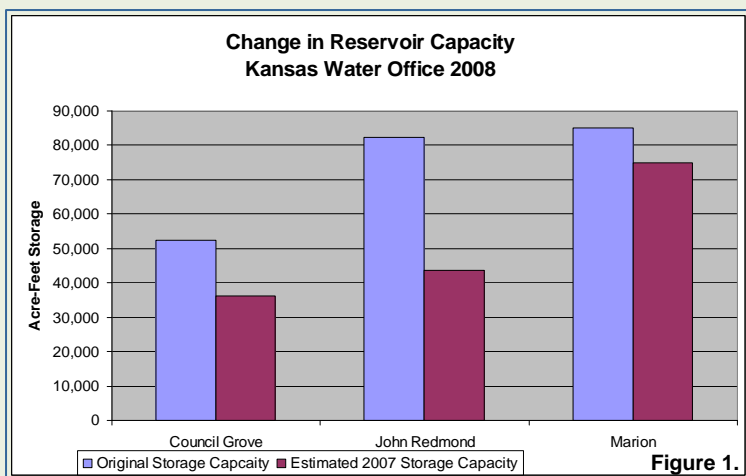


Neosho Basin High Priority Issue Water Supply Management and Conservation January 2009

Issue

Evaluation of [surface water](#) supply, demand, management, and conservation, is needed to improve reservoir sustainability and provide adequate public water supply to meet long-term needs in the [Neosho basin](#).

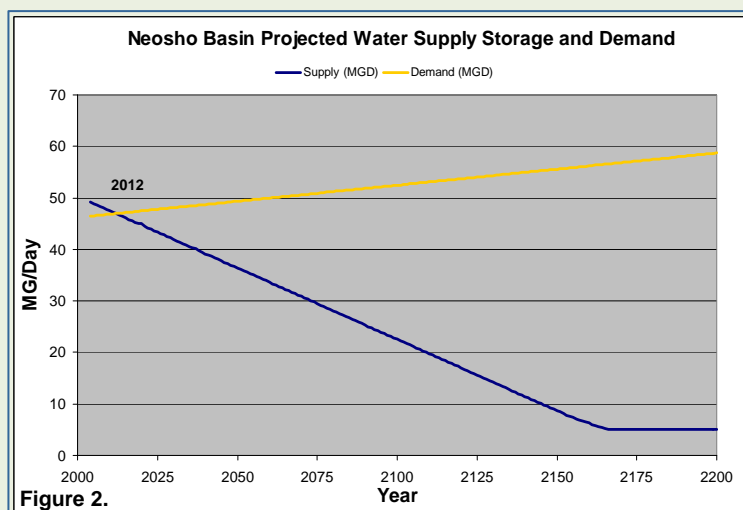
Increasing [population](#) and development in portions of the Neosho basin along with aging reservoirs (Figure 1) and public water supply infrastructure indicate a need to evaluate the long-term water system capacity to meet demands in the basin. The Neosho River has been having increasingly frequent low flow problems which have caused aquatic life stress and more frequent administration of water rights. Administration of water rights in the Spring River system occurred for the first time in 2006. The Neosho River is an area of high biological importance in the state with populations of freshwater mussels, sensitive fish species such as the Neosho Madtom, and populations that have declined from historic levels such as the paddlefish.⁽⁸⁾ The viability of the river to support aquatic life and meet minimum desired stream flows needs to be maintained, while balancing the availability of water for public water supply.



In 2007, the Kansas Water Office (KWO) initiated an analysis of water supply and demand in several eastern Kansas river basins.⁽¹⁾ The analysis utilized historic climate and flow and current census information to predict the total water supply and demand in the Neosho basin over time. The preliminary finding for the Neosho basin is that in those counties primarily served by the Neosho River and tributaries, demand could exceed supply during a 2 percent probability drought by the year 2012 (Figure 2). This analysis did not include the far southeastern counties in the basin in which ground water and the Spring River are the primary water supplies. See the [Management of the Ozark Plateau Aquifer System and](#)

[the Spring River System](#) issue for information on that area.

Of the four major southeastern Kansas river basins evaluated with this method, the Neosho basin has predicted water supply shortfalls the soonest. Enhanced modeling is underway to better understand where shortages could occur in specific reaches and to develop a means of evaluating alternatives and scenarios for water management, conservation and development that can be used for future planning and operations of the system.



