# City of Franklin

## Integrated Water Resources Plan

June 1, 2011

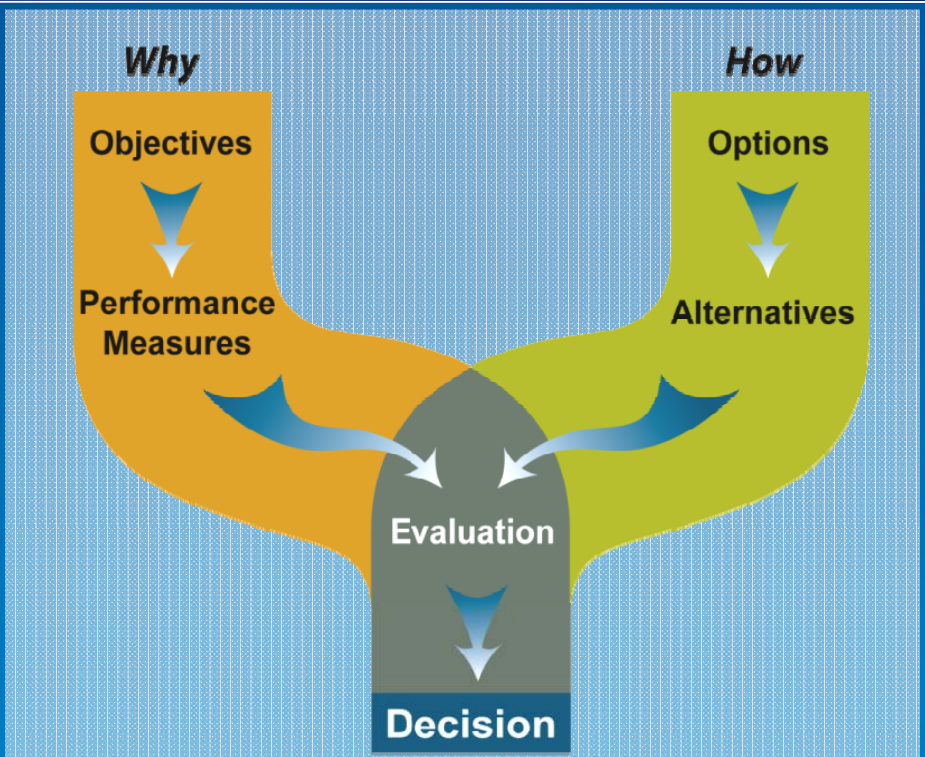
Stakeholder Meeting

CDM

# Meeting Agenda

- Introductions
- Task 1 Preliminary Technical Findings
- Overview of STELLA Modeling and CDP
- Next Steps
- Discussion & Feedback
- Adjourn

# Fundamental IWRP Concept
## *The Most Important Thing to Remember!*

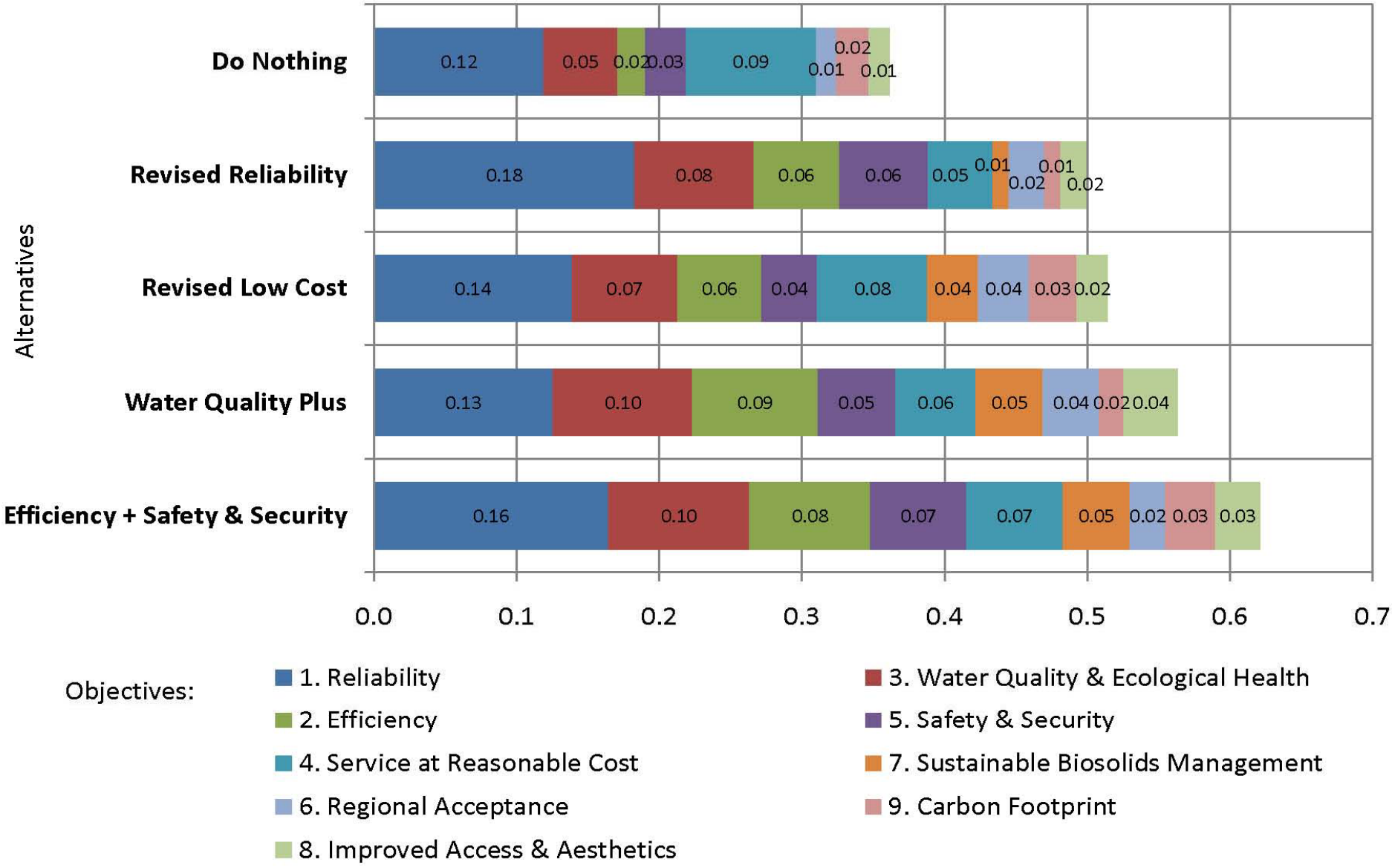



*Blending the two tracks of water resource planning enables us to move from technical needs to "interest-based" solutions.*

# IWRP Objectives

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

# Phase I Alternatives Comparison



# Recommended Alternatives

1. Efficiency plus Safety & Security (Alt07)
2. Water Quality Plus
   (Alt01 minus new WWTP and withdrawals from Harpeth River)
3. Low Cost
   (all wastewater through existing WWTP)
4. Reliability Alternative
   (option to add stormwater, water conservation)

# Technical Evaluations

- Existing WWTP
- New WWTP
- Reclaimed Water
- Biosolids
- Collection System
- Water Treatment
- Water Distribution System
- Stormwater
- Water Conservation
- Stream/River Restoration
- Robinson Lake Evaluation
- Harpeth River Analysis/ Water Quality Modeling

