Cumberland County Regional Water Supply Plan

Systems Model Development, Regional Water Supply Need Determination, and Water Supply Alternatives Yield Evaluation

US Army Corps of Engineers
Nashville District

September 11, 2012

GKY
&Associates,inc.

PRESENTATION OVERVIEW

» Introductions
» Project history
» Overall scope
» Systems model

PROJECT HISTORY

» Regional water demand projections
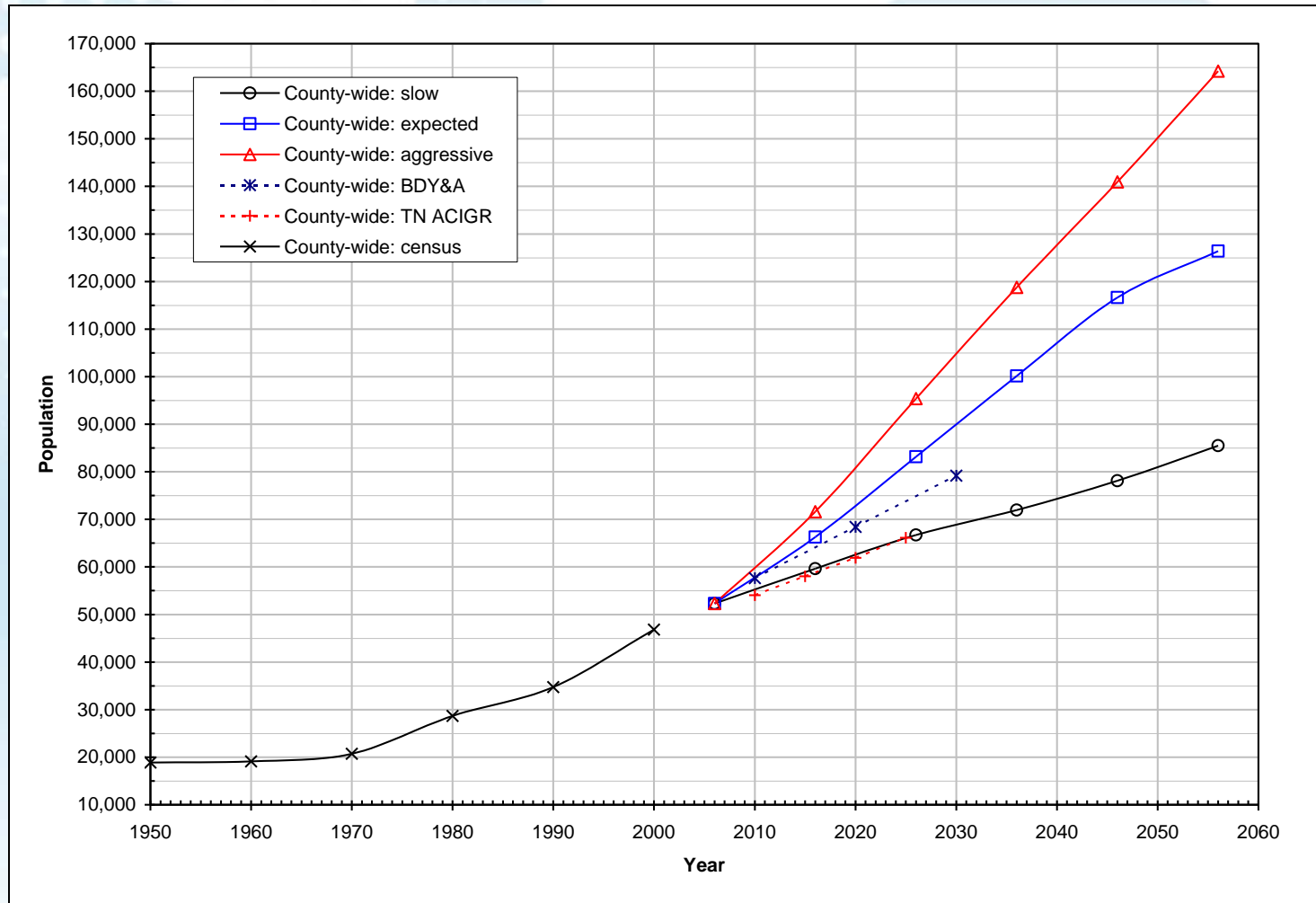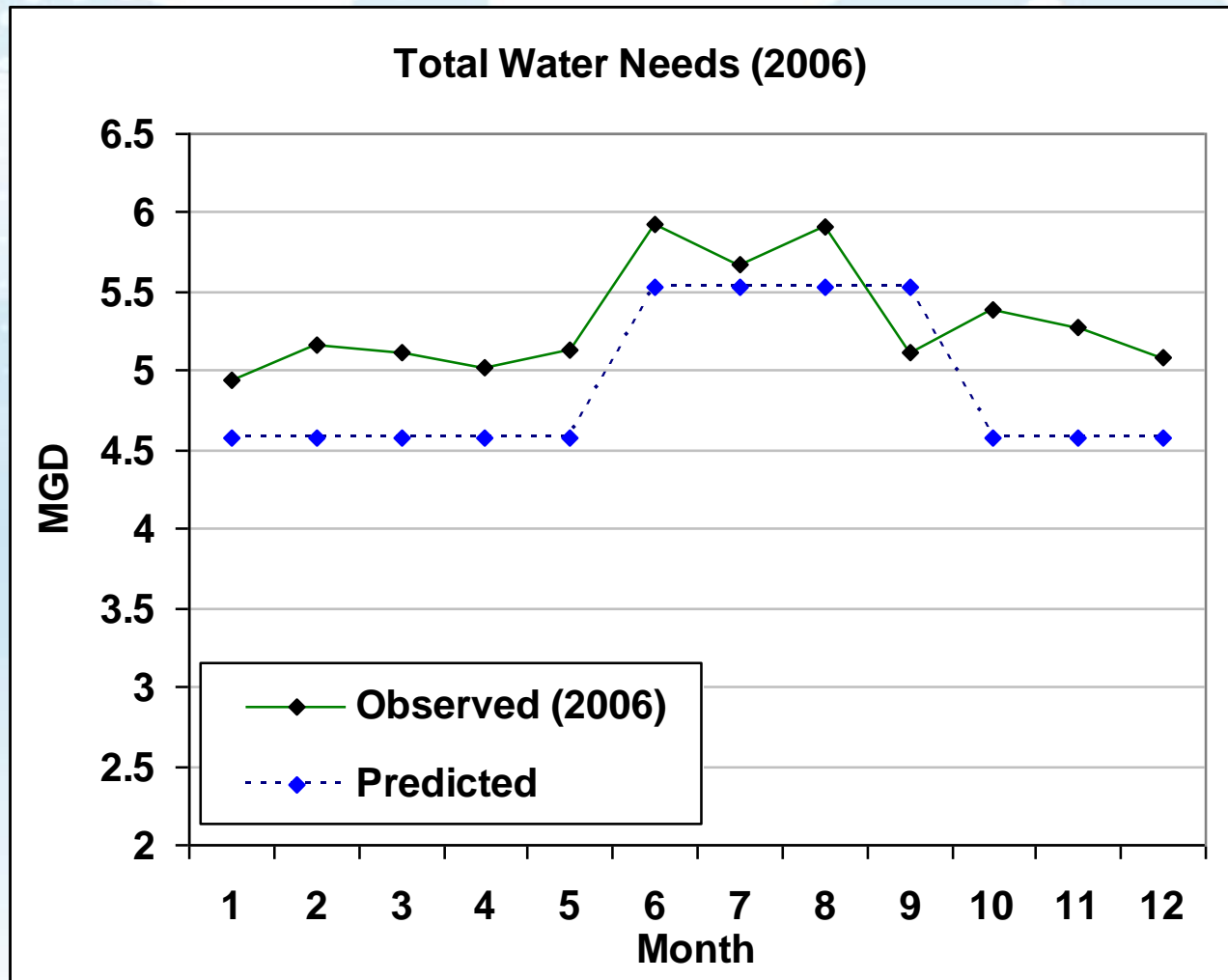» Conservation plan

