

7-20-2004

Economic and Environmental Aspects of Site Evaluation for Stream Augmentation Recharge Ponds in Colorado

Shrier

Follow this and additional works at: http://opensiuc.lib.siu.edu/ucowrconfs_2004

This is the abstract of a presentation given on Tuesday, 20 July 2004, in session 16 of the UCOWR conference.

Recommended Citation

Shrier, "Economic and Environmental Aspects of Site Evaluation for Stream Augmentation Recharge Ponds in Colorado" (2004). 2004. Paper 74.

http://opensiuc.lib.siu.edu/ucowrconfs_2004/74

This Article is brought to you for free and open access by the Conference Proceedings at OpenSIUC. It has been accepted for inclusion in 2004 by an authorized administrator of OpenSIUC. For more information, please contact opensiuc@lib.siu.edu.

Economic and Environmental Aspects of Site Evaluation for Stream Augmentation Recharge Ponds in Colorado

Catherine J. Shrier, Doctoral Candidate

Darrell G. Fontane, Professor

Water Resources Planning & Management Program

Department of Civil Engineering, Colorado State University

(970) 217-9207, watercat90@hotmail.com

Managed groundwater recharge ponds have been used in stream-aquifer systems for streamflow augmentation as a method of conjunctive use water management to re-time streamflows and offset stream depletions caused by withdrawals from alluvial aquifers. By selecting suitable pond site locations and appropriately designing and operating recharge ponds, well users can mitigate the stream depletion impacts of their pumping on more senior water rights under a *prior appropriation* doctrine legal system. In the Lower South Platte River Basin of Colorado, local experts have historically been relied upon to select pond sites. There had previously been no formal, systematic approach to the selection of recharge pond sites, nor had scientific studies been completed on the site selection process and requirements. Some of the information that could be used to select potential recharge sites is available in tabular databases or in GIS coverages and attribute tables, but this data had not been organized and made available in a manner that would support the evaluation of potential recharge sites.

The goal of this research was to develop a methodology by which expertise on site evaluation for water resources management from local managers and water users can be captured and compiled in a computerized knowledge-based system (KBS) using knowledge acquired from local and scientifically-based sources, inputs from spatial databases, and a multi-criteria decision analysis (MCDA) as the KBS reasoning engine. This KBS was developed to provide maximum transparency on the input data and criterion evaluations used to develop the overall site evaluation, with minimum user effort, drawing site attribute data from a spatial database and domain and rule knowledge bases developed through knowledge acquisition. A prototype application was developed for the evaluation of potential groundwater recharge sites for streamflow augmentation in the Lower South Platte River Basin of Colorado. Prototype criterion selection was based on a review of the site attributes, measurement methods, and threshold values that could be determined from knowledge acquisition with local experts and from available databases.

The major aspects of the decision making process for the evaluation of potential recharge pond sites for stream augmentation under the prior appropriation doctrine were characterized and organized into a formal decision-making structure. Although not all of the site data and site evaluation process can currently be represented in an automated computerized system, this characterization lays the groundwork for future research to improve databases and the understanding of the decision-making process.

Economic and financial concerns were found to be major considerations in site selection, although few of the site characteristics impacting site development and operations costs could be identified using readily available spatial databases.

Environmental and ecological benefits were also often considered, since there were several habitat partnership programs available in the target region which would provide funding support and other financial incentives to landowners in exchange for the development of waterfowl habitat through modified design of the recharge ponds. In related research, site characteristics for potential waterfowl habitat pond sites were identified through knowledge acquisition, and an initial prototype was developed to support automated evaluation of pond sites for waterfowl habitat suitability, to be used in conjunction with the prototype developed for evaluation of potential recharge pond sites for stream augmentation.

Using scenario analysis, prototype testing showed that the thought process of local experts for potential recharge site evaluation can be replicated by an automated knowledge-based process for some aspects of this process, and that spatial databases and evaluation tools can be an effective component of this decision support tool. Site criteria evaluations that may potentially be supported by the use of spatial databases and evaluation tools include surface soil type, stream depletion factor, well density as an approximation of aquifer suitability, water source locations, and gradient between the selected site and potential water sources. Other aspects of site evaluation cannot be readily represented in spatial databases, including landowner preferences and willingness to participate in habitat partnership programs.