Texas Association of Clean Water Agencies

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NTMWD's Approach to Long-Term Water Resource Recovery Planning

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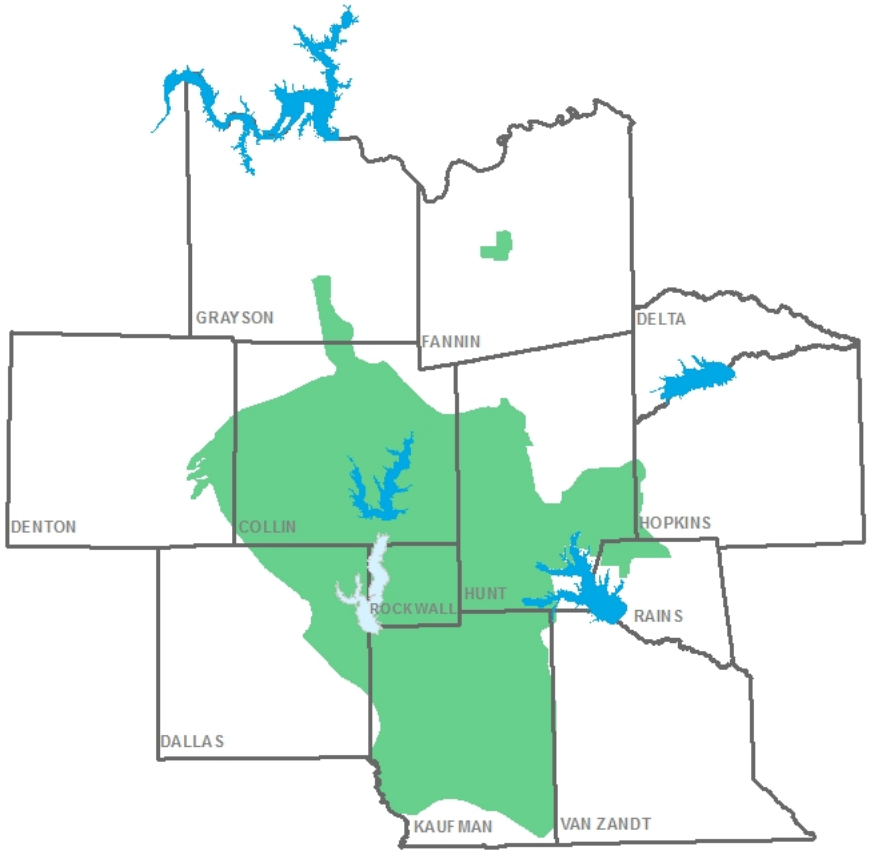
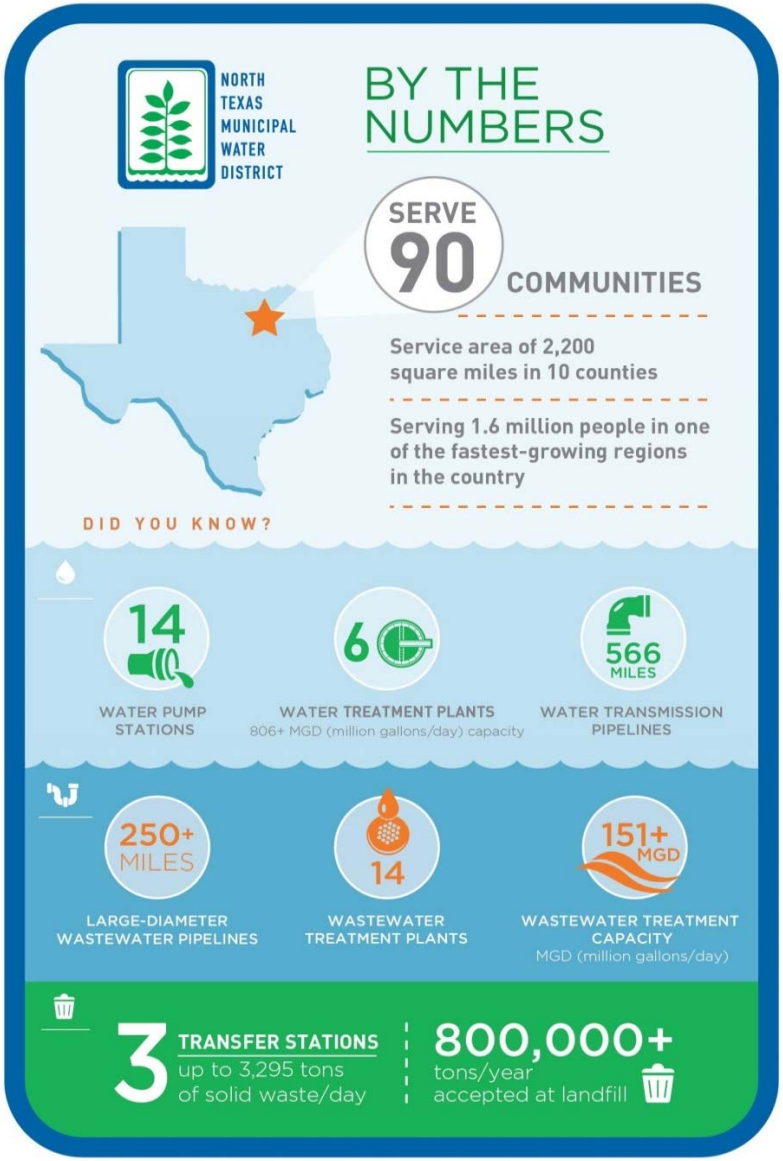
NORTH TEXAS MUNICIPAL WATER DISTRICT

