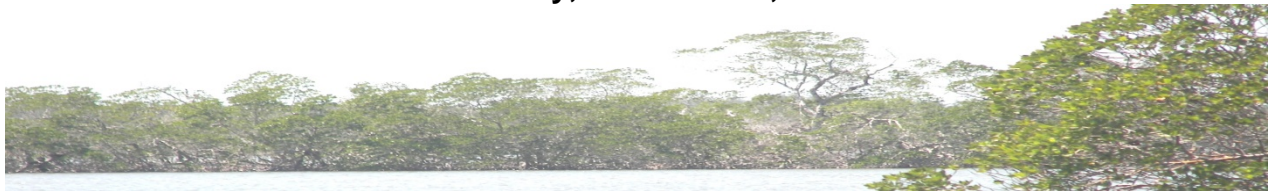


**GIS Symposium:
Inspiration Through Networking and Technology**

Rookery Bay National Estuarine Research Reserve
Environmental Learning Center
300 Tower Road, Naples, FL 34113

Wednesday, November 9, 2011



8:30 a.m.	Registration	Front Desk
9:00	Welcoming Remarks & Symposium Overview Jill Schmid, GIS Specialist Tabitha Stadler, Coastal Training Coordinator Rookery Bay National Estuarine Research Reserve	Auditorium
9:10	Leveraging ArcGIS Online Ali Fain, Senior Account Executive, ESRI Michele Lundeen, Solutions Engineer, ESRI	Auditorium
10:40	Break	Art Gallery
11:00	Assess-Report-Map: How a GIS tool was used for Tuscaloosa's Damage Assessment Karyn Tareen, CEO, Geocove	Auditorium
Noon	Lunch- <i>donated by The Lunch Bucket Cafe</i>	Back Patio
1:00 p.m.	Exhibitors, Interactive Demos and Poster Session <ul style="list-style-type: none"> • ESRI - Ali Fain • Avatar Systems with HP demo – Rick Kahn • Atkins with Python demo– Steven Drake • Weiler Engineering – Todd Helt • Geocove – Karyn Tareen • GPServ, Inc – Jim Robeson • International Right of Way Assoc. – Gary Bigelow • Stantec – James Hale • Trimble – Jeff Smith 	Classroom Classroom Second Floor Second Floor Back Patio Back Patio Back Patio Back Patio Back Patio
2:00	Incorporating a Stormwater Management Model Into ArcMap David Jones, Vice President Jones Edmunds & Associates, Inc.	Auditorium

2:20 p.m.	How to Squeeze Out More Results with Python Steven Drake, Senior GIS Analyst, Atkins	Auditorium
2:40	ADA Sidewalk Crossing Assessment Shellie Watts, GIS Analyst, City of Fort Myers	Auditorium
3:00	Break	Art Gallery
3:20	GIS Data Automation Andrew Brown, Senior GIS Programmer Analyst Collier County	Auditorium
3:30	Collier Zoning Viewer Jason Regula, Senior GIS Programmer Analyst Collier County	Auditorium
3:40	Assessment of Land Use Change Impact on Water Resources Variability Using GIS and Hydrological Model Dr. Shimelis Setegn, Postdoctoral Research Scientist Florida International University	Auditorium
4:00	Poster Session and Social Hour	Second Floor
5:30 p.m.	Departure	

Special Thanks to the 2011 GIS Symposium Planning Committee

Jill Schmid, GIS Specialist, Rookery Bay National Estuarine Research Reserve

Anthony Myers, GIS Manager, City of Naples

Beth McCartney, President, Geospatial & Environmental Services

James Hale, GIS Analyst, Stantec

Jessica Lukacs, Coastal Training Specialist, Rookery Bay

Tabitha Stadler, Coastal Training Coordinator, Rookery Bay

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Thank You!

