



TEXAS WATER
RESOURCES
INSTITUTE

twri

Texas Commission on Environmental Quality
&
Texas State Soil and Water Conservation Board

Bacteria Total Maximum Daily Load Task Force Report



Allan Jones

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Seven-member Task Force

- ◇ C. Allan Jones, Chairman
Texas Water Resources Institute
- ◇ George Di Giovanni
Texas Agricultural Experiment Station at El Paso
- ◇ Larry Hauck
Texas Institute for Applied Environmental Research
- ◇ Joanna Mott
Texas A&M University – Corpus Christi
- ◇ Hanadi Rifai
University of Houston
- ◇ Raghavan Srinivasan
Texas A&M University
- ◇ George Ward
The University of Texas at Austin

Expert Advisory Group

TCEQ

Linda Brookins
Faith Hambleton
Jim Davenport
Patrick Roques
Andrew Sullivan
Tom Weber

TSSWCB

John Foster
Aaron Wendt

TPWD

Patricia Radloff
Duane Schlitter
Dave Sager

DSHS

Monica Kingsley
Kirk Wiles

TDA

Richard Eyster
David Villarreal

BRA

Tiffany Morgan

LCRA

Dave Bass

TFB

Ned Meister

Landowner

John Barrett

Harris County

John Blount

SARA

Greg Rothe

City of Waco

Wiley Stem

Baylor

Rene D. Massengale

Hamilton County

Fred Cox
Dickie Clary

USDA – ARS

Tom Edrington

USEPA – Region 6

Randy Rush
Shawneille Campbell
Mike Schaub

USGS

Bob Joseph
Don Stoeckel

NWF

Myron Hess

Consulting Firms

Mel Vargas
David Harkins
James Miertschin
Michael Bloom

UT at Austin

David Maidment

TAMU–Corpus Christi

Richard Hay

TAMU

Terry Gentry
Mark McFarland
Bruce Lesikar
Patty Haan Smith
Yongheng Huang
R. Karthikeyan
Binayak Mohanty
Clyde Munster

Agency Staff

TCEQ

Ashley Wadick
Betsy Chapman
Jason Skaggs
Greg Merrell
Elaine Lucas

TWRI

Kevin Wagner
Rosemary Payton
Kathy Wythe

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Draft Two	Dec. 4, 2006
Draft Three	Jan. 24, 2007

All drafts, appendices, supporting material and
comments are posted on Web site:
<http://twri.tamu.edu/bacteriatmdl/>

Charge:

- ◇ examine approaches that other states use to develop and implement bacteria TMDLs
- ◇ recommend cost-effective and time-efficient methods for developing TMDLs
- ◇ recommend effective approaches for developing TMDL & Implementation Plans (I-Plans)

Charge (cont.)

- ◇ evaluate a variety of models and BST methods available for developing TMDLs and I-Plans, and recommending under what conditions certain methods are more appropriate
- ◇ develop a roadmap for further scientific research needed to reduce uncertainty about how bacteria behave under different water conditions in Texas

Bacteria Fate & Transport Models

- ◇ load duration curves (LDC)
- ◇ spatially explicit statistical models
 - Arc Hydro
 - SPARROW
 - SELECT
- ◇ mass balance models
 - BLEST
 - BIT
- ◇ mechanistic hydrologic/water quality models
 - HSPF
 - SWAT
 - SWMM
 - WASP

Bacteria Source Tracking (BST) Methods

- ◇ ERIC-PCR
- ◇ Ribotyping
- ◇ PFGE
- ◇ KB-ARA
- ◇ CSU
- ◇ *Bacteroidales* PCR



Three-Tier Approach to Bacteria TMDLs & I-Plans

- ◇ **Tier 1 Analysis (T1)**
Year 1 – Required for all bacteria TMDLs

- ◇ **Tier 2 Analysis (T2)**
Year 2 – Implemented for most bacteria TMDLs or I-Plans for non-controversial TMDLs

- ◇ **Tier 3 Analysis (T3)**
Years 3 and 4 – Normally used for I-Plans or complex “phased TMDLs”

Tier 1 Analysis (T1)

