

MONITORING STANDARDS FOR BEACH EROSION CONTROL PROJECTS

May 2014

Edited: October 2014



Division of Water Resource Management
Department of Environmental Protection
State of Florida

**MONITORING STANDARDS
FOR
BEACH EROSION CONTROL PROJECTS**

TABLE OF CONTENTS

<u>Introduction</u>	3
01000 - <u>Beach Profile Topographic Surveying</u>	6
01100 - <u>Offshore Profile Surveying</u>	13
01200 - <u>Borrow Site, Shoal and Other Bathymetric Surveying</u>	19
02000 - <u>Aerial Photography</u>	25
02100 - <u>Environmental Aerial Photography</u>	32
<u>Appendix A – Monument Information Report</u>	38

MONITORING STANDARDS FOR BEACH EROSION CONTROL PROJECTS

INTRODUCTION

1.0 Background

The Division of Water Resource Management within the Florida Department of Environmental Protection (FDEP) has an extensive history of coastal data acquisition along Florida's sandy coastal shores, dating back to the early 1970's. Initial data acquisition was primarily conducted to support the coastal construction control line program. Historic shoreline position data was subsequently assembled, documenting shoreline change back to the late 1800's. In more recent years, regional monitoring and erosion control project-related data collection has become an integral part of the State's Beach Management Program.

With the legislative commitment to a dedicated funding source for beach erosion control projects, emphasis on project-related data collection and its associated methods has increased due to the growth in the number of projects and increased funding to maintain existing projects.

This document establishes FDEP data collection and processing standards for erosion control projects. It is intended to provide local sponsors and contractors with standard procedures and specifications for project monitoring. For ease of use, each section is designed to act as a stand-alone document for the specified data collection method, including definition and reference sections.

2.0 Statement of Monitoring Policy

It is the policy of the FDEP to acquire, review, maintain, and make available to all internal and external users high-quality, accurate coastal data for the purpose of monitoring Florida's beaches and coastal systems. These data are utilized in support of Florida's comprehensive beach management programs as defined in Chapter 161, F.S.

Project monitoring supports the needs of the public and the agency in a variety of ways. Data collected for specific projects is used to document and evaluate project performance, to perform beach management planning, and to assist in conducting regulatory reviews related to the coastal construction control line (CCCL) and joint coastal permitting (JCP). It is also used in the review and documentation of hurricane and other storm impacts to Florida's beaches and coastal systems.

3.0 Purpose of Data Collection and Processing Standards

The purpose of this document is to define and compile technical standards and specifications for project-specific data acquisition and processing and to provide a standard

INTRODUCTION

for systematic physical data collection monitoring of erosion control projects along Florida beaches for beach management and regulatory purposes. The products developed from use of this document will be consistent statewide, thereby facilitating efficient comparative analysis of coastal data and its dissemination to the public.

4.0 Data Components

Data components contained in this document include the following:

- Topographic and Bathymetric Profile Surveys
- Bathymetric Surveys for Open Water Areas
- Aerial Photography
- Aerial Photography for Environmental Assessments

Associated technical specifications are included for all of the listed data components, including survey accuracy standards.

This document contains an appendix illustrating the format of the information to be included in the Monument Information Report. Control and Range Monument information is available from the FDEP Internet web site at:

<http://www.dep.state.fl.us/beaches/data/coastmon.htm>.

5.0 Standards Document Accessing and Updating

Monitoring Standards for Beach Erosion Control Projects will be available from the FDEP Internet web site. The address for the site is: <http://www.dep.state.fl.us/beaches>. These technical specifications will be reviewed and updated as needed. Revisions and updates will occur as new concepts and technologies become available and are implemented in beach erosion control projects. Input and involvement in development and updating of this document by the technical community and the general public is welcome and encouraged.

6.0 Electronic submittals

In accordance with the Department's paperless initiative, all data and reports should be provided to FDEP in electronic format.

Files less than or equal to 20 megabytes (MB) in size are to be emailed to JCPCCompliance@dep.state.fl.us. When submitting monitoring information, please include within the transmittal a list of all attached reports or data files, the FDEP permit number, and the specific permit condition(s) that are applicable. Please use a file name for attached reports and data files that reflects the permit number and the specific deliverable. For example, file name "Gasparilla 2014 Physical Monitoring Report 0174403-001-JC" would represent the 2014 physical monitoring report prepared for the Gasparilla Project that was authorized under FDEP permit 0174403-001-JC.

INTRODUCTION

Files larger than 20 MB should be saved to the ftp site at: <ftp://ftp.dep.state.fl.us/pub/incoming/BEACHES JCP/>. After uploading the file, please send an email to JCPCompliance@dep.state.fl.us with the ftp file name, the list of all uploaded files (i.e. physical monitoring report, biological monitoring report, turbidity report, survey data, etc.), FDEP permit number, and the specific permit condition(s) that are applicable.

Where a FDEP permit or FDEP approved monitoring plan requires a report, image, or metadata file delivered on CD or DVD, the disk should be labeled with the description of contents, permit number, and monitoring period. Please mail the deliverable(s) to: Florida Department of Environmental Protection, Division of Water Resource Management, Attn. JCP Compliance Officer, 2600 Blair Stone Road, MS 3544, Tallahassee, FL 32399-2400.

If the monitoring is also cost-shared through the Beach Management Funding Assistance Program, please include the FDEP Project Agreement Number in your communication with the JCP Compliance Officer.

SECTION 01000

BEACH PROFILE TOPOGRAPHIC SURVEYING For BEACH EROSION CONTROL PROJECTS

PART I - GENERAL

A. DESCRIPTION OF WORK

1. Work described in this section includes the acquisition, horizontal and vertical control (either by conventional or Global Positioning System (GPS) methods), post processing, quality control/quality assurance, and deliverables of topographic survey data. Conventional topographic survey data shall be collected at FDEP reference points, which are approximately 1,000 feet apart alongshore, or other lines or areas as described in the contract Scope of Work.

B. DEFINITIONS

1. Contractor – The organization or individual that will provide topographic survey services to the FDEP.
2. HARN – The Florida High Accuracy Reference Network.
3. NAD 83/90 – The North American Datum 1983 adjustment of 1990.
4. NAVD 88 – The North American Vertical Datum of 1988.
5. TBM – Temporary bench mark.
6. Control Monument or Benchmark – 2nd order or higher control point, typically but not necessarily known as an “A” station.
7. Range Monuments – FDEP reference points, spaced approximately 1000 ft. apart alongshore, typically known as “R” stations.
8. RTAB – A table of range monument locations (vertical and horizontal), elevations, and profile azimuths.
9. RMSE – Root mean square error

C. REFERENCE DOCUMENTS

1. Federal Geographic Data Committee, *Geospatial Positioning Accuracy Standards, Parts 1, 2, and 3*, Final Draft, U.S. Geological Survey, Reston, Virginia, 1998.

SECTION 01000

2. Federal Geographic Data Committee, *Content Standard for Digital Geospatial Metadata*, FGDC-STD-001-1998, 1998.
3. Federal Geodetic Control Committee, *Standards and Specifications for Geodetic Control Networks*, September 1984.
4. Florida Minimum Technical Standards. Chapter 5J-17, Florida Administrative Code (F.A.C.).
5. National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOS NGS-58, *Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 cm and 5 cm)*, November 1997.

PART II - EXECUTION

A. DATA COLLECTION

1. Survey Control - Topographic surveys shall use FDEP "A" monuments (as recorded in the County public records) or other National Geodetic Survey (NGS) published 2nd order or higher marks for survey control. Tabular listings of all horizontal and vertical control on all existing "A" monuments shall be obtained through either the FDEP web site or directly from the FDEP office.