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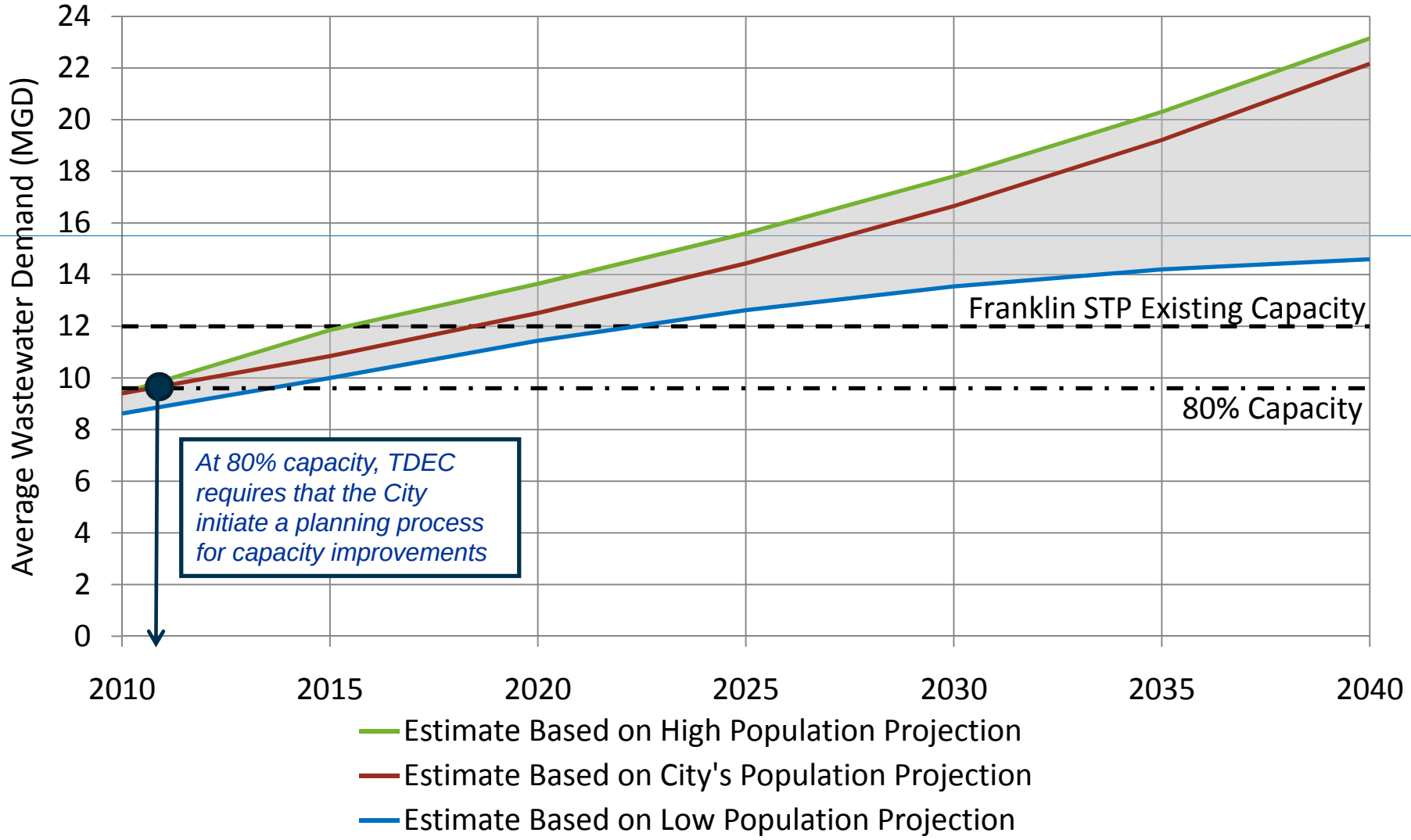
# EXISTING WWTP

# Franklin Wastewater Flow Projections



# Existing WWTP - Overview

TREATMENT CAPACITY

- Biological capacity could be increased
- Limiting process
  - Denitrification filters
  - Maximum of 13 mgd AADF
- Biological capacity = 18 mgd AADF

HYDRAULIC CAPACITY

- Several bottlenecks identified
- Some headloss could be recovered via hydraulic modifications

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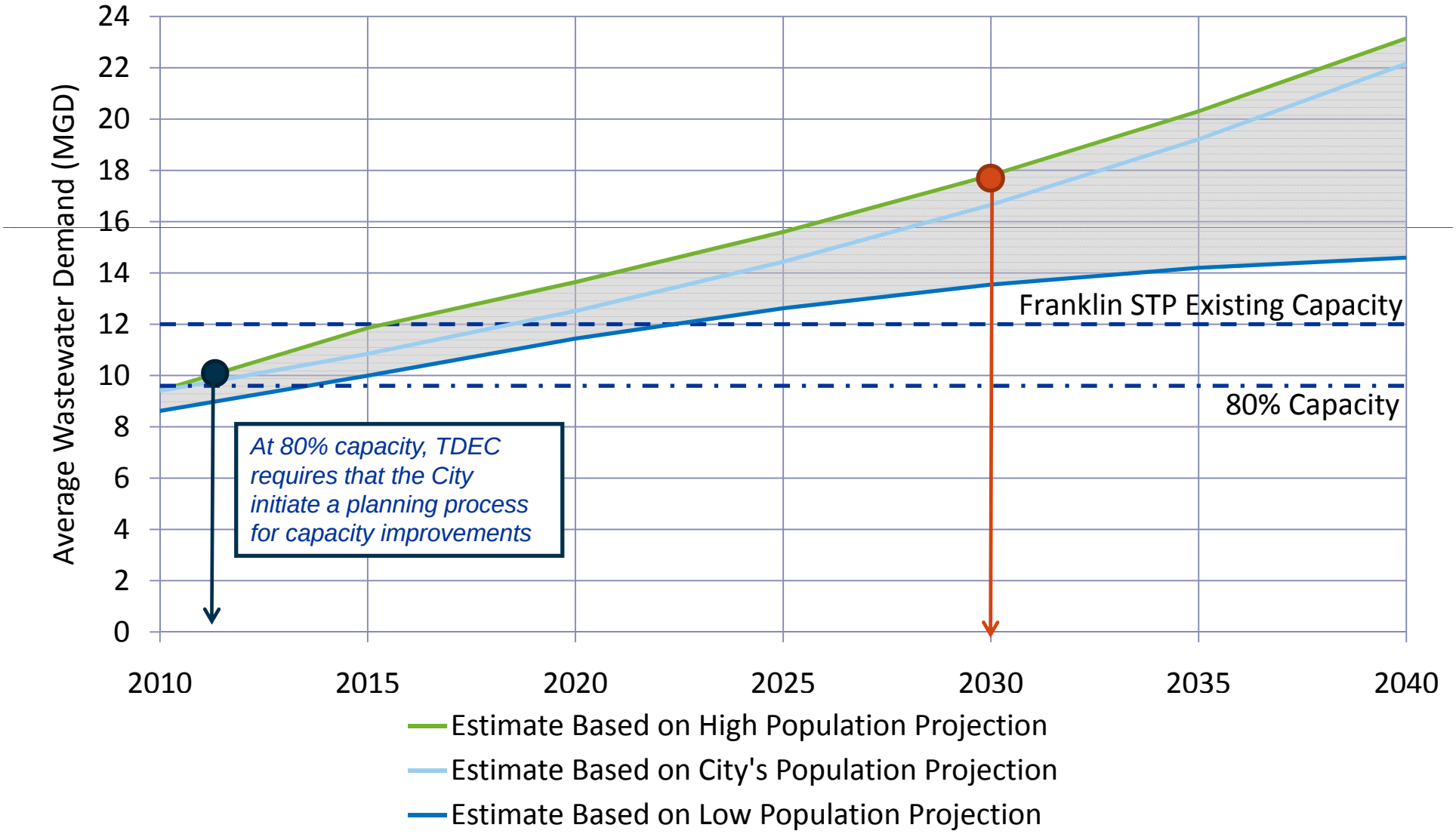
# NEW WWTP

# Franklin Wastewater Demand Projection



# New WWTP Design Criteria

- Design Flow – ADF = 6 mgd
- Anticipated Future NPDES Permit Requirements
  - Advanced Wastewater Treatment (AWT)
    - CBOD/TSS
    - Nitrogen
    - Phosphorus
  - Seasonal Discharge Limits
  - Reuse Requirements

