Realistic Water Demand Forecasting in Uncertain Times

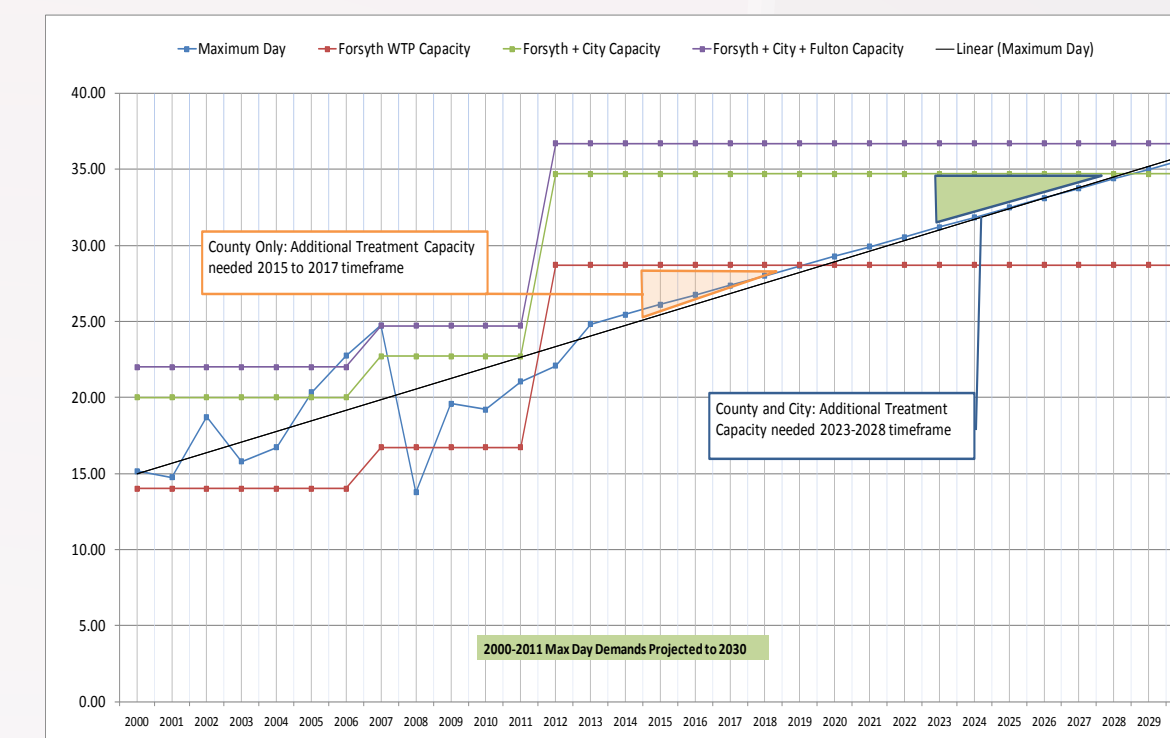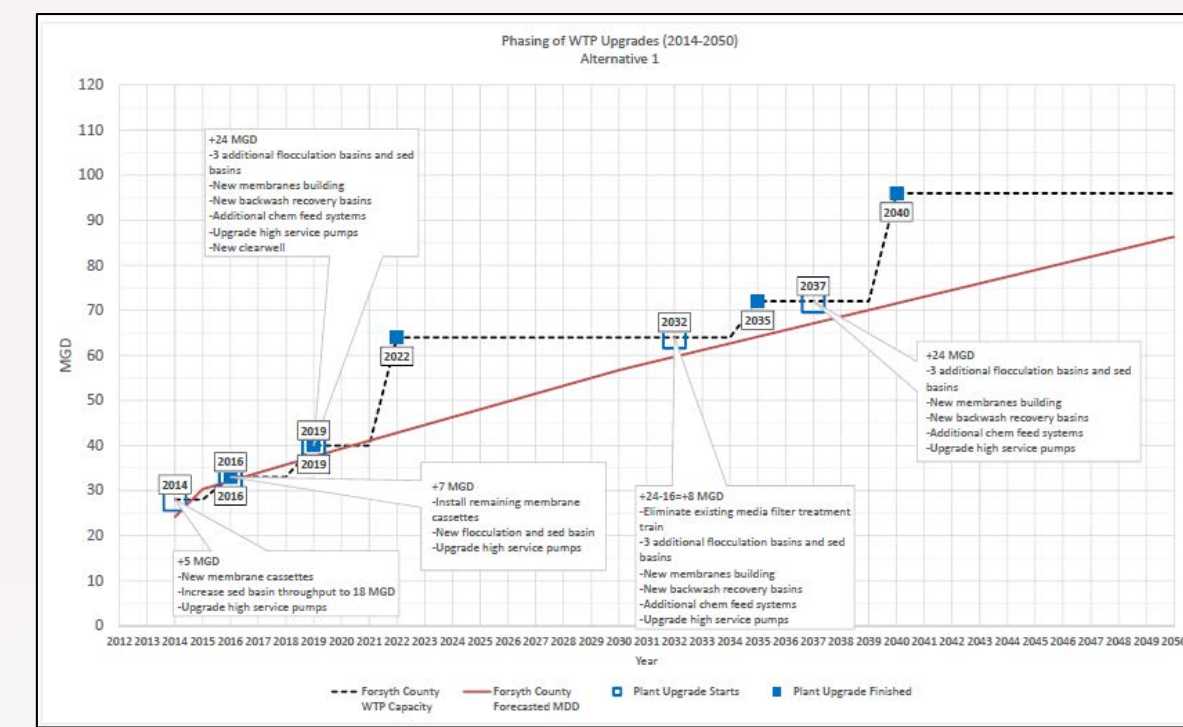October 7, 2015