All GPS radio base station control or range/azimuth system control shall be established or recovered from control monuments (typically "A" stations) and shall meet or exceed Geospatial Positioning Accuracy Standards, Range VIII. Designation, stamping, description, horizontal position, horizontal RMSE, elevation (in NAVD 88) and elevation RMSE shall be provided to FDEP for all established base station control in the Monument Information Report as outlined in Part III.B.3.

2. Ground Support – The Contractor shall provide all manpower and equipment as needed to complete the required topographic work.
3. Range Monuments and Azimuths - All beach profile surveys shall be referenced to FDEP range monument locations and conducted along azimuths as defined in the latest edition of the RTAB listing. Alternate baseline coordinate locations and azimuths may be used upon approval by FDEP for consistency in project monitoring. Documentation and verification of the alternate locations shall be obtained by the contractor and provided to FDEP as outlined below. The appropriate RTAB listing shall be obtained through either the FDEP web site or directly from the FDEP office.

The Contractor shall prepare a Monument Information Report as required in Part III.B.3 that describes the location of given, found, and used

SECTION 01000

monuments and TBMs including identifications, establishment dates, coordinates, elevations, and profile azimuths. TBM identification shall include reference monument origin, identification, azimuth, distance down line, and TBM elevation. The Monument Information Report shall also include tables of differences between given and found values, given and used values, and found and used values. An example format for the report is provided in Appendix A.

4. Beach/Dune Profiles - All upland profiles including any intermediate profiles shall be collected on Florida State Plane Coordinate Systems and FDEP established grid bearings and shall be in accordance with accuracy specifications in Part II.A.7 below.
5. Horizontal Datum - The horizontal datum shall be the HARN NAD 83/90.
6. Vertical Datum - The vertical datum shall be the NAVD 88.
7. Accuracy – Reference monuments: The vertical accuracy of the data shall meet or exceed GPS-derived heights (5cm) standard and Chapter 5J-17, F.A.C., minimum technical standards for a topographic survey (see Part I.C.4) and be verified by two (2) controlling benchmarks. Leveling instruments shall be “peg” tested. The horizontal accuracy of the data shall meet or exceed Geospatial Positioning Accuracy Standards, Range VIII, (maximum of 0.66 ft.) (See Part I.C.1).

Profile Data: The vertical accuracy of the topographic profile data shall meet or exceed GPS-derived heights (5cm) standard and Chapter 5J-17, F.A.C., minimum technical standards for a topographic survey (see Part I.C.4). Accuracy shall be verified by two (2) controlling benchmarks, and checked back into the reference monument at each profile line or checked into adjoining TBM, Benchmark, or reference point at each profile line.

The check back method must be described in the metadata as required in Part III.B.4 of this specification.

The horizontal accuracy of the data shall meet or exceed Geospatial Positioning Accuracy Standards, Range X, (maximum of 3 ft.). GPS observations, poly-chain, an electronic distance measuring (EDM) device, or stadia observation shall be used to measure distances. Redundancy in horizontal measurement is required. Redundant methods must be described in the metadata as required in Part III.B.4 of this specification.

Survey accuracy shall comply with all standards contained in references in Part I.C.

8. Units of Measure - All required data shall be collected in U.S. Survey Feet.

SECTION 01000

9. Data Resolution – The data shall be collected at intervals not to exceed 25 ft. and at all grade breaks and attributed items along the profile sufficient to accurately describe the topography at the profile locations. Attribute codes are to be as discussed in Part II.A.12, below. All rod readings shall be read and recorded to the nearest hundredth of a foot (2 decimal places).
10. Data Collection Area – The topographic data shall be collected seaward out to a depth sufficient to establish continuity with offshore data, and landward to the DEP monument location or approximately 150 feet landward of the vegetation line, whichever is more landward. If a wading depth survey is performed of the beach and upland only, without an offshore survey component, then the survey shall, at a minimum, extend to approximately one foot below mean low water.

If the point 150 feet landward of the vegetation line cannot be reached because of an obstruction, such as a building, bay water, mangroves, or other impassable vegetation or obstacle, then the survey line may be stopped at the obstacle and shall be noted as such in the survey field book. Coastal armoring is generally not an impassable obstacle and is normally to be surveyed.

The FDEP range monument locations shall be established as the 0.0 locations for recording all horizontal distances along profiles. Horizontal distances along profile lines shall be recorded as positive seaward of the monument location and negative landward of the monument location.

11. Procedural Control – The Contractor shall outline and maintain a schedule for planned data collection and shall itemize all procedures, including quality control and instrumentation, to be followed during the completion of this work. Procedural standards are outlined in reference documents listed in Part I.C. All procedures and milestones achieved during completion of this work shall be described in the metadata as required in Part III.B.4 of this specification.
12.
 - a. Conventional field book entries are to include the following information for each profile: Survey monument identification, stamping or TBM identification, the date of the survey, the profile azimuth (grid), the survey crew members, and attribute identification. Distance and elevation readings shall be recorded in a standard columnar arrangement on the field book pages.
 - b. Profile data collected digitally will include the following information for each profile: Survey monument identification, stamping or TBM identification, the date of the survey, and attribute identification. Distance and elevation readings or X, Y, Z data shall be recorded. Any

SECTION 01000

feature attribute abbreviations must be described in the metadata as required in Part III.B.4 of this specification and/or the surveyors report.

In addition to the observation points required in Part II.A.9, features shall be attributed with associated location and elevation. Features to be attributed may include the following:

- Buildings
- Centerlines of all roads, streets, trails
- Edges of dense vegetation
- Edges of water
- Edges of pavement
- Tops of escarpments
- Concrete monuments
- Iron pipes
- Iron rods
- Monuments on grade such as a cap on a seawall
- Monuments off grade
- Seaward limits of profile data collection
- Landward limits of profile data collection
- Revetments
- Peat or Mulch
- Naturally occurring rock such as coquina or worm rock
- Tops of seawalls
- Edges of vegetation
- Landward limits of wet sands

Single character codes shall be included in the DEP formatted data set as follows:

CODE	FEATURE
C	Centerlines of all roads, streets, trails
R	Edges of hardened shoreline such as revetments or naturally occurring rock
S	Tops of seawalls
V	Edges of vegetation
W	Landward limits of wet sands

B. DATA PROCESSING

Topographic data collected by these methods shall have quality checks performed and verified by the surveyor in responsible charge and detailed in the metadata (see Part III.B.4).

SECTION 01000

C. DATA SUBMITTALS

Survey data is to be provided in the datum in which the data is collected.

When submitting permit required monitoring information to FDEP, the contractor shall include a transmittal letter clearly labeled with the following: "This monitoring information is submitted in accordance with the approved Monitoring Plan for Permit No. [XXXXXX] for the monitoring period [XXXXXX]." If the monitoring is not required by permit, but cost-shared through the Beach Management Funding Assistance Program, the transmittal letter shall be labeled, "This monitoring information is submitted in accordance with FDEP Project Agreement [XXXXXXXX]." If mailed, the exterior of all digital products shall be labeled with the description of contents, Project Agreement Number, or Permit Number and monitoring period.

PART III - PRODUCTS

A. SURVEY REPORTS

A report from a person licensed pursuant to Chapter 472, F.S., certifying that the survey meets the technical specifications established herein (Part.II.A of this specification) and minimum technical standards of Chapter 5J-17, F.A.C. Report is to be submitted electronically, when possible. If the report is electronically signed and sealed and the report and other products listed below are transmitted electronically, hard copies of these deliverables are not required.