# Wastewater Treatment Evaluation Summary

- Existing WWTP capacity under review
- New WWTP conceptual level design ongoing
- Collection system analysis is ongoing

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# RECLAIMED WATER

# Reclaimed Water Status

- Potential reclaimed water supply is equal to WWTP effluent
- Analysis
  - Demand
  - Distribution
  - Storage Requirements
- Balancing the reclaimed water requirements
  - WWTP discharges
  - WTP demands
  - Harpeth River quality and quantity

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# BIOSOLIDS

# Process Alternatives

- Biosolids Workshop was held to identify process alternatives
- Biosolids Regulations and disposal options by "Class" were reviewed with Steering Committee and WWTP Staff

| Process Train | Thickening | Stabilization | Dewatering | Drying | Biosolids Class |
|---|---|---|---|---|---|
| Option 1 (Existing) | DAF | None | Belt Filter Press | None | N/A |
| Option 2 | Drum Thickener | Anaerobic Digestion | Screw Press | Solar Dryer | A |
| Option 3 | Screw Thickener | Anaerobic Digestion | Centrifuge | Rotary Drum/Belt Dryer | A |
| Option 4 | Gravity Belt Thickener | None | Centrifuge | Belt Dryer with ERS | N/A |

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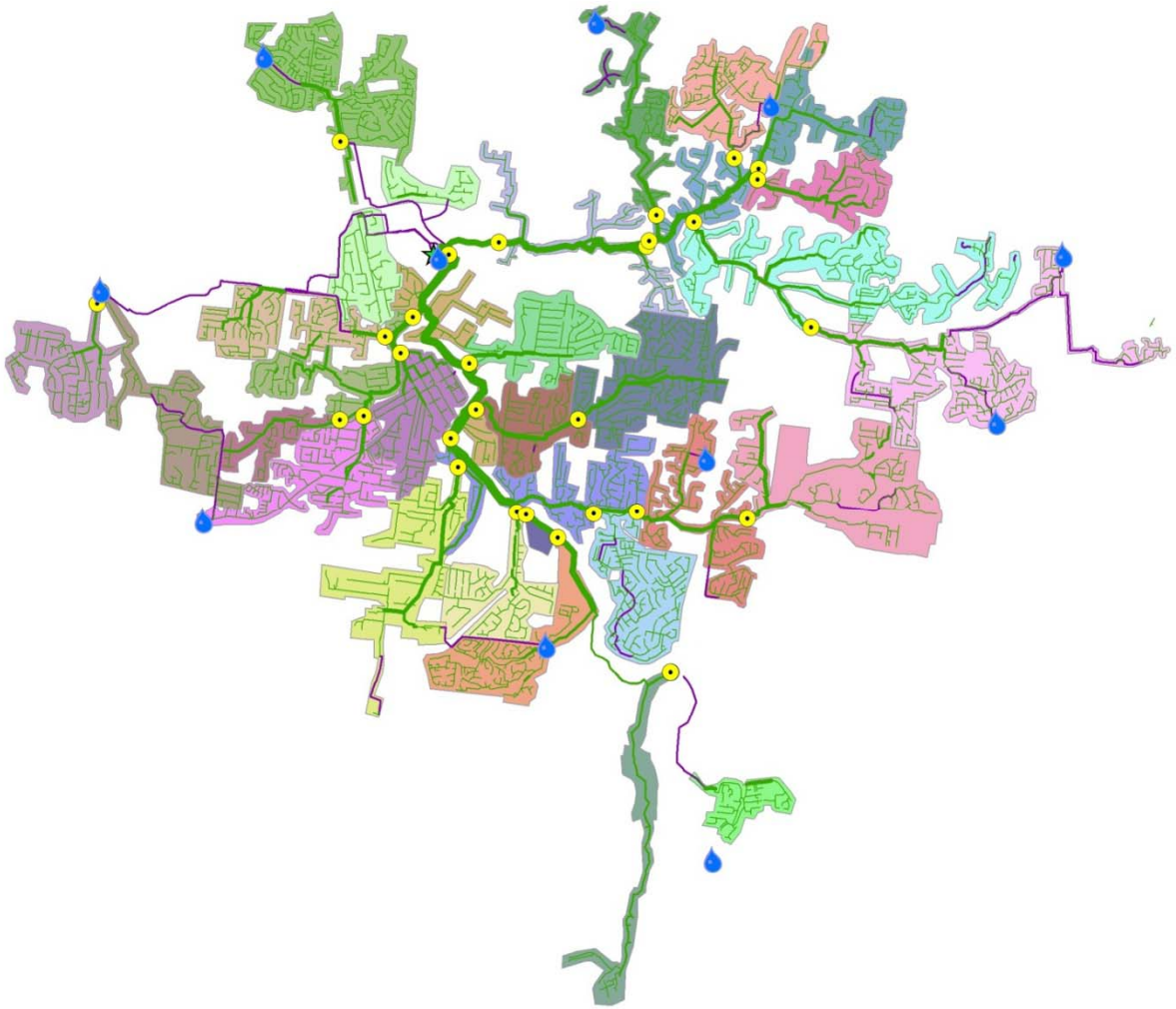
# COLLECTION SYSTEM

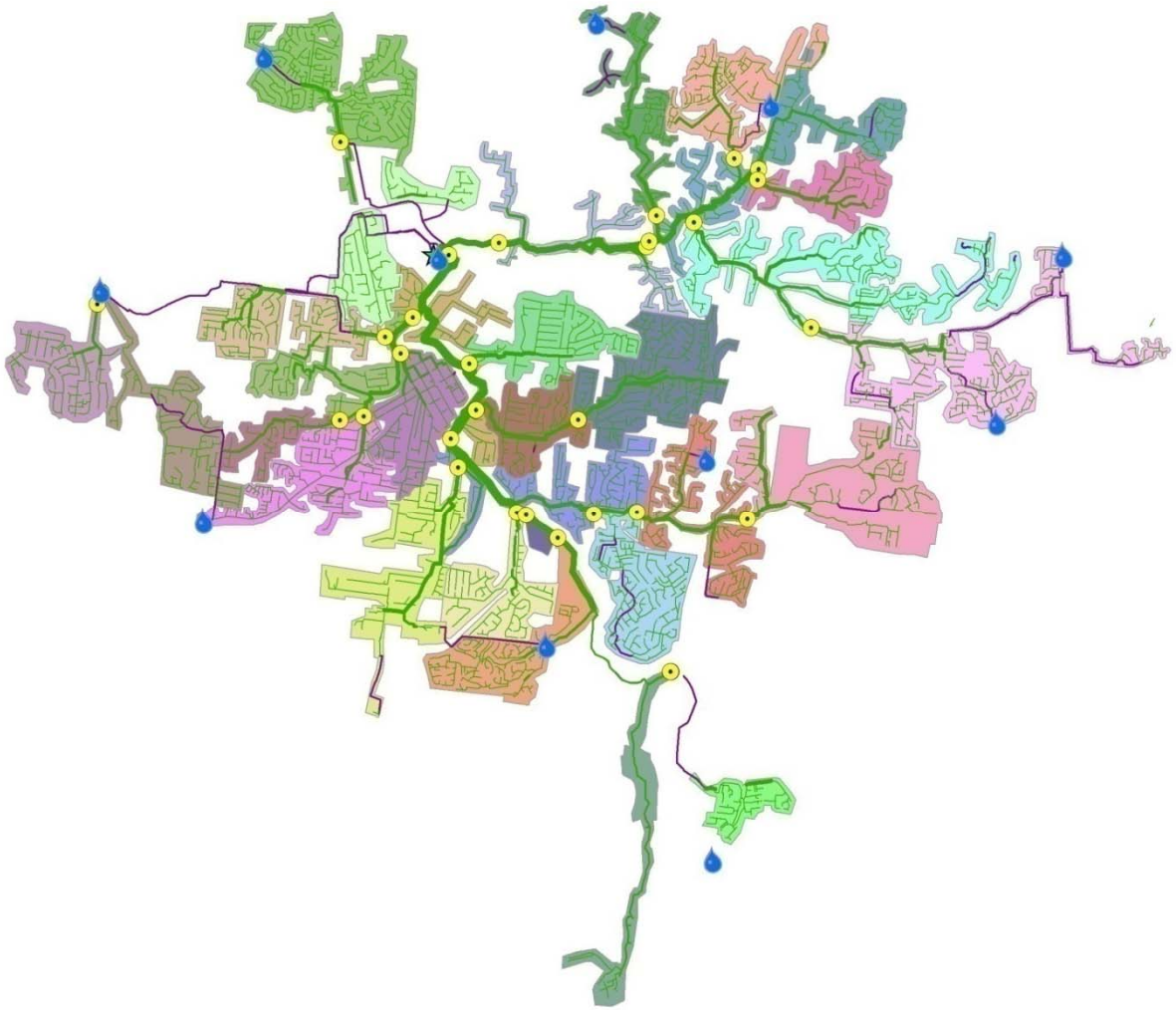
# Wastewater Collection System



Flow Monitoring

- 20 square miles sewered area
- 31 flow monitors
- Corresponding sewersheds
- 11 rain gauges

