

Integrating GIS and Groundwater Modeling Technologies for SWAPP Development

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Groundwater Modeling and GIS Technologies: Powerful Tools for Data Integration and Analysis

Groundwater modeling and Geographic Information System (GIS) technologies are useful tools for developing a Source Water Assessment and Protection Plan (SWAPP) to assist planners in protecting groundwater resources.

Using Groundwater Models to Estimate Capture Zones

- The 2-D analytical element groundwater flow model WhAEM 2000 (USEPA, 2000) is used to simulate 2-, 5-, and 30-year time-of-travel capture zones for the production wells.
- The capture zones are converted to shape (*.shp) files and integrated into the GIS ArcView v.3.2 (ESRI, 2000) to delineate source water protection areas.
- The spatial information from the shape files is used to query the GIS database for potential contaminant sources.

Integration of Predicted Capture Zones and Environmental Data into GIS

- Production well construction information and contaminant characteristics are integrated into the GIS database and used to estimate the susceptibility of each production well to all identified contaminants.

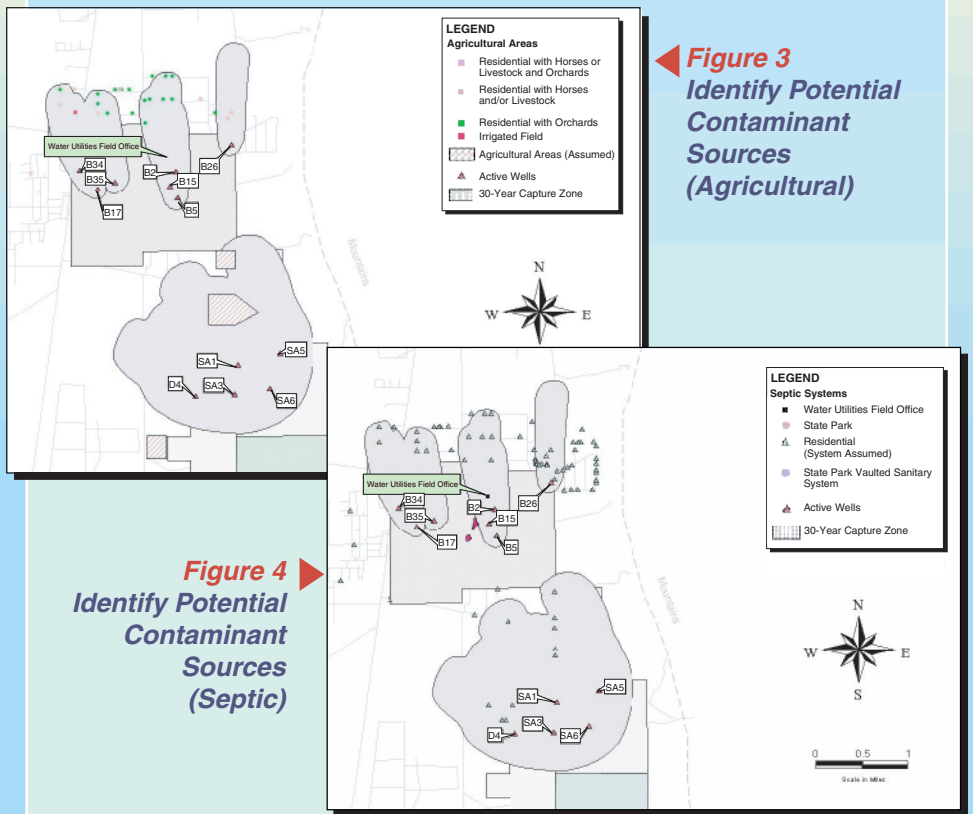


Figure 3
Identify Potential Contaminant Sources (Agricultural)