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Speaker Biographies



Ali Fain

Ali Fain is currently an Account Executive with ESRI working at the West Palm Beach satellite office where she is responsible for accounts in South Florida. She attended Florida International University and Miami Dade College and held various IT related positions with both the public and private sector, including serving as an IT Manager for Miami-Dade County. While there, she served as Project Manager in the GIS area and was responsible for the conversion of their parcel landbase – a partnership with Florida Power and Light. She has been with ESRI for 18 years and was previously at the ESRI office in Denver.

Michele Lundeen

Michele Lundeen is currently a Solutions Engineer with ESRI, working in their West Palm Beach satellite office. She attended the University of Florida and is a serious Gator fan attending every home game when possible. Michele has many years of experience with GIS in both the technical and managerial capacity, and has been with ESRI for 18 years working in various areas including professional services and sales. Michele is considered a leader in South Florida in the technical GIS area.

Karyn Tareen



Karyn Tareen is currently the CEO of Geocove, a corporation based in Orlando, and has earned her Geographic Information Specialist Professional (GISP) certification. While previously employed with ESRI, she served as technical resource personnel responsible for customizing and maintaining a damage assessment tool for local governments. During her tenure with Geocove, she has led the development of a damage assessment solution based on requirements from various city, county and state organizations. Most recently, Ms. Tareen has supported Tuscaloosa, Alabama and Joplin, Missouri during their recent damage assessment processes following their devastating tornados.

David Jones

David Jones is a water resources engineer and GIS professional with Jones Edmunds and Associates. He has extensive experience in applying GIS to solve water resource engineering problems and has worked in the discipline of water resource engineering for nearly 25 years.



Steven Drake

Steven Drake graduated from Northern Arizona University with a Bachelor's in Forestry Management. He is currently a GIS Analyst with Atkins North America, which was formerly known as PBS&J, where he performs a variety of engineering and environmental support tasks.

Shellie Watts

Shellie Watts is a graduate of Florida Gulf Coast University in Ft. Myers. She has over 10 years of GIS experience and is currently the GIS Coordinator with the City of Fort Myers Public Works Department. Her responsibilities include utility data conversion, data analysis and reporting, asset data collection using GPS mobile devices, and training.

Andrew Brown



Andrew Brown is a Senior GIS Programmer with the Collier County Information Technology department. He has a B.S. in Engineering, formerly was an application developer, and began working with GIS in 2006.

Jason Regula

Jason Regula is a GIS Programming Analyst and has over ten years experience working with technology. He studied at Full Sail University, and through the union of art and computers, he found his niche in Collier County where he merged his analytical mind with implementing software systems. He is also the doting father of two daughters.

Dr. Shimelis Setegn

Dr. Shimelis Gebriye Setegn is a Postdoctoral Research Scientist at the Department of Earth and Environment, Florida International University, Miami, Florida. Dr. Setegn earned his Ph.D. in Land and Water Resources Engineering. He has extensive skills in GIS, watershed modeling, climate and land use change impact assessment, soil erosion and sediment transport. He has more than 15 years of teaching, research, and industrial experience in the United States, Caribbean, Africa and Europe.



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Presenter Abstracts

Incorporating a Stormwater Management Model (EPA SWMM5) into ArcMap

Junshan Su, Ph.D., P.E.; **David Jones**, P.E., GISP; Khansith Boupha, P.E., GISP
Jones Edmunds and Associates, Inc
Email: dtjones@jonesedmunds.com

Hillsborough County has developed a stormwater analysis system inside ArcMap. The system is integrated with their modeling software, SWMM5, and allows the County to quickly develop floodplain information including inundation extents and flood depth grids in GIS. The system addresses the long-standing issue of keeping the GIS and model in sync by providing the modeling environment inside the GIS where the stormwater model is available on-demand, generated from the geodatabase. The system includes the capability to extract a model for a sub-area of an existing model, complete with boundary conditions extracted from the overall watershed-wide model's binary results file. Model extraction is useful for quickly evaluating alternatives for a particular region of the model, as long run times associated with large models are avoided. This presentation will also describe the County's development strategy which was centered on minimizing future redevelopment efforts when the ArcObjects library is modified by ESRI.

