

Report for 2002CO1B: Managed Ground Water Recharge for Habitat Restoration: The Development of a Biological Component to the South Platte Mapping and Analysis Program (SPMAP)

- Conference Proceedings:
 - Shrier, Catherine J., 2002, Habitat Potential Assessment Tool (HPAT): Planning Tools to Support Development of Recharge Ponds and Wetland Habitat in the Lower South Platte of Colorado, in South Platte Forum Proceedings, Information Series No. 94, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado, p. 32.
 - Shrier, Catherine J., Jay Stafford, and Jon Altenhofen, 2002, Integration of Habitat Enhancement Efforts into Managed Groundwater Recharge Facilities, in AWRA 2002 Summer Specialty Conference Proceedings, Ground Water / Surface Water Interactions, American Water Resources Association, Herndon, VA. 473-477.

Report Follows:

SYNOPSIS

Problem and Research Objectives:

The South Platte Lower River Group (SPLRG) was organized to address critical water management problems in the lower portion of the South Platte basin. SPLRG'S focus is the creation and enhancement of (1) groundwater well augmentation, (2) in-stream flows for which Colorado receives credit in a Platte Basin Endangered Species Program or ESRP, and (3) wetlands and wetland habitat for aquatic wildlife species of concern, waterfowl and other wildlife species. The increased flows in the Platte River during critical periods are to be developed by re-timing the flows in the South Platte, mainly through the creation of new recharge ponds in the Lower South Platte. In Colorado this activity is referred to as the "Tamarack Plan", after the Tamarack Ranch State Wildlife Area, where several of the recharge facilities are being developed. The entire Tamarack Plan, however, will include recharge facilities on both public and private lands, particularly in the last 30 miles of the South Platte River in Colorado, where return flows are unlikely to be diverted prior to reaching the state line. Under the Tamarack Plan, SPLRG is overseeing the development of a series of managed groundwater recharge projects to re-time river flows in order to assist with in-state water management and to provide Colorado's water contributions to the Platte River ESRP. In pilot recharge projects developed at the Tamarack Ranch State Wildlife Area, SPLRG, the Colorado Division of Wildlife (CDOW), and Ducks Unlimited (DU) have integrated habitat components into recharge facility designs, including the use of multiple recharge ponds to control temperature of return flows, the development of a live stream fed by ponds, and the development of a wetland area fed by recharge return flows (see Figure 1).

There is strong interest among private land owners in the region in developing additional recharge facilities for the Tamarack Plan to meet interstate water obligations, and in designing these recharge facilities both for wildlife habitat and for recharge credits for in-state water use. There is also strong interest from CDOW in continuing to restore wildlife habitat at the new recharge facilities. In 2001, the CDOW received a directive from Colorado Department of Natural Resources Director Greg Walcher to work towards the prevention of further federal threatened and endangered species listings in Colorado, and to attempt to recover currently listed species to the point where they can be de-listed. Several partnership programs with state and federal agencies and private wildlife organizations are available that can provide financial and technical assistance to private landowners who develop habitat on their property. The partnership programs include the U.S. Fish and Wildlife's Partners for Fish and Wildlife and the Natural Resources Conservation Service's Wildlife Habitat Incentive Program (WHIP) and Wetlands Reserve Program (WRP). These partnership programs can fund 75% to 100% of the costs for construction of the recharge facilities, and also provide technical expertise for the design of the facilities to maximize the potential habitat benefits. Joining private landowners with habitat partnership programs also helps the mainly agricultural users to meet the costs of developing recharge facilities for well augmentation and for the Three States Agreement.

COLORADO
TAMARACK PLAN
RECHARGE, MINNOW STREAM & WETLAND HABITAT PROJECT
Tamarack Ranch State Wildlife Area, West Side

