# SYSTEM WIDE WATER RESOURCES PROGRAM
# UNIFYING TECHNOLOGIES
# GEOSPATIAL APPLICATIONS
# (GIS IN SWWRP)

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# TOPICS

- Geospatial R & D Program
  - Geospatial Program FOCs
- SWWRP Unifying Technologies – Geospatial Applications
  - Operating Principles
  - Approach
  - Summary of Geospatial Issues and Needs
  - Initial Activities and Products
- Discussion

# GEOSPATIAL TECHNOLOGY AREA

## Future Operating Capabilities

1. Capability to optimize data collection through :
   A corporate approach to SHARED GEOSPATIAL DATA that supports projected needs and ensures a high level of reliability.

2. Capability to provide new system components that allow:
   Efficient access of geospatial data at MULTIPLE SCALES.

3. Capability to offer: LINKED PROCESS MODELS that allow transparent flow of data between models.

4. Capability to provide: WEB MAPPING through Internet-enabled data access and analysis capabilities.

# 1) SHARED GEOSPATIAL DATA

## Benefits

- Reduced duplication in data collection
- Fewer errors from inconsistent data sets
- More accurate data collection
- Reduced costs for project planning, design, operation and maintenance

## Thrust areas

- Improved remote sensing, survey, and in-situ data collection methods
- Standardizing approaches to data development
- Expanded data collection through use of positioning systems
- Collection, inventory, and assessment of legacy data
- Integration of spatial data into existing Corps databases (NRMS, RAMS, REMIS)

# 2) DATA ACCESS AT MULTIPLE SCALES

## Benefits

- Accurate depiction of geospatial processes at regional scales
- Better capability to track cumulative impacts of regulatory actions
- Improved water allocation and emergency management strategies

## Thrust areas

- Development of interoperable spatial data management system
- Develop technologies to depict geospatial data at multiple scales
- Integration of geospatial technology into Corps regional watershed, sediment, and ecosystem management models

