

Evaluation of Conflicting Views on Future Water Use in Newport News, VA

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Executive Summary

In November 1998 the Norfolk District of the U.S. Army Corps of Engineers asked the Institute for Water Resources (IWR) to help resolve significant uncertainty about the future water use in the service area of the Regional Raw Water Study Group, a consortium of water utilities representing Newport News, Hampton, Poquoson, Williamsburg, York County, and James City County, Virginia. The District's concern stems from its responsibility under Section 401(c) of the Clean Water Act to decide whether to permit the City of Newport News (the city) to build a new water supply reservoir. IWR is the Corps center of expertise for water use forecasting and water conservation. This is the report on IWR's expert panel analysis.

The water supply augmentation that has been proposed will have significant environmental effects. Therefore, IWR assumed that Newport News would have to convincingly demonstrate need. There is no precise answer to the question of future water demand. There are variables and most utilities use a sensitivity analysis or range coupled with a reliability assessment to arrive at a justified prudent investment, giving serious consideration to staging if economical. IWR's expert panel reached consensus judgements of the future needs, but even a "center of opinion" does not adequately convey the imprecise nature of a forty year projection. Forecasts are but a general guide of what is required to avoid shortages at a possible frequency of occurrence.

In this case, the need for new supply was supported by a water use forecast that has been criticized by PMCL and others as biased upward and unaffected by some factors that could raise or lower water use. Certain assumptions underlying the forecast (population growth, employment structure, industrial water use rates, etc.) appear questionable. An alternative calculation, incorporating modest and well supported changes in the questionable assumptions only, does not support the statement of need by Newport News. In addition, Newport News appears not to have sufficiently considered reliability-based planning incorporating drought management. This would allow us to better assess the risk from future deficits as defined in the EIS. Therefore, the panel concluded that Newport News has not convincingly established the need for an expansion of its water supply at this time.

IWR reviewed each section of the demand and supply projections. These are our findings:

Population.--The panel concluded that the water use forecast should have been based on a lower population estimate, or range of values including lower and higher estimates. In this case, the city is establishing future supply requirements on the basis of a single point forecast of water use. If that is unavoidable - and we recommend that a risk based approach be used in its stead - that forecast should be derived from assumptions that reflect the center of opinion. It is clear from the evidence provided in the various critiques that the RRWSG population forecast is significantly higher than the center of opinion. If RRWSG wishes to consider the consequences of the higher population growth assumption, that should be done as part of a comprehensive assessment of reliability, considering all sources of risk and uncertainty. No such assessment was conducted.

Employment.--Total employment can be reasonably assumed to be linked with population (population may be thought to be somewhat dependent on employment opportunities), so our concerns with total employment are the same as our concerns with population estimates .

Domestic water use.--The RRWSG analysis of conservation, as noted by PMCL and other reviewers, is limited, especially by the lack of regional data on the current inventory of water conserving fixtures. The panel believes that conservation beyond what was estimated by Newport News will likely occur. We believe that the "center of opinion" on how much water will be saved per capita falls between the Newport News and PMCL estimates.

Commercial-institutional-light industry water use.--Correcting the major deficiencies in the forecast may have an ambiguous effect on this sector. Reducing the forecast of total employment (as a result of reducing the population forecast) would reduce water use, as would an assumption of increased conservation. However, a structural shift in employment from heavy industry to service activities could increase employment, as would productivity gains in this sector, and therefore water use, even with a lower population forecast.

Heavy industry water use.--The panel felt that this was the area of the study with the greatest uncertainty, but it felt that new industries were unlikely to use 640 gallons per employee per day as Newport News estimated. As PMCL noted, the only credible basis for expecting a major increase in the use of potable water per employee is a sharp increase in employee productivity. But this could also lead to a reduction in the total employment in this sector and, in any case, seems not to have been considered by RRWSG. The panel believes that total water use in this sector has been significantly overestimated. In addition, if the environmental impacts are significant, the city must also consider the alternative of not accepting new industries that use water at a very high rate.

Federal water use.-- The panel felt that future Federal water use may be more or less than forecast, but since Federal use will be about 5% of total use, it should not affect the decision to build or not build the reservoir.

Unaccounted for water.--The panel believes the estimate used by Newport News is probably conservative because it doubts that the actual unaccounted for water use is less than 10% now.

Safe yield.--The panel did not review the simulation models that were used to calculate safe yield, but did review the issues in contention. The panel treated the Newport News yields as very conservative (i.e., that the water systems would be very unlikely to produce less than 58.4 Mgd by 2040).

Deficits--The panel believes, given how infrequently the water system will fail to yield 58.4 Mgd, that deficits should be calculated by subtracting curtailed drought water use (not unconstrained water use) from the safe yield. As PMCL pointed out:

"When withdrawals exceed the safe yield, shortages should occur only during years of drought, which is at least as severe as the design drought. Many public water supply systems in the United States withdraw water from their systems at rates that exceed safe yield, thus facing some risk of water shortages."

A preliminary analysis using the National Electronic Drought Atlas indicates that the safe yield was calculated using a design drought that can be expected to recur once every 70-100 years. As an example of how "deficit" should be interpreted, using the EIS methods of calculating "deficit," a deficit of 5 mgd in 2010 means that in 2010 RRWSG customers would have less than a 2% chance of having to curtail unconstrained water use during a drought, but could survive the drought with the measures Newport News touches on in the EIS.

Alternative Supply Sources

New water supply other than the King William Reservoir would further reduce the risk of future water shortages. In the EIS, Newport News described two groundwater developments it will undertake in addition to the proposed King William Reservoir. These groundwater sources are expected to increase the safe yield by 7-10 mgd. If these sources are used as planned, they will reduce deficits and the risks of water shortage significantly.

Late in our study, the City of Norfolk revealed that it had water for sale because Virginia Beach (now using water from Lake Gaston) no longer needed it. The amount of water is significant - from various reports 30-45 mgd. IWR agrees with Newport News to the extent that it cannot be assumed that this water will solve the city's long term water needs. That could only be determined through a regional water supply planning effort. However, if some or all of this water is available in the near to mid-term, it further diminishes the risk of water shortages to the RRWSG.