Please provide the following information, and submit to the NOAA DM Plan Repository.

Reference to Master DM Plan (if applicable)

As stated in Section IV, Requirement 1.3, DM Plans may be hierarchical. If this DM Plan inherits provisions from a higher-level DM Plan already submitted to the Repository, then this more-specific Plan only needs to provide information that differs from what was provided in the Master DM Plan.

URL of higher-level DM Plan (if any) as submitted to DM Plan Repository:

1. General Description of Data to be Managed

1.1. Name of the Data, data collection Project, or data-producing Program:

2014 NCFMP Lidar: Statewide North Carolina (Phase 2)

1.2. Summary description of the data:

This project was a joint effort between NC Emergency Management, NC Geodetic Survey, and the NCDOT. The following people served as the main representatives for each stakeholder: NC Emergency Management- Hope Morgan(primary contact) and John Dorman; NC Geodetic Survey- Gary Thompson and Steve Kauffman; NCDOT- Keith Johnston and Marc Swartz. The United States Marine Corps (USMC), United States Geological Survey (USGS), and the National Resources Conservation Service(NRCS)were also stakeholders and their representative roles can be found in the project coordination Issue Papers. The data set was collected specific to the 2014 Phase Two project area consisting of 20 North Carolina counties which are listed below in the " Place Keywords" section of this metadata record. The LiDAR was collected between January 30 and March 13 of 2014, at nominal post spacing of 0.7 meters or better for a total project area of 14,500 square miles. Three sensors were used for the data collection; two Leica ALS70HP-II (serial numbers 7198 and 7123) and an Optech Pegasus HA500 (serial number 13SEN303). All data was collected during leaf-off conditions and the three coastal counties within the project area were collected during low tide conditions. Ground survey support for the project included the establishment of GPS base stations and the collection of control points used for calibration. All data was delivered in the North Carolina State Plane Coordinate System, with a horizontal datum of NAD83 (2011), vertical datum of NAVD88 (Geoid 12A), in US Survey Feet. Data was delivered tiled to a 5, 000 foot by 5,000 foot tiling scheme unless otherwise specified in this product description. All LiDAR was delivered in LASer (LAS) version 1.3 standard format. Products for this project derived from the source LiDAR included: intensity images in GeoTIFF format, hydro-flattening breaklines in ESRI File Geodatabase format, Digital Elevation Models (DEMs) in ESRI Grid format, ESRI Terrain Datasets (by county) in ESRI File Geodatabase format, product and project-level metadata, and project reports to include the Report of Survey, Post-Acquisition Report, and Project Report. All LiDAR and derivative products for this project met the specifications stipulated in Delivery Order 59 and the NC LiDAR Standard.

Original contact information:

Contact Name: Hope Morgan

Contact Org: NC Emergency Management

Title: GIS Manager - GTM

Phone: 919-825-2336

Email: Hope.Morgan@ncdps.gov

1.3. Is this a one-time data collection, or an ongoing series of measurements?
One-time data collection

1.4. Actual or planned temporal coverage of the data:
2014-01-30 to 2015-03-13

1.5. Actual or planned geographic coverage of the data:
W: -79.483096, E: -77.047314, N: 36.566115, S: 33.81971

1.6. Type(s) of data:
(e.g., digital numeric data, imagery, photographs, video, audio, database, tabular data, etc.)

1.7. Data collection method(s):
(e.g., satellite, airplane, unmanned aerial system, radar, weather station, moored buoy, research vessel, autonomous underwater vehicle, animal tagging, manual surveys, enforcement activities, numerical model, etc.)

1.8. If data are from a NOAA Observing System of Record, indicate name of system:

1.8.1. If data are from another observing system, please specify:

2. Point of Contact for this Data Management Plan (author or maintainer)

2.1. Name:
NOAA Office for Coastal Management (NOAA/OCM)

2.2. Title:
Metadata Contact

2.3. Affiliation or facility:
NOAA Office for Coastal Management (NOAA/OCM)

2.4. E-mail address:
coastal.info@noaa.gov

2.5. Phone number:

(843) 740-1202

3. Responsible Party for Data Management

Program Managers, or their designee, shall be responsible for assuring the proper management of the data produced by their Program. Please indicate the responsible party below.

