NOAA IOOS Program Office Regional Status Assessment for Great Lakes Observing System

February 29, 2008

Roger L. Gauthier, Principal Investigator

GLOS Structure and Governance

- GLOS-RA leadership
  - Roger Gauthier, Interim Executive Director
  - Christine Manninen, E/O and Communications Coordinator, NFRA Board member
  - 12 member Board of Directors
  - Program Review Panel not yet constituted
  - Great Lakes Sea Grant Network lead for E/O
- Organizational structure
  - Public non-profit, Michigan corporation
  - 501(c)(3) tax exempt status pending

GLOS Structure and Governance

- Board membership
  - No affiliations
  - No formal user group representation
  - Monthly conference calls
  - Annual Business/Technical meetings
  - Quarterly calls/meetings of subsystem teams

Board of Directors

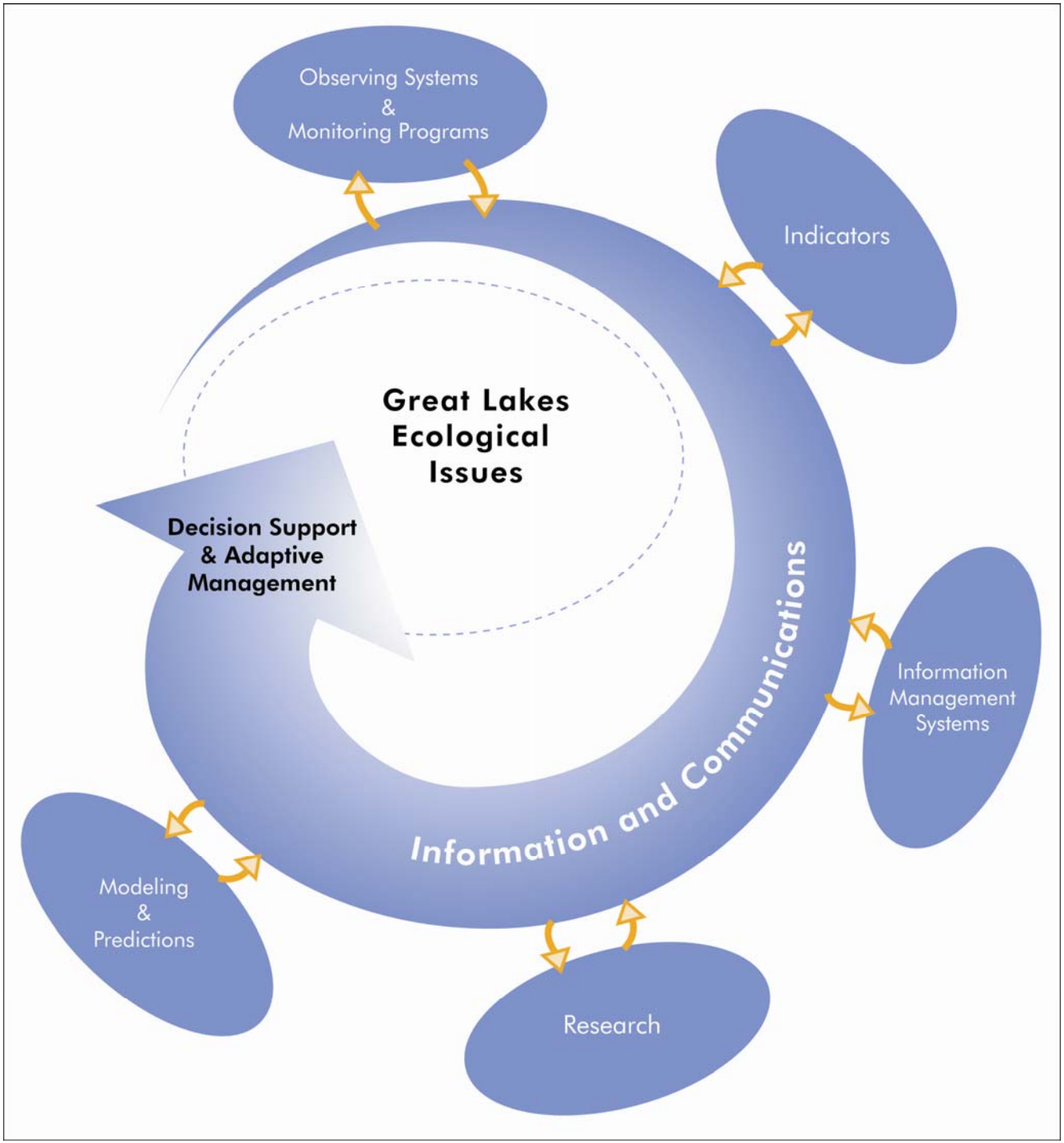
- Dr. Alfred Beeton (Treasurer)
- Dr. Jeffrey Boehm (Secretary)
- Dr. Gerald Galloway (BG, Ret)
- Mr. Mark Grazioli, P.E.
- Mr. Philip Keillor
- Dr. Gail Krantzberg
- Dr. Frank Kudrna, P.E. (Vice Chair)
- Mr. Dale Phenicie
- Dr. Harvey Shear
- Dr. Richard Stewart
- Mr. Nelson Thomas
- Mr. Bill Werick (Chair)

Stakeholder Engagement

- Stakeholder types: extensive
- Key stakeholder groups or individuals
- Annual meetings / Periodic workshops
- Periodic listserv announcements
- Level of involvement - high

Stakeholder Engagement

- Key issues of importance to regional stakeholders, and how the RA addresses them?
- Quantifiable, tangible expressions of support from stakeholders
  - Specific examples that demonstrate benefit of the RA to the region
- Other stakeholders?



Great Lakes Regional Collaboration Strategy

Protect drinking water supplies

Restore biologic integrity

Reduce loadings of nutrients, sediments and nutrients

Clean up toxic hot spots

Enhance resiliency to climatic variability / change

Limit adverse affects from aquatic invasive species

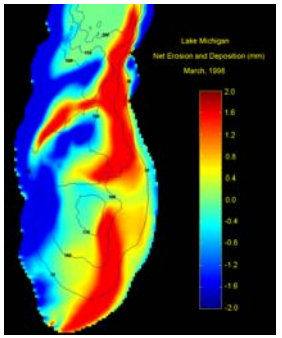
Improve navigation safety and efficiency

