Development and Implementation of an Interactive Alabama Sand Resource Mapper

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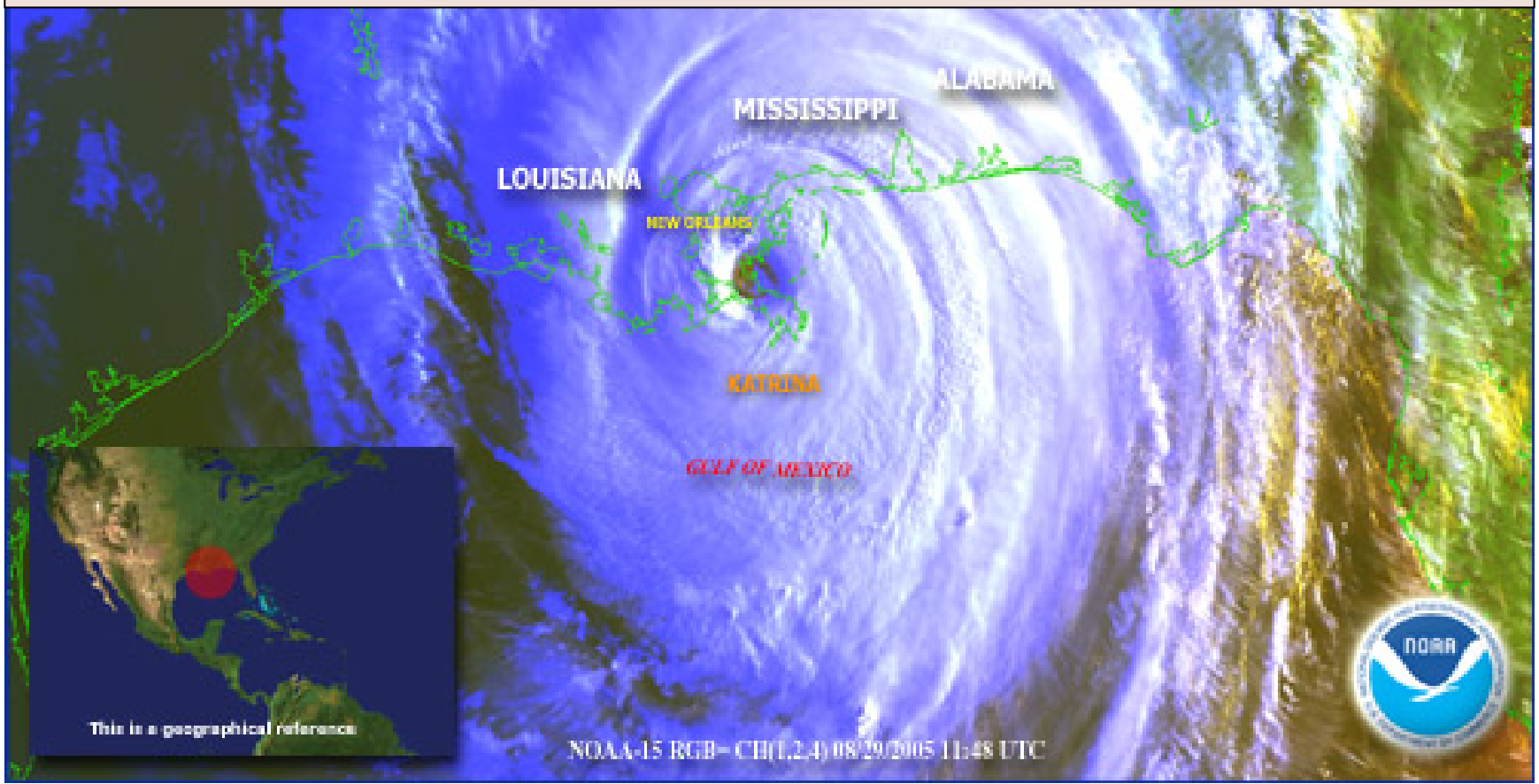
6–8 January 2009

Stephen C. Jones
Geological Survey of Alabama
Geological Investigations Division

Funding: Minerals Management Service/Gulf Coast Hurricane Recovery Initiative



Purpose

The project supports coastal restoration efforts associated with the damages of Hurricanes Katrina and Rita and promotes resource identification and dredging feasibility of federal Outer Continental Shelf sand deposits.

The project will

- compile geotechnical and ancillary data into a GIS interactive mapping system that promotes OCS data and resources,
- provide a tool that further delineates sand resource potential, and
- help minimize data redundancy and unnecessary spending.

Project Objectives

- **Identify and compile all available supporting sand resource and supplementary/ancillary data**

  federal, state, academic, and private sources

- **Construct a comprehensive interactive mapping interface**

  facilitates rapid updating

  promotes data dissemination

  web-deployed guidance tool

- **Develop conclusions and recommendations about sand source potential**

Previous Work—GSA

Hummell, R.L. and W.E. Smith. 1995. Geologic and environmental characterization and near-term lease potential of an offshore sand resource site for use in beach nourishment projects on Dauphin Island, Alabama. Alabama Geological Survey Open-File Report. 193 p.

Hummell, R.L. and W.E. Smith. 1996. Geologic resource delineation and hydrographic characterization of an offshore sand resource site for use in beach nourishment projects on Dauphin Island, Alabama. Alabama Geological Survey Open-File Report. 207 p.

Hummell, R.L. and W.E. Smith. 1998. Geologic resource delineation and hydrographic characterization of an offshore sand resource site for use in beach nourishment projects on Dauphin Island, Alabama. Alabama Geological Survey, unpublished manuscript. 180 p.

Kopaska-Merkel, D.C. and A.K. Rindsberg. 2002. Progress report on analysis of Alabama beach sediment characteristics. In: Natharius, J. A., compiler. 2002. Sand resources and shoreline profile geospatial data and interactive maps, fiscal year 2001/2002 project deliverable for Minerals Management Service cooperative agreement 1435-01-98-CA- 30935. Alabama Geologic Survey Open-File report (on CD-ROM).

Kopaska-Merkel, D.C. and A.K. Rindsberg. 2005. Sand-quality characteristics of Alabama beach sediment, environmental conditions, and comparison to offshore sand resources. Alabama Geologic Survey Open-File Report 0508 (on CD-ROM).

Kopaska-Merkel, D.C. and A.K. Rindsberg. 2006. Sand-quality characteristics of Alabama beach sediment, environmental conditions, and comparison to offshore sand resources. Annual report 2: Alabama Geologic Survey Open-File Report 0607 (on CD-ROM).

Parker, S.J.1990. Assessment of nonhydrocarbon mineral resources in the exclusive economic zone in offshore Alabama. Alabama Geological Survey Circular 147. 73 p.

Parker, S.J., D.J. Davies, and W.E. Smith. 1993. Geological, economic, and environmental characterization of selected near-term leasable offshore sand deposits and competing onshore sources for beach nourishment. Alabama Geological Survey Open-File Report. 284 p.

Parker, S.J., D.J. Davies, and W.E. Smith. 1997. Geological, economic, and environmental characterization of selected near-term leasable offshore sand deposits and competing onshore sources for beach nourishment. Alabama Geological Survey Circular 190.173 p.

Select Related Previous Work

Byrnes, M.R., R.M. Hammer, B.A. Vittor, J.S. Ramsey, D.B. Snyder, K.F. Bosma, J.D. Wood, T.D. Thibaut, and N.W. Phillips. 1999. Environmental survey of identified sand resource areas offshore Alabama: Volume I: Main text; Volume II: Appendices. Herndon, Virginia, U.S. Department of Interior, Minerals Management Service, International Activities and Marine Minerals Division (INTERMAR), OCS Report MMS 99-0052. 326 + 132 p. appendices. http://www.mms.gov/sandandgravel/AlabamaStudies.htm. Accessed 21 March 2005.

Byrnes, M.R., R.M. Hammer, T.D. Thibaut, and D.B. Snyder. 2004. Physical and biological efforts of sand mining, offshore Alabama, U.S.A. Journal of Coastal Research, 20(1):6–24.

Olsen Associates, Inc. 2001. Gulf Shores, Alabama beach restoration project, sand search investigation: Report submitted to the City of Gulf Shores, AL. Olsen Associates, Inc., Jacksonville, Florida. 22 p.

Olsen Associates, Inc. 2003. Orange Beach/Gulf State Park/Gulf Shores Beach restoration project, Baldwin County, AL. Sand search investigation: Report submitted to the City of Orange Beach, Alabama Department of Conservation and Natural Resources and the City of Gulf Shores, AL. Olsen Associates, Inc., Jacksonville, Florida. 47 p.

Olsen Associates, Inc. 2006. Orange Beach/Gulf State Park/Gulf Shores 2006 phase I deep-water sand search, Baldwin County, AL. Report submitted to the City of Orange Beach, Alabama Department of Conservation and Natural Resources and the City of Gulf Shores, AL. Olsen Associates, Inc., Jacksonville, Florida. 59 p.

Areas of Historic Sand Placement

(excluding upland recovery, Perdido Pass maintenance)

Source: Alabama Placement Inventory

Orange Beach/Gulf State Park/Gulf Shores
2005–2006 Beach Restoration Project
≈ 8 million yd^3 and 15.3 miles

"Orange Beach Dune Project"
Unknown quantity 2004

12,000 m^3 ,1991
(Douglass 1994)

140,000 m^3 ,1980
(Douglass 1994)

Gulf Shores Beach Restoration
1,800,000 yd^3, 2001
(Duke PSDS database 2006)

Florida Point Dune Restoration
App 562,000 yd^3, 2004
USACE 2004

Protective Berms
330,000 yd3, 2000
(Trembanie and Pilkey 2000)
562,000 yd3, 2007
(Godsey 2007)

?