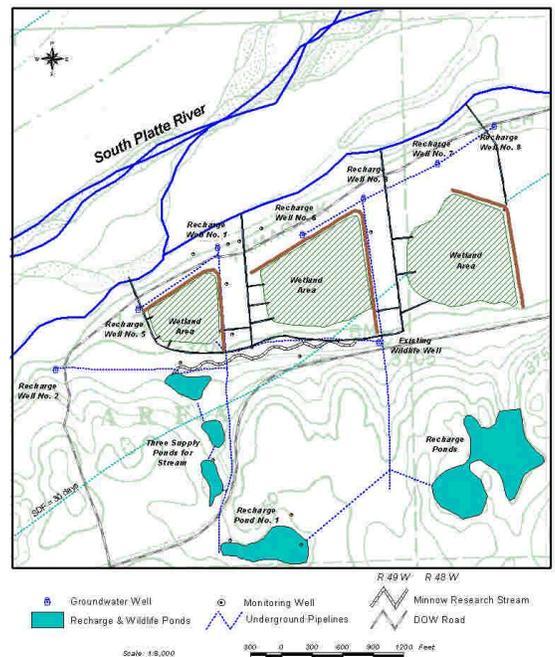


Figure 1. Tamarack Plan Recharge, Minnow Stream
Wetland Habitat Project

The goal of the research outlined in this synopsis was to increase the amount of wetlands and wetlands habitat for aquatic wildlife species of concern, waterfowl, and other wildlife species in the lower South Platte River by linking recharge facility development with habitat development partnership programs. We accomplished this primarily by:

developing a screening tool to identify locations for recharge facility development; collecting and providing information on existing habitat development activities, species sampling activities, CDOW wildlife management activities at State Wildlife Areas, CDOW data on riparian vegetation, and water user organization information on the location and availability of water storage and delivery facilities to partnership programs that develop habitat; and facilitating a more formal relationship between habitat development partnership programs and the water user organizations, and providing educational materials on habitat development on private lands in the lower South Platte River of Colorado, so that the development of habitat on private lands and distribution of funds to private landowners can occur in a more coordinated manner.

Methodology:

1) Developing a screening tool to identify locations for recharge facility development

The tools developed for this project, collectively called HPAT (Habitat Potential Assessment Tool), were created as modular additions to the South Platte Mapping and Analysis Program (SPMAP). SPMAP is a GIS-based water management decision support system that has been used by most of the major water user groups in the Lower South Platte basin since SPMAP's inception in 1995. SPMAP was created as a "user-directed effort". HPAT adds a biological

component to the SPMAP tools. For HPAT, a multi-criteria decision analysis approach has been developed to analyze and compare individual sites for their potential to be developed as recharge pond sites and as waterfowl habitat sites.

One of the GIS-supported site assessment tools included in HPAT is the Recharge Potential Assessment Tool (RPAT). It has been developed in ArcView GIS, using Avenue programming. RPAT was developed based upon the knowledge acquired from interviews with local experts and literature reviews on what information was needed for assessment of recharge potential.

The Recharge Potential Assessment Tool (RPAT) provides information to support decisions regarding the feasibility of developing a recharge facility at a potential site. Several of the coverages containing maps and data necessary for assessment of recharge potential at a site were already available as a part of SPMAP. New coverages added to SPMAP specifically for RPAT include National Resources Conservation Service soil maps for Morgan and Sedgwick Counties and Digital Raster Graphics (DRGs), which are digital versions of the U.S. Geological Survey topographic maps. The graphical user interface for RPAT automatically opens the appropriate coverages and provides maps and reports showing information related to recharge potential for a user-selected site.

The following information is provided in the RPAT report and map layout:

Site location:

- Site name, owner, and contact information.
- Name of and distance (in meters) to the nearest town.

Proximity to water sources:

- Distance (in meters) to the South Platte River (which is always assumed to be downhill from the site).
- Location, name, and distance (in meters) to the 3 nearest ditches and whether the ditch is uphill or downhill from the site.
- Location, name, and distance (in meters) to the 3 nearest wells, and whether the well is uphill or downhill from the site.

Site characteristics:

- Soil type.
- Stream depletion factor (in days).

