



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Realistic Restoration of Streamflow in the Chipuxet Basin

Focus Categories: WATER SUPPLY

Descriptors: Water Supply, Aquifer Recharge, Water Reuse, Wastewater Treatment, Drinking Water Treatment, Irrigation

Duration: March 1, 2000 – April 30, 2001

FY-2000 Federal Funds:	<u>(\$28,197)</u>	<u>(\$28,197)</u>	<u>(0)</u>
	Total	Direct	Indirect
Non-federal Funds Allocated:	<u>(\$57,343)</u>	<u>(\$32,601)</u>	<u>(\$24,742)</u>
	Total	Direct	Indirect

Names, university, and city of principal investigators:

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Congressional district of university performing the research: Second Congressional District

Statement

The Chipuxet Basin is located in South Kingstown with smaller areas in Exeter and North Kingstown. The Chipuxet Aquifer is a source of drinking water for the University of Rhode Island (12,000 people) as well as the Kingston Water District (1,000 accounts). In addition to URI and KWD’s withdrawals United Water (private company serving Wakefield, Narragansett and North Kingstown owns a 27 acre parcel located along Plains Road which has been earmarked for future development. Currently, the annual average withdrawal from the aquifer is 1.1+ million gallons per day. This number is deceiving since it represents only an average demand over the entire year. During times of peak demands (summer for KWD, fall and spring for URI) the demands are considerably higher. Peak demands have exceeded the 7Q10 of the Chipuxet River. In fact, the demands are sufficient to dry up the Chipuxet River at times.

Nature, Scope and Objectives of the Research

This project will first quantify water demands on the Chipuxet Aquifer and classify them as to use. Once the major sources of water demands are quantified the next part of the study will be initiated. An evaluation of these water demands will be conducted to determine the feasibility of returning the water to the aquifer. Special attention will be

given to the elimination of the exporting of water out of the Chipuxet Basin. Since the largest user of water is URI, efforts to reuse their water will be emphasized. One potential option would be to separate the wastewater that is used by URI into Grey Water (from showers and washing in the URI athletic and housing complexes) and use this water for irrigation. Black water (sewage) currently being pumped to the South Kingstown Wastewater Treatment Facility in Narragansett, RI. could be treated by conventional processes (activated sludge) or by new technology (membrane processes). This treated water could be returned to the aquifer by irrigation or by direct injection. The results from this proposal can serve as a pilot program for other water utilities that rely on stressed aquifers.

Figure 1 illustrates the 1990 water usage in the Chipuxet Basin. The major users of the water are URI and the KWD. The first part of this research will be to update this information.