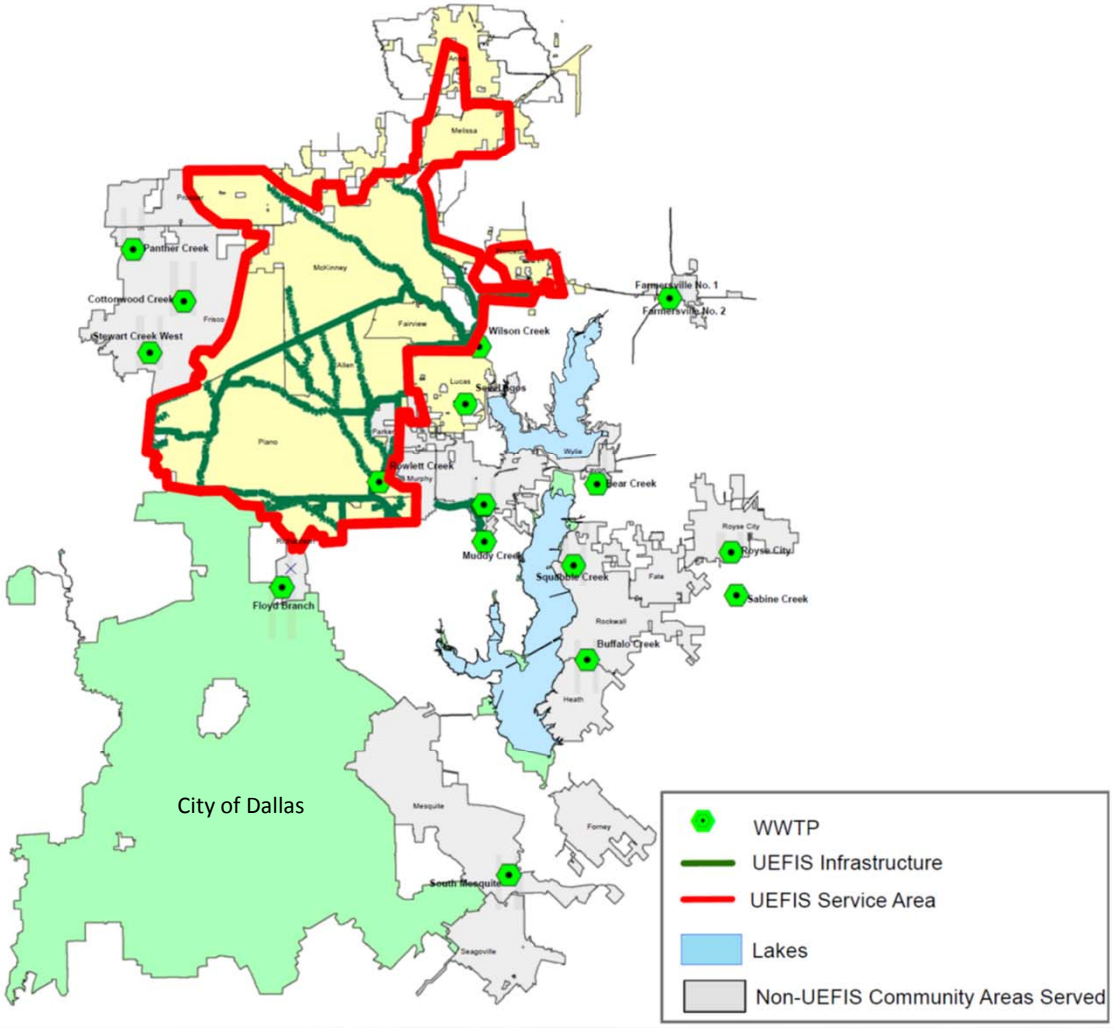
ch2m SM

North Texas Municipal Water District Overview



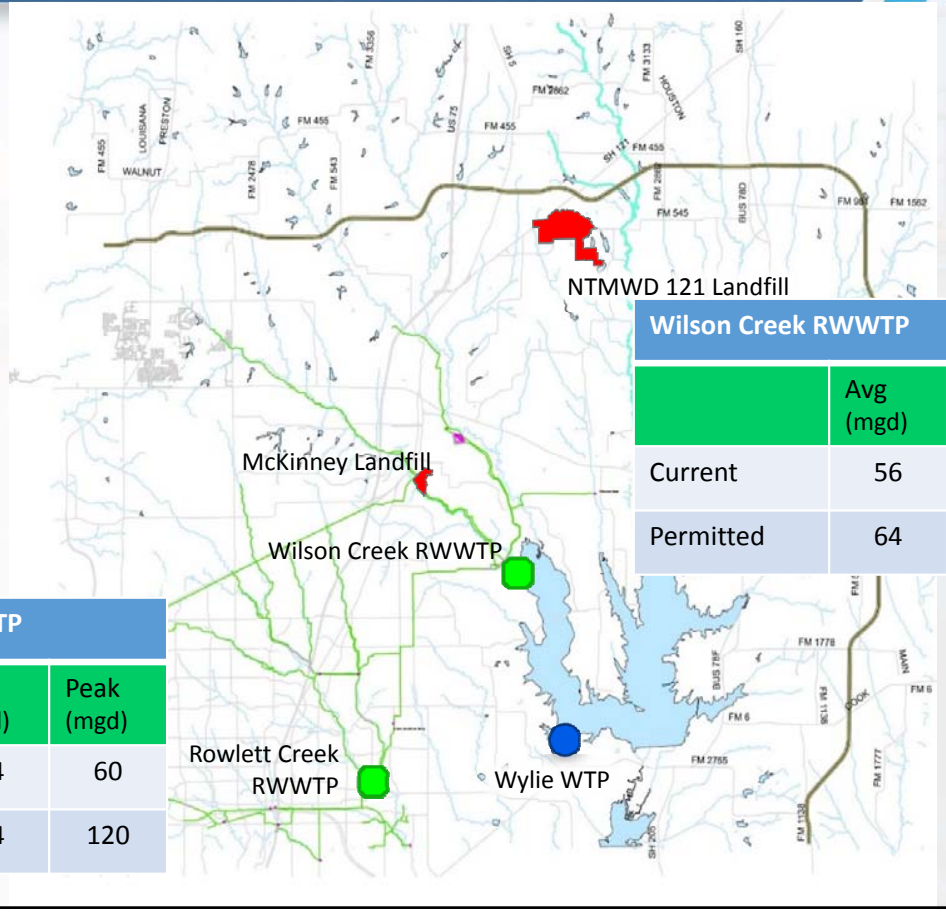


UEFIS Largest of Multiple NTMWD WW Service Areas



UEFIS Regional WWTPs Approaching Permitted Capacity

- Wilson Creek RWWTP Capacity
  - *56 mgd annual average daily flow (AADF)*
  - *Expanding to 64 mgd AADF*
  - *TCEQ permit up to 64 mgd AADF*
- Rowlett Creek RWWTP
  - *24 mgd AADF*
- Combined future RWWTP capacity of 88 mgd AADF

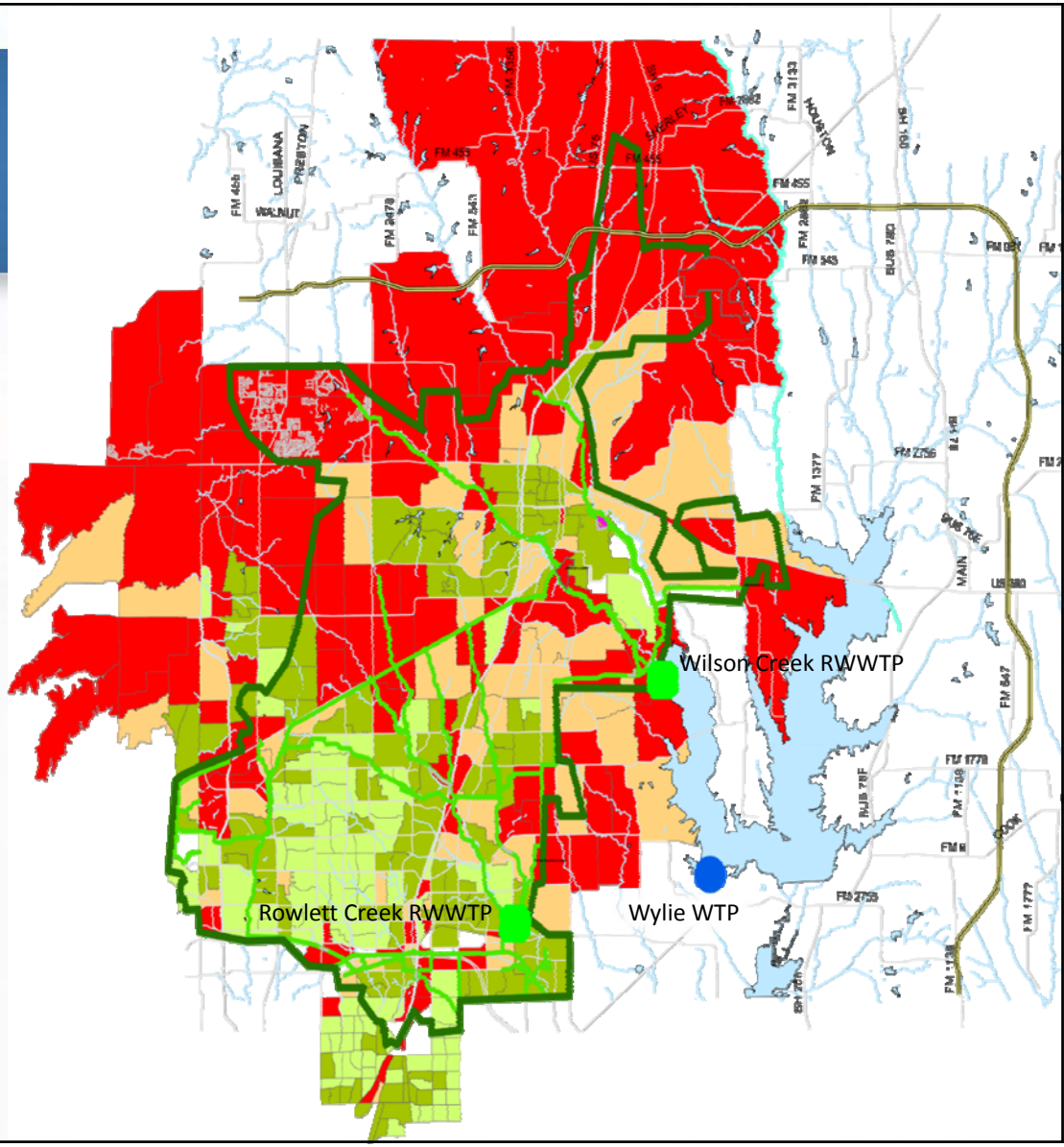


Wilson Creek RWWTP	Avg (mgd)	Peak (mgd)
Current	56	172
Permitted	64	224

Rowlett Creek RWWTP	Avg (mgd)	Peak (mgd)
Current	24	60
Permitted	24	120

Rapid Wastewater Flow Growth Projected

- Population of UEFIS projected to almost double by 2040
  - » *~600,000 to ~1.1 M*
  - » *Flows increasing quickly*
- Growth concentrated in northern/eastern areas of UEFIS
  - » *Served by Wilson Creek RWWTP*
- Amended TCEQ discharge permit required for expansion beyond 64 mgd or new permit for new plant



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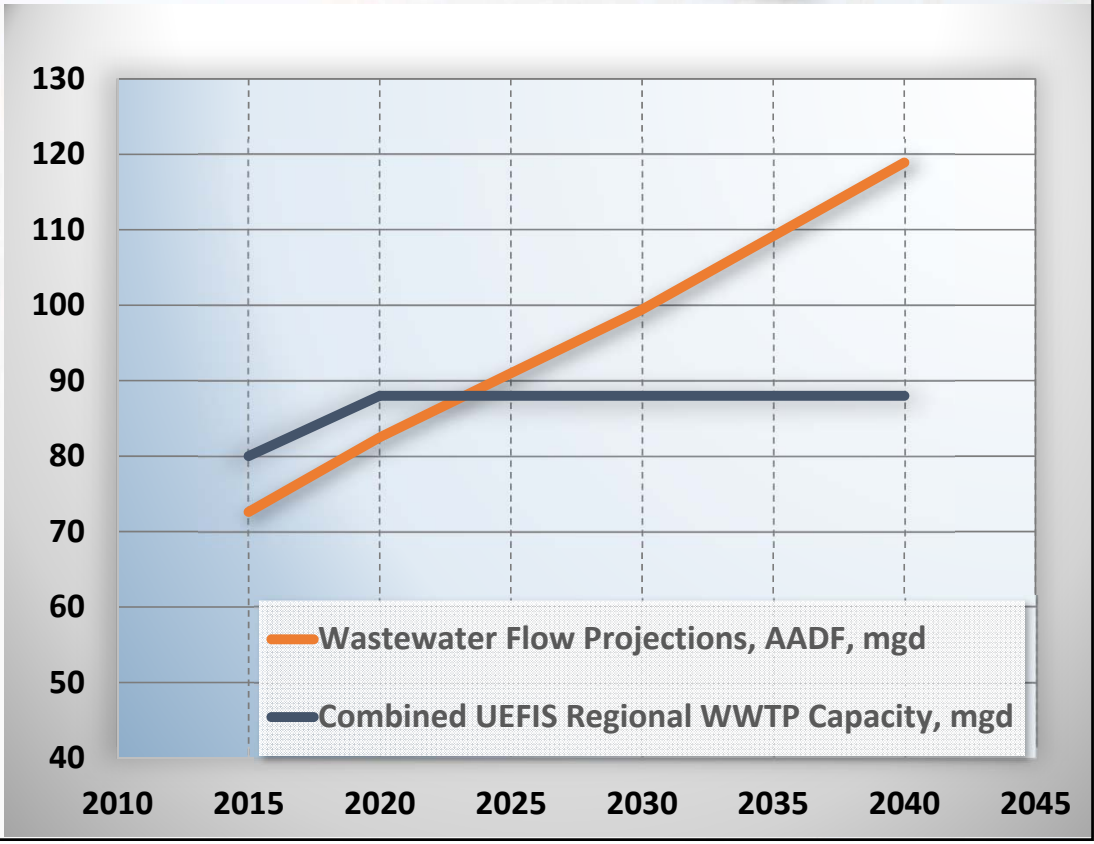