How to Squeeze Out More Results with Python

Steven Drake, Senior GIS Analyst, Atkins N.A.
Email: steven.drake@atkinsglobal.com

Most organizations today have to do more with less time and money. The easy to learn Python scripting language included with ArcGIS is an excellent tool for this. Scripts from the 2010 "Hole in the Donut" Everglades National Park project will be presented in both ArcGIS 9.3 and 10. These scripts allowed consistent data production, saved processing time & storage space and even provided documentation.

Time permitting; there will be a Q&A session afterwards -- bring your computer, Python scripts and questions. Example data and scripts will be available for download.

ADA Sidewalk Crossing Assessment

Shellie Watts, City of Fort Myers
Email: Swatts@cityftmyers.com

The City of Fort Myers was found to be non-compliant with *The Americans with Disabilities Act (ADA) of 1990*, which is a disability rights law that protects qualified individuals with disabilities from discrimination and provides for equal access and opportunity. The ADA requires that city owned and maintained facilities, sidewalk crossings and buildings must be readily accessible and useable by persons with disabilities.

The Department of Engineering was assigned the task of identifying and repairing all non-compliant sidewalk intersection crossings for all streets, roads, and highways that had been constructed or altered since January 26, 1992 (that are owned and maintained by the city), within the city limits.

In order to meet this requirement the engineering staff had to come up with a way to physically inspect and inventory all of the City's non-compliant sidewalk crossings within the entire city boundary. Staff realized quickly that a GIS enabled solution was needed to solve this issue. A GIS SDE database was used to store, manipulate, and create graphics and mapbooks of the data that were used throughout the project.

The City's GIS and engineering staff compiled an exhibit depicting all streets, roads and highways that were constructed or altered since January 1992 and all of the sidewalk crossings and ramps under City jurisdiction per the Settlement Agreement that may not comply with the Standards or UFAS.

All the data collected for each intersection of roads, streets, and highways having curbs or other barriers to entry from the street level was inputted into this GIS layer for ease of reporting, identification and costing purposes. After the field inspections were complete the City then analyzed the data and provided a report depicting the ramps under City jurisdiction which did not comply with the given standards. A breakdown of why they did not comply, the corrective measures needed and cost estimates to achieve compliance was also compiled for consideration.

GIS Data Automation

Andrew Brown, Collier County GIS, IT,
Email: andrewbrown@colliergov.net

Automating the processes to maintain GIS data is becoming more valuable every day. For an organization whose systems rely on GIS data in more than one format, automation can drastically reduce the time needed to maintain it. Collier County developed processes that combine multiple technologies and platforms to automate the maintenance and conversion of GIS data. The goals of these processes were to;

leverage existing enterprise server technologies to provide a way to publish spatial data and in so doing offer an alternative to expensive licensing costs, convert and transfer data from Shapefile and flat file format to ArcSDE Feature Class format and again to Microsoft SQL Server 2008 tables using the spatial data type and finally to automate the update of ESRI ArcGIS Server geocoding services thereby reducing the time and steps required to accomplish that task. The processes use varying combinations of ESRI's ArcGIS Server services, ArcSDE, ArcObjects Development Platform, native Python and the arcgisscripting module and Microsoft SQL Server 2008 with the spatial data types.

Collier County Flex Zoning Viewer

Jason Regula, Collier County Growth Management Division Operations & Regulatory Management
Email: jasonregula@colliergov.net

The Growth Management Division (GMD) develops and maintains zoning boundary designations that provide the public with requirements (guidance) for new and existing developments. The public often requests access to this data, either in written or presentation form, and would need to visit the Division's offices in order to do so. These requests require GMD staff time to research and provide; delaying additional services provided by the Division. In order to facilitate this process, the Division worked to create an online mapping-application that would allow the public to perform basic searches. The application consisted of four components: zoning feature data in the Division's GIS; a digital map designed in ESRI's ArcGIS Desktop; an ESRI ArcServer map service based on the map; and an Adobe Flex web application utilizing ESRI's Flex Application Programming Interface (API) which provided the user interface (UI). The existing data stored the zoning and overlay designations within a single attribute field and was divided to reduce complexity when symbolizing in the map and displaying within the UI. Further enhancements were made by simplifying the data based on these attribute fields to reduce the overall amount of features returned by the map service. Utilizing the Division's address point and the Collier County Property Appraiser's parcel data, the web application allows the public to search for zoning and overlay designations either by address or parcel identifier.