- ◇ Form TMDL stakeholder advisory group
Essential to success of TMDL process

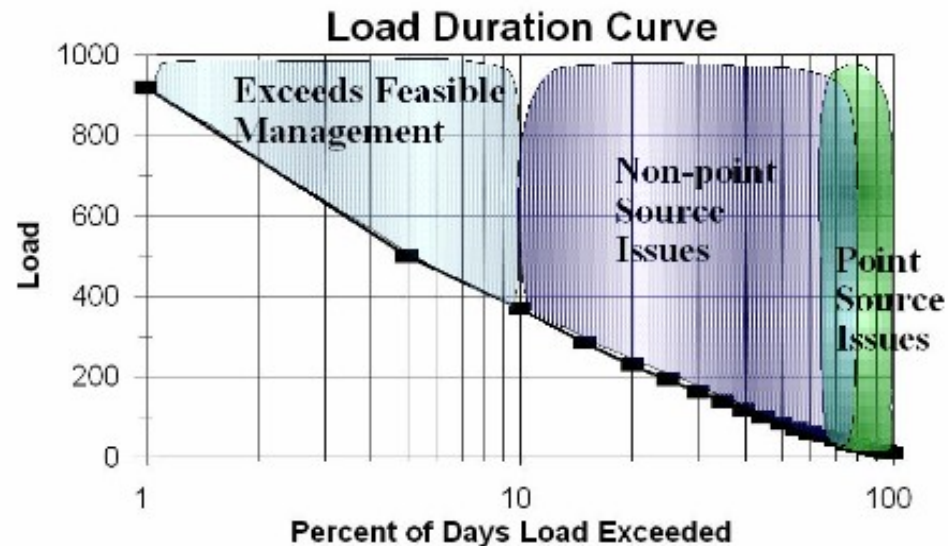


Tier 1 Analysis (T1)

- ◇ Develop comprehensive GIS inventory for watershed
- ◇ Implement source survey for watershed



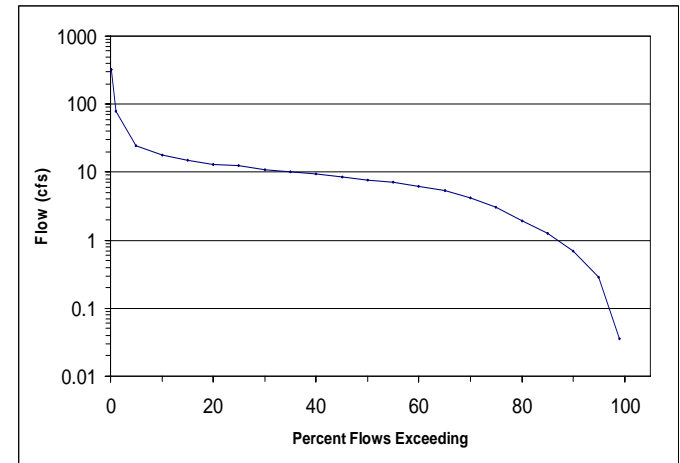
Tier 1 Analysis (T1)



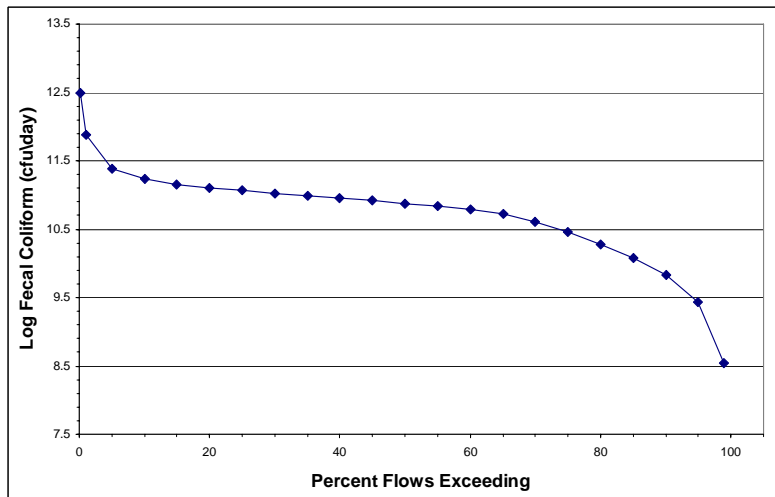
- ◇ Calculate LDCs
- ◇ Analyze Tier 1 data with stakeholder advisory group