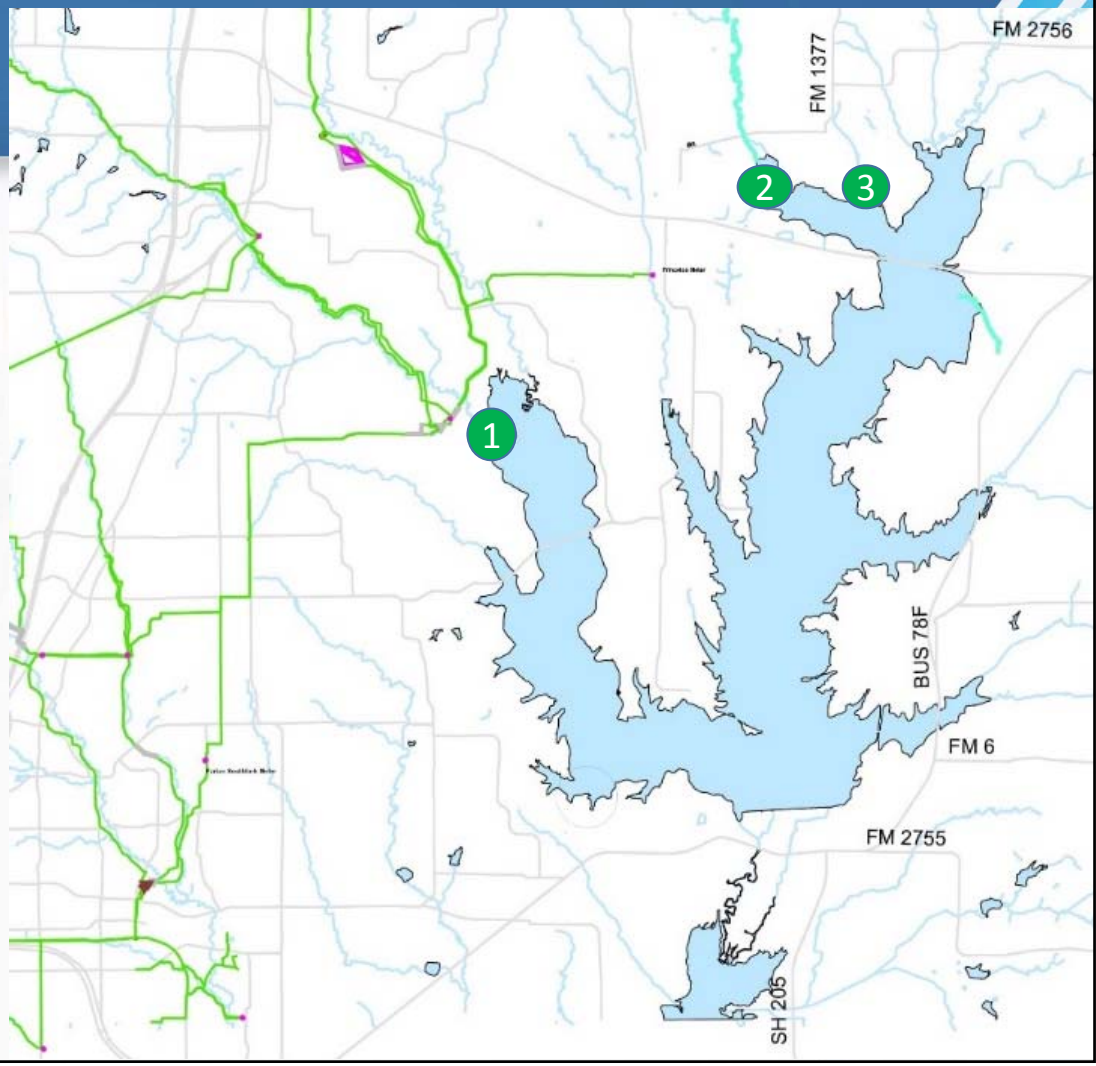
Project Objective – Plan to meet 50-year UEFIS Regional WWTP Capacity Needs

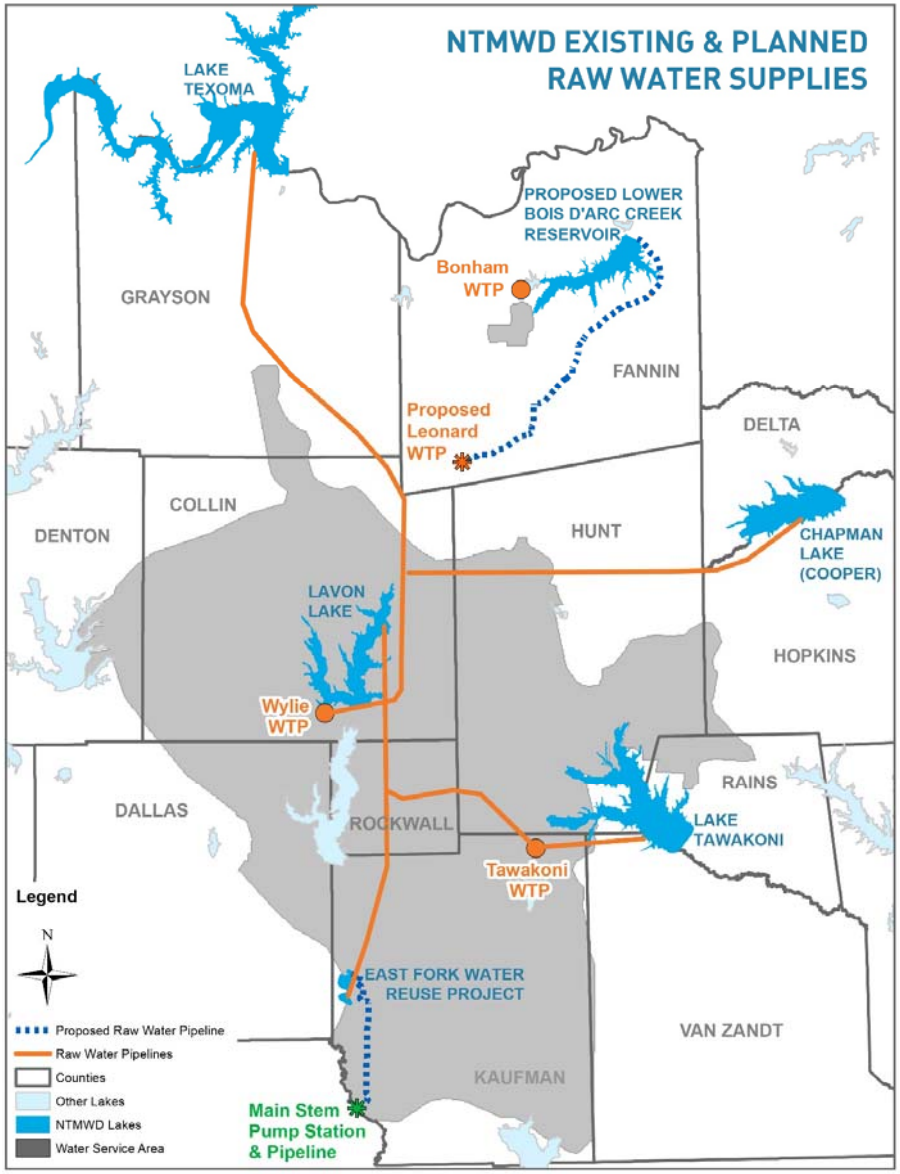
- Accommodate Growth:
  - » *From 600,000 to 1M customers by 2040 in the UEFIS*
  - » *Addition of future customers*
- Maintain Lavon Lake water quality
  - » *Meet future regulatory requirements*
- Consider Biosolids Processing, Conveyance, Treatment implications on overall alternative capital/life cycle costs.

The Regional WWTP Conceptual Design to guide best value decisions for a "future proof" long-term strategy and an "actionable" short-term implementation plan.

Conceptual Design Study to Determine Path Forward to Address Capacity Needs

1. Expand Wilson Creek RWWTP – existing permitted discharge location
2. Expand Wilson Creek RWWTP – secondary permitted discharge location, Sister Grove arm
3. Design new RWWTP – Sister Grove arm discharge location