Description

Water Supply

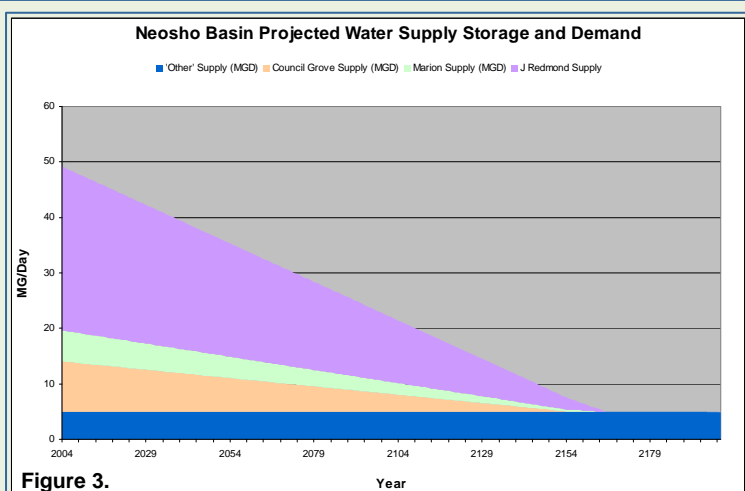
Water supply in the basin is provided primarily by three federal reservoirs, [Marion](#), [Council Grove](#), and [John Redmond](#), along with numerous multipurpose or city owned small lakes, and natural stream flows. Coffey County State Fishing Lake provides cooling water for the Wolf Creek Nuclear Power Plant. Based on bathymetric survey information, federal reservoir water supply pool yields were used in the 2007 KWO analysis of supply and demand in the Neosho basin. This analysis combined the yield available from the federal reservoirs in the basin along with natural flows to calculate the total available water supply in a dry condition (Figure 3). Smaller city owned lakes were not included in this analysis.

The analysis described above was not structured to account for the quantity of water supply available in location specific areas under different conditions. A more refined modeling process using the OASIS (Operational Analysis and Simulation of Integrated Systems) model to identify water supply and demand at specific points in

Neosho Basin High Priority Issue

Water Supply Management and Conservation

January 2009



the basin is being calibrated by the KWO in the Neosho basin. Once complete, the available water supply at specific demand points under various conditions in the basin will be able to be estimated. To assist with developing the model, KWO staff have been assigned to work directly with water supply utilities, industries, other water users, and the Neosho Basin Advisory Committee (BAC), to obtain detailed information on expected water demand in the future. Minimum desirable stream flows for aquatic and wildlife support are accounted for in the model.

Marketing and Assurance

Reservoirs are used, in part, to provide dependable water supplies in streams with highly variable flow. The 1958 Federal Water Supply Act made storage in federal reservoirs available to local governments if the local entities agreed to repay the cost of construction, operation, and maintenance of the water supply storage. The State of Kansas has purchased water supply storage in each of the federal reservoirs in the basin. All three reservoirs support both the Water Marketing and the Water Assurance Programs.

In 1985, through a Memorandum of Agreement between the State of Kansas and the U.S. Army Corps of Engineers (Corps), water quality storage in all three federal reservoirs in the basin was reallocated to water supply storage and purchased by the state at the original cost of storage. The state purchased the maximum amount made available in the reallocation. In exchange for the significant reduction in cost, the state agreed to obtain water reservation rights for water quality storage and to protect water quality releases from diversion by water right holders. In addition, the state developed the [Water Assurance Program](#) to operate the reservoirs as a coordinated system, maximizing the use of the water. A Wa-

ter Assurance District (WAD) was formed in 1993 by the municipal and industrial water rights holders on the Cottonwood and Neosho Rivers. The WAD has purchased a portion of the state-owned storage in all three reservoirs and repays the state's capital cost investment along with annual operation and maintenance costs. Operation agreements under the Water Assurance Program allow the municipal and industrial water right holders in the Neosho basin to own storage that is released during dry periods to support their water rights.⁽⁴⁾

Water Demand

Municipal and Industrial Demand

In the 2007 KWO supply and demand analysis,⁽¹⁾ demand was combined for the basin in the same manner as water supply. Since all population projections were developed from the county level, entire counties were assigned to the basin based upon predominance of area *and* existence of larger incorporated areas. The Neosho River corridor included Allen, Chase, Coffey, Labette, Lyon, Marion, Morris, Neosho and Woodson counties.

