Indiana Water Resources Research Center

Annual Technical Report

FY 1999

Introduction

Research Program

Basic Project Information

Basic Project Information	
Category	**Data**
Title	FY 1999-2000 State Water Research Institute Program
Project Number	B-01
Start Date	03/01/1999
End Date	02/28/2000
Research Category	Not Applicable
Focus Category #1	None
Focus Category #2	None
Focus Category #3	None
Lead Institution	Purdue University

Principal Investigators

Principal Investigators			
Name	**Title During Project Period**	**Affiliated Organization**	**Order**
Jeff R. Wright	Professor	Purdue University	01

Problem and Research Objectives

The Indiana Water Resources Research Center continues to work on the development of a distributed water resources information system known as WETnet, for Indiana Water Network. WETnet has evolved into a system used by water resources professionals and students for a variety of purposes and applications. The development of WETnet has not only focused on the design and implementation of a state-of-the-art distributed information system, but also a complete distance learning environment for use by participating organizations, students, faculty, practicing engineers and scientists, and other water resources "stakeholders" in and around Indiana.

The Center has also continued development of a comprehensive distributed database for the National Institutes for Water Resources (NIWR). Each of the 54 institutes in the NIWR responds to state and regional research, information transfer and training needs; all work closely with the national organization to meet national needs through the U.S. Geological Survey's Water Resources Institute Program (WRIP).

Through support from the Maple Point Foundation, the Indiana Water Resources Research Center coordinates the Maple Point Foundation Graduate Research Award for Women in Civil Engineering. This award is a cash award of $5,000 given annually to a woman graduate student in the Purdue School of Civil Engineering to further the recipient's progress toward her Ph.D. The student must be a full-time woman graduate student in the School of Civil Engineering with a clear intention of completing a Ph.D. degree at Purdue University. She must possess a record of outstanding academic achievement at the undergraduate and graduate levels, and have made significant contributions to the Purdue academic community. The student must also demonstrate that the receipt of this award will have a significant impact on her further academic and scholarly development. Special consideration is given to applicants working in areas related to water resources and environmental sensitivities, however applications from students in all areas of water related work are considered.

Methodology

Principal Findings and Significance

Descriptors

Articles in Refereed Scientific Journals

    None

Book Chapters

    None

Dissertations

    None

Water Resources Research Institute Reports

    None

Conference Proceedings

    None

Other Publications

    None

Basic Project Information

Basic Project Information	
Category	**Data**
Title	Design and Implementation of a Distributed Water Resources Information System
Project Number	B-02
Start Date	03/01/1999
End Date	02/28/2000
Research Category	Not Applicable
Focus Category #1	None
Focus Category #2	None
Focus Category #3	None
Lead Institution	Purdue University

Principal Investigators

Principal Investigators			
Name	**Title During Project Period**	**Affiliated Organization**	**Order**
Jeff R. Wright	Professor	Purdue University	01

Problem and Research Objectives

This system has been developed using the client/server compute architecture of the global Internet, but accessible only by users authorized by the National Institutes of Water Resources (NIWR). This system is most properly viewed as a distributed intranet. Using this system, the institutes that comprise the NIWR are able to accomplish such things as:

- Develop and manage consistent databases of NIWR project profiles including research projects, technology transfer and educational outreach projects, and institute administration.
- Develop consistent databases of human resources affiliated with each institute including research faculty and graduate student personnel, state professional personnel and water resources practitioners, institute staff, and other members of the water resources community within the state and region served by a particular institute.
- Maintain financial information about projects of the institute.
- Electronically construct and submit a variety of institute reports including periodic review and evaluation reports, annual technical reports, and annual applications for recurring federal support.

The ultimate goal is for these systems and functions to provide a comprehensive framework for communication within and among the NIWR institutes that will greatly extend the impact of individual institute initiatives. As a result of this enhanced virtual interconnectivity among the institutes, our program should become considerably more valuable to the water resources community within each state, to the university research communities within each state, and to water resources "stakeholders" at

large. A natural extension of this system could extend to state USGS offices, and to other appropriate governmental agencies.

