

City of Franklin

Integrated Water Resources Plan

September 13, 2011



BOMA Presentation

CDM

Meeting Agenda

- Fluoridation of Drinking Water
- WATER QUALITY MODELING
 - Review the questions we are trying to address
 - Differences between STELLA model and River WQ model
 - Review of WQ tool selection
 - Our understanding of the river
 - Model development notes
 - Calibration and validation
 - Initial sensitivity analysis
 - Limitations, Next Steps
- INTEGRATED MODELING UPDATE (STELLA)

Fluoridation of Drinking Water

Recent News

- January 2010 – EPA finalized risk exposure assessment and announced intent to review the drinking water regulations
- December 2010 – EPA published “Fluoride: Exposure and Relative Source Contribution Analysis”
- December 2010 – EPA published “Fluoride: Dose-Response Analysis for Non-cancer Effects”
- January 2011 – EPA and US Department of Health and Human Services (HHS) released a joint statement announcing new efforts on fluoride standards and guidelines based on new scientific data
- Concurrently, HHS reaffirmed health benefits of fluoridation and solicited comments on proposal to lower the recommended level to 0.7 mg/L; from a range of 0.7 mg/L to 1.2 mg/L.
- August 2011 – New Harvard study clears fluoride as a cause for bone cancer

Fluoridation of Drinking Water Recommendations



**American Water Works
Association**

The Authoritative Resource on Safe Water®

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Statement of Policy on Public Water Supply Matters

Fluoridation of Public Water Supplies

The American Water Works Association (AWWA) supports the recommendations of the World Health Organization (WHO), American Medical Association (AMA), Canadian Medical Association (CMA), Centers for Disease Control (CDC), American Dental Association (ADA), Canadian Dental Association (CDA), and other professional organizations in the medical community, for the fluoridation of public water supplies as a significant public health benefit. AWWA supports the application of fluoride in a safe, effective, and reliable manner that includes adequate monitoring and control of fluoride levels within limits mandated by provincial, state, and federal laws and that is subject to community acceptance through applicable local decision-making processes.

Water Quality Questions for IWRP

- Phase I modeling focused on river flow and pollutant loads, *but not instream water quality*
- This is not a load allocation study
- Questions for Phase II:
 - Which alternative is likely to yield the best water quality in the Harpeth River in Franklin and downstream?
 - What are the likely water quality impacts of the selected alternative?
 - How will Franklin's IWRP affect the river:
 - If water quality upstream meets DO standards?
 - If water quality upstream *does not* meet DO standards?

Drivers of Low Dissolved Oxygen

BOD

Sources: upstream watershed runoff, wastewater effluent
Result: Depletes oxygen directly



SEDIEMNT

Solids from watershed runoff, wastewater effluent, debris settle to bottom
Result: Depletes oxygen directly in shallow, slow river



NUTRIENTS

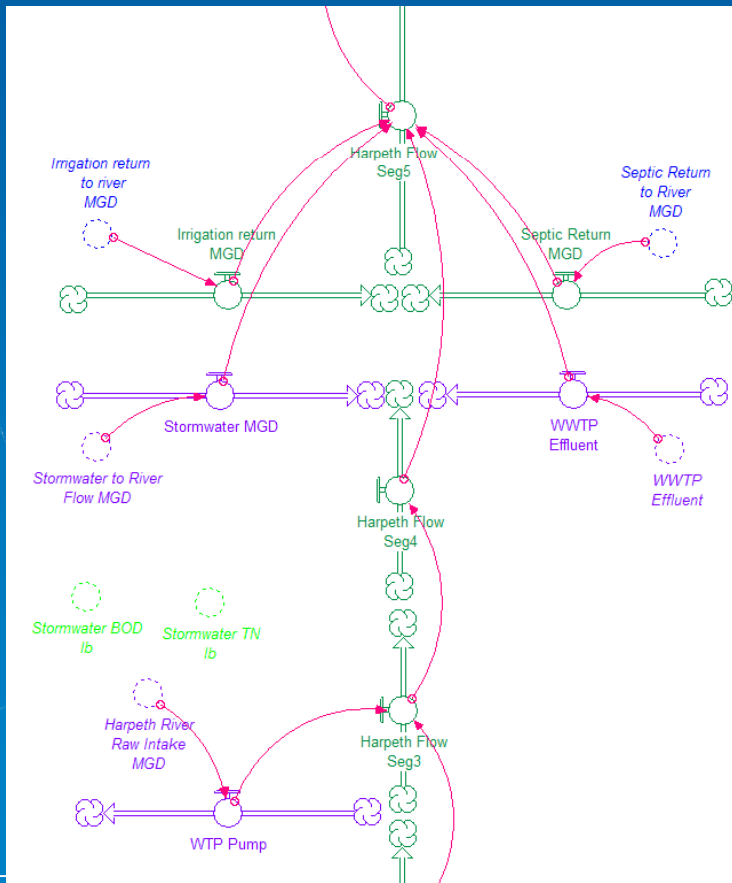
Sources: upstream watershed runoff (fertilizer and soil), wastewater effluent
Result: Feeds algae growth
Indirect result: Algae creates oxygen in daytime, consumes oxygen at night