Load Duration Curve Development

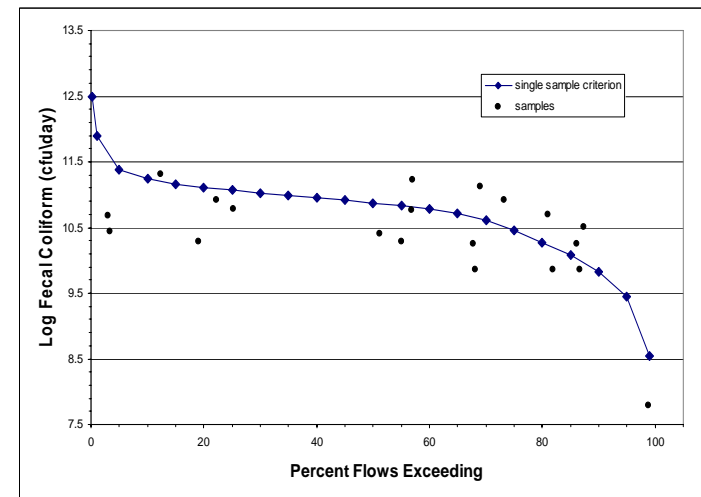
Step 1. Develop flow duration curve



Step 2. Multiply flow curve by standard



Step 3. Plot data on standard curve



Texas Agricultural
Experiment Station
THE TEXAS A&M UNIVERSITY SYSTEM



Tier 1 Decision

After reviewing Tier 1 data with stakeholders:

- ◇ Complete and submit a draft TMDL
- or*
- ◇ Request evaluation of designated use of water body
- or*
- ◇ Proceed to Tier 2

Tier 2 Analysis (T2)

- ◇ Implement targeted monitoring to fill data gaps
- ◇ Perform library-independent BST and/or limited library dependent BST analysis



Tier 2 Analysis (T2)

- ◇ Develop simple LDC, GIS and/or Mass Balance Models
- ◇ Analyze Tier 2 data with stakeholder advisory group

Tier 2 Decision

After reviewing Tier 1 & Tier 2 data with stakeholders:

- ◇ Complete and submit a draft TMDL (or I-Plan if TMDL was developed after Tier 1)
or
- ◇ Request evaluation of designated use of water body
or
- ◇ Initiate a “phased TMDL” & proceed to Tier 3

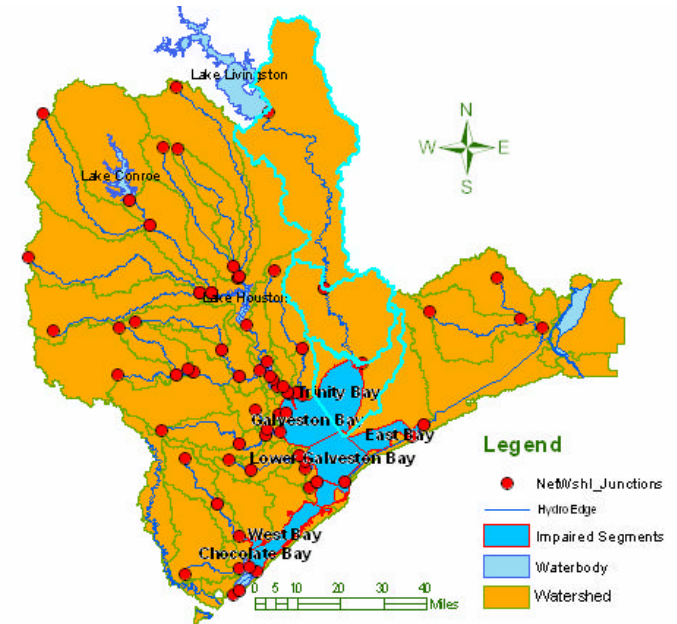
Tier 3 Analysis (T3)

Used only when detailed analysis is needed or for complex watersheds

- ◇ Assure extensive stakeholder involvement
- ◇ Implement extensive targeted monitoring
- ◇ Perform extensive library-dependent BST analysis

Tier 3 Analysis (T3)

- ◇ Complete mechanistic modeling
- ◇ Analyze Tier 3 data with stakeholder advisory group



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Tier 3 Decision

After reviewing Tier 3 data with stakeholders:

- ◇ Complete and submit a draft I-Plan (or revise “phased TMDL”) for agency approval

or

- ◇ Complete and submit a draft TMDL that includes a recommended change in designated use

Recommended approach may be altered if everyone agrees that a more time- and cost-effective approach is feasible.



Research and Development Needs

- ◇ Characterization of sources
- ◇ Characterization of kinetic rates and transport mechanism
- ◇ Enhancements to bacteria fate and transport models and BST
- ◇ Determination of effectiveness of control mechanism and quantification of uncertainty and risk