# Wastewater Collection System

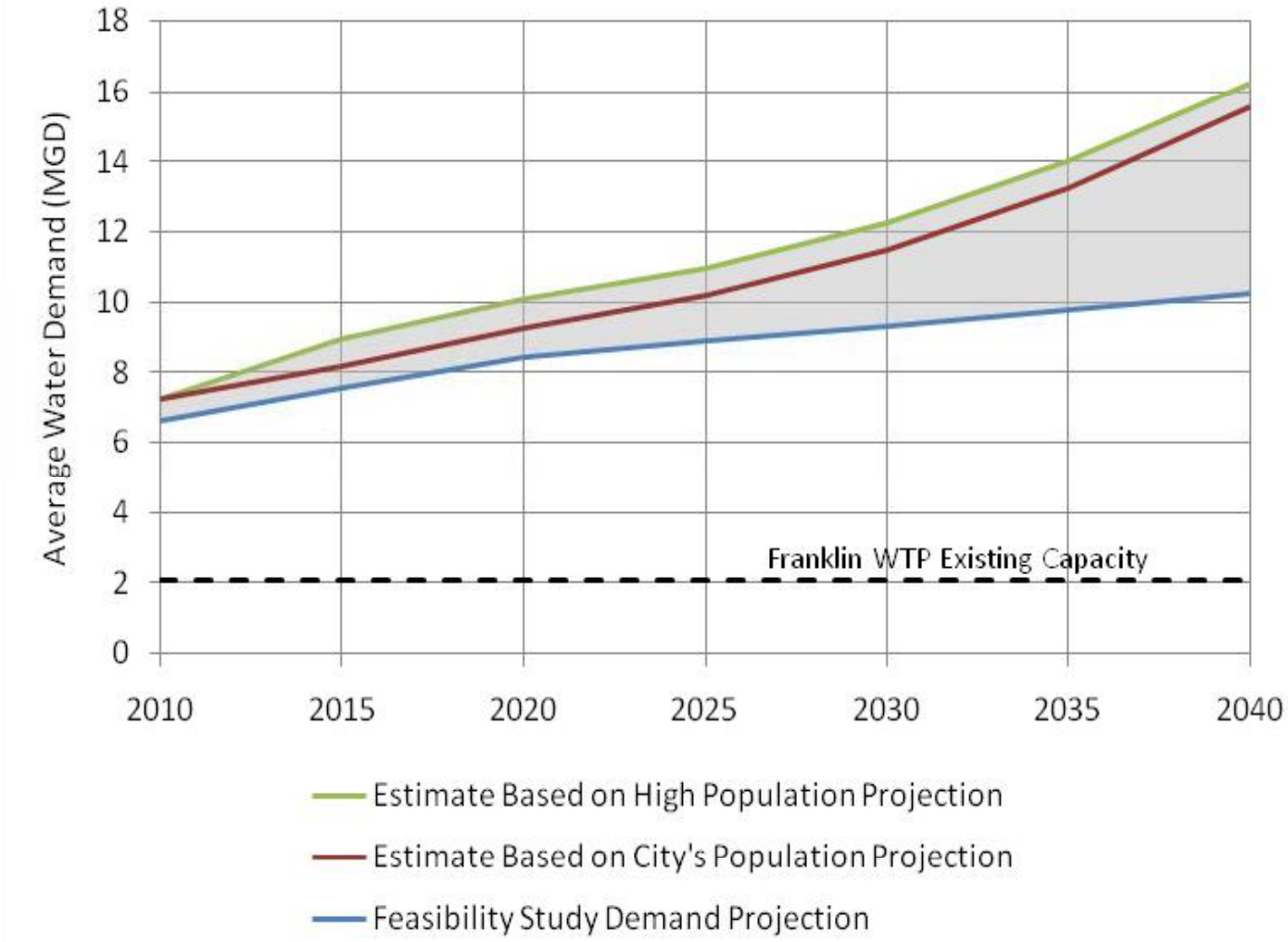


RDII reduction

- Target poor conditioned sewers
- Repairs to reduce wet weather flows
- Alleviate sewer overflows
- Save at WWTP
  - Plant capacity
  - Capital Expenditures

# WATER TREATMENT PLANT AND DISTRIBUTION SYSTEM

# Potable Water Demand Projections




| Year | COF Demand Projection in million gallons per day |
|---|---|
| 2010 | 7.2 |
| 2015 | 8.2 |
| 2020 | 9.2 |
| 2025 | 10.2 |
| 2030 | 11.5 |
| 2035 | 13.3 |
| 2040 | 15.6 |

# Existing WTP - Overview

- CDM Reviewed Existing WTP Design Report
  - Costs to upgrade existing capacity
  - Costs to expand to 4.0 mgd
    - Conventional
    - Membranes
- Regulatory Compliance
  - D/DBP Rules – THM/HAAs
  - LT2ESWTR – BIN2 Classification of source water
    - Operational changes to WTP process
    - Membranes
    - UV AOP Process

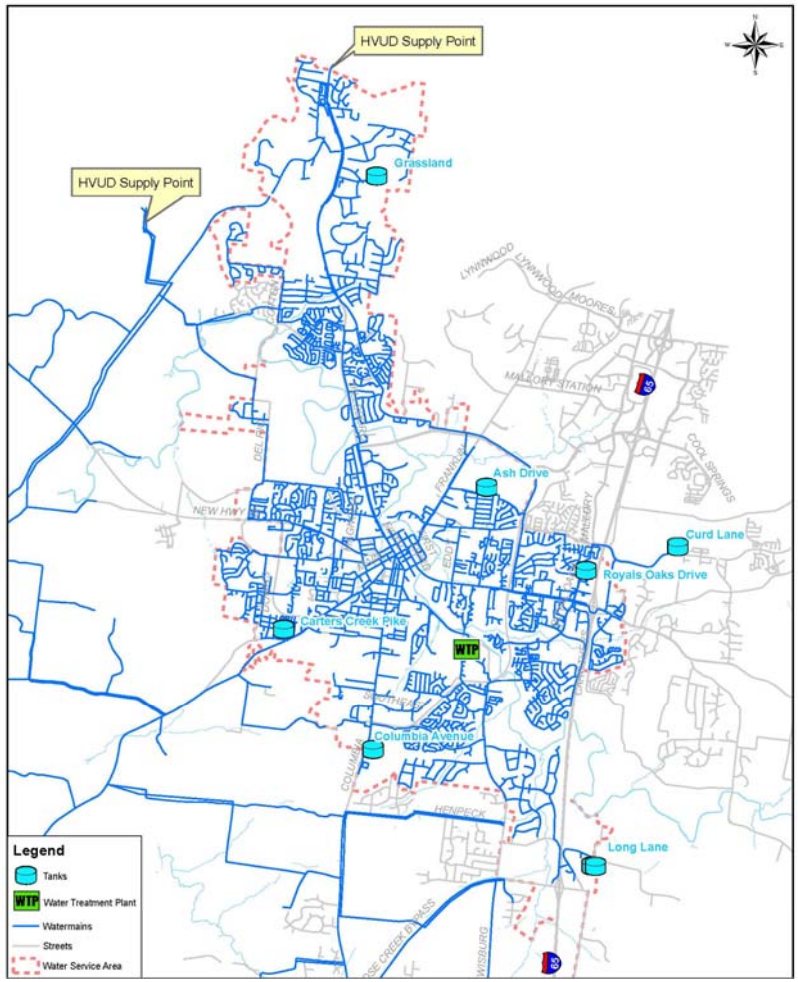
# Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) Compliance