# Data Access and Integration at Local and Regional Scales


US Army Corps of Engineers

Engineer Research and Development Center

# 3) LINKED PROCESS MODELS

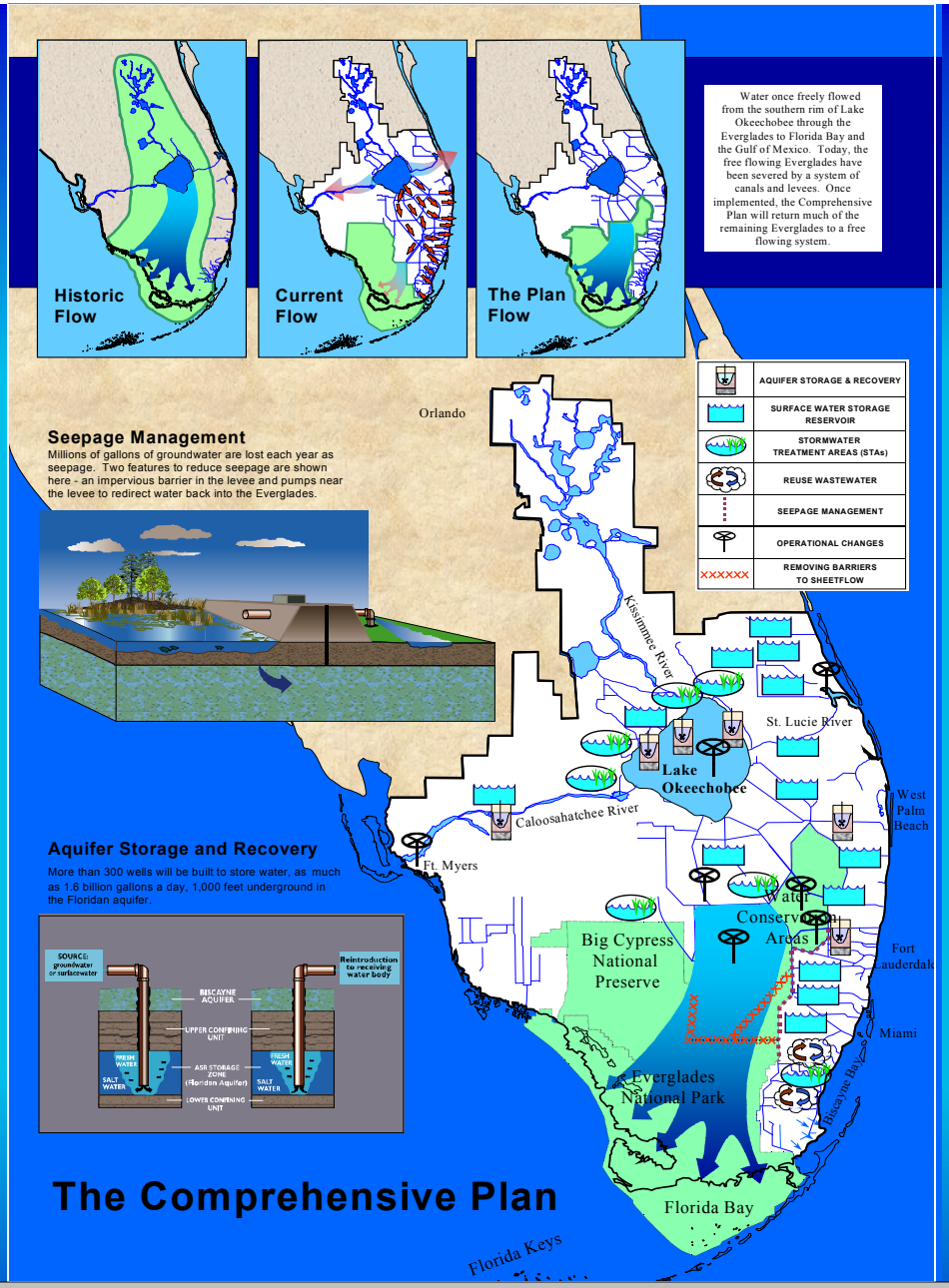
## Benefits

- Increased model efficiency by providing transparent flow of data between models
- Improved decision support system through development of interoperable system
- Reduced costs for project planning, design, operation and maintenance

## Thrust areas

- Transfer of geospatial data between various GIS and model hardware and software without user intervention
- Integrated GIS, GPS, RS, CADD data and systems
- Water supply and flood control
- Natural resource management

# Linked Process Models




*America's Everglades are in Serious Peril*

# 4) WEB MAPPING

## Benefits

- Improved decision support
- Better mapping, mission tracking, and hazards analysis in emergency operations.
- Improved flood damage and project benefit assessment
- Transparent access to necessary data on the Web

