

# Wyoming Water Resources Center

## Annual Technical Report

### FY 1999

#### Introduction

#### Research Program

#### Information Transfer Program

##### Basic Project Information

Basic Project Information	
Category	Data
<b>Title</b>	Water Resources Data System Water Library
<b>Description</b>	
<b>Start Date</b>	03/01/1999
<b>End Date</b>	02/29/2000
<b>Type</b>	Library And Database Services
<b>Lead Institution</b>	University of Wyoming

##### Principal Investigators

Principal Investigators			
Name	Title During Project Period	Affiliated Organization	Order
Dennis Feeny	Professional Staff	The University of Wyoming	01
Tony Bergantino	Professional Staff	The University of Wyoming	02
Barbara Muller	Professional Staff	The University of Wyoming	03
Autumn McEachron	Professional Staff	The University of Wyoming	04

##### Problem and Research Objectives

In the west, water is critical to survival. Data and information concerning this resource are very valuable. However, unless information developed from research is readily available, all of the effort and expense of collecting, analyzing, and reporting the information is of little use. Therefore, the objective of this project was to establish an efficient and effective way to disseminate the data and information developed by the Water Research Program.

## Methodology

The funds provided by the United States Geological Survey, State Water Resources Research Institute Program allowed the Wyoming Water Resources Data System to successfully implement the transfer of water resources information to Wyoming and the region. Thanks to this program we have been able to develop our Water Library as our method of disseminating the data and information developed by the Water Research Program. This is accomplished through the Water Library's holdings, its offerings, and its access.

Over the past year, our collection has grown and access to the print materials has improved. Our print materials have increased from approximately 18,000 to 20,000 holdings. Our video collection has increased from approximately 90 to 125 videos. We have increased the number of titles in our on-line Wyoming Water Bibliography from approximately 2,500 to 3,000 titles.

Personnel from the Water Resources Data System made numerous presentations to students in University of Wyoming water resource classes, the University of Wyoming's Institute for Environment and Natural Resources, and at Wyoming State Water Plan meetings. We attended conferences hosted by the Wyoming Association of Rural Water Systems, the Wyoming Geographic Information Advisory Council, and the Wyoming Water Association. At each presentation and at every conference we promoted the Water Library. Additionally, the Water Library hosted part of the spring meeting of the Wyoming Library Association's Government Information Section with a library tour and a hands-on presentation about our on-line Water Bibliography.

Access to our holdings is much better with the renovation of Room 4072 in the University of Wyoming's College of Engineering. The Water Library is a true circulation library where our offerings are available for check-out to University of Wyoming students, faculty, and staff, and the public and private sectors. Thanks to the Water Resources Grant Program, the Water Library is a visible and functional resource to Wyoming and the region. In fact, our Water Library (and the Water Resources Data System) is growing at such a rate that we are renovating two more rooms in the College of Engineering. One of these, Room 4086, is specifically for the expansion of the Water Library. The Wyoming Water Development Commission is providing funding for this renovation.

## Principal Findings and Significance

Development of the Water Library is a successful method of transferring data and information on water-related issues and research. The following examples detail specific and significant ways this has been accomplished:

*Direct Library Access.* The Water Library has regular business hours, and is staffed by a  $\frac{3}{4}$  time librarian and one student employee. Students, faculty, staff, and the general public can visit the library, contact our staff via phone or e-mail, and access the on-line Water Bibliography at the following URL:

<http://www.wrds.uwyo.edu/wrds/dbms/waterbib/sel.html>

*Research Support.* University of Wyoming researchers, state and federal agencies, and members of the public and private sectors receive improved access to our water and climate data from our professional staff. Research support is also enhanced through our continual updating of the Water Library holdings and on-line Water Bibliography. The Water Resources Data System also serves as a depository for

water related research reports.

*Wyoming Water Bibliography Enhancement.* An important goal of the Water Resources Data System is to enter on-line bibliographic records for our entire collection including our new acquisitions. As the public's demand for the Internet grows, the Wyoming Water Bibliography will provide the most up to date method of access.

*Water Planning Support.* The State of Wyoming is currently updating its 1973 Framework Water Plan. The Water Resources Data System supports this plan through our professional staff and our Water Library. The Wyoming Water Development Commission, the Wyoming State Engineer's Office, the Water Resources Data System, and private consulting firms work together on this effort. Towards this end, the Water Library provides valuable historical references to the Water Planning team.