West Gulf Shores Emergency Beach Fill
700,000 yd^3, 2003
(Duke PSDS database 2006)

660,000 yd^3 ,1986
(Trembanis and Pilkey 1998)

20,000 yd^3 ,1996
(Trembanis and Pilkey 1998)

The Alabama Sand Island berms
-feeder berm research area
(Hands 1992)

300,000 yd^3, 2002
(Duke PSDS database 2006)

Mobile Outer Mound
17,000,000 yd^3, 1988–1990

Sand Island Bar
464,000 yd^3, 1987

Sand Island Mound

Little Lagoon Pass bypassing
Unknown quantities
1993 (14x),
1995 (7x),
1996 (5x),
1997 (5x)
1998 (6x),
2000 (4x),
2001 (1x)
2002 (1x)
2003 (1x)
2004 (1x)
2005 (1x)
2006 (6x)
2007 (6x)
2008 (6x)
(Calametti 2007)

Perdido Key Beach Nourishment
App 714,000 yd^3, 2004
(Olsen and Associates 2004)

For full citations, see
"Additional References,"
slide 32

Native Beach Characteristics

Range: 0.21 mm–0.46 mm (2.252ø to 1.120ø)

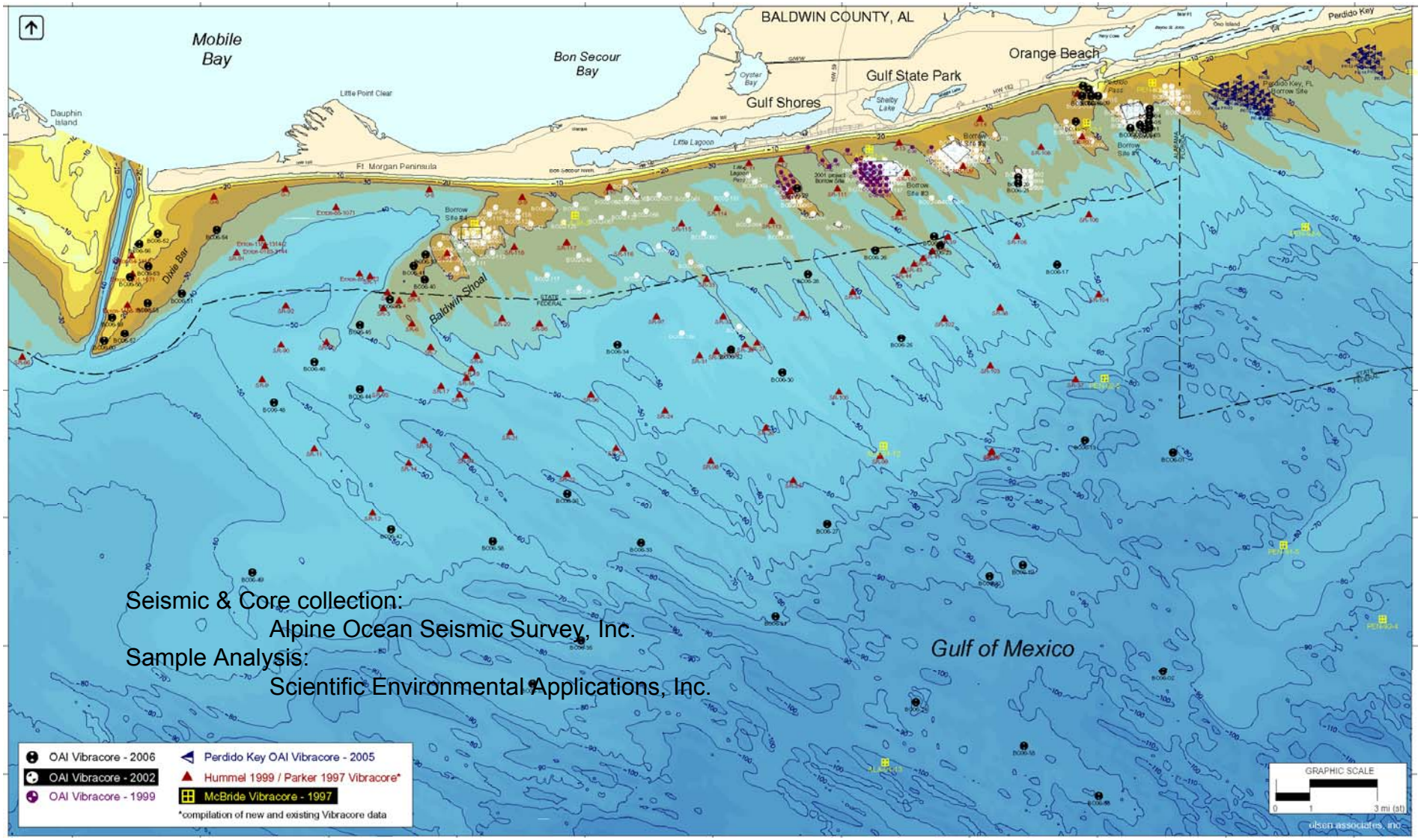
Sorting Coefficient: Well-sorted (0.47ø to 0.50ø)

Shell Content: << 1%

Color: 10YR 9.0/1.0 to 9.0/1.5 (Munsell's nearly Whites)

Orange Beach/Gulf State Park/Gulf Shores 2006 Phase I Sand Search

Olsen Associates, Inc. – Jacksonville, Florida



Orange Beach/Gulf State Park/Gulf Shores 2006 Phase I Sand Search

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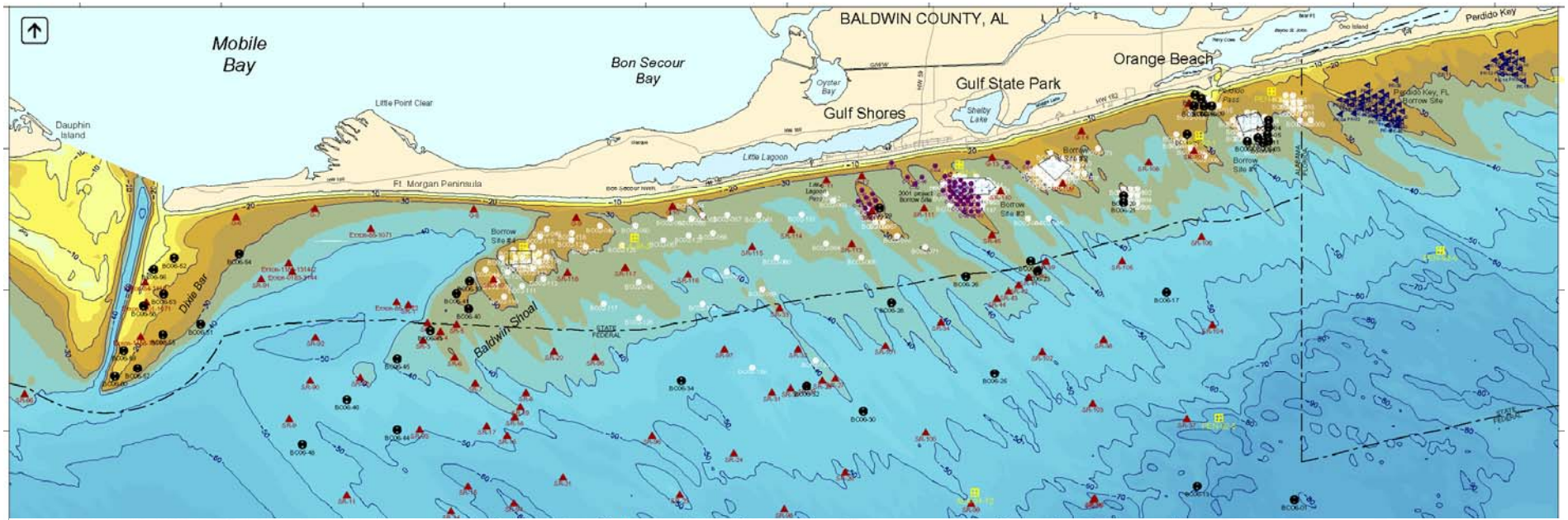