PROJECT HISTORY
POPULATION PROJECTIONS

PROJECT HISTORY
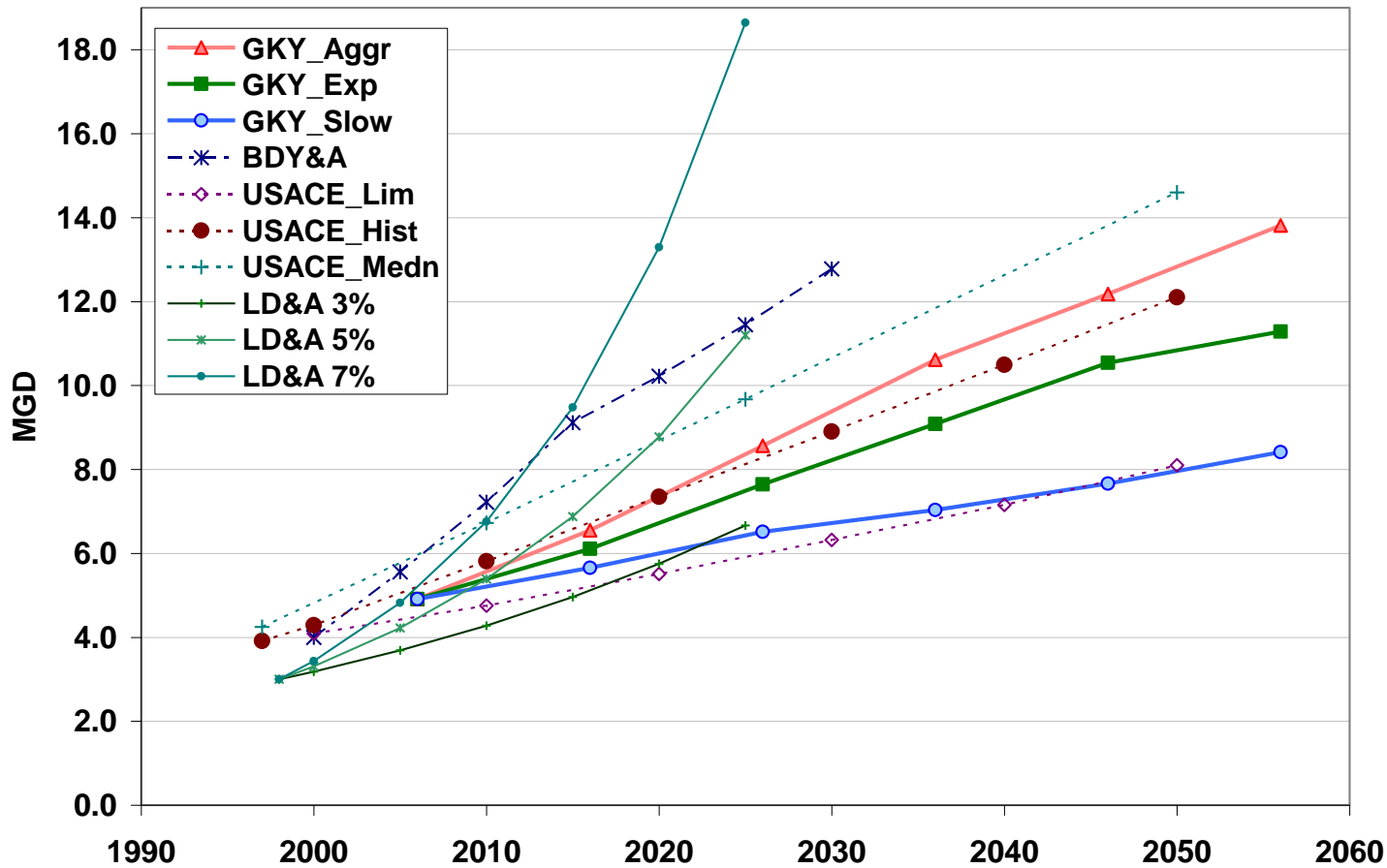# PREDICTED AND OBSERVED
CUMBERLAND COUNTY DEMAND

*Above average losses in 2006
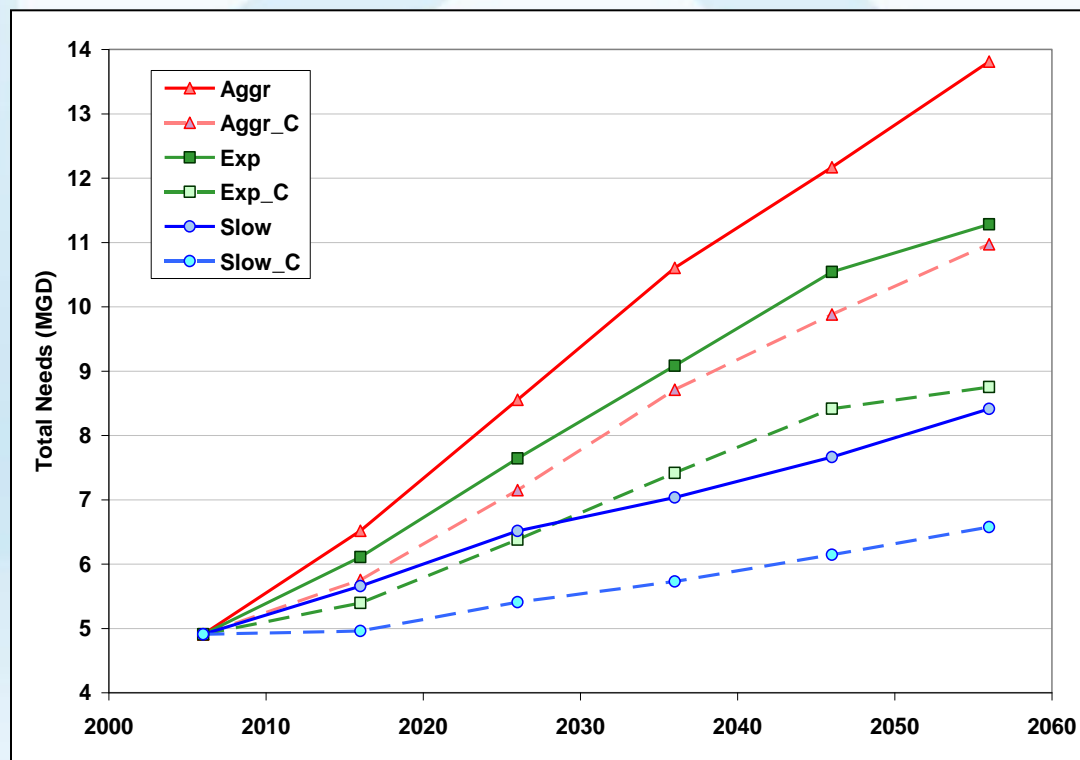
PROJECT HISTORY
DEMAND PROJECTIONS