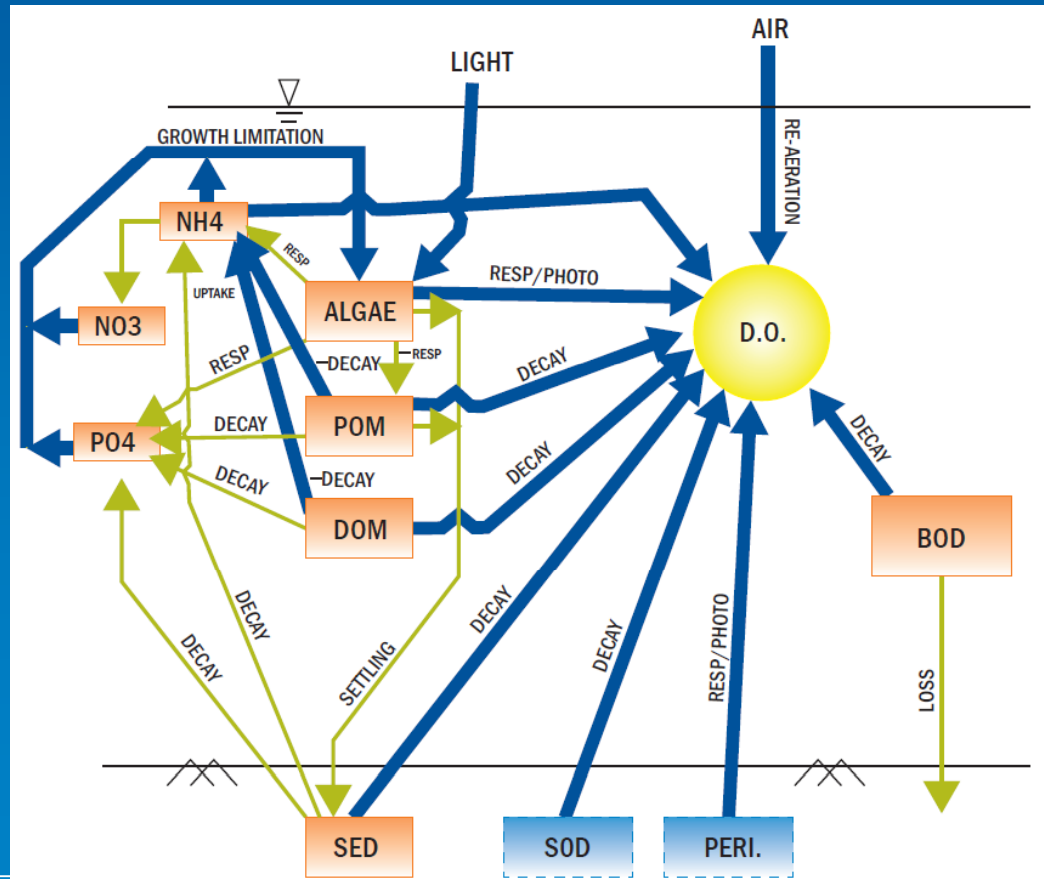
DISSOLVED OXYGEN

How This Differs from Integrated Model

Integrated Model:
Flows and Loads Into River



Water Quality Model:
Pollutant Concentrations Within River

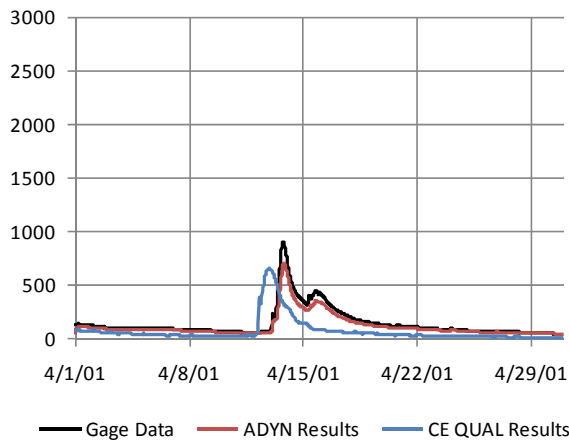


Water Quality Model Selection

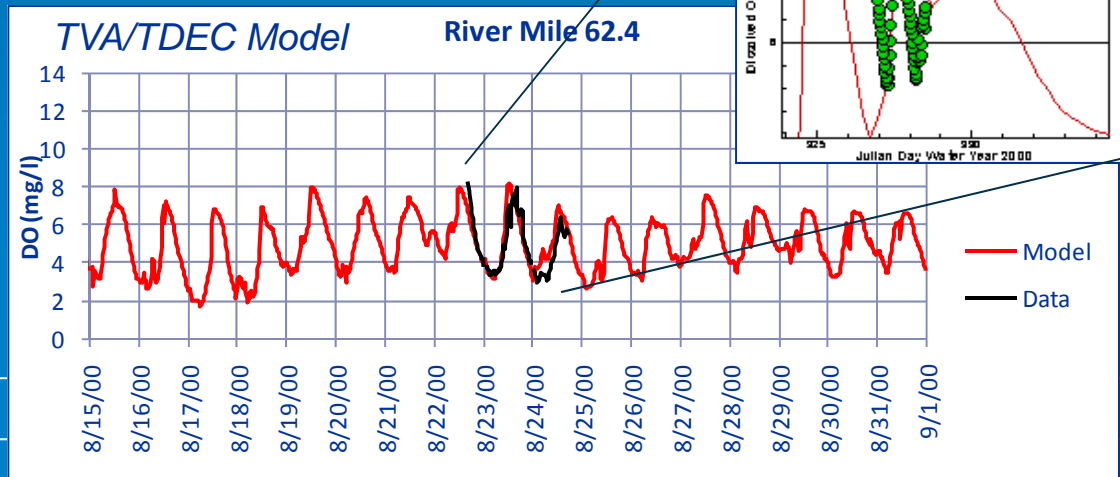
CRITERIA	TMDL: (CE-QUAL / WASP)	TVA/TDEC: RMS
Hydrologic / Hydraulic Performance		•
Dissolved Oxygen Performance		•
Peer Reviews	•	•
Hydraulic Parameterization		•
Water Quality Parameterization		•
Functionality		•

Hydrology/Hydraulics

RM 88.1 Boundary Condition
(USGS Gage @ Franklin)



Dissolved Oxygen



Our Understanding of the River

- Impaired by the time it reaches Franklin
- River in Franklin and Downstream Dominated by Streambed Dynamics
 - Sediment Oxygen Demand
 - Fixed Algae (periphyton)
- Changes to WWTP
 - May help augment low flows
 - Not likely to have significant impact on dissolved oxygen

Collaboration on Model Development

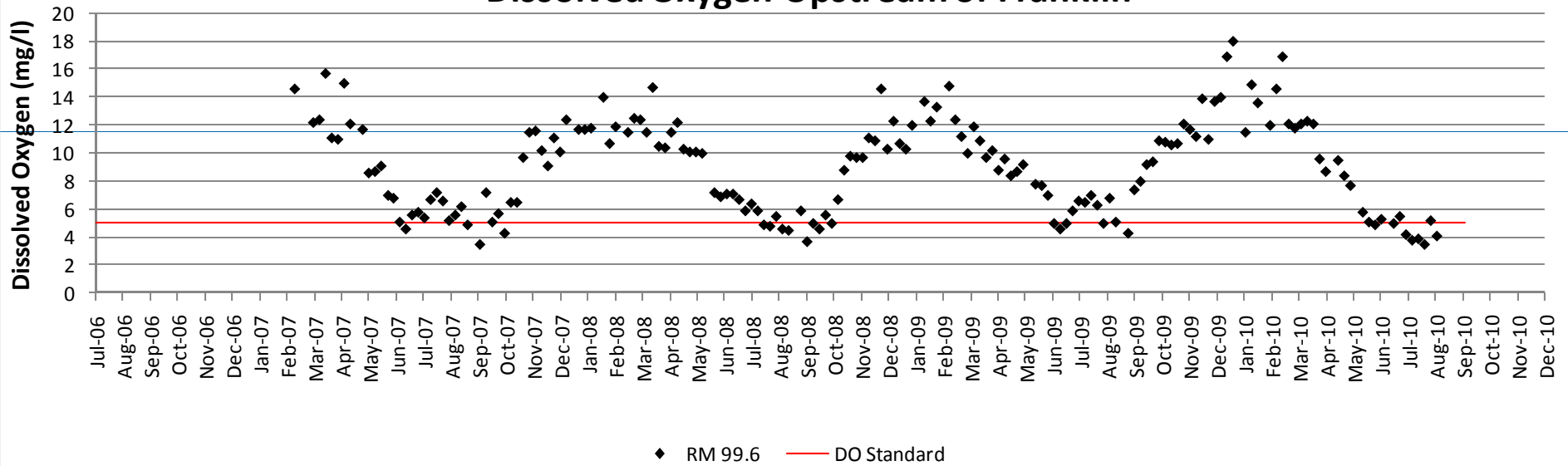
- Met with TDEC modelers to discuss parameterization
- Met with HRWA to discuss river dynamics and obtain additional monitoring data
- Regular meetings with Steering Committee to discuss tool selection and progress
- Technical Review by:
 - Dr. Gene LeBoeuf (Vanderbilt, Steering Committee)
 - Gary Mercer (CDM, reviewed original TMDL model)