Water demand (Figure 4) associated with the population projections is based on municipal water use as gallons per capita per day usage (gpcd) reported to the Kansas Department of Agriculture-Division of Water Resources (DWR) for 2000 through 2004 by suppliers in the Neosho basin.⁽²⁾ The quantity of water that municipalities sold for non-domestic use is not included in gpcd calculations and was added to the total for this analysis. To develop the projected water use from industry, commerce, agriculture, and recreation, all non-municipal surface water points of diversion within five miles of the mainstem of each basin were selected.

The [surface water](#) demand increase on the Neosho River corridor is primarily associated with the anticipated demand increase of Lyon County, specifically the industrial sector growth seen in Emporia in the past 12 to 15 years. Also considered is future demand by the Wolf Creek Nuclear Power Generating Plant. Although a significant increase in demand was demonstrated in Neosho County, specifically in the recreational sector in the last 12 -15 years, that sector's growth was limited to current levels, since it is understood there is little to no desirable land remaining near the mainstem in Neosho County that has not already been developed for recreational use. Crawford and Cherokee counties were excluded from the future demand projections because of the ground water supplies and the supply from Spring River available to them.

Neosho Basin High Priority Issue Water Supply Management and Conservation January 2009

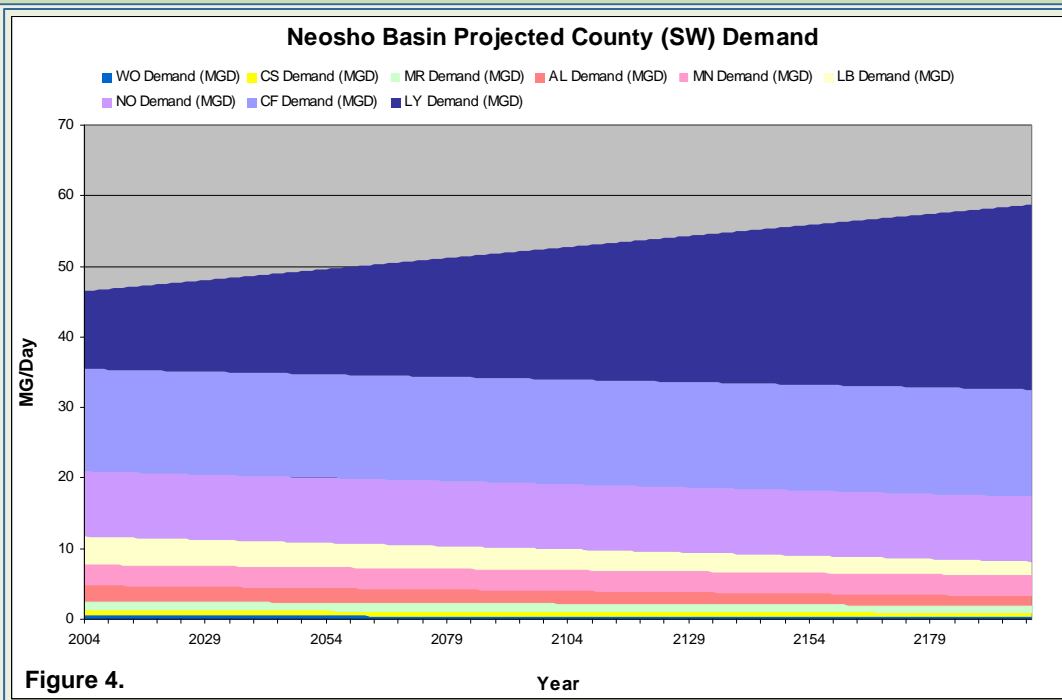


Figure 4.

Location Specific Demand

Further modeling in the Neosho basin will identify demand in specific locations and project this demand over time. The KWO is using the OASIS model to analyze the supply and demand projections for the Neosho basin. OASIS models the operations of a river reservoir system by simulating the routing of water through a system represented by nodes (reservoirs, cities, etc.) and arcs (rivers). OASIS can account for physical constraints such as reservoir capacity, evaporation, and sedimentation. The model can also account for system management issues such as minimum release requirements and lake level management plans.