B. DIGITAL PRODUCTS

1. ASCII file containing raw x, y, and z profile data points, if x,y,z data are collected.
2. ASCII files containing the profile data processed into the DEP distance and depth format. DEP format includes data as well as header records.
3. Monument Information Report (Given/Found/Used Report) with regard to monumentation described in Parts II.A.1 and II.A.3 above shall be submitted in Excel format (.xls) or equivalent spreadsheet format. Format shall be provided as shown in Appendix A of this document. Document templates are available from the FDEP web site or directly from the FDEP office.
4. Complete federally compliant metadata file including methodology of the data collection and processing procedures utilized in accordance with standards set forth by the Federal Geographic Data Committee as referenced in Part I.C.2 of this specification.

SECTION 01000

5. Copies of all checked, standard field books, computation and reduction files, and abstracted final positions shall be provided to the FDEP. Field books shall be scanned and pages amassed into a .pdf document for electronic submittal.

END OF SECTION

SECTION 01100

OFFSHORE PROFILE SURVEYING For BEACH EROSION CONTROL PROJECTS

PART I - GENERAL

A. DESCRIPTION OF WORK

1. Work described in this section includes the acquisition, horizontal and vertical control (either by conventional or GPS methods), post processing, quality control/quality assurance, and deliverables of coastal bathymetric survey data. Bathymetric survey data shall be collected at FDEP reference points, which are approximately 1,000 feet apart alongshore, or other lines or areas as described in the contract Scope of Work. This specification is applicable to nearshore (referred to as “offshore” herein) profile surveying and does not include full consideration of surveying in areas such as inlets and offshore borrow areas.

B. DEFINITIONS

1. Contractor – The organization or individual providing bathymetric survey services to the local sponsor or consultant acting in behalf of the local sponsor.
2. HARN – The Florida High Accuracy Reference Network.
3. NAD 83/90 – The North American Datum 1983 adjustment of 1990.
4. NAVD 88 – The National American Vertical Datum of 1988.
5. TBM – Temporary bench mark.
6. Control Monument or Benchmark – 2nd order or higher control point, typically but not necessarily known as an “A” station.
7. Range Monuments – FDEP reference points, spaced approximately 1000 ft. apart alongshore, typically known as “R” stations.
8. RTAB – A table of range monument locations (vertical and horizontal), elevations, and profile azimuths.
9. RMSE – Root Mean Square Error

SECTION 01100

C. REFERENCE DOCUMENTS

1. Federal Geographic Data Committee, *Geospatial Positioning Accuracy Standards*, Parts 1, 2, and 3, Final Draft, U.S. Geological Survey, Reston, Virginia, 1998.
2. Federal Geographic Data Committee, *Content Standard for Digital Geospatial Metadata, FGDC-STD-001-1998*, 1998.
3. Federal Geodetic Control Committee, *Standards and Specifications for Geodetic Control Networks*, September 1984.
4. Florida Minimum Technical Standards. Chapter 5J-17, F.A.C
5. US Army Corps of Engineers, *Hydrographic Surveying, Engineering and Design Manual, EM1110-2-1003*, 1999.
6. National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOS NGS-58, *Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 cm and 5 cm)*, November 1997.

PART II - EXECUTION

A. DATA COLLECTION

Bathymetric surveys have historically been conducted by the use of boat-mounted echo sounding equipment (fathometer). Accuracy of bathymetric surveying has historically been subject to water level (e.g., tidal elevation) variations and sea conditions and the subsequent successful establishment of tidal correction and filtering of sea conditions. The use of kinematic GPS, including “on-the-fly” methods, has greatly increased the capability of achieving acceptable accuracy levels. Accuracy standards set forth by FDEP in this document are based on the demonstrable accuracy of these improved technologies. All bathymetric surveying shall meet or exceed accuracy levels achievable by these improved technologies. Generally these accuracy levels cannot be met using a tide gauge.

1. Survey Control

All control work shall be completed prior to performing any profile surveys for a given survey area, unless otherwise specified by FDEP.

- a. Ground Control - Bathymetric surveys shall use FDEP “A” monuments (as recorded in the County public records) or other National Geodetic Survey (NGS) published 2nd order or higher control for survey control. Tabular listings of all horizontal and

SECTION 01100

vertical control on all existing "A" monuments shall be obtained through either the FDEP web site or directly from the office.

All GPS radio base station control or range/azimuth system control shall be established or recovered from control monuments (typically "A" stations) and shall meet or exceed Geospatial Positioning Accuracy Standards, Range VIII. Designation, stamping, description, horizontal position, horizontal RMSE, elevation (in NAVD 88) and elevation RMSE shall be provided to FDEP for all established base station control in the Monument Information Report as outlined in Part III.B.3.

- b. Ground Support – The Contractor shall provide all manpower and equipment as needed to complete the required bathymetric survey work.
2. Range Monuments and Azimuths - All offshore profile surveys shall be referenced to FDEP range monument coordinate locations and conducted along azimuths as defined in the latest edition of the FDEP RTAB listing. Alternate baseline coordinate locations and azimuths may be used upon approval by FDEP for consistency in project monitoring. Documentation and verification of the alternate locations shall be obtained by the contractor and provided to the FDEP as outlined below. The appropriate RTAB listing shall be obtained through either the FDEP web site or directly from the office.

The Contractor shall provide the following information concerning all given, found, and used monuments and TBMs in the Monument Information Report as required in Part III.B.3: identification, establishment dates, coordinates, elevations, and profile azimuths. TBM identification shall include reference monument origin, identification, azimuth, distance down line and TBM elevation. Accuracy standards shall be in accordance with Part II.A.8.d. The Monument Information Report shall also include tables of differences between given and found values, given and used values and found and used values. An example format for the report is given in Appendix A.

3. Offshore Profiles – All offshore profiles including any intermediate profiles shall be collected on Florida State Plane Coordinate Systems and FDEP established grid bearings and shall be in accordance with accuracy specifications in Part II.A.8.d below.
4. Horizontal Datum - The horizontal datum shall be the HARN NAD 83/90.
5. Vertical Datum - The vertical datum shall be the NAVD 88.

SECTION 01100

6. Equipment and Calibration

All survey equipment shall be properly calibrated and operated as appropriate for specific work being performed in accordance with standards established in Part I.C.4 of this specification. All depth measurement equipment shall be verified for accuracy at the beginning and end of each survey day. A direct depth measurement check (e.g. via pole, lead line, bar checks, etc.) shall be conducted and recorded at both shallow and maximum depths relative to the work area at the beginning and end of each survey day, and more frequently if necessary. Use of a velocity probe is acceptable for speed of sound calculations to calibrate depth-recording instruments.

If sea conditions preclude performing the depth check at the end of the day, sea conditions and indication of inability to perform the depth check shall be recorded and reported in the field book. At the beginning of each survey day, the last survey line of the previous day shall be repeated the following survey day to verify the measurement from the previous day. A similar check shall be performed whenever a change in conditions during a survey warrants a check, such as unforeseen circumstances (i.e., equipment problems which may temporarily suspend a survey day) to ensure that the survey work is properly grounded with depth checks.

7. Data Measurement

- a. Bathymetric survey data collection shall be performed as close in time as possible with the upland topographic survey data collection. Difference in time between the onshore and offshore data shall be no greater than 14 days.
- b. Bathymetric survey data collection shall be conducted in calm seas. Maximum wave heights during the data collection period shall not exceed 3 feet.
- c. Bathymetric survey data shall be acquired as close to time of high tide as possible, and shall extend landward to a depth sufficient to establish continuity with upland survey data. The offshore survey shall continue seaward, extending to a minimum of 3000 feet offshore (from the most landward offshore data point) or to -30 feet (NAVD 88), whichever is reached first.
- d. Accuracy – The vertical accuracy of the profile data shall meet or exceed GPS-derived heights (2 cm and 5 cm) standard (see Part I.C.6). The allowable horizontal positioning system accuracy of the

SECTION 01100

data shall be a maximum of 2.0 feet. The allowable off-line horizontal deviation shall be a maximum of 30 feet.