Assessment of land use change impact on water resources variability using GIS and hydrological model

Shimelis Setegn¹, Assefa Melesse¹, Felipe Vicioso², Rafael Veloz², Francisco Nunez³

¹Department of Earth and Environment, Florida International University

²The Nature Conservancy, Central Caribbean Program, Santo Domingo, Dominican Republic

³Universidad Autónoma de Santo Domingo / UASD
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In this study we have used SWAT (Soil and Water Assessment Tool) model to predict the impact of land management practices on water and sediment yield in the Haina watershed, Dominican Republic. The SWAT system is embedded within geographic information system (GIS) that can integrate various spatial environmental data including soil, land cover, climate and topographic features. The ArcSWAT is an ArcGIS-ArcView extension and a graphical user input interface for the SWAT model. ArcSWAT uses hydrologic response units (HRUs) to describe spatial heterogeneity in terms of land cover, soil type and slope within a watershed. The digital elevation model (DEM) is used to delineate the watershed and to analyze the drainage patterns of the land surface terrain under GIS environment. Sub-basin parameters (slope gradient, slope length of the terrain), and the stream network characteristics (channel slope, length, and width) were derived from the DEM. The annual and seasonal hydrological water balances as well as the spatial distribution of hydrological resources in the watersheds were estimated. Three land use scenarios were proposed for the year 2030. First proposed scenario show an increase in broad leaf scrubs, rice, urban areas and broadleaf forest, and a decline of intensive agriculture, cocoa and coffee, and pastures. The second scenario includes an increase in forest cover that is considered as "Best scenario". The third scenario shows an Increase in intensive and extensive agriculture, pastures, urban areas and human settlement in high lands, and important decrease in forest land in mid and upper watershed. The different land use scenario maps were imported to the ArcSWAT model. The modeling result based on the different land use scenarios indicated that the stream flow changes between -3 to 4% in the basin for the year 2030. The result of this study will help the decision makers for appropriate land and water resources planning and management.

Keywords: Hydrological Modeling, Land use change impact, GIS, ArcSWAT, Water balance

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Poster Presentations – At A Glance

1. **Integration of GIS Technology and Soil Erosion Models Towards Tropical Watersheds Management. Case of Upper Ruvu catchment in Tanzania** - Juliana Msaghaa and Assefa M. Melesse
2. **Spatiotemporal Trends of Contaminants in the Broward County Portion of the Biscayne Aquifer** - Leigh Ammon and Assefa M. Melesse
3. **Analysis of Land Use Change and Possible Influence on Rainfall Pattern in South Florida** - Hari Kandel and Assefa Melesse
4. **Benthic Habitat Characterization in Estuarine Complexes of Southwestern Florida** - Jeffrey R. Schmid
5. **Lost and Found: The Search for Jack Collier’s Place and Other “Lost” Cultural Sites in Rookery Bay National Estuarine Research Reserve** - Matthew Betz, Jill Schmid, and Steve Bertone
6. **Rookery Bay National Estuarine Research Reserve Habitat Mapping** - Michael Barry and Beth McCartney
7. **Hydrant Data Collection for Fire Response Zone Maps** - Andie Dodd
8. **Implementing GIS for Construction Management, Operations, and Maintenance at the Key Largo Wastewater Treatment District** - Todd F. Helt
9. **GIS Exercises for Mapping Sustainability in the Western Everglades** - Dr. Marguerite S.E. Forest and Kim Pierce

Poster Presentations - Abstracts

1. Integration of GIS technology and Soil erosion models towards tropical watersheds management. Case of Upper Ruvu catchment in Tanzania

Juliana Msaghaa; Assefa M. Melesse
Florida International University: Department of Earth and Environment
Email: jmsag001@fiu.edu

