Beth O'Donnell, Executive Director,
Kentucky Public Service Commission
211 Sower Boulevard
Frankfort, Kentucky 40602-0615

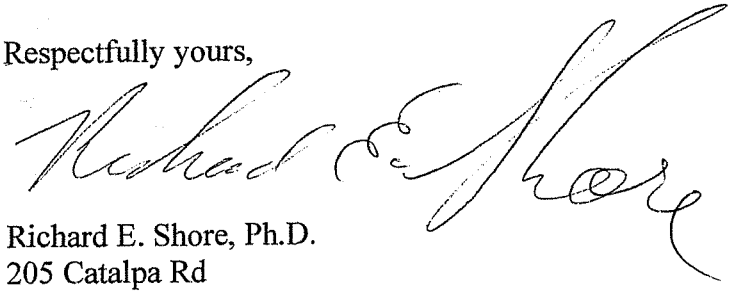
February 5, 2008
Re: Case 2007-100134, Kentucky American Water

Ms O'Donnell:

Enclosed please find a public comment I am offering on the case 2007-00143, Kentucky American Water.

I have provided the original and 3 copies to facilitate the review of this comment.

Respectfully yours,



Richard E. Shore, Ph.D.
205 Catalpa Rd
Lexington KY 40502
Ph: 1-888-445-6847

A POOL NINE OPTION

A Public Comment
For Kentucky Public Service Commsion

Case 2007 – 00134 Kentucky American Water

Prepared and offered by
Richard E. (Dick) Shore, MBA, PhD
2008 . II . 06

Contents:

Case Identification
2007-00134 Kentucky American (Water Supply for Lexington and Fayette County)

Subject: The Pool Nine Option, A Cost-effective Water Supply Option for Lexington.

Prepared and Submitted by
Richard E. (Dick) Shore, PhD.

The Author: I reside at 205 Catalpa Rd, Lexington. I am a citizen of the Commonwealth and a ratepayer of Kentucky American Water (KAW). I have had professional experience with constructed wetlands for tertiary water treatment. I have graduate degrees in Zoology (PhD) and Operations Analysis (MBA). I am very concerned that we use best available technology and not impose more of a debt burden on our community than is necessary for utility service.

1. Overview

It appears that there is a way, for about $63.4M, a third of the capital cost of the KAW proposal, that Lexington could have 50% more water than KAW proposes to provide to Lexington and increase the security of its source quality. This appears to call into question the cost-effectiveness of the KAW proposal.

2. The purpose of this comment is to raise as a realistic possibility:
   2.1. that Lexington Fayette Urban Government (LFUCG) has a "Pool Nine" option for meeting water supply problem in its area rather than the "Pool Three" one offered by KAW,
   2.2. that said option
      2.2.1. uses proven technology appropriate to the situation,
      2.2.2. would put 30 MGD more of drinking-source quality water in Pool Nine,
      2.2.3. can be made operational for about $63.4 million,
      2.2.4. is within Lexington's legal authority to pursue,
      2.2.5. is within Lexington's fiscal ability to pursue,
      2.2.6. can be operational in 10 years, and
      2.2.7. would increase the security of Lexington's water source.

3. This Pool Nine option.
   3.1. **Short Pipe**. To meet the water shortage problem of low flow in Pool Nine, replaces water drawn from KY River Pool Nine back into Pool Nine,
      3.1.1. LFUCG would lay pipe from its two sewage treatment plants to carry secondary treated waters to a point that will discharge into Pool Nine.
      3.1.2. Said pipe would go a distance of some 32 miles along existing road and highway rights of way.
   3.2. **Constructed Wetland**. To meet the water quality problem of nutrients in the effluent from its two treatment plants, LFUCG use a Constructed Wetland,
      3.2.1. which LFUCG would construct for tertiary treatment
      3.2.2. which would be fed by this new pipeline and
      3.2.3. which would discharge on a path leading to Pool nine.

3.3. **Lake**. To serve both water needs, LFUCG would construct a reservoir,
- 3.3.1. fed by the constructed wetland,
- 3.3.2. discharging to Pool Nine, and
- 3.3.3. upstream from the KAW withdrawal point.

3.4. Cost.
- 3.4.1. We need a cost-feasibility study.
- 3.4.2. I have made an estimate based on customary rules of thumb of $62 M.
  - 3.4.2.1.This estimate includes
    - 3.4.2.1.1. study, design, and construction,
    - 3.4.2.1.2. twenty miles of 30-inch and 36 inch PVC pipe,
    - 3.4.2.1.3. ditching & laying along highway rights of way,
    - 3.4.2.1.4. pumping stations at both existing sewage plants,
    - 3.4.2.1.5. acquisition of land for wetland and lake, and
    - 3.4.2.1.6. grading for wetland and lake.

