Planning model for rural water systems how to meet future drinking water demands in Oklahoma

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1. Background

Rural Water System Concerns

- Population increase in certain rural communities in Oklahoma
- Long tradition of serving primarily rural customers
- Many different types of rural water systems
- Aging infrastructure
- Future financing
- More stringent water quality standards
- Changing demand profile due to urban/rural interface:
  - Annexation
  - Housing developments

2. Research Question

How to optimally (least cost) meet the increasing demands of drinking water in growing rural water distribution areas in Oklahoma?

Individual vs. cooperative solutions to meet future drinking water demands:

1. Determine the projected feasibility and cost of meeting the demands if each rural water district acts alone
2. Determine the potential cost savings from centralized treatment plants

3. Importance of Study

1. Addresses anticipated needs of rural water systems
2. Develops a decision support system that can be applied to other systems
3. Benefit water use planners and rural and municipal water system managers.

4. Study Area

Figure 1: Northeast Oklahoma: Tulsa, Wagoner and Rogers Counties. Tulsa: Mainly urban population, Wagoner and Rogers: Mainly rural with urban clusters in the county subdivisions close to Tulsa County's border. Five rural water districts (RWDs) in Wagoner and two RWDs in Rogers County (Figure 2).

5. Method: Decision Support System (DSS)

USER INTERFACE

INPUT
Land-Use Plans Per Fastest Growing Areas Close to Rural Water Systems

INPUT
Population Projections up to 2060 Per County Subdivisions and Census Tracts

INPUT
Estimate Future Drinking Water Demands: demand source, patterns and types

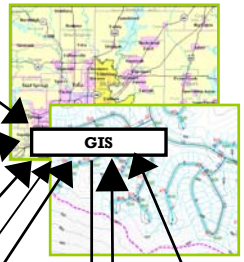
INPUT
Sources of Water

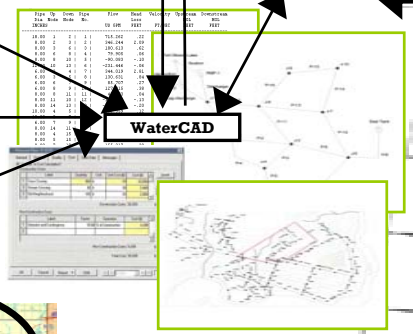
INPUT
Rural Water District Service Areas

INPUT
Rural Water District Infrastructure Data

INPUT
Cost Estimates: transmission, energy, capital, treatment, source, storage

SIMULATION MODELS





Model Output

Increased Demand with Different Scenarios:

Determine source availability, system capability, and total costs to meet increased drinking water demand when:

1- Rural water district operates alone

2- Rural water district cooperates with another water supplier

6. DSS Results

TOTAL COST MODEL :

TC = Treatment + Distribution

The model will be assembled and applied to rural water districts in Wagoner and Rogers counties in Oklahoma. Two operation scenarios will be investigated: operations alone and operations in conjunction with another water supply system. It can be assumed that the unit cost of treatment will decrease with increasing production of drinking water. When different transportation, distribution, construction, treatment and storage costs, and spatial and demographic variables are incorporated into the model, it is anticipated that economies of scale will not necessarily exist. The least cost operation scenario will determine the least cost service area.

7. Implications

The DSS can be used to study different long-term policy and planning alternatives due to changes in increased drinking water demand patterns and volumes.

- Utilities identify anticipated infrastructural needs
- State officials and water providers better develop and manage water sources
- Future financing needs identifiable
- Informing stakeholder about water prices, quality and sources

8. Funding Source

Oklahoma Water Resources Research Institute (OWRRI) at the Oklahoma State University.

Further Information

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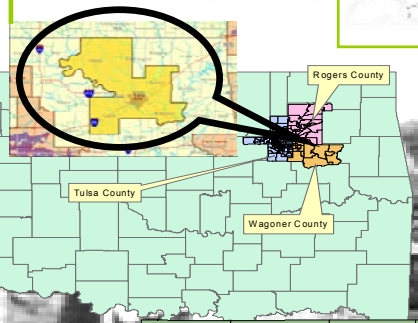
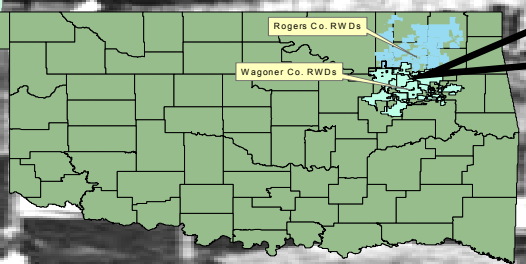


Figure 1: Study Area



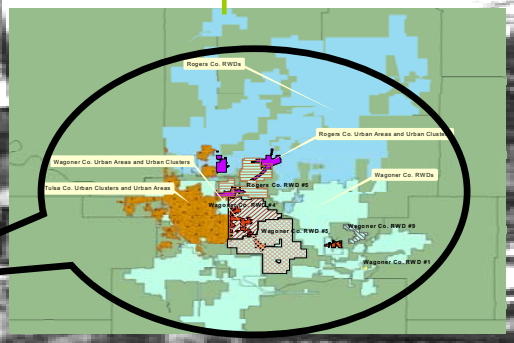


Figure 2: Urban areas and clusters with respect to location of RWDs