

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.

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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 wellheads to minimize dilution effects.
- Monitor aquifer response to pumping changes to assess future aquifer depletions and contaminant source capture.