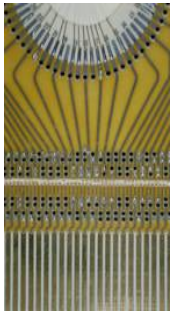
Support sustainable coastal communities

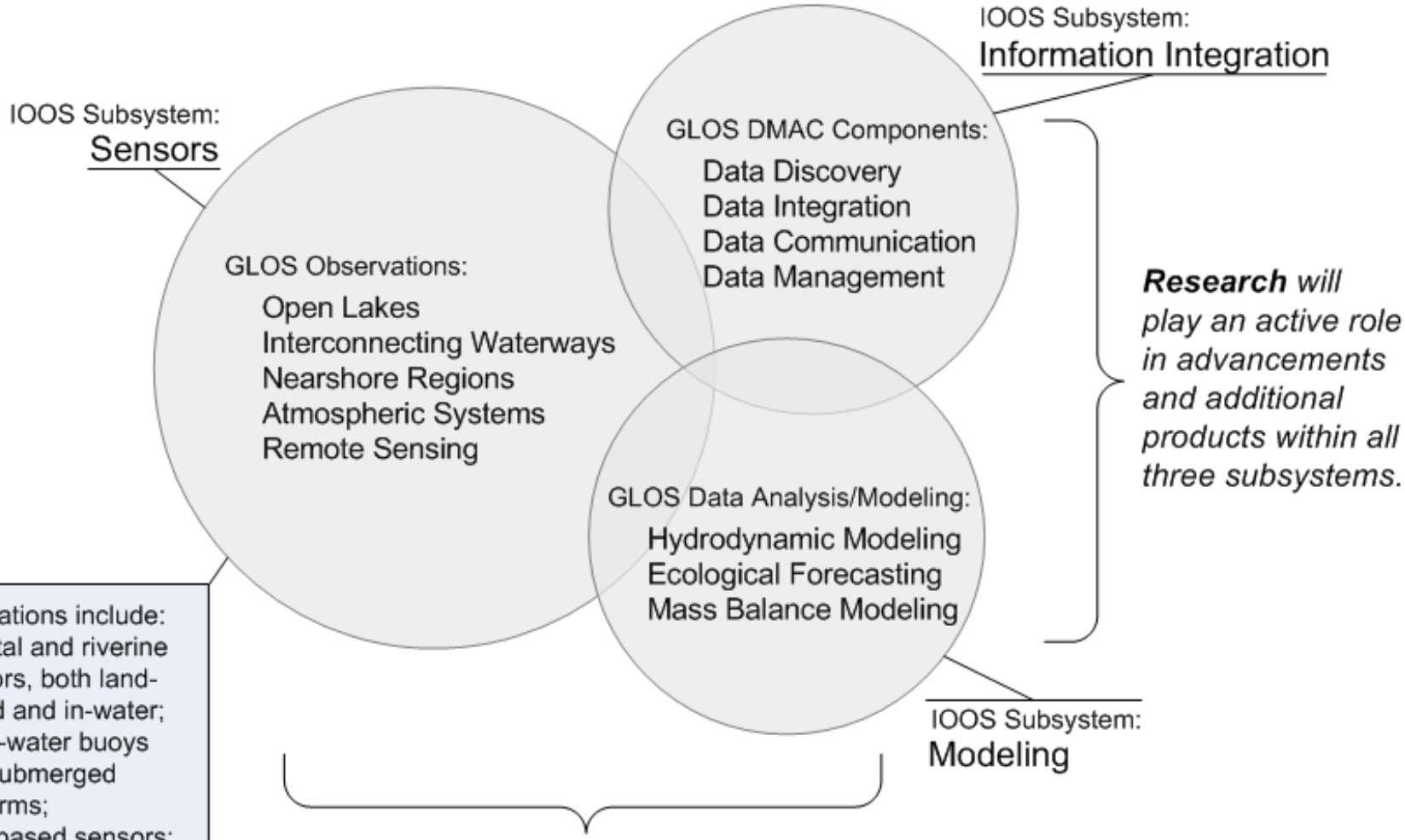
Great Lakes Observing System

Subsystems:

- Deep Water Observations
- Science Vessels
- Interconnecting Waterways
- Nearshore Observations
- Atmospheric Monitoring
- Remote Sensing
- Modeling and
  Ecological Forecasting
- Information Integration
- Education and Outreach