Existing and Planned Raw Water Supplies – Multiple Sources into Lavon Lake

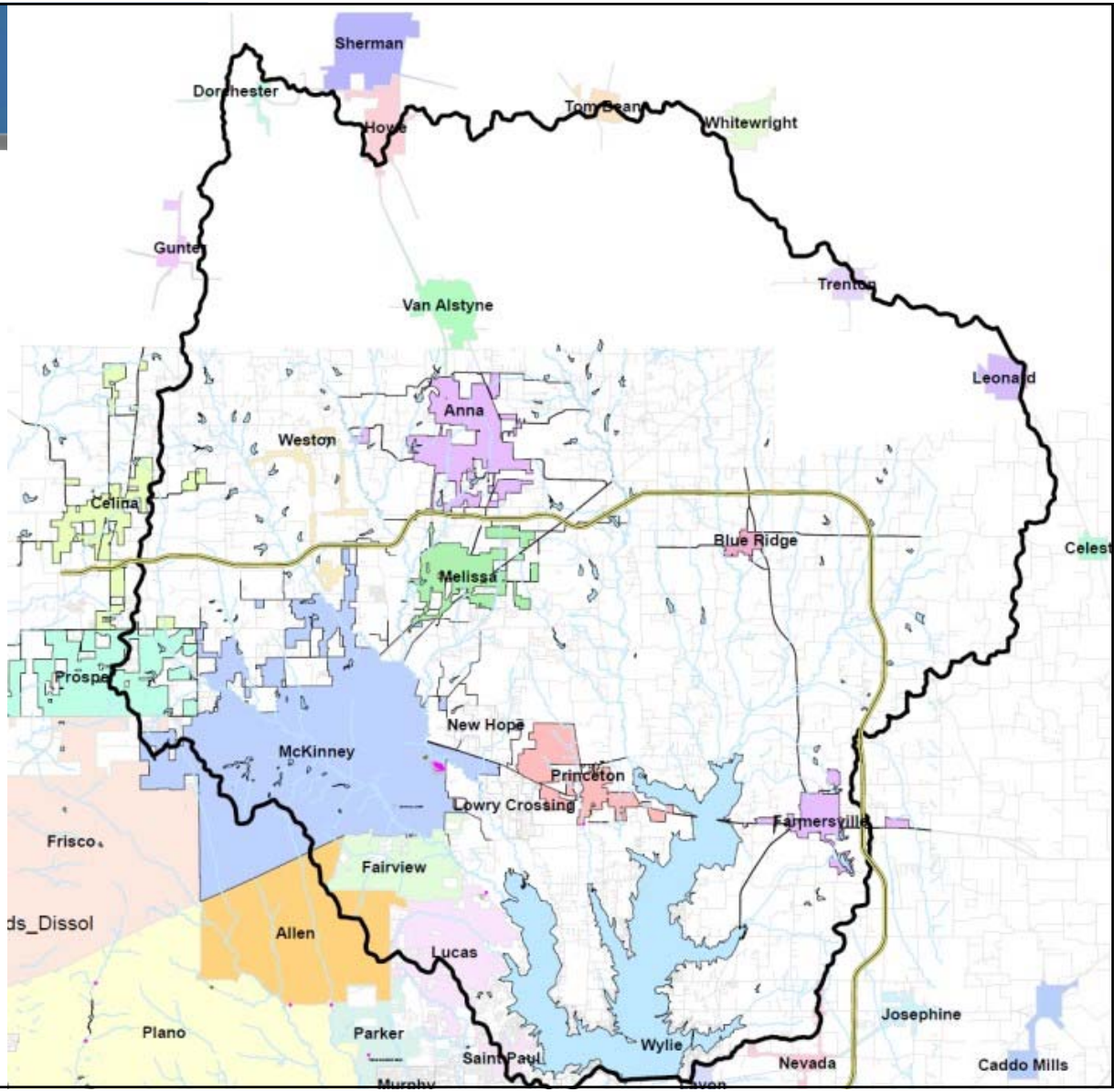
Existing:

- Lavon Lake
- Lake Texoma
- Lake Tawakoni
- Chapman Lake
- Reuse/Wetland

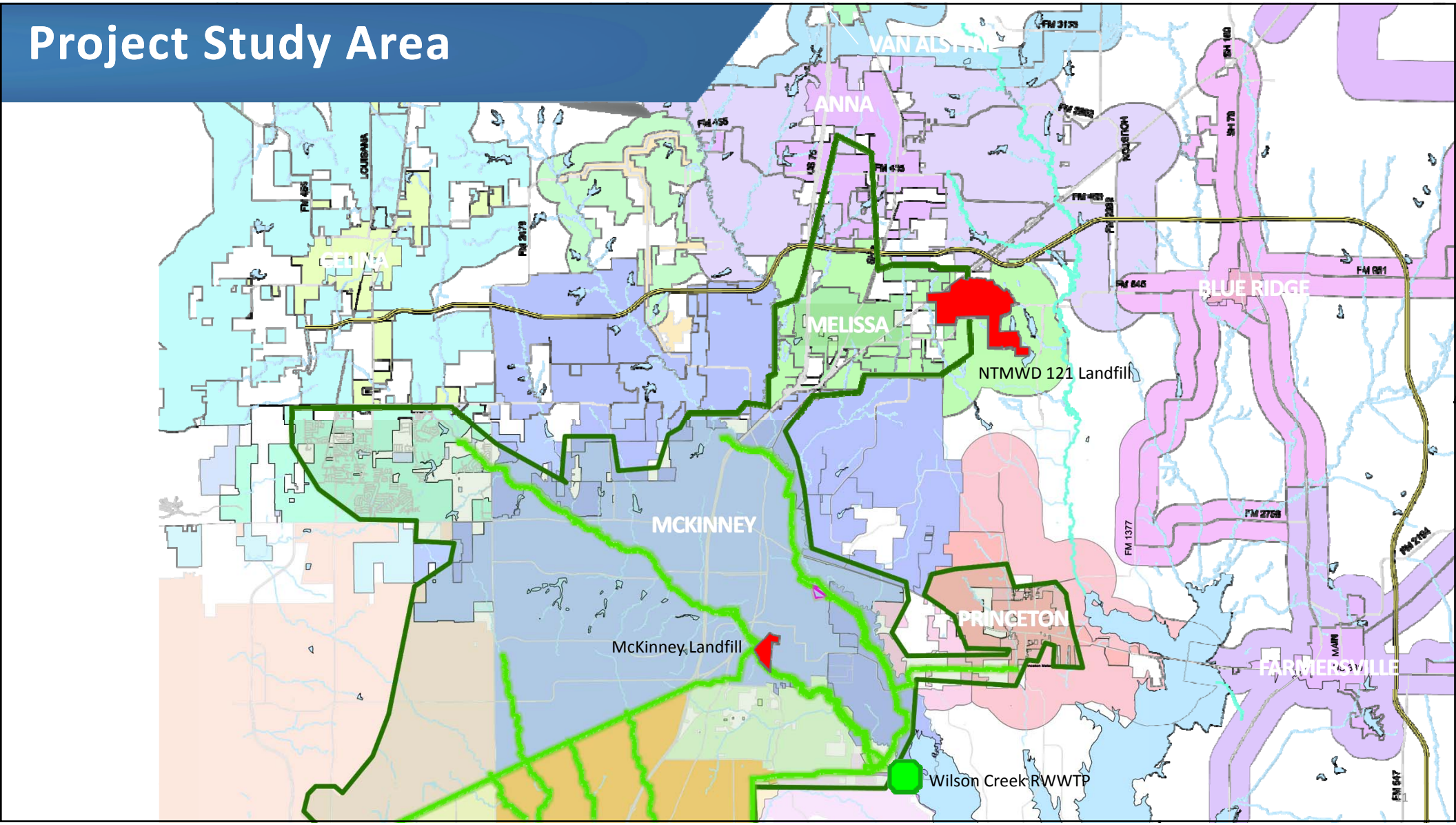
Proposed:

- Lower Bois d'Arc Creek Reservoir

Project Study Area



Project Study Area



A defensible solution must consider wide range of scenarios

- *"Future-proof" long-term strategy*
- *"Actionable" short-term implementation recommendations*

Voyage™ model leverages various model inputs for system assessment

Voyage™

Water Balance Model
- Historical Data
- Scenario Management
- Operating Rules
- Water Balance Model
- Outputs

Cost Calc Workbook
- Output Data
- Capital and O&M Costs

Water Quality Analysis Model (CEQUAL-W2, QUAL-TX, WASP)

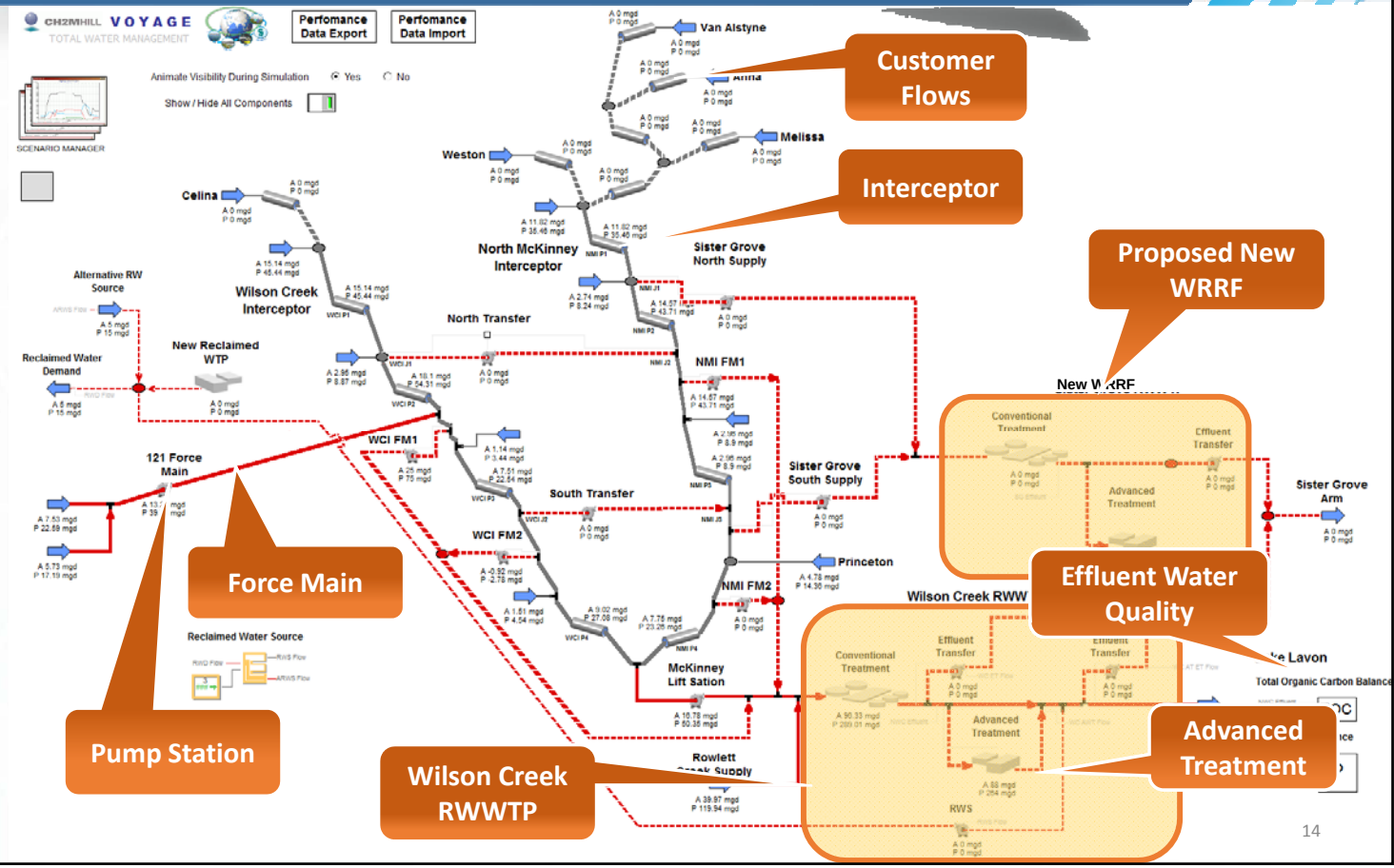
Biosolids Model

Conveyance Model (InfoSWMM)

