**Deep Water Habitat Mapping and Biological Resource Survey Best Management Practices for Coastal Development Projects in the Southeast Region**
*(July 2012)*

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**Best Management Practices:**

- Compile and summarize existing information from peer-reviewed and gray literature pertaining to the study site of the proposed project. Examples of sources of pertinent existing deep water habitat data include, but are not limited to: National Oceanic and Atmospheric Administration (NOAA) National Geophysical Data Center, NOAA Coastal Services Center, South Atlantic Fishery Management Council (SAFMC), Florida Fish and Wildlife Conservation Commission (FL FWC). The temporal component of past studies should be considered as part of the analysis. Bathymetric data has been demonstrated to change over relatively short time spans (< 1 year), for example from sand burial and uncovering resulting from events such as hurricanes. Deepwater is defined as depths > 40 meters (130 feet).

- Complete a preliminary report that provides information to 1) guide impact minimization and avoidance practices, 2) guide site selection for targeted benthic surveys, and 3) identify areas that require further investigation. This report should include:

    - Assessment of current known characterizations of benthic habitats and geophysical conditions
    - GIS maps created from available information of survey area
    - Describe the habitat types known to be contained within the survey area and include a discussion on the designation of Essential Fish Habitat and Habitat Area of Particular Concern by the South Atlantic Fishery Management Council.

- Consult previous studies and determine a common terminology scheme that will be used for benthic habitat mapping that can incorporate past mapping efforts with new results (from proposed study) to generate a comprehensive map.

    - The *Coastal and Marine Ecological Classification Standard Version 4.0* (CMCES) provides guidelines for determining adequate benthic habitat mapping categories and should be consulted when determining benthic habitat classification schemes. Previous studies conducted in or near the current study area should also be reviewed and assessed to see if they contain a viable classification scheme that can be used (See References

section for example deep water habitat mapping and biological resource surveys conducted in southeast Florida).

- Develop survey methods for geophysical and benthic surveys. Selected methods should take into account findings from the preliminary existing data review report.

    - *Guidelines for Conducting Offshore Benthic Surveys (DEP Office of Intergovernmental Programs Offshore Projects Section)* provides detailed guidelines for developing appropriate protocols for deep water habitat mapping and biological resource surveys, and also includes important federal and state requirements that should be addressed for deep water construction projects. Included within this report are guidelines for both preliminary and focused survey methods (e.g., data to be collected, data collection methods, data analysis, etc.), which have the purpose, "to locate, characterize, and determine the distribution of benthic marine communities in the study areas" (See Appendix 1 for complete document).

    - Dehlsen Associates, LLC. (2012) - *FINAL REPORT – Siting Study for Hydrokinetic Energy Project Located Offshore Southeastern Florida: Protocols for Survey Methodology for Offshore Marine Hyrdokinetic Energy Projects* provides a comprehensive framework and example of an appropriate survey methodology. The report details bottom habitat surveys, geophysical surveys, benthic surveys, data collection, analysis, and result reporting. Also included in the report are important considerations and recommendations for deep water projects (e.g., agency input, etc.).

    - Examples of deep water habitat characterization and mapping efforts for coastal development projects include: Messing et al., 2006a, 2006b, and Reed et al., 2008. A survey methodology is provided in Dehlsen Associates, LLC, (2010; 2012) and an analysis of archived deep water habitat surveys is provide in Reed & Farrington (2010).

- Experienced personnel trained in the methodologies selected for deep water benthic habitat mapping and deep water biological resource surveys should conduct all surveys.

- Technically qualified personnel trained in the survey methods being employed should conduct data collection. Experienced personnel trained in deep water organism and habitat identification should conducted identification and data analyses. All questionable identifications should be reviewed by the Principal Investigator (P.I.). The P.I. or personnel experienced with deep water organism identification should review at least a portion of all results produced as Quality Assurance/Quality Control (QA/QC) measures (10% re-analysis of Coral Point Count image analyses, images for habitat identification and classification, and

organism identification is suggested). The re-reads should be selected blindly so that the original reader is unaware of which tapes will be double read to avoid disproportionate identification effort.