Methodology

A principal strength of the national network is access to the latest water resources information through the clearing house resources of all institutes that can provide easy connection between water resources needs and expertise/research. That access might entail the latest research reports, ongoing projects, talented student expertise for employment, knowledgeable and experienced faculty, and connections to state and regional efforts. In effect, the National Institutes for Water Resources is a series of networks, beginning with a national network and proceeding to many regional, state, and local networks; all can be accessed via the national network.

The data maintained by and administered through the NIWR intranet resides on a single host computer within an SQL-based relational database structure. The database is made up of five data subsystems, each with a "projects" perspective: 1) a project profile system, 2) a program finance system, 3) an institute personnel system, 4) a publications system, and 5)an institute profile system. Each of these subsystems are linked through data table relations so that reports can be generated quickly and efficiently, and with an appropriate degree of consistency among institutes. This expedites greatly the federal reporting obligations of each institute, and provides a more effective means of evaluating institute activities.

Data access is achieved using standard SQL query functionality making the system accessible by other (authorized) systems. Data may thus physically reside at multiple and dispersed locations consistent with the capabilities of each individual institute (which may change over time). This structure will also facilitate the upgrade of system support infrastructure (hardware and software over time, and in a manner that will be transparent to the community of users.

The database management system is configured as an Internet server with user access through any Web browser. Security and access control is achieved using standard client/server protocols, with an appropriate level of client-side functionality within reasonable standards. This will insure that the functionality of the system will be driven by user community needs and capabilities rather than by the state-of-technology as it grows over time.

Principal Findings and Significance

Descriptors

Articles in Refereed Scientific Journals

Book Chapters

Dissertations

Water Resources Research Institute Reports

Conference Proceedings

Other Publications

Basic Project Information

Basic Project Information	
Category	**Data**
Title	Assessing the Hydrologic and Geomorphic Impacts of Land Use Change in Urbanizing Watersheds, Indianapolis
Project Number	B-03
Start Date	03/01/1999
End Date	03/01/2000
Research Category	Engineering
Focus Category #1	Geomorpological and Geochemical Processes
Focus Category #2	None
Focus Category #3	None
Lead Institution	Purdue University

Principal Investigators

Principal Investigators			
Name	**Title During Project Period**	**Affiliated Organization**	**Order**
Jon Harbor	Professor	Purdue University	01

Problem and Research Objectives

A wide range of city, county and state-level agencies and organizations are involved in work that generates scientific and technical questions concerning water resources that their staff are not trained to answer. The overarching goal of this project was to provide a demonstration of the way in which university water resources research can fruitfully respond to the information needs of grass roots, city, county and state-level agencies and organizations. Thus we hoped to demonstrate and facilitate water resources research focused on important information and knowledge needs of the citizens and government organizations of the State of Indiana. More specifically, responding to the information needs of community to city level organizations, the goal was to provide specific research in to the hydrologic and geomorphic impacts of urban development in Indianapolis. This involved two major thrusts: an empirical study of the impacts of development on stream sediment, and ways in which community groups can measure this; and upgrading an existing user-friendly hydrologic impact assessment tool to include non-point source pollution loadings.