Wami- Ruvu basin is approximately 66,820 km² and is drained by major rivers in eastern Tanzania, which are the major water supply source for major cities. Wami-Ruvu basin and its associated resources are critical important not only ecologically but also culturally, as people depend on it for their essential services. Water resource management at Wami-Ruvu basin is facing challenges related to land use and human activities. Increased activities in agricultural towards Uluguru mountains together with higher demand for water supplies have resulted in concerns about resource management. The sustainability of water resources in the basin as the result of different management practices needs to be studied and monitored with reliable baseline information. This study is identifying sediments potential sources in different land uses and sub-watersheds. The study used Universal Soil Loss equation (USLE) integrated in raster GIS environment to map soil erosion of the upper Ruvu Catchment. The final output is erosion risk map showing mean annual soil loss in tones per hector per year. The result shows the spatial variation of the erosion dependent on rainfall, land use, soil and management factors. It provides an estimate of the vulnerability of erosion and also numerical results that can be used for site evaluation and planning purposes and also for assisting in the decision process of selecting erosion control measures including comparing results with other field scale erosion models.

Key words: GIS models, erosion and sediments, tropical watersheds, Upper Ruvu catchment

2. Spatiotemporal Trends of Contaminants in the Broward County Portion of the Biscayne Aquifer

Leigh Ammon; Assefa M. Melesse
Department of Earth and Environment, Florida International University
Email: lammo001@fiu.edu

The western portion of Broward County obtains drinking water from the unconfined Biscayne Aquifer which is also highly susceptible for contaminants. Since 2006, the Broward County Wellfield Protection Program has been monitoring businesses and utilities through the federally endorsed Source Water Assessment and Protection Program. The core of this program is continuous and reliable monitoring of regulated substances in drinking water that adversely affect human health. Contaminant sampling is accomplished by licensing selected businesses and utilities located within the

protected zones of the wellfield that use, store, and/or handle these regulated substances. Different regulated substances, or contaminants, are then associated with specific types of land use for tracking purposes. As contaminants enter the porous limestone aquifer they are able to diffuse rapidly. Many outside variables influence these spatiotemporal contaminant concentration trends within the aquifer. In this analysis, we tracked the spatiotemporal trends of certain regulated substance concentrations as they are influenced by changing land cover and varying rainfall volume. Remote sensing images, corresponding to specific time frames, were used to create land cover layers for western Broward County. GIS tools were utilized to generate average yearly runoff using the raw SFWMD rainfall data. The individual monitoring well, potable well and NPDES surface station locations were used to create a raster network of continuous contaminant detections for each time frame. The lateral movements of contaminants across the aquifer are trending in a southeast direction. In the case of nitrates the concentration trend change is linked with varying rainfall intensity. Further research regarding the vertical movement of contaminants as well as the identification of those areas susceptible to contaminant leaching will lead to a greater understanding of contaminant flow in this karst aquifer.

Key words: Biscayne Aquifer, GIS, contaminants, spatiotemporal trends, Broward

3. Analysis of Land Use Change and Possible Influence on Rainfall Pattern in South Florida

Hari Kandel and Assefa Melesse
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Email: hkand001@fiu.edu

Growing concerns over the possible impacts of anthropogenic land cover changes on ecohydrology of south Florida have motivated this research. It is said that expansion of urban and agricultural land at the expense of natural wetlands and forests introduces changes in heat budget of the area with reduced latent heat (heat of evapotranspiration) and raised sensible heat, resulting in decreased convective rainfall. This project analyzes spatial extent and distribution of land use - land cover change and changes in annual rainfall pattern in south Florida for the period of 1974 to 2006. Spatial analysis and geostatistical analysis tools of ArcGIS are used. Wetlands as well as urban impervious lands are found to be expanded with the expense of water bodies and green areas (forest, shrub, and grassland). It is also observed that the total annual precipitation is decreasing throughout the period. Finally, a conclusion has been made that the total annual rainfall does not exhibit direct influence of the land use change. The results indicate a need of long term analysis of seasonal rainfall, particularly of summer, and land use change instead of short term and annual only precipitation in order to scrutinize the influence of wetland loss and urban heat island on convective rainfall. This will also call for studying the interaction of the closely interfaced urban, agriculture and wetland ecosystems for possible horizontal advection.