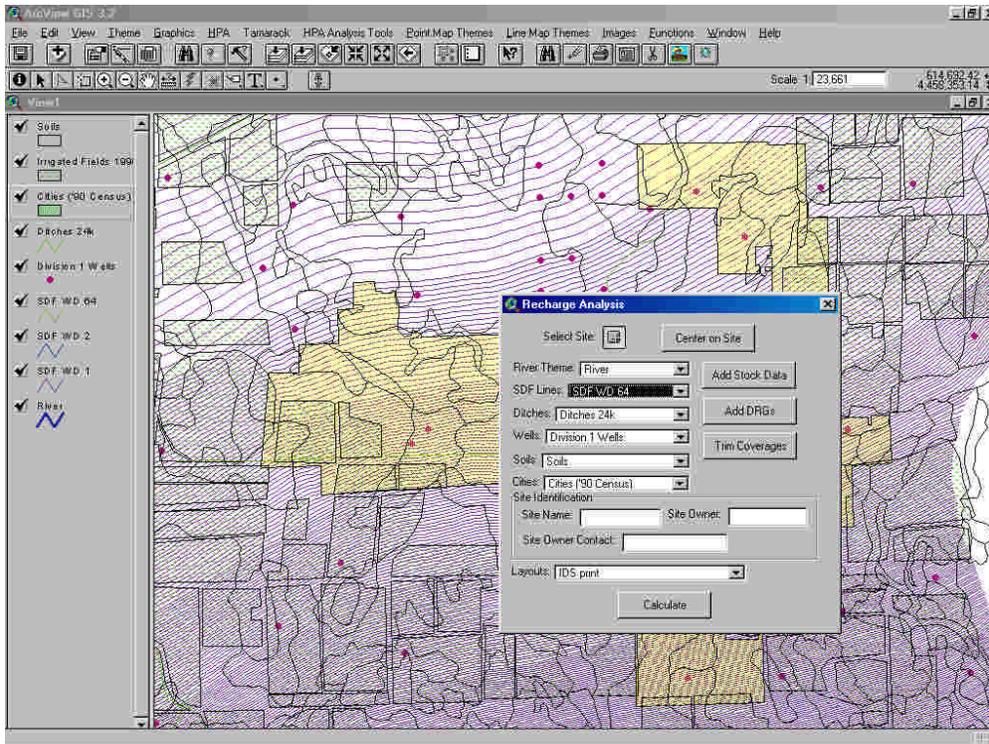


Figure 2. RPAAT Graphical User Interface

2) Collecting and providing information on existing habitat development activities, species sampling activities, CDOW wildlife management activities at State Wildlife Areas, CDOW data on riparian vegetation, and water user organization information on the location and availability of water storage and delivery facilities to partnership programs that develop habitat.

A second GIS-supported site assessment tool included in HPAT is the Waterfowl Habitat Assessment Tool (WHAT). Like RPAAT, WHAT has been developed in ArcView GIS, using Avenue programming. WHAT was developed based upon the knowledge acquired from interviews with local experts and literature reviews on what information was needed for assessment of waterfowl habitat potential.

The Waterfowl Habitat Assessment Tool (WHAT) provides information to support decisions regarding the feasibility of developing waterfowl habitat at a potential site. Several of the coverages containing maps and data necessary for assessment of waterfowl habitat potential for a site were not available as part of SPMAP, and were acquired or created based on data from various wildlife agencies and habitat partnership programs. Like RPAAT, the graphical user interface for WHAT automatically opens the appropriate coverages and provides maps and reports showing information related to recharge potential for a user-selected site. The assessment provides some basic information about the site that can be used by a representative from a habitat partnership program prior to a site visit.

The following information is provided in the WHAT report and map layout:

Site location:

- Site name, owner, and contact information.
- Name of and distance (in meters) to the nearest town.

Proximity to water sources:

- Distance (in meters) to the South Platte River (which is always assumed to be downhill from the site).
- Location, name, and distance (in meters) to the 3 nearest ditches and whether the ditch is uphill or downhill from the site.
- Location, name, and distance (in meters) to the 3 nearest wells, and whether the well is uphill or downhill from the site.

Site characteristics:

- Soil type.
- Vegetation type.

Proximity to wetlands and managed habitat areas:

- Location, name and distance (in meters) of all Ducks Unlimited, Partners for Fish and Wildlife, or Natural Resources Conservation Services EQIP/WRP/WHIP sites within a five-mile radius of the selected site.
- Location, name, and distance (in meters) to all State Wildlife Areas within a five-mile radius of the selected site.
- Location and distance (in meters) to all recharge ponds within a five-mile radius.
- Location, species name, and distance (in meters) to all Colorado Natural Heritage Program (CNHP) Element Occurrences with a five-mile radius of the selected site.
- Location, biodiversity significance and rank, and distance (in meters) to all CNHP Potential Conservation Areas within a five mile radius of the selected site.

In addition to the Wildlife Habitat Assessment Tool, HPAT includes a Fish Sampling Coverage, Report Maker, and Site Photo Links. Data records from fish sampling in the Lower South Platte have been put into a coverage and associated tools. The records include fish sampling from the South Platte basin, the Lodgepole Creek tributary, and the Republican River Basin. These records are electronic versions of the data from actual CDOW field reports including sets of photographs for each sampling site taken on the date of sampling.