- e. Units of Measure - All required data shall be collected in U.S. Survey Feet.
- f. Data Resolution – The data shall be collected at intervals not to exceed 25 ft. and at all grade breaks along the profile sufficient to accurately describe the bathymetry at the profile locations.
- g. Procedural Control – The Contractor shall itemize all procedures including quality control and instrumentation followed during the completion of this work. Procedural standards are outlined in reference documents listed in Part I.C. Any deviations from procedures and standards contained within this specification shall be identified and approved by FDEP prior to conducting the survey work. All survey methodologies, quality control/quality assurance procedures, and milestones achieved during completion of this work shall be described in the metadata as required in Part III.B.4. Any findings, corrections, and results of those procedures shall also be included in the submittal.

B. DATA PROCESSING

All data processing shall be in accordance with National Geodetic Standards (as established by reference to Parts I.C.1 and I.C.6), Florida Minimum Technical Standards (reference Part I.C.4), requirements for a U.S. Army Corps of Engineers Class II Hydrographic Survey (with the exception that vertical accuracy shall conform to the FDEP specification in Part II.A.7.d above and referenced in Part I.C.5), accepted survey practice, and FDEP data standards and format requirements.

C. DATA SUBMITTALS

Survey data is to be provided in the datum in which it was collected.

When submitting permit required monitoring information to the FDEP, the Contractor shall include a transmittal letter clearly labeled with the following: "This monitoring information is submitted in accordance with the approved Monitoring Plan for Permit No. [XXXXXX] for the monitoring period [XXXXXX]." If the monitoring is not required by permit, but cost-shared through the Beach Management Funding Assistance Program, the transmittal letter shall be labeled, "This monitoring information is submitted in accordance with FDEP Project Agreement [XXXXXX]."

SECTION 01100

PART III - PRODUCTS

A. SURVEY REPORTS

A report from a person licensed pursuant to Chapter 472, F.S., certifying that the survey meets the technical specifications established herein (Part.II.A of this specification) and minimum technical standards of Chapter 5J-17, F.A.C. Report is to be submitted electronically, when possible. If the report is electronically signed and sealed and the report and other products listed below are transmitted electronically, hard copies of these deliverables are not required.

B. DIGITAL PRODUCTS

1. ASCII file containing raw x, y, and z profile data points.
2. ASCII files containing the profile data processed into the DEP distance and depth format. DEP format includes data as well as header records.
3. Monument Information Report (Given/Found/Used Report) with regard to monumentation described in Parts II.A.2.a and II.A.3. above. Information shall be submitted in Excel format (.xls) or equivalent spreadsheet format. Format shall be provided as shown in Appendix A of this document. Document templates are available from the FDEP web site or directly from staff.
4. Complete federally-compliant metadata file including data collection and processing methods utilized in this work in accordance with standards set forth by the Federal Geographic Data Committee as referenced in Part I.C.2 of this specification.
5. Copies of all standard field books, all computation and reduction files, and abstracted final position depths and distances from reference points shall be provided to FDEP. Field books shall be scanned and pages amassed into .pdf format for electronic submittal.

END OF SECTION

SECTION 01200

BORROW SITE, SHOAL AND OTHER BATHYMETRIC SURVEYING For BEACH EROSION CONTROL PROJECTS

PART I - GENERAL

This specification is applicable to offshore areas, giving full consideration to surveying in areas such as ebb and flood shoals, borrow sites and borrow site development. A separate specification, Offshore Profile Surveying, shall be used for all bathymetric surveying associated with beach profiles.

A. DESCRIPTION OF WORK

1. Work described in this section includes the acquisition, horizontal and vertical control (either by conventional or GPS methods), post processing, quality control/quality assurance, and deliverables of coastal bathymetric survey data.

B. DEFINITIONS

1. Contractor – The organization or individual providing bathymetric survey services to the local sponsor or consultant acting on behalf of the local sponsor.
2. HARN – The Florida High Accuracy Reference Network.
3. NAD 83/90 – The North American Datum 1983 adjustment of 1990.
4. NAVD 88 – The National American Vertical Datum of 1988.
5. TBM – Temporary bench mark.
6. Control Monument or Benchmark – 2nd order or higher control point, typically but not necessarily known as an “A” station.
7. RMSE – Root Mean Square Error.

C. REFERENCE DOCUMENTS

1. Federal Geographic Data Committee, *Geospatial Positioning Accuracy Standards, Parts 1, 2, and 3*, Final Draft, U.S. Geological Survey, Reston, Virginia, 1998.
2. Federal Geographic Data Committee, *Content Standard for Digital Geospatial Metadata*, FGDC-STD-001-1998, 1998.

SECTION 01200

3. Federal Geodetic Control Committee, *“Standards and Specifications for Geodetic Control Networks,”* September 1984.
4. Florida Minimum Technical Standards. Chapter 5J-17, F.A.C.
5. US Army Corps of Engineers, *Hydrographic Surveying*, Engineering and Design Manual, EM1110-2-1003, 1999.
6. National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOS NGS-58, *“Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 cm and 5 cm),”* November 1997.

PART II - EXECUTION

A. DATA COLLECTION

Bathymetric surveys have historically been conducted by the use of boat-mounted echo sounding equipment (fathometer). Accuracy of bathymetric surveying has historically been subject to water level (e.g., tidal elevation) variations and sea conditions and the subsequent successful establishment of tidal correction and filtering of sea conditions. The use of kinematic GPS, including “on-the-fly” methods, has greatly increased the capability of achieving acceptable accuracy levels. Accuracy standards set forth by FDEP in this document are based on the demonstrable accuracy of these improved technologies. All bathymetric surveying shall meet or exceed accuracy levels achievable by these improved technologies. Generally these accuracy levels cannot be met using a tide gauge.

1. Survey Control

All control work shall be completed prior to surveying a given area, unless otherwise specified by FDEP.

- a. Ground Control - Bathymetric surveys shall use FDEP “A” monuments (as recorded in the County public records) or other National Geodetic Survey (NGS) published 2nd order or higher control for survey control. Tabular listings of all horizontal and vertical control on all existing "A" monuments listing shall be obtained through either the FDEP web site or directly from staff

All GPS radio base station control shall be established or recovered from FDEP control monuments (typically “A” stations) and shall meet or exceed Geospatial Positioning Accuracy Standards, Range VIII. Designation, stamping, description, horizontal position, horizontal RMSE, elevation (in NAVD 88) and elevation RMSE shall be provided for all established base station control in the

SECTION 01200

Monument Information Report as outlined in Part III.B.4. The Monument Information Report shall also include tables of differences between given and found values, given and used values and found and used values. An example format for the report is given in Appendix A.

- b. Ground Support – The Contractor shall provide all manpower and equipment as needed to complete the required bathymetric survey work.
2. Horizontal Datum - The horizontal datum shall be the HARN NAD 83/90.
 3. Vertical Datum - The vertical datum shall be the NAVD 88.
 4. Equipment and Calibration

All survey equipment shall be properly calibrated and operated as appropriate for specific work being performed in accordance with standards established in Part I.C.4 of this specification. All depth measurement equipment shall be verified for accuracy at the beginning and end of each survey day. A direct depth measurement check (e.g. via pole, lead line, bar check, etc.) shall be conducted and recorded at both shallow and maximum depths relative to the work area at the beginning and end of each survey day, and more frequently if necessary. Use of a velocity probe is acceptable for speed of sound calculations to calibrate depth-recording instruments.

If sea conditions preclude performing the depth check at the end of the day, sea conditions and indication of inability to perform the depth check shall be recorded and reported in the field book. At the beginning of each survey day, the last survey line of the previous day shall be repeated the following survey day to verify the measurement from the previous day. A similar check shall be performed whenever a change in conditions during a survey warrants a check, such as unforeseen circumstances (i.e., equipment problems which may temporarily suspend a survey day) to ensure that the survey work is properly grounded with depth checks.

