RHODE ISLAND OIL SPILL SCIENCE TEAM

GIS AND MAPPING PLAN

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Rev 2.0: November 8, 2003

OBJECTIVE

The objective of this GIS and Mapping Plan is to:

- Ensure that GIS hardware, software, and technical personnel are ready to support scientific activities during oil spills.[1]
- Ensure that accurate, up-to-date geospatial data and maps are supplied to the state science coordinator.
- Ensure that new data collected during a spill are fully documented, logically organized, and rapidly entered into a GIS database appropriate for natural resource damage assessment.

CORE FUNCTIONS

The RIOST GIS and Mapping Group will be prepared to perform a variety of database, mapping, and analytical functions, under the Science Coordinator's direction:

Cartography: Maps will be made to depict themes, including natural resources at risk, spill trajectory, environmental injuries, response assets, and general locational reference maps. Hard-copy maps will range in size from 8.5 x 11" to poster size and include regularly updated image and vector data. Digital maps will be created for web sites, press releases, and general distribution. Images and data will be prepared for distribution via the web and IMS (Internet Map Server). All cartography will have a standard presentation layout with appropriate logos, legends, and disclaimers.

Data Conversion, Consolidation, Distribution, and Storage: New data will be standardized from a variety of input formats: GPS coordinates (UTM, latitude/longitude, State Plane) and formats, hand drawn maps, street addresses, unrectified imagery, and vector/raster GIS data in different formats and cartographic specification. Geospatial data that are integrated during the spill will follow RIGIS standards, as discussed in the Data Control section below.

Analysis: Geospatial data analyses will include simple assessment of resources at risk (overlay), measurement of areas and distances, and neighborhood analysis (distances between resource or response assets and the plume). Complex 3-

[1] *Since GIS needs and assets for an oil spill can resemble those for other emergencies (e.g., hurricanes, floods), much of this plan may be transferable.*

(space) and 4-dimensional (space, time) modeling of pollutants will be provided by contractors.

Internet Services: With real-time access to web servers, major GIS response centers will create and post simple html pages with maps and data distributions.

Since a major spill may challenge GIS capacities, tasks will be prioritized as follows:

Table 1. Summary of priorities for GIS tasks during a Level 3 spill.	
Priority	**Task Description**
High (in first days)	
	Recording location of spill events
	Recording location of pollutants
	Recording location of chemical and biological samples
	Record daily search areas (and results) of SCAT teams
	Preparing locational base maps for field surveys
	Preparing assessment and maps of resources at risk
	Recording chain-of-custody information for key datasets
	Establishing a database organization for archiving and dissemination of new data
	Recording critical fields for FGDC-compliant metadata
	Converting new data to standard format
	Providing "real-time" synthesis and display for response leadership
	Providing "real-time" mapping of assessment team sampling locations and survey regions
	Backing-up data and multiple-site archiving
Medium (in first week)	
	Preparing maps and images for public dissemination via web and print
	Logging and organizing digital images of site and impacts
	Recording location of animal mortalities
Low (in first weeks)	
	Finalizing FGDC-compliant metadata
	Producing Reports

ORGANIZATION, STAFF, AND FACILITIES

Infrastructure

The core public sector GIS assets[2] for an environmental emergency are:

- DEM GIS Center, 290 Promenade Street, Providence. Paul Jordan
- RIGIS GIS Lab, One Capitol Hill, Providence. John Stachelhaus
- RIEMA GIS Station, Emergency Response Center. John Stachelhaus
- URI Environmental Data Center (EDC), URI Kingston Campus. Charles LaBash
- NOAA National Estuarine Research Reserve (NERR) Lab, Prudence Island. Ken Raposa

[2] *Appendix A lists the technology resources available at each site.*

These facilities have varying capacity for input/output, web services, IMS, complex spatial analysis, and modeling. The DEM and URI nodes have a robust capacity; the others have less. All facilities will have a complete copy of the RIGIS vector and image databases (C. Damon data consolidation project[3]).