Methodology

1. Indian Lake/Creek sedimentation project. The need to study sediment pollution associated with

urban development originated as a widespread concern across Indianapolis, and a particular concern of a local watershed community near Indian Lake, a 60 acre reservoir near Indianapolis. Previous studies indicate that, in urbanizing areas, construction sites are often the most significant source of sediment. The Indian Lake/Indian Creek watershed is presently undergoing widespread development from agricultural land use to commercial and residential, and there has been growing concern over rapid sedimentation in the lake (which has been very expensive to remove through dredging). A monitoring program was set up determine if a rise in in-stream suspended sediment loads could be measured as Indian Creek passed through a construction site, and to place this in the context of the total sediment load entering the reservoir. This was achieved by deploying both low tech (US-D49 siphon sampler) and the high tech (ISCO 3700 sampler and 4150 logger) monitoring equipment upstream and downstream of a 400-acre development site and at the entry to Indian Lake. Deployment of these two sets of equipment allows analysis of the extent to which low tech approaches can deliver data of equivalent usefulness as a high tech method, potentially providing local watershed organizations an affordable approach to collecting critical environmental data. Suspended sediment samples and stage data were collected over the spring and summer of 2000. Samples were analyzed in the lab for suspended sediment concentration from which total load was calculated. To determine discharge, stream cross sections, water surface profiles, and velocity data were collected.

2. LTHIA-NPS upgrade. Although much has been written in general about the hydrologic and geomorphic impacts of land use change, very little research has been directed towards developing tools that can be used to evaluate both impacts and proposed management options, making use only of readily available data. Over the past 8 years we have progressively developed a model, called L-THIA (Long-Term Hydrologic Impact Assessment), that makes use of readily available data for land use, soils and climate to assess the impact of past and proposed future land use change. The web-based version of this program is available at http://www.ecn.purdue.edu/runoff. One limitation of the LTHIA approach as it is applied at present is the failure to include point sources of pollution. This makes it hard to compare model output with empirical data, because the model simply predicts the nonpoint source component of the pollutant load in the stream or river, whereas most empirical data include both point and non point sources. In the work proposed here we sought to assemble data needed to run LTHIA for watersheds identified by the City of Indianapolis as of interest to them in watershed planning and to develop an additional ability in the model to allow the user to enter data on point source pollution loadings to the watershed. In collaboration with the City of Indianapolis, satellite imagery was used to derive land cover maps for target watersheds, and these were used as the basis of LTHIA analyses. Development of the point source component of LTHIA was approached by expanding the program code to allow the user to enter time variant pollutant loadings at specified points in the watershed, which will then be added to the calculated nonpoint source pollution loadings during the daily simulation calculations .

Principal Findings and Significance

1. Suspended Sediment Load: Monitoring data shows that the development adds a 'first flush' high sediment concentration pulse to Indian Creek, with suspended sediment concentrations of 5 to 6 kg/m3 (compared to typical low flow suspended sediment concentrations of less than .0001 kg/m3 and storm peak flow concentrations of 1 kg/m3). Although analysis of the total sediment load entering the reservoir is still ongoing, preliminary results suggest that development is a very significant contributor to total load. The significance of this work includes impetus to increase the emphasis on erosion control programs during urban development, and in particular to target sediment control devices to intercept first flush runoff.

2. Comparison of high tech and low tech suspended sediment sampling methods: Despite the large price difference between the methods ($5000 vs $100 in initial equipment cost), both approaches provided useful data. Installation efforts were similar for both setups, but the low tech method proved significantly more susceptible to damage by floating debris. At this study site most of the suspended sediment load occurred during rising stages. This means the low tech samplers, which collect only during the rising stage, can sample the most significant period of sediment carrying flows. However, the high tech sampler offers much more control over sampling.
3. LTHIA upgrade. LTHIA-NPS is now available through the internet at http://www.ecn.purdue.edu/runoff and is proving to be a very useful tool in assessing relative impacts of alternate development scenarios. Development of the LTHIA point source pollution capability is ongoing, and is currently scheduled for completion during fall 2001.
4. LTHIA data for Indianapolis: Remote sensing data were successfully used to develop land cover maps for Indianapolis watersheds. This represents the current most detailed and comprehensive land coverage available to the city, for a variety of uses. LTHIA analyses of target watersheds have been presented at meetings of the City of Indianapolis' inter-departmental Watershed Management Teams.