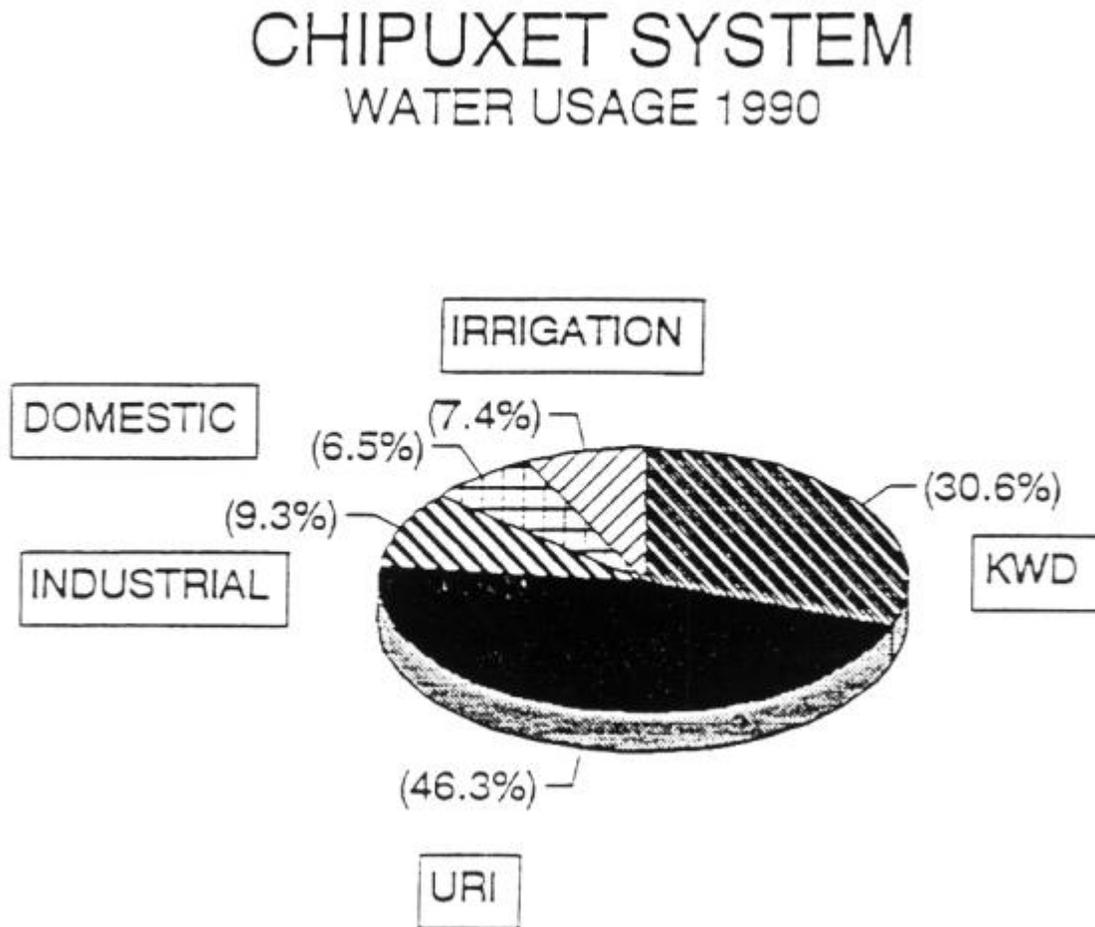


Figure 1. Water Usage in the Chipuxet Basin

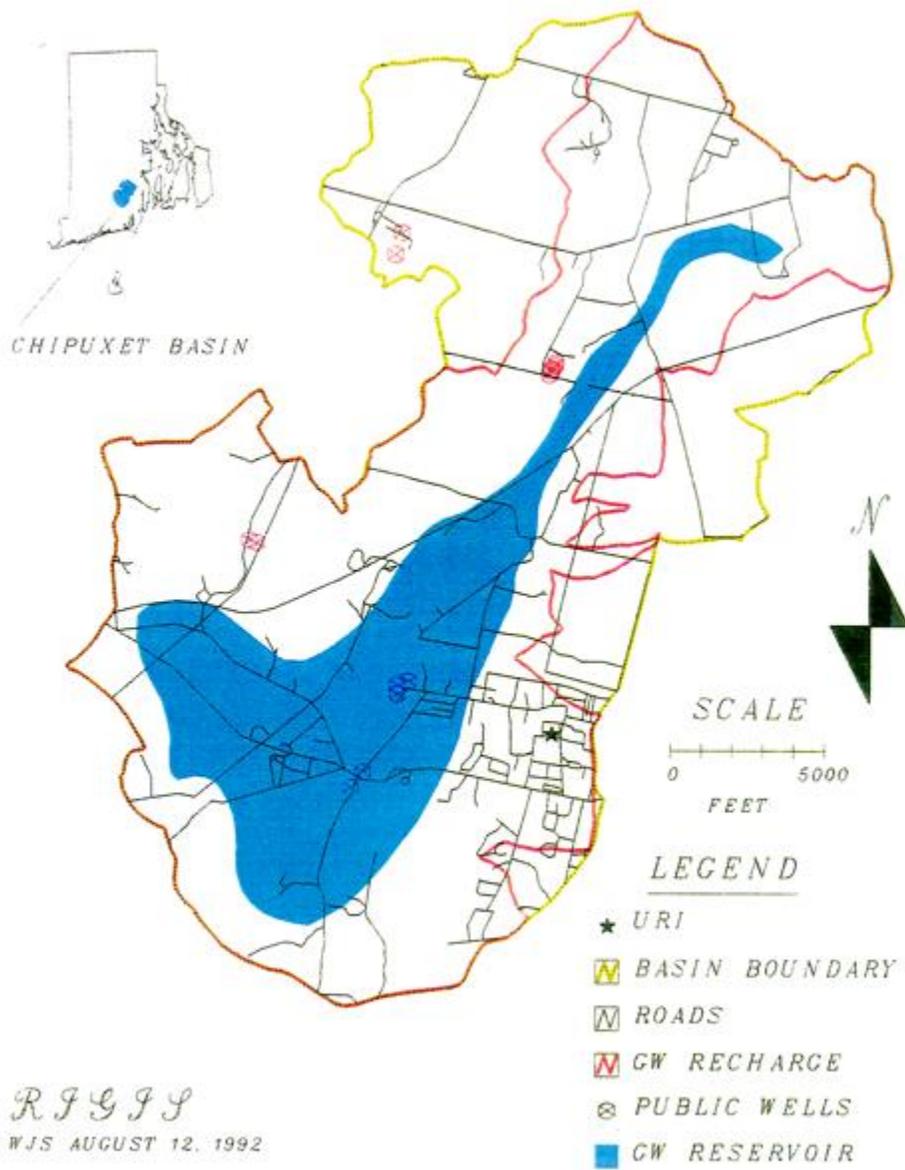


Figure 2. Chipuxet Basin Boundaries

Figure 2 serves to delineate the boundaries of the Chipauxet Basin. All major points of withdrawal will be mapped. In addition to mapping each of the wells the seasonal demands will be determined in order to determine the times of major stress on the aquifer.

Figure 3 illustrates the degree of depletion of the Chipuxet Basin. During the summer months the flow in the Chipuxet River was below the 7Q10. Even this figure does not show the seriousness of the depletion because the gaging station that this flow is measured is above the location that water in the river is withdrawn for irrigation.