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Needs for Water Demand Forecasting

All aspect of water system planning
- Water supplies
- Water production and treatment
- Water distribution system
- Wastewater collection system
- Water/sewer rates and finances
- Others?
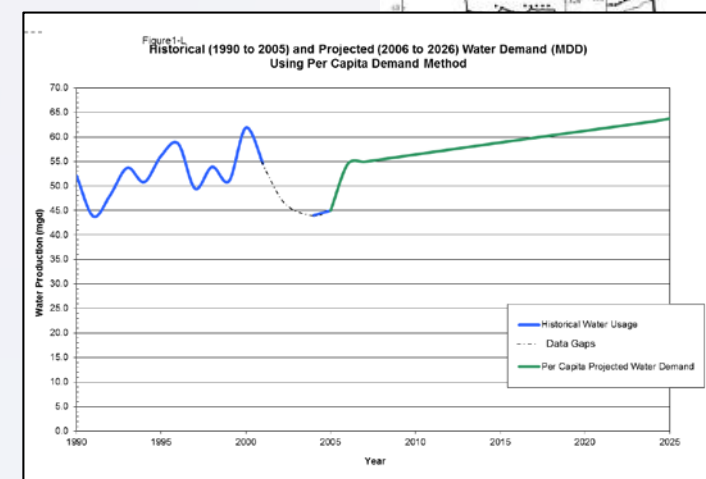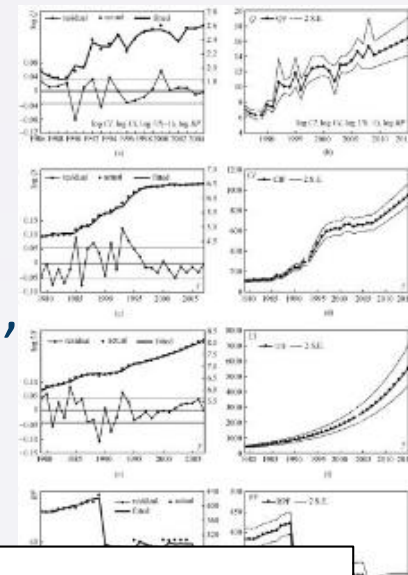
We need a target, right?