3.5. **Legal Authority**. LFUCG would do this under its existing authority to modify the sewage treatment system which it owns and operates. The result would have the added benefit of increasing water supply for Lexington by about the amount of its current sewage discharge base flow, 30 MGD.

3.6. **Fiscal Ability**. LFUCG has no available bonding authority for general obligation bonds. It has bonding authority for revenue bonds. It could issue a revenue bond secured by sewage fees for the construction of this project. When the project is complete LFUCG could use the savings in operating expenses (about $4.8 M/yr) to retire the bond early and consider lowering sewage rates.

3.7. **Source Security**.
- 3.7.1. The current water source, Pool Nine, is exposed to several kinds of potential threats to water quality. As examples:
  - 3.7.1.1.Interstate 75 crosses the pool. Gasoline trucks and other hazardous cargo cross that bridge regularly.
  - 3.7.1.2.An oil pipeline on the hill above Pool Nine ruptured in winter releasing oil that reached the edge of the river. Had that ruptured in summer the oil would have reached the pool.
  - 3.7.1.3.A whiskey warehouse fire caused discharge of large amounts of whiskey into the Kentucky River downstream from Lexington.
  - 3.7.1.4.Lexington does not control what goes into the Kentucky River upstream by legal or illegal discharge.
  - 3.7.1.5.The present emergency supply, as backup to Pool Nine, is Jacobson Lake, which city engineers characterize as a two-day supply.
- 3.7.2. The security of the nations water supplies is a matter of national concern.
  - 3.7.2.1.The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 provided $89 million to the U.S. EPA to improve the security of the nation's water supplies by reducing water system vulnerabilities to terrorist attacks, enhancing water infrastructure security and improving the ability of water purveyors to respond to emergencies. Grant monies were made available to "large" water purveyors, agencies serving over 100,000 customers. [1]

4. Lexington Situation, key facts about its water and sewer system,.
   4.1. Lexington now gets its drinking water supply from Kentucky River Pool Nine through a treatment plant and distribution system owned and operated by KAW.
   4.2. Lexington discharges secondary treated wastewater from two sewage treatment plants owned and operated by LFUCG.
      4.2.1. The easterly one discharges into Hickman Creek, thence to Pool Seven.
      4.2.2. The westerly one discharges into Town Branch, thence to Pool Three.
   4.3. To meet current requirements for phosphorus removal, LFUCG owns and operates a chemical treatment plant at the Hickman Creek site at a cost of some $2.4 million annually for operation and haulage fees. The sludge created is hauled to a landfill.
   4.4. To meet the anticipated (TMDL) requirements for phosphorus removal at Town Branch, LFUCG expects to construct a second phosphorus removal plant at the Town Branch site at a capital cost of about $35 million, and incur an additional $2.4 million in annual operating expenses, unless it can find a better alternative.
   4.5. LFUCG owns and operates a Constructed Wetland treating leachate at its Construction and Demolition landfill.
   4.6. LFUCG has in its files a concept proposal created by LFUCG engineering staff in 1999 for a short pipe, a constructed wetland, and a holding reservoir discharging to Pool Nine.
   4.7. The burden on Lexington ratepayers for the total of the KAW proposal ($164 M) and the future phosphorus plant on Town Branch ($35 M) is thus about $200 M.
   4.8. Citizens are urging LFUCG to update that concept proposal and pursue a cost-feasibility study, to see if it is closer to $62 M or $200 M.

5. Constructed Wetland Description
   5.1. A Constructed Wetland is a part of a tertiary treatment system for water improvement. The US EPA provides guidance on their construction and operation. [2]. Constructed Wetlands are being used in many jurisdictions for tertiary treatment of sewage waters. [3]. They are especially useful to remove nitrogen and phosphorus at the levels that remain after traditional primary and secondary treatment methods. A Constructed Wetland consists of an area of land divided into slowly flowing pools or cells by dikes and lined with appropriate compacted earth and membrane barriers to contain the water. The cells are planted with reeds and rushes. These plants pump oxygen down to their root zone creating an aerobic zone. Bacteria in this aerobic zone do the first part of the nitrogen removal. Anaerobic bacteria living in the open water between the clumps of reeds and rushes complete the remainder of the nitrogen removal. The Nitrogen evaporates into the air as free gaseous nitrogen (N2). The plants take phosphorus into their own bodies, which bodies can be harvested for use as animal fodder or composted mulch.