3.1. Name:

3.2. Title:

Data Steward

4. Resources

Programs must identify resources within their own budget for managing the data they produce.

4.1. Have resources for management of these data been identified?

4.2. Approximate percentage of the budget for these data devoted to data management (specify percentage or "unknown"):

5. Data Lineage and Quality

NOAA has issued Information Quality Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information which it disseminates.

5.1. Processing workflow of the data from collection or acquisition to making it publicly accessible

(describe or provide URL of description):

Process Steps:

- 2014-02-15 00:00:00 - ESP Associates conducted a ground control survey in support of this project to provide horizontal and vertical positions on predominantly hard surfaces. Bare-earth/low grass surfaces were considered as an alternative in areas where a suitable hard surfaces could not be found. Field procedures were consistent with the National Geodetic Survey Guidelines for Real Time GNSS Networks, March 2011, v.2.0. These procedures included making redundant occupations under different satellite configurations and field conditions for each point. The calibration points were spread throughout the collection area in accordance to the project point layout plan. ESP collected 695 well-distributed GPS survey control points to supplement airborne GPS (ABGPS) accuracy. No control panels were placed as part of this effort. The control was used to facilitate calibration of LiDAR flightlines/blocks, perform mean adjustment, and conduct preliminary testing of the fundamental vertical accuracy of the data (FVA). The calibration control adhered to the following guidelines: (1) Located only in open terrain, where there was high probability that the sensor would detect the ground surface without influence from surrounding vegetation. (2) On flat or uniformly sloping terrain at least five meters away from any breakline where a change in

slope occurs. (3) Checkpoint accuracy satisfied a Local Network accuracy of 5 cm at the 95% confidence level. Accuracy was tested using National Standard for Spatial Data Accuracy guidelines. (4) Photos were taken at each control point location. The North Carolina Geodetic Survey Real-Time Network was used for control for the ground control surveys. Static GPS procedures were used in cell coverage gap areas. The horizontal datum referenced NAD83/2011 Epoch 2010.00 and elevations referenced NAVD88 and used the Geoid12A model to determine orthometric heights. A comprehensive Survey Report was provided to the North Carolina Floodplain Mapping Program, containing the NCPLS certification, list of points, methodology, map book, NGS bench mark tie map, and calibration point datasheets.
- 2014-03-13 00:00:00 - All LiDAR data for the project was collected by three aerial vendors on the ESP team between January 30, 2014 and March 13, 2014, using a combination of Leica ALS-70HP-II sensors (serial numbers 7198 and 7123) and an Optech Pegasus HA500 sensor (serial number 13SEN303). The aerial vendors on the ESP team were Surdex Corporation, The Atlantic Group, and Merrick & Company. The project design was developed to ensure that the acquired LiDAR data met or exceeded the requirements for the current USGS Quality Level 2 (QL2) LiDAR Specification at a Fundamental Vertical Accuracy (FVA) of 18.2 centimeters (cm) at the 95-percent confidence level (9.25cm RMSEZ). Prior to flight operations, a calibration site was selected and flown with all three sensors to ensure that each sensor was capable of meeting project specifications, and to establish sensor settings that would result in a more homogeneous intensity appearance across all three sensors. Each aerial vendor began flight operations once their respective calibration test site data were approved. The data collection plan was broken into a total of 45 sub-blocks covering the project area. The sub-block plan included limiting flight line acquisition to < 20 minutes, or approximately 31 miles. This was done to reduce the potential for inertial drift by improving inertial precision. In addition, each block contained at least one cross flight, which was used for the bundle adjustment calibration procedure. Flight lines extended 100 meters or more beyond the project limits to ensure coverage. Over three coastal counties, flights were coordinated with low tide levels. These counties were Pender, New Hanover, and Brunswick. Roving base stations were not required in support of the flights due to the dense Continuously Operating Reference Station (CORS) network in the State of North Carolina. The project requirement to maintain flights less than 50 km (31 miles) from each base station was satisfied using the existing network. For contingency purposes, flight crews operated GPS base stations a airport operations sites. Once flown, blocks were submitted to productions units for QA/QC and calibration. Upon completion of all flights, a Post-Acquisition Report report detailing all flight operations, calibration, and QA/QC process was submitted to the North Carolina Floodplain Mapping Program. Raw LiDAR data and ancillary files were archived at ESP Associates and at each respective flight vendor upon verification of the data.
- 2014-04-15 00:00:00 - Data calibration was accomplished by a bundle adjustment approach for each acquisition block to efficiently and accurately address the flight

