# Memo

**To:** Tim Begley, City of Crossville Director of Engineering
Everett Bolin, Crab Orchard Utility District Manager
Sandra Brewer, South Cumberland Utility District Manager
David Bell, West Cumberland Utility District Manager

**From:** Stuart Stein and Aaron George, GKY & Associates, Inc. (GKY)

**CC:** Walter Green, Ben Rohrbach, and Parvathi Gaddipati, Nashville District Corps of Engineers

**Date:** July 12, 2012

**Re:** Cumberland County Regional Water Supply Plan – Assumptions

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GKY would like the City of Crossville and all Cumberland County Utility District (UD) Managers approval on the following assumptions/methods:

## 1.0 Drought Operations

### Original Data:

GKY was provided with the **Water Utility Districts of Cumberland County Drought Management Plan** (Approved August 2010) from the City of Crossville, Crab Orchard UD, and West Cumberland UD. This plan documents the various stages of emergency for the Cumberland County UDs and their level of response for each stage. The Drought Management Plan was a collaborative effort, developed by Crossville/Cumberland County Emergency Management Agency in consultation with all the Cumberland County UDs.

### Assumptions:

GKY assumes that since all UDs were involved in creating this document that they all follow the guidance outlined in the document. Specifically, GKY assumes that each UD with a Water Supply Source monitors the varying levels of drought and implements appropriate demand management measures during these stages (i.e., follows conservation measures outlined in the document).

Specific assumptions GKY will make regarding drought operations among the Cumberland County Utility Districts are listed below:

- The City of Crossville and Crab Orchard UDs would monitor reservoir days storage (relative to the total demand on each UD supply). The existing systems model will simulate reservoir levels; therefore drought stage will be determined using reservoir levels (days storage). Precipitation data will not be analyzed for drought triggers in this task.

- UDs that do not have water supply sources of their own would follow the drought stages of their source UD. Conservation measures enforced by the Water Supply UD would also be enforced on a dependent UD. (i.e., South Cumberland relies on Crossville, if Crossville is in Stage 3 Emergency then South Cumberland is in Stage 3 Emergency and both would follow the water conservation measures associated with Stage 3)



(P)703 642 5080 (F)703 642 5367 WWW.GKY.COM
4229 LAFAYETTE CENTER DRIVE : SUITE 1850 : CHANTILLY, VA 20151
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- No individual conservation measures will be analyzed. GKY will assign each stage a percent reduction in aggregate demand based on guidance in the Drought Management Plan. The following reduction in aggregate demand will be applied at each stage:
    - Stage 1 (Drought Watch) – Source has less than 120 days of storage available. The document states a 5-10% reduction in water usage. GKY will assign a **7.5%** reduction in aggregate demand during a Stage 1 drought.
    - Stage 2 (Drought Warning) – Source has less than 90 days of storage available. The document states a 10-20% reduction in water usage. GKY will assign a **15%** reduction to aggregate demand during a Stage 2 drought.
    - Stage 3 (Drought Emergency) – Source has less than 60 days of storage available. The document states a 30% reduction in water usage. GKY will assign a **30%** reduction to aggregate demand during a Stage 3 drought.
- Days of storage will be determined by dividing the active storage in a source by the UD's average daily demand. Seasonal demand variations will not be considered since the demand reductions do not consider seasonal variation in conservation effectiveness.

Several of the UDs do not have formal agreements but have stated that they would supply water to another UD if the others needed it (i.e., in an emergency or during a system failure). System failures cannot be predicted and will not be modeled. GKY is proposing to use one operational philosophy (or operational assumption) to define how the UDs would operate during "emergency conditions". GKY is requesting approval of the operational philosophy from the City of Crossville and Cumberland County UD Managers. The operational philosophy is as follows:

- **Cumberland County Focused Operations** – This philosophy would move water to the UD most in need. In other words, water would move from a UD in a less severe drought condition to a UD in a more severe drought condition. As an example, if Crossville was in Stage 1 and Crab Orchard was in Stage 2 then Crossville would supply water (up to the physical constraint) to Crab Orchard.