- City testing found *Cryptosporidium* in source water
- Places Franklin in "Bin 2" of LT2ESWTR, requiring an extra log of treatment. Previous work assumed "Bin 1"
- EPA lists options, including for example:
  - Maintaining < 0.15 NTU in each filter in greater than 95% of the time
  - Ultraviolet (UV) disinfection
  - Membrane filtration

# Water Distribution System

## Work Accomplished:

- Reviewed existing system and model
- Updated hydraulic model to reflect current system
- Processed HVUD pressure data to update/verify modeled supply points
- Completed initial request list of STELLA inputs
- Finalizing demand allocations



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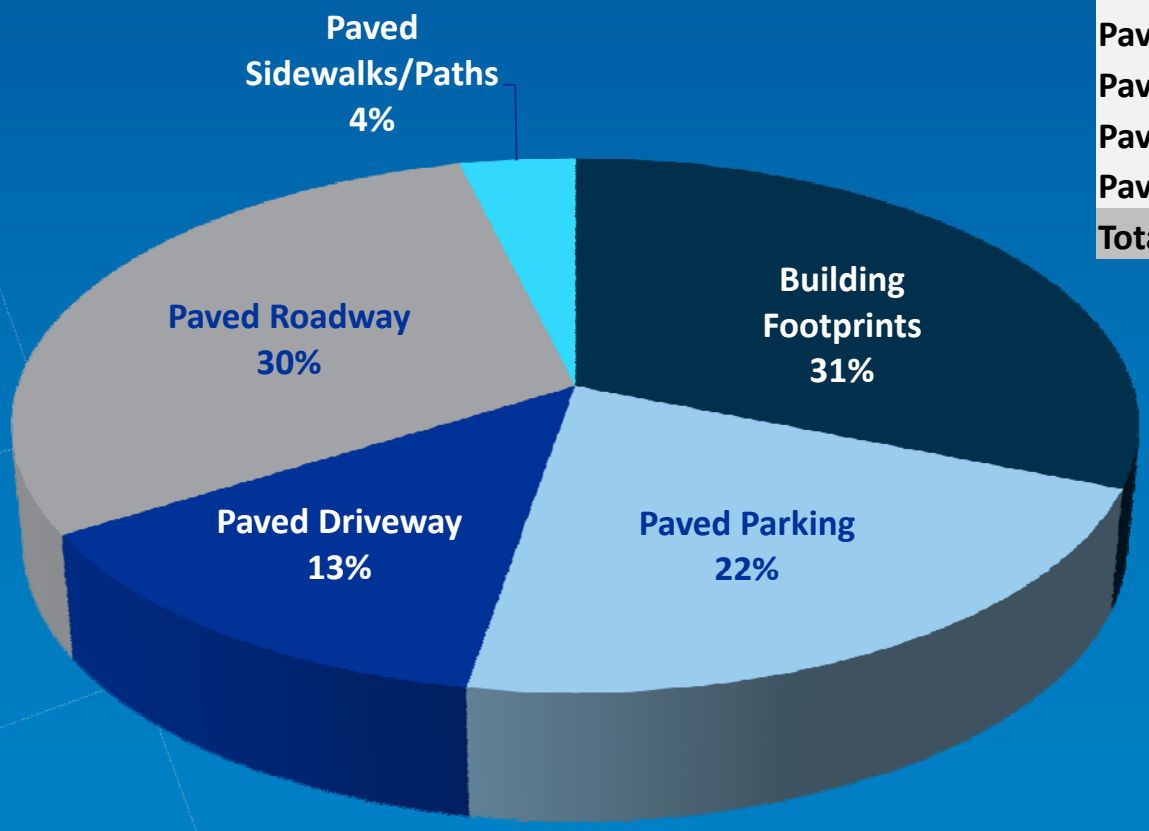
# STORMWATER MANAGEMENT

# How Much Impervious Area Are We Talking About?




| Impervious Cover (by type) | Area (sq. ft.) |
|---|---|
| Building Footprints | 84,000,000 |
| Paved Parking | 58,000,000 |
| Paved Driveway | 36,000,000 |
| Paved Roadway | 81,000,000 |
| Paved Sidewalks/Paths | 10,000,000 |
| Total | 269,000,000 |

# What Tools Do We Have To Control Runoff?
## *The BMP Treatment Train*


PublIc Information, Source Controls, Erosion Control, Minimize Pavement, Control Illicit Connections & Illegal Dumping, Reduced Clearing

Swales, Filter Inlets, Baffle Boxes, Oil-Water Separators

Small Channels, In-Line Storage, Sediment Basins, Onsite Detention

Regional Detention, Baffle Boxes, Wetlands, Stream Restoration

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# GREEN INFRASTRUCTURE & RAINWATER HARVESTING

# What Can **Green** Do for You?

*(apologies to **UPS**!)*

| Benefit | Reduces Stormwater Runoff | | | | Increases Available Water Supply | Increases Groundwater Recharge | Reduces Salt Use | Reduces Energy Use | Improves Air Quality | Reduces Atmospheric $CO_2$ | Reduces Urban Heat Island | Improves Community Livability | | | | | Improves Habitat | Cultivates Public Education Opportunities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Reduces Water Treatment Needs | Improves Water Quality | Reduces Grey Infrastructure Needs | Reduces Flooding | | | | | | | | Improves Aesthetics | Increases Recreational Opportunity | Reduces Noise Pollution | Improves Community Cohesion | Urban Agriculture | | |
| Practice | | | | | | | | | | | | | | | | | | |
| Green Roofs | ● | ● | ● | ● | ○ | ○ | ○ | ● | ● | ● | ● | ● | ◒ | ● | ◒ | ◒ | ● | ● |
| Tree Planting | ● | ● | ● | ● | ○ | ◒ | ○ | ● | ● | ● | ● | ● | ● | ● | ● | ◒ | ● | ● |
| Bioretention & Infiltration | ● | ● | ● | ● | ◒ | ◒ | ○ | ○ | ● | ● | ● | ● | ● | ◒ | ◒ | ○ | ● | ● |
| Permeable Pavement | ● | ● | ● | ● | ○ | ◒ | ● | ◒ | ● | ● | ● | ○ | ○ | ● | ○ | ○ | ○ | ● |
| Water Harvesting | ● | ● | ● | ● | ● | ◒ | ○ | ◒ | ◒ | ◒ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● |

● Yes ◒ Maybe ○ No

Source: The Value of Green Infrastructure (Center for Neighborhood Technology)

# Runoff Capture Potential for Municipal Properties via Low Impact Development/Green Infrastructure

- Assume retrofit of 50% of existing impervious areas for treatment
- Potential runoff capture of 90% for treated areas
- Total potential rainfall capture is 103 million gallons annually

| Impervious Cover (by type) | Area (sq. ft.) |
|---|---|
| Building Footprints | 2,000,000 |
| Paved Parking/Driveways | 3,600,000 |
| Paved Roadway | 400,000 |
| Paved Sidewalks/Paths | 800,000 |
| **Total** | **6,800,000** |

# Municipal Rainwater Harvesting Potential

- Two million square feet of rooftop on municipally-owned facilities
- Approximately 57 million gallons available for capture annually
- 100% retrofit of municipal facilities could result in a 2% reduction in total demand city-wide