line-to-flight line separation and fundamental accuracy requirements.Supporting data was reviewed to analyze GPS baseline distances and GPS satellite constellation geometry and outages during the trajectory processing. A verification was conducted to ensure that proper Airborne GPS (AGPS) surveying techniques were followed including: pre and post mission static initializations and review of In-air IMU alignments, both before and after on-site collection to ensure proper self-calibration of the IMU accelerometers and gyros were achieved. A minimum of one cross-flight was planned throughout each project block area across all flightlines and over roadways where possible. The cross-flights provided common control surfaces used to remove any vertical discrepancies in the LiDAR data between flightlines and aided in the bundle adjustment process with review of the roll, pitch, heading (omega, phi, kappa). The cross-flights were critical to ensure flight line ties across the sub-blocks and the entire project area. The areas of overlap between flightlines were used to calibrate (aka boresight) the LiDAR point cloud to achieve proper flight line to flight line alignment in all 6 degrees of freedom. This includes adjustment of IMU and scanner-related variables such as roll, x,y, z, pitch, heading, and timing interval (calibration range bias by return) Each LiDAR mission flown was independently reviewed, bundle adjusted (boresighted), and/if necessary, improved by a hands-on boresight refinement. Once relative accuracy adjustments were complete, the data were adjusted to the high order GPS calibration control to achieve a zero mean bias for fundamental accuracy computation, verification, and reporting. All data calibration for the project team was conducted in the same office under the supervision of a North Carolina Professional Land Surveyor (NCPLS).
- 2014-06-30 00:00:00 - Automated filtering was conducted on the LiDAR utilizing macros, containing one or more filtering algorithms, to derive LAS files separated into the different classification groups as defined in the ASPRS point classification requirements of the project. Automated filters were used to derive the following classifications: Class 1 (unclassified), Class 2 (ground), Class 3 (low vegetation), Class 4 (medium height vegetation), Class 5 (high vegetation), Class 6 (building), Class 7 (low noise), Class 11 (high noise), Class 17 (overlap default), Class 18 (overlap ground) . The remaining classifications for the project (such as water and road points) were classified during subsequent process steps in the project and are documented in the respective process step desciptions in this metadata file. During this process step, the macros were tested in several portions of the project area to verify the appropriateness of the filters and adapted when needed to accommodate changes in land cover and terrain features. All team members were provided with identical macros to ensure continuity between production groups. Filtering results were reviewed for gross processing errors prior to the data being released to the next process step.
- 2014-12-19 00:00:00 - A road point classification, Class 13, was incorporated into the LAS classified point clouds by generating road polygons in shapefile format for the majority of state and federally-maintained hard-surface roads. The polygons were mapped using a combination of the LiDAR data, the latest available statewide orthophotography, and a state-provided road line file. Polygons were mapped at