*Student Support.* Water resource topics are taught in many departments at the University of Wyoming. The Water Library is a valuable resource to the students and faculty alike. Over the past year, professors at the University of Wyoming have utilized the Water Library in a number of ways, such as:

- taking their students on tours of the Water Library
- giving their students assignments to research information found in the Water Library
- using the Water Library as a resource in graduate student research projects

Additionally, the Water Library employs one University of Wyoming student who works approximately 10 to 15 hours per week during the fall and spring semesters, and approximately 25 hours per week during the summer.

## Articles in Refereed Scientific Journals

## Book Chapters

## Dissertations

## Water Resources Research Institute Reports

## Conference Proceedings

## Other Publications

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## Basic Project Information

Basic Project Information	
Category	Data
Title	Developing an Enhanced Framework for Visualization and Distribution of Digital Spatial Water Resources Data in Wyoming
Description	
Start Date	03/01/1999
End Date	02/29/2000
Tvnel	Library And Database Services

<b>Lead Institution</b>	University of Wyoming
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### Principal Investigators

Principal Investigators			
Name	Title During Project Period	Affiliated Organization	Order
Jeffrey D. Hamerlinck	Professional Staff	University of Wyoming	01

### Problem and Research Objectives

The integration of geographic information system-based spatial data technologies in water resources management has grown dramatically over the last ten years through hydrologic modeling, watershed analysis applications, and the development of spatially-referenced water resource data products such as the USFWS National Wetlands Inventory, USEPA Reach Files, and more recently, the USGS National Hydrography Dataset. In Wyoming, development of statewide digital spatial water resources data has traditionally been carried out by numerous state and university entities. In 1996, the Spatial Data and Visualization Center (SDVC) was established at the University of Wyoming with a goal of coordinating dissemination of many types of spatial data (including water resources) through the Wyoming Natural Resources Data Clearinghouse. Paralleling its data clearinghouse, the SDVC also developed a World Wide Web-based interactive GIS query and display application called the Wyoming Internet Map Server (WIMS). WIMS was designed to extend the use of spatial digital data beyond the GIS professional to a non-technical end-user audience for decision support and educational purposes. *While a strong foundation of 'base' data layers have been developed for Wyoming's water resources, a need exists to both address critical data 'gaps' and integrate spatial water resource data in the Wyoming Internet Map Server.*

The overall objective of this project was to further develop, integrate, display, and distribute selected spatial digital data layers in two major water resource sub-theme categories-surface water and groundwater. The scope of work involved development of two exemplary data layers representing information needs identified from cooperating state resource management agencies. Completed digital products are scheduled for integration within the Wyoming Internet Map Server. Future customized graphical spatial query tools will provide end-user access to these and other spatial water resource data in accordance with guidelines established under the National Spatial Data Infrastructure.

### Methodology

The project matched three major spatial data activities (data development, data integration, and data visualization) with two thematic sub-categories of water resource data:

#### **Digital Water Resource Data Development: *Aquifer Prioritization Mapping***

This portion of the project involved development of a statewide aquifer prioritization map. The data layer was created in conjunction with the development of a plan for creation of a statewide ambient groundwater monitoring network (Funded by the Wyoming Department of Environmental Quality, this complimentary research was a joint effort of the SDVC and the University of Wyoming Department of Civil and Architectural Engineering.).

Digital well data from the Wyoming State Engineer's Office was combined with GIS-based representations of aquifer sensitivity, land use, and aquifer utilization to create a relative sampling priority rating scheme. Major land use categories included: known groundwater contamination sources, potential groundwater contamination sources, urban and agricultural land use, oil and gas wells and pipelines, active mine lands, and rural ranchette developments. The current use of the aquifers was differentiated by whether or not the aquifer was used primarily for drinking water. If an aquifer was used for drinking water, higher priority was placed on it. If an aquifer was also used for municipal use, an additional value was assigned.