Cumberland Projections- Total Water Needs

PROJECT HISTORY CONSERVATION ANALYSIS

» Non-leakage UAW reduction

» Leakage reduction

» Education programs

» Codes and ordinances

OVERALL SCOPE

Task 1 – Integrated System-wide Model of Cumberland County Water Supply System

» Data collection
» Report review
» Systems model setup
» Systems model analysis
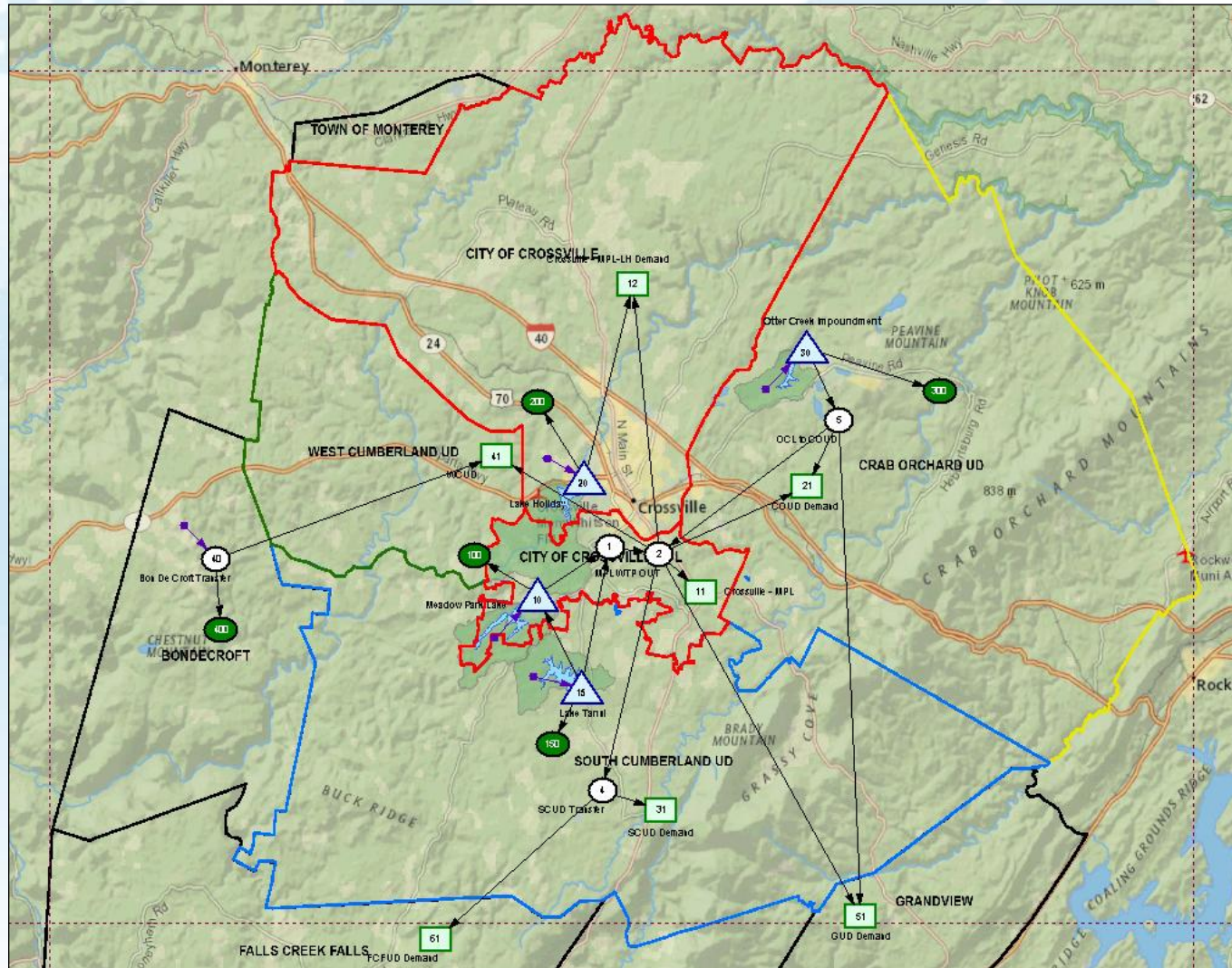» Reporting, meetings, coordination

OVERALL SCOPE

Task 2 – Water Supply Alternatives Yield Analysis

» Raising dams
» New impoundments
» Water conservation
» Interconnection and operation modifications
» Reporting, meetings, coordination

SYSTEMS MODEL
MODEL SCHEMATIC

SYSTEMS MODEL DEMAND

» Used GKY analysis for demand data

» Disaggregated demand using 2006 parcel data

» GKY "expected" growth scenario (w/ UAW)

» Summer (June through Sept - 1.06) and winter (0.97) demand multipliers derived from 5 years of Crossville data

» Demand nodes: Crossville (MPL Only), Crossville (MPL/LH), Crab Orchard UD, Falls Creek Falls UD, Grandview UD, South Cumberland UD, West Cumberland UD

Demand	UD		2006	2016	2026	2036	2046	2056
Total	Crab Orchard		1.15	1.74	2.57	3.65	4.74	5.07
	South Cumberland		0.54	0.94	1.54	2.06	2.50	2.77
	West Cumberland		0.26	0.30	0.32	0.36	0.40	0.46
	Crossville	MPL/Holiday	2.27	2.95	3.46	3.69	3.94	4.18
		MPL/Holiday Optional	0.43	0.47	0.50	0.51	0.52	0.54
		MPL	0.25	0.32	0.37	0.37	0.38	0.39
	Falls Creek Falls		0.00	0.03	0.07	0.10	0.13	0.17
	Grandview		0.09	0.11	0.14	0.17	0.20	0.25