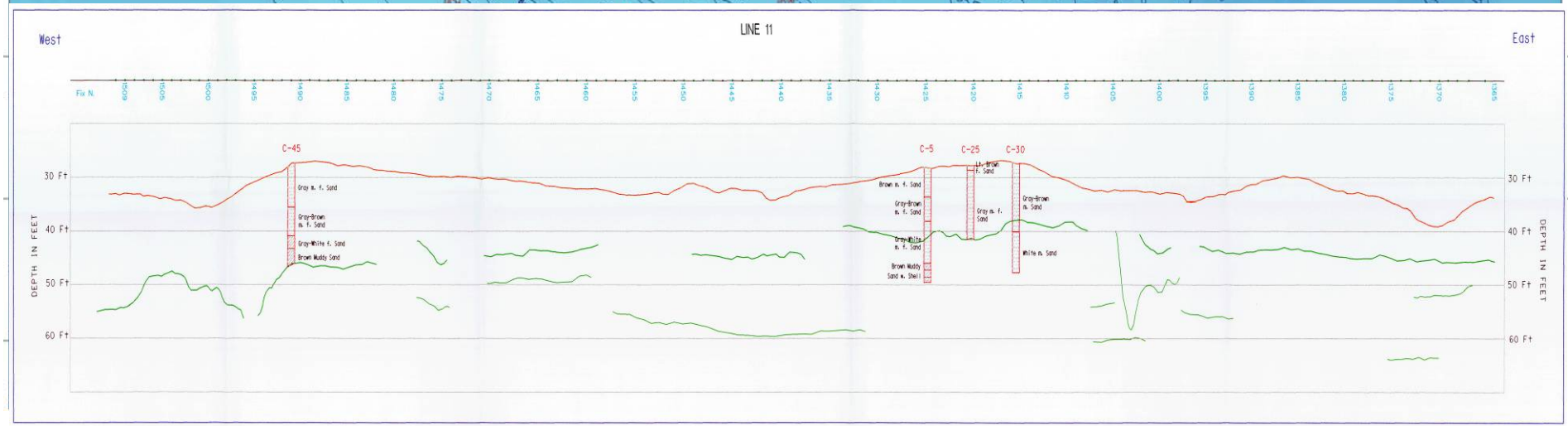

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Orange Beach/(

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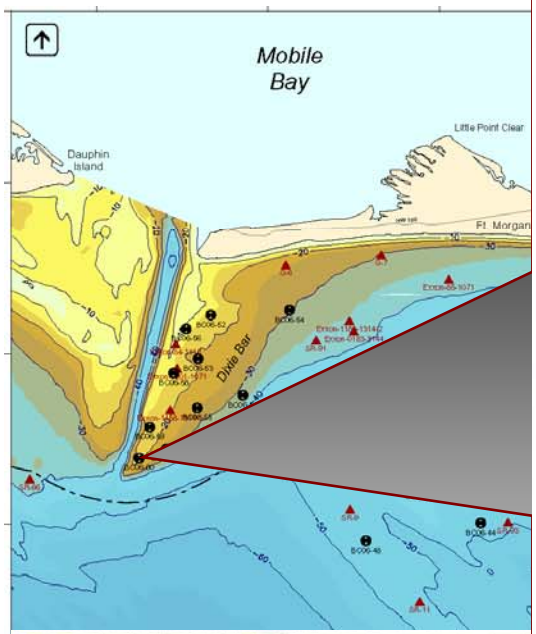
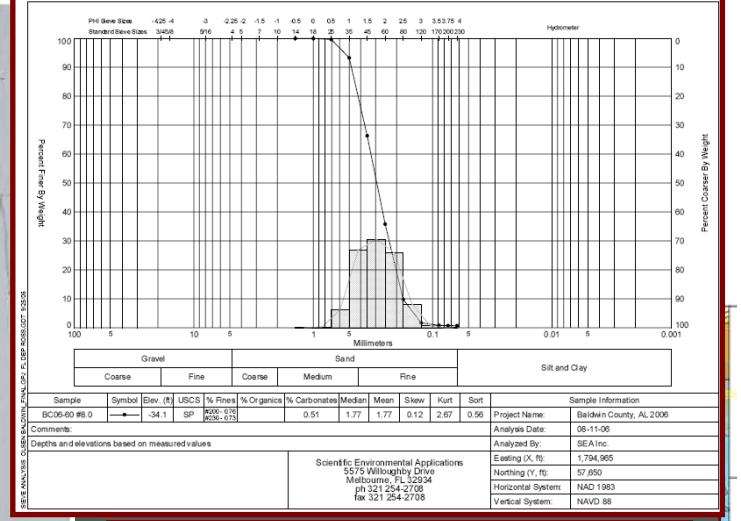
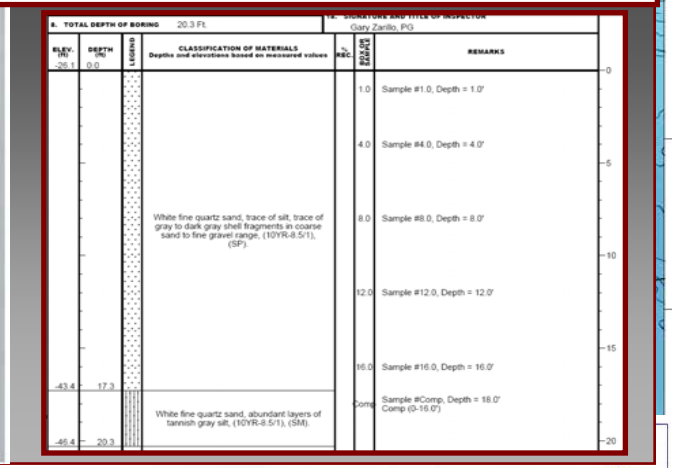






For Alabama beaches, are OCS sand deposits needed in the near future?

Reported:

Within state waters, 1.5–4.9 million yd^3 of sand remains within 3 borrow site permit and design limits

Olsen Associates, Inc. 2006. Orange Beach/Gulf State Park/Gulf Shores 2005–2006 Beach Restoration Project, Baldwin County, AL: Report submitted to the City of Orange Beach, Alabama Department of Conservation and Natural Resources, and the City of Gulf Shores, AL. Olsen Associates, Inc., Jacksonville, Florida. 91 p.

Reported:

Expanding three state water borrow sites " … may yield over 3.0 million cubic yards of sand."

Olsen Associates, Inc. 2006. Orange Beach/Gulf State Park/Gulf Shores 2006 phase I deep-water sand search, Baldwin County, AL: Report submitted to the City of Orange Beach, Alabama Department of Conservation and Natural Resources, and the City of Gulf Shores, AL. Olsen Associates, Inc., Jacksonville, Florida. 59 p.

Consider that 8-million yd^3 of beach quality sand was needed to restore about 15.3 miles of GOM-fronting Baldwin County beaches with a dune and beach berm features.

Geotechnical Data

Sediment Sampling

Parker, S.J., D.J. Davies, and W.E. Smith. 1993. Geological, economic, and environmental characterization of selected near-term leasable offshore sand deposits and competing onshore sources for beach nourishment. Alabama Geological Survey Open-File Report. 284 p.

59 vibracores and Peterson grabs; Positioning LORAN-C

Hummell, R.L. and W.E. Smith. 1995. Geologic and environmental characterization and near-term lease potential of an offshore sand resource site for use in beach nourishment projects on Dauphin Island, Alabama. Alabama Geological Survey Open-File Report. 193 p.

18 vibracores and grabs;

11 foundation borings (Exxon Company, U.S.A);

4 in MMS Study Areas

Hummell, R.L. and Smith, W.E. 1996. Geologic resource delineation and hydrographic characterization of an offshore sand resource site for use in beach nourishment projects on Dauphin Island, Alabama. Alabama Geological Survey Open-File Report. 207 p.

10 vibracores in MMS Study Area 4

Hummell, R.L. 1999.

35 vibracores; 6 within MMS Study Areas

Olsen Associates, Inc. 2003.

160 vibracores;13 collected within MMS Study Areas

Olsen Associates, Inc. 2006.

60 vibracores;12 collected within MMS Study Areas

usSEABED

Geophysical

NOAA NOS

Brande, Scott. 1983.

High resolution, shallow seismic 1980 (USGS cooperative; Minisparker) – data locate unknown

Locker, S.D., K.T. Logue, and L.O. Doyle. 1988.

High resolution (Boomer) – east of MMS Study Area 1

Olsen Associates, Inc. 1999.

High resolution, shallow seismic (Chirp) – MMS Study Area 1 – State water

Olsen Associates, Inc. 2006.

High resolution, shallow seismic (Pinger)

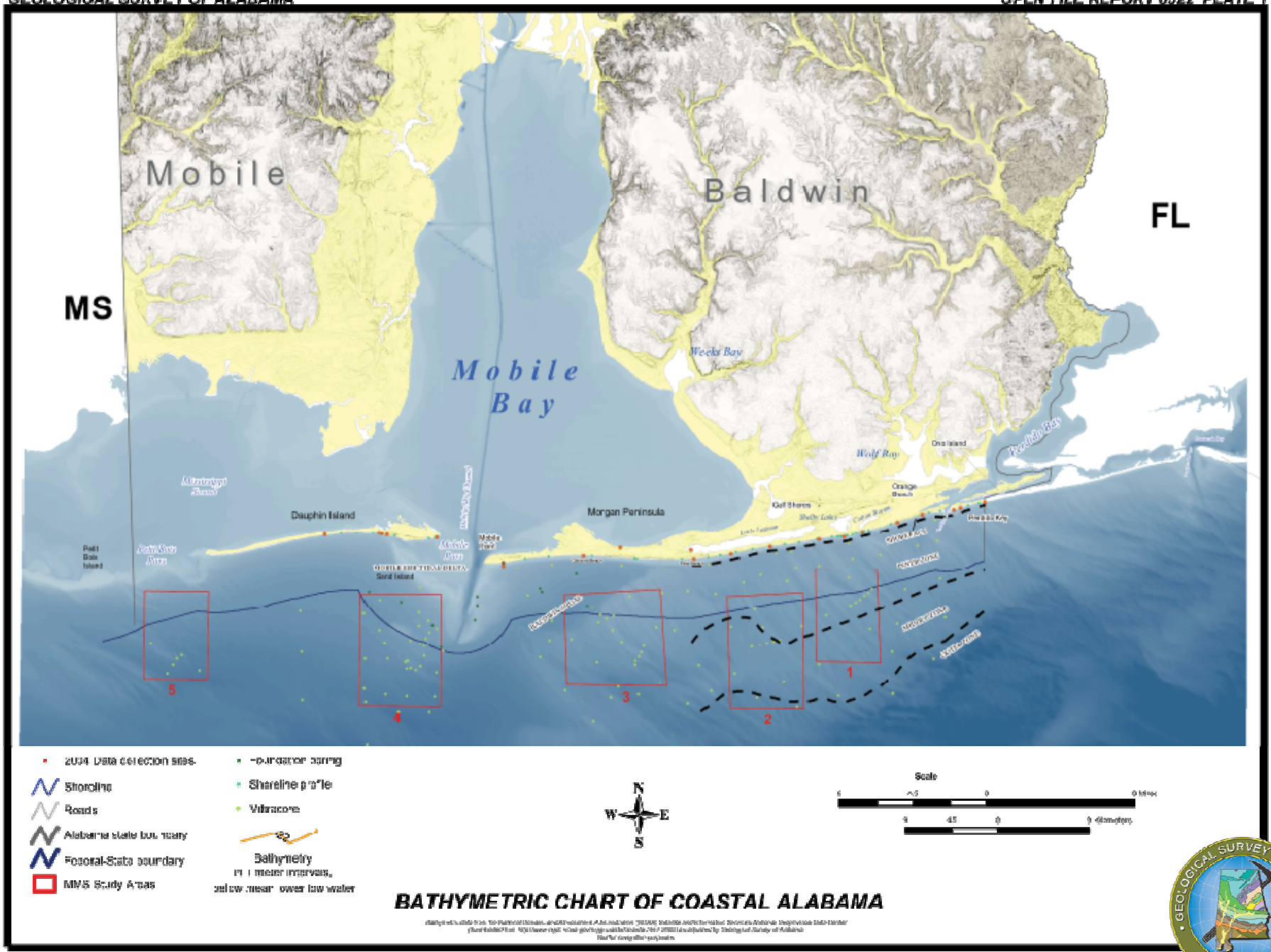
USGS. high resolution, shallow

1981 (81CA1) – Boomer

1981 (81GY6) – Minisparker

1990 (90KI1) – Boomer

1991 (91KI2) – Boomer



BATHYMETRIC CHART OF COASTAL ALABAMA

(Rindsberg, A.K. and D.C. Kopaska-Merkel. 2006. Geological Survey of Alabama. Open File Report 0522.)

Task 1

Data Rescue and GIS Development

resource samples

(sand search cores, bottom grabs, geotechnical borings)

geophysical data

(seismic imagery, track lines, magnetic surveys, shot points, bathymetry)

environmental data

(hydrodynamic data, artificial reefs, study areas, borrow pits, beach restorations)

infrastructure data

(pipelines, lease blocks, boundaries, platforms)

navigational data

(fairways, prohibited areas, marine markers, permit areas, etc.)

geology

(sub-bottom and surficial interpretations, paleo-channel or incised valleys, etc.)

