USING AN ENVIRONMENTAL DATA WAREHOUSE TO INTEGRATE ANALYTICAL DATA, GIS, AND THE WEB

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What Is The Problem?

- Large, complex sites/facilities have a multitude of reports, extensive data, technical information and drawings related to:
  - Engineering,
  - Environmental Sciences
  - Biological Sciences
  - Safety

Examples

- CERCLA/RCRA (superfund) Sites
- Defense Installations
- Industrial Sites
- Hazardous Waste Storage Facilities
- Disaster Areas such as New Orleans

What are the Issues?

- Sites have many years of activity and research.
- Multiple contractors, researchers, and regulatory agencies hold “pieces” of complete data sets & technical information.
- Accumulated knowledge not readily accessible

As knowledge is gained so do concerns

Engineering Challenges

- Site & Facility Plans are not created equal
  - Details vary from one technical drawing to another depending on
    - » scopes of work for individual projects
    - » or areas of interest and
    - » contractor
- Variety of coordinate systems
  - Evolves over time
- Symbols and scales are not uniform
  - Different ways to represent same features

Scientific Challenges

- Data Generated from a Wide Range of Studies
  - Geotechnical and geophysical
  - Surface and Ground Water Studies & Modeling
  - Environmental Analyses
  - Emergency Response
  - Fauna and Flora Habitats
  - Land Use
  - Risk Assessment

Scientific Challenges

- Unique databases
  - From index cards to high-end relational dbs
  - Variety of field names representing same type of data or data collection locations
  - Unique naming of the same features
- Different levels of reporting standards
  - Always improving detection limits
  - Data Quality erratically reported
  - Data Validation erratically reported
  - Each researcher handles & reports data quality “exceptions” differently

Security, Safety, and other Regulatory Challenges

Federal, State, and Local Agencies

- Data Reporting Requirements differ between regulatory agencies
  - Multiple submissions of same data in different formats
- Security Issues
  - New levels of security bureaucracy in Post 9-11 era
  - New security rules in Post 9-11 era
  - Access to classified data?
- Paper, paper, paper
  - submission, tracking & storage via traditional reporting mechanisms

SOLUTION?

The Concept of an Integrated Data Management/Retrieval System

- A systematic and consistent approach
  - Ability to retrieve and display data, maps, and models in a consistent and easy-to-use format
  - Automatic and customized reformatting of data from a variety of inputs
  - Appropriate Security Access to data depending on security clearance

Who Will Benefit?

- Site/Facility Owners
- Contractors
- Researchers
- Regulators
- Public

Components of an Integrated Data Management/Retrieval System

- Data Warehouse
- Geographic Information System
- Web access
  - Intranet
  - Internet

Data Warehouse

- Analytical data from all known sources of data integrated into a single database.
  - Spatially-enabled data tables (likened to a master sample location feature table in GIS)
  - Unified parameter names, units, dates, and location names.
  - Consistent, rule-based loading of data applied
    - Detection limits,
    - Missing data,
    - Non-detects

Geographic Information System

- Uses geodatabase concept
  - Centralized spatial and attribute data storage
  - Line and polygon topology models
  - Easy-to-use customizing and validation rules
  - Available Standards for a variety of features

Geographic Information System

- Integrate features from a variety of GIS and CAD datasets
  - Consistent coordinate system
  - Layers converted to feature classes
  - Versioning abilities
  - Include raster datasets

