APPENDIX F

WORKSHOPS

Duck River Development Agency
Comprehensive Regional Water Supply Plan

***DRAFT* AGENDA**
WORKSHOP NO. 1 / KICKOFF MEETING
Henry Horton State Park
June 24, 2009
9 AM - 2 PM

Introductions (9 am)
- Consultant Team - O'Brien & Gere / CTI Team, other team members
- Workshop Format / Opportunities for Stakeholder Input

Missions and Goals
- Fulfilling DRA's Mission
- Project Goal
- Stakeholders Objectives

Project Overview
- Scope of Work
- Project Approach
- Schedule
- Communications

Meeting Participant Input / Comments

Break (10:30 am)

Stakeholder Participation

Steering Committee
- Roles and Responsibilities
- Membership

Triple Bottom Line and Shared Vision Planning

Demand Projections and Water Supply Needs
- Service Area
- Conservation
- Yield and Reliability
- Water Quality / Wasteload Assimilation
- Threatened and Endangered Species
- Recreation/Scenic Values
- OASIS Modeling

Meeting Participant Input / Comments

Lunch (12 Noon)

Cost Methodology

Evaluation Criteria

- Decision Making
- Draft Evaluation Criteria
- Additional Criteria

Draft List of Available Studies

Draft List of Alternatives

Next Steps

Meeting Participant Input / Comments

Adjourn (2 pm)

Duck River Development Agency
Comprehensive Regional Water Supply Plan

Meeting Minutes
WORKSHOP NO. 1 / KICKOFF MEETING

Henry Horton State Park
June 24, 2009
9 AM - 2 PM

Meeting Participants

Name	Organization	E-Mail	Telephone
George Rest	O'Brien & Gere (OBG)	restgb@obg.com	301.731.1160
Tom Dumm	OBG	dummte@obg.com	301.731.1162
Doug Murphy	Duck River Agency (DRA)	doug@duckriveragency.org	931.684.7620
Paul Myatt	DRA	---	931.388.5977
Kelly Powell	Columbia Water		
Randal Braker	Duck River Utility Commission	manager@druc.org	931.455.6458
Joanne Pogue	Duck River Board (DRB)	jpogue_2000@yahoo.com	931.381.2169
Bill Walter	DRB	williamrwalter@gmail.com	931.381.0393
Eugene Crowell	DRB	crowelle@bellsouth.net	931.684.6483
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Elaine Boyd	TDEC - Strategic Management	Elaine.Boyd@tn.gov	615.532.0288
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Rodney Knight	US Geological Survey	rrknight@usgs.gov	615.837.4731
Kim Elkin	TWRA	kimberly.elkin@tn.gov	615.781.6643
Steven Barnes	TVA	---	423.756.6136
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Name	Organization	E-Mail	Telephone
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Jim Clark	Columbia Water & Power	jim.clark@cpws.com	931.375.7601
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Bill Ketron	State Senate	sen.bill.ketron@capitol.tn.gov	615.858.8966
Jim Tracy	State Senate	sen.jim.tracy@capitol.tn.gov	---
Brian McCrodden	HydroLogics	bmccrodden@hydrologics.net	919.856.1288
Barry Burgess	USDA, Rural Development	barr.burgess@tn.usda.gov	615.783.1345
David Money	TDEC – DWS	david.money@state.tn.us	831.840.4172
Tom Puckett	HB&TS Utility District, Williamson County	tpuckett.hbts@bellsouth.net	615.794.7796
Larry Jones	DRA Board	larry417@att.net	931.359.1355
Kenneth Carr	Lewisburg Water & Wastewater	kenneth@lewisburgwater.org	931.359.6831
David Jackson	BDY Environmental	djackson@bdy-inc.org	615.460.9797
Richard Quin	Duck River Watershed Association	Rquin@bellsouth.net	931.797.5541
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Becki Bates	Geoservices, LLC	becki@geoservicesllc.com	931.729.6900
Betty Wiley	Duck River Watershed Association	Bettydwiley@comcast.net	615.776.5257

Name	Organization	E-Mail	Telephone
Michael Eiffe	TVA	maeiffe@tva.gov	865.632.3074
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Caryl A. Giles	City of Spring Hill	cgiles@springhilltn.org	931.489.5791
Neil Loeffler	TMRPC	loeffler@cafes.net	931.393.3539
Jeff Bowie	NRCS	---	931.388.5977
Joe Bishop	CTI Engineers, Inc.	jbishop@ctiengr.com	615.834.8300
Jerry Hightower	CTI Engineers, Inc.	jhightower@ctiengr.com	423.267.7613

Attachments: Agenda, MS PowerPoint presentation

Introductions

OBG introduced the Consultant Team to meeting participants and discussed the format for the workshops.

Missions and Goals

OBG presented Duck River Agency's mission and the project goal. Meeting attendees were asked to introduce themselves and state their objectives or their agency's objectives for the study. A summary of the project objectives identified by meeting participants follows:

- Identify alternatives that provide adequate water supply
- Learn about the project
- Emphasize regional planning approaches
- Provide adequate water supply for wasteload assimilation
- Emphasize water conservation in the study
- Support a process that fully considers all the uses of the Duck River
- Identify alternatives that maintain instream flows
- Provide support and expertise for the study
- Assess impact of alternatives on Duck River
- Develop a reliable long-term water supply

Project Overview

Presented key project issues, approach graphic, schedule and communications plan. Identified that establishing the need for an alternative and clearly defining the evaluation criteria is critical. Communications will include posting the MS PowerPoint presentation on

DRA website. The project website is under development. Participants identified the following URL for the website: "drawsp". Workshops will be open to the public and each phase of the study will include several "open houses" which will be extensively publicized.

Participant Input / Comments

Participant comment: The title for the study "Comprehensive Regional Water Supply Plan" may indicate a lack of emphasis on other factors such as the environment. Doug Murphy identified that water supply is the primary focus because that is how the project is being paid.

Participant comment: Establishing the need for water supply is critical because there is so much difference of opinion in what need is.

Several questions and points were presented regarding communication via the website:

- Comments sent in by email will be posted on website.
- Informal questions should be asked and answered by telephone.
- Should anonymous questions/comments be posted on website (e.g., blog)? Further discussion needed on this question.

Stakeholder Participation

Stakeholders were identified as those invited to Workshop No. 1. Stakeholder input increases with increasing level of involvement in decision-making. The roles of stakeholders were discussed.

Steering Committee

The roles and membership of the steering committee were presented for discussion. The steering committee will not be used for decision-making; rather the committee will be used as a sounding board for the consultant team.

Triple Bottom Line and Shared Vision Planning

OBG identified that the water supply study is one of many elements (i.e., storm water management, etc.) comprising a comprehensive integrated water resources plan. Through the course of the water supply study OBG will attempt to identify alternatives that integrate with those elements.

Demand Projections and Water Supply Needs

Water demands

USGS described their demand forecast work for the Duck River watershed.

- 1989 Study: First forecast was driven by Saturn project and other industries. Data was compiled by visiting each utility; obtaining customer records; and consulting with community planning agencies, Mayors of counties, and cities.
- 1999-2000 Study: Second forecast of demand data was through 2030 and identified less demand than predicted in the first study. Demand data in first study had an industrial focus while the second study concluded that the region was trending toward a "bedroom community" with more residential demand than predicted. The study included the Upper Duck River region. The demands were limited to public water supplies (i.e., agricultural demand was not included in the study). USGS compiled data from projections done by others. USGS identified that the growth rate for TUB was 4 percent per year while the University of TN data identified a 1.5 percent growth rate per year over the entire county.
- Note that the eastern part of the Coffee County is in a different watershed.
- The growth rate has been in decline in recent years due to the downturn in the economy.
- TDEC's Division of Water Supply has records for 10 years of all water utilities.
- USDA identified that there are several water mains that extend beyond the Duck River watershed (e.g., Lewisburg to Cornersville which is in the Elk River watershed). Duck River and the Elk River are considered to be in the same watershed and are exempt from interbasin transfer law.
- DRUC identified the USGS report was accurate in predicting the 5-yr demand. Conservation typically amounts to about a 10 percent reduction in demand and water supply is a small portion of the flow allocation in the Duck River. Well water usage is declining (i.e., residents connecting to public supplies) due to contamination of groundwater consumption (e.g., problems in Wartrace).
- TNC identified that the Division of Economic and Community Development completed a study considering buildout of the current zoning and has competed demand projections based on those population projections.
- TVA conducted a new water demand study in cooperation with USGS using a new source of demand projections for the Duck River area. TVA conducts the water study every 5 years.

Participant comment: Objectives of the water demand studies completed by USGS and TVA should not cloud the results of the studies.

River Constraints

- The original requirement for the Normandy Reservoir was to meet 165 cfs at Shelbyville (155 cfs waste assimilation; 5 cfs for current drinking water supply; and 5 cfs for future drinking water supply). In 1981, TVA and TDEC agreed (after an assimilative capacity study of the river) on a summer/winter flow release scheme and lowered the winter flow requirement to 80 cfs in response to the drought of 1980-1981 (summer flow rate was not changed). In addition, during the early years of reservoir operation, the winter pool was increased from 859 ft to 864 ft to assist with filling the reservoir during dry years. In 1994, the flow requirement at Shelbyville was increased from 80 cfs to 120 cfs.
- Centerville has discharge into Duck River.
- TNC identified that there are 6 native endangered mussel species in the Duck River.
- A constraint of 100 cfs has been used as the minimum for wasteload assimilation at Columbia.
- The DRA adopted a "Drought Plan" that addresses restricted and unrestricted water demands.
- TDEC identified that agriculture withdrawals are exempt from allocation restrictions (i.e., we don't know where, how many, or how much).
- NRCS identified that livestock users are asked to voluntarily report withdrawals. NRCS can provide information for the watershed area, but will not provide withdrawals for specific locations.
- USGS published water use projections by "sector." This information is included in TVA study.
- A study was completed on the stretch of river between Normandy and Columbia and it was concluded that the river does actually lose water in certain reaches.
- The USGS had studies that seemed good until the drought of 2007. USGS contends that Normandy Reservoir was managed properly during the drought because it was the way the reservoir had been operated for 40 years. The drought of 2007 was the worst in 115 years and the reservoir had water for water supply and downstream flow for wasteload assimilation and the environment.
- It will be important to establish how much flow is returned to Duck River in drought/non-drought conditions.
- OBG asked stakeholders what flow regimes should be considered solely for maintenance of aquatic habitat and what limits on wastewater discharges are associated with desired flow regimes. The parameters and limits in wastewater permits (and the corresponding flows) that affect aquatic habitat will need to be defined. TVA is experimenting with pulsed flow releases from Tims Ford to promote desired aquatic life downstream. A key question is what improvements are

needed at the WWTPs in order to allow for reducing the flow released from Normandy Reservoir for wasteload assimilation. TDEC identified that the minimum flow releases are for waste assimilation. TWRA, US Fish & Wildlife, and TVA can assist with determining the flow and wetted perimeter needed to maintain aquatic habitat. The questions about flows for maintenance of aquatic habitat and wasteload assimilation have never been delinked.

- City of Columbia identified that wastewater treatment plants seem to always be the culprits, but the NPDES permits need to be modified. It was noted that the permits combine worst case conditions for flow/BOD/temperature, which would not actually all occur at the same time. Releases from Normandy Reservoir are set to assimilate the permitted WWTP discharge (maximum) which does not occur during drought conditions (i.e., low flows).

Cost Methodology

- Doug Murphy explained that funding for DRAWSP is paid by 5¢/1,000 gallons sold by member water systems. Alternatives should not be screened out due to cost because other forms of financing may be available.
- OBG will generate capital and operation and maintenance costs for alternatives.

Evaluation Criteria and Decision Making

Decision making

- The Board of DRA will be the "ultimate decision maker". They will consult with DRATAC, Water Resources Council (WRC), and the Consultant Team.

Evaluation criteria

- Evaluation criteria proposed for this study include: reliable capacity, raw water quality, cost, implementability/risk of delays, flexibility, environmental or recreational benefit.
- Risk of not meeting needs is incorporated into reliable capacity criteria.
- There does not appear to be a point at which water quality in Normandy Reservoir cannot be treated to meet drinking water regulations. The additional cost for treatment due to lower water levels in Normandy Reservoir will be included. Retain water quality criteria to reflect taste and odor issues that occur at low water levels in Normandy Reservoir. Water quality can also be used to address wastewater improvements.
- TEC identified that various recreational needs should be considered for the alternatives (e.g., type of fishing that may be done under one alternative vs. other

should be listed). May want to differentiate between reservoir and riverine recreation.

- May want to consider "Economic Development" as a criterion. This criterion is separate from recreation. What is the cost to the community if you don't provide water supply? What is the whole region going to look like in the future? Need to balance growth and recreation. Recreational use may be suitable for justification of a lake in the region if that is what the DRA Board decides (i.e., do not have to construct a reservoir for water supply if there are better options).
- TNC identified that if endangered species drop off the endangered species list as a result of an alternative, it is a positive benefit.

Draft List of Available Studies and Initial Alternatives

The list of alternatives in the TVA Draft E.I.S. (2000) report will be used as the starting point for identifying new alternatives. OBG requested that participants reconfigure alternatives included in the list or provide new alternatives not included in the list.

Participant Input / Comments

Meeting projected needs is a risk analysis and the stakeholders will need to make some decisions regarding the magnitude of the "insurance policy" that is appropriate to meet future droughts.

Participant Comment: 50-year planning period is not a long time for planning. A 100-year planning period should be considered. DRA noted that the study has a 100 year vision.

Workshop No. 2

Workshop No. 2 scheduled for August 26, 2009 at HHSP.

Key Action Items

- OBG will finalize website and post meeting materials.
- OBG will obtain most recent TVA / USGS water demand projections study and study conducted by Division of Community and Economic Development.
- Contact TDEC to define constraints along the Duck River, wasteload assimilation requirements under alternate flow conditions, NPDES permit limits, define improvements at wastewater facilities, etc.
- Obtain NRCS estimates for water withdrawals for agriculture.
- OBG will draft a definition for environmental and recreational criteria.

Duck River Comprehensive Regional Water Supply Plan

Workshop No. 1
Kickoff Meeting

June 24, 2009

O'BRIEN & GERE
www.obg.com

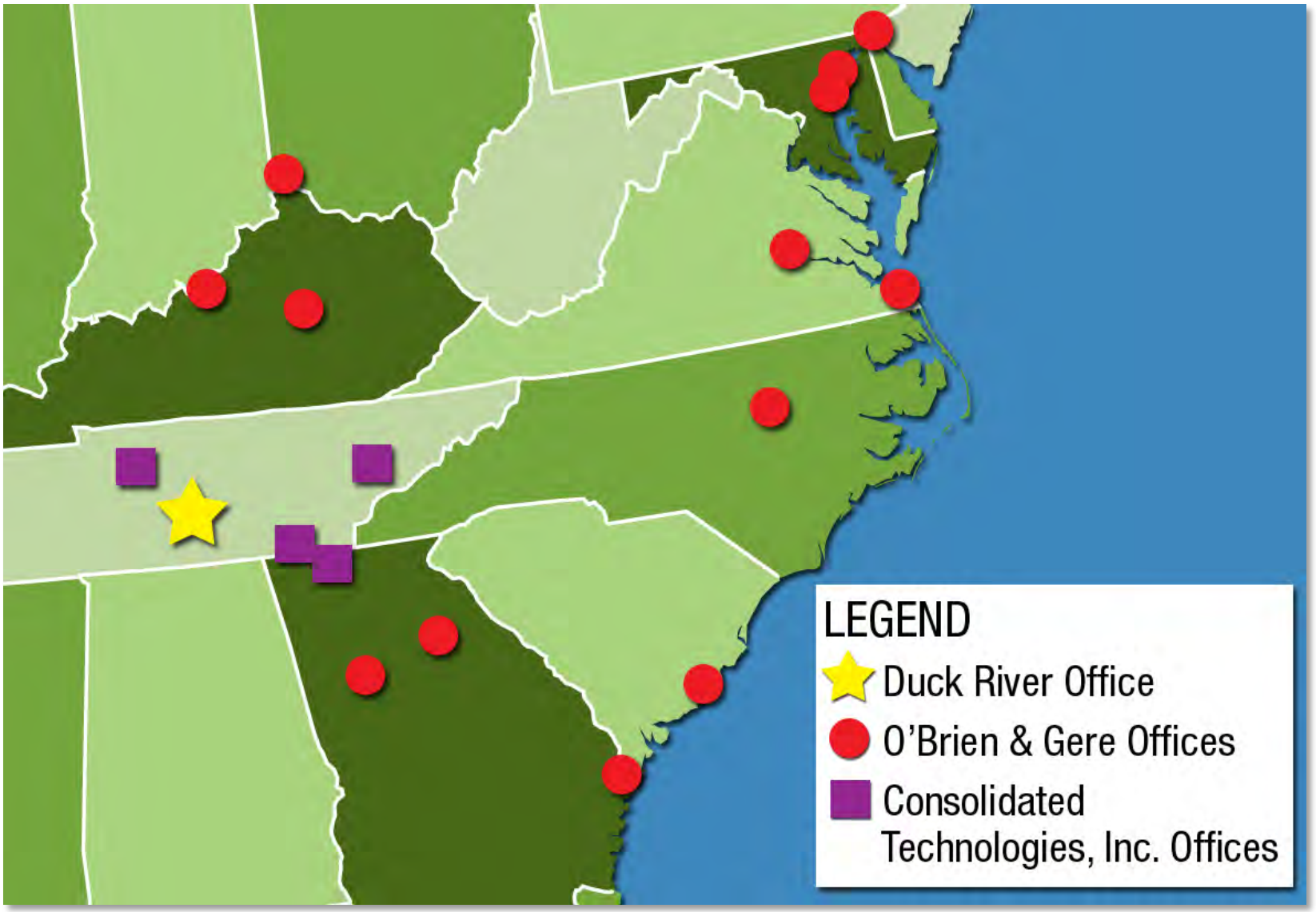
Workshop Agenda

- **Introductions and Workshop Format**
- Missions and Goals
- Project Overview
- Stakeholder Participation
- Steering Committee Role
- Triple Bottom Line and Shared Vision Planning
- Demand Projections and Water Supply Needs
- Cost Methodology
- Evaluation Criteria
- Draft List of Available Studies and Initial Alternatives
- Next Steps

Introductions

- **O'Brien & Gere / Consolidated Technologies Inc. (CTI) Consultant Team**
  - Blend of national expertise and Tennessee resources
  - Proven track record achieving innovative solutions for regional water supply
  - Inclusive approach that integrates input from stakeholders and builds consensus
  - Employee-owned firms
  - "Source to Tap" water supply services

O'Brien & Gere - CTI Office Locations



O'Brien & Gere – Prime Consultant

- **George Rest, PE** – Project Manager and Principal-in-Charge
  - 30+ years of water supply experience involving master planning, designs, and construction
  - Successful regional water programs in Kentucky, Virginia, Maryland, Michigan, Alabama, New York, and New Jersey
  - Applied Decision Support Systems for over 20 water projects
- **Thomas Dumm, PE** – Water Supply Planning
  - 20+ years of water supply and infrastructure planning
  - Chair of AWWA's Water Resources Planning and Management Committee (includes subcommittee on Climate Change)
  - Expertise in drought mitigation planning, hydrologic and hydraulic modeling

CTI – Subconsultant

- **Joseph Bishop, PE** - Quality Review and Advisory
  - 30+ years of planning, design, and construction administration experience involving supply, treatment, storage, pumping, and transmission in Tennessee
- **Jerry Hightower, PE** - Water Supply Planning / Facilities
  - 30+ years of water resource planning and design experience, including water supply, treatment, storage, pumping, transmission in Tennessee
  - Project manager on numerous Duck River Utility Commission projects (Water Treatment Plant, etc)
- **Gary Cosby, PE** - Environmental / Permitting – TVA / TDEC
  - Specialized experience in environmental permitting, consultation, and negotiation with TDEC

Other Consultants

- Specialty Sub-consultants to O'Brien & Gere:
  - **Dinkins Biological Consulting** (Gerald Dinkins and Steve Ahlstedt)
    - Duck River fish and mussels species
  - Network of other specialists
- Consultants to DRA:
  - **BDY Environmental, LLC**
    - Environmental Permitting
  - **Public Relations Firm (TBD)**
    - Communications support
    - Outreach to elected officials
  - **HydroLogics**
    - Modeling support

Workshop Format

- Transparent Planning Process
  - Workshops are open to the public
- Workshop Format
  - Invited participants (stakeholders) – your input is welcome at any time
  - Public – you are welcome to observe, and you have several opportunities for input. Please:
    - Identify yourself
    - State if you are representing a group/organization
    - Limit your comments to 2-3 minutes
  - Written questions or questions should be directed to Doug Murphy, Executive Director, Duck River Agency
    - *Doug@duckriveragency.com*

Workshop Agenda

- Introductions
- **Missions and Goals**
- Project Overview
- Stakeholder Participation
- Steering Committee Role
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- Draft List of Available Studies and Initial Alternatives
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Fulfilling DRA's Mission

Mission of the Duck River Agency (DRA)

"To develop, protect and maintain a clean and dependable water resource for all citizens in the Duck River Region"

Bedford, Coffee, Hickman, Marshall, and Maury Counties

Project Goal

"The goal is to have a (comprehensive) Plan that will provide direction to the DRA regarding the management of available water resources, including the implementation of specific water supply infrastructure projects."

Stakeholders Objectives

- Please identify your (or agency's) objectives
  - What do you need from this Study to make your investment of time worthwhile?
    -
    -
    -
    -

Workshop Agenda

- Introductions
- Missions and Goals
- **Project Overview – Issues, Approach & Schedule**
- Stakeholder Participation
- Steering Committee Role
- Triple Bottom Line and Shared Vision Planning
- Demand Projections and Water Supply Needs
- Cost Methodology
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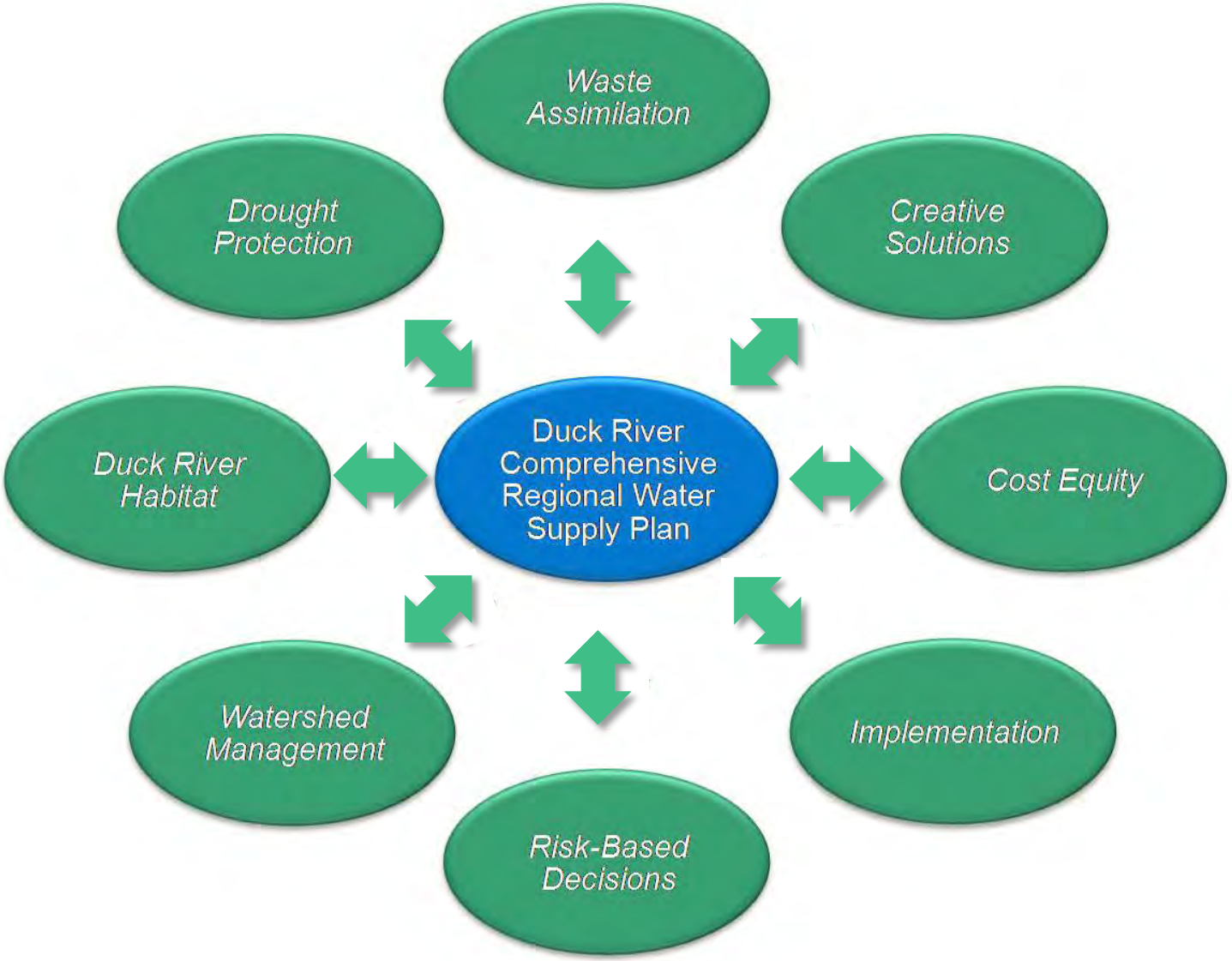
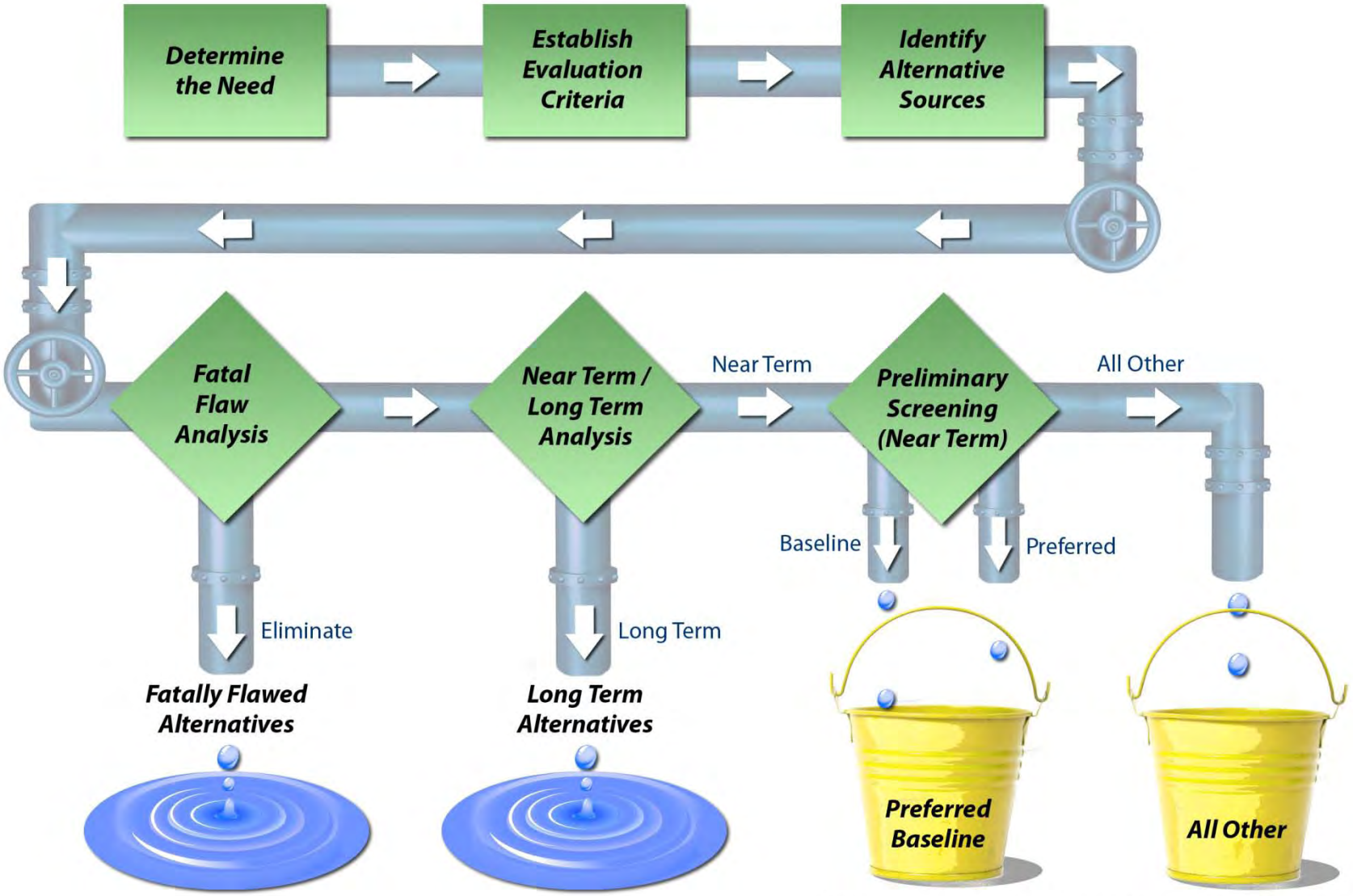
Key Project Issues



Project Approach

- An approach (**see graphic**) that integrates:
  - Water Quality and Capacity
  - Reliability and Permitting
  - Financial
  - Community Impacts and Public Policy
- Need your help to address stakeholder input

Alternatives Evaluation



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Summary of Approaches and Tools

- Integrate technical, environmental permitting, financial, community impact and public policy elements to reduce potential for rework
- Engage potential participants/decision-makers in a step-wise process for selection of recommended alternative
  - A series of steps proceeding from goals to criteria to actions
- Use proven cost models and decision models to enhance confidence and efficiency

Project Schedule

PHASE I	
Workshop No. 1 - Kick-off	Today
Workshop No. 2 - Preliminary Feasibility	Aug. 26?
Open House Meetings	Sept. 30?
PHASE II	
Workshop No. 3 - Developing Alt's	Early Dec
Workshop No. 4 - Evaluating Alternatives	Early Feb '10
Open House Meetings	March '10
PHASE III	
Workshop No. 5 - Implementation Planning	April '10
Draft Report	May '10
Workshop No. 6 - Conclusions	June '10
Final Report	July '10
Open House Meetings	August '10

Communications - Key Elements

- Routine points of contact:
  - Doug Murphy – DRA
  - George Rest – O'Brien & Gere
  - Thomas Dumm – O'Brien & Gere
- Stakeholder participation
  - Interactive work sessions
- Agency outreach – Tennessee Department of Environmental Conservation, Tennessee Valley Authority, Nature Conservancy, US Fish and Wildlife, Tennessee Wildlife Resources Agency, etc.
- Briefings for elected officials, and as desired, water purveyors, news media



Communications - Tools and Techniques

- Open-house style public meetings
- Website in development
  - Access to work products and schedules
  - Solicit / receive input
- Printed media



Communications adapted to project needs

Feedback Period #1



Workshop Agenda

- Introductions
- Missions and Goals
- Project Overview
- **Stakeholder Participation**
- Steering Committee Role
- Triple Bottom Line and Shared Vision Planning
- Demand Projections and Water Supply Needs
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Key Issue in Stakeholder Participation

- **Issue:**
  - How to consider stakeholder input in evaluating water supply alternatives?
- **Options (In order of increasing stakeholder input):**
  - Agree on Evaluation Criteria and Definitions
  - ***Input*** on Evaluation Criteria ***Weighting***
  - ***Consensus*** on Evaluation Criteria ***Weighting***
  - ***Input*** on Water Supply Alternative ***Selection***
  - ***Consensus*** on Water Supply Alternative ***Selection***

Stakeholder Participation

- Who are the Stakeholders?
- Role of Stakeholders
  - In workshops
  - As advisors outside of workshops
  - Input on alternatives
  - Other roles?
    - Public outreach?
    -
    -

Workshop Agenda

- Next Steps
- Introductions
- Missions and Goals
- Project Overview
- Stakeholder Participation
- **Steering Committee**
- Triple Bottom Line and Shared Vision Planning
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Steering Committee

- Roles of Steering Committee
  - Guidance on:
    - Technical approach and scope
    - Workshop agenda and format
    - External communication
  - Sounding board on key decisions
- Proposed membership
  - Diverse representation of stakeholders:
    - DRA Board
    - Utilities
    - Regulatory agencies
    - Environmental interest groups
- Your input on use of a Steering Committee

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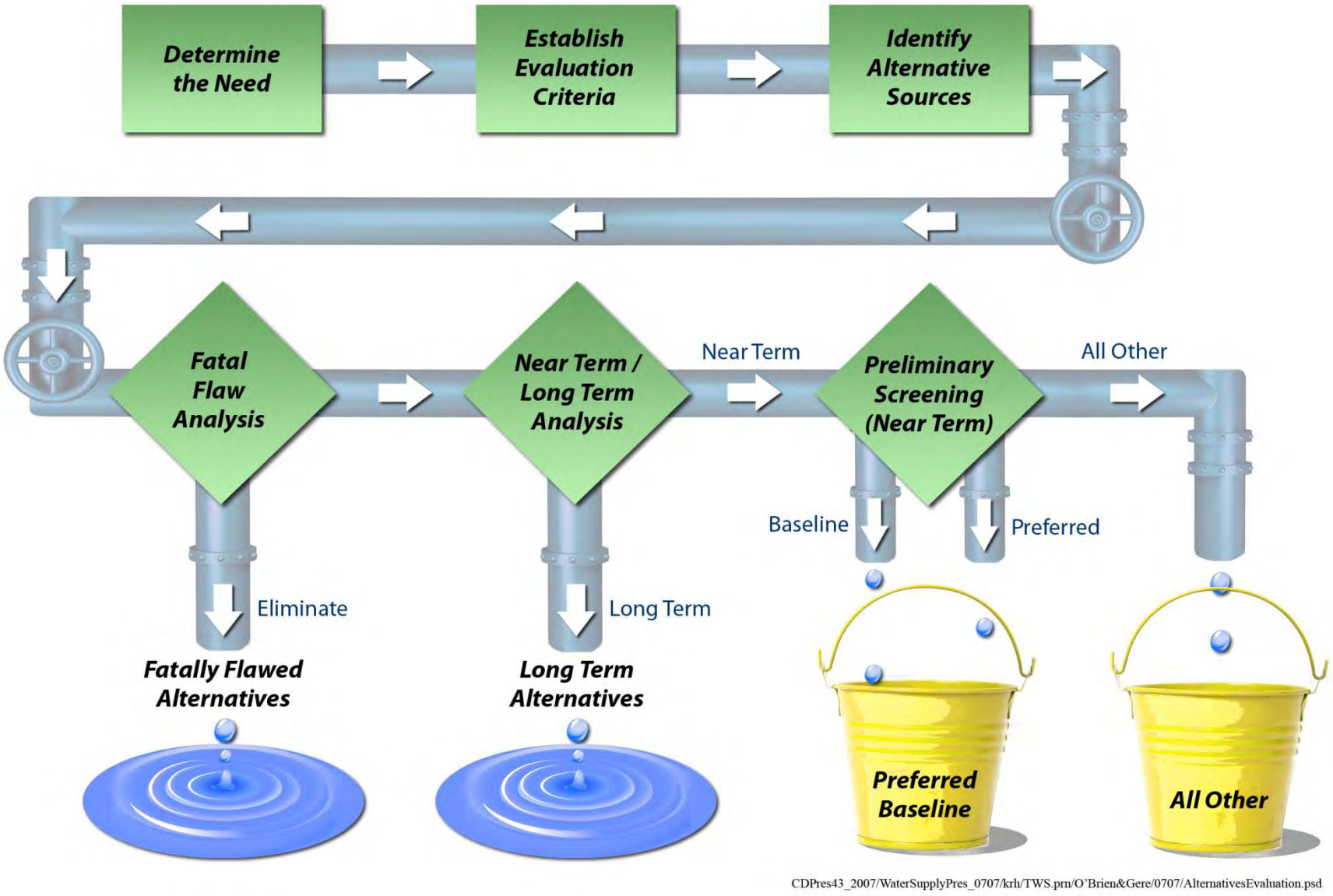
Alternatives Evaluation



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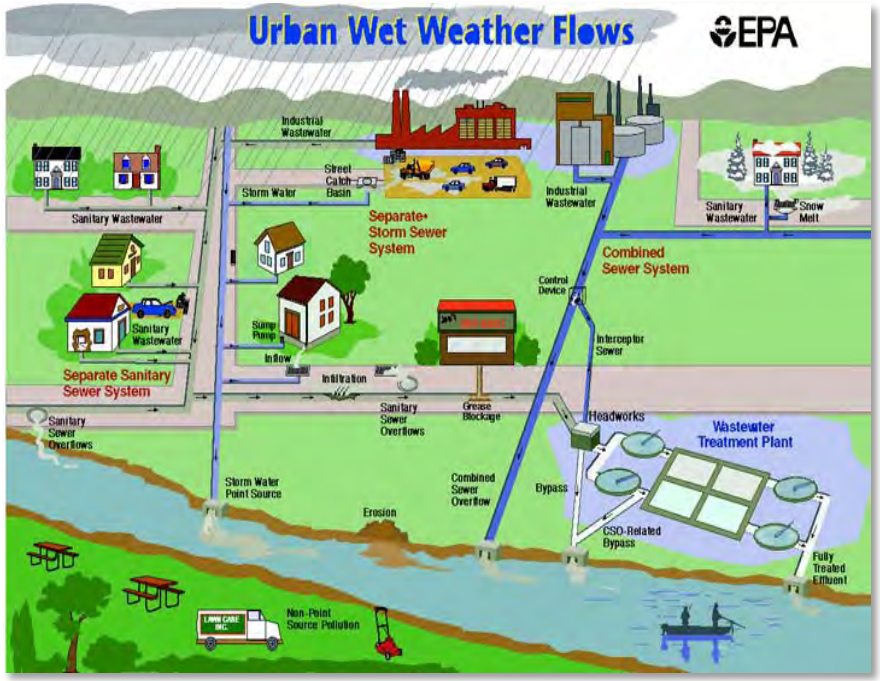
Environmental Issues for Duck River

- Problems
  - Modification of natural flow regimes
  - Sedimentation
  - Nutrient loading
  - Habitat disturbance or destruction



- Causes
  - Mill dams along the river
  - Surface withdrawals (municipal & industrial)
  - Agricultural practices
  - Land development practices
  - Wastewater treatment /effluent
  - Urban stormwater run-off

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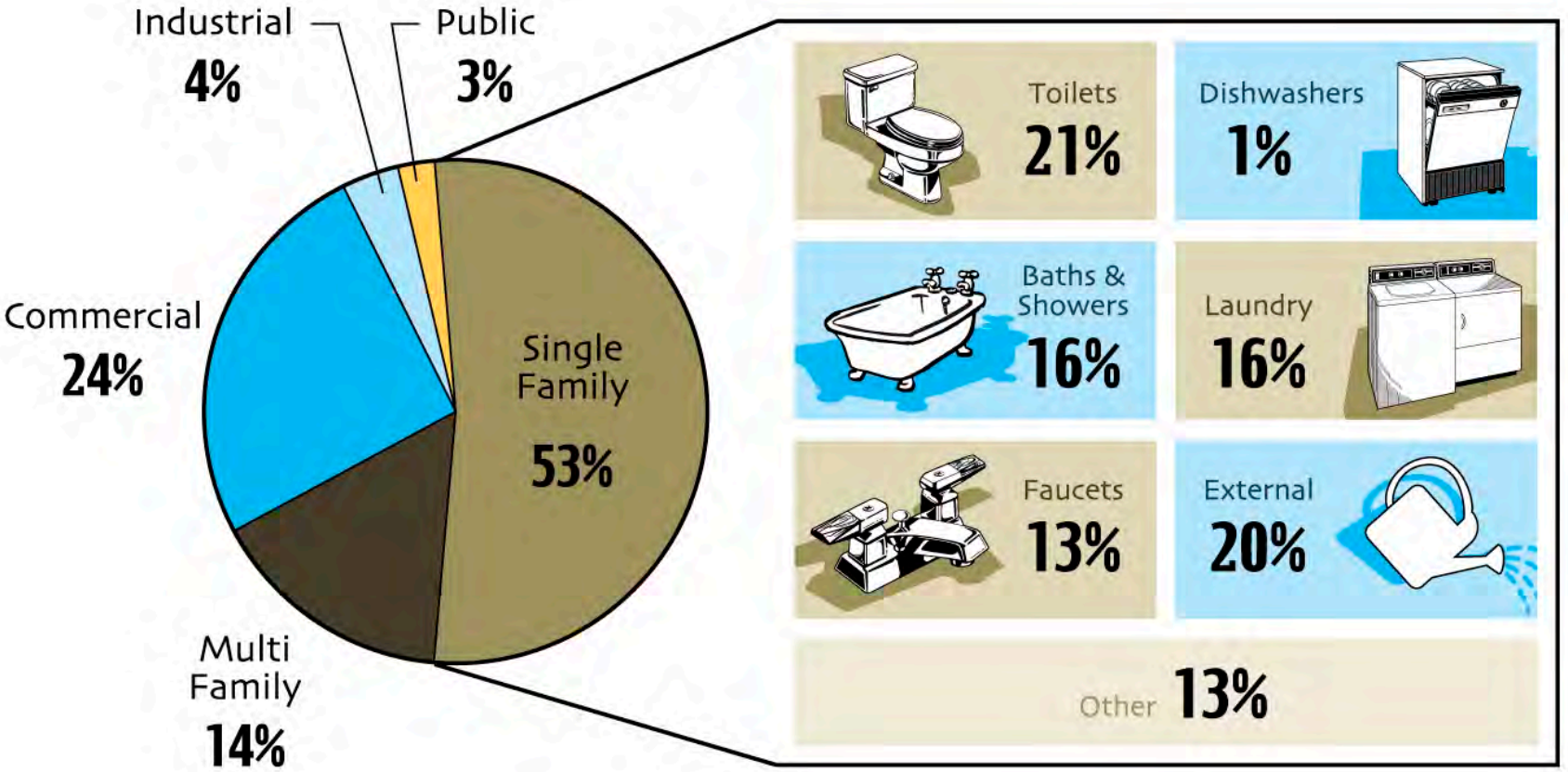
How Average and Peak Demand Projections are Typically Used

Water Components	Average Day	Drought Demand	Maximum Day	Maximum Hour/Fire Flow
Source of Supply • With Storage	✓			
Source of Supply • Run-of-River or Groundwater			✓	
Source of Supply • Normandy Lake/Duck River		?		
Water Treatment Plant			✓	
Pumping & Transmission			✓	✓
Finished Water Storage				✓
Distribution				✓

Demand Projection Model Overview - Water Use Profile for Metro Atlanta

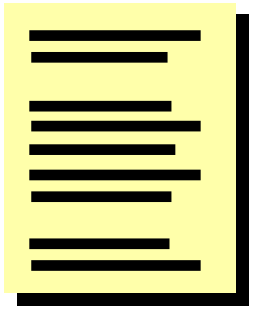


Conservation, Efficiency & Demand Management

- Save money on capital projects, O&M
- Lessen environmental impacts
- Public desires water efficiency
- Meet regulatory requirements



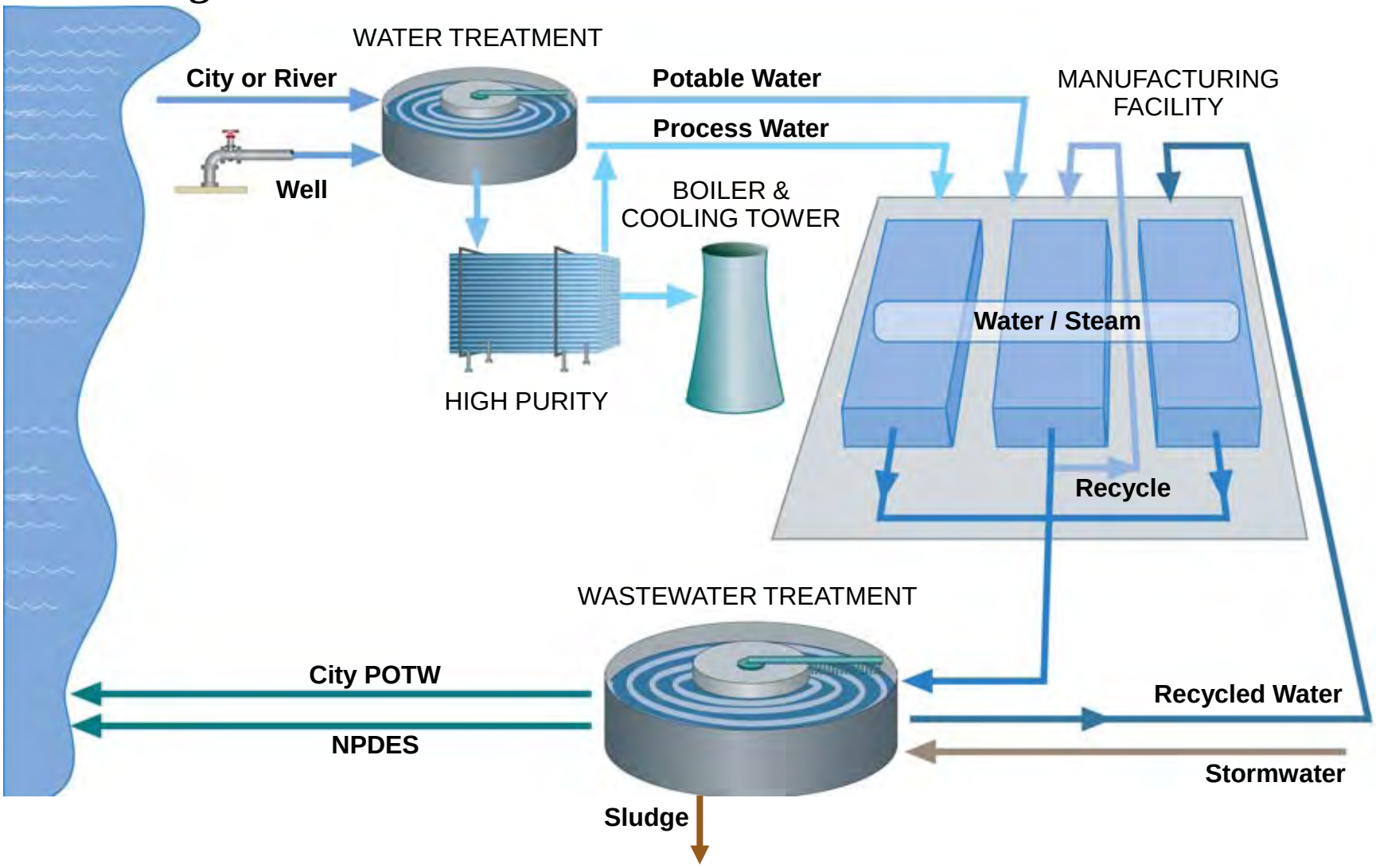




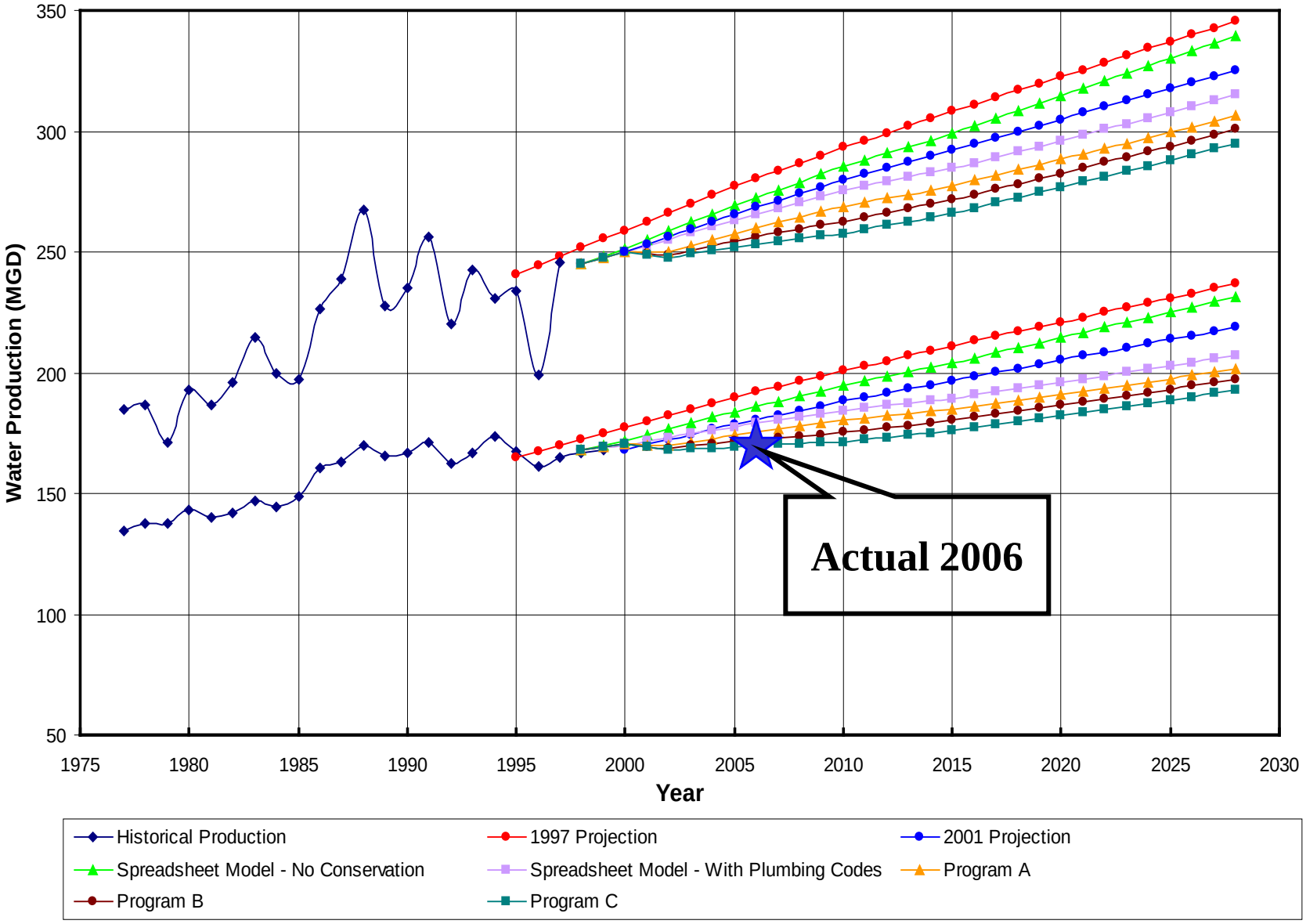


Customer / Marketplace Demand

Addressing the industrial water market:



Average and Peak Day Production/Demand Projections



River Constraints

- Normandy Reservoir intended to provide recreation, flood protection, water supply and water quality benefits
- Originally Normandy Dam releases expected to provide 165 cfs at Shelbyville
- Drought of 1980-1981, TVA reduced the Normandy Dam release from 155 cfs to 80 cfs (December – May) at Shelbyville
- In 1991, Shelbyville requested that the Normandy Dam release be raised to 120 cfs at Shelbyville for winter and early spring months
- Currently, TVA provides a minimum release of 40 cfs from Normandy Dam to sustain aquatic habitat in the reach immediately downstream of dam and an additional release to maintain seasonal varying flow at Shelbyville (155 cfs for 6/1-11/30 and 120 cfs for 12/1-5/31)

River Constraints

- WWTPs along Duck River: Shelbyville, Tyson Foods, Chapel Hill, and Columbia
- Water supply intakes along Duck River: Shelbyville, Bedford County, Lewisburg, Spring Hill, and Columbia
- Six mussels federally listed as endangered in this vicinity, one fish federally listed and three federal candidate mussels
- During drought of 2008, Normandy Dam releases set at minimum of 165 cfs at Milltown gage (80 cfs at Shelbyville plus additional local inflow) and ammonia level less than 0.3 mg/L at Halls Mill Station triggered higher releases (February-May 2008)

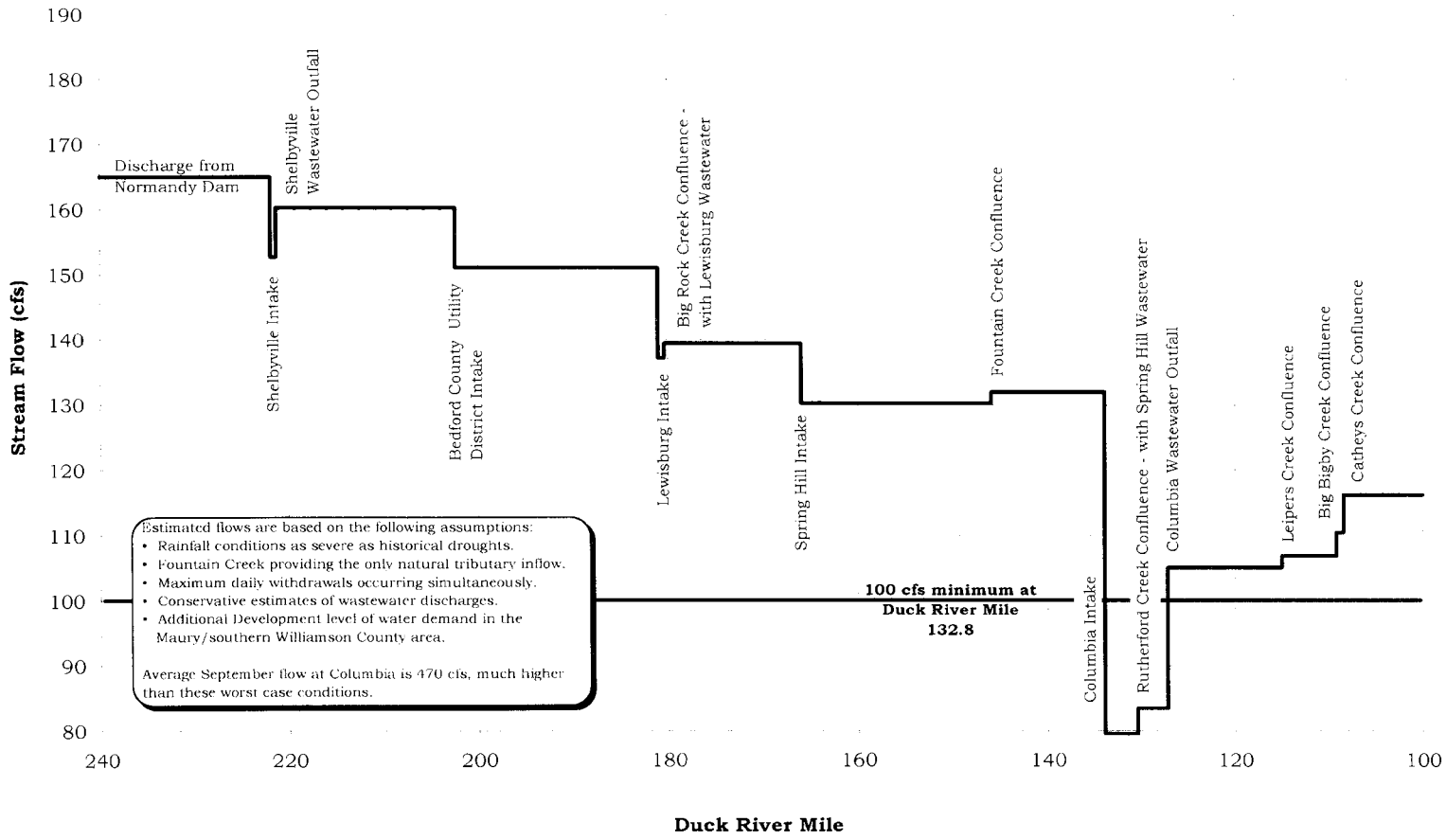


Figure 3. The potential effects of anticipated water supply withdrawals and wasterwater discharges on flows in the Duck River during possible drought conditions in 2050.

Projected Supply Deficits

- **Maximum Day Deficit (Unrestricted) = ?**
- **Maximum Day Deficit (Restricted) = ?**
- **Worst-case Drought Deficit = ?**
- *Are all users subject to the same water restriction policies?*

Key Issues for Water Needs

- How to determine the quantity needs, given these strategic issues:
  - Address both drought deficit and non-drought deficit?
  - Include conservation/demand management as an alternative?
  - Agricultural withdrawals during drought and non-drought conditions?
  - Interruptibility…use minimum permitted withdrawal?
  - Planning period…50-year projection (2060)?
  - Potential for water users to want more or less than projected need?
  - How much flow is returned to Duck River from WWTPs?
  - What flow regimes should be considered solely for aquatic habitat?
  - What limits on wastewater discharges associated with desired flow regimes?

Feedback Period #2



Workshop Agenda

- Introductions
- Missions and Goals
- Project Overview
- Stakeholder Participation
- Steering Committee
- Triple Bottom Line and Shared Vision Planning
- Demand Projections and Water Supply Needs
- **Cost Methodology**
- Evaluation Criteria
- Draft List of Available Studies and Initial Alternatives
- Next Steps

Cost Methodology

- Concept (order-of-magnitude) level cost estimates:
  - Rule-of-thumb and unit pricing
  - Develop “apples to apples” cost estimates
    - Capital and operating costs
  - Use cost model to compare present worth costs
    - Sensitivity tests on financing options

Developing Cost Estimates

- Typical unit costs
  - Dams, reservoirs, intakes
  - Wells
  - Water treatment plants
  - Pumping stations
  - Pipelines
- Compare with previously reported costs

Workshop Agenda

- Introductions
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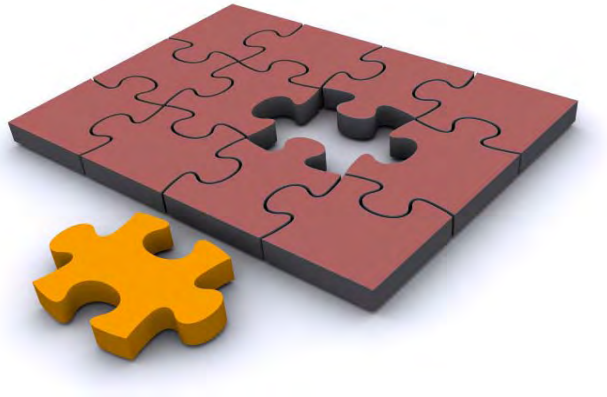
- Cost Methodology
- **Evaluation Criteria and Decision Making**
- Draft List of Available Studies and Initial Alternatives
- Next Steps

Decision Making



- Who makes decisions and how?
  - DRA Board has final decision
  - DRATEC, WRC and others provide input
  - Consultant Team will make a recommendation
  - Compare alternatives using “apples to apples” cost estimates
    - Capital and operating costs
  - Identify non-cost evaluation criteria, such as:
    - Water quantity and quality
    - Implementation (including ability to meet schedule)
    - Adaptability for the future
    - Environmental benefits and impacts
  - Use “pair-wise” decision process to include all cost and non-cost criteria

Draft Evaluation Criteria

- Reliable capacity
- Raw water quality
- Cost
- Implementability / risk of delays
  - Permitable
  - Public acceptance
  - Property acquisition
- Flexibility
  - Phased implementation
- Environmental or Recreational benefits?

Other criteria?

Draft Evaluation Criteria

- **Reliable Capacity**
  - Reliable quantity of raw water and finished water to meet projected needs through the planning period. This criterion addresses interruptibility of sources of supply.

Draft Evaluation Criteria

- **Raw Water Quality**
  - Raw water quality that meets existing water quality requirements, and can readily achieve future anticipated regulations. This criterion may also address water quality preferences such as superior raw water quality, and finished water taste.

Draft Evaluation Criteria

- **Cost**
  - The present worth cost for proposed water improvements, including capital, operating and maintenance costs. This cost could include allowance for wholesale water purchases.

Draft Evaluation Criteria

- **Implementability**
  - The relative ease of implementing the proposed improvements in time to meet projected needs. This criterion considers the potential that regulatory permitting (including environmental considerations), public acceptance, property acquisition, or constructability issues could delay implementation.

Draft Evaluation Criteria

- **Flexibility**
  - The ability to phase implementation and spread the cost over time while still meeting projected needs. This criterion addresses the ability to extend beyond the planning period and to accommodate changes in the service area.

Draft Evaluation Criteria

- **Environmental or Recreational Benefits?**

Using Pair-Wise to Weight Evaluation Factors

		Adequate Capacity	Raw / Finished Water Quality	Cost	Implementability	Flexibility	
1	Adequate Capacity		5	2	1	3	18
2	Raw / Finished Water Quality	1		1	1	2	8
3	Cost	4	5		3	4	27
4	Implementability	5	5	3		3	27
5	Flexibility	3	4	2	3		20
							100 Total

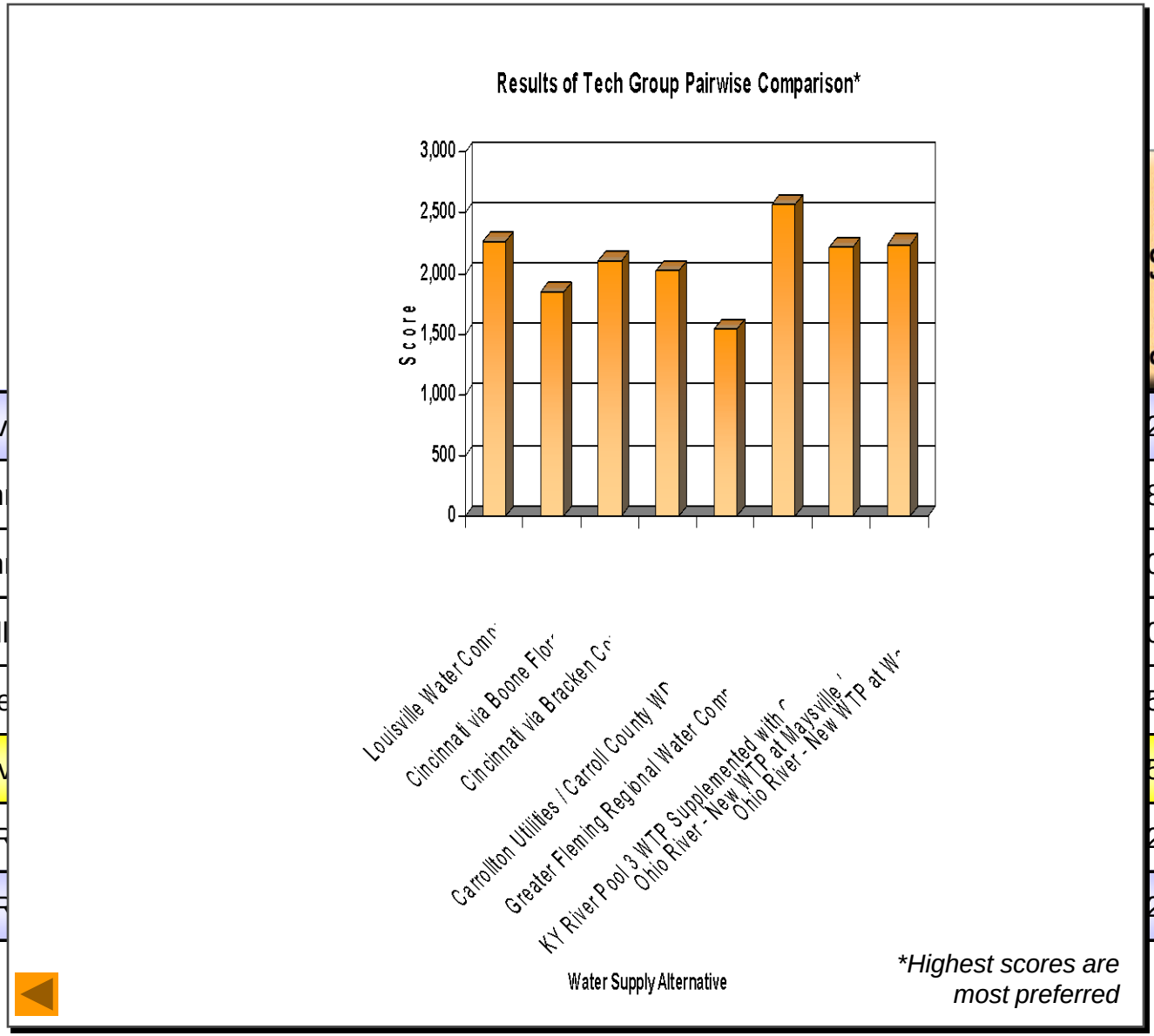
Note: Rank the relative importance of the left-column criteria against the top row criteria on a scale of 1 to 5.
1 = much less important; 3 = equivalent; 5 = much greater importance

Selecting Additional Sources of Supply

BWSC - Preferred Option Ranking Worksheet

Criteria Summary	Adequate Capacity	Raw / Finished Water Quality	Cost	Implementability	Flexibility	Sum of Scores	Rank
Louisville Water Company	468	168	729	459	440	2,264	2
Cincinnati via Boone Florence	414	168	594	391.5	280	1,848	7
Cincinnati via Bracken County	414	168	594	513	410	2,099	5
Carrollton Utilities / Carroll County WD No. 1	342	168	540	567	410	2,027	6
Greater Fleming Regional Water Commission	144	168	297	648	280	1,537	8
KY River Pool 3 WTP Supplemented with Ohio River	414	168	594	796.5	600	2,573	1
Ohio River – New WTP at Maysville / Dover	414	168	594	580.5	460	2,217	4
Ohio River – New WTP at Warsaw	414	168	594	580.5	480	2,237	3

Selecting Additional Sources of Supply



	Sum of Scores	Rank
Louisv	264	2
Cincin	348	7
Cincin	099	5
Carroll	027	6
Greate	537	8
KY Riv	573	1
Ohio R	217	4
Ohio R	237	3

Workshop Agenda

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- Next Steps

Suggested ways of meeting the anticipated need for additional water supply in the Maury / southern Williamson County Water Service Area (Duck River DEIS, 2000)

Suggestions within the Maury / southern Williamson County Water Service Area

- Finish Columbia Dam
- Build Fountain Creek Reservoir (at elev. 630)
- Build some other full-pool reservoir in the area
- Build a run-of-the-creek reservoir on Fountain Creek (elev. 600)
- Increase capacity of the pool upstream from the existing Columbia City dam
- Construct a water intake at River Mile 163 to supply the Maury County and southern Williamson County water systems
- Construct a water intake at River Mile 108 to help supply this service area
- Ground water – intercept 5 to 10 cfs loss along Duck River
- Improve the river habitat downstream from River Mile 133 and request a waiver from the State for that reach during droughts (down to 80 cfs)
- Discharge the Columbia wastewater closer to the water intake
- Pump water downstream for the sewage outfall to the Columbia City damn pool
- Recycle wastewater
- Go to a closed-loop system at Columbia

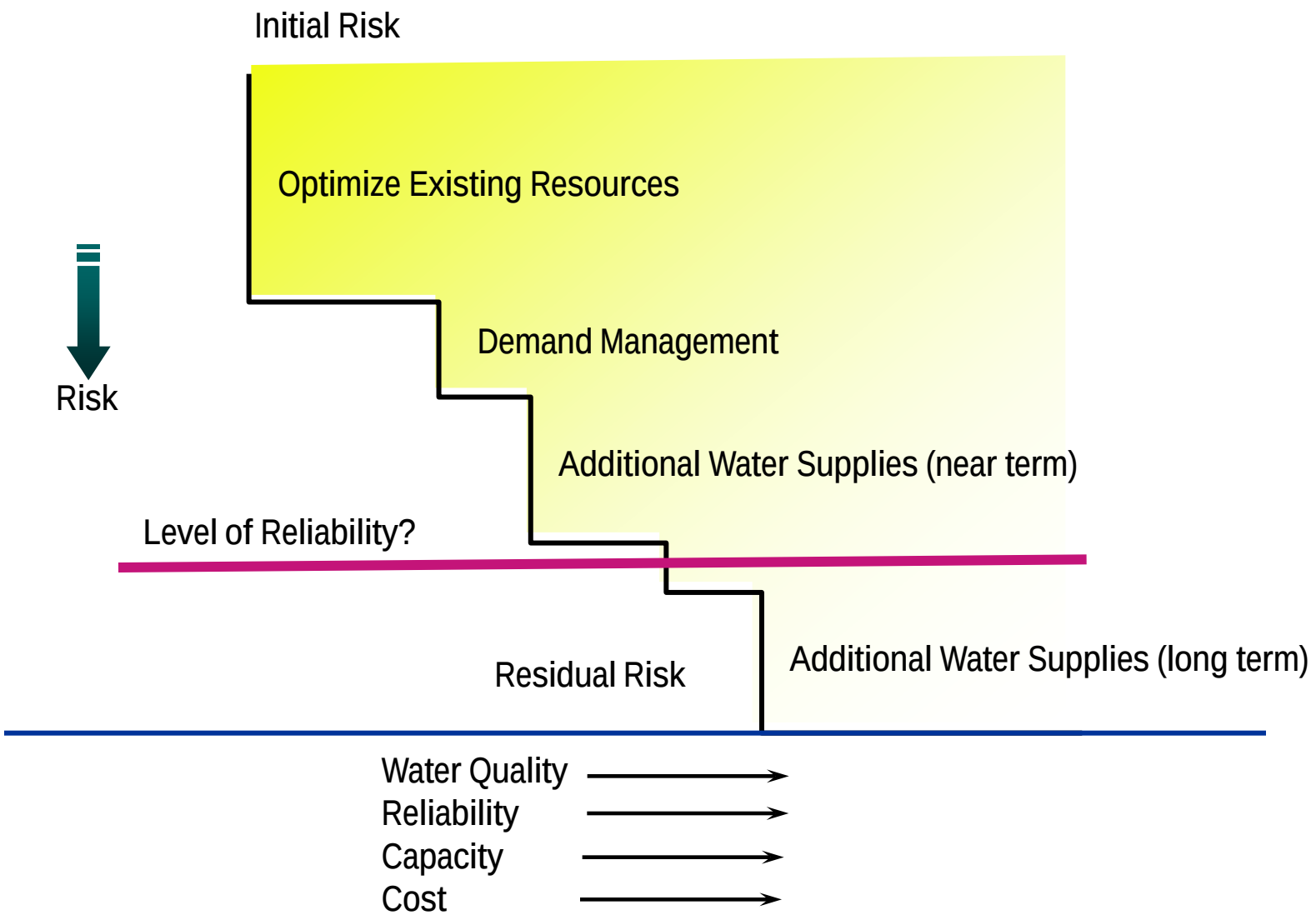
Suggestion within the Duck River Watershed

- Higher discharge from Normandy Reservoir
- Re-evaluate Normandy curve guide
- Raise Normandy pool elevation
- Build off-stream storage to harvest flood water (active or passive filling)
- Raise and repair Lillard Mill dam to augment its use as a source
- Relocate the Lewisburg wastewater outfall to the Duck River
- Drill wells in the watershed
- Reduce irrigation withdrawals and develop a plan to compensate farmers
- Require industrial water conservation
- Require return of all withdrawals from the Duck River
- Impose mandatory reductions during droughts
- Water conservation through pricing and other measures; withdrawal charges
- Water rates – Jack price up past 7000 gpd use; index to rainfall records
- Promote better cooperation between water systems (consolidations?)
- Water allocation formula – consensus approach
- Manage future growth; recognize water limits
- Restrict future growth
- Educate the public about the integrated nature of water use
- Establish an (annual) intensive water use / availability assessment program

Suggestions Involving a Wider Area

- Pipe water in from some other source (inter-basin transfer)
- Pipeline between Tims Ford and Normandy Reservoirs
- Discharge Arnold Engineering cooling water into Duck
- Buy water from nearby systems
- Search for nearby groundwater sources

Sample Risk Reduction



Workshop Agenda

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Feedback Period #3



WORKSHOP 2

Duck River Development Agency
Comprehensive Regional Water Supply Plan

***Draft* AGENDA**
WORKSHOP NO. 2
Henry Horton State Park
August 26, 2009
9 AM to 2:30 PM

Introductions (9 am)

- Consultant Team - O'Brien & Gere / CTI Team, other team members
- Meeting Participants

Review of Minutes from Workshop No. 1

Summary of Activities Since Workshop No. 1

Present Project Website

Objectives for Workshop No. 2

Water Supply Availability
- Service Area
- Yield and Reliability
- Reservoir and River Constraints
- Results of OASIS Modeling

Meeting Participant Input / Comments

Break (10:30 am)

Water Demand Projections
- Sources of Information
- Historic Water Use for Utilities, including peaking and return flow issues
- Existing and Future Water Demands by Water Service Area and Region
- Non-utility Water Uses

Needs Assessment
- Comparison of Existing and Future Water Supplies and Demands
- Discussion of Timing and Magnitude of Water Needs

Meeting Participant Input / Comments

Lunch (12 Noon)

Alternatives Evaluation Criteria

- Decision Making Process
- Review and Finalize Evaluation Criteria and Definitions
- Discuss Potential for Fatal Flaws
- Develop Weighting Factors

Discussion of Water Supply Options

- Preliminary Review of Potential Alternatives
- Solicit Input on Options

Cost Estimating Approach

Planning for Open House (Public Meetings)

- Format
- Roles and Responsibilities
- Dates and Locations

Next Steps

- Next Meeting
- Action Items Summary

Meeting Participant Input / Comments

Adjourn (2:30 pm)

Duck River Development Agency
Comprehensive Regional Water Supply Plan

Meeting Minutes
WORKSHOP NO. 2
Henry Horton State Park
August 26, 2009
9 AM – 2:30 PM

Meeting Participants

Name	Organization	E-Mail	Telephone
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Rhedona Rose	TN Farm Bureau Federation	rrose@tfbf.com	931.388.7872

Attachments: Agenda, MS PowerPoint presentation

Introductions

Meeting participants introduced themselves and the format for the workshops was discussed. O'Brien & Gere presented Duck River Agency's mission and the project goal.

Review of Minutes from Workshop No. 1

O'Brien & Gere briefly summarized the key points from Workshop No. 1.

Summary of Activities Since Workshop No. 1

O'Brien & Gere reviewed the activities conducted subsequent to Workshop No. 1.

Present Project Website

The project website was presented to the meeting participants and should be available to the public the week of August 31.

Objectives of Workshop No. 2

O'Brien & Gere identified key objectives of Workshop No. 2 including water supply needs analysis and review of evaluation criteria.

Water Supply Availability

- O'Brien & Gere identified four water service areas which correspond to the water service aeras used in the 2008 USGS study: Coffee, Bedford, Marshall, and Maury/southern Williamson.
- The TVA timeline illustrated that there has been an extensive amount of water supply planning conducted in the Duck River watershed dating back to the 1930's.
- The DRUC withdraws water directly from Normandy Reservoir while Shelbyville, BCUD, Lewisburg, Spring Hill and Columbia withdraw water directly from the main stem of the Duck River.
- For wastewater discharges, Manchester discharges upstream of Normandy Reservoir; Tullahoma discharges to the Elk River; Shelbyville, Tysons, Chapel Hill, and Columbia discharge to the main stem of the Duck River; and Lewisburg and Spring Hill discharge to tributaries of the Duck River.
- Participant comment: The operating protocol (i.e., operating curve) for Normandy Reservoir is based on flood control and not water supply.
- A plot of historic water levels indicates that Normandy Reservoir has dropped to around 852 ft in 1981 (before changes were made to the operating guideline) and 2007, but information on reservoir water quality and pump operating characteristics if the reservoir drops below 852 ft is unknown.
- A "constraint" for purposes of this workshop discussion is considered to be enforceable requirement from TVA, TDEC, etc. The presentation focused on constraints addressing reservoir releases and minimum instream flow. Water withdrawal permit limits were not included in the hydrologic modeling constraints, but will be included in the Needs Assessment Report.
- Reservoir constraints used in the modeling analyses were presented.
- HydroLogics identified that the OASIS model incorporates multiple constraints, withdrawals and returns.
- O'Brien & Gere identified that utility withdrawals from the reservoir were based on average daily demands whereas utility withdrawals from the river were based on peak day. O'Brien & Gere identified aggregate peaking factor for river utilities which was computed by adding the daily water withdrawals for 2003-2007.

- HydroLogics identified that the OASIS model is capable of "perfect" releases during the 2007 drought and the model runs indicate that TVA released approximately 20 cfs of excess flow from Normandy Reservoir to the river (as measured at Shelbyville) for an extended period during the 2007 drought.
- O'Brien & Gere identified that the available supply during the 2007 drought (critical drought of record) based on the defined constraints was roughly 42 mgd. Much discussion followed with several participants emphasizing that it is important that it be clearly stated that this available flow reflects a single event in the period of record.
- Participant comment: We would have had lots of water in 2007 if the releases more closely matched the flows needed and that should be noted. We would have preserved storage in Normandy Reservoir.
- Participant comment: It is important to recognize that 2007 drought is the drought of record, but a more severe drought could occur. Should the study use a drought worse than the 2007 drought?
- Participant comment: Note that additional river constraints may include the water utilities' current limits on maximum permitted withdrawals. O'Brien & Gere agreed to include withdrawal permit information in the Needs Assessment Report.
- Participant comment: The supply available is based on a single point during the drought of 2007 and needs to be put in context (i.e., quantity, duration, probability, etc.).
- Participant comment: Flow in the river for wasteload assimilation will be a greater need than water use. This situation should be considered in the alternatives discussion.
- Participant comment: Do the water demands account for water used from the Duck River outside the Duck River Basin such as Spring Hill North, HB & TS, Cornersville? The USGS identified that these areas were included in the water service areas.

Water Demand Projections

- Several sources of information such as USGS, UT's CBER, and TVA (1979) were used to estimate future water demands. O'Brien & Gere identified that UT's CBER data appears to be an independent and sound source of information and was used to project water demands to 2030 and to extrapolate water demands from 2030 to 2060. O'Brien & Gere noted that a key assumption was that the mix of domestic, commercial and industrial would remain consistent with current conditions through the planning period and therefore population could be used to estimate overall water demands through the planning period.
- Five years of daily data (2003-2007) were compiled to define the aggregate peaking factors for the Duck River users (Shelbyville, Bedford County, Lewisburg,

Spring Hill and Columbia). This information was used to account for the ratio of peak day/average day demands.

- Participant comment: The study identified that the per capita water use was held constant throughout the planning period. O'Brien & Gere identified that water conservation and demand management impacts would be considered in the alternatives analysis.
- Participant comment: Did the CBER data account for the economic downturn in 2008-2009? Other participant identified that the data was based on 1990 and 2000 census data, migration, birth rates and death rates. Economic downturn may impact water usage on short term, but may not impact the 2060 demands because the water demands will eventually return to their long term trend.
- Participant comment: The 9/11 event impacted utilities in 2005 and the water demands have continued to be depressed due to the drought. Future planning should reflect the likelihood of a surge in water demands.
- Participant comment: O'Brien & Gere should obtain the most recent USGS report on climate change and the USGS is available to meet to discuss how climate change should be addressed.
- Participant comment: The 2008 USGS report and demand projections reflected some of the impact of drought conditions because the per capita demand was based on both normal and drought conditions.

Needs Assessment

- O'Brien & Gere identified that the deficit in 2060 was estimated to be 15 mgd average day and 23 mgd maximum day based on extrapolation of the CBER data and the supply available predicted from the reservoir and river constraints. Much discussion followed with several participants emphasizing that again it is important that it be clearly stated that this deficit reflects a single event in the period of record.
- The timing for the deficit was predicted to occur between 2020 and 2035. O'Brien & Gere agreed to review the reservoir and river availability separately to help confirm the supply and deficit estimates.
- Participant comment: A detailed explanation of the 42 mgd supply is needed. The quantity, duration and probability of deficit needs to be documented. O'Brien & Gere agreed to furnish additional data to explain the quantity, duration and probability of deficit.
- NRCS was requested to furnish agricultural demands, but demands have not been furnished. TDEC confirmed that agricultural irrigation does not require permitting or reporting. Irrigation of golf courses is regulated, and believed to be in the range of about 2 million gallons per day. Based on comments from participants, there was no indication that specific demands for agriculture could be defined.



However, historic streamflow gage data effectively reflects the agricultural withdrawals, and O'Brien & Gere will consider that approach to account for agricultural irrigation.

- Agricultural demands have been included in the historic streamflow gage data, but have not been included in the water demands used in the model. Information on agricultural demands are estimated to be a couple of million gallons per day, but based on discussions with NRCS it appears that the agricultural demands cannot be documented.
- Participant comment: The deficit in the reservoir lasts longer than the deficit in the river system.
- Participant comment: Likelihood and duration needs to be addressed including the impacts of climate change, etc.

Alternatives Evaluation Criteria

Water Quality

- Participant comment: The water quality criteria should reflect improvements in river water quality derived from reuse applications or improvements in effluent quality from wastewater plants. The ability to address future contaminants such as endocrine disruptors (EDCs) should be taken into account in the criteria. O'Brien & Gere edited the Water Quality definition.

Recreation

- Participant comment: Recreational and Environmental Benefits should be separate criteria, not combined as presented.
- Participant comment: It should be noted that for the recreation criteria it is not clear whether Congress continues to allow recreation to be used as a basis for justifying reservoir projects.

Cost

- Participant comment: Costs should be on a unit basis and $ per number of days of deficit. O'Brien & Gere edited the Cost criteria definition.
- Participant comment: Wholesale water options would result in a monopoly because there is only one supplier. O'Brien & Gere identified that suppliers could be asked to submit bids for wholesale delivery.

Environmental Benefits

- Participant comment: Why are we releasing flow from Normandy Reservoir for environmental purposes?

- O'Brien & Gere noted that costs for environmental mitigation will be included in the cost estimates.
- Participant comment: The environmental benefits criteria should reflect the ability of the alternative to promote recovery of endangered species. O'Brien & Gere requested suggestions for specific wording for the criteria.
- Participant comment: What about alternatives that impact the Elk River? O'Brien & Gere said that they did not intend to include benefits to the Elk River in this criterion. O'Brien & Gere will rely on input from regulatory agencies to address negative impacts.
- Participant comment: Environmental benefits criteria should reflect main stem of Duck River and tributaries.
- Participant comment: If too many studies are needed to generate data on environmental benefits it will minimize the value of the project.
- Participant comment: Economic costs, such as fisheries impact in tailwater due to dam construction, needs to be balanced with environmental benefits.
- O'Brien & Gere will work with participants to identify whether the environmental costs can be captured under the overall project cost.

Discussion of Water Supply Options

The list of alternatives in the TVA Draft EIS (2000) report will be used as the starting point for identifying new alternatives. OBG requested that participants provide input on suggestions to reconfigure alternatives included in the list or provide new alternatives not included in the list.

Cost Estimating Approach

OBG will generate capital and operation and maintenance costs for alternatives based on unit costs.

Planning for Open House (Public Meetings)

"Open House" style public meetings will be held September 22-24, 2009 in Manchester, Chapel Hill, and Columbia. The public meetings will be from 4 pm to 7 pm.

Next Steps

O'Brien & Gere will be focused on preparing materials for the Open House, finalizing the evaluation criteria, documenting the Needs Assessment, and developing the alternatives. DRA will explore whether to conduct focused work sessions in advance on Workshop No. 3.

Duck River Comprehensive Regional Water Supply Plan

Workshop No. 2



August 26, 2009

O'BRIEN & GERE
www.obg.com

Workshop Agenda

- **Introductions**
- Review of Minutes from Workshop No. 1
- Summary of Activities Since Workshop No. 1
- Project Website
- Objectives for Workshop No. 2
- Water Supply Availability
- Water Demand Projections
- Needs Assessment
- Alternatives Evaluation Criteria
- Discussion of Water Supply Options
- Cost Estimating Approach
- Planning for Open House (Public Meeting)
- Next Steps

Introductions

- **Strategic Team**
  - **O'Brien & Gere / Consolidated Technologies, Inc. (CTI) Consultant Team**
  - Consultants to Duck River Agency:
    - **HydroLogics**
    - **BDY Environmental, LLC**
      - Environmental Permitting
    - **Public Relations Firm (TBD)**
      - Communications support
      - Outreach to elected officials
    - **Trauger & Tuke**
- **Workshop Participants**

Workshop Format

- Transparent Planning Process
  - Workshops are open to the public
- Workshop Format
  - Invited participants (stakeholders) – your input is welcome at any time
  - Public – you are welcome to observe, and you have several opportunities for input. Please:
    - Identify yourself
    - State if you are representing a group/organization
    - Limit your comments to 2-3 minutes
  - Written questions or questions should be directed to Doug Murphy, Executive Director, Duck River Agency
    - *Doug@duckriveragency.com*

Fulfilling DRA's Mission

Mission of the Duck River Agency (DRA)

"To develop, protect and maintain a clean and dependable water resource for all citizens in the Duck River Region"

Bedford, Coffee, Hickman, Marshall, and Maury Counties

Project Goal

"The goal is to have a (comprehensive) Plan that will provide direction to the DRA regarding the management of available water resources, including the implementation of specific water supply infrastructure projects."

Workshop Agenda

- Introductions
- **Review of Minutes from Workshop No. 1**
- Summary of Activities Since Workshop No. 1
- Project Website
- Objectives for Workshop No. 2
- Water Supply Availability
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- Needs Assessment
- Alternatives Evaluation Criteria
- Discussion of Water Supply Options
- Cost Estimating Approach
- Planning for Open House (Public Meeting)
- Next Steps

Summary of Workshop No. 1

- DRA Mission and Study Goals
- Project Overview and Approach
- Plan for Stakeholder Participation and Public Outreach
- Explored Demand Projections and Water Supply Needs
  - Methodology used in prior studies
- Described Cost Methodology
- Draft Evaluation Criteria
  - Identified additional criteria

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Since We Last Met…..

- Attended meetings with DRATAC (7/8) and WRC (7/9)
- Conducted conference call with USGS to discuss water demands (7/13)
- Attended DRA Quarterly Board Meeting (7/23)
- Attended South Cumberland regional water supply planning meeting (8/11)
- Incorporated comments and finalized minutes from Steering Committee meeting and WS#1
- Requested or obtained water demand or supply data from the following:
  - TN Department of Economic and Community Development
  - USGS
  - UT Center for Business and Economic Research
  - NRCS
  - TDEC

Since We Last Met…..

