Upper Trinity River Basin Coordinating Committee Meeting

Metroplex Conference Room

Tuesday, February 11, 2020

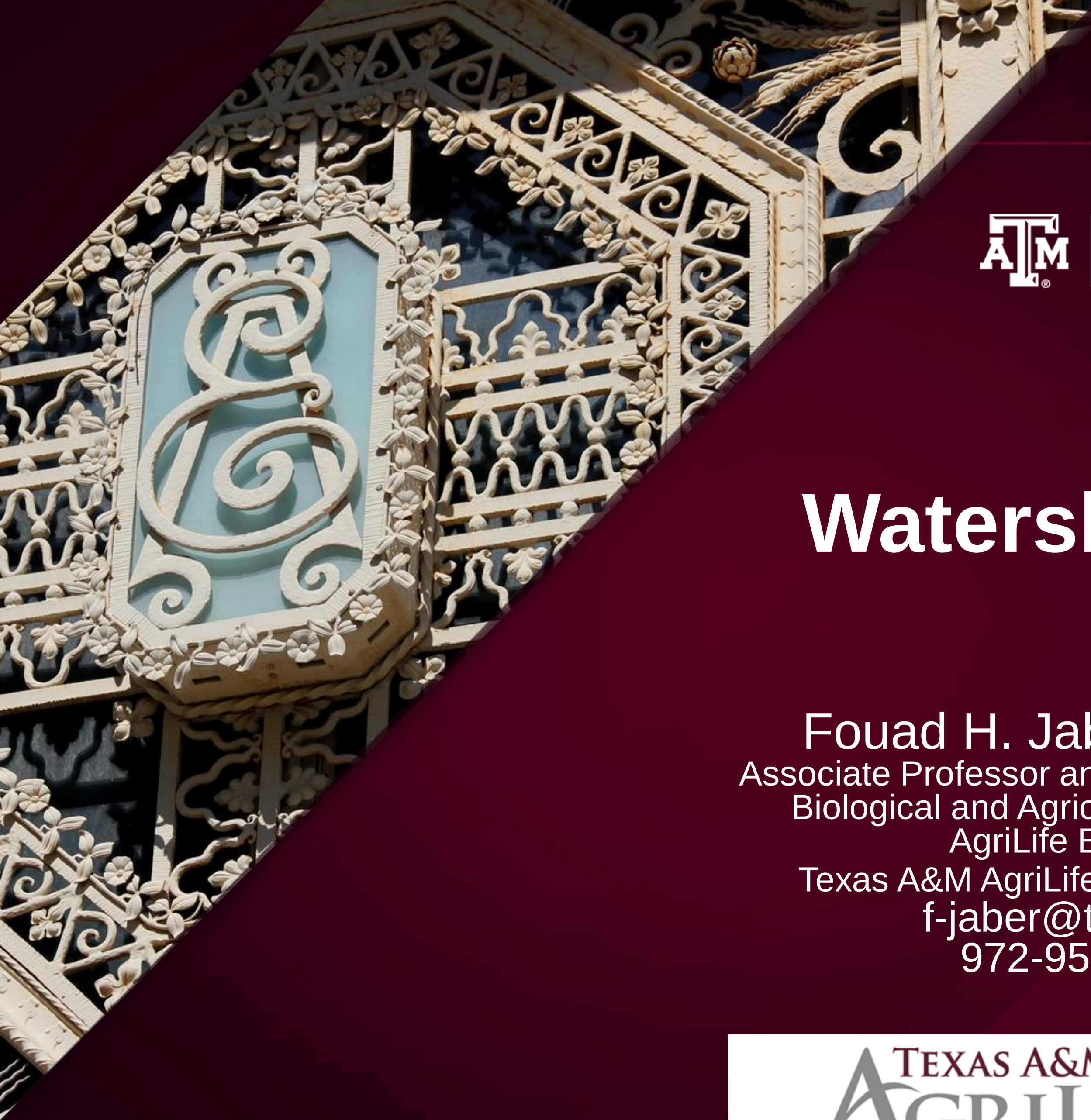
9:30 am

North Central Texas Council of Governments
Environment & Development

www.nctcog.org/TMDL

Welcome and Introductions

UTRB-CC Overview



BIOLOGICAL & AGRICULTURAL ENGINEERING
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Modeling for Watershed Planning