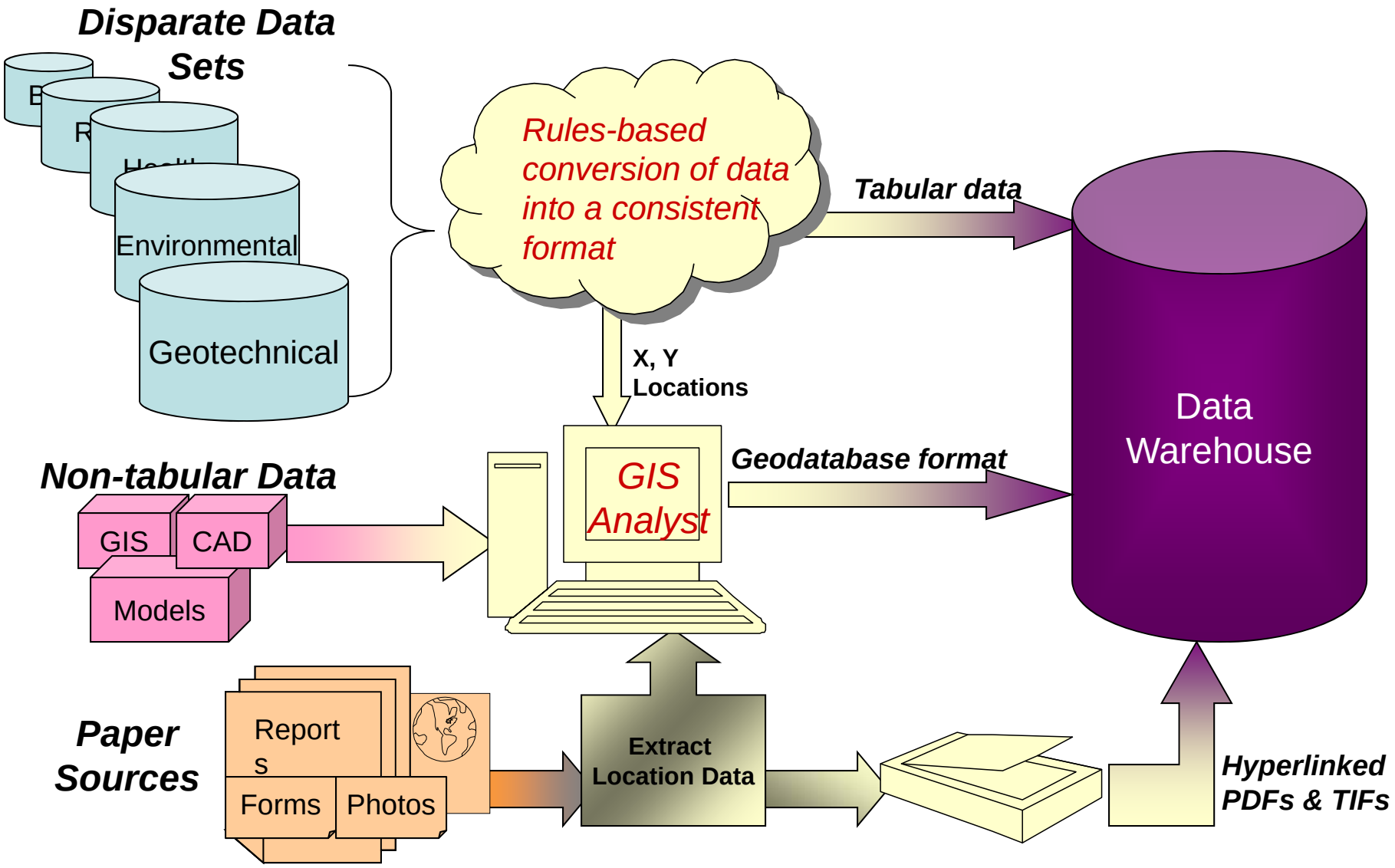
WEB Access

- Multiple query options
  - By form (drop-down lists)
  - By Map (point and click)
  - SQL queries (text-based)
- Multiple Views
  - Documents
  - Tabular data
  - maps