Key words: remote sensing; urban; spatial analysis; land use; rainfall

4. Benthic Habitat Characterization in Estuarine Complexes of Southwestern Florida

Jeffrey R. Schmid
Conservancy of Southwest Florida
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Systematic benthic sampling has been used to characterize sediment types and biological assemblages within Estero, Clam, and Naples Bays and a portion of the Ten Thousand Islands, and the distribution of benthic habitats within each system has been mapped using geographic information systems (GIS) software. Aerial photographs were used to delineate the shoreline boundary of the bays and subsequently establish the benthic sampling grid. A study area polygon was created by digitizing the shoreline via ArcView. East-west transects were systematically placed over the study area polygon and sampling sites were located at intervals along each transect. Sampling sites were uploaded to a handheld global positioning system with differential correction and sites were navigated in the field using the graphic display. A Ponar grab sampler was used to collect benthic substrate at each sampling site. A wet-sieving method was used to sort substrates and proportions of mud, sand, and shell were estimated from visual inspection of the portions remaining within the sieves. Presence of flora (macroalgae and seagrasses) and fauna (live bottom [sponges, gorgonians, tunicates, and bryozoans] and polychaete worms) was also noted at each site. Habitat data were entered into an Excel spreadsheet and the resulting habitat database was used to produce raster maps of the study areas using the ArcView Spatial Analyst extension. These studies have provided information on habitat distributions and biological effects of freshwater inflow alterations that are needed for the management and conservation of natural resources within the respective estuarine complexes.

5. Lost and Found: The Search for Jack Collier's Place and Other "Lost" Cultural Sites in Rookery Bay National Estuarine Research Reserve

Matthew Betz¹, MA, RPA, Jill Schmid², Steve Bertone²
¹ SEARCH, ²Rookery Bay National Estuarine Research Reserve
Email: mattabetz@gmail.com

ArcGIS has proven to be instrumental in locating areas to survey for historic and prehistoric cultural resources within Rookery Bay National Estuarine Research Reserve (RBNERR) managed lands. John "Jack" L. Collier lived on Cannon Island, within RBNERR, in the early 1900's. The land was sold to develop the Hamill-Crayton subdivision. Historic deed research shows Roy Cannon bought two lots comprising Jack Collier's property and house. The subdivision failed and Roy Cannon was the island's only resident. The homestead site was forgotten until RBNERR staff stumbled upon the remains of a house with a partially standing brick chimney. After hearing of the "lost" Jack Collier's Place and the potential existing and unrecorded archaeology, the author embarked on an effort to locate the remains of the homestead. ArcGIS was

used to layer historic and modern aerial photography with LiDAR (Light Detection And Ranging) to locate potential historic and prehistoric sites. Three areas were identified for field survey and their coordinates were loaded into a Trimble GeoXT GPS. Field reconnaissance resulted in locating the house remains with the brick chimney as well as an adjacent tabby constructed cistern and a site that is very likely one of the two earliest homesteads in the Rookery Bay Reserve area, dating back to 1882. ArcGIS was an essential tool in finding these once “lost” homesteads.

6. Rookery Bay National Estuarine Research Reserve Habitat Mapping

Michael Barry¹, Beth McCartney²

¹Institute for Regional Conservation, ²Geospatial and Environmental Services
Email: barry@regionalconservation.org