**City of Franklin Police Headquarters**

**GREEN FEATURES**

- **Storm water runoff reduces 30% from pre-development conditions using green roof and rainwater cistern system.**
- **250,000 gallons per year in irrigation water and waste water intake savings via harvesting**

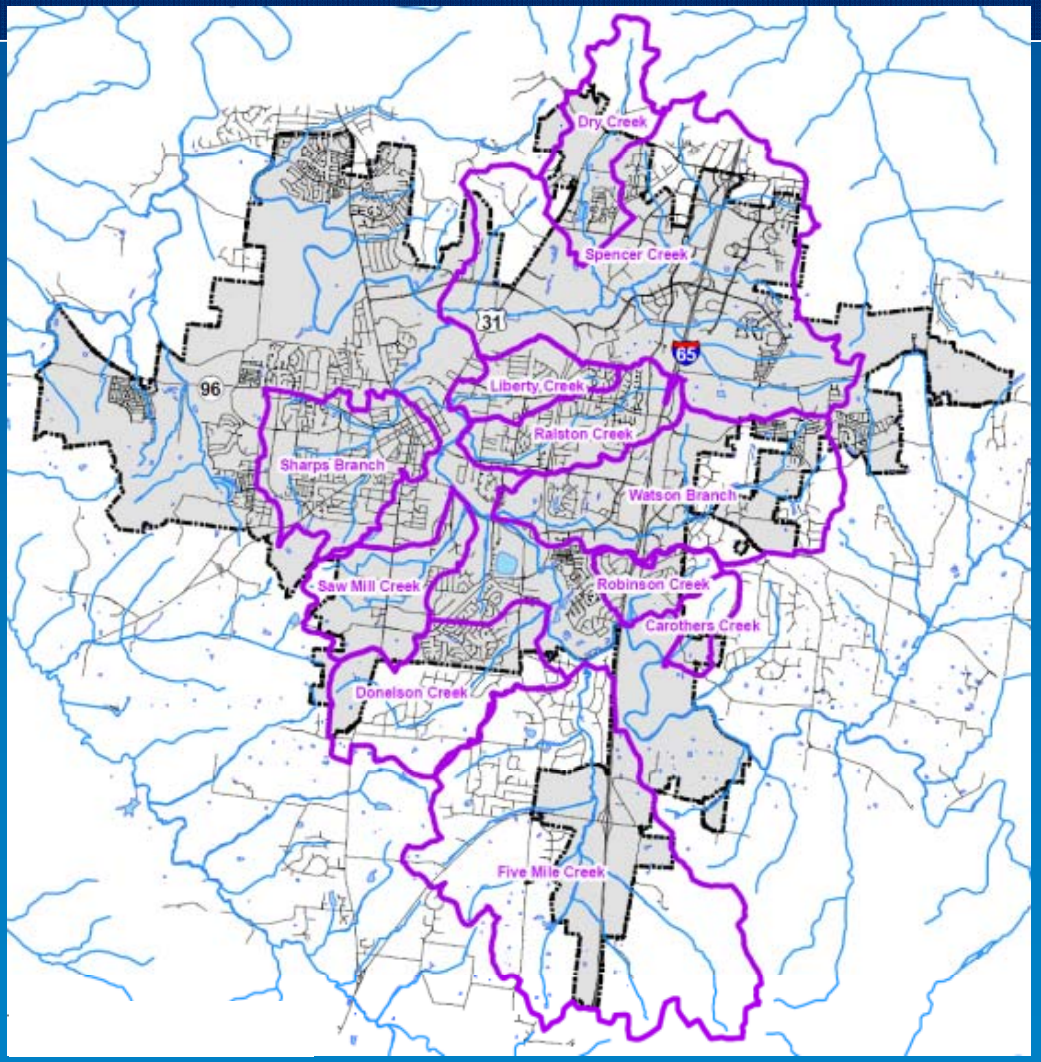
# Neighborhood Scale Rain Barrel Program

- Example:  Chestnut Bend
- 185 homes; 600,000 sq. ft.
- Assume 40% participation rate (based on other CDM studies)
- 1.6 million gallons captured
- Assume 2 rain barrels per participating home

# TRADITIONAL STORMWATER BMP TREATMENT OPTIONS

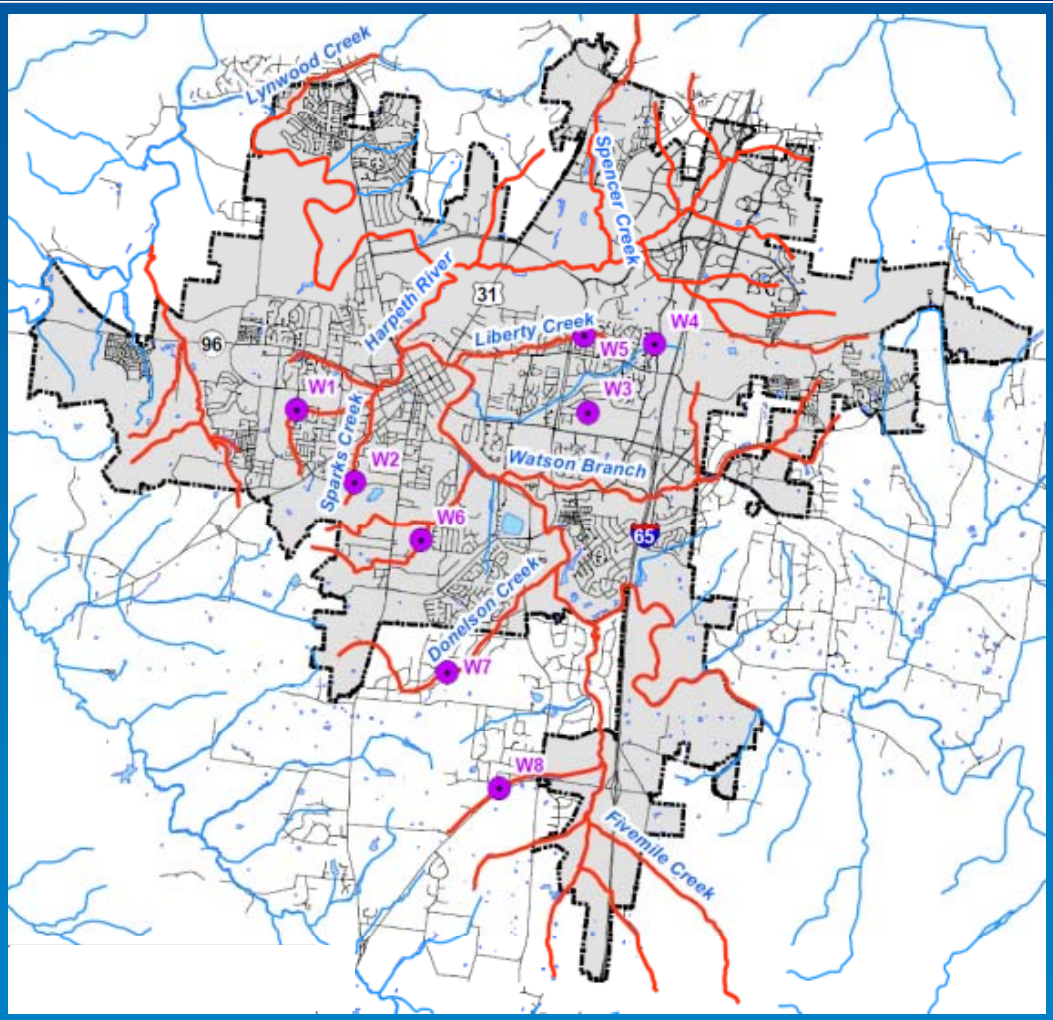
# Stormwater Master Planning for Franklin

- 11 subbasins
- Studied by CDM between 1998 and 2006
- Primarily focused on flooding issues
- Re-evaluate to consider potential water quality improvements