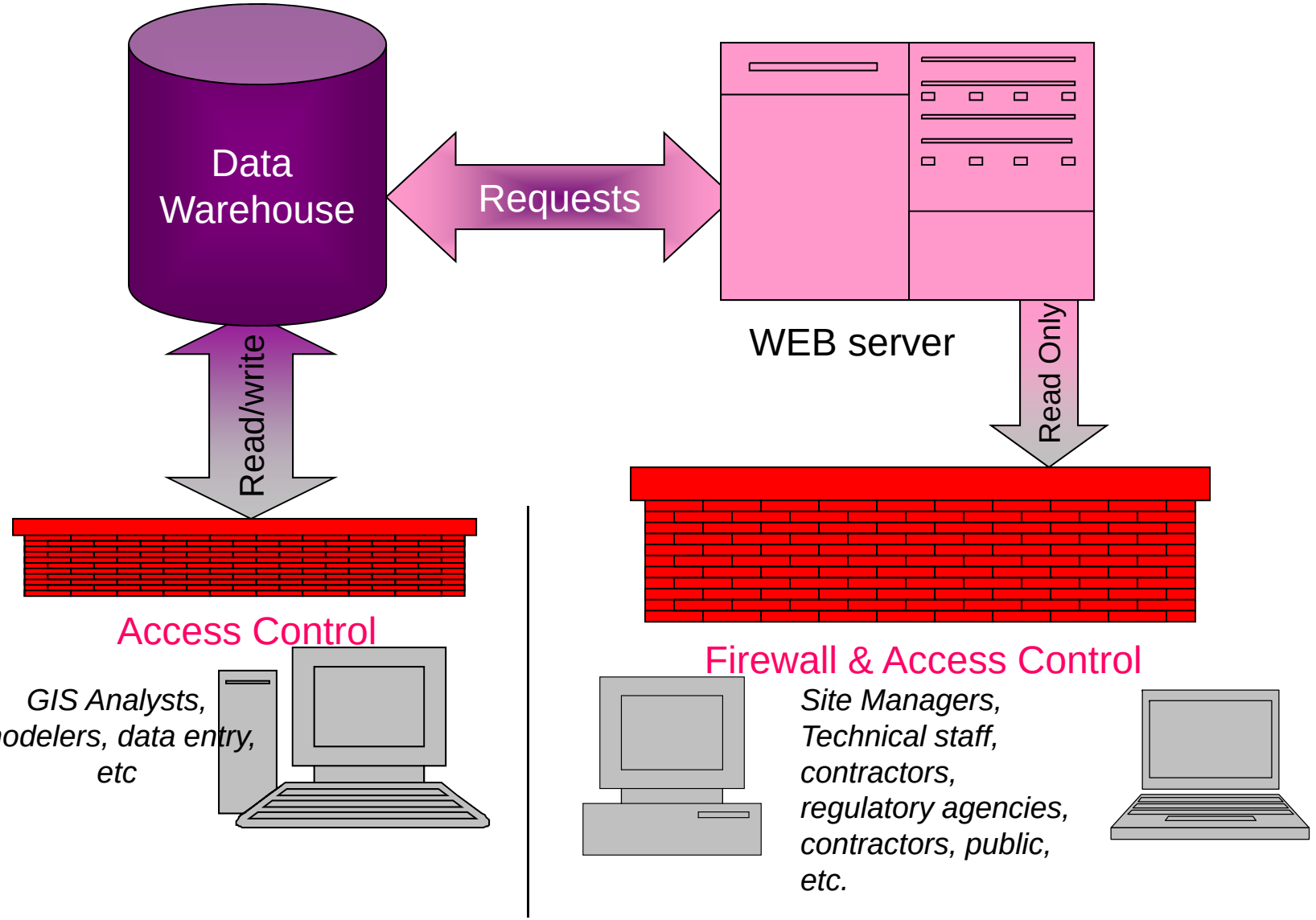
WEB Access

- INTRAnet OR INTERnet
- Variety of export features
  - To spreadsheets
  - Predefined models or applications
  - To reports
- Secure Access
  - Username and Password
  - “Public” access