RWWTP Process Model (Pro2D)

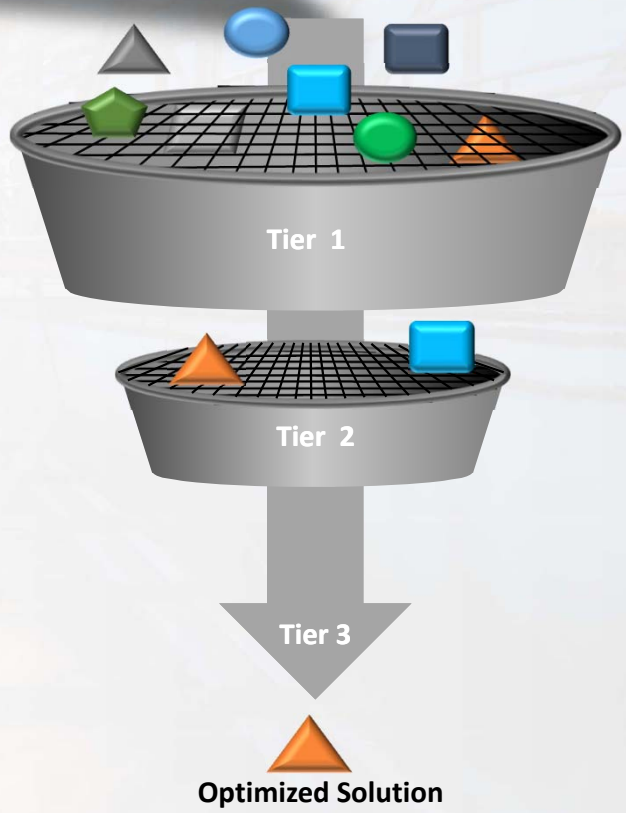
NTMWD Voyage™ Model

- Customer Flows
- Collection & Transmission
  - *Gravity Sewers*
  - *Force Mains*
  - *Pump Stations*
- Treatment
  - *Wilson Creek RWWTP*
  - *Advanced Treatment*
  - *New Water Resource Recovery Facility (WRRF)*
- Lavon Lake water quality impacts on permitting/treatment requirements
- Biosolids processing facility impacts
- Capital/O&M costs



Tiered decision process to facilitate comprehensive evaluation of RWWTP Conceptual Design options

- Projected Flows – Current and Potential Future Customers (NTMWD)
- Discharge Location
- Current and Potential Future Water Quality Standards/ Discharge Permit Requirements (APAI)
- Treatment Technologies and Locations
- Biosolids Processing Technologies and Locations
- Non-cost criteria



Planning Approach and Key Issues

50-year planning horizon requires "Future-proof" planning methodology

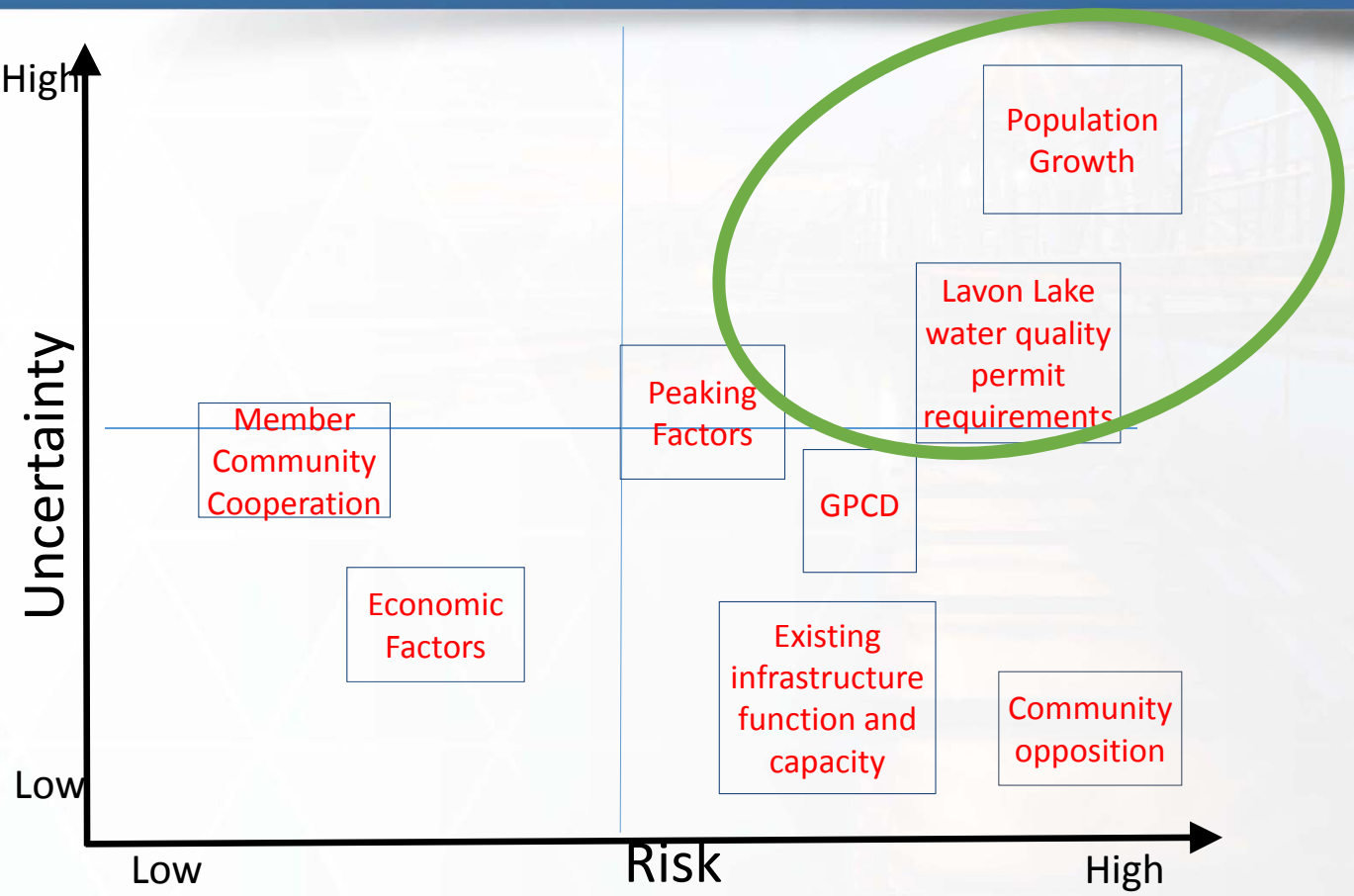
- Scenario Planning – method of planning to evaluate a spectrum of future conditions, considering risk.
- **Scenario** – Unique combination of future conditions that must be met
- How do we identify the driving future conditions (scenarios) to be considered?

Step 1 – Identifying Project Drivers

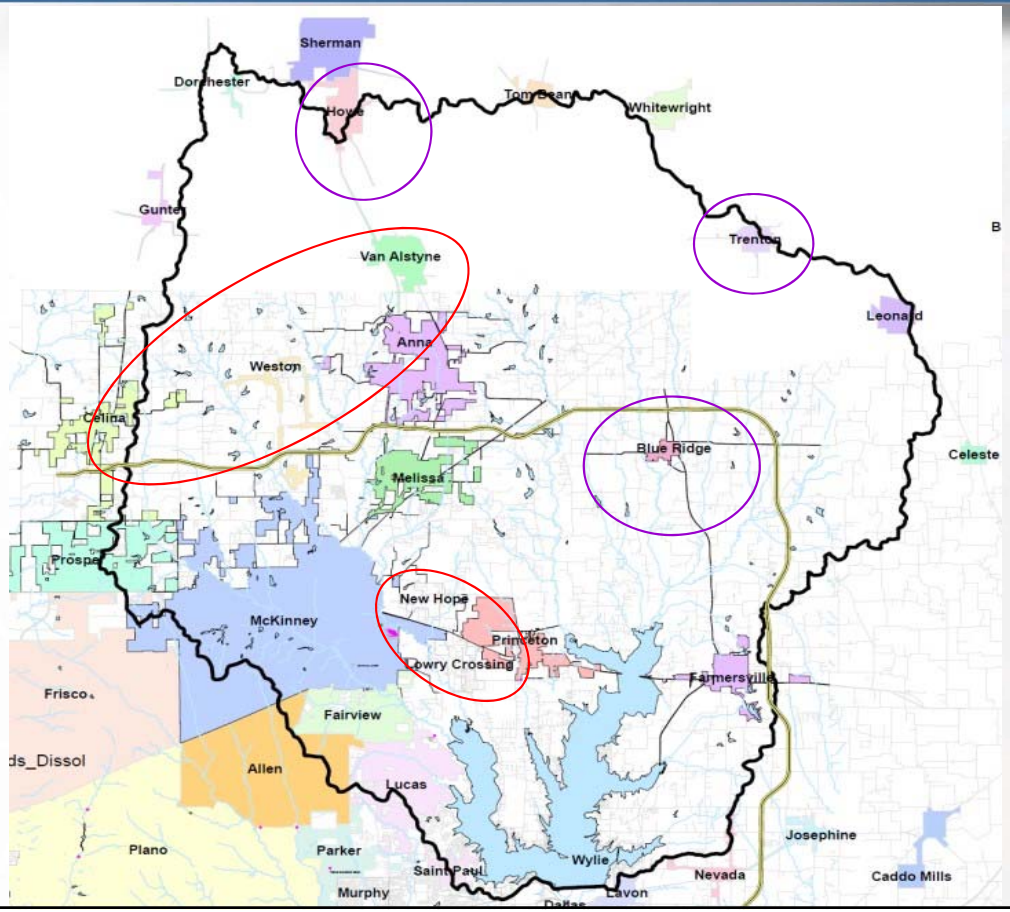
Driving forces - external social, technological, environmental, economic, political and legal (STEEPL) trends likely to influence the strategy selected to meet the project objective.

