EIM SENSOR

An Intelligent Environment For Decision Making

Environmental Monitoring Sensor Intelligence

Towards Predictive/Operational Assessment of Beach Closures Using Remotely Sensed Data

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Pensacola Beach Monitoring Pilot

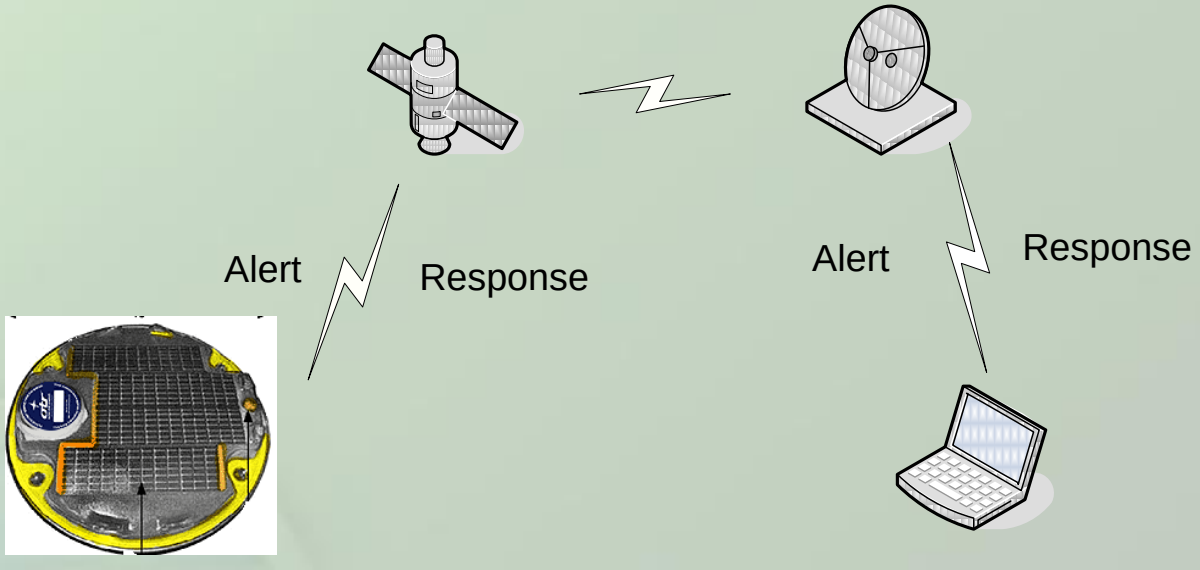
Implement a Beach Management solution to enhance beach monitoring services at multiple scales.

- Incorporate data from various sources (NASA, Buoys, Weather Stations) for initial calibration.
- Water quality data obtained from buoys will substantially improve upon existing practices to manage beach advisories (persistence models based on coli form bacteria).

❖Explore the multivariate factors to better understand drivers that impact the water quality, beach condition and the impact of beach closures on tourism.

❖Provide a data-rich, highly intuitive tool to facilitate management and reporting of beach advisories, and current environmental conditions.