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SYSTEMS MODEL SETUP
OASIS

SYSTEMS MODEL CITY OF CROSSVILLE

» Split into two demand nodes
» Sells water to South Cumberland UD, Grandview UD, Falls Creek Falls UD
» Emergency connections with Crab Orchard UD, Town of Monterey, and West Cumberland UD
» Three water supply sources: Meadow Park Lake, Lake Holiday and a new connection to Lake Tansi
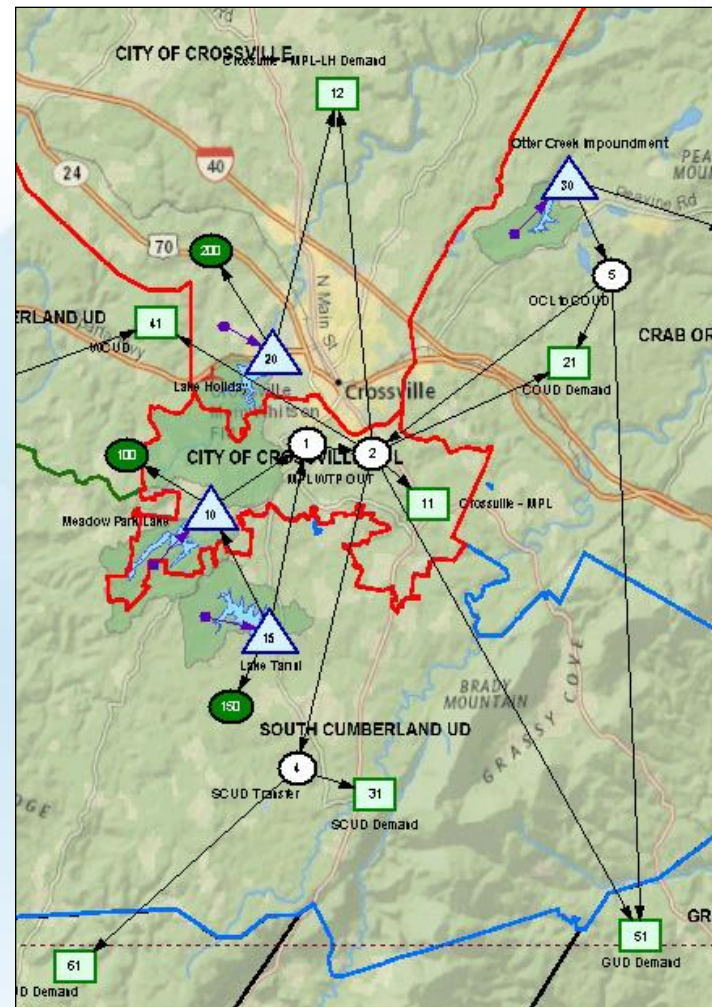
SYSTEMS MODEL
CITY OF CROSSVILLE

Water Treatment (WTP)

» Lake Holiday WTP Capacity = 2.0 MGD (4.0 MGD with increased staff)

» Meadow Park Lake WTP Capacity = 3.5 MGD

Interconnections

» To Crab Orchard UD = 1.8144 MGD (Emergencies Only)

» To Falls Creek Falls UD = 0.3 MGD (Physical/Institutional)

» To Grandview UD = 0.72 MGD (Physical)

» To S. Cumberland UD = 2.174 MGD (Physical)

» To West Cumberland UD= 0.504 MGD (Emergencies Only)

» From Town of Monterey = 0.2 MGD (Institutional) - not modeled

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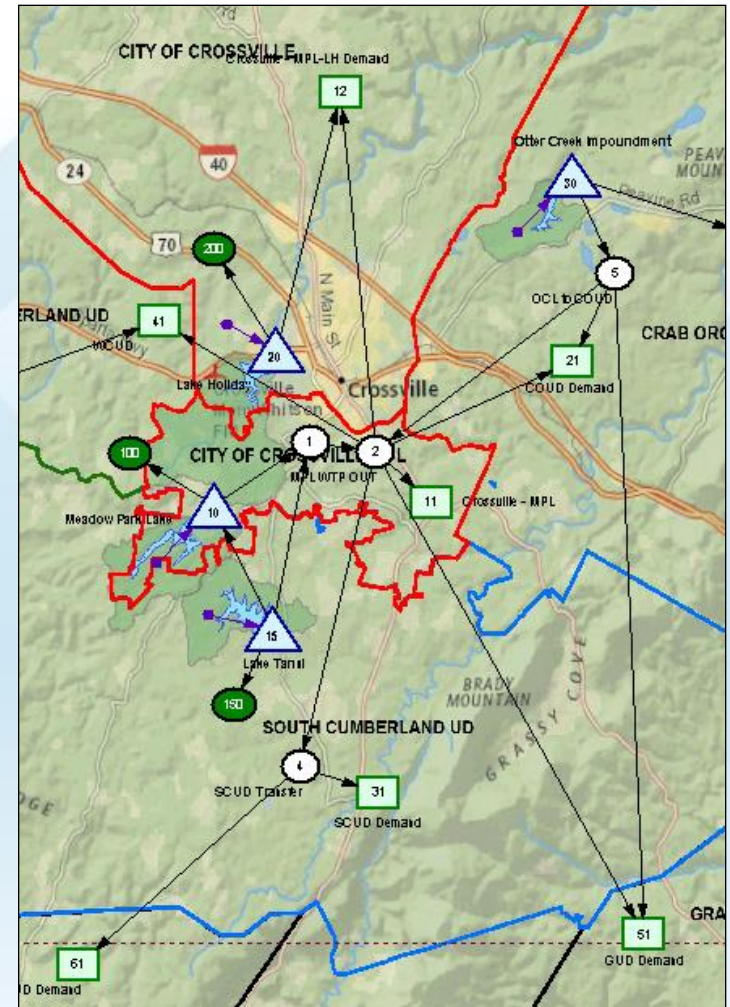
SYSTEMS MODEL
CITY OF CROSSVILLE

Water Supply

» Lake Holiday
  » Normal Pool @ 1761.38 (ECE)
  » Low Intake @ 1742

» Meadow Park Lake
  » Normal Pool @ 1818.10
  » Low Intake @ 1803.6

» Lake Tansi
  » Normal Pool @ 1862.71
  » Low Intake @ 1858.25

Lake Tansi Connection

» Primary transfer to MPL WTP

» Able to transfer to both WTP and MPL with 14 MGD pump capacity

» Does not operate April 15 – October 15

» Allowed to take overflow and draw down 4" from normal pool October 15 – April 15
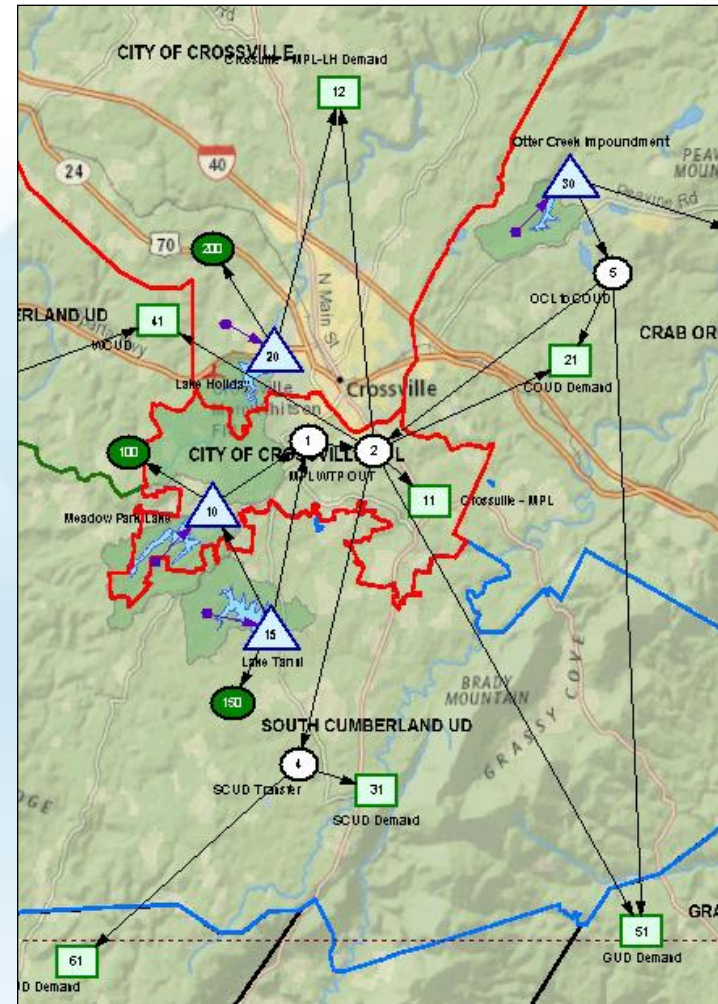
SYSTEMS MODEL CRAB ORCHARD UD