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## 2.0 Outside Utility Districts

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The Cumberland County Water Supply System has several connections to outside utility districts (UD). Crossville has connections/agreements with Falls Creek Falls (Sell), Grandview (sell, through South Cumberland UD), and the Town of Monterey (Buy). Crab Orchard has a connection to Grandview (No Agreement). The West Cumberland UD has a connection Bon De Croft (Buy).

GKY was not tasked with modeling water supply sources or demands outside the County under the existing scope of work. Given the data supplied to GKY, assumptions will have to be made for transfers with UDs outside the County.

**Original Data:**

GKY was provided with physical/institutional transfer limitations as well as transfer agreements (contracts) for all existing connections. The following agreements were supplied to GKY:

- Crossville – Town of Monterey Agreement – Approved October 31st, 2002
- Crossville – Grandview Agreement – Approved April 10th, 2007
- Crossville – Falls Creek Falls / South Cumberland (Transport) – Approved May 11th, 2007
- West Cumberland – Bon De Croft – Approved October 15, 2007

Assumptions:

The following assumptions will be made for transfers with UDs outside the County in the Cumberland County Systems Model:

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- Crossville – Town of Monterey Agreement – **0 MGD** – Utilized during outages, maintenance, and localized conditions that will not be modeled.
- Crossville – Grandview Agreement – **0 MGD** – If this is a critical connection for the Grandview customers, GKY will need additional guidance to assign transfer amounts. Since we are not modeling Grandview's demand, a constant transfer is probably required if a non-zero value is to be used. If a constant transfer were provided, a reduction to transfer could be applied during drought conditions. The reduction would be proportional to the percent reduction in aggregate demand applied to Crossville. Whatever we assume, there are limitations since we are not modeling the Grandview demand.
- Crossville – Falls Creek Falls / South Cumberland (Transport) – **0 MGD** – To the best GKY's knowledge this connection has only been utilized for flushing operations since it's construction (interviews with South Cumberland)
- Crab Orchard – Grandview – **0 MGD** – Crab Orchard has stated that this connection can be utilized for emergency supply. GKY cannot model this scenario since it is not modeling Grandview's demand or source.
- West Cumberland – Bon De Croft – **<= 0.75 MGD** - Since West Cumberland relies solely on Bon De Croft for its water supply and GKY is not scoped to model the outside source, GKY will assume that Bon De Croft provides the West Cumberland demand up to the institutional constraint at all times. In other words, West Cumberland's demand will be met by Bon De Croft up to the contractual limit with any shortfall to be handled though the Crossville connection.

GKY acknowledges that these assumptions are a major limitation in the approach for this systems model. The scope of work does not cover modeling outside sources or demands. Therefore, without additional guidance, GKY deems this the most reasonable approach.

## 3.0 Existing Source – Lake Tansi

Lake Tansi will be studied for the first time during this task. A detailed stage-storage curve has not been provided to GKY. Storage estimates were provided from Crossville and from the Tennessee dam inventory data sheet (Safe Dams Section). Storage estimates were provided for max pool, normal pool, and an eight foot drawdown from normal pool. Contractual agreements only allow for a 4" drawdown from normal pool.

GKY must make assumptions on storage since the original data available is limited. GKY will develop a stage-storage curve with the known storage amounts and interpolated data points at a reasonable stage interval (2-5'). Storage available for water supply will be calculated by a simple volume calculation using the surface area and four inch drawdown (i.e., Normal Pool Surface Area X 4" depth = water supply volume).

## 4.0 Demand Growth Scenario

GKY will calculate a disaggregate demand based on the projections detailed in the *Cumberland County Water Needs Assessment and Water Conservation Plan*, completed by GKY (dated March 2009). The **"expected"** growth scenario will be used for calculating the various demand scenarios.