# Water Quality Impairments and BMP Locations

- 87 stream miles impaired within City limits
  - Siltation, nutrients, habitat loss, low DO, bacteria, etc.
- 8 potential BMP location opportunities (from past plans)



# Potential Pollutant Removal Benefits of Proposed BMP Projects

- Total Nitrogen Reduction Potential:
  - 2,500 to 5,900 lbs/yr
- Total Phosphorus Reduction Potential:
  - 400 to 1,200 lbs/yr
- Total Sediment Reduction Potential:
  - 290 to 350 tons/yr

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# ECOLOGICAL RESTORATION

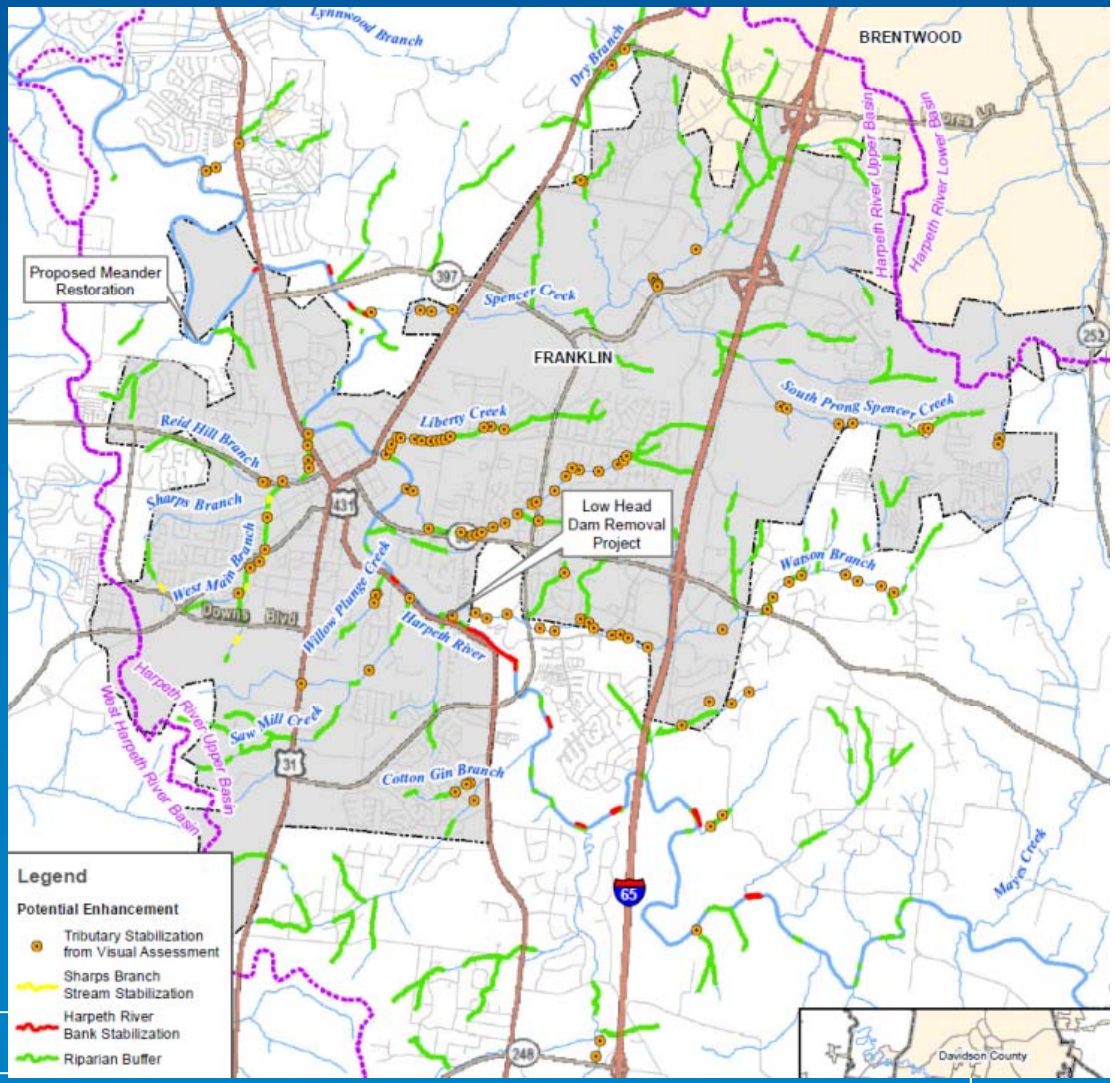
# Benefits of Restoration/Stabilization

- Reduced bank erosion and subsequent channel sedimentation;
- Filtering of runoff before it enters the stream; and
- Improved wildlife habitat;
- Improved aesthetics for recreation;
- Stream temperature reduction from tree shade.
- Improved connection with and contributions from terrestrial flora and fauna;

Source: Volunteer Stream Bank Erosion Study (HRWA)

# What is the Scale of the Problem in Franklin?

- CDM collected data from a variety of local sources:
  - Previous CDM drainage basin studies
  - Visual Stream Assessments (VSA) performed by City staff
  - Harpeth River Watershed Association (HRWA) studies
  - Desktop GIS evaluation using aerial photography




CDM

# Applicable Treatment Levels to Address Impairments

- Stream restoration
  - Return pre-disturbance hydrologic function
  - Difficult for large systems
- Bank stabilization
  - Restore conveyance functions, reduce erosion, improve condition
- Riparian restoration
  - Planting of native vegetation to provide buffer (per City code)
- Cattle exclusion
  - Cost effective source control
  - Applicable to less impacted reaches

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# WATER CONSERVATION

# Benefits of Water Conservation

- Reduction in operation and maintenance costs:
  - Lower user of energy for pumping
  - Less chemical use in treatment and disposal
- Reduced purchases from wholesalers
- Delaying of capital facilities projects

# Effective Conservation Programs

- Hardware Replacement and Rebates
- Irrigation Technologies
- Education, Information, and Awareness
- Audits and Accountability Measures
- Conservation Rate Structures

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# ROBINSON LAKE EVALUATION

# Background and Purpose

- Robinson Lake located adjacent to Harpeth River
- Evaluate potential to use lake storage volume to augment seasonal low flows in Harpeth
- Identify recommended flow rate and drawdown time


CDM

# Proposed Improvements & Results

- Raise dam to provide additional storage
- Construct new intake and spillway
- Design discharge for lake
  - Target difference between typical low-flow condition (3.78 MGD in September) and minimum stream withdrawal limit for plant (10 cfs or 6.46 MGD)

| Flow Rate (MGD) | % of Differential Flow[1] | Duration[2] (Days) |
|---|---|---|
| 0.5 | 8% | 28.8 |
| 1 | 48% | 14.4 |
| 1.5 | 64% | 9.6 |
| 2 | 80% | 7.2 |
| 2.5 | 96% | 5.8 |
| 2.68 | 100% | 5.4 |

*Notes:*

- *2.68 MGD is difference between minimum river flow specified by the 2007 Aquatic Resource Alteration Permit of 6.46 MGD (10 cfs) and median low flow in September of 3.78 MGD (Phase I, 2010).*
- *Duration based on an available volume of 12.6 million gallons.*