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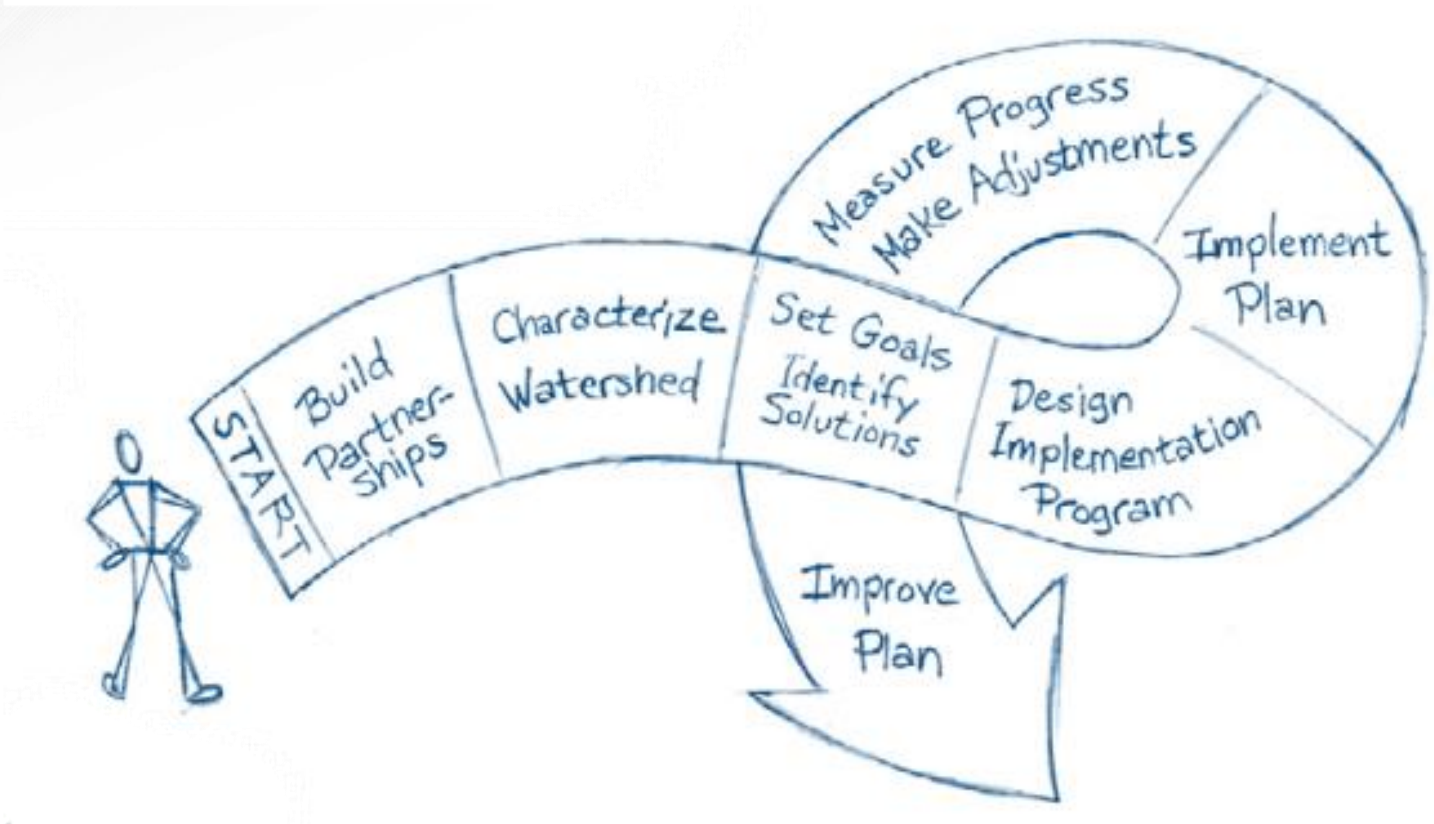
RESEARCH | EXTENSION

Cuyahoga River Fire 1969

What is a Watershed Protection Plan

- A strategy that provides
  - assessment and management information for a geo-graphically defined watershed,
  - analyses, actions, participants, and resources to develop and implement the plan.
- The development of watershed plans requires a certain level of technical expertise and the participation of a variety of people with diverse skills and knowledge.