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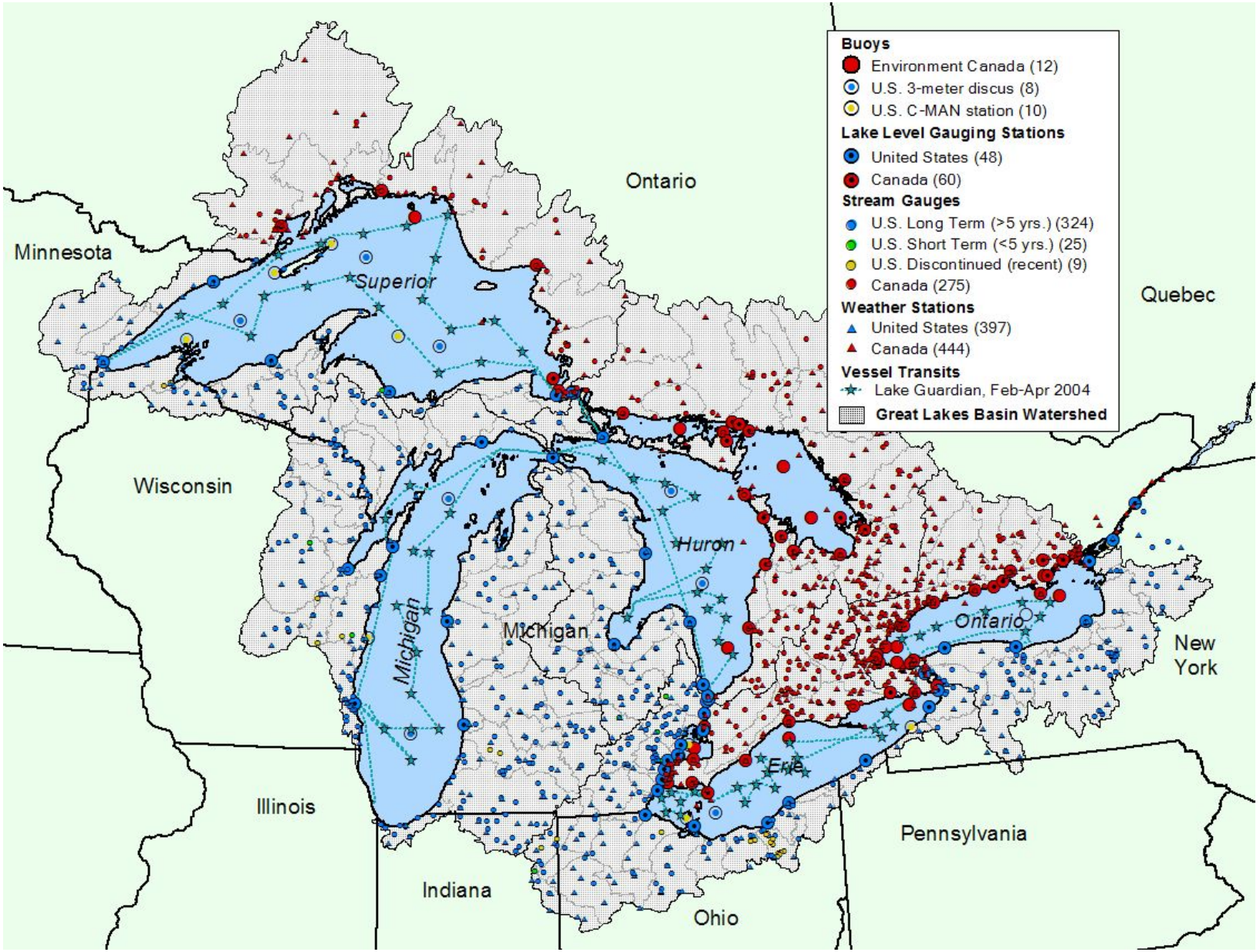
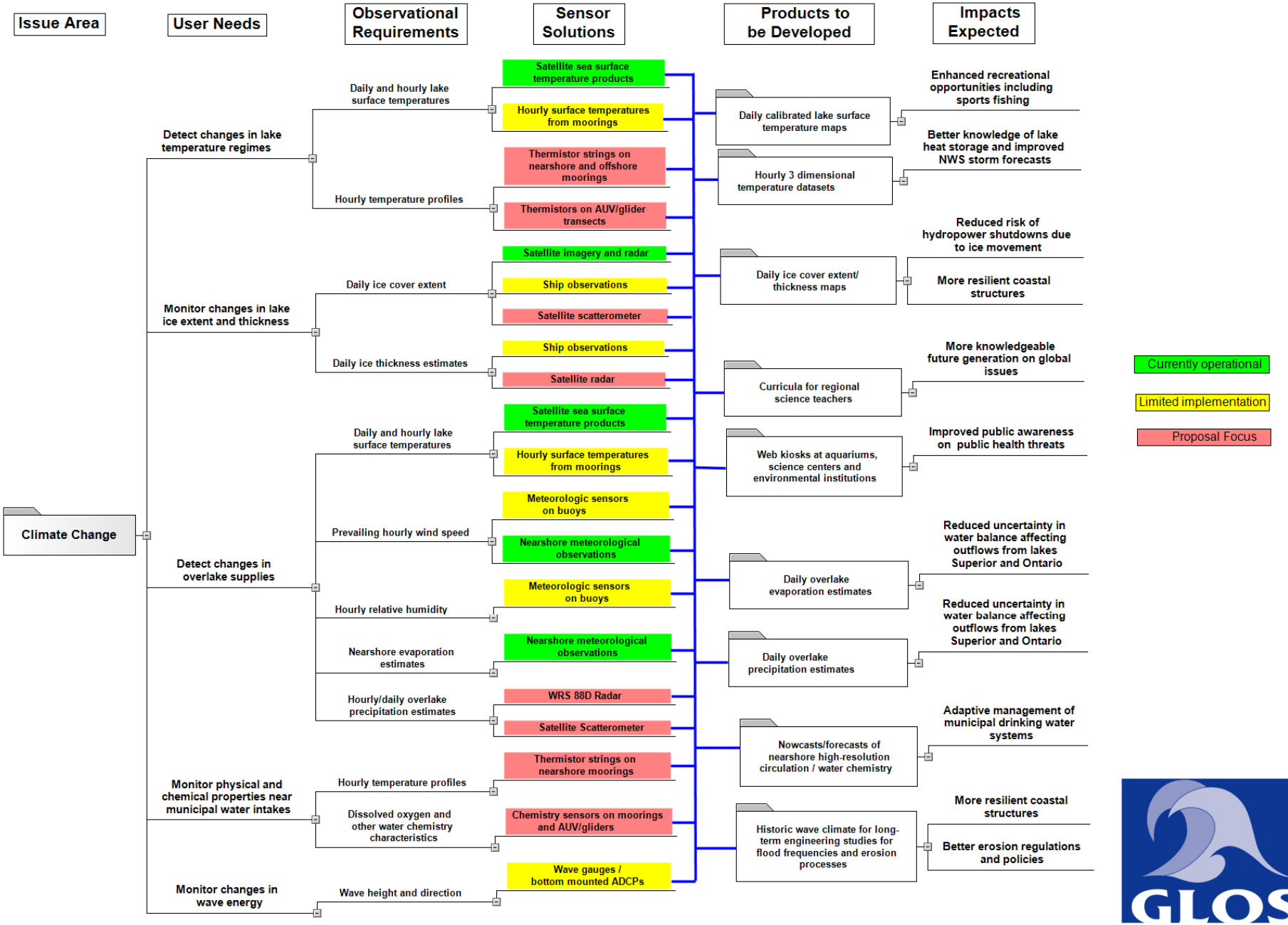
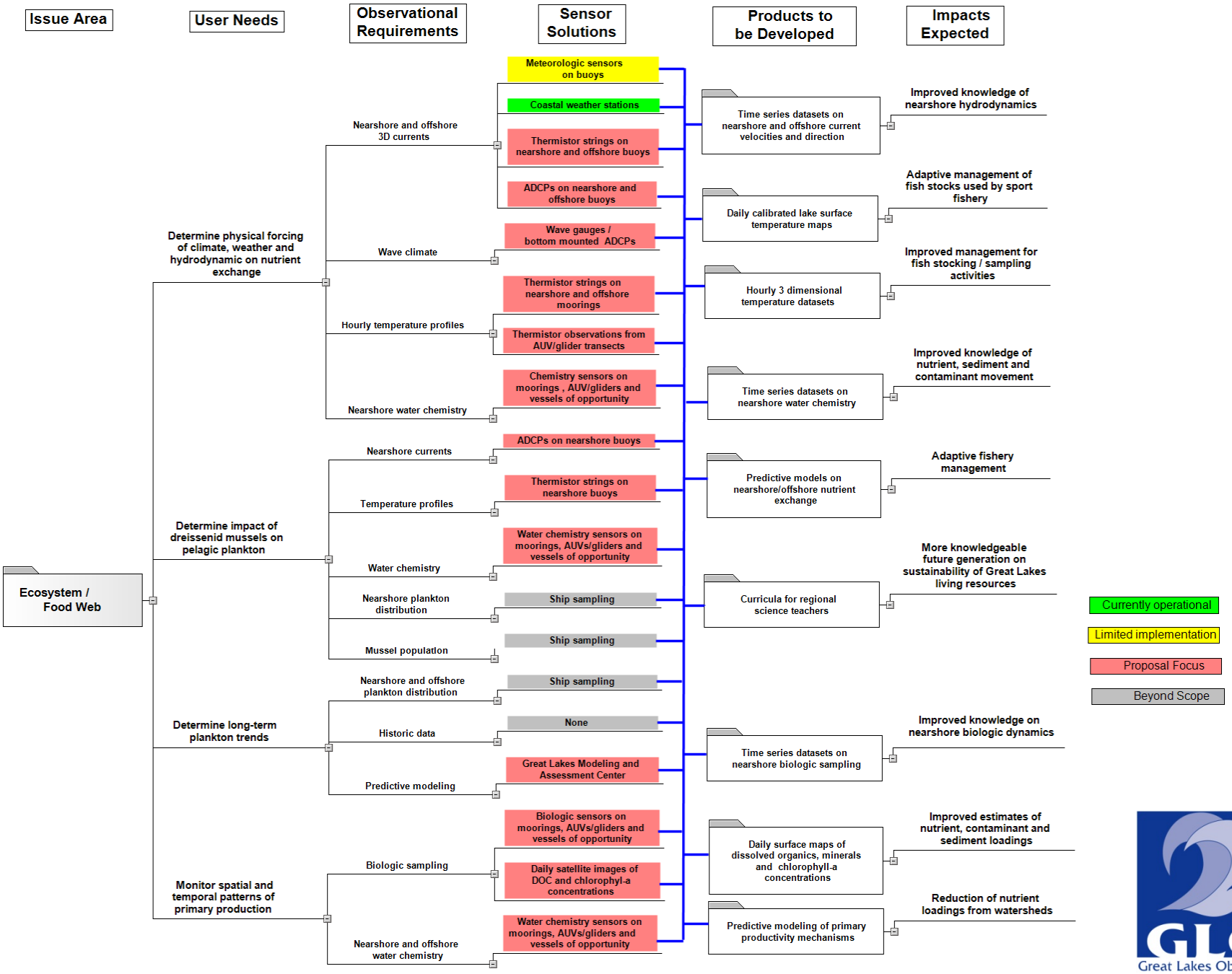
Great Lakes Observing System