- Population and economic growth
- Peaking factors in wastewater flow rates
- Per-capita wastewater flows
- Public support for facilities or projects
- Existing infrastructure nearing capacity
- Changing economic factors affecting future costs
- Increased cooperation with Member/Customer communities
- Lavon Lake water quality and effects on future permit requirements

Risk Mapping of Key Uncertainties Identifies Primary Drivers/Defines Scenario Matrix



Population and Customer Scenarios



Lavon Watershed

Tier 1 most probable potential customers

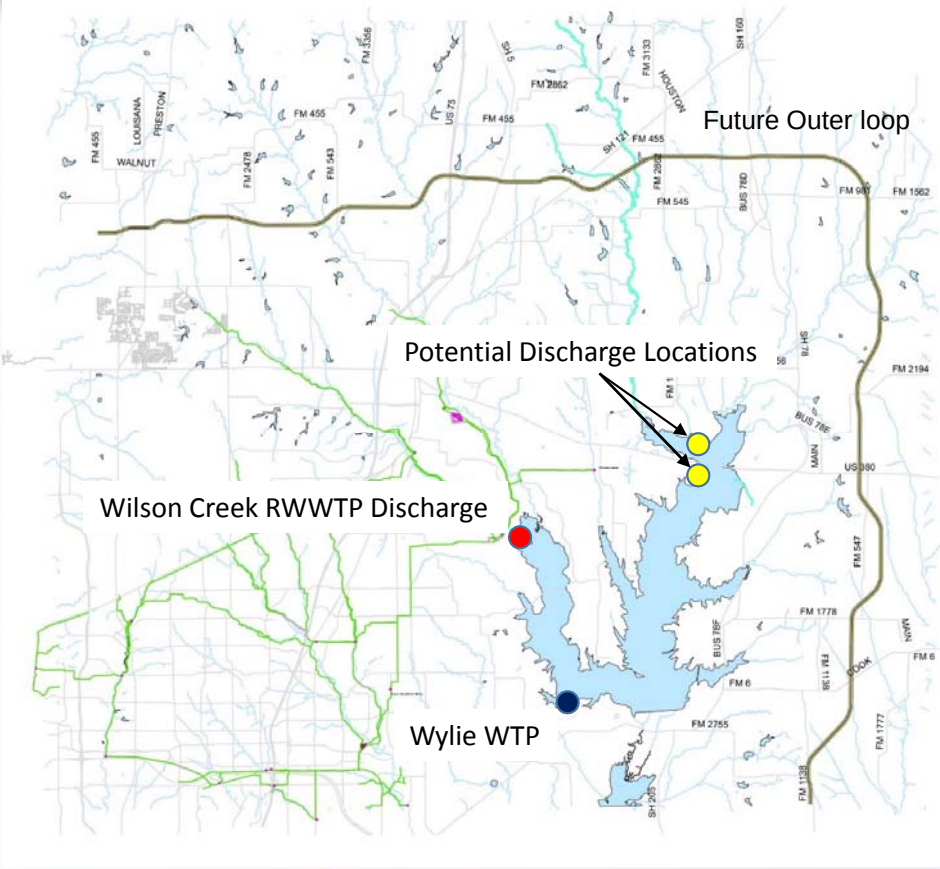
Tier 2 probable potential customers

Key Constituents for Permitting and Water Quality Management

- Dissolved Oxygen
  - » *BOD*
  - » *NH3*
- Chlorophyll-a
  - » *Total Phosphorus*
- TDS

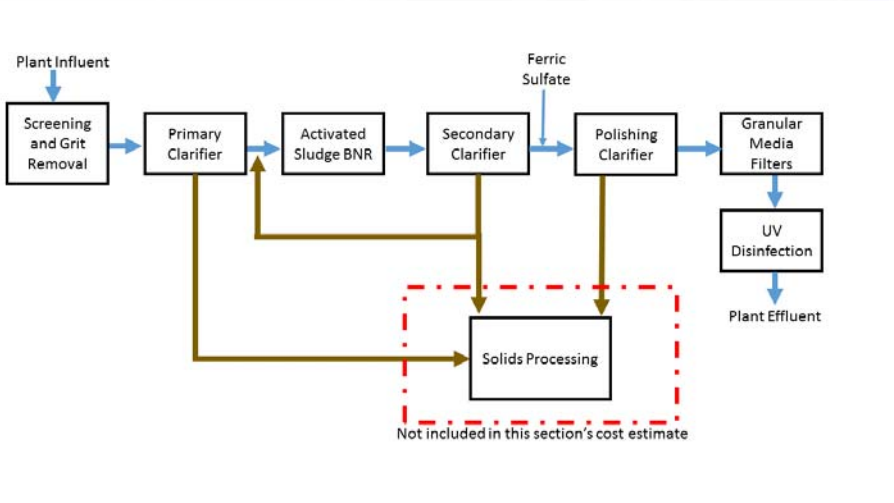
Regulatory Condition Scenarios

- Primary goal of protecting Lavon Lake Water Quality
- **Phosphorus assumed as proxy limiting parameter** by which suitability of treatment technologies for meeting potential for meeting future permit limits is assessed.

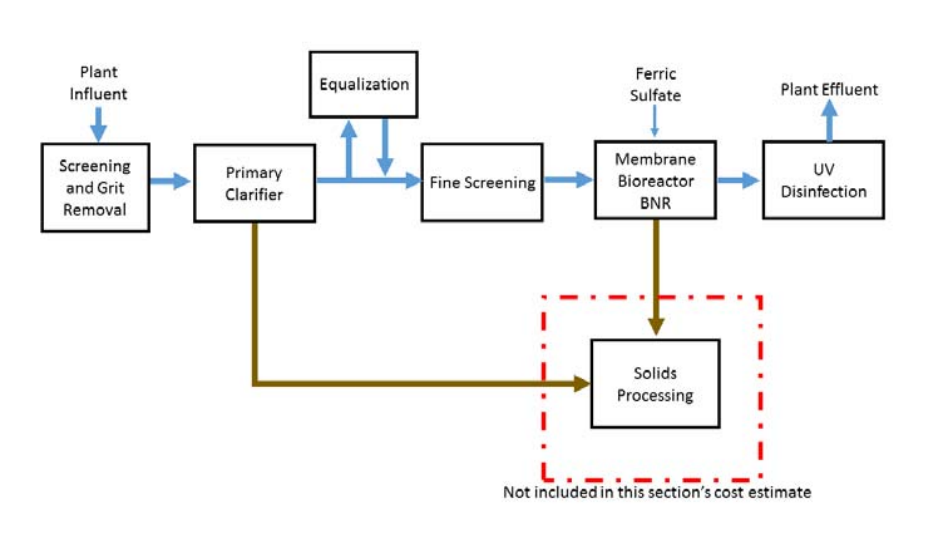


Treatment Approaches

Conventional BNR + Tertiary Polishing



Membrane Bioreactor



- A representative technology was selected for achieving each treatment objective for screening analysis – others are available
- P2HF:AADF ratio of 4.0
- EPA Class 1 reliability requirements
- Upgrade for Wilson Creek assumes addition of tertiary polishing for full plant flow, reusing existing filters

Scenario Matrix for 50-year Planning Assessment

Scenario 2 – Medium Population, Less Conservative P Limit
• Tier 1 and Tier 2 w/ medium projections
  • Projected 1.78 million people served
• Technology driven by use of tertiary clarification and filters
	Scenario 1 – High Population, Conservative Effluent P Limit
	• All Tiers w/ high projections
	  • Projected 2.26 million people served
	• Technology driven by use of membranes