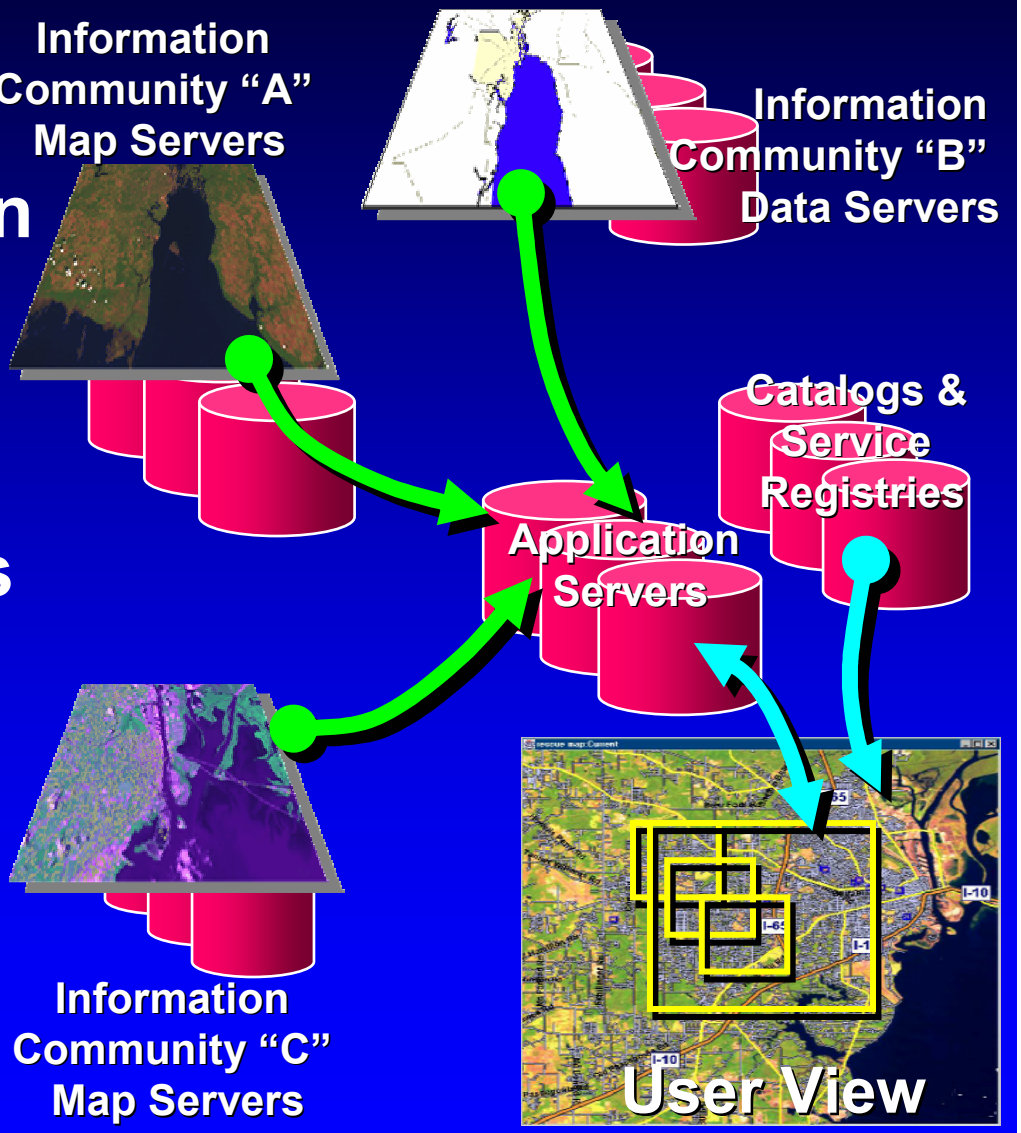
## Thrust areas

- Internet-enabled data access and analysis
- Rapid mapping techniques
- Web Mapping Technology II
- Ecological and economic risk assessment technologies
- ??

# Web Mapping Technology

Discover, access and exploit online geodata from multiple information communities simultaneously using:

- web mapping client
- internet/intranet access
- industry specifications for interoperability.



# SWWRP GEOSPATIAL APPLICATIONS AREA

**KEY:**

To support the development of watershed/water resource management systems through the integration of geospatial strategies, techniques, tools, and database structures for improved analysis, understanding, and decision support.

# SWWRP GEOSPATIAL APPLICATIONS AREA

## MAJOR GOALS:

1) Geospatially enabled models from the SWWRP pillars.

2) Integrated modeling environment enhanced by shared geospatial data and distributed and collaborative geospatial tools.

3) Seamless data flow.

# SWWRP GEOSPATIAL APPLICATIONS AREA

## MAJOR GOALS:

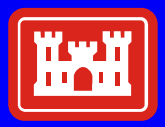
4) Improved applications, analysis, display, and decision support through appropriate use of geospatial technologies.