Located at the northern end of the Ten Thousand Islands on the Gulf coast of Florida, the Rookery Bay National Estuarine Research Reserve (RBNERR) represents one of the few remaining undisturbed mangrove estuaries in North America and the largest in the United States. A myriad of plants and wildlife, including 150 species of birds along with threatened/endangered plants and animals thrive in estuarine upland and island habitats comprising nearly 110,000 acres of hammocks, pinelands, scrub, mangrove forest, as well as fresh and salt water marshes. Estuarine habitats are ideal sites for gathering frontline data on the effects of climate change and sea level rise. The Institute for Regional Conservation (IRC) was contracted to develop baseline habitat maps of RBNERR’s plant communities. These habitat maps were created using ESRI ArcMap in correlation with recent and historic 1940 aerial photographs along with LiDAR data. Ground truthing was conducted for certain areas using a Magellan Professional Mobile Mapper GPS with ArcPad 9. Habitats were categorized using the Comprehensive Everglades Restoration Plan (CERP) hierarchical classification system which allows distinction between ecological communities, individual species and physical characteristics such as density and height. The resulting dataset enables RBNERR’s resource management and research teams to accurately assess and predict changes in habitats and to better understand the effects of sea level rise and climate change.

7. Hydrant Data Collection for Fire Response Zone Maps

Andie Dodd, Intern

City of Punta Gorda

Email: ADodd@CI.PUNTA-GORDA.FL.US

One of my first projects as an intern at the city was a fire hydrant data collection project. The task was to update an incomplete existing record of the city’s fire hydrants. A handheld Trimble GPS was used to collect points for just under 200 hydrants in the field. After tracking down all of the hydrants, the records were post processed Trimble

GPS Pathfinder Office Software. Following this step, the data was transferred into ArcMap10, which is run on the city's network and viewable through Citrix on a desktop computer. The data was collected for use by the fire department for an Insurance Services Office (ISO) map review. A series of maps were created displaying a now complete record of all of the hydrants in the city as well as fire response zones, fire stations, and buildings with a height of 35 feet or greater.

8. Implementing GIS for Construction Management, Operations, and Maintenance at the Key Largo Wastewater Treatment District

Todd F. Helt, GIS Manager
Weiler Engineering Corporation
Email: thelt@weilerengineering.org

The Key Largo Wastewater Treatment District (KLWTD) Regional Wastewater Project originated from recognition of the need to eliminate septic tanks and illegal cesspits that exist within Key Largo in order to restore the health and economic vitality of its near-shore waters. KLWTD has recently completed construction of a \$130,000,000 centralized wastewater collection and treatment system that includes over 90 miles of force main, vacuum main, and gravity main sewer lines; 2,800 vacuum pits; and 12,000 connections, as well as five vacuum pump stations and a 2.3 MGD regional wastewater treatment plant. ESRI ArcGIS and Trimble GPS have been used throughout the five year project as construction management tools, with the resulting geospatial database providing the foundation for the District's asset inventory and maintenance management system. Every component of the wastewater collection system was GPS located during construction and integrated into the District's GIS, along with record drawings, construction photos, shop drawings, and operations and maintenance manuals.

9. GIS Exercises for Mapping Sustainability in the Western Everglades

Dr. Marguerite S.E. Forest, Assistant Professor¹, and Kim Pierce, GIS Instructor²

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GIS Exercises are being developed for students in introductory level environmental science courses at Florida Gulf Coast University. All of the exercises focus on regional sustainability issues in southwest Florida, using spatial data from local, regional, state,

and national sources. Sample topics at various levels of development include Hurricanes & Storm Surges, Land Use & Water Quality, Population Growth (complete), Panthers & Habitat, Sea Turtle Nesting & Movements, and Sea Level Rise (in process). The focus is on basic spatial and technical skills, so these exercises do not require any prior training with the licensed ESRI ArcGIS software. Students can work at their own paces by following instructions in a step-by-step manner, answering relevant content questions, and producing a final project or map. Evaluation can be based on responses, project completion, or student assessment of learning gains. Initial results indicate high levels of student engagement, good understanding of the topics, and confidence in using basic GIS. These ArcGIS exercises will be adapted for use with free software packages and for use by non-formal environmental educators, middle and high school teachers, and their students. Pre- and in-service training sessions are being planned. Many other topics, such as Solar Energy, are being investigated. Integration of GPS data collection and processing skills is a high priority.