Water Treatment (WTP)

» Crab Orchard WTP Capacity = 4.0 MGD

Interconnections

» To Crossville = TBD (Emergencies Only)

» To Grandview UD = 0.216 MGD (Emergencies Only)

Water Supply

» Otter Creek Lake

  » Normal Pool @ 1775

  » Low Intake @ 1755

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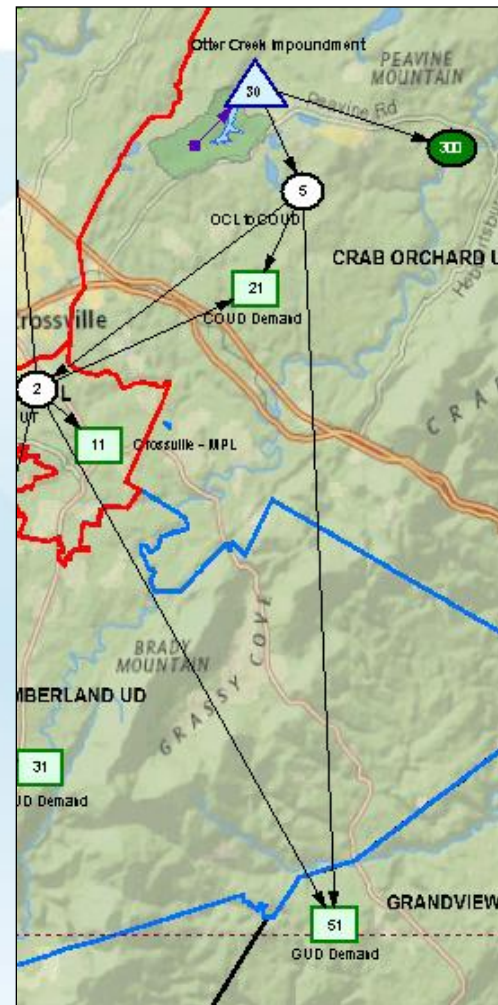
SYSTEMS MODEL
SOUTH CUMBERLAND UD

Water Treatment (WTP)

» N/A

Interconnections

» From Crossville = 2.174 MGD (Physical)

» To Falls Creek Falls UD = 0.3 MGD (Physical/Institutional)

Water Supply

» N/A

SYSTEMS MODEL
WEST CUMBERLAND UD
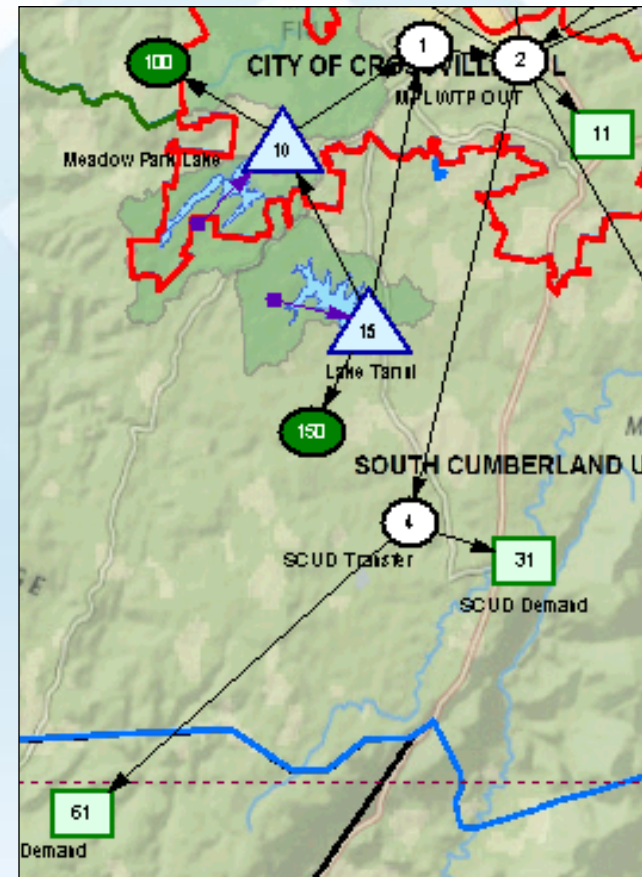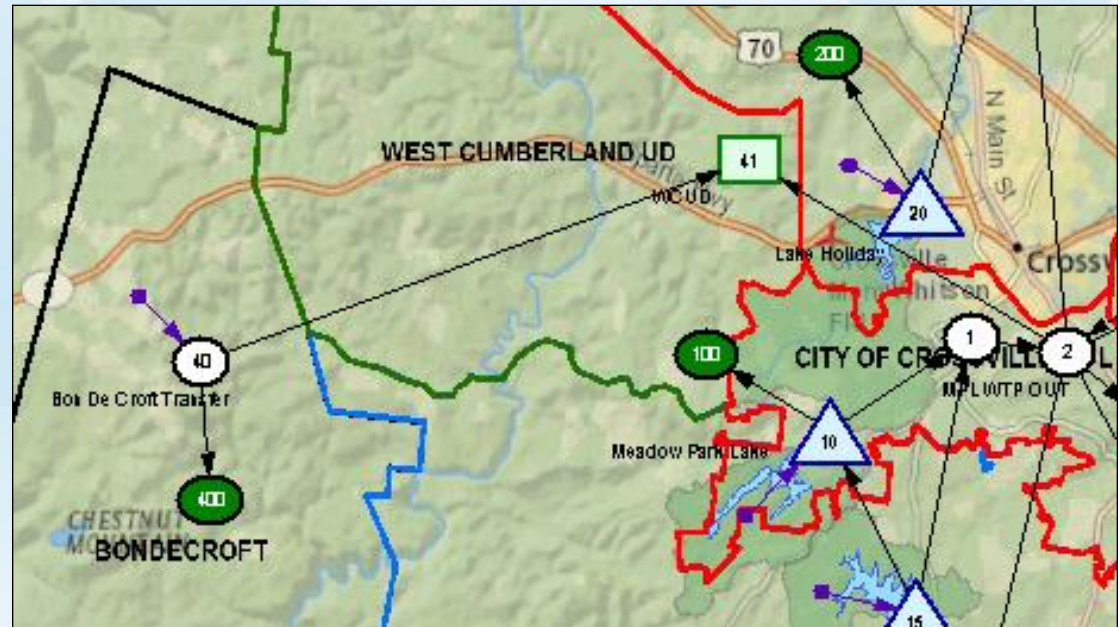
Water Treatment (WTP)

» N/A

Interconnections

» From Bondecroft UD = 0.75 MGD (Institutional)

» From Crossville = 0.504 MGD (Emergencies Only)

Water Supply

» N/A

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SYSTEMS MODEL
OUTSIDE UTILITY DISTRICTS

Grandview UD

» Purchases from Crossville (Crab Orchard during emergencies)

Falls Creek Falls UD

» Purchases from Crossville (though S. Cumberland)

Bondecroft UD

» Sells to West Cumberland UD (NOTE: 0.75 MGD is available in all scenarios, Bondecroft water supply not modeled)