- Obtained water withdrawal data from TDEC for non-utility entities(2002-2008)
- Obtained wastewater discharge data
- Obtained historic water level data for Normandy Reservoir (1976-present)
- Conducted conference call to discuss reservoir constraints with DRUC (7/29)
- Met with TDEC to discuss river constraints (8/25)
- Prepared water demand projections
- Coordinated modeling assessment of available water supply with HydroLogics
- Set up project website

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Project Website

(O'Brien & Gere linked to the project website and described where information was located)

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Objectives of Workshop No. 2

- Review Water Supply Needs Analysis
  - Initial findings for supply and demand
  - Data gaps
  - Develop plan to finalize
- Discuss Whether to Proceed with Phase II Study
- Prepare for “Open House” (Public Meetings)
- Finalize Evaluation Criteria and Definitions
- Weight Evaluation Criteria (time permitting)

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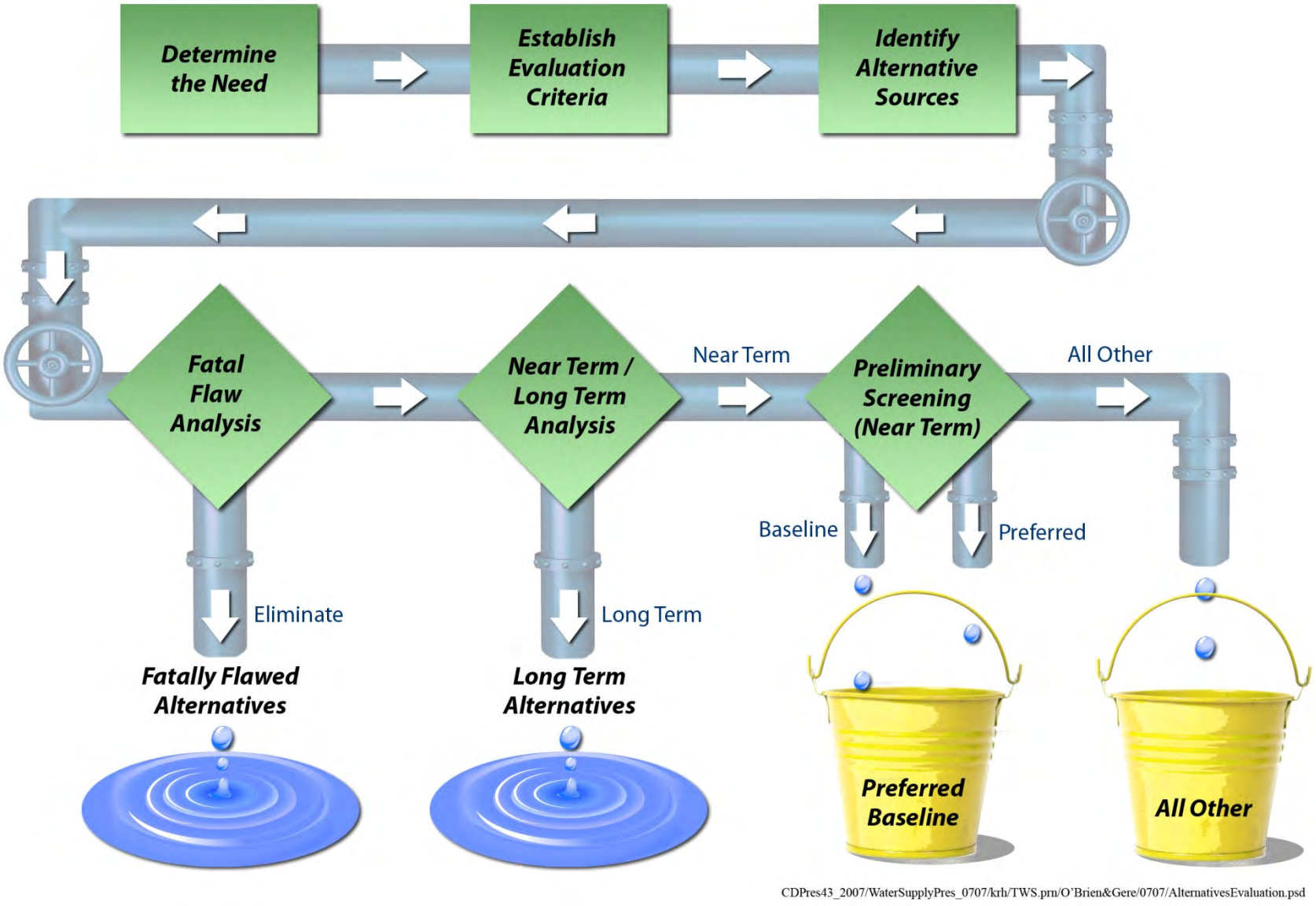
Water Supply Evaluation Process



CDPres43_2007/WaterSupplyPres_0707/krh/TWS.prn/O'Brien&Gere/0707/AlternativesEvaluation.psd

Service Area

"Estimated Use of Water in the Upper Duck River Watershed, Central Tennessee, and Water Demand Projections through 2030 ," USGS, 2008

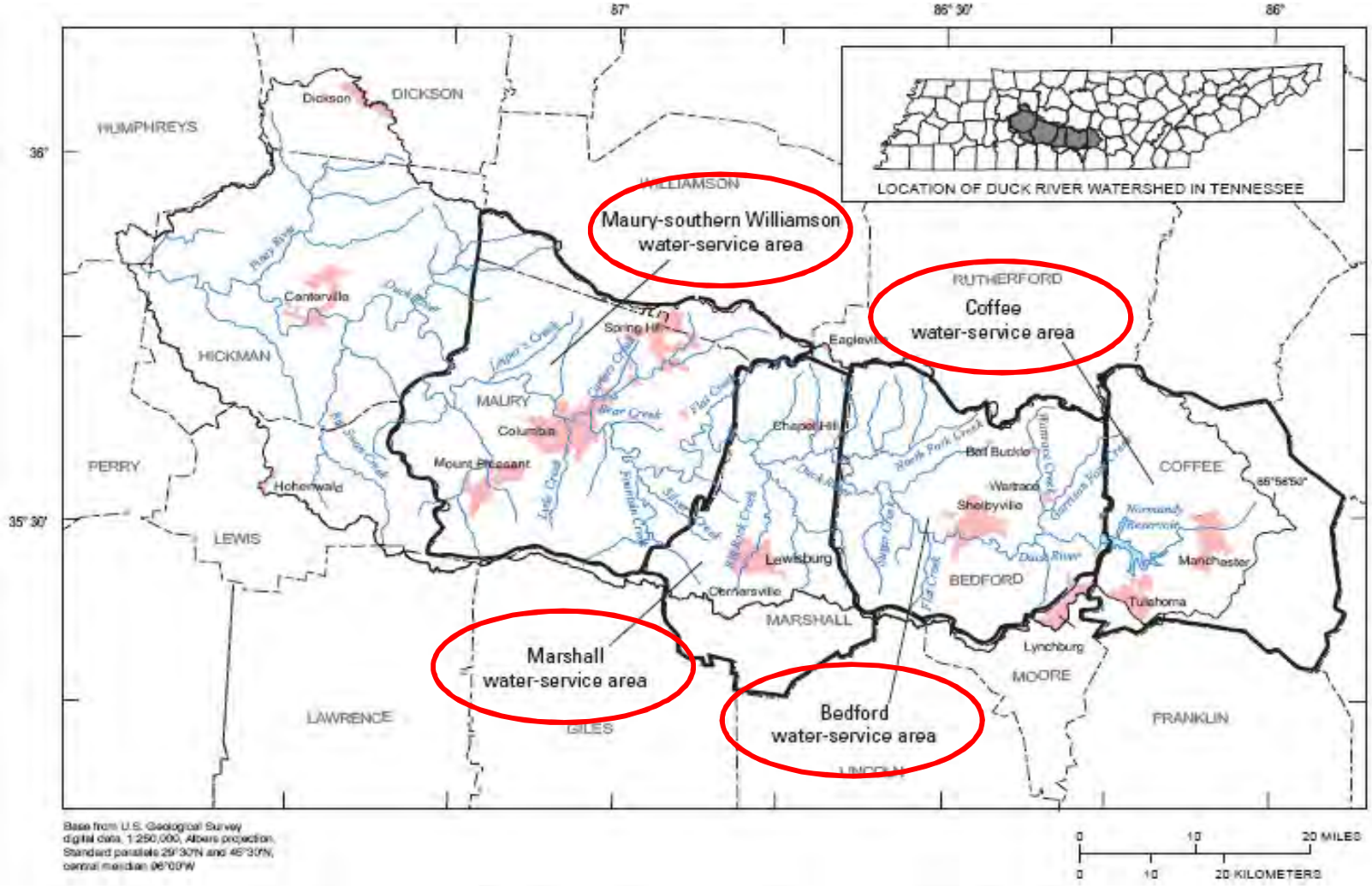
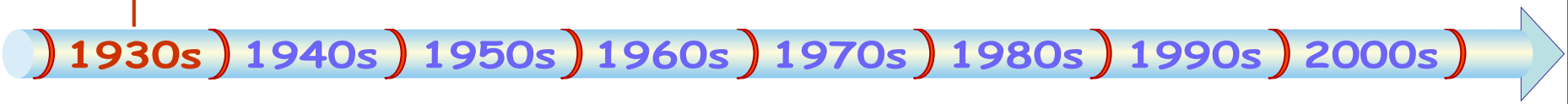


Figure 1. Upper Duck River study area and the Maury-southern Williamson, Marshall, Bedford, and Coffee water-service areas.

TVA Timeline for Duck River Supplies

1930 - Report to 71st Congress evaluating 6 dam sites on Duck



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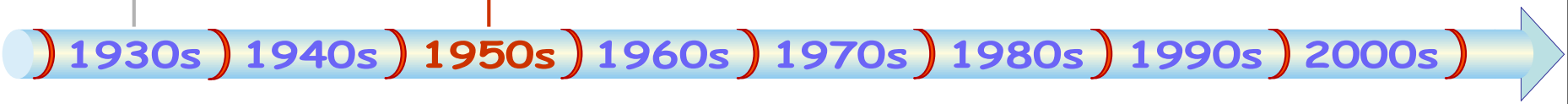

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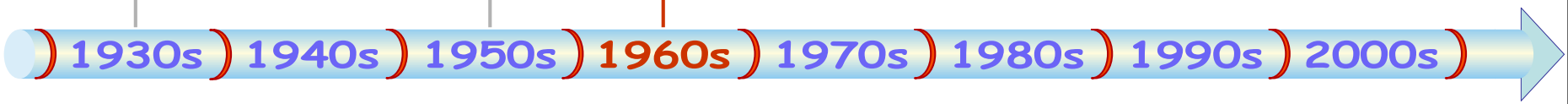

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1972 - Environmental Defense Fund Lawsuit

1973 - Construction begins at Columbia

1973 - Endangered Species Act passed

1976 - USFWS lists 5 T&E mussels

1976 - Normandy completed

1977 - ESA consultation - Columbia jeopardizes 2 T&E mussels

1979 - OMB challenges TVA, considers alternative pool levels

1930s 1940s 1950s 1960s 1970s 1980s 1990s 2000s

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1980 - Columbia halted

1982 - Mussel transplants in other rivers, construction resumes

1983 - Columbia halted again

1986 - OMB, unfavorable cost benefit analysis

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1995 - TVA Chairman Crowell announces formal cancellation of Columbia Dam

1997 - Land owners file lawsuit

1998 - TVA, regional water supply needs analysis

1998 - Land Use EIS

1999 - Supreme Court petitioned

1999 - Columbia Dam removed, land transferred

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1999 - Supreme Court petitioned

1999 - Columbia Dam removed, land transferred

2000 - EIS, water supply alternatives

1. Dam on Fountain Creek
2. New water intake downstream of Columbia
3. Raise Normandy Dam
4. Pump from Tims Ford Reservoir

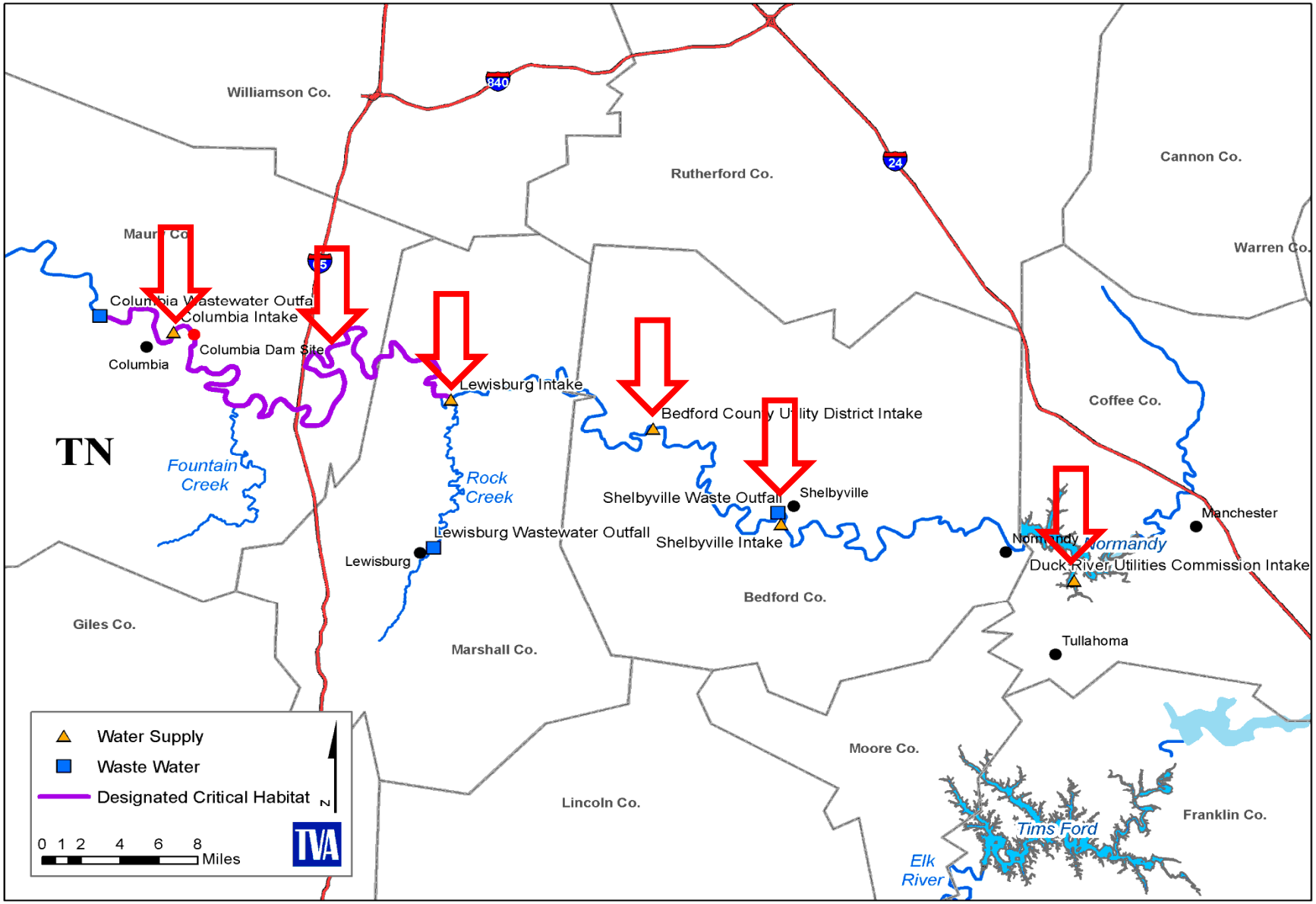
Aug 2007 - DRA requests study on raising Normandy Dam

Oct 2007 - DRA requests state to reduce flows

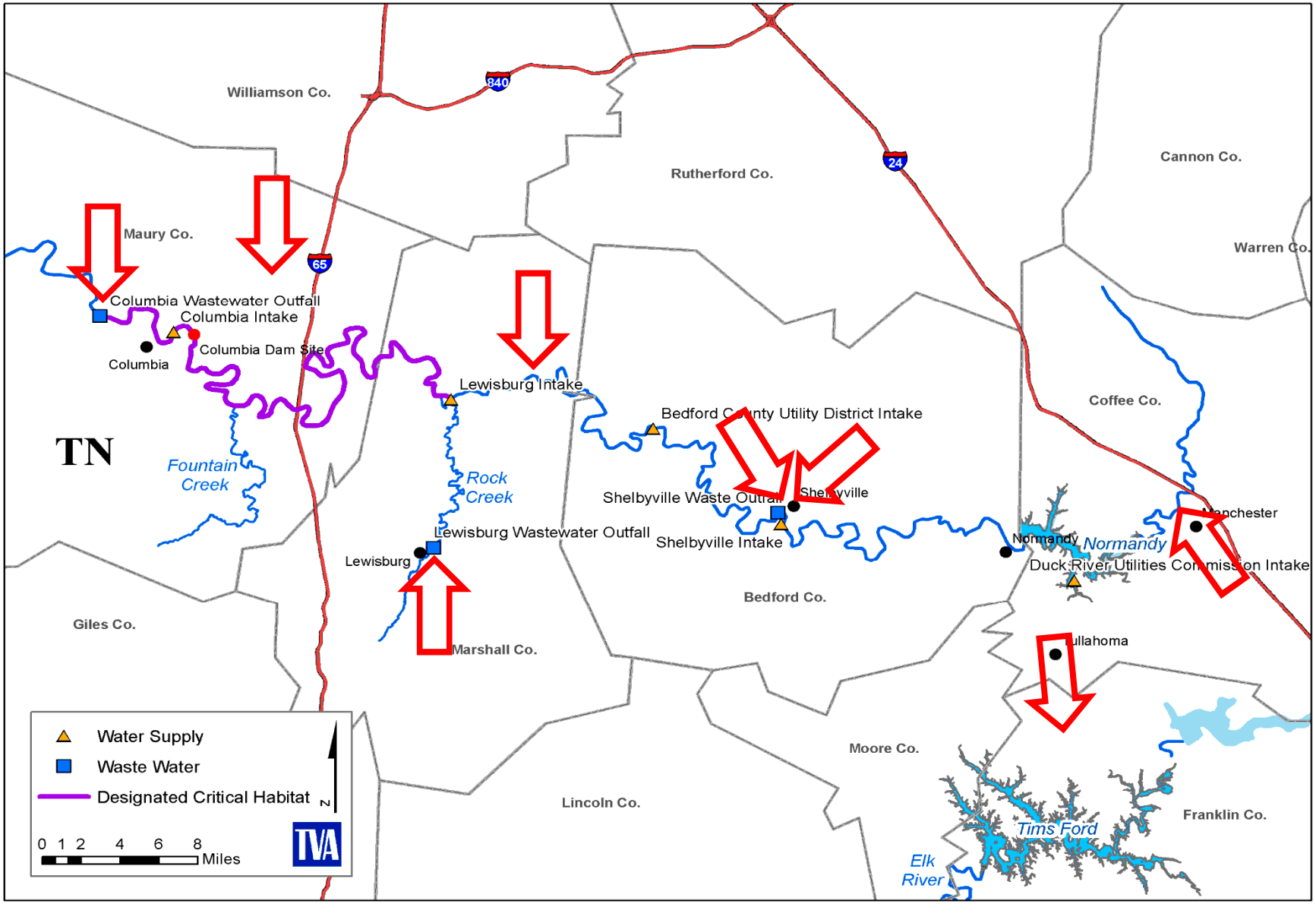
Dec 2007 - DRA requests TVA to reduce flows

Jan 2008 - Letter from Duck River Utility Commission to Governor Bredesen encouraging reduced flow

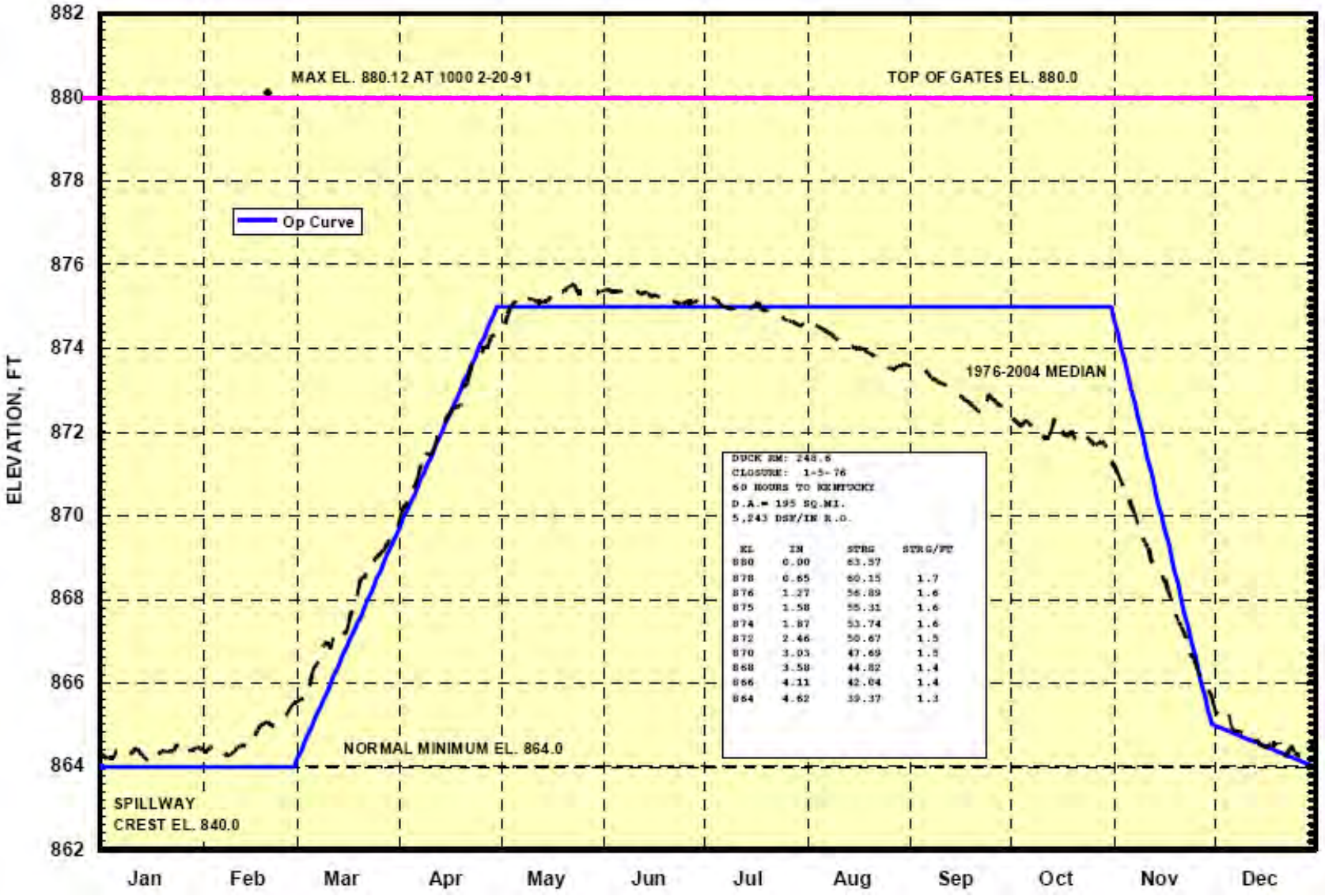
WTP Intake Locations



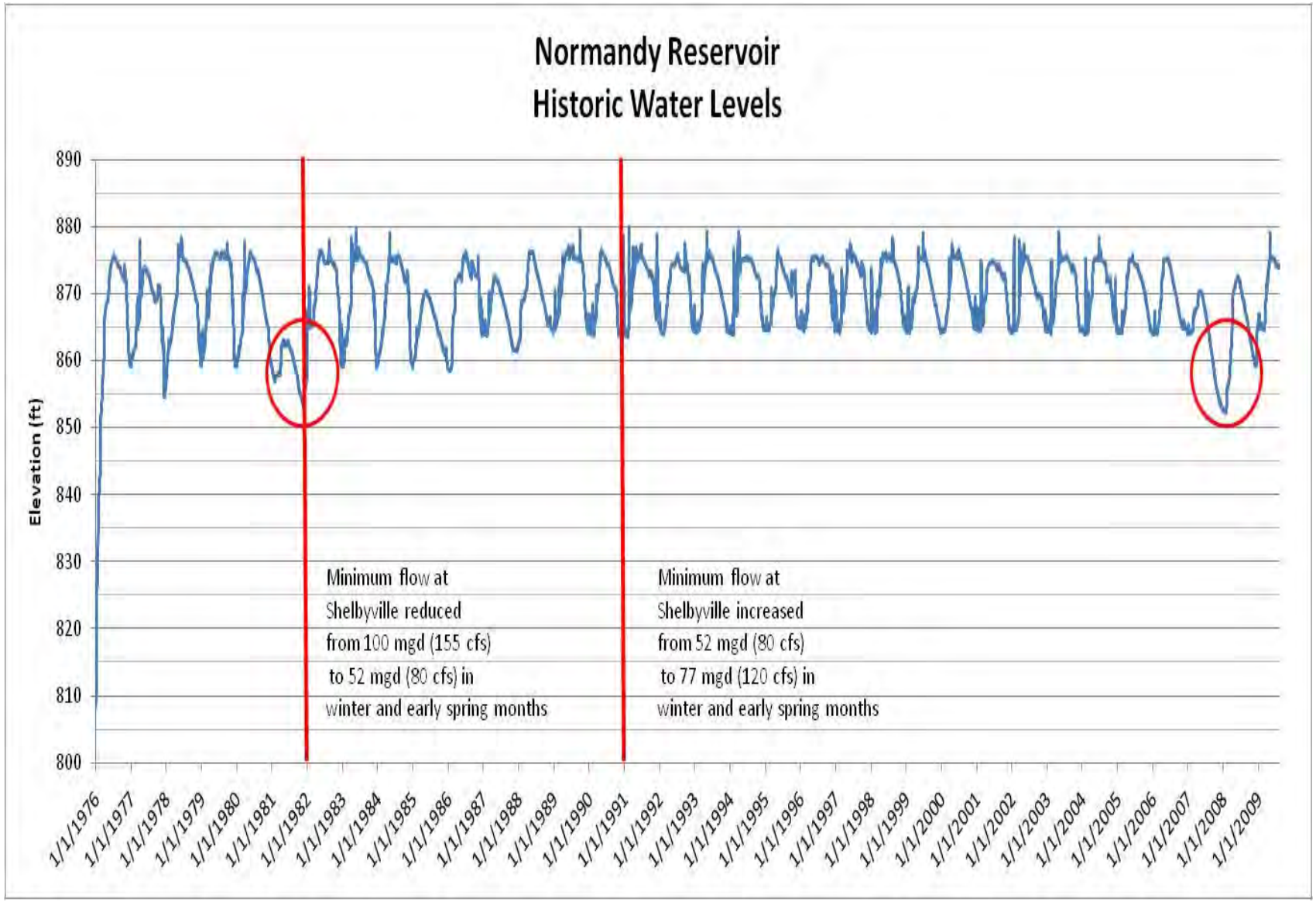
Wastewater Outfalls



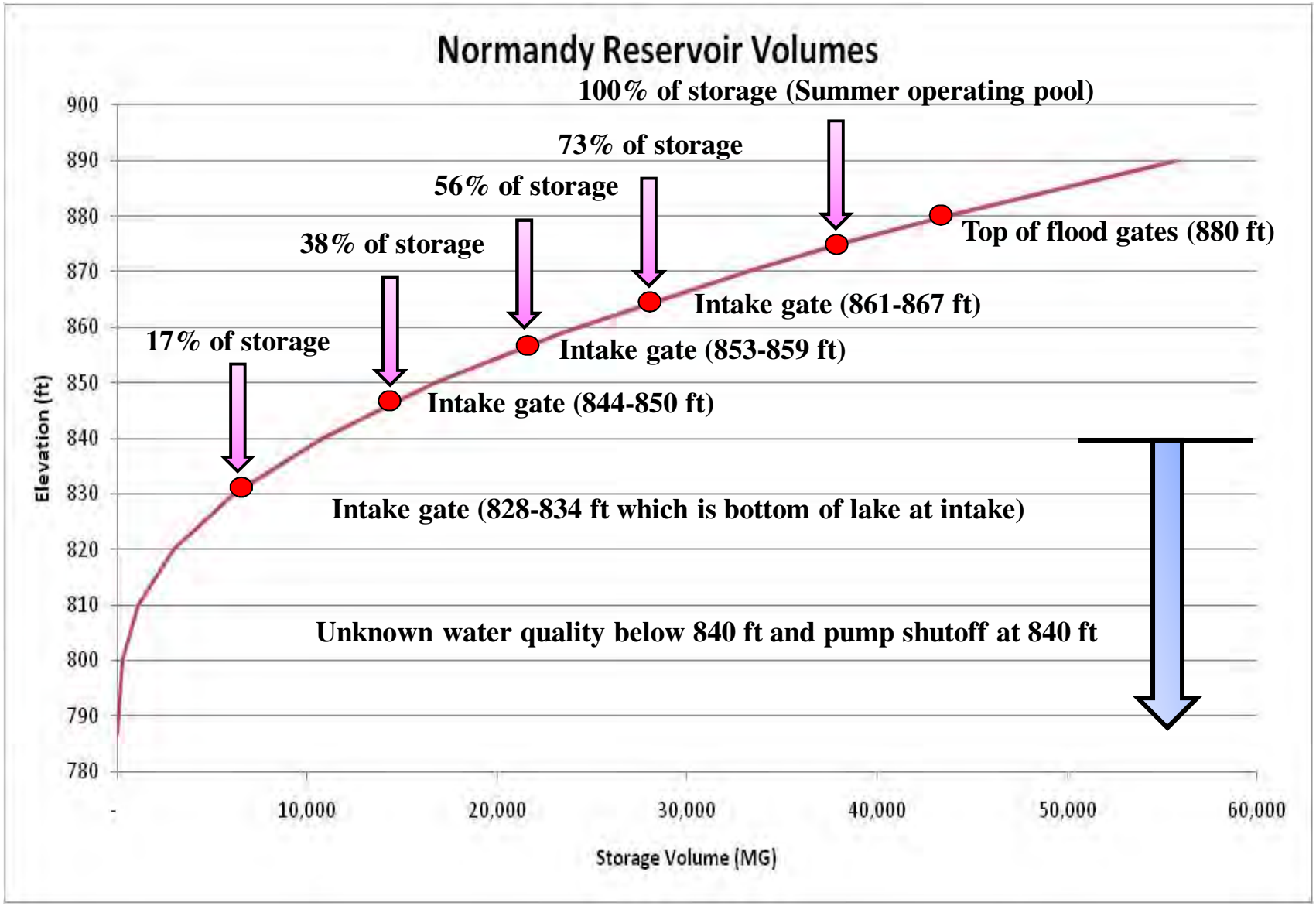
Normandy Reservoir Operating Curve



Normandy Reservoir Water Levels



Normandy Reservoir Volumes



River Constraints Just Downstream of Normandy Reservoir

- Release from Normandy Reservoir to maintain 25.8 mgd (40 cfs) minimum instantaneous flow just downstream of the dam





River Constraints at Shelbyville

- 77.5 mgd (120 cfs) minimum instantaneous flow at Shelbyville (December through May) at USGS gage at Duck River Mile 221.4
- 100.2 mgd (155 cfs) minimum instantaneous flow at Shelbyville (June through November) at USGS gage at Duck River Mile 221.4
- 6.5 mgd (10 cfs) allocation for Shelbyville's water supply intake located at Duck River Mile 221.9

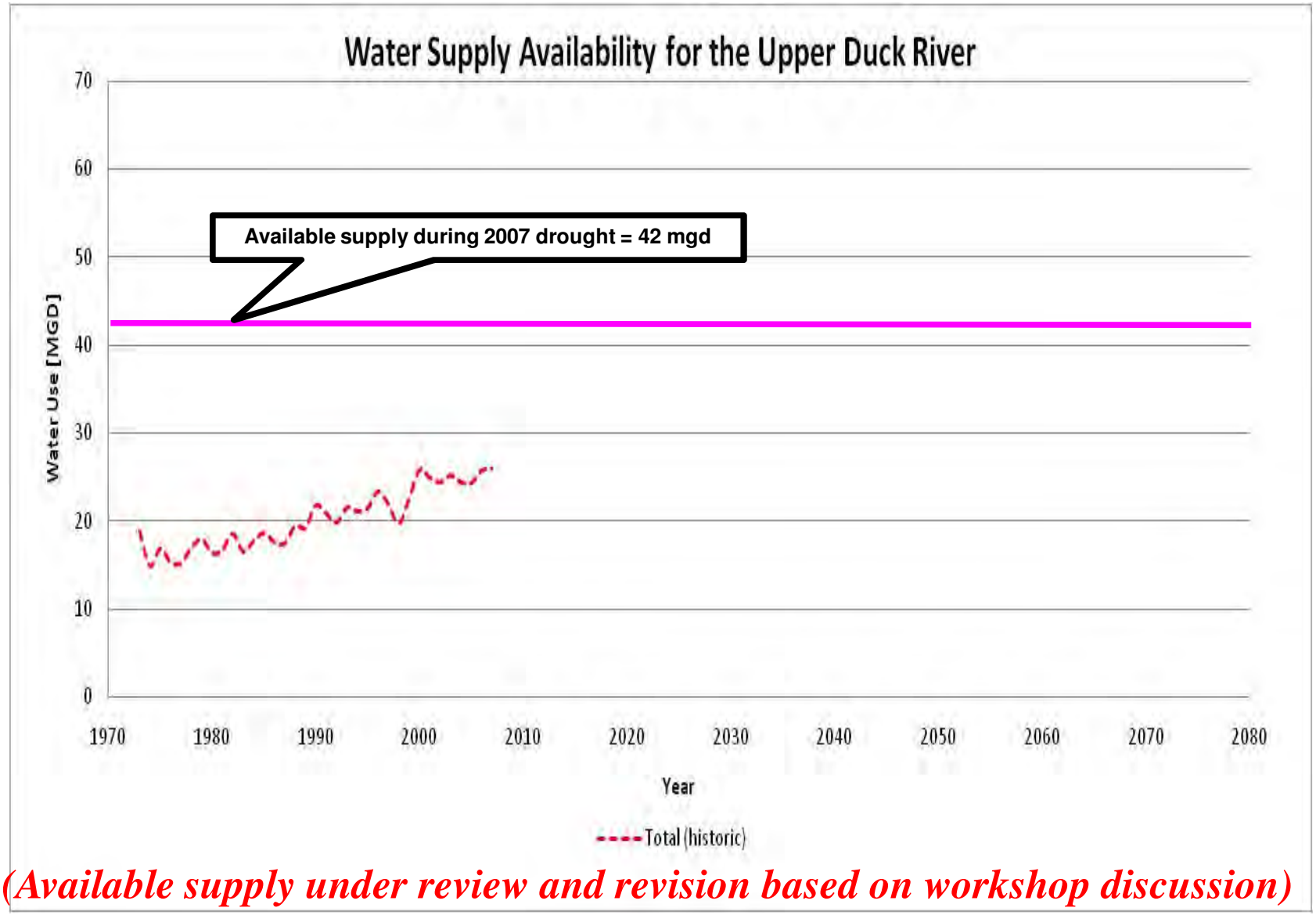


River Constraints at Columbia

- Columbia Power and Water System's Aquatic Resource Alteration Permit identifies the following permit conditions:
  - Columbia Power and Water System's maximum instantaneous withdrawal rate shall be limited to 19.4 mgd (30 cfs)
  - Columbia Power and Water System's withdrawal shall not result in a reduction of flow in the Duck River of less than 64.6 mgd (100 cfs) as measured downstream of the intake
- Columbia's NPDES permit has an outstanding permit appeal
- No release requirement from Normandy Reservoir stipulated for Columbia



Summary of Supply Availability



(Available supply under review and revision based on workshop discussion)

Feedback Period #1



Workshop Agenda

- **Introductions**
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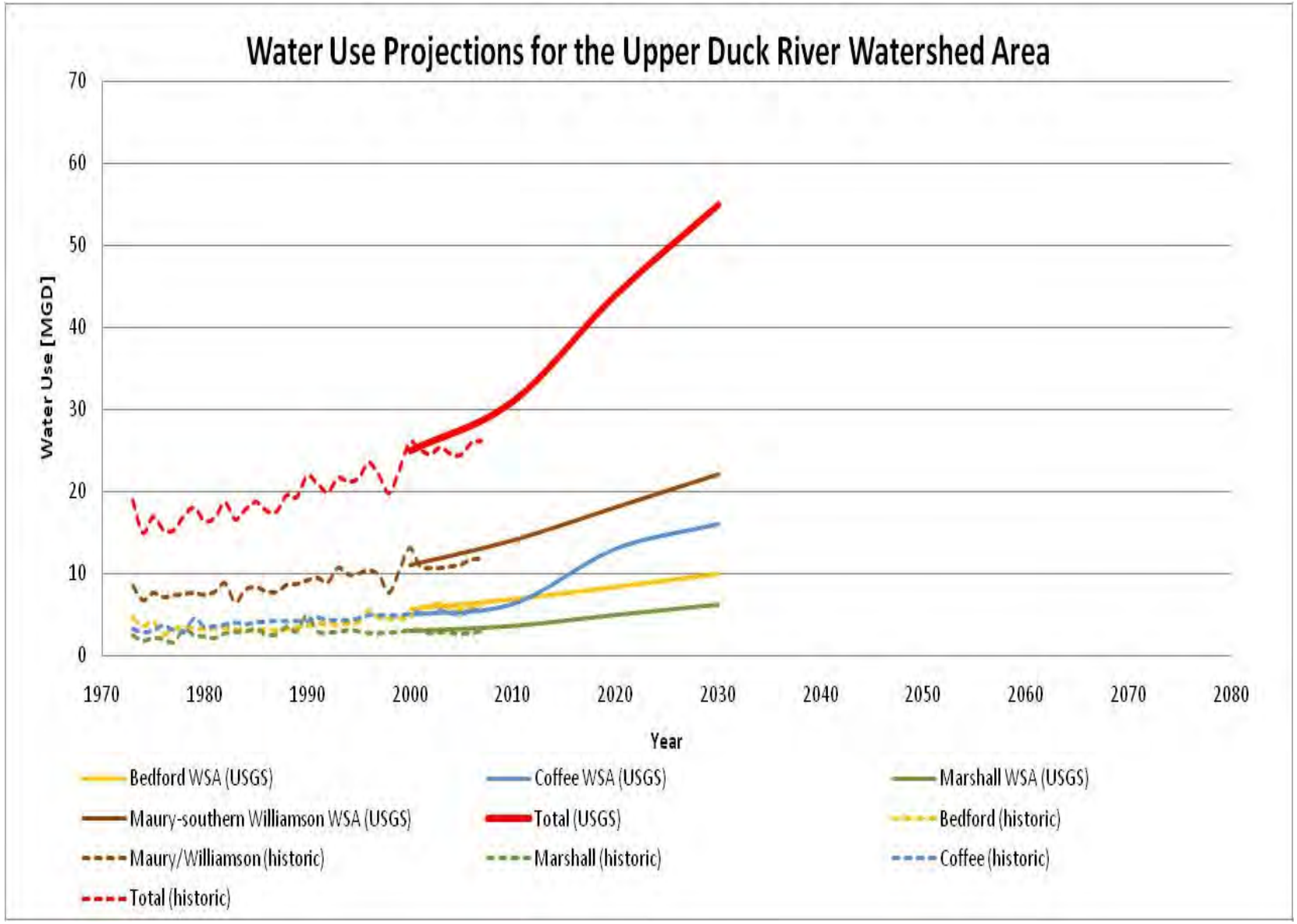
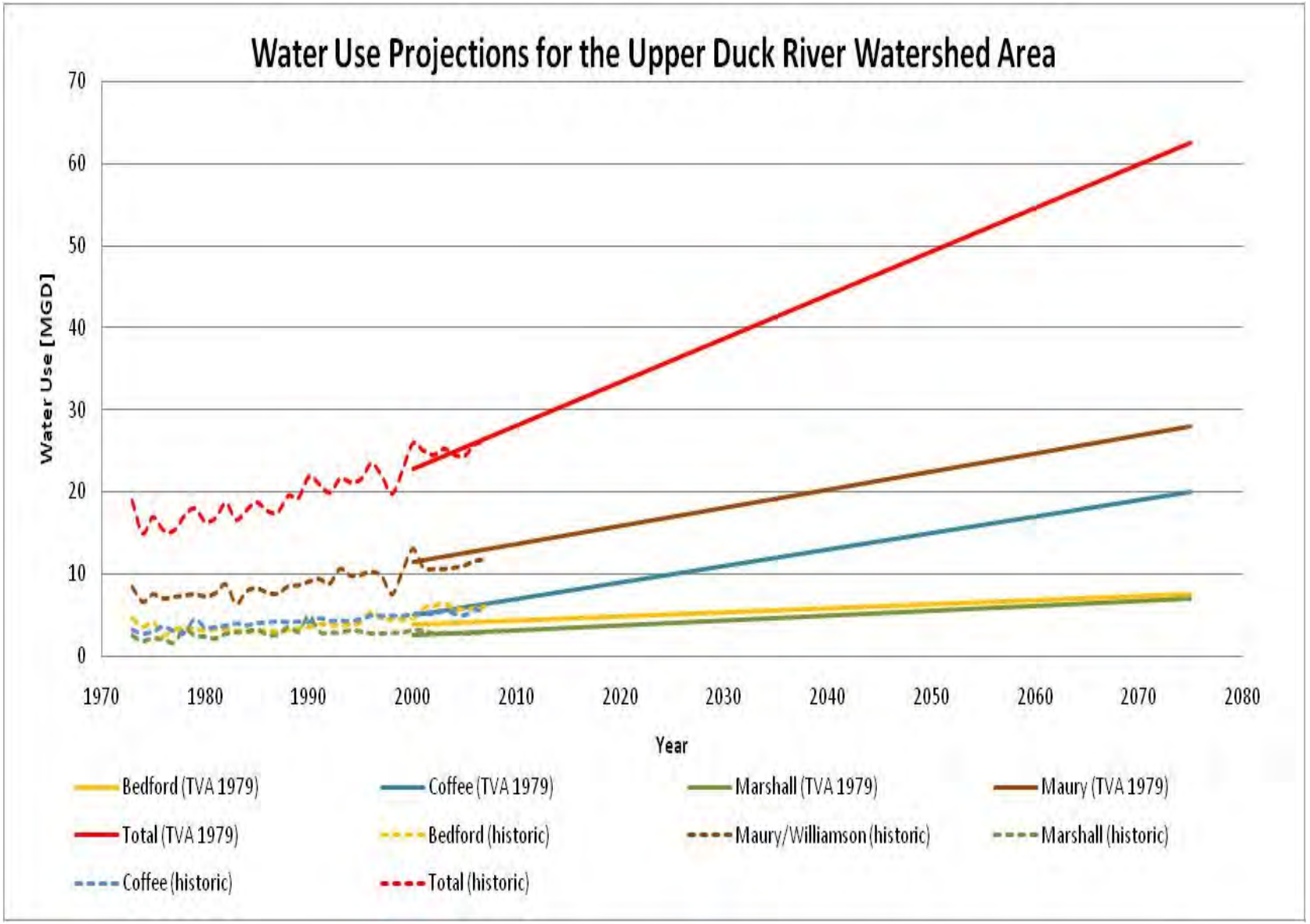
Water Demands

- **Key Sources of Information:**
  - USGS
  - TVA
  - UT Center for Business and Economic Research (CBER)
  - TN Department of Economic and Community Development
  - TDEC

Future Water Demands (USGS, 2008)



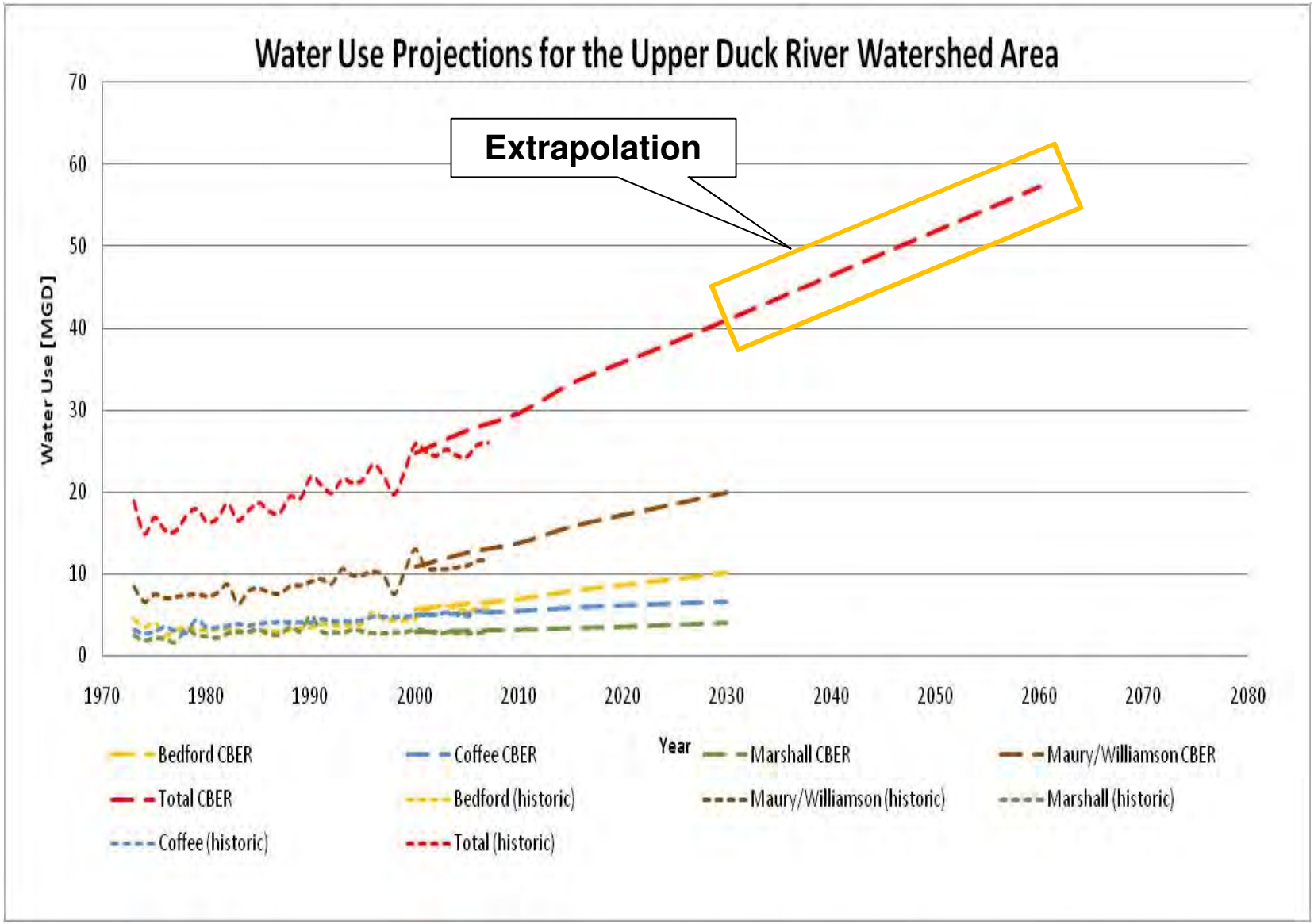
Future Water Demands (TVA, 1979)



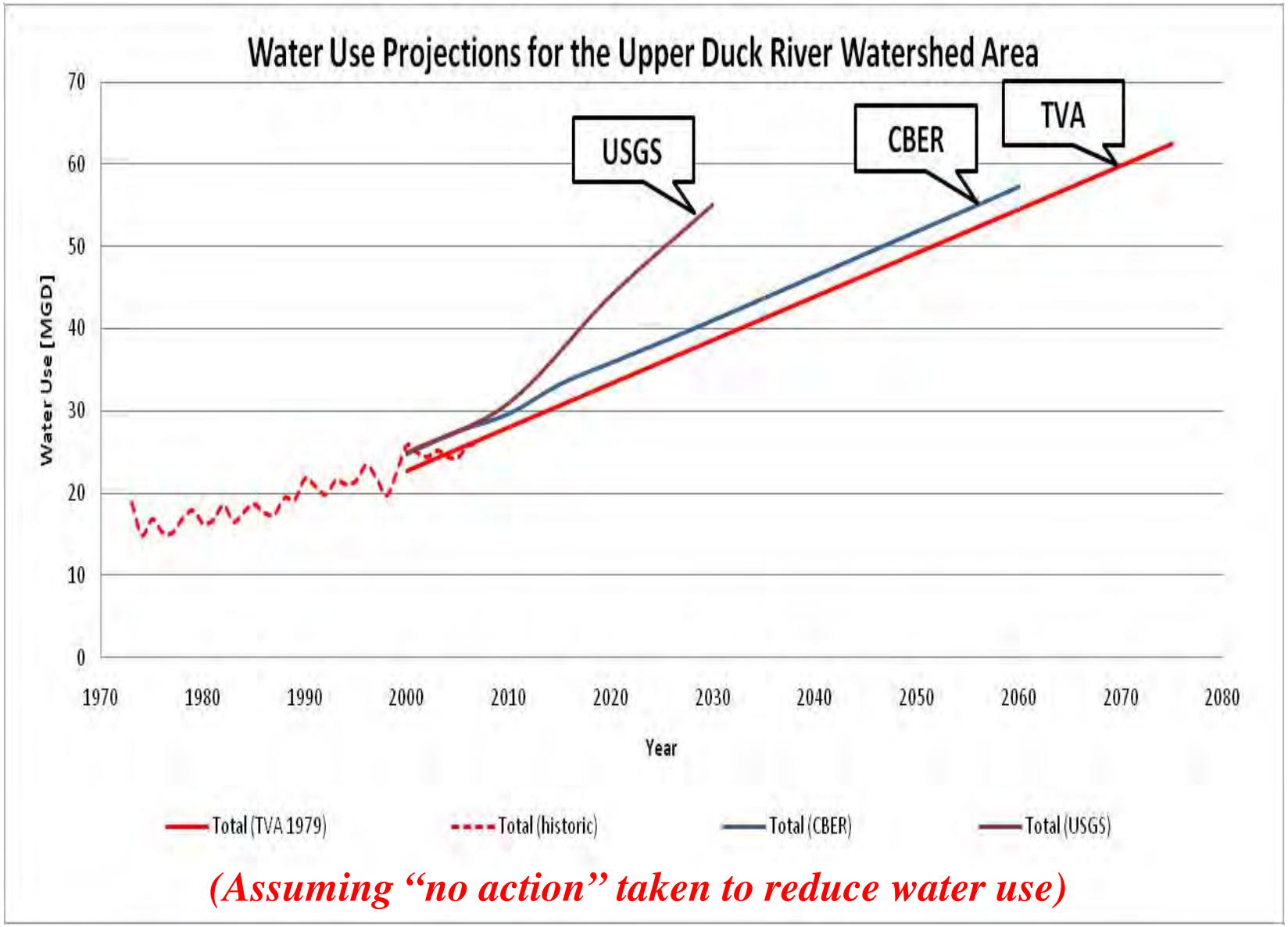
Projection of Future Demands

- Used CBER populations for 2010 – 2030
- Used DRA data ($0.05/1000 gal) for billed water for 1973 – 2008
- Adjusted DRA data to include water losses as defined by USGS (2008)
- Calculated average usage per resident inclusive of domestic, commercial, industrial and water losses
- Applied average usage per resident to projected population through 2030 and extrapolated through 2060

Future Water Demands (CBER, 2009)



Summary of Future Water Demands



(Assuming "no action" taken to reduce water use)

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Service Area

"Water Supply and Demand in Tennessee River Watershed Streams Below Reservoirs," TVA, July 2009

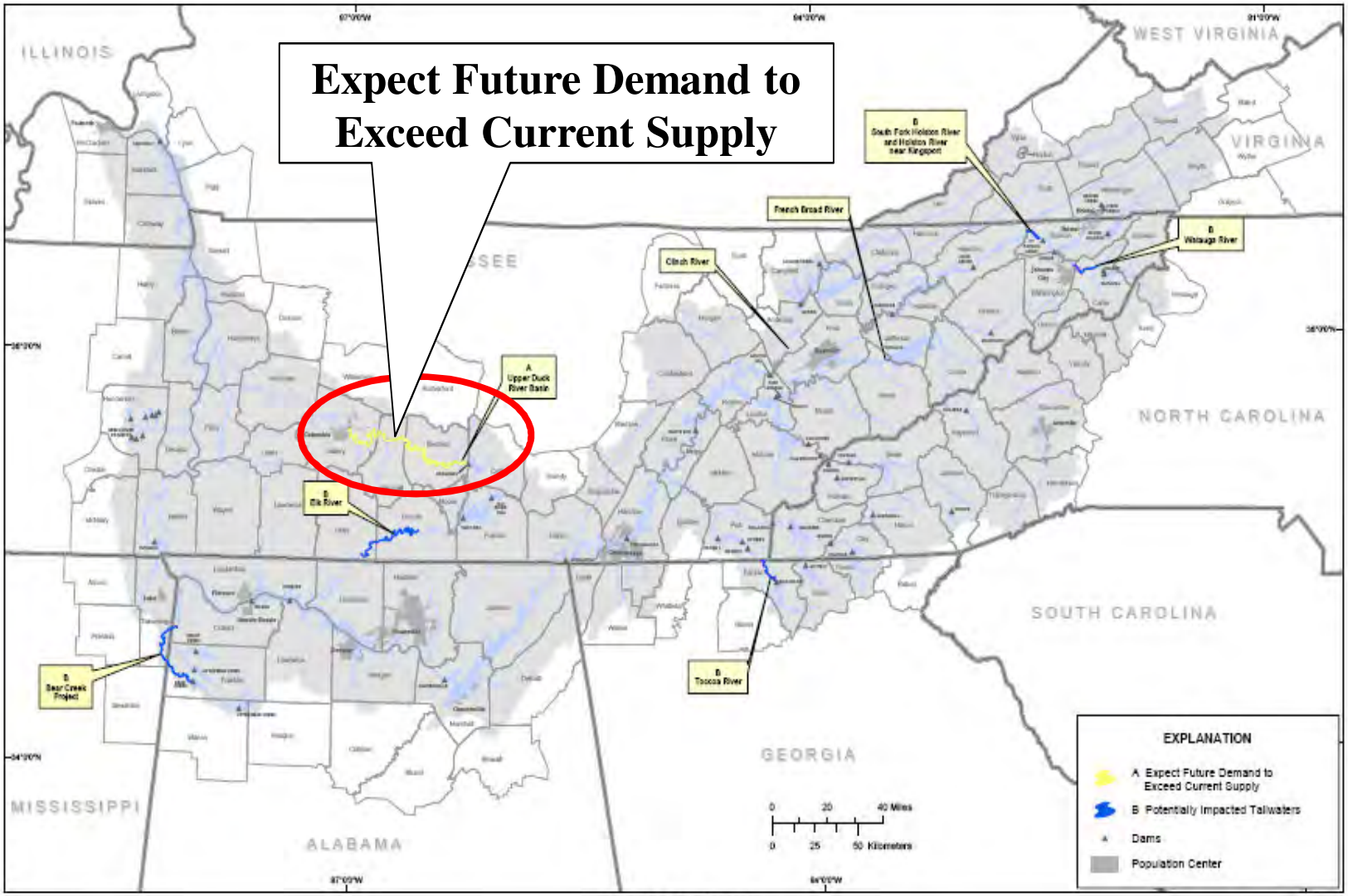


Figure 2-1: Tailwater Areas

Water Needs Assessment

"Water Supply and Demand in Tennessee River Watershed Streams Below Reservoirs," TVA, July 2009

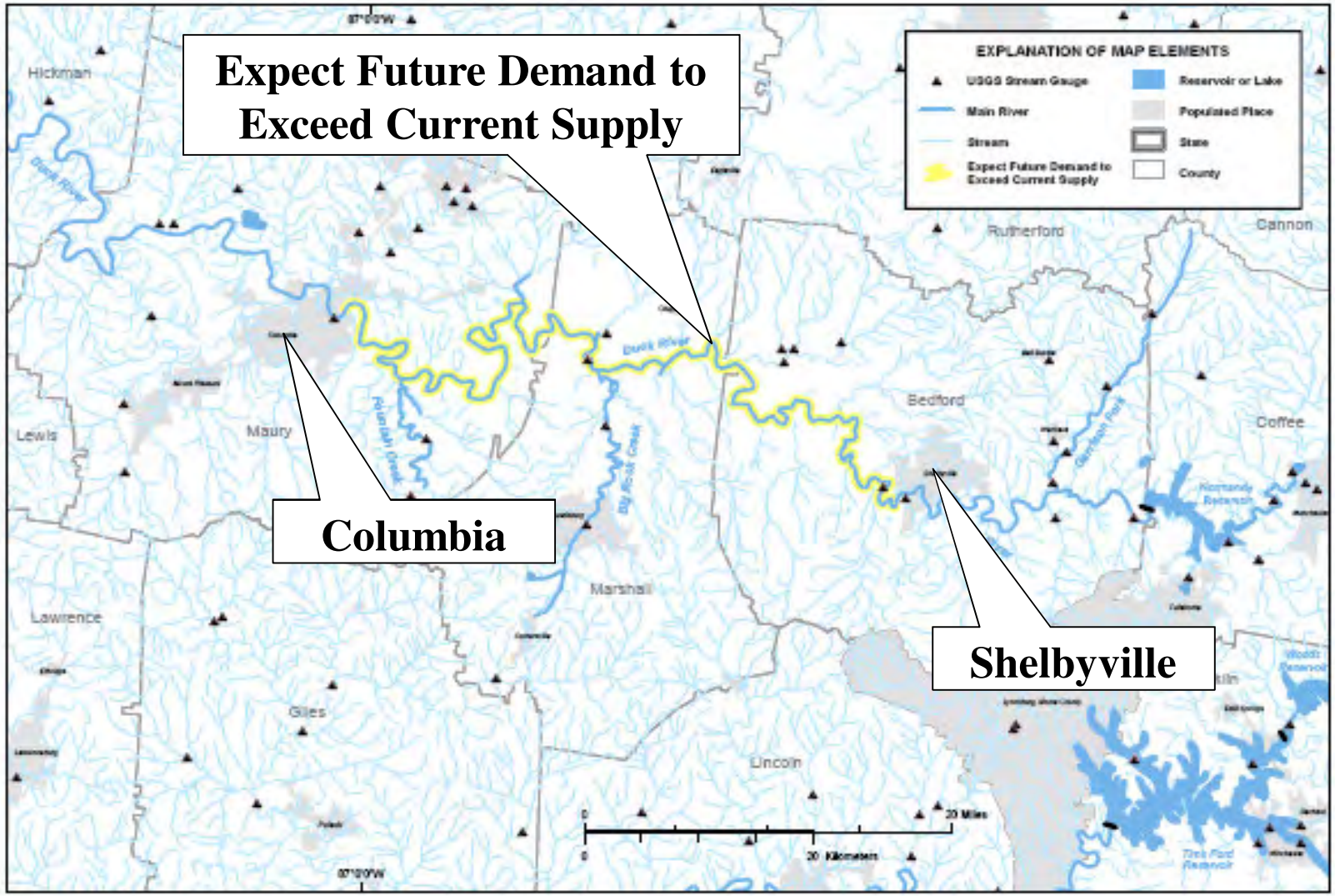
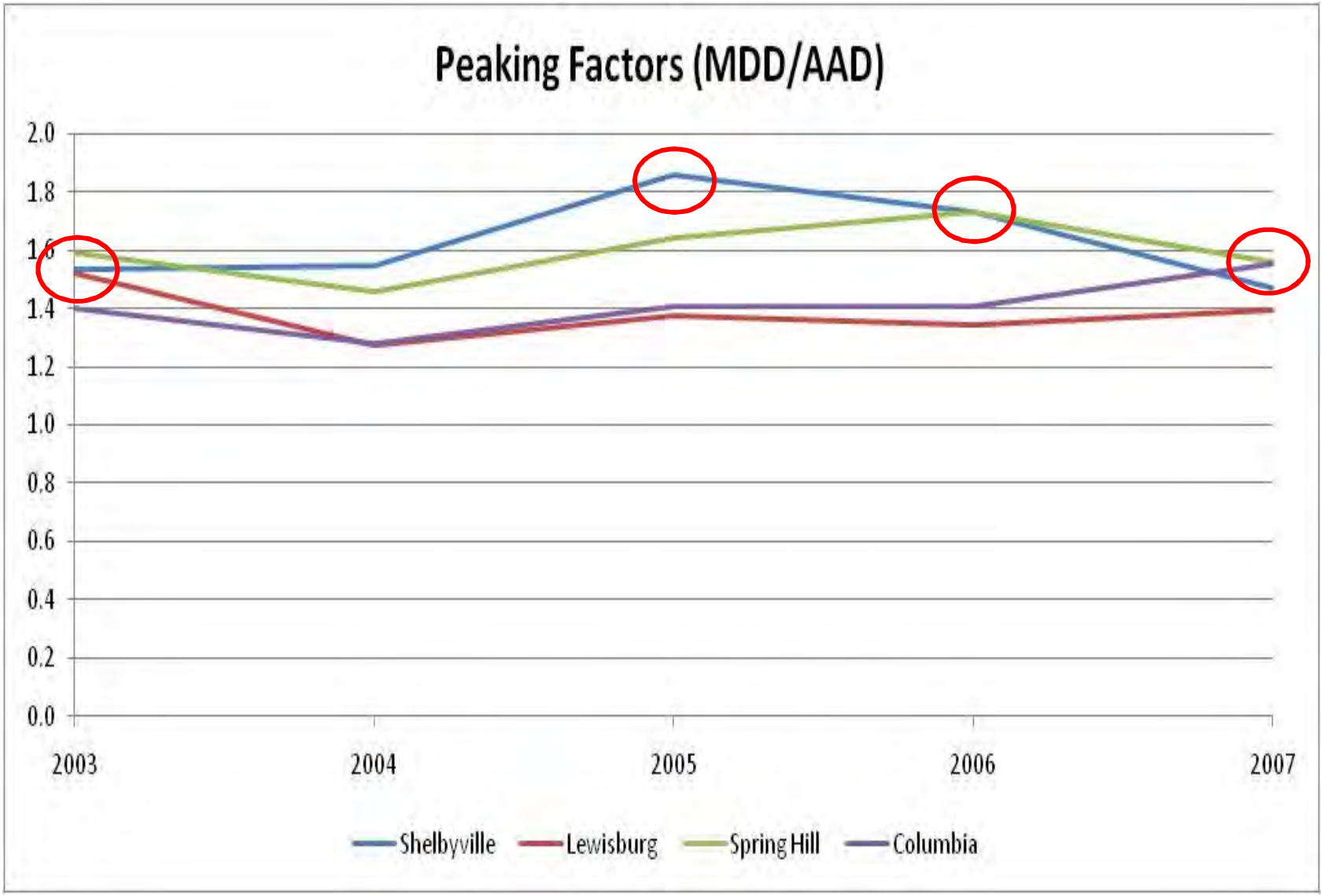
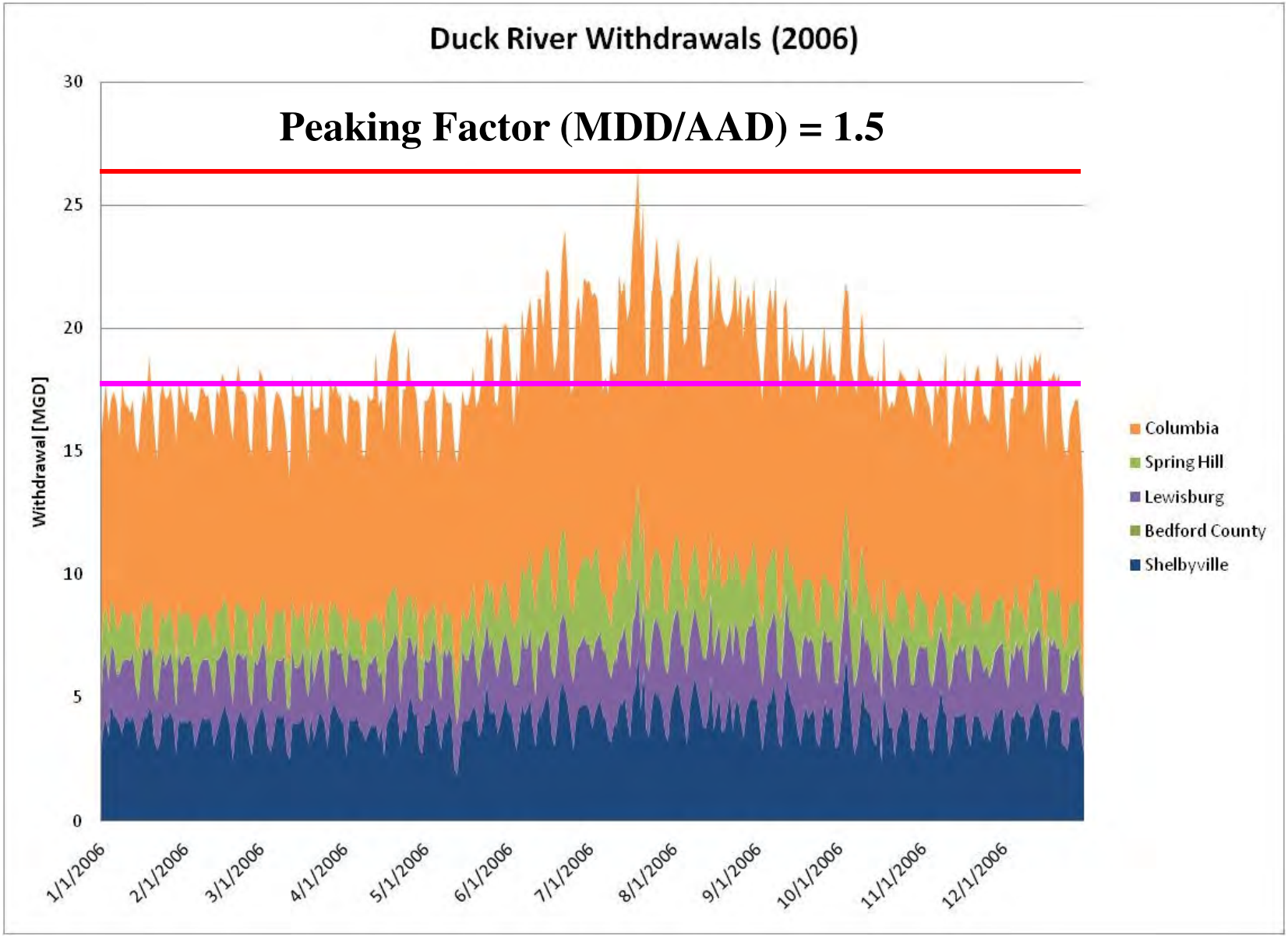


Figure 2-2: Upper Duck River Basin

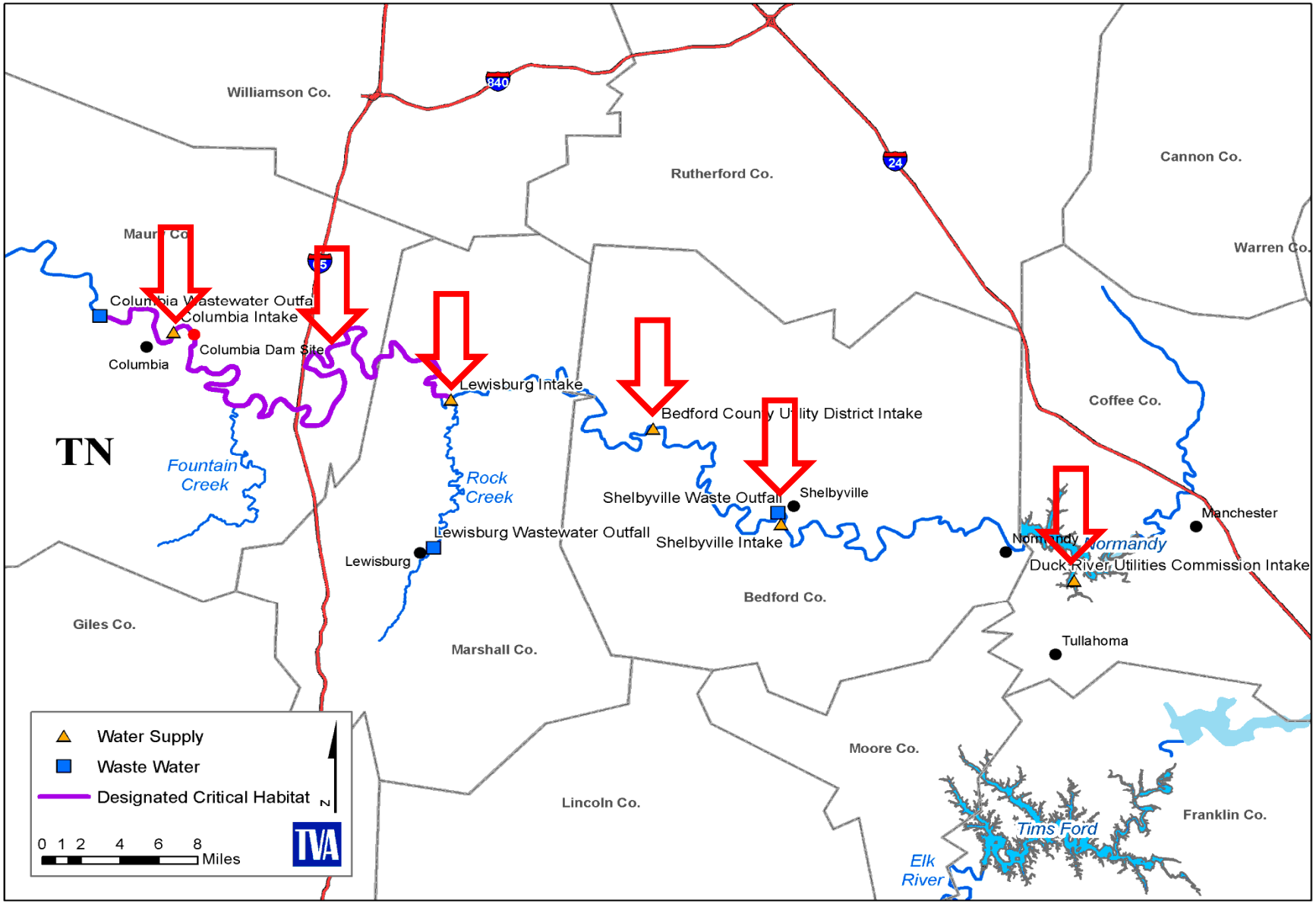
Historic Water Use



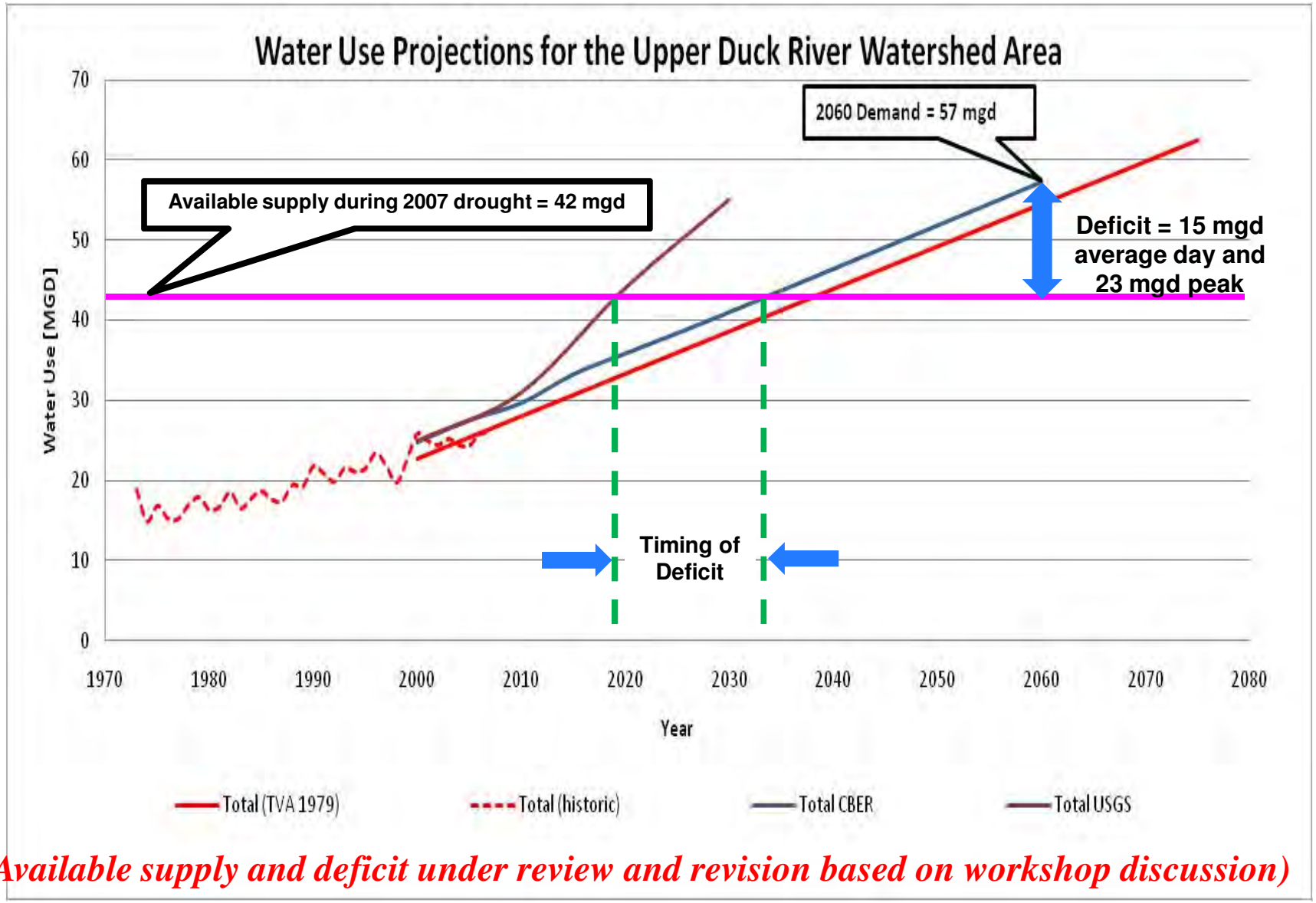
Historic Water Use



WTP Intake Locations



Summary of Needs Assessment



(Available supply and deficit under review and revision based on workshop discussion)

Feedback Period #2



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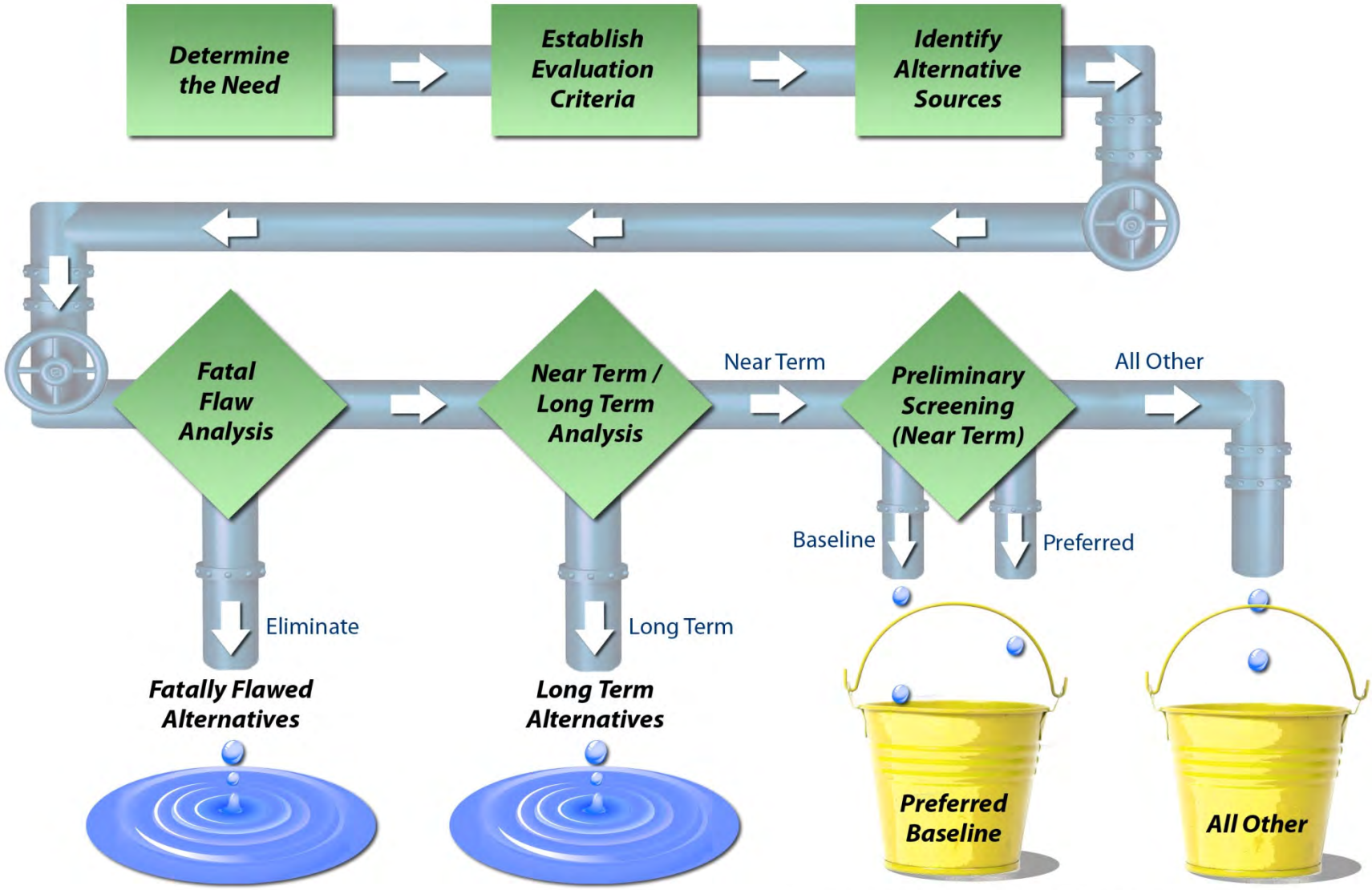
Alternatives Evaluation



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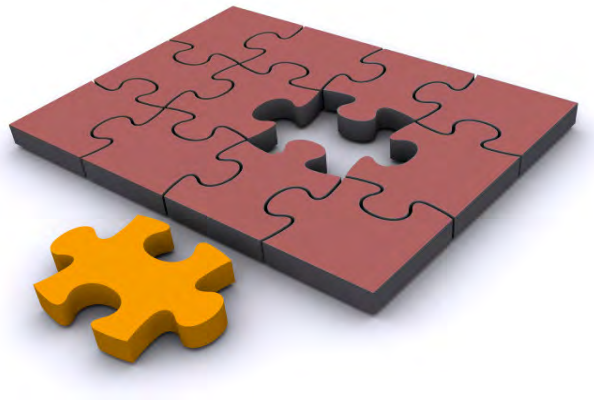
Decision Making



- How to make decisions?
  - Decide who gets input, and how
  - Compare alternatives using “apples and apples” cost estimates
    - Capital and operating costs
  - Identify non-cost evaluation criteria, such as:
    - Water quantity and quality
    - Implementation (including ability to meet schedule)
    - Adaptability for the future
    - Environmental benefits and impacts
  - Use “pair-wise” decision process to include all cost and non-cost criteria

Draft Evaluation Criteria

- Reliable Capacity
- Raw Water Quality
- Cost
- Implementability / Risk of Delays
  - permitable
  - public acceptance
  - property acquisition
- Flexibility
  - phased implementation
- Environmental or Recreational Benefits

Draft Evaluation Criteria

- **Reliable Capacity** - Reliable quantity of raw water to meet projected demands through the planning period. This criterion addresses interruptibility of sources of supply.

Draft Evaluation Criteria

- **Raw Water Quality** - The ability of raw water quality to meet existing and future drinking water quality requirements. This criterion may also address water quality preferences such as superior raw water quality, and finished water taste. The potential for the alternative to address currently unregulated compounds, such as endocrine disrupting compounds (EDC).

Draft Evaluation Criteria

- **Cost** - The present worth cost for proposed raw and finished water improvements, including capital, operating and maintenance costs. The costs may be viewed on a unit basis when the alternatives reflect different capacity. This cost could include allowance for wholesale water purchases.

Draft Evaluation Criteria

- **Implementability** - The relative ease of implementing the proposed improvements in time to meet projected demands. This criterion considers the potential that regulatory permitting (including environmental considerations), public acceptance, property acquisition, or constructability issues could delay implementation.

Draft Evaluation Criteria

- **Flexibility** - The ability to phase implementation and spread the cost over time, while still meeting projected demands. This criterion addresses ability to expand capacity beyond the identified need.