Redundancy in operations will ensure safe performance even as spill sites vary (Upper Bay, East Bay, South Shore) or electrical supplies are interrupted. The NOAA NERR node will be especially useful for spills near Prudence Island in the Upper Bay. In major incidents there will be multiple levels of redundancy – the DEM, URI EDC, NERR, and RIGIS/RIEMA GIS facilities. The sites will work with a common database (C. Damon data consolidation project). Copies of all new datasets created during the spill will be received at the source sites and immediately sent to the URI EDC for initial QA/QC, archiving, backup, and redistribution among the other GIS nodes.

GIS modeling at Applied Science Associates (ASA) will be conducted in parallel. As appropriate, the DEM Emergency Response Office will rapidly activate ASA's plume-tracking and forecasting services. ASA will work in close conjunction with the GIS team.

The RIGIS/RIEMA, DEM, NERR, and URI EDC sites will rely upon existing hardware and software configurations. If a Science Command Center is established at the Coastal Institute Bay Campus (CIBC), a small GIS system will be deployed. It will consist of one or two PC Workstations with ArcGIS software and a full complement of the RIGIS data, a black and white laser printer, a 11 x 17" color printer, and a computer projector. The PC and color printer will be moved from the CI Directors Office. A second system and laser printer will be brought over from the URI EDC lab. The CIBC GIS node will perform light mapping and map production, light data entry and consolidation, and real-time viewing of GIS data for briefings and decision-making. ASA may establish a workstation at the science command center (CIBC) to perform modeling activities.

Detailed inventories of the hardware and software capacities of the GIS Centers are presented in Appendix A. A brief synopsis of site configurations is provided in Table 2.

Table 2. Hardware and software configuration among GIS nodes.

Component	GIS Node				
	DEM	EDC	NERR	CIBC	RIEMA
Large format plotter	●	●	●		●
Small format printer	●	●	●	●	
1-3 Workstations				●	●
3-10 Workstations	●		●		
> 10 Workstation		●			
ArcView GIS	●	●	●	●	●
ArcGIS	●	●	●	●	
GPS differential correction	●	●			
High-speed Internet access	●	●	●	●	
Network security firewall		●			

[3] *C. Damon (URI) is inventorying and consolidating core geospatial data that would be used in a spill response. He will distribute those data on CD to major GIS nodes.*

Data backup	●	●	●		
Computer projection	●	●	●	●	
Digital image georegistration	●	●		●	
Web page creation	●	●	●	●	
Web site hosting		●			
Secondary power		●		●	●
Tablet digitizing	●	●			
Small format scanning			●		
Map lamination	●	●			

A summary of the kinds of GIS activities that would occur at each site is provided in Table 3.

Table 3. GIS activities among technical centers.

Task	GIS Node				
	DEM	EDC	NERR	CIBC	RIEMA
Rapid, simple cartography	●	●	●	●	●
Complex cartography	●	●	●		
Simple spatial analysis	●	●	●	●	●
Complex spatial analysis	●	●	●		
Plume modeling					
Simple new data entry (coordinates, heads-up digitizing of imagery)	●	●	●	●	●
Large scale data entry	●	●			
Digital image creation and distribution	●	●	●	●	●
Web development and maintenance		●		●	
Short term data archiving	●	●	●		
New data distribution	●	●	●		
Press briefings				●	●

Data Control

All geospatial data or map products entering or leaving GIS nodes will conform to the following standards.

- All data will be expressed in State Plane Feet NAD83 coordinates.
- All vector data will ultimately be stored in Arc/Info coverage format. Shape file and geodatabase formats are acceptable as intermediary data products.
- Raster data will be stored in Arc Grid format.
- Raster and vector data will be distributed in Arc EXPORT format.
- All new data will be accompanied by FGDC-Compliant metadata.

- A data entry log sheet (see Appendix B) will accompany all geospatial data being entered in the GIS database.
- Georegistered imagery will be stored in GeoTIFF format.
- Digital imagery that is not geographically registered will be stored in gif, tif, or jpeg formats.
- All map documents produced will conform to a common output format (see C. Damon data consolidation project).
- The URI EDC will be the repository for all new data entered into the GIS. The EDC will provide web-based data access among all GIS nodes involved in the response.
- The URI EDC will have primary data backup and archiving responsibilities.
- The DEM Emergency Response Administrator will have ultimate say in matters of data distribution.