Data Inputs

- Hydrology and Hydraulics
 - USGS stream gages on Harpeth mainstem
 - River channel geometry from TDEC / FEMA
- Historic Water Quality (calibration and boundary conditions)
 - TDEC
 - Franklin
 - HRWA
- Unmeasured water quality dynamics
 - Literature values for similar rivers
- Sediment and river bed effects
 - TDEC observations of fixed algae on river bottom
 - Literature values for similar rivers

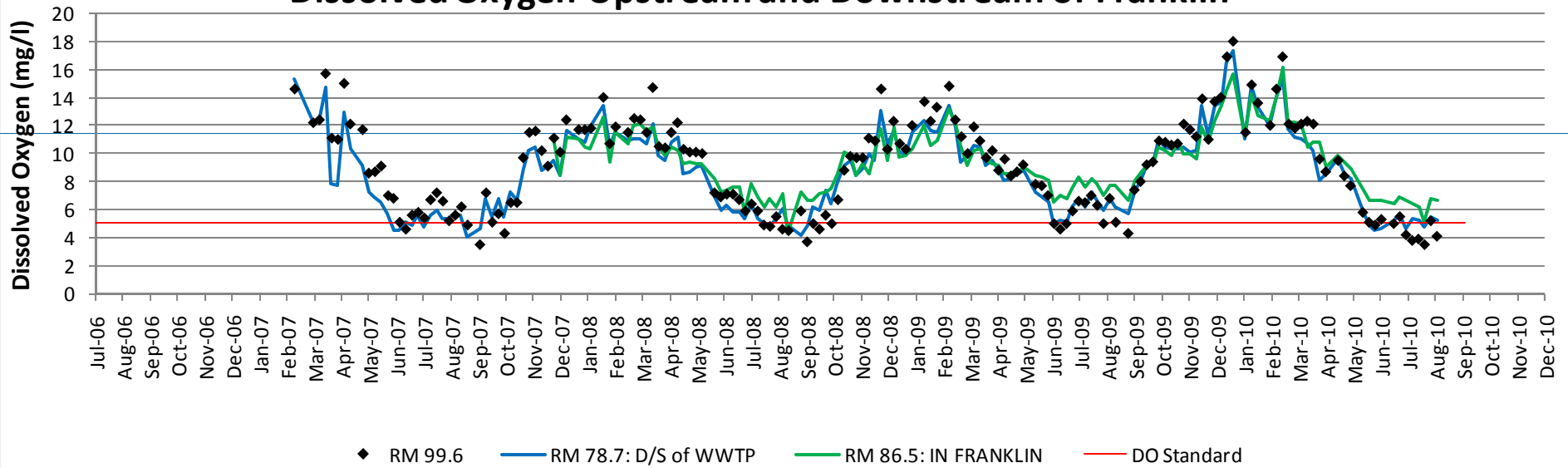
Understanding Upstream Conditions

Dissolved Oxygen Upstream of Franklin



Understanding Upstream Conditions

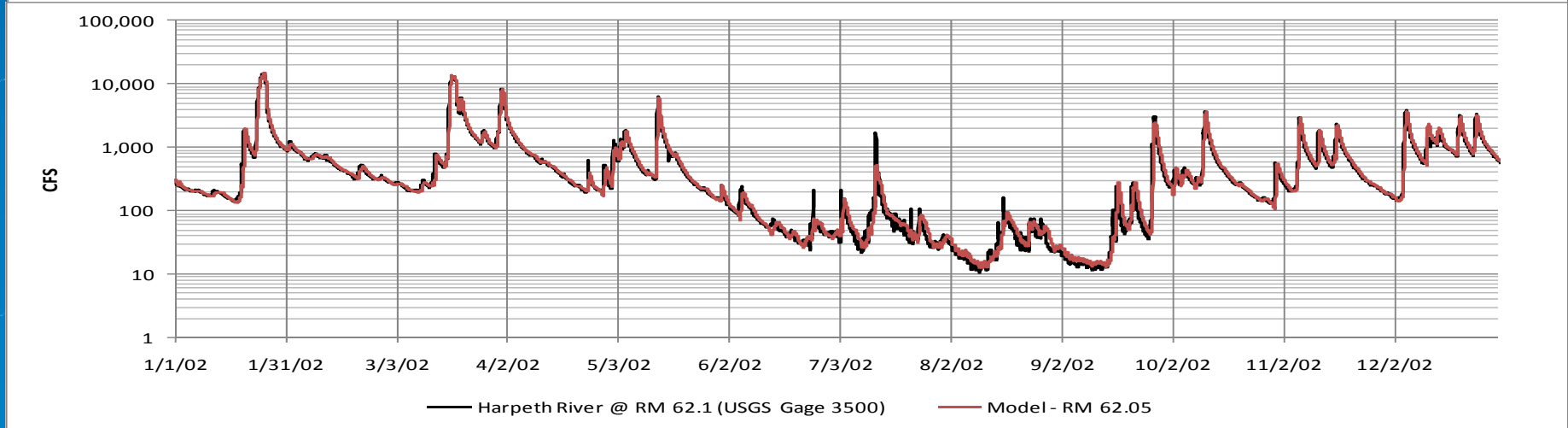
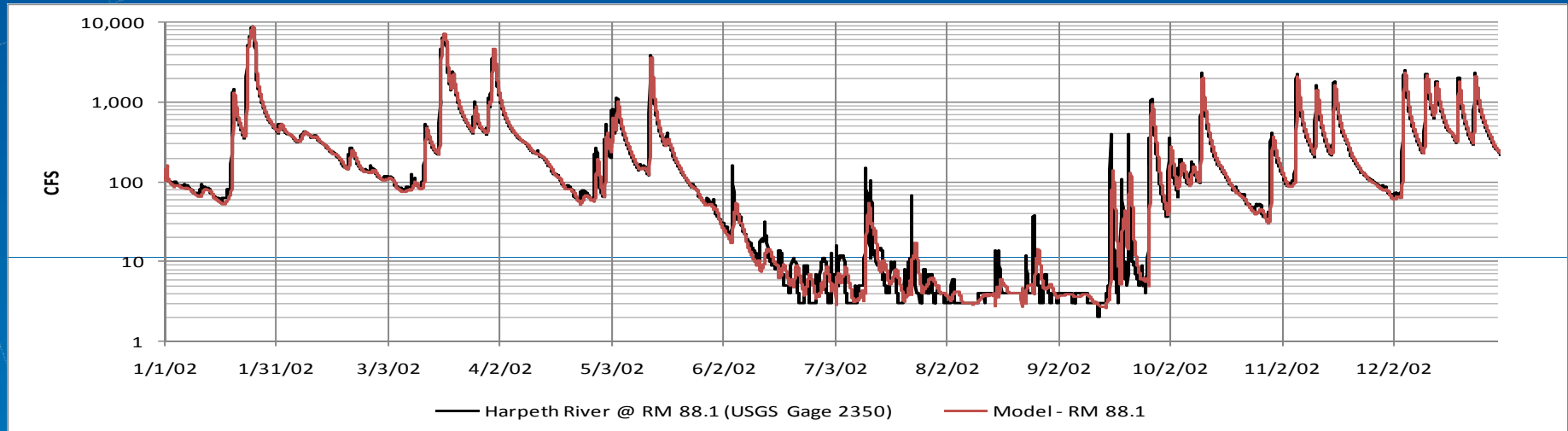
Dissolved Oxygen Upstream and Downstream of Franklin