Current Data Index

CATEGORY	SUB-	EXAMPLES
POLITICAL/ADMINISTRATIVE	Study Areas	MMS Study Area delineations
	Federal/State Legislation	NOAA Legislative Atlas data
	Boundaries	Federal districts; Federal/State boundary; Limit of "8(g) Zone"
ENERGY	Management	MMS field units, Federal/State lease blocks, protraction polygons, active lease blocks
	Oil & Gas	Federal/State platforms and pipelines
CULTURAL RESOURCES		archaeology survey spacing requirements
INFRASTRUCTURE		shipping fairways, highways, buoys
CONSERVATION, ENVIRONMENTAL, & ECOLOGY	Hazards	AWOIS, dangers to navigation, NOAA marine debris, military warning and ordnance disposal
	Areas	sand borrow sites, offshore disposal areas, artificial reef permit areas, closed fishing areas
	Studies	Coastal Vulnerability Index, shoreline change rates
	Other	artificial reefs, fish havens, essential fish habitats, oyster reefs, live bottom stipulation blocks
GEOLOGICAL & GEOPHYSICAL	Grab Sampling	ROSS Neogene Study; usSEABED
	Core Sampling	USACE, GSA, Olsen, McBride 1997, usSEABED, DECK41,
	Geophysical	seismic (NOAA NOS, USGS, Olsen, Locker) - tracklines, shotpoints
	Interpreted	sedimentary facies, surface sediment lithology, sand isopach delineations, cross sections
REFERENCE		grids (latitude, longitude), State Plane, geodetic control
BASELAYER		State boundaries, bathymetry, urban areas, hydrography

(DataFinder - Minnesota Geospatial Data Categories and ISO 19115 topic category definitions)

Task 2

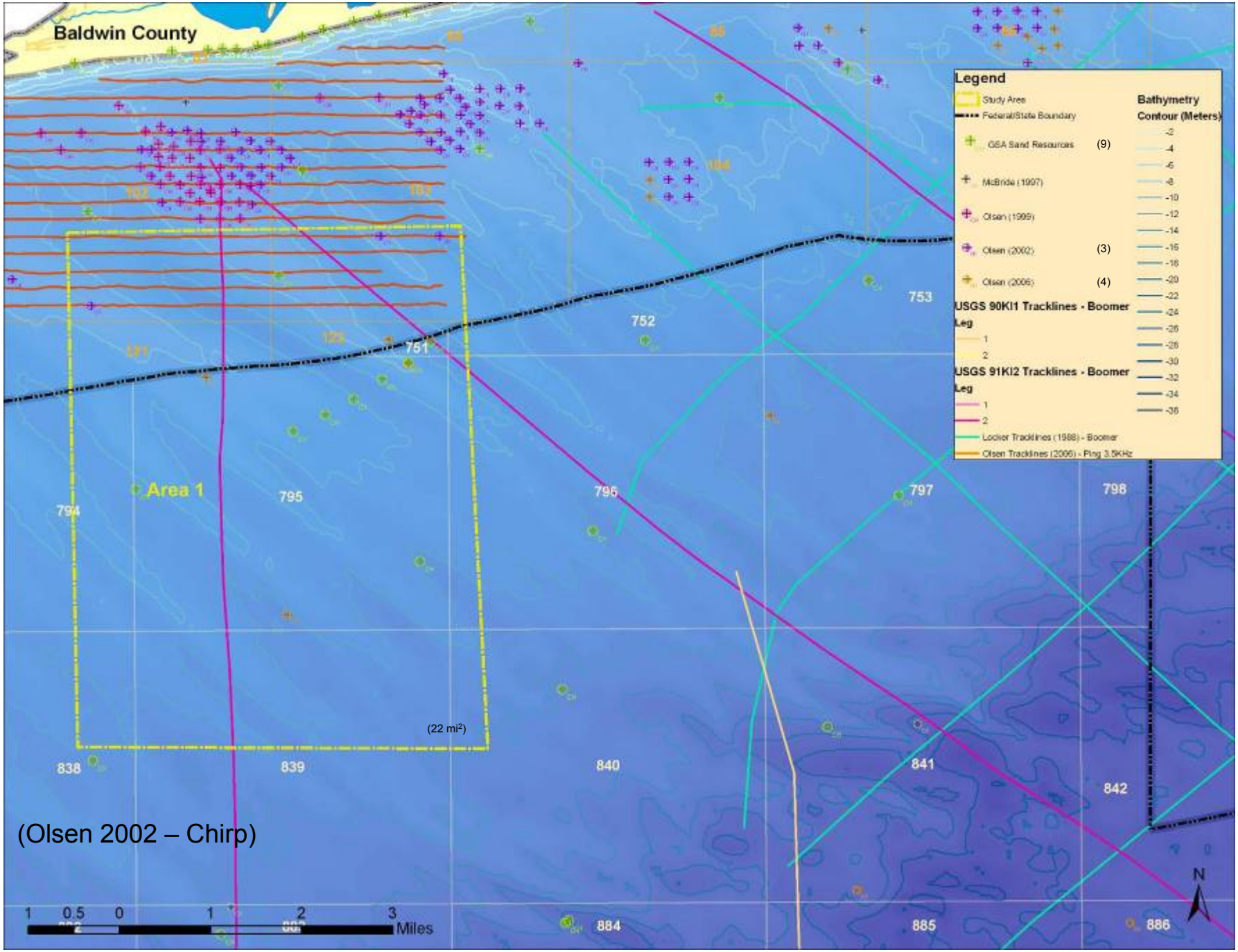
Delineation for borrow site potential

The dataset will be used to delineate borrow site potential within the offshore study areas with considerations to include

- pipeline and platform buffers
- shipping fairways
- various sand resource data
- permit requirements

Generate feasible investigative areas within the five study areas.

Provide a guide for future sand search efforts within and beyond the current study area extents.