Steps in the Watershed Planning and Implementation Process



Characterize the Watershed

1. Gather existing data and create watershed inventory
2. Identify data gaps and collect additional data if needed
3. Analyze data
4. Identify causes and sources of pollution that need to be controlled
5. Estimate pollutant loads

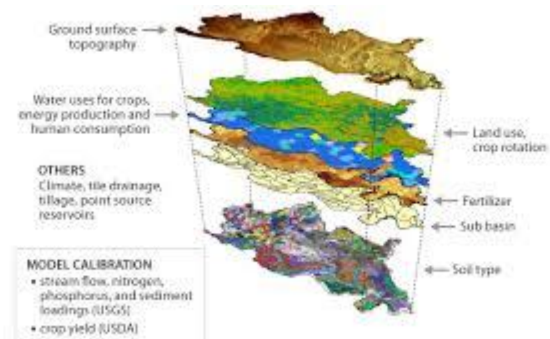
Characterization and Analysis Tools

- GIS
- Statistical packages
- Monitoring
- Load calculations
- Model selection tools
- Models
- Databases (environmental and social tools)

Finalize Goals and Identify Solutions

1. Set overall goals and management objectives
2. Develop indicators targets
3. Determine load reductions needed
4. Identify critical areas
5. Develop management measures to achieve goals

Models for Pollutant Load Estimation



- Load Duration Curve
  - Monitoring data
- Literature review
  - Export coefficient model
- Watershed modeling
  - add more detailed procedures that represent the separate processes of rainfall, erosion, loading, transport, and management practices.

Load Duration Curves

- https://engineering.purdue.edu/mapserve/ldc/pldc/

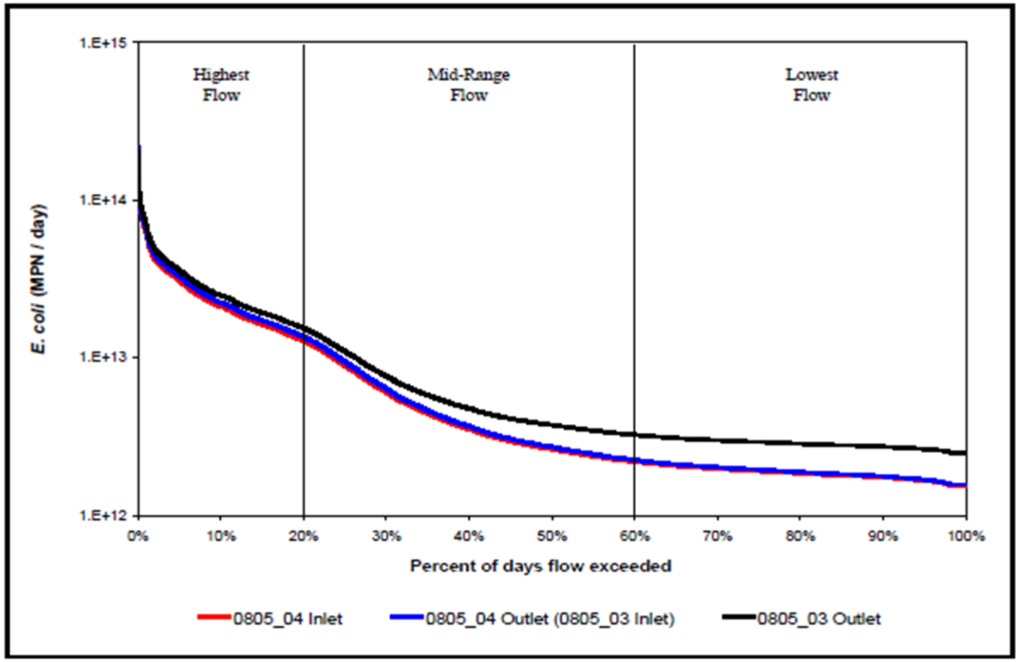


Figure 7. Load duration curves for the inlets and outlets of 0805_04 and 0805_03.