Concept: Buoy Sensor Data-Driven Beach Monitoring



Buoy/Weather Stations

Beach Operations

- Health Departments
- Notifications
- Regulatory Agencies
- Academic Scientists

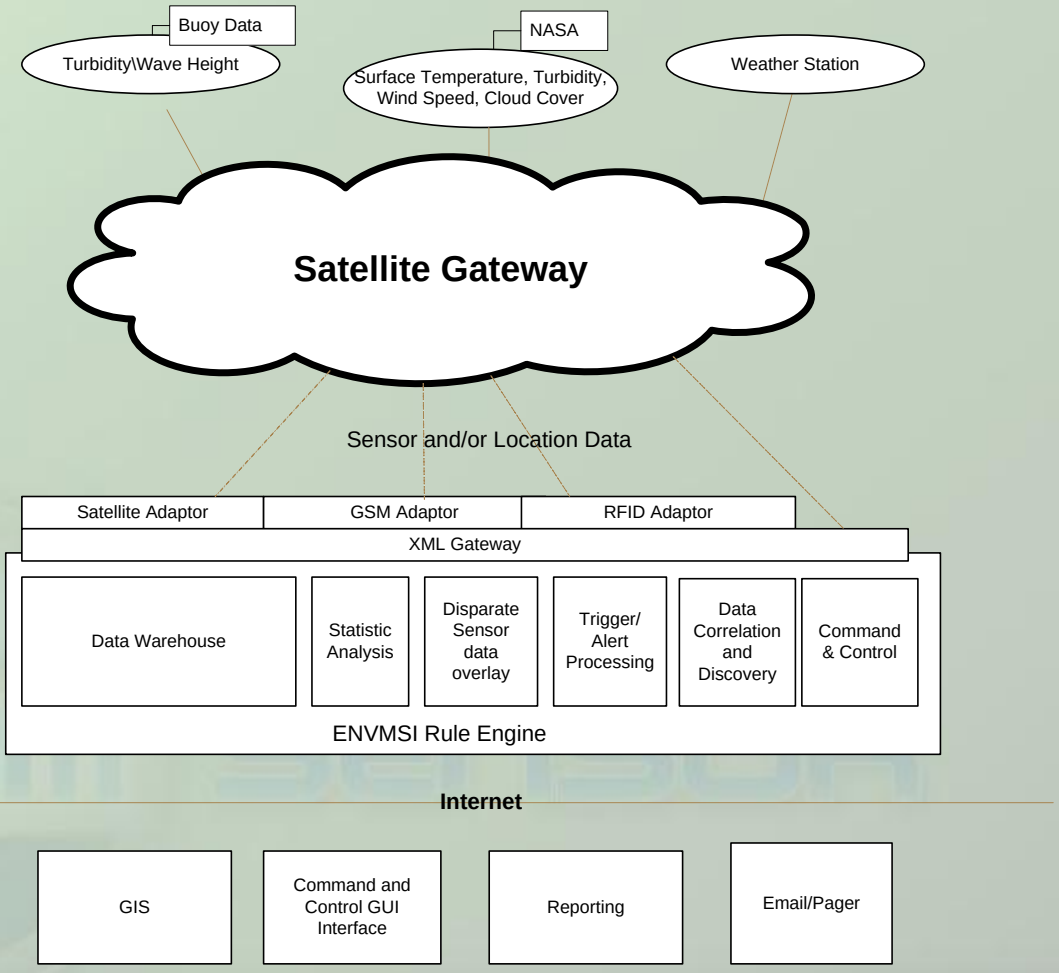
Approach

- Provide Near Real-time Sensor Data to feed into Beach Models
  - Turbidity
  - Wave Height
  - Water Temperature
  - Cloud Cover/Rain Fall
  - Wind Speed/Direction
  - Water Surface Temperature
  - Salinity

- Model Integration
  - Combine empirical models of beach contamination with Sensor Data providing a creditable and scientific approach for decision making.

- Web Based Decision Support
  - Ability to integrate virtually any type of sensor with GIS web application.
  - Decision dashboards provide near-real time sensor data combined with ecological models.

Concept of Operations



Internet Telemetry

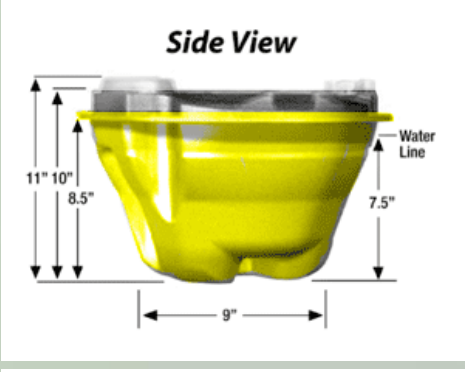
Monitor and control a broad range of environmental factors.