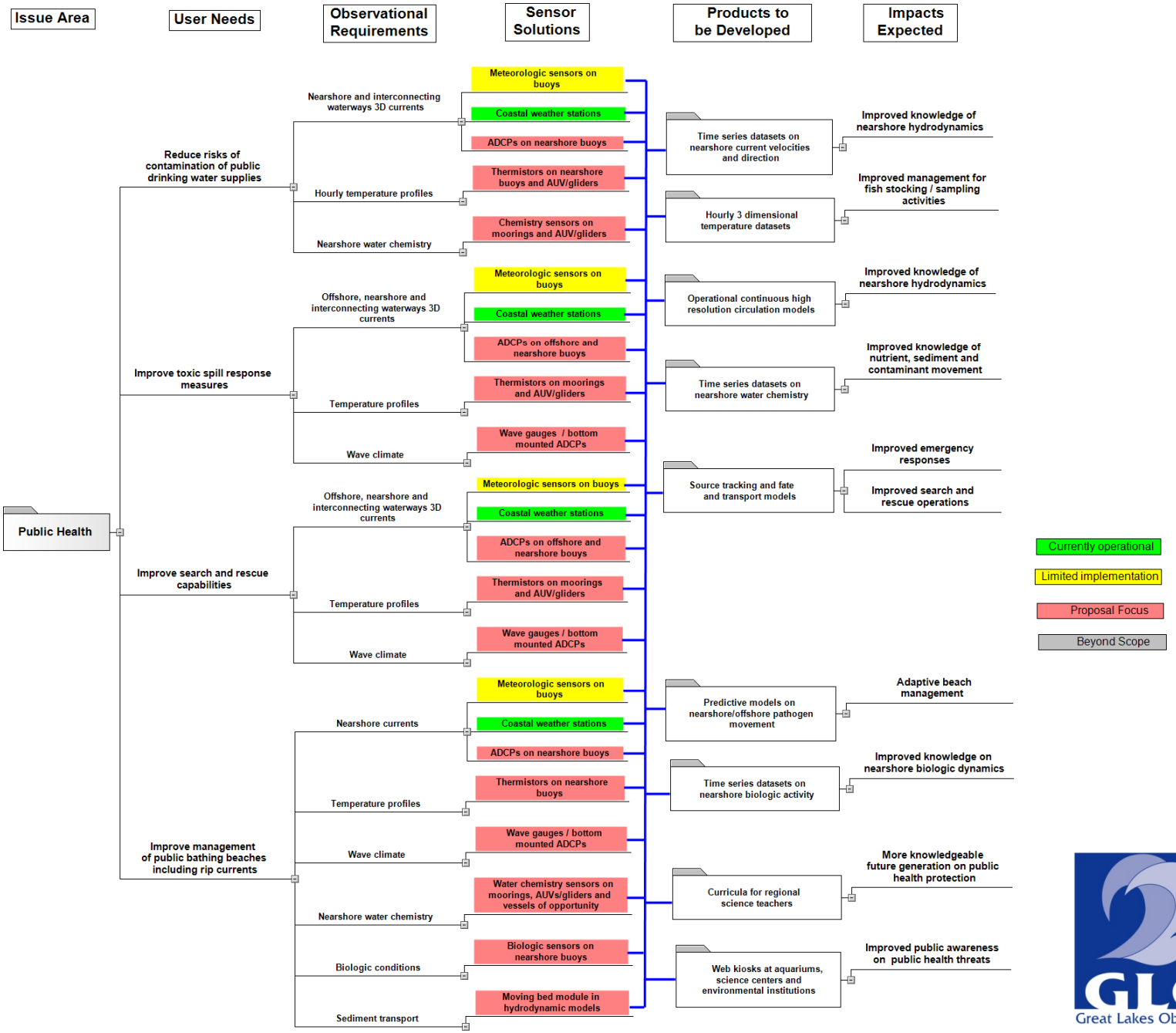
Great Lakes Federal Backbone Observations