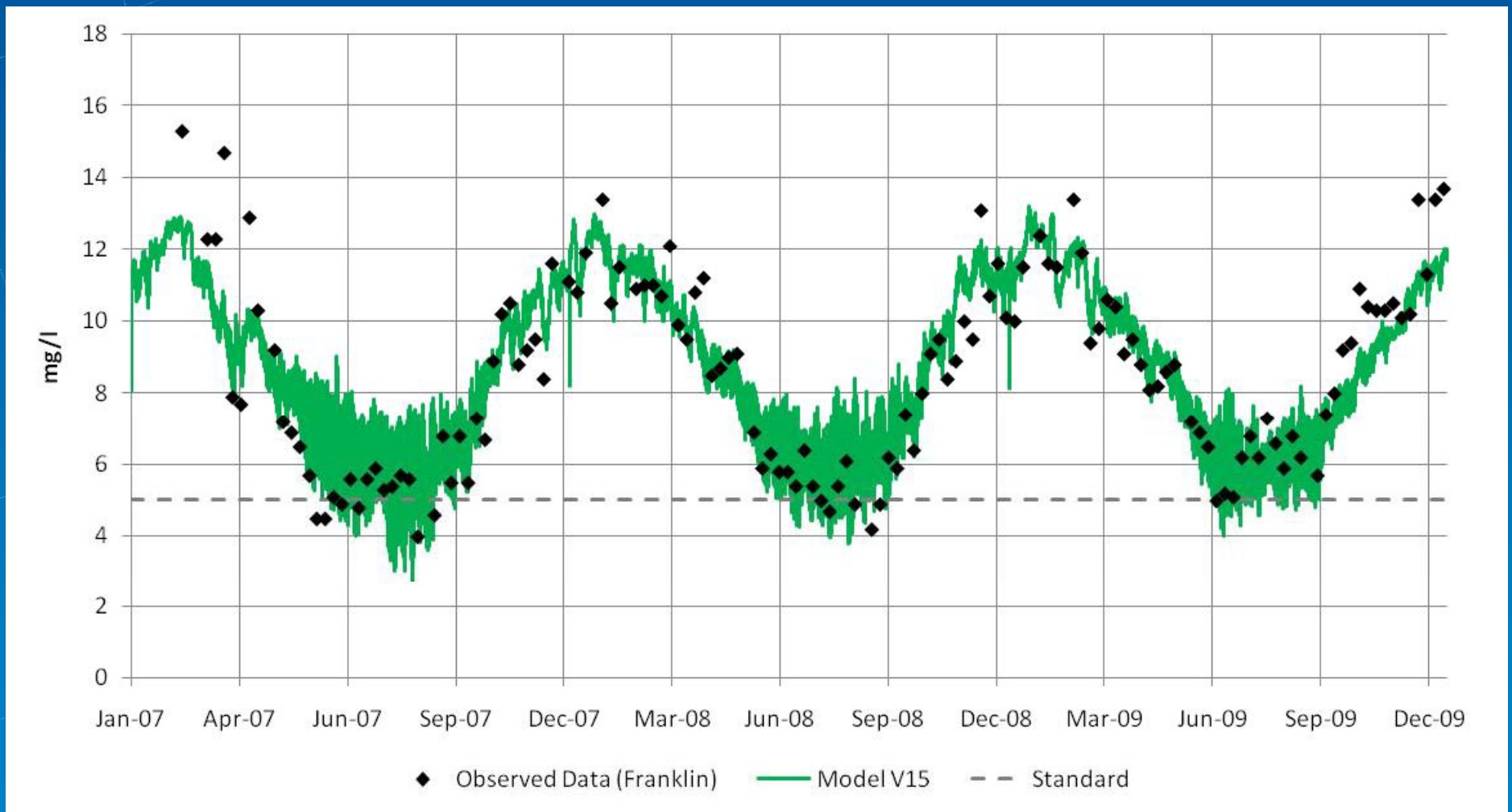
Calibration Goals

- What we **ARE NOT** trying to do:
 - Determine compliance with water quality standards
 - Match observed data at every river mile
- What we **ARE** trying to do:
 - Reproduce general observations of diurnal DO amplitude
 - Represent seasonal trends in average DO
 - Demonstrate reasonable sensitivity to:
 - Nutrients and floating algae growth
 - Sediment effects
 - Fixed algae
 - Biochemical oxygen demand