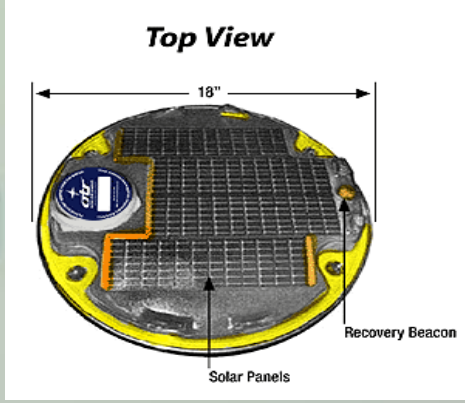
- Water Level, Flow Rate, Temperature, Soil Moisture, Air Quality, Humidity, PH, Wind Direction, Barometric Pressure, Rain Gauge.

Remote Telemetry Units are compact with a rugged design for easy installation.

Buoy Features

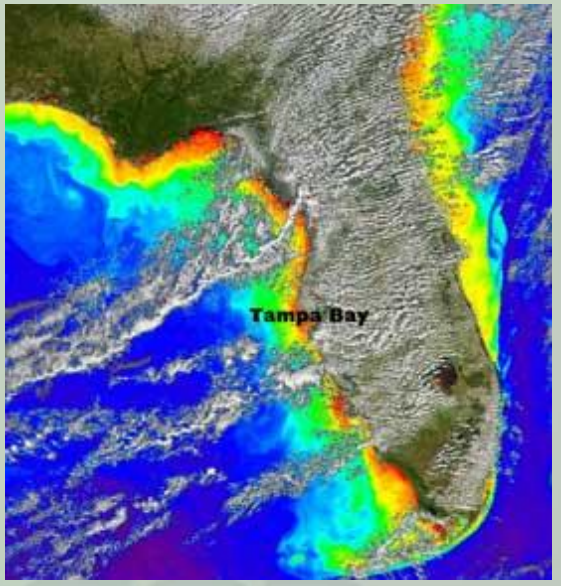
- INMARSAT Satellite Network
- Sea Surface Temperature & Turbidity Sensors
- Bi-directional Communications
- Long-Life Rechargeable Battery
- Solar Panel
- Fully Integrated Beach Monitoring Software
- High Intensity Recovery Beacon
- Standby, Operational and Recovery modes





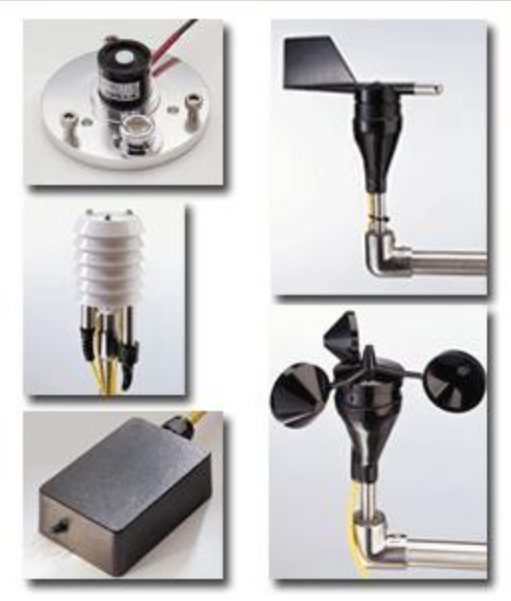
NASA Sensor Data

- Wind Direction: QuickSCAT
- Wave Height: Jason-1
- Sea Surface Temperature: MODIS
- Ocean Color: MODIS



➢EPA Recognizes need to enhance the interoperability of NASA-supported geophysical models, such as climate models, and various types of ecological models for ecosystems management and management of biodiversity.