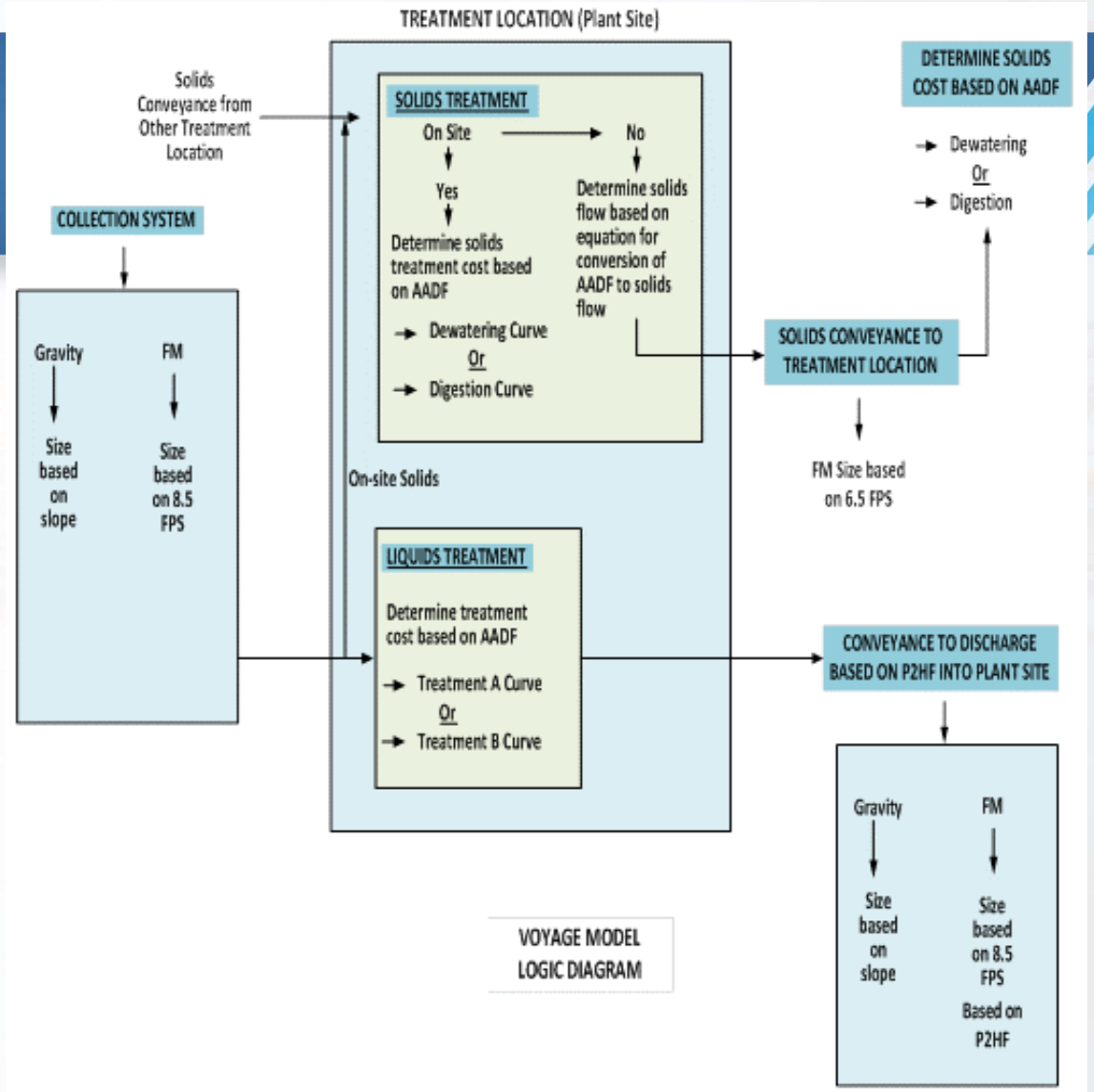
Scenario 4 – Low Population, Less Conservative P Limit
• Existing Cities
  • Projected 1.3 million people served
• Technology driven by use of tertiary clarification and filters
	Scenario 3 – Medium Population, Conservative Effluent P Limit
	• Tier 1 w/ medium projections
	  • Projected 1.61 million people served
	• Technology driven by use of membranes

Biosolids Considerations

- Two major treatment alternatives considered against all scenario conditions:
  - » *Advanced digestion*
  - » *Dewatering/landfilling*
- Alternatives considered:
  - » *Sludge processed on-site (Wilson Creek, Rowlett Creek, New WRRF (if applicable))*
  - » *Sludge processed at Regional Facility*
    - —Takes into account transfers of solids between plants (solids pipelines/pumping)
- Updated capital/O&M costs from 2013 Biosolids Master Plan (power, polymer, trucking)

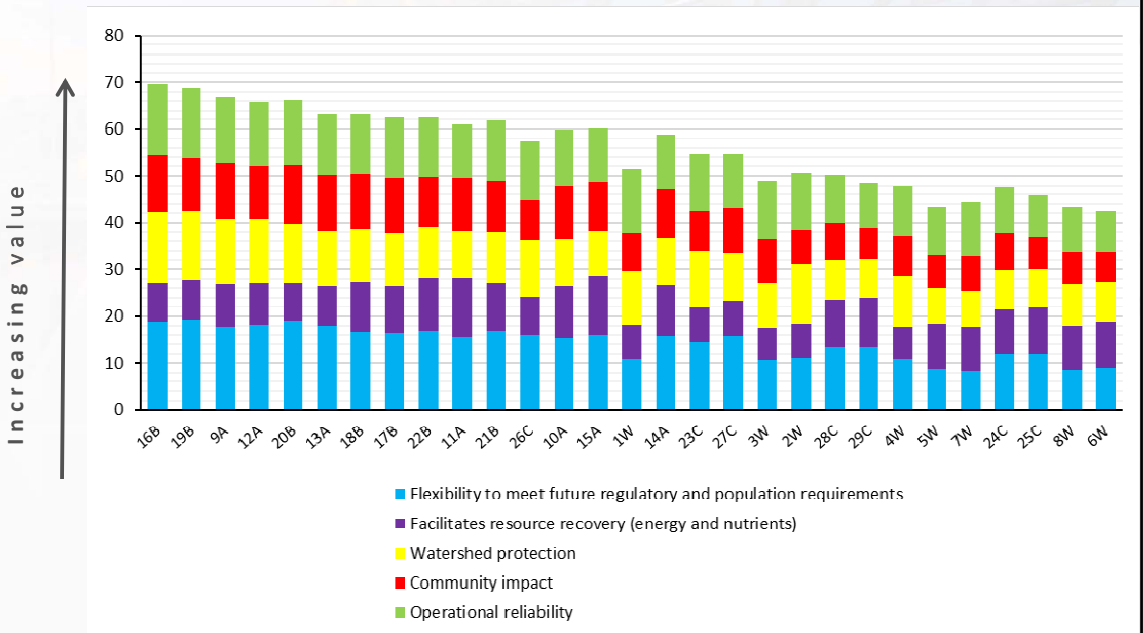
Alternative Assessment

- Assessed 29 total individual alternatives for each year of the planning horizon and for each of the 4 planning scenarios
  - —4 Major WWTP Site/Discharge Options Considered
  - —3 Discharge locations
  - —4 Biosolids Processing Alternative Elements
- Voyage model used in assessment and generated life cycle costs (LCC)

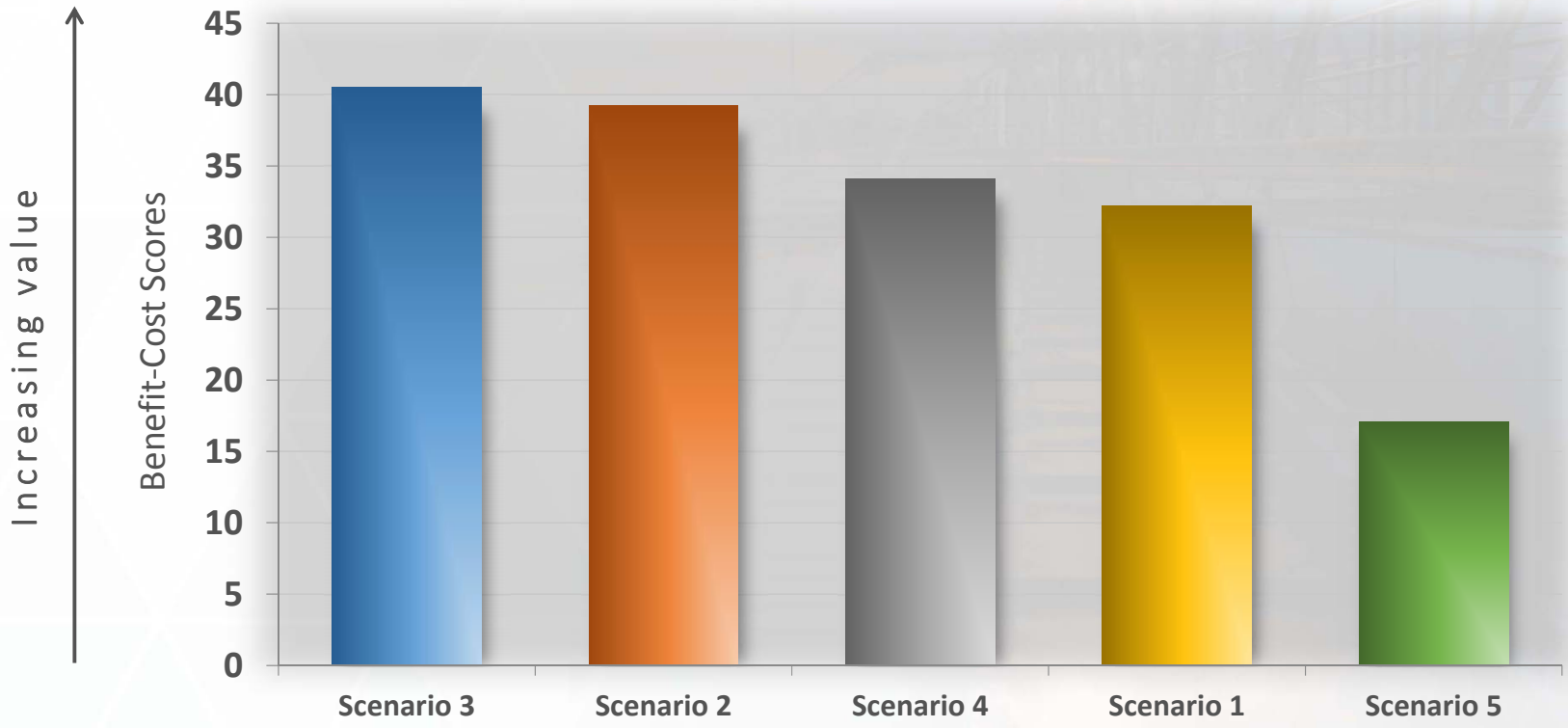


General WRRF Considerations and Non-Cost Criteria

- Non-cost criteria combined with alternative cost results to determine best-value solutions
- Non-cost criteria considered:
  1. *Flexibility to meet future regulatory and population requirements*
  2. *Operational flexibility*
  3. *Watershed protection*
  4. *Community impact*
  5. *Facilitates resource recovery (energy and nutrients)*