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## HARPETH RIVER WATER QUALITY MODELING STATUS

# Overview

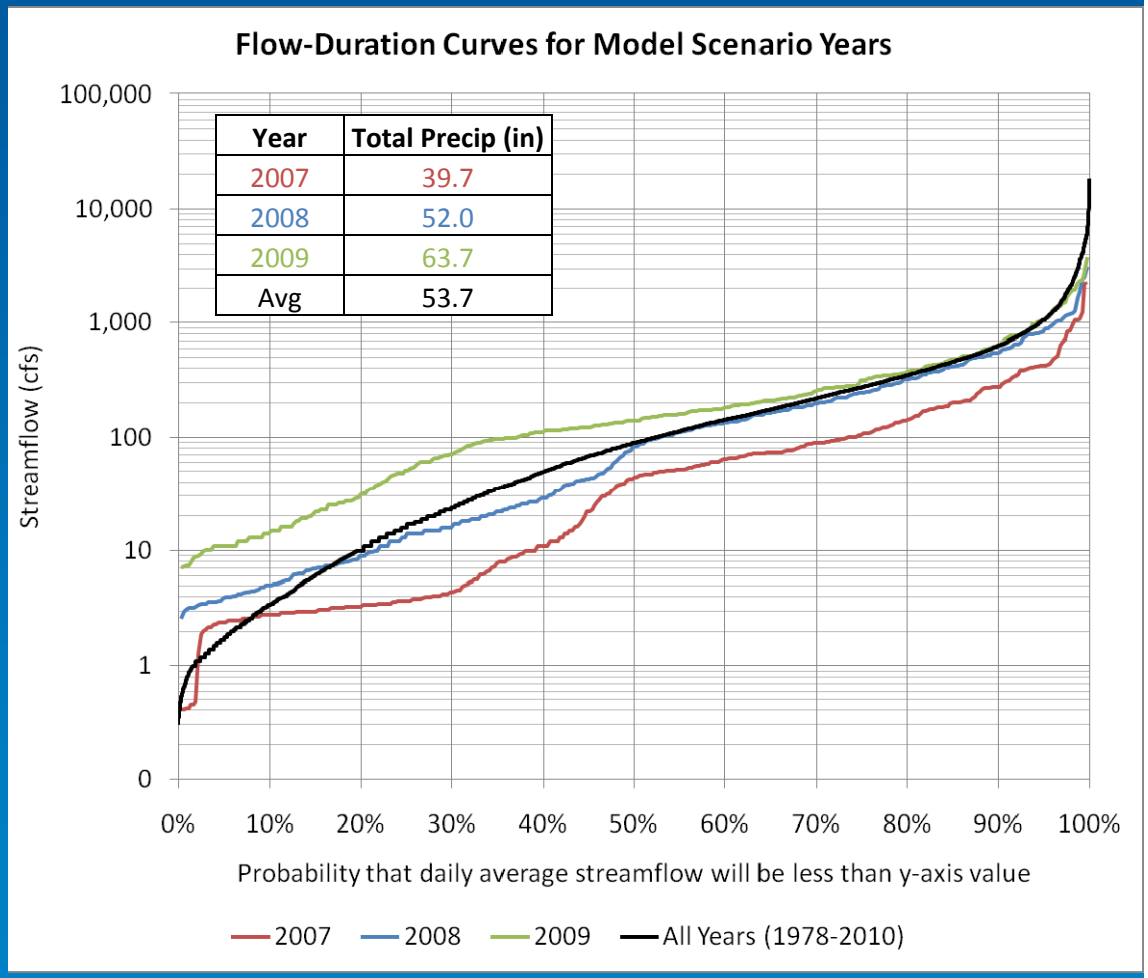
- Water quality questions related to IWRP
- Scenarios to be analyzed
- Review of model selection
- Performance of RMS model
- Data extension progress
- Validation Results
- Next steps

# 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 likeliest 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?

# Planned Scenarios

- Quantifiable Alternatives:
  - Wastewater plant(s)
  - River withdrawals
  - Reuse dependence
  - Stormwater controls
  - Others
- Hydrologic conditions:
  - Dry Year
  - Wet Year
  - 'Normal' Year
- Upstream conditions:
  - DO standards met
  - DO standards not met



# Current Steps for WQ Modeling

- Water quality validation (2002, 2006)
  - We have identified key parameters with TDEC
  - We have collected data from TDEC, Franklin, and HRWA
  - We have qualitative observations on attached algae
- Input data extension for 2007-2009 (alternatives analysis)
  - Flows
  - Boundary conditions pollutant loads
- Scenario analysis with alternatives (wet / dry / normal)

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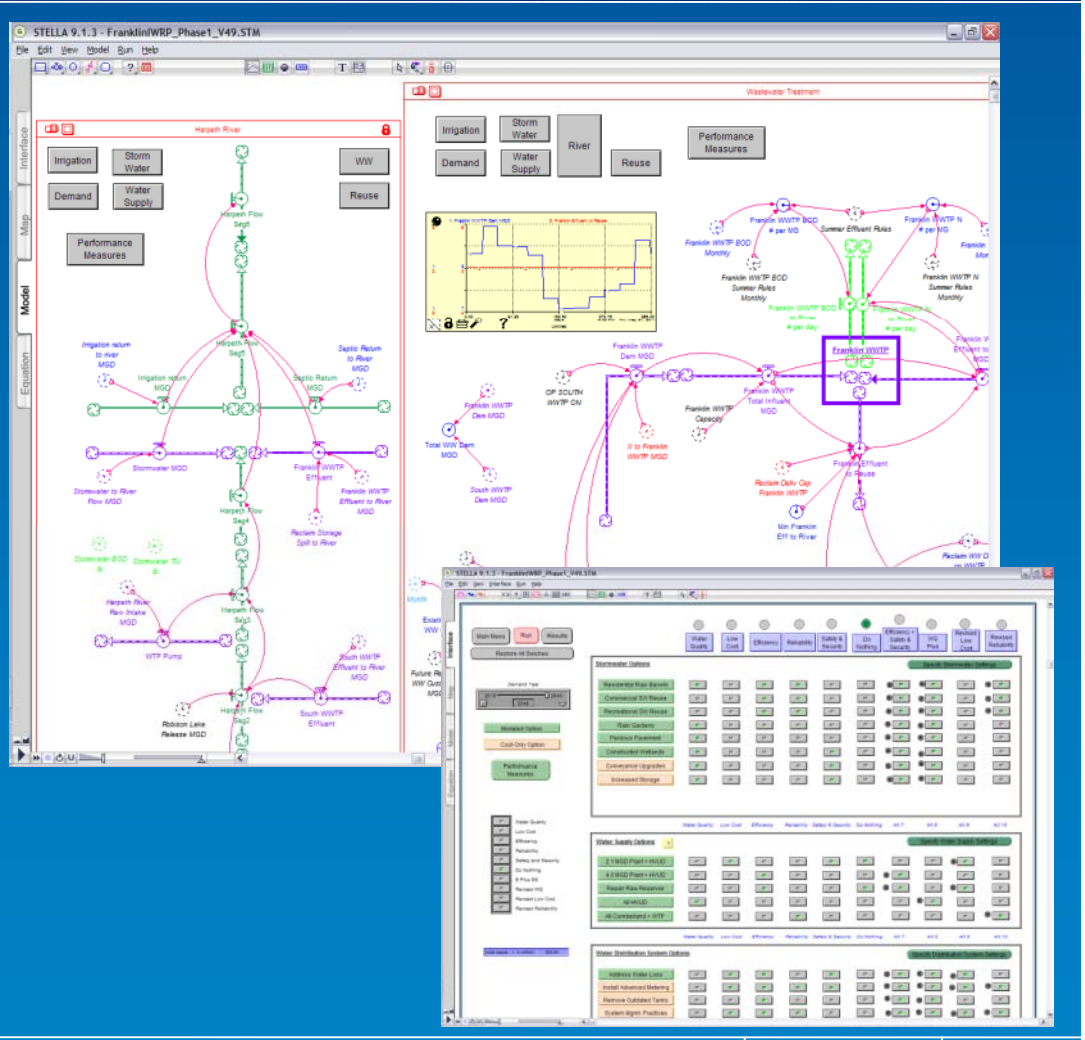
# OVERVIEW OF STELLA MODELING AND CDP

# Updates to Integrated Model

Update inputs:

- Unit costs ($ per gallon treated, etc)
- Capital and maintenance costs
- Unit energy requirements (kWh per gallon treated or pumped, etc)
- Treatment capacities
- Inflow/Infiltration estimates
- Stormwater BMP performance
- Complex phasing of capital projects
- Effluent concentrations



# Next Steps

- Completion of Technical Evaluations
- STELLA Modeling
- Public Forum
- Stakeholder Workshop 6
- Conceptual Designs
- Report Generation