Critical Issues to be Addressed


Issue Area
User Needs
Observational Requirements
Sensor Solutions
Products to be Developed
Impacts Expected
Climate Change
Detect changes in lake temperature regimes
Daily and hourly lake surface temperatures
Hourly temperature profiles
Monitor changes in lake ice extent and thickness
Daily ice cover extent
Daily ice thickness estimates
Detect changes in overlake supplies
Daily and hourly lake surface temperatures
Prevailing hourly wind speed
Hourly relative humidity
Nearshore evaporation estimates
Hourly/daily overlake precipitation estimates
Monitor physical and chemical properties near municipal water intakes
Hourly temperature profiles
Dissolved oxygen and other water chemistry characteristics
Monitor changes in wave energy
Wave height and direction
Satellite sea surface temperature products
Hourly surface temperatures from moorings
Thermistor strings on nearshore and offshore moorings
Thermistors on AUV/glider transects
Satellite imagery and radar
Ship observations
Satellite scatterometer
Ship observations
Satellite radar
Satellite sea surface temperature products
Hourly surface temperatures from moorings
Meteorologic sensors on buoys
Nearshore meteorological observations
Meteorologic sensors on buoys
Nearshore meteorological observations
WRS 88D Radar
Satellite Scatterometer
Thermistor strings on nearshore moorings
Chemistry sensors on moorings and AUV/gliders
Wave gauges / bottom mounted ADCPs
Daily calibrated lake surface temperature maps
Hourly 3 dimensional temperature datasets
Daily ice cover extent/ thickness maps
Curricula for regional science teachers
Web kiosks at aquariums, science centers and environmental institutions
Daily overlake evaporation estimates
Daily overlake precipitation estimates
Nowcasts/forecasts of nearshore high-resolution circulation / water chemistry
Historic wave climate for long-term engineering studies for flood frequencies and erosion processes
Enhanced recreational opportunities including sports fishing
Better knowledge of lake heat storage and improved NWS storm forecasts
Reduced risk of hydropower shutdowns due to ice movement
More resilient coastal structures
More knowledgeable future generation on global issues
Improved public awareness on public health threats
Reduced uncertainty in water balance affecting outflows from lakes Superior and Ontario
Reduced uncertainty in water balance affecting outflows from lakes Superior and Ontario
Adaptive management of municipal drinking water systems
More resilient coastal structures
Better erosion regulations and policies
Currently operational
Limited implementation
Proposal Focus
GLOS
Great Lakes Observing System


Issue Area
User Needs
Observational Requirements
Sensor Solutions
Products to be Developed
Impacts Expected
Ecosystem / Food Web
Determine physical forcing of climate, weather and hydrodynamic on nutrient exchange
Determine impact of dreissenid mussels on pelagic plankton
Determine long-term plankton trends
Monitor spatial and temporal patterns of primary production
Nearshore and offshore 3D currents
Wave climate
Hourly temperature profiles
Nearshore water chemistry
Nearshore currents
Temperature profiles
Water chemistry
Nearshore plankton distribution
Mussel population
Nearshore and offshore plankton distribution
Historic data
Predictive modeling
Biologic sampling
Nearshore and offshore water chemistry
Meteorologic sensors on buoys
Coastal weather stations
Thermistor strings on nearshore and offshore buoys
ADCPs on nearshore and offshore buoys
Wave gauges / bottom mounted ADCPs
Thermistor strings on nearshore and offshore moorings
Thermistor observations from AUV/glider transects
Chemistry sensors on moorings , AUV/gliders and vessels of opportunity
ADCPs on nearshore buoys
Thermistor strings on nearshore buoys
Water chemistry sensors on moorings, AUVs/gliders and vessels of opportunity
Ship sampling
Ship sampling
Ship sampling
None
Great Lakes Modeling and Assessment Center
Biologic sensors on moorings, AUVs/gliders and vessels of opportunity
Daily satellite images of DOC and chlorophyl-a concentrations
Water chemistry sensors on moorings, AUVs/gliders and vessels of opportunity
Time series datasets on nearshore and offshore current velocities and direction
Daily calibrated lake surface temperature maps
Hourly 3 dimensional temperature datasets
Time series datasets on nearshore water chemistry
Predictive models on nearshore/offshore nutrient exchange
Curricula for regional science teachers
Time series datasets on nearshore biologic sampling
Daily surface maps of dissolved organics, minerals and chlorophyll-a concentrations
Predictive modeling of primary productivity mechanisms
Improved knowledge of nearshore hydrodynamics
Adaptive management of fish stocks used by sport fishery
Improved management for fish stocking / sampling activities
Improved knowledge of nutrient, sediment and contaminant movement
Adaptive fishery management
More knowledgeable future generation on sustainability of Great Lakes living resources
Improved knowledge on nearshore biologic dynamics
Improved estimates of nutrient, contaminant and sediment loadings
Reduction of nutrient loadings from watersheds
Currently operational
Limited implementation
Proposal Focus
Beyond Scope
GLOS
Great Lakes Observing System



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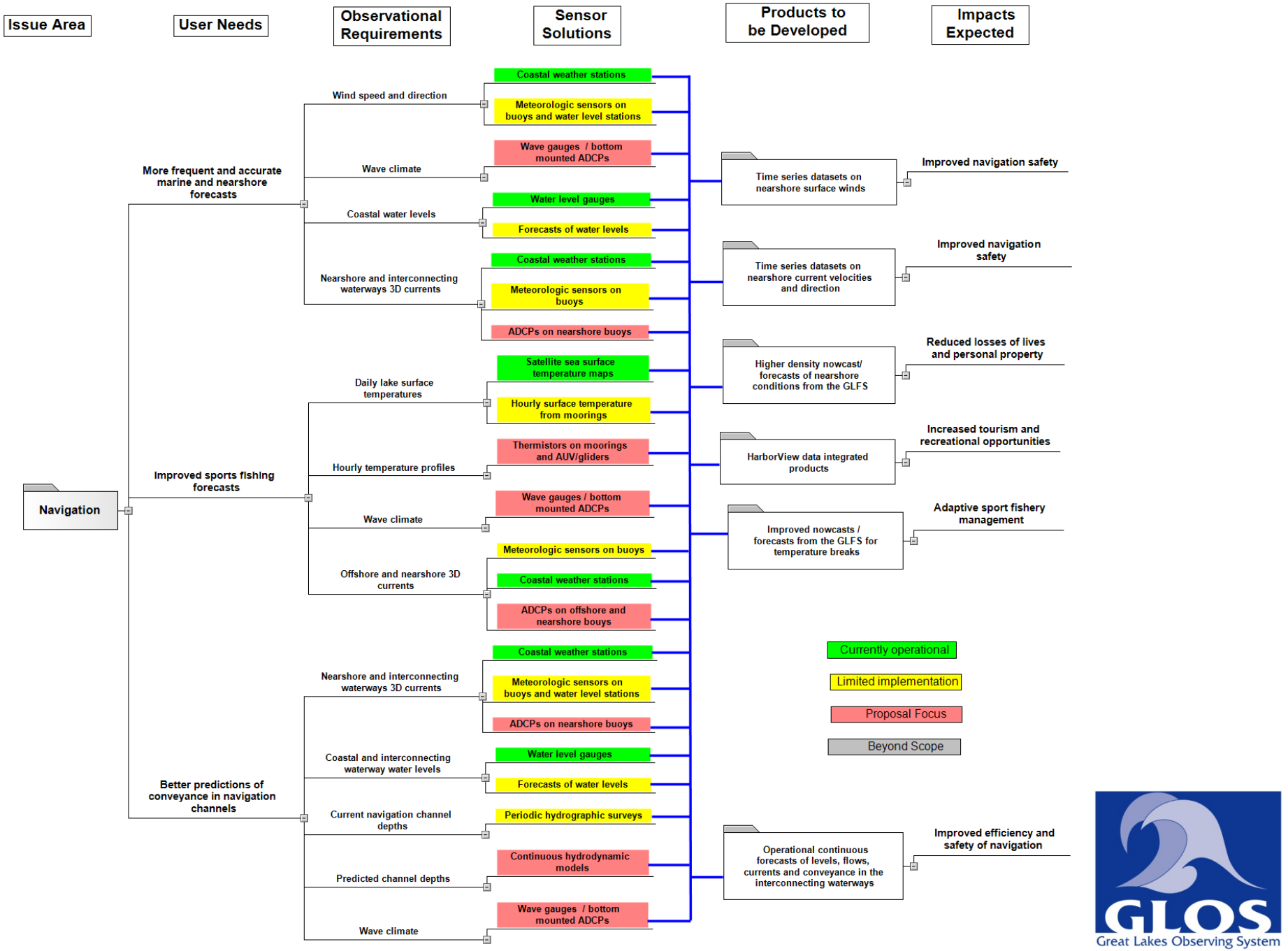