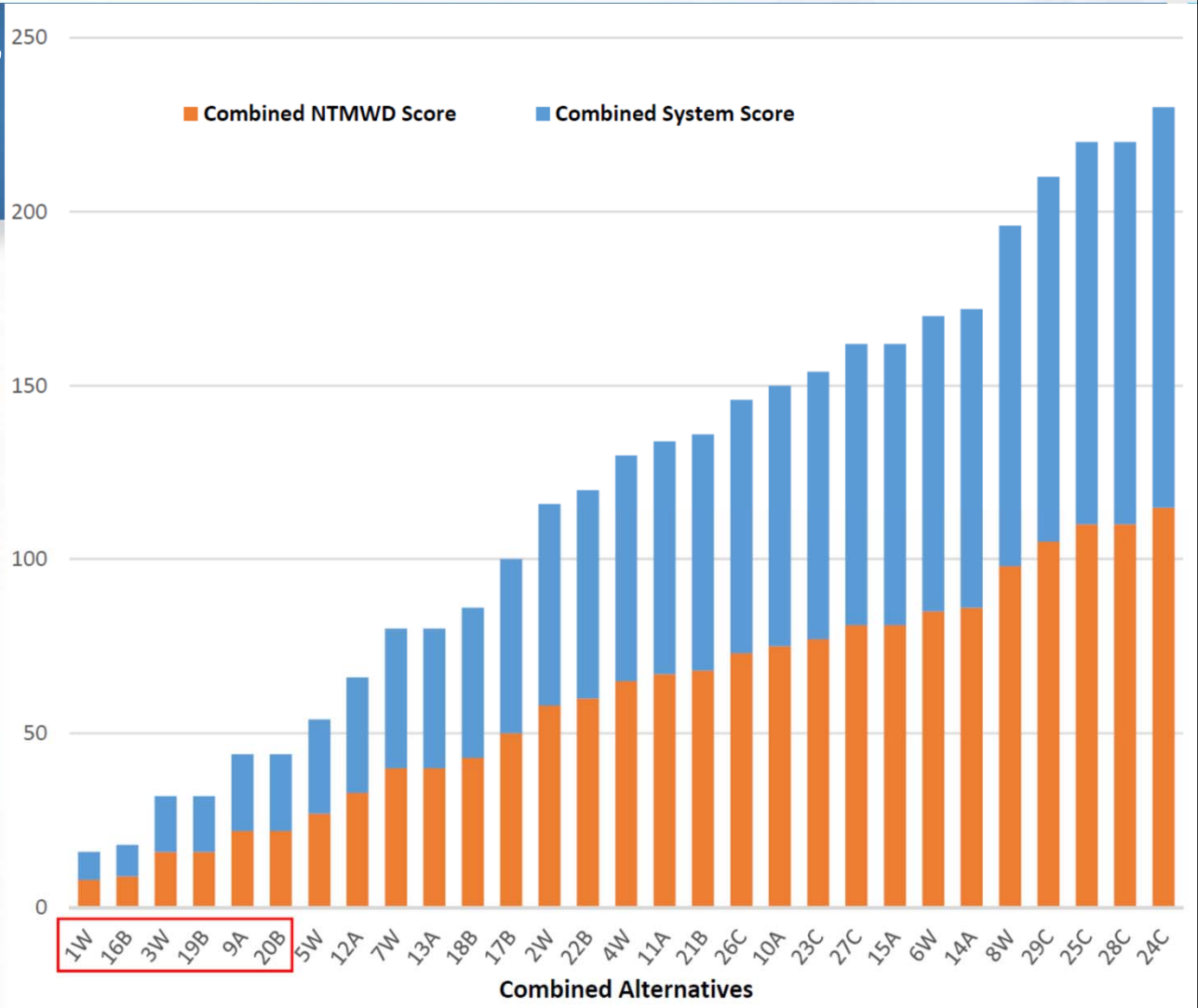
Benefit-cost analysis identifies best balance of monetary and non-monetary criteria



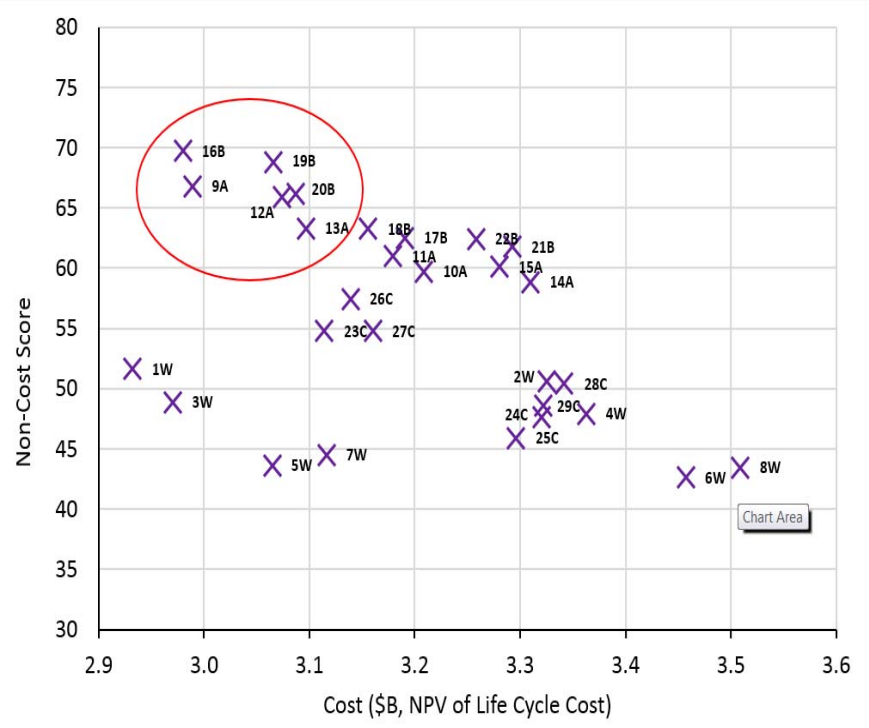
Assessment Results

Best Performing Alternatives, Total System Life Cycle Cost Only

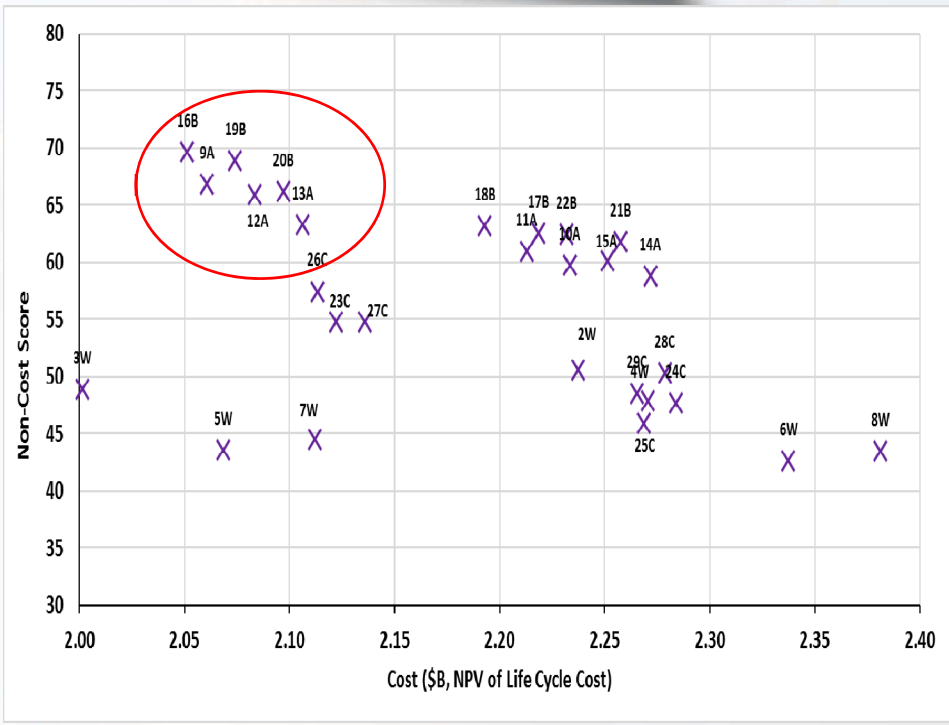
- Wilson Creek Expansion/Existing Discharge alternatives least expensive
- Followed closely by alternatives at Greenfield site “B”



Top-Performing Alternatives – Benefit-Cost Scores



Scenario 1, 2070



Scenario 2, 2070

Top-Performing Alternatives – All Scenarios

- Top-performing alternatives across full range of future conditions considered (scenarios):

Alternative	Plant Location/Solids Processing
16B	New WRRF Site B /Landfill from site generation
19B	76 MGD to WC WWTP, remainder to New WRRF Site B/Landfill from site generation
9A	New WRRF Site A/Landfill from site generation
20B	76 MGD to WC WWTP, remainder to New WRRF Site B/ WC offsite dewatering with landfill, remainder landfill from site generation

Wilson Creek RWWTP Expansion(s)

(not recommended)

- Lake water quality modeling indicates 76 mgd is possible, but not at existing permit limits
  - *additional process improvement likely required to reliably meet DO standard*
  - *% blend/mixing in East Fork Arm*
- Full Expansion to meet 2070 projection, all Tiers, high growth – additional 120 mgd
  - *not feasible long-term due to water quality, land needs, community concerns; relocated discharge cost prohibitive*
- Projections with new customers indicate potential for near simultaneous partial expansion/new WWTP permitting/implementation

Alternatives Recommended for Further Evaluation/Current Status

- Top 2 alternatives
  - » *Site A*
  - » *Site B*
- NTMWD in property acquisition phase
  - » *Some conceptual design comparison of alternatives to facilitate acquisition*
    - —Conceptual costs
    - —Layouts
    - —Land acquisition requirements
- Additional WQ modeling (creek, lake)
- Complete conceptual design study report following site selection/WQ modeling
- Meet with TCEQ/USACE to vet findings/approach
- NTMWD preparing permit application

Questions?