6. Pipeline Route
   6.1. A possible route for a pipeline exists along highway rights of way from both the LFUCG sewage treatment plants thence to the eastern part of Fayette County. That is an area with underlying geology (shale) more suitable for the structural

loading posed by a constructed wetland than is the limestone karst within the urban area. [4]

6.1.1. From the Town Branch plant the route would follow Manchester Street westerly to New Circle Rd (KY State Route 4), thence northerly and then easterly along New Circle to Winchester Rd (US Highway 60), thence easterly along that road to the shale area between Lexington and Winchester, a distance of some 16 miles.

6.1.2. From the Hickman Creek plant the route would follow Tates Creek Rd (KY Hwy 1974) northerly to New Circle Rd, thence easterly and northerly to Winchester Rd, joining the other pipe at that point, a distance of some 6 miles.

7. Constructed Wetland Location

7.1. A location to be preferred for Constructed Wetland would meet several criteria:

7.1.1. Low land price,

7.1.2. Soil and underlying geology to support the load and provide soil for dikes,

7.1.3. Proximity to the source, destination, or route of water to be treated.

7.2. An area meeting these criteria exists between Lexington and Winchester. The rural lands are a lower price than land in the built-up portion of the urban area. The underlying rock is shale rather than limestone karst, providing greater stability. The site is near Pool Nine and between two cities that may be able to cooperate in the construction and operation of the wetlands and both benefit from it as a means for removal of nutrients from sewage waters, and as an augmentation water source. LFUCG has taken no action to identify suitable parcels of land nor any action to begin the acquisition of these.

8. Estimated Costs

The following cost summary is based on assumptions that are presented in detail in Appendix A, attached, titled, "Assumptions for CW calculations". The actual calculations are shown in Appendix B, the spreadsheet attached titled "CW cost to construct worksheet". The costs assume a 30 MGD capacity. That is the combined base flow rate of the two LFUCG wastewater treatment plants.

Table 1. Summary of cost estimate. in millions

Buy Land		$18.7
Buy & Lay Pipe		$36.1
Grade CW & Dam		$4.6
Pump stations		$1.6
	SUBTOTAL	$61.0
Study & Design		$2.4
	TOTAL	$63.4

9. Operating Cost. There would be electrical and mechanical operation and maintenance cost on the pipeline. The wetlands would require removal of reeds and rushes on a cycle. The earth-fill dikes and dam would require inspection and periodic maintenance. These costs would reasonably be much less than for a traditional water treatment plant.

10. Regional Cooperation
    10.1. The City of Winchester draws water from the Kentucky River just upstream from LFUCG. They also have problems with phosphorus removal. If LFUCG could cooperate with Winchester on the construction and operation of constructed wetlands it could serve the interests of both communities. Such a regional solution may have a better chance of federal funding, thus relieving some of the financial burden on local rate payers for the capital cost.

11. Timing
    11.1. LFUCG could have the option in operation in about 10 years.
        11.1.1. LFUCG could have a full feasibility study completed in about 10 months from Decision. That would provide the basis for proceeding to design and then construction. Allowing a year for design and 5 years to finalize the route and make land acquisition, construction could begin in the eighth year with completion by the tenth. This estimate is based on the delays experienced on similar projects recently within LFUCG.

12. Filtration Capacity
    12.1. This analysis ignores the possibility of need for additional filtration and treatment capacity to supply Lexington. I do so for two reasons.
        12.1.1. First, the filtration capacity of a treatment plant depends in part on the load of suspended solids in the feed water. The water from a Constructed Wetland would have far less suspended solids than that in Pool Nine, where silt is a major pollutant. Therefore providing cleaner water has the effect of increasing the filtration capacity.
        12.1.2. Second, I believe that additional capacity could be provided for Lexington users by adding modules to the existing plant. I have a hard time believing that pumping water from the Lexington take-out point to Lexington will be dramatically more expensive than pumping it from the Frankfort area.

13. Summary

Thus it appears that there really is a way, for about a third of the capital cost of the KAW proposal, that Lexington could have 50% more water than KAW proposes to provide to Lexington and increase the security of its source quality. This appears to call into question the cost-effectiveness of the KAW proposal.

References Cited

1. International Conference on Pipeline Engineering and Construction 2003 Mohammad Najafi - Editor, July 13--16, 2003, Baltimore, Maryland, USA. Applying Security and Vulnerability Assessments to Large Water Wholesaling Agencies . Patrick T. Huston, P.E.; Donald R. Kendall, Ph.D., P.E.; Bruce W. Fischer, Susan Mulligan, P.E.; and Sandra Carlson, P.E.