### **Data Integration: *Surface Water Hydrography and Watershed Unit Delineations.***

This activity stemmed from a critical need in Wyoming (and nationwide) to incorporate new surficial hydrography and watershed unit delineation data into a comprehensive statewide spatial water resources database. In the past, compatibility issues existed between various stream network products (e.g., Digital Line Graphs, RF3, TIGER, etc.). In October 1999, the SDVC began a cooperative project with state and federal agencies to digitally delineate watersheds and sub-watersheds for Wyoming's major river basins. The purpose of the two-year project is to create 5th and 6th level hydrologic unit boundaries (HUBs) for the State at a 1:24,000-scale. Boundaries will be defined using the *USGS Interagency Guideline on Delineation of Watershed and Subwatershed Hydrologic Unit Boundaries*. Fifth-level HUBs, known as watersheds, will be between 40,000 and 250,000 acres in size and 6<sup>th</sup> level HUBs (sub-watersheds) will be between 10,000 and 40,000 acres. The delineation is being conducted using ArcView GIS and ArcInfo GIS. In Phase I of the project, draft delineations at the 1:100,000-scale are being completed. In Phase II of the project, final delineations will be made at the 1:24,000-scale. Once the final changes are completed, SDVC's Wyoming Natural Resources Data Clearinghouse will become the repository for the watershed data.

### **Principal Findings and Significance**

*Aquifer Prioritization Mapping.* The final product of this task is a GIS data layer depicting areas of high, low, low-moderate, and high-moderate priority. The high priority areas will be the focus of the development of a statewide groundwater monitoring and protection strategy.

In addition to creating a base from which to continue the development of a Ambient Ground-Water Quality Monitoring Plan, this layer will be tremendously useful to state government, county and local planning authorities, students, and individual property or business owners. An understanding of the potential aquifers that underlie a particular spot as well as their past quality and yield will be a valuable tool for future management of Wyoming's groundwater resources.

*Surface Water Hydrography and Watershed Unit Delineations.* Integration of the National Hydrography Dataset and the Hydrologic Unit Boundary data layer will facilitate improved watershed management at both basin- and stream-reach levels. Further, the combination of these data with the National Elevation Dataset has resulted in implementation of a semi-automated watershed delineation method which has become a prototype standard for similar statewide mapping efforts. Future associated tasks will involve migration to a feature-based "Spatial Database Engine" environment with full FGDC metadata documentation and Z39.50 protocol compliance.

*Data Visualization and Distribution.* The SDVC's Wyoming Internet Map Server (WIMS) provides the layperson with advanced GIS-based spatial display and query capabilities of digital data. As a result,

WIMS is playing a vital role in the education of citizens as well as prospective businesses considering Wyoming as a destination. The final objective of the project calls for the inclusion of several critical layers into the SDVC's Wyoming Internet Map Server (WIMS), as well as improving current base layers within the system. The spatial data to be added to the site through this project include the aquifer and watershed boundary layers described above, as well as some recently develop climate information related to drought index ratings across the state. Inclusion of the aquifer layer will provide a more broad depiction of Wyoming's ground water resources to go with the detailed well data currently being served. These aquifer delineations as well as the text characterizations that go with them, will provide the user with a better idea of what ground water resources are available at any given location in the State. Availability of this data layer is anticipated in September 2000. WIMS will also be a vehicle with which to both educate and distribute the recently completed National Hydrography Dataset and the inter-agency hydrologic unit boundary data. Initial availability of this data for the first priority basins in the state is anticipated in September 2000, with statewide completion scheduled for September 2001. Integrated delivery of these datasets will prove to be a great leap forward in Wyoming's efforts to digitally map its resources. WIMS has shown itself to be an outstanding method for both allowing users to work with data they would not otherwise be able to access and also to educate potential users to what data is available.

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## USGS Internship Program

### Student Support

<b>Student Support</b>					
<b>Category</b>	<b>Section 104 Base Grant</b>	<b>Section 104 RCGP Award</b>	<b>NIWR-USGS Internship</b>	<b>Supplemental Awards</b>	<b>Total</b>
<b>Undergraduate</b>	1	N/A	N/A	N/A	1
<b>Masters</b>	N/A	N/A	N/A	N/A	N/A
<b>Ph.D.</b>	N/A	N/A	N/A	N/A	N/A
<b>Post-Doc.</b>	N/A	N/A	N/A	N/A	N/A
<b>Total</b>	1	N/A	N/A	N/A	1

## Awards & Achievements

# **Publications from Prior Projects**

**Articles in Refereed Scientific Journals**

**Book Chapters**

**Dissertations**

**Water Resources Research Institute Reports**

**Conference Proceedings**

**Other Publications**