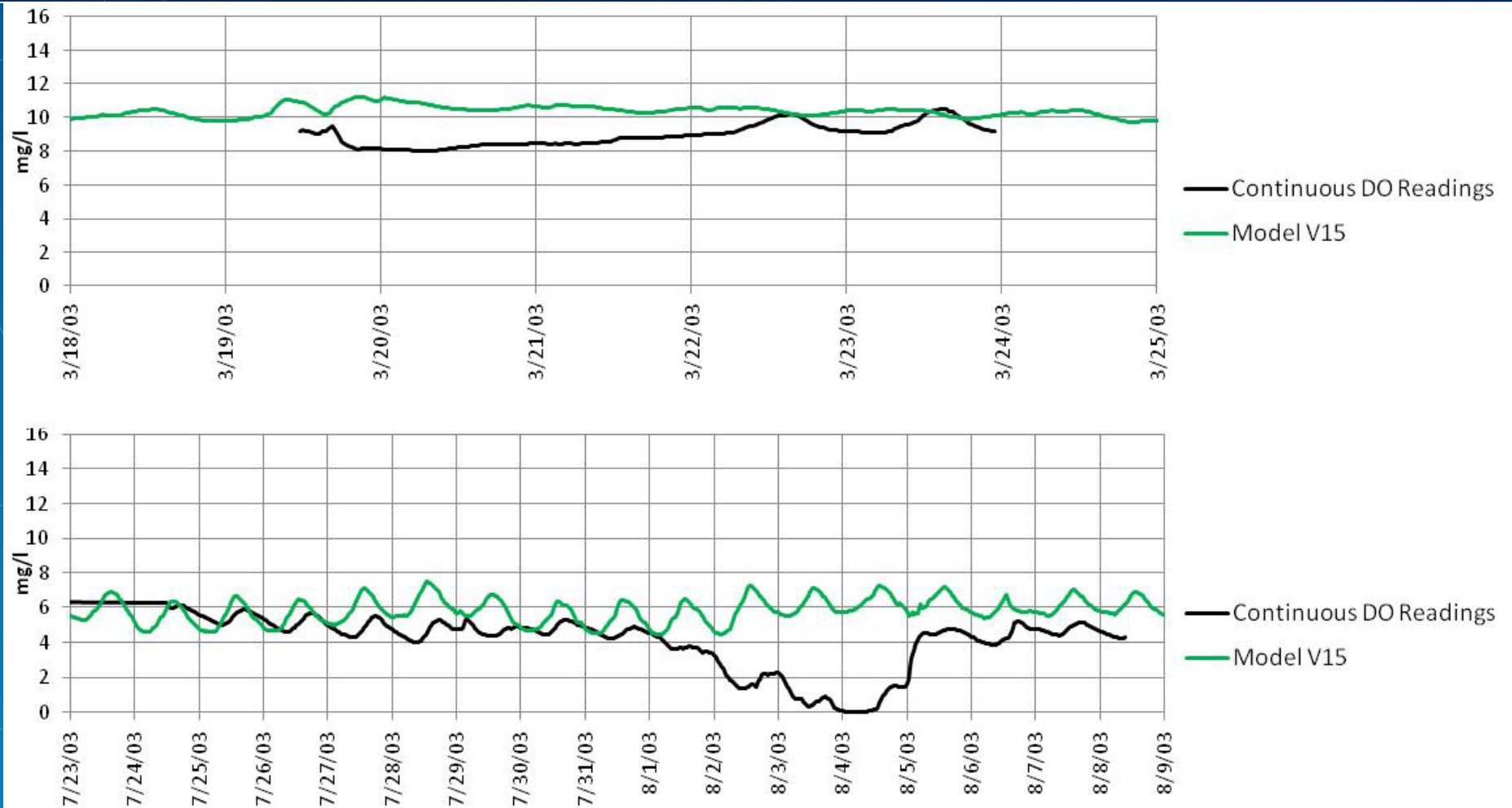
Hydrologic Model Performance



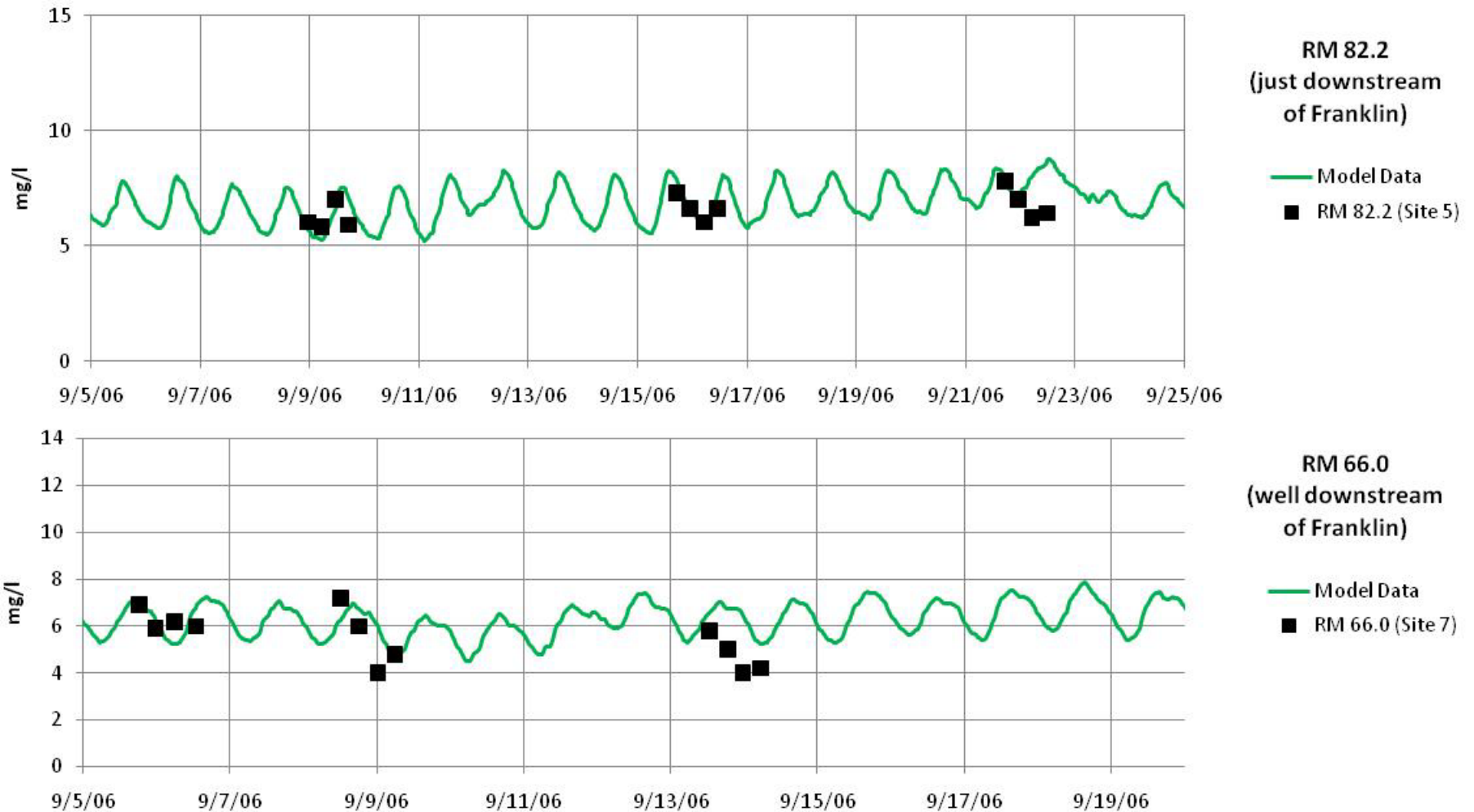
DO Performance at RM78.7 (downstream of Franklin)



DO Performance at RM84.4 (just downstream of WWTP)