2. United States Environmental Protection Agency, 2000. *Manual, Constructed Wetlands Treatment of Municipal Wastewaters.* Office of Research and Development Cincinnati, Ohio 45268. EPA/625/R-99/010. http://www.epa.gov/ORD/NRMRL

3. Nature's filter: Constructed wetlands. American City and County. Apr 1, 2002 12:00 PM, Misty Reagin, Assistant Editor. http://americancityandcounty.com/mag/government_natures_filter_constructed/

4. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Assumptions.

(For calculations, see spread sheet Appendix B. "CW cost worksheet".)

1. Pipe is in three legs,
    a. From Town Branch WWTP to a junction east of Lexington
    b. From Hickman Creek WWTP to that junction
    c. From Junction to a site east of Lexington
2. Pipe lengths, volumes and sizes.
    a. About 6 miles, 16 MGD, 30 inch
    b. About 13 miles 14 MGD, 30 inch
    c. About 12 miles, 30 MGD, 36 inch
3. Pipe Specification
    a. AWWA – C905, DR 41
4. Labor and equipment for laying pipe
    a. As a minimum, an amount equal to price of pipe
    b. As a maximum, an amount twice the pipe price.
5. Grading and diking of Constructed Wetland itself
    a. Area will be on soils over shale
    b. Soils on site will be sufficient for fill and dike
    c. Base will be 1 ft thick
    d. Dike will be 10 ft wide, and 4 ft high
    e. Water channel will be divided into 5 parallel runs, bounded by 6 dikes, or some equivalent arrangement.
    f. Dike volume neglects slope of face, simply V = L x W x H.
    g. Area required in water calculated from daily volume x dwell time / depth
    h. Volume of bed compacted is area of water, one foot deep.
    i. Allow 10% additional area for fencing plus a 30 ft access road.
        i. This comes to 10.7 acre per MGD neat for the water
        ii. And about 12-15 acre /MGD gross land area
    j. Cost for grading is estimated as $4 to $8 per cubic yard.
6. Land acquisition.
    a. Area required is calculated from volume, dwell, depth, with allowance for dikes, fence, and road. This does not include land for park if any.
    b. The required area lies within the Florida actual of 10 to 20 acres/MGD.
    c. I used a land acquisition cost of $50,000 per acre for rural farm land.
        i. My research of Fayette PVA records found land values in rural eastern Fayette of $15-30,000 per acre. I have no data for Clark.
        ii. I assume that actual acquisition will cost twice that amount.
7. Hydro plant omitted.
    a. At present no estimate is included for a hydro-electric plant at the outfall back to pool nine (which might defray electrical requirements for pumping).

Description of calculations.

1. The Capital Cost of a short pipe, constructed wetland, and reservoir are estimated as follows:
   1.1. Pipeline :
      1.1.1. Pipe. Twenty miles along existing public rights of way.
         1.1.1.1.Cost of pipe per foot is a "budget quote" from local pipe supplier.
         1.1.1.2.Cost of laying is based on rule of thumb:"1-2 times pipe cost"
         1.1.1.3.Pipe price per foot is extended by distances found by MapQuest along the proposed route.
      1.1.2. Pumps. Two pump stations for 15 MGD each feeding 20 miles of main at $800,000 each.

   1.2. Wetland:
      1.2.1. Land acquisition:
         1.2.1.1.Quantity of land, 374 acres, based on 30 MGD, 7-day dwell time, 2 ft depth, 20 ft dikes, 5 parallel flow paths, 30 ft access road.
         1.2.1.2. Location of land, in eastern rural Fayette county, not currently in residential or horse-farm use, and western Clark county.
         1.2.1.3. The land acquisition cost is estimated at $50,000/acre.
      1.2.2. Grading, compaction, and diking: 374 acres, based on rule of thumb, "$4-$8 per cubic yard of earth moved", and dimensions above.
      1.2.3. Piping and flow control devices. $0.1M.
   1.3. Lake:
      1.3.1. Land acquistion: 15 acres in eastern rural Fayette County, and western Clark county, not currently in residential or horse-farm use, at $50,000/acre.
      1.3.2. Dam construction: 1,000 feet of earth fill dam, to a height of 20 ft, at $5 per cubic foot,
   1.4. Study & Design, at 4% of subtotal

   1.5. Total Capital cost is total of above. A summary table appears at the end of the spread sheet.

COST Worksheet

5.69 mi: New Circle at Leestown to New Circle at Winchester Rd Mapquest
13.3 mi: 3174 Ash Grove Rd via Tates Creek Rd to New Circle at Winchester Rd

PIPE	miles	MGD	diam, inch	price (a)	
leg 1	5.69	14	30	$75	/ft
leg 2	13.3	16	30	$75	/ft
leg 3	11.7	30	36	$112	/ft
5280	ft/mile				
Spec	AWWA -C905	DR 41		(a) budget quote	
30-inch length, ft	100,267	$7,520,040		Hayes Pipe 1300 Cahil Ln	
36-inch length, ft	61,776	$6,918,912		Lexington KY	
	total pipe cost	$14.44	million	859/231-8323	
Min tot x	2	$28.88	million		
Max tot x	3	$43.32	million		
Midpoint		$36.10	million		

Florida data for comparison, not used in estimate.