Draft Evaluation Criteria

- **Environmental Benefits -** This criterion includes:
  - environmental benefits (e.g., improving ecology of Duck River and its tributaries ***beyond*** that required by regulation)

(Definition under review and revision based on workshop discussion)

Draft Evaluation Criteria

- **Recreational Benefits -** This criterion includes:
  - recreational benefits, either reservoir or riverine (e.g., boating, fishing, canoeing, sightseeing)
  - related economic benefit of the recreational features (e.g., tourism/eco tourism, enhanced property values)
- This criterion does not measure the economic value of additional water supply because all alternatives will be sized to accommodate projected demands

(Definition under review and revision based on workshop discussion)

Fatal Flaw Analysis

- Fatal flaws will eliminate an alternative from further consideration
- Each evaluation criteria will now be assessed for potential fatal flaws
- Reliable Capacity
  - Will an alternative be considered that does not meet our water supply goal?
  - Is there a minimum size component?
- Raw Water Quality
  - Alternatives must provide water quality that is acceptable to TDEC
    - *Unlikely fatal flaw*

Fatal Flaw Analysis (continued)

- Cost
  - Is there a maximum cost?
    - *Unlikely fatal flaw*
- Implementability / Risk of Delays
  - Would we retain an alternative that does not meet TDEC requirements for instream flow or NPDES conditions?
    - *Potential fatal flaw*
- Flexibility
  - *Unlikely fatal flaw*
- Environmental or Recreational Benefits
  - *Unlikely fatal flaw*

Using Pair-Wise to Weight Evaluation Factors

		Adequate Capacity	Raw / Finished Water Quality	Cost	Implementability	Flexibility	
1	Adequate Capacity		5	2	1	3	18
2	Raw / Finished Water Quality	1		1	1	2	8
3	Cost	4	5		3	4	27
4	Implementability	5	5	3		3	27
5	Flexibility	3	4	2	3		20
							100 Total

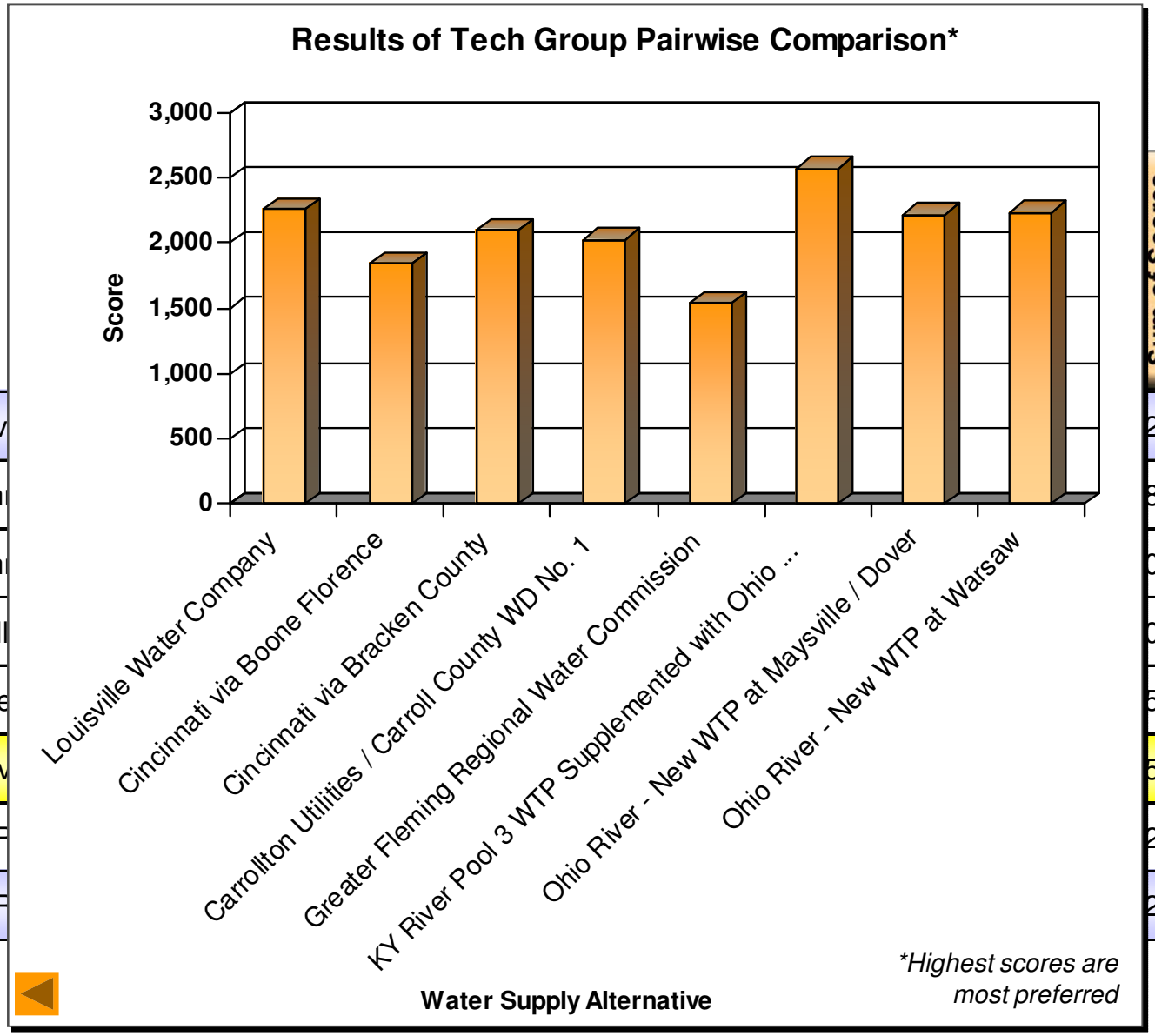
Note: Rank the relative importance of the left-column criteria against the top row criteria on a scale of 1 to 5.
1 = much less important; 3 = equivalent; 5 = much greater importance

Selecting Additional Sources of Supply

BWSC - Preferred Option Ranking Worksheet

Criteria Summary	Adequate Capacity	Raw / Finished Water Quality	Cost	Implementability	Flexibility	Sum of Scores	Rank
Louisville Water Company	468	168	729	459	440	2,264	2
Cincinnati via Boone Florence	414	168	594	391.5	280	1,848	7
Cincinnati via Bracken County	414	168	594	513	410	2,099	5
Carrollton Utilities / Carroll County WD No. 1	342	168	540	567	410	2,027	6
Greater Fleming Regional Water Commission	144	168	297	648	280	1,537	8
KY River Pool 3 WTP Supplemented with Ohio River	414	168	594	796.5	600	2,573	1
Ohio River – New WTP at Maysville / Dover	414	168	594	580.5	460	2,217	4
Ohio River – New WTP at Warsaw	414	168	594	580.5	480	2,237	3

Selecting Additional Sources of Supply



	Sum of Scores	Rank
Louisv	264	2
Cincin	348	7
Cincin	099	5
Carroll	027	6
Greate	537	8
KY Riv	573	1
Ohio F	217	4
Ohio F	237	3

Workshop Agenda

- **Introductions**
- Review of Minutes from Workshop No. 1
- Summary of Activities Since Workshop No. 1
- Project Website
- Objectives for Workshop No. 2
- Water Supply Availability
- Water Demand Projections
- Needs Assessment
- Alternatives Evaluation Criteria
- **Discussion of Water Supply Options**
- Cost Estimating Approach
- Planning for Open House (Public Meeting)
- Next Steps

Suggested ways of meeting the anticipated need for additional water supply in the Maury / southern Williamson County Water Service Area (Duck River DEIS, 2000)

Suggestions within the Maury / southern Williamson County Water Service Area	Suggestion within the Duck River Watershed	Suggestions Involving a Wider Area
• Finish Columbia Dam	• Higher discharge from Normandy Reservoir	• Pipe water in from some other source (inter-basin transfer)
• Build Fountain Creek Reservoir (at elev. 630)	• Re-evaluate Normandy curve guide	• Pipeline between Tims Ford and Normandy Reservoirs
• Build some other full-pool reservoir in the area	• Raise Normandy pool elevation	• Discharge Arnold Engineering cooling water into Duck
• Build a run-of-the-creek reservoir on Fountain Creek (elev. 600)	• Build off-stream storage to harvest flood water (active or passive filling)	• Buy water from nearby systems
• Increase capacity of the pool upstream from the existing Columbia City dam	• Raise and repair Lillard Mill dam to augment its use as a source	• Search for nearby groundwater sources
• Construct a water intake at River Mile 163 to supply the Maury County and southern Williamson County water systems	• Relocate the Lewisburg wastewater outfall to the Duck River	
• Construct a water intake at River Mile 108 to help supply this service area	• Drill wells in the watershed	
• Ground water – intercept 5 to 10 cfs loss along Duck River	• Reduce irrigation withdrawals and develop a plan to compensate farmers	
• Improve the river habitat downstream from River Mile 133 and request a waiver from the State for that reach during droughts (down to 80 cfs)	• Require industrial water conservation	
• Discharge the Columbia wastewater closer to the water intake	• Require return of all withdrawals from the Duck River	
• Pump water downstream for the sewage outfall to the Columbia City damn pool	• Impose mandatory reductions during droughts	
• Recycle wastewater	• Water conservation through pricing and other measures; withdrawal charges	
• Go to a closed-loop system at Columbia	• Water rates – Jack price up past 7000 gpd use; index to rainfall records	
	• Promote better cooperation between water systems (consolidations?)	
	• Water allocation formula – consensus approach	
	• Manage future growth; recognize water limits	
	• Restrict future growth	
	• Educate the public about the integrated nature of water use	
	• Establish an (annual) intensive water use / availability assessment program	

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Cost Methodology

- Concept (order of magnitude) level cost estimates
  - Rule-of-thumb and unit pricing
  - Develop “apples and apples” cost estimates
    - Capital and operating costs
  - Use cost model to compare present worth costs
    - Sensitivity tests on financing options

Developing Cost Estimates

- Typical unit costs
  - Dams and reservoirs - $/cubic yard (dam), $/acre (area)
  - Wells - $/gallon capacity
  - Water treatment plants - $/gallon capacity
  - Intakes and pumping stations - $/gallon capacity
  - Pipelines - $/inch diameter-linear foot
  - Factors for urban vs rural alignments
- Compare with previously reported costs

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Project Communications - Key Elements

- Routine points of contact:
  - Doug Murphy – DRA
  - George Rest – O'Brien & Gere
  - Thomas Dumm – O'Brien & Gere
- Stakeholder participation
  - Interactive work sessions
- Agency outreach – Tennessee Department of Environmental Conservation, Tennessee Valley Authority, Nature Conservancy, US Fish and Wildlife, Tennessee Wildlife Resources Agency, etc.
- Briefings for elected officials, and as desired, water purveyors, news media



Open House Style Public Meetings (cont'd)

- Topics/Stations:
  - The Duck River Agency
  - Study Approach/Schedule
  - Water Needs
  - River Constraints
  - Decision-making
    - Evaluation Factors
    - Criteria Weighting
  - How to Provide Input
    - Web Site
- Printed media



Open House (Public Meeting)

- Approach:
  - Provide public with opportunity to learn about the Water Supply Plan, and ask questions directly of the Strategic Team in an informal setting
- Locations:
  - Three Open House Meetings in Manchester, Chapel Hill and Columbia
- Dates:
  - September 22-24, 2009 from 4 pm to 7 pm



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- Planning for Open House (Public Meeting)
- **Next Steps**

Next Steps

- Prepare technical memorandum on water needs
- Debrief the DRA Board on Phase 1 and discuss initiation of Phase 2
- Prepare for Open House meetings
- Initiate development of water supply alternatives

Project Schedule

PHASE I	
Workshop No. 1 - Kick-off	June 24, 2009
Workshop No. 2 - Preliminary Feasibility	Aug. 26, 2009
Open House Meetings	Sept. 22-24, 2009
PHASE II	
Workshop No. 3 - Developing Alt's	Early Dec. 2009
Workshop No. 4 - Evaluating Alternatives	Early Feb. 2010
Open House Meetings	March 2010
PHASE III	
Workshop No. 5 - Implementation Planning	April 2010
Draft Report	May 2010
Workshop No. 6 - Conclusions	June 2010
Final Report	July 2010
Open House Meetings	Aug. 2010

Feedback Period #3



WORKSHOP 3

Duck River Development Agency
Comprehensive Regional Water Supply Plan

***Draft* AGENDA**
WORKSHOP No. 3
Henry Horton State Park
December 9, 2009
9 AM to 3:00 PM

Introductions (9 am)

- Consultant Team - O'Brien & Gere / CTI Team, other team members
- Meeting participants

Review of Minutes from Workshop No. 2

Summary of Activities Since Workshop No. 2

Objectives for Workshop No. 3

Update on Needs Assessment
- Water demands
- Yield of Normandy Reservoir
- Yield of Duck River

Supplemental OASIS (hydrologic) Modeling
- Frequency, duration and volume of deficits
- Potential impacts of changes to reservoir operations

Meeting Participant Input / Comments

Break (10:30 am)

Evaluation Criteria
- Review evaluation criteria descriptions
- Potential fatal flaws

Water Supply Alternatives
- Review Draft Alternatives Matrix

Meeting Participant Input / Comments

Lunch (12:15 Noon)

Continue Review of Draft List of Water Supply Alternatives
- Additions?
- Required alternatives

- Fatally-flawed alternatives
- Select alternatives for further consideration (identify those to be eliminated on “first cut”)
- Identify key information needs
- Cost model

Alternatives Evaluation Process

- Assign Weighting Factors

Meeting Participant Input / Comments

Next Steps

- Next meeting
- Action items summary

Adjourn (3:00 pm)

Duck River Development Agency
Comprehensive Regional Water Supply Plan

Meeting Minutes

Workshop No. 3
Henry Horton State Park
December 9, 2009

Meeting Participants

Name	Organization	E-Mail	Telephone
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Kenneth Carr	Lewisburg Water & Wastewater	kenneth@lewisburgwater.org	931.359.6831
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Richard Quin	Duck River Watershed Association	rquin@bellsouth.net	931.797.5541
Martin Davis	BCUD	bcudgm@bellsouth.net	931.684.1667
Ed Penrod	Local resident		931.388.7131
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Jerry Hightower	CTI Engineers, Inc.	jhightower@ctiengr.com	423.267.7613
Joe Brooks III	DRWA		931.619.4423
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Tom Moss	TDEC	tom.moss@tn.gov	615.532.0190

Attachments: Agenda, MS PowerPoint presentation

A summary of the discussion follows:

Needs Assessment

- Participant comment: When computing the safe yield for Normandy Reservoir, using a maximum drawdown to Elevation 840 ft for planning purposes is unacceptable due to impact on recreation and degradation of water quality in Normandy Reservoir. Using 850 ft as the maximum drawdown for Normandy Reservoir is much better.
- Participant comment: Does the water demand projection include full buildout of the industrial parks? Team response: No.
- Participant comment: What would the river deficit look like if Columbia's modeling constraint was set to 105 cfs or 110 cfs instead of 125 cfs as a weekly average? Team response: 100 cfs is the instantaneous minimum flow so the analyses used 125 cfs as a weekly average target. Additional modeling runs can be conducted to present the deficits for 105 cfs and 110 cfs weekly average targets. Modeling runs were conducted for 135 cfs and 150 cfs weekly average targets at Columbia which yield about 1 BG to 3 BG of deficit.
- Participant comment: It is important to document the daily need or duration of the deficit in the reliable capacity column which currently reflects the annual volume requirement. Team response: The number of days of deficit in each year of the period of record will be identified.

- Participant comment: Will there be a written document explaining the key points in the Needs Assessment? Team response: Yes. We are waiting on some additional information on water demands and then we can finalize the Needs Assessment.
- Participant comment: There are concerns about cultural impacts with some alternatives and whether they are addressed in the implementability criteria. An impact could occur that might not be reflected in the permitting process. Consider changing "environmental benefits" criteria to "environmental" to allow the inclusion of environmental impacts. Environmental impacts will be addressed under the permitting aspects of the Implementability criteria, but may not cause a delay in the project. Team response: We want to make sure we do not double count the impacts, and we will consider changing the definition for the environmental benefits criteria.

Alternatives

- *Alternative #1 – Water Efficiency Measures*
  - Participant comment: The "up to 30% reduction" in the alternative description is not a realistic goal for water efficiency. Could show a range of 10% to 30% for potential reduction in water demand. The high range in the estimate is not applicable for Duck River utilities because EPA protocol includes utilities that have lots of room for improvements (i.e., systems with no water metering in place, etc.) and the Duck River utilities have implemented these measures.
  - Participant comment: Current regulations already require that utilities have water efficiency plans in place. Utilities have no authority to enforce water conservation. Realistic expectation is 5% savings for water efficiency.
  - Participant comment: Regarding full cost pricing for water, Tennessee utilities include depreciation in the rate schedule.
  - Participant comment: Water conservation is voluntary and that should be noted under implementability criteria.
  - Participants agreed that this is a Baseline Alternative.

- *Alternative #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels*
  - Participant comment: Consider changing the title from "modify" to "increase". Team response: Title changed subsequent to workshop.
  - Participant comment: This alternative should be fatally flawed. It does not add storage for the region and relies on the Normandy Reservoir as the sole source of supply to meet the projected needs. This alternative is not acceptable because it unfairly burdens the reservoir users with problems in the downstream segment.



- Participant comment: This alternative would put the reservoir and river system in the same condition as in the drought of 2007.
- Participant comment: The additional impact on recreation associated with drawdown in Normandy Reservoir should not be considered as an issue because the drought of record is such a severe and infrequent occurrence.
- Participant comment: The Normandy Reservoir- Duck River system survived the drought of 2007.
- There was disagreement among workshop participants regarding whether to fatally flaw this alternative so additional information will be provided.
- The status of this alternative is to be determined in future stages of the project.

- *Alternative #3 – Regional Drought Management Plan*
  - Participant comment: Change title to Regional Drought Management Plan. Team response: Title changed subsequent to workshop.
  - Participant comment: Based on experience from the 2007 drought, the water utilities got little or no help from the State agencies. The water utilities support development of a drought management plan, but Agencies need to react faster than in 2007 to preserve water in the Normandy Reservoir-Duck River system.
  - TDEC will require each water utility on the Duck River to have a separate drought management plan and the plans will reflect the need for collaboration during a drought.
  - Participant comment: An alternative rule curve could be used for Normandy Reservoir during drought periods rather than instituting a permanent rule curve.
  - Participants agreed that this is a Baseline Alternative.

- *Alternative #4 – Optimize Releases from Normandy Reservoir*
  - Modeling assumes that we can better match releases from Normandy Reservoir to meet the target at Shelbyville. Options to better match releases and flow targets might include installation of additional stream gages, dam controls, instrumentation, etc. Automatic control is a possibility that should be investigated. Need to define a reasonable mode of operation from TVA's perspective.
  - Participant comment: Combine this alternative with changing from instantaneous to average weekly or daily flow constraints at Shelbyville or Columbia.
  - Participants agreed that this is a Baseline Alternative.

- *Alternative #5 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam*
  - Participant comment: The USACE has good tools for presenting impacts due to flooding.
  - Participant comment: Normandy Reservoir was built for flood control.
  - Participant comment: Would power of attorney (i.e., eminent domain) be required to acquire additional land downstream?
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #6 – Modify Normandy Reservoir Flood Rule Curve*
  - Participant comment: Revise text for alternative to identify that it "will" increase flooding due to a reduction in flood storage.
  - Participant comment: Need more detail about flooded areas and impacts in order to make a decision.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #7 – Reduce Irrigation Withdrawals*
  - Participants agreed with a fatal flaw designation for this alternative.

- *Alternative #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir*
  - Participant comment: Reducing the flow constraint at Shelbyville could ultimately increase the deficiency at Columbia. TDEC identified that changing the constraints at Shelbyville and Columbia are not mutually exclusive.
  - Participant comment: Are we mandated to provide 100 cfs at Columbia? TDEC identified that Normandy releases water to meet the Shelbyville constraint not Columbia. TVA identified that the goal of Normandy Reservoir's operation is based on maintaining flow at Shelbyville.
  - Participant comment: The flow numbers could be changed in the future.
  - Participant comment: The technical memorandum should include a detailed explanation of river constraints.
  - Participant comment: Lots of improvements are already in place or are taking place at the WWTPs because of USEPA requirements or guidelines.
  - Participant comment: Flow requirements could be altered with improved wastewater treatment that reduces nitrogen levels. However, wastewater assimilation is not the only consideration. Consequently, wastewater improvements may not lead to a reduction in flow constraints.



- Participant comment: Goal should be to obtain the highest quality of water for all needs.
- Participant comment: Regarding driver for wastewater improvements, Tysons is subject to more stringent industry guidelines and Shelbyville made improvements to reduce nutrients in order to avoid nitrogen toxicity.
- Participant comment: If the Columbia constraint is not met and the Shelbyville constraint is met, will a release from Normandy Reservoir be enacted? Will releases to meet the Columbia constraint eventually become the new operating policy? If so, making releases from Normandy Reservoir to meet the Columbia constraint actually becomes the "No Action" alternative at some point in the future.
- The status of this alternative is to be determined in future stages of the project.

- *Alternative #9 – Raise Normandy Dam*
  - State Designated Natural Area at Short Springs would be impacted at about 2 ft above the current pool level. Alternative could be phased in by changing the pool level as needed if the dam was raised.
  - Participant comment: How much additional private land is needed? Team response: Approximately 50 acres. Eminent domain may be needed to acquire permanent flood easements.
  - Participant comment: Impacts to roads and bridges near Normandy Reservoir should be considered.
  - Participant comment: This alternative offers the advantage of additional flood storage.
  - Participant comment: Is reference to obtaining permit "likely" an accurate statement? Team response: Five years ago a study was conducted on this alternative and the ability to obtain a permit was discussed. TVA identified that the permits could be obtained and recommended this alternative in the 2000 DEIS.
  - This alternative and the other three alternatives from 2000 DEIS plus the Tennessee River pipeline alternative are designated required alternatives and their status will be determined in future stages of the project.

- *Alternative #10 – Improve DRUC Intake*
  - Participant comment: Consider this alternative as part of Alternative #2.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #11 – Construct Second DRUC Intake*
  - Participant comment: Consider this alternative as part of Alternative #2.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #12 – Construct Fountain Creek Reservoir*
  - Participant comment: Constructing Fountain Creek Reservoir will require knowledge of water losses and locations in the reservoir area. If water goes underground due to karst topography it may not be available for storage in the reservoir.
  - This alternative and the other three alternatives from 2000 DEIS plus the Tennessee River pipeline alternative are designated required alternatives and their status will be determined in future stages of the project.

- *Alternative #13 – Construct Fountain Creek Reservoir with Downstream Release*
  - Participant comment: Modify title to clarify what is meant by "run-of-the-creek" reference. Team response: Title changed subsequent to workshop.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #14 – Upgrade Existing Columbia City Dam to Allow Releases*
  - Participants agreed with a fatal flaw designation for this alternative.

- *Alternative #15 – Build Offstream Storage Reservoir along Duck River*
  - Participant comment: This alternative appears to be fatally flawed.
  - Participant comment: Could hydroelectric facilities be added to an offstream impoundment to make this a better option?
  - A 5 BG reservoir with an average depth of 30 ft would need roughly 500 acres.
  - Participant comment: What is meant by the term "offstream"? Team response: Offstream refers to construction of a dam on a small stream or in an area where the possibility of impacting wetlands is minimal. The reservoir would "skim" high flows from the Duck River for refill and would provide storage during drought events.
  - Participant comment: Are there areas suitable for offstream storage? Team response: There are areas along the Duck River that would be suitable. The site would likely have a very small drainage area.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #16 – Utilize Quarries*
  - Records for the Belfast and Hardison Mill Quarries have been requested.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #17 – Construct Pipeline from Tennessee River*
  - Need to identify whether the pipeline would extend to the Columbia WTP or the Duck River at the Columbia pool.
  - Participant comment: Has the water quality of the Tennessee River been reviewed? TVA identified at the workshop that the water quality in the Tennessee River is very good.
  - Participant comment: Is this an interbasin transfer? Team response: No. The intake would be located in the immediate vicinity of the confluence of the Duck River and the Tennessee River so water withdrawals would be returned to their origin.
  - Participant comment: It needs to be pointed out that pumping from the Tennessee River would only take place in drought years.
  - Participant comment: It is important to note that this alternative is drought proof.
  - This alternative and the four alternatives from 2000 DEIS are designated required alternatives and their status will be determined in future stages of the project.

- *Alternative #18 – Construct Pipeline from Tims Ford Reservoir*
  - This alternative and the other three alternatives from 2000 DEIS plus the Tennessee River pipeline alternative are designated required alternatives and their status will be determined in future stages of the project.

- *Alternative #19 – Discharge Arnold Cooling Water to Duck River*
  - Revise description of the alternative to include reference to Woods Reservoir and the 57 MG holding tank.
  - Additional information will be collected on this alternative.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #20 – Purchase Water from Nearby Systems*
  - Participant comment: Water will have to be treated again due to likelihood of disinfection byproducts formed due to long travel times.



- Participant comment: Smaller version of alternative could be used to serve Williamson County or some partial area in the initial years of the planning period.
- Include interbasin transfer in the implementability criteria.
- The status of this alternative is to be determined in future stages of the project.

- *Alternative #21 – Utilize Groundwater Resources*
  - Based on USGS studies, there would not be a sufficient quantity of water available to meet the need especially during drought years. In addition, the Duck River is closely connected to groundwater aquifers and groundwater withdrawals could cause a reduction in river flow.
  - Participants agreed with a fatal flaw designation for this alternative.

- *Alternative #22 – Pump Treated Water from Columbia to WWTP to Columbia Dam*
  - Participant comment: Not supportive of this alternative because of the issue with potential flow vs. real flow. This alternative would require a detailed discussion of what problem this alternative solves.
  - Identify need for upgrade to Columbia WWTP and potential cost.
  - Revise the description of the alternative to identify that pumping would only be necessary during drought conditions.
  - Participant comment: Could we do a pumpback similar to this at Shelbyville?
  - TDEC identified that they would not necessarily be opposed to the idea of pumping treated wastewater to a point downstream of the existing Columbia Dam.
  - The status of this alternative is to be determined in future stages of the project.

- *Alternative #23 – Construct New Water Intake for Maury County at River Mile 163*
  - Participants agreed with a fatal flaw designation for this alternative.

- *Alternative #24 – Construct New Water Intake for Maury County at River Mile 108*
  - This alternative and the other three alternatives from 2000 DEIS plus the Tennessee River pipeline alternative are designated required alternatives and their status will be determined in future stages of the project.

- *Alternative #25 – Construct New Water Intake at River Mile 108 and Pump Back to Columbia Dam Pool*
  - Participant comment: It would be informative to know the flow in the Duck River at River Mile 108 near Williamsport when pumping occurs.

- Participant comment: When would this alternative be operated? Team response: Pumping would only occur on an as-needed basis.
- Revise title to identify that the discharge is to the Columbia Pool. Team response: Title changed subsequent to workshop.
- The status of this alternative is to be determined in future stages of the project.

- *Alternative #26 – Construct Infrastructure to Return Treated Water from Tullahoma WWTP to Normandy Reservoir*
  - Participant comment: Could Tullahoma get water from another source? Team response: Tullahoma is on a ridge between the Duck River and the Elk River basins and it just happens that the wastewater plant is located in the Elk River basin. It is appropriate that Tullahoma gets its water from Normandy Reservoir in the Duck River basin.
  - Participant comment: The cooling water from Arnold could be used to offset the loss of water from the Duck River through the Tullahoma WWTP. Team response: The wastewater flow would occur every day whereas the Arnold Cooling Water discharge may be periodic. Additional information will be obtained for Arnold cooling water.
  - The status of this alternative is to be determined in future stages of the project.

Draft Summary of Water Supply Alternatives Matrix ("Required Alternatives" shaded in green and "Baseline Alternatives" shaded in yellow)

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
Non-Structural Alternatives									
1	Water Efficiency Measures	Better management of water including water conservation, public outreach, system optimization, water reuse, etc. Full cost pricing of water including setting rates to reflect the full cost of service to help utilities capture the actual cost of operating water systems, raise revenues and help conserve water. Efficient water use including reducing leaks, metering, building retrofits, water sensing fixtures, irrigation systems, rainwater harvesting, etc. Watershed approaches including source water protection, return water to river, etc.	- Satisfies a portion of 32 mgd river deficit in 2060. - In aggregate, Water Efficiency Measures likely reduce water demands by 5% or 10% and potentially up to 30% of the total unrestricted demand. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Cost to implement water efficiency measures.	- Public acceptance could delay implementation of certain water efficiency measures. - Minimal permitting, property acquisition or constructability issues. - Voluntary participation required by customers for certain water efficiency measures.	- Alternative can be implemented in multiple phases.	- Water Efficiency Measures can reduce water supply withdrawals and thereby provide environmental benefits.	- No recreational benefits or impacts.
2	Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels	Modify Normandy Reservoir release protocol to increase releases during low flow conditions (i.e., drought events) to meet the 64 mgd (100 cfs) constraint at the Columbia gage. This alternative does not include raising the Normandy Dam height or pool levels.	- Satisfies entire river deficit of 32 mgd in 2060. - Compared to 2010 conditions, release from Normandy Reservoir to meet Columbia constraint in 2060 results in approximately 3 ft lower water levels in Normandy Reservoir under conditions of 2007 drought and 2060 water demands. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Consider cost of impact on recreation due to lower water levels. Consider increased cost for treatment and pumping.	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely.	- Alternative can be implemented in multiple phases.	- Need to identify if increased release has significant impact/ environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Lower water levels in Normandy Reservoir as a result of satisfying constraint at Columbia (maximum of 3 ft additional drawdown during critical drought and 2060 demands) could further impact recreation during drought.
3	Regional Drought Management Plan	Develop drought management plan that reflects both human and environmental uses of flow. Drought Plan will identify triggers or actions to be taken during drought conditions based on numerous factors which could include time of year, reservoir water levels, groundwater conditions, downstream flow conditions, etc. Consequently, the Drought Management Plan would consist of a package of alternatives and would define the timing and trigger for enacting elements of alternatives such as water use restrictions, reductions in releases from Normandy Reservoir, etc.	- Reduction in demand or storage preserved in Normandy Reservoir covered by implementation of other alternatives under this Drought Management Plan. - Drought management planning could involve demand management during droughts that could extend the supply availability. Could also involve reduced releases during initial stages of droughts for use at latter stages of drought. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Reduced demand has potential for negative revenue impacts on utilities.	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - Requires participation and actions from State agencies.	- Alternative can be implemented in multiple phases.	- Need to identify if increased release and modified operating protocol has significant impact/ environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Benefits or impacts to recreation associated with changes in reservoir operation are uncertain.
4	Optimize Releases from Normandy Reservoir	Install stream gages and modify dam controls as needed to allow releases from Normandy Reservoir to more closely match flow requirements at Shelbyville. Alternative preserves storage at initial stages of drought and allows for releases in latter stages when lower flow conditions occur.	- Projected deficits used in this study were computed assuming optimization of releases from Normandy Reservoir. - Continued reliance on Normandy Reservoir (208 sq	- No change.	$?? Cost for installation and maintenance of stream gages.	- No change in operating rules.	- Alternative can be implemented in multiple phases.	- Need to identify if reduced release during initial stages of drought has significant impact/ environmental benefits associated with hydrologic regime,	- Preserves pool storage for recreation in Normandy Reservoir due to ability to match required release.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
			mi drainage area) as sole source of water during severe droughts to satisfy many needs.					physical habitat, water quality and biota.	
5	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam	Raise Normandy Reservoir Winter/Spring pool level from 864 ft to 869 ft to preserve water storage from Winter/Spring pool for human and environmental needs during drier Summer/Fall months. This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	- Satisfies entire river deficit of 32 mgd in 2060. - Increases water supply storage by approximately 5 BG and 1.4 BG needed to meet Columbia constraint in 2060. Reduces flood storage volume by roughly 5 BG. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? May require land acquisition in flood prone areas downstream of dam.	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - May require land acquisition in flood prone areas downstream of dam.	- Alternative can be implemented in multiple phases.	- Potential negative impacts on stream due to higher frequency of flooding.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought due to higher water levels.
6	Modify Normandy Reservoir Flood Rule Curve	Initiate refill of Normandy Reservoir earlier in the Spring (say February 1st instead of March 1st) in order to capture high Spring flows and refill prior to dry weather conditions which begin in June. This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy a portion of the projected deficit of the downstream users. This alternative could be combined with other alternatives involving modification of the operating rule curve at Normandy Reservoir.	- No added reliable capacity. - Increases storage for water supply by capturing high spring flood flows. Risk associated with potential for no storm event in Normandy Reservoir drainage area between February 1st and March 1st. - Reduces volume of flood storage between February 1st and March 1st. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? May require land acquisition in flood prone areas downstream of dam.	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain. - May require land acquisition in flood prone areas downstream of dam.	- Alternative can be implemented in multiple phases.	- Downstream restrictions could be an issue but this alternative is better for reservoir biota. Objective is to fill it and maintain a steady pool level in the reservoir for spawning.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought due to higher water levels.
7	Reduce Irrigation Withdrawals **(FATAL FLAW)**	Reduce irrigation withdrawals and develop a plan to compensate farmers or provide water storage for use during drought conditions.	- No added reliable capacity. - Withdrawals could be significant for short term (i.e., a few days) but cannot be defined because irrigation withdrawals are not restricted and effectiveness of incentives will have to be based on voluntary participation.	- No change.	$??	- Delays in implementation possible due to need for voluntary participation. - Requires legislative action.	- Alternative can be implemented in multiple phases.	- Not applicable.	- No recreational benefits or impacts.
8	Modify River Constraints to Preserve Storage in Normandy Reservoir	Modify flow constraints at Columbia by changing instantaneous requirement of 100 cfs to weekly average (or similar) or by reducing 100 cfs instantaneous flow requirement.	- Potential to satisfy entire river deficit of 32 mgd in 2060. - Reduced releases during droughts which preserves storage for use at latter stages of drought. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Raw water quality improvement if wastewater discharge treated to a higher level.	$?? Cost for wastewater treatment improvements to allow flow reductions.	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- Alternative can be implemented in multiple phases.	- Environmental benefits associated with improvements in level of wastewater treatment.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought due to higher water levels.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
Structural Alternatives									
9	Raise Normandy Dam *(Alternative D from 2000 PEIS)*	Increase the height of Normandy Dam and Winter/Fall pool level by 5 ft (i.e., increase flood pool from 880 ft to 885 ft, retain Summer/Fall pool at 875 ft, and increase Winter/Spring pool from 864 ft to 869 ft). Increase releases from Normandy Reservoir to meet needs at Shelbyville and Columbia.	- Satisfies entire river deficit of 32 mgd in 2060. - Increases storage by approximately 5.5 BG. - No impact on flood storage volume. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Costs for dam modifications, as well as roadway and boat launch modifications. Affected area to be inundated is in public ownership.	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - Need to document number of stream miles inundated. - Short Springs (State Designated Natural Area) along Bobo Creek could experience prolonged periods of occasional inundation and impede approval or limit increase in height of dam. Higher pool level will inundate 2 to 3 acres of flora and hiking trails at Short Springs. - Loss of shoreline vegetation.	- No flexibility to phase implementation for construction, but could phase increases in pool level.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Potential impacts to campgrounds and boat ramps.
10	Improve DRUC Intake	Modify the existing DRUC intake to allow access to water below the current low water level threshold (approximately 840 ft). This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	- No added reliable capacity to meet deficit for downstream users. - Provides DRUC with more reliable access to roughly 10 BG of storage between elevation 845 ft and 830 ft.	- Potentially lower raw water quality compared to other alternatives. - In the event of a severe drought, DRUC would make alternative provisions (i.e., floating intake, etc.) to utilize this storage and water would also continue to be released to meet downstream needs.	$?? Cost for intake modifications.	- EIS involving detailed environmental studies of intake modifications will be required, but ability to obtain necessary permits is likely.	- No flexibility to phase implementation.	- No direct impact associated with hydrologic regime, physical habitat, water quality and biota, because the minimum required instream flow would be maintained.	- No recreational benefits or impacts.
11	Construct Second DRUC Intake	Construct a second 20 mgd intake and pumping station for DRUC near the Normandy Dam to allow access to water below the operating range of the existing DRUC intake (approximately 840 ft). Construct a 30-inch pipe (4 miles) to convey flow from the new intake to the existing DRUC WTP. This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	- No added reliable capacity to meet deficit for downstream users. - Provides DRUC with more reliable access to roughly 15 BG of storage between elevation 845 ft and 800 ft.	- Potentially lower raw water quality compared to other alternatives. - In the event of a severe drought, DRUC would make alternative provisions (i.e., floating intake, etc.) to utilize this storage and water would also continue to be released to meet downstream needs. - Construct a multi-port intake to obtain highest quality water available.	$?? Cost for new intake and piping.	- EIS involving detailed environmental studies of new intake will be required, but ability to obtain necessary permits is likely.	- No flexibility to phase implementation.	- No direct impact associated with hydrologic regime, physical habitat, water quality and biota, because the minimum required instream flow would be maintained.	- No recreational benefits or impacts.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
12	Construct Fountain Creek Reservoir *(Alternative B from 2000 PEIS)*	Construct a dam on Fountain Creek 0.2 miles upstream of confluence with Duck River at River Mile 145.8. At this location, the watershed drainage area for Fountain Creek Reservoir is 102 square miles. The inundated area of the reservoir under normal pool level is approximately 2,200 acres. Alternative includes construction of 32 mgd reservoir intake and pumping station, a 42-inch pipeline to a treatment plant (5 miles) and a continuous downstream release of 5 cfs.	- Satisfies entire river deficit of 32 mgd in 2060. - 48 mgd yield based on 2000 PEIS. - Potential for significant water loss from reservoir due to karst geology. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Shallow reservoir with long residence time yields high potential for nutrient enrichment, low dissolved oxygen, and water quality issues based on 2000 PEIS. - Construct a multi-port intake to obtain highest quality water. - Fountain Creek watershed contains high levels of nutrients. - Potential to discharge high temperature and low DO water to free flowing segment of Duck River. - Two 303(d) listed streams drain to Fountain Creek. Stream listing due to municipal/industrial landfills (Cedar Ridge Landfill and other landfill are regulated by solid waste). - Basin management plan may be required to minimize watershed impacts on reservoir water quality.	$?? Costs for dam, intake, pumping station, 5 miles of pipeline based on PEIS 800 acres of land needed for reservoir and 50 acres of easements needed along pipeline route based on 2000 PEIS. Identify mitigation costs for environmental impacts.	- EIS involving detailed environmental studies will be required and ability to obtain necessary permits is uncertain. - 2000 PEIS identified potential impacts on species diversity, wetlands, and T&E species habitat. - Potential substantial loss of forested wetlands (225 acres) - Inundation of Fountain Creek will alter ecology of the impounded tributary. - Need field determination of wetland impacts and development of a mitigation plan. - Need to establish release downstream of dam. - Rare, threatened, or endangered species may exist in Fountain Creek.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Inundation of Fountain Creek results in loss of riverine environment on Fountain Creek and land on Game Reserve. - Potential for fishing and other recreational opportunities associated with Fountain Creek Reservoir.
13	Construct Reservoir on Fountain Creek with Downstream Release	Construct dam on Fountain Creek just upstream of confluence with Duck River at River Mile 145.8. Alternative includes construction of 32 mgd reservoir intake and a continuous downstream release of 5 cfs. Storage in Fountain Creek Reservoir is released downstream to the existing Columbia Pool for withdrawal at the existing Columbia intake.	- Satisfies entire river deficit of 32 mgd in 2060. - 48 mgd yield based on 2000 PEIS. - Potential for significant water loss from reservoir due to karst geology. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Shallow reservoir with long residence time yields high potential for nutrient enrichment, low dissolved oxygen, and water quality issues based on 2000 PEIS. - Construct a multi-port intake to obtain highest quality water. - Fountain Creek watershed contains high levels of nutrients. - Potential to discharge high temperature and low DO water to free flowing segment of Duck River. - Two 303(d) listed streams drain to Fountain Creek. Stream listing due to municipal/industrial landfills (Cedar Ridge	$?? Cost for dam and intake. 800 acres of land needed for reservoir.	- EIS involving detailed environmental studies will be required and ability to obtain necessary permits is uncertain. - 2000 PEIS identified potential impacts on species diversity, wetlands, and T&E species habitat. - Potential substantial loss of forested wetlands (225 acres) - Inundation of Fountain Creek will alter ecology of the impounded tributary. - Need field determination of wetland impacts and development of a mitigation plan. - Need to establish release downstream of dam. - Rare, threatened, or	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Inundation of Fountain Creek results in loss of riverine environment on Fountain Creek and land on Game Reserve. - Potential for fishing and other recreational opportunities associated with Fountain Creek Reservoir.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
				Landfill and other landfill are regulated by solid waste). - Basin management plan may be required to minimize watershed impacts on reservoir water quality.		endangered species may exist in Fountain Creek.			
14	Upgrade Existing Columbia City Dam to Allow Releases **(FATAL FLAW)**	Install valves or gates in the existing Columbia Dam to allow intermittent releases downstream of the dam to temporarily maintain flow constraint at Columbia with refill of the Columbia Reservoir occurring from releases from Normandy Reservoir, releases from quarry storage, or from the Duck River watershed.	- No added reliable capacity.	- Potential impact due to release of sediments downstream of the dam. - Requires review of data on sediment accumulation behind dam and the need for dredging.	$?? Cost for dam improvements to allow controlled releases.	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
15	Build Offstream Storage Reservoir along Duck River	Construct 5 BG offstream storage reservoir along Duck River. Construct new dam, pumping station along the Duck River, and piping (say 2 miles) to allow refill of the storage reservoir from the Duck River with supply back to the Duck River during low flow conditions. Refilling of the storage reservoir would occur by "skimming" high flows from the Duck River.	- 5 BG of new storage satisfies 1.4 BG river deficit in 2060. - Capacity would be sized to meet projected needs. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Construct a multi-port intake to avoid release of cold water from storage.	$?? Cost for new dam, intakes, pumping stations, piping, and land.	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Potential for fishing and other recreational opportunities associated with construction of an offstream storage reservoir.
16	Utilize Quarries	Utilize storage in existing inactive quarries (Hardison Mills and Belfast) to supply flow to Duck River during low flow conditions. For Hardison Mills Quarry (estimated 300 MG of storage), construct 5 mgd intake and pumping station on the Duck River, 16-inch pipeline from Duck River to quarry (1300 ft), and 5 mgd intake and pumping station at quarry. Use quarry water storage to augment flows in the Duck River during low flow conditions to meet Columbia constraint and refill quarry by "skimming" water from the Duck River during high flow conditions. For Belfast Quarry (estimated 500 MG of storage), utilize existing Lewisburg intake and pipeline during low water production periods and high river flows to pump water from Lewisburg WTP to Belfast Quarry and supply water from Belfast Quarry to Lewisburg WTP and Duck River during low flow conditions. Construct new 5 mgd pumping station at Lewisburg WTP, 16-inch pipeline (3 miles), and intake and pumping station at Belfast Quarry.	- Existing inactive quarries satisfy estimated 0.8 BG of 1.4 BG river deficit in 2060. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Need to construct multi-port intake or floating intake to allow withdrawal of appropriate temperature water from storage.	$?? Cost for new intakes, pumping stations, and piping.	- EIS involving detailed environmental studies of flow alteration may be required and ability to obtain necessary permits is likely.	- No flexibility to phase implementation. Numerous quarries along the Duck River that could be added in the future as they become inactive.	- Utilizing quarries protects quarry site from illicit dumping or other uses that could impact water quality.	- No recreational benefits or impacts.
17	Construct Pipeline from Tennessee River	Construct 32 mgd intake and pumping station and 42-inch pipeline from Tennessee River near I-40 crossing to Columbia WTP (60 miles). Additional piping could be constructed in the future to extend supply to other utilities.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Potential for future increases in supply. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Cost for new intake, pumping station and 50 miles of piping.	- EIS involving detailed environmental studies of flow alteration may be required and ability to obtain necessary permits is likely. - DRA may need to obtain condemnation authority to obtain ROWs. - Potential to artificially extend range of exotic species or increase the likelihood that exotic species could invade these watersheds.	- Could be constructed in stages starting in Columbia and working toward the Tennessee River.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
18	Construct Pipeline from Tims Ford Reservoir *(Alternative E from 2000 PEIS)*	Construct 10 mgd intake and pumping station at Tims Ford and 24-inch pipeline from Tims Ford Reservoir to DRUC WTP or intake (16 miles). This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Potential for future increases in supply. - Provides emergency backup source of supply for DRUC customers if Normandy Reservoir water is unavailable. - Supplying 1.4 BG of storage deficit during critical drought in 2060 from Tims Ford Reservoir would result in a drop in water level in Tims Ford Reservoir of approximately 8 inches.	- Need to construct multi-port intake to allow withdrawal of appropriate temperature and quality of water from Tims Ford.	$?? Cost for new intake, pumping station, booster pumping station, and 16 miles of pipeline based on 2000 PEIS Approximately 75 acres of permanent easements and 125 acres of construction easements needed along pipeline based on 2000 PEIS.	- Need to address interbasin transfer concerns. - Potential to artificially extend range of exotic species or increase the likelihood that exotic species could invade these watersheds.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts likely due to maximum water level drop of 8 inches during critical drought.
19	Discharge Arnold Cooling Water to Duck River	Release cooling water from cooling lake at Arnold AFB to the Little Duck River which is tributary to Normandy Reservoir.	- Concerns related to reliable capacity because periodic operation.	- Need to define source and location of water contamination. - Need to address temperature concerns for discharge of cooling water.	$?? Cost to provide temperature reduction at discharge location.	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
20	Purchase Water from Nearby Systems	Construct 42-inch finished water pipeline from Nashville to Columbia (50 miles).	- No added reliable capacity. - Serious concerns regarding access to reliable capacity. - Requires an interbasin transfer.	- No change.	$?? Cost of new pumping stations and piping.	- Minimal permit requirements. - Requires an interbasin transfer.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
21	Utilize Groundwater Sources **(FATAL FLAW)**	Construct new groundwater wells or access underground flow for the Duck River between Shelbyville and Columbia.	- No added reliable capacity. - Serious concerns regarding access to reliable groundwater sources.	- No change.	$?? Cost for new wells, pumping station and piping.	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- Alternative can be implemented in multiple phases.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
22	Pump Treated Wastewater from Columbia WWTP to Columbia Dam	Construct a 20 mgd pumping station at the Columbia WWTP and a 36-inch pipeline (5 miles) to return treated wastewater from the Columbia WWTP to a location just downstream of the existing Columbia Dam. Pumping flow back to the location downstream of the Columbia Dam would only be required under this alternative during low flow conditions in the Duck River.	- Satisfies 20 mgd of 32 mgd river deficit in 2060. - Drought proof and highly reliable. - Capacity increases over time. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Must meet TDEC water quality requirements for discharge. - Higher levels of treatment may be needed to avoid impacts on raw water quality immediately downstream of dam where threatened and endangered species exist.	$?? Cost for new pumping station, 5 miles of piping and potential upgrades for WWTP.	- EIS involving detailed environmental studies will likely be required and ability to obtain necessary permits is uncertain. - TDEC may not permit or may require a higher level of treatment of wastewater. - Potential impact to threatened and endangered mussels immediately downstream of existing Columbia Dam.	- High level of flexibility in that capacity can be increased over time.	- Potential environmental benefit if higher level of treatment is provided for Columbia WWTP discharge to meet assimilative capacity requirements just downstream of Columbia Dam.	- No recreational benefits or impacts.
23	Construct New Water Intake for Maury County at River Mile 163	Construct a 32 mgd water intake on Duck River at River Mile 163 and 42-inch pipeline (24 miles) for Maury and South Williamson Counties (Columbia gage is at River Mile 132 which is roughly 30 river miles downstream).	- No added reliable capacity.	- No change.	$?? Cost for new intake, pumping	- TDEC permit needed for water supply withdrawal but ability to obtain necessary permits is likely.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water	- No recreational benefits or impacts.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
	(FATAL FLAW)				station and 24 miles of piping.			quality and biota.	
24	Construct New Water Intake for Maury County at River Mile 108 *(Alternative C from 2000 PEIS)*	Construct a 32 mgd water intake and pumping station on Duck River in vicinity of River Mile 108 near Williamsport and 17 miles of 42-inch pipeline to the Columbia water treatment plant.	- <u>Satisfies entire river deficit of 32 mgd in 2060.</u> - Drought proof and highly reliable. - Minor reduction in downstream flows due to consumptive uses in the Maury and South Williamson County water systems. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Cost for new intake, pumping station, and 13 miles of pipeline based on 2000 PEIS. Roughly 2 acres of land needed for intake and pumping station along Duck River. Approximately 50 acres of permanent easements and 80 acres of construction easements needed along pipeline based on 2000 PEIS.	- EIS involving detailed environmental studies of flow alteration will be required but ability to obtain necessary permits is likely. - Lower downstream flows not likely to cause adverse impacts on aquatic life.	- No flexibility to phase implementation but piping could become part of future solution such as Tennessee River option.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
25	Construct New Water Intake at River Mile 108 and Pump Back to Columbia Dam Pool	Construct a 32 mgd water intake and pumping station on Duck River at River Mile 108 near Williamsport and a 42-inch pipeline (17 miles) to convey water to the pool behind the existing Columbia Dam.	- <u>Satisfies entire river deficit of 32 mgd in 2060.</u> - Drought proof and highly reliable. - Minor reduction in downstream flows due to consumptive uses in the Maury and South Williamson County water systems. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$?? Cost for new intake, pumping station and 17 miles of piping.	- EIS involving detailed environmental studies of flow alteration could be required but ability to obtain necessary permits is likely.	- Alternative could ultimately be a component of the Tennessee River pipeline alternative.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
26	Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir	Construct 10 mgd pumping station and 24-inch pipeline (9 miles) to return treated wastewater from Tullahoma WWTP to Normandy Reservoir. This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	- <u>Satisfies entire river deficit of 32 mgd in 2060.</u> - Reliable 2 mgd in 2010 increasing over time to 3 mgd in 2060 as Tullahoma wastewater flow increases (assumes 70% return flow). - Slight reduction in the level of reliance on Normandy Reservoir.	- Must meet TDEC water quality requirements for discharge, but current level of treatment is apparently adequate.	$?? Cost for new pumping station and 9 miles of piping.	- Need to conduct studies and obtain a new NPDES permit for wastewater discharge, but ability to obtain necessary permits is likely.	- Flexible to accommodate increases in flow over time. - Could extend piping to Tims Ford Reservoir in future to convey flow to Normandy Reservoir or DRUC WTP.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.



Duck River Comprehensive Regional Water Supply Plan

Workshop No. 3 / December 9, 2009

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Agenda

- **Review of Minutes from Workshop No. 2**
- Summary of Activities Since Workshop No. 2
- Objectives for Workshop No. 3
- Update on Needs Assessment
- Supplemental OASIS (hydrologic) Modeling
- Evaluation Criteria
- Water Supply Alternatives
- Next Steps

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Review of Minutes from Workshop No. 2

- Reviewed water supply needs assessment
  - Discussed river constraints
  - Presented initial findings for supply and demand from USGS, TVA, CBER and other sources
  - Identified data gaps
  - Outlined proposed plan to refine supply and demand results
- Agreed to proceed with Phase II of study based on findings from needs assessment
- Discussed preparations for "Open House" (Public Meetings)
- Discussed and refined evaluation criteria and definitions
- Reviewed next steps including development of draft list of alternatives

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Agenda

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Summary of Activities Since Workshop No. 2

- Held work session with DRATAC and DRA Board (9/22/09)
- Held work session with TVA and TDEC (9/23/09)
- Held work session with TNC, USFWS, and TWRA (9/24/09)
- Held three Open House Public Meetings (9/22/09 - 9/24/09) in Tullahoma, Henry Horton State Park, and Columbia
- Conducted additional hydrologic modeling of drought frequency and duration and computed deficits based on meeting Shelbyville constraint and Columbia constraint in 2010, 2020, 2040 and 2060 (10/7/09)
- Developed summary matrix of alternatives based on evaluation criteria (10/8/09)
- Provided briefing on project status at WRC meeting (10/8/09)

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Summary of Activities Since Workshop No. 2

- Met with TVA to discuss water supply alternatives (10/21/09)
- Held work session with DRATAC and attended DRA Board meeting to discuss needs assessment and water supply alternatives (10/22/09)
- Held work session with TNC, USFWS and TWRA and TVA (11/9/09 – 11/10/09)
- Conducted site visit to DRUC water intake and water plant as well as Short Springs State Designated Natural Area (11/9/09)
- Conducted additional hydrologic modeling of drought frequency and duration and computed deficits based on meeting Shelbyville constraint and Columbia constraint in 2010, 2020, 2040 and 2060 with period of records including 1921-1934 (12/1/09)

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Agenda

- Review of Minutes from Workshop No. 2
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Objectives for Workshop No. 3

- Provide an update on needs assessment
- Generate list of alternatives to be carried forward for more detailed evaluation

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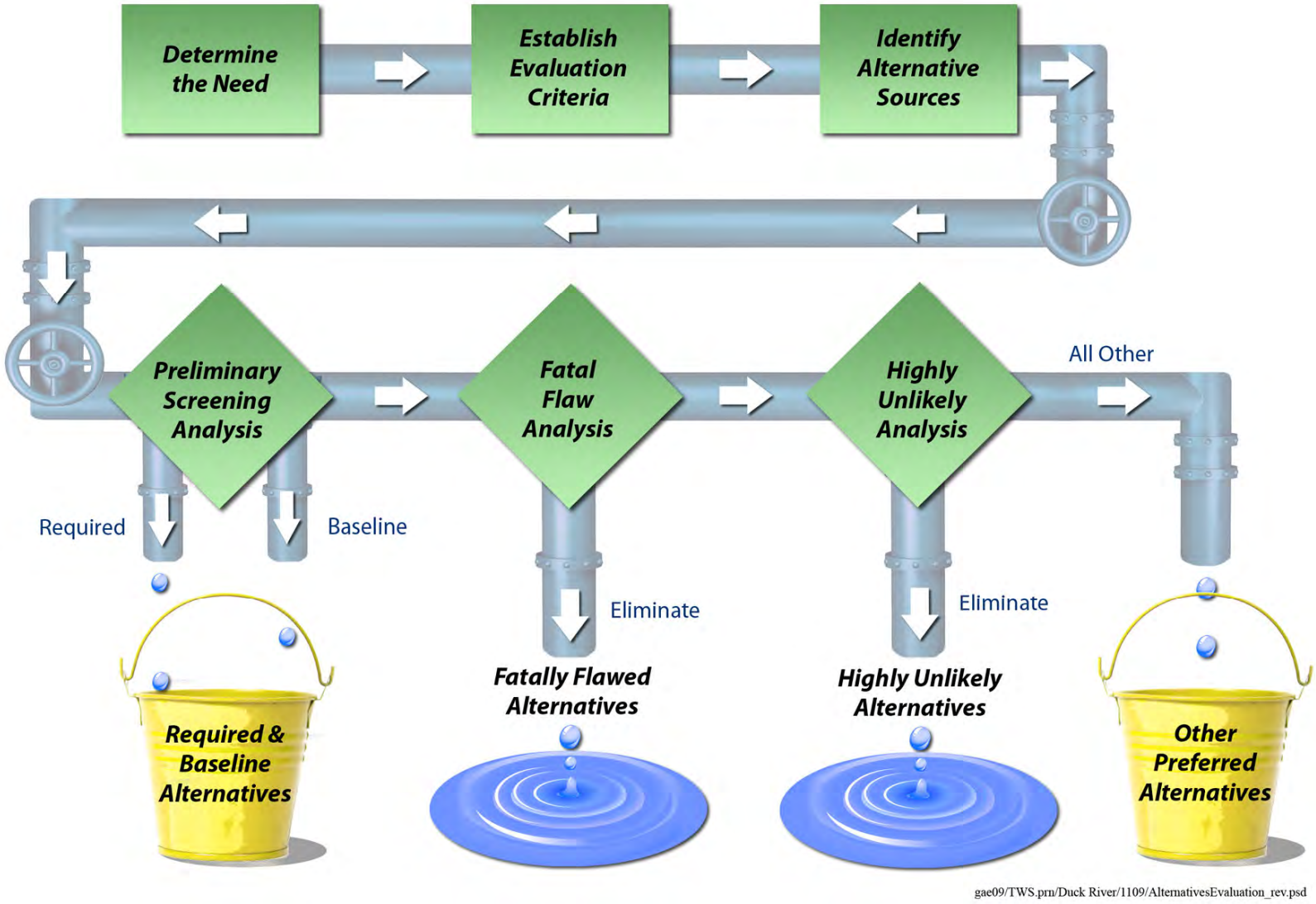
Water Supply Evaluation Process



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Service Area

"Estimated Use of Water in the Upper Duck River Watershed, Central Tennessee, and Water Demand Projections through 2030 ," USGS, 2008

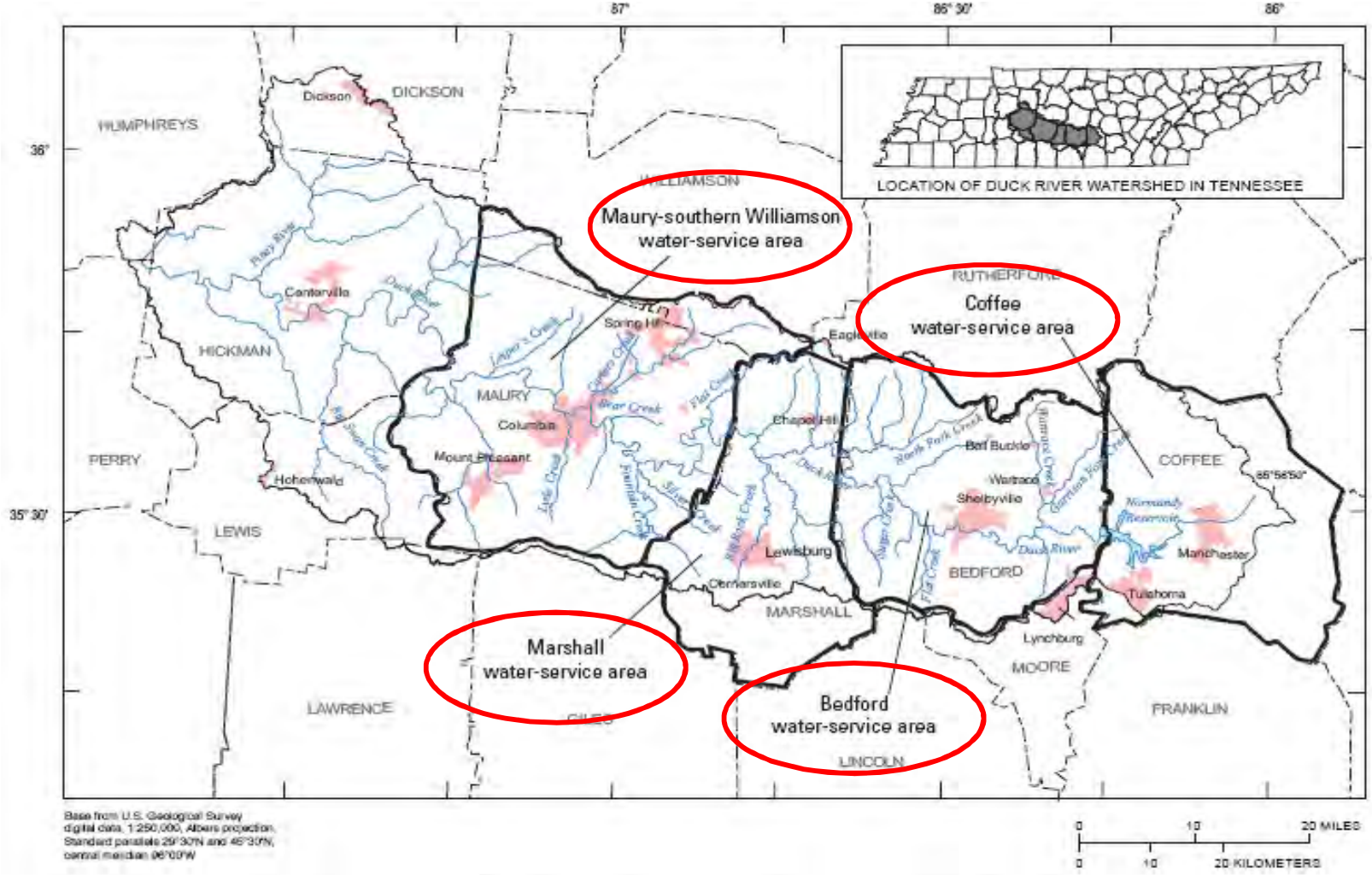

Figure 1. Upper Duck River study area and the Maury-southern Williamson, Marshall, Bedford, and Coffee water-service areas.

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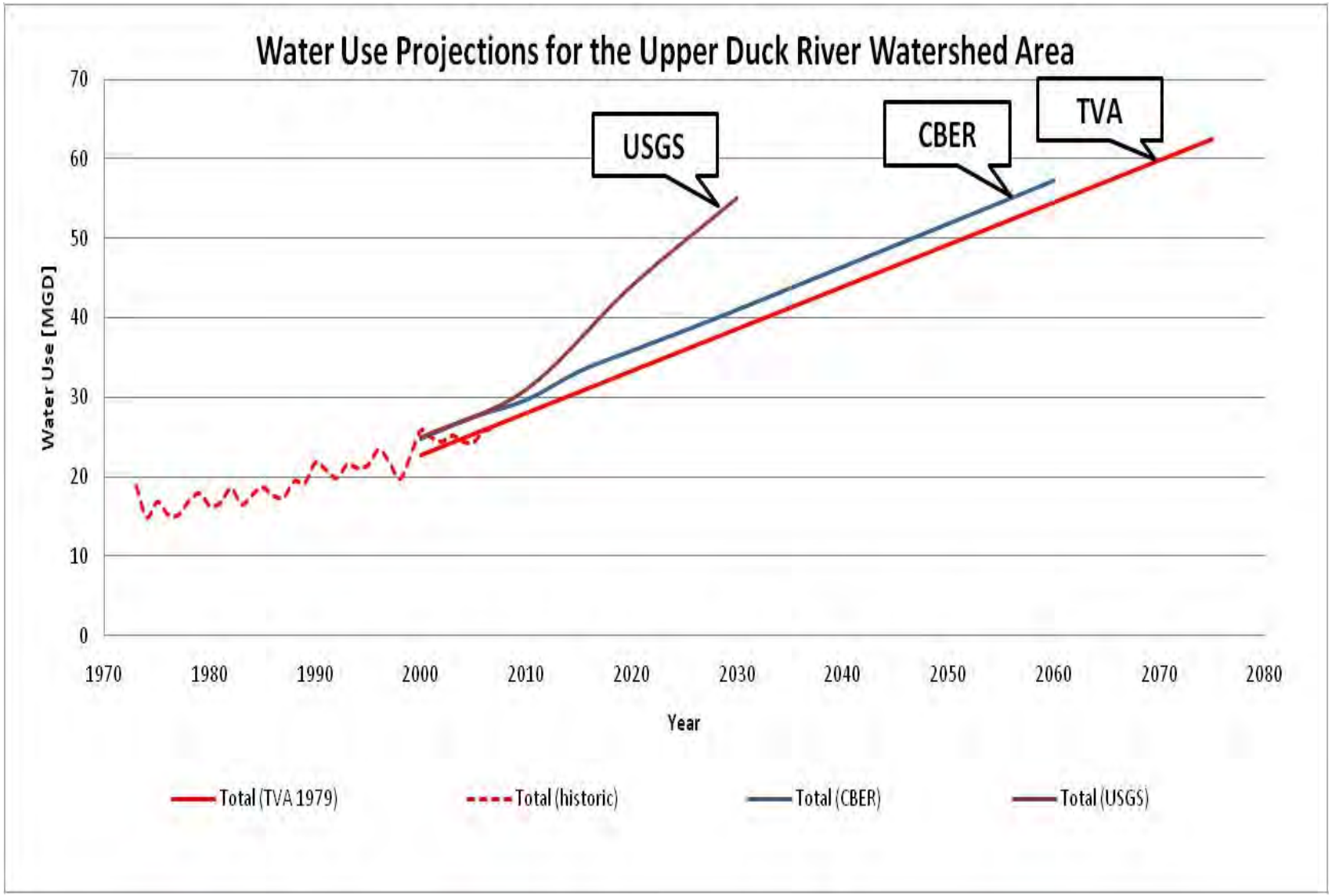
Summary of Future Water Demands



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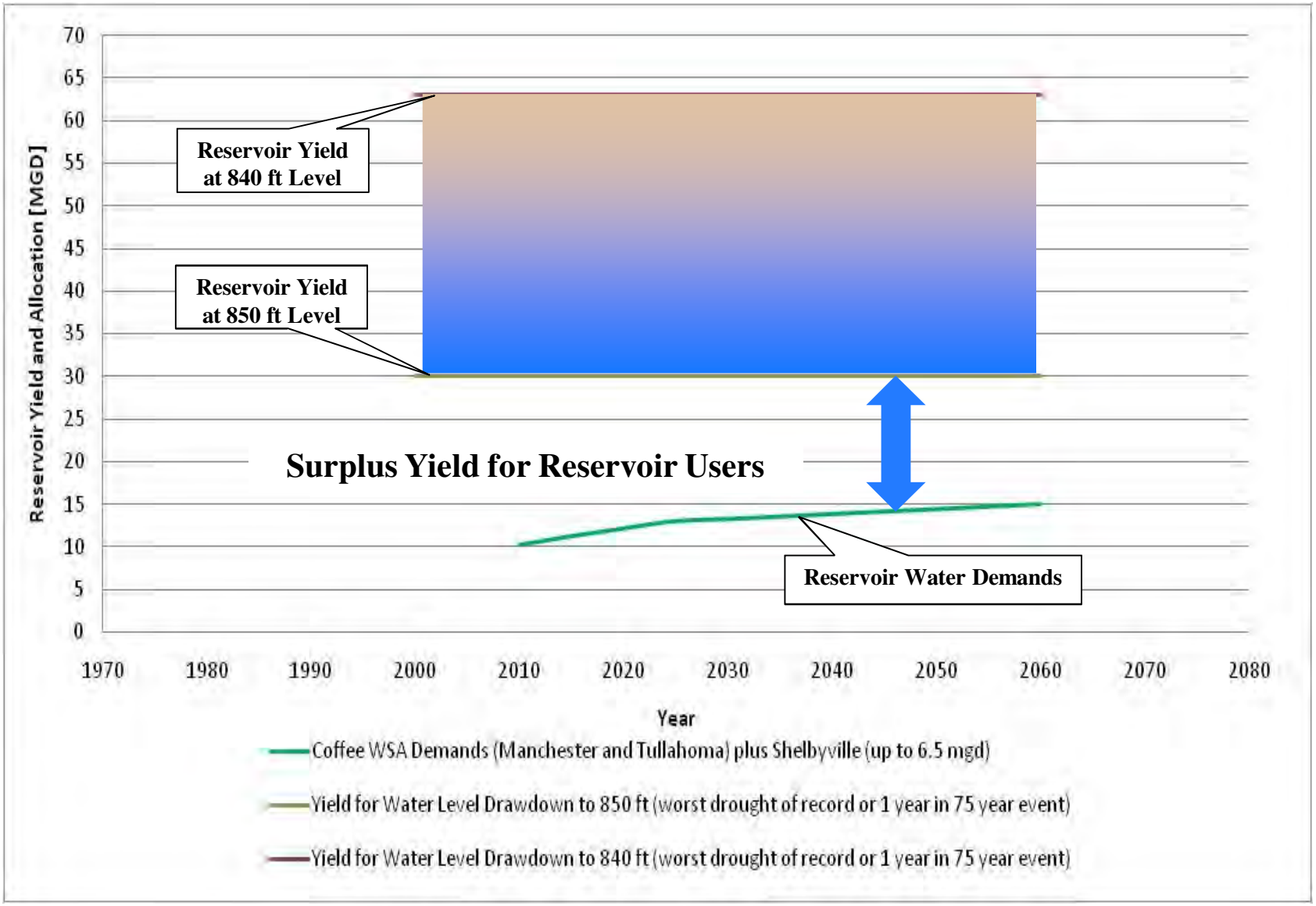
Needs Assessment for Normandy Reservoir Supply (No Action Alternative)



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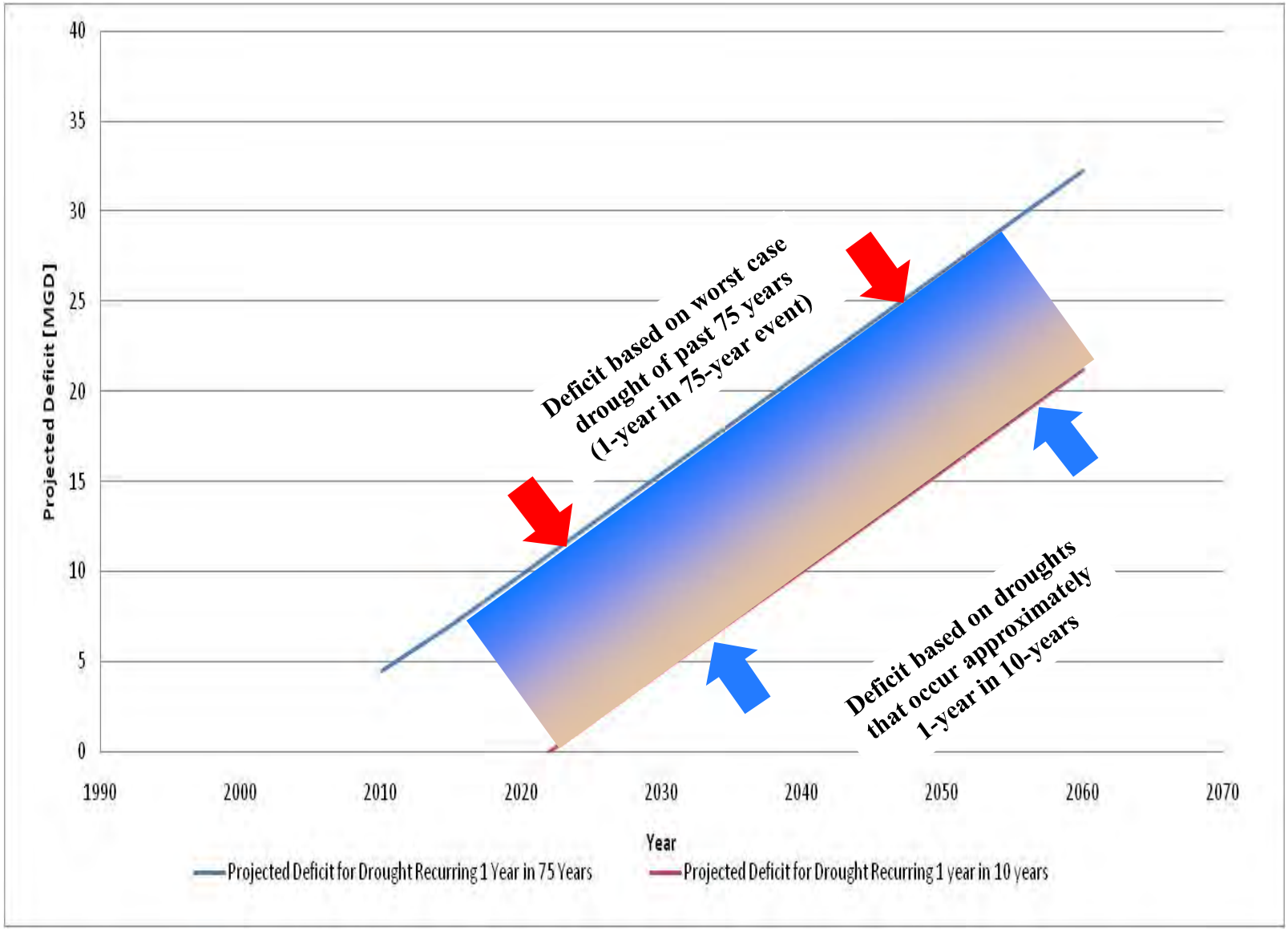
Needs Assessment for Duck River Supply (No Action Alternative)



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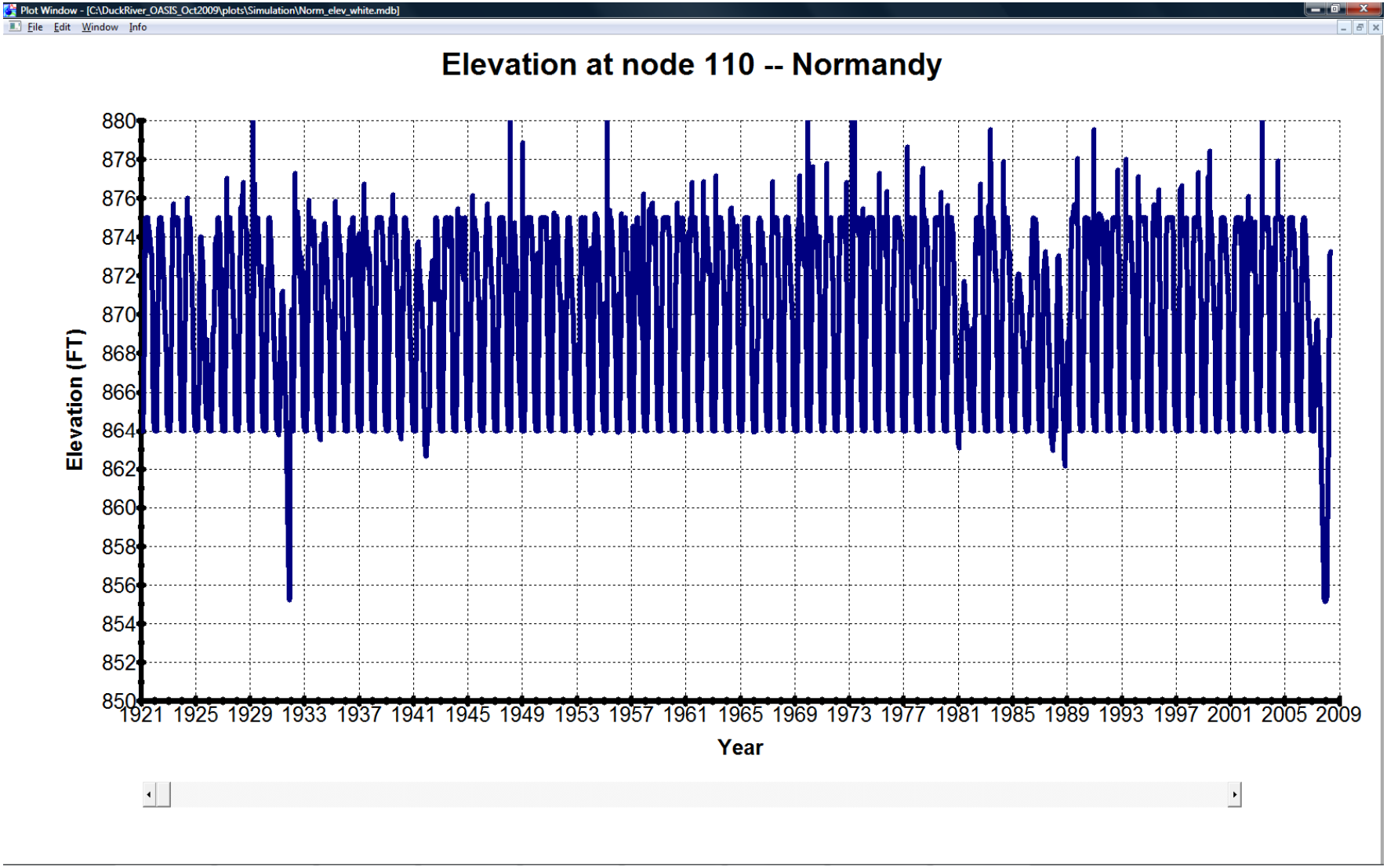
Normandy Elevations for entire inflow record – 2010 demand levels, current operating policy



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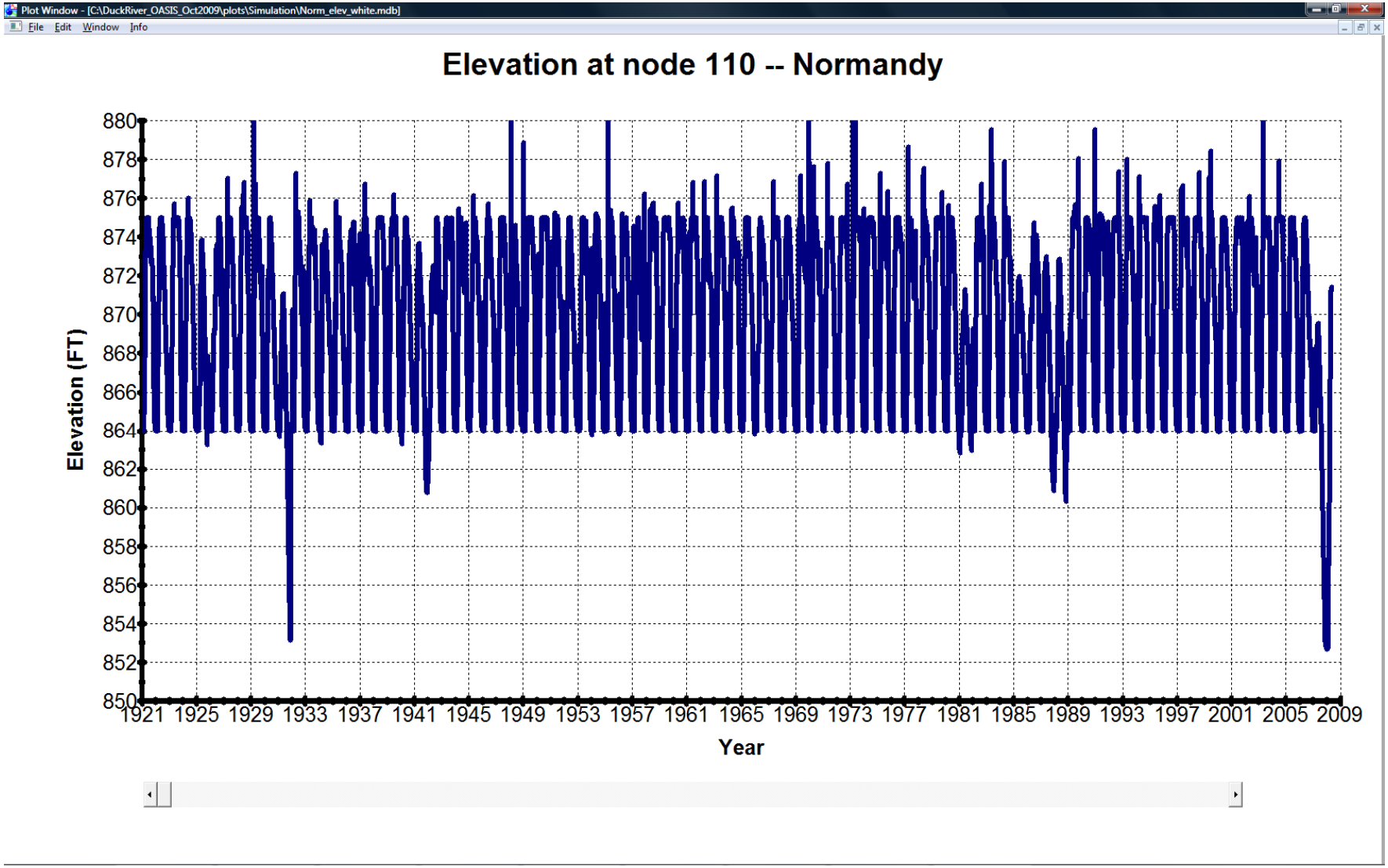
HYDROLOGICS
Advancing the management of water resources

Normandy Elevations for entire inflow record – 2060 demand levels, current operating policy



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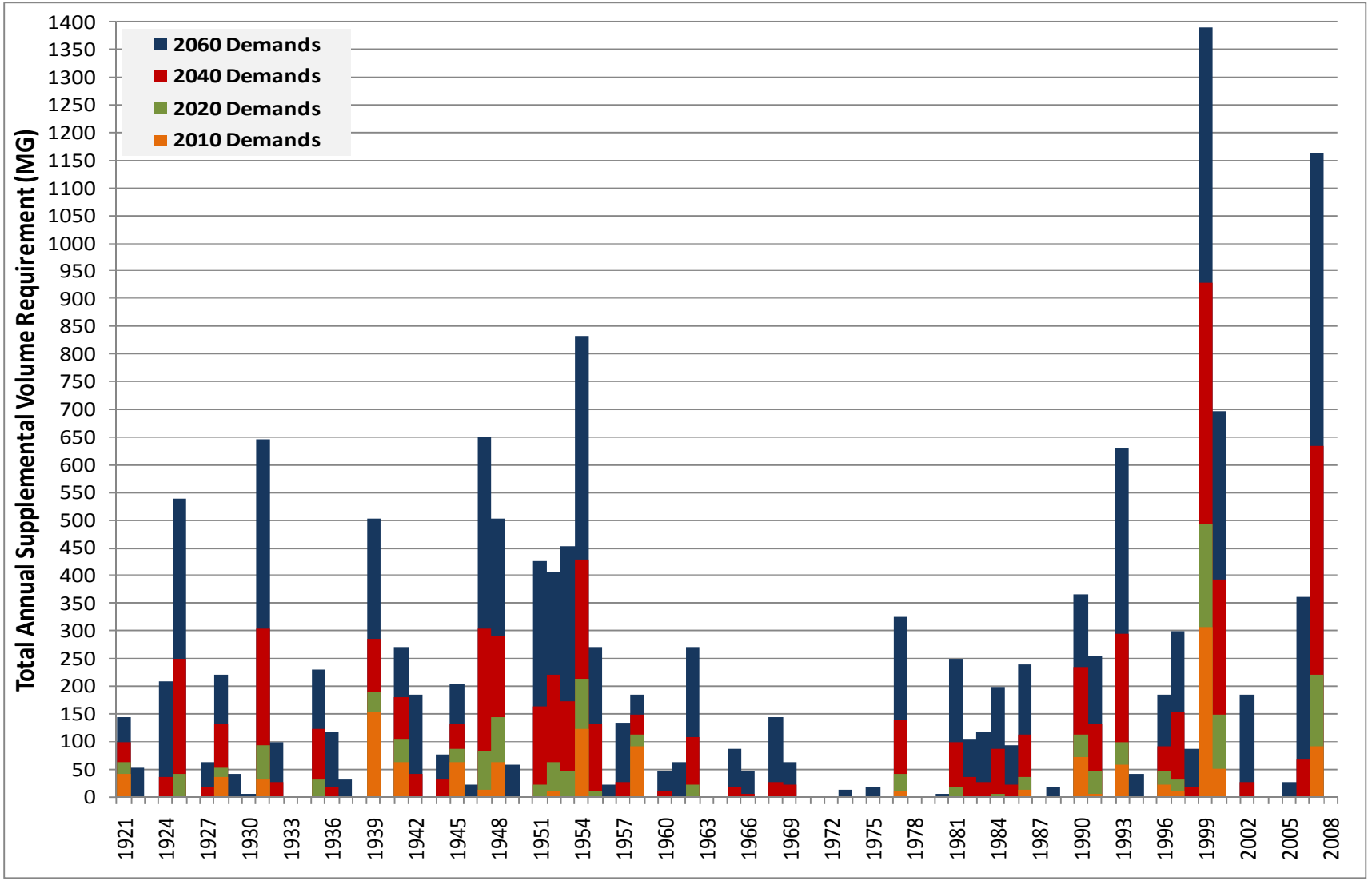
HYDROLOGICS
Advancing the management of water resources

Supplemental Annual Volume Required to Maintain Columbia Weekly Avg. Flow at 125 cfs



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HYDROLOGICS
Advancing the management of water resources

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Evaluation Criteria

- Reliable Capacity
- Raw Water Quality
- Cost
- Implementability / Risk of Delays
  - permittable
  - public acceptance
  - property acquisition
- Flexibility
  - phased implementation
- Environmental Benefits
- Recreation

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Evaluation Criteria

- **Reliable Capacity** - Reliable quantity of raw water to meet projected demands through the planning period. This criterion addresses interruptibility of sources of supply and the perceived value of multiple supplies. It also considers the impact of the alternative on flood control.

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Evaluation Criteria

- **Raw Water Quality** - The ability of raw water quality to meet existing and future drinking water quality requirements. This criterion may also address water quality preferences such as superior raw water quality, and finished water taste and the potential for the alternative to address currently unregulated compounds, such as endocrine disrupting compounds (EDC).

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Evaluation Criteria

- **Cost** - The present worth cost for proposed raw and finished water improvements, including capital, operating and maintenance costs. The costs may be viewed on a unit basis when the alternatives reflect different capacity. This cost could include allowance for wholesale water purchases.

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Evaluation Criteria

- **Implementability** - The relative ease of implementing the proposed improvements in time to meet projected demands. This criterion considers the potential that regulatory permitting (including environmental considerations), public acceptance, property acquisition, or constructability issues could delay implementation.

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Evaluation Criteria

- **Flexibility** - The ability to phase implementation and spread the cost over time, while still meeting projected demands. This criterion also addresses ability to expand capacity beyond the identified need.

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Evaluation Criteria

- **Environmental Benefits -** This criterion includes environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.

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Evaluation Criteria

- **Recreation -** This criterion includes:
  - recreational benefits, either reservoir or riverine (e.g., boating, fishing, canoeing, sightseeing)
  - related economic benefit of the recreational features (e.g., tourism/eco tourism, enhanced property values)
- This criterion does <u>not</u> measure the economic value of additional water supply because all alternatives will be sized to accommodate projected demands.

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#1 Water Efficiency Measures

- Water conservation, full cost pricing, reducing leaks, etc.
- Could reduce demands of roughly 10% to 30% (4 mgd to 12 mgd).
- Potential for negative revenue impacts on utilities.
- Required by EPA Region 4 prior to permitting new reservoir supplies.

- **Baseline Alternative?**

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#2 Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels

- Satisfies entire river deficit of 32 mgd in 2060.
- EIS required.
- Need to identify if increased release has significant impact / environmental benefits.
- Lower water levels in Normandy Reservoir could impact recreation during drought.

- **Status: To be determined.**

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#3 Regional Drought Management Plan

- Drought Plan would identify triggers to enact water restrictions, reductions in releases from Normandy Reservoir, etc.
- Impacts on deficit covered by other alternatives.
- Potential for negative revenue impacts on utilities.
- EIS will be required for flow alteration.

- **Baseline Alternative?**

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#4 Optimize Releases from Normandy Reservoir

- Install additional stream gages and modify dam controls to more closely match flow requirements at Shelbyville.
- Projected deficits used in this study were computed assuming optimization of releases from Normandy Reservoir.

- **Baseline Alternative?**

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#5 Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam

- Raise winter pool level from 864 ft to 869 ft to preserve winter storage.
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users.
- Satisfies entire river deficit of 32 mgd.
- Increases flooding.
- May require land acquisition in flood prone areas.

- **Status: To be determined.**

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#6 Modify Normandy Reservoir Flood Rule Curve (Early Refill)

- Initiate refill of Normandy Reservoir earlier in Spring in order to capture high Spring flows.
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users.
- No added reliable capacity in most of historic droughts.
- Increases flooding.

- **Status: To be determined.**

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#7 Reduce Irrigation Withdrawals

- Irrigation withdrawals for agriculture are not restricted.
- Effectiveness based on voluntary participation.

- **Fatally Flawed Alternative?**

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#8 Modify River Constraints to Preserve Storage in Normandy Reservoir

- Reduce flow constraints at Shelbyville and Columbia by improving wastewater treatment.
- Environmental benefits associated with improvements in level of wastewater treatment.

- **Status: To be determined.**

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#9 Raise Normandy Dam

- Increase Normandy Dam and pool levels by 5 ft.
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users.
- Satisfies entire river deficit of 32 mgd.
- Higher pool level will inundate 2-3 acres of flora and hiking trails at Short Springs.
- Potential impacts to campgrounds and boat ramps.
- Potential to phase increased pool levels.

- **Required Alternative**

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#10 Improve DRUC Intake

- Modify DRUC intake for access below current low level threshold (840 ft).
- Improves reliable access but does not increase capacity.
- Potentially lower raw water quality during drought.

- **Status: To be determined.**

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#11 Construct Second DRUC Intake

- Construct second intake and pumping station for DRUC with access to water below 840 ft.
- Improves reliable access but does not increase capacity.
- Potentially lower raw water quality during drought.

- **Status: To be determined.**

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#12 Construct Fountain Creek Reservoir

- Alternative includes reservoir intake, pumping station and pipeline to water treatment plant.
- Satisfies entire river deficit of 32 mgd.
- Reduces reliance on Normandy Reservoir.
- Shallow reservoir may yield poor water quality.
- EIS required.
- Potential for substantial loss of wetlands.
- Loss of riverine environment.
- Rare, threatened or endangered species may exist in Fountain Creek.

- **Required Alternative**

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#13 Construct Fountain Creek Reservoir with Downstream Release

- Alternative includes reservoir intake and release to Columbia Pool for withdrawal at existing Columbia Intake.
- Satisfies entire river deficit of 32 mgd.
- Reduces reliance on Normandy Reservoir.
- Shallow reservoir may yield poor water quality.
- EIS required.
- Potential for substantial loss of wetlands.
- Loss of riverine environment.
- Rare, threatened or endangered species may exist in Fountain Creek.

- **Status: To be determined.**

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#14 Upgrade Existing Columbia City Dam to Allow Releases

- Install valves or gates for intermittent releases downstream of dam to maintain flow constraint at Columbia gage.
- No added reliable capacity.
- Potential release of sediments
- Requires review of sediment accumulation behind dam.

- **Fatally Flawed Alternative?**

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#15 Build Offstream Storage Reservoir Along Duck River

- Construct 5 BG offstream storage reservoir.
- Construct dam, pumping station along Duck River and piping to refill reservoir from Duck River during high flows with supply back to Duck River during low flows.
- Satisfies entire river deficit of 32 mgd.
- Reduces reliance on Normandy Reservoir.
- Potential for fishing and other recreational opportunities.

- **Status: To be determined.**

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#16 Utilize Quarries

- Utilize storage in existing inactive quarries to supply flow to Duck River during low flow conditions.
- Construct intake and pumping station along Duck River and piping to refill quarry from Duck River during high flows with supply back to Duck River during low flows.
- Existing quarries satisfy a portion of the deficit for river users.
- Active quarries could provide additional storage capacity in the future.

- **Status: To be determined.**

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#17 Construct Pipeline from Tennessee River

- Construct intake and pumping station and pipeline from Tennessee River to Columbia (50 miles).
- Satisfies entire 32 mgd river deficit.
- Reduces reliance on Normandy Reservoir.

- **Required Alternative**

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#18 Construct Pipeline from Tims Ford Reservoir

- Construct intake and pumping station at Tims Ford and pipeline to Shelbyville.
- Alternative discharge to DRUC WTP or Normandy Reservoir.
- Satisfies entire 32 mgd river deficit.
- Reduces reliance on Normandy Reservoir.