- Equipment selected for gathering data should be accompanied by justification explaining why the equipment is appropriate for the environmental conditions present at the study site. For example: the Television Observed Nautical Grappling System (TONGS) can operate at depths up to 10,000 feet (3,048 meters), in currents in excess of 5 knots, and stay within a 1-m radius of the seafloor (Messing et al., 2006a). If study site conditions exceed the limitations of equipment, appropriate equipment should be selected.

- The area surveyed for benthic habitat mapping and biological resource surveys should include adequate buffers based on previous studies, local characteristics, and previous project results to account for the improper placement and movement of equipment being installed (e.g., cables). The inadequacy of the "Right of Way" rule of allowing ±150 feet (46 meters) on each side of a cable being laid is exemplified by the Columbia-Florida Express (CFX-1 BC1) Telecom Cable (See Reed et al., 2008 for details), which found that the cable deployed had drifted 400 meters (1,312 feet) north of the original deployment location. Based on this finding, projects such as cable deployments should survey large enough areas to ensure that there is an adequate buffer between the deployment site and benthic habitats that are to be avoided. Adequate buffer zones should be determined on a case-by-case basis based on local factors. For example, in areas under the Gulf Stream, it is very unlikely to have drift to the south, therefore it would be reasonable to have a buffer of "x meters" to the south, and a larger buffer to the north (e.g., "3x meters"), as drift in this direction is much more likely.

- Provide NMFS (and other consulting agencies) with draft survey methods for review prior to finalizing the survey plan and conducting field work.

**Minimum Reporting Requirements:** (largely from: *Guidelines for Conducting Offshore Benthic Surveys DEP Office of Intergovernmental Programs Offshore Projects Section)*

- Survey dates
- Location (latitude and longitude)
- Name of person(s) or party conducting survey
- Benthic habitat mapping method selection and justification (including Minimum Mapping Unit justification)
- GIS maps that display areal extent of all benthic habitat types overlaid with:
    - Geophysical information (including bathymetry with isobaths)
    - Geographic coordinates
- Report detailing survey and sample methodologies used to produce GIS maps
- Biological resource survey method selection and justification

- Species inventory of survey area by habitat type
- Quantitative assessment including: species composition and density results for each benthic habitat type
- Habitat assessment (photo/video):
    - Geological conditions for each habitat type (relief and substrate characteristics)
    - Include discussion of other reported literature on benthic communities found in surveys
- Quantify potential areas of each habitat type to be impacted both 1) directly and 2) indirectly by the proposed projects
- Characterize critical benthic marine habitats identified in surveys to delineate areas that may be more vulnerable to impacts

When compiling GIS data, a multi-layer GIS database may be the most beneficial. Such a database can include a layer that meets the minimum reporting requirements, as well as additional layers that may not meet the minimum reporting requirements, but still provide useful information (e.g., to assist in determining confidence in different data sets).

**References:**

Dehlsen & Associates, LLC. 2010. WORK PLAN: Siting Study Framework and Survey Methodology for Marine and Offshore Hydrokinetic Energy Projects in the Atlantic Ocean, Offshore Southeast Florida. 30 pp.

Dehlsen Associates, LLC. 2012. FINAL REPORT: Siting Study for Hydrokinetic Energy Project Located Offshore Southeastern Florida: Protocols for Survey Methodology for Offshore Marine Hyrdokinetic Energy Projects. DOE Grant Award Number: DE-EE0002655.000. 93 pp.

Messing, C.G., Walker, B.K., Dodge, R.E., Reed, J., & Brooke, S.D. 2006a. Calypso LNG Deepwater Port Project, Marine Benthic Video Survey. Final Report submitted to: Ecology and Environment, Inc. & SUEZ Energy North America, Inc. 62 pp.