Input & Conversion

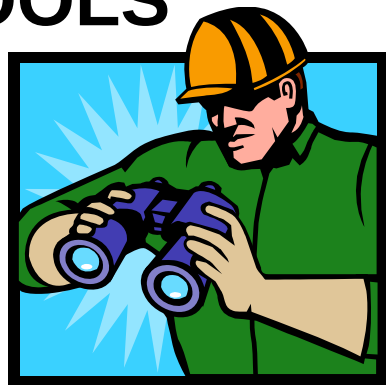


End-User Access

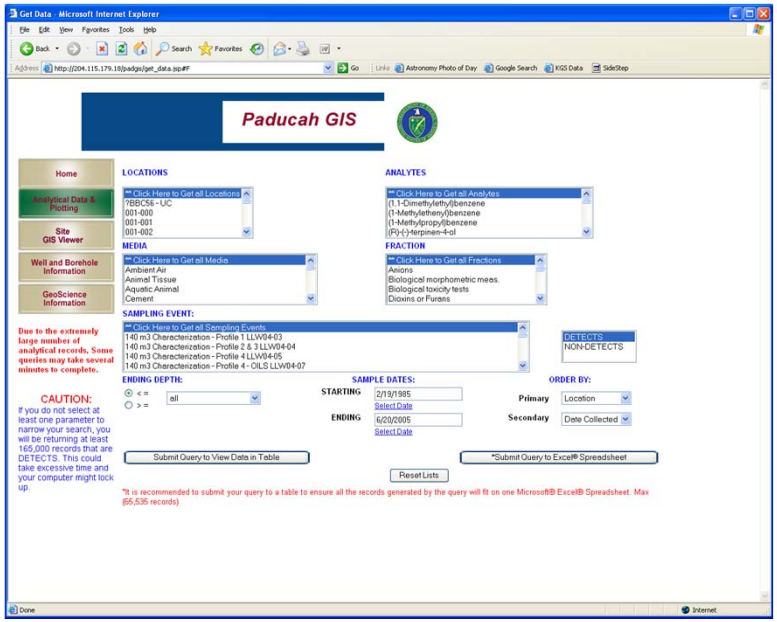


WEB Products

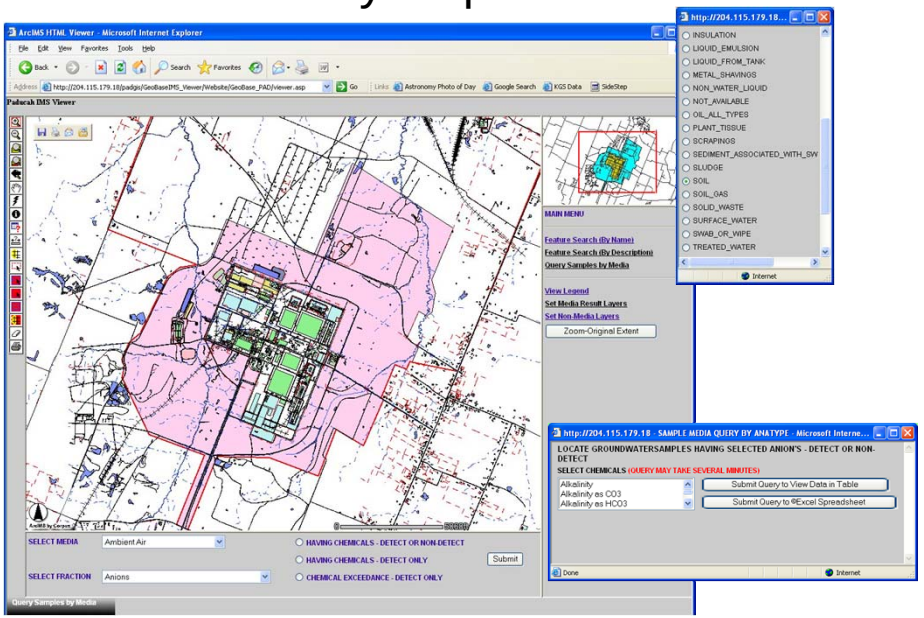
SEARCH TOOLS



By Map



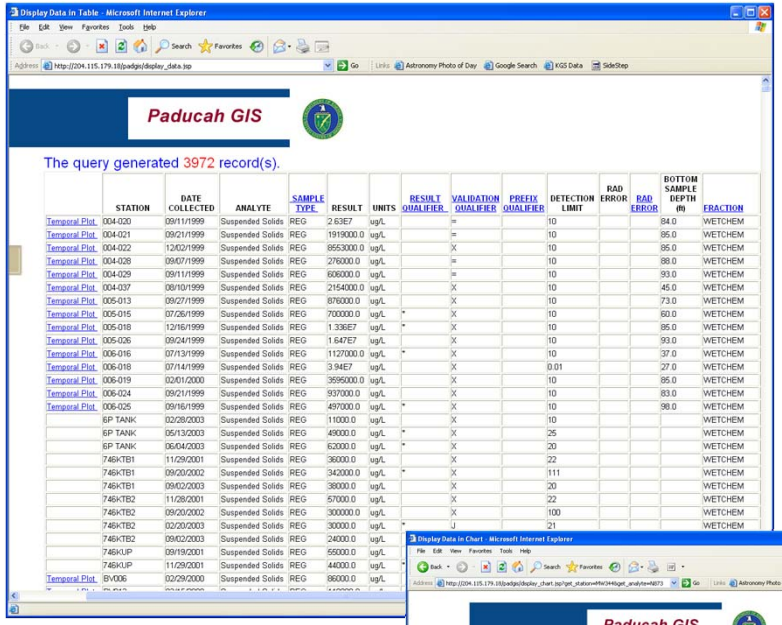
By Form

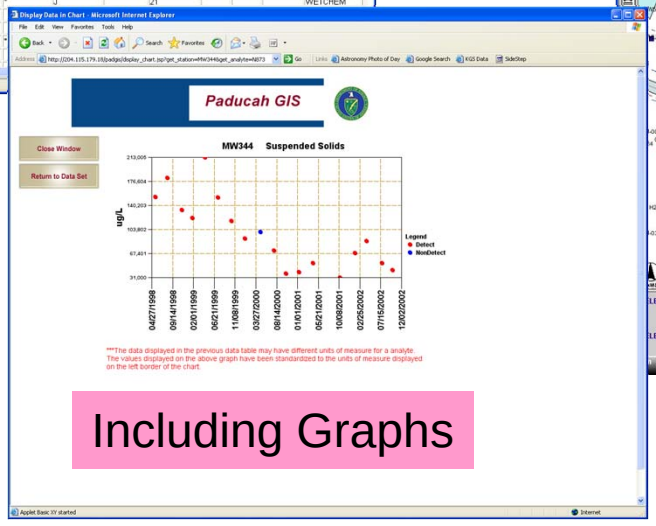


WEB Products

Display Results

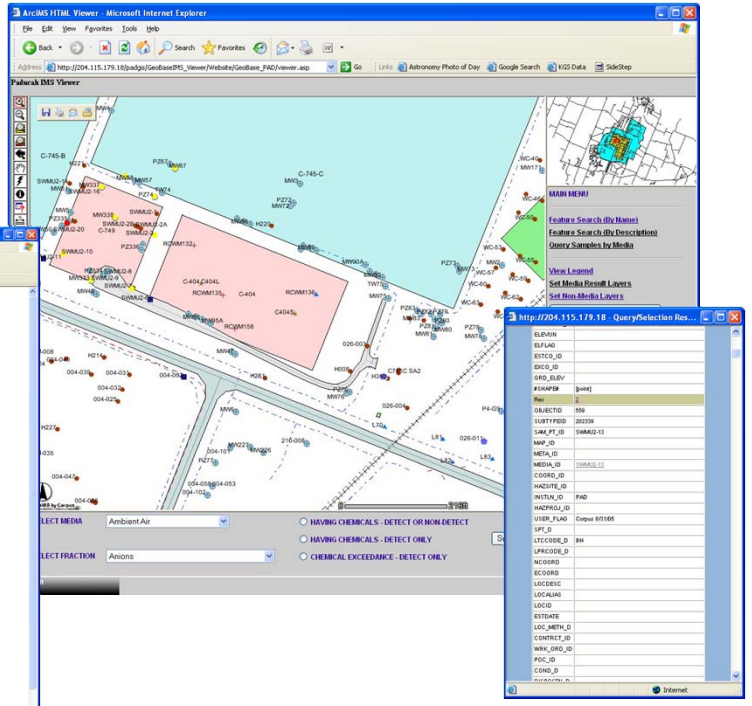
Tabular





Including Graphs

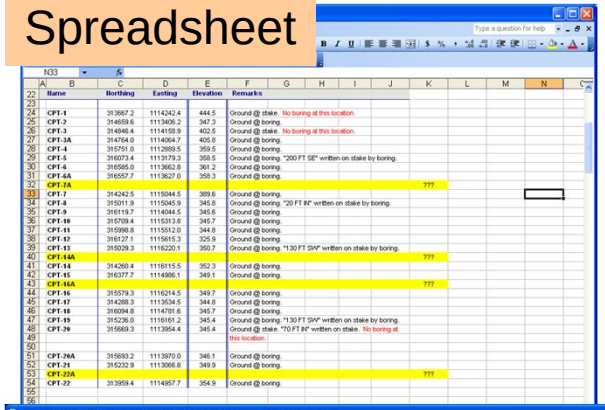
Graphical



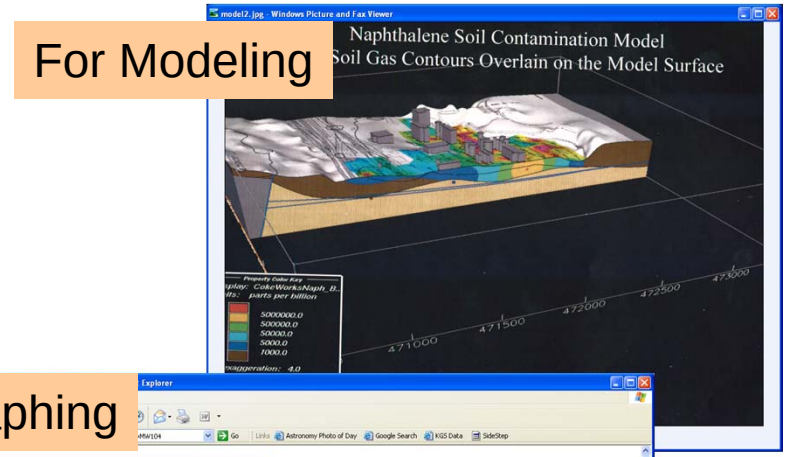
WEB Products