Baldwin County
Legend
Study Area
Federal/State Boundary
GSA Sand Resources (9)
McBride (1997)
Olsen (1999)
Olsen (2002) (3)
Olsen (2006) (4)
USGS 90KI1 Tracklines - Boomer
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2
USGS 91KI2 Tracklines - Boomer
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Lockor Tracklines (1988) - Boomer
Olsen Tracklines (2006) - Ping 3.5KHz
Bathymetry
Contour (Meters)
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Area 1
(22 mi²)
(Olsen 2002 – Chirp)
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Miles
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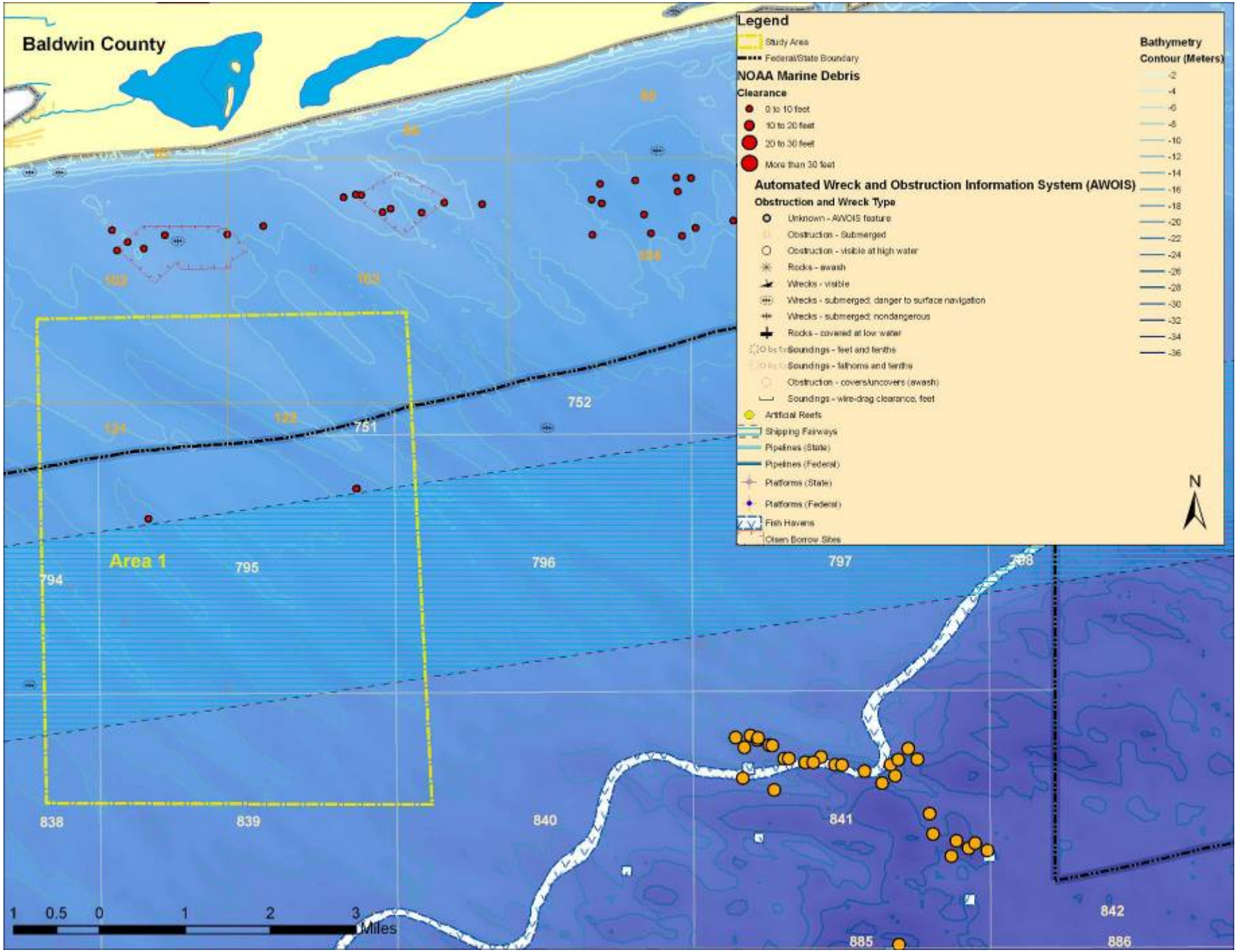
Baldwin County
Legend
Study Area
Federal/State Boundary
NOAA Marine Debris
Clearance
0 to 10 feet
10 to 20 feet
20 to 30 feet
More than 30 feet
Automated Wreck and Obstruction Information System (AWOIS)
Obstruction and Wreck Type
Unknown - AWOIS feature
Obstruction - Submerged
Obstruction - visible at high water
Rocks - awash
Wrecks - visible
Wrecks - submerged; danger to surface navigation
Wrecks - submerged; nondangerous
Rocks - covered at low water
Soundings - feet and tenths
Soundings - fathoms and tenths
Obstruction - covers/uncovers (awash)
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Artificial Reefs
Shipping Fairways
Pipelines (State)
Pipelines (Federal)
Platforms (State)
Platforms (Federal)
Fish Havens
Olsen Borrow Sites
Bathymetry
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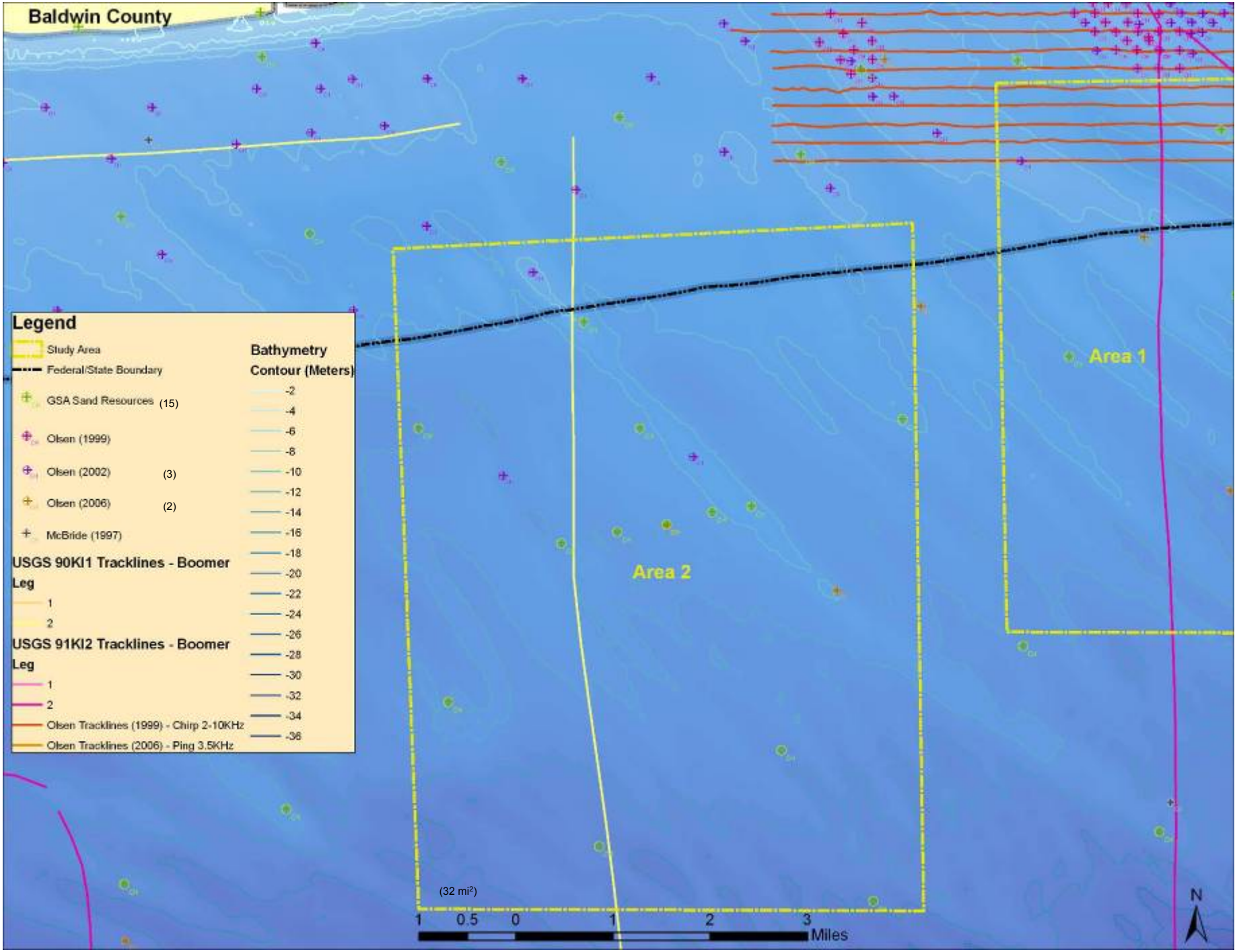
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GSA Sand Resources (15)
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Olsen (2002) (3)
Olsen (2006) (2)
McBride (1997)
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USGS 91KI2 Tracklines - Boomer
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Olsen Tracklines (1999) - Chirp 2-10KHz