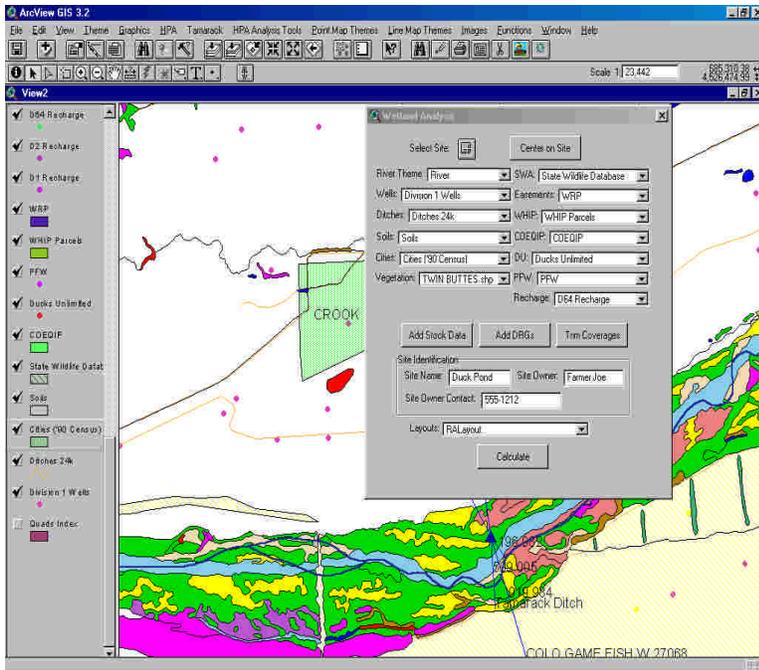


Figure 3: WHAT User Interface

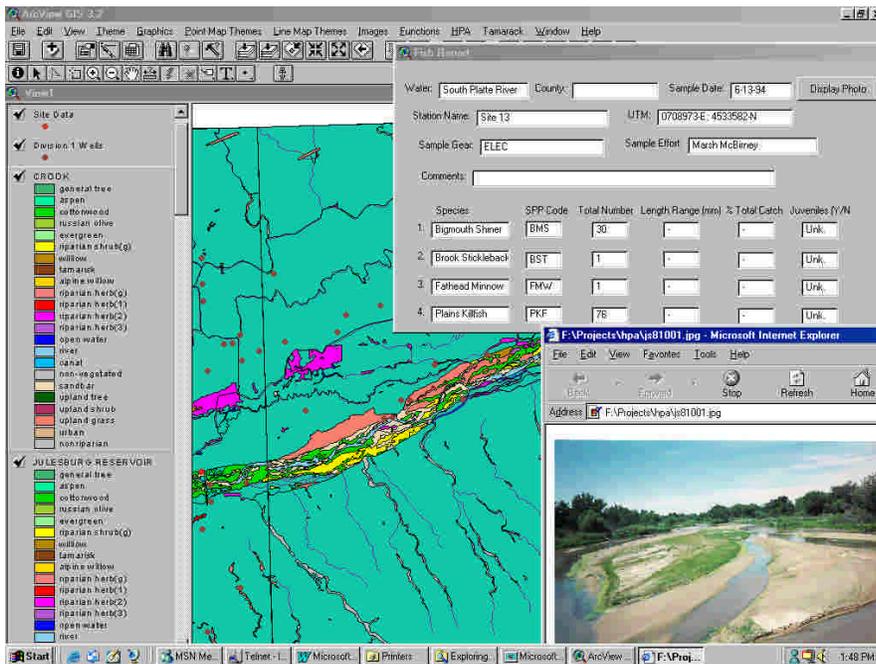


Figure 4. Fish Sampling Tool

Facilitating a more formal relationship between habitat development partnership programs and the water user organizations, and providing educational materials on habitat development on private lands targeted to the lower South Platte River of Colorado, so that the development of

habitat on private lands and distribution of funds to private landowners can occur in a more coordinated manner

The HPAT project provided a biological module to SPMAP, which has been used extensively by water users in the region. This module was developed to be compatible with existing GIS coverages and tools. This provides water users and habitat users with a similar platform of tools with which to work.