The advantages of OASIS are that it can simulate the interaction of multiple reservoirs and rivers in a system. It improves the ability to simulate system management issues. OASIS can also identify “problem” areas in a system and evaluate alternative improvements to the system (off-stream storage, new reservoirs, reallocation, etc.). The KWO will be working with all users in the Neosho River corridor to get inputs for the model and then presenting the results upon completion of the model.

Nearly all the growth and associated water demand in the Neosho basin is associated with expansion of the Emporia area. In the southern part of the Neosho basin, interest in expansion of the old Army Ammunition Plant might add demand in that area. Depending on the re-

sults of location specific modeling, communities may need to consider water demand of future industries based on the projected supply.

Conservation

The objective of water conservation is to achieve efficient use of the limited water resources of the state through cost-effective practices to curtail the waste of water and to ensure water use does not exceed reasonable needs. In the Neosho basin, conservation includes efficiency management in public water supply along with maintaining existing reservoir storage and water supply. See the [Watershed Restoration and](#)

[Protection Strategy](#) (WRAPS) basin priority issue in this section for additional information about efforts underway to improve water quality and preserve storage capacity of reservoirs in the basin.

Local land use planning and zoning authorities provide cities and counties with effective tools to minimize the potential impacts of development on water resources. Counties with planning and zoning regulations often require landscape plans for new development. While landscaping can provide aesthetic and environmental benefits, heavily irrigated landscape designs can increase demand on public water supplies.

Demand management is an important component of extending water supplies but has not typically been incorporated into water utility operations. With the recognition of the potential for future water shortages, water suppliers and communities should begin to incorporate this concept into operational planning. Demand management may include less water intensive landscaping, low water use plumbing, conservation design for urban areas, water reuse, and other elements including responsible use of water. A movement beyond excessive use of water into more sustainable long-term management is needed. Increases in consumptive use cannot occur under existing, vested, or otherwise fully perfected water rights. If a municipality is considering substantial changes in their system to reuse water, the DWR must be consulted.

Neosho Basin High Priority Issue

Water Supply Management and Conservation

January 2009

Conservation of reservoir storage has received attention as the impacts of sedimentation become increasingly apparent. While supply in the Neosho basin is being evaluated to develop management strategies, recreational impacts are also occurring, along with low flows in streams which can impact aquatic organisms. Research has been conducted addressing the causes of reservoir storage loss and identifying solutions. These measures generally fall into short-term strategies such as efficiency of reservoir operations or longer-term restoration of storage. Examples of reservoir efficiency include pool reallocation, raising dams/pools, modification of operational rules, and treatment of the upstream watershed to limit erosion. Restoration includes dredging, reservoir flushing, or other means of removing accumulated sediment.

Recommended Actions

1. Continue the calibration of the OASIS basin model with location specific supply and demand information.
2. Identify options for supply and demand management: reservoir pool raise, pool reallocation, dredging, off-channel storage, new supplies, modify reservoir operations, conservation measures, reverse levee operations.
3. Refine model to reflect possible outcomes of identified options and share results.
4. Implement the most beneficial and cost-effective options.
5. Begin incorporation of water demand management into utility operating plans. Demand management should also include education of and interaction with the development community and include existing local authorities.

Resources

1. Surface Water Supply and Demand Projections for Selected Basins in Eastern Kansas. 2007. Kansas Water Office.
2. Kansas Municipal Water Use. 2006. Kansas Water Office.
3. Kansas Municipal Water Conservation Plan Guidelines. 2007. Kansas Water Office.

4. Status Report. 2002. State of Kansas, Water Marketing and Assurance Programs, Multipurpose Small Lakes Program. Kansas Water Office.
5. Public Water System Capacity Development Assessment. 2006. Kansas Department of Health and Environment.
6. Public Water Supplies Drought Vulnerability Assessment. 2006. Kansas Department of Health and Environment.
7. Public Water Suppliers, Sources and Purchasers. 2006. Kansas Department of Agriculture, Division of Water Resources.
8. Instream Flow Assessment and Verdigris and Neosho River Basins. 2006. Kansas Department of Agriculture, Division of Water Resources.