- **Required Alternative**

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#19 Discharge Arnold Cooling Water to Little Duck River

- Tributary to Duck River upstream of Normandy Reservoir.
- Concerns related to reliable capacity due to periodic operation of the cooling system.
- Concerns related to temperature of cooling water and potential contamination.

- **Fatally Flawed Alternative?**

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#20 Purchase Water from Nearby Systems

- Closest systems do not have substantial available capacity.
- Up to 50 miles of pipeline required to reach Nashville.
- Requires interbasin transfer.

- **Status: To be determined**

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#21 Utilize Groundwater Sources

- Construct new groundwater wells or access underground from Duck River through limestone channels between Shelbyville and Columbia.
- Unreliable groundwater capacity during drought.
- Underground flow linked to river flow so no net capacity increase.

- **Fatally Flawed Alternative?**

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#22 Pump Water from Columbia WWTP to Below Columbia Dam

- Construct pumping station at Columbia WWTP and pipeline (5 miles) to return treated wastewater to location just downstream of Columbia Dam.
- Satisfies up to 20 mgd of 32 mgd river deficit.
- Reduces reliance on Normandy Reservoir.
- Higher levels of wastewater treatment may be required to avoid impacts on river water quality where threatened and endangered species exist.

- **Status: To be determined.**

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#23 Construct New Intake for Maury County at River Mile 163

- Construct new intake and pipeline for Maury and South Williamson Counties at River Mile 132 which is 30 miles upstream of Columbia.
- No added reliable capacity.
- **Fatally Flawed Alternative?**

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#24 Construct New Intake for Maury County at River Mile 108

- Construct new intake and pipeline for Maury and South Williamson Counties at River Mile 108 near Williamsport to new water treatment plant.
- Satisfies entire river deficit of 32 mgd.
- Reduces reliance on Normandy Reservoir.

- **Required Alternative**

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#25 Construct New Intake for Maury County at River Mile 108 and Pump Back to Columbia Dam Pool

- Construct new intake and pipeline for Maury and South Williamson Counties at River Mile 108 near Williamsport to Columbia Dam Pool.
- Utilizes existing Columbia intake and water treatment plant.
- Satisfies entire river deficit of 32 mgd.
- Reduces reliance on Normandy Reservoir.

- **Status: To be determined.**

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#26 Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir

- Construct pumping station and pipeline to return treated wastewater to Normandy Reservoir.
- Return flows estimated to increase to 3 to 4 mgd by 2060.
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users.
- Satisfies portion of 32 mgd river deficit for downstream users.
- Must meet TDEC water quality requirements for discharge, but current level of treatment is apparently adequate.

- **Status: To be determined.**

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Feedback Period



PARTICIPANT INPUT / COMMENTS QUESTIONS

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Required Alternatives

- #9 – Raise Normandy Dam (Alternative D from 2000 DEIS)
- #12 – Construct Fountain Creek Reservoir (Alternative B from 2000 DEIS)
- #17 – Construct Pipeline from Tennessee River
- #18 – Construct Pipeline from Tims Ford Reservoir (Alternative E from 2000 DEIS)
- #24 – Construct New Water Intake for Maury County at River Mile 108 (Alternative C from 2000 DEIS)



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Baseline Alternatives

- #1 – Water Efficiency Measures
- #3 – Regional Drought Management Plan (inclusive of temporary intake provisions for DRUC)
- #4 – Optimize Releases from Normandy Reservoir



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Fatally-Flawed and Highly Unlikely Alternatives

- #7 – Reduce Irrigation Withdrawals
- #14 – Upgrade Existing Columbia City Dam to Allow Releases
- #21 – Utilize Groundwater Sources
- #23 – Construct New Water Intake for Maury County at River Mile 163



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Alternatives With Undetermined Status

- #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels (with #10 - Improve DRUC Intake or #11 - Construct Second DRUC Intake)
- #5 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam
- #6 – Modify Normandy Reservoir Flood Rule Curve
- #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir
- #13 – Construct Run-of-the-Creek Reservoir on Fountain Creek
- #15 – Build Off-stream Storage Reservoir along Duck River
- #16 – Utilize Quarries
- #19 – Discharge Arnold Cooling Water to Duck River
- #20 – Purchase Water from Nearby Systems
- #22 – Pump Treated Water from Columbia WWTP to Columbia Dam
- #25 – Construct New Water Intake at River Mile 108 and Pump Back to Columbia Dam Pool
- #26 – Construct Infrastructure to Return Treated Water from Tullahoma WWTP to Normandy Reservoir

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Duck River Comprehensive Regional Water Supply Plan

Workshop No. 3 / December 9, 2009

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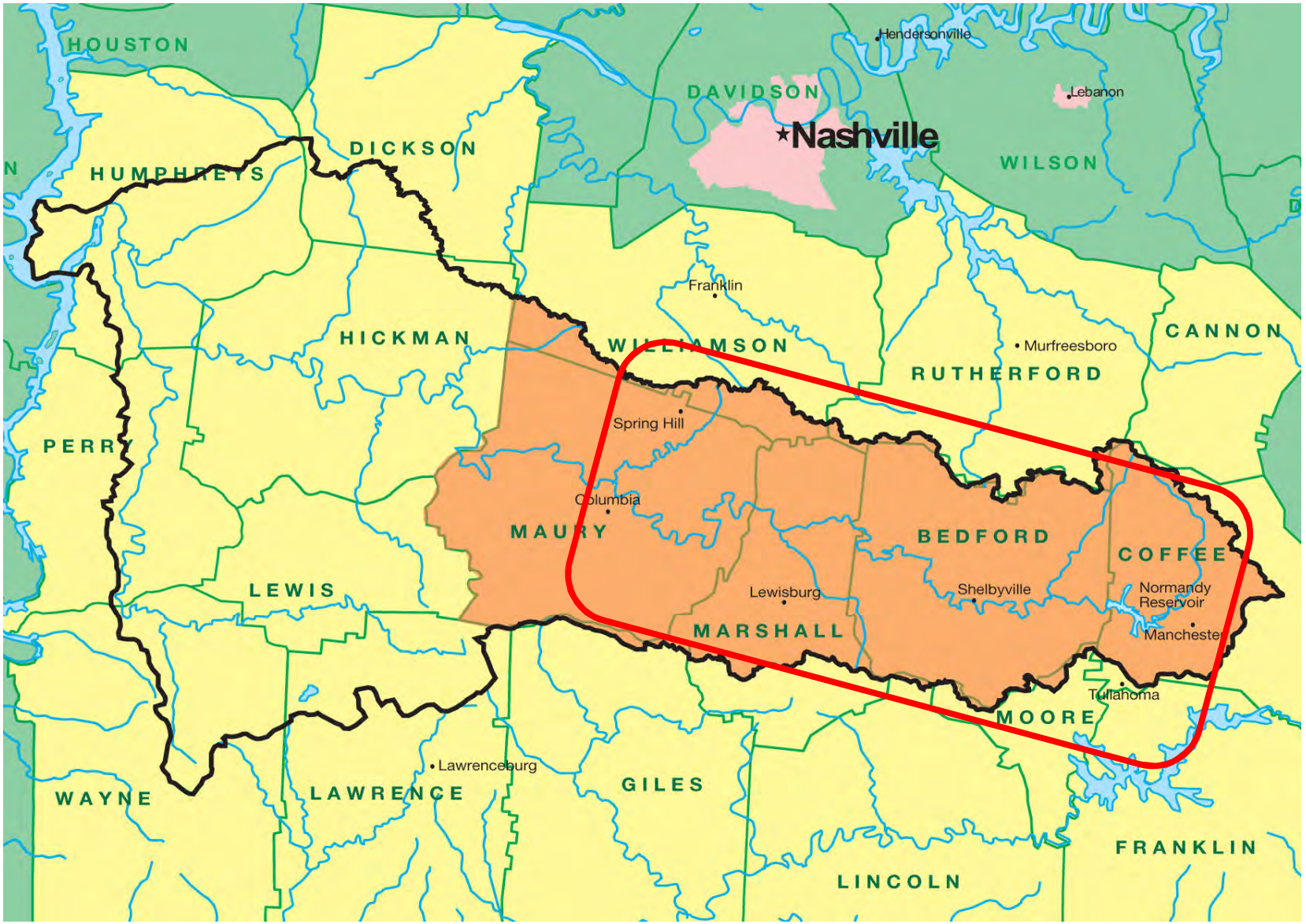
#1 Water Efficiency Measures



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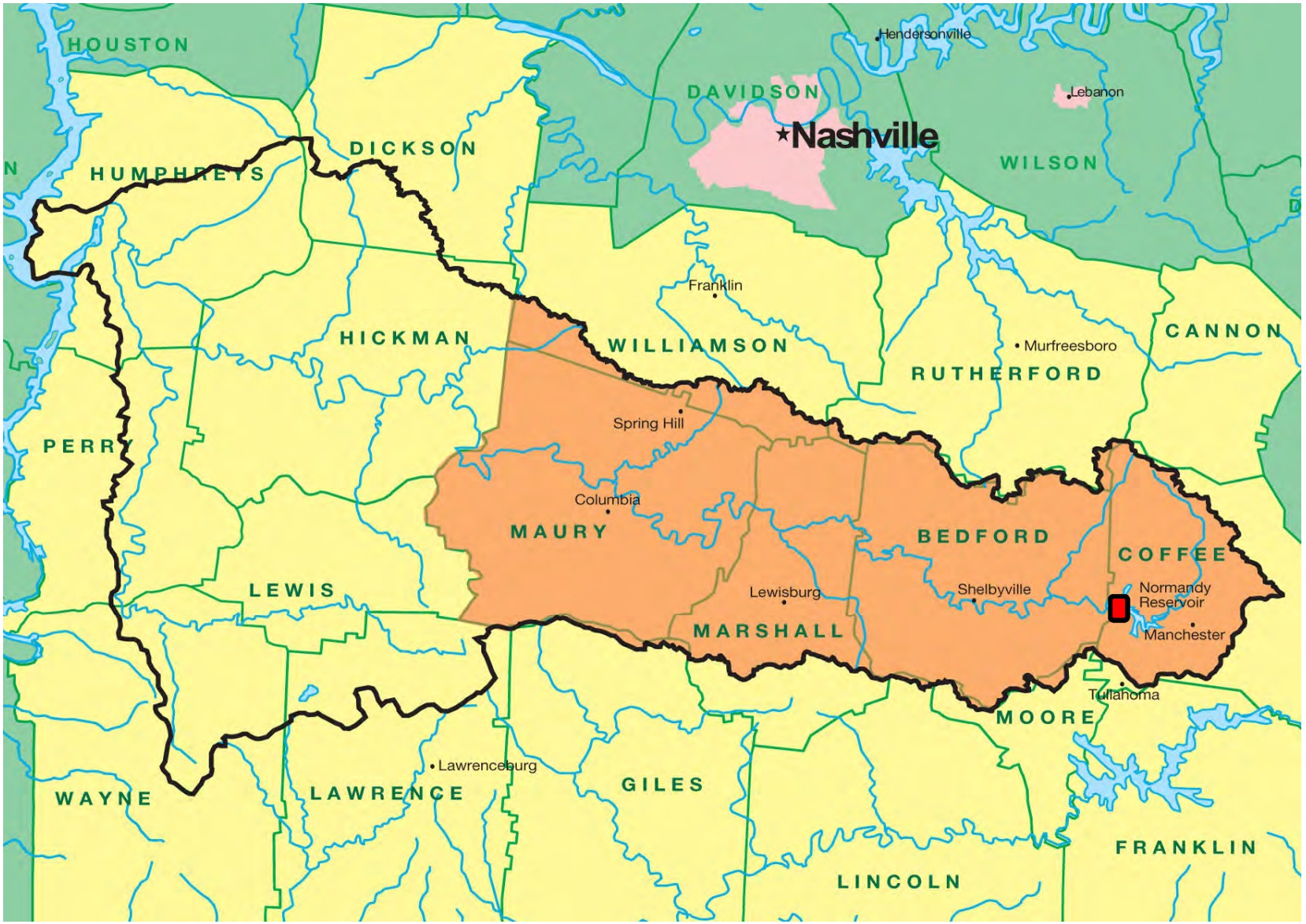
#2 Increase Normandy Reservoir Release to Meet Columbia Constraint without Raising Dam or Pool



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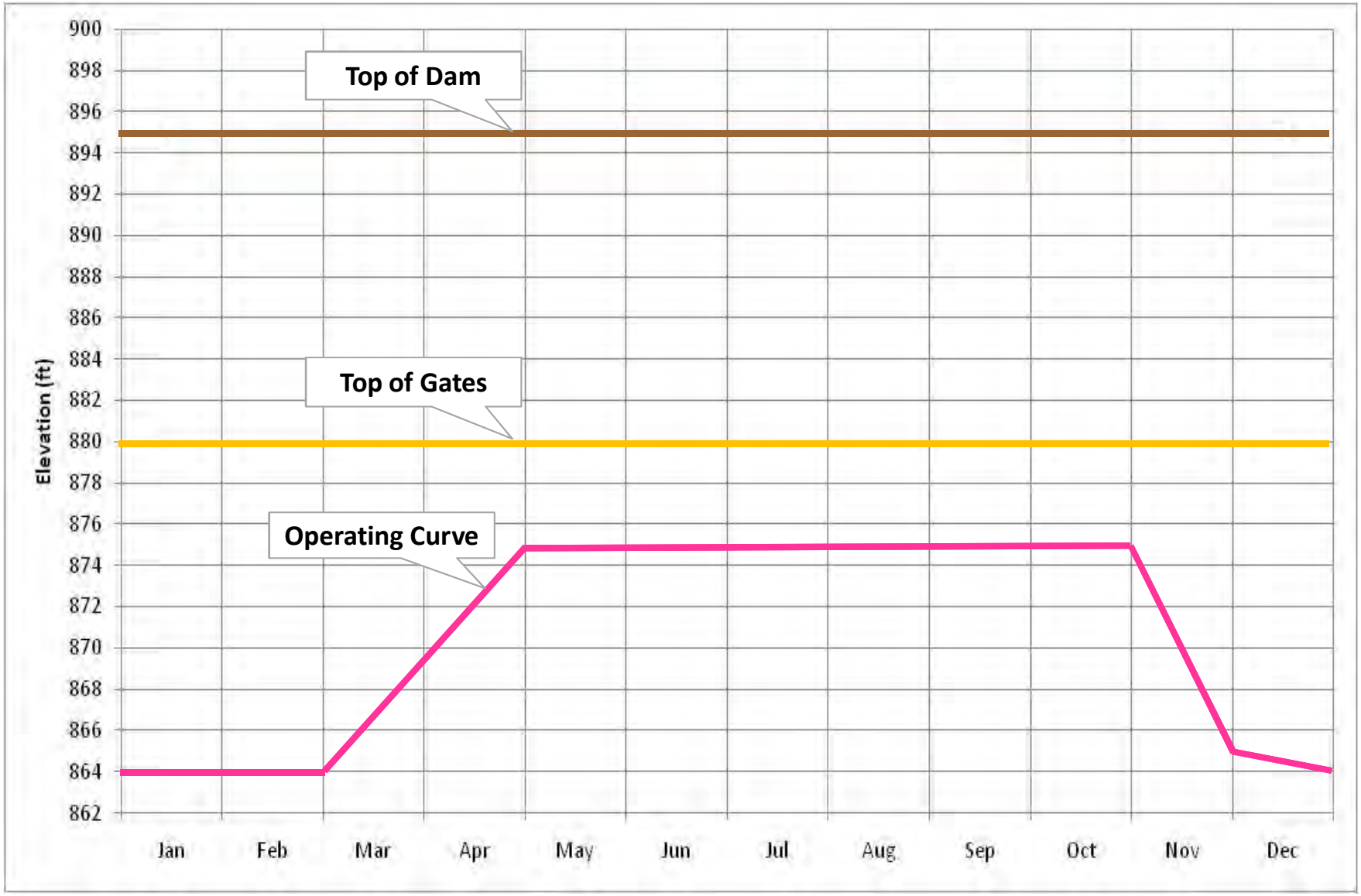
#2 Increase Normandy Reservoir Release to Meet Columbia Constraint without Raising Dam or Pool



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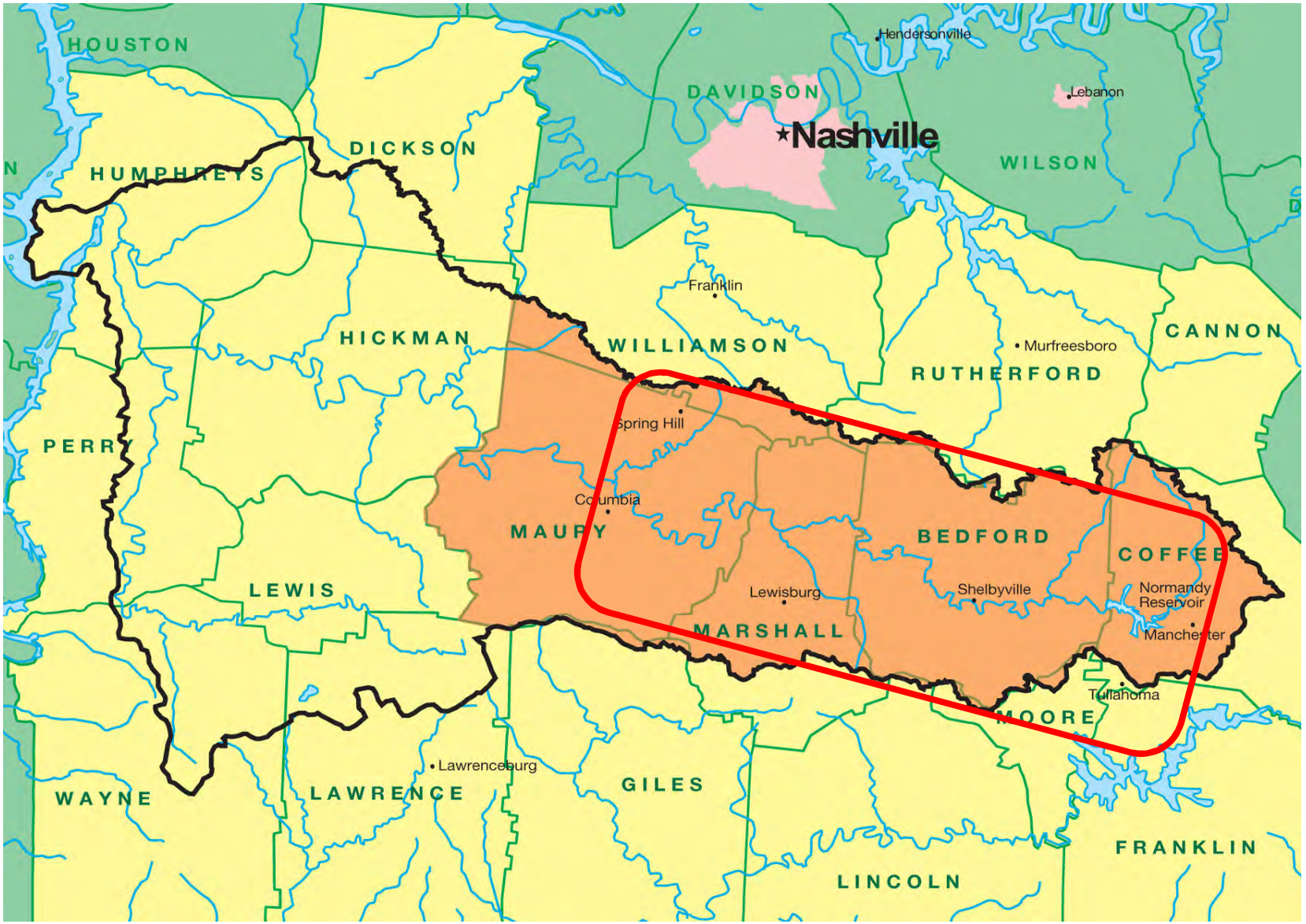
#3 Regional Drought Management Plan



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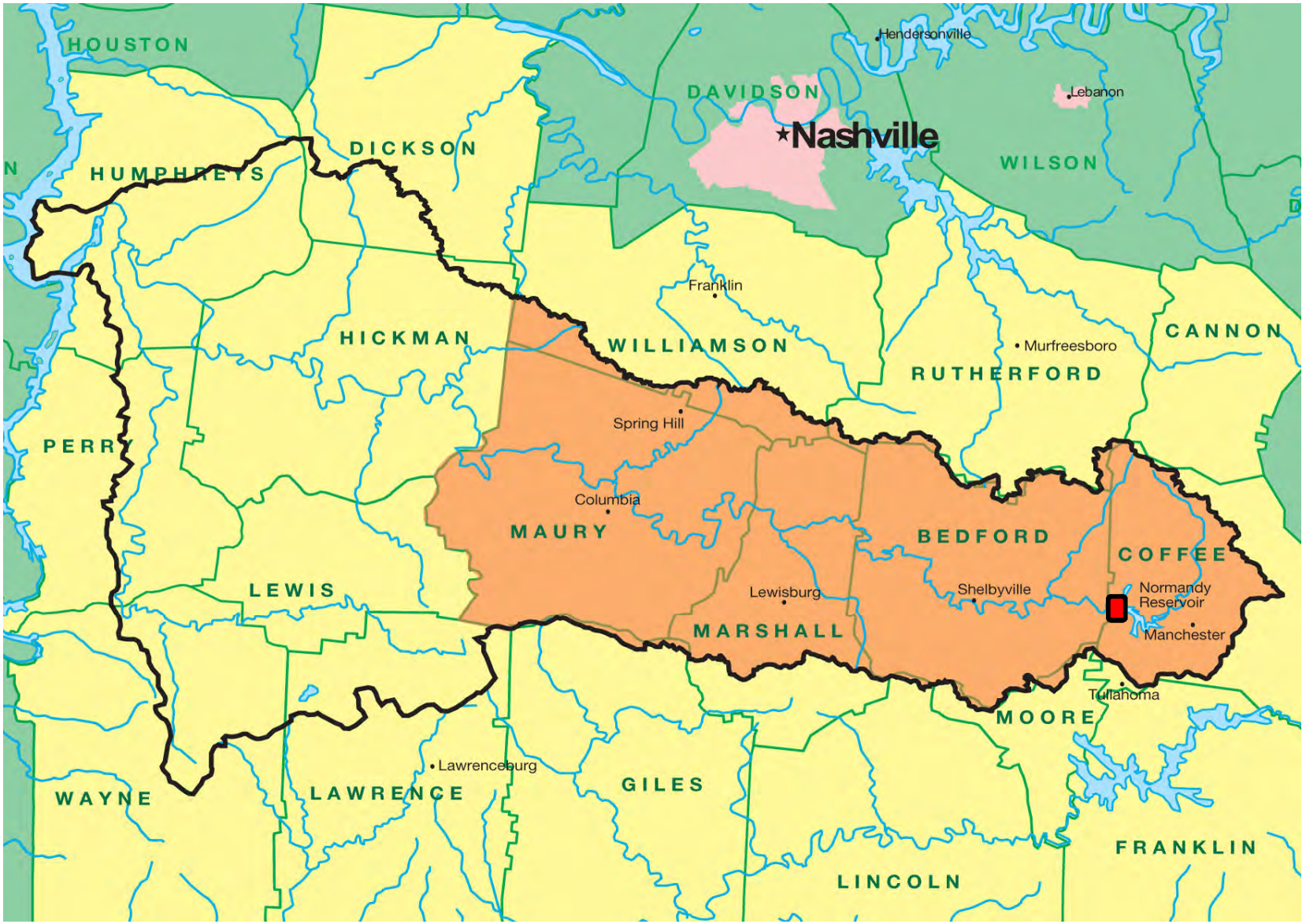
#4 Optimize Releases from Normandy Reservoir



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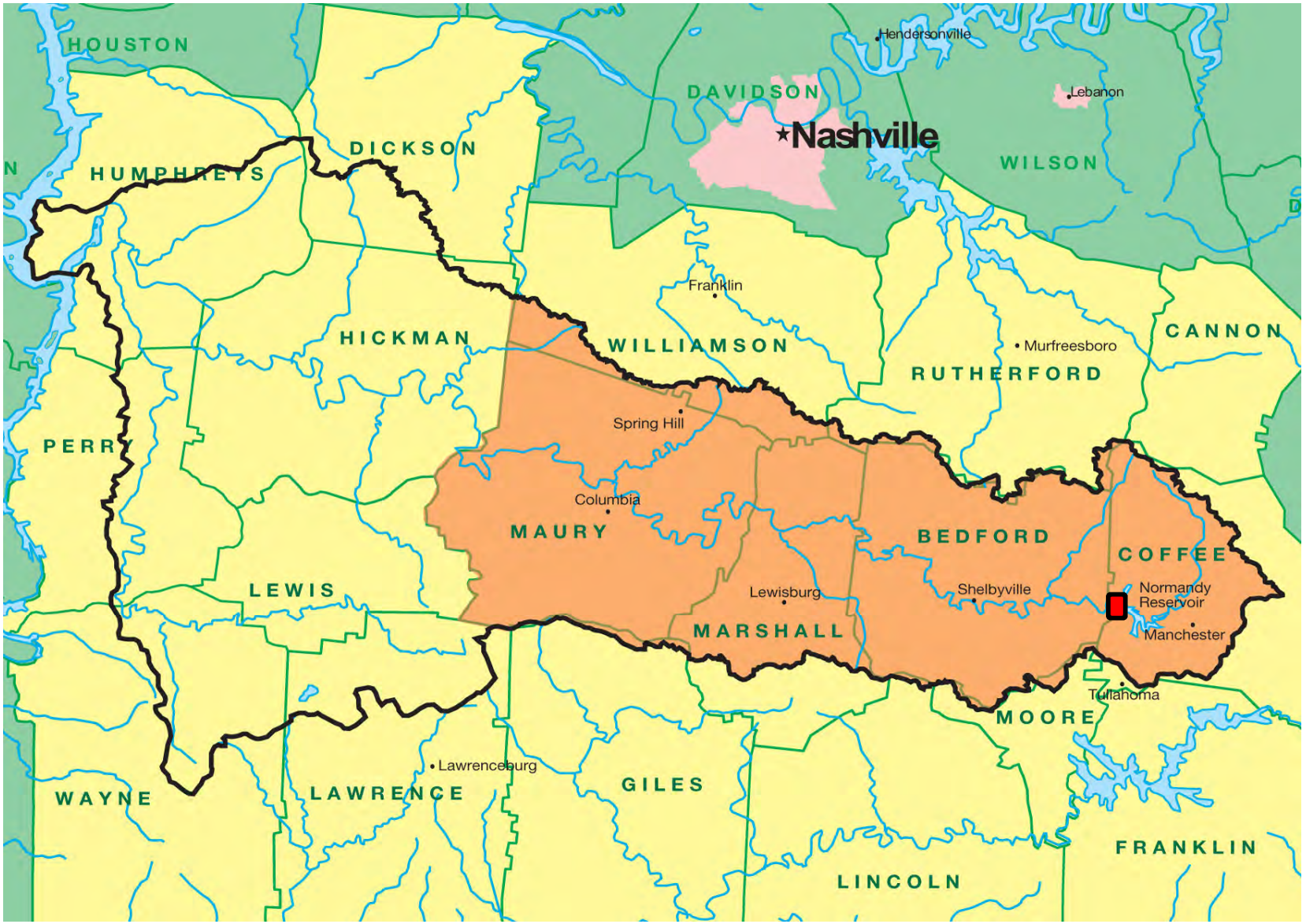
#5 Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam



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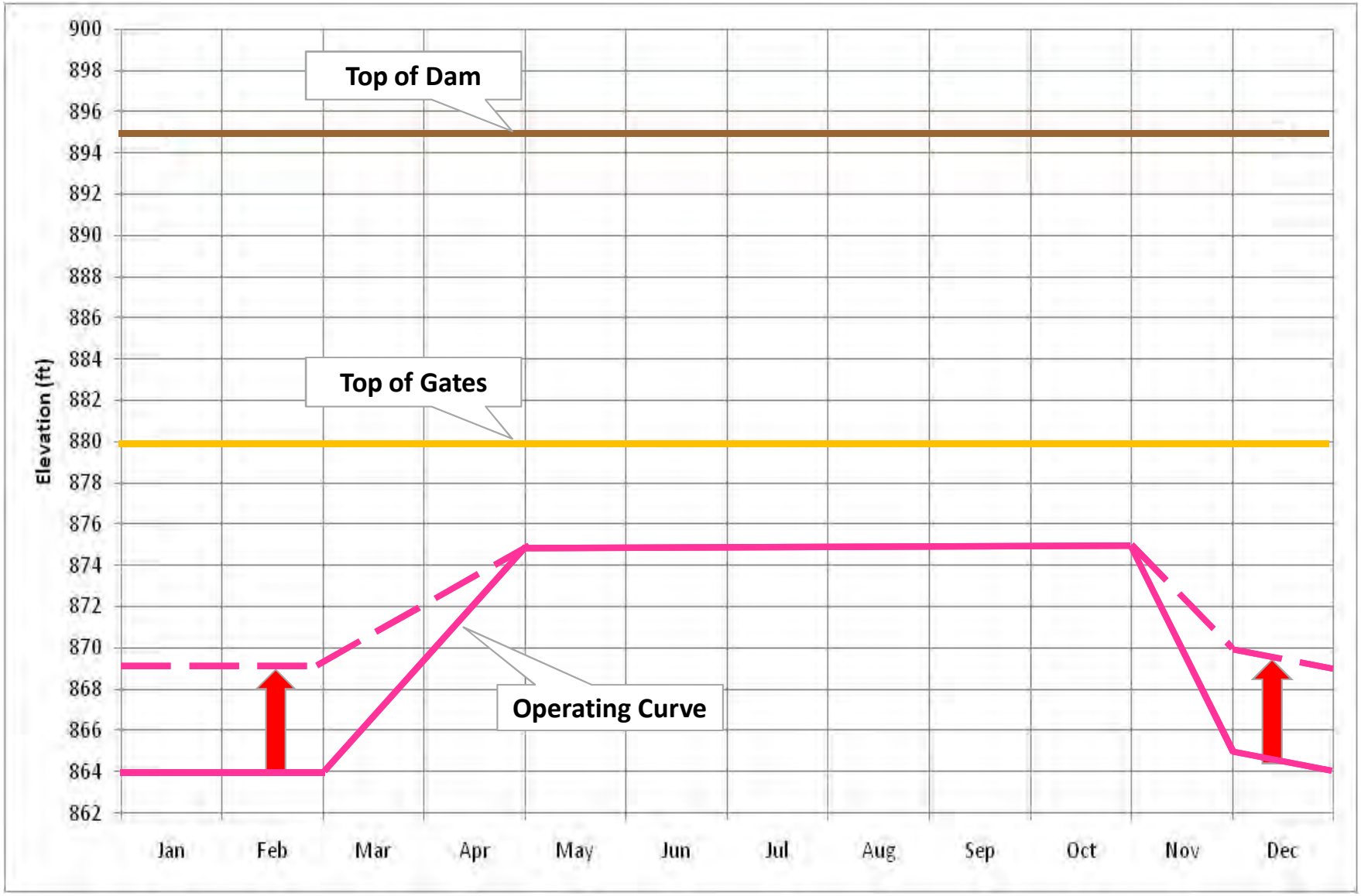

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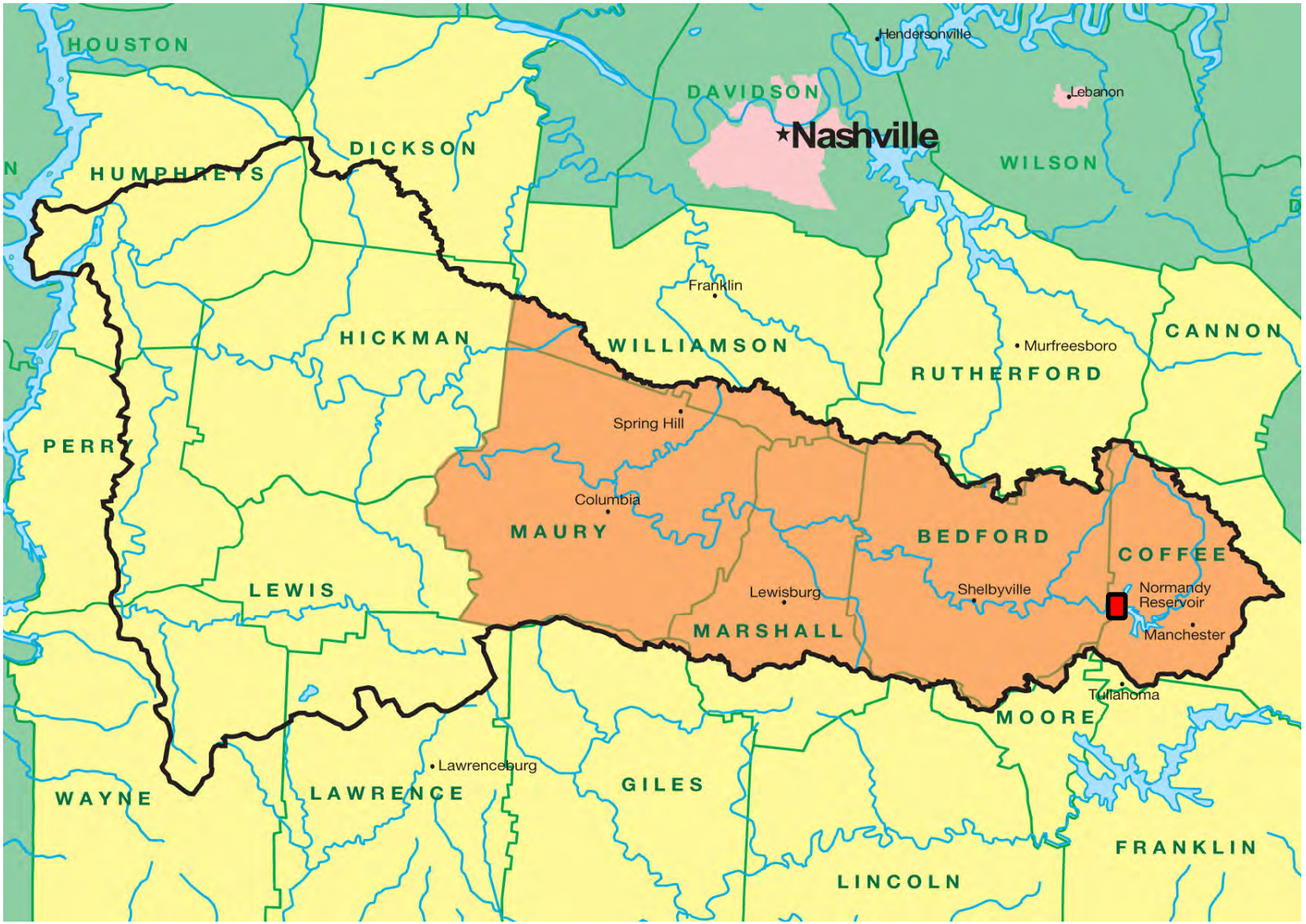
#6 Modify Normandy Reservoir Flood Rule Curve



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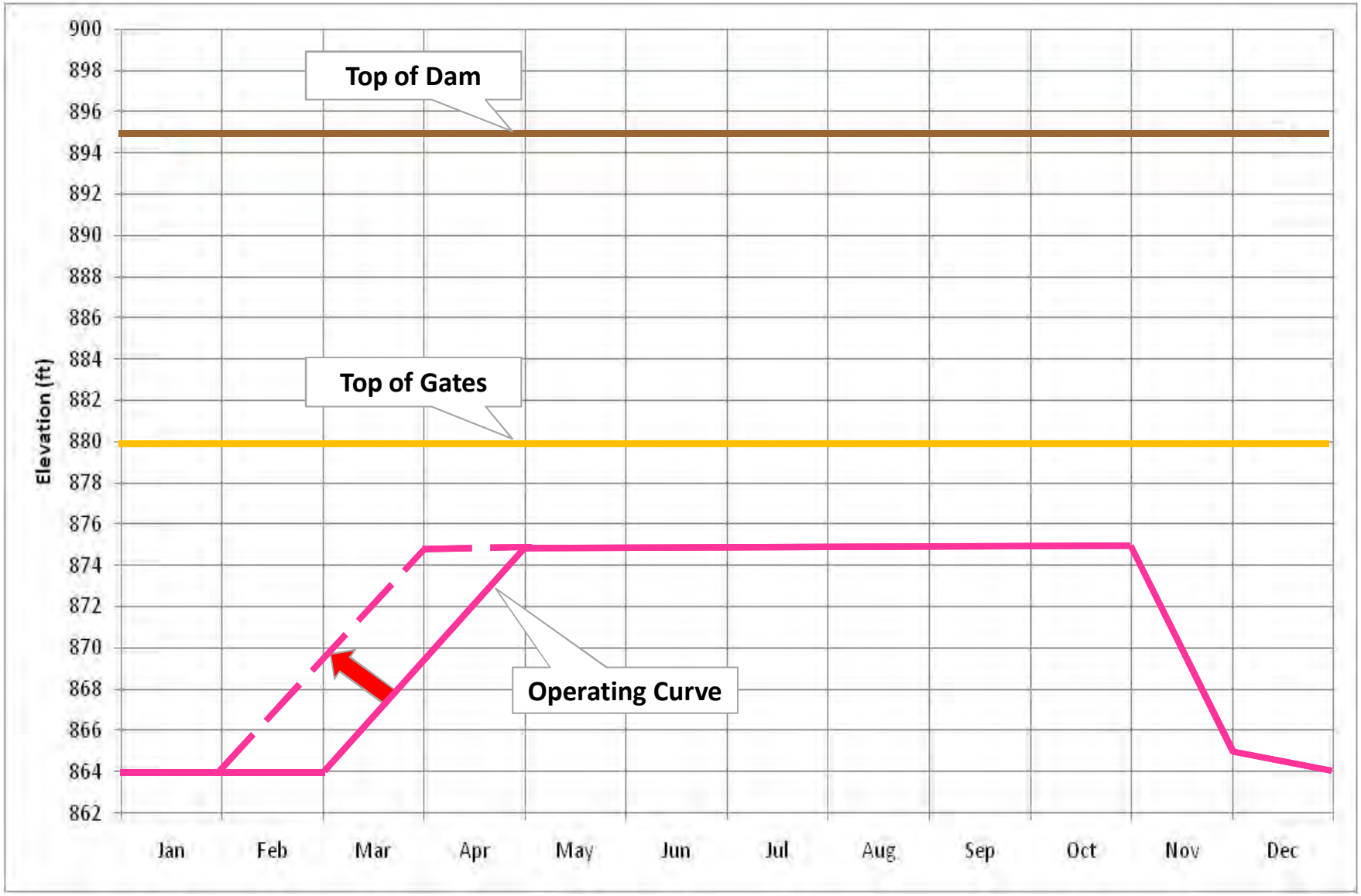

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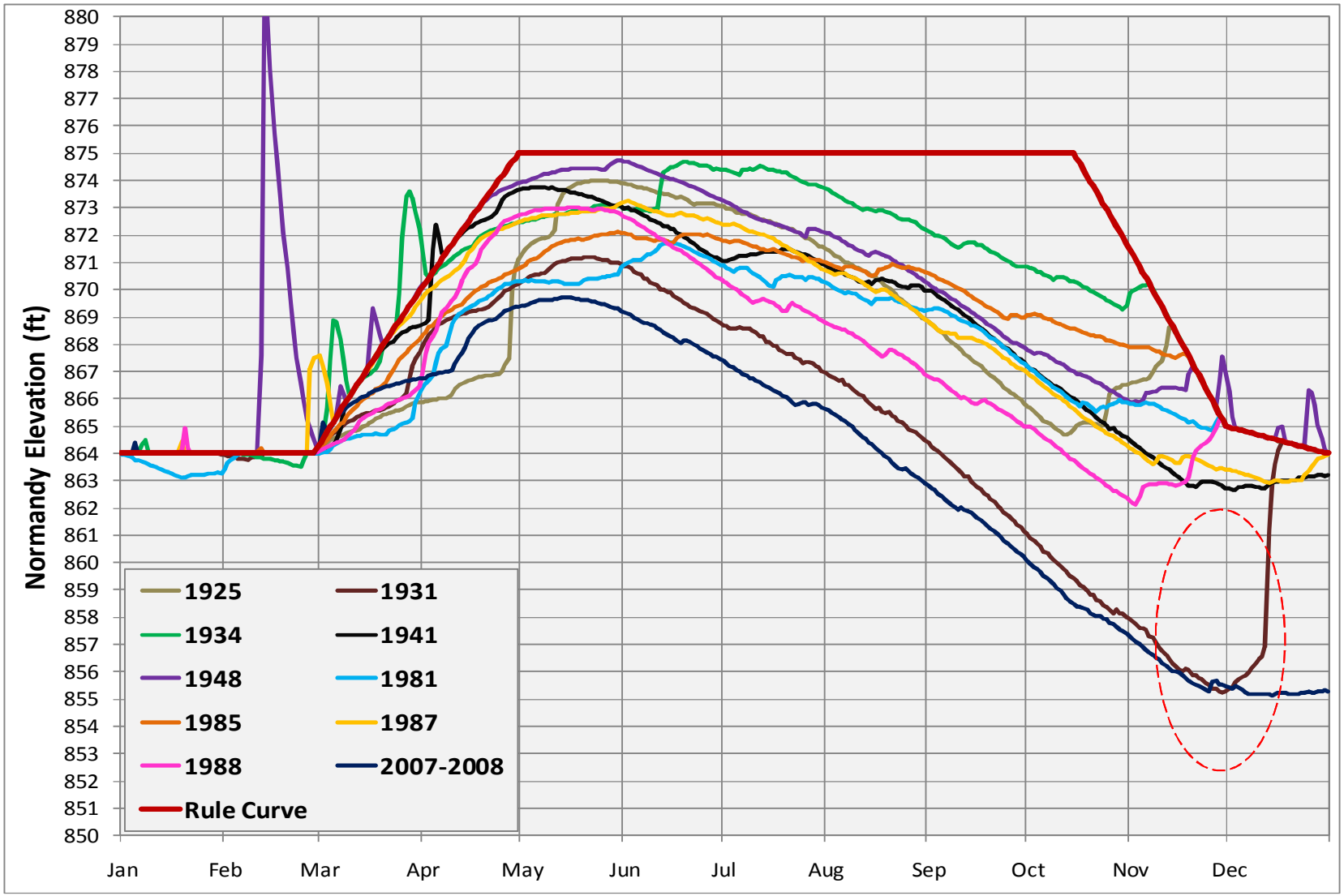
Major Droughts – Existing Rule Curve
2010 Demand Levels



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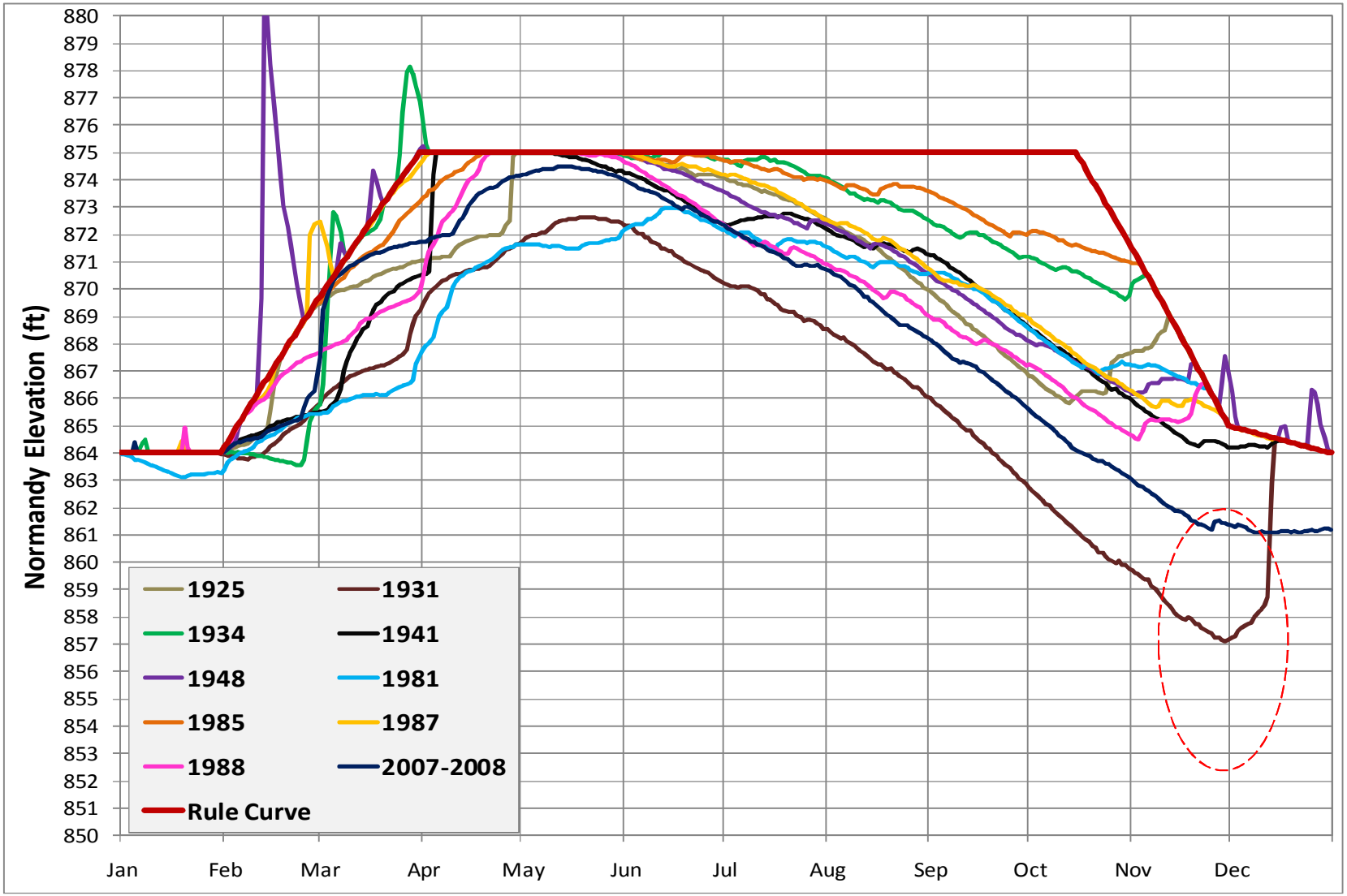
Major Droughts – New Rule Curve
2010 Demand Levels



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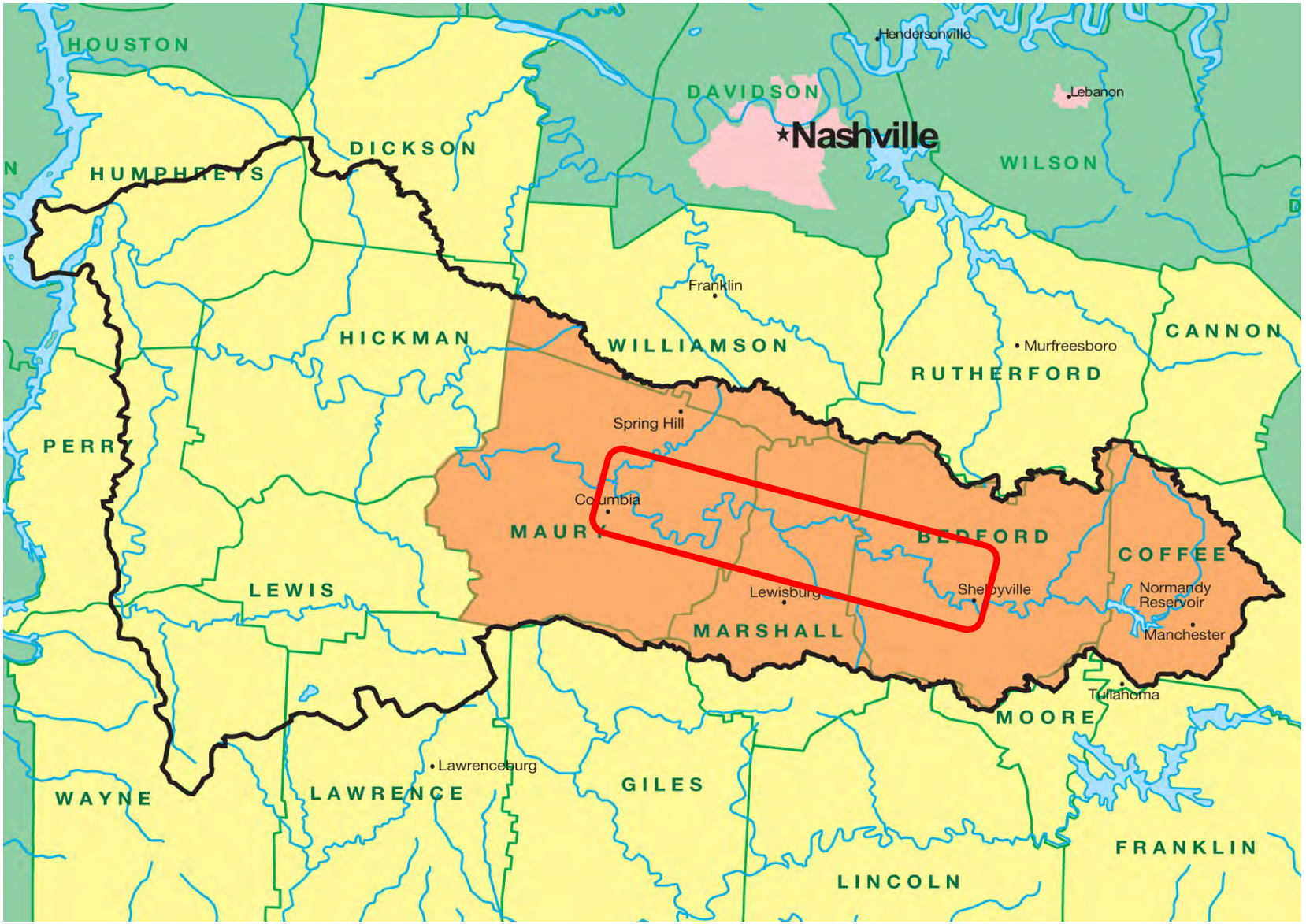
#7 Reduce Irrigation Withdrawals



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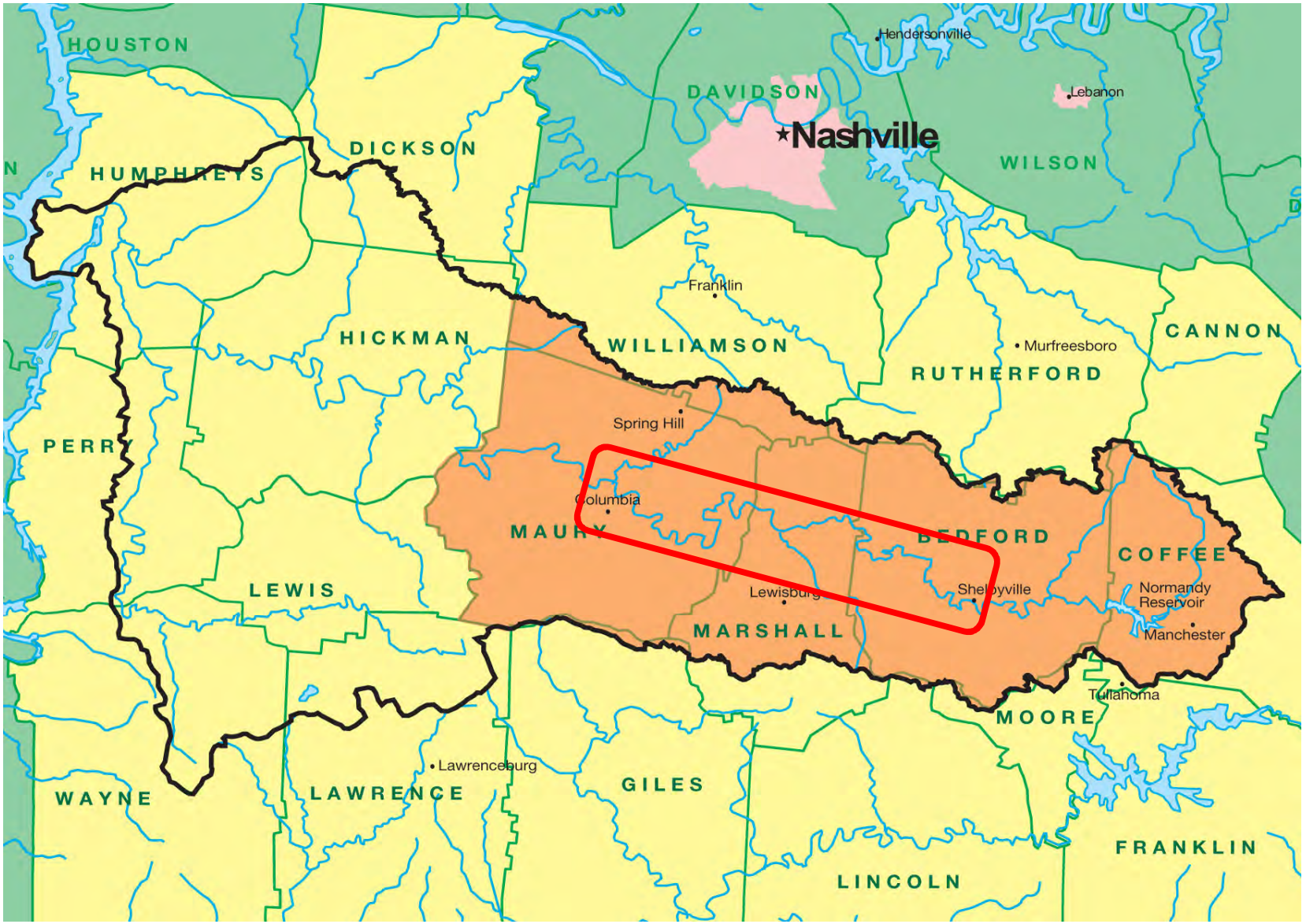
#8 Modify River Constraints to Preserve Storage in Normandy Reservoir



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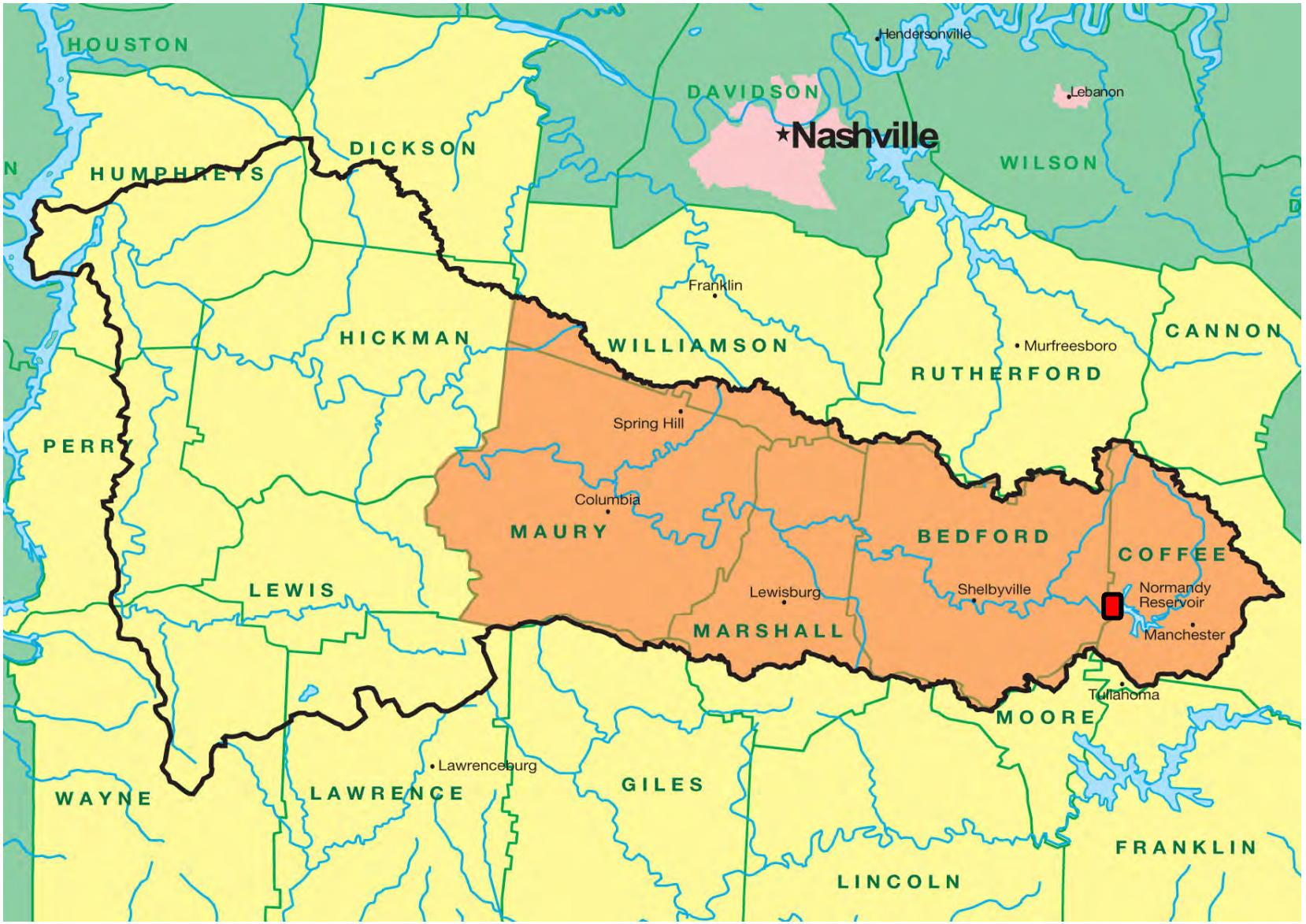
#9 Raise Normandy Reservoir



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#9 Raise Normandy Reservoir



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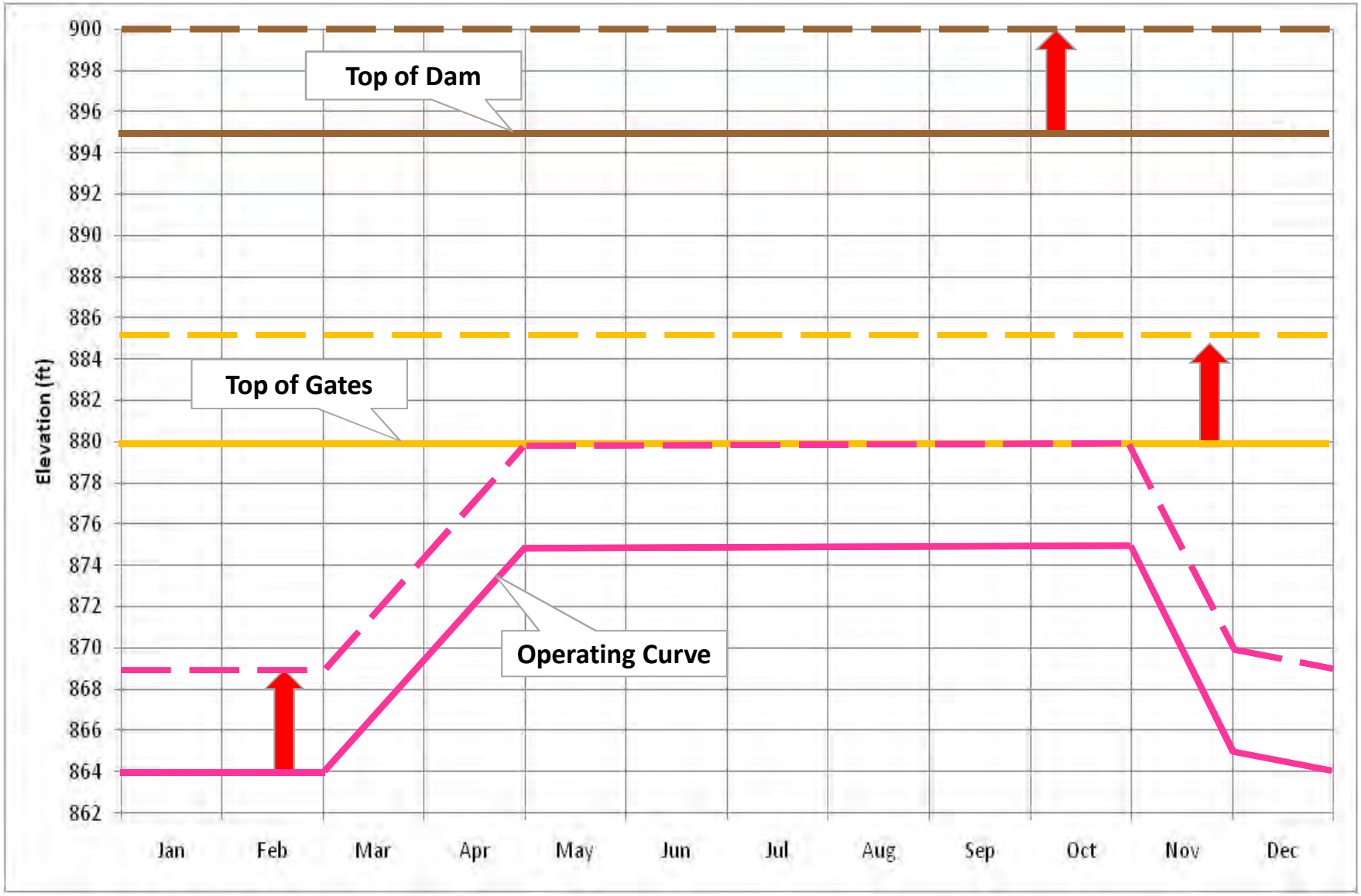
#9 Raise Normandy Reservoir



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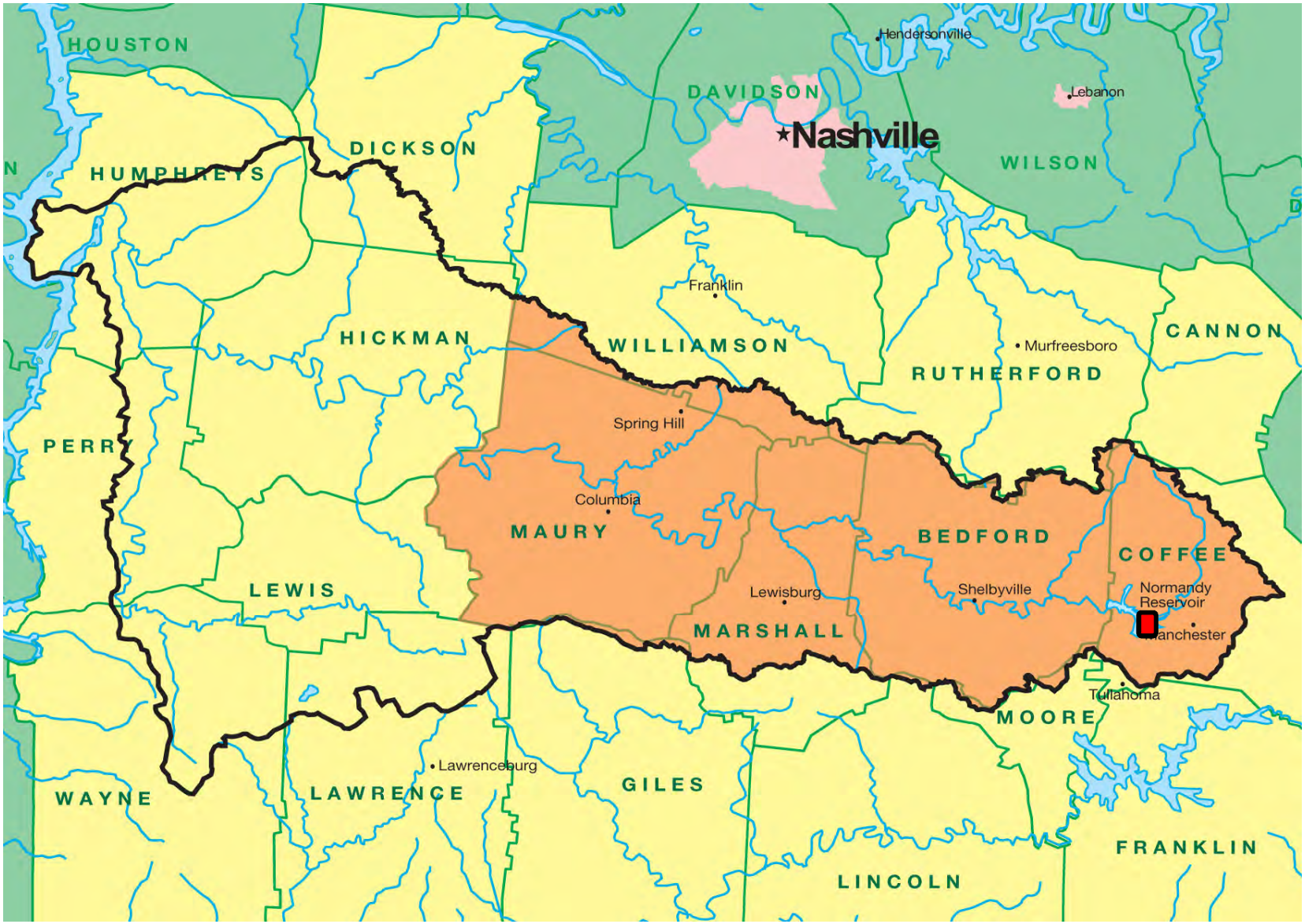
#10 Improve DRUC Intake



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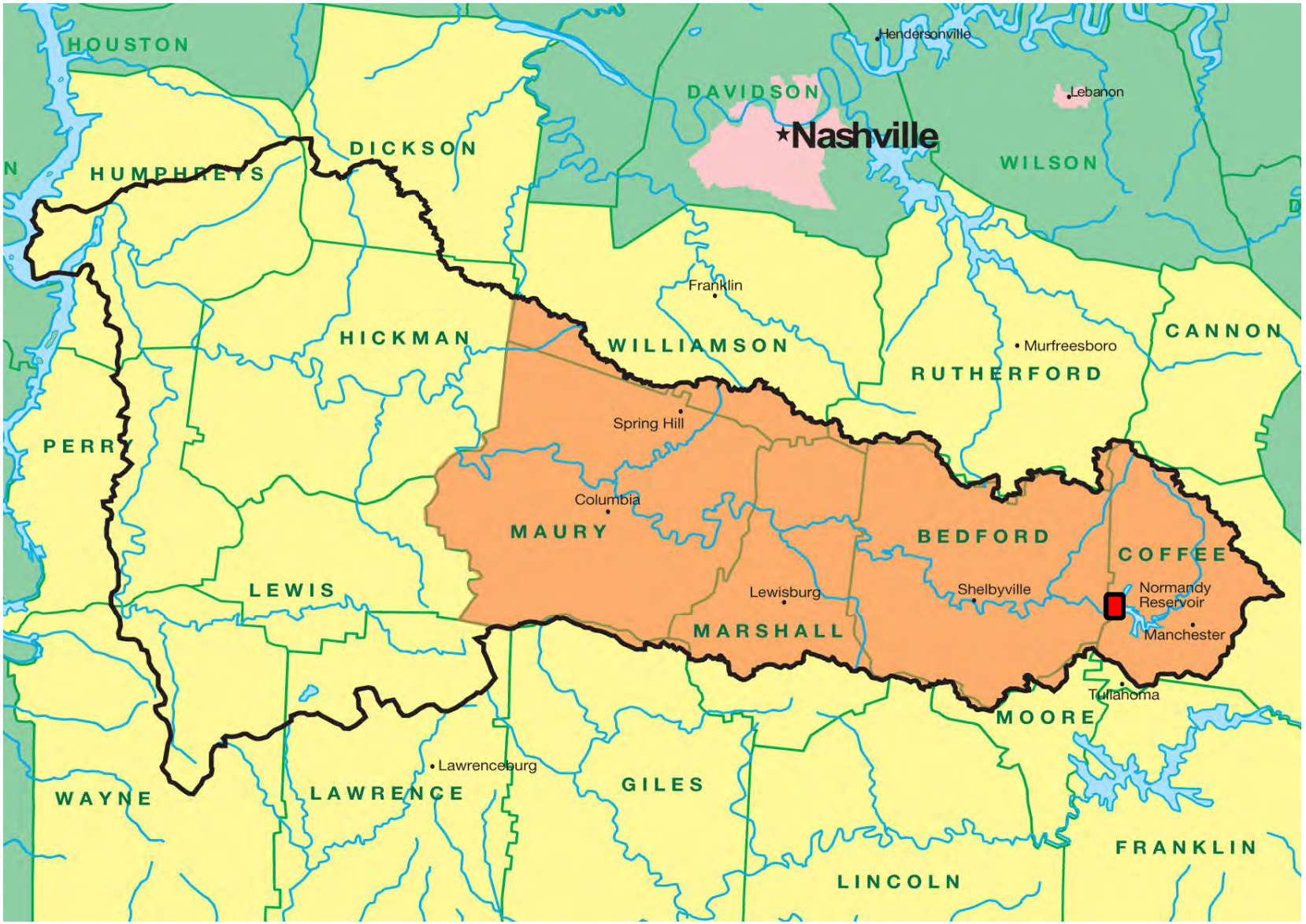
#11 Construct Second DRUC Intake



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#12 Construct Fountain Creek Reservoir



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#13 Construct Fountain Creek Reservoir with Downstream Release



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#14 Upgrade Existing Columbia Dam to Allow Releases



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#14 Upgrade Existing Columbia Dam to Allow Releases



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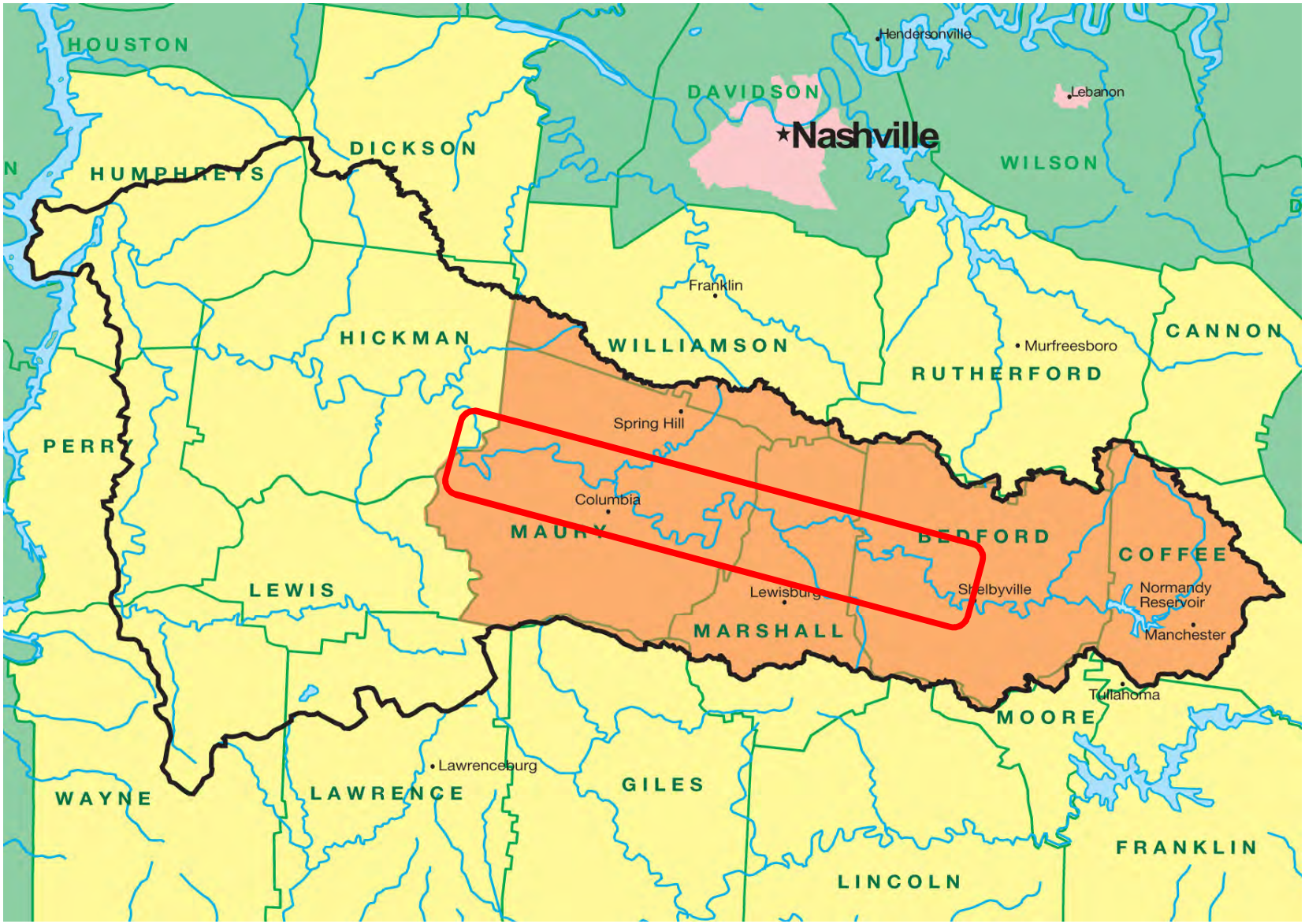
#15 Build Offstream Storage Reservoir along Duck River



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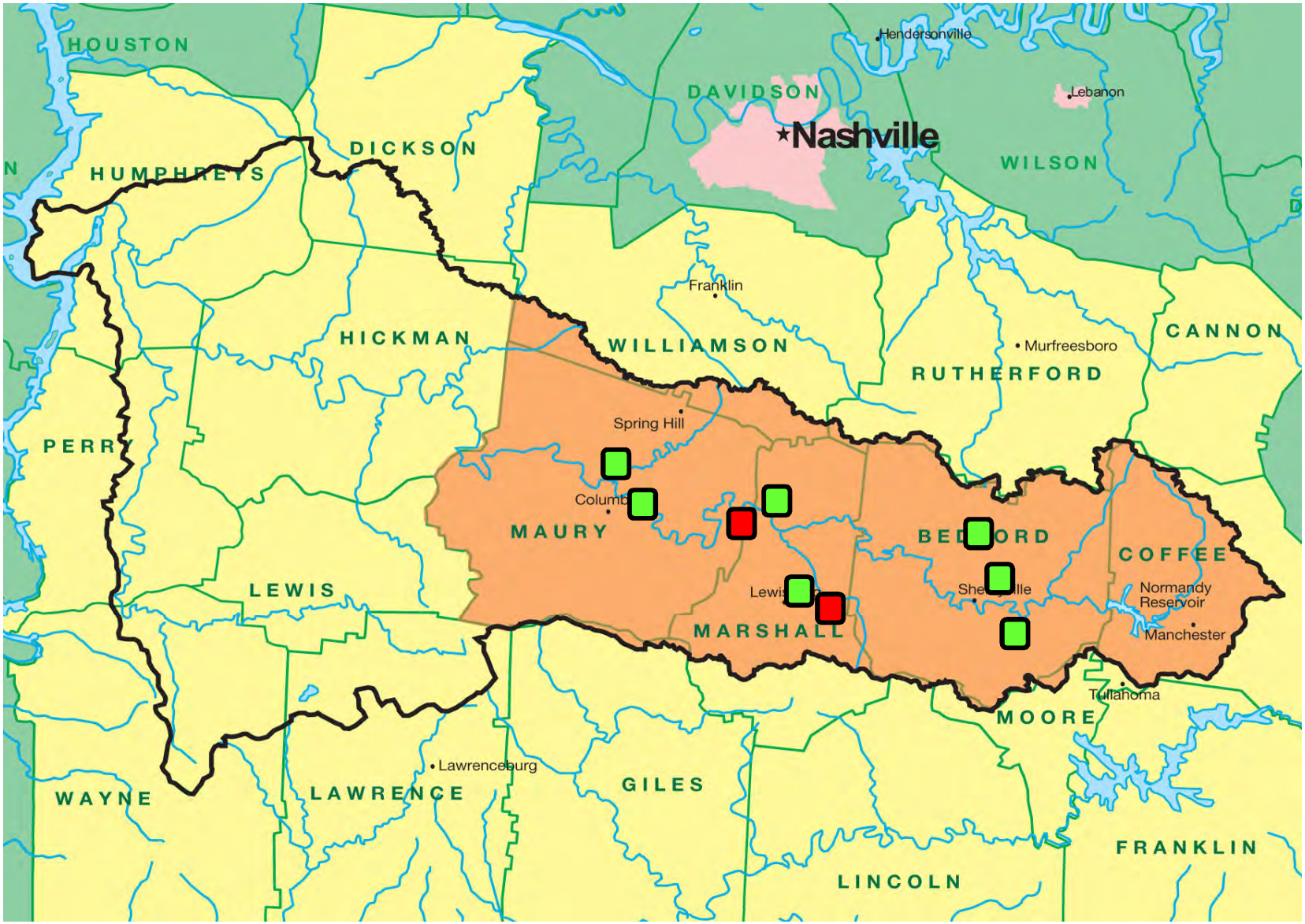
#16 Utilize Quarries – Map of Active (green) and Inactive (red) Quarries



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#16 Utilize Quarries



Frederick County Sanitation Authority Quarry Supply

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#16 Utilize Quarries – Belfast Quarry



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#16 Utilize Quarries – Hardison Mill Quarry



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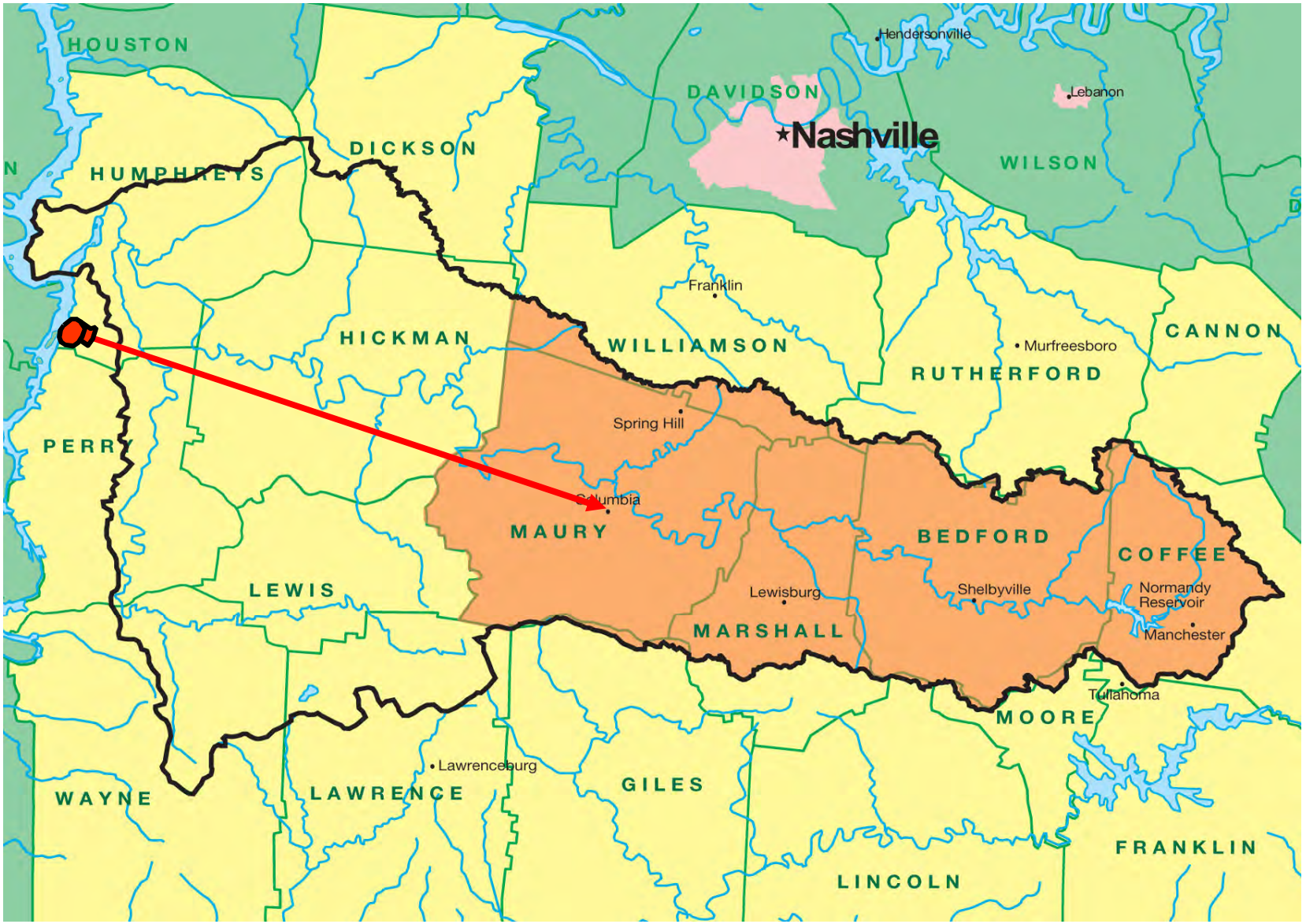
#17 Construct Pipeline to Tennessee River



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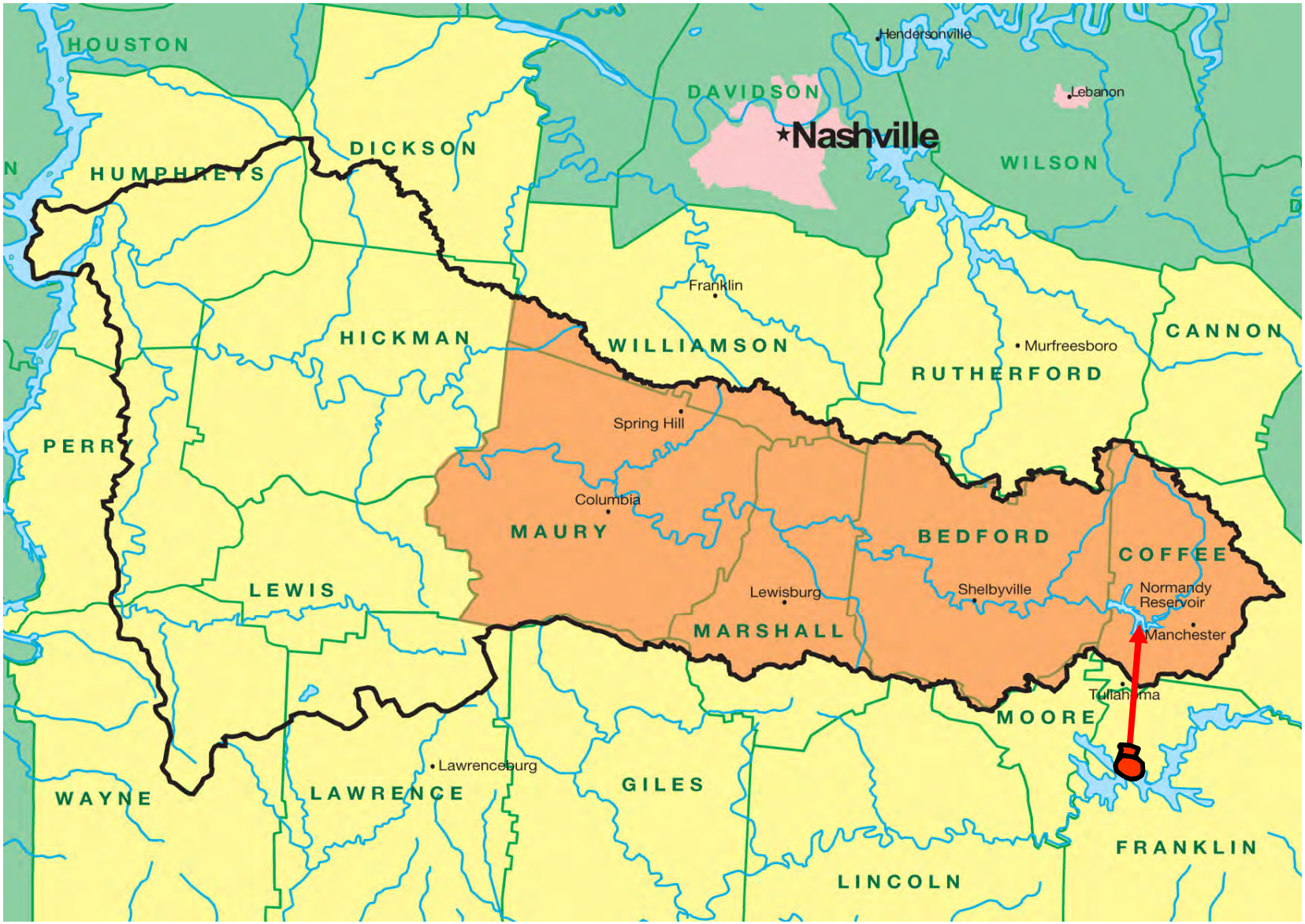
#18 Construct Pipeline to Tims Ford Reservoir