By combining data and information from diverse contacts, the HPAT project helped to more firmly establish relationships between habitat development partnership programs and water user organizations. For this project, the programs which have been most interested in supporting waterfowl habitat projects within the South Platte region, for which recharge ponds could provide the greatest benefits, were identified, namely:

Ducks Unlimited, Inc., which administers North American Wetlands Conservation Act (NAWCA) grant money
Natural Resources Conservation Service Habitat Programs
Environmental Quality Incentives Program (EQIP)
Wildlife Habitat Incentives Program (WHIP)
Wetlands Reserve Program (WRP)
U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program (PFW)

The HPAT guidance manual was developed to provide background information on recharge requirement, Colorado water law, and habitat programs in the region. This manual also provides information on eligibility requirements, funding mechanisms, and local program contacts for each of these programs.

Principle Findings and Significance:

Knowledge Base Development. Through interviews with local experts in managed groundwater recharge and habitat development programs, the essential site characteristics sought to assess the potential for a site to be developed for recharge or waterfowl habitat were identified. The site characteristics for recharge and for waterfowl habitat in this region had previously been poorly represented in the literature. This effort also represented one of the first attempts to use a knowledge-based approach to the development of site assessment tools in this region, and the first to develop integrated knowledge bases addressing both water management and habitat development concerns.

GIS Coverage Compilation. To support site assessments based upon the site characteristics identified through the knowledge base development, several GIS coverages were acquired, enhanced, or created, and compiled as part of the HPAT biological module, including:

- Soil types
- State Wildlife Areas
- Vegetation Types
- Ducks Unlimited sites

- NRCS habitat program (EQIP/WHIP/WRP) sites
- Partners for Fish and Wildlife sites
- Recharge ponds
- CNHP element occurrences and potential conservation areas

In some cases, map coverages were available with little or no data provided in the attribute tables, which were needed to provide data for the assessment reports. There were also cases in which, site databases were available separate from the map coverages, but the identifiers for the sites for which data was available did not match the identifiers in a map coverage. In these cases, HPAT developers attempted to match sites identified in the databases with those represented in the map coverage. This process revealed the need for better coordination among database managers and GIS coverage developers, to ensure that spatial and tabular data are developed in a compatible and consistent format.

GIS Coverage and Assessment Tool Applications: Waterfowl Habitat Programs. The GIS coverages and assessment tools have proven to be immediately applicable to support water resources and habitat planning and management efforts in the region. The GIS coverages have been used by the South Platte Wetlands Focus Area Committee (SPWFAC) to develop maps for inclusion in the SPWFAC Strategic Plan and to support the South Platte's inclusion in the Intermountain West Joint Venture for the administration of North American bird conservation initiatives. The coverages compiled and criteria identified during the HPAT project are also being used by Ducks Unlimited as a basis for the identification of target areas for restoration in the region.

GIS Coverage and Assessment Tool Applications: Fish Sampling Data. The fish sampling data program has been used as a model for a similar fish data program developed by the Colorado Division of Wildlife (CDOW). The graphical user interfaces for the fish sampling data tool and the other HPAT tools were also reviewed by the CDOW Integrated Management Program South Platte Prototype Workgroup to provide guidance on the development of tools to support agency habitat management programs.

GIS Coverage and Assessment Tool Applications: Water Users. The criteria identified through the recharge potential knowledge base has been used by water managers in educational programs for water users to explain what to consider in selecting recharge sites. Future work has also been discussed by area water managers regarding the potential use of coverages and assessment tools to support regional planning efforts by identifying potential recharge pond sites using GIS.

HPAT Application for Multi-Criteria Decision Analysis Development for Recharge Pond and Waterfowl Habitat Development. The knowledge bases, GIS coverages, and assessment tools developed for the HPAT project provided basic information on user-selected sites to support the users' assessment of that site for recharge and/or habitat potential. The HPAT project has led to additional work to support the site-specific and regional analysis of recharge and habitat potential on the basis of multiple criteria. This new research, which is being conducted as dissertation research by the graduate student who had been supported by the HPAT project, involves the development of a Multi-Criteria Decision Analysis (MCDA) using knowledge bases and GIS coverages developed as part of the HPAT project. The criteria for the MCDA were also

identified through a knowledge base development process, and the GIS coverages and knowledge bases were enhanced and linked to the Excel-based MCDA prototype.