Issue Area
User Needs
Observational Requirements
Sensor Solutions
Products to be Developed
Impacts Expected
Navigation
More frequent and accurate marine and nearshore forecasts
Improved sports fishing forecasts
Better predictions of conveyance in navigation channels
Wind speed and direction
Wave climate
Coastal water levels
Nearshore and interconnecting waterways 3D currents
Daily lake surface temperatures
Hourly temperature profiles
Wave climate
Offshore and nearshore 3D currents
Nearshore and interconnecting waterways 3D currents
Coastal and interconnecting waterway water levels
Current navigation channel depths
Predicted channel depths
Wave gauges / bottom mounted ADCPs
Coastal weather stations
Meteorologic sensors on buoys and water level stations
Water level gauges
Forecasts of water levels
Meteorologic sensors on buoys
ADCPs on nearshore buoys
Satellite sea surface temperature maps
Hourly surface temperature from moorings
Thermistors on moorings and AUV/gliders
ADCPs on offshore and nearshore bouys
Periodic hydrographic surveys
Continuous hydrodynamic models
Time series datasets on nearshore surface winds
Time series datasets on nearshore current velocities and direction
Higher density nowcast/ forecasts of nearshore conditions from the GLFS
HarborView data integrated products
Improved nowcasts / forecasts from the GLFS for temperature breaks
Operational continuous forecasts of levels, flows, currents and conveyance in the interconnecting waterways
Improved navigation safety
Improved navigation safety
Reduced losses of lives and personal property
Increased tourism and recreational opportunities
Adaptive sport fishery management
Improved efficiency and safety of navigation
Currently operational
Limited implementation
Proposal Focus
Beyond Scope
GLOS
Great Lakes Observing System

Current Activities and Funding

- A summary of key activities in the region that are related to or support IOOS, including those not funded by NOAA IOOS
- Interaction/joint work with other federal agencies
- How can NOAA IOOS best support you in engaging other Federal agencies?

Current Activities and Funding

- Sources of funding
  - NOAA IOOS and other NOAA funds
  - Other Federal
  - Non-Federal
- RA plans/efforts to match IOOS dollars with funding from other sources
  - What sources, and in what areas of work?
  - How can the NOAA Program Office help?

Regional Association Funding

Calendar Years	Funding Level	Tasks
2003 - 2004	$ 110 K	Convene Steering Committee and establish scope
2004 - 2005	$ 99 K	Draft Business Plan, define governance approach integrate with national elements
2005 - 2006	$ 248 K	Establish Regional Association and Board of Directors
2006 - 2007	$ 325 K	Enlist RA membership; conduct outreach, coordinate Regional DMAC
2007 - 2008	$ 400 K	Expand RA membership; refine Business Plan; implement regional DMAC

Systems Grant Funding

Calendar Years	Fund Level	Tasks
2007-2008	$ 360 K	Initiate Huron to Erie Corridor hydrodynamic modeling
		NOAA-GLERL ($100 K for continuous 2d model integration), USGS-MI ($125 K for 3d model development) Baird & Associates ($125K for 3d model risk assessment) GLOS-RA ($10K for coordination)
	$ 50 K	Develop “HarborView” pilots
	$ 65 K	Initiate Great Lakes Modeling and Assessment Center
	$ 25 K	Offshore Implementation Plan
Total	$500K	

RA Coordination: Cooperative Agreements

- As we reach the end of the first set of RA coordination grants, provide a summary of overall progress
  - Milestones and status
  - Updates to the RA progress reports
  - Any new information?
  - How are you doing?

RA Coordination: Cooperative Agreements

- What will change with the new RA grant in FY08?
- New directions, partners, etc.?

RA Future Development

- RA views on function and performance metrics
  - How can we best measure outputs and outcomes?
- Objectives of the RA and plans for the near-term FY08-12

RA Future Development

- Summary of top five priorities for development of RCOOS capabilities with cost estimates

Conceptual Plan

VI. Projected Costs (in $0.1M)

Subsystem	Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Offshore/Deepwater	Offshore Buoys	$0.0	$0.2	$0.2	$0.2	$0.4	$0.5	$0.5	$1.0	$1.0	$1.0
	AUVs/Gliders	$0.0	$0.2	$0.2	$0.2	$0.2	$0.4	$0.5	$0.5	$0.5	$0.5
Nearshore/Coastal	Nearshore Buoys	$0.0	$1.1	$1.2	$1.3	$1.4	$1.5	$1.6	$1.7	$2.0	$2.5
	HF Radar	$0.0	$0.0	$0.1	$0.2	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Airborne Mapping	$0.0	$0.0	$0.0	$0.0	$0.4	$1.0	$1.8	$2.5	$3.0	$3.5
Ships and Vessels	Vessels of Opportunity	$0.0	$0.1	$0.1	$0.1	$0.3	$0.3	$0.3	$0.3	$0.3	$0.5
	Scientific Ships	$0.0	$0.0	$0.0	$0.0	$0.2	$0.2	$0.2	$0.5	$0.8	$1.2
Interconnecting Waterways	Levels and Flows Instrumentation	$0.0	$0.1	$0.1	$0.1	$0.3	$0.3	$0.3	$0.3	$0.5	$0.5
	Hydrodynamic Modeling	$0.4	$0.3	$0.3	$0.2	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5
Remote Sensing	Lake Surface Monitoring	$0.0	$0.2	$0.2	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
	Image Data Clearinghouse	$0.0	$0.0	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Atmospheric	Overlake Precipitation and Evaporation	$0.0	$0.1	$0.1	$0.1	$0.3	$0.3	$0.3	$0.2	$0.2	$0.1
	Contaminant and Toxic Deposition Monitoring	$0.0	$0.0	$0.0	$0.0	$0.3	$0.3	$0.8	$0.8	$1.0	$1.5
Modeling and Assessment	GLMAC	$0.0	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.5	$0.5	$0.5
	Great Lakes Coastal Forecasting System	$0.0	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
	HarborView Products	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Outreach and Education	Outreach	$0.0	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.3	$0.5	$0.5
	Curricula Development, Teacher Training	$0.0	$0.2	$0.2	$0.2	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5
DMAC	Regional Operations Center	$0.0	$0.1	$0.1	$0.1	$0.3	$0.3	$0.3	$0.3	$0.5	$0.5
	Product Development	$0.0	$0.1	$0.1	$0.1	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4
Management	Workshops and Coordination	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.2
Totals		**$0.50**	**$3.30**	**$3.50**	**$3.50**	**$6.50**	**$7.50**	**$9.00**	**$11.00**	**$13.00**	**$15.00**