Issues with Current Methods

Advanced econometric and land use methods:
- May require significant, complex, expensive, or unattainable data
- These may not be feasible due to cost, data availability, complexity

These are overly simple:
- Rate and Driver method
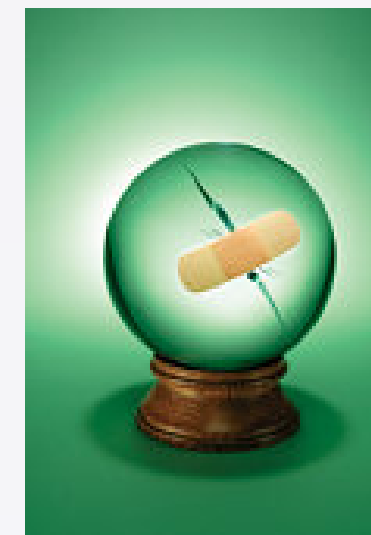- Historical method
- Straight line methods

We Have Been Overestimating
- Efficiency improvements are reducing per capitas
- Water conservation programs and more frequent droughts are changing behaviors
- Decoupling of population growth rate and water demand
- Changing non-domestic water use types and rates
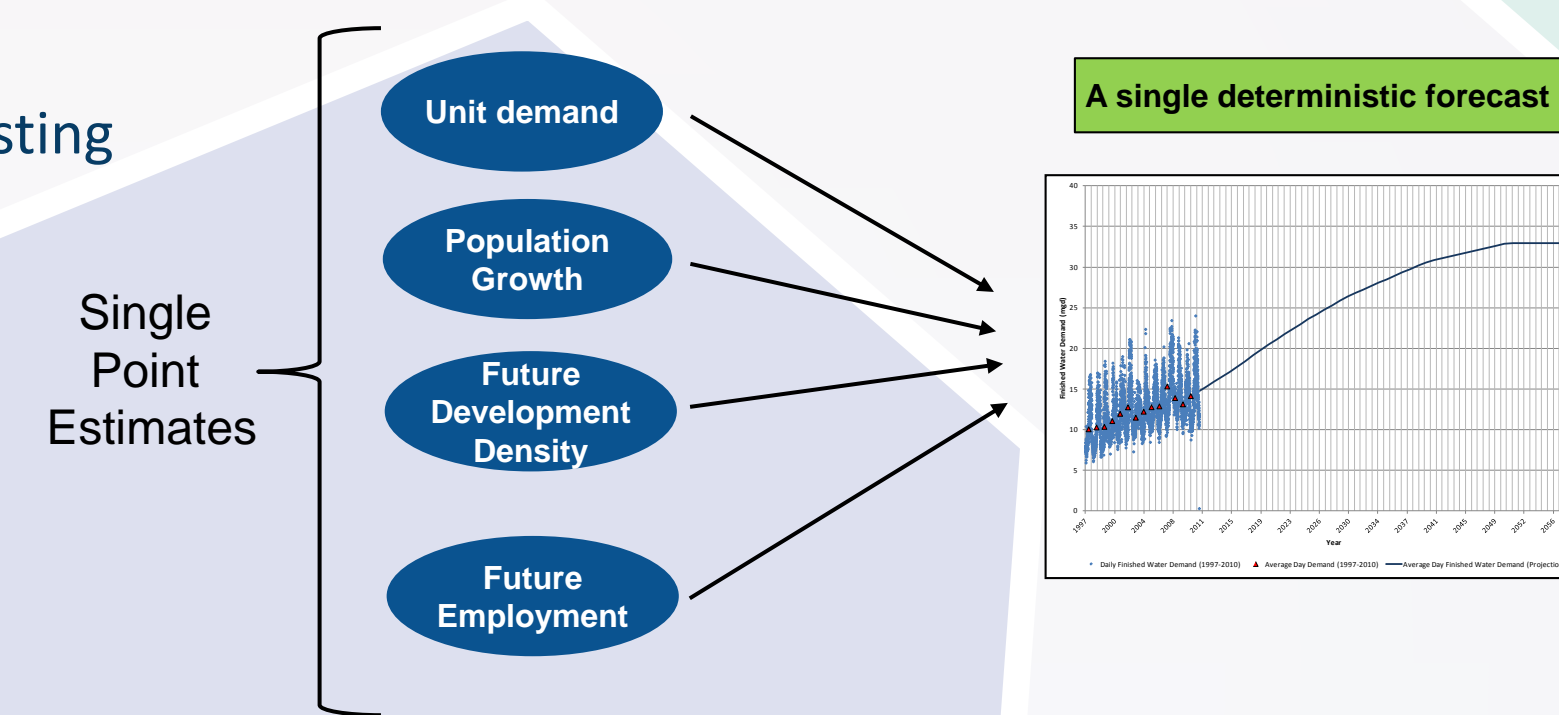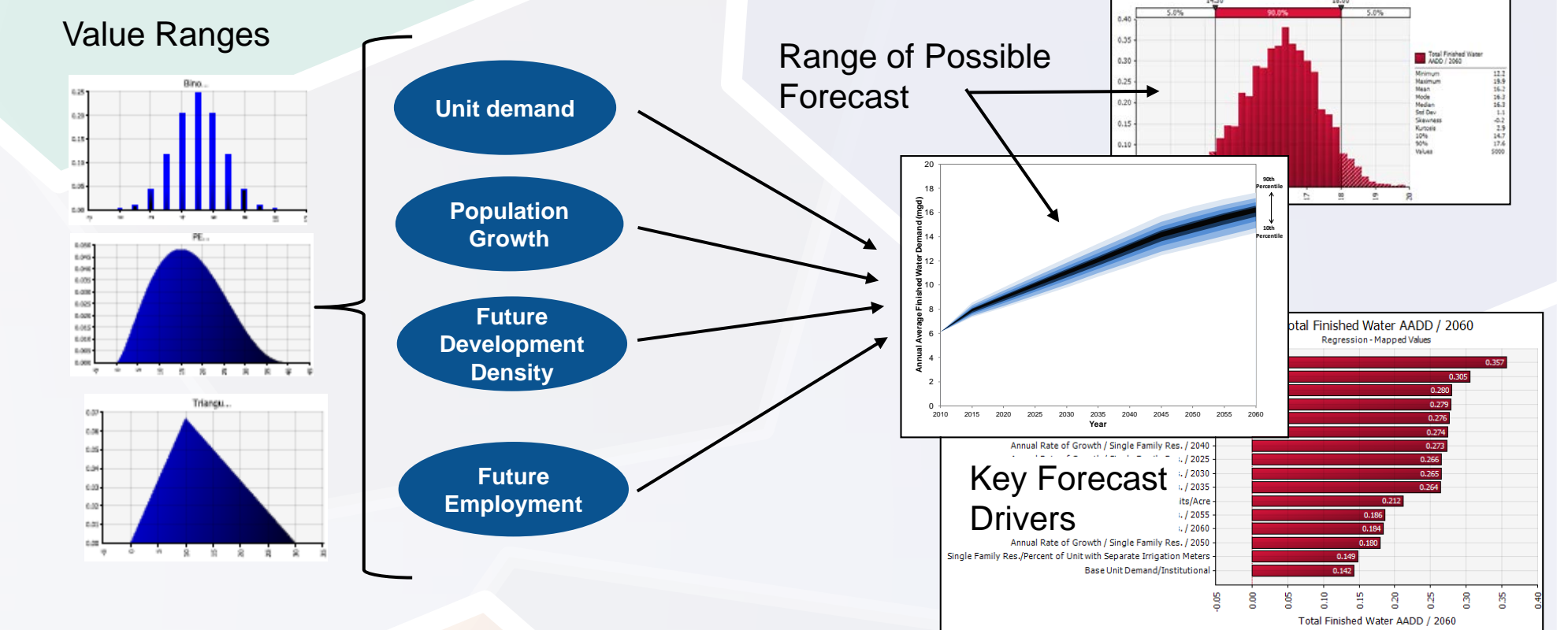- Economic factors