Descriptors

Articles in Refereed Scientific Journals

Book Chapters

Dissertations

Water Resources Research Institute Reports

Conference Proceedings

Other Publications

Basic Project Information

Basic Project Information	
Category	**Data**
Title	Development and Implementation of a Distributed Database System for the 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management
Project Number	S-01
Start Date	03/01/1999
End Date	09/01/2000
Research Category	Not Applicable
Focus Category #1	None

Focus Category #2	None
Focus Category #3	None
Lead Institution	Purdue University

Principal Investigators

Principal Investigators			
Name	**Title During Project Period**	**Affiliated Organization**	**Order**
Jeff R. Wright	Associate Professor	Purdue University	01
German Gavilan	Student	Purdue University	02
Yiguo Zhang	Student	Purdue University	03

Problem and Research Objectives

Water2000, the distributed information system used to manage the 2000 ASCE Joint Conference on Water Resources Engineering & Water Resources Planning and Management, held in Minneapolis, Minnesota on July 30 - August 2, 2000, best utilizes the concept of a *thin client* - a structure where the client is responsible for handling only those issues that relate directly to the user interface, and the server responsible for handling everything else, including all query processing, database management, and all monitoring and control functionality. This is particularly important because it is virtually impossible to anticipate the client-side environments of all users of the system, even the relatively small group of conference committee members. Within the Water2000 information management system, full database functionality is achieved through the application logic and data management components on the server-side, and several important administrative functions are provided by a server-side interface management system.

Methodology

Interface Management on the Server Side

Interface management on the server side of the Water2000 information management system was designed to be responsive to the specific needs of each individual member of the conference organizing committee. This was accomplished by the design and implementation of four functional components into what was referred to as the conference Administration Desk:

Authentication Management. The administrative functionality of the Administration Desk is only available to authorized individuals. Consequently, each authorized user must be known to the system, and must therefore posses a valid ID and password to be used to gain access to the Administration Desk area.

Access Control. Once a user is authenticated, access to the functionality of the Administration Desk and the system database depends on their specific authorization level. Each member of the committee has his/her own specific authorization level allowing restricted access control as appropriate.

Virtual Document Preparation. Because the system requires authentication, the view of the content of the information system at any point in time can be "customized" explicitly for each individual. The document that is presented to an authorized user is created at the time it is requested specifically for that individual.

User Monitoring and Notification. Authentication also allows monitoring and tracking of all requests to the server, and through the server into the database. This not only assists in identifying and correcting system errors, but also suggests areas for improving the functionality of the system. Because system use by individuals can be tracked, subsequent person-specific notification (such as e-mail notification of problem occurrences) can also be achieved.

Principal Findings and Significance

The information system being used to manage the conference groups is an example of a comprehensive distributed informaton management system that uses the full range of Internet protocols and procedures as described above. It includes the careful integration of several servers. The main home page for the system is served from a server hosted at the ASCE headquarters domain (http://www.mpls2000.asce.org), which serves general information about the conference in the form of static html documents. Links from this document allow access to a hierarchy of Web pages served from this site, including information about conference local arrangements, sponsors and exhibits, spouse programs, and a variety of tours and conference activities. In addition, links are provided that allow users to obtain services from other Internet servers not directly maintained by ASCE or by conference organizers, such as for hotel and conference registration including collection of fees through electronic transaction services.

Database functionality for managing the content of the conference is provided via two servers located within the Engineering Computing Network (ECN) at Purdue University (1) an http server (http://www.ecn.purdue.edu/Water2000/administration), which provides secure interface management and applications logic for the conference technical organizing committee, and (2) and SQL database server that houses and maintains all content data for the conference. Collectively, thie hierarchy of servers (which may also function as clients to other servers as needed) are configured as a somewhat "seamless" system, with each component being administered by the entity most responsible for its content.

System Subcomponents

The heart of the Water2000 conference management system is a set of functional tools for accessing, managing, and manipulating five separate, but closely related database components:

Personnel Database. Each individual wishing to have a specific association with the Water2000 event creates an individual personal profile (including contact information) within the conference database. This includes conference organizers, ASCE personnel, authors of conference papers, session moderators, and other individuals wishing to be kept informed of conference activities.