5. Data Measurement
 - a. Bathymetric survey data collection shall be conducted in calm seas. Maximum wave heights during the data collection period shall not exceed 3 feet.
 - b. Accuracy – The vertical accuracy of the data shall meet or exceed GPS-derived heights (2 cm and 5 cm.) standard (see Part I.C.6). The allowable horizontal positioning system accuracy of the data shall

SECTION 01200

be a maximum of 2.0 feet. The allowable off-line horizontal deviation shall be a maximum of 30 feet.

- c. Data Resolution – The data shall be collected at intervals not to exceed 25 ft. and in sufficient density to accurately describe the bathymetry of the subject area.
- d. Procedural Control – The Contractor shall itemize all procedures including quality control and instrumentation followed during the completion of this work. Procedural standards are outlined in reference documents listed in Part I.C. Any deviations from procedures and standards contained within this specification shall be identified and approved by FDEP prior to conducting the survey work. All survey methodologies, quality control/quality assurance procedures, and milestones achieved during completion of this work shall be described in the metadata as required in Part III.B.3. Any findings, corrections, and results of those procedures shall also be included in this submittal.

B. DATA PROCESSING

All data processing shall be in accordance with National Geodetic Standards (as established by references Parts I.C.1 and I.C.6), Florida Minimum Technical Standards (reference Part I.C.4), requirements for a U.S. Army Corps of Engineers Class II Hydrographic Survey (with the exception that vertical accuracy shall conform to the higher FDEP specification in Part II.A.5.b, above and referenced in Part I.C.5), accepted survey practice, and FDEP data standards and format requirements.

C. DATA SUBMITTALS

In accordance with the Department's paperless initiative, contractors are encouraged to submit all reports and data electronically. Survey data is to be provided in the datum in which it was collected. When submitting permit required monitoring information to the FDEP, the Contractor shall include a transmittal letter clearly labeled with the following: "This monitoring information is submitted in accordance with the approved Monitoring Plan for Permit No. [XXXXXX] for the monitoring period [XXXXXX]." If the monitoring is not required by permit, but cost-shared through the Beach Management Funding Assistance Program, the transmittal letter shall be labeled, "This monitoring information is submitted in accordance with FDEP Project Agreement [XXXXXXXX]." If mailed, the exterior of all digital products shall be labeled with the description of contents, Project Agreement Number, or Permit Number and monitoring period.

SECTION 01200

PART III - PRODUCTS

A. SURVEY REPORTS

A report from a person licensed pursuant to Chapter 472, F.S., certifying that the survey meets the technical specifications established herein (Part.II.A of this specification) and minimum technical standards of Chapter 5J-17, F.A.C. Report is to be submitted electronically when possible. If the report is electronically signed and sealed and the report and other products listed below are transmitted electronically, hard copies of these deliverables are not required.

B. DIGITAL PRODUCTS

1. ASCII file containing raw x, y, and z data points.
2. .DWG or .DXF of the borrow area with information provided on the following layers:
 - a. Point drawing of "A" monuments used to control the survey with a listing of monument coordinates (x,y, and z) and description.
 - b. Line drawing of survey extents with points of intersection listed on the drawing.
 - c. Line drawing of transects surveyed.
 - d. Point drawing of all data points collected, with elevation.
3. Complete federally-compliant metadata file including data collection and processing methods utilized in this work in accordance with standards set forth by the Federal Geographic Data Committee as referenced in Part I.C.2 of this specification.
4. Monument Information Report (Given/Found/Used Report) with regard to all ground control monument information described in Part II.A.2.a., above. Information to be included in the report is outlined in Part II.A.2.a.
5. Copies of all standard field books, all computation and reduction files, and abstracted final position depths and distances from reference points shall be provided to the FDEP, if used. When possible, field books shall be scanned and pages amassed into .pdf document for electronic submittals.

END OF SECTION

SECTION 02000

AERIAL PHOTOGRAPHY ACQUISITION for BEACH EROSION CONTROL PROJECTS

PART I - GENERAL

A. DESCRIPTION OF WORK

This technical specification has been developed for project monitoring of beach erosion control projects. This technical specification is specific for use with digital aerial camera system.

B. DEFINITIONS

1. Aerial Photography System - An airborne digital aerial photography system shall consist of a precision digital aerial camera, airborne Global Positioning System (GPS) with attendant GPS base station(s), and an Inertial Measuring Unit (IMU).
2. CORS - Continuously Operating Reference Stations.
3. Contractor – The aerial survey or photogrammetric company that will provide aerial survey and/or photogrammetric services.
4. Crab – The condition caused by incorrect orientation of the camera with respect to the track of the aircraft. Any turning of an airplane which causes its longitudinal axis to vary from the track of the plane.
5. Digital Aerial Camera – Digital cameras utilized in conjunction with this contract must be large format, direct digital, frame-based camera systems. Small or medium frame format systems or Line Scanning (push broom technologies) will not be considered.
6. Ground Sampling Distance - GSD is the distance captured by each pixel. Our specification is for the size when collected. Altitude to achieve this GSD will determined by the camera's capabilities.
7. HARN - The Florida High Accuracy Reference Network.
8. NAD83/90 - The North American Datum of 1983 adjustment of 1990.
9. NAVD 88 – North American Vertical Datum of 1988.

SECTION 02000

10. Pixel – The smallest cell size with a uniform value of an image. This digital image grain is produced in varying sizes, usually referred to in ground units such as 6 inches, 1 foot, or 3 meters. Pixels are the resolution of the photograph/image.
11. Scale – The relationship between a given distance on the ground and the corresponding distance on a photograph or image. Scale can be expressed in two different ways, both as ratios. The first method uses common measuring systems to relate the distance on the photo to the actual distance on the earth (e.g., 1" = 200'). The second method uses a ratio where the unit of measure is arbitrary (e.g., 1:1200). For this method meters, feet, miles, etc. can all be used as the measuring unit to relate distance on a photo or image with distance on the earth.

C. REFERENCE DOCUMENTS

1. Oklahoma Department of Transportation, *Specifications for Aerial Photography – Digital Camera*, April 2012.
2. American Society for Photogrammetry and Remote Sensing (ASPRS), *ASPRS Accuracy Standards for Digital Geospatial Data*, March 2014.
3. Federal Geographic Data Committee, *Geospatial Positioning Accuracy Standards, Parts 1, 2, and 3*. Final Draft, U.S. Geological Survey, Reston, Virginia, 1998.
4. Federal Geographic Data Committee, *Content Standard for Digital Geospatial Metadata*. FGDC-STD-001-1998, 1998.
5. U.S. Geological Survey, *USGS Aerial Camera Specifications*. January 8, 2013.

PART II - EXECUTION

A. PRE-FLIGHT

The Contractor shall submit the most recent camera calibration report for the camera utilized for photo acquisition according to the standards of Part I.B.5 of this specification. The date of calibration shall not exceed the proposed flight date by more than three years.

B. FLIGHT

1. Scale – The images shall be at scale of 1" = 500' (1:6000).

SECTION 02000

2. Flight Altitude – The altitude of the aircraft used to obtain the photography shall be determined by the contractor to insure the GSD of 15 cm (~6 inches) or better. It is the responsibility of the contractor to coordinate the flight with the appropriate authority when operating in restricted air space.
3. Ground Control- Ground control includes all necessary ground support and GPS receivers (base stations) for the required number of ground control points to be occupied during the flight. All ground control will be based on the Florida State Plane Coordinate System, NAD83/90 adjustment and tied to the HARN.