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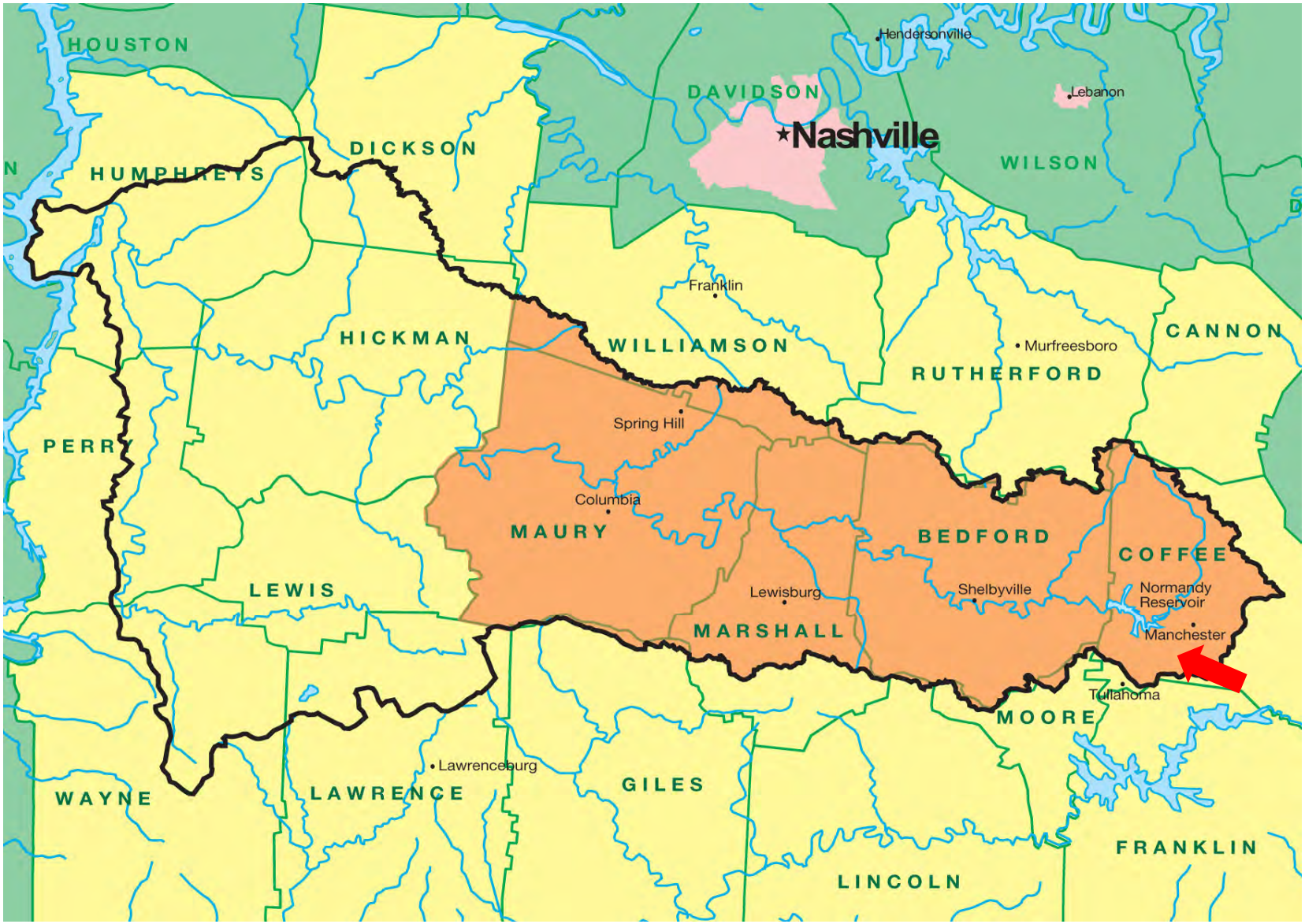
#19 Discharge Arnold Cooling Water to Duck River



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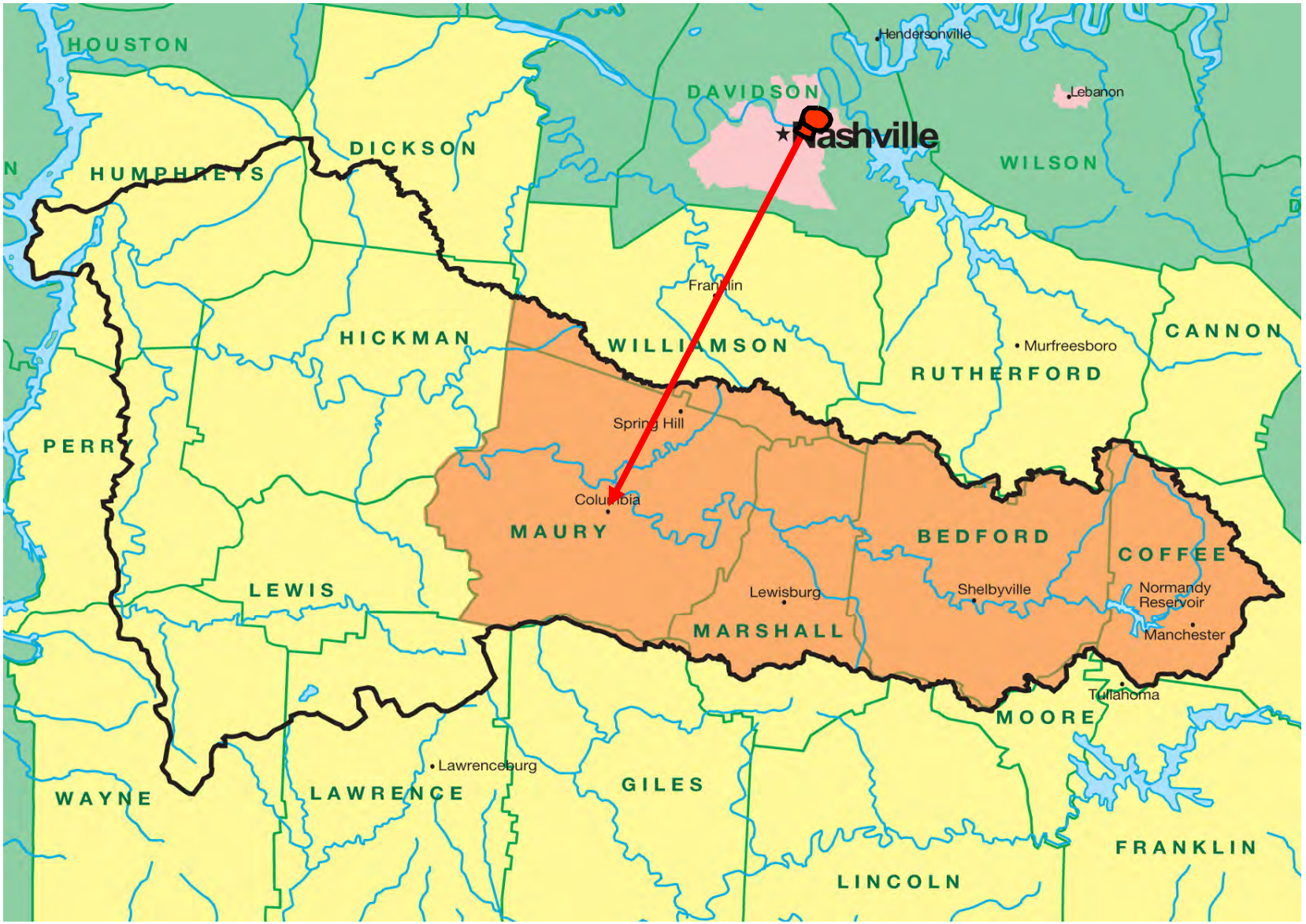
#20 Purchase Water from Nearby Systems



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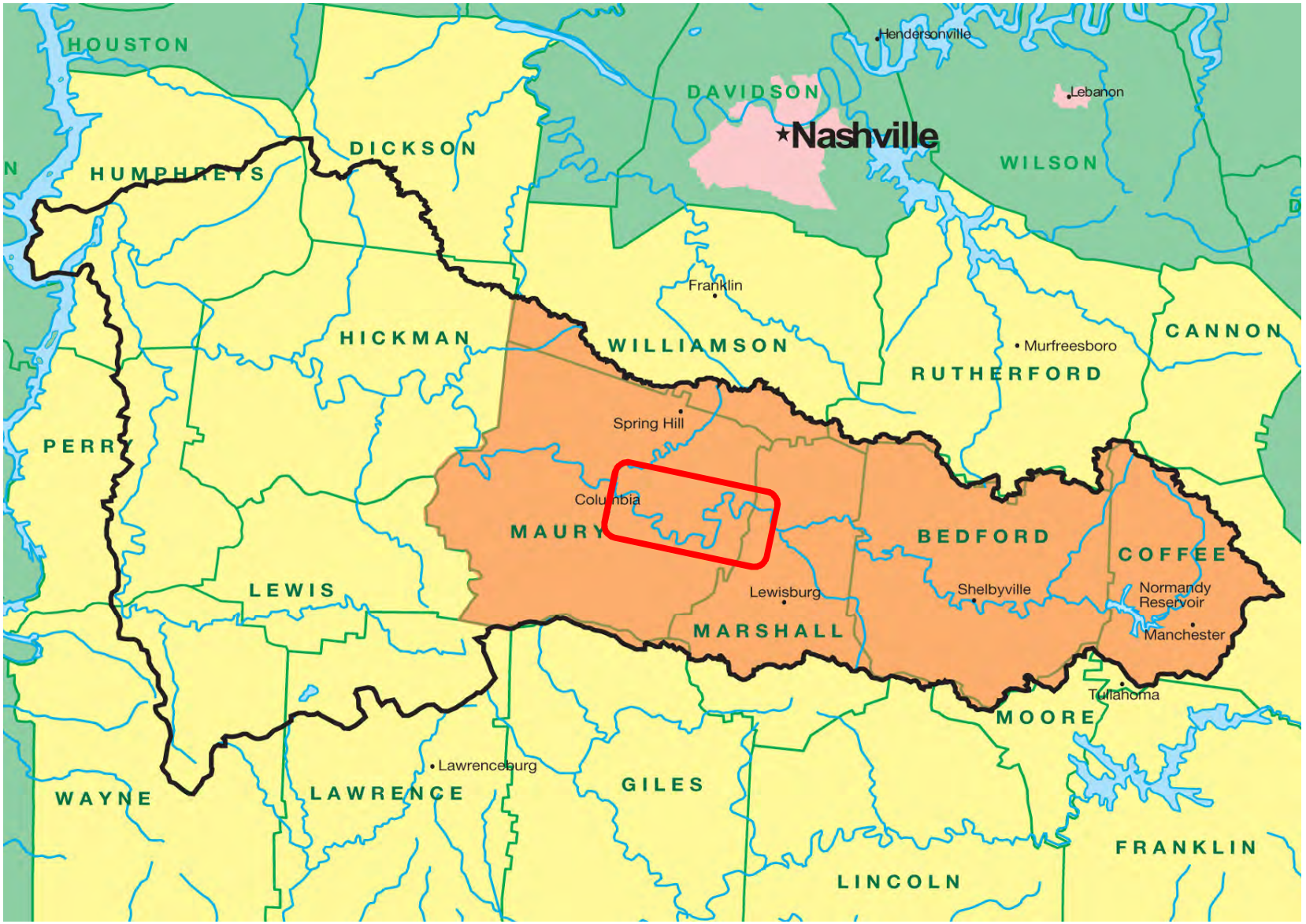
#21 Utilize Groundwater Sources (including underground flow of Duck River)



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#22 Pump Treated Water from Columbia WWTP to Duck River Downstream of Columbia Dam



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#23 Construct New Water Intake for Maury County at River Mile 163



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#24 Construct New Intake for Maury County at River Mile 108



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#25 Construct New Intake at River Mile 108 and Pumpback to Columbia Dam Pool



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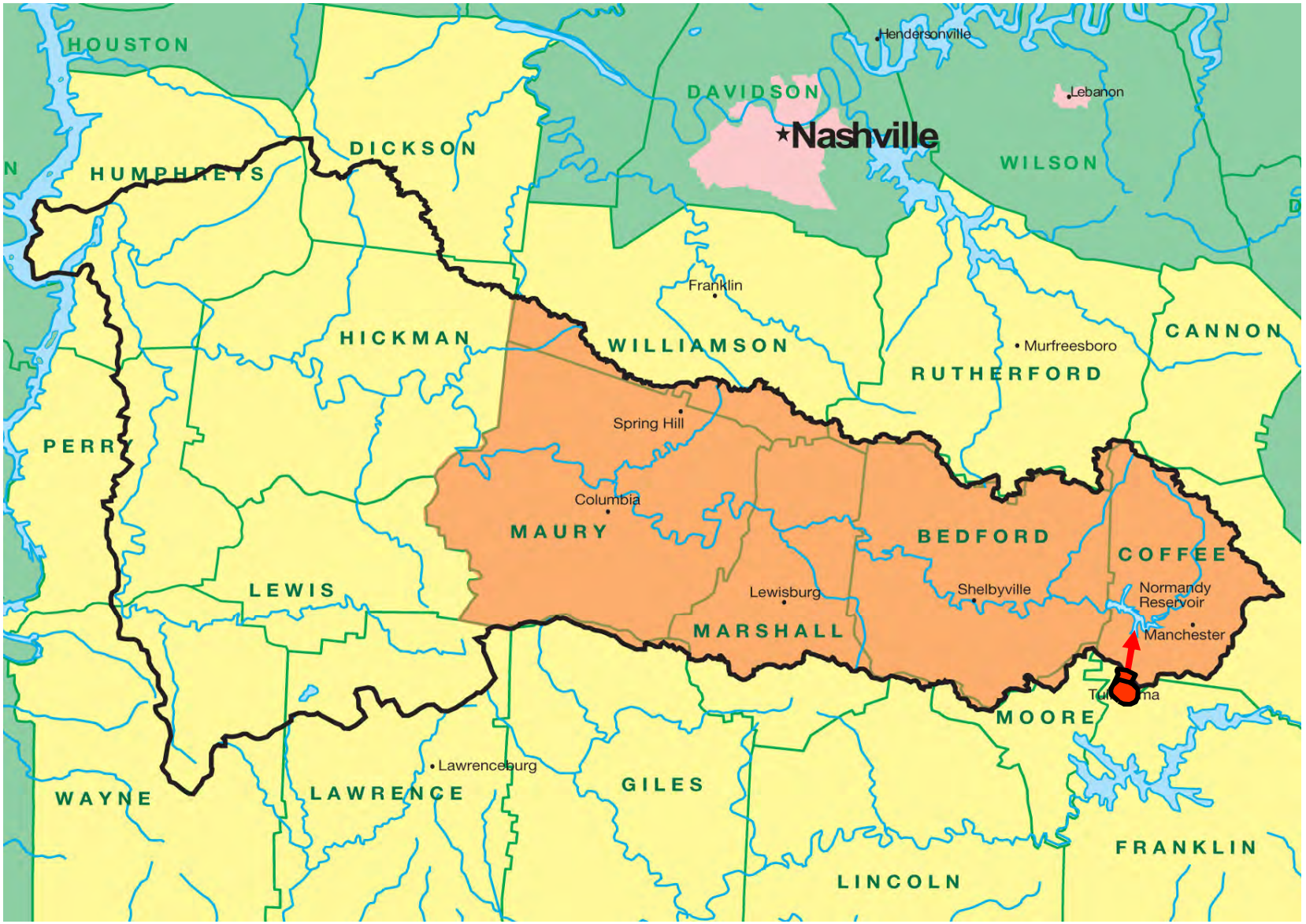
#26 Construct Infrastructure to Return Treated Water from Tullahoma WWTP to Normandy Reservoir



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WORKSHOP 4

Duck River Development Agency
Comprehensive Regional Water Supply Plan

AGENDA
WORKSHOP No. 4
Henry Horton State Park
February 24, 2010
9 AM to 3 PM

Welcome / Getting Started
- Review of Minutes from Workshop No. 3
- Summary of Activities since Workshop No. 3
- Objectives for Workshop No. 4
- Decision Process Review

Update on Needs Assessment
- Review of Prior Findings
- Water Efficiency Survey Findings

OASIS Hydrologic Modeling

Environmental Permitting Briefing
- Overview of the permitting process and impact on selected alternatives

Water Supply Alternatives
- Result of first round of screening at Workshop No. 3
- Review each remaining Alternative
  - New information and costs
  - Re-defining alternatives
  - Eliminating similar alternatives

Meeting Participant Input / Comments

Lunch (Noon to 1:00 PM)

Continue Review of Water Supply Alternatives
- Identify highly unlikely alternatives
- Identify alternatives that require extended time and effort
- Select alternatives for further consideration

Next Steps
- Open House Public Meeting
- Planning for Workshop No. 5

Meeting Participant Input / Comments

Adjourn (3:00 pm)

Duck River Development Agency
Comprehensive Regional Water Supply Plan

Meeting Minutes

Workshop No. 4
Henry Horton State Park
February 24, 2010

Meeting Participants

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Attachments: Agenda, MS PowerPoint presentation

A summary of the discussion follows:

Update on Needs Assessment

- Participant comment: Is the river deficit localized and specific to Columbia's withdrawal? Team response: The river deficit represents the deficit in the reach from Shelbyville to Columbia, but is most critical at Columbia because only Columbia has the withdrawal permit tied to the river flows.

OASIS Hydrologic Modeling

- Participant comment: Does the hydrologic modeling slide showing the number of days of deficit at Columbia reflect 2060 demand conditions? Team response: Yes.
- Participant comment: The modeling runs should be considered "best case" model runs because they assume perfect releases and river conditions. Team response: Agree that it is harder to do in practice than what we do with the model and it will be noted.

Environmental Permitting Briefing

- Participant comment: Does the Team think that Fountain Creek Reservoir will work? Team response: No. The water supply need to meet the projected deficit does not justify the reservoir.
- Participant comment: Utilities have been obtaining permit approvals using Safe Drinking Water Act security provisions (TCA 68221711 (?)) that may not have been justified otherwise. This provision relates to taking water from a reservoir to

meet downstream needs and denying water users adequate supply. In addition, water has been misappropriated for the users of the Duck River related to releases during drought conditions.

Water Supply Alternatives - General

- Each $0.01 per 1000 gallons sold generates approximately $70,000 - $80,000 annually for DRA. In general, the nickel fee would go up about $0.01 for roughly every $1 million in capital cost. Other financing options such as grants may also be appropriate.
- Participant comment: What is the accuracy of the cost estimates? Team response: Costs are "order-of-magnitude" estimates which are essentially +50% to -30%.
- Participant comment: The purpose and need of the study does not include recreation so why is recreation considered in the water supply criteria. Recreation criteria should be removed so as not to skew the decision. Team response: Recreation was added to the list of criteria at one of the early workshops in response to stakeholder requests.

Alternative #1 – Water Efficiency Measures

- Joe Bishop provided an update on the utility survey.
- No comments.

Alternative #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels and Improve DRUC Intake

- Participant comment: Suggest Alternative #2 be removed from the analysis. Remove the 2.5 ft reference under recreation criteria or qualify that this is based on modeling and ideal or optimum conditions. This alternative has a negative impact on recreation.
- Participant comment: If recreation is at a zero level when the reservoir is 20-25 feet below normal, what difference does it make if the level drops an additional 2-3 feet.

Alternative #3 – Regional Drought Management Plan

- Participant comment: Need to make sure "crisis" actions are included in the regional drought management plan. Need to act in early stages of the drought.
- Participant comment: Do we know if there will be any changes to the river or reservoir release requirements if WWTP effluent is improved?

Alternative #4 – Optimize Releases from Normandy Reservoir

- Participant comment: What impact will the upgrades to the Shelbyville WWTP have on the study? Will the improvements at the Shelbyville WWTP change the target

flow for release from Normandy Reservoir? Participant response: The bid for construction of the improvements will be solicited this Spring and it will be a 30 month project. Team response: A reduction in the release requirement for Shelbyville would likely not impact deficits for river users due to existing 100 cfs instantaneous constraint at Columbia.

Alternative #5 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam

- Participant comment: The relationship between the frequency and magnitude of flood events needs to be defined and will require more information.
- Participant comment: Floods would not be worse than prior to construction of Normandy Reservoir (pre-1976). Floods could actually be more severe depending on reservoir releases and reservoir operation.
- Participant comment: Does the increase in reservoir level have to be 5 ft? Team response: No.
- Participant comment: Do the gates need to be replaced? Team response: No.
- Participant comment: How much advance notice does TVA need for storm events? TVA response: TVA uses rain gages and rainfall forecasts to set the release schedule. Worst flood events have been due to higher than expected rainfall amounts. Operation of the reservoir is a balancing act.
- Participant comment: One approach for determining the potential footprint of the flooding downstream of Normandy could be to define the magnitude of in-bank and out-of-bank flows in the Duck River.

Alternative #6 – Modify Normandy Reservoir Flood rule Curve (Early Refill)

- Alt. #6 is not as reliable as Alt. #5 in terms of refilling to the Summer/Fall pool level in Normandy Reservoir.
- Combine with Alt. #5.

Alternative #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir

- Brian McCrodden and George Rest clarified the relationship between 125 cfs weekly average and 100 cfs instantaneous.
- Participant comment: The 100 cfs constraint at Columbia is out-of-date and is not a natural flow.
- Participant comment: Why would an EA or EIS be required? What would trigger the EA or EIS? No changes in the Normandy release are proposed. USF&WS identified that an EA or EIS would be required due to the change in flow regime and it is a State issue (environmental permitting is needed). In addition to the permitting identified by the Strategic Team, Section 7 would also be required.



Alternative #9 – Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)

- Participant comment: Does Normandy Reservoir need to be raised 5 ft? Team response: No. It may be possible to reduce the cost by raising the pool level by some increment of 5 ft.
- Participant comment: Should we be saying "increase" Normandy Reservoir release in the title for the alternative rather than modify? Participants agreed that it could increase or decrease and that modify was the best term.
- Participant comment: Would the Normandy Reservoir improvements (flood gates, etc.) add any benefit? In addition, new facilities (campgrounds, beaches, etc.) at Normandy Reservoir should be included under the recreation criteria. Team response: Newer gates would certainly add benefit because the existing gates are over 30 years old and the new campground and beach facilities will be included under recreation criteria.
- Participant comment: What negative impact might be associated with this alternative? If an EIS is required, what is the impact that would trigger the EIS? Participants identified that the current flow regime is beneficial to the species density and any change in flow release would need to be studied. Team response: Issues regarding inundation at Short Springs would need to be reviewed.
- Participant comment: There are two plant species of concern in Short Springs. Team response: No Summer/Fall inundation of the Short Springs area is proposed because the pool level will be retained at its current level of 875 ft. Some additional periodic flooding will occur in the Winter/Spring due to the increase in Winter/Spring pool level.

Alternative #12 – Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP

- Participant comment: Karst topography raises concerns about the ability of the reservoir to hold water and Cedar Creek Landfill upstream of the proposed Fountain Creek Reservoir may impact water quality.
- Participant comment: Regarding the acres of wetlands impacted by construction of the reservoir, more wetlands will be created through mitigation. Don't agree with the "Highly Unlikely" classification for this alternative. All projects will be difficult.

Alternative #13 – Construct Fountain Creek Reservoir with Downstream Release

- No comments.

Alternative #15 – Monsanto Lake (Existing Offstream Storage Reservoir)

- Participant comment: How many acres is the reservoir and watershed? Team response: Monsanto Lake is roughly 450 acres when filled with water, the watershed is approximately 650 acres and the parcel on that side of the Duck River which includes the reservoir is approximately 850 acres.
- Participant comment: This is a large expense considering that it is three times the cost of raising Normandy Reservoir.
- Participant comment: Is the integrity of the earth dam sound? Team response: Indications from reports are that it is sound.
- Participant comment: Local perception is that this area has toxic materials and is not fit for water supply. This will be a difficult sell to water customers due to the contamination issue. Team response: It is our understanding that the contamination issue was on the Monsanto site on the opposite side of the river and that the Team is not aware of any contamination issues associated with Monsanto Lake.

Alternative #16 – Utilize Quarries

- Participant comment: Any history of the Hardison Mills quarry going dry during drought? Team response: The bottom of the Hardison Mills quarry is above the Duck River based on some field calculations and it did not go dry during the 2007 drought.

Alternative #17 – Construct Pipeline from Tennessee River to the Columbia WTP

- Participant comment: How often would you need to pump? Team response: Pumping would be need roughly 8 out of 10 years and the average number of days of pumping for the period of record was 23 days.

Alternative #18 – Construct Pipeline from Tims Ford Reservoir

- Participant comment: Interbasin transfers are common so this is not a significant hurdle.
- Participant comment: Tims Ford is a hydroelectric generating project so revenue reduction would need to be taken into account and that could be difficult to sell.

Alternative #19 – Convey Arnold Cooling Water to Normandy Reservoir

- Participant comment: What river feeds Woods Reservoir and how large is the watershed? Team response: Woods Reservoir is fed by the Elk River and its drainage area is 263 square miles.

Alternative #20 – Purchase Water from Nearby Systems

- No comments.

Alternative #22 – Pump Treated Wastewater from Columbia WWTP to Below Columbia Dam

- No comments.

Alternative #24 – Construct Water Intake near Williamsport and Pump Back to Columbia WTP

- Participant comments: The cost of water per day of need should be calculated in order to generate a cost for the alternative.
- Participant comment: In addition to data presented for 2060, how many days per year would pumping be required for 2020 and 2040?
- Participant comment: What is the impact on the water quality below the intake at Williamsport? What percent of the flow is reduced? Team response: The 2000 PEIS identified that a withdrawal of 31 cfs would reduce the flow in the river by about 21% during dry weather conditions.
- Participant comment: What about the Mt. Pleasant WWTP leak? Team response: Team will review issue.
- Participant comment: Would this facility only operate during drought conditions? Team response: Yes.

Alternative #25 – Construct Water Intake near Williamsport and Pump Back to Columbia Dam Pool

- No comments.

Alternative #26 – Construct infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir

- No comments.

General

- Participant comment: May want to group alternatives based on those that can be phased in to meet demands as they grow and those that need to be implemented all at once.
- Participant comment: What discount rate is proposed? Team response: A discount rate of 4% or 5% will most likely be used.
- Participant comment: What is the distinction between Backup and Cornerstone? Team response: Each of the "short listed" plans will include a Cornerstone alternative, along with one or more Backup plans that are compatible with the Cornerstone.
- Participant comment: Team should take a hard look at the backup alternatives and assess whether a combination of projects best meets the objectives.

- Participant comment: It may be worthwhile to review and polling data on the alternatives scorecard and describe what the polling data means.
- Participant comment: The accuracy of the demand forecast needs to match the accuracy of the hydrologic modeling. Provide demand forecasts and show shortfalls in 10 year increments.
- The Open House is scheduled for March 24, 2010 at Henry Horton State Park.

Draft Summary of Water Supply Alternatives Matrix ("Required Alternatives" shaded in green, "Baseline Alternatives" shaded in yellow, "Fatally Flawed Alternatives" shaded in purple) – Workshop No. 4

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
1	Water Efficiency Measures **(BASELINE)**	Better management of water including water conservation, public outreach, system optimization, water reuse, etc. Full cost pricing of water including setting rates to reflect the full cost of service to help utilities capture the actual cost of operating water systems, raise revenues and help conserve water. Efficient water use including reducing leaks, metering, building retrofits, water sensing fixtures, irrigation systems, rainwater harvesting, etc. Watershed approaches including source water protection, return water to river, etc.	- Satisfies a portion of 32 mgd river deficit in 2060. - In aggregate, Water Efficiency Measures likely reduce water demands by 5% to 10% of total unrestricted demand. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$??	- Public acceptance could delay implementation of certain water efficiency measures. - Minimal permitting, property acquisition or constructability issues. - Voluntary participation required by customers for certain water efficiency measures.	- Alternative can be implemented in multiple phases.	- Water Efficiency Measures can reduce water supply withdrawals and thereby provide environmental benefits.	- No recreational benefits or impacts.
2	Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels and Improve DRUC Intake **(UNDETERMINED)**	Modify Normandy Reservoir release protocol to increase releases during low flow conditions (i.e., drought events) to meet the 64 mgd (100 cfs) constraint at the Columbia gage. This alternative does not include raising the Normandy Dam height or pool levels. Improvement to the existing DRUC intake are proposed to allow access to water below the current low water level threshold (approximately 840 ft) in the event that the water levels in Normandy Reservoir drop below the future levels predicted for 2007 drought conditions (roughly 851 ft).	- Satisfies entire river deficit of 32 mgd in 2060. - Compared to 2010 conditions, release from Normandy Reservoir to meet Columbia constraint in 2060 results in approximately 3 ft lower water levels in Normandy Reservoir under conditions of 2007 drought and 2060 water demands. Three feet is considered to be the minimum reduction or best case condition under ideal modeling and river conditions. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$4 million (project cost)	- EA or EIS involving detailed environmental studies of flow alteration will be required. Likely would require ESA Section 7 consultation with USF&WS. - Intake modifications would require TVA 26a permit and NEPA compliance, Corps Section 404/Section 10 permit NWP or IP, and TDEC Section 401 Certification.	- Alternative can be implemented in multiple phases.	- Need to identify if increased release has significant impact/ environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Lower water levels in Normandy Reservoir as a result of satisfying constraint at Columbia (maximum of 3 ft additional drawdown during critical drought and 2060 demands is best case condition based on ideal modeling and river conditions) could further impact recreation during drought.
3	Regional Drought Management Plan **(BASELINE)**	Develop drought management plan that reflects both human and environmental uses of flow. Drought Plan will identify triggers or actions to be taken during drought conditions based on numerous factors which could include time of year, reservoir water levels, groundwater conditions,	- Drought management planning could involve demand management during droughts that could extend the supply availability. Could also involve reduced releases during initial stages of	- No change.	$??	- EA or EIS involving detailed environmental studies of flow alteration will be required. Likely would require ESA Section 7 consultation with USF&WS. - Requires participation	- Alternative can be implemented in multiple phases.	- Need to identify if increased release and modified operating protocol has significant impact/	- Benefits or impacts to recreation associated with changes in reservoir operation are uncertain.

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
		downstream flow conditions, etc. Consequently, the Drought Management Plan would consist of a package of alternatives and would define the timing and trigger for enacting elements of alternatives such as water use restrictions, reductions in releases from Normandy Reservoir, etc.	droughts for use at latter stages of drought. Amount of impact to be determined in proposed Drought Management Plan. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.			and actions from State agencies.		environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	
4	Optimize Releases from Normandy Reservoir **(BASELINE)**	Install stream gages and modify dam controls as needed to allow releases from Normandy Reservoir to more closely match flow requirements at Shelbyville. Alternative preserves storage at initial stages of drought and allows for releases in latter stages when lower flow conditions occur.	- Projected deficits used in this study were computed assuming optimization of releases from Normandy Reservoir. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$??	- No change in operating rules.	- Alternative can be implemented in multiple phases.	- Need to identify if reduced release during initial stages of drought has significant impact/ environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Preserves pool storage for recreation in Normandy Reservoir due to ability to match required release.
5	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam **(UNDETERMINED)**	Raise Normandy Reservoir Winter/Spring pool level from 864 ft to 869 ft to preserve water storage from Winter/Spring pool for human and environmental needs during drier Summer/Fall months. This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users. Cost includes an allowance for acquisition of 2000 acres of flood prone land downstream of Normandy Reservoir (delineation of flood prone areas is needed).	- Satisfies entire river deficit of 32 mgd in 2060. - Increases water supply storage by approximately 5 BG, exceeding the 2-3 BG of storage needed at Normandy Reservoir to meet the 1.4 BG constraint at Columbia in 2060. Reduces flood storage volume by roughly 5 BG. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$15 million (project cost) Cost includes an allowance for acquisition of 2000 acres of flood prone area downstream of Normandy Reservoir that may be required.	- EA or EIS involving detailed environmental studies of flow alteration will be required. Likely would require ESA Section 7 consultation with USF&WS. - May require land acquisition in flood prone areas downstream of dam.	- Alternative can be implemented in multiple phases.	- Potential negative impacts on stream due to higher frequency of flooding.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought due to higher water levels.
6	Modify Normandy Reservoir Flood Rule Curve **(COMBINED WITH ALT. 5)**	Initiate refill of Normandy Reservoir earlier in the Spring (say February 1st instead of March 1st) in order to capture high Spring flows and refill prior to dry weather conditions which begin in June. This alternative would need to be combined with a modified release from Normandy Reservoir to	- No added reliable capacity. - Increases storage for water supply by capturing high spring flood flows. Risk associated with potential for no storm event in Normandy	- No change.	Not applicable.	- EA or EIS involving detailed environmental studies of flow alteration will be required. May require ESA Section 7 consultation with USF&WS. - May require land	- Alternative can be implemented in multiple phases.	- Downstream restrictions could be an issue but this alternative is better for reservoir biota. Objective is to	- Preserves pool storage and extends recreation in Normandy Reservoir during drought due

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
		satisfy a portion of the projected deficit of the downstream users. This alternative could be combined with other alternatives involving modification of the operating rule curve at Normandy Reservoir.	Reservoir drainage area between February 1st and March 1st. - Reduces volume of flood storage between February 1st and March 1st. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.			acquisition in flood prone areas downstream of dam.		fill it and maintain a steady pool level in the reservoir for spawning.	to higher water levels.
7	Reduce Irrigation Withdrawals **(FATAL FLAW)**	Reduce irrigation withdrawals and develop a plan to compensate farmers or provide water storage for use during drought conditions.	- No added reliable capacity. - Withdrawals could be significant for short term (i.e., a few days) but cannot be defined because irrigation withdrawals are not restricted and effectiveness of incentives will have to be based on voluntary participation.	- No change.	Not applicable	- Delays in implementation possible due to need for voluntary participation. - Requires legislative action.	- Alternative can be implemented in multiple phases.	- Not applicable.	- No recreational benefits or impacts.
8	Modify River Constraints to Preserve Storage in Normandy Reservoir **(UNDETERMINED)**	Modify flow constraints at Columbia by changing instantaneous requirement of 100 cfs to weekly average (or similar) or by reducing 100 cfs instantaneous flow requirement.	- Potential to satisfy entire river deficit of 32 mgd in 2060. - Reduced releases during droughts which preserves storage for use at latter stages of drought. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Raw water quality could improve if wastewater discharge treated to a higher level.	$2 million (project cost)	- EA or EIS involving detailed environmental studies of flow alteration will be required. May require ESA Section 7 consultation with USF&WS.	- Alternative can be implemented in multiple phases.	- Environmental benefits associated with improvements in level of wastewater treatment.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought due to higher water levels.
9	Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level) **(REQUIRED)**	Increase the height of Normandy Dam and Winter/Spring pool level by 5 ft (i.e., increase flood pool from 880 ft to 885 ft, retain Summer/Fall pool at 875 ft, and increase Winter/Spring pool from 864 ft to 869 ft). Increase releases from Normandy Reservoir to meet needs at Shelbyville and Columbia.	- Satisfies entire river deficit of 32 mgd in 2060. - Increases storage by approximately 5.5 BG. - No impact on flood storage volume. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$15 million to $30 million (project cost) Range of cost depends on need to raise roads and bridges, etc.	- EA or EIS involving detailed environmental studies of flow alteration will be required. May require ESA Section 7 consultation with USF&WS. - Inundated streams and wetlands would require TDEC ARAP and Antidegradation analysis. - Short Springs (State Designated Natural	- No flexibility to phase implementation for construction, but could phase increases in pool level.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Potential impacts to campgrounds and boat ramps would be minimized by retaining Summer/Fall Pool level. - Upgrades to existing 30-year old campground

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
						Area) major issue. - Loss of shoreline vegetation. - If action requires placement of dredged or fill material, Corps Section 404 permit required. Must be shown to be LEDPA pursuant to 404(b)(1).			facilities, beaches and boat ramps.
12	Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP **(REQUIRED)**	Construct a dam on Fountain Creek 0.2 miles upstream of confluence with Duck River at River Mile 146. At this location, the watershed drainage area for Fountain Creek Reservoir is 102 square miles. The inundated area of the reservoir under normal pool level is approximately 2,200 acres. Alternative includes construction of 32 mgd reservoir intake and pumping station, a 42-inch pipeline to a treatment plant (5 miles) and a continuous downstream release of 5 cfs.	- <u>Satisfies entire river deficit of 32 mgd in 2060.</u> - 48 mgd yield based on 2000 PEIS. - Potential for significant water loss from reservoir due to karst geology. - Direct ownership maximizes control of supply. - Direct connection between reservoir and Columbia WTP assures delivery of required supply (eliminates potential for loss of raw water or other needs in Duck River between Normandy Reservoir and Columbia). - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Shallow reservoir with long residence time yields high potential for nutrient enrichment, low dissolved oxygen, and water quality issues based on 2000 PEIS. - Construct a multi-port intake to obtain highest quality water. - Fountain Creek watershed contains high levels of nutrients. - Potential to discharge high temperature and low DO water to free flowing segment of Duck River. - Two 303(d) listed streams drain to Fountain Creek. Stream listing due to municipal/industrial landfills (Cedar Ridge Landfill and other landfill are regulated by solid waste). - Basin management plan may be required to minimize watershed impacts on reservoir water quality.	$70 million (project cost)	- EIS involving detailed environmental studies will be required and ability to obtain necessary permits is uncertain. - 2000 PEIS identified potential impacts on species diversity, wetlands, and T&E species habitat. - Potential substantial loss of forested wetlands (225 acres). - Inundation of Fountain Creek will alter ecology of the impounded tributary. - Need field determination of wetland impacts and development of a mitigation plan. - Need to establish release downstream of dam. - Rare, threatened, or endangered species may exist in Fountain Creek. - Corps Section 404 IP required. Must be found to be LEDPA pursuant to 404(b)(1). - TDEC Section 401 certification.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Inundation of Fountain Creek results in loss of riverine environment on Fountain Creek and land on Game Reserve. - Potential for fishing and other recreational opportunities associated with Fountain Creek Reservoir.
13	Construct Reservoir on Fountain Creek with Downstream	Construct dam on Fountain Creek just upstream of confluence with Duck River at River Mile 146. Alternative includes construction of	- <u>Satisfies entire river deficit of 32 mgd in 2060.</u> - 48 mgd yield based on 2000 PEIS.	- Shallow reservoir with long residence time yields high potential for nutrient	$43 million (project cost)	- TVA lead agency EIS involving detailed environmental studies will be required and	- No flexibility to phase implementation.	- No apparent environmental benefits associated with	- Inundation of Fountain Creek results in loss of

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
	Release **(UNDETERMINED)**	32 mgd reservoir intake and a continuous downstream release of 5 cfs. Storage in Fountain Creek Reservoir is released downstream to the existing Columbia Pool for withdrawal at the existing Columbia intake.	- Potential for significant water loss from reservoir due to karst geology. - Direct ownership maximizes control of supply. - Release proximate to Columbia Dam Pool enhances reliability of delivery of required supply (eliminates potential for loss of raw water or other needs in Duck River between Normandy Reservoir and Columbia). - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	enrichment, low dissolved oxygen, and water quality issues based on 2000 PEIS. - Construct a multi-port intake to obtain highest quality water. - Fountain Creek watershed contains high levels of nutrients. - Potential to discharge high temperature and low DO water to free flowing segment of Duck River. - Two 303(d) listed streams drain to Fountain Creek. Stream listing due to municipal/industrial landfills (Cedar Ridge Landfill and other landfill are regulated by solid waste). - Basin management plan may be required to minimize watershed impacts on reservoir water quality.		ability to obtain necessary permits is uncertain. - 2000 PEIS identified potential impacts on species diversity, wetlands, and T&E species habitat. - Potential substantial loss of forested wetlands (225 acres) - Inundation of Fountain Creek will alter ecology of the impounded tributary. - Need field determination of wetland impacts and development of a mitigation plan. - Need to establish release downstream of dam. - Rare, threatened, or endangered species may exist in Fountain Creek. - Corps Section 404 IP required. Must be found to be LEDPA pursuant to 404(b)(1). - TDEC Section 401 certification.		hydrologic regime, physical habitat, water quality and biota.	riverine environment on Fountain Creek and land on Game Reserve. - Potential for fishing and other recreational opportunities associated with Fountain Creek Reservoir.
14	Upgrade Existing Columbia City Dam to Allow Releases **(FATAL FLAW)**	Install valves or gates in the existing Columbia Dam to allow intermittent releases downstream of the dam to temporarily maintain flow constraint at Columbia with refill of the Columbia Reservoir occurring from releases from Normandy Reservoir, releases from quarry storage, or from the Duck River watershed.	- No added reliable capacity.	- Potential impact due to release of sediments downstream of the dam. - Requires review of data on sediment accumulation behind dam and the need for dredging.	Not applicable	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
15	Monsanto Lake (Existing Offstream Storage Reservoir) **(UNDETERMINED)**	Purchase Monsanto Lake which is a 5 BG offstream storage reservoir along Duck River approximately 8 miles northwest of Columbia. Utilize existing Columbia intake, upgrade existing Columbia pumping station, and construct 42-inch pipeline (10 miles) from reservoir to Columbia	- 5 BG of new storage delivered directly to Columbia satisfies minimum 1.4 BG river deficit at Columbia in 2060. - Direct ownership maximizes control of	- Construct a multi-port intake in the reservoir to obtain highest quality water.	$45 million (project cost) Cost includes an allowance of $7 million for potential improvement	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review.	- Alternative can be implemented in multiple phases.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water	- Potential for fishing and other recreational opportunities associated with offstream

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
		WTP to convey water from reservoir to WTP and to refill reservoir from the Duck River.	supply. - Direct connection between reservoir and Columbia WTP assures delivery of required supply (eliminates potential for loss of raw water or other needs in Duck River between Normandy Reservoir and Columbia). - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.		s to dam and spillway that may be required.			quality and biota.	storage reservoir.
16	Utilize Quarries **(UNDETERMINED)**	Utilize storage in existing inactive Hardison Mills Quarry (300 MG) to supply flow to Duck River during low flow conditions. Construct 5 mgd intake and pumping station on the Duck River, 16-inch pipeline from Duck River to quarry (1300 ft), and 5 mgd intake and pumping station at quarry. Use quarry water storage to augment flows in the Duck River during low flow conditions to meet Columbia constraint and refill quarry by "skimming" water from the Duck River during high flow conditions.	- Existing Hardison Mills Quarry is located along the Duck River upstream of Columbia and satisfies 0.3 BG of roughly 2 BG river deficit at Columbia in 2060. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Need to construct multi-port intake or floating intake to allow withdrawal of appropriate temperature water from storage.	$4 million (project cost)	- Would have to demonstrate that quarry water was not connected to Duck River baseflow (groundwater). - Intake and pumping station on Duck River would require Section 10 /Section 404 permit – Section 404(b)(1) compliance. TDEC 401 certification and Antidegradation review. TVA 26a permit required.	- No flexibility to phase implementation. Numerous quarries along the Duck River that could be added in the future as they become inactive.	- Utilizing quarries protects quarry site from illicit dumping or other uses that could impact water quality.	- No recreational benefits or impacts.
17	Construct Pipeline from Tennessee River to Columbia WTP **(REQUIRED)**	Construct 32 mgd intake and pumping station and 42-inch pipeline from Tennessee River near I-40 crossing to Columbia WTP (60 miles). Additional piping could be constructed in the future to extend supply to other utilities.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Potential for future increases in supply. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$165 million (project cost)	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review. Intake and pumping station on Tennessee River would require Section 10/Section 404 permit – Section 404(b)(1) compliance. TDEC 401 certification and Antidegradation review. TVA 26a permit required. - Potential to artificially extend range of exotic species or increase the likelihood that exotic species could invade these watersheds.	- Could be constructed in stages starting in Columbia and working toward the Tennessee River.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
18	Construct Pipeline from Tims Ford Reservoir	Construct 10 mgd intake and pumping station at Tims Ford and 24-inch pipeline from Tims Ford	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly	- Need to construct multi-port intake to allow withdrawal of	$25 million (project cost)	- Pipeline crossing of jurisdictional waters subject to Section 404,	- No flexibility to phase implementation.	- No apparent environmental benefits	- No recreational benefits or

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
	(REQUIRED)	Reservoir to DRUC WTP or intake (16 miles). This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	reliable. - Potential for future increases in supply. - Provides emergency backup source of supply for DRUC customers if Normandy Reservoir water is unavailable. - Supplying 2-3 BG of storage to Normandy Reservoir during critical drought in 2060 from Tims Ford Reservoir would result in a drop in water level in Tims Ford Reservoir of approximately 12-16 inches.	appropriate temperature and quality of water from Tims Ford.		TDEC 401 certification, and TVA 26a review. Intake and pumping station on Tims Ford would require Section 10/Section 404 permit – Section 404(b)(1) compliance. TDEC 401 certification and Antidegradation review. TVA 26a permit required. - Need to address interbasin transfer concerns. - Potential to artificially extend range of exotic species or increase the likelihood that exotic species could invade these watersheds.		associated with hydrologic regime, physical habitat, water quality and biota.	impacts likely due to maximum water level drop of 8 inches during critical drought.
19	Convey Arnold Cooling Water to Normandy Reservoir (UNDETERMINED)	Construct a 24-inch pipeline (7 miles) to convey cooling water from the cooling lake at Arnold AFB to a pipeline which discharges directly to Normandy Reservoir. Cooling lake obtains water pumped from Woods Reservoir (approximately 25 BG total storage) which was constructed exclusively for water supply (1 mgd) and cooling water for Arnold AFB and its operation is controlled by Arnold AFB. Water from the Woods Reservoir system is treated and supplied to the AFB for drinking and other potable water needs.	- Adequate storage in Woods Reservoir to satisfy 2-3 BG of storage needed at Normandy Reservoir to meet 1.4 BG deficit at Columbia in 2060. - Arnold AFB would need to identify any restrictions on use to assess reliability.	- Need to define source and location of water contamination.	$8 million (project cost)	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review. - TVA NEPA compliance required, EA/EIS, TDEC ARAP, and Antidegradation review.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
20	Purchase Water from Nearby Systems (UNDETERMINED)	Construct 42-inch finished water pipeline from Nashville to Columbia (50 miles).	- No added reliable capacity. - Serious concerns regarding access to reliable capacity. - Requires an interbasin transfer.	- No change.	$??	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review. - Requires TDEC interbasin transfer permit.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
21	Utilize Groundwater Sources (FATAL FLAW)	Construct new groundwater wells or access underground flow for the Duck River between Shelbyville and Columbia.	- No added reliable capacity. - Serious concerns regarding access to reliable groundwater sources.	- No change.	Not applicable	- EIS involving detailed environmental studies of flow alteration will be required and ability to obtain necessary permits is uncertain.	- Alternative can be implemented in multiple phases.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
22	Pump Treated Wastewater from Columbia WWTP to Columbia Dam **(UNDETERMINED)**	Construct a 20 mgd pumping station at the Columbia WWTP and a 36-inch pipeline (5 miles) to return treated wastewater from the Columbia WWTP to a location just downstream of the existing Columbia Dam. Pumping flow back to the location downstream of the Columbia Dam would only be required under this alternative during low flow conditions in the Duck River.	- Satisfies 20 mgd of 32 mgd river deficit in 2060. - Drought proof and highly reliable. - Capacity increases over time. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- Must meet TDEC water quality requirements for discharge. - Higher levels of treatment may be needed to avoid impacts on raw water quality immediately downstream of dam where threatened and endangered species exist.	$14 million (project cost) Potential costs which might be required for a higher level of wastewater treatment not included.	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review. - TDEC may not permit or may require a higher level of treatment of wastewater. - Potential impact to threatened and endangered mussels immediately downstream of existing Columbia Dam.	- High level of flexibility in that capacity can be increased over time.	- Potential environmental benefit if higher level of treatment is provided for Columbia WWTP discharge to meet assimilative capacity requirements just downstream of Columbia Dam.	- No recreational benefits or impacts.
23	Construct Water Intake for Maury County at River Mile 163 **(FATAL FLAW)**	Construct a 32 mgd water intake on Duck River at River Mile 163 and a 42-inch pipeline (24 miles) for Maury and South Williamson Counties (Columbia gage is at River Mile 132 which is roughly 30 river miles downstream).	- No added reliable capacity.	- No change.	Not applicable	- TDEC permit needed for water supply withdrawal but ability to obtain necessary permits is likely.	- No flexibility to phase implementation.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
24	Construct Water Intake near Williamsport and Pump Back to Columbia WTP **(REQUIRED)**	Construct a 32 mgd water intake and pumping station on Duck River in vicinity of River Mile 108 near Williamsport and a 42-inch pipeline (17 miles) to convey water to the Columbia water treatment plant.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Minor reduction in downstream flows due to consumptive uses in the Maury and South Williamson County water systems. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$56 million (project cost)	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review. - Lower downstream flows not likely to cause adverse impacts on aquatic life.	- No flexibility to phase implementation but alternative could ultimately be a component of the Tennessee River pipeline alternative.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.
25	Construct Water Intake near Williamsport and Pump Back to Columbia Dam Pool **(UNDETERMINED)**	Construct a 32 mgd water intake and pumping station on Duck River in vicinity of River Mile 108 near Williamsport and a 42-inch pipeline (17 miles) to convey water to the pool behind the existing Columbia Dam.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Minor reduction in downstream flows due to consumptive uses in the Maury and South Williamson County water systems. - Reduces reliance on Normandy Reservoir (208 sq mi drainage	- No change.	$56 million (project cost)	- Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review. - Lower downstream flows not likely to cause adverse impacts on aquatic life.	- No flexibility to phase implementation but alternative could ultimately be a component of the Tennessee River pipeline alternative.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.

No.	Raw Water Source (Workshop #3 Status)	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost (Order of Magnitude Concept Level Estimates)	Implementability	Flexibility	Environmental Benefits	Recreation
			area) as sole source of water during severe droughts to satisfy many needs.						
26	Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir **(UNDETERMINED)**	Construct 10 mgd pumping station and 24-inch pipeline (9 miles) to return treated wastewater from Tullahoma WWTP to Normandy Reservoir. This alternative would need to be combined with a modified release from Normandy Reservoir to satisfy the projected deficit of the downstream users.	- Return flow satisfies roughly 1.5 BG of the 2-3 BG of storage needed at Normandy Reservoir to meet 1.4 BG deficit at Columbia in 2060. - Reliable 2 mgd in 2010 increasing over time to 3 mgd in 2060 as Tullahoma wastewater flow increases (assumes 70% return flow). - Slight reduction in the level of reliance on Normandy Reservoir.	- Must meet TDEC water quality requirements for discharge, but current level of treatment is apparently adequate.	$16 million (project cost) Cost includes an allowance of $4 million for higher level of wastewater treatment that may be required.	- Need to conduct studies and obtain permit for a new NPDES permit for wastewater discharge into Normandy Reservoir. - Pipeline crossing of jurisdictional waters subject to Section 404, TDEC 401 certification, and TVA 26a review.	- Flexible to accommodate increases in flow over time. - Could extend piping to Tims Ford Reservoir in future to convey flow to Normandy Reservoir.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- No recreational benefits or impacts.

Draft Summary of Water Supply Alternatives Scorecard (note that number represents the number of persons in workshop that assigned alternative to the given category and the ✔ represents category assigned by the Strategic Team).

Alt. No.	Description	Highly Unlikely	Backup	Cornerstone	Comments
2	Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels and Improve DRUC Intake	12	15 ✔	2	(See Separate Sheet for Comments)
5/6	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam/Flood Rule Curve Modifications	0	3	26 ✔	
8	Modify River Constraints to Preserve Storage in Normandy Reservoir	9	12 ✔	8	
9	Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)	3	7	18 ✔	
12	Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP	25 ✔	3	0	
13	Construct Reservoir on Fountain Creek with Downstream Release	23 ✔	1	4	
15	Monsanto Lake (Existing Offstream Storage Reservoir)	6	6	16 ✔	
16	Utilize Quarries	7	18 ✔	3	
17	Construct Pipeline from Tennessee River to Columbia WTP	27 ✔	1	1	
18	Construct Pipeline from Tims Ford Reservoir	25 ✔	3	1	
19	Convey Arnold Cooling Water to Normandy Reservoir	15	13 ✔	1	
20	Purchase Water from Nearby Systems	27 ✔	2	0	
22	Pump Treated Wastewater from Columbia WWTP to Columbia Dam	23 ✔	5	1	
24	Construct Water Intake near Williamsport and Pump Back to Columbia WTP	8	10	11 ✔	
25	Construct Water Intake near Williamsport and Pump Back to Columbia Dam Pool	21 ✔	5	3	
26	Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir	18 ✔	8	2	

DUCK RIVER
WATER SUPPLY STUDY
WORKSHOP NO. 4
COMMENTS ON ALTERNATIVES SCREENING

Alt. No. 2	Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels and Improve DRUC Intake
•	Benefits entire watershed
•	Effects on reservoir recreation too damaging
•	No "new" H20
•	Not acceptable to client
•	Seems like preferred alternative
•	Why spend money that provides no effect in water availabity to entire region?
•	No action
•	If needed after detailed biological analysis
•	Unknown environmental impact / no new water
•	Would require new operations and commitment from TVA and full ecological analysis
•	Does not provide new water; recreation could be impaired
•	116 river miles from Normandy to Columbia; does not provide "new" water
•	Will not work; will put Tullahoma out of water
•	Not acceptable to reservoir users - risky; very negative impact on recreation
•	Places Tullahoma and Manchester residents at too much risk
•	Also significant legal issues that make this unlikely
•	Recreational impact

Alt. No. 5/6	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam/Flood Rule Curve Modifications
•	Benefits entire watershed
•	Subject to cost of buying flood-prone areas; can be phased-use in conjunction with 16 & 19
•	Flood probability & extent increase
•	Revise description to one alternative
•	Seems like preferred alternative
•	$15M?
•	If needed after detailed biological analysis
•	Satisfies entire deficit? Flood potential
•	Lump together and fully analyze all Normandy options
•	Captures and stores water during most opportune time
•	Non-structural
•	Flood issue?

DUCK RIVER
WATER SUPPLY STUDY
WORKSHOP NO. 4
COMMENTS ON ALTERNATIVES SCREENING

Alt. No. 8	Modify River Constraints to Preserve Storage in Normandy Reservoir

- Benefits entire watershed
- Lots of work still needed to be sure of environmental impacts and anti-degradation of exceptional waters
- Weekly average versus instantaneous average
- Requires reduction as much as 50 cfs - TDEC will not approve
- Is this not a trivial change after a "small" study?
- Is change of Columbia constraint the ONLY way to do this?
- Formal request to TDEC would be required
- Change instantaneous to weekly average at Columbia
- May require EA or EIS; 100 cfs at Columbia
- Needs to be pursued; 100 cfs is arbitrary number
- "Speculative"

Alt. No. 9	Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)

- Benefits entire watershed
- Too much cost? Big costs to boat ramps, bridges etc. still unknown
- Less reliable than other storage
- Unneeded when demand is revised
- Would like to see opinion on impact on state endangered species as well as federal ones
- Environmental impact unknown; more info needed
- Satisfies entire 32 MGD deficit in 2060; +5ft
- Impacts to marinas, ramps an campgrounds, bridges and roads
- Build and use when necessary

Alt. No. 12	Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP

- Contains numerous hurdles including ecological implications, water quality management and liability; high phosphorous, algae
- Project does not fit "purpose and need" high environmental impacts
- Permitting and public obstacles
- Not permittable
- Wholly uneconomic and unneeded and not a legitimate practicable alternative
- A Fountain Creek dam is another Rock Island! Cedar Ridge Landfill - leaking; too much karst topography - bye-bye water everwhere but in the reservoir.
- Cost prohibitive; environmental permitting hurdles
- Permitting issues/other options available with less environmental impact
- Recreation; too costly-difficult to permit
- Strong karsh topography; water quality impacted by WWT
- May be too difficult

DUCK RIVER
WATER SUPPLY STUDY
WORKSHOP NO. 4
COMMENTS ON ALTERNATIVES SCREENING

Alt. No. 13 Construct Reservoir on Fountain Creek with Downstream Release

- Contains numerous hurdles including ecological implications, water quality management and liability; high phosphorous, algae
- Project does not fit "purpose and need" high environmental impacts
- Preferred to #12 in either is retained as an alternative
- Wholly uneconomic and unneeded and not a legitimate practicable alternative
- A Fountain Creek dam is another Rock Island! Cedar Ridge Landfill - leaking; too much karst topography - bye-bye water everwhere but in the reservoir.
- Extensive environmental impact
- Cost prohibitive; environmental permitting hurdles
- Recreational benefits
- Too costly; difficult to permit
- May be too difficult

Alt. No. 15 Monsanto Lake (Existing Offstream Storage Reservoir)

- $15 million / 5 BG; - Legacy contamination? Phosphorus produces algae
- Costs high and difficult to phase in a cost-effective way; high O&M cost
- 400 acre pool/650 acre watershed; fill from Duck/drain to Columbia WTP
- Dam Safety, liability concerns
- Will be shown to be uneconomic when demand is corrected
- Some question of history of land (environmental Issues or perception of)
- Watershed can be controlled completely
- Water quality unknown; 850 acres; river divides
- Good new idea; environmental?? And cost??

Alt. No. 16 Utilize Quarries

- Limited volumes
- Potential for recharge without pumping (high cost-effectiveness); low cost per MGD; to be implemented in conjunction with other incremental alternatives
- Not large enough
- Waste of time
- Groundwater questions
- Significant implementability requirements for small volume
- Small amount of storage
- Small volume
- Unreliable, quesionable recharge, not enough capacity
- Too small?

DUCK RIVER
WATER SUPPLY STUDY
WORKSHOP NO. 4
COMMENTS ON ALTERNATIVES SCREENING

Alt. No. 17 Construct Pipeline from Tennessee River to Columbia WTP

- Cost too great compared to other alternatives (Low cost-effectiveness)
- High capital; high O&M
- Too expensive - needs to be operated daily to be effective
- Wholly uneconomic
- Environmental impacts costs; Residence issues for water in pipe?
- Cost prohibitive
- Too costly; complex
- 60 miles of pipe $165 million
- Too costly and operational costs high
- Too expensive

Alt. No. 18 Construct Pipeline from Tims Ford Reservoir

- Disagree with consultant on permitting issues
- Generation, hydro facilities; trout fisheries
- Local opposition
- Wholly uneconomic
- Implementability
- Complex permitting and significant opposition
- TVA charge for water transfer?
- Local opposition and permitting

Alt. No. 19 Convey Arnold Cooling Water to Normandy Reservoir

- Unknown water quality, or consistency of quality/quantity
- Good cost-effectiveness (use in conjuction with rock quarries); to be implemented in conjuction with other incremental alternatives
- Crumpton Creek vs. pipeline
- Potential contamination; Implementability; public perception
- Potential raw water contamination
- Why risk contamination and challenges of dealing with DOD? BAD IDEA.
- Lack of control
- Water temp? Coordinate with Arnold Air Force Base

Alt. No. 20 Purchase Water from Nearby Systems

- Most would be in high-demand scenarios at same time
- Growth potential in other areas would be limited
- Nashville/Cumberland connection
- Not available
- Corps moratorium on any of the utilities increasing their withdrawal from Cumberland
- Interbasin transfer issues
- Not feasible; interbasin tranfser
- High cost / no control

DUCK RIVER
WATER SUPPLY STUDY
WORKSHOP NO. 4
COMMENTS ON ALTERNATIVES SCREENING

Alt. No. 22	Pump Treated Wastewater from Columbia WWTP to Columbia Dam

- Only satisfies Columbia and downstream
- Permitting problems
- Requires treatment upgrade
- Does not make sense
- Yuck
- Permitting obstacles; no new water
- Endocrine nightmare
- Water quality? TDEC?

Alt. No. 24	Construct Water Intake near Williamsport and Pump Back to Columbia WTP

- Only Satisfies Columbia and downstream; Cornerstone if Mt. Pleasant fixed, or intake moved upstream of Big Bigby
- Low cost-effectiveness; difficult to phase
- No new water
- Not as good as #25
- Wholly uneconomic
- Water quality issues from Big Bigby Creek due to Mt. Pleasant lagoon leaking; potential saltcake landfill
- Water quality
- Lots of questions - Re: downstream impacts and water quality at intake
- Consider cost of additional WTP at Williamsport intake - instead of pipeline
- Adds new water
- Could probably be permitted
- What about endocrine disruptors
- High cost - other alternatives better
- Change to build regional water plant downstream to take load off Columbia
- "Rob Peter to pay Paul"
- Possible/but cost??

DUCK RIVER
WATER SUPPLY STUDY
WORKSHOP NO. 4
COMMENTS ON ALTERNATIVES SCREENING

Alt. No. 25	Construct Water Intake near Williamsport and Pump Back to Columbia Dam Pool

- Only Satisfies Columbia and downstream
- Low cost-effectiveness; difficult to phase
- Difficult permitting
- No new water
- Prefer to alt. #24
- Wholly uneconomic
- Water quality issues from Big Bigby Creek due to Mt. Pleasant lagoon leaking; potential saltcake landfill
- Bigby, Greenlick creeks
- Not to pool
- Adds new water
- Could probably be permitted
- Toilet to tap
- High cost - riskier than #24
- "Rob Peter to pay Paul"
- Environmental? #24 better

Alt. No. 26	Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir

- Only satisfies Columbia and downstream
- Difficult permitting
- From Elk to Normandy
- Not large enough
- Wholly uneconomic
- Insignificant benefit
- Difficult permitting
- Flow in stream is mostly from WWTP in summer; high cost, difficult to permit
- Environmental and permitting

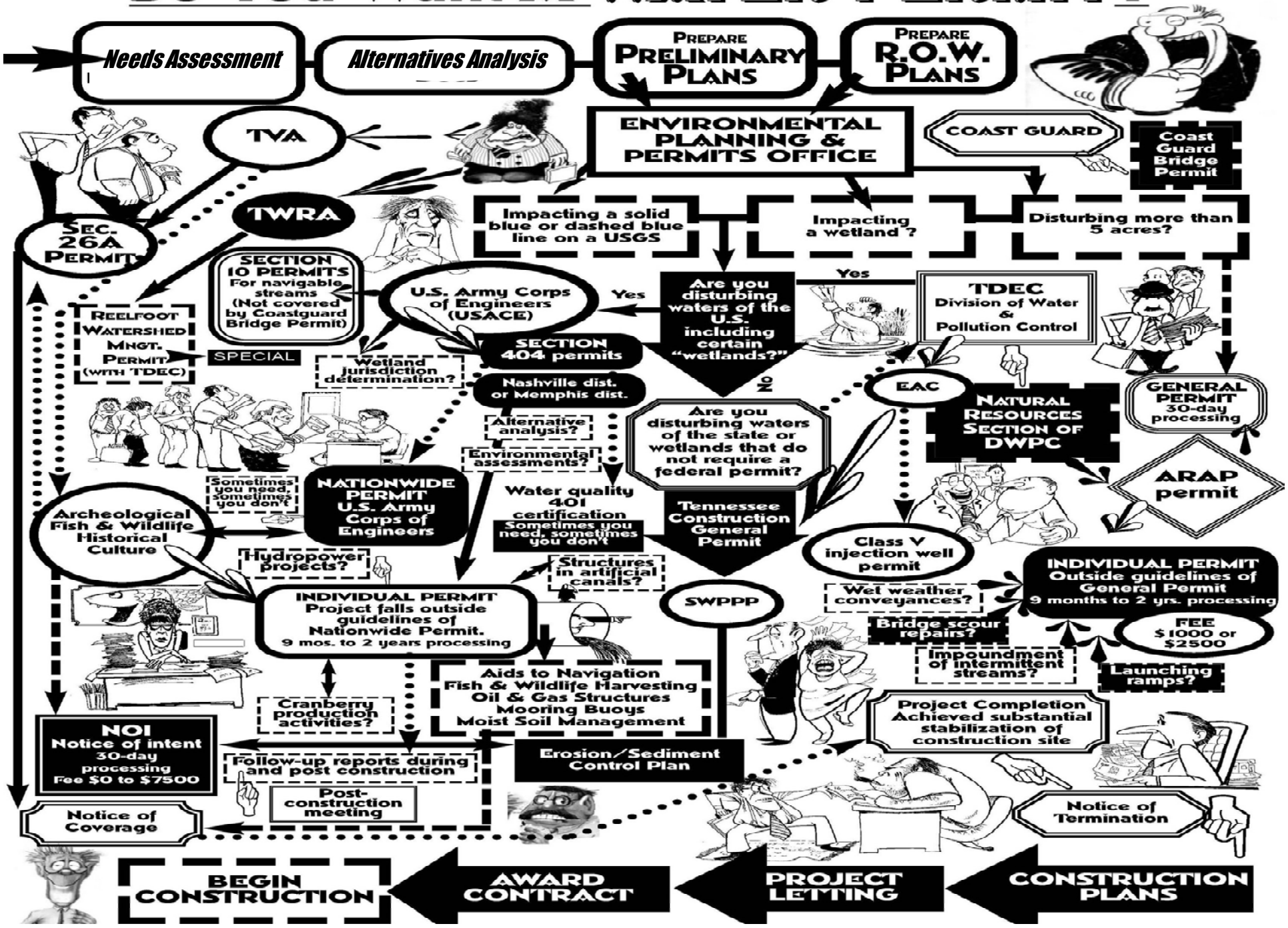
Environmental Permitting of Water Supply Projects

Richard C. Young, M.S.

Richard W. Whiteside, Ph.D.

David E. Jackson, P.G.

So You Want A WATER PERMIT?



Four Largest Regulatory Hurdles

- National Environmental Policy Act
  - Environmental Assessment or
  - Environmental Impact Study
- Clean Water Act
  - Section 404(b)(1)
- Endangered Species Act
  - Section 7 Consultation
- Tennessee Clean Water Act
  - Antidegradation Review Exceptional TN Water
  - ARAP/Section 401 Certification

Federal Clean Water Act Section 404

- Four primary sets of regulations governing 404 permit review:
  - NEPA
  - Corps Regulations (including Public Interest Review)
  - 404(b)(1) Guidelines
  - Section 401 Water Quality Certification
- All allow adjustment in the level of review and analysis.
  - NEPA – 40 CFR 1500.4 – Cat. Ex., EA, EIS
  - Regulatory Program Regulations – 33 CFR 320.4 and 325.4 – Varying weights applied to public interest factor and different types of permits.
  - 404(b)(1) Guidelines – 40 CFR 230.6 and 230.10 - Adaptability and Flexibility (as clarified in EPA-Corps August 23, 1993 Memo).

Federal Clean Water Act Section 404

- Analysis is normally tailored in regard to level of impacts.
- Flexibility typically reduced for large-scale projects, particularly those with potential for significant impacts to aquatic resources
- Water projects typically fall into this category

Key Points

- Public Interest Review
- Purpose and Need
- Alternatives
- Impact Analysis
- Triggers Compliance with other Regulations

Public Interest Review

- Public Notice Required
  - Give public opportunity to review the work and analysis.
  - Provide feedback whether comments/issues raised have been adequately addressed.
  - Identify other issues that were not previously identified.

Public Interest Review

- Corps balances benefits and detriments of project to public
- Permits issued only for projects consistent with public interest (***project is not contrary to the public's interest***)

Purpose and Need

- Projects are to have defined ***purpose***(s) based on ***need***(s).
- Regulations require the Corps evaluate and document these.
  - NEPA – Council on Environmental Quality Regulations – 40 CFR 1508.9(b) and 1502.13 and Corps' Procedures for Implementing NEPA – 33 CFR Part 325 (Appendix B) Section 9b(4).
  - Section 404 – Corps Regulatory Program Regulations - 33 CFR 320.4(a)2(i), 33 CFR 325.1(d) and Section 404(b)(1) guidelines – 40 CFR 230.10(a).

Purpose and Need

- Applicant identifies ***purpose***(s) and ***need***(s) to be addressed by proposed action. May be **single** or **multiple** needs.
- For NEPA/404 analysis, Corps defines project purpose statement in light of applicant's stated objectives as well as public's perspective (33 CFR Part 325 Appendix B, Section 9(b)(4) and formal policy guidance Plantation Landing Resort, Inc. 404(q) elevation).
- Cannot be overly narrow nor too broad (May 12, 2003 CEQ Guidance).

Purpose and Need

- Appropriate substantiation for definition of Purpose and Need. Requires information be provided by applicant/participants.
  - Water Use Patterns and Rates
  - Projected Demands
  - Conservation Measures
- Corps can conclude that purpose is too speculative and halt review process.

Purpose and Need

- Impacts Permit Process
  - Definition sets the stage for NEPA and public interest review
  - Critical to ***alternative analysis*** (practicability)
- Project Specific
  - Context/Applicant sensitive (one size does not fit all)

Alternatives

- NEPA requires all "***reasonable***" alternatives be evaluated in detail
- Clean Water Act - 404(b)(1) guidelines requires Corps approve only the Least Environmentally Damaging **Practicable*** Alternative (***LEDPA***)
- NEPA/404(b)(1) alternatives analysis satisfies public interest review requirements

***Practicable** – costs, logistics, technology in light of project purpose. 404b1 analysis can be more restrictive than NEPA

Alternatives

- What is being considered for alternatives in water supply projects?
  - Structural elements (e.g. dams, water harvesting, pipelines, treatment plants, pumps, etc.)
  - Non-structural elements (e.g. conservation, drought management, water reuse, potential storage, operational change in existing dams, etc.)

Alternatives

- Ownership of a property right does not confine ***alternatives analysis*** to that right or location.
  - Options not currently owned which may be reasonably obtained, utilized, expanded or managed must be evaluated – 40 CFR 230.10(a)(2)
  - Alternatives not desirable by the applicant are to be evaluated (CEQ 40 Most Asked Questions – Question 2a)

Impact Analysis

- Impacts vary from one project to another. Analysis of effects will vary as well.
- NEPA requires "***hard look***" and disclosure. Corps' Appendix B requires that scope of analysis of effects be the same as the benefits.
- Public Interest review provides guidance on what to consider. Factors and their evaluation typically mesh with NEPA requirements.
- 404(b)(1) requirements focus on aquatic resources (see 40 CFR Part 230 Subparts C thru H).

Impact Analysis

- Metrics and methods adjusted to significance of issue.
  - Qualitative assessments
  - Semi-Quantitative assessments
  - Quantitative assessments
- Availability of existing data, studies and information influences method selection
  - Budget and schedule are additional factors

Impact Analysis

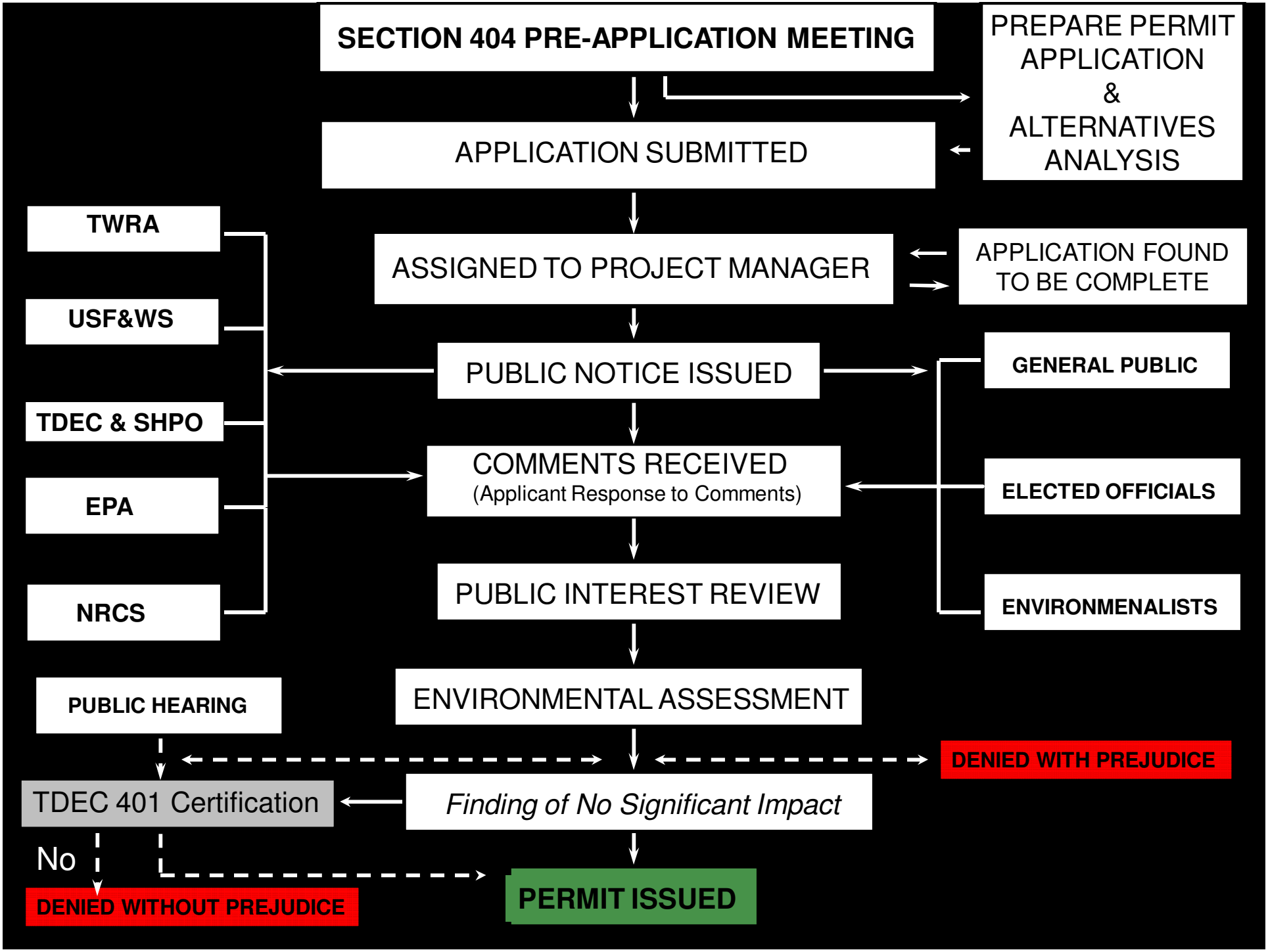
- Corps considers causal relationship between project to be authorized and impacts.
  - Underlying need for identified water supply projects is to address demands and issues related to growth.
  - Corps holds that typically, growth will occur without permit being issued for water supply projects.

Impact Analysis

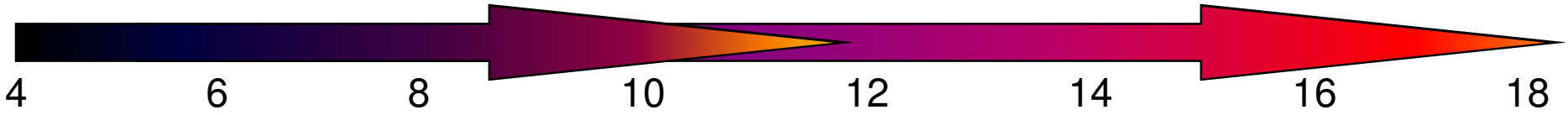
- Cumulative Effects – Common themes for current water supply projects
  - Identification of reasonably foreseeable actions and predicting their effects
  - Establishing scope of evaluation
    - Varies depending on resource (how far downstream, within viewshed, species habitat, etc.)

Summary

How these regulations interact; putting the pieces together…

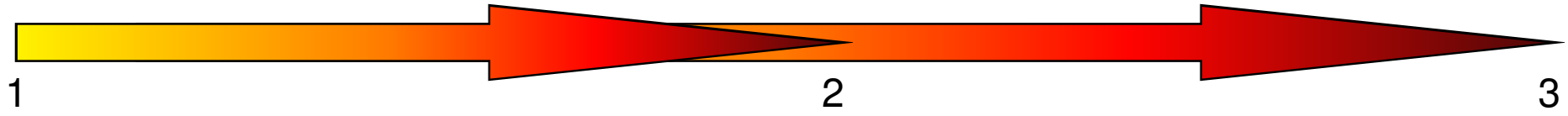

SECTION 404 PRE-APPLICATION MEETING
PREPARE PERMIT APPLICATION & ALTERNATIVES ANALYSIS
APPLICATION SUBMITTED
TWRA
USF&WS
TDEC & SHPO
EPA
NRCS
ASSIGNED TO PROJECT MANAGER
APPLICATION FOUND TO BE COMPLETE
PUBLIC NOTICE ISSUED
GENERAL PUBLIC
COMMENTS RECEIVED
(Applicant Response to Comments)
ELECTED OFFICIALS
PUBLIC INTEREST REVIEW
ENVIRONMENALISTS
PUBLIC HEARING
ENVIRONMENTAL ASSESSMENT
DENIED WITH PREJUDICE
TDEC 401 Certification
Finding of No Significant Impact
No
DENIED WITHOUT PREJUDICE
PERMIT ISSUED

Water Supply Permitting Timeline



Months from Complete Application

NOTE: TIME REQUIREMENTS ARE HIGHLY VARIABLE AND ARE NEGATIVELY INFLUENCED BY PROJECT VISIBILITY, CONTROVERSY, DEGREE OF IMPACTS, AGENCY STAFF WORKLOAD AND PRECEDENT SETTING PROPOSALS.



Years from Complete Application

What Do the Section 404(b)(1) Guidelines Require?

- Set the substantive standards for permit decisions (supplemented by a public interest review)
- Designed to protect aquatic ecosystems and wetlands
- Require a ***rigorous examination of alternatives***
- Presume availability of alternatives for non-water dependent projects
- Require permit denial where significant degradation of aquatic resource will result
- Impose stringent mitigation requirements

Tennessee's Antidegradation Policy (rule)

- Prohibits degradation of Exceptional Tennessee Waters unless and until it is affirmatively demonstrated that:
  - Withdrawal for water supply use is justified as a result of necessary economic or social development

    and

  - will not interfere or become injurious to any of the classified uses for such waters

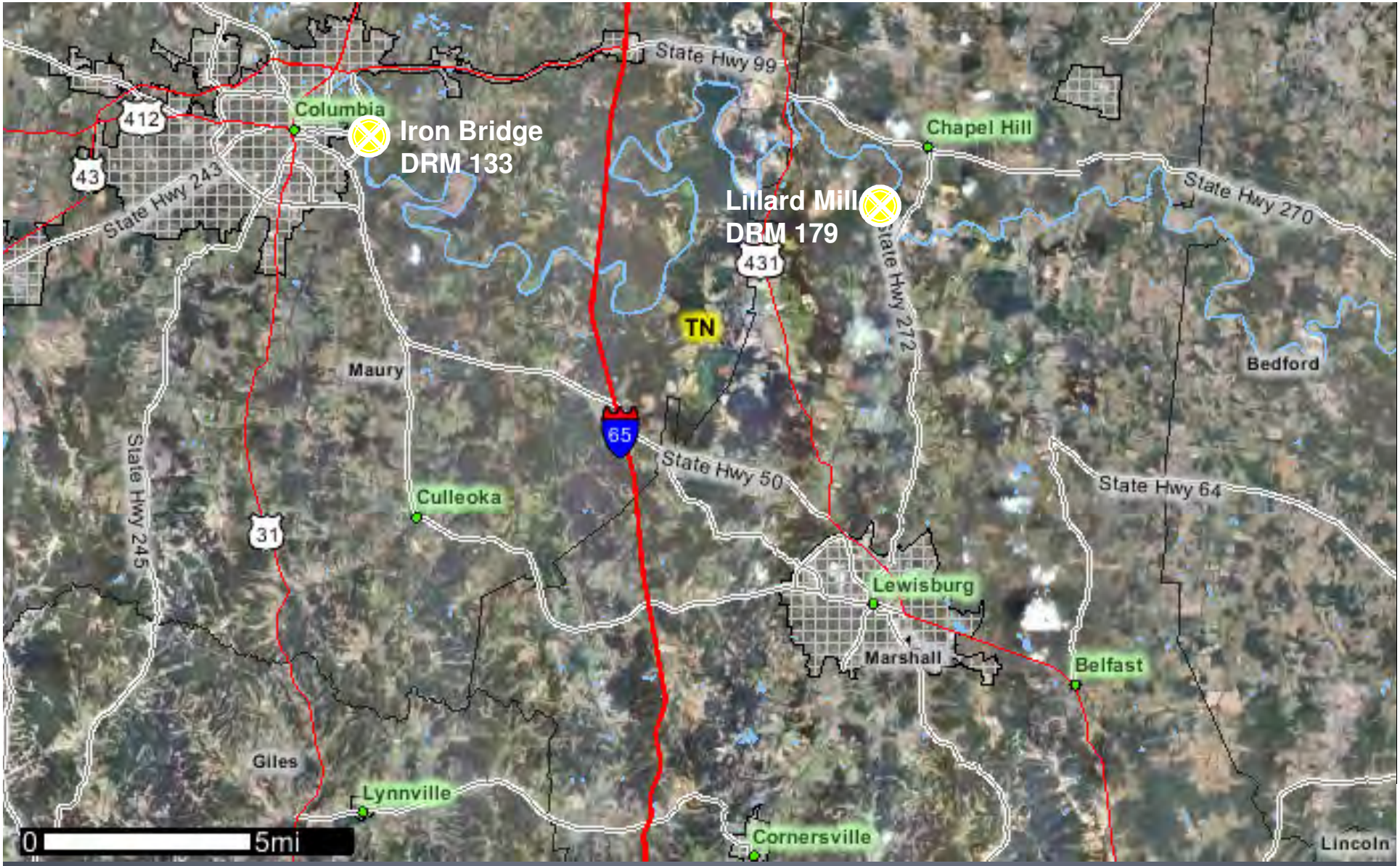
Tennessee's Antidegradation Policy (rule)

Decision is predicated on the following components:

(1) a determination of applicability of the ETW process,
(2) review of the applicant's ***alternatives analysis***,
(3) weighing of socio-economic justification (provided in the applicant's ***needs assessment***) vs. water quality issues,
(4) public notice review/input prior to
(5) a final decision

The Endangered Species Act (ESA)

- If federal agency determines the action may "jeopardize the continued existence" of protected species or adversely affect its critical habitat, the agency must comply with Section 7 of the (ESA).
  - Agency prepares a ***Biological Assessment*** (BA)
  - FWS issues a ***Biological Opinion*** ("BiOp")
    - Based on the ***"best scientific and commercial data available."***
    - must include a ***Reasonable and Prudent Alternative***
    - must include an ***Incidental Take Statement*** setting conditions under which the agency may proceed



Duck River from Lillard Mill in Marshall County to Iron Bridge in Maury County designated as "critical habitat" pursuant to the Endangered Species Act for the Cumberlandian combshell (*Epioblasma brevidens*) & Oyster mussel (*Epioblasma capsaeformis*). *Flows must ≥ 165 cfs at DRM 180.2 to protect listed species & habitat*

Level of Regulatory Review Depends on the Propose Action

Projects which require change in TVA reservoir operations

- NEPA
  - ESA – Section 7
  - plus other applicable reg's & executive orders
- R&HA Section 10?