Abstract Database. A database of all conference abstracts is included in the database. An abstract must include a title, one or more authors having personal profiles in the database, and a summary textual

abstract.

Symposia Database. The Water2000 conference consists of six program components: four conference symposia, one track of poster presentations, and a general conference track. Database entries for each of these includes a title, component chair, and auxiliary information about that component.

Sessions Database. Conference papers (abstracts) are grouped into individual sessions. EAch session consists of a title, proposer, sponsor, moderator, schedule informatoin (time, room assignment, etc.), and list of papers assigned to that session.

Database Archive. An archive of data is maintained that allows tracking of the system in such a way as to identify problems that may arise. This includes such things as user password information and logging of broadcast e-mail activity. The database archive also serves as an intermediate and quick access backup of essential, but short term information.

The status of these database components is available to those individuals having access to the Administration Desk and its database functionality.

System Functionality

The Water2000 information management system provides a wide range of functionality to users at all authentication level--all users who are known to the system by virtue of having a personal provile entry in the personnel database. Depending on each individuals' access level, (s)he has access to the following database management tools:

User Profile Entry System. Each user is responsible for creating and maintaining their own personal profile. Upon entering a minimum amount of information, each user is provided, by automatic return e-mail, a user ID and password, which they can use at any time to edit their own personal profile.

Sessions Proposal System. A user who has an entry in the personnel database may propose a conference session. By specifying a title and description for their session, they are provided, by automatic return e-mail, a Session Code that can be distributed to authors of papers they would like to include in their session.

Abstract Submission System. A user who has an entry in the personnell database may submit one or more abstracts for consideration by the conference committee for presentation at the conference. All co-authors must also have entries in the conference database, and upon submitting an abstract, all authors receive automatic e-mail confirmation of the submission.

Session Configuration System. Conference organizers may assign papers that have been submitted to the general conference track to individual symposia for subsequent assignment to a conference or symposium session.

Symposium Configuration System. From the pool of abstracts assigned to a given symposium, the symposium chair can create session, assign papers to sessions, and order the papers in a given session.

Session Scheduling System. The chair of each symposium (or the general conference chair) can schedule each session for inclusion in the conference program. Because of multiple authors and multiple papers by individual authors, a system to minimize scheduling monitors this operation.

Moderator Assignement System. Moderators may subsequently be assigned to individual sessions.

Database Search Systems. A number of tools are provided to allow users at all levels (and depending on access control criteria) to search the conference database and to prepare individual reports that result from those searches.

Custom Agenda Configuration System. All users are able to use this feature to construct an individualized program agenda for their use during the conference.

Systems Administration

In addition to the tools listed above, which support the management and maintenance of data within the Water2000 conference database, a number of additional functional tools are available to enhance the administration of conference organization as well as to increase the efficiency of communication between and among conference organizers and potential system users:

Broadcast E-Mail Tool. Broadcast e-mail can easily be sent to different groups within the conference database, including all people, all authors, corresponding authors, moderators, conference organizing committee, session proposers and symposium chairs, and other groups as identified.

User Password Management. A system is available that allows conference organizers to update user passwords as needed.

Virtual Report Generation. A large number of different reports reflecting the state of the database is available to conference organizers depending on their access control level.

Abstract Review System. A system is available allowing the program chairpersons to review and accept or reject conference abstracts prior to requesting full manuscripts to be submitted.

Committee Task Management (*todo list*). A running todo list is maintained allowing authorized individuals to post tasks needing attention and direct these tasks to individuals or groups. Posting a task launches an automatic e-mail to all individuals involved. Target individuals may subsequently access the todo list to accept a task or to mark it as having been completed. The scope of the todo list is determined by individual access control levels.

Committee Monitoring System. The se of the system by authorized users may be monitoried, including the level of activity as well as the specific information (or functionality) that was requested from the database. This assists system designers in developing more responsive tools and features for the system.

Statistics on User Access. Detailed information on user access are available to authorized users.