Literature Review

Land Use	Area (ha)	Nitrogen Export Coefficient (kg/ha/yr)	Total Nitrogen Load (kg/yr)	Percent of Nitrogen Load	Phosphorus Export Coefficient (kg/ha/yr)	Total Phosphorus Load (kg/yr)	Percent of Phosphorus Load
Forest	100	1.8	180	0.91	0.11	11	0.52
Corn	200	11.1	2220	11.24	2	400	18.95
Cotton	100	10	1000	5.6	4.3	430	20.37
Soybeans	20	12.5	250	1.27	4.6	92	4.36
Small Grain	50	5.3	285	1.34	1.5	75	3.55
Pasture	300	3.1	930	4.71	0.1	30	1.42
Feedlot or Dairy	5	2,900	14,500	73.39	220	1,100	52.11
Idle	30	3.4	102	0.52	0.1	3	0.14
Residential	20	7.5	150	0.76	1.2	24	1.14
Business	10	13.8	138	0.7	3	30	1.42
Industrial	5	4.4	22	0.11	3.8	19	0.9
Total	840	-	19,757	1	-	2,111	100

Where to Get Export Coefficients

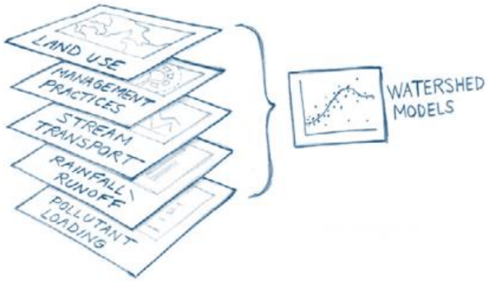
Lin (2004) summarizes and reviews published export coefficient and event mean concentration (EMC) data for use in estimating pollutant loading into watersheds. Some references included in that review and commonly used for export coefficients are

Beaulac, M.N., and K.H. Reckhow. 1982. An examination of land use-nutrient export relationships. *Water Resources Bulletin* 18(6): 1013–1024.

Reckhow, K.H., M.N. Beaulac., and J.T. Simpson. 1980. *Modeling phosphorus loading and lake response under uncertainty: A manual and compilation of export coefficients*. EPA-440/5-80-011. U.S. Environmental Protection Agency, Office of Water Regulations, Criteria and Standards Division, Washington, DC.

Definitions of Watershed Models

- Model: A representation of an environmental system through the use of mathematical equations or relationships.
- Modeling system: A computer program or software package that incorporates a model and input and output systems to facilitate application.
- Model application: The use of a model or models to address defined questions at a specific location



Factors to Consider When Selecting a Model

- **Relevance**: has it been previously used for a WPP in a similar area (urban vs. agriculture)
- **Credibility**: documentation; peer-reviewed papers; public domain; available source code
- **Usability**: manual available for your application; Explanation of parameters; Online sources from forums
- **Utility for watershed planning:** can model scenarios; BMPs; GSI; landuse change

Physical vs. Empirical

Level of Detail	Equation	Assumptions
Generalized	Percentage of rainfall that runs off the land into the water (rational method/ regression of rainfall and runoff observations)	Simple relationship between rainfall and runoff. One factor represents the loss associated with evaporation and plant uptake. No special consideration of slope or soil characteristics. No consideration of soil moisture.
Mid-level	Curve number	Simple relationship based on studies across the country. Varies depending on soil type, vegetation, and slope. Considers soil moisture (antecedent moisture condition). Does not consider variations in storm intensity; uses daily rainfall.
Detailed	Infiltration equation	Describes infiltration of water and evapotranspiration. Considers soil moisture and soil type, vegetation, and slope. Considers variations in storm intensity. Time step is typically hourly rainfall or less.