Many non-GIS database issues will be significant in a major spill. These include:

- Developing a classification and naming/numbering system for biological and chemical samples, animal mortalities, and plume distributions. These ID systems must be consistent among the field teams, the analytical labs, the GIS databases, and the data archives.
- Documenting chain of custody. (Core datasets may be severely scrutinized in future litigation. See www.ci.uri.edu/projects/riost/erpdocs/datadoc.pdf.)
- Developing a standard system of recording time, effort, and expenses among personnel.
- Developing a standard system of field definitions and names for data variables.
- Determining which data are confidential, sensitive, or publicly accessible.
- Providing logistic support to GIS technical personnel during a major event: meals, showers, rest facilities, and transportation.
- Use of the world-wide web to convey current information on the spill. The RI Sea Grant program has performed this service in the past and is able to redirect staff and the Sea Grant web server to provide a communication function in large spills.

There are also a number of important overarching issues that spill response leadership and GIS personnel should be cognizant of prior to the event. These include:

- All geospatial data are ultimately stored in Rhode Island State Plane Feet coordinates referenced to NAD83. Field personnel should use this system of coordinates when recording locations.
- All new data being entered into the GIS database during the spill should follow chain-of-custody and metadata documentation standards.
- A single GIS site should be clearly declared the central data repository during an emergency event to minimize redundancy and confusion. A second site should be designated the back-up and this site should have a duplicate copy of all new data entered into the GIS system.
- Chain of command must be adhered to in all transaction with the GIS data system. There will be a large volume of requests made of the technology and priorities will have to be established by the scientific response coordinators.
- In the current organization scheme, the DEM Incident Command Coordinator and the DEM Science Coordinator will be responsible for ensuring smooth delivery of

data from field teams to the GIS team. They will determine what the priority data entry, analysis, and mapping tasks will be.

- Coordination between RIOST GIS activities and other mapping teams (e.g., the US Coast Guard, NOAA) will occur at the through the DEM Incident Command Coordinator. In the first days of a spill, this might not be a major issue. But as the members of Incident Command structure settle in and establish their bases of operation, coordination among mapping nodes will be essential. Especially with respect to smooth and efficient exchange of data. This might in fact be somewhat complex depending on the hardware and software systems other parties use.

For Data Management and QA/QC policy, the GIS team will consult guidelines in NOAA's Rapid Assessment Protocol for the Scientific Study of Oil Spill Effects (Draft, May 2003). Over the next few months, RIOST and DEM staff should review these guidelines to reach a consensus on appropriate standards, data formats, and flow control that are relevant to the RIOST GIS plan. The documents can be obtained from www.ci.uri.edu/projects/riost/erpdocs/qa_qc.pdf and www.ci.uri.edu/projects/riost/erpdocs/data_management.pdf

Staffing

The GIS team will work under the direction of the RI DEM Emergency Response Administrator (Mulhare) or his/her designee, normally the DEM Science Coordinator (Deacutis).

Each member of the GIS Team will have a designated Site Leader who will engage and supervise staff and coordinate activities at each of their respective GIS nodes. These Site Leaders are:

- DEM – Paul Jordan
- URI – Chuck LaBash
- NOAA NERR – Ken Raposa
- RIGIS/RIEMA – John Stachelhaus

Peter August will serve as liaison between the GIS team, the DEM Science Coordinator, and RIOST, as required.

The current roster of technical support staff who have agreed to serve during an oil spill, and their areas of expertise are given in Table 4. Contact information for these people are provided in Appendix C.

Table 4. Staff available and expertise to provide GIS technical support among GIS nodes.