5) A geospatially enabled system permitting evaluation of the probability of success of an action and evaluation of alternatives

# SWWRP GEOSPATIAL APPLICATIONS AREA

## OBJECTIVE:

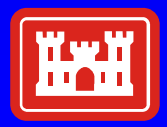
To meet both modelers and end-users requirements for effective display of model results, geospatial analysis and integration and use of geospatial data in the SWWRP.



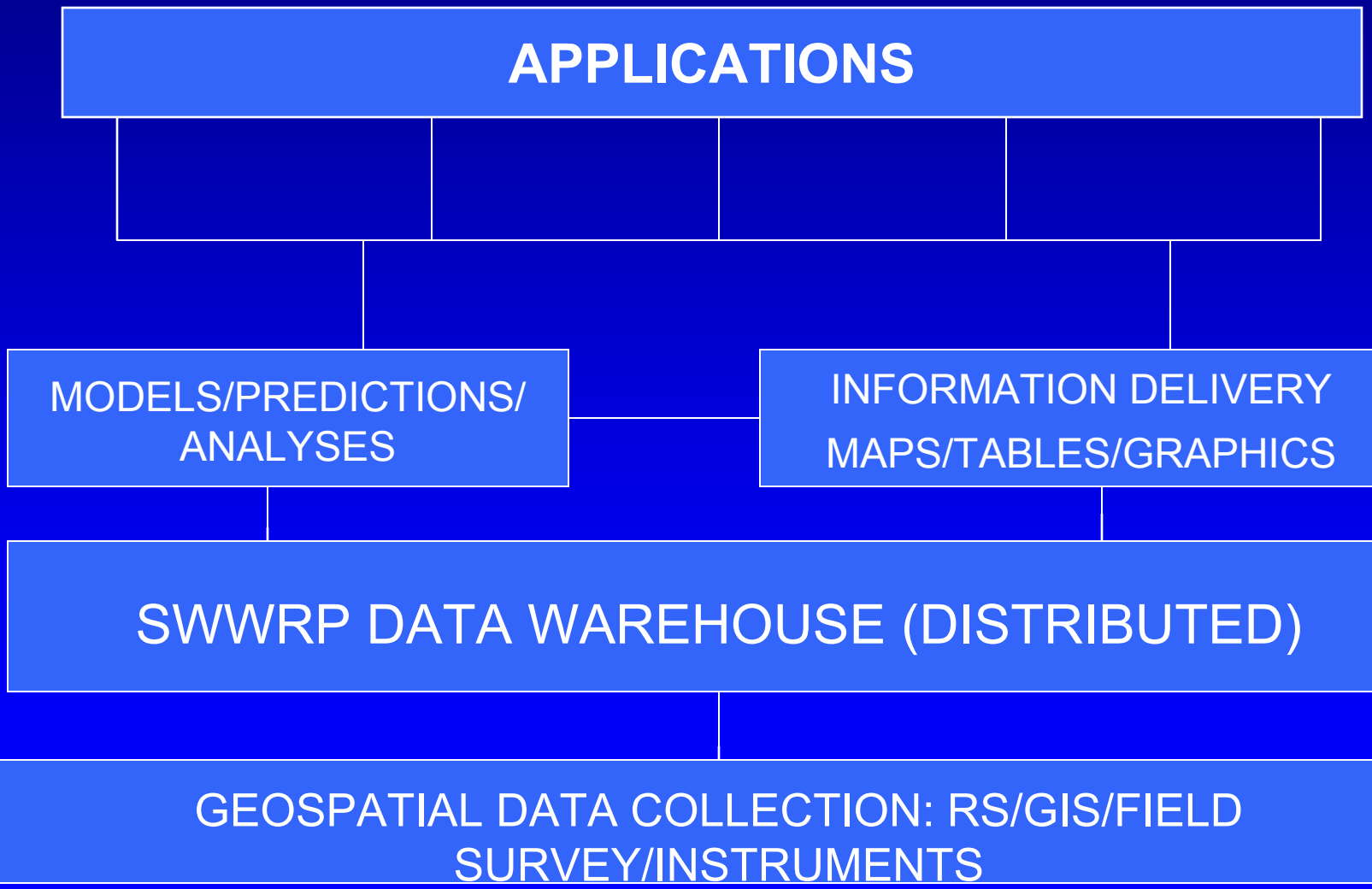
# SWWRP GEOSPATIAL APPLICATIONS AREA

## STRATEGY:

- Needs-based approach predicated upon modelers and end-user requirements
- Significant leveraging of existing enterprise programs and Automated Information Systems
- Open ongoing dialog with related business program requirements