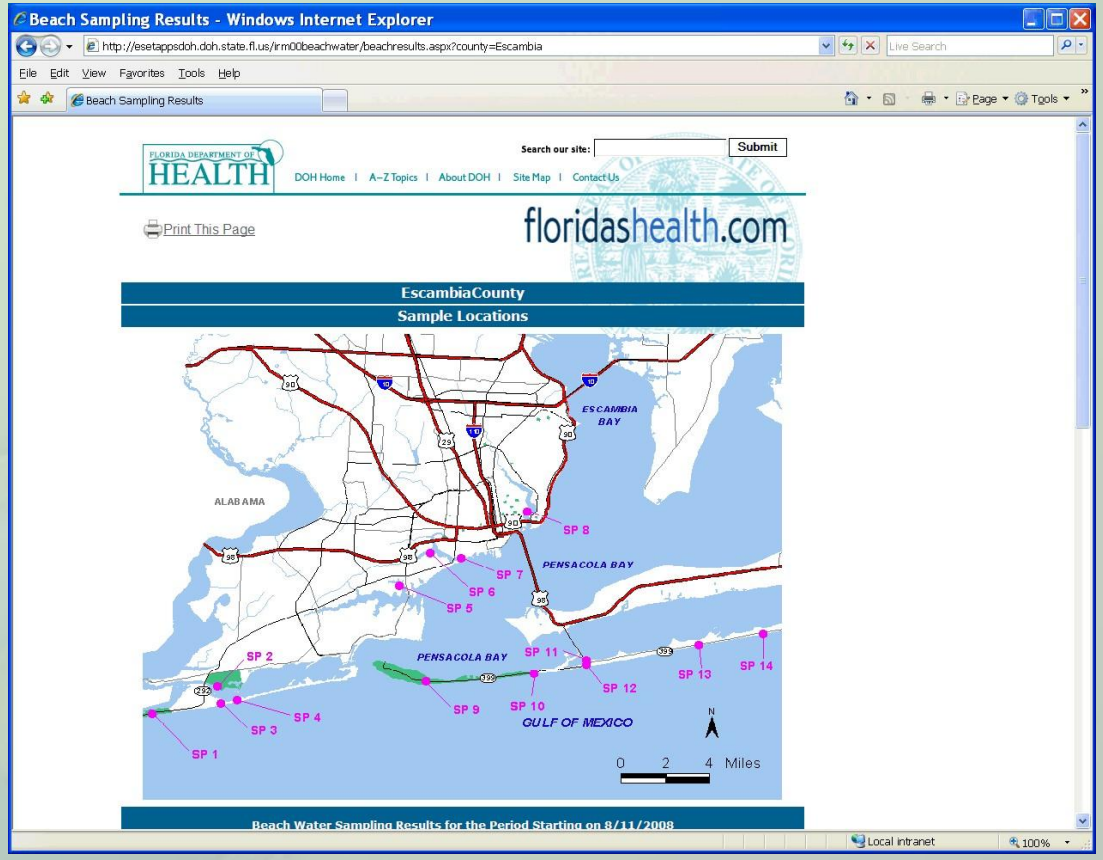
Environmental Monitoring



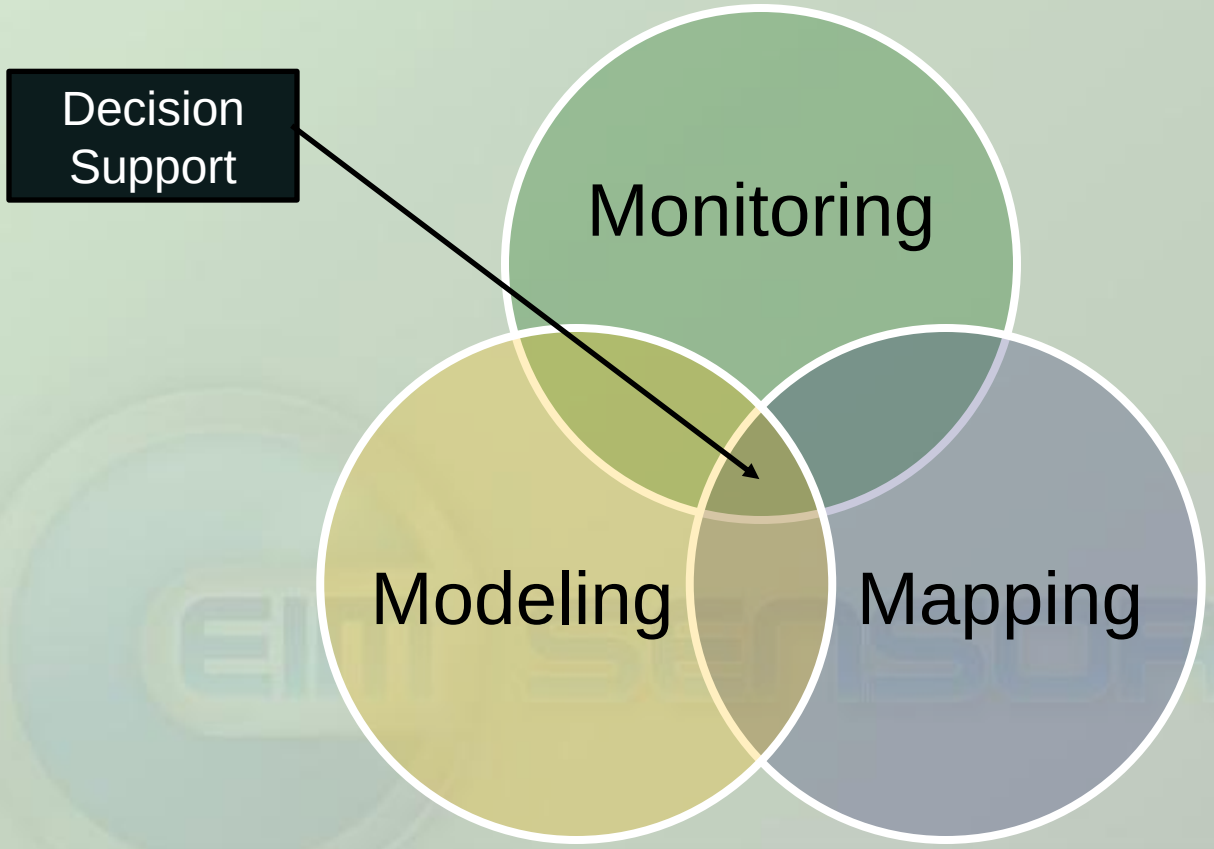
Weather Station data collected in close proximity to beach and coastal areas of interest.

➢**Monitor Barometric Pressure, Solar Radiation, Wind Speed, Wind Direction, Humidity, and Temperature**.