GLOS Core Variables

Physical	Chemical	Biological
Lake level	Contaminants	Fish Species
Landform	Nutrients	Abundance
Bottom character	Dissolved Oxygen	Phytoplankton
Temperature	Salinity	Zooplankton
Surface waves		Pathogens
Surface currents		Macrophytes
Ice distribution		
Surface sediments		
Surface color		
Heat flux		

Core GLOS-DMAC Functionalities

Components

Data Discovery

Data Visualization

Data Evaluation

Data Access

Data Publishing

Tenants

Empower user/organizations

Make data accessible to ALL

Be extensible/expandable

Minimize duplication

Metadata driven

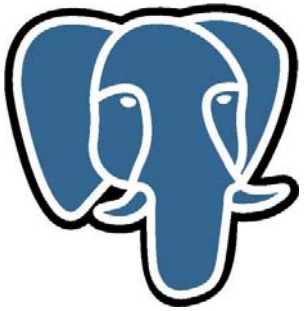
Standards based

Leverage open source software

Service Oriented Architecture

Open Source Software Framework

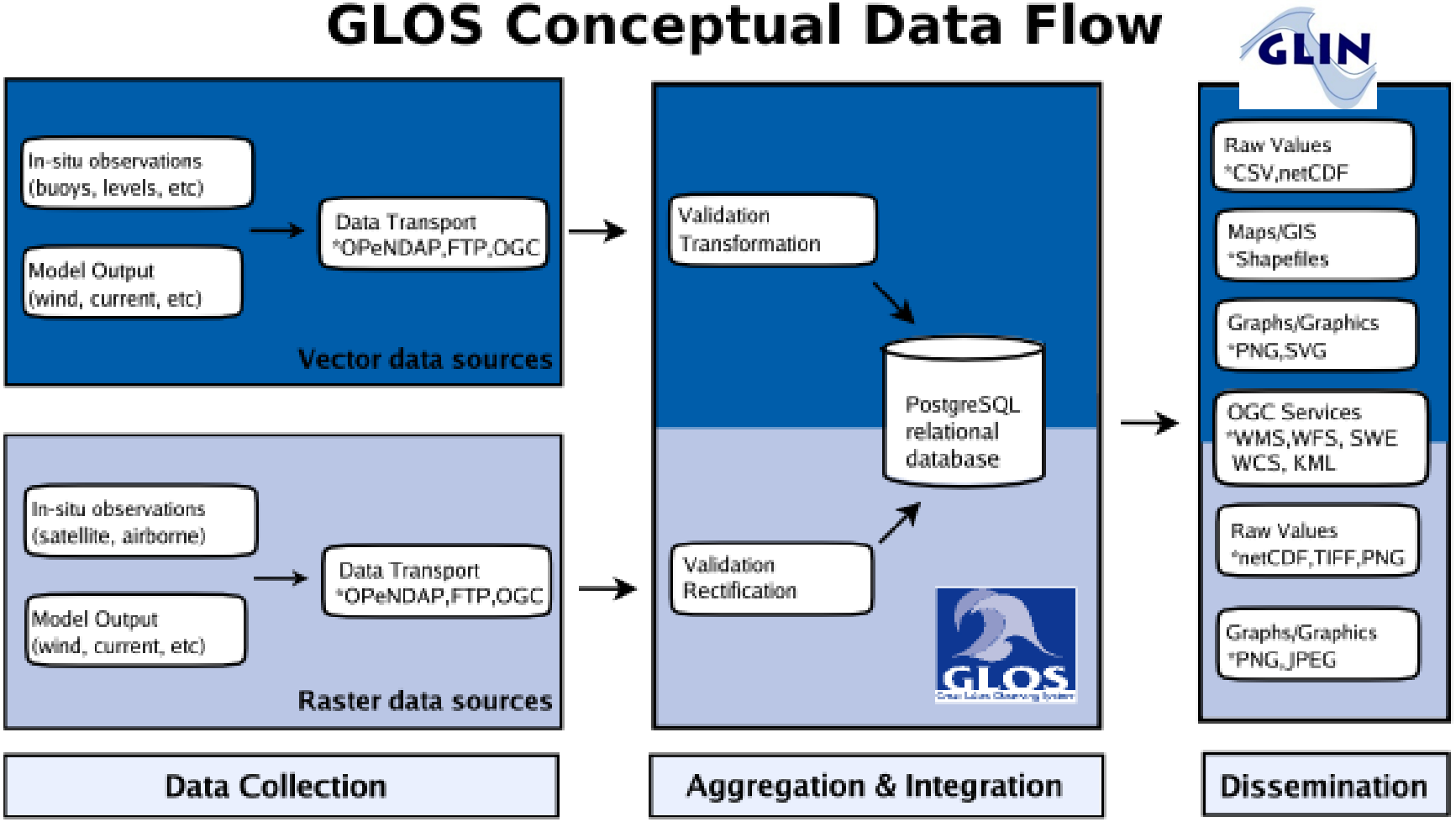
Back-end Storage



Back-end Map/Feature Generation

Front-end Data Access

GLOS Conceptual Data Flow



Data Collection

- Ingest data from a variety of sources including federal, state, local, tribal and NGO agencies.

- Collect and integrate data of varying types including observational data, model output, remotely sensed data, “traditional” GIS Layers, et al.

- Collect data across differing time scales, including historical, real-time, and near real-time datasets.