Site/Person	Mapping	Analysis	Data Entry	IMS
RI DEM				
Paul Jordan	●	●	●	●
RIGIS/RIEMA				
John Stachelhaus	●	●	●	
Christine Delage	●	●	●	
URI EDC				
Pete August	●	●	●	
Chuck LaBash	●	●	●	

Roland Duhaime	●	●	●	●
Greg Bonynge	●	●	●	●
Christopher Damon	●	●	●	●
Jeff Hollister	●	●	●	
Arty Rodriguez	●	●	●	
Aimee Mandeville	●	●	●	
Dennis Skidds	●	●	●	
Michael Bradley	●	●	●	
Lenny Bellet	●	●	●	
Julia Brownlee	●	●	●	
NOAA NERR				
Ken Raposa	●	●	●	
Robin Weber	●	●	●	
Tom Kutcher	●	●	●	
EPA AED				
Jane Copeland	●	●	●	●
Mike Charpentier	●	●	●	●
Doug McGovern	●	●	●	●

LEVELS OF GIS SUPPORT

GIS support will vary with the severity of the incident (for details see "Incident Severity" in the RIDEM ERP, www.ci.uri.edu/projects/riost/erpdocs/severity.pdf).

Level 1 – Minor Spill

Minor (Level 1) incidents are managed and staffed by the DEM Office of Emergency Response and its contractors. If additional GIS support is required, the Emergency Response Administrator or his/her designee will contact the DEM GIS Center (Jordan).

Level 2 – Moderate Spill

In moderate (Level 2) incidents, the DEM Emergency Response Administrator gains support from other DEM divisions and/or contractors.

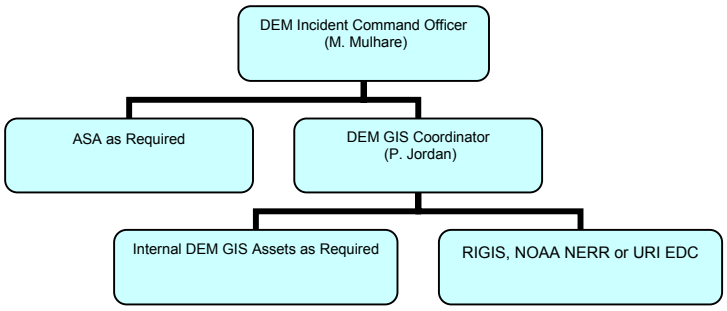
Call List:

1. Paul Jordan. Chief of GIS Operations, RI DEM
2. As required, Applied Science Associates
3. As required, Peter August (URI), Charles LaBash (URI), Ken Raposa (NERR), John Stachelhaus (RIGIS)

Operation Center:

The DEM GIS lab will serve as the main operation center. The DEM GIS coordinator (Jordan), in consultation with the DEM Emergency Response Administrator (Mulhare) or his/her designee will decide if supplemental GIS support is required. Supplemental sites can be mobilized, as required. If the event is small and supplemental GIS tasks consist mostly of mapping, any of the sites will suffice. If the event requires significant web, IMS, modeling, or extensive I/O services, the EDC will be used.

Lines of Communication:



Level 3 – Major Emergency

A major (Level 3) event requires yet more state assets, beyond DEM, including RIOST and the GIS team.

Call List:

1. Paul Jordan, DEM
2. Applied Science Associates
3. Peter August, Charles LaBash, URI
4. Ken Raposa, NERR
5. John Stachelhaus, RIGIS/RIEMA

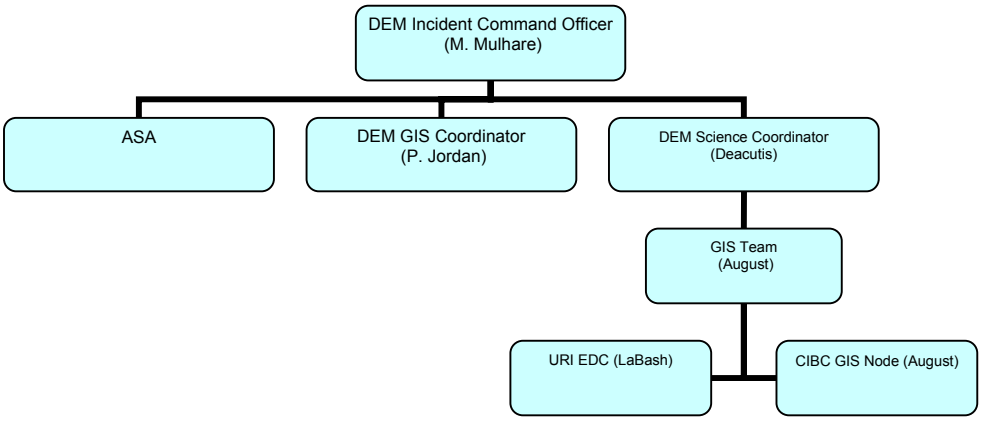
Operation Center:

The DEM GIS lab will provide GIS support for within-DEM activities. The DEM GIS Coordinator (Jordan) will oversee these activities and be directed by the DEM Emergency Response Administrator (Mulhare).