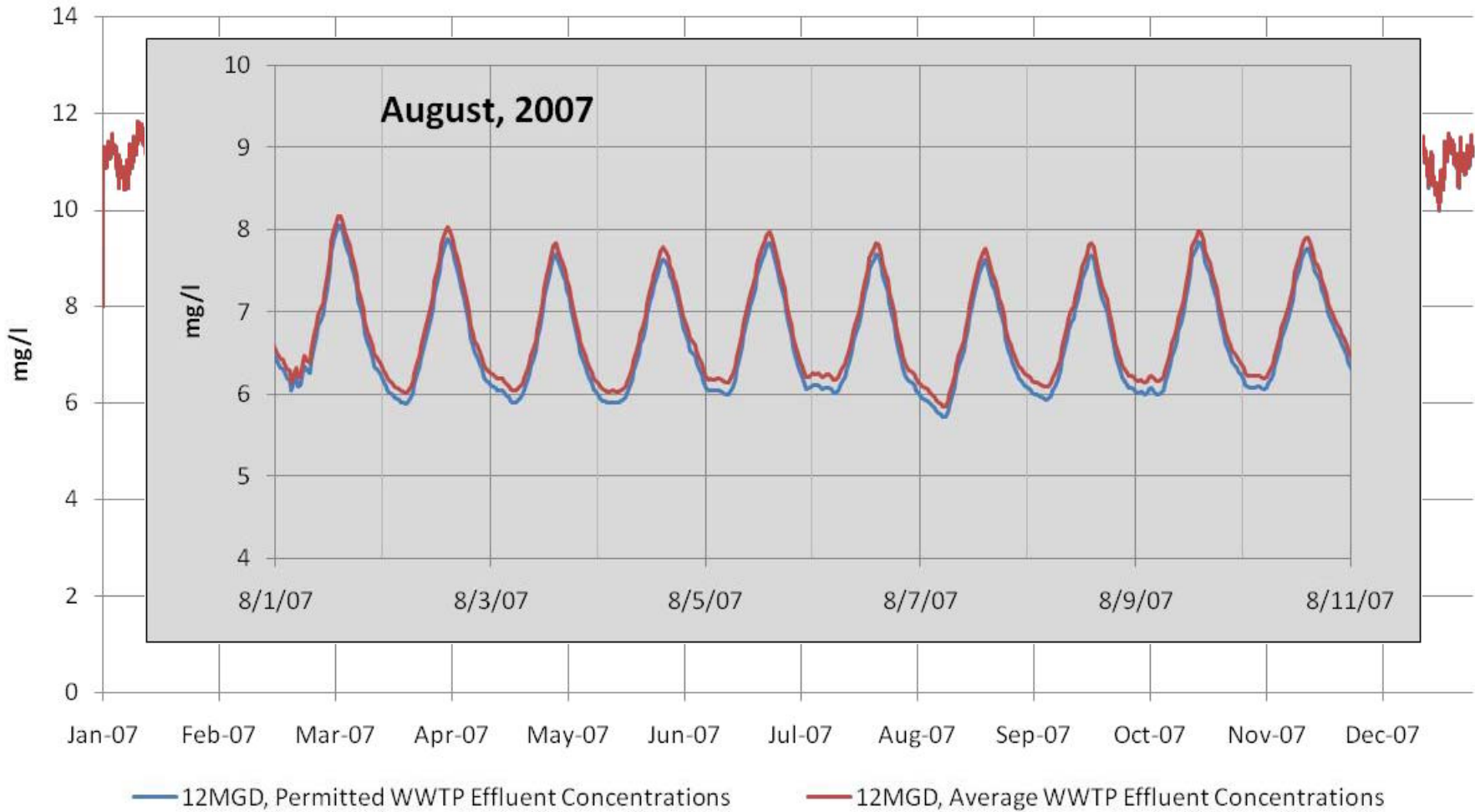


DO Performance (2006 HRWA data)

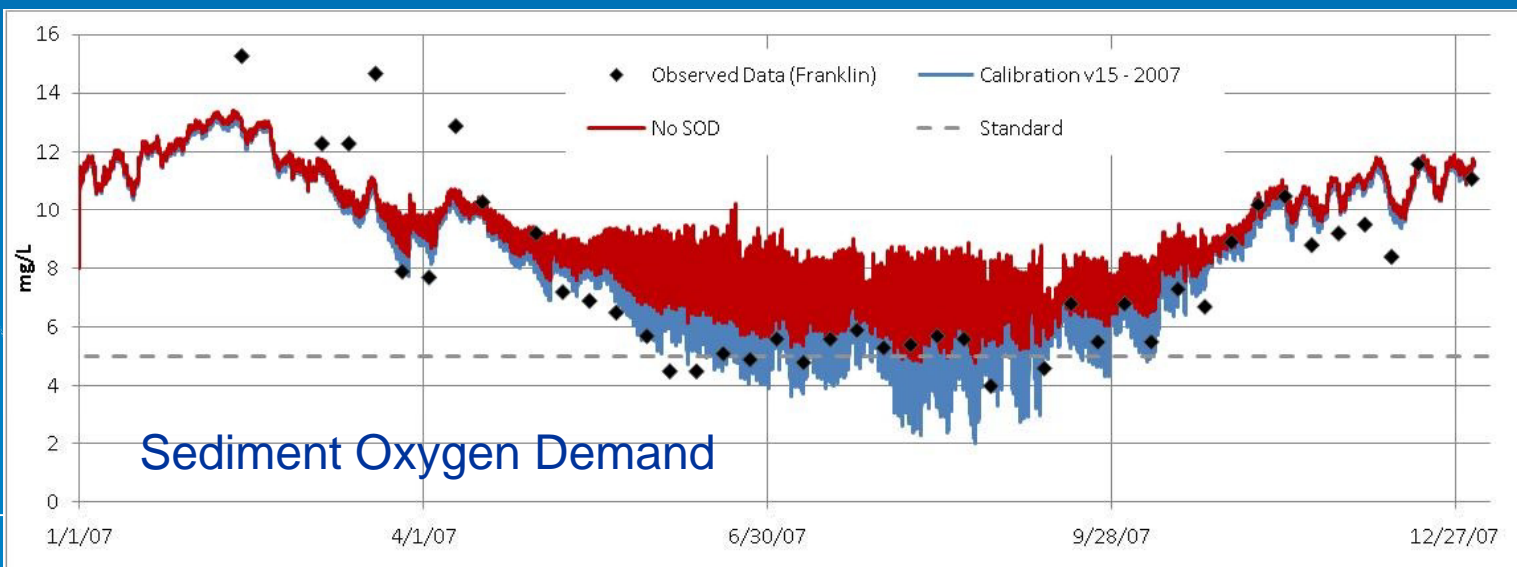
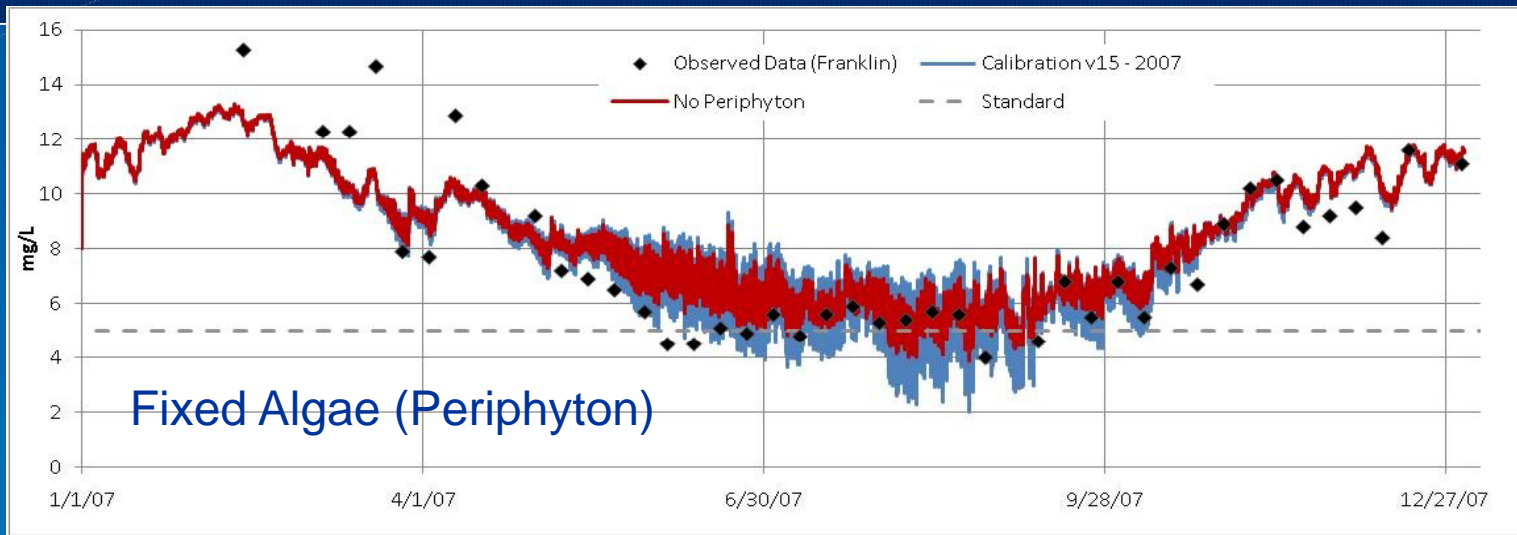