Projects which require placement of dredge or fill material in jurisdictional waters

- Section 404 Individual permit
  - 404(b)(1)
  - NEPA
  - ESA – Section 7
  - NHPA – Section 106
  - plus other applicable reg's & executive orders
- Section 401 Certification (TDEC)
- TVA 26a permit

Duck River Regional Water Supply Baseline Alternatives

- #1 – Water Efficiency Measures
- #3 – Regional Drought Management Plan (inclusive of temporary intake provisions for DRUC)
- #4 – Optimize Releases from Normandy Reservoir

Duck River Regional Water Supply Required Alternatives

- #9 – Raise Normandy Dam (Alternative D from 2000 DEIS)
- #12 – Construct Fountain Creek Reservoir (Alternative B from 2000 DEIS)
- #17 – Construct Pipeline from Tennessee River
- #18 – Construct Pipeline from Tims Ford Reservoir (Alternative E from 2000 DEIS)
- #24 – Construct New Water Intake for Maury County at River Mile 108 (Alternative C from 2000 DEIS)

Duck River Regional Water Supply Alternatives - Undetermined Status

- #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels (with #10 - Improve DRUC Intake or #11 - Construct Second DRUC Intake)
- #5 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam
- #6 – Modify Normandy Reservoir Flood Rule Curve
- #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir
- #13 – Construct Fountain Creek Reservoir with Downstream Release
- #15 – Build Offstream Storage Reservoir along Duck River (Monsanto Lake)
- #16 – Utilize Quarries
- #19 – Discharge Arnold Cooling Water to Duck River
- #20 – Purchase Water from Nearby Systems
- #22 – Pump Treated Water from Columbia WWTP to Columbia Dam
- #25 – Construct New Water Intake at River Mile 108 and Pump Back to Columbia Dam Pool
- #26 – Construct Infrastructure to Return Treated Water from Tullahoma WWTP to Normandy Reservoir



Duck River Comprehensive Regional Water Supply Plan

Workshop No. 4 / February 24, 2010

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Agenda

- **Review of Minutes from Workshop No. 3**
- Summary of Activities Since Workshop No. 3
- Objectives for Workshop No. 4
- Update on Needs Assessment
- Supplemental OASIS (hydrologic) Modeling
- Environmental Permitting Briefing
- Water Supply Alternatives Screening
- Next Steps

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Review of Minutes from Workshop No. 3

- Reviewed water supply needs assessment and supplemental hydrologic modeling
  - Assessed volume, frequency and duration of river deficit
- Finalized evaluation criteria and definitions
- Reviewed 26 alternatives
- Identified 17 alternatives for further consideration

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Summary of Activities Since Workshop No. 3

- Conducted survey of DRA Water Systems on water efficiency
- Provided briefing on project status at DRATAC and WRC meetings (1/13/10 and 1/14/10)
- Held work session with DRA Board (1/28/10)
- Held work session with TDEC (1/29/10)
- Conducted additional hydrologic modeling of drought frequency, duration and deficits, and the yield of some alternatives
- Conducted site visits to inactive quarries, Monsanto Lake (off-stream reservoir), and AEDC
- Updated summary matrix including preliminary costs of alternatives

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Objectives for Workshop No. 4

- Provide briefing on preliminary water efficiency survey
- Provide briefing on permitting issues
- Sort the 17 remaining “undetermined” alternatives
- Discuss next steps

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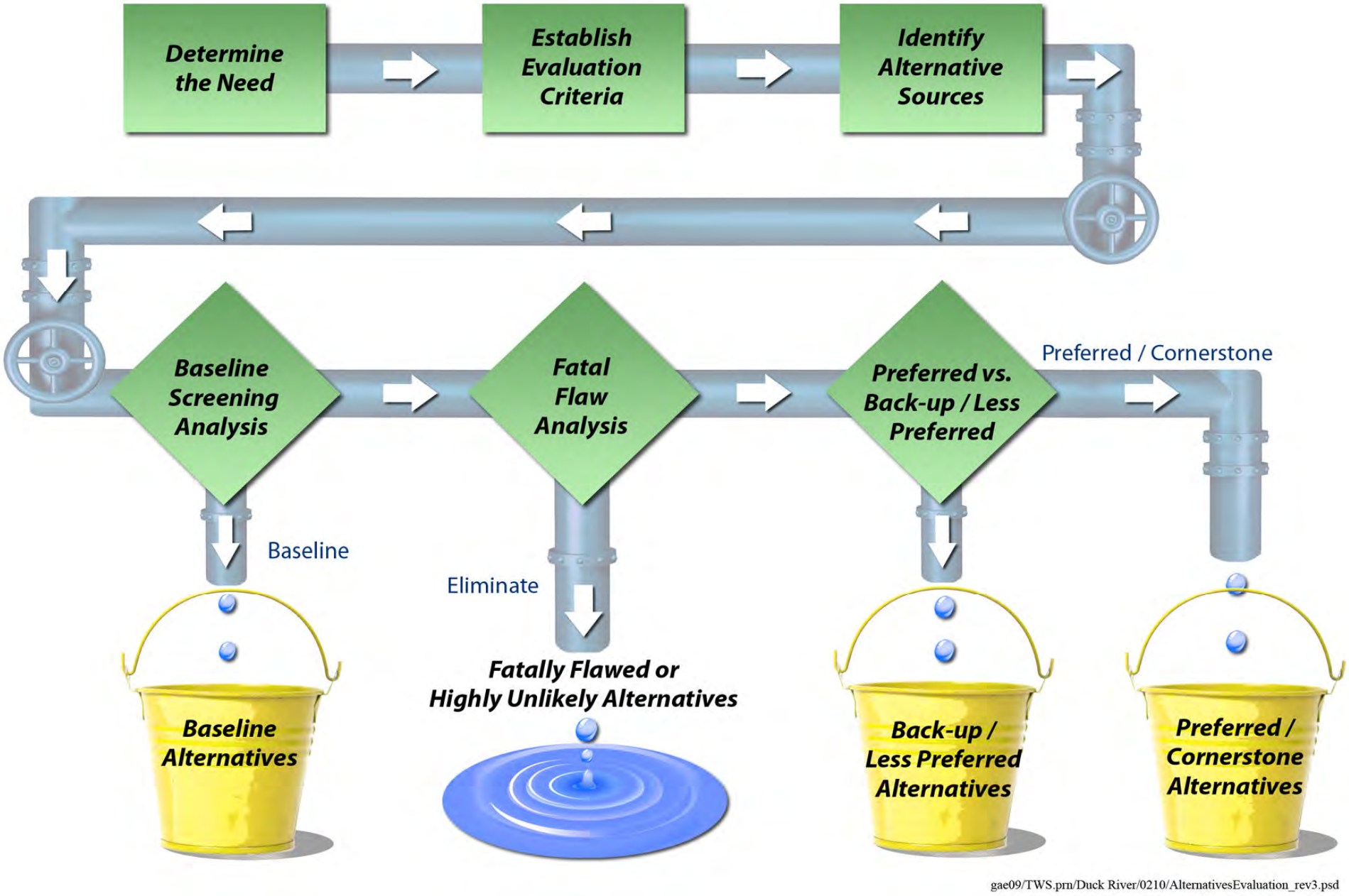
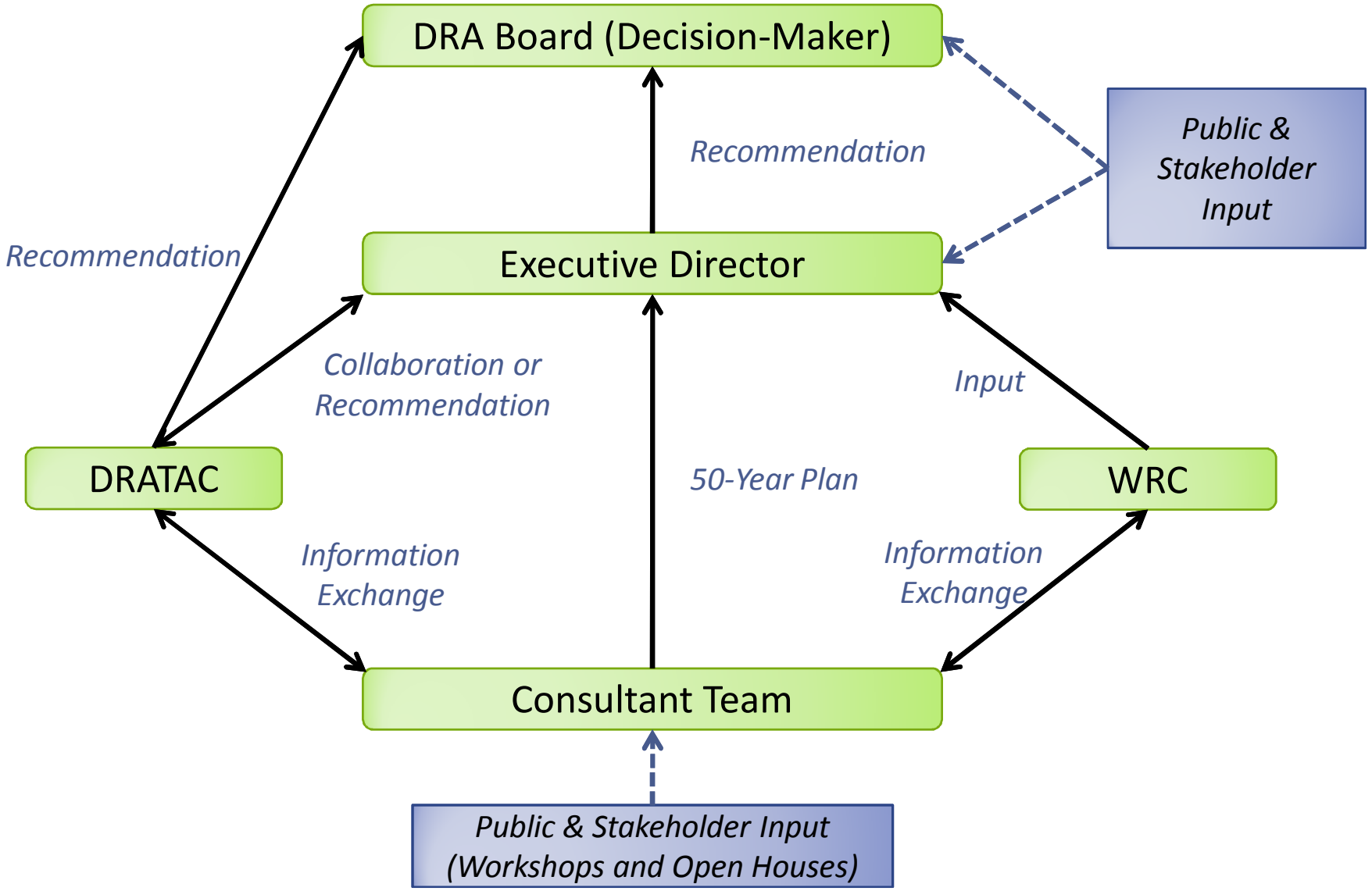
Revised Water Supply Evaluation Process



gae09/TWS.prn/Duck River/0210/AlternativesEvaluation_rev3.psd

Roles of Key Participants in the Decision Process



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Service Area

"Estimated Use of Water in the Upper Duck River Watershed, Central Tennessee, and Water Demand Projections through 2030 ," USGS, 2008

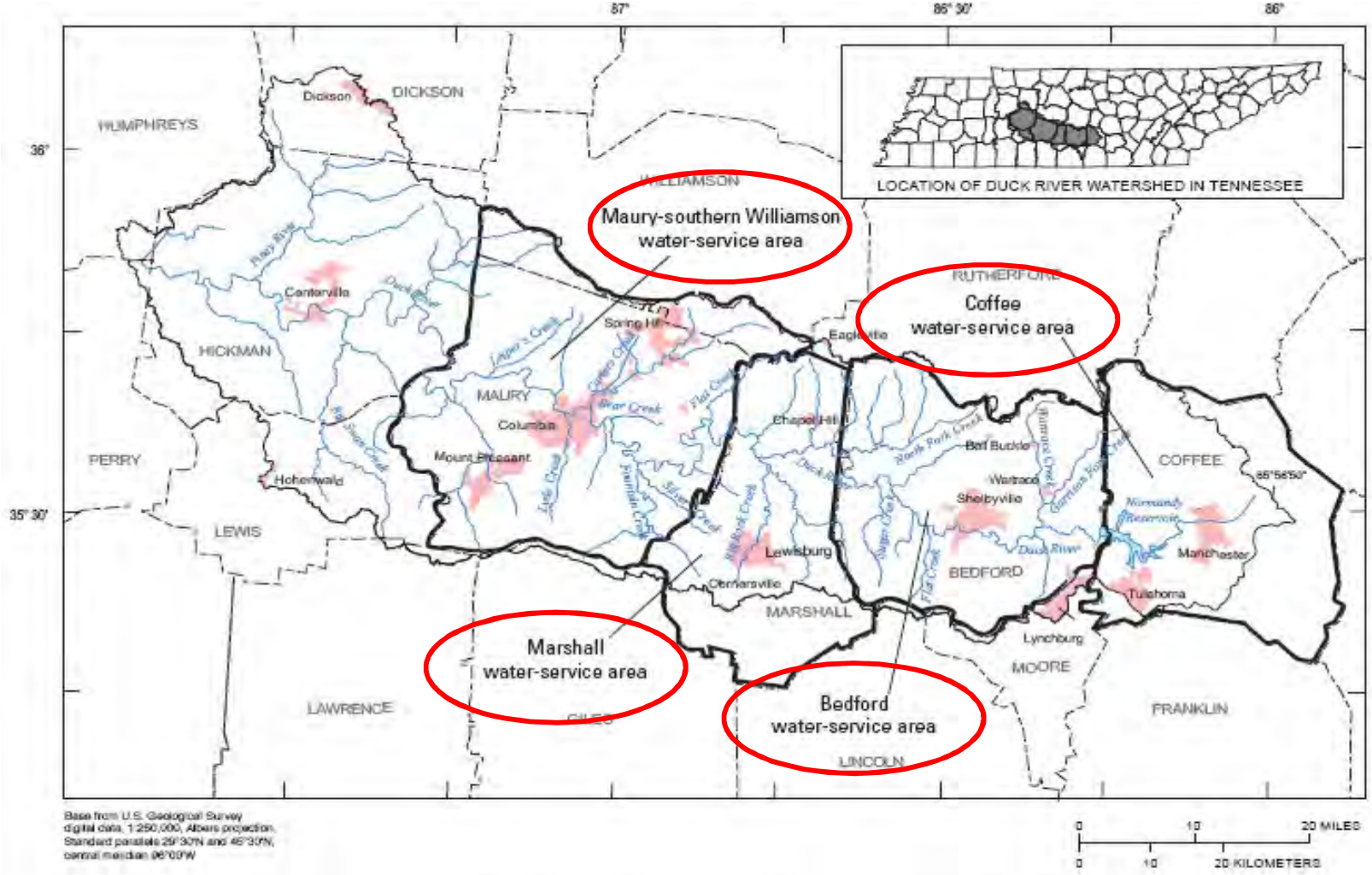

Figure 1. Upper Duck River study area and the Maury-southern Williamson, Marshall, Bedford, and Coffee water-service areas.

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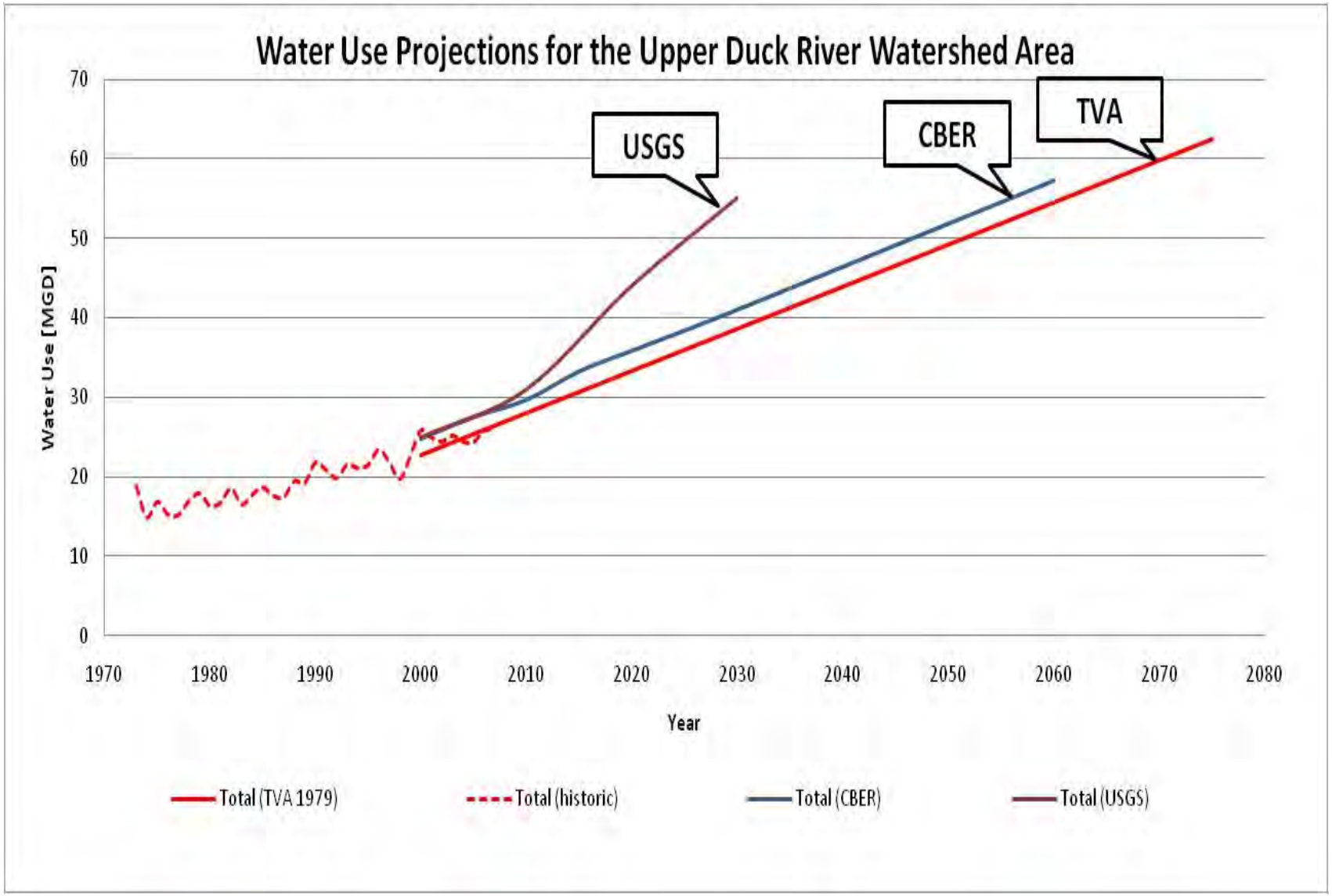
Summary of Future Water Demands



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CBER Revisions Coming

- CBER plans to release revised Statewide population projections in early March:
  - Statewide population projections in 2035 could be reduced by roughly 10% in comparison with earlier projections
    - If true for the Planning area, that would reduce river deficit from 32 mgd to about 26 mgd to 29 mgd
- Above change is unlikely to have a significant affect on the screening of alternatives

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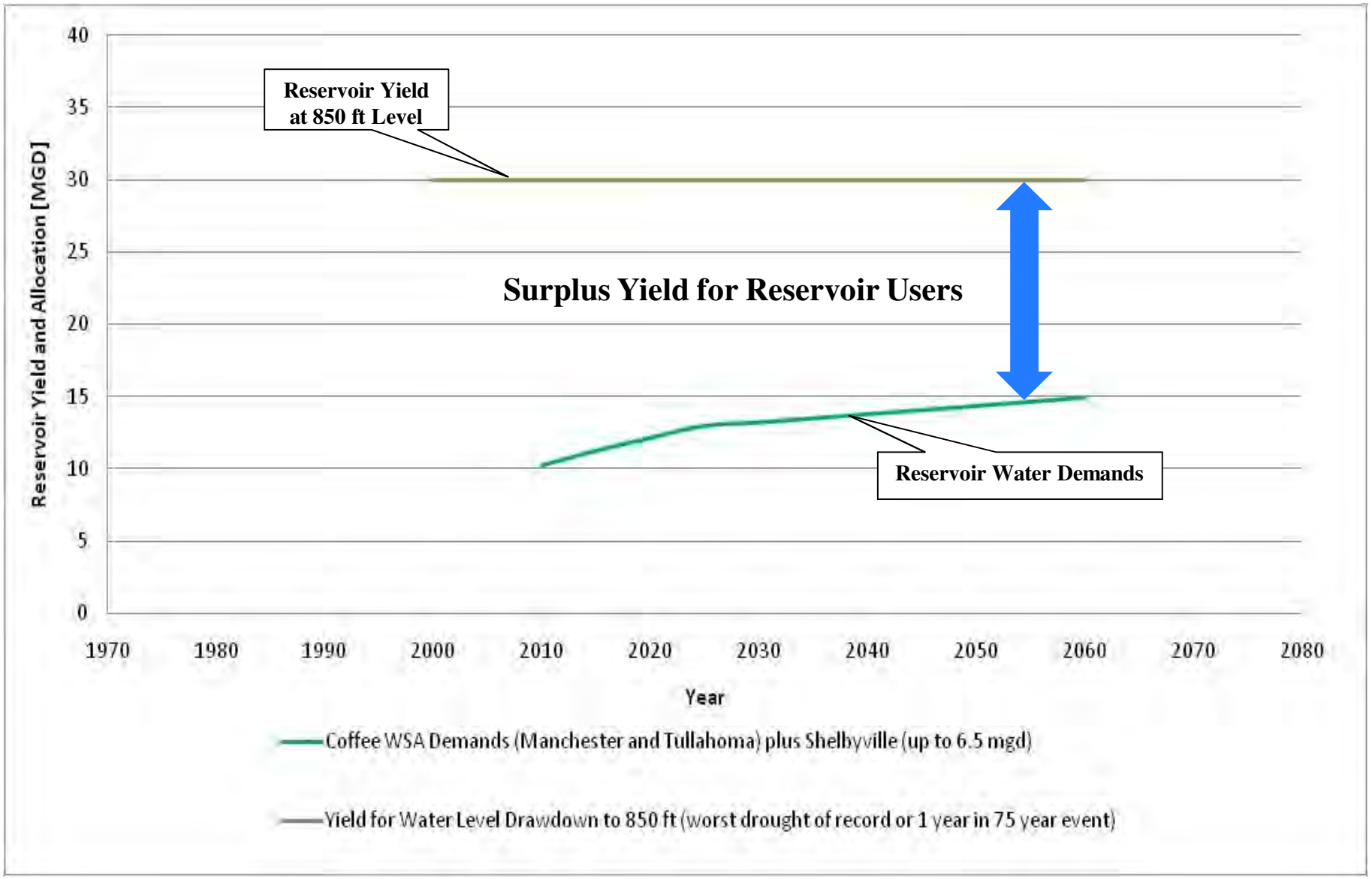
Needs Assessment for Normandy Reservoir Supply



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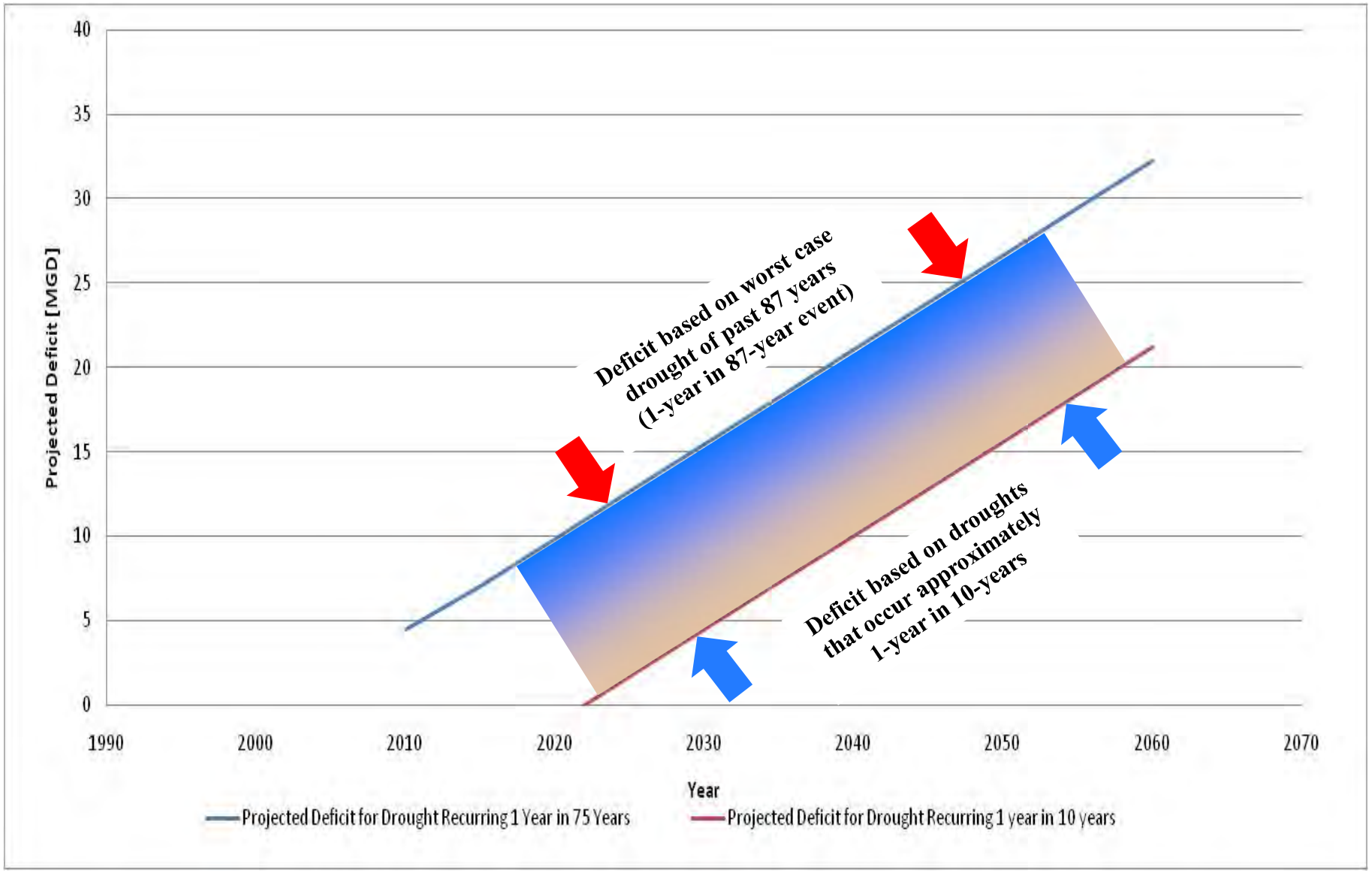
Needs Assessment for Duck River Supply



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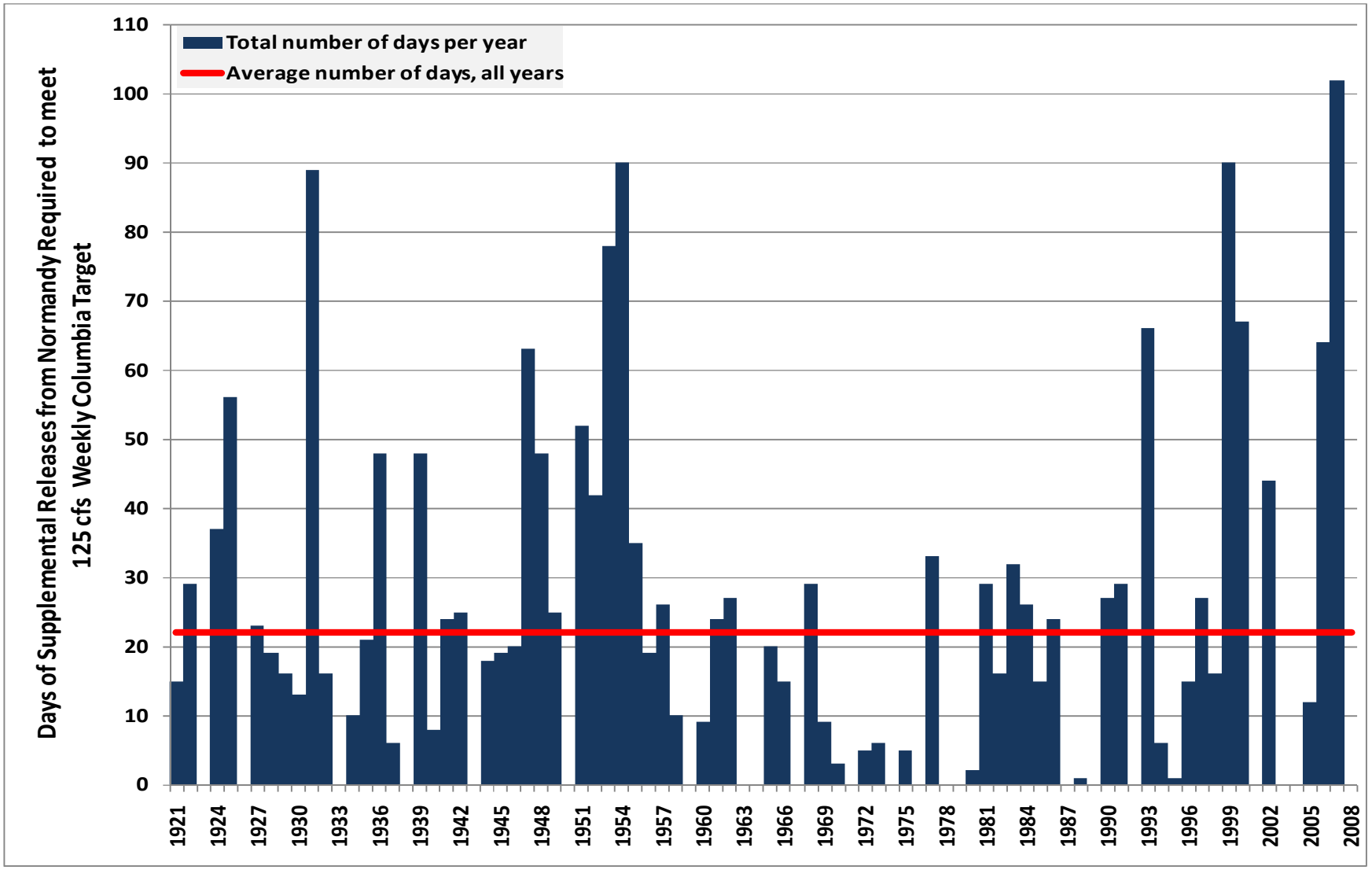
Number of days per year that extra water is needed to meet 125 cfs Columbia weekly flow target for 2060 demands



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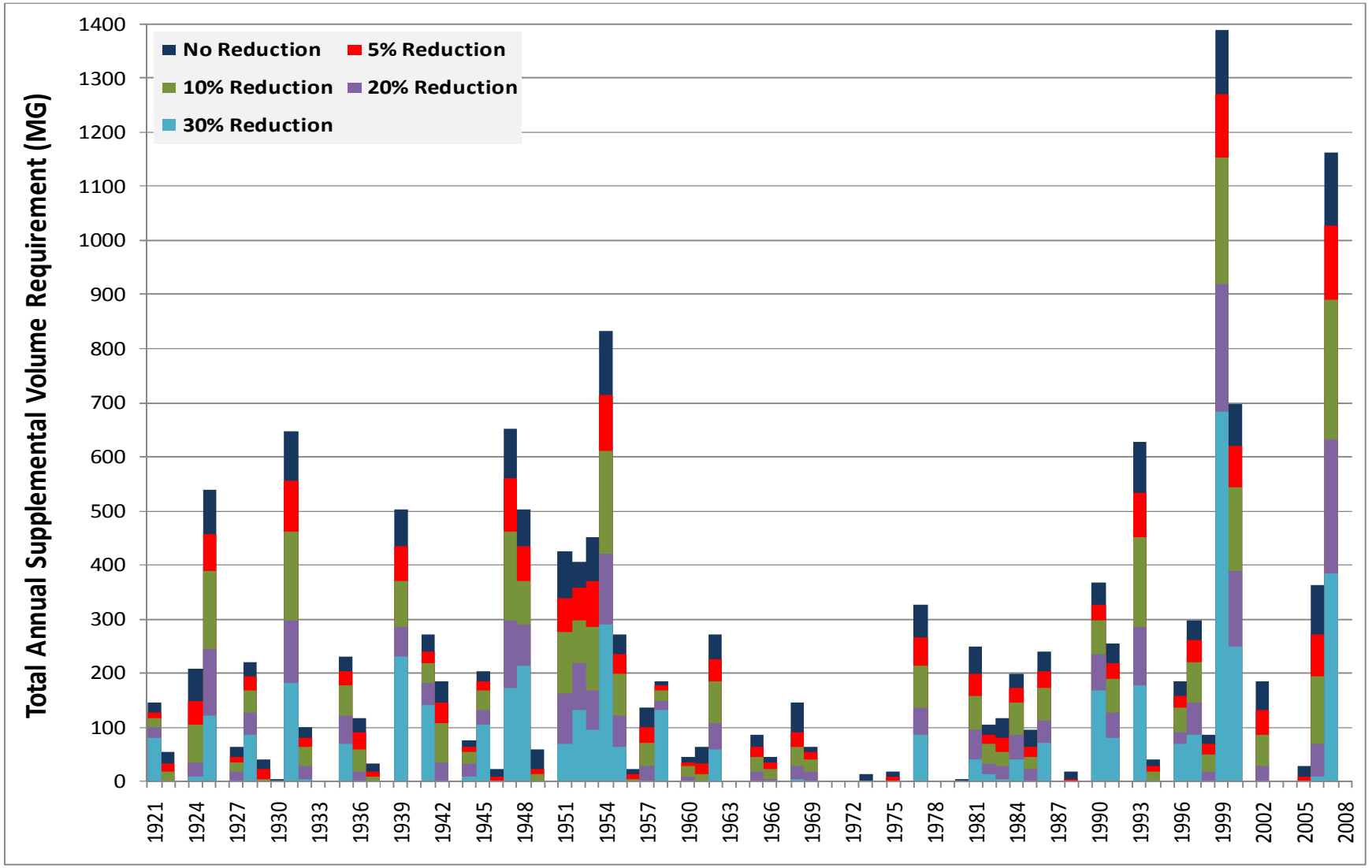
HYDROLOGICS
Advancing the management of water resources

Alt. #1: Supplemental annual volume required to maintain 125 cfs Columbia weekly avg. flow – 2060 demand with various reductions



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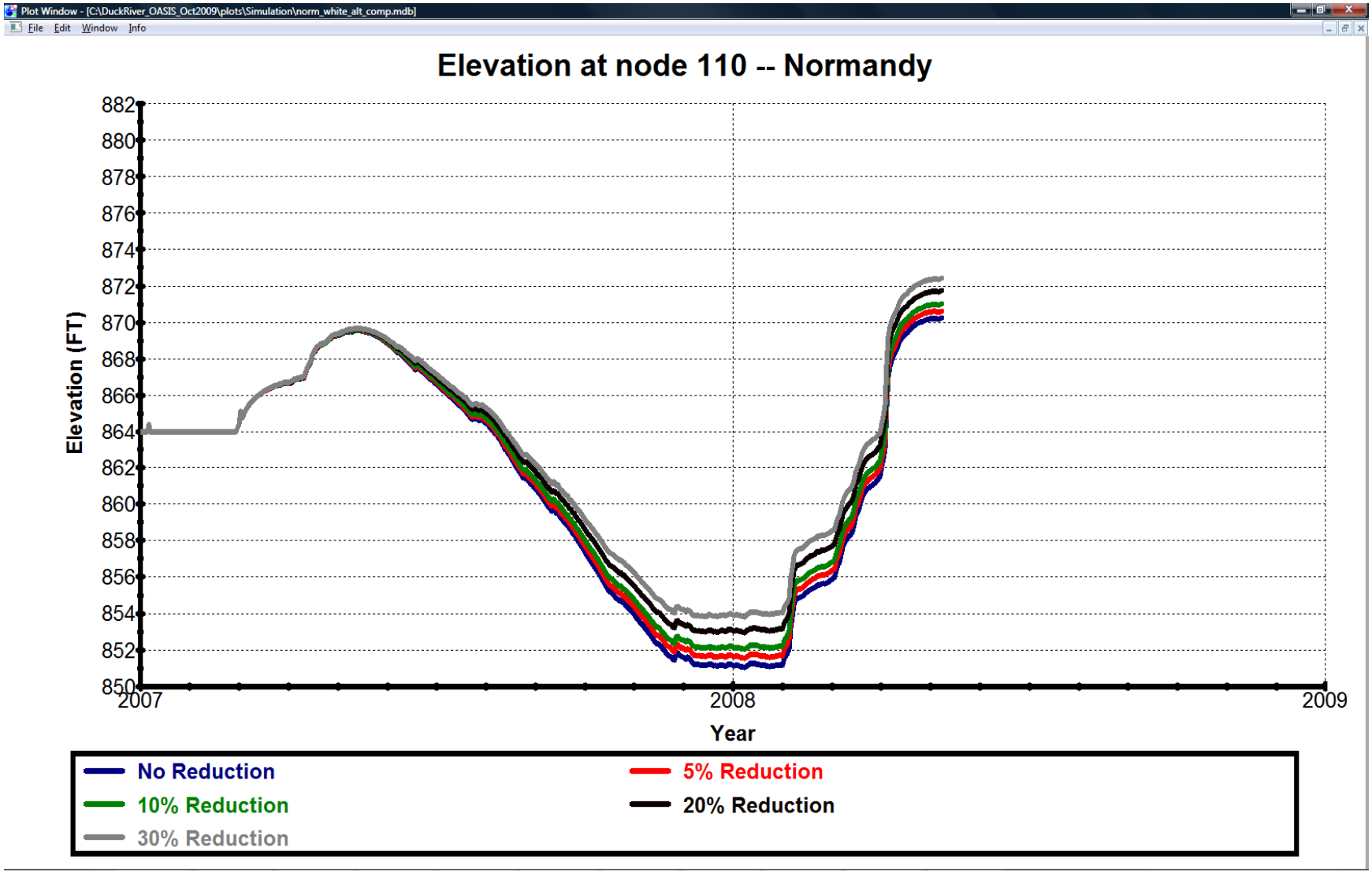
HYDROLOGICS
Advancing the management of water resources

Alt. #1: Normandy elevations – 2060 demand, 2007/2008 drought, comparison of demand reduction scenarios



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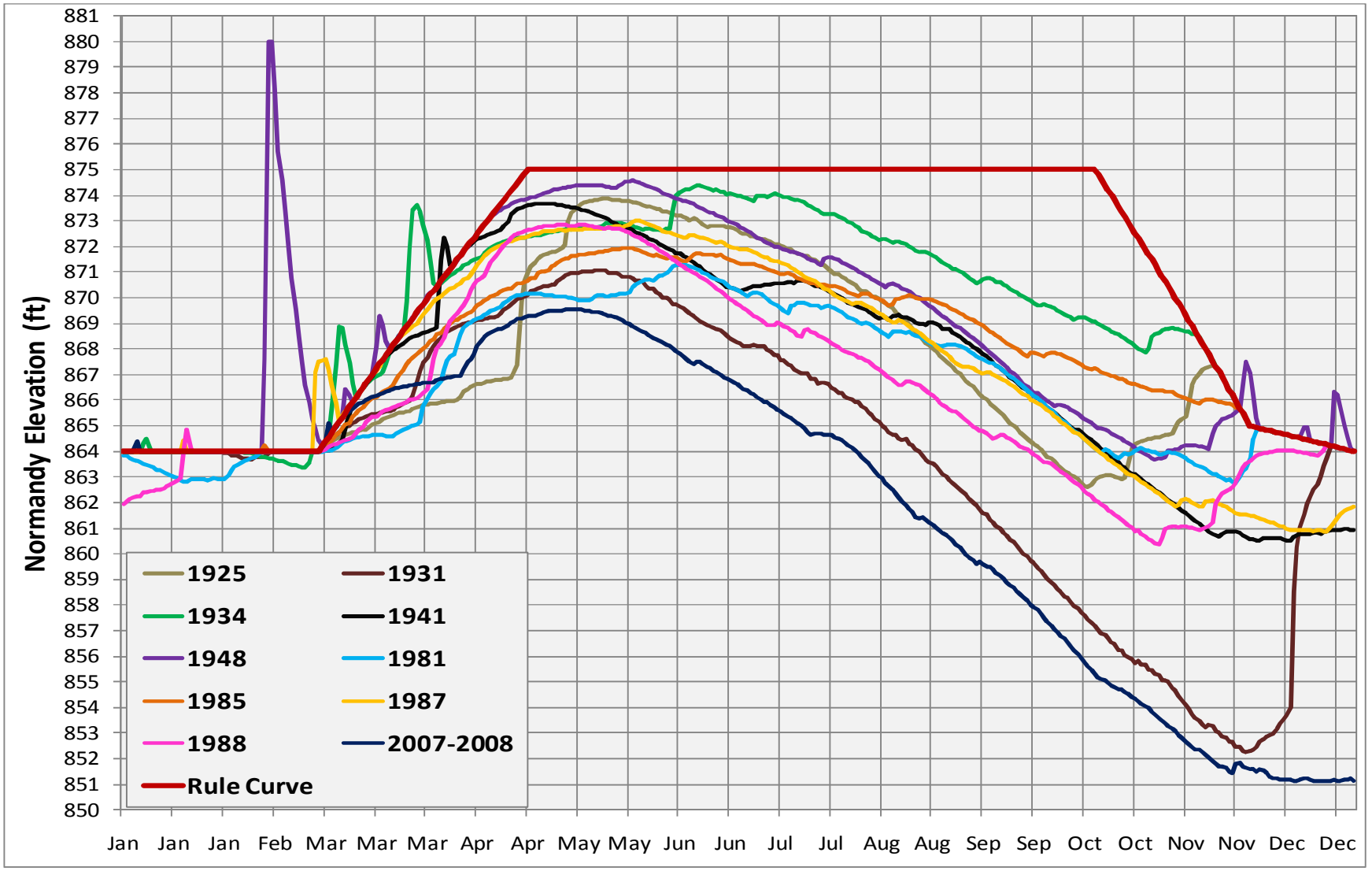
HYDROLOGICS
Advancing the management of water resources

Major droughts – Existing rule curve 2060 demand levels, 125 cfs weekly Columbia target



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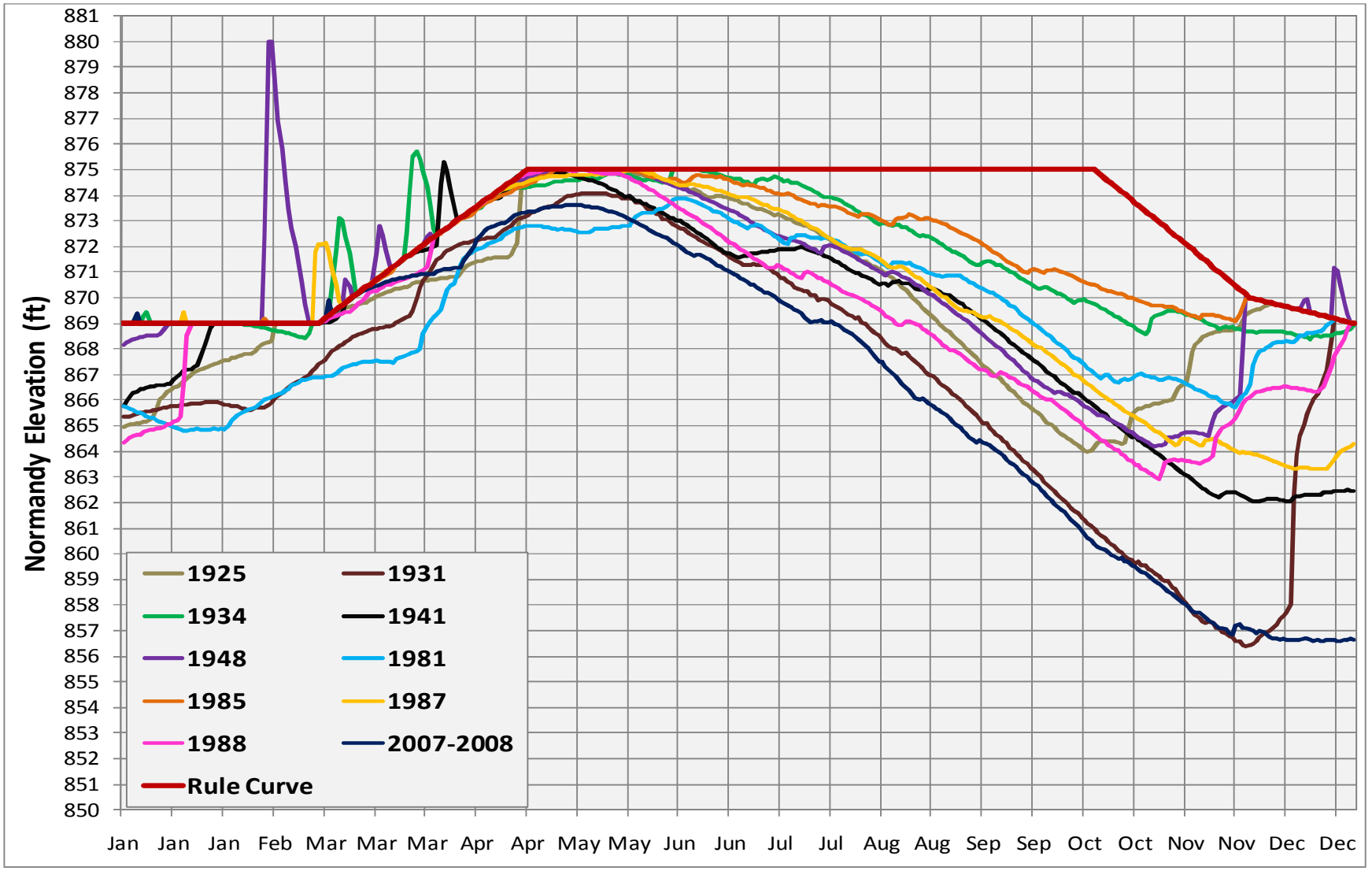
HYDROLOGICS
Advancing the management of water resources

Alts. #5 & #9: Major droughts – Modified rule curve 2060 demand levels, 125 cfs weekly Columbia target



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HYDROLOGICS
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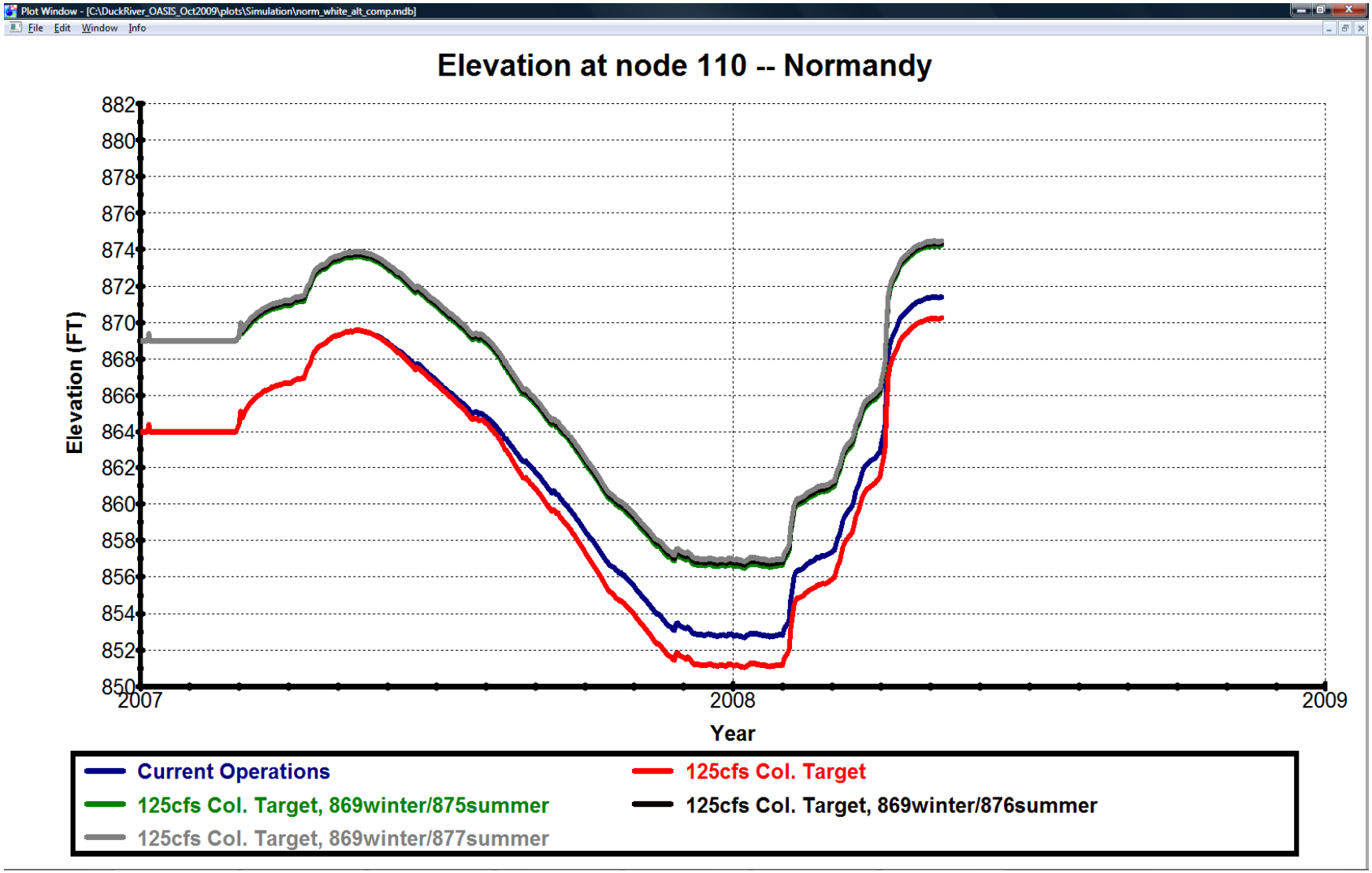
Alts. #5 & #9: Weekly Normandy elevations – 2060 demand, 2007/2008 drought, comparison of operating scenarios



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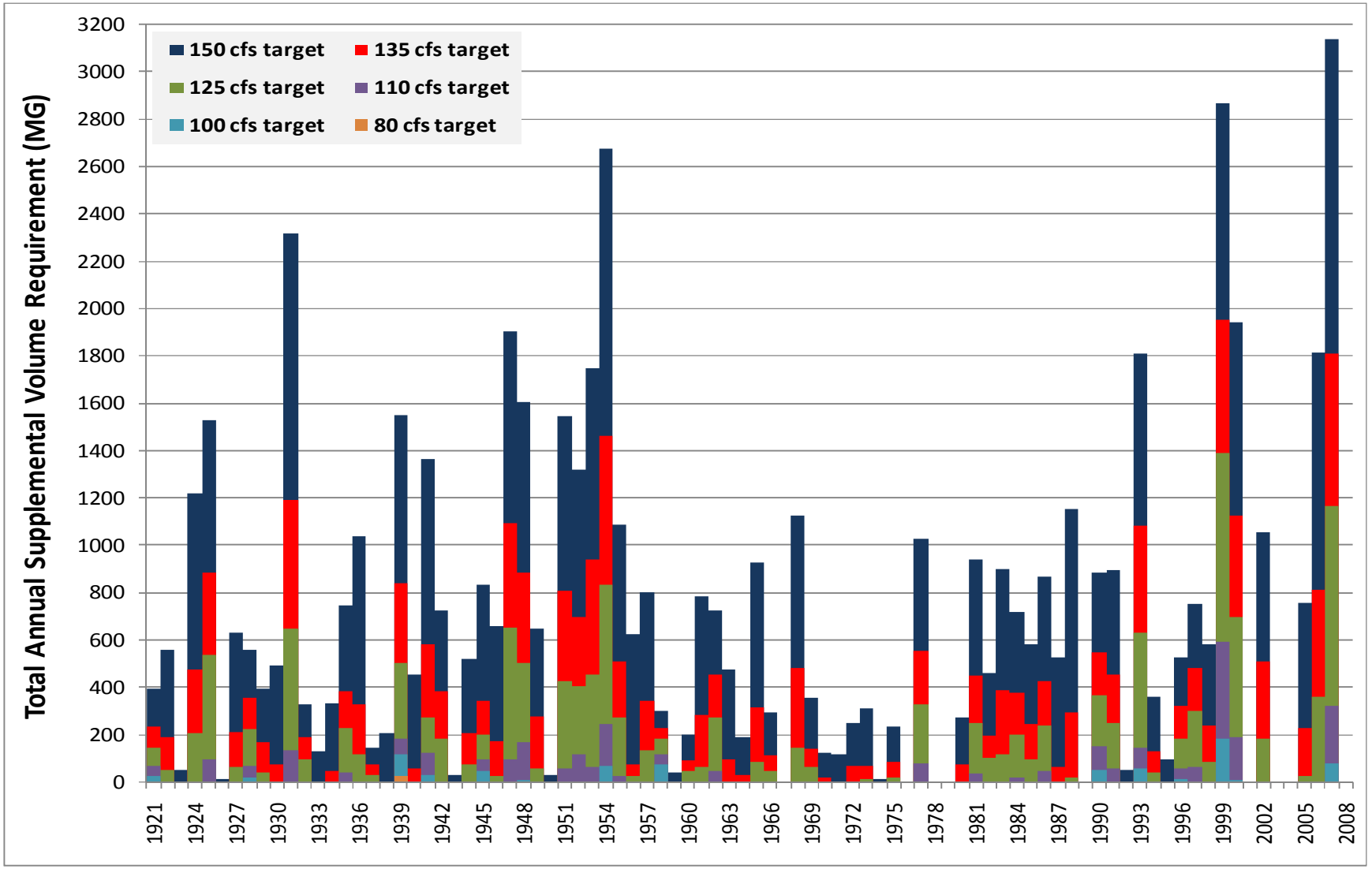
Alt. #8: Supplemental annual volume required to maintain Columbia weekly average flow at various targets – 2060 Demand Levels



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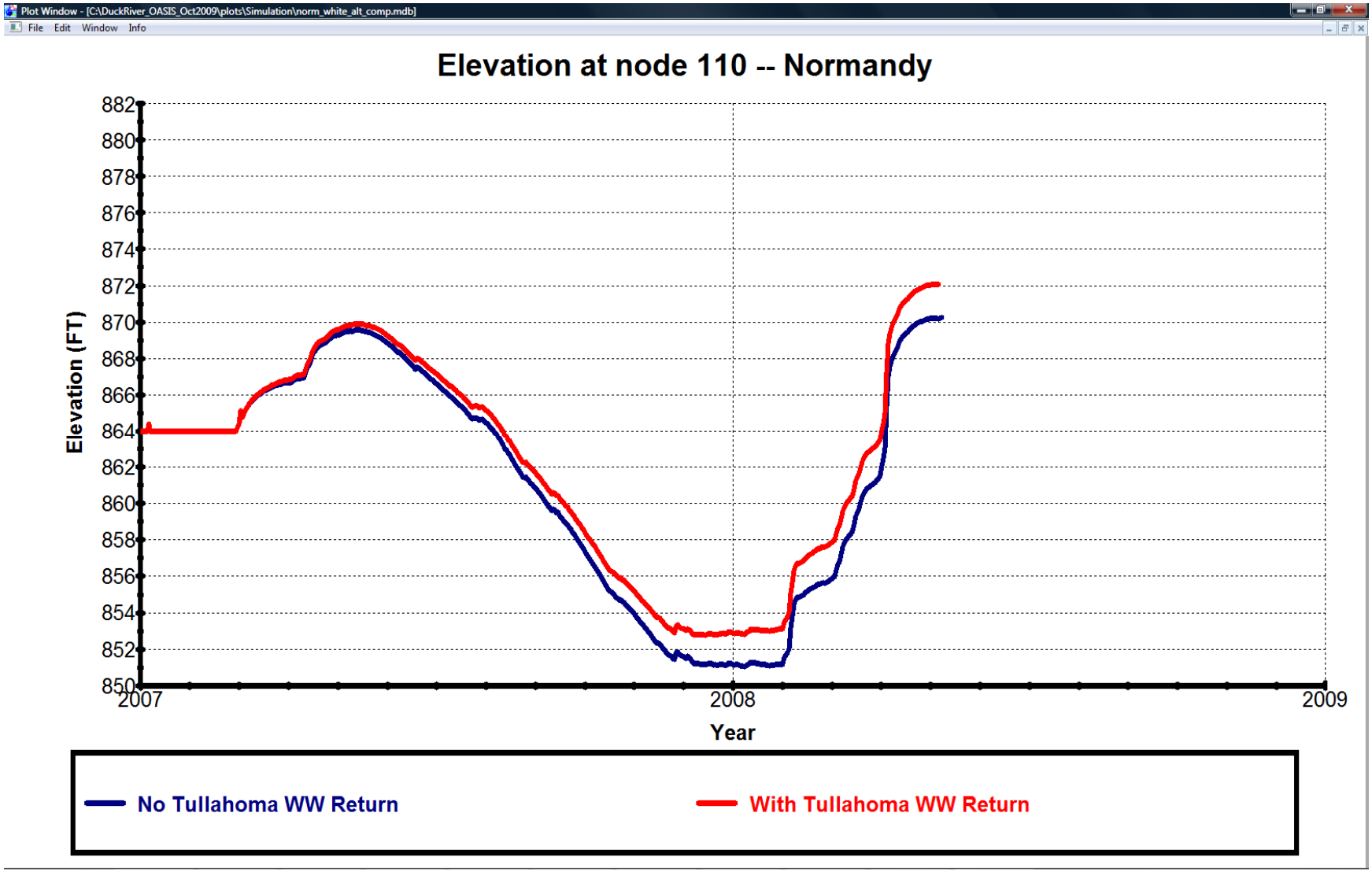
Alt. #26: Normandy elevations – 2060 demand, weekly 125 cfs Columbia target, comparison of Tullahoma WW scenario to current operation



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HYDROLOGICS
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Agenda

- Review of Minutes from Workshop No. 3
- Summary of Activities Since Workshop No. 3
- Objectives for Workshop No. 4
- Update on Needs Assessment
- Supplemental OASIS (hydrologic) Modeling
- **Environmental Permitting Briefing**
- Water Supply Alternatives Screening
- Next Steps

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Water Supply Alternatives Screening

- Getting Grounded:
  - Recap of the results from Workshop No. 3
  - Cost estimates
  - Affordability discussion
- Review each of 17 remaining "undetermined" alternatives
  - Updated Alternatives Matrix
  - Sort each of the 17 remaining alternatives into one of these groups:
    - **Fatally Flawed or Highly Unlikely** – eliminate from further consideration
    - **Backup** – separate from the "preferred" shortlist of alternatives, revisit later for possible combinations
    - **Cornerstone -** those alternatives in the "shortlist", receiving further consideration as cornerstone elements of the 50-year water supply plan

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Recap from Workshop No. 3 - Required Alternatives

- #9 – Raise Normandy Dam (Alternative D from 2000 PEIS)
- #12 – Construct Fountain Creek Reservoir (Alternative B from 2000 PEIS)
- #17 – Construct Pipeline from Tennessee River
- #18 – Construct Pipeline from Tims Ford Reservoir (Alternative E from 2000 PEIS)
- #24 – Construct New Water Intake for Maury County at River Mile 108 (Alternative C from 2000 PEIS)

Note: Today we can revise or eliminate the Required Alternatives



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Recap from Workshop No. 3 - Baseline Alternatives

- #1 – Water Efficiency Measures
- #3 – Regional Drought Management Plan
- #4 – Optimize Releases from Normandy Reservoir



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Recap from Workshop No. 3 - Fatally-Flawed and Highly Unlikely Alternatives

- #7 – Reduce Irrigation Withdrawals
- #14 – Upgrade Existing Columbia City Dam to Allow Releases
- #21 – Utilize Groundwater Sources
- #23 – Construct New Water Intake for Maury County at River Mile 163



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Recap from Workshop No. 3 - Alternatives with Undetermined Status

- #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels (with #10 - Improve DRUC Intake)
- #5 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam
- #6 – Modify Normandy Reservoir Flood Rule Curve
- #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir
- #13 – Construct Fountain Creek Reservoir with Downstream Release
- #15 – Build Offstream Storage Reservoir along Duck River (Monsanto Lake)
- #16 – Utilize Quarries
- #19 – Discharge Arnold Cooling Water to Duck River
- #20 – Purchase Water from Nearby Systems
- #22 – Pump Treated Wastewater from Columbia WWTP to Columbia Dam
- #25 – Construct New Water Intake at River Mile 108 and Pump Back to Columbia Dam Pool
- #26 – Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir

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Cost Methodology

- Concept (order-of-magnitude) level cost estimates:
  - Rule-of-thumb and unit pricing for:
    - Pipelines
    - Intakes
    - Pumping stations
    - Land acquisition
    - Permitting

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Capital Cost Estimates and "Nickel Fees"

- Capital Costs include:
  - Current estimated construction cost
  - Contingency of 20%
  - Allowance of 20% for engineering, legal and miscellaneous
  - Permitting
- "Nickel Fees":
  - Rough estimates include debt service and allowance for operations and maintenance

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Affordability

- In screening alternatives, it helps to get a feel for what is considered affordable:
  - If there are "good/better/best" options, at what point will cost inhibit the selection?
  - Points of reference:
    - Most expensive alternative (Tennessee River Pipeline) has capital cost of $165 M:
      - "Nickel fee" would increase by roughly $1.50/1,000 gallons sold
        - $10/month for each household
    - Monsanto Lake has capital cost of $45 M:
      - "Nickel fee" would increase by roughly $0.40/1,000 gallons for every gallon sold
        - $2.60/month for each household

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Evaluation Criteria

- Reliable Capacity
- Raw Water Quality
- Cost
- Implementability / Risk of Delays
  - permittable
  - public acceptance
  - property acquisition
- Flexibility
  - phased implementation
- Environmental Benefits
- Recreation

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Issues Related to Releasing Water from Normandy Reservoir to Satisfy Deficit at Columbia

- Normandy Reservoir Dam is located at Duck River Mile 248.6
- Shelbyville USGS gage is located at Duck River Mile 221.4 or 27 river miles downstream of Normandy Reservoir Dam (say 18 hours travel time for releases)
- Columbia USGS gage is located at Duck River Mile 132.8 or 116 river miles downstream of Normandy Reservoir Dam (80 hours travel time for releases)
- Factors that could impact ability of releases from Normandy Reservoir to efficiently match a target at Columbia:
  - Long travel time
  - Irrigation withdrawals
  - Inflows from tributary streams
  - Personnel and equipment limitations associated with monitoring river flows and reservoir releases

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Issues Related to Releasing Water from Normandy Reservoir to Satisfy Deficit at Columbia (continued)

- Conclusion: To satisfy deficit at Columbia, it requires more storage at Normandy Reservoir than at a location near Columbia
  - Difficult to estimate, but best guess is about 2-3 BG, rather than 1.4 BG

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#1 Water Efficiency Measures

- Required by EPA Region 4 prior to permitting new reservoir supplies
- Ongoing water efficiency programs address:
  - Leakage
  - Metering
  - Conservation/Wise use of water
  - Pricing of water
- Potential for 5% - 10% reduction of unrestricted demand
- Potential negative revenue impacts on utilities

- **Baseline Alternative**

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#2 Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels

- Satisfies entire river deficit of 32 mgd in 2060
- Includes improvements to DRUC Intake for access to lower pool water (formerly Alt. #10)
- Project cost $4 million
- EA or EIS required
- Need to identify if increased release has significant impact / environmental benefits

- **Status: Backup?** (alternative does not provide “new” water)

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#3 Regional Drought Management Plan

- Drought Plan would identify triggers to enact water restrictions, reductions in releases from Normandy Reservoir, etc.
- Potential for negative revenue impacts on utilities
- EA or EIS will be required for flow alteration

- **Baseline Alternative**

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#4 Optimize Releases from Normandy Reservoir

- Install additional stream gages and modify dam controls to more closely match flow requirements at Shelbyville
- Projected deficits used in this study were computed assuming optimization of releases from Normandy Reservoir

- **Baseline Alternative**

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#5 Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam

- Raise winter pool level from 864 ft to 869 ft to preserve winter storage
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users
- Satisfies entire river deficit of 32 mgd
- Increases flooding
- Project cost primarily for land acquisition in flood prone areas which is to be determined (additional information expected from FEMA to refine estimate of flood prone areas)

- **Status: Cornerstone?** (combine with Alt. #6)

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#6 Modify Normandy Reservoir Flood Rule Curve (Early Refill)

- Initiate refill of Normandy Reservoir earlier in Spring in order to capture high Spring flows
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users
- No added reliable capacity in most of historic droughts
- Increases flooding

- **Status: Backup?** (combine with Alt. #5)

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#8 Modify River Constraints to Preserve Storage in Normandy Reservoir

- Modify flow constraints at Columbia by changing instantaneous requirement of 100 cfs to weekly average (or similar) or by reducing 100 cfs instantaneous flow requirement
- May require improving wastewater treatment
- Environmental benefits associated with improvements in level of wastewater treatment
- EA or EIS required

- **Status: Backup?** (no indication that flow constraints will change)

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#9 Raise Normandy Dam

- Increase Winter/Spring pool level by 5 feet, but retain Summer/Fall pool level
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users
- Satisfies entire river deficit of 32 mgd
- Approach reduces impact on flora and hiking trails at Short Springs
- Project cost $15-30 million, depending on need to raise bridges, rebuild roads, etc.
- EA or EIS required
- Potential impacts to campgrounds and boat ramps

- **Status: Cornerstone?**

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#12 Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP

- Alternative includes reservoir intake, pumping station and pipeline to Columbia water treatment plant
- Satisfies entire river deficit of 32 mgd
- Reduces reliance on Normandy Reservoir
- Shallow reservoir may yield poor water quality
- Project cost $70 million (or more)
- EIS required
- Potential for substantial loss of wetlands
- Loss of riverine environment
- Rare, threatened or endangered species may exist in Fountain Creek
- **Status: Highly Unlikely?** (due to permitting obstacles…pursue only if based on other needs)

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#13 Construct Fountain Creek Reservoir with Downstream Release

- Alternative includes reservoir intake and release to Columbia Pool for withdrawal at existing Columbia Intake
- Satisfies entire river deficit of 32 mgd
- Reduces reliance on Normandy Reservoir
- Shallow reservoir may yield poor water quality
- Project cost $43 million (or more)
- EIS required
- Potential for substantial loss of wetlands
- Loss of riverine environment
- Rare, threatened or endangered species may exist in Fountain Creek
- **Status: Highly Unlikely?** (due to permitting obstacles…pursue only if based on other needs)

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#15 Monsanto Lake (Existing Offstream Storage Reservoir)

- Purchase Monsanto Lake, which is a 5 BG offstream storage reservoir along Duck River approximately 8 miles northwest of Columbia
- Utilize existing Columbia intake, upgrade existing Columbia pumping station, and construct 42-inch pipeline (10 miles) from reservoir to Columbia WTP to convey water from reservoir to WTP, and to refill reservoir from the Duck River
- $45 million capital cost
- Appears readily permittable
- Satisfies entire river deficit of 32 mgd
- Reduces reliance on Normandy Reservoir
- Potential for fishing and other recreational opportunities
- Awaiting water quality data, and report on recommended dam improvements
- **Status: Cornerstone?**

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#16 Utilize Quarries

- Utilize storage in existing inactive quarries (300 MG) to supply flow to Duck River during low flow conditions
- Construct intake and pumping station along Duck River and piping to refill quarry from Duck River during high flows with supply back to Duck River during low flows
- Existing quarry satisfies a small portion of the deficit for river users
- Project cost $4 million
- Active quarries could provide additional storage capacity in the future

- **Status: Backup?** (due to relatively small storage volume)

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#17 Construct Pipeline from Tennessee River to Columbia WTP

- Construct intake and pumping station and pipeline from Tennessee River to Columbia (60 miles)
- Satisfies entire 32 mgd river deficit
- Reduces reliance on Normandy Reservoir
- Most expensive alternative, at $165 million project cost
- Energy intensive to operate

- **Status: Highly Unlikely?** (due to high cost and energy requirements)

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#18 Construct Pipeline from Tims Ford Reservoir

- Construct intake and pumping station at Tims Ford and pipeline to Normandy Reservoir or DRUC WTP
- Satisfies entire 32 mgd river deficit
- Reduces reliance on Normandy Reservoir
- Complex permitting issues
- Environmental and interstate issues and local opposition
- $25 million project cost

- **Status: Highly Unlikely?** (complex permitting and significant opposition)

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#19 Convey Arnold Cooling Water to Normandy Reservoir

- Construct a 24-inch pipeline to convey cooling water from the cooling lake at Arnold AFB to Normandy Reservoir
- Cooling lake obtains water pumped from Woods Reservoir (approximately 25 BG total storage) which was constructed exclusively for water supply (1 mgd) and cooling water for Arnold AFB
- $8 million project cost
- Should be readily permittable, but Arnold AFB would need to identify any restrictions on use to assess reliability
- Concerns related to temperature of cooling water and potential contamination

- **Status: Backup?** (potential lack of control makes this poor fit as cornerstone)

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#20 Purchase Water from Nearby Systems

- Closest systems do not have substantial available capacity
- Up to 50 miles of pipeline required to reach Nashville
- Requires interbasin transfer

- **Status: Highly Unlikely?** (potential high costs and lack of control)

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#22 Pump Water from Columbia WWTP to Below Columbia Dam

- Construct pumping station at Columbia WWTP and pipeline (5 miles) to return treated wastewater to location just downstream of Columbia Dam
- Satisfies up to 20 mgd of 32 mgd river deficit
- Reduces reliance on Normandy Reservoir
- Higher levels of wastewater treatment may be required to avoid impacts on river water quality where threatened and endangered species exist

- **Status: Highly Unlikely?** (due to potential permitting obstacles)

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#24 Construct Water Intake near Williamsport and Pump Back to Columbia WTP

- Construct new intake at River Mile 108 near Williamsport and pipeline to Columbia water treatment plant (17 miles)
- Satisfies entire river deficit of 32 mgd
- $56 million project cost
- EIS required, but should be permittable
- Reduces reliance on Normandy Reservoir

- **Status: Cornerstone?**

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#25 Construct New Intake for Maury County at River Mile 108 and Pump Back to Columbia Dam Pool

- Same as Alternative #24, except water pumped to Columbia Dam pool rather than Columbia WTP
- Potential for adverse impact of pumped water on the reach of Duck River just below Columbia
- **Status: Highly Unlikely?** (compared to Alt. #24)

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#26 Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir

- Construct pumping station and pipeline to return treated wastewater to Normandy Reservoir
- Return flows estimated to increase to about 3 mgd by 2060
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users
- Project cost $16 million
- Satisfies portion of 32 mgd river deficit for downstream users
- Must meet TDEC water quality requirements for discharge, but current level of treatment may be adequate
- Potential for adverse impact and opposition if flow is removed from existing receiving stream

- **Status: Highly Unlikely?** (difficult permitting)

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Feedback Period



PARTICIPANT INPUT / COMMENTS QUESTIONS

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Status of Required Alternatives from Workshop No. 3

- #9 – Raise Normandy Dam (Modified from Alternative D from 2000 PEIS), with no change in Summer Pool Elevation
  - **Cornerstone**
- #12 – Construct Fountain Creek Reservoir (Alternative B from 2000 PEIS)
  - **Highly Unlikely** pursue only if based on other needs.
- #17 – Construct Pipeline from Tennessee River.
  - **Highly Unlikely** based on high cost and energy use.
- #18 – Construct Pipeline from Tims Ford Reservoir (Modified from Alternative E from 2000 PEIS)
  - **Highly Unlikely**
- #24 – Construct New Water Intake for Maury County at River Mile 108 (Modified from Alternative C from 2000 PEIS)
  - **Cornerstone**

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Status of Alternatives With Undetermined Status from Workshop No. 3

- #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels (with #10 - Improve DRUC Intake or #11 - Construct Second DRUC Intake). **Backup** due to inefficiency of releasing over 116 river mile, and absence of "new water"
- #5/#6 – Modify Normandy Reservoir Flood Rule Curve Without Raising Dam. **Cornerstone**
- #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir. **Backup** due to inefficiency of releasing over 116 river mile, and absence of "new water"
- #13 – Construct Fountain Creek Reservoir with Downstream Release. **Highly Unlikely** for water supply, pursue only if based on other needs (recreation, flood control, etc).
- #15 – Monsanto Lake (Offstream Storage Reservoir along Duck River). **Cornerstone**
- #16 – Utilize Quarries. **Backup** relatively small amount of storage capacity in currently inactive quarries
- #19 – Convey Arnold Cooling Water to Normandy Reservoir. **Backup** potential lack of control makes this poor fit as cornerstone
- #20 – Purchase Water from Nearby Systems. **Highly Unlikely** unlikely long term supply and potential lack of control make this poor fit as cornerstone.
- #22 – Pump Treated Wastewater from Columbia WWTP to Columbia Dam. **Highly Unlikely**, due to potential permitting obstacles
- #24 – Construct New Water Intake at River Mile 108 and Pump Back to Columbia WTP **Cornerstone**
- #25 – Construct New Water Intake at River Mile 108 and Pump Back to Columbia Dam Pool **Highly Unlikely** #24 is better alternative
- #26 – Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir. **Highly Unlikely**

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Possible Grouping of Alternatives

- Alternatives involving use of Normandy Reservoir to meet constraint at Columbia

- Alternatives that supplement downstream water supplies (near Columbia)

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Eight Alternatives Involving Use of Normandy Reservoir to Meet Constraint at Columbia

- #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels , **Backup**
- #5/#6 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam/Flood Rule Curve Modifications to Meet Columbia Constraint **Cornerstone**
- #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir **Backup**
- #9 – Raise Normandy Dam, no increase in summer pool elevation **Cornerstone**
- #18 – Construct Pipeline from Tims Ford Reservoir **Highly Unlikely**
- #19 – Convey Arnold Cooling Water to Normandy Reservoir **Backup**
- #26 – Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir **Highly Unlikely**

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Nine Alternatives that Supplement "Downstream" Water Supplies (Most Near Columbia)

- #12 or #13 – Construct Fountain Creek Reservoir **Highly Unlikely**
- #15 – Monsanto Lake (Offstream Storage Reservoir along Duck River) **Cornerstone**
- #16 – Utilize Quarries **Backup**
- #17 – Construct Pipeline from Tennessee River **Highly Unlikely**
- #20 – Purchase Water from Nearby Systems **Highly Unlikely**
- #22 – Pump Treated Wastewater from Columbia WWTP to Columbia Dam **Highly Unlikely**
- #24 – "Pump-back" to Columbia WTP **Cornerstone**
- #25 – "Pump-back" to Columbia Dam Pool **Highly Unlikely** (Alt. #24 is better alternative)

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Project Schedule Status

PHASE I	
Workshop No. 1 - Kick-off	June 24, 2009
Workshop No. 2 - Preliminary Feasibility	Aug. 26, 2009
Open House Meetings	Sept. 22-24, 2009
PHASE II	
Workshop No. 3 - Developing Alt's	Dec. 9, 2009
Workshop No. 4 - Evaluating Alternatives	**Feb. 24, 2010**
Open House Meetings	**March 2010**
PHASE III	
Workshop No. 5 - Implementation Planning	April 2010
Draft Report	May 2010
Workshop No. 6 - Conclusions	June 2010
Final Report	July 2010
Open House Meetings	Aug. 2010

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Next Steps

- Open House Workshop Preparation
- Prior to Workshop No. 5
  - Prepare additional information for review at Workshop No. 5
  - Combine each Cornerstone Alternative with compatible Backup Alternatives
- Workshop No. 5
  - Select Cornerstone Alternative for inclusion in 50-year water supply plan
  - Identify Backup Alternatives that are most compatible for the 50-year water supply plan
- Workshop No. 6
  - Present Implementation Plan and Draft Report

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Workshop No. 4



Thank You!

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Duck River Comprehensive Regional Water Supply Plan

Workshop No. 4 / February 24, 2010

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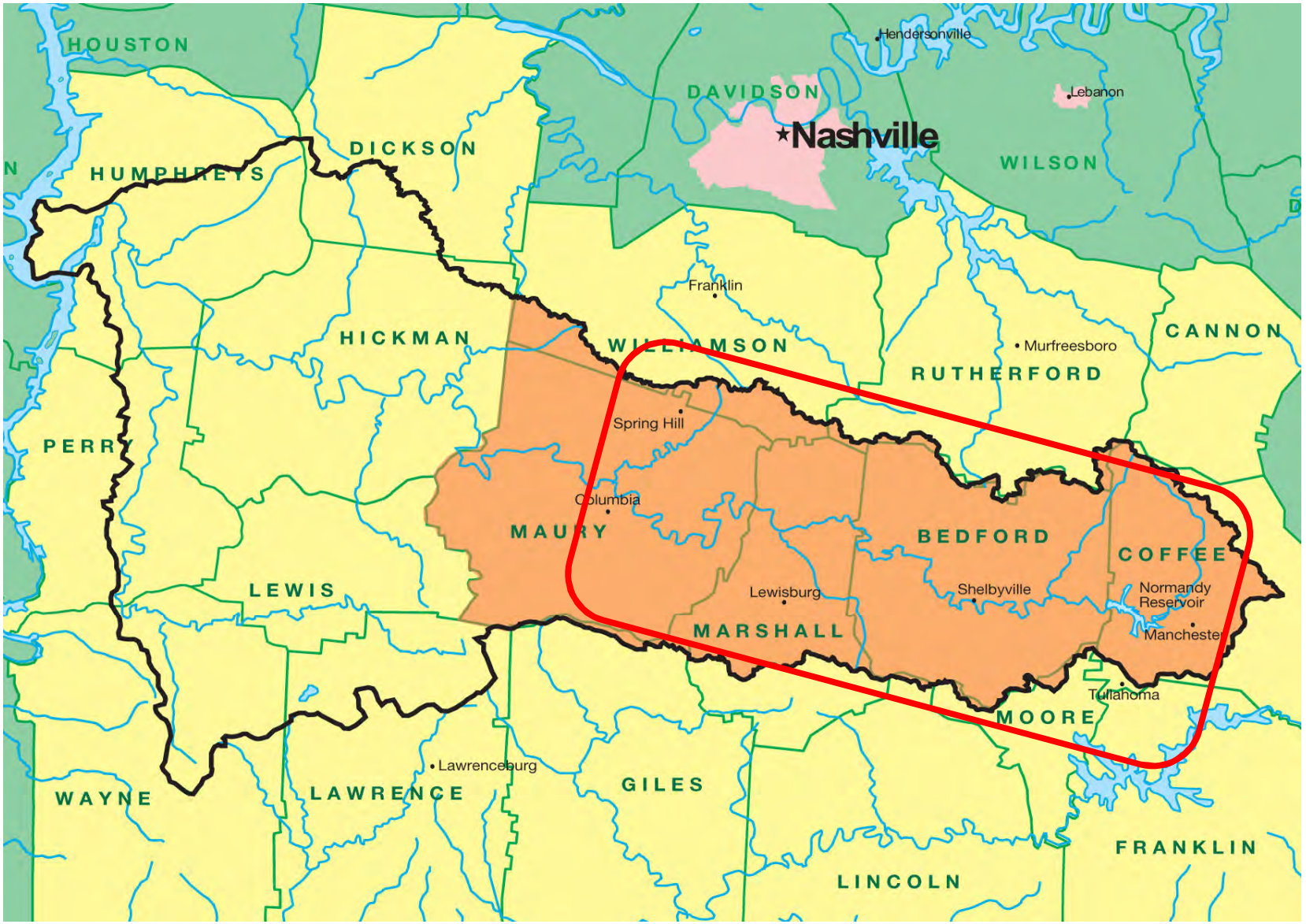
#1 Water Efficiency Measures



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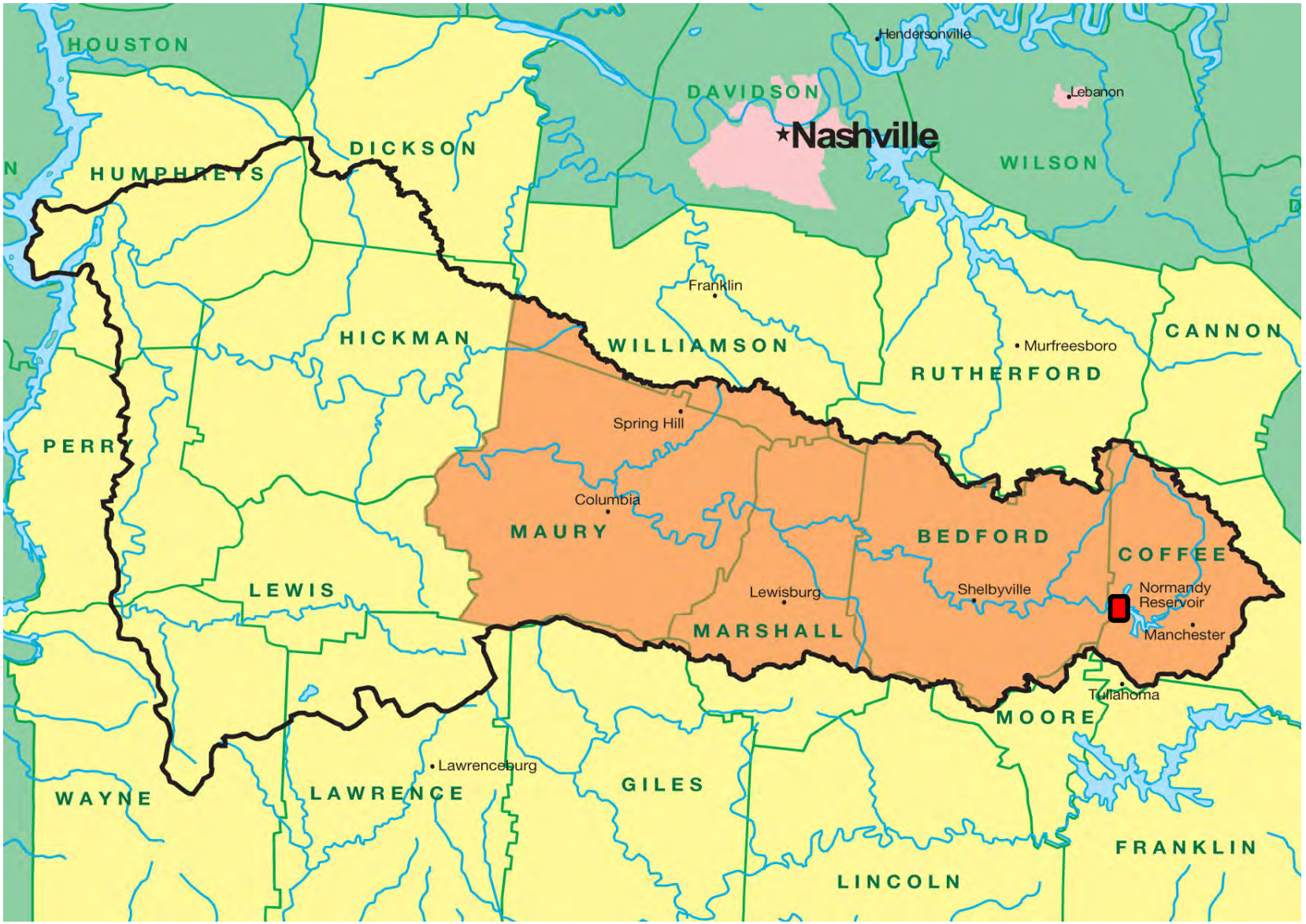
#2 Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool



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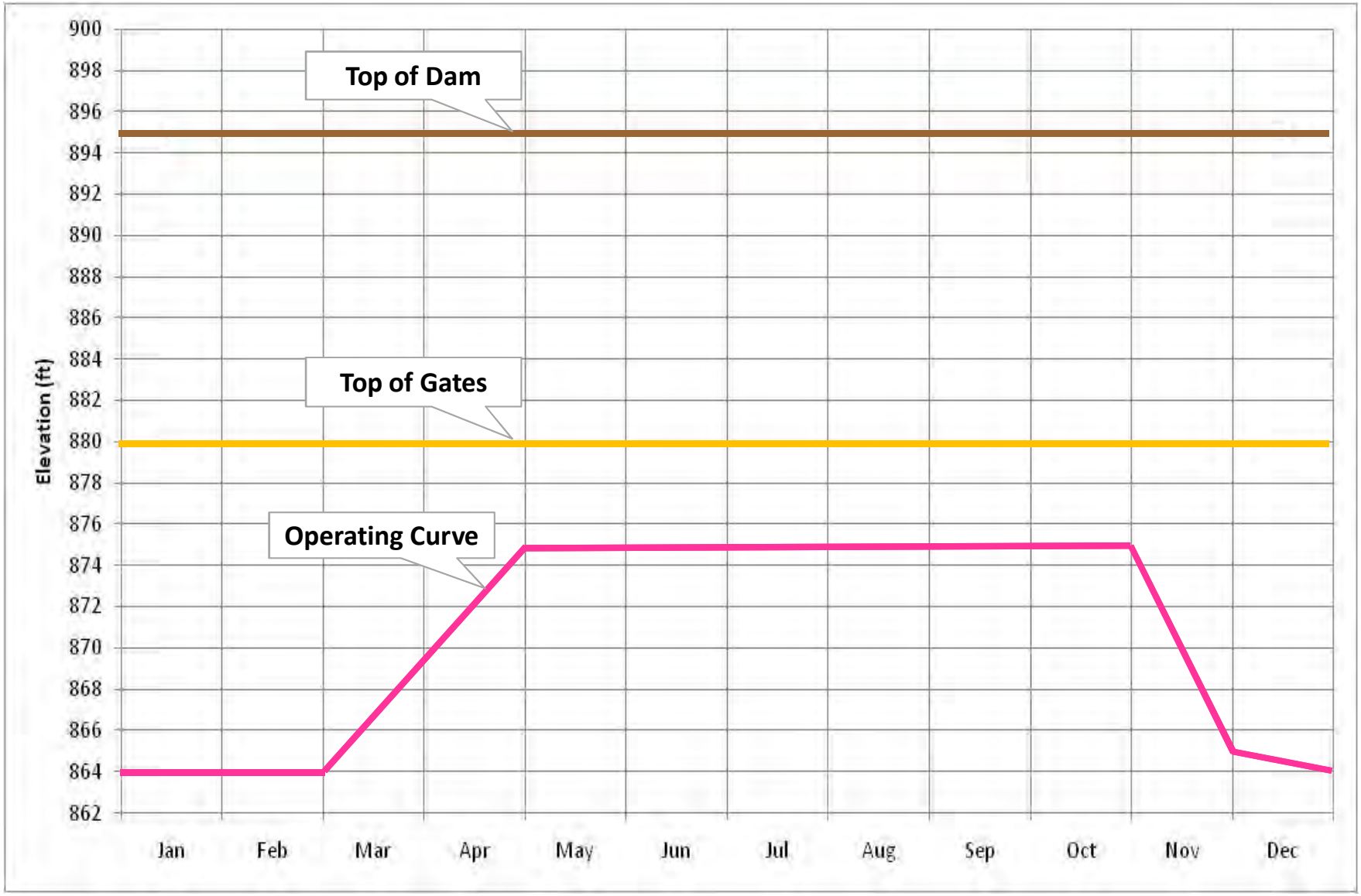
#2 Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool



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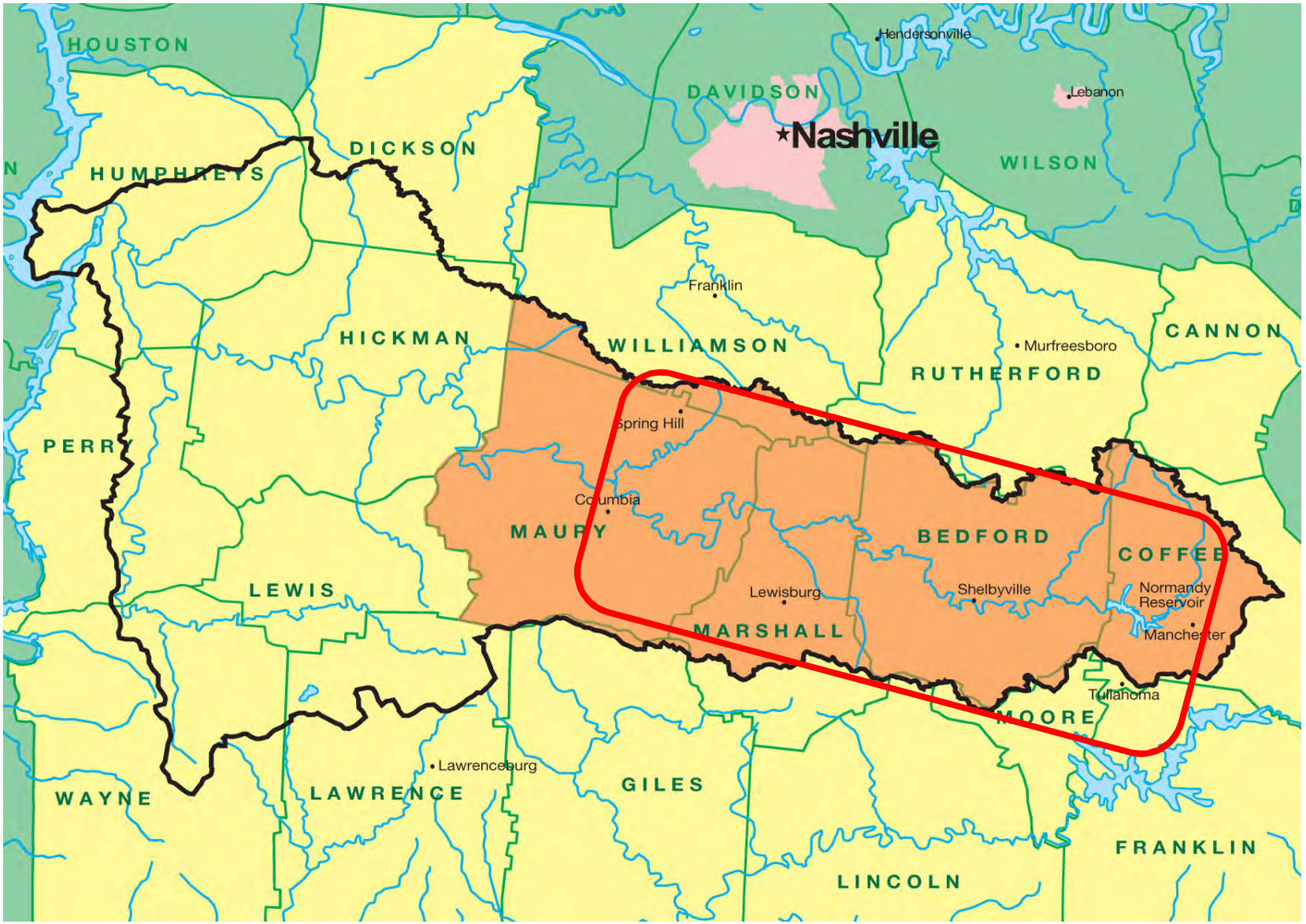
#3 Regional Drought Management Plan