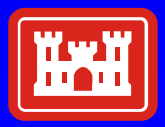


# SWWRP GEOSPATIAL DATA



# GEOSPATIAL ISSUES AND NEEDS

- Geospatial enabling of select models
- Scalability
  - Micro- and meso-scale understanding do not necessarily scale up
  - Representation
  - Data access
- Web Mapping
- Uncertainty
- Characterization
- Common look and feel
- Linked process models
  - Input/Output



# Arkansas River Capability Demonstration

- Problem:
  - Methodology for collecting geologic, geomorphic, and structural data at a project location is well-defined using data sheets
  - Currently data assimilation and processing is time-consuming and labor intensive
  - Spatial data are not easily incorporated with other data
  - Digital spatial data are not readily available in the field to assist with data collection and verification
  - Data in a spatial context

# Arkansas River Capability Demonstration

- **Project Scope:**

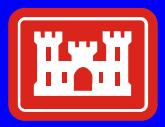
  Development of a suite of tools to identify and analyze geomorphology in the river and to evaluate geomorphology with riverine habitats and fish communities.

- **Needs include:**
  - Ability to differentiate between sand and gravel deposits without detailed sampling
  - Development of a habitat suitability index for river channels that includes:
    - Topography
    - Soils
    - Aquatic vegetation
    - Substrate variability
    - Water depth
    - Important/sensitive species

# Arkansas River Capability Demonstration

Approach:

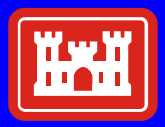
- Phase 1: Tool for automating field data collection and location information
  - ArcPad
- Phase 2: Methodology for storing data back at the office
- Phase 3: Utility for processing and analyzing field data in a spatial context
  - ArcGIS 9 extension



# Statistical Methods for Water Resources Engineering

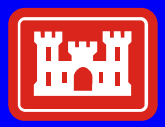
- Objective: To combine current and new statistical techniques with the regional analysis capabilities available in GIS software to provide improved knowledge of the risk associated with floods, low flow periods, and drought.

The statistical methods analytical engine will be loosely coupled with ArcGIS and data will be retrievable using the ArcHydro data model.



# Statistical Methods for Water Resources Engineering

- Intermediate Products: Risk estimates and uncertainty measures for:
  - Flood, high flow, and low flow analysis
  - Environmental concerns related to best management practices and ecosystem restoration
  - Drought analysis and water supply planning