The URI EDC will provide GIS support for the DEM Science Coordinator (Deacutis). The GIS lab in the Coastal Institute in Kingston will be the primary venue for this work.

The RIGIS GIS office will provide GIS support to RIEMA at the One Capitol Hill site or the RIEMA site. This node will be managed by the RIGIS coordinator (Stachelhaus) and be directed by RIEMA.

Lines of Communication:



Budget

The GIS team understands that expenses for personnel and supplies will be reimbursed after the spill. Since technical staff often work as are "soft money" contractors rather than state employees, their time spent supporting the state must be reimbursed. A system will also have to be established to provide immediate access of funds to cover the purchase of supplies and provisioning of staff if GIS labs running on a 24-7 basis.

Equipment

All major pieces of GIS hardware and software required in the response are in place and are operational. Indeed, the philosophy behind our response plan is to minimize purchase of new equipment and make full use of existing resources.

Nextel or cell telephones will have to be provided if they the standard means of communication. It is possible that videoconferencing among nodes and Incident Command might be required to ensure full communication abilities. This may involve purchase of video conferencing technology before the event.

Securing accurate locational data is central to all aspects of the science response to a spill. It will be important that field teams have adequate access to and training in the use of GPS technology. It would be prudent to review existing GPS instruments that would be used in an emergency to ensure their compatibility with the GIS systems. Mundane matters like downloading waypoints from a rover GPS, or the need to perform differential correction on coordinates could become a significant problem if system incompatibilities exist among data processing sites.

Issues For Discussion

- We need to discuss data management in the broad context. GIS information will be a significant form of spill-relevant data, but so will other data types that may not be spatially related. It might be prudent to have a dedicated CIO (Chief Information Officer) assigned to shadow the DEM Incident Command Officer at the Incident Command Center to ensure the smooth collection, documentation, management, and exchange of all spill-related data (including asset tracking, personnel, budget, etc.). The CIO would need a reasonable level of authority and be able to direct staff activities and establish data management priorities and contingencies.
- In a large event there will be significant GIS activity by the RI EMA, RI Department of Transportation, and RI Department of Health. There will have to be excellent communication and coordination among these centers of activity.
- We need to consider how centers of activity will communicate. Land line telephones, cells phones, and the Internet are effective vehicles for communication. However, in a very large event, especially under adverse weather conditions that effect electricity and power, standard methods of communication may not work properly.
- There is a real need to drill with this plan. Many aspects such as coordination and the ease with which data can be exchanged among sites and systems will be unknown until we actually try it. Some of the anticipated problems include moving large databases via the Internet, moving data through secure firewalls and security systems, and communication among GIS nodes and Incident Command.

Appendix A – Detailed overview of technical resources available in each major GIS node.

Environmental Data Center
Department of Natural Resources Science
University of Rhode Island

***Description*.** The Environmental Data Center (EDC) is a Geographic Information System (GIS) and spatial data analysis laboratory in the URI Department of Natural Resources Science, College of the Environment and Life Science (CELS). The mission of the EDC is to support the use of contemporary tools of spatial data processing and electronic dissemination in the analysis and distribution of environmental data. This is achieved through collaborative research with faculty in the Department of Natural Resources Science and projects with agencies external to URI. The EDC is the center of technical expertise in GIS for the state of Rhode Island. The Rhode Island Geographic Information Systems (RIGIS) database is stored at the EDC. The RIGIS database is the most comprehensive and detailed of any state in the country and contains information on almost all aspects of Rhode Island's natural and cultural resources (e.g., wetlands, aquifers, soils, forests, land use, topography, historic sites, etc.). Major areas of research at the EDC are spatial data modeling, ecological mapping, and data integration for environmental applications.

The technical staff at the EDC consists of full-time research associates, graduate student research assistants, and undergraduate students. All staff are paid from research grant or extension projects.