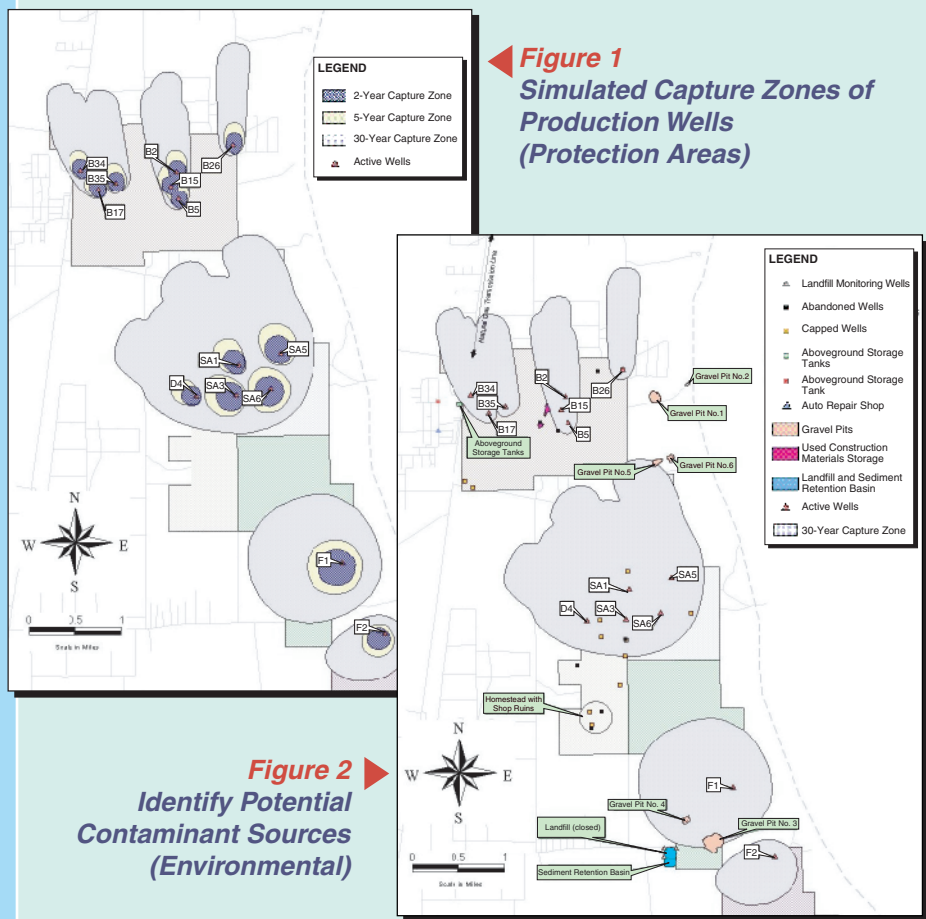
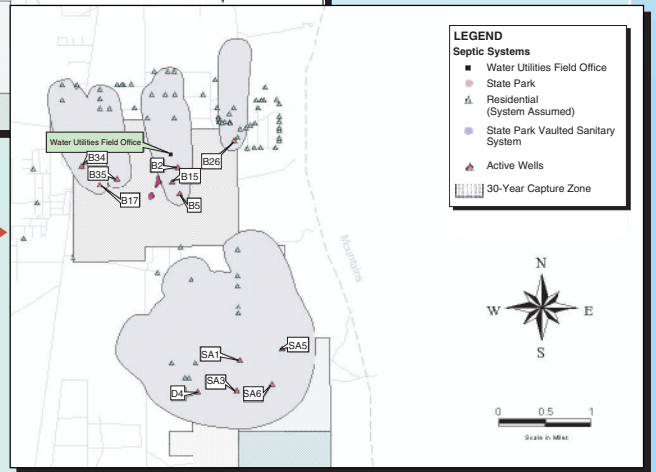


Figure 1
Simulated Capture Zones of Production Wells (Protection Areas)

Figure 4
Identify Potential Contaminant Sources (Septic)



Uses of GIS Technology

The GIS technology is used to examine the spatial relationships between the production wells, their capture zones, and the following potential sources of groundwater contamination:

- Environmental sites (e.g., spill areas and landfills)
- Abandoned wells
- Septic Systems
- Mining sites and agricultural practices

Assessing the Susceptibility of Production Wells to Contamination

Contaminant sources are prioritized using a weighting scheme that accounts for both source type and proximity of sources to the production wells.

SWAPP Objectives Satisfied Using Modeling and GIS Techniques

- Delineated the source water protection areas.
- Identified three primary potential contaminant sources
 - Point Sources:
 - a. Fuel spill area (active groundwater remediation)
 - b. Closed municipal landfill
 - Non-Point Source: Septic systems
- Evaluated the susceptibility of production wells to contaminant sources.

Recommended Additions to Groundwater Monitoring Program

- Monitor water quality at individual well heads to minimize dilution effects.
- Monitor aquifer response to pumping changes to assess future aquifer depletions and contaminant source capture.