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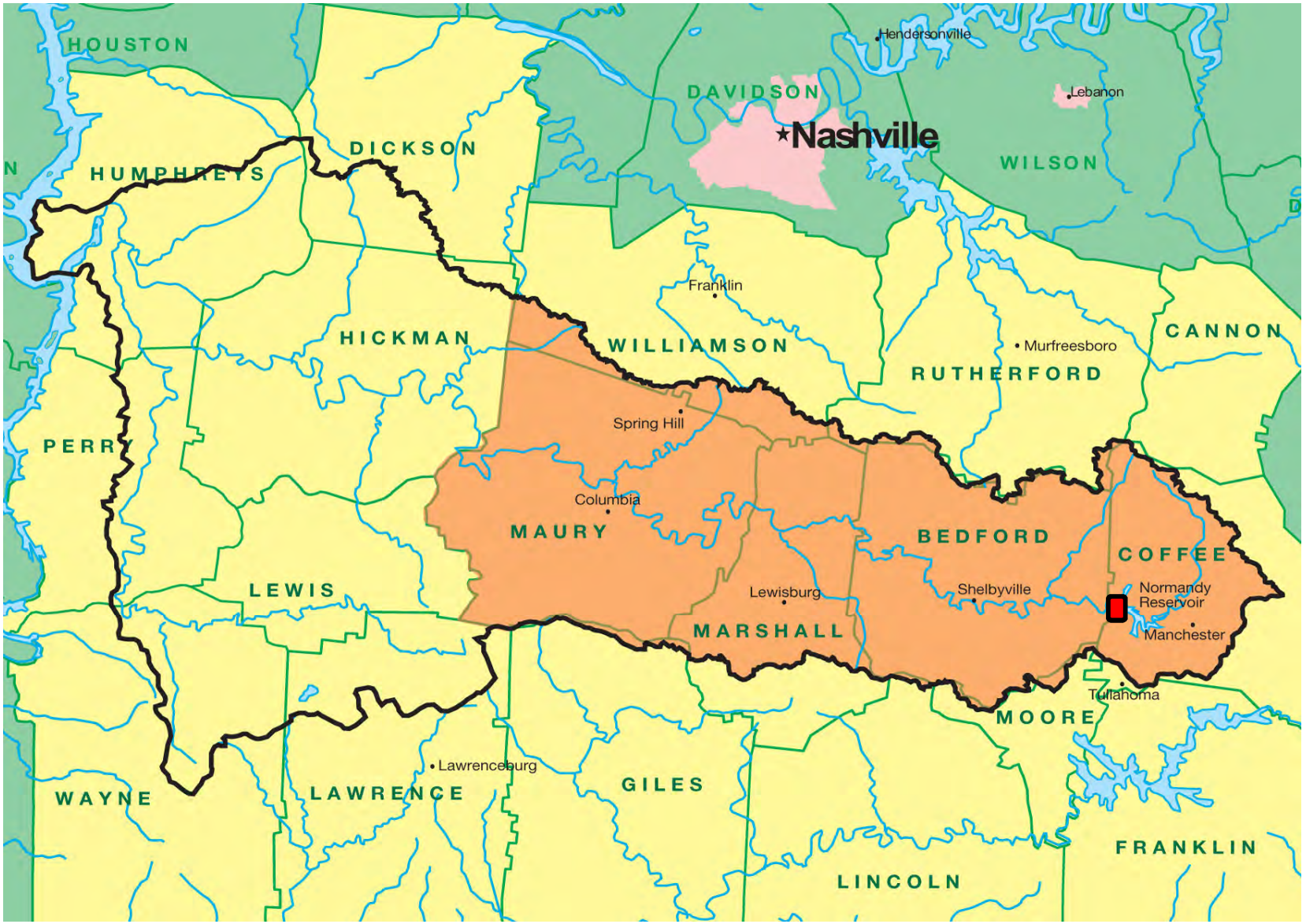
#4 Optimize Releases from Normandy Reservoir



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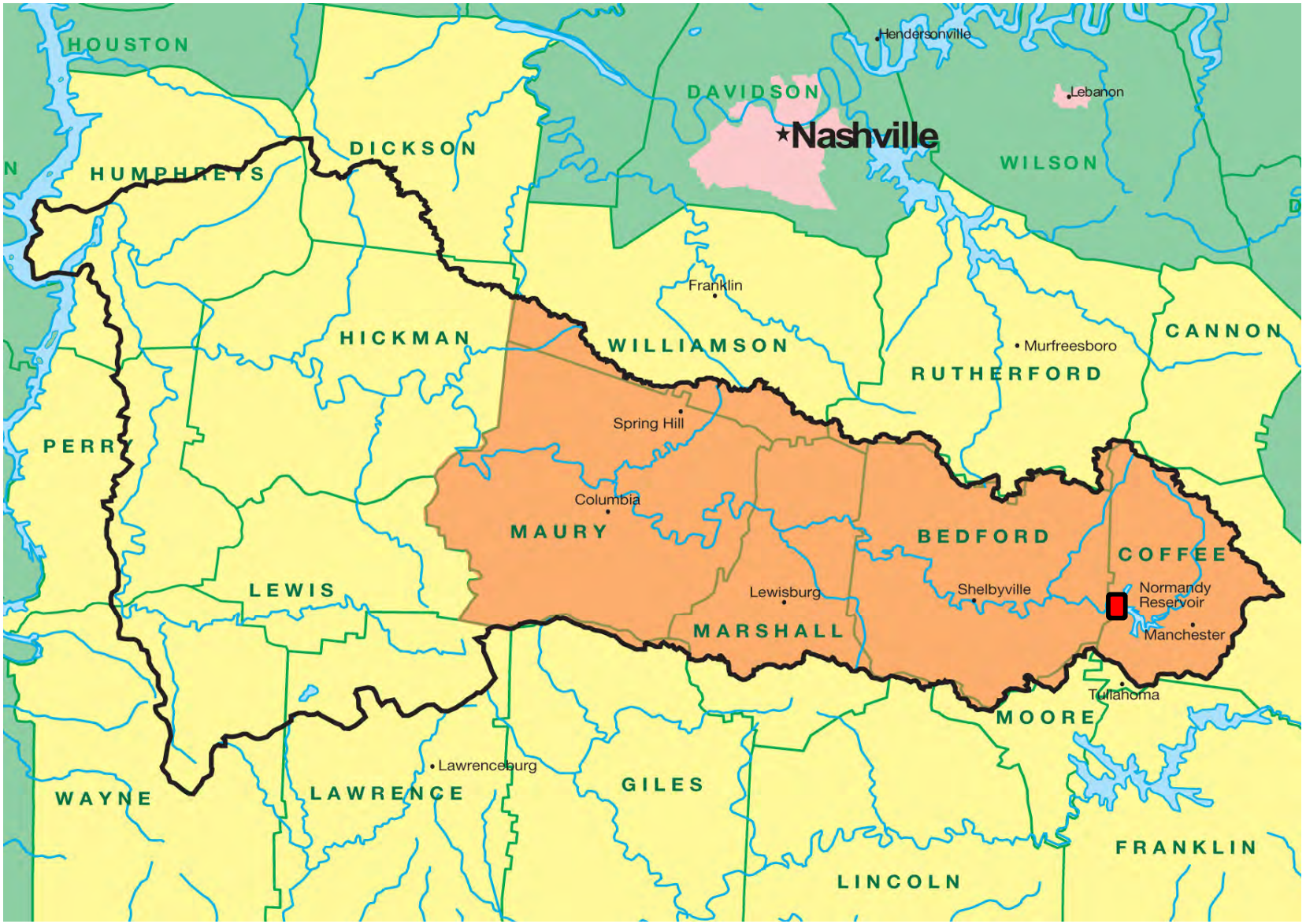
#5 Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam



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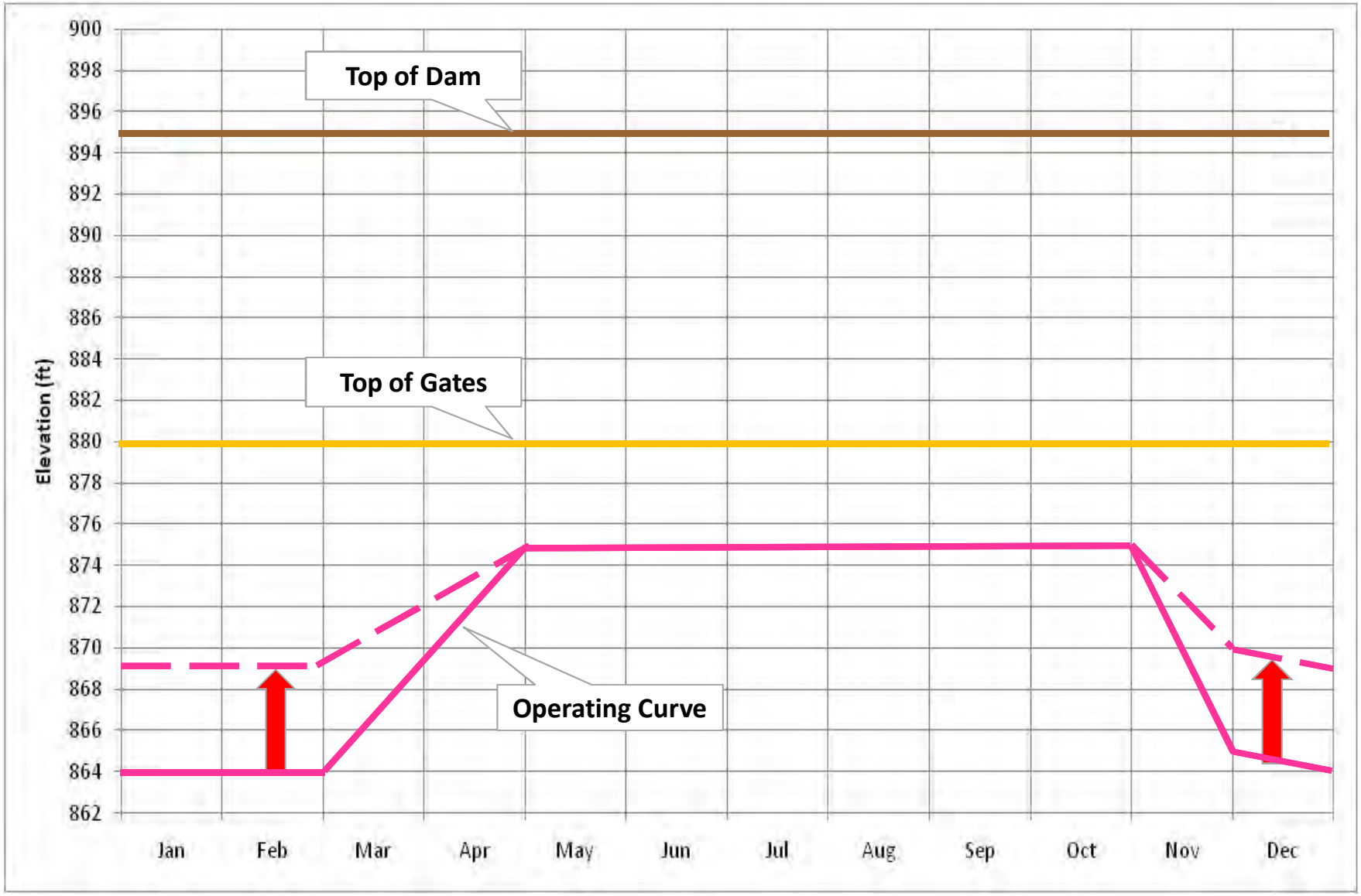
#5 Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam



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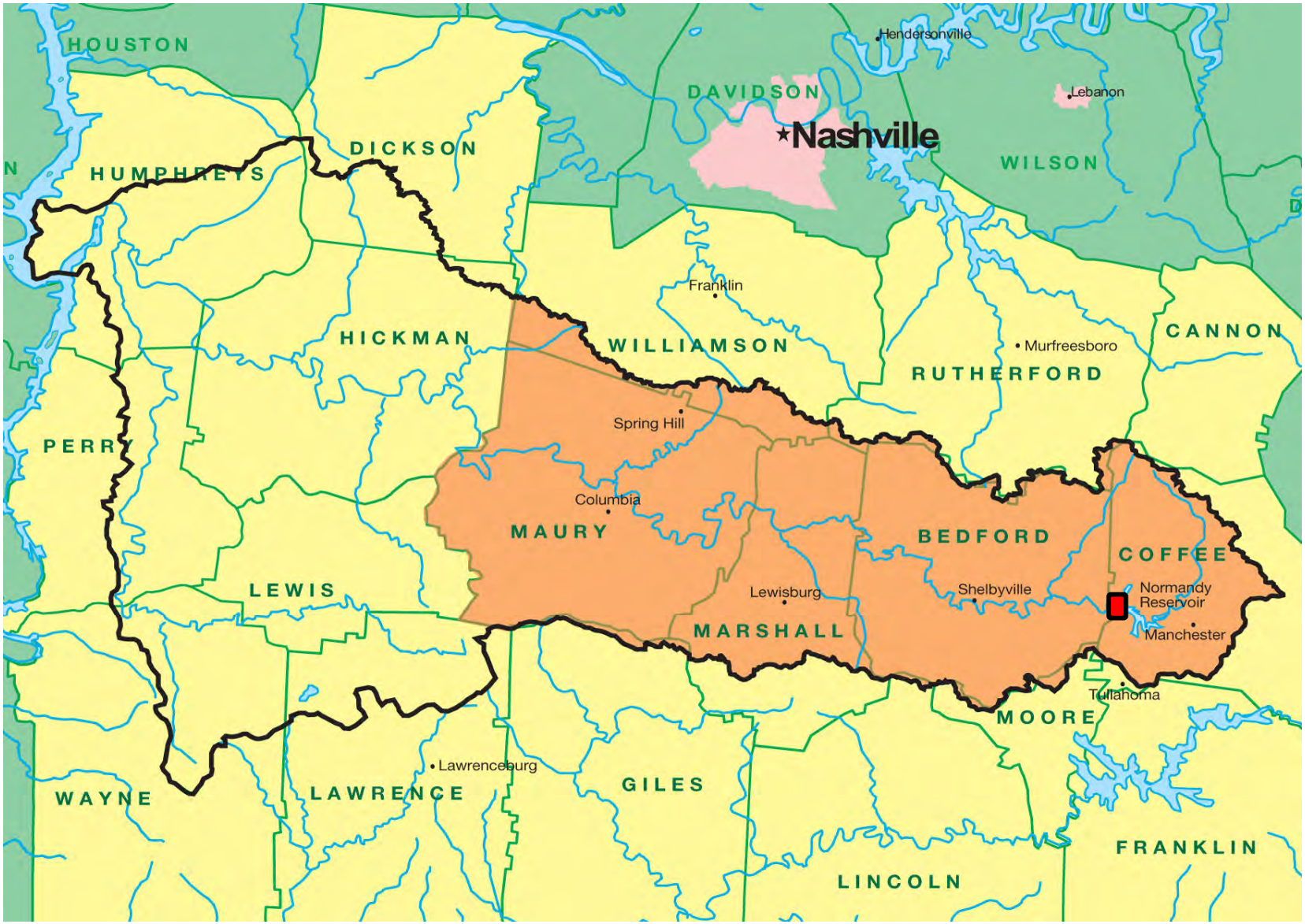
#6 Modify Normandy Reservoir Flood Rule Curve (Early Refill)



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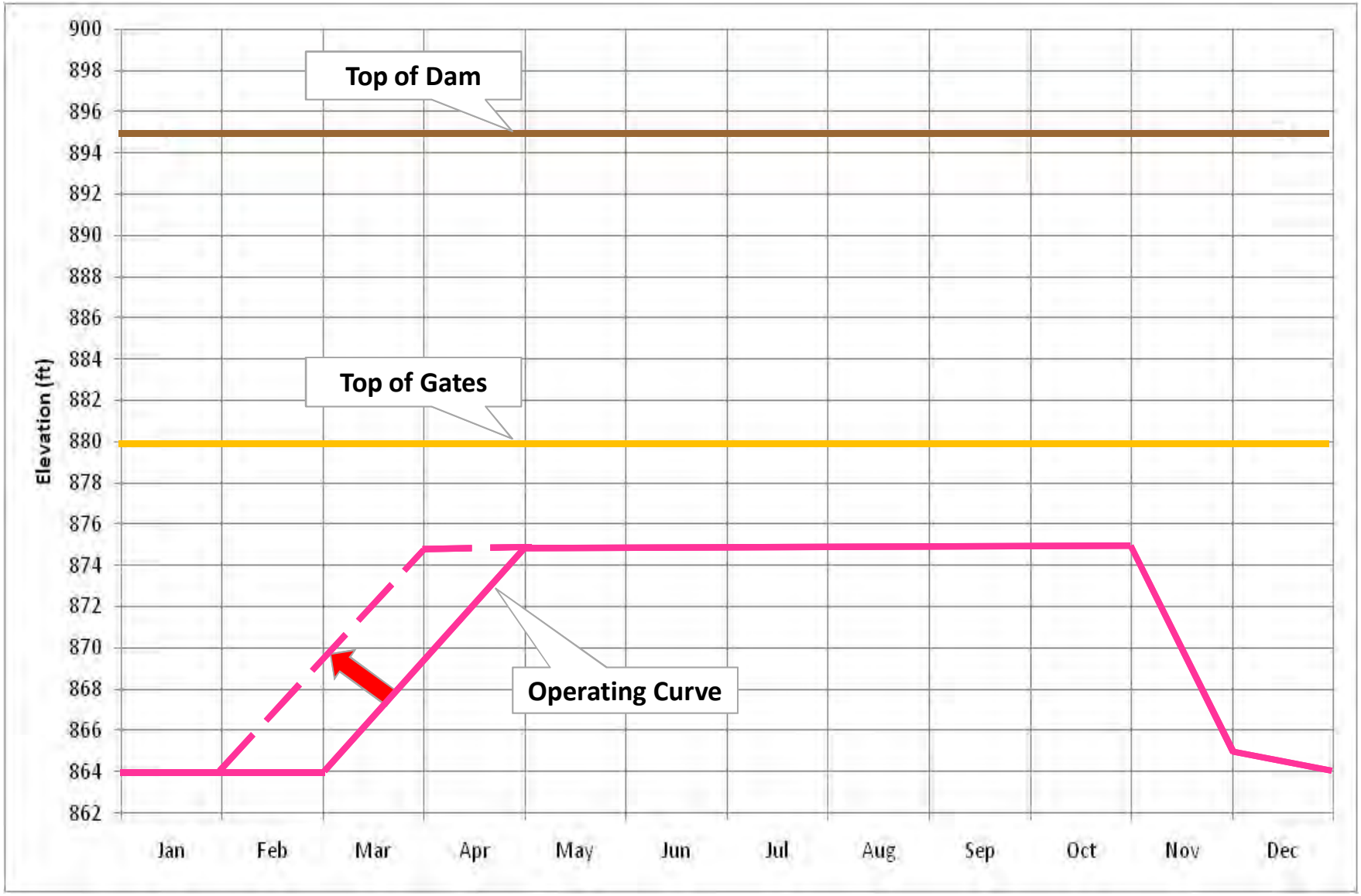
#6 Modify Normandy Reservoir Flood Rule Curve (Early Refill)



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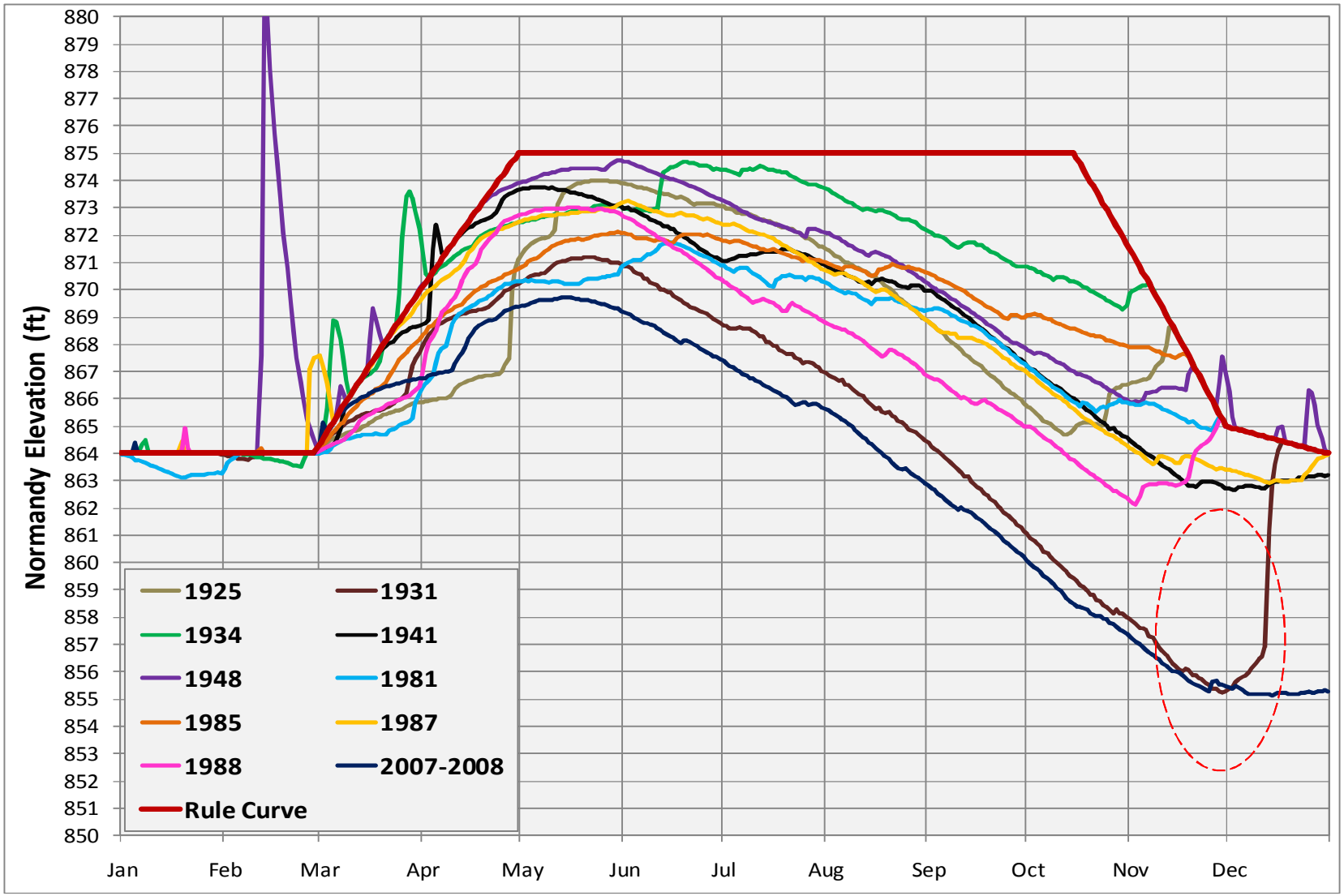
Major Droughts – Existing Rule Curve
2010 Demand Levels



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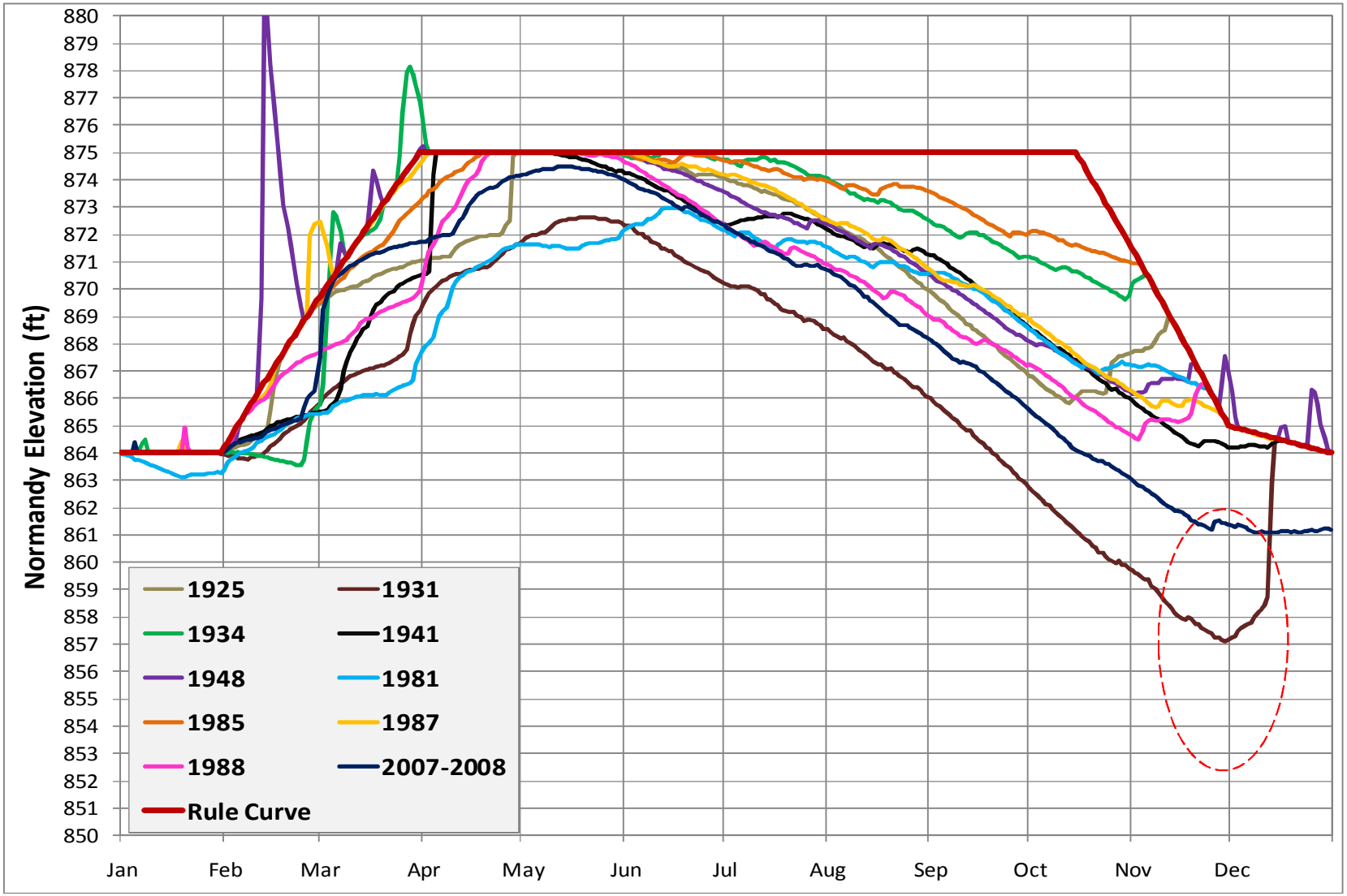
Major Droughts – New Rule Curve
2010 Demand Levels



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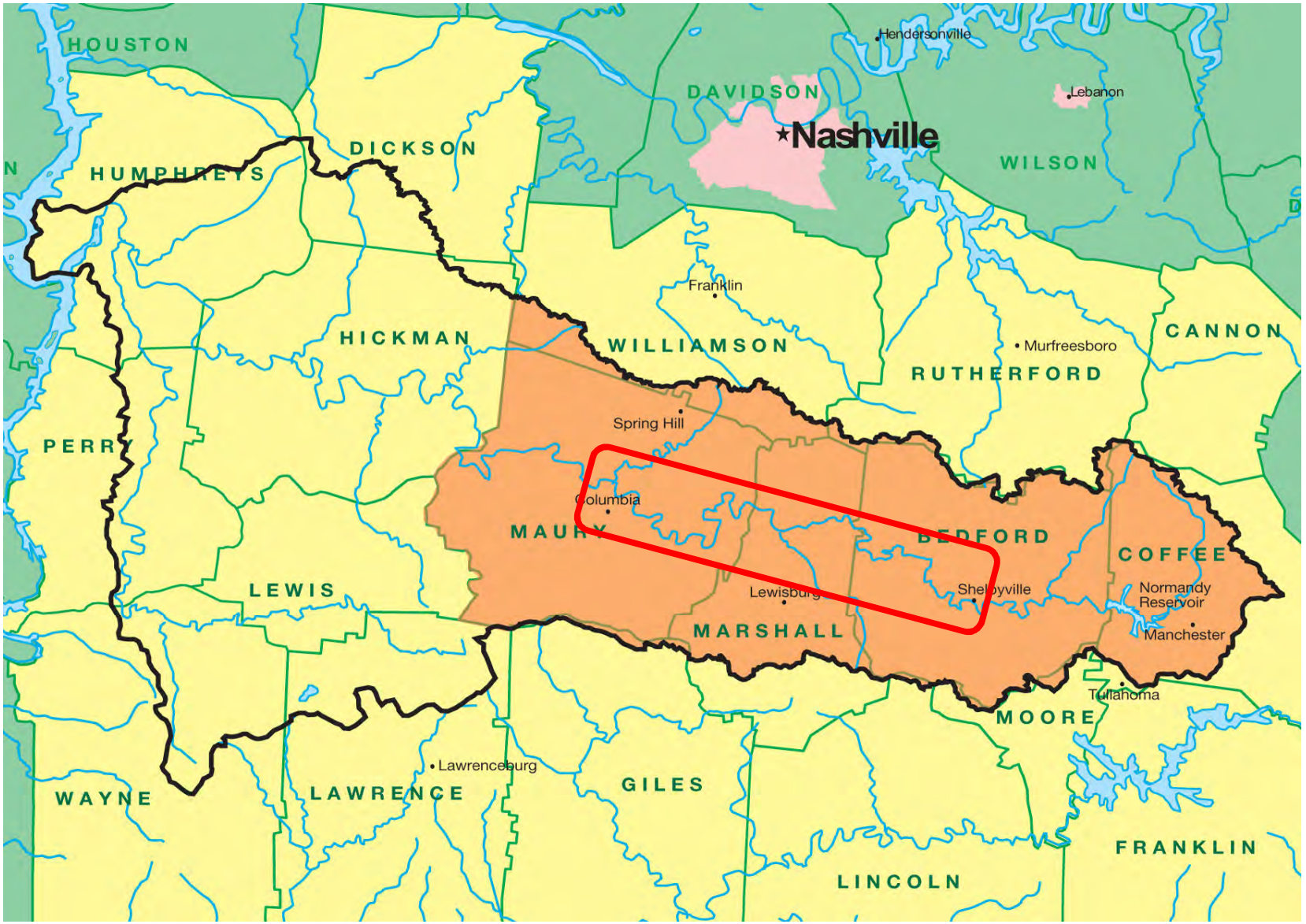
#8 Modify River Constraints to Preserve Storage in Normandy Reservoir



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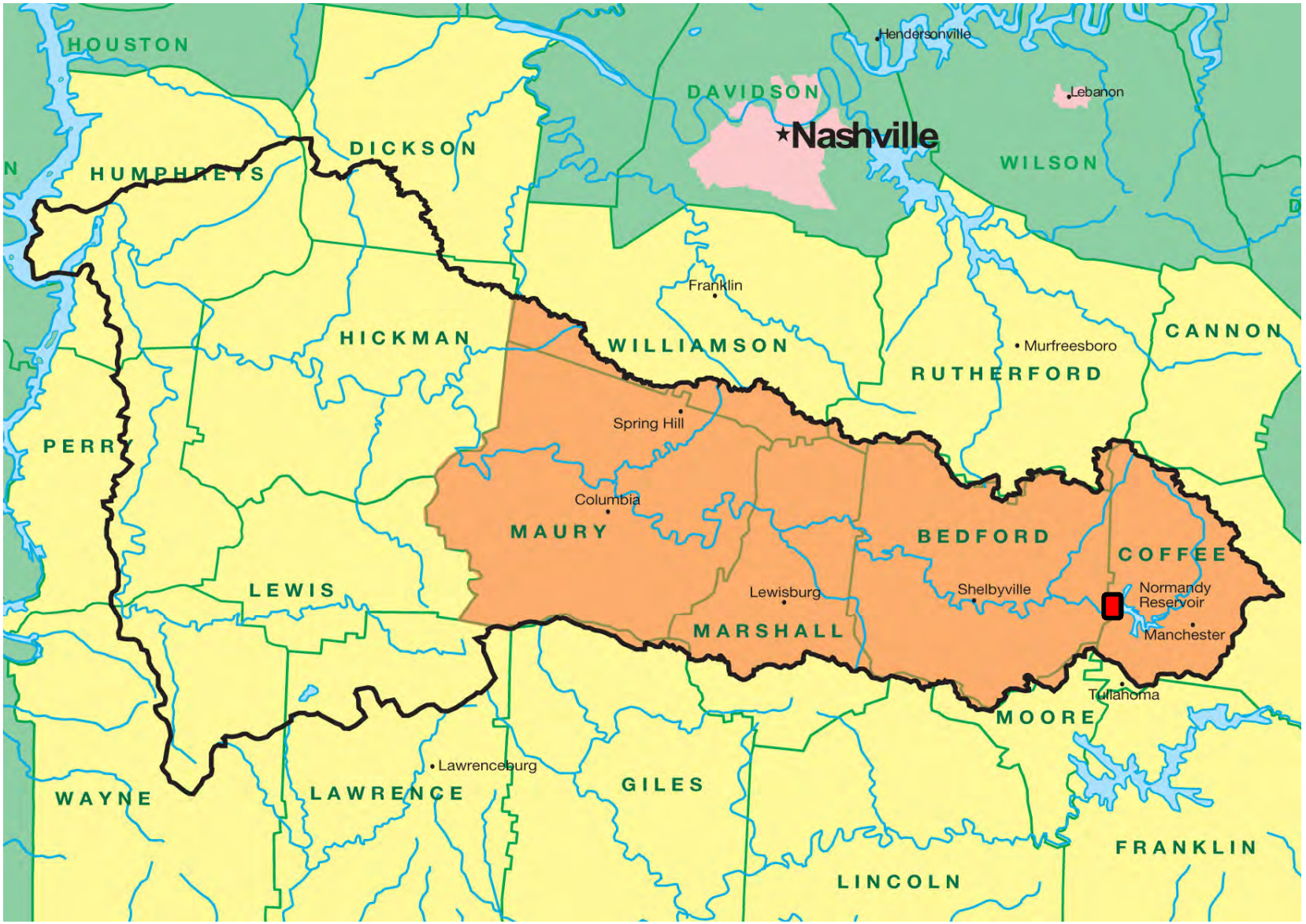
#9 Raise Normandy Reservoir



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#9 Raise Normandy Reservoir



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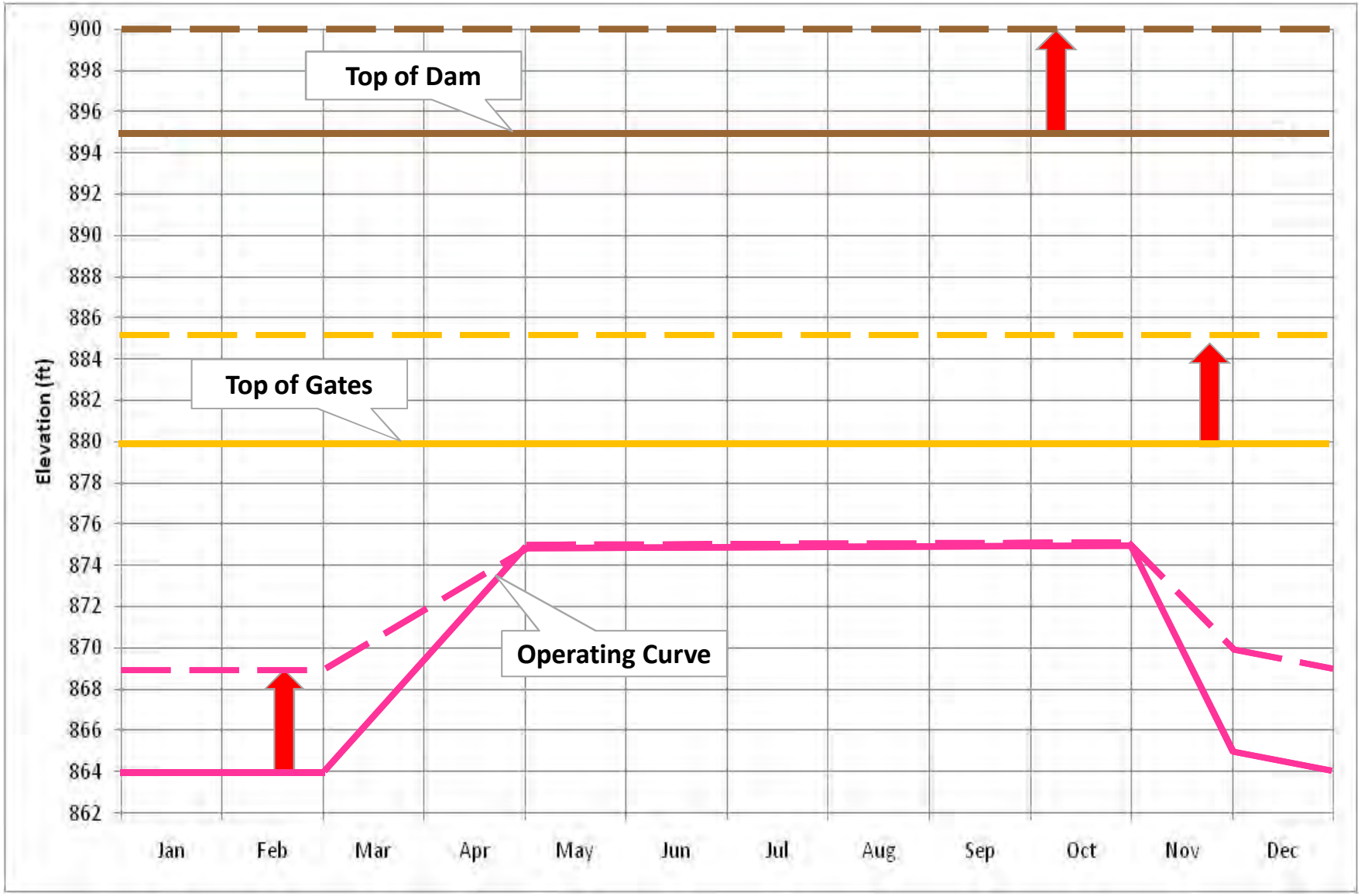
#9 Raise Normandy Reservoir



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#12 Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP



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#13 Construct Fountain Creek Reservoir with Downstream Release



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#15 Monsanto Lake (Existing Offstream Storage Reservoir)



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#15 Monsanto Lake (Historic Photo)



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#15 Monsanto Lake (Current Photo)



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#16 Utilize Quarries



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#16 Utilize Quarries – Hardison Mill Quarry



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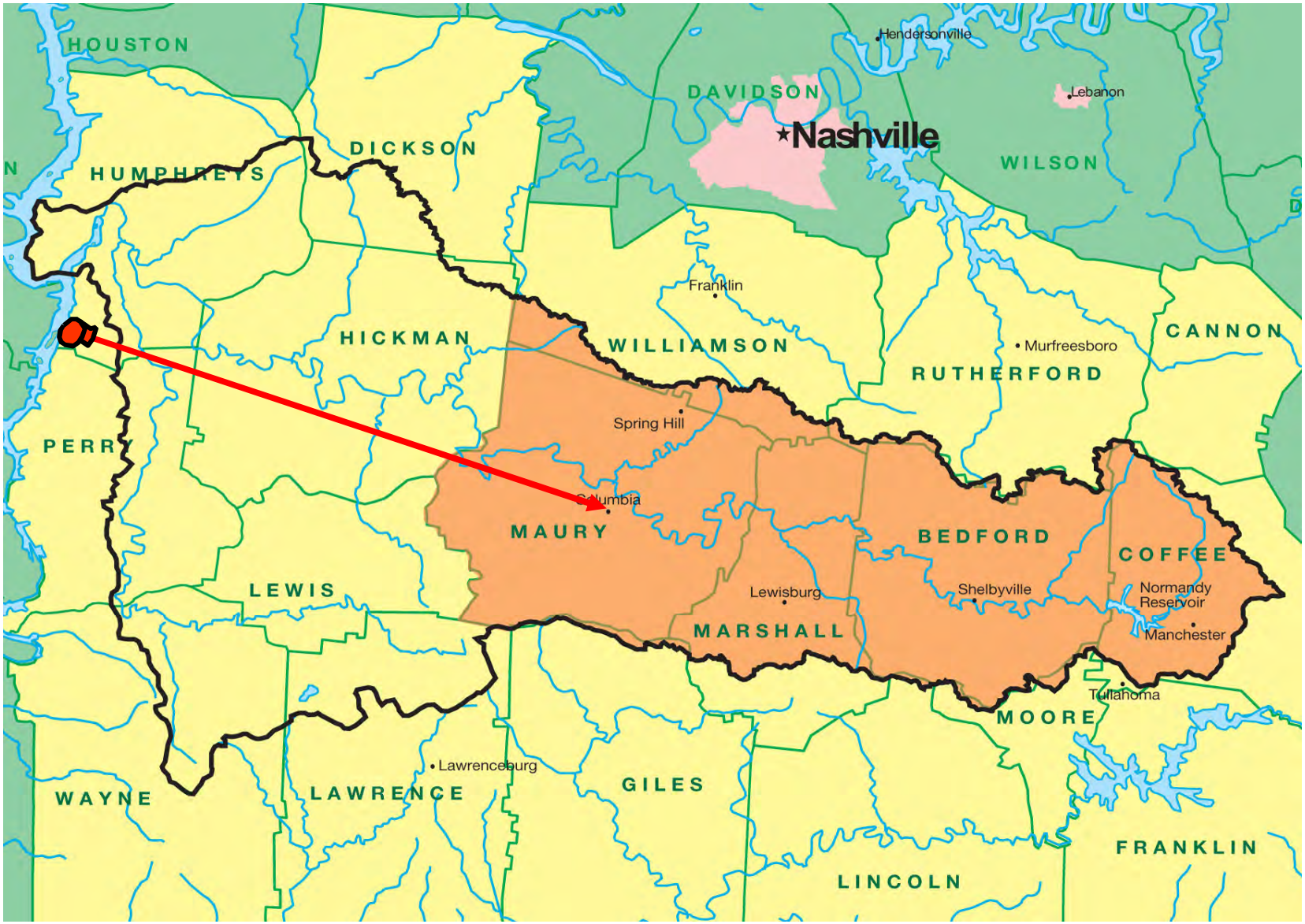
#17 Construct Pipeline to Tennessee River to Columbia WTP



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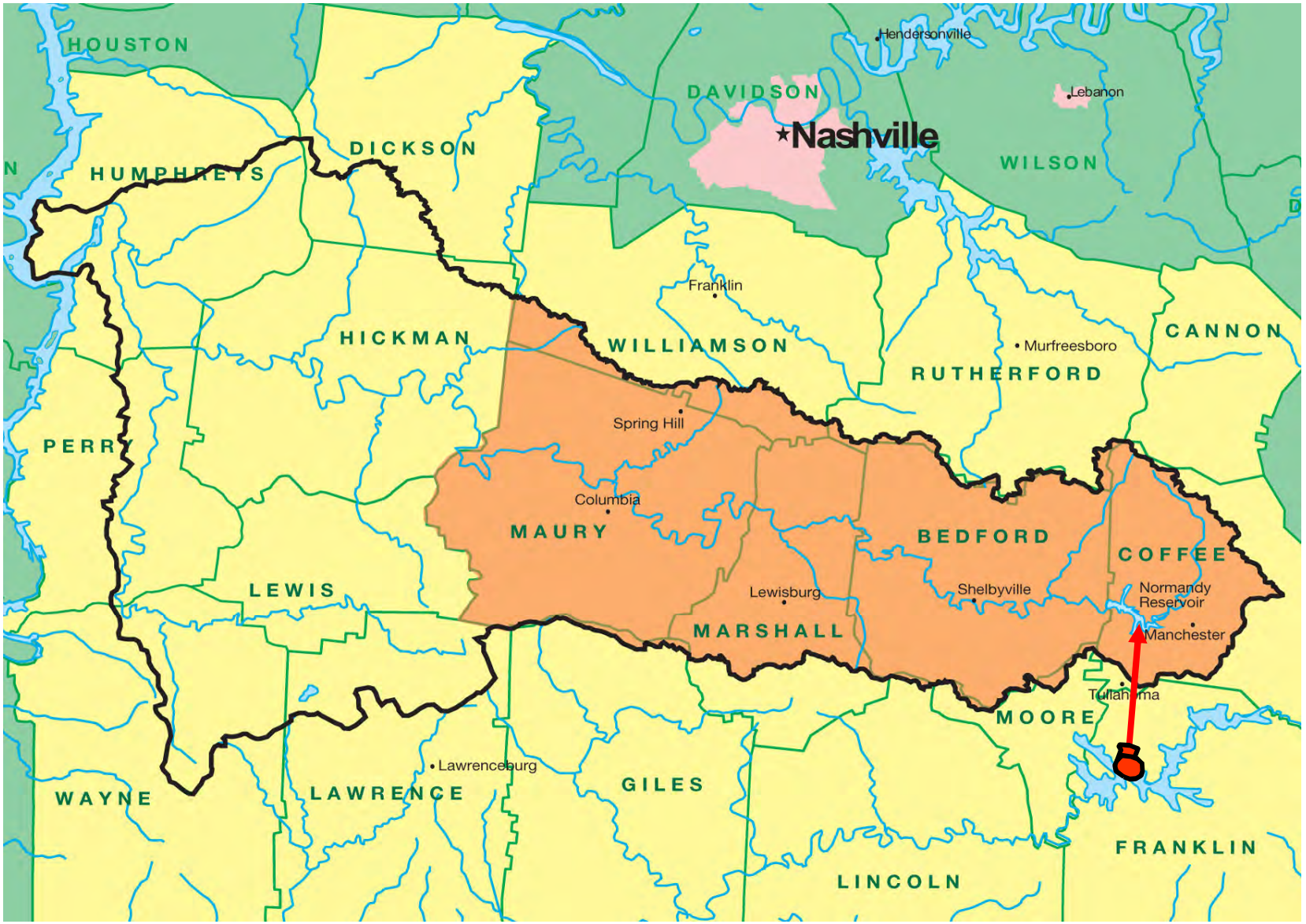
#18 Construct Pipeline from Tims Ford Reservoir



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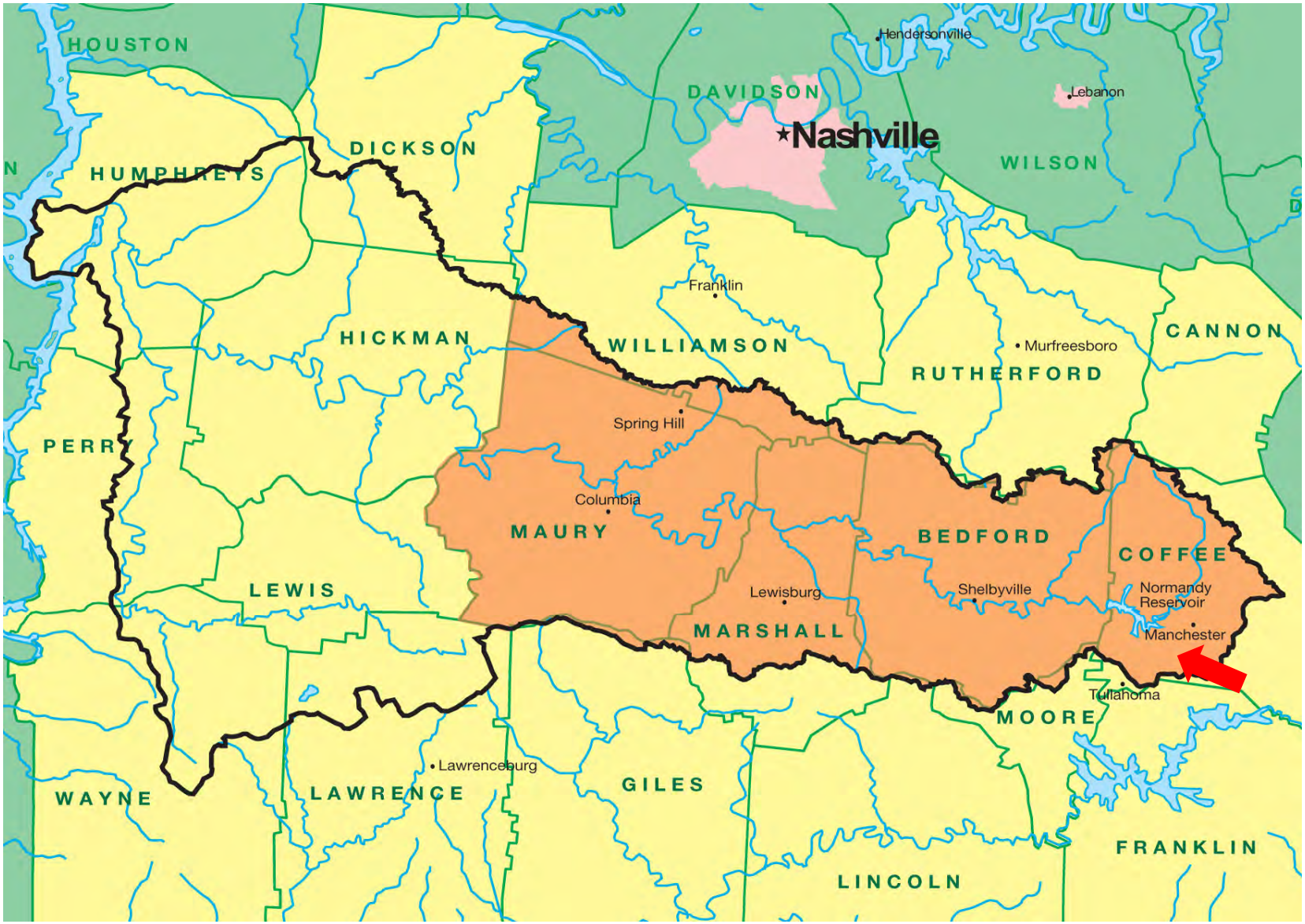
#19 Convey Arnold Cooling Water to Normandy Reservoir



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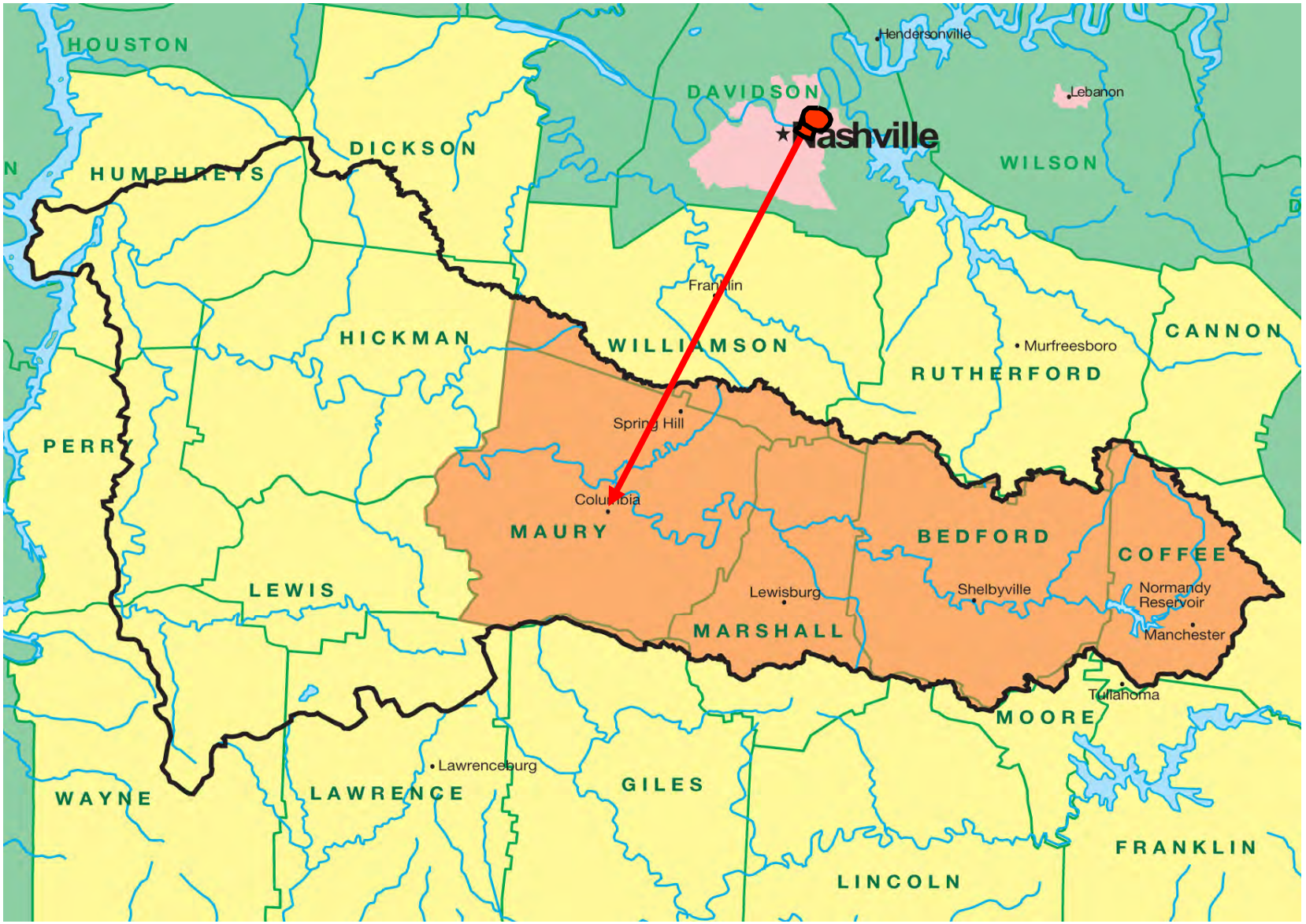
#20 Purchase Water from Nearby Systems



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#22 Pump Treated Water from Columbia WWTP to Below Columbia Dam



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#24 Construct Water Intake near Williamsport and Pump Back to Columbia WTP



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#25 Construct New Intake for Maury County at River Mile 108 and Pump Back to Columbia Dam Pool



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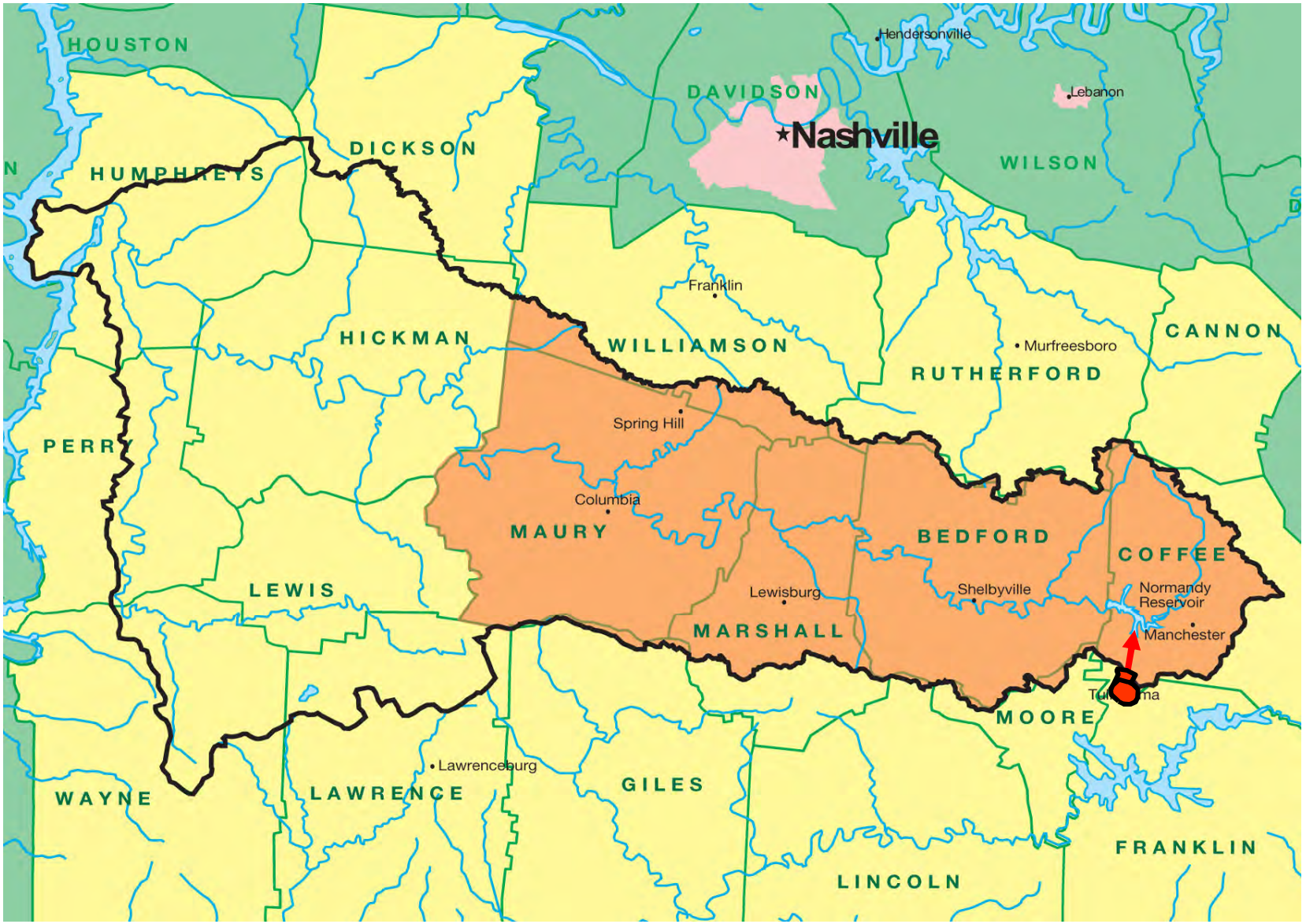
#26 Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir



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WORKSHOP 5

Duck River Development Agency
Comprehensive Regional Water Supply Plan

AGENDA
WORKSHOP No. 5
Henry Horton State Park
May 5, 2010
9 AM to 3 PM

Welcome / Getting Started

- Review of minutes from Workshop No. 4
- Summary of activities since Workshop No. 4
- Objectives for Workshop No. 5
- Decision process review

Update on Water Supply Alternatives

- Review of screening results from Workshop No. 4
- Updates on Cornerstone Alternatives
  - Cornerstone Matrix
- Long Term Plan/Companion Alternatives
  - Alternative Companion Matrix
- Stakeholder input/preferences

Lunch (Noon to 1:00 PM)

Continue Discussion of Cornerstone Alternatives and Long Term Plan

- Conclusion/Consensus on Cornerstone Alternatives

Implementation Planning

- Overall Schedule
- Technical decisions
- Financial issues, including renewing Agreement for "nickel fee"
- Ownership issues/shared equity?
- Organizational impacts of Water Supply Plan

Next Steps

- Planning for Workshop No. 6
  - List of action items…

Meeting Participant Input / Comments

Adjourn (3:00 pm)

Duck River Development Agency
Comprehensive Regional Water Supply Plan

Meeting Minutes
Workshop No. 5
Henry Horton State Park
May 5, 2010

Meeting Participants

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Bill Walter	DRB		931.381.0393

Attachments: Agenda, MS PowerPoint presentation

A summary of the discussion follows:

Alternative #5 - Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam, and Modify Normandy Reservoir Flood Rule Curve to Meet Columbia Constraint

- Participant comment: What is the worst impact of raising Normandy Reservoir Winter/Spring pool level? Team response: Potential for increased flooding downstream of farmland and areas around Shelbyville, but the impacts are not defined at this point in the study. Information that could assist with assessing the potential for flooding is being compiled by TVA and we will know more in the upcoming months.

Alternative #9 – Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)

- Participant comment: Raising Normandy Reservoir Dam opens the door to raising the Summer pool level at some point in the future. Team response: A federal action is needed to raise the pool level in the future even if the dam is raised now. Increasing the pool level would initiate a NEPA review. Any change in the current guidelines or operation of Normandy Reservoir will require a NEPA review.

Alternative #15 – Monsanto Lake (Existing Offstream Storage Reservoir)

- Participant comment: Would Monsanto Lake water be conveyed to the Columbia WTP, Columbia Pool, or released to maintain the 100 cfs flows in the Duck River at Columbia? Team response: Monsanto Lake water would be supplied directly to the Columbia WTP as it is currently configured.
- Participant comment: Columbia does not want water from Monsanto Lake and will not support this alternative. There are concerns related to operations and

treatment, water quality and potential opposition associated with draining the lake for water supply when needed. If the lake was upstream of the Columbia pool, then it would possibly work. Team response: Additional information related to the concerns will be requested. A review of topographic mapping indicated that there are no desirable sites upstream of Columbia's intake for an offstream storage facility (pumped storage).

- Participant comment: The Monsanto Lake alternative does not affect the operation of Normandy Reservoir during drought. Team response: Correct. The Monsanto Lake alternative addresses the future deficit at Columbia which is currently not a river constraint for Normandy Reservoir.
- Participant comment: What about discharging water from Monsanto Lake upstream of the Columbia intake on the Duck River to blend water quality? Team response: Introducing the water from Monsanto Lake to the Duck River raises concerns related to differences in water quality. The water quality of the discharge to the Duck River from Monsanto Lake would need to be monitored.

<u>Alternative #24 – Construct Water Intake near Williamsport and Pump Back to Columbia/Maury County</u>

- Participant comment: This alternative has lots of potential. Bringing water back to Columbia from a location downstream with water from the Duck River (i.e., same water quality) is an advantage. Solving the problem locally makes this a good option.
- Participant comment: Locating the river intake for this alternative on the Duck River near Williamsport probably doubles the amount of flow available to Columbia compared to the current location of the Columbia intake.
- Participant comment: How far downstream would we need to go with a pipeline to capture flow from Swan Creek? Team response: Swan Creek enters the Duck River just above Centerville so approximately 20 miles downstream.
- Participant comment: Could this pipeline be part of the Tennessee River pipeline alternative in the future if the pipeline at Williamsport was extended to the Tennessee River? Team response: Yes. The pipeline could be extended approximately 40 miles from Williamsport to the Tennessee River in the future if desired.
- Participant comment: Isn't the Army Corps of Engineers planning to do some water supply work on the lower Duck River watershed? Team response: Yes. Most of the work appears to be south of the Duck River watershed. Doug will check with the Corps activities.
- Participant comment: Are any studies being conducted on the "underground" river where water seems to enter below Shelbyville and return to the Duck River below Columbia? Team response: This was discussed with USGS, but no studies are being conducted as part of this work. The USGS identified that about one-third of the

water in the Duck River below Shelbyville goes underground during low flow conditions. Where the flow goes is not well defined, but it appears to flow back to the Duck River below the Columbia WWTP. Pumping from this underground cavern or aquifer would likely further dewater the river and cause lower the flows in the Duck River.

- Participant comment: What is biggest negative of this alternative? Team response: Capital cost which is slightly higher than some of the Normandy Reservoir alternatives and cost to operate is higher. Compared to the other remaining cornerstone alternatives, the major advantage of the pumpback from Williamsport alternative is that DRA or the utilities would have ownership and control over the operation. In addition, this was one of the four final alternatives identified in the 2000 TVA study and the agencies concluded that this would be the most practical alternative to permit.
- Participant comment: What is the elevation difference between the intake location and the Columbia WTP? Team response: The elevation difference is only about 10-15 ft, but there are a few hills that need to be crossed by the pipeline and the static pressure is roughly 117 psi for a southern alignment and 170 psi for a northern alignment.
- Participant comment: Do we only need to operate this alternative during a drought? Team response: Probably want to operate the pumps on routine basis to maintain water quality and pump operation.
- Participant comment: Will the customers in the upper Duck River basin pay for this alternative also? Yes.
- Participant comment: Would consideration be given to improving Columbia's WWTP under this alternative? Team response: No. The proposed intake near Williamsport is located a long distance downstream of the Columbia WWTP so it would not be necessary to improve the wastewater plant discharge for the water supply alternative. Future wastewater improvements will likely be driven by a requirement not related to this water supply withdrawal.

<u>Alternative #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir</u>

- Participant comment: Has this alternative gone off the table? Team response: No. This alternative will be part of the regional drought management plan which will be initiated and developed in the upcoming year.
- Participant comment: Why are the municipalities treated differently with regard to river constraints? Why is Columbia the only utility with a river withdrawal constraint? Team response: Other communities upstream of Columbia have wastewater limits based on assimilative flow requirements. Columbia's wastewater permit is linked to its water withdrawal.

- Participant comment: Columbia's withdrawal requests are met with opposition from the environmental community while the other utilities such as Spring Hill may be one-fifth the withdrawal, but they didn't have opposition to their withdrawal (TNC indicated that they did oppose the Spring Hill withdrawal). It is not clear why there is no specific flow constraint written into the Spring Hill permit. TNC identified that it appears that the 3 to 6 mgd maximum withdrawal for Spring Hill reflects the 100 cfs flow constraint at Columbia.
- TDEC is the sole authority to say "yes" or "no" on the water withdrawal permit. Anti-degradation will be required for any additional withdrawal from the Duck River. Anti-degradation requires an alternatives analysis.

Alternative #19 – Convey Arnold Cooling Water to Normandy Reservoir or DRUC WTP

- Participant comment: This alternative brings new water to Normandy Reservoir users. There have been talks about Arnold shutting down their water treatment plant and taking water from DRUC. If Arnold was served water from Tullahoma, then it seems logical that this water could be replaced with return flows from Arnold.
- This alternative uses a pipeline to supply water from Arnold to the DRUC WTP.
- Participant comment: How long is the pipeline from Arnold to the DRUC WTP? Team response: The 24-inch pipe is approximately 7 miles to reservoir and 9 miles to the DRUC WTP. It would cost approximately $2 million more to take the water directly to the DRUC intake. Taking the water directly to the DRUC WTP would allow Normandy Reservoir to be drawn down to satisfy other needs without impacting DRUC's ability to serve its customers. This alternative would significantly enhance flexibility because reservoir water quality and pumping concerns at low water levels would not be a factor.
- Participant comment: During the 2007 drought, the poor water quality was located away from the intake.

Compatibility Matrix

- Participant comment: Raising Normandy Reservoir is affordable now. There is no need to raise rates because DRA has adequate funds available to complete the project. It will be very hard to get all the local governments to change their agreements. DRA has one-half of the money in the bank and the nickels should carry the DRATAC members through the debt service period.

Implementation Schedule

- Participant comment: It is very clear that the DRA Board will have an approach or recommendation to make a decision on.
- The Board will need to decide on the timing for implementation of the alternatives.



- Participant comment: Is there a factor of safety in the safe yield analysis? Need to plan for a worse drought than 2007. Team response: The needs presented in this study are based on the critical drought for the period of record (1921-2008).
- Participant comment: The drought of 2007 is still fresh in people's minds. The water supply plan will be met as welcome news that we have a plan and solutions. The process has gone well and we will have positive outcomes. The public is going to have confidence in what we come up with in this study. No need to make the case for a worse drought.
- Participant comment: It is important to point out that there will be a worse drought of record in the future.
- Participant comment: Risk needs to be conveyed to the DRA Board. Present how the alternatives address risk mitigation. Suggest providing the Board with a menu of options categorized according to risk assessment (i.e., low, high). Team response: The regional drought management plan will define the level of risk because it identifies the triggers for actions and decisions.

Cornerstone and Backup Alternatives Matrix - Workshop No. 5

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
Cornerstone Alternatives									
5	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam	Raise Normandy Reservoir Winter/Spring pool level from 864 ft to 869 ft to preserve water storage from Winter/Spring pool for human and environmental needs during drier Summer/Fall months. Increase releases from Normandy Reservoir to meet needs at Shelbyville and Columbia. Cost includes acquisition of roughly xxx acres of flood prone land. Delineation of the extent of increased flooding required.	- Satisfies entire river deficit of 32 mgd in 2060 - Increases storage by approximately 5 BG, exceeding the minimum 1.4 BG needed to meet Columbia constraint in 2060. Reduces flood storage volume by roughly 5 BG. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	No change.	$?? million (project cost)	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - May require extended time to acquire land in flood prone areas downstream of dam.	- Winter pool can be raised in stages, as needed over time.	- Acquisition of flood prone land along stream buffer area may be viewed as environmental benefit. - Potential negative impacts due to higher frequency of flooding.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought.
9	Raise Normandy Dam (Increase Winter/Spring Pool Level, and Retain Summer/Fall Pool Level)	Increase the height of Normandy Dam and Winter/Spring pool level by 5 ft (i.e., increase flood pool from 880 ft to 885 ft, retain Summer/Fall pool at 875 ft, and increase Winter/Spring pool from 864 ft to 869 ft). Increase releases from Normandy Reservoir to meet needs at Shelbyville and Columbia.	- Satisfies entire river deficit of 32 mgd in 2060. - Increases storage by approximately 5 BG, exceeding the minimum 1.4 BG needed to meet Columbia constraint in 2060. - No impact on flood storage volume. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	No change.	$15 million to $30 million (project cost), depending on need to raise roads and bridges, etc.	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - Need to document number of stream miles inundated. - Short Springs (State Designated Natural Area) along Bobo Creek could experience prolonged periods of occasional inundation. Retaining summer pool level avoids need to inundate 2 to 3 acres of flora and hiking trails at Short Springs. - Loss of shoreline vegetation.	- No flexibility to phase implementation for construction, but could raise winter pool in stages, as needed over time.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought. - Potential impacts to campgrounds and boat ramps.
15	Monsanto Lake (Existing Offstream Storage Reservoir)	Purchase Monsanto Lake which is a 5 BG offstream storage reservoir along Duck River approximately 8 miles northwest of Columbia. Utilize existing Columbia intake, upgrade existing Columbia pumping station, and construct a *pipeline (10 miles) from reservoir to Columbia WTP to convey water from reservoir to WTP, and to refill reservoir from the Duck River. *Note: One 42-inch pipeline, or two 30-inch pipelines provides at least 32 MGD capacity. One 30 inch pipeline included in costs, to provide initial capacity of approximately 20 MGD.	- 5 BG of new storage satisfies minimum 1.4 BG river deficit in 2060. - Direct ownership maximizes control of supply. - Direct connection between reservoir and Columbia WTP assures delivery of required supply (eliminates potential for unanticipated loss of raw water from Duck River between Normandy Reservoir and Columbia). - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	Construct a multi-port intake in the reservoir to obtain highest quality water. Need to collect additional data on quality of raw water and sediments.	$34 million (project cost) excluding land costs and wetland replacement	- Jurisdictional wetlands identified, but ability to obtain necessary permits is likely.	- Alternative can be implemented in multiple phases. - Provides option to serve Spring Hill from Monsanto Lake, instead of Spring Hill's existing Duck River intake. - Alternative flexible for providing either raw water or finished water to Columbia and Spring Hill.	- Discontinuing use of existing Spring Hill intake (at least during droughts) would increase flow in sensitive reach of Duck River just above Columbia.	- Potential for fishing and other recreational opportunities associated with offstream storage reservoir.
24	Construct Water Intake near Williamsport and Pump Back to Columbia/Maury County	Construct a 32 mgd water intake (or utilize existing intake) and pumping station on Duck River near Williamsport and a *pipeline (approx. 17 miles) to convey water to the Columbia water treatment plant, or to a new WTP in Maury County. *Note: One 42-inch pipeline, or two 30-inch pipelines provides at least 32 MGD capacity. One 30 inch pipeline included in costs, to provide initial capacity of approximately 20 MGD.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Minor reduction in downstream flows due to consumptive uses in the Maury and South Williamson County water systems. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$38 million (project cost)	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - Lower downstream flows not likely to cause adverse impacts on aquatic life.	- Alternative can be implemented in multiple phases. - Provides option to serve Spring Hill from Williamsport intake, instead of Spring Hill's existing Duck River intake. - Alternative flexible for providing either raw water or finished water to Columbia and Spring Hill.	- Discontinuing use of existing Spring Hill intake (at least during droughts) would increase flow in sensitive reach of Duck River just above Columbia.	- No recreational benefits or impacts.

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
Backup Alternatives									
19	Convey Arnold Cooling Water to Normandy Reservoir or DRUC WTP	Construct a 24-inch pipeline (7 miles) to convey cooling water from the cooling lake at Arnold AFB to a pipeline which would discharge directly to Normandy Reservoir. Alternatively, could construct 9 miles of 24-inch pipeline and discharge directly to the DRUC WTP. Cooling lake obtains water pumped from Woods Reservoir (approximately 25 BG total storage) which was constructed exclusively for water supply (1 mgd) and cooling water for Arnold AFB and its operation is controlled by Arnold AFB. Water in the cooling lake is treated and supplied to the AFB for drinking and other potable water needs.	- Adequate storage in Woods Reservoir to satisfy minimum 2-3 BG of storage needed at Normandy Reservoir to meet 1.4 BG river deficit in 2060. - Alternatively, if Arnold cooling water is conveyed to DRUC WTP, adequate to meet full potable supply needs of DRUC for 90-180 days (approximately 1-2BG). - Arnold AFB would need to identify any restrictions on use to assess reliability.	- Need to define source and location of water contamination.	$8 million (project cost) to reservoir, $10 million to DRUC WTP.	- Minimal permit requirements.	- No flexibility to phase implementation.	- Could allow more complete utilization of Normandy Reservoir storage, by accessing this alternate supply when reservoir pool level drops too low for DRUC access, or when Normandy Reservoir reaches level where water quality is unacceptable for water supply.	- No recreational benefits or impacts.



Duck River Comprehensive Regional Water Supply Plan

Workshop No. 5 / May 5, 2010

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Agenda

- Review of Minutes from Workshop No. 4
- Summary of Activities Since Workshop No. 4
- Objectives for Workshop No. 5
- Update on Water Supply Alternatives
- Alternative Compatibilty Matrix
- Stakeholder Input on Alternative Preferences
- Long Term Planning/Implementation Planning
- Next Steps

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Review of Minutes from Workshop No. 4

- Screened the remaining alternatives
  - 3 identified as “baseline” alternatives
  - 12 identified as “fatally flawed or highly unlikely”
  - 4 identified as potential “back-ups”
  - 4 identified as potential “cornerstones”
- Stakeholder input “alternative scorecard”

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Summary of Activities Since Workshop No. 4

- Attended TDEC's Drought Management Planning Seminar (3/16/10)
- Held Open House Public Meetings (3/24/10)
- Updated alternatives matrix
- Developed alternative compatibility matrix
- Started implementation planning



- Held meetings and discussions with Monsanto Lake property owners, TVA, USGS and TNC.
- Conducted site tour of pump-back route and potential intake site
- Provided briefing on project status at DRATAC and WRC meetings (4/7/10 and 4/8/10)
- Held work session with DRA Board (4/22/10)

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Objectives for Workshop No. 5

- Provide briefing on:
  - Remaining water supply alternatives
  - Alternative compatibility matrix
- Obtain input from stakeholders on:
  - Alternatives and preferences
  - Implementation planning
- Review steps to complete Comprehensive Regional Water Supply Plan

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Project Goal

"The goal is to have a (comprehensive) Plan that will provide direction to the Duck River Agency regarding the management of available water resources, including the implementation of specific water supply infrastructure projects."