The current hardware/software configuration of the EDC is given below. The EDC uses these resources on a daily basis and, among the faculty, staff, and students of the lab, has collective expertise in operating and maintaining all these systems. Referred to as *EDC Computer Lab Support,* funding for EDC computer hardware, software, and maintenance originates from direct charges on extramural grants.

Internet/*File Servers* (Intel-based):

- Dell 2600 PowerEdge (Dual – Pentium IV Xeon 3.06Ghz) 512 mb RAM, 219 gb RAID 5 hard drive array, dual-port 100mbps Ethernet adapter
- Dell 4400 PowerEdge (Dual - Pentium III Xeon 1Ghz) 1.5 gb RAM, 54 gb RAID 5 hard drive array, dual-port 100 mbps Ethernet adapter;
- Dell 4400 PowerEdge (Pentium III Xeon 800 MHz) 512 mb RAM, 72 gb RAID 5 hard drive array, dual-port 100 mbps ethernet adapter;
- Dell 6300 PowerEdge (dual Pentium II Xeon 400 MHz) 512 mb RAM, 54 gb RAID 5 hard drive array, tri-port 100 mbps ethernet adapters;
- Dell 2300 PowerEdge (dual Pentium II 400 MHz) 256 mb RAM, 18 gb hard drive, 100 mbps ethernet adapter;
- Dell 4100 PowerEdge (Pentium Pro 200 MHz) 128 mb RAM, 25gb hard drive, 100 mbps ethernet adapter

Dell 500SC PowerEdge (Pentium III 1 GHz) 256 mb RAM, 10 gb hard drive, 10/100 ethernet adapter

- Dell Dimension 4550 (Pentium IV 2.4 Ghz) 256 mb RAM, 30 gb hard drive, 100 mbps ethernet adapter

Dell Dimension 8200 (Pentium IV 2.26 Ghz) 512 mb RAM, 80 gb hard drive, dual 100 mbps ethernet adapters

Mass Storage Devices

Dell 340 WS PowerEdge (Pentium IV 1.8 GHz) 512 mb RAM, Dual 120 gb hard drives, 10/100 ethernet adapter

Dell 340 WS PowerEdge (Pentium IV 1.8 GHz) 512 mb RAM, Dual 120 gb hard drives, 10/100 ethernet adapter

Workstations/*Desktops*/*Notebooks*:

5 Pentium IV Xeon 2.0 GHz workstations
2 Pentium IV 2.4 GHz workstations
3 Pentium IV 2.8 GHz workstation
2 Pentium IV 1.4 GHz workstations
6 Pentium III (500 – 866) MHz workstations
1 Pentium IV 2.4 Ghz notebook
2 Pentium III 800Mhz notebooks
2 Pentium II 300 MHz notebooks
1 Pentium 133 MHz notebook
8 Pentium Pro 200 MHz workstations

Network Security: Microsoft ISA Server 1.1, ZoneAlarm Pro Firewall

Network: Ethernet, fiber optic/twisted pair Cisco Catalyst 3500XL 24-port 10/100 mbps switch with gibabit fiber uplink, Cisco 3500XL 48-port twisted pair with gigabit fiber uplink to Campus Internet1/Internet2 connection - 45 mbps.

Printers/Plotters: HP DesignJet 500 PS 42-inch large format inkjet 600 dpi; HP 755CM large-format inkjet 300dpi, HP DeskJet 1000C inkjet 600dpi, HP 820 Ci inkjet 300dpi, HP LaserJet 4200N B&W Laser 1200dpi, HP Laserjet 4050N B&W laser 1200dpi, GBC Ultima 65 large-format laminator, Lasergraphics Film Recorder (in CELS Computer Lab).

Backup/*Storage Devices*: 40/80gb DLT IV backup, 15/30gb DLT III backup, Yamaha 16x CD-R, Yamaha 4x CD-R, 4/8 gb 4mm DAT backup, IOMEGA 1gb Jazz and 100mb ZIP drives.

Input Devices: GTCO Accutab backlit 36 x 48 inch digitizing tablet, GTCO 3036 Roll-Up II digitizer, HP ScanJet ADF 1200dpi, Nikon Coolpix 900 digital camera, Snappy Image Capture System, , Polaroid Sprintscan 35mm slide scanner (in CELS).