When possible, GPS base stations shall have ellipsoid heights to an accuracy of 2 centimeters relative to the CORS or the HARN. A ground control report shall be prepared and must include all pertinent base station information and mission notes, including information on GPS station monument names, descriptions, coordinates, visibility diagrams, and stability.

4. Ground Control Base-Station Spacing – Ground control base stations shall be 7 miles to a maximum of 12 miles apart.
5. Overlap – The aerial photography shall have a minimum of 30% forward overlap.
6. Sidelap – Generally, the aerial photography shall be acquired on a single flight path. However, areas that require more than one flight path shall have a minimum of 30% side overlap.
7. Tilt - Care shall be used to reduce tilt to a minimum of less than 5 degrees for any one photograph, 2 degrees for any 10 or more consecutive photographs, or one degree for the entire flight-line.
8. Crab - Crab shall not exceed 10 degrees as measured from the flight path, as indicated by two or more consecutive photographs.
9. Image Collection – Image shall have a Ground Sampling Distance (GSD) of 15 cm (~6”) or better at time of collection. It shall be collected in four bands consisting of Red, Green, Blue and Infrared to achieve color balance in post-production. Horizontal accuracy shall follow ASPRS Digital Standards for Planimetric Maps at 1:6000 scale Level 2 precision. Vertical accuracy while not required by DEP should follow ASPRS standards to insure sufficient data for post processing by the contractor.

SECTION 02000

10. Obscurations – Photography shall not be acquired when haze, smoke, or dust obscure the ground, or when clouds or cloud shadows will appear on any photograph.
11. Shadows/Reflection – Photography shall minimize shadows caused by trees or topographic relief. Photography shall not be taken when the sun's inclination is less than thirty (30) degrees above the horizon. Use of an anti-vignette filter is required.
12. The center of the first and last exposure for every flight line shall be beyond the limits of the project being monitored.
13. Flight Log – A flight log representing aircraft flight time shall be maintained on an hourly basis. The time of takeoff, start of photograph, end of photograph, and landing shall be recorded to the nearest of 0.1 of an hour.
14. Weather Log – A weather log shall be maintained to substantiate any delays due to inclement weather. The weather log shall include date, location, weather report, and weather forecast from the National Weather Service. This information may be supplemented by direct observation.
15. Tide Log – The Contractor shall maintain a tide log to substantiate any delay due to incorrect or unacceptable tides. The tide log shall include the date, time, location of the nearest NOAA tide station(s) being reported, and the tide elevation at the beginning, middle, and end of data collection as calculated for photo collection location (through interpolation between adjacent tide stations). All reported tide elevations shall be referenced to NAVD 1988.
16. Flight Time – The entire flight shall occur between one (1) hour before and one (1) hour after mean low tide in the region to be photographed, unless otherwise authorized by DEP.
17. Procedural Control – The Contractor shall outline and maintain a schedule for planned data collection and itemize all procedures including quality control and instrumentation to be followed during the completion of this work. Procedural standards are outlined in reference documents listed in Part I.B. All procedures and milestones achieved during completion of this work shall be described in the metadata as required in Part I.B.4 of this specification.

SECTION 02000

C. POST-FLIGHT

Flight Report – The Contractor shall submit a copy of a flight report signed by the pilot or the aerial photographer. The flight report shall contain the flight, tide, and weather logs.

D. DATA SUBMITTALS

In accordance with the Department's paperless initiative, you are encouraged to submit all reports and data electronically. When submitting permit required monitoring information, the Contractor shall include a transmittal letter clearly labeled with the following: "This monitoring information is submitted in accordance with the approved Monitoring Plan for Permit No. [XXXXXX] for the monitoring period [XXXXXX]." If the monitoring is not required by permit, but cost-shared through the DEP Beach Management Funding Assistance Program, the transmittal letter shall be labeled, "This monitoring information is submitted in accordance with FDEP Project Agreement [XXXXXXXX]." If mailed, the exterior of all digital products shall be labeled with the description of contents, Project Agreement Number, or Permit Number and monitoring period.

PART III – PRODUCTS

If the reports and other products listed below are electronically transmitted, hard copies of these deliverables are not required. Reports are to be in Word or PDF format.

A. REPORTS

1. Camera Calibration Report - The camera calibration report shall be submitted in accordance with Part II.A.1 of this specification.
2. Flight Report – The flight report shall be submitted in accordance with Part II.C.1 of this specification. The following reports will be submitted as sections of this report: Flight Log (Part II.B.13), Weather Log (Part II.B.14), and the Tide Log (Part II.B.15).
3. MetaData - Complete federally compliant metadata file in ASCII or HTML format for the flight and image processing in accordance with standards set forth by the Federal Geographic Data Committee as referenced in Part I.B.4 of this specification.

SECTION 02000

B. DIGITAL PRODUCTS

1. Digital images shall be in TIFF files with world file format (uncompressed). The digital images shall be submitted on DVD or uploaded to the Division's FTP site. Other forms of delivery are acceptable with prior approval of the compliance officer.

2. Images shall be named using the following schema: DEP two letter county abbreviations, Date in YYYYMMDD format, Underscore, then any convenient sequence number. E.g. PB140321_729. It is not necessary to change the county even though the flight line may capture images in an adjacent county.

END OF SECTION

SECTION 02100

ENVIRONMENTAL AERIAL PHOTOGRAPHY ACQUISITION For BEACH EROSION CONTROL PROJECTS

PART I - GENERAL

A. This technical specification has been developed for application to beach erosion control project monitoring associated with the Beach Management Funding Assistance Program and Joint Coast Permits of the FDEP. This specification is intended for assessments of nearshore hardbottom coverage and spreading of beach nourishment fill placement. This technical specification is specific for use with a digital aerial camera system.

B. DEFINITIONS

1. Aerial Photography System - An airborne digital aerial photography system shall consist of a precision digital aerial camera, airborne Global Positioning System (GPS) with attendant GPS base station(s), and an Inertial Measuring Unit (IMU).
2. CORS - Continuously Operating Reference Stations.
3. Contractor – The aerial survey or photogrammetric company that will provide aerial survey and/or photogrammetric services.
4. Crab – The condition caused by incorrect orientation of the camera with respect to the track of the aircraft. Any turning of an airplane, which causes its longitudinal axis to vary from the track of the plane.
5. Digital Aerial Camera – Digital cameras utilized in conjunction with this contract must be large format, direct digital, frame-based camera systems. Small or medium frame format systems or Line Scanning (push broom technologies) will not be considered.
6. Ground Sampling Distance - GSD is the distance captured by each pixel. Our specification is for the size when collected. Altitude to achieve this GSD will determined by the camera's capabilities.
7. HARN - Florida High Accuracy Reference Network.
8. NAD 83/90 - North American Datum of 1983 adjustment of 1990.
9. NAVD 88 – North American Vertical Datum of 1988.

SECTION 02100

10. Pixel – The smallest cell size with a uniform value of an image. This digital image grain is produced in varying sizes, usually referred to in ground units such as 6 inches, 1 foot, or 3 meters. Pixels are created during the collection of the digital aerial imagery and are key to establishing the resolution of the image.
11. Scale – The relationship between a given distance on the ground and the corresponding distance on a photograph or image. Scale can be expressed in two different ways, both as ratios. The first method uses common measuring systems to relate the distance on the photo to the actual distance on the earth (e.g., 1" = 200'). The second method uses a ratio where the unit of measure is arbitrary (e.g., 1:1200). For this method meters, feet, miles, etc. can all be used as the measuring unit to relate distance on a photo or image with distance on the earth.