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Data Aggregation and Integration

- Common database schema for incoming data
- Adherence to IOOS database schema
- Extensible / expandable
- Open source, cost effective
- Archive/repository broker

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Data Access

- Standards-based (Service Oriented Architecture)
- Interoperable
- Provide multiple ways GLOS-related datasets
  - Using 3 compatible approaches:
    - Open layers, Chameleon/Map Server, Flash
  - Static maps and images
  - Time series and animated data
  - Web mapping applications
  - Direct file and database access

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GLOS-DMAC Next Steps

Refine a comprehensive data schema

Incorporate additional geospatial datasets

Integrate with other IOOS DMAC and Canadian nodes

Provide additional formats and data types

(e.g. point and time series data, raster and imagery)

Improve search capabilities

Improve user interfaces

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RA Views on Regional and National IOOS

- RA needs with regard to the integration of regional and national planning efforts
- RA expectations for development of the “national backbone” of observations
  - In situ, remote sensing, and data management and communications (DMAC) capabilities

Cross-regional Coordination

- Discuss existing and potential coordination with other IOOS RAs
  - On regional efforts/issues?
  - On a national scale?

Best Practices and Lessons Learned

- Describe problems encountered to date and their resolutions
- What are some “good ideas” or best practices that you can share with other RAs?

Parting Thoughts

- What support or information do you need from NOAA that you are not currently receiving?
- Is there input you would like to give to us, but don’t have a venue?

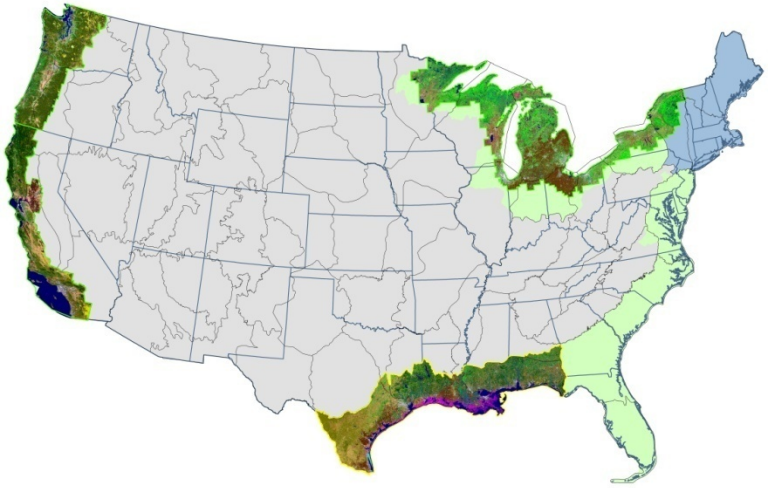
Parting Thoughts

- How can NOAA IOOS best receive regular updates or information from the RAs?
  - RA and partner achievements, news items, expressions of stakeholder support, engagement of new stakeholders
  - How can NOAA IOOS best understand (and articulate) how RAs support the national system?
  - How can we help to support your
- Other parting thoughts?

Short-Term “Work-Arounds”

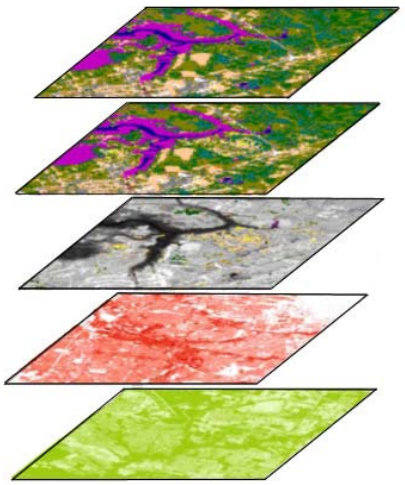
Coastal Change Analysis Program

- Standardized, accessible inputs
- Innovative, repeatable procedures
- Consistent national coverage
- Relevant, accurate products



Current Great Lakes Land Cover Products:

- **Land cover circa 2001**
- **Land cover circa 1996**
- **Change data (1996 to 2001)**
- **Percent impervious surface**
- **Percent canopy surface**



Station LSCM4 - Lake St Clair, MI

Owned and maintained by National Data Buoy Center
C-MAN station
VEEP payload
42.47 N 82.76 W (42°27'54" N 82°45'18" W)

Site elevation: 178.5 m above mean sea level
Air temp height: 6.0 m above site elevation
Anemometer height: 14.4 m above site elevation
Barometer elevation: 179.8 m above mean sea level

Conditions at LSCM4 as of
(5:00 am EDT)
0900 GMT on 07/21/2006:

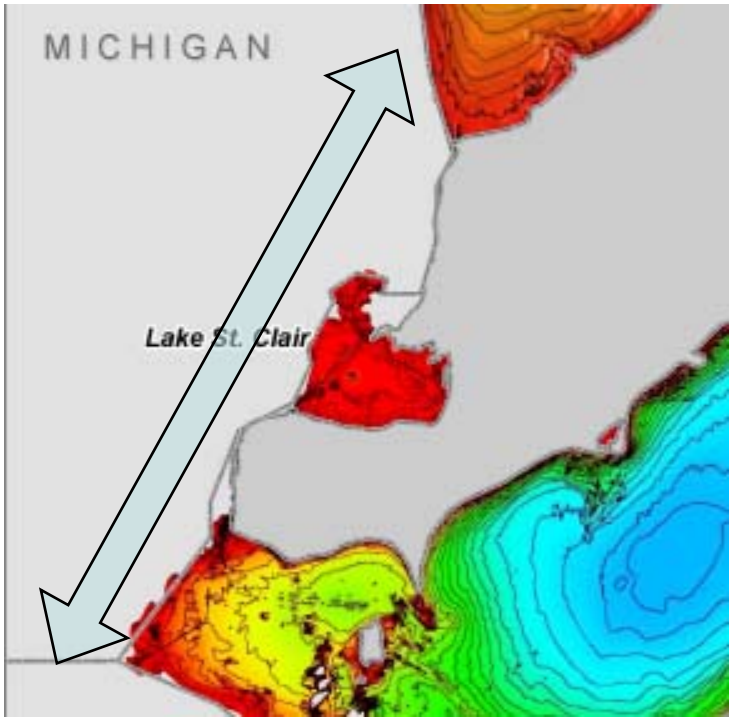
Unit of Measure: English Time Zone:
Station Local Time Select

Click on the graph icon in the table below to see a time series plot of the last five days of that observation.

Wind Direction (WDIR):	N (360 deg true)
Wind Speed (WSPD):	13 kts
Wind Gust (GST):	15 kts
Atmospheric Pressure (PRES):	29.95 in
Pressure Tendency (PTDY):	+0.00 in (Steady)
Air Temperature (ATMP):	72.9 °F
Water Temperature (WTMP):	74.7 °F
Combined plot of Wind Speed, Gust, and Air Pressure	

- **Funded through 2008**
- **Add ADCP in 2007**
- **Add directional waves in 2007**
- **Explore means for supporting other chemical and biologic sensor deployments**

3-D Modeling Initiative for the Huron to Erie Corridor



Attachment 8/3