Town of Monterey

» No transfer through existing connection to Crossville

SYSTEMS MODEL DROUGHT OPERATIONS

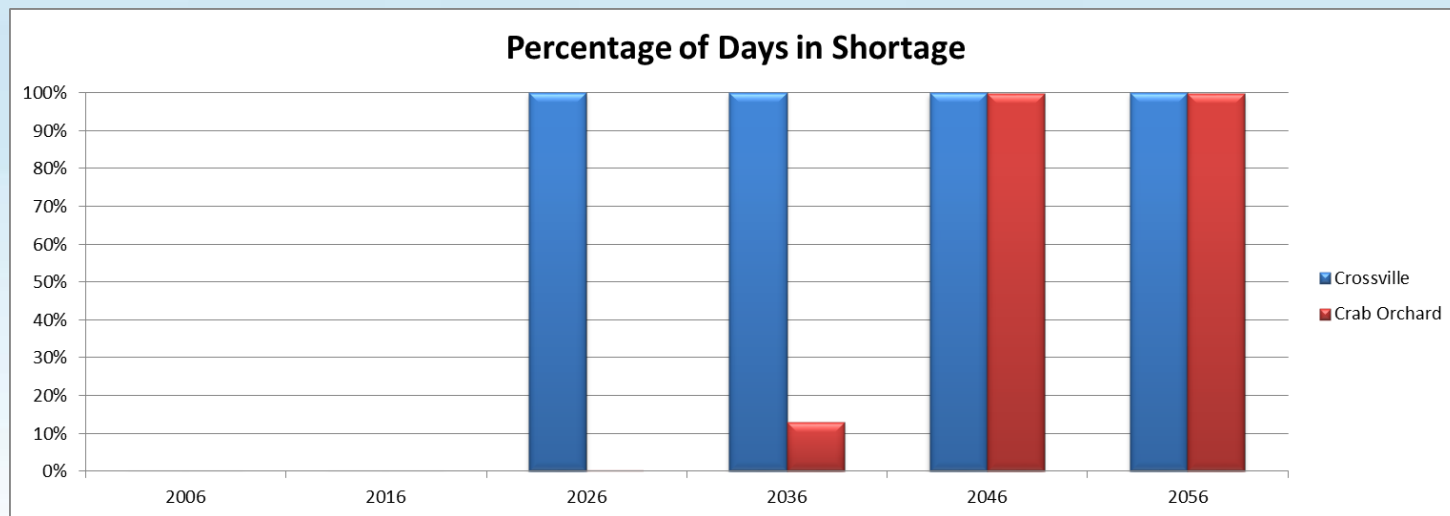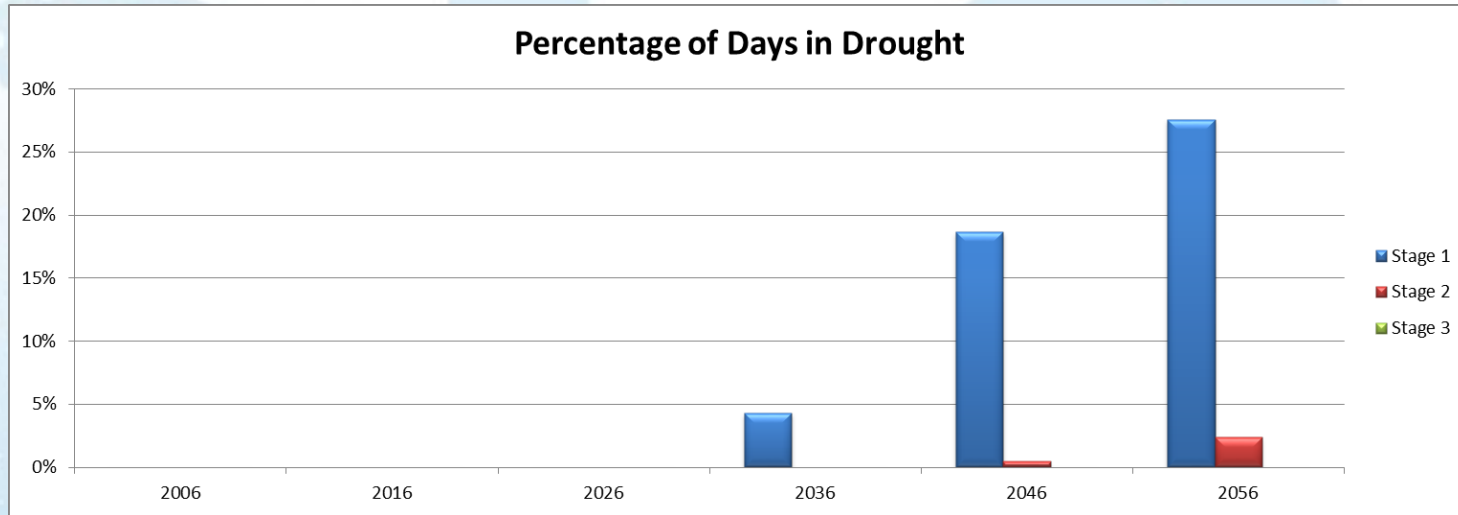**Derived from Crossville/Cumberland County Drought Management Plan**

Stages of drought
» Stage 1 drought
 » 120 days usable storage in system
 » 7.5% reduction in demand
» Stage 2 drought
 » 90 days usable storage in system
 » 15% reduction in demand
» Stage 3 drought
 » 60 days usable storage in system
 » 30% reduction in demand

Emergency interconnections
 » Turned on during all stages of drought

SYSTEMS MODEL DRAFT RESULTS
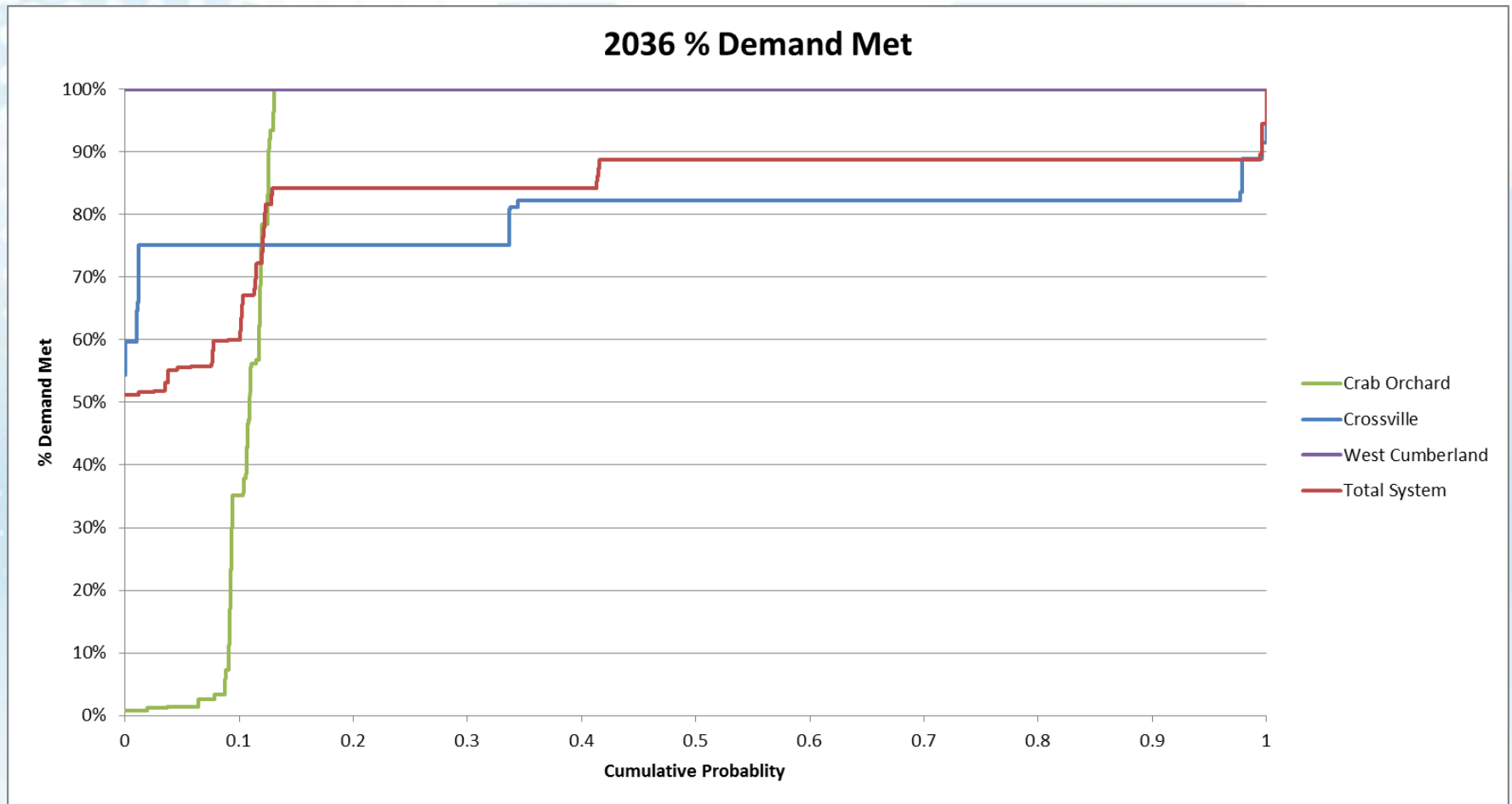
Percentage of Days in Drought