C. REFERENCE DOCUMENTS

1. Oklahoma Department of Transportation, *Specifications for Aerial Photography – Digital Camera*, April 2012.
2. American Society for Photogrammetry and Remote Sensing (ASPRS), *ASPRS Accuracy Standards for Digital Geospatial Data*, March 2014.
3. Federal Geographic Data Committee, *Geospatial Positioning Accuracy Standards, Parts 1, 2, and 3*. Final Draft, U.S. Geological Survey, Reston, Virginia, 1998.
4. Federal Geographic Data Committee, *Content Standard for Digital Geospatial Metadata*, FGDC-STD-001-1998, 1998.
5. U.S. Geological Survey, *USGS Digital Aerial Camera Certification*, January 8, 2013.

PART II - EXECUTION

A. PRE-FLIGHT

1. The Contractor shall submit the most recent camera calibration report for the camera utilized for photo acquisition according to the standards of Part I.B.5. The date of calibration shall not exceed the proposed flight date by more than three years.
2. Sea conditions in the project area shall be checked each morning to identify an appropriate flight window which shall comply with the following:

SECTION 02100

- a. Seas have been calm for a minimum of 24 hours preceding flight.
 - b. Water clarity is such that an aerial image of submerged hardbottom may be successfully obtained.
 - c. Tides are incoming during morning hours with cloud cover at less than 10%. In order to minimize glint, the flight window shall occur when the sun angle is between 15 to 30 degrees to the horizon.
3. The project sponsor shall identify and concur with the Contractor on an intended flight week window. During the designated flight week, the Contractor shall be notified by telephone by the project sponsor or authorized designee on the morning of an appropriate day in which acceptable weather and water conditions exist. The Contractor shall be prepared to conduct the aerial photography work the same morning that the notice to proceed is provided.

B. FLIGHT

1. Scale – The images shall be at scale of 1" = 500' (1:6000).
2. Flight Altitude – The altitude of the aircraft used to obtain the photography shall be determined by the contractor to insure the GSD of 15 cm (~6"). It is the responsibility of the contractor to coordinate the flight with the appropriate authority when operating in restricted air space.
3. Ground Control - Ground control includes all necessary ground support and GPS receivers (base stations) for the required number of ground control points to be occupied during the flight. All ground control will be based on the Florida State Plane Coordinate System, NAD83/90 adjustment and tied to the Florida High Accuracy Reference Network (HARN).

When possible, GPS base stations shall have ellipsoid heights to an accuracy of 2 centimeters relative to the Continuously Operating Reference Stations (CORS) or the HARN.

A ground control report shall be prepared and must include all pertinent base station information and mission notes, including information on GPS station monument names, descriptions, coordinates, visibility diagrams, and stability.

4. Ground Control Base-Station Spacing – Ground control base stations shall be approximately 7 miles (preferred) to 12 miles (maximum) apart.
5. Overlap – The aerial photography shall have a minimum of 30% forward overlap.

SECTION 02100

6. Sidelap – Generally, the aerial photography shall be acquired on a single flight path. However, areas that require more than one flight line shall have a minimum of 30% side overlap.
7. Tilt - Care shall be used to reduce tilt to a minimum of less than 5 degrees for any one photograph or 2 degrees for any 10 or more consecutive photographs, or one degree for the entire flight path.
8. Crab - Crab shall not exceed 10 degrees as measured from the flight path, as indicated, by two or more consecutive photographs.
9. Image Collection – Image shall have a Ground Sampling Distance (GSD) of 15 cm (~6”) or better at time of collection. It shall be collected in four bands consisting of Red, Green, Blue and Infrared to achieve color balance in post-production. Horizontal accuracy shall follow ASPRS Digital Standards for Planimetric Maps at 1:6000 scale Level 2 precision. Vertical accuracy, while not required by DEP, should follow ASPRS standards to insure sufficient data for post processing by the contractor.
10. Obscurations – Photography shall not be acquired when haze, smoke, or dust obscures the ground, or when clouds or cloud shadows will appear on any photograph. The image will be clear and sharp in detail, free from clouds, shadows or any other blemishes that would render the image as uncertain for mapping rock and reef features to –15 feet NAVD.
11. Shadows/Reflection – Photography shall minimize water reflection in order to decrease uncertainties in the mapping of submerged rock, reef and vegetation features. Photography shall be taken in the early morning when the sun’s inclination is between 15 degrees and 30 degrees above the horizon. Use of an anti-vignette filter is required.
12. The center of the first and last exposure for every flight line shall be beyond the limits of the project being monitored
13. Flight Log – A flight log representing aircraft flight time shall be maintained on an hourly basis. The time of takeoff, start of photograph, end of photograph, and landing shall be recorded to the nearest of 0.1 of an hour.
14. Weather Log – A weather log shall be maintained to substantiate any delays due to inclement weather. The weather log shall be include date, location, weather report, and weather forecast from the National Weather Service. This information may be supplemented by direct observation.

SECTION 02100

15. Tide Log – The Contractor shall maintain a tide log to substantiate any delay due to incorrect or unacceptable tides. The tide log shall include the date, time, the location of the nearest NOAA tide station(s) being reported, and the tide elevation at the beginning, middle, and end of data collection as calculated for photo collection location (through interpolation between adjacent tide stations). All reported tide elevations shall be referenced to NAVD 1988.
16. Flight Time – The flight shall be at such time that the midpoint of the flight occurs at mean low tide in the region to be photographed.
17. Procedural Control – The Contractor shall outline and maintain a schedule for planned data collection and itemize all procedures including quality control and instrumentation to be followed during the completion of this work. Procedural standards are outlined in reference documents listed in Part I.B. All procedures and milestones achieved during completion of this work shall be described in the metadata as required in Part III.B.2 of this specification.

C. POST-FLIGHT

Flight Report – The Contractor shall submit a copy of a flight report signed by the pilot or the aerial photographer. The flight report shall contain the flight, tide, and weather logs.

D. DATA SUBMITTALS

In accordance with the Department's paperless initiative, you are encouraged to submit all reports and data electronically. When submitting permit required monitoring information to the FDEP, the Contractor shall include a transmittal letter clearly labeled with the following: "This monitoring information is submitted in accordance with the approved Monitoring Plan for Permit No. [XXXXXX] for the monitoring period [XXXXXX]." If the monitoring is not required by permit, but cost-shared through the Beach Management Funding Assistance Program, the transmittal letter shall be labeled, "This monitoring information is submitted in accordance with FDEP Project Agreement [XXXXXXXX]." If mailed, the exterior of all digital products shall be labeled with the description of contents, Project Agreement Number, or Permit Number and monitoring period.

SECTION 02100

PART III – PRODUCTS

A. REPORTS

If the reports and other products listed below are electronically transmitted, hard copies of these deliverables are not required.

1. Camera Calibration Report - The camera calibration report shall be submitted in accordance with Part II.A of this specification in Word or PDF format.
2. Flight Report – The flight report shall be submitted in accordance with Part II.C.1 of this specification in Word or PDF format. The following reports will be submitted as sections of this report: Flight Log (Part II.B.13), Weather Log (Part II.B.14), and the Tide Log (Part II.B.15). Reports are to be submitted electronically.
3. MetaData - Complete federally compliant metadata file in ASCII or HTML format for the flight and image processing in accordance with standards set forth by the Federal Geographic Data Committee as referenced in Part I.B.4 of this specification.

B. DIGITAL PRODUCTS

1. Digital images shall be in TIFF with world file format (uncompressed). The digital images shall be delivered on DVD or uploaded to the Division's FTP site. Other forms of electronic delivery are acceptable with prior approval of the compliance officer.
2. Images shall be named using the following schema: DEP two letter county abbreviations, Date in YYMMDD format, Underscore, then any convenient sequence number. E.g. PB140321_729. It is not necessary to change the county even though the flight line may capture images in an adjacent county.