Global Positioning Systems (*GPS*): Trimble 4700 Continuously Operating Reference Station; Trimble GeoXT 512mb with GPSCorrect and ArcPad, Basic Plus 6-channel C/A Code GPS hand-held field receiver, Garmin GPS III.

Projection Systems: InFocus LP-130 1024x768 micro projection system, NEC Multitheatre projection system (portable) with Truepath airmouse pointer system,

Software, *Operating Systems*: Windows 2000, including latest service packs and security patches.

Software, GIS/GPS/Remote Sensing/Mapping: ArcInfo Workstation 8.3, ArcGIS Desktop 8.3, ArcSDE, ArcView 3.3, Spatial Analyst 2.0, 3-D Analyst, ArcPress 2.0; PC Arc 3.51 (n.b. URI maintains a site license contract with ESRI and has access to all ESRI software and data), ERDAS Imagine 8.4; ER Mapper, Geographic Calculator, Trimble Reference Software, Trimble Pathfinder Office.

Software, Communication: Microsoft Exchange 2000 enterprise, Microsoft Outlook 2000

Software, Database: Microsoft SQL Server 2000

Software, *Internet*: ArcIMS 4.01, MS IIS 4.0, Big Nose Bird Forms, Apache, O'Reilly Website, O'Reilly Polyforms, ActivePerl 5.6 Perl Script and Active Server Pages, NetScape Communicator, MS Internet Explorer 6.0

Software, *Statistics*: PC SAS 8, Statistica, GS +, GeoEse.

Software, *Image Processing*: Adobe Photoshop, CorelDRAW, Corel PHOTO-PAINT, Paint Shop Pro.
Software, *General Purpose*: Microsoft Word, Powerpoint, Excel, Access.
Software Antivirus: McAfee, Norton.
Web Services: EDC GIS Resources http://edc.uri.edu/gis; RI Statewide digital orthophotos and topographic maps http://ortho.edc.uri.edu; Survey/Mapping-grade NOAA Cooperative CORS GPS Reference Data http://www.edc.uri.edu/gps; Coastal Institute http://www.ci.uri.edu; Narragansett Bay http://www.narrbay.org; interactive maps., http://www.edc.uri.edu/eelgrass; USA Water Quality http://www.usawaterquality.org/newengland

Instructional programs in GIS and spatial data analysis occur in the College of the Environment and Life Science's computer laboratory. This facility is dedicated to CELS teaching and demonstration applications and consists of 15 Pentium IV level PC's. The lab supports ArcInfo 8.3 Workstation, ArcView 3.3, and ERDAS Imagine software along with many other analytical packages. All PC's are connected to the campus network.

Narragansett Bay National Estuarine Research Reserve

Description. The Narragansett Bay National Estuarine Research Reserve (NBNERR) is a 4,300 acre estuarine and coastal management area located in central Narragansett Bay. The Reserve is managed by the Rhode Island Department of Environmental Management as part of the National Estuarine Research Reserve System, which is a multi-reserve system funded by the National Oceanographic and Atmospheric Administration (NOAA). The primary functions of the Reserve are research and monitoring, education and public outreach, and environmental stewardship. The NBNERR staff uses Geographic Information Systems (GIS) daily, for all phases of management, and limited GIS loaded computers are available for visiting researchers. The Reserve is also a GIS node for the RI Oil Spill Emergency Response Team. The GIS database on site consists of public and original datasets, and a system for off-site redundancy has not been established. Following is a list of GIS related tools currently in use at NBNERR.