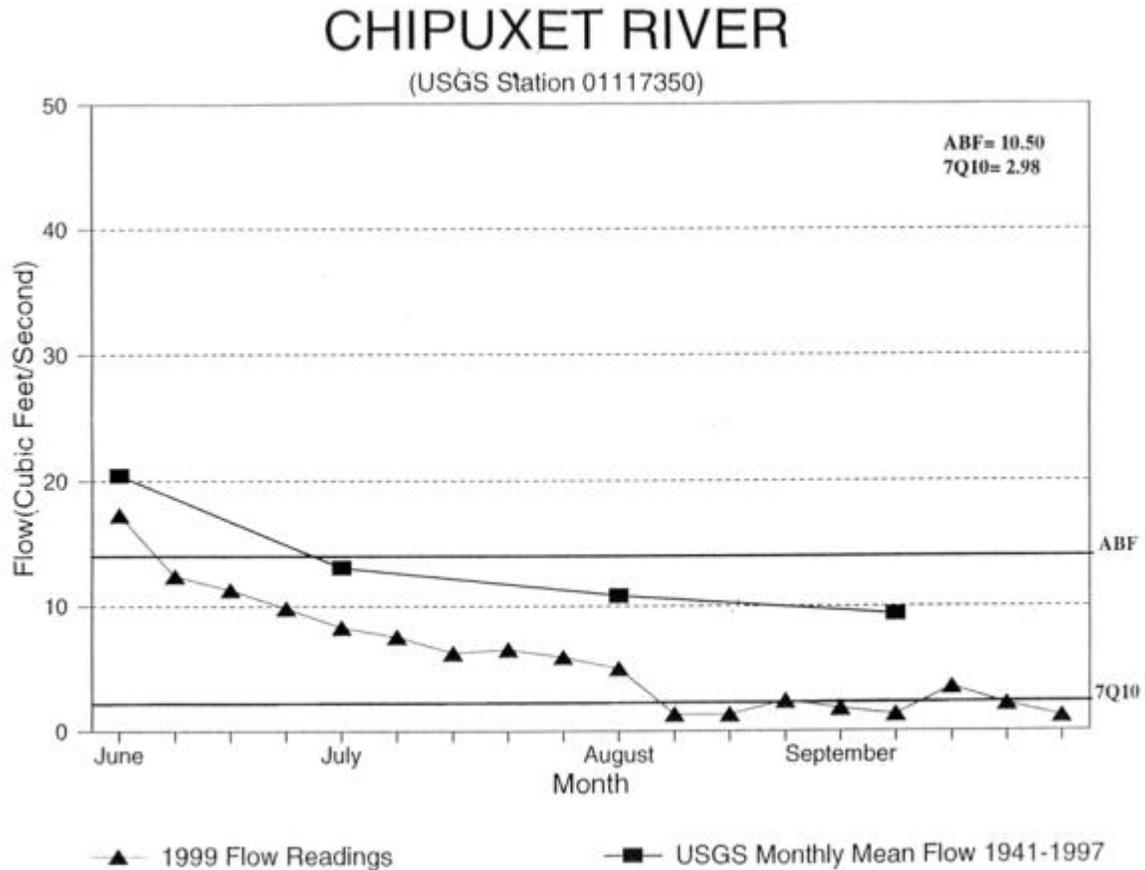


Figure 3. Current Flow Measurements in the Chipuxet River

It is important to determine the water quality needs of the major withdrawers from the aquifer. Depending on their needs (agriculture in particular) it is possible that they could utilize treated (partially or completely) water. Rather than sending the water out of the basin to the South Kingstown Wastewater Treatment Facility as is currently done the water can be treated on-site and remain within the basin.

The quality of the water that results from use of the water within the basin is important. It is likely that the water that is used can be characterized (grey and black water) and separated so that an individualized treatment process can be performed.

A feasibility study can be conducted on traditional and advanced treatment options to allow in-basin re-use of the water. The degree and type of treatment will depend on the final use of the water.

The objectives of this study include the following:

1. Quantify the water withdrawals from the Chipuxet Basin both spatially and temporally.
2. Estimate the water quality needs of the major withdrawers.
3. Characterize the quantity and quality of water discharges from the Chipuxet Basin.
4. Perform a feasibility study on conservation, wastewater separation and treatment with subsequent discharge within the Chipuxet Basin.

Methods, Procedures and Facilities

- Extend and update Spizuoco's data on withdrawal from the aquifer
- Document current withdrawals by contacting the users
- Document types of uses and quantities either from records or from estimating uses where data does not exist
- Project future needs by analyzing past data as well as reviewing long-range build-out plans for the Town and for URI
- Sample and analyze various waste streams
- Identify potential practices that would be candidates for conservation and estimate savings
- Conduct preliminary designs and estimate costs of constructing and operating the facility for each treatment option

Samples will be analyzed in the URI Environmental Engineering Lab and the analysis of the data and the design of the facilities will be conducted on computer available in the College of Engineering.

Related Research

Reverse Osmosis and Nanofiltration are being increasingly used in both drinking water and wastewater treatment. They can be used to provide water both for drinking purposes and for aquifer recharge. California is evaluating the reuse of wastewater to supplement surface potable supplies. A plant in Fountain valley, California produces high quality reclaimed water for direct injection in the aquifer. This plant has operated successfully

and is scheduled for expansion. Several other communities in California and Oregon are investigating the use of reverse osmoses or nanofiltration for groundwater (aquifer) recharge. While the concept has gained acceptance in arid area of the west it has not been applied in the more water abundant areas along the East Coast.

The Membrane Bioreactor process is a recent development in wastewater treatment. In this process a membrane is used to separate solids from liquids. The membrane can be used directly in activated Sludge reactor or separately in the effluent stream from the activated sludge reactor. This process offers three benefits. The facility has a smaller foot print than the conventional process since it can be operated at higher suspended solids levels. Since the settling tanks are not necessary, the frequency of sludge wasting and equipment needed is further reduced. This reduction in operation significantly reduces the need for constant monitoring and testing. The disadvantages include requiring the need for membrane monitoring and cleaning.

Progress Review

This project has not been previously funded.