Legend: Stage 1, Stage 2, Stage 3

Percentage of Days in Shortage

Legend: Crossville, Crab Orchard

SYSTEMS MODEL DRAFT RESULTS

2036 % Demand Met

SYSTEMS MODEL DRAFT RESULTS

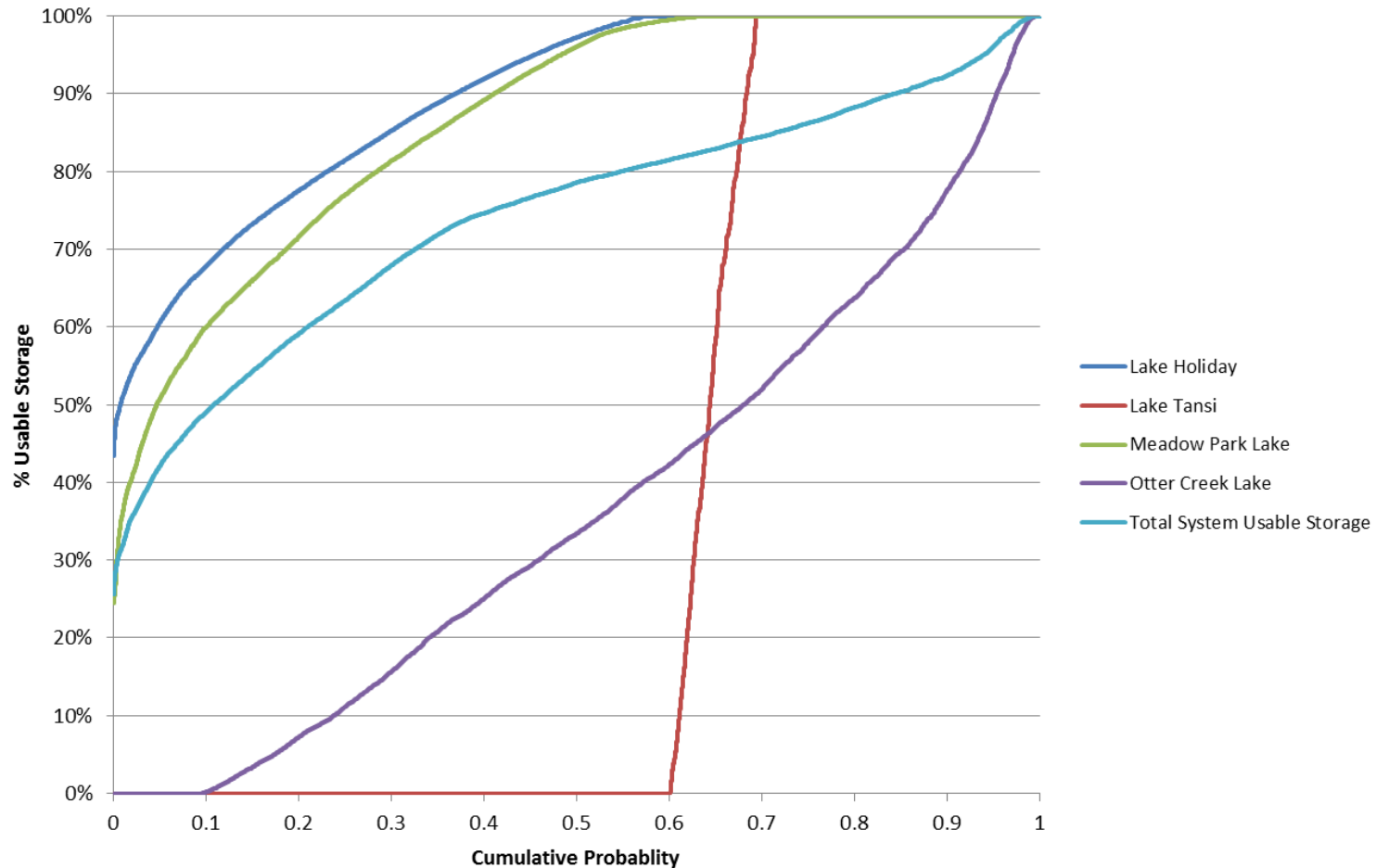2036 Usable Storage

SYSTEMS MODEL DRAFT RESULTS
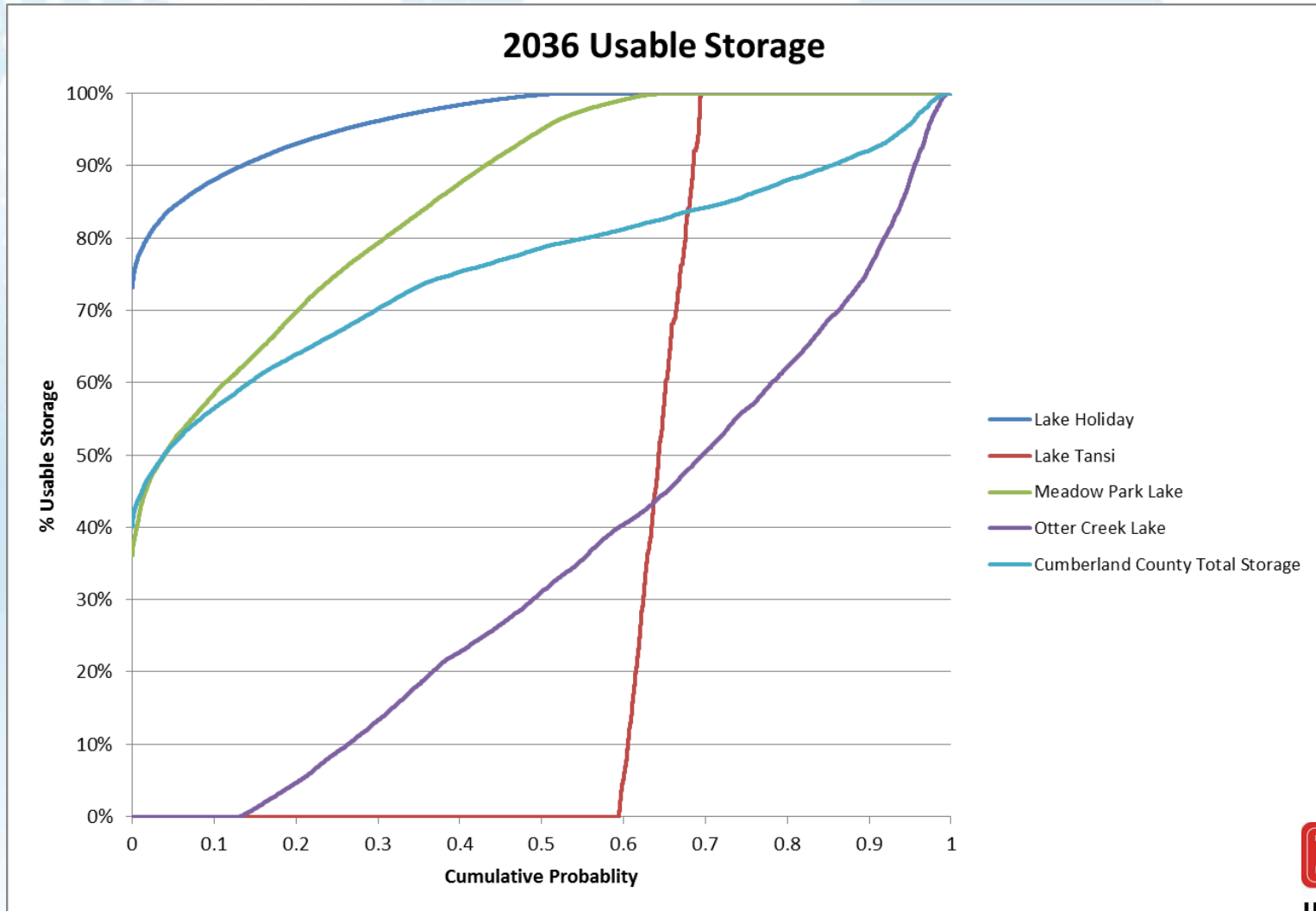
2036 (w/o WTP Constraint) % Demand Met
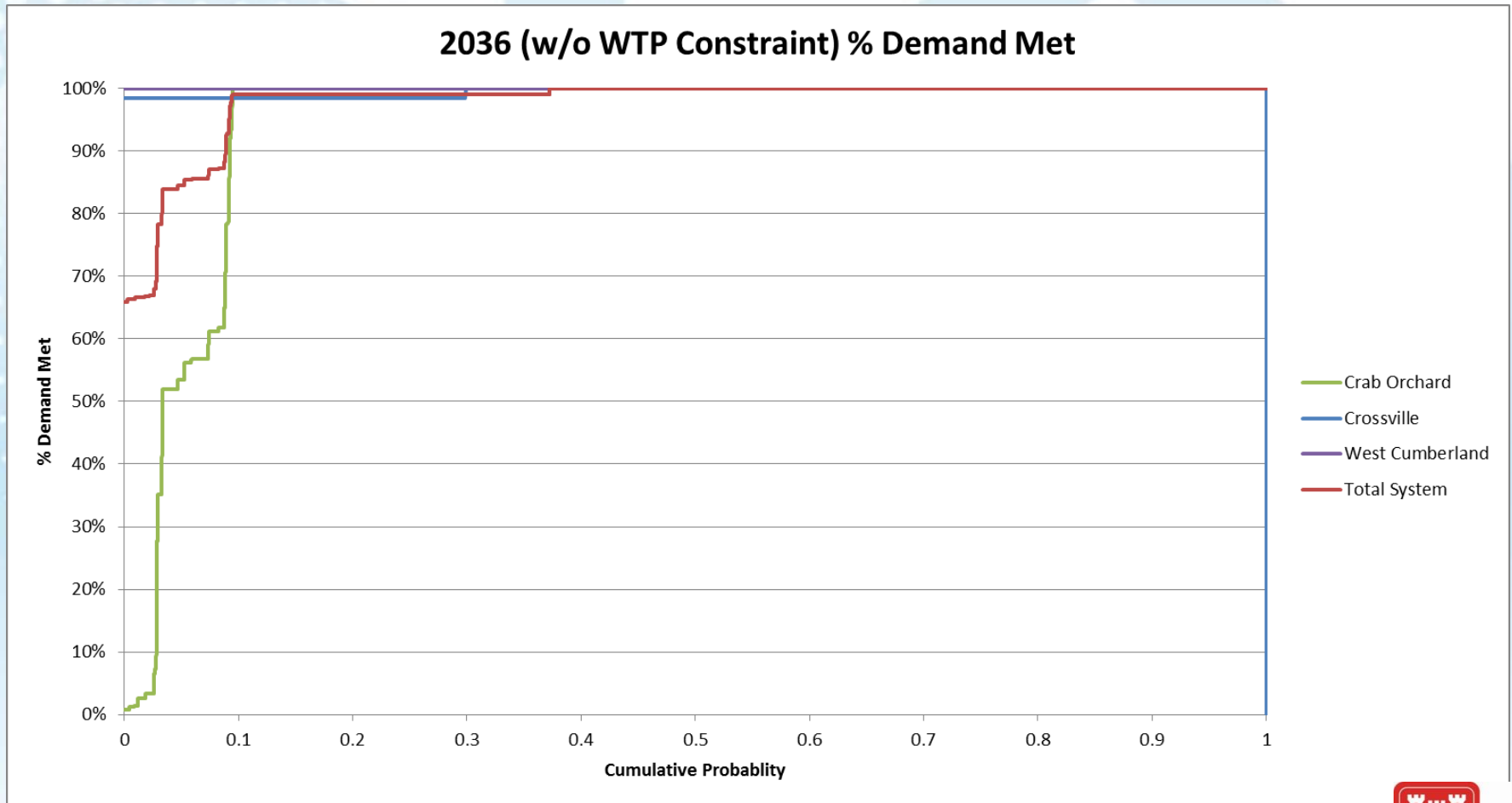
SYSTEMS MODEL
DRAFT RESULTS

2036 (w/o WTP constraint) Usable Storage

SYSTEMS MODEL LIMITATIONS/OUTSTANDING WORK

Limitations

» West Cumberland UD demand met by Bondecroft in all future scenarios
» WTP capacity limits existing model analysis
» System-wide drought stages limited by WTP capacity
» Drought operations/Lake Tansi pumping duration
» All customers treated equally

Outstanding Work

» Add emergency connection between Crossville and Crab Orchard
» Fine-tuning of Lake Tansi – MPL operation

TASK 1
NEXT STEPS

» Address outstanding work to finalize model
» Estimate firm yield
» Identify constraints on yield ("areas of need")
» Recommend alternatives that address constraints
» Develop technical memorandum summarizing task results

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Supply Need Determination, and Water Supply
Alternatives Yield Evaluation

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