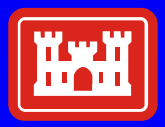


# Onondaga Lake Capability Demonstration

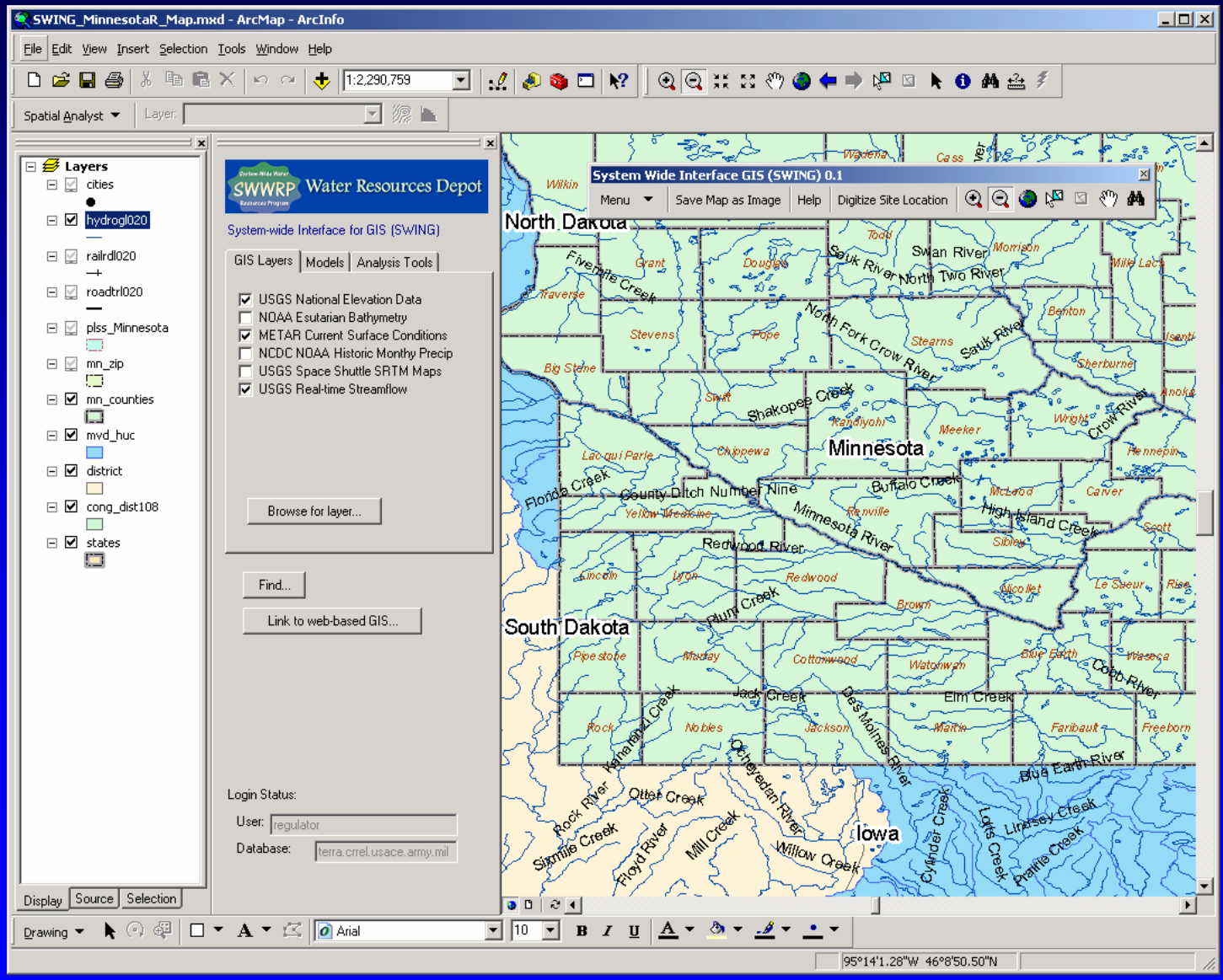
- Objective: Develop guidance on data required for basic watershed studies and an ArcGIS extension to identify useful analyses with pointers to appropriate data types at appropriate scales. The tool will address the effects of scale and resolution as they relate to specific models and analyses at the site scale and basin/sub-basin scales.

# System-Wide Interface GIS (SWING) for the System-Wide Water Resources Program: Minnesota River Basin Capability Demonstration