END OF SECTION

**MONITORING STANDARDS
FOR
BEACH EROSION CONTROL PROJECTS**

APPENDIX A

MONUMENT INFORMATION REPORT

Figure 1: Control Monument Information Report Format

Figures 2 - 7: Range Monument Information Report Format

APPENDIX A

SURVEY CONTROL

The following figures are examples of the format for submission of control and range monument information used in the data collection and processing phases of project related surveys. Two distinct sets of information are required: control monument and range monument.

Control monument information shall be provided as shown in Figure 1 below. One table for each control monument used is to be provided to the FDEP. All control monuments must be 2nd order marks or higher to achieve the horizontal and vertical accuracy required by these monitoring standards.

**CONTROL MONUMENT USED BY [Contractor]
for [Survey Project Name]
[Date of Survey]**

DATUMS: NAD83/90 / NAVD1988

CONTROL METHOD	VALUE
DESIGNATION	0041
STAMPING	17-84-A23
NORTHING	1111111.11
EASTING	999999.99
HORIZONTAL RMSE	.01
ELEVATION	9.99
VERTICAL RMSE	.10
DESCRIPTION	The mark is located at the intersection of U.S. Highway 19 and State Road 453. The mark bears 35.0 feet north of a stop sign 65.3 feet south of the SE corner of a metal building 3.0 feet north of a metal witness post. The mark is a standard DEP brass cap glued into a concrete sidewalk stamped 17-84A23.

Figure 1: Control Monument Information Report Format

Range monument information used as a profile reference location is to be reported in the formats depicted below. The information as shown in Figure 2 is the reference locations from the RTABS distributed by the FDEP. Range monuments that are located during the course of the field survey are tabulated as shown in Figure 3. Figure 4 depicts the format of the monument information used to reduce and process the data into the DEP data format.

APPENDIX A

**EXAMPLE COUNTY MONUMENT COMPARISON 2002
DATUMS: NAD83/90 / NAVD1988
DEP GIVEN MONUMENTS**

MON ID	M. DATE	NORTHING	EASTING	AZ	M. ELEV.
R001	MMM1980	1481070.240	787346.470	90.00	7.23
R002	MMM1972	1480231.740	787295.480	90.00	9.36
R003	MMM1972	1479170.250	786910.980	90.00	8.30
R004	MMM1995	1478243.100	786645.050	90.00	7.51
R005	MMM1972	1477340.250	786340.980	90.00	8.89
R006	MMM1985	1476402.770	786076.100	90.00	8.06
R007	MMM1980	1475489.760	785758.980	90.00	7.58
R008	MMM1979	1474610.260	785520.480	90.00	6.99
R009	MMM1972	1473671.770	785405.480	90.00	9.03
R010	MMM1986	1472764.770	785228.480	90.00	9.71

Figure 2: Monument Information Provided by FDEP.

**EXAMPLE COUNTY MONUMENT COMPARISON 2002 DATUMS: NAD83/90 /
NAVD1988
MONUMENTS FOUND BY CONTRACTOR 2002**

MON ID	M. DATE	NORTHING	EASTING	AZ	M. ELEV.
R-1-T	80	1481070.163	787346.934	90.00	7.10
R-2	72	1480231.455	787294.435	90.00	9.33
R-3	72	1479170.198	786910.287	90.00	8.30
T-4	95	1478242.711	786644.778	90.00	7.41
R-5	72	1477339.664	786341.179	90.00	8.81
R-6	RESET	1476402.887	786150.950	90.00	9.07
R-7-T	80	1475489.691	785758.501	90.00	7.09
R-8	79	1474610.283	785521.752	90.00	6.60
R-9	72	1473671.826	785405.312	90.00	8.73
T-10	86	1472764.519	785228.533	90.00	9.73

Figure 3: Monument Information Found During Field Investigation by Surveyor.

APPENDIX A

**EXAMPLE COUNTY MONUMENT COMPARISON 2002
DATUMS: NAD83/90 / NAVD1988
MONUMENTS USED BY CONTRACTOR 2002 SURVEY**

MON ID	M. DATE	NORTHING	EASTING	AZ	M. ELEV.
R-1-T	Jan-80	1481070.240	787346.470	90.00	7.23
R-2	Aug-72	1480231.740	787295.480	90.00	9.36
R-3	Aug-72	1479170.250	786910.980	90.00	8.30
T-4	COE1995	1478243.100	786645.050	90.00	7.51
R-5	Aug-72	1477340.250	786340.980	90.00	8.89
R-6	RESET02	1476402.887	786150.950	90.00	9.07
R-7	Jan-80	1475489.760	785758.980	90.00	7.09
R-8	COE1979	1474610.260	785520.480	90.00	6.60
R-9	Aug-72	1473671.770	785405.480	90.00	8.73
T-10	Jan-86	1472764.770	785228.480	90.00	9.71

FIGURE 4: Monument Information Used to Process Data.

A comparison of the northing, easting, azimuth, and elevation values of the given and found range monuments is shown in Figure 5, where ΔN , ΔE , ΔAZ and ΔZ are the differences in northing, easting, azimuth and elevation values, respectively. Differences in the northing and easting values greater than five (5) feet should be clearly designated, such as the easting value below, highlighted in yellow. Differences in the azimuth values greater than 1° and in the elevation values greater than 0.3 feet shall be designated in a similar manner. Figures 6 and 7 are similar comparisons between given and used values, and found and used values respectively.

**EXAMPLE COUNTY MONUMENT COMPARISON 2002 DATUMS:
NAD83/90 / NAVD1988
GIVEN -VS-FOUND**

MON ID	ΔN	ΔE	ΔAZ	ΔZ
R-1-T	0.077	-0.464	0.000	0.130
R-2	0.285	1.045	0.000	0.030
R-3	0.052	0.693	0.000	0.000
T-4	0.389	0.272	0.000	0.100
R-5	0.586	-0.199	0.000	0.080
R-6	-0.117	-74.850	0.000	-1.010
R-7	0.069	0.479	0.000	0.490
R-8	-0.023	-1.272	0.000	0.390
R-9	-0.056	0.168	0.000	0.300
T-10	0.251	-0.053	0.000	-0.020

Figure 5: Comparison of Found Monuments to Those Given by FDEP.

APPENDIX A

**EXAMPLE COUNTY MONUMENT COMPARISON 2002 DATUMS: NAD83/90 /
NAVD1988
GIVEN -VS-USED**

MON ID	ΔN	ΔE	ΔAZ	ΔZ
R-1-T	0.000	0.000	0.000	0.000
R-2	0.000	0.000	0.000	0.000
R-3	0.000	0.000	0.000	0.000
T-4	0.000	0.000	0.000	0.000
R-5	0.000	0.000	0.000	0.000
R-6	-0.117	-74.850	0.000	-1.010
R-7	0.000	0.000	0.000	0.490
R-8	0.000	0.000	0.000	0.390
R-9	0.000	0.000	0.000	0.300
T-10	0.000	0.000	0.000	0.000

Figure 6: Comparison of Monuments Used to Process Survey Data to Those Given by FDEP.

**EXAMPLE COUNTY MONUMENT COMPARISON 2002 DATUMS: NAD83/90 /
NAVD1988
FOUND-VS-USED**

MON ID	ΔN	ΔE	ΔAZ	ΔZ
R-1-T	-0.077	0.464	0.000	-0.130
R-2	-0.285	-1.045	0.000	-0.030
R-3	-0.052	-0.693	0.000	0.000
T-4	-0.389	-0.272	0.000	-0.100
R-5	-0.586	0.199	0.000	-0.080
R-6	0.000	0.000	0.000	0.000
R-7	-0.069	-0.479	0.000	0.000
R-8	0.023	1.272	0.000	0.000
R-9	0.056	-0.168	0.000	0.000
T-10	-0.251	0.053	0.000	0.020

Figure 7: Comparison of Monuments Used in a Survey to Those Found During Field Investigation.

END OF SECTION