEP LU



# QUINNIPIAC WATERSHED – LAND USE DISTRIBUTION & EIA



CT DEP Category	Percent Assumed to be Effectively Impervious (EIA)	Impervious Model Category
Impervious Surface	85	Urban
High Density Residential/ Commercial	40	
Medium Density Residential	15	
Roof	85	
Pavement	85	
Barren	10	
Major Road	50	Road



SEGMENT	REACH	PERLND								IMPLND				TOTAL acres
		FOREST		AG/OTHER		URBAN PER.		WETLAND		URBAN IMP.		ROAD		
		acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	
100	1	3998	35	1907	17	3538	31	527	5	1049	9	373	3	11392
100	2	20156	59	4999	15	6076	18	978	3	1446	4	341	1	33995
200	3	1913	25	1359	18	2825	37	252	3	1051	14	230	3	7629
200	4	6344	37	3430	20	5183	30	432	2	1699	10	247	1	17335
300	5	4290	34	3172	25	3686	29	383	3	1037	8	235	2	12803
300	6	5956	43	4319	32	2143	16	636	5	481	4	169	1	13704
300	7	1174	15	675	9	2860	38	1217	16	1514	20	166	2	7606
<b>Totals</b>		<b>43831</b>	<b>42</b>	<b>19860</b>	<b>19</b>	<b>26310</b>	<b>25</b>	<b>4424</b>	<b>4</b>	<b>8277</b>	<b>8</b>	<b>1761</b>	<b>2</b>	<b>104464</b>

# FINAL CTWM SEGMENTATION