GIS Loaded Computers:
- 1 Dell *Dimension DIM 2100* PC
- 2 Dell *Optiplex QX 260* PC, Pentium 4, 2.40 GHz PC
- 1 Dell Laptop PC

Printers/Plotters:
- 1 HP *Designjet 1055cm plus*, 36-inch, roll feed, 700 dpi plotter
- 2 HP *Deskjet 5550* small format color printers
- 1 HP *Deskjet 990 cxi* small format color printer

Scanners:
- 1 HP *PSC 2110 All in One* small format scanner

GPS Tools:
- 1 Trimble *TDC 1 Asset Surveyor* with *Pro XR* reciever
- 1 Garmon *GPS III Plus Personal Navigator* 12 Channel hand-held unit
- 1 Garmon *GPS 45 Personal Navigator* 8 Channel hand-held unit

GIS/GPS Software:
- ESRI *ArcGIS 8.3* (starting October, 2003)
- ESRI *Arcview GIS 3.2a* with *Image Analysis* and *Spatial Analyst* extensions
- Trimble *Pathfinder Office*

Imaging Software:
- Adobe *Photoshop*

General Purpose software:
- Microsoft *Word*
- Microsoft *Powerpoint*
- Microsoft *Excel*

Internet Capabilities:
- High speed *T-1* internet access

Other Related Tools:
- Masterpiece *500T-X* 24”x 36” laminator

RIGIS/RIEMA GIS in the Emergency Operation Center

GIS Loaded Computer

Dell Precision 340 – Pentium 4, 2.3 GHz PC

Printer/Plotters

HP DesignJet 500, 42-inch, roll feed, 1200/600 dpi
HP Deskjet 1220, 11X17 color , 2400/1200 dpi

GIS and Related Software

ArcView 3.3 with Spatial Analyst, ESRI StreetMap
*ArcView 8.3 (on Order 11/03)
CATS-JACE Emergency Management Extension
DeLorme Mapping

General Purpose Software

Microsoft Office 2000 (MSWord, Access,Excell,PowerPoint)

Internet Capabilities

Cox Cable Business Package

DEM GIS Center
Room 320, DEM Main Office – Foundry Complex

Description:The GIS Program at RIDEM provides support for a broad cross-section of activities touching almost every aspect of the Department's work. GIS workstations in the GIS office and throughout the DEM Foundry offices have access to a complete copy of the RIGIS database of vector and raster data. DEM also maintains copies of significant Oil Spill related datasets including the NOAA Environmental Sensitivity Index and the RI Resource Protection Project. Most of the data is available on the DEM Internet Map Server (IMS) "Oil Spill Planning & Response" application at http://zog.doa.state.ri.us/website/ospar. The IMS application would be updated periodically during a spill with mapping of oiled extents, modeled trajectories, fisheries closures and other spill related information.

Resources:

Reserved GIS Workstations:

- 1 Dell Precision 420, dual P3 933 MHz, 1 GB ram, 40 GB SCSI hard-drive, CD-Read/Write and 40GB dds4-tape drive, 250 MB Iomega Zip drive, Windows 2000
- 1 Dell Precision 410, dual P3 500 MHz, 1 GB ram, 18 GB SCSI hard-drive, CD Read, Travan 20 GB tape drive, 250 MB Iomega Zip drive, Windows 2000
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- 1 Dell Precision M50 Laptop, P4 1.8 GHz, 1GB ram, 40 GB IDE hard-drive, CD/DVD Read/Write, Windows 2000

Servers:

- Dell Poweredge 4300, dual P2 500 MHz, 1 GB ram, 3 18 GB hard-drives, RAID 5, Windows 2000, ArcIMS & Apache webserver (intranet)
- Compaq, dual P3 933 MHz, 2 GB RAM, 3 18 GB hard-drives, RAID 0, ArcIMS & Apache webserver (internet)

Printers/Plotters:

- HP 750 36 inch 4 color plotter
- HP 1055CM 36 inch 4 color plotter
- HP Color LaserJet 4600 PS printer
- HP Deskjet 970 Cxi Inkjet printer

GPS Hardware:

- Trimble GPS GeoExplorer (4)
- Trimble GPS ProXR w/differential correction (1)

Software:

- ArcView 3.3
- ArcInfo/ArcMap 8.3
- TIN/3d Analyst
- GRID/Spatial Analyst
- Arcpress
- ArcIMS 4.01, with Apache webserver & Jakarta-Tomcat servlet engine

- Trimble Pathfinder Office 2.9
- Microsoft Office
- Adobe Acrobat
- Adobe Photoshop

Miscellaneous Hardware:

- AGFA Duoscan 8x14 inch scanner
- 25 Inch Ledco Laminator
- Rotatrim 42” paper cutter