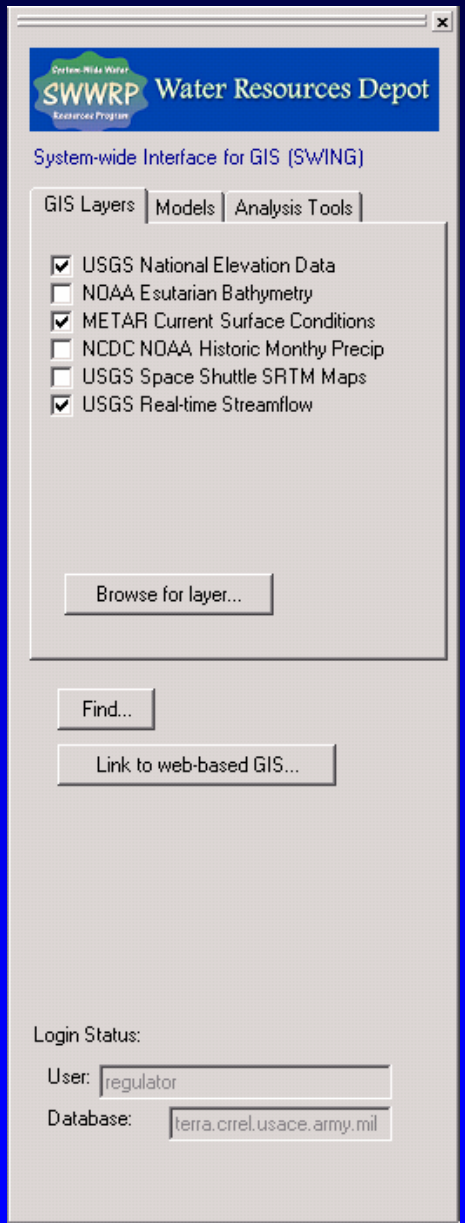
- Task: Create a GIS-enabled Extension for SWWRP projects to leverage existing geospatial data, models and analysis techniques.
- Solution: An Extension for ArcGIS 9.1 with access to centralized GIS and database tables.



# System-Wide Interface for GIS (SWING)
# Minnesota River Basin Capability Demonstration



# System-Wide Interface for GIS (SWING)
# Minnesota River Basin Capability Demonstration





Existing GIS data layers and SWING tools can be used to automatically fill in spatial information such as coordinates, state, county, zip code, hydrologic unit code, township and range information.

Tools are flexible:

Users with little or no GIS training can quickly learn to use the tools and find and use SWWRP data layers, models and analysis tools.

GIS professionals can make use of SWWRP data dictionary, water resources models and analysis tools from within ArcGIS.

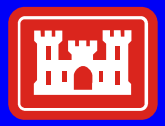
# System-Wide Interface for GIS (SWING)
# Minnesota River Basin Capability Demonstration

- By creating an ArcGIS Extension for access to the SWWRP Data Dictionary, Models and Applications, Corps of Engineers personnel will have access to local and centralized multi-agency GIS data layers in order to streamline the work efforts of Water Resources Projects.

# SWWRP GEOSPATIAL APPLICATIONS

# QUESTIONS???

# BACKUP SLIDES



# SWWRP Unifying Technologies
# Geospatial Applications - Products

- Identification of methodologies, models, and algorithms (MMAs) being used by or planned for SWWRP that require geospatial implementation
- Develop structure of SWWRP GIS capabilities
- Develop an ARCIMS web mapping interface to the SWWRP data engine
- Integration of GIS with data and models
- Integration of GIS with Decision Support Systems (DSSs)
- Identification of geospatial uncertainty requirements of SWWRP and geospatial solutions

# Unifying Technologies – Geospatial Applications

- Collect requirements for geospatial MMAs from Regional Water Management, Regional Sediment Management, and Ecosystem Assessment Modeling pillar focus area leaders
- Collect requirements for geospatial MMAs from other business areas: navigation, flood and coastal storm damage reduction, hydropower, regulatory, environment, emergency management, recreation, water supply, and work for others
- Assess approaches to development of the structure of SWWRP GIS capabilities based upon programmatic needs and lessons learned in Corps enterprise GIS toolsets (CorpsMap, ENGLink, CorpsVIew, and MSC approaches [e.g., MVD, SAD])

# Unifying Technologies – Geospatial Applications
# Requirements Collection Leading to a Design Manual- The Approach

- Identification of protocols being used within and outside USACE available to connect system-wide components
- Selection of prototype system environment (possibly CWMS or XMS)
- Design document for geospatial applications