Proposed Solution

How to fix water demand forecasting:
- Move from deterministic to probabilistic forecasting (single line to range of outcomes)
- Identify key uncertainties of a forecast
- Understand forecast sensitivity of individual variables affecting the long term forecast
- Make the process more accessible

Move From This Single Line

Single Point Estimates
- Unit demand
- Population Growth
- Future Development Density
- Future Employment

A single deterministic forecast

To This Probabilistic Forecast

Value Ranges
- Unit demand
- Population Growth
- Future Development Density
- Future Employment

Range of Possible Forecast

Key Forecast Drivers

Example Application

Typical Uncertainty Variables in Water Demand Forecasting:
- Unit consumption
- Growth rate
- Future demand management
- Various System Factors
  - Non-revenue water
  - WTP system process water loss
  - Maximum day peaking factors
- Use historic data & subjective judgment
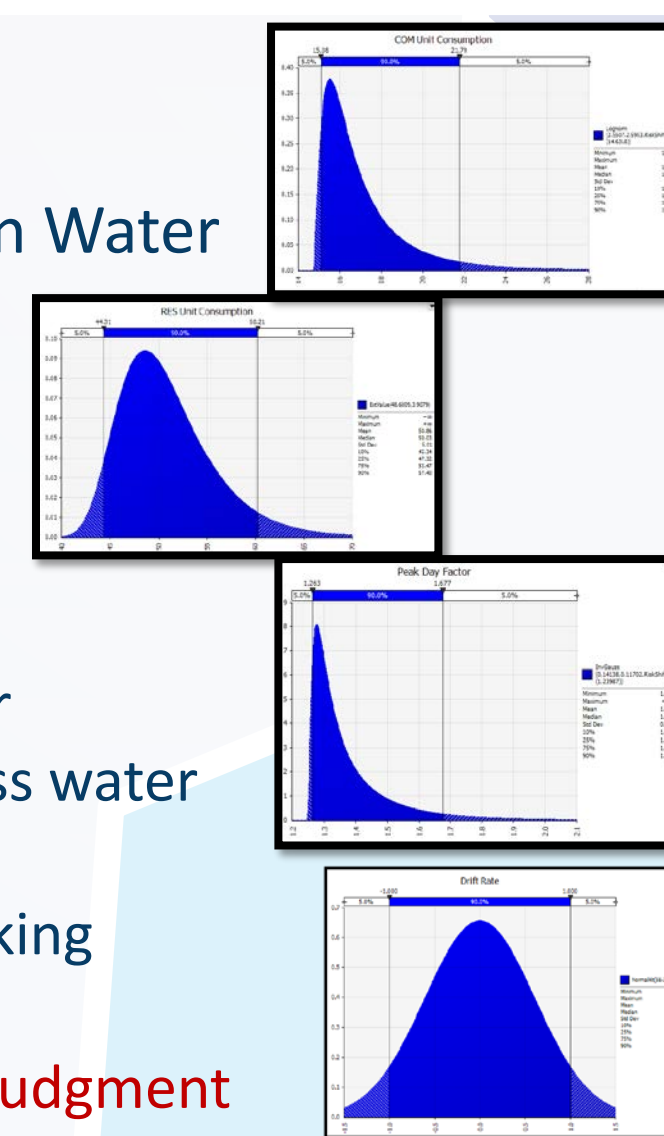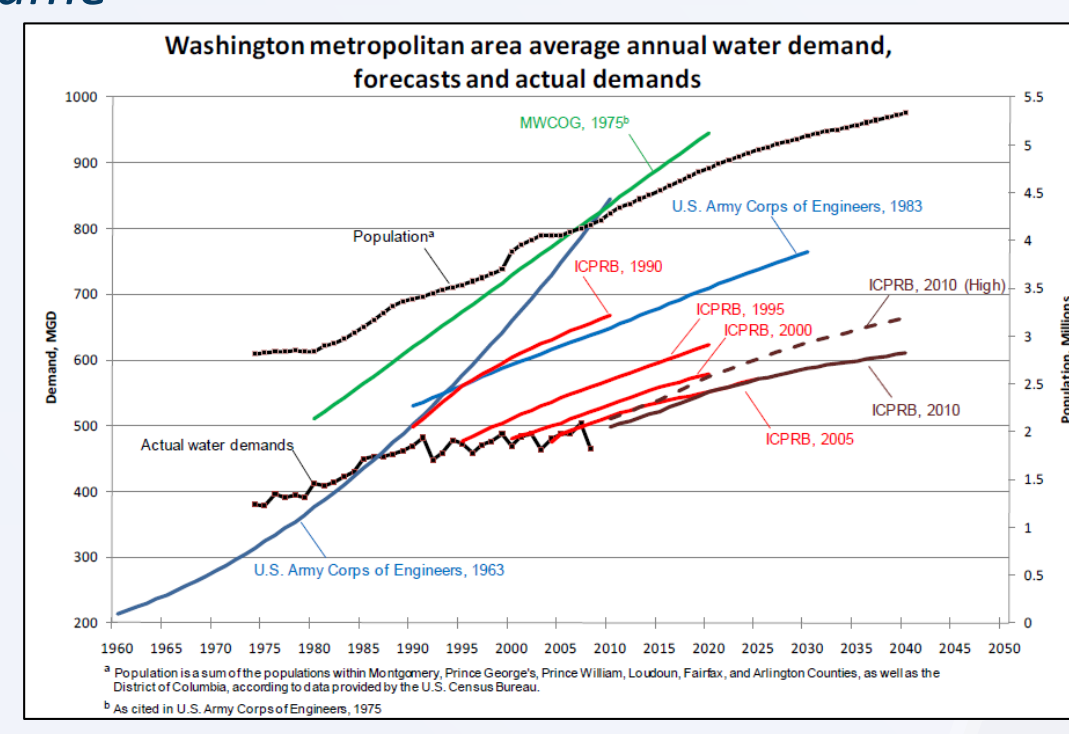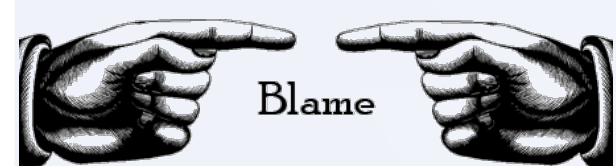
Tying It All Together