Florida Department of Health



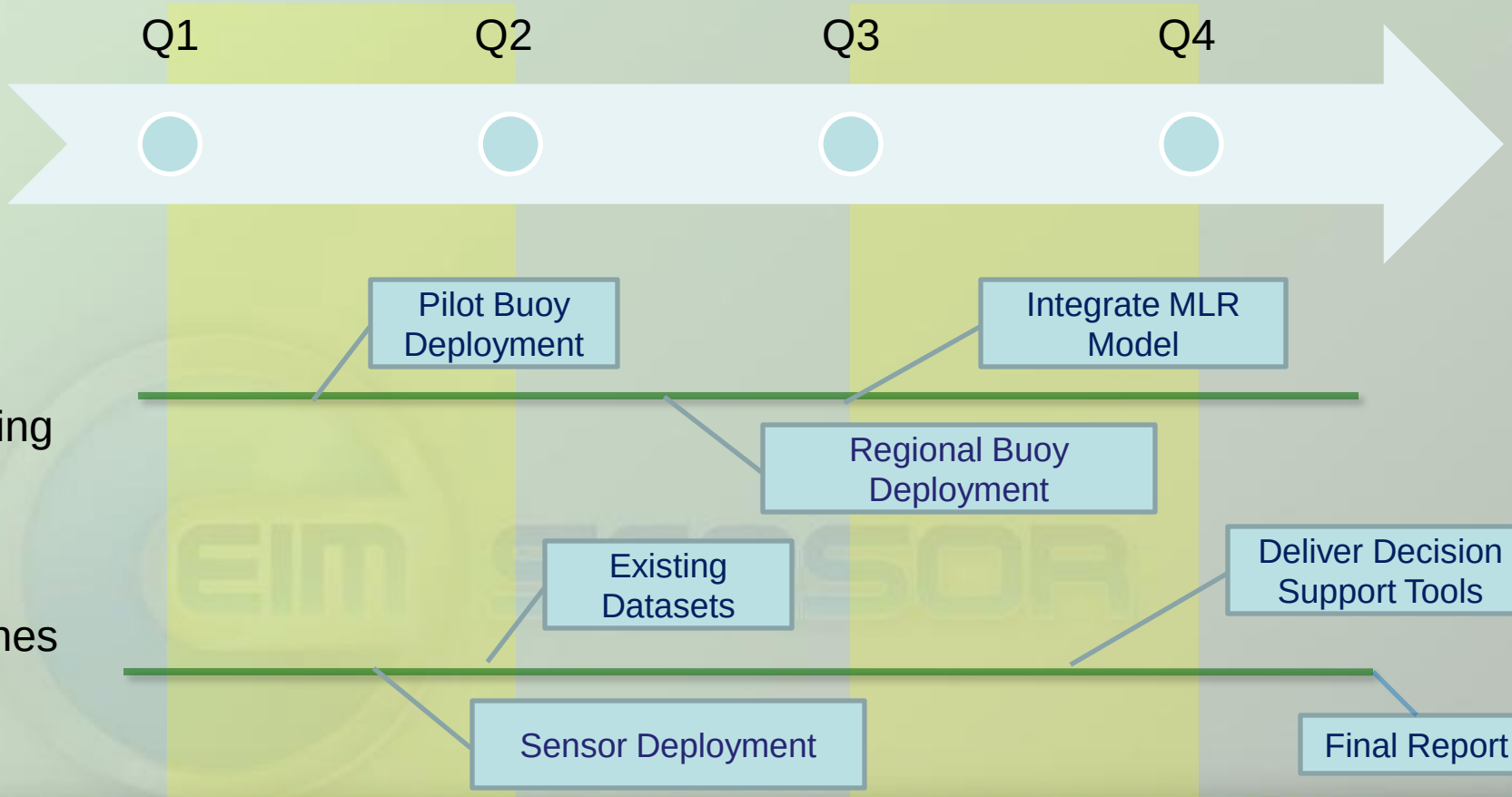
Decision Making



Data Quality
Coverage
Granularity

Project Timeline

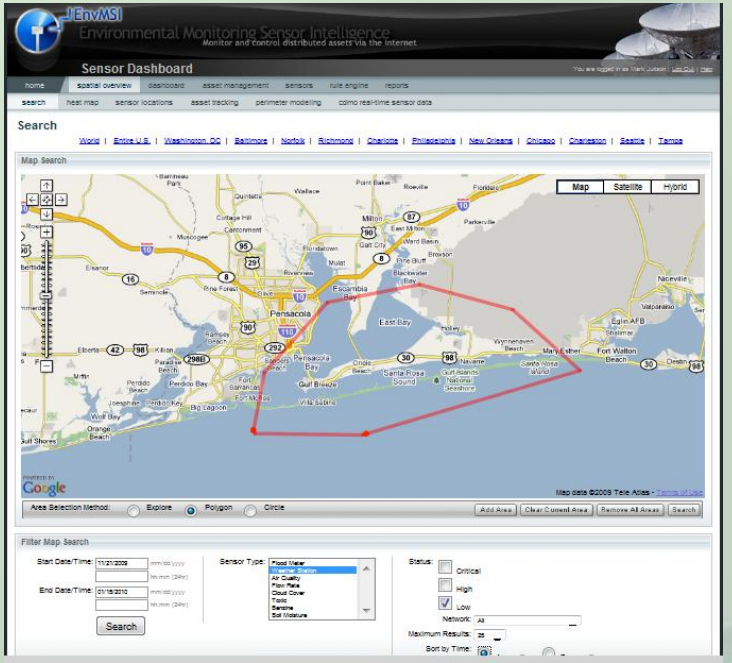
August 15 2009 – August 14 2010



Project Timeline (Continued)