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Bathymetry
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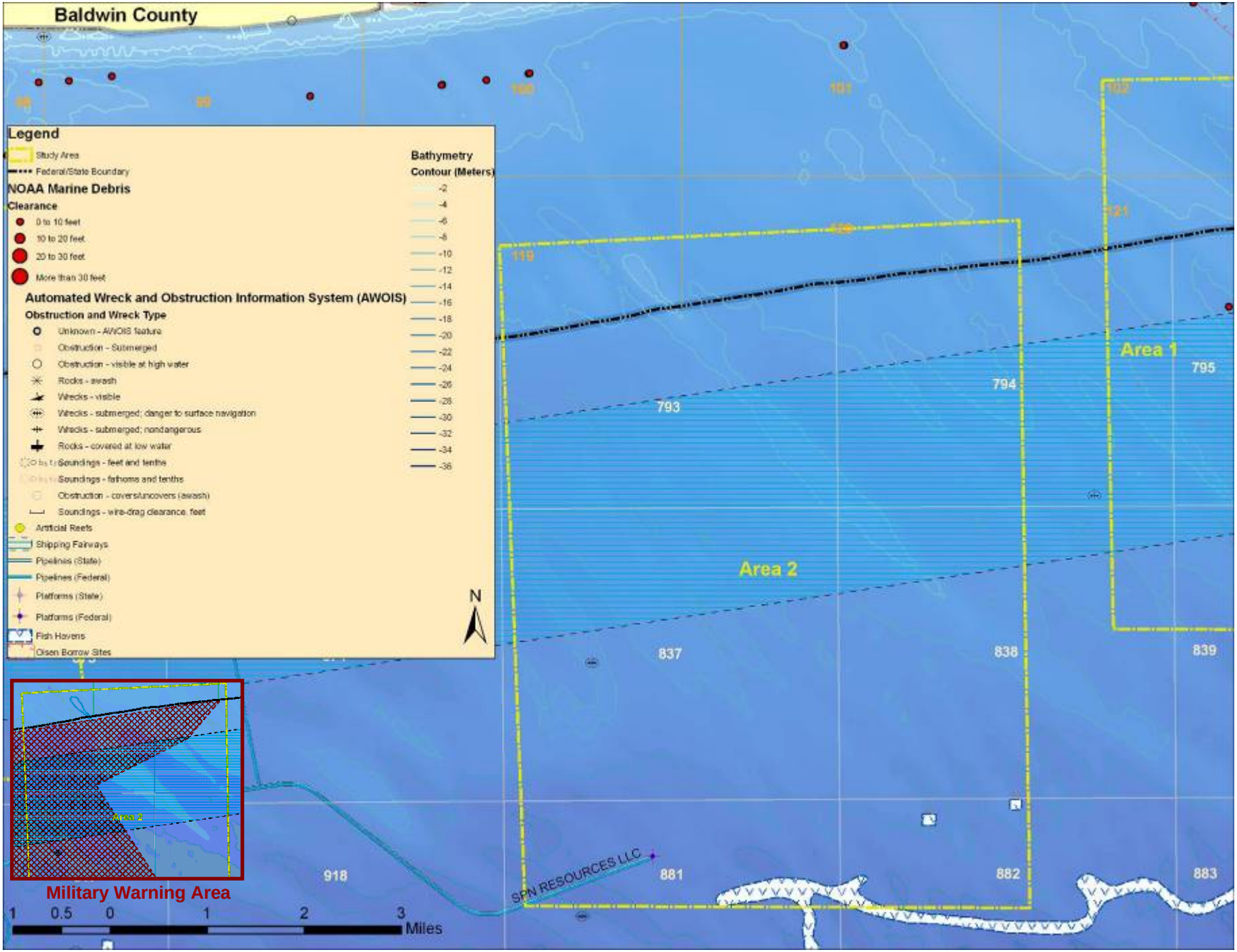
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SPN RESOURCES LLC
Military Warning Area
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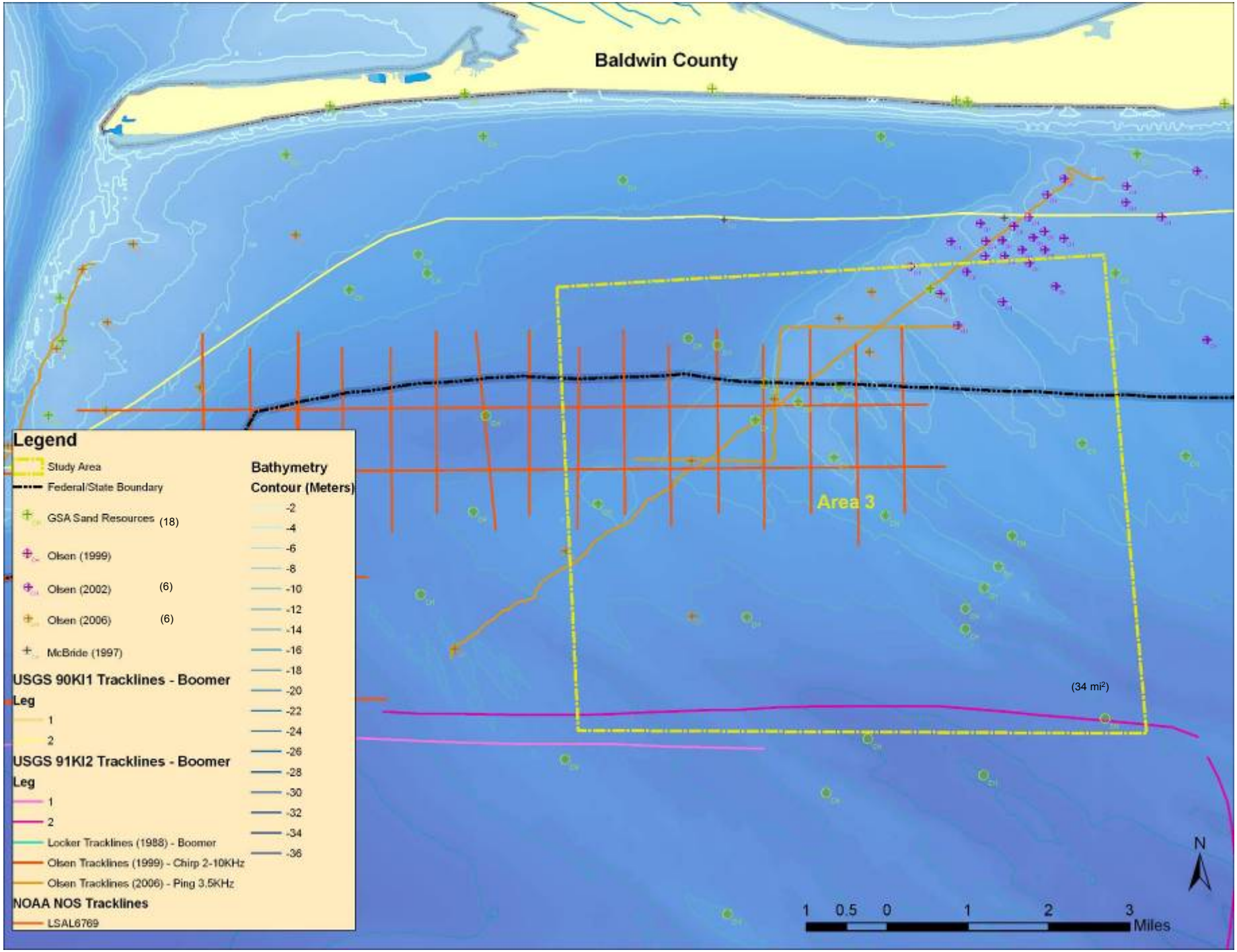
Baldwin County
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(34 mi²)
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Olsen (1999)
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Olsen Tracklines (2006) - Ping 3.5KHz
NOAA NOS Tracklines
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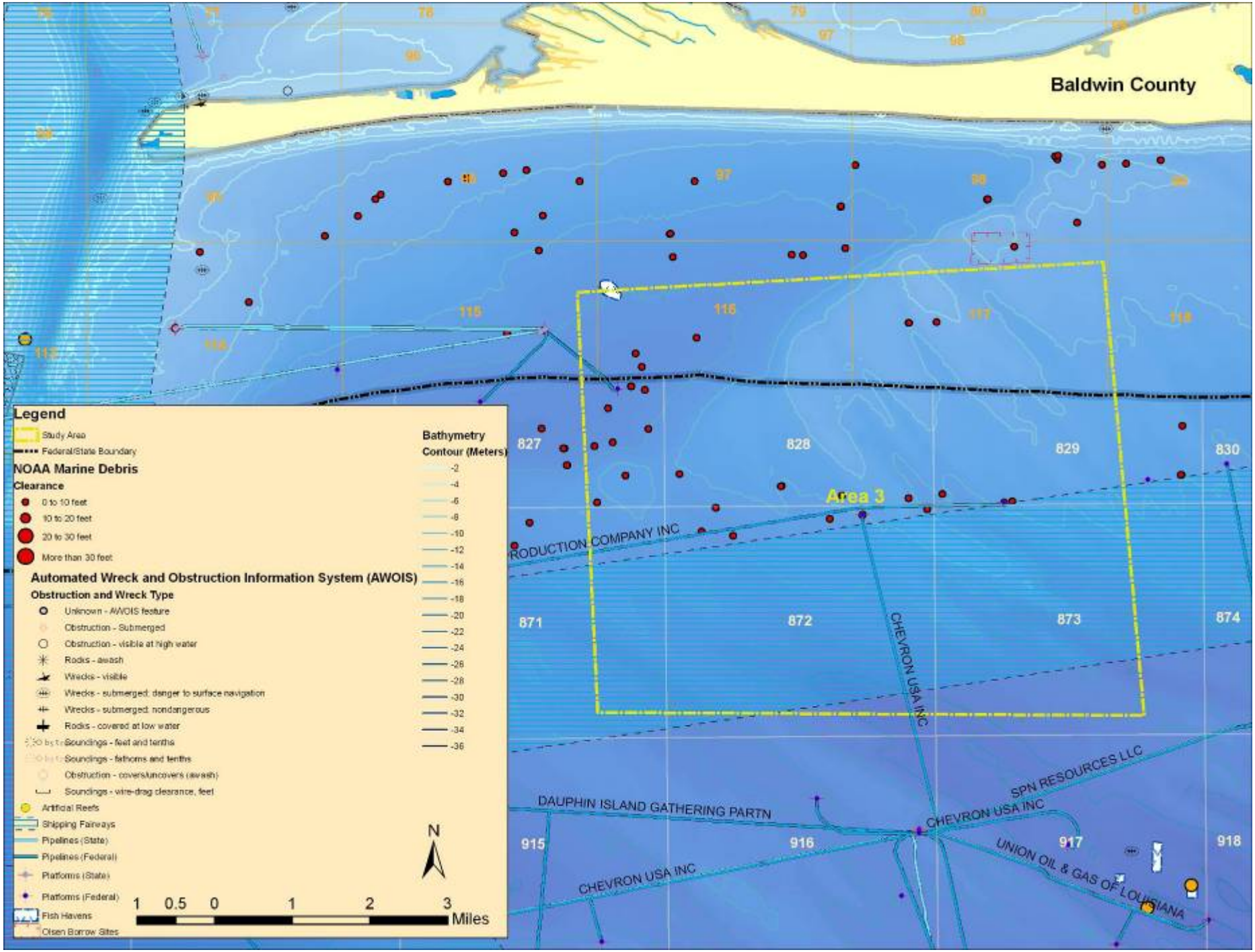
Baldwin County
Area 3
PRODUCTION COMPANY INC
CHEVRON USA INC
DAUPHIN ISLAND GATHERING PARTN
SPN RESOURCES LLC
CHEVRON USA INC
UNION OIL & GAS OF LOUISIANA
CHEVRON USA INC
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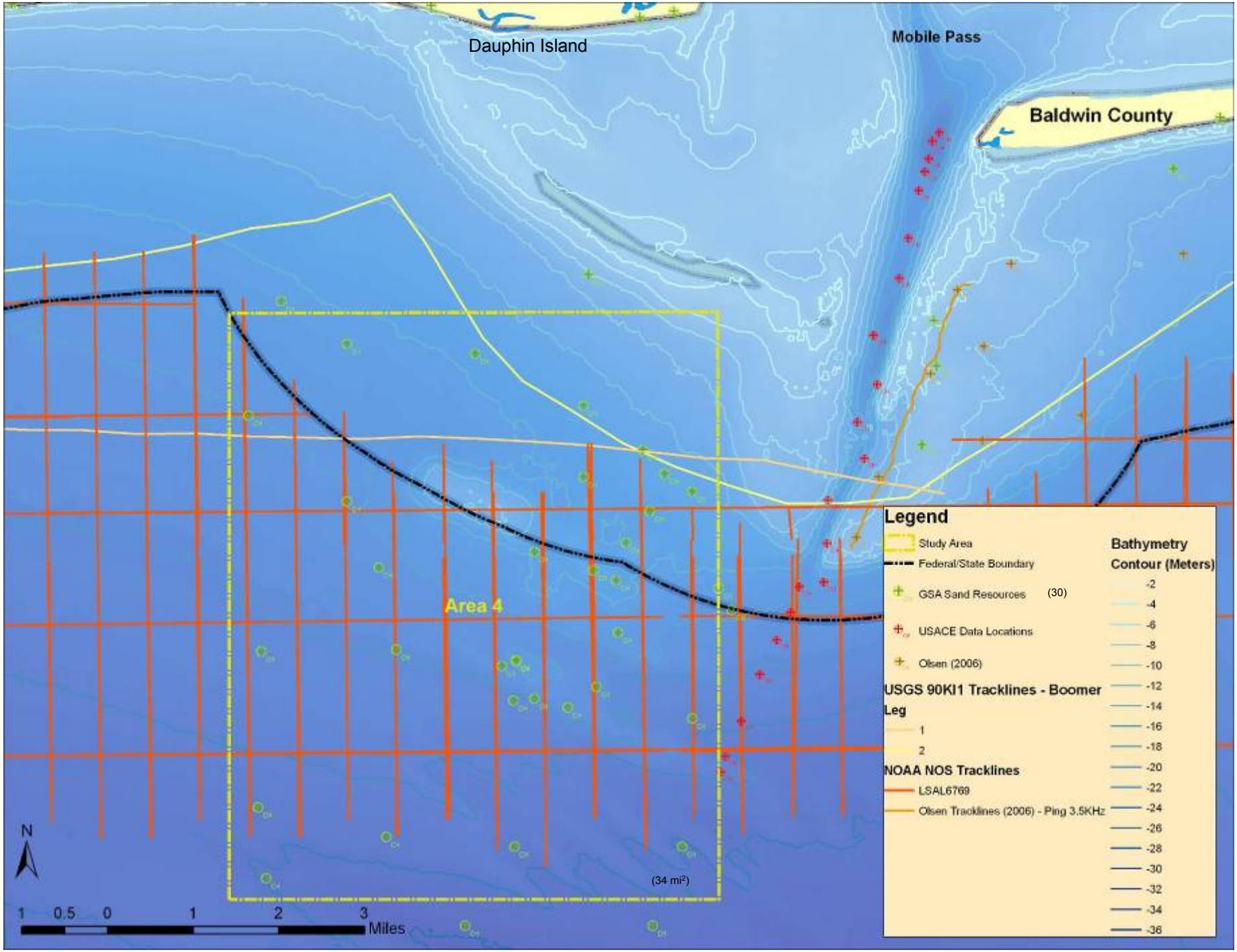
Dauphin Island
Mobile Pass
Baldwin County
Area 4
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Study Area
Federal/State Boundary
GSA Sand Resources (30)
USACE Data Locations
Olsen (2006)
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NOAA NOS Tracklines
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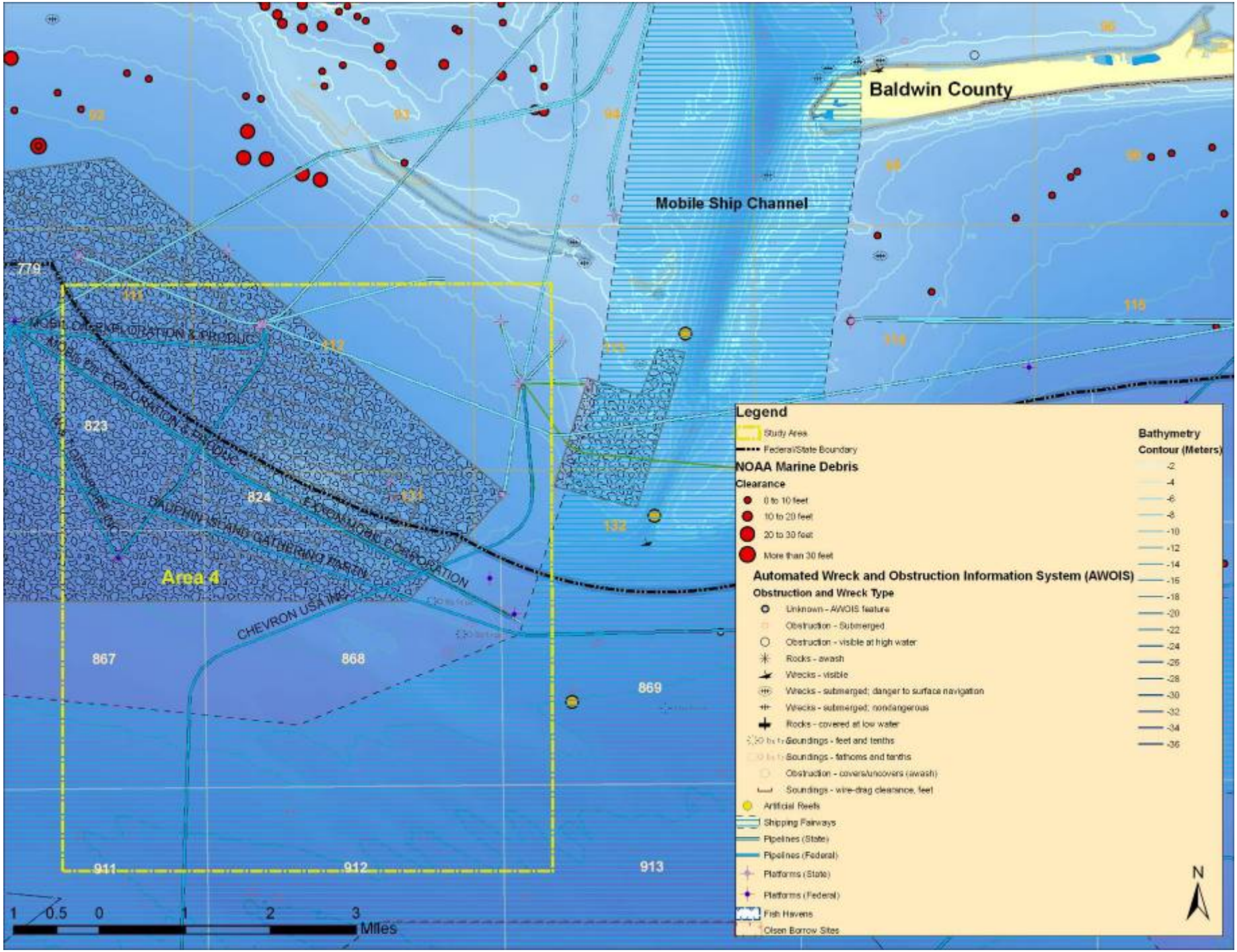
Baldwin County
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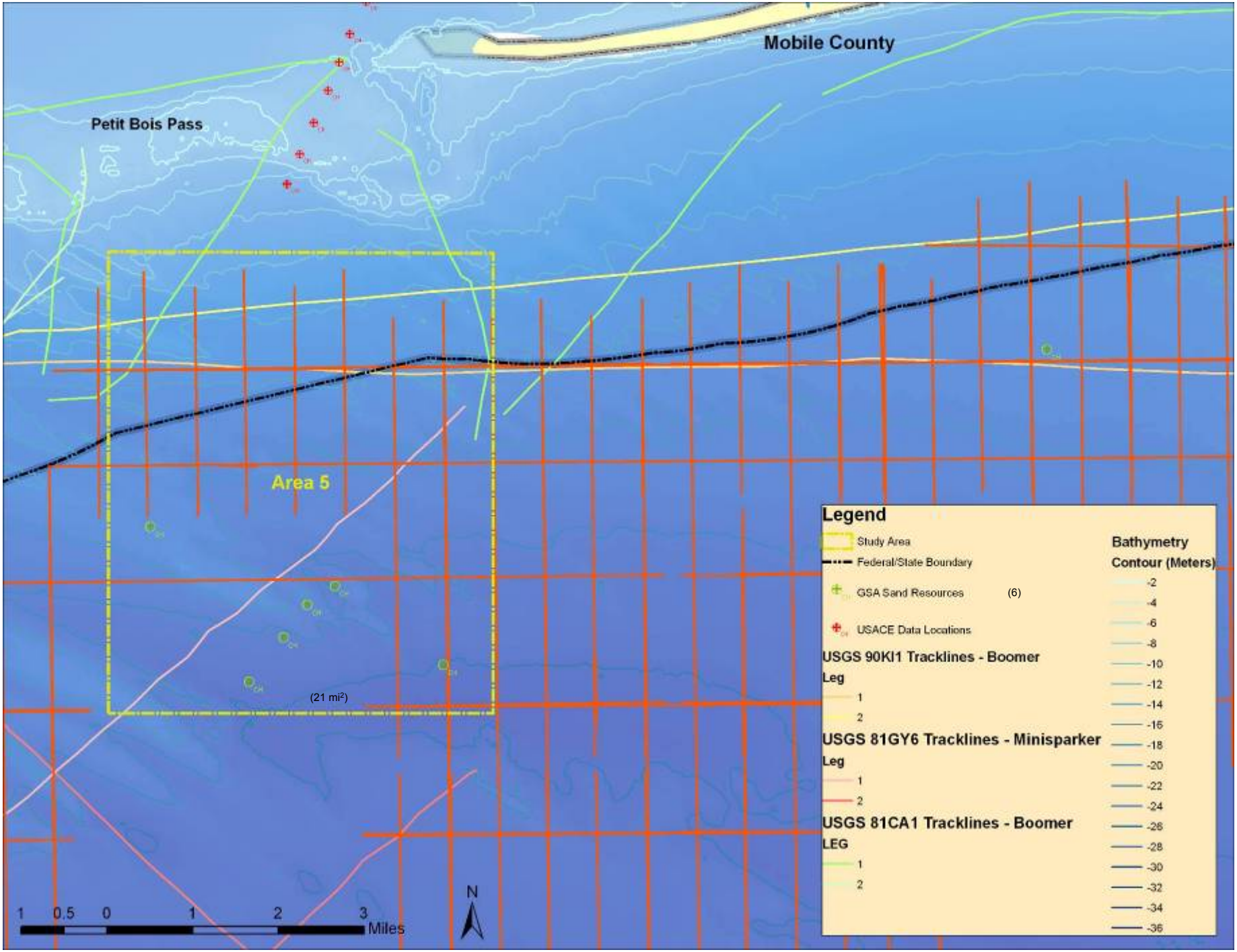
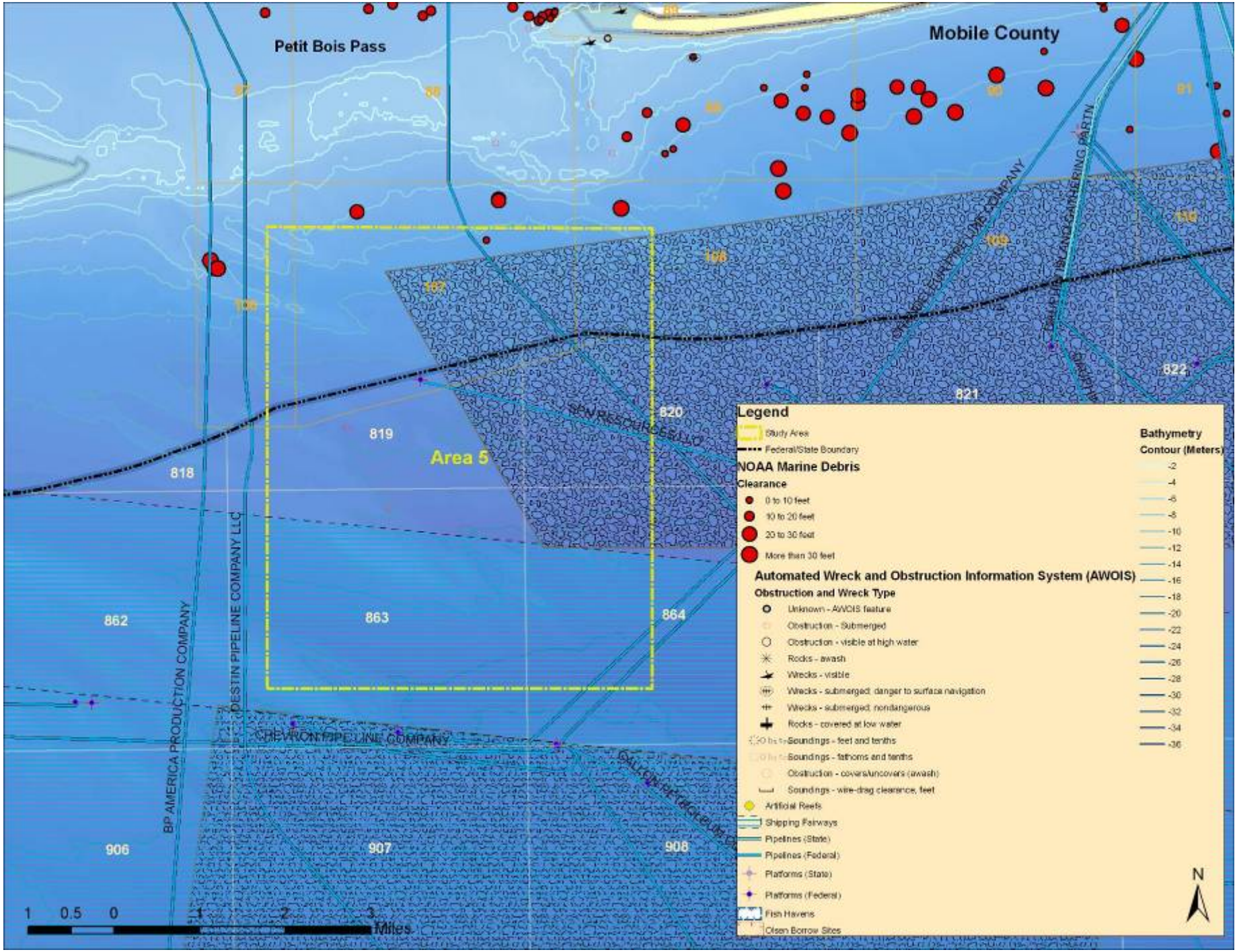
Rocks - covered at low water
Soundings - feet and tenths
Soundings - fathoms and tenths
Obstruction - covers/uncovers (awash)
Soundings - wire-drag clearance, feet
Artificial Reefs
Shipping Fairways
Pipelines (State)
Pipelines (Federal)
Platforms (State)
Platforms (Federal)
Fish Havens
Olsen Borrow Sites
Bathymetry
Contour (Meters)
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
N
1 0.5 0 1 2 3
Miles