Messing, C.G., Walker, B.K., Dodge, R.E., & Reed, J. 2006b. Calypso U.S. Pipeline, LLC, Mile Post (MP) 31- MP 0 Deep-water Marine Benthic Video Survey. Final Report submitted to: Calypso U.S. Pipeline, LLC. 64 pp.

Reed, J.K., Duncan, L., & Furman, B. 2008. Results of the deep-water benthic video survey of the Colombia-Florida Express 1 (CFX-1 BC-1) Telecom Cable Route. Characterization of benthic habitat and biota with documentation of hard/live bottom habitat along the CFX-1 cable route within U.S. Federal waters from the Florida State 3-nm boundary to the U.S.-Bahamas EEZ boundary off eastern Florida. HBOI Technical Report Number 108. 60 pp.

Reed, J. & Farrington, S. 2010. Distribution of Deep-water Commercial Fisheries Species-Golden Crab, Tilefish, Royal Red Shrimp- in Deep-water Habitats off Eastern Florida from Submersible and ROV Dives. 81 pp.

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## Appendices:

**Appendix 1: "***Guidelines for Conducting Offshore Benthic Surveys DEP Office of Intergovernmental Programs Offshore Projects Section Updated March 2006"*

The intent of these guidelines is to provide applicants with a general description of the information necessary to accurately assess the impacts of projects proposed offshore of Florida. Because each project and its resulting impacts to resources may differ, necessary project-specific information or methods for collecting information may vary. The Department encourages applicants to work with staff in the early stages of project development to ensure that adequate information is collected and analyzed in reports. This will help to facilitate efficient and timely reviews by the state and avoid the necessity of conducting additional surveys.

*Background*
Live-bottom habitats are the foundation of the marine ecosystem of the Florida shelf, supporting fisheries, marine fauna and recreational activities. Hard or rocky live-bottom is especially important because its structure provides a stable substrate on which biological communities flourish, thereby attracting associated organisms. These habitats and their associated communities generally occur in clear, clean waters and contribute to the maintenance of water quality. Federal law describes this resource as "Essential Fish Habitat" for many marine species, including those found in Florida waters.

The potential for impacts to these important habitats in coastal and offshore waters is a major concern of the state. Avoiding impact to these communities is the preferred way to protect them. If avoidance is not possible, then actions that minimize impacts are required. As a last resort, where impacts to habitat cannot be avoided, mitigation is necessary.

*General*
Surveys conducted in both state and federal offshore waters should provide complete geophysical and biological characterization of the seabed and associated benthic communities potentially affected by installation and operational activities. Survey protocols should incorporate, as appropriate, the Minerals Management Service's requirements for outer continental shelf oil and gas exploration/development under 30 CFR 250 and described in detail in Notices to Lessees (1) No. 2005-G07, Archeological Resource Surveys and Reports; (2) No. 98-20 Shallow Hazards Requirements; (3) No. 2004-G05, Biologically Sensitive Areas of the Gulf of Mexico (see especially Live

bottom Low Relief Features); and (4) No. 2003-G17, Guidelines for Submitting Exploration Plans and Development Operations Coordination Documents. The following guidelines are derived from these sources, previous experience, the requirements of the state of Florida's federal consistency review and some elements of the environmental resource permit review.

The footprint of the project includes all areas directly affected by the project, such as: bottom areas contacted by structures, anchors, cables; the construction swath for pipeline entrenchment; and associated impacts occurring in adjacent areas due to bottom disturbance, sedimentation, and anchor placement and cable sweep of pipelay barges and support vessels. In cases where project footprint details are not yet known (e.g., installation methodology has not been determined)surveys should cover the area corresponding to the project design with the greatest areal impacts (i.e., worst-case). The state encourages the use of construction methodologies that minimize benthic and water column impacts. Should significant live/hard-bottom communities be encountered at a preferred site or along a preferred route, alternative locations should be surveyed.