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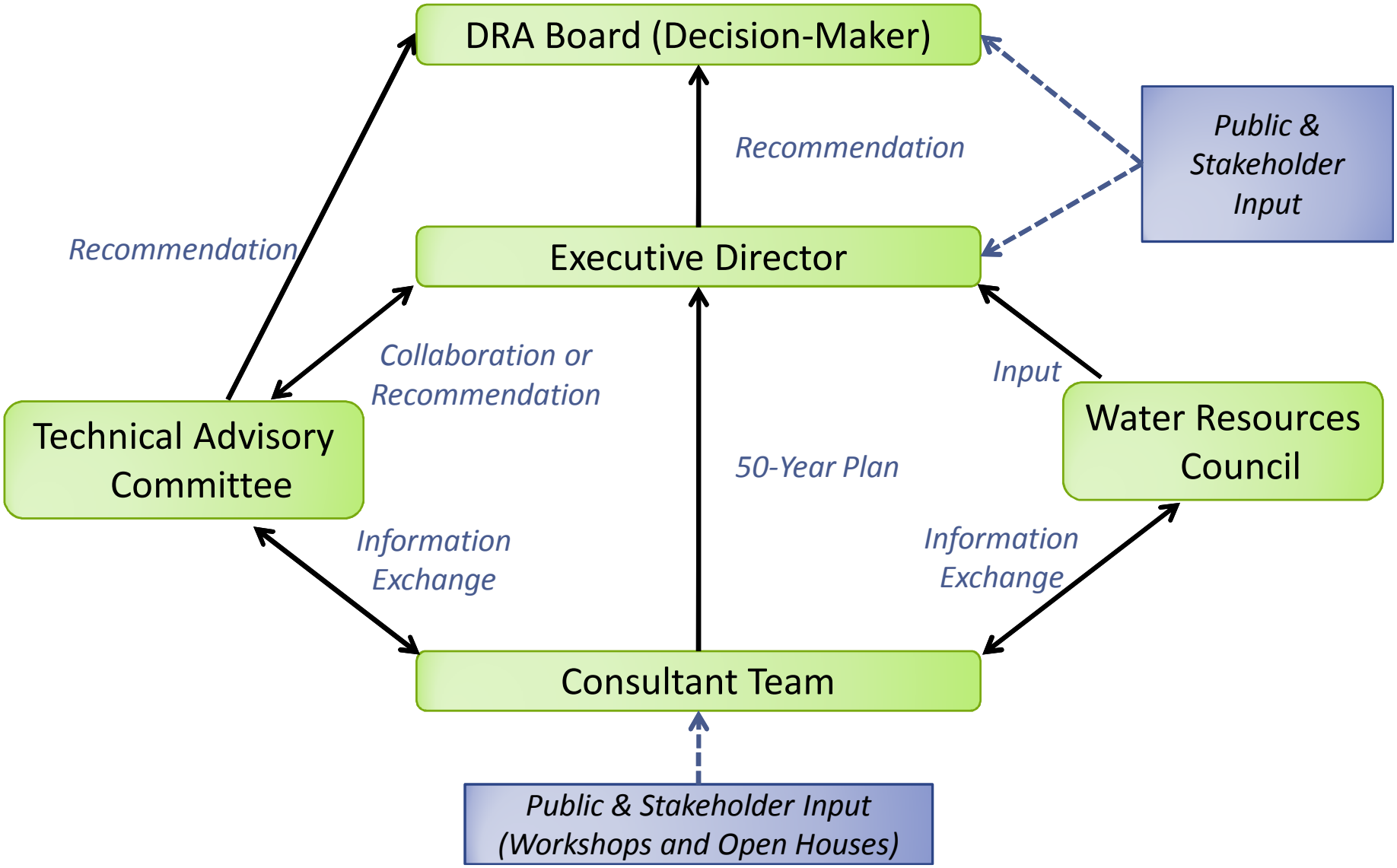
Roles of Key Participants in the Decision Process



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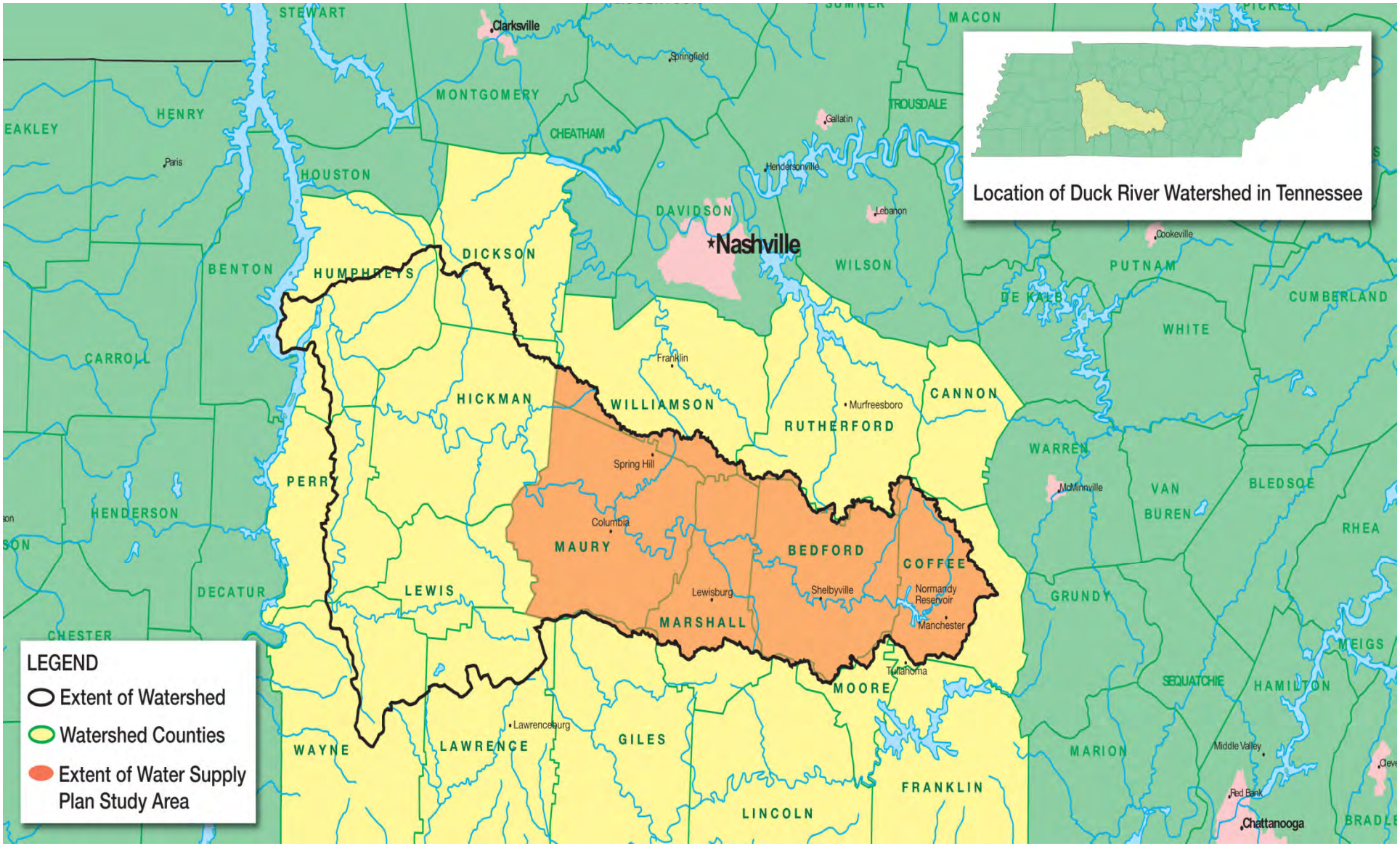
Location Map



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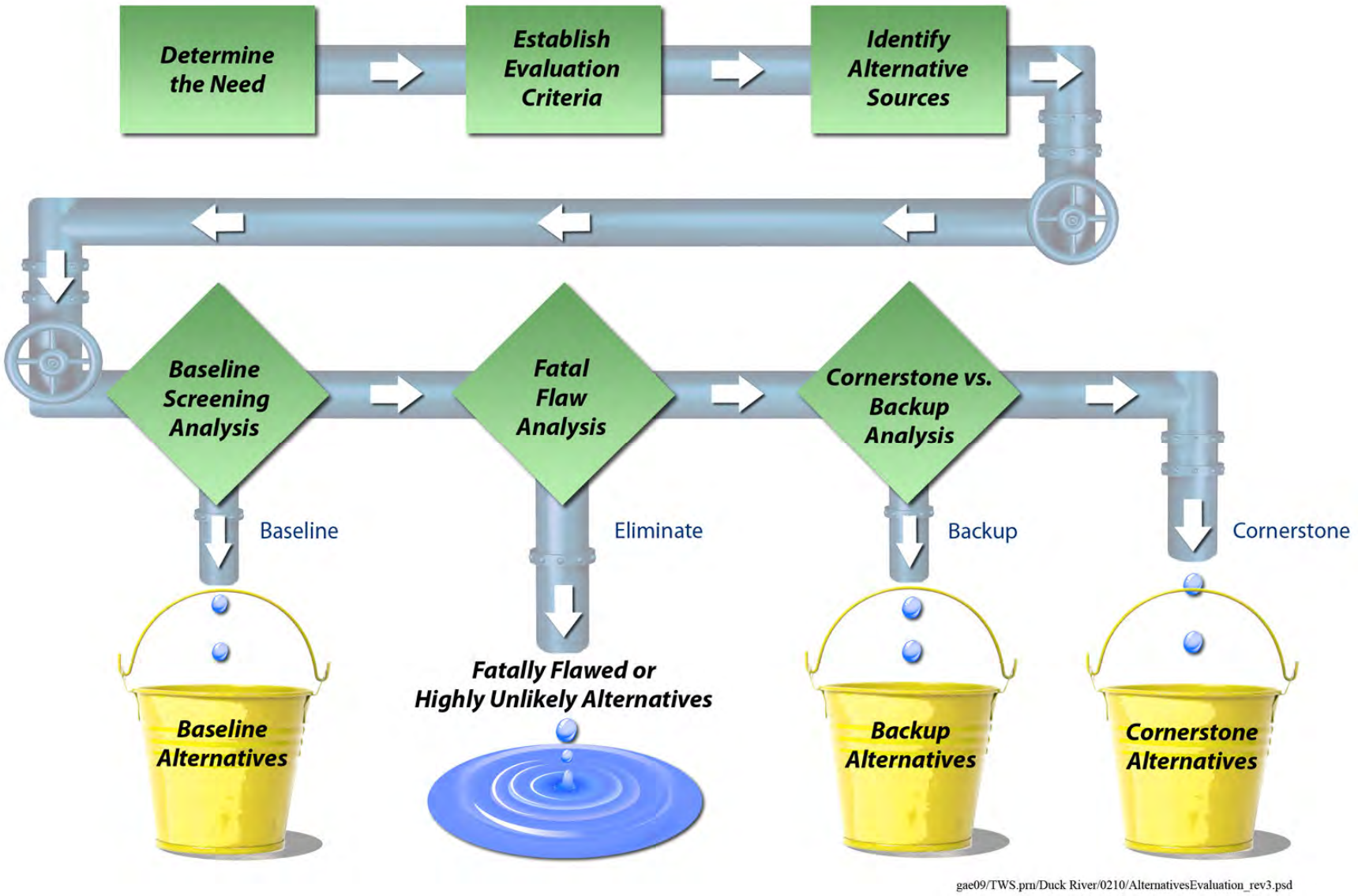
Water Supply Evaluation Process



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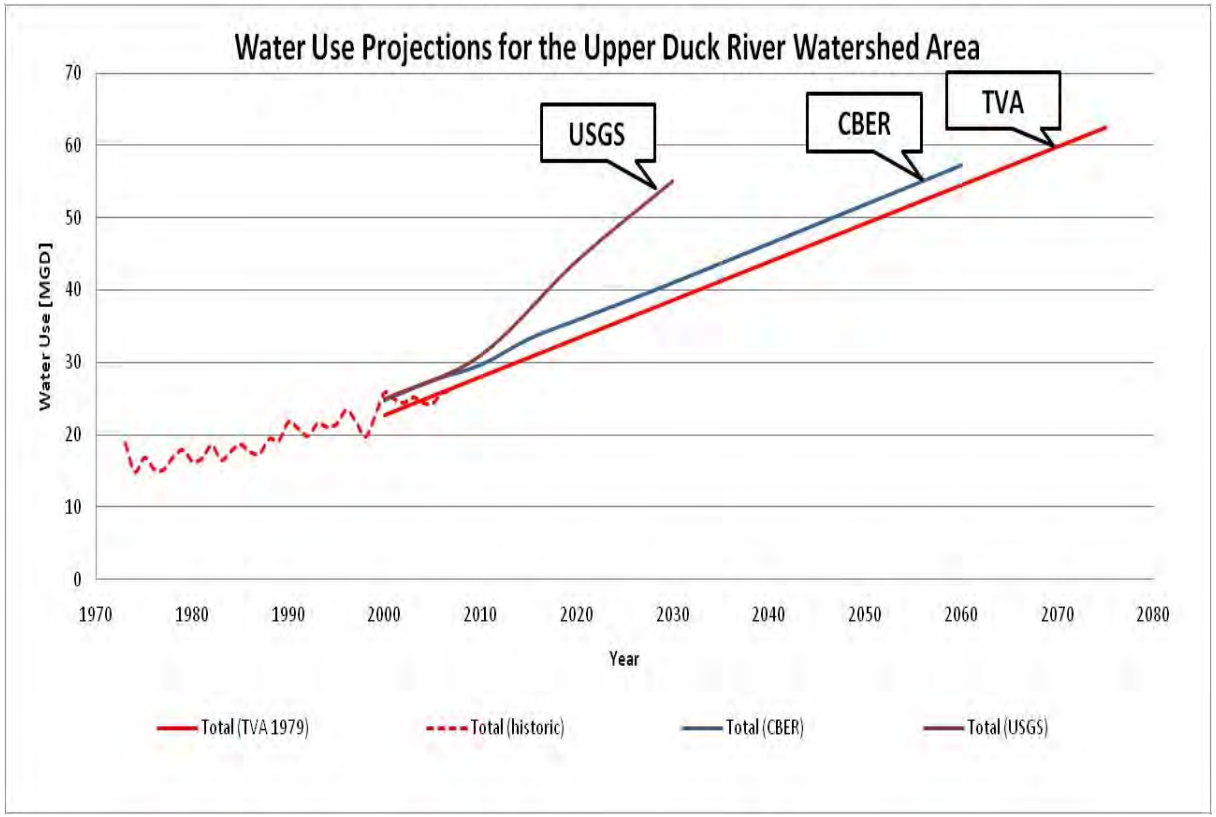
File Location

Update on Needs Assessment

- CBER released revised Statewide population projections in early March:
  - No significant change to population in study area



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Water Supply Needs – Normandy Reservoir Users

- Projected demands (2060) of reservoir users are within safe yield based on 2007 drought
- Reservoir reached record low water levels during the 2007 drought (roughly 42% full)
  - Concern over water quality at lower pool levels
- Primary risk is a multi-year drought, more severe than 2007





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Water Supply Needs – Duck River Users

- Competing uses for the Duck River include:
  - Wasteload assimilation
  - Environmental flow for threatened and endangered species
  - Municipal and industrial water supply
  - Irrigation
  - Recreation
- Duck River is nationally recognized as one of the most biologically diverse rivers in the United States
- Water supply deficit at Columbia could reach 32 mgd in 2060
- Deficit requires additional 1.4 BG of storage if located near Columbia, or roughly 2-3 BG if attempting to release from Normandy



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Evaluation Criteria

- Reliable Capacity
- Raw Water Quality
- Cost
- Implementability / Risk of Delays
  - permittable
  - public acceptance
  - property acquisition
- Flexibility
  - phased implementation
- Environmental Benefits
- Recreation

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Affordability

- In screening alternatives, it helps to get a feel for what is considered affordable:
  - At what point will cost inhibit the selection?
  - Points of reference:
    - Most expensive alternative (Tennessee River Pipeline) has capital cost of $165 M:
      - "Nickel fee" would increase by roughly $1.50/1,000 gallons sold
        - $10/month increase for each household
    - Combination of a cornerstone alternative, plus the baselines, and a companion/backup component has capital cost of roughly $50 M:
      - "Nickel fee" would increase by roughly $0.45/1,000 gallons for every gallon sold
        - $3/month increase for each household

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Water Supply Alternatives

Identified 26 non-structural and structural measures including:

- Implementing additional water efficiency measures
- Implementing a regional drought management plan
- Changing operation of Normandy Reservoir
- Modifying river constraints
- Constructing pipelines from reservoirs, rivers or other water systems
- Constructing tributary reservoirs (Fountain Creek Reservoir)
- Building offstream storage reservoirs (pumped storage)
- Utilizing quarries
- Raising Normandy Dam



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Water Supply Alternatives Screening

- Alternatives were sorted into one of these groups:
  - **Baseline** – an alternative that was selected to be a component of the recommended water supply plan
  - **Fatally Flawed or Highly Unlikely** – an alternative that was eliminated from further consideration
  - **Back-up** – an alternative that was not selected as a Cornerstone, but will be considered as a potential component of the 50-year water supply plan
  - **Cornerstone -** an alternative in the "shortlist" that could satisfy the entire deficit, and is receiving further consideration as a key element of the 50-year water supply plan

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Baseline Alternatives

- #1 – Water Efficiency Measures
- #3 – Regional Drought Management Plan
- #4 – Optimize Releases from Normandy Reservoir

Baseline alternatives will be a component of the recommended water supply plan



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Fatally-Flawed and Highly Unlikely Alternatives

- #7 – Reduce Irrigation Withdrawals
- #12 – Construct Fountain Creek Reservoir and Pipe Raw Water to Columbia WTP
- #13 – Construct Fountain Creek Reservoir with Downstream Release
- #14 – Upgrade Existing Columbia City Dam to Allow Releases
- #17 – Construct Pipeline from Tennessee River to Columbia WTP
- #18 – Construct Pipeline from Tims Ford Reservoir
- #20 – Purchase Water from Nearby Systems
- #21 – Utilize Groundwater Sources
- #22 – Pump Treated Wastewater from Columbia WWTP to Columbia Dam
- #23 – Construct Water Intake for Maury County at River Mile 163
- #25 – Construct Water Intake near Williamsport and Pump Back to Columbia Dam Pool
- #26 – Construct Infrastructure to Return Treated Wastewater from Tullahoma WWTP to Normandy Reservoir

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Cornerstone Alternatives

- #5 – Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam, and Modify Normandy Reservoir Flood Rule Curve to Meet Columbia Constraint
- #9 – Raise Normandy Dam (Increase Winter/Spring Pool Level and Retain Summer/Fall Pool Level)
- #15 – Monsanto Lake (Existing Offstream Storage Reservoir)
- #24 – Construct Water Intake near Williamsport and Pump Back to Columbia Water Treatment Plant/Maury County

Cornerstone alternatives are receiving further consideration as key elements of the 50-year water supply plan



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#5 Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam

- Raise winter pool level from 864 ft to 869 ft to preserve winter storage
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users
- Satisfies entire river deficit of 32 mgd
- Increases frequency and likely the extent of flooding
- Project cost primarily for land acquisition in flood prone areas which is to be determined (additional investigations ongoing, using information from TVA and FEMA to refine estimate of flood prone areas)
- Continues region's sole reliance on Normandy Reservoir for water supply



- **Status: Cornerstone**

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#9 Raise Normandy Dam
Retain Summer Pool Elevation, Maintain Flood Storage

- Increase Winter/Spring pool level by 5 feet, and retain Summer/Fall pool level
- Alternative needs to be combined with modified release from Normandy Reservoir to satisfy the deficit of downstream users
- Satisfies entire river deficit of 32 mgd
- Retaining summer pool mitigates impact on flora and hiking trails at Short Springs
- Project cost $15-30 million, depending on need to raise bridges, rebuild roads, etc.
- EA or EIS required
- Potential impacts to campgrounds and boat ramps
- Continues region's sole reliance on Normandy Reservoir for water supply
- **Status: Cornerstone**



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#15 Monsanto Lake (Historic Photo)



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#15 Monsanto Lake (Current Photo)



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#15 Monsanto Lake (Existing Offstream Storage Reservoir)

- Purchase Monsanto Lake, which is a 5 BG offstream storage reservoir along Duck River approximately 8 miles northwest of Columbia
- Utilize existing Columbia intake, upgrade existing pumping station, and construct approximately 10 miles of pipeline between reservoir and Columbia WTP to fill and draw from reservoir.
  - Could use one 42" pipeline to meet entire river deficit of 32 mgd, or build in phases, starting with 30" pipeline for approximately 20 mgd
- Appears to have jurisdictional wetlands, which would require Section 404 Permit from ACOE and Section 401 from TDEC
  - Compensatory mitigation requirements would increase costs
- $34 million capital cost (30" pipeline) ***plus land costs and wetland replacement, if required***
- Reduces reliance on Normandy Reservoir
- Potential for fishing and other recreational opportunities
- Awaiting reports on water quality and needed improvements to dam
- Flexible to serve all of Maury County with raw or finished water
  - Could curtail use of existing Spring Hill intake in a sensitive reach of Duck River, above Columbia
- **Status: Cornerstone**

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#24 Construct Water Intake near Williamsport and Pump Back to Columbia/Maury County



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#24 Pumpback - Existing Intake Near Williamsport





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#24 Construct Water Intake near Williamsport and Pump Back to Columbia/Maury County

- Construct new intake at near Williamsport and approximately 17 miles of pipeline to Columbia water treatment plant (WTP) or a new WTP in Maury County
  - Intake location can be upstream of Big Bigby Creek
  - Could use one 42" pipeline to meet entire river deficit of 32 mgd, or build in phases, starting with 30" pipeline for approximately 20 mgd
- $38 million project cost (30" pipeline)
- EIS required, but likely able to obtain permits
- Reduces reliance on Normandy Reservoir
- Flexible to also serve all of Maury County with raw or finished water
  - Could curtail use of existing Spring Hill intake in a sensitive reach of Duck River above Columbia
- **Status: Cornerstone**

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Backup Alternatives

- #2 – Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels
- #8 – Modify River Constraints to Preserve Storage in Normandy Reservoir
- #16 – Utilize Quarries
- #19 – Discharge Arnold Cooling Water to Normandy Reservoir or DRUC WTP

Backup alternatives were not selected as Cornerstones, but each of them is being considered as a potential component of the 50-year water supply plan



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#2 Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels

- Satisfies entire river deficit of 32 mgd in 2060, but reduces reliability of Normandy Reservoir
- Includes improvements to DRUC Intake for access to lower pool water (formerly Alt. #10)
- Project cost $4 million
- EA or EIS required
- Need to identify if increased release has significant impact / environmental benefits

- **Status: Backup, primarily for interim**

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#8 Modify River Constraints to Preserve Storage in Normandy Reservoir

- Modify flow constraints at Columbia by changing instantaneous requirement of 100 cfs to weekly average (or similar) or by reducing 100 cfs instantaneous flow requirement
- May require improving wastewater treatment
- Environmental benefits associated with improvements in level of wastewater treatment
- EA or EIS required

- **Status: Backup, primarily for interim**

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#16 Utilize Quarries

- Utilize storage in existing inactive quarries (300 MG) to supply flow to Duck River during low flow conditions
- Construct intake and pumping station along Duck River and piping to refill quarry from Duck River during high flows with supply back to Duck River during low flows
- Existing quarry satisfies a small portion of the deficit for river users
- Project cost $4 million
- Active quarries could provide additional storage capacity in the future

- **Status: Backup** (due to relatively small storage volume)

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#19 Convey Arnold Cooling Water to Normandy Reservoir or DRUC WTP

- Construct a 24-inch pipeline to convey cooling water from the cooling lake at Arnold AFB to Normandy Reservoir or to DRUC WTP
- Cooling lake obtains water pumped from Woods Reservoir (approximately 25 BG total storage) which was constructed exclusively for water supply (1 mgd) and cooling water for Arnold AFB
- $8-$10 million project cost
- Should be readily permittable, but Arnold AFB would need to identify any restrictions on use to assess reliability
- Concerns related to temperature of cooling water and potential contamination
  - Concerns may be mitigated by discharging directly to DRUC WTP
- **Status: Backup**

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Compatibility of Cornerstone and Backup Alternatives

Alt. No.	Description	Alt. 5/6 Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam/Flood Rule Curve Modifications	Alt. 9 Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)	Alt. 15 Monsanto Lake (Existing Offstream Storage Reservoir)	Alt. 24 Construct Water Intake near Williamsport and Pump Back to Columbia WTP
2	Increase Normandy Reservoir Release to Meet Columbia Constraint Without Raising Dam or Pool Levels and Improve DRUC Intake	Interim Note 1	Interim Note 7	Interim Note 10	Interim Note 10
5/6	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam/Flood Rule Curve Modifications	Cornerstone Note 2	Interim Note 8	Long-term Note 4	Long-term Note 4
8	Modify River Constraints to Preserve Storage in Normandy Reservoir	Interim Note 1	Interim Note 9	Interim Note 10	Interim Note 10
9	Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)	Incompatible Note 3	Cornerstone Note 2	Long-term Note 4	Long-term Note 4
15	Monsanto Lake (Existing Offstream Storage Reservoir)	Long-term Note 4	Long-term Note 4	Cornerstone Note 2	Incompatible Note 12
16	Utilize Quarries	Backup Note 5	Backup Note 5	Backup Note 5	Backup Note 5
19	Convey Arnold Cooling Water to Normandy Reservoir	Incompatible Note 6	Incompatible Note 6	Backup Note 11	Backup Note 11
24	Construct Water Intake near Williamsport and Pump Back to Columbia WTP	Long-term Note 4	Long-term Note 4	Incompatible Note 12	Cornerstone Note 2

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Compatibility of Cornerstone and Backup Alternatives

Alt. No.	Description	Alt. 5/6 Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam/Flood Rule Curve Modifications	Alt. 9 Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)	Alt. 15 Monsanto Lake (Existing Offstream Storage Reservoir)	Alt. 24 Construct Water Intake near Williamsport and Pump Back to Columbia WTP
5/6	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam/Flood Rule Curve Modifications	Cornerstone Note 1	Interim Note 5	Long-term Note 3	Long-term Note 3
9	Raise Normandy Dam (Increase Winter/Spring Pool and Retain Summer/Fall Pool Level)	Incompatible Note 2	Cornerstone Note 1	Long-term Note 3	Long-term Note 3
15	Monsanto Lake (Existing Offstream Storage Reservoir)	Long-term Note 3	Long-term Note 3	Cornerstone Note 1	Incompatible Note 7
19	Convey Arnold Cooling Water to Normandy Reservoir	Incompatible Note 4	Incompatible Note 4	Backup Note 6	Backup Note 6
24	Construct Water Intake near Williamsport and Pump Back to Columbia WTP	Long-term Note 3	Long-term Note 3	Incompatible Note 7	Cornerstone Note 1

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Revised Matrix of Cornerstone and Backup Alternatives

- Your review and input on the revised matrix is welcome

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Feedback Period



PARTICIPANT INPUT / COMMENTS QUESTIONS

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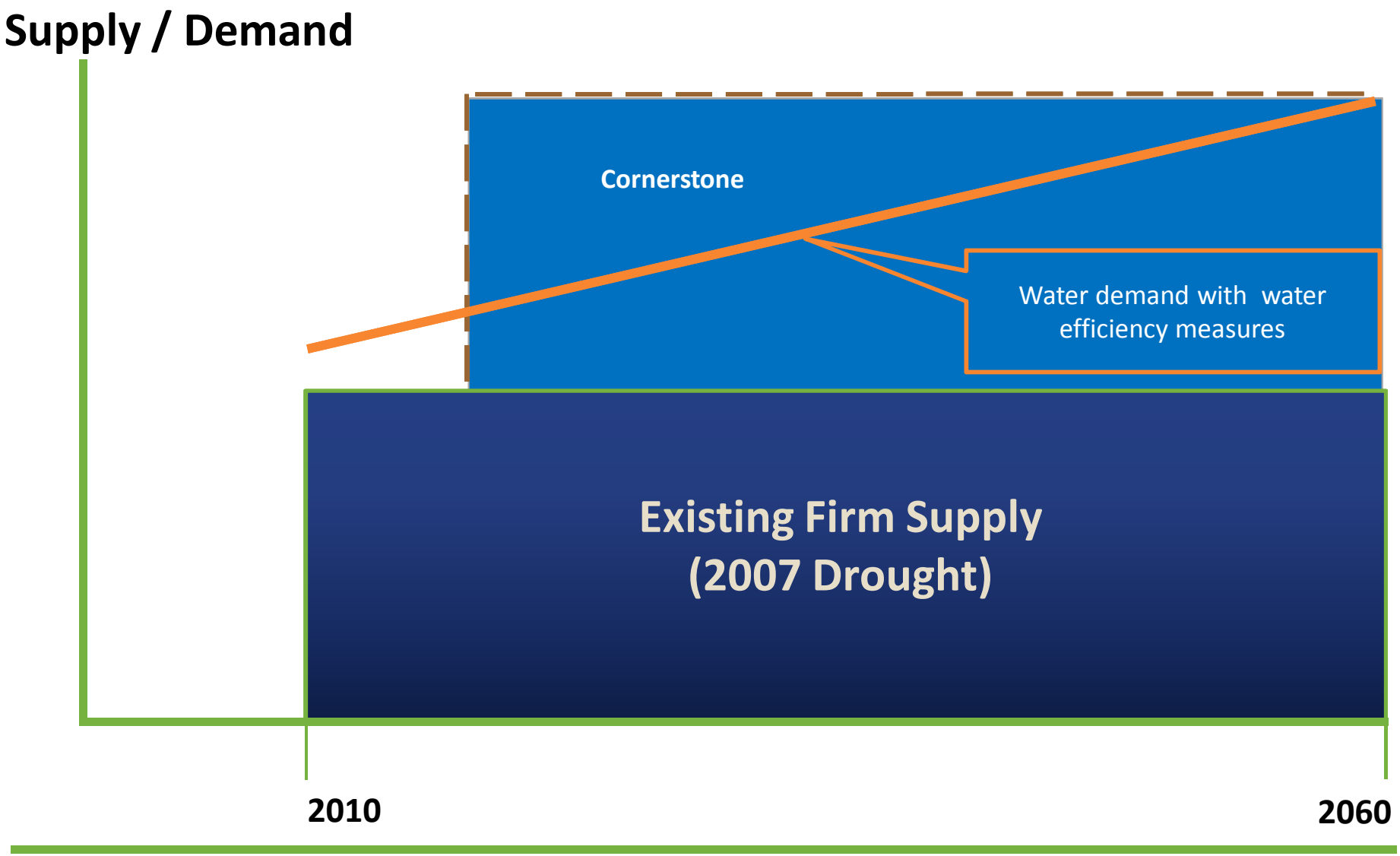
Long Term Water Supply Plan – Single Cornerstone Approach



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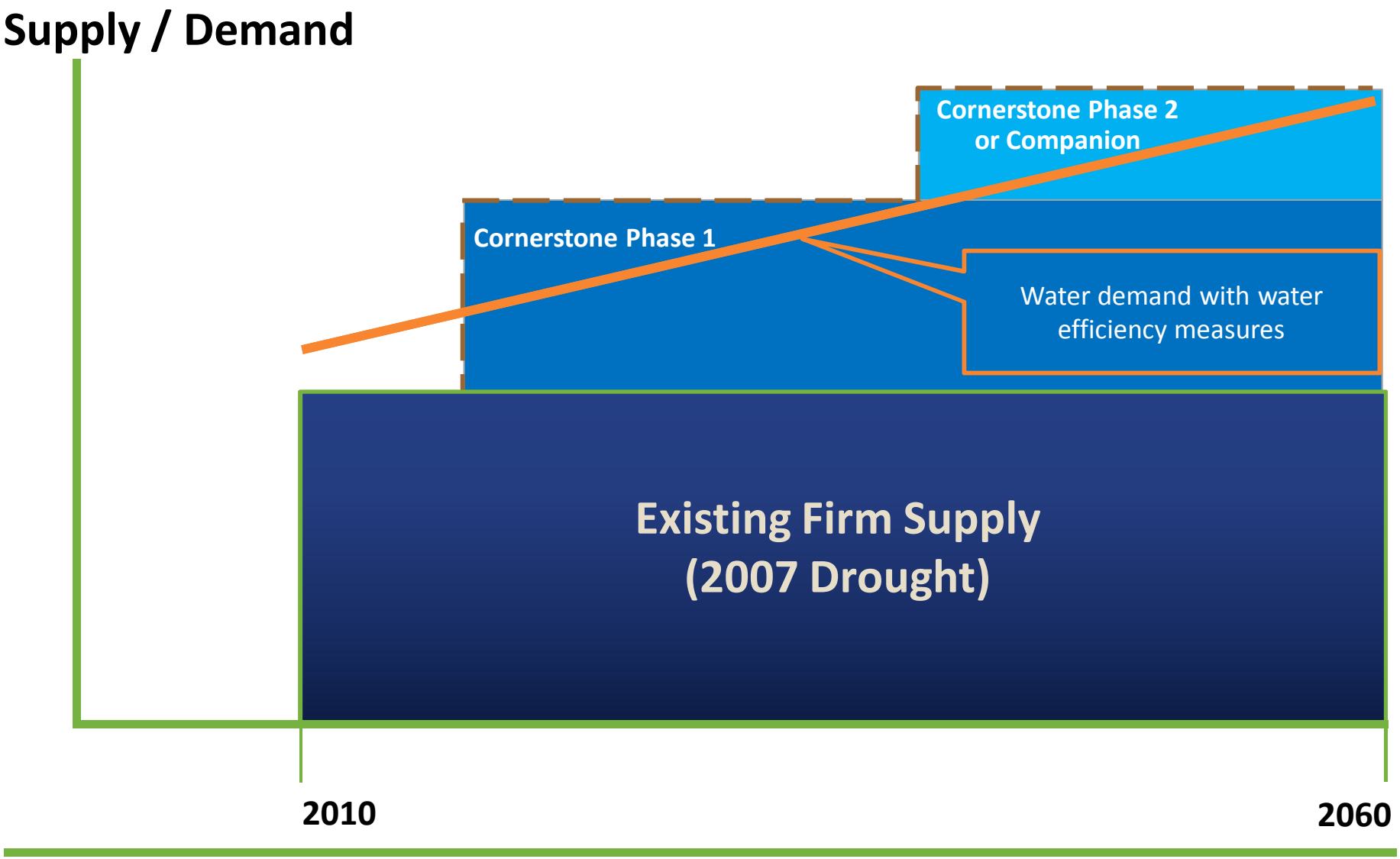
Long Term Water Supply Plan – Phased Approach



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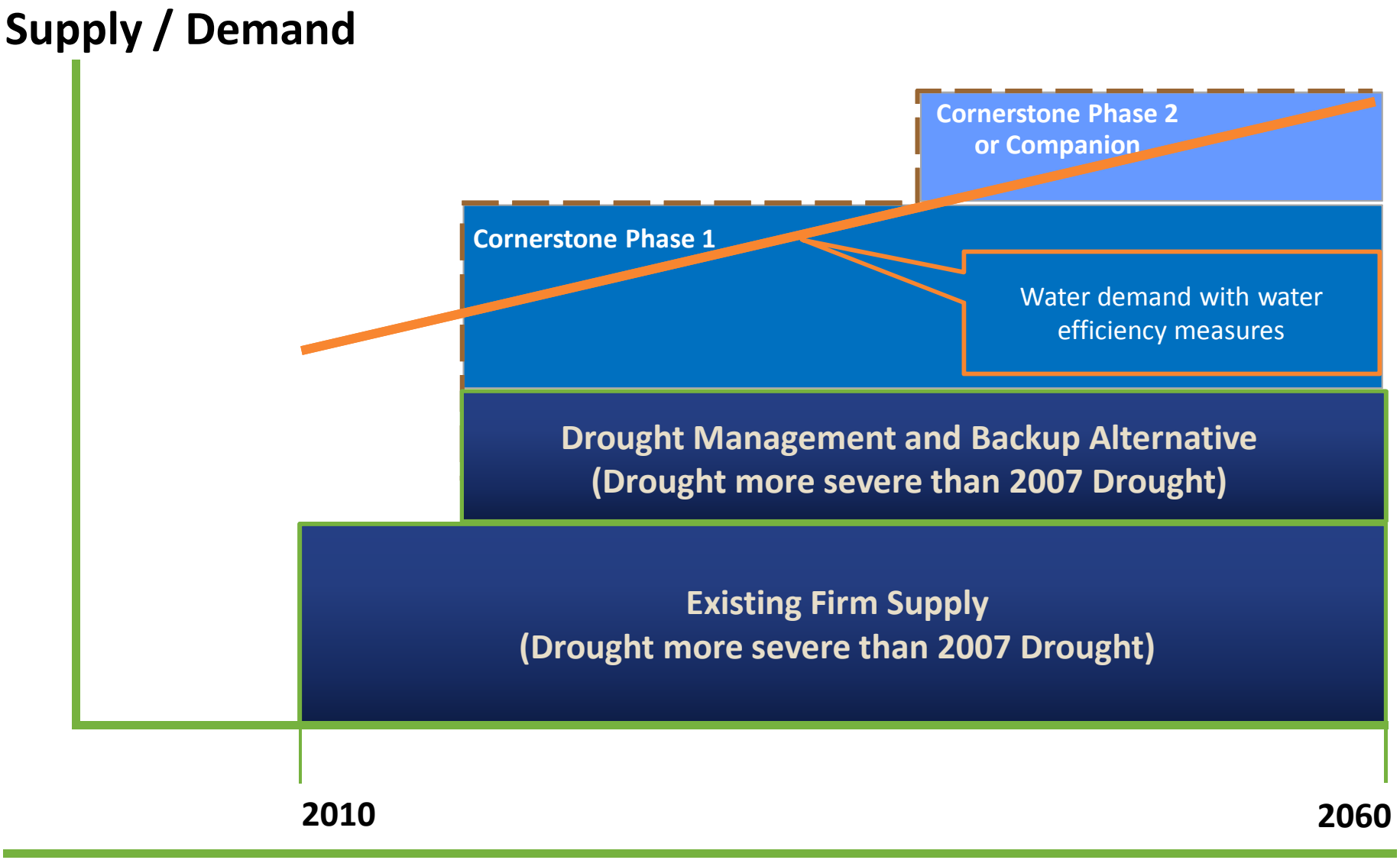
Long Term Water Supply Plan – Backup Alternative



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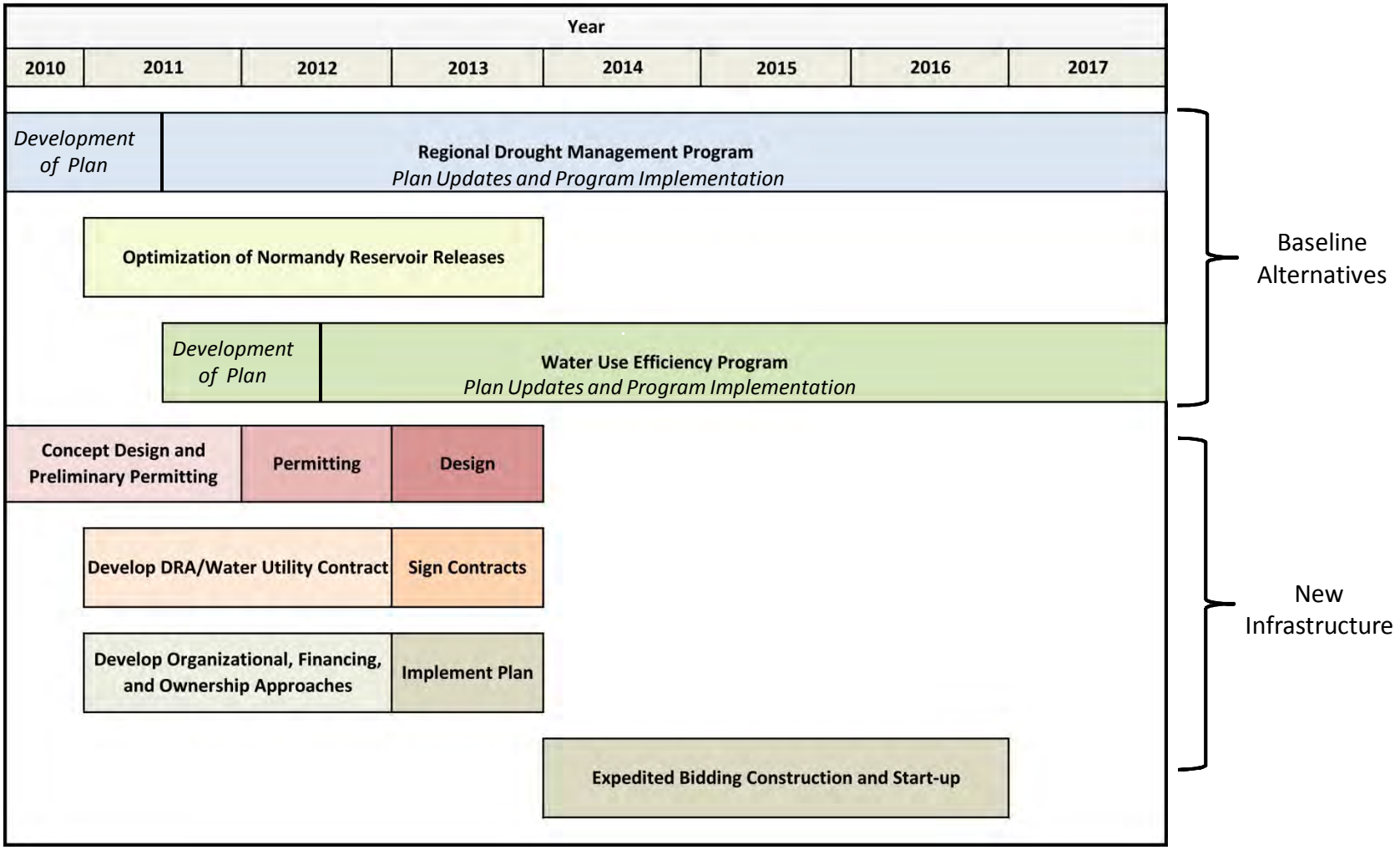
Draft Implementation Plan

Water Supply Improvements
Duck River Agency
22-Apr-10
Preliminary Draft Implementation Plan and Schedule



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Next Steps

- Collect supplemental information to complete evaluation of remaining alternatives
- Prepare draft report with draft recommendation for alternatives to include in the 50-year water supply plan
- Develop Implementation Plan that is adaptable to address uncertainty in future conditions including:
  - Alteration of instream flow conditions from USFWS study
  - Changes in projected water demands or water use characteristics
  - Changes in regulatory requirements
  - Likelihood of more severe hydrologic conditions
- Present Implementation Plan and Draft Report at Workshop No. 6

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Project Schedule Status

PHASE I	
Workshop No. 1 - Kick-off	June 24, 2009
Workshop No. 2 - Preliminary Feasibility	Aug. 26, 2009
Open House Meetings	Sept. 22-24, 2009
PHASE II	
Workshop No. 3 - Developing Alt's	Dec. 9, 2009
Workshop No. 4 - Evaluating Alternatives	Feb. 24, 2010
Open House Meetings	March 24, 2010
PHASE III	
Workshop No. 5 - Implementation Planning	**May 5, 2010**
Draft Report	June 2010
Workshop No. 6 - Conclusions	July 2010
Final Report	Aug. 2010
Open House Meetings	Sept. 2010

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Feedback Period



PARTICIPANT INPUT / COMMENTS QUESTIONS

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WORKSHOP 6

Duck River Development Agency
Comprehensive Regional Water Supply Plan

AGENDA
WORKSHOP No. 6
Henry Horton State Park
August 11, 2010
9 AM to Noon

Welcome / Getting Started

- Review of minutes from Workshop No. 5
- Summary of activities since Workshop No. 5
- Objectives for Workshop No. 6
- Decision process review

Update on Water Supply Alternatives

- Review of screening results from Workshop No. 5
- Updates on the five Cornerstone and Backup Alternatives
  - Updated Matrix
- Stakeholder input/preferences
- Recommendations for Comprehensive Long Term Plan

Implementation Planning

Next Steps

- Open House Public Meetings
- DRA Board action

- **Lunch (Noon)**

- **Duck River Float?**

Duck River Development Agency
Comprehensive Regional Water Supply Plan

Meeting Minutes

Workshop No. 6
Henry Horton State Park
August 11, 2010

Meeting Participants

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Attachments: Agenda, MS PowerPoint presentation

A summary of the discussion follows:

- Participant comment: For the Williamsport intake, note that there is no impact to Centerville because Centerville obtains water from a tributary to Duck River. Add a bullet to Slide 20 to make it clear what (if any) potential impacts might be downstream of the Williamsport intake due to withdrawal. People need to realize that the Duck River does not end at Columbia and we need to make it clear what we know about impacts that might occur downstream. TDEC identified that there is more water in the Duck River near Williamsport compared to Columbia due to the inflows from tributaries between Columbia and Williamsport.
- Participant comment: The Williamsport intake alternative benefits the entire Duck River system because it reduces reliance on Normandy Reservoir.
- Participant comment: Are you saying we would move the Columbia intake downstream or is this new intake at Williamsport? Team response: This is a new intake at Williamsport. Both could be kept active and it's a matter of how TDEC would link the intakes and regulate the withdrawals. If the future water treatment

plant is located near Williamsport, then this intake at Williamsport would be the primary intake.

- Participant comment: O&M costs (life cycle costs) need to be developed to calculate the net present value of each alternative. Team response: Including the O&M cost would further support selection of the intake over selection of Pond 15 because the O&M costs for pumping would be roughly the same and the O&M costs for the dam and structures at Pond 15 would be significantly higher. In addition, O&M and life cycle analyses would be very different if a finished water system was constructed because the water would likely be treated near the intake. In this case, the facilities would be used 365 days per year. The life cycle cost will also depend on the timing for construction and implementation of the raw water facilities. The O&M cost for Pond 15 is much more than the O&M for the intake.
- Participant comment: What about the water quality issues associated with going downstream of Big Bigby due to Mt. Pleasant wastewater discharge? Perception is that there is poor water quality downstream of Big Bigby. Team response: A feasibility study will need to be conducted to identify the location of the water intake near Williamsport. A number of factors will need to be considered including: intake design, water depth, etc. We believe that either location (upstream or downstream of Big Bigby Creek) would meet the supply objectives.
- Participant comment: Would TDEC reduce releases from Normandy Reservoir because Columbia would now have up to an additional 20 mgd in the river? No. Normandy Reservoir's required release and the river constraint at Columbia are not linked.
- Participant comment: For Slide 21, the Friends of Short Springs identified that they strongly object to raising Normandy Reservoir because it is possible that the water level in the Summer pool could be raised in the future. In addition, it is not clear how much this alternative would help Columbia. Team response: TVA identified that raising the Summer pool at Normandy Reservoir in the future would require a NEPA review process.
- Participant comment: For Slide 23, would TVA be able to control the temperature of the release from Normandy Reservoir? Team response: Yes, water could be released from different levels in the reservoir.
- Participant comment: Not sure I understand bullet on downstream habitat. How will operational changes to the release/flood guide curve be addressed? Team response: Having a larger volume of water would allow releases from Normandy Reservoir to continue further into a drought which should benefit downstream habitat. It is possible that TVA's operating policies for Normandy Reservoir would change with the increase in storage volume. Could use the OASIS model to assist with changes in reservoir operation.

- Participant comment: Consider adding a bullet on the additional benefits of raising Normandy Reservoir on the public health and welfare.
- Participant comment: Clarify "avoids" inundation of hiking trails for Short Springs. Team response: This is a comparison with the alternative as configured in the TVA 2000 study not a comparison to existing conditions. Bullet will be removed to avoid confusion.
- Participant comment: Count on regulatory change for water treatment.
- Participant comment: What about the nickel fees collected in Trust B? Team response: For the Normandy Reservoir project, $5.7M was owed to TVA and the debt was written off when the Columbia Dam was not completed. Money in Water Supply Escrow Fund Trust will be used to fund any future water supply infrastructure projects.
- Participant comment: What is the "ballpark" figure for the one-time system development charge for new customers or larger services? Team response: "Ballpark" figure might be $600 per household.
- Participant comment: How many new connections were used to estimate the system development charge? Team response: 100,000 new connections
- Participant comment: Do any of the listed funding arrangements include contributions from outside funding sources such as grants, revolving state funds, etc? Team response: No. This is very affordable and reasonable compared to other water supply projects around the US. DRA is working on obtaining a financial consultant for guidance on financing options. Implementing the components in phases can save the Duck River users lots of money through the years. This is one project with three components: baseline alternatives, raise Normandy Reservoir, and construct new Williamsport intake. Need to consider increasing water supply at Normandy Reservoir first. DRA has some money to pay for a portion of the project which will keep the increase in the withdrawal fee down.
- Participant comment: WRC would be interested in providing input on the implementation schedule.
- Participant comment: Might consider leaving more options on the table such as Pond 15 until the recommendations are implemented.
- Participant comment: Will customers served by wells that are then connected to the public water system be subject to the system development charge under the Growth Pays for Growth strategy? Team response: Yes, because they will put an additional demand on the water source.
- Participant comment: What is optimization of releases from Normandy Reservoir? Team response: A number of factors limit TVA's ability to closely match the required release from Normandy Reservoir to meet the flow constraint at Shelbyville (18 hours travel time) including withdrawals for irrigation between

Normand Dam and Shelbyville, inflows from tributaries, etc. Optimizing releases could include installation of stream gages on tributaries and other improvements.

- Participants were asked to review the Fact Sheet and Doug identified that comments on the Fact Sheet are due by Monday August 16th.
- Participant comment: Have you verified that Normandy Dam can be raised? Team response: No. Additional investigations will be needed to confirm ability to raise dam, but no fatal flaws have been identified to-date.
- Participant comment: Can more investigation of Alt. #5 be conducted because it can provide the most environmental benefits? Team response: Yes.
- Participant comment: What permit process will be required for raising Normandy Dam? Team response: The permit is not clearly defined at this time but a NEPA review will be performed.
- Participant comment: DRA and the Team did a good job of getting information out to the stakeholders and public.
- Participant comment: TDEC identified that compared with other programs this solution is affordable.
- Participant comment: Baseline alternatives will be critical to the program. Consider all the scenarios and solicit agency input on the programs. The water efficiency use program is really important. DRA and Team will need to collect good information to justify programs, set up triggers, and defend and justify the implementation timeline. The plan should include triggers for implementation of various phases of the project/alternatives.
- Participant comment: The report for the Comprehensive Regional Water Supply Plan should be provided to the WRC for review.
- Participant comment: Doug has shown great leadership throughout the study.

Cornerstone and Backup Alternatives Matrix - Workshop No. 6 (DRAFT)

No.	Raw Water Source	Description	Evaluation Criteria						
			Reliable Capacity	Raw Water Quality	Cost	Implementability	Flexibility	Environmental Benefits	Recreation
5	Raise Normandy Reservoir Winter/Spring Pool Level without Raising Dam	Raise Normandy Reservoir Winter/Spring pool level from 864 ft to 869 ft to preserve water storage from Winter/Spring pool for human and environmental needs during drier Summer/Fall months. Increase releases from Normandy Reservoir to meet needs at Shelbyville and Columbia. Cost will include acquisition of increased flood prone land. Need to finalize delineation of the extent of increased area of flooding.	- Satisfies entire river deficit of 32 mgd in 2060. - Increases storage by approximately 5 BG, exceeding the minimum 1.4 BG needed to meet Columbia constraint in 2060. - Reduces flood storage volume by roughly 5 BG. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	No change.	$9 million (project cost)	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - May require extended time to acquire land in flood prone areas downstream of dam.	- Winter pool can be raised in stages, as needed over time.	- Acquisition of flood prone land along Duck River and tributaries may be viewed as environmental benefit. - Potential negative impacts due to higher frequency of flooding.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought.
9	Raise Normandy Dam (Increase Winter/Spring Pool Level, but Retain Summer/Fall Pool Level)	Increase the height of Normandy Dam and Winter/Spring pool level by 5 ft (i.e., increase flood pool from 880 ft to 885 ft, retain Summer/Fall pool at 875 ft, and increase Winter/Spring pool from 864 ft to 869 ft). Increase releases from Normandy Reservoir to meet needs at Shelbyville and Columbia.	- Satisfies entire river deficit of 32 mgd in 2060. - Increases storage by approximately 5 BG, exceeding the minimum 1.4 BG needed to meet Columbia constraint in 2060. - No impact on flood storage volume. - Continued reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	No change.	$15 million to $30 million (project cost), depending on need to raise roads and bridges, etc.	- EIS involving detailed environmental studies of flow alteration will be required, but ability to obtain necessary permits is likely. - Need to document miles of stream feeding Normandy Reservoir that will be inundated. - Short Springs (State Designated Natural Area) along Bobo Creek could experience prolonged periods of occasional inundation. Retaining summer pool level avoids need to inundate 2 to 3 acres of flora and hiking trails at Short Springs. - Loss of existing shoreline vegetation and establishment of new vegetation.	- No flexibility to phase implementation for construction, but could raise winter pool in stages, as needed over time.	- No apparent environmental benefits associated with hydrologic regime, physical habitat, water quality and biota.	- Preserves pool storage and extends recreation in Normandy Reservoir during drought. - Potential impacts to campgrounds and boat ramps.
15	Pond 15 (Existing Offstream Storage Reservoir)	Purchase Pond 15 which is a 5 BG offstream storage reservoir along Duck River approximately 8 miles northwest of Columbia. Utilize existing Columbia intake, upgrade existing Columbia pumping station, and construct a *pipeline (10 miles) from reservoir to Columbia WTP to convey water from reservoir to WTP, and to refill reservoir from the Duck River. *Note: One 42-inch pipeline or two 30-inch pipelines provide at least 32 MGD capacity. One 30-inch pipeline included in costs to provide initial capacity of approximately 20 MGD.	- 5 BG of new storage satisfies minimum 1.4 BG river deficit at Columbia in 2060. - Direct ownership maximizes control of supply. - Direct connection between reservoir and Columbia WTP assures delivery of required supply (eliminates potential for unanticipated loss of raw water from Duck River between Normandy Reservoir and Columbia). - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	Construct a multi-port intake in Pond 15 to obtain highest quality water. Water and sediment sampling does not indicate contamination.	$48 million (project cost) including land costs	- Reportedly no jurisdictional wetlands. - Ability to obtain necessary permits is likely.	- Alternative can be implemented in multiple phases. - Provides option to serve Spring Hill from Pond 15, instead of Spring Hill's existing Duck River intake. - Alternative flexible for providing either raw water or finished water to Columbia and Spring Hill.	- Ability to discontinue use of existing Spring Hill intake (at least during droughts) would increase flow in sensitive reach of Duck River just above Columbia.	- Potential for fishing and other recreational opportunities associated with offstream storage reservoir.
19A (Raw Water)	Convey raw water from Arnold AFB to Normandy Reservoir or DRUC WTP	Construct a 24-inch pipeline (7 miles) to convey raw water from the 57 MG reservoir at Arnold AFB to a pipeline which would discharge directly to Normandy Reservoir. Alternatively, could construct 9 miles of 24-inch pipeline and discharge directly to the DRUC WTP. The 57 MG reservoir receives water pumped from Woods Reservoir (approximately 25 BG total storage) which was constructed exclusively for water supply and cooling water for Arnold AFB, and its operation is controlled by Arnold AFB.	- Adequate storage in Woods Reservoir to satisfy minimum 2-3 BG of storage needed at Normandy Reservoir to meet 1.4 BG river deficit in 2060. - Alternatively, raw water from Arnold AFB could be conveyed to DRUC WTP, adequate to meet future potable supply needs of DRUC for 90-180 days (approximately 1-2BG). - Arnold AFB would need to identify any restrictions on use to assess reliability.	- Using water from the 57 MG reservoir should avoid reported water quality issues in the cooling water.	$8 million (project cost) to reservoir, $10 million to DRUC WTP	- Minimal permit requirements. - Requires approval of Arnold AFB.	- No flexibility to phase implementation.	- Could allow more complete utilization of Normandy Reservoir storage by accessing this alternate supply when reservoir pool level drops too low to access, or when Normandy Reservoir water quality is unacceptable for water supply.	- No recreational benefits or impacts.
24A (Raw Water)	Construct Water Intake near Williamsport and Pump Back to Columbia / Maury County	Construct a 32 mgd water intake and pumping station on Duck River near Williamsport and a *pipeline (approximately 17 miles) to convey water to the Columbia water treatment plant. *Note: One 42-inch pipeline or two 30-inch pipelines provides at least 32 MGD capacity. One 30 inch pipeline included in costs, to provide initial capacity of approximately 20 MGD.	- Satisfies entire river deficit of 32 mgd in 2060. - Drought proof and highly reliable. - Minor reduction in downstream flows due to consumptive uses in the Maury and South Williamson County water systems. - Reduces reliance on Normandy Reservoir (208 sq mi drainage area) as sole source of water during severe droughts to satisfy many needs.	- No change.	$38 million (project cost)	- EIS involving detailed environmental studies of flow alteration will be required but ability to obtain necessary permits is likely. - Lower downstream flows not likely to cause adverse impacts on aquatic life.	- Alternative can be implemented in multiple phases. - Provides option to serve Spring Hill from Williamsport intake, instead of Spring Hill's existing Duck River intake. - Flexible to provide either raw or finished water to Columbia and Spring Hill.	- Ability to discontinue use of existing Spring Hill intake (at least during droughts) would increase flow in sensitive reach of Duck River, just above Columbia.	- No recreational benefits or impacts.



Duck River Comprehensive Regional Water Supply Plan

Workshop No. 6 / August 11, 2010

O'BRIEN & GERE
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Executive Summary

- **Comprehensive 50-Year Water Supply Plan with 100-Year Vision**
  - Multiple sources of water supply increase reliability, flexibility and sustainability
- **Credible process with good science and collaborative decision-making**
  - Sound technical approach using state of the art tools and techniques
- **Regional approach with benefits beyond water supply**
  - Reduces flood risk to communities downstream of Normandy Dam
  - Extends recreation (reservoir and river)during droughts
- **Affordable solution**
  - Long range water supply for $1.50/month or less per house!
  - *"Working Together Works"*

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Agenda

- Review of Minutes from Workshop No. 5
- Summary of Activities Since Workshop No. 5
- Objectives for Workshop No. 6
- Update on Water Supply Alternatives
- Presentation of Recommended Plan and Financial Approach
- Discussion
- Planning for Open House Public Meeting
- Next Steps

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Review of Minutes from Workshop No. 5

- Updated the remaining alternatives
  - 4 potential “back-ups”
  - 4 potential “cornerstones”
- Evaluated compatibility matrix
- Selected 5 alternatives for continued consideration
- Agreed to investigate some finished water options

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Summary of Activities Since Workshop No. 5

- Meetings / discussions with Pond 15 property owners, TVA, and TDEC
- Met with Columbia Water and Power and Maury County Water System to discuss raw and finished water approaches for Maury County
  - Reviewed finished water quality data to assess need for water treatment upgrades
- Met with DRUC, TUB and AEDC, toured AEDC water supply facilities, and discussed raw and finished water approaches for AEDC/DRUC/TUB
- Updated remaining alternatives matrix
- Briefed DRATAC and WRC on project status (7/7/10 and 7/8/10)
  - DRATAC passed a resolution indicating their preferences
- Held work session with DRA Board (7/22/10)
- Implementation planning and preliminary financial analysis

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Objectives for Workshop No. 6

- Obtain input from stakeholders on Recommended Comprehensive Regional Water Supply Plan
- Review next steps
- Celebrate!

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Project Goal

"The goal is to have a (comprehensive) Plan that will provide direction to the Duck River Agency regarding the management of available water resources, including the implementation of specific water supply infrastructure projects."

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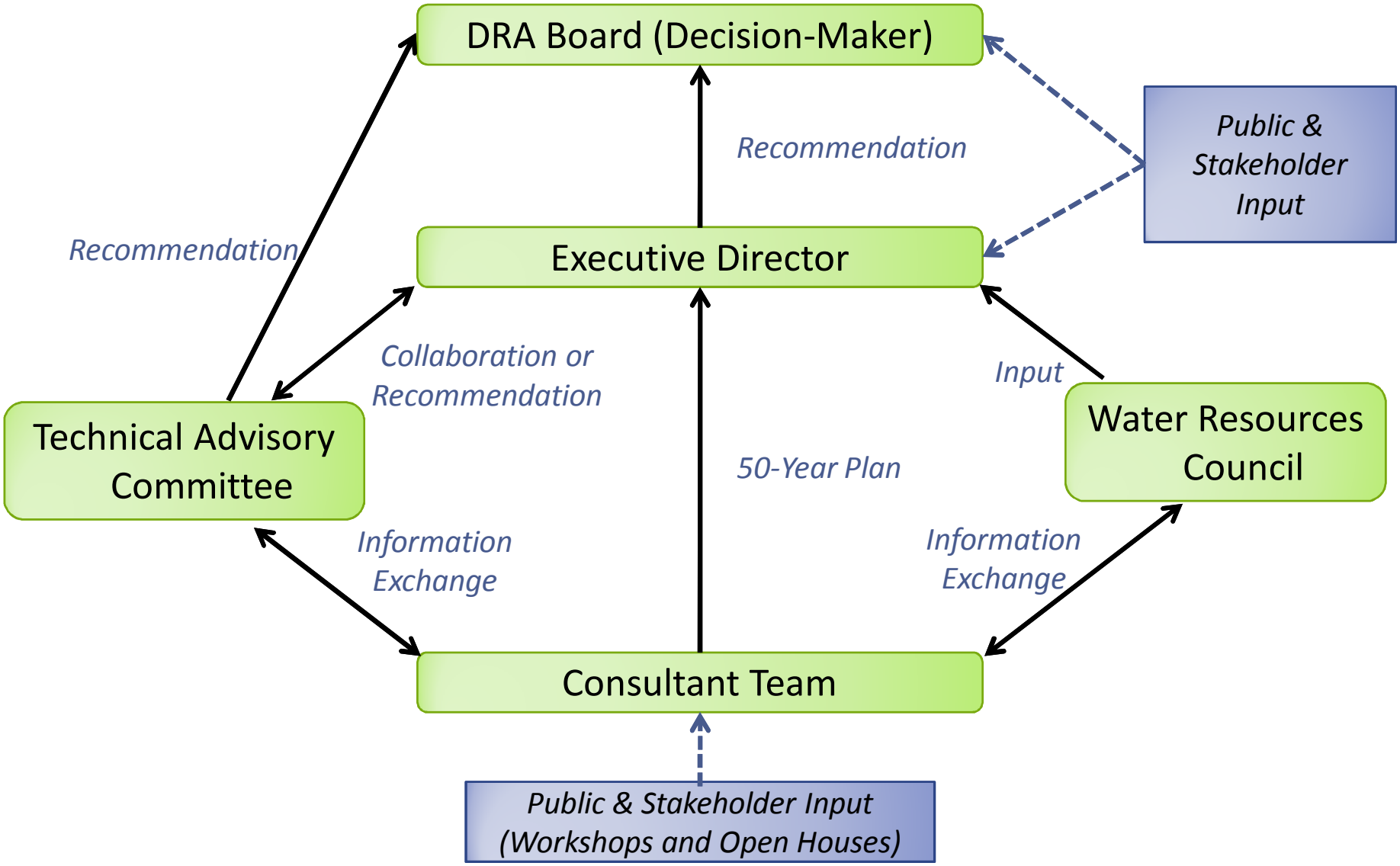
Roles of Key Participants in the Decision Process



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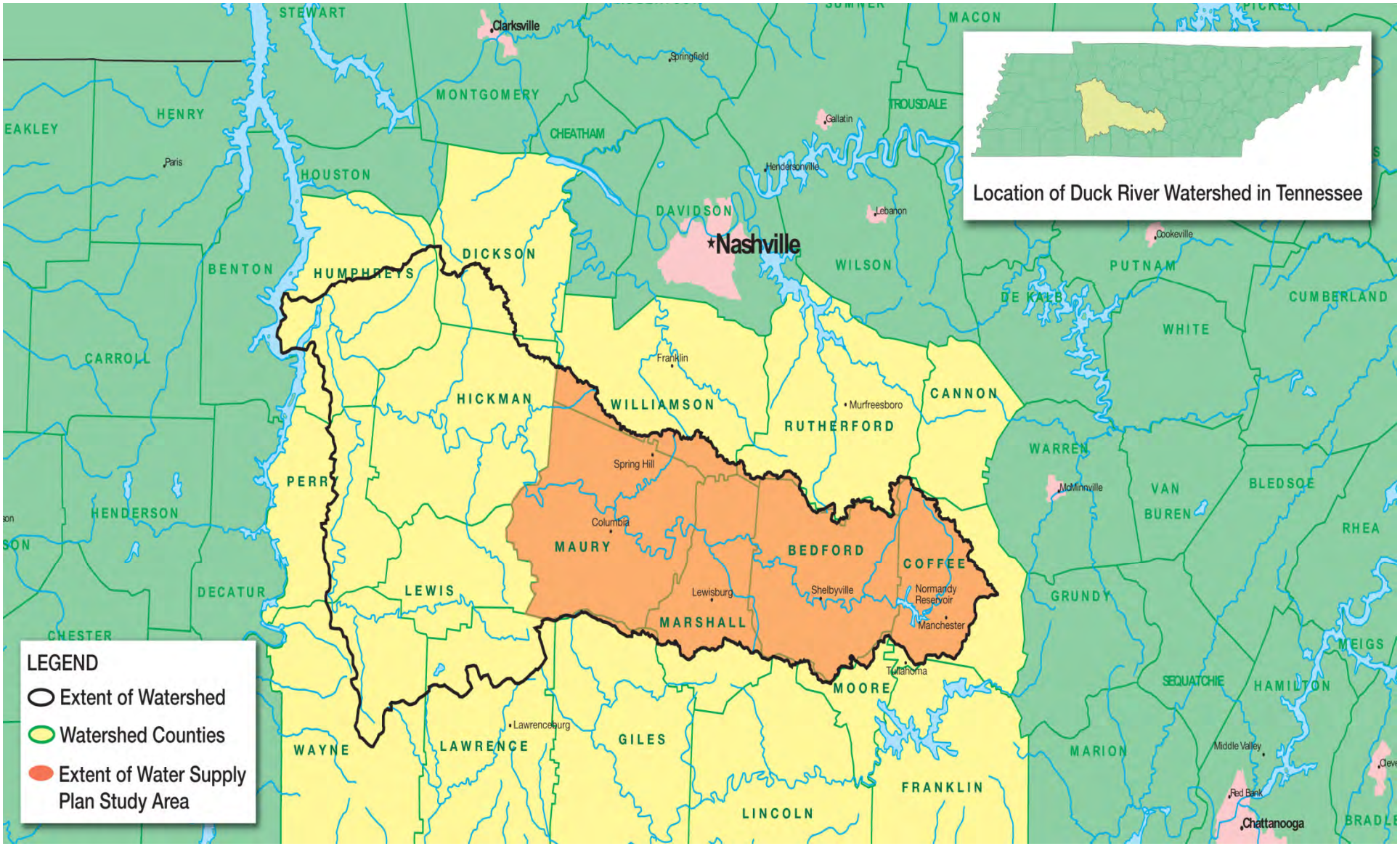
Location Map



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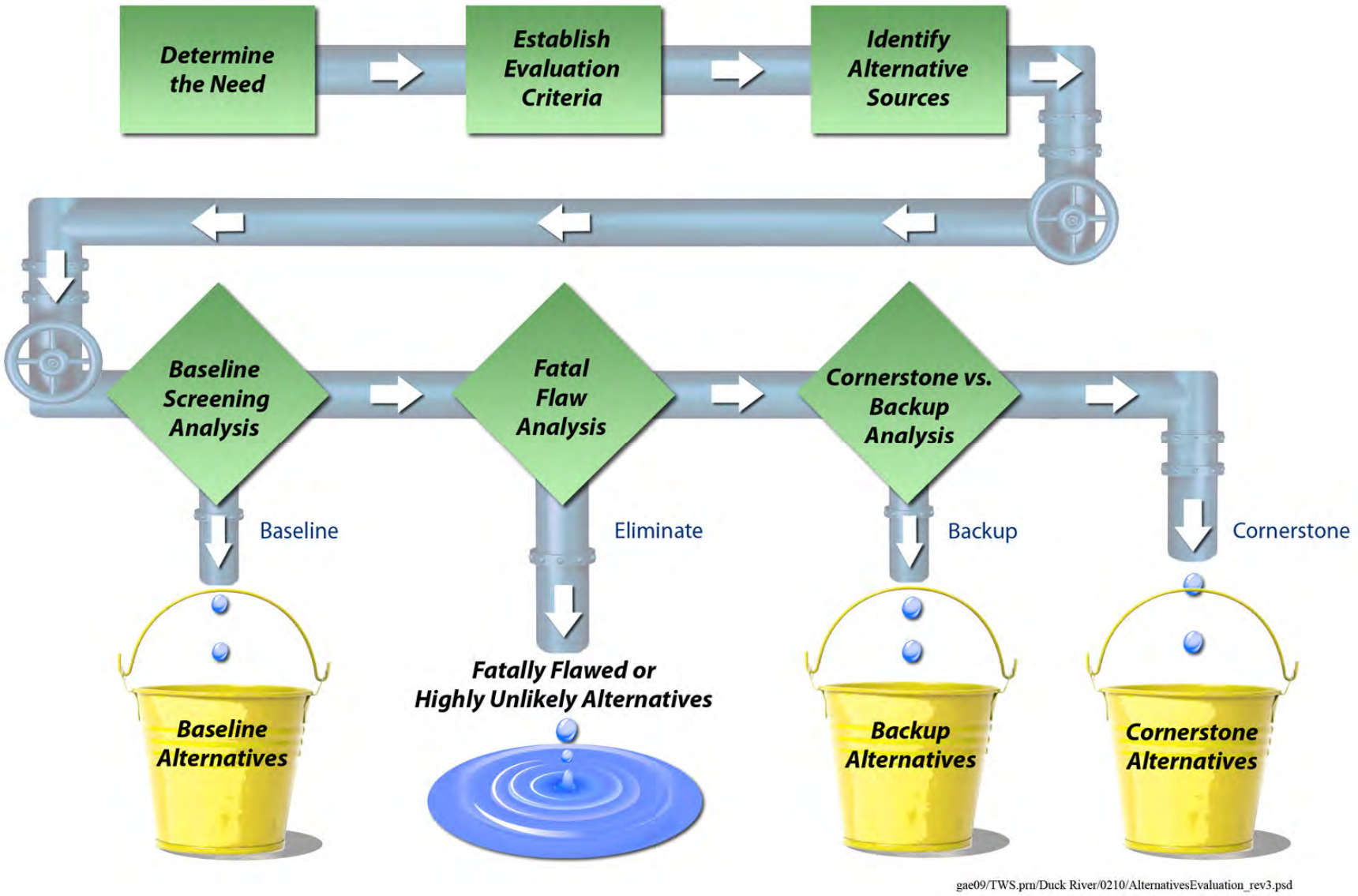
Water Supply Evaluation Process



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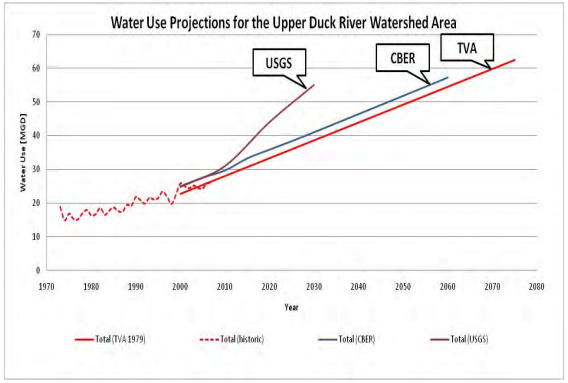
File Location

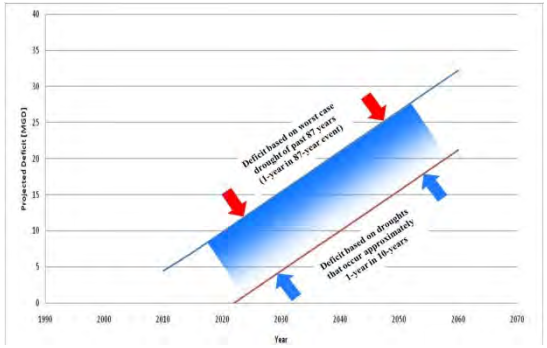
Duck River Regional Statement of Need

Defining the Need

- Normandy Reservoir and the Duck River supply virtually all the public water supply needs in the five county planning area
- The drought of 2007-2008 heightened awareness of the limitations of the Duck River, as Normandy Reservoir fell to approximately 42% capacity
  - Water use restrictions and emergency reductions to releases from Normandy Reservoir were approved
- Population projections from CBER and current water usage patterns were used to project future water usage, which will roughly double by 2060
- OASIS model utilized the water demand projections, current flow constraints and 87 years of hydrologic data to assess the reliability of the Normandy Reservoir and Duck River to meet the water supply and environmental needs of the Duck River Region
  - A 4 mgd deficit currently exists under the drought of record and current constraints
  - A deficit of up to 32 MGD in the year 2060 is projected under the drought of record and current constraints which equates to 1.4 BG to 3 BG of storage







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Evaluation Criteria

- Reliable Capacity
- Raw Water Quality
- Cost
- Implementability / Risk of Delays
  - permittable
  - public acceptance
  - property acquisition
- Flexibility
  - phased implementation
- Environmental Benefits
- Recreation

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Results from Workshop No. 5 (continued)

5 Remaining Cornerstone and Backup Alternatives:

- 4 Cornerstones:
  - #5 - Raise Normandy Reservoir Winter/Spring Pool without Raising Dam
  - #9 - Raise Normandy Dam (Increase Winter/Spring Pool Level, but Retain Summer/Fall Pool Level)
  - #15 - Pond 15 (Existing Off-stream Storage Reservoir)
  - #24 - Construct Water Intake near Williamsport and Pump Back to Columbia/Maury County
- 1 Backup:
  - #19 - Convey Raw Water from Arnold AFB to Normandy Reservoir or DRUC WTP

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#5 Raise Normandy Reservoir Winter/Spring Pool Level Without Raising Dam

- Raise winter pool level from 864 ft to 869 ft to preserve winter storage
- Increases frequency and likely extent of flooding
  - Current 100-Year Flood coverage about 6,700 acres
  - Estimate less than 10% increase to the extent of 100-Year Flood
- Rough budget for land purchase and/or flood easements set at $10 million, but more detailed investigations required
- Continues region's sole reliance on Normandy Reservoir for water supply



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#9 Raise Normandy Dam
Retain Summer Pool Elevation, Maintain Flood Storage

- Increase Winter/Spring pool level by 5 feet, and retain Summer/Fall pool level
- Project cost previously estimated at $15-30 million, depending on need to raise bridges, rebuild roads, etc.
  - Impacts appear to involve 1.6 miles of county roads, and 2.4 miles of minor roads. No apparent impacts to state roads or bridges.
  - Ongoing assessment of dam stability
- Continues region's sole reliance on Normandy Reservoir for water supply



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#15 Pond 15 (Existing Offstream Storage Reservoir)

- Purchase Pond 15, which is a 5 BG offstream storage reservoir along Duck River approximately 8 miles northwest of Columbia
- Utilize existing Columbia intake, upgrade existing pumping station, and initially construct approximately 10 miles of 30-inch pipeline between reservoir and Columbia WTP to fill and draw from reservoir
  - 30-inch pipeline conveys roughly 20 mgd; 2nd pipeline required for 32 mgd
- Property owners report there are no jurisdictional wetlands
- Water and sediment data indicates Pond 15 is suitable for water supply
- $48 million capital cost includes $14 million asking price for land, and recommended improvements to dam
- Reduces reliance on Normandy Reservoir

Historic Photo





Current Photo

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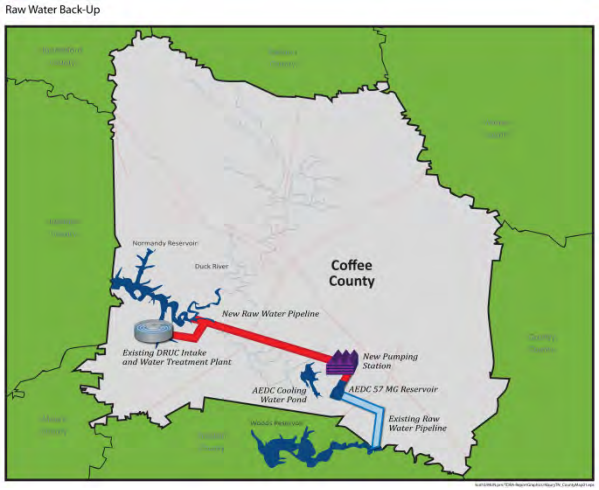
#19 A - Convey Raw Water from Arnold AFB to Normandy Reservoir or DRUC WTP

- Construct a 24-inch pipeline to convey raw water from the 57 MG reservoir at Arnold AFB to Normandy Reservoir or to DRUC WTP
- 57 MG reservoir receives water pumped from Woods Reservoir (approximately 25 BG total storage) and supplies the Arnold AFB WTP
  - Approach should avoid water quality issues
- $8-$10 million project cost
- Arnold AFB and potentially TVA would need to identify any restrictions on use of water from Woods Reservoir



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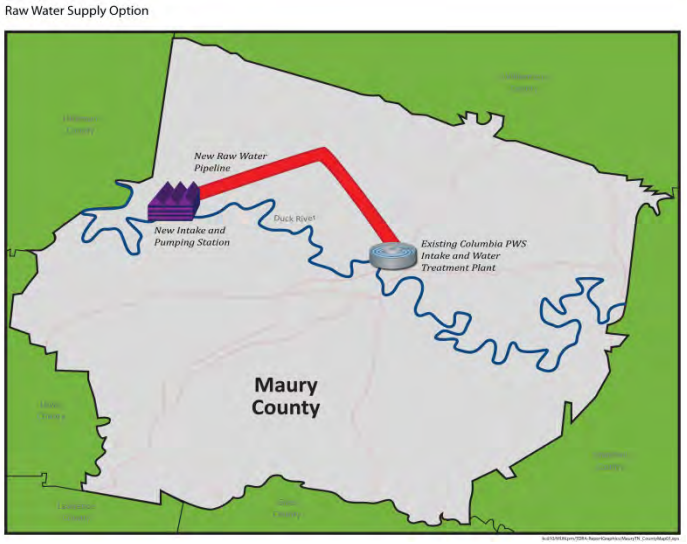
#24 A - Construct Water Intake near Williamsport and Pump Back to Columbia/Maury County (Raw Water Option)

- Intake location about 25 miles downstream of existing Columbia intake
- Construct approximately 17 miles of 30-inch pipeline to Columbia water treatment plant
  - 30-inch pipeline conveys roughly 20 mgd; (Equals capacity of Columbia's existing withdrawal permit)
  - 2nd pipeline required for 32 mgd
- $38 million project cost
- Reduces reliance on Normandy Reservoir
- Flexible to serve all of Maury County
  - Could curtail or eliminate use of existing Spring Hill intake in a sensitive reach of Duck River above Columbia
  - Could also serve Mt. Pleasant



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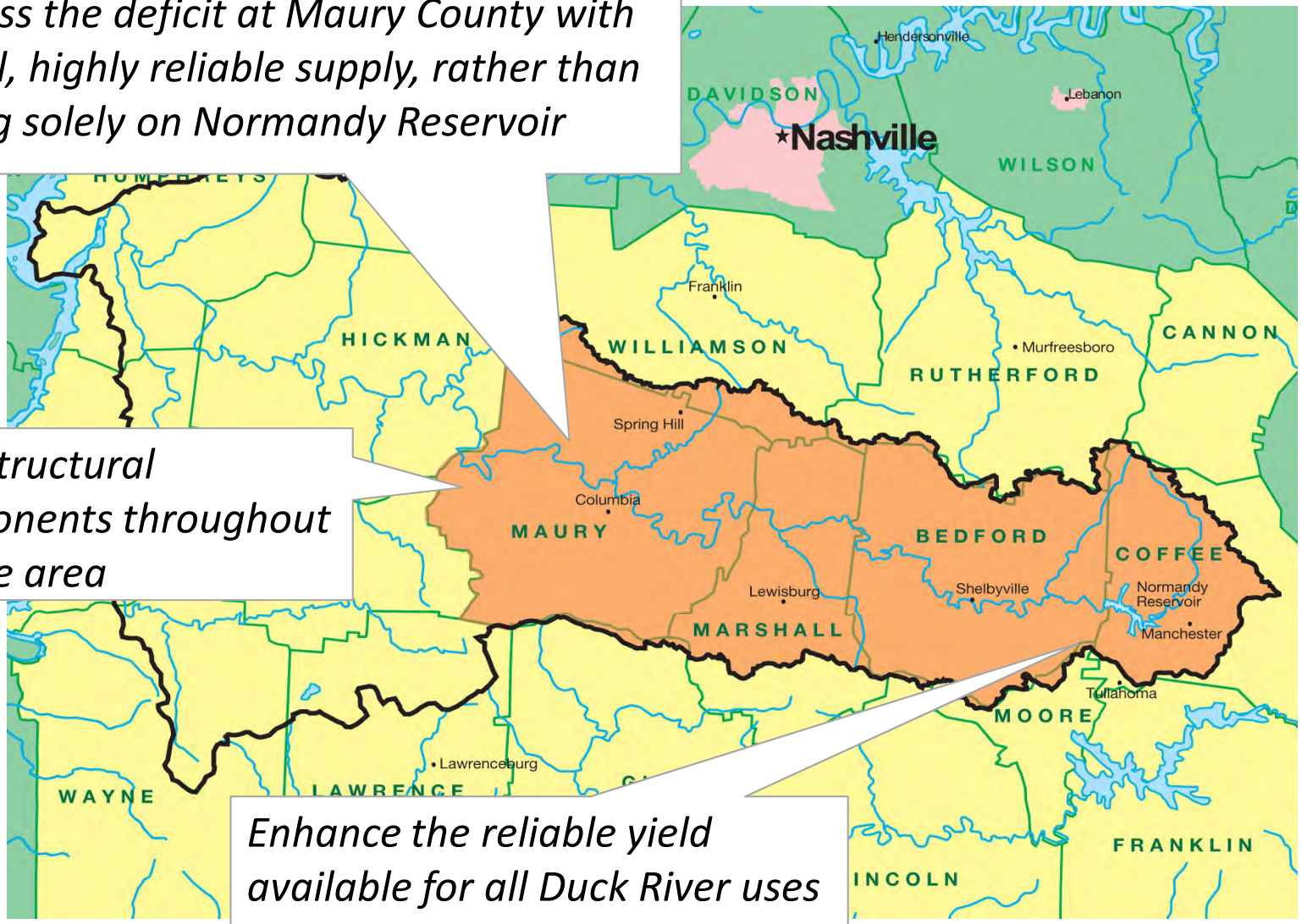
Comprehensive 50-year Water Supply Plan with 100-year Vision

Address the deficit at Maury County with a local, highly reliable supply, rather than relying solely on Normandy Reservoir



Non-structural components throughout service area

Enhance the reliable yield available for all Duck River uses

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Comparison of Alternatives for Maury County

Pond 15 (Offstream Storage)

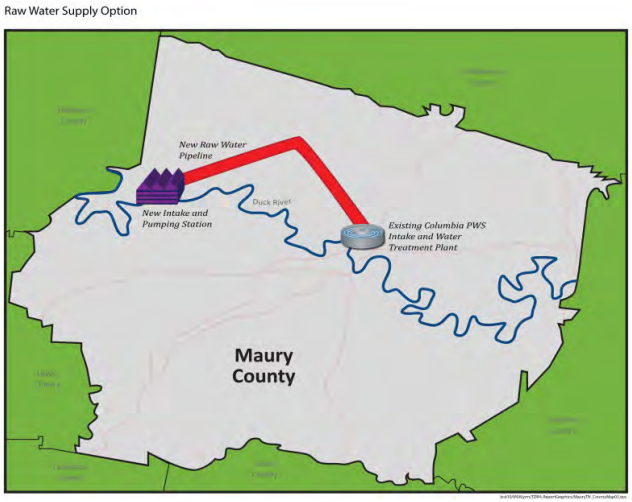
- $48 million capital cost
- Limited resource in a prolonged drought
- Long-term maintenance of dam
- Some recreational benefits
- Raw and finished water options



Williamsport Pump-back

- $38 million capital cost
- More reliable in prolonged drought
- Raw and finished water options

RECOMMENDED OPTION



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Comparison of Alternatives at Normandy Reservoir

Alternative #5, Raise Normandy Pool without Raising Dam

- $10 million (rough estimate) to acquire land/flood easements
- Increases frequency and/or extent of downstream flooding

Alternative #9, Raise Normandy Dam

- $15-30 million capital cost
- Reduces risk of downstream flooding

RECOMMENDED OPTION



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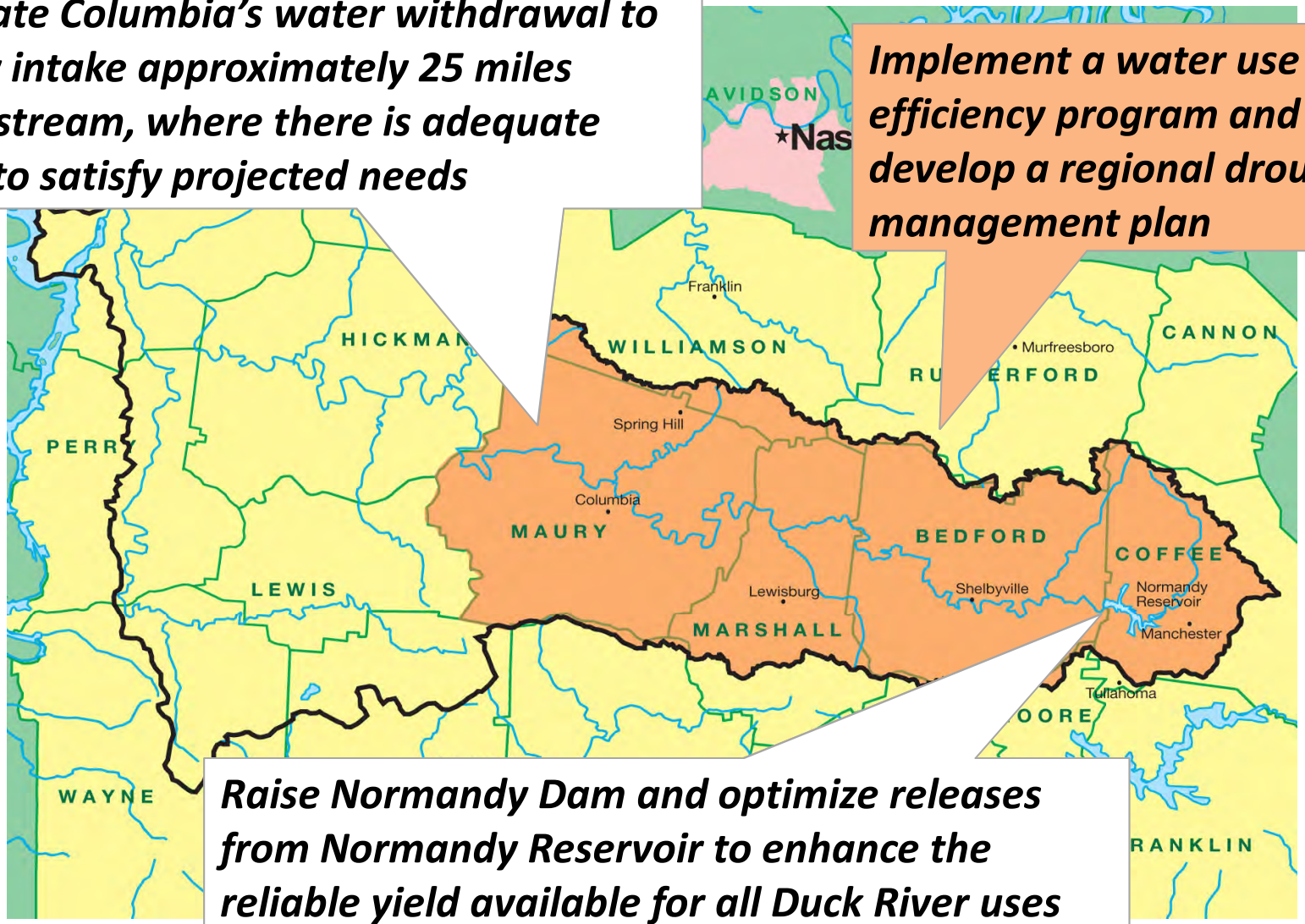
Comprehensive 50-year Water Supply Plan with 100-year Vision

Relocate Columbia's water withdrawal to a new intake approximately 25 miles downstream, where there is adequate flow to satisfy projected needs

Implement a water use efficiency program and develop a regional drought management plan



Raise Normandy Dam and optimize releases from Normandy Reservoir to enhance the reliable yield available for all Duck River uses

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Normandy Reservoir – Benefits

- **Water supply** – enhances reliable yield for water supply
- **In-lake recreation** – higher pool level for longer use during drought
- **Instream flow** – longer duration of releases from Normandy Reservoir to Duck River during drought periods
- **Flooding** – reduction in flood risk to communities/property downstream of Normandy Dam due to increase in flood storage
- **Shoreline** – reduces exposed shoreline and erosion
- **Environmental** – avoids impacts to upstream wetlands and streams

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Williamsport Intake – Benefits

- **Water supply reliability** – Highly reliable source of supply (not limited by instream flow), which eliminates reliance on Normandy Reservoir as the source of water supply during drought
- **River constraint** – Increases instream flow at Columbia gage to maintain minimum 100 cfs for all uses
- **Columbia intake** – Eliminate routine withdrawal from Columbia Pool (existing intake could be used as a back-up)
- **Spring Hill intake** – Eliminate routine withdrawal from Duck River upstream of Columbia Pool increasing instream flow in designated critical habitat (existing intake could be used as a back-up)
- **Regional water system** – Potential to create a regional water system

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Advantages of Implementing All Components

- **Multiple sources of supply** – Increases reliability by utilizing multiple sources of water supply
- **Regional solution with benefits beyond water supply**
  - Extends recreation (reservoir and river)during droughts
  - Reduces flood risk downstream of Normandy Dam
- **Finances** – Encourages financial support from entire region/ lower cost per customer … "*Working Together Works*"
- **Flexibility** – Combination of structural and non-structural components address uncertainty in future conditions including:
  - Alteration of instream flow conditions
  - Changes in projected water demands or water use characteristics
  - Changes in regulatory requirements
  - Likelihood of more severe hydrologic/climatic conditions
  - Changes in land use and hydrologic conditions in watershed

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Cost Summary

Estimated Project Costs for Recommended Plan:

Williamsport Intake and Raw Water Pipeline to Columbia (with one 30-inch pipeline for 20 mgd)	$38 million
Raise Normandy Dam	$20 million
Baseline Alternatives	$4 million
Total Costs	**$62 million**

Note: Additional cost to extend raw water pipeline to Spring Hill is approximately $6 million

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Financing Approach - Philosophy

- Cost sharing philosophy:
  - "*Growth Pays For Growth*"
    - System development charge for new services and larger services
  - Common charge based on all water withdrawals

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Financing Approach – Potential Cost per Household

- Three examples of initial estimated increase in cost per household (typical usage = 5,000 gallons/month)

1. Using solely water withdrawal fees:
   - **Approximately $3.00/month**

2. Using water withdrawal fees (all customers) and System Development Charges (for new services and larger services):
   - **Approximately $1.50/month**

3. Using water withdrawal fees (all customers) and System Development Charges (for new services and larger services), ***plus*** phasing the construction and using current reserve funds:
   - **Approximately $0.60/month**

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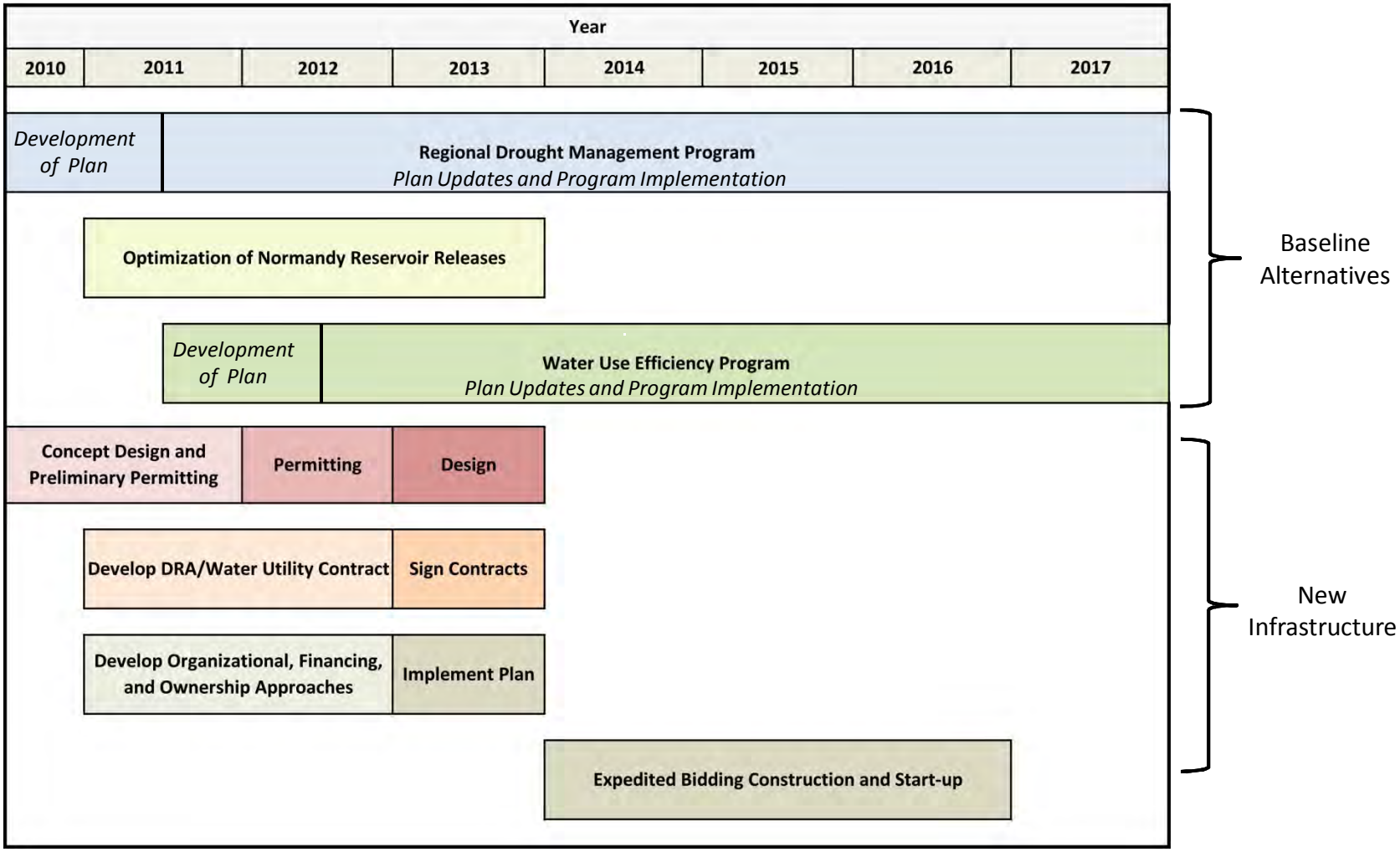
Draft Implementation Plan

Water Supply Improvements
Duck River Agency
22-Apr-10
Preliminary Draft Implementation Plan and Schedule



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Feedback Period



Comments on 50-Year Plan and Fact Sheet

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Your Comments Requested

- **On the structural and non-structural components recommended for the Comprehensive 50-Year Water Supply Plan:**
- **On the study process:**
- **On the financial plan and affordability:**
- **On obstacles and key challenges for implementation:**
- **On the Fact Sheet and Public Meeting:**

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Next Steps

- Receive comments on Fact Sheet
- Open house public meetings on September 9th
  - 1:30 PM – 3:30 PM and 5:30 PM – 7:30 PM
- Complete Report with Recommendations and Implementation Plan
- Board endorses Report and Recommendations in October
- Implementation!

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Feedback Period



Thank You!

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