Mobile County
Petit Bois Pass
Area 5
(21 mi²)
Legend
Study Area
Federal/State Boundary
GSA Sand Resources (6)
USACE Data Locations
USGS 90KI1 Tracklines - Boomer
Leg
1
2
USGS 81GY6 Tracklines - Minisparker
Leg
1
2
USGS 81CA1 Tracklines - Boomer
LEG
1
2
Bathymetry
Contour (Meters)
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
1 0.5 0 1 2 3
Miles
N


Petit Bois Pass
Mobile County
Area 5
819
820
821
822
818
862
863
864
906
907
908
DESTIN PIPELINE COMPANY LLC
BP AMERICA PRODUCTION COMPANY
CHEVRON PIPE LINE COMPANY
Legend
Study Area
Federal/State Boundary
NOAA Marine Debris
Clearance
0 to 10 feet
10 to 20 feet
20 to 30 feet
More than 30 feet
Automated Wreck and Obstruction Information System (AWOIS)
Obstruction and Wreck Type
Unknown - AWOIS feature
Obstruction - Submerged
Obstruction - visible at high water
Rocks - awash
Wrecks - visible
Wrecks - submerged; danger to surface navigation
Wrecks - submerged; nondangerous
Rocks - covered at low water
Soundings - feet and tenths
Soundings - fathoms and tenths
Obstruction - covers/uncovers (awash)
Soundings - wire-drag clearance, feet
Artificial Reefs
Shipping Fairways
Pipelines (State)
Pipelines (Federal)
Platforms (State)
Platforms (Federal)
Fish Havens
Olsen Borrow Sites
Bathymetry
Contour (Meters)
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-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
N
1 0.5 0 1 2 3
Miles

Task 3

Interactive web development

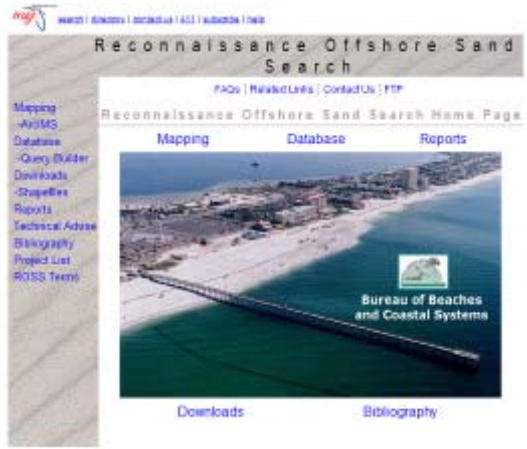
- an online management tool supported with a comprehensive GIS inventory and ancillary data to design a concise physical field acquisition and data analysis program to efficiently manage physical and financial resources.