Companies may wish to consider using a phased approach, beginning with qualitative video reconnaissance surveys to scope broad areas and eliminate unsatisfactory locations, followed by more detailed qualitative and quantitative investigations at preferred locations. Ongoing consultation with state and federal resource agencies throughout this process will ensure a final site location that fully minimizes impacts to resources.

*Geophysical*
Survey components include: bathymetry (multibeam quality); high-resolution side scan sonar; subbottom profiling; cores; magnetometer; surficial sediment quality, percent fines and grain size analysis. Collectively, the information from these surveys should provide complete geophysical characterizations of the surface and subsurface geology in the areas affected by the project. Core and sediment samples should be of sufficient number and distribution to allow statistically reliable and valid interpretations throughout the area affected by the project.

All geophysical information should be displayed on a detailed map at an appropriate scale showing the preferred project location, alternative locations and routes surveyed, and the related construction impact zones. A depiction of the subbottom trace should be displayed adjacent to the plan view, at the same scale. The locations of all geologic and photographic sampling stations should be indicated on the map. Because it provides highly useful comparative information, a composite map that displays the interpreted geological and biological information together is required. All maps should display geographic coordinates and fix points so that locations in the survey area can be easily associated with photographic information.

*Biological*
Biological surveys include precise mapping and characterization of benthic habitats using high- resolution video photography and color still photography taken close to the seafloor in areas which will be directly (e.g., anchoring, trenching) or indirectly (e.g.,

sedimentation) impacted by the proposed project. Video and still photography together should allow not only presence/absence mapping of habitats and communities by type, but also quantitative interpretations of species composition and densities. Accurate benthic characterization should include a description of sediment types, organisms identified to the lowest practicable taxonomic level (species if possible) and percent cover of identified species. The number and spacing of video tracks should be sufficient to provide accurate documentation of the presence/absence and general characterization of each habitat/community type encountered. For linear projects, complete video surveys should be conducted from the shoreline to at least a depth of 200m. Video surveys beyond 200m may be necessary for all types of projects where geophysical data indicate hard/live bottom may exist. Where significant live/hard-bottom areas are found, the video record should be augmented with additional tracks, extending outward from the center line in the proper direction and in sufficient numbers to accurately document the full extent of the trend. In shallow waters, photographic surveys may be collected by divers.

For those surveys conducted from a vessel, all videos should be operated with a surface monitor and recorder, preferably with an audio track on which navigation fix points are indicated. Regardless of the collection method, videos should also be annotated with date, time, and geographic coordinates (state plane or lat/long) that are clearly legible on the video monitor. Graphic coordinate annotations should also be depicted on project maps so that features on the map can be easily located and inspected on the video record. Video surveys should be conducted under the proper conditions of tow speed, water clarity and height above the bottom to enhance the reviewers' ability to determine presence/absence and characterize the communities present.

Qualitative and quantitative still photographs should be taken throughout the survey area, illustrating typical assemblages and densities of all epibenthic habitats encountered. Quantitative photography stations should be located in representative depth ranges and epibenthic habitat types. It is anticipated that a minimum of 100 quantitative photographs will be necessary to provide sufficient data for the proper characterization of each benthic community type. Quantitative assessments should be based on species counts obtained by analyzing a statistically sufficient number of photographs encompassing a standard surface area (e.g., 0.5 meter squared) at each habitat being surveyed. Quantitative and qualitative photos should be taken from a camera with surface control capability that is mounted with the video camera.

*Reports*

Using photographic and geophysical information collected in the surveys, maps should be prepared displaying the areal extent of all habitat types overlaid with geophysical information, including bathymetry with isobaths at appropriate intervals (e.g., 1, 2, or 5 meters), and geographic coordinates. A benthic habitat survey report should be prepared to describe in detail the survey and sampling methodologies used to produce the maps. The report should include species lists and the results of the quantitative assessment of species composition and density in live-bottom areas. Using the video and still photography, both soft (sand veneer) and hard/live bottom communities should be characterized. Habitat assessments should describe the geologic conditions, such as relief

and substrate characteristics, associated with each habitat type. The report should also include a discussion of published and unpublished literature describing benthic communities, both hard and soft bottoms, on the Florida shelf and a comparison of survey results with information found in the literature.