Access/Error Logging. All access (requests) to the system (server) are recorded as are all error that occur. This assists developers in modifying and enhancing the system.

Descriptors

Articles in Refereed Scientific Journals

Book Chapters

Dissertations

Water Resources Research Institute Reports

Conference Proceedings

Wright, Jeff R., German Gavilan, Yiguo Zhang and Kamie Redinbo, 2000, Emerging Technologies for Developing Distributed Database Systems, in 2000 Joint Conference on Water Resources Engineering and Water Resources Planning & Management, ASCE, Minneapolis, Minnesota, July 30-August 2, 2000)

Other Publications

Information Transfer Program

Basic Project Information

Basic Project Information	
Category	**Data**
Title	Indiana WETnet Distributed Water Information Systems Design and Development
Description	Data, information and communication
Start Date	03/01/1999
End Date	02/28/2000
Type	Library And Database Services
Lead Institution	Purdue University

Principal Investigators

Principal Investigators			
Name	**Title During Project Period**	**Affiliated Organization**	**Order**
Jeff R. Wright	Professor	Purdue University	01

Problem and Research Objectives

Indiana WETnet was developed to demonstrate full Internet functionality within the context of water resources research, education, planning, management, and sustainment.

Methodology

Indiana WETnet is a data, information, and communication server accessible, via the existing electronic

communications infrastructure, to anyone in the state who is interested in communicating with other interested water-related professionals, viewing or retrieving data and information, and even posting or depositing their data or information. A simplistic metaphor for WETnet would be a public domain electronic bulletin board and filing cabinet for water-related information and communication accessible to anyone with a phone-line and any model of computer. The WETnet concept is hardware and software independent and includes no capital expenditure for the communications infrastructure other than the one computer that would be the server. This computer is connected to the Internet and consequently virtually every other computer in the world that is connected to the previously described existing electronic network of computers. The WETnet server is indifferent to what type of computer or operating system that a user has to communicate with it, nor will it care what type of software generated the data that are being supplied by or to the user.

Principal Findings and Significance

An important consequence of connecting currently isolated individuals or groups to the WETnet is that they then will have access to the World Wide Web of interconnected computers and all the services and benefits that they provide. The WETnet resource will provide training and education to new users for not only how to use the WETnet, but also an introduction to the sometimes intimidating amount of information and resources that can be found on the Internet. As the Information Superhighway is developed the WETnet resource will be positioned to take advantage of its yet unknown set of functionalities and tools for the water resources community. In the process of developing the Indiana Water Resources Data Communications Plan that resulted in the WETnet prototype several exciting new questions were raised that go beyond merely setting up a protocol or method for water resources communication and information sharing. How can water resources education benefit from this new hypermedia paradigm for structuring information and developing educational materials? Can the relationship between the general public and government policy makers and agencies be improved with these new computer mediated information dissemination tools? How can water resources modelers, decision makers and researchers benefit from tools that let them share ideas, test theories, and collaboratively communicate in a virtual, graphical environment from there own distributed work place essentially in real-time? These are just a sampling of the questions that the IWRRC plans to continue this research and outreach effort with by endeavoring to answer.

Articles in Refereed Scientific Journals

Book Chapters

Dissertations

Water Resources Research Institute Reports

Conference Proceedings

Other Publications

USGS Internship Program

Student Support

	Student Support				
Category	Section 104 Base Grant	Section 104 RCGP Award	NIWR-USGS Internship	Supplemental Awards	Total
Undergraduate	N/A	N/A	N/A	N/A	N/A
Masters	N/A	N/A	N/A	N/A	N/A
Ph.D.	1	N/A	N/A	4	5
Post-Doc.	N/A	N/A	N/A	N/A	N/A
Total	1	N/A	N/A	4	5

Awards & Achievements

Publications from Prior Projects

Articles in Refereed Scientific Journals

Book Chapters

Dissertations

Water Resources Research Institute Reports

Conference Proceedings

Other Publications