- There is data available for most water demand forecasting efforts to incorporate uncertainty
- Uncertainty in forecasts helps make informed decisions
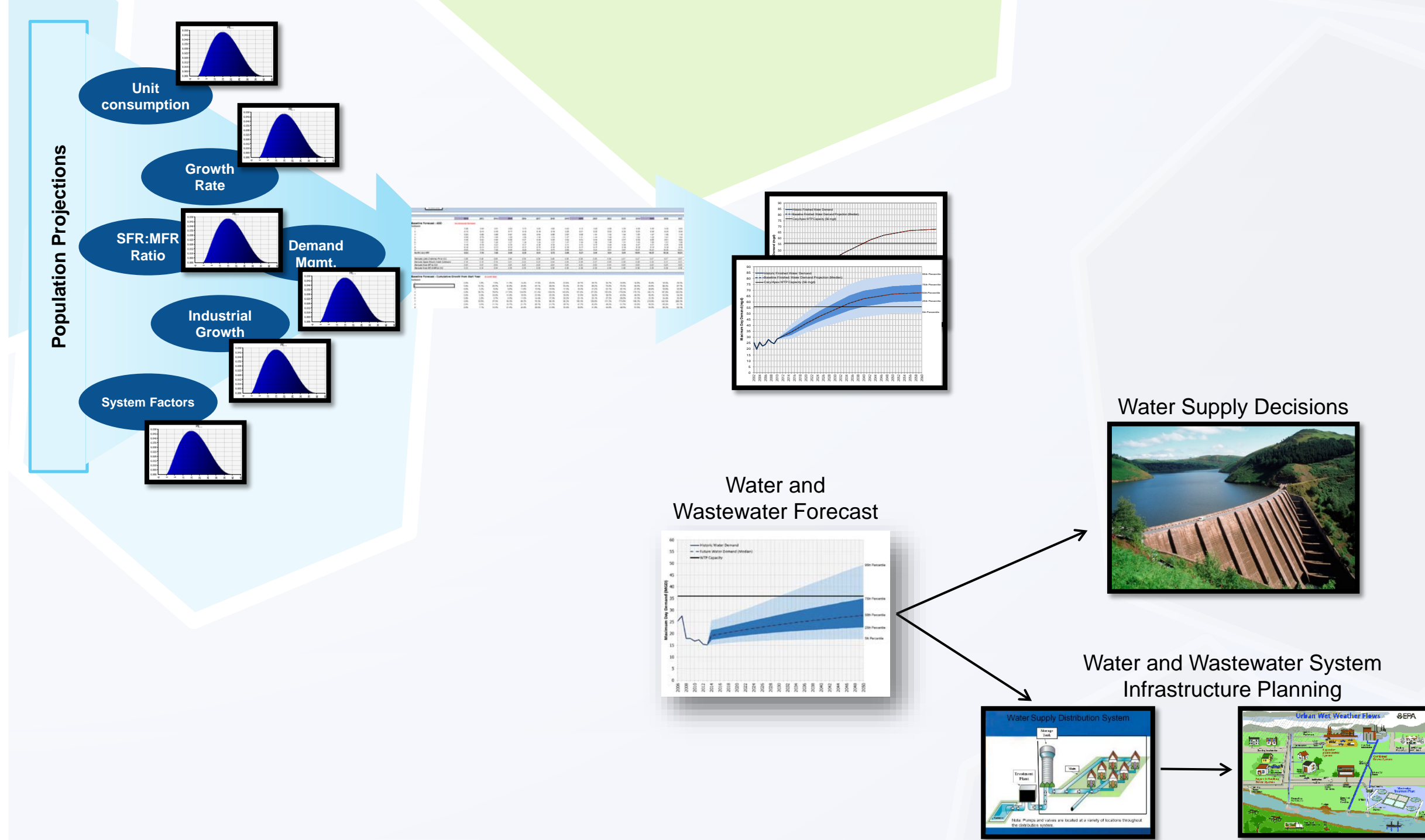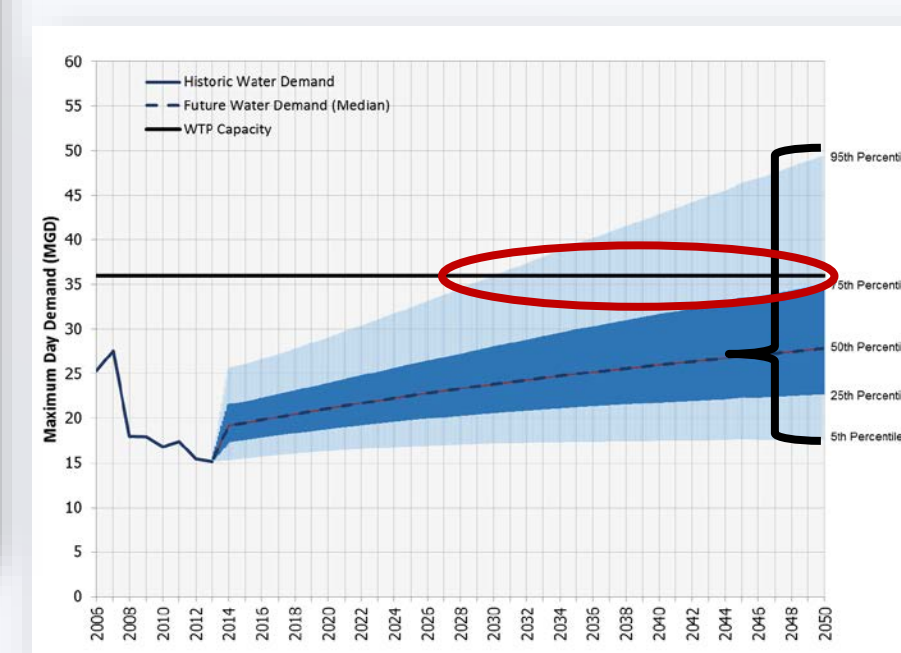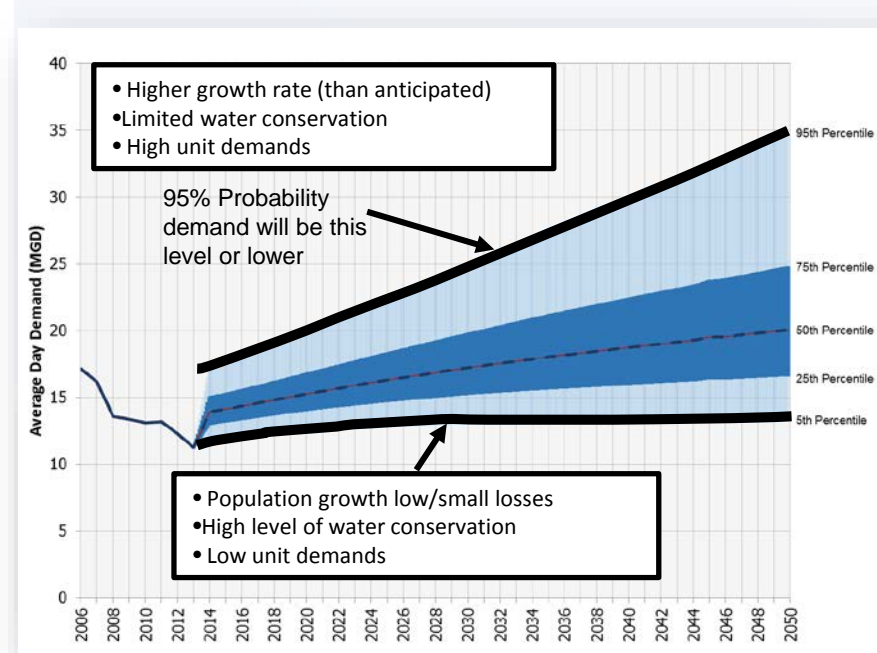
Impact of Overestimating

- Overbuilding of infrastructure, supplies, treatment
- Higher than necessary water rates
- Water quality issues in distribution systems
- Inefficient energy use

Loss of faith in forecasting
Playing the blame game

Interpreting the Results

Make decisions by understanding probability of exceeding limitations

- Higher growth rate (than anticipated)
- Limited water conservation
- High unit demands

95% Probability demand will be this level or lower

- Population growth low/small losses
- High level of water conservation
- Low unit demands

Population Projections
- Unit consumption
- Growth Rate
- SFR:MFR Ratio
- Demand Mgmt.
- Industrial Growth
- System Factors

Water and Wastewater Forecast

Water Supply Decisions

Water and Wastewater System Infrastructure Planning

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Source: 2010 Washington Metropolitan Area Water Supply Reliability Study, ICPRB