Ancillary Output Possibilities

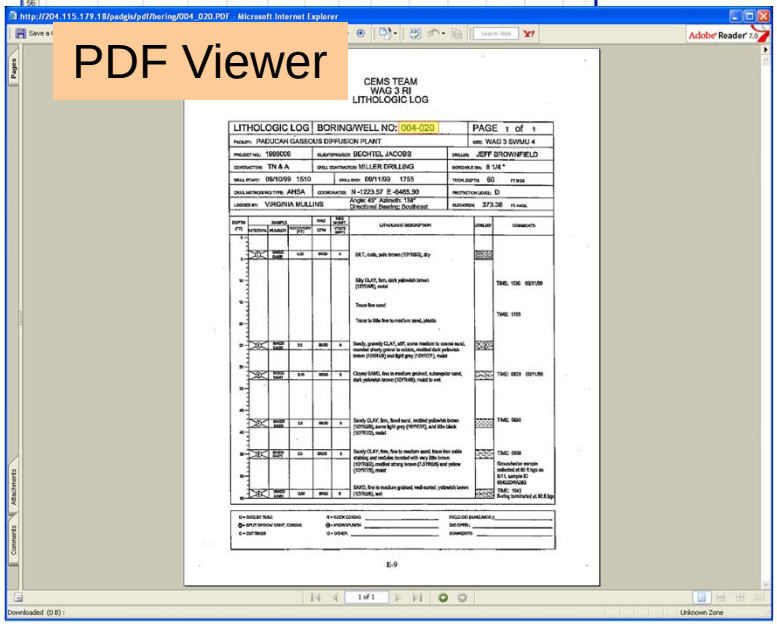
Spreadsheet



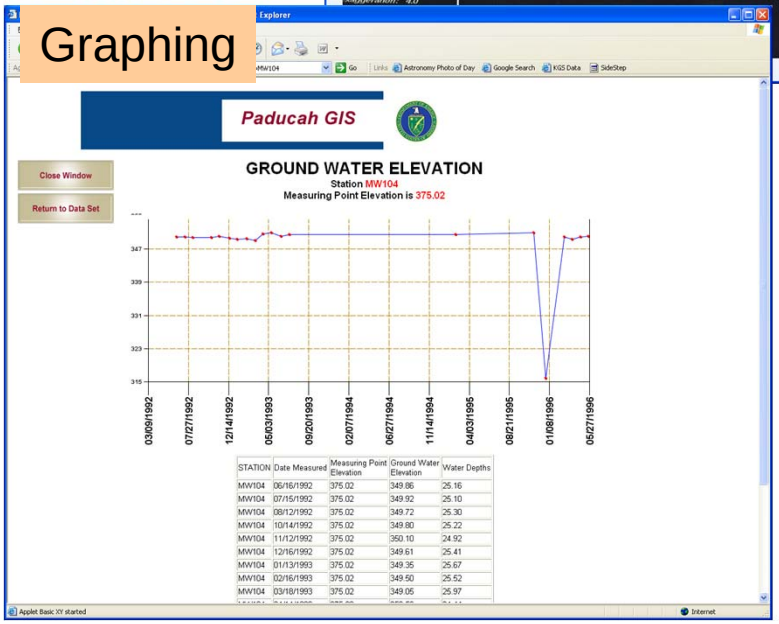
For Modeling



PDF Viewer



Graphing



STATION	Date Measured	Measuring Point Elevation	Ground Water Elevation	Water Depths
MW104	06/16/1992	375.02	349.86	25.16
MW104	07/15/1992	375.02	349.92	25.10
MW104	08/12/1992	375.02	349.72	25.30
MW104	10/14/1992	375.02	349.80	25.22
MW104	11/12/1992	375.02	350.10	24.92
MW104	12/16/1992	375.02	349.61	25.41
MW104	01/13/1993	375.02	349.35	25.67
MW104	02/16/1993	375.02	349.50	25.52
MW104	03/18/1993	375.02	349.05	25.97

Advantages/Disadvantages

- Minuses
  - DW requires routine updates
  - Conversion to geodatabases
  - Need to update security as users come and go
  - Very sophisticated system
- Pluses
  - 1 Stop Shopping for Site/Facility Data
  - Ends redundancy of Site/Facility data mining activities
  - Multiple Data format Output Capability
    - Each user does not have to convert data
    - Consistent formats
  - Uniform interface