The report should also quantify the potential acreage of each substrate and habitat type that would be directly and indirectly impacted by the proposed project. These estimates should account for a range of construction options if the precise method of construction, installation, anchor handling, etc. is not known.

*Electronic Submission of Geophysical and Biological Data*
Geophysical and biological data should be submitted on CD to the Department in either AutoCad or Arc compatible forms. Data should be recorded using the following formats:

*All location data in decimal degrees to 6 places.*
Longitude expressed as a decimal (regardless of coordinate system) Longitude field name: lon_dd Latitude field name: lat_dd

*Projections*:
Here is an example to UTM Zone 17N NAD_1983_UTM-Zone17N Projection:
Transverse_Mercator Parameters:
False_Easting: 500000.000000
False_Northing: 0.000000
Central_Meridian: -81.000000
Scale_Factor: 0.999600
Latitude_Of_Origin: 0.000000
Linear Unit: Meter (1.000000)
Geographic Coordinate System: Name: GCS_North_American_1983
Angular Unit: Degree (0.0174532925199433295)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.000000000000000000
Semiminor Axis: 6356752.314140356100000000
Inverse Flattening: 298.257222101000020000

*If Albers projection is used:*
False_Easting: 400000.000000
False_Northing: 0.000000
Central_Meridian: -84.000000
Standard_Parallel_1: 24.000000
Standard_Parallel_2: 31.500000
Latitude_Of_Origin: 24.000000
GCS_North_American_1983
Datum: D_North_American_1983
Prime Meridian: 0

**Appendix 2:** *"9.10 Summary of Offshore Survey Protocols for Facility Siting" text directly from page 80 of Dehlsen Associates, LLC (2012)*

### *9.10 Summary of Offshore Survey Protocols for Facility Siting*

In general, high-resolution multibeam or side-scan sonar surveys followed by high-resolution video and digital still camera transects will assist with site selection in order to avoid or minimize impact to hard-bottom habitats. If potential hard-bottom is present and unavoidable, potential impacts at the proposed site may require mitigation measures and alternative site surveys may be surveyed.

1) Evaluate existing data (i.e., geophysical, biological, archeological) in the areas of interest prior to the initial planning of geophysical and benthic video/photographic survey activities.
2) Early agency and stakeholder consultation.
3) Conduct high-resolution multibeam or side-scan sonar survey to assist with site selection in order to avoid or minimize impact to possible hard-bottom habitat.
4) Evaluate alternative sites if unavoidable impacts are likely at proposed site.
5) Survey proposed and alternative sites with high-resolution video and digital still cameras. Transect spacing of the video/photographic surveys may require approval by various agencies and may include offsets of ±300 m for cable routes in areas of potential hard-bottom habitat and 1-nmi x 1-nmi grids around turbine or other fixed facility sites.
6) A biologist knowledgeable in the regional deep-water fauna should provide descriptions of the habitat and biota on the videotape during the survey; these data must be georeferenced and entered into and Excel spreadsheet or Access database.
7) Still images should be captured at 5-10-min intervals while over sediment habitat and continuously over all hard-bottom habitat (no less than 3-4$m^{-1}$).
8) Images must be georeferenced and stored in digital format for analysis.
9) Digital still images should be analyzed using CPCe software (or similar) to determine percent cover of hard bottom substrates and major taxonomic groups in areas of biological interest.
10) Images should be analyzed in greater detail to determine faunal composition and organism densities in areas of biological interest.
11) Field notes and video/photo data should be reviewed and summarized to identify habitats and faunal distributions.
12) Summaries should be complied in GIS format and used to produce habitat maps.