Element	Generalized	Mid-level	Detailed
Land			
Land use	Category (Agriculture)	Subcategory (Cropland)	Specific (Corn, ridge-tilled)
Slope	N/A	Average for area	Average for area
Soil moisture	N/A	Antecedent moisture condition (3 levels)	Calculated
Hydrology	Percent runoff	Curve number	Infiltration equations
Pollutants	Single	Multiple	Chemical and biological interactions between pollutants
Load	lb/ac/year	lb/day; daily average concentration	lb/hr; hourly average concentration
Management Practices			
Management Practices	Percent removal	Percent removal and estimated volume captured	Hydrology Deposition/settling First order decay and transformation
Streams/Rivers			
Hydrology	Single flow, steady state	Single flow, steady state	Continuous or variable flow
Water quality	Regression, simple relationships	Eutrophication cycle	Eutrophication cycle, carbon/nutrient/BOD processes
Toxic substances	Regression, simple relationships	Settling, 1st-order decay	Transformation, biodegradation, other processes

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Model Acronym	Source	Type		Level of Complexity			Time step				Hydrology		Water Quality							Type of BMPs				
		Landscape only	Comprehensive	Export coefficients	Loading functions	Physically based	Sub-daily	Daily	Monthly	Annual	Surface	Surface and ground water	User-defined	Sediment	Nutrients	Toxic/pesticides	Metals	BOD	Bacteria	Detention basin	Infiltration practices	Vegetative practices	Wetlands	Other structures
AGNPS (event-based)	USDA-ARS	●	●	—	—	●	●	—	—	—	●	—	—	●	●	●	—	—	—	●	—	●	—	—
AnnAGNPS	USDA-ARS	—	●	—	—	●	—	●	—	—	●	—	—	●	●	●	—	—	—	●	—	●	—	—
BASINS	EPA	—	●	●	●	●	●	●	—	—	●	●	●	●	●	●	●	●	●	●	—	●	—	●
DRAINMOD	North Carolina State University	—	—	—	—	●	●	—	—	—	—	●	—	—	●	—	—	—	—	—	—	—	●	—
EPIC	Texas A&M University–Texas Agricultural Experiment Station	—	—	—	—	—	—	●	—	—	●	—	—	●	●	●	—	—	—	●	●	—	●	—
GLEAMS	USDA-ARS	—	—	—	—	—	—	●	—	—	●	—	—	●	●	●	—	—	—	—	—	—	—	—
GSSHA	USACE	●	●	—	—	●	●	—	—	—	—	●	—	●	—	—	—	—	—	●	●		●	●
GWLF	Cornell University	—	●	—	●	—	—	—	●	—	—	●	—	●	●	—	—	—	—	—	—	●	—	—
HEC-HMS	USACE	—	●	—	—	●	●	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—
HSPF	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	—	—	—	—	—
KINEROS2 (event-based)	USDA-ARS	—	●	—	—	●	●	—	—	—	●	—	—	●	—	—	—	—	—	●	—	●	—	●
MIKE SHE	Danish Hydraulic Institute	—	●	—	—	●	●	—	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—	—
PCSWMM	Computational Hydraulics Int.	—	●	—	●	●	●	—	—	—	—	●	●	●	●	●	●	—	●	●	●	—	—	●
SWAT	USDA-ARS	—	●	—	—	●	—	●	—	—	—	●	—	●	●	●	●	—	—	●	●	●	—	●
SWMM	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	●	—	—	—
TMDL Toolbox	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	—	●	—	●
TOPMODEL	Lancaster University (UK), Institute of Environmental and Natural Sciences	—	—	—	—	●	●	●	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—	—

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Project Updates

NCTCOG Updates

- First Quarter TMDL Newsletter available online for review.

- Annual TMDL Questionnaire was released yesterday!

- The **Managing Overabundant Urban Wildlife Webinar** was held on January 28, 2020. The webinar slides and recording will be available online soon.

- **Upcoming TMDL Coordination Committee Meeting:**
  - June 18, 2020 at 9:30 AM, Regional Forum Room

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Project Updates

- City of Arlington
- City of Dallas
- City of Fort Worth
- City of Grand Prairie
- City of Irving
- City of Plano
- DFW Airport
- North Texas Municipal Water District
- Tarrant Regional Water District
- Texas A&M AgriLife
- Texas Stream Team
- Trinity River Authority
- Upper Trinity Regional Water District

Roundtable

Schedule for Next Meeting:

August 26, 2020
9:30 AM
Tarrant Regional Water District's Offices
Fort Worth, TX

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