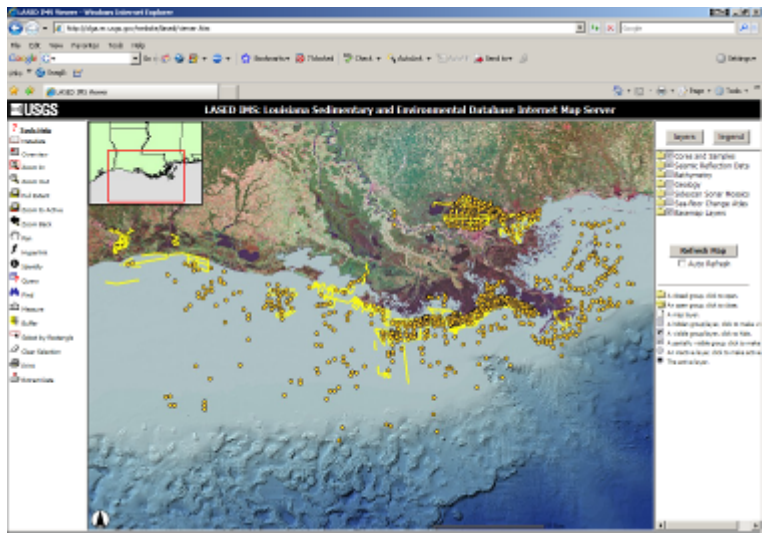
- customized map viewer (ArcGIS Server) directly linked to project GIS data with hyperlinked supporting imagery and data.

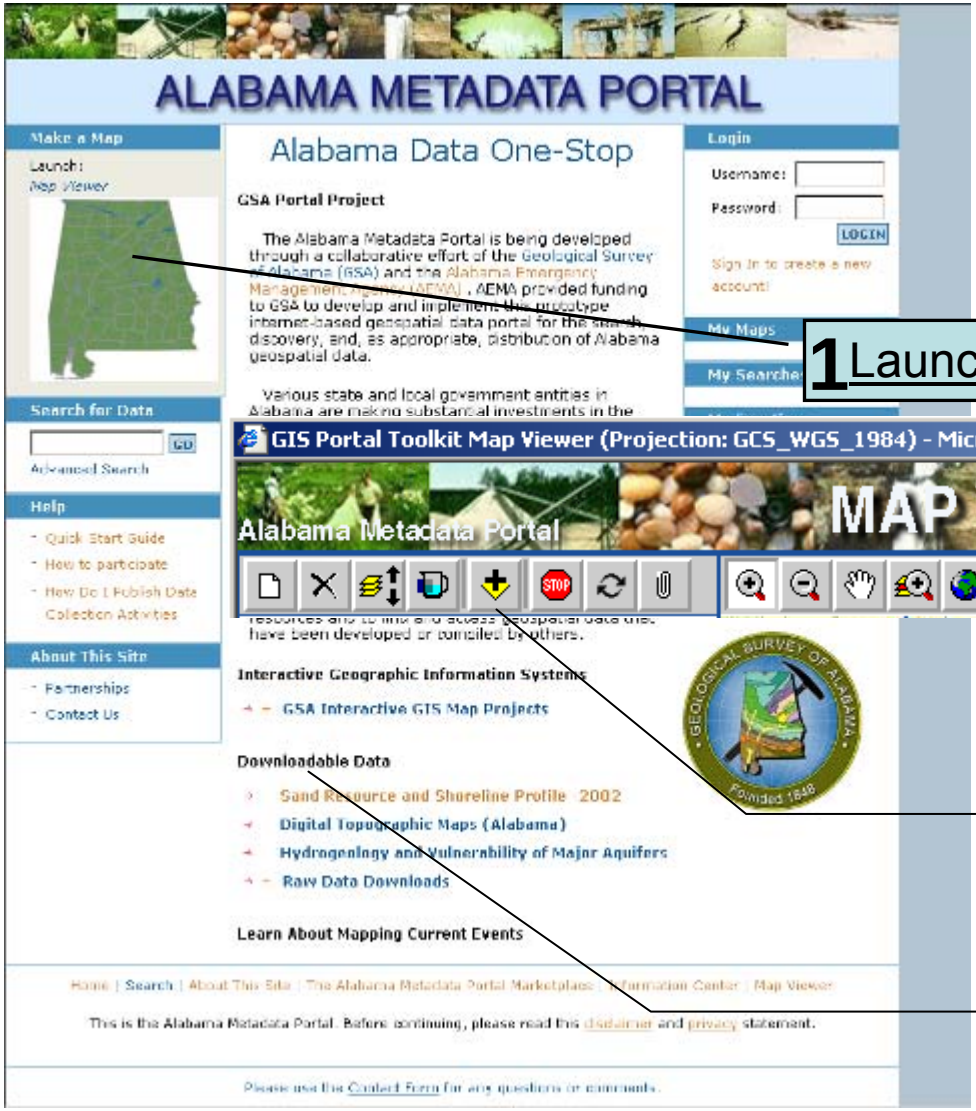
Additional data may include scans, photographs, web links, data sources, and analytical results.

Examples of Guidance Mapping Services:

- Louisiana Sand Resource Database (LASARD) – LSU/LDNR
- Reconnaissance Offshore Sand Search (ROSS) – URS/Bureau of Beaches and Coastal Systems
- Louisiana Sedimentary and Environmental Database (LASED) – USGS
- Sand Search Feasibility Study: Eastern Texas Offshore Geodatabase – Coastal Planning and Engineering







Current access to sand resource and related data is through the "Alabama Metadata Portal"

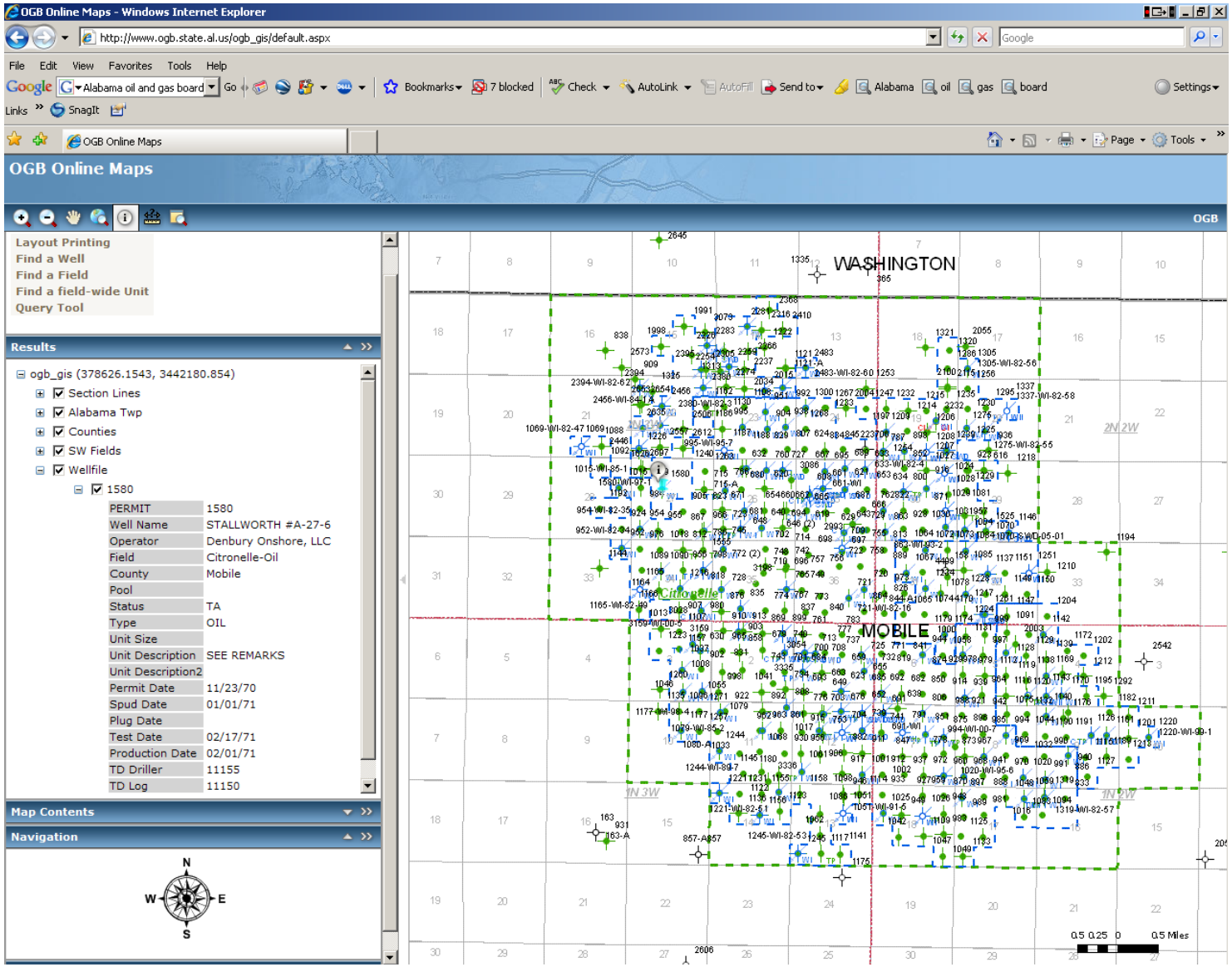
1 Launch map viewer

2 Add service "Sand Resources 2006"

3 Downloadable data "Sand Resource and Shoreline Profile – 2002"

http://portal.gsa.state.al.us/Portal

Web Application: ESRI's ArcGIS Server



Conclusion

- **The GSA is working to compile all identifiable and obtainable offshore data that supports the identification of viable sand borrow sites**
- **Geospatial data, associated geophysical and geotechnical data, and ancillary data will be assessed in a GIS to define the feasibility of borrow sites and their extent within the MMS Study Areas**
- **An interactive web site with an internet mapping service will be developed**
  - **Support this OCS sand investigation to depict data and illustrate opportune areas as determined through GIS analysis**
  - **Promote other research options**
  - **Guide the planning of future sand investigations**
  - **Refine optimal investigation locations**
  - **Support the expansion of identified data to further sand site characterization**
  - **Disseminate historical sand search reports and published map files**
  - **Summarize methods and accomplishments**
  - **Delineate likely areas for sand reserves as determined through GIS analysis**

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