Sensitivity to WWTP Loads

Actual Average versus Permitted WWTP Effluent Concentrations



Sensitivity to Sediment Effects



Model Considerations

- Things to Keep in Mind
 - Upstream of Franklin, the Harpeth River already falls below state standards for oxygen
 - TDEC acknowledges that gages for oxygen monitoring were unreliable during extremely low flow conditions
- Model Limitations
 - Extreme low flow conditions cannot be simulated hydraulically
 - No linkage between upstream loads and sediment effects
 - Some river segments may be more susceptible to algae blooms
 - Sufficient water quality data not available for the tributaries

Next Steps

- Begin studying the alternatives:
 - How sensitive is the river to IWRP alternatives?
 - Which alternative is likely to yield the best water quality in the Harpeth River in Franklin and downstream?
 - How will the IWRP alternatives affect the river:
 - If water quality upstream meets DO standards?
 - If water quality upstream *does not* meet DO standards?

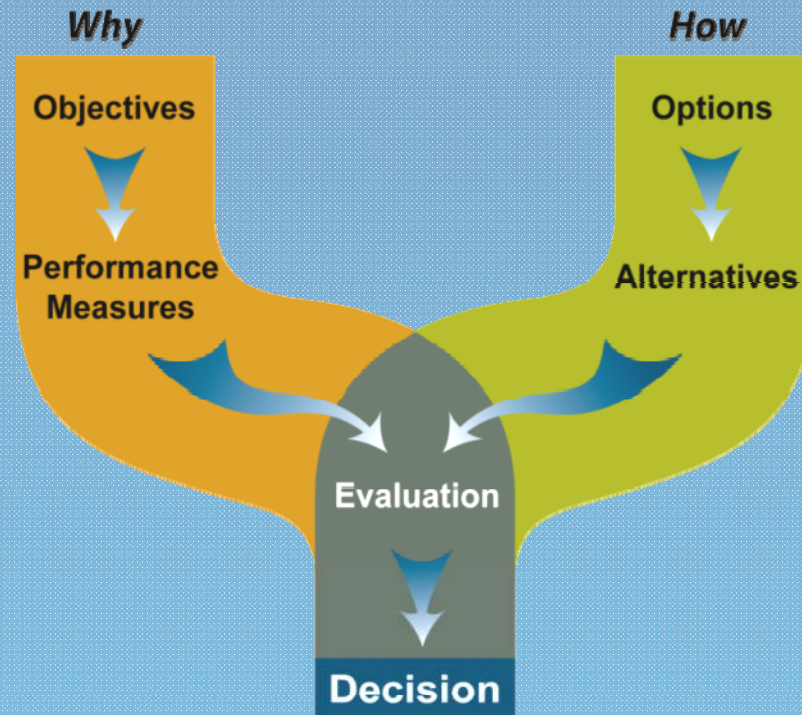
City of Franklin Integrated Water Resources Plan
OVERVIEW OF STELLA MODELING AND CDP

Purpose of Integrated Model

- High level representation of all systems
- Integrate information from:
 - Other Studies
 - All Phase II Technical Analysis
- Compare tradeoffs between alternatives
- Evaluate alternative management strategies
- Generate performance measures for each alternative
- Guide refinement of alternatives (eg: Balance between WW discharge and reuse)

Fundamental IWRP Concept

The Most Important Thing to Remember!



Blending the two tracks of water resource planning enables us to move from technical needs to "Interest-based" solutions.