WETLAND	http://www.dep.state.fl.us/water/wastewater/dom/wetsites.htm#top				
Fla min	10	Acre/MGD			
Fla avg of 10	20	Acre/MGD			
based on Fla Acr/MGD:					
Capacity MGD	10	20	30		
Area min Acre	100	200	300		
Area max Acre	200	400	600		
Based on					
dwell time, days	7	7	7		
Volume MG	70	140	210		
MCuFt (x/gal)	9.359	18.718	28.077	0.1337	cu ft/gal
M sq ft (/x deep)	4.6795	9.359	14.0385	2	assme
as acre Neat wtr	107.4	214.9	322.3	43560	sq ft/acr
wid Ft (/x L)	177.25	354.51	531.76	26400	ft/5 miles
chanel if N=x	35.45	70.90	106.35	5	n chanels
L ft dike N+1	158,400	158,400	158,400	4	dike ht
vol cf dike if x=w	6,336,177	6,336,355	6,336,532	10	dike width
vol dike cu yd	234,673	234,680	234,686	27	cuft/cuyd
min $ dike if	$938,693	$938,719	$938,745	$4	/cu yd (b)
max $ dike if	$1,877,386	$1,877,438	$1,877,491	$8	/ cu yd (b)
Gross width, ft	237.25	414.51	591.76		(b) rule of thu
Gross/neat	1.34	1.17	1.11		
wtr&Dike Acr/MGI	14.38	12.56	11.95		
				30	ft road width
vol bed M cu ft	4.6795	9.359	14.0385		
cu yd	173,315	346,630	519,944		
min $ bed grade	$693,259	$1,386,519	$2,079,778	4	rule of thumb
max $ bed grade	$1,386,519	$2,773,037	$4,159,556	8	rule of thumb
subtot CW lolo	$1,631,952	$2,325,238	$3,018,523		
subtot CW hihi	$3,263,904	$4,650,475	$6,037,046		
subtot cW mid	$2,447,928	$3,487,857	$4,527,785		

COST Worksheet

as $M	$2.45	$3.49	$4.53		
DAM if L=				1000	assumed
area Acr	10	15	assumed		
vol cuft if x Ht	8,712,000	13,068,000		20	assumed
vol MG	65.16	97.74			
vol Dam cu ft			400,000		
cu yd			14,815		
$ min			$59,259	4	rule of thumb
$ max			$118,519	8	rule of thumb
$ mid			$88,889		
Land Acquisition					
MGD	10	20	30		
% for fence& rd				10	assumed
CW Area acre	158.17	276.34	358.64		gross
Lake area	15.00	15.00	15.00	15	assumed
Total	173.17	291.34	373.64		
$ if $/Acr x	$8,658,460	$14,566,919	$18,682,163	$50,000	assumed
$ M	$8.66	$14.57	$18.68		
				$750,000	

SUMMARY	($ in millions)			
MGD capacity	10	20	30	
Buy Land	$8.7	$14.6	$18.7	+/- ??
Buy & Lay Pipe	$36.1	$36.1	$36.1	+/- $4
Grade CW	$2.4	$3.5	$4.5	+/- 25%
Grade Dam	$0.1	$0.1	$0.1	+/- 25%
TOTAL	$47.3	$54.2	$59.4	

Buy Land		$18.7	Million
Buy & Lay Pipe		$36.1	
Grade CW & Dam		$4.6	
Pump stations		$1.6	
	SUBTOTAL	$61.0	Million
Study & Design		$2.4	
	GRAND TOTAL	$63.4	Million

Pump stations		
quantity	2	
capacity each	15	MGD
head	150	ft
price/ ea	0.8	$M
total	1.6	$M

Design as x% of SubTotal

4	$2.44

COST Worksheet

FINANCING				
BOND for	$63.44	Million	$63.44	million
at interest	6	%	6	%
over period of	30	years	20	
annual pmt	($3.63)	Million	($5.53)	million
monthly	($302.70)	thousands	($460.89)	thouand

using "PMT" function in Excel spreadsheet