	2009 Q4	2010 Q1	2010 Q2	2010 Q3
Tasks				
Performance needs assessment based on discussion with decision-makers.	X	X		
Integrate existing MLR model into the EIM Sensor Decision Dashboard.	X			
Acquire satellite data sets.	X	X	X	X
Evaluate use of existing empirical algorithms to derive environmental data from satellite imagery.	X			
Evaluate best locations for deployment of new sensor arrays	X			
Deploy in-situ satellite internet telemetry enabled sensors to monitor sea surface temperature, turbidity and other factors.		X	X	X
Coordinate live data streams from sensors with satellite data		X	X	
Refine satellite data processing based on semi-analytical algorithms and comparison with in-situ measurements			X	X
Integrate MLR model with live data stream and imagery within EIM Sensor framework and test alert system			X	X
Document and disseminate final results				X
Work with FDH to establish criteria for an operational system				X
Milestones				
Documentation of existing datasets, models and needs	X			
Sensor deployment		X		
Development of web-based Decision Dashboard			X	
Project Final Report with evaluation of performance enhancement in beach monitoring				X

Develop Decision Support Tool



Sample Point (SP)	Location Click on a Location Name to review sampling history. * Entries indicate resampling events.	Enterococcus	Enterococcus Geometric Mean	Fecal Coliform	Advisory / Warning Issued
1	PERDIDO KEY STATE PARK	Good	Good	Good	No
2	BIG LAGOON STATE PARK	Good	Good	Good	No
3	JOHNSON BEACH	Good	Good	Good	No
4	JOHNSON BEACH- SOUND SIDE	Good	Good	Good	No
5	NAVY POINT	Poor	Good	Poor	Yes
6	BAYOU CHICO	Poor	Good	Moderate	No
7	SANDERS BEACH	Moderate	Good	Moderate	No
8	BAYVIEW PARK PIER	Poor	Good	Moderate	Yes
9	FORT PICKENS	NR	NA	NR	No
10	COUNTY PARK WEST	Good	Good	Good	No
11	* QUIET WATER BEACH	N/A	NA	Poor	Yes
11	QUIET WATER BEACH	Moderate	Good	Poor	No
12	PENSACOLA BEACH	Good	Good	Good	No
13	COUNTY PARK EAST	Good	Good	Good	No
14	SANTA ROSA ISLAND PARK	NR	NA	NR	No

***Enterococcus* Results Description**

GOOD	MODERATE	POOR*
0-35 *Enterococcus sp* per 100 ml of marine water 0-35 CFU/100 mL *Enterococcus sp Geometric Mean*	36-104 *Enterococcus sp* per 100 ml of marine water	105 or greater *Enterococcus sp* per 100 ml of marine water 36 and over CFU/100 mL *Enterococcus sp Geometric Mean*

Fecal Coliform Results Description

GOOD	MODERATE	POOR*
0-199 fecal coliform organisms per 100 ml of marine water	200-399 fecal coliform organisms per 100 ml of marine water	400 or greater fecal coliform organisms per 100 ml of marine water

*A Poor rating may result in a resampling event to confirm poor conditions, otherwise a Health Advisory or Warning will be issued immediately. These indicate that contact with the water at this site may pose increased risk of infectious disease, particularly for susceptible individuals. A reading of **NR** means "No Result." This could indicate that no sample was taken at this point because of weather or other factors, or that an analysis result was not obtained from the laboratory.

Spatial Searching Engine for Water Quality Monitoring Data

Interactive Water Quality models based on user defined rules engine

Acknowlegements

- Working Team:
  - EIM Sensor
    - Barney, Yang, Lidd, Petrova, Gustafson
  - EPA Gulf Ecology Division
    - Russell

Question & Answers

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