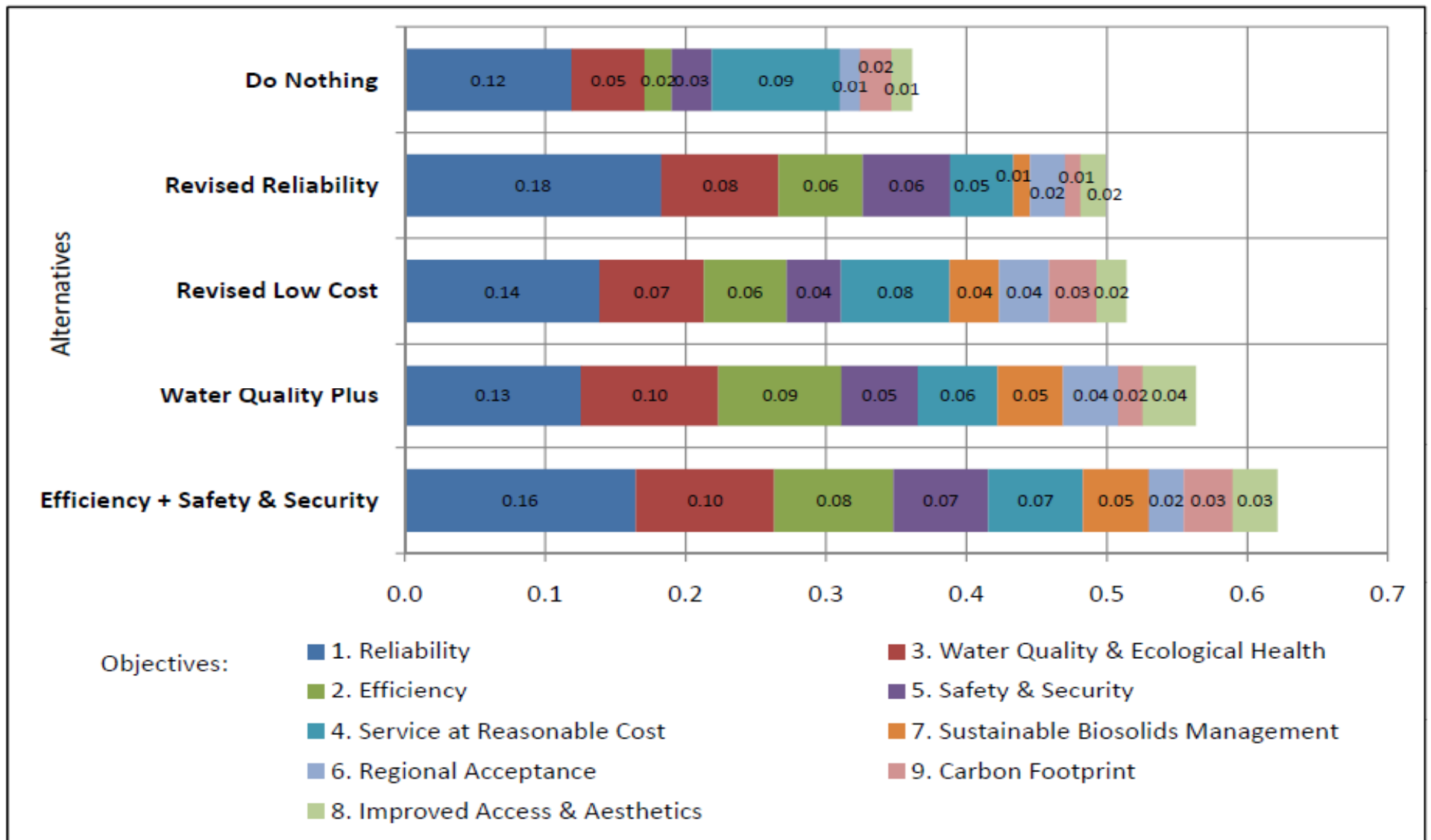
The WHY: IWRP Objectives

1. Meet current and future demands for water and wastewater reliably
2. Maximize efficiency of water use and value of water resources
3. Improve water quality and ecological health of Harpeth River and watershed
4. Provide excellent level of water/wastewater utility services at reasonable cost
5. Provide safety and security of water resources systems
6. Achieve regional acceptance
7. Achieve sustainable biosolids management
8. Provide improved access and aesthetics of Harpeth River
9. Minimize carbon footprint of water resources operations

The HOW: Recommended Alternatives

1. Efficiency plus Safety & Security (New WWTP; expand WTP)
2. Water Quality Plus (No new WWTP and no WTP)
3. Low Cost (No new WWTP, minimal extra options)
4. Reliability Alternative (New WWTP, upgrades to existing WWTP and new raw water line from Cumberland River so City can supply all of Franklin's water)

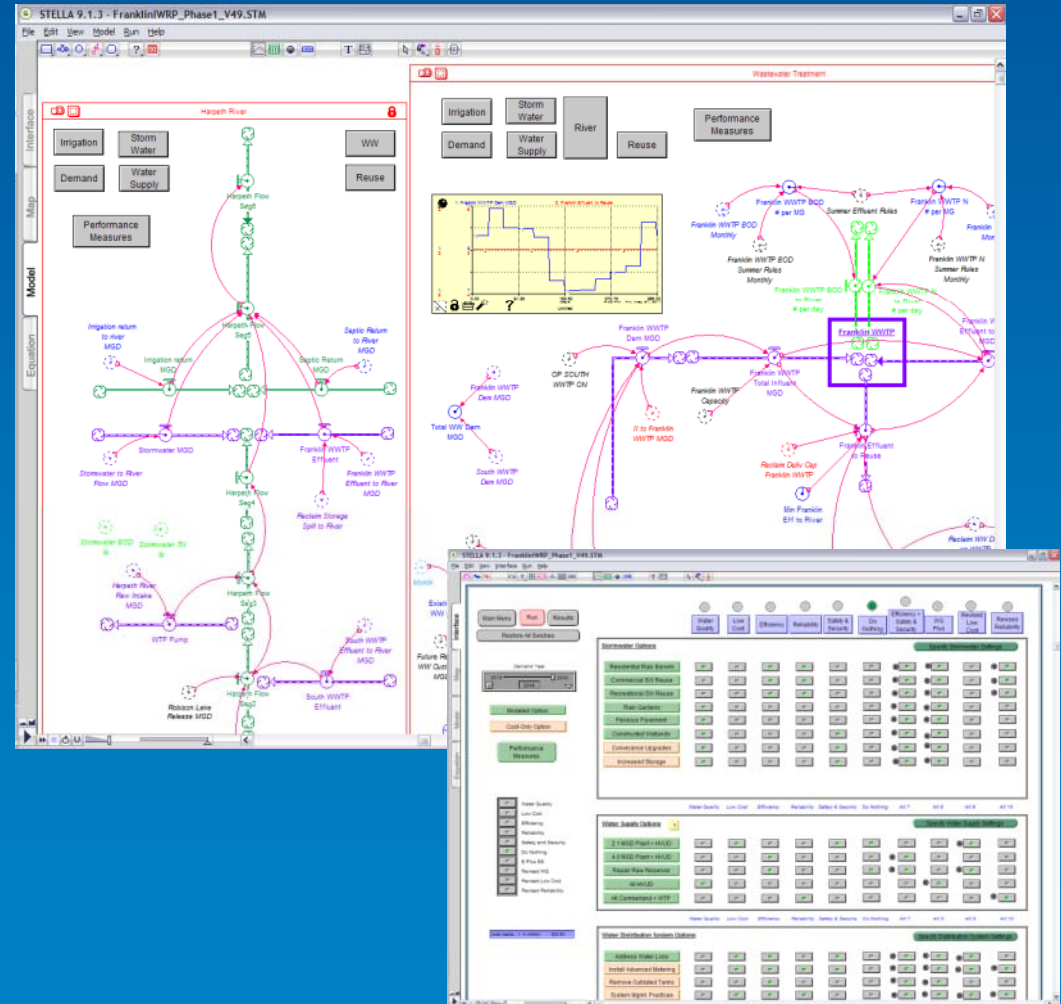
Phase I Alternatives Comparison



Updates to Integrated Model based on Phase II Technical Analysis

Update inputs:

- Unit costs (\$ per gallon treated, etc.)
- Capital and maintenance costs
- Unit energy requirements (kWh/gal treated or pumped)
- Treatment capacities
- Inflow/Infiltration estimates
- Stormwater BMP performance
- Phasing of capital projects
- WWTP effluent concentrations



Other Updates to Integrated Model

- Added another WWTP at Goose Creek
 - Impacts on water supply availability
 - Opportunities for reclaimed water
- Revised reclaimed demands
 - Accounting for existing customers and locations near reuse lines
 - Demand = 3.4 mgd average day, 11.4 mgd peak day
- Distribution system improvements
- Nutrient trading between stormwater and WWTP loads

Next Steps With Integrated Model

- Finalize input from Phase II Technical Analysis
- Revisit current formulation of alternatives
- Adjust alternatives based on Phase II findings
- Use STELLA to refine the alternatives
 - Different blend of options
 - Different balances between WW effluent and reclaimed uses
- Reproduce performance measures and rank the alternatives
- Workshop with Stakeholders to present results
- Workshop with Stakeholders to recommend final IWRP

Harpeth River Watershed and Key Locations