edge of pavement where visible and used to automatcially re-classify ground points on the road surface to Class 13. Road features such as private drives, commercial roads, parking lots, and dirt and gravel roads were not collected or re-classified. The polygon shapefiles used to produce the road classification were not a deliverable and are not available for future use.
- 2014-12-19 00:00:00 - A bridge point classification, Class 14, was incorporated into the LAS classified point clouds via manual review and classification of bridge features. Analysis and classification of bridges was assisted through the use of ancillary information such as aerial photography, a state-provided bridge point file, and direct interpretation of the LiDAR data. Where possible, large box culverts and other culvert features were not classified as bridge and left in the ground and road classifications. Where possible, technicians identified and classified other types of bridges such as railroad, covered, and pedestrian bridges.
- 2014-12-19 00:00:00 - Breaklines were collected to further define (hydro-flatten) the terrain and enhance the accuracy of the LiDAR DEMs produced at a later process step. Breaklines for this project consisted of two primary categories; water bodies greater than 2 acres and rivers greater than 100 feet in width. The hydrographic breaklines were compiled in 3D directly from the LiDAR bare earth data. Color cycles in the TIN model were used to provide a clear indication of where breaklines were to be collected. During this process step, polygon and polyline vertices were created at highly accurate horizontal/vertical coordinates providing for a hydroflattened DEM. Double line drain features (Rivers) will be enforced monotonically (have downhill directionality) for linear hydrographic features. The hydro-flattening breaklines were compiled based on the guidelines and principles outlined in the USGS LiDAR Base Specification Version 1.0.
- 2014-12-19 00:00:00 - Water point (Class 9) and breakline proximity point (Class 10) classifications were incorporated into the LAS classified point clouds by using the compiled line work from the previous process step to automatically classify water points and a buffer of breakline proximity points around the line work.
- 2014-12-19 00:00:00 - Terrain datasets were created for each county in the project. The terrains were be stored in individual File Geodatabase format in ArcGIS version 10.2. The Terrains were loaded with the processed LiDAR .las file bare earth points (Ground(2) and Road(13)), each Classification was converted to multipoint features prior to being loaded. These multipoint features were stored as Surface Feature Type (SFType) 'mass points' and were individually embedded into the Terrain dataset. The dissolve of the NCLRM Tiles were used for the county boundaries as SFType 'hard clip'. The designation of tiles for each county was primarily determined by assigning a tile to a county by a majority area rule, which results in zero duplicate tiles across the project area. Some modifications were made based on the data seam between Phase One and Phase Two, the NC buffering requirement, and direction from NCEM. Any breaklines developed as part of the project were included within the Terrain and contain the appropriate SFType assigned based on the type of input feature. The Pyramid Type was set to the Z Tolerance setting with the Pyramid Levels of (0, 0.5, 1, 2, 4, 8, 16, 32, 64, 128)(ft.).

The precision of the Feature Dataset was 0.01
- 2014-12-19 00:00:00 - LiDAR intensity images were generated using the classified LiDAR points and their associated intensity returns with the exception of Class 7 Noise and Class 12 Flight Line Overlap. The intensity images were exported in grayscale, 8-bit, GeoTIFF format using the same tile scheme as the other LiDAR deliverables. The 8-bit format was an Unsigned 8-bit depth with 256 available unique values from 0 to 255.
- 2015-09-01 00:00:00 - Data were received by the NOAA Office for Coastal Management from the North Carolina Flood Mapping Program in the form described above. It was ingested into the Digital Coast Data Access Viewer system for distribution by: 1) reprojecting to geographic coordinates with vertical meters; 2) transforming the vertical datum to NAD83 ellipsoid heights using the NGS GEOID12a model; and 3) compressing the data using laszip (LAStools version 150828) to LAZ format.

5.1.1. If data at different stages of the workflow, or products derived from these data, are subject to a separate data management plan, provide reference to other plan:

5.2. Quality control procedures employed (describe or provide URL of description):

6. Data Documentation

The EDMC Data Documentation Procedural Directive requires that NOAA data be well documented, specifies the use of ISO 19115 and related standards for documentation of new data, and provides links to resources and tools for metadata creation and validation.

6.1. Does metadata comply with EDMC Data Documentation directive?

No

6.1.1. If metadata are non-existent or non-compliant, please explain:

Missing/invalid information:
- 1.6. Type(s) of data
- 1.7. Data collection method(s)
- 3.1. Responsible Party for Data Management
- 4.1. Have resources for management of these data been identified?
- 4.2. Approximate percentage of the budget for these data devoted to data management
- 5.2. Quality control procedures employed
- 7.1. Do these data comply with the Data Access directive?
- 7.1.1. If data are not available or has limitations, has a Waiver been filed?
- 7.1.2. If there are limitations to data access, describe how data are protected
- 7.4. Approximate delay between data collection and dissemination
- 8.1. Actual or planned long-term data archive location
- 8.3. Approximate delay between data collection and submission to an archive

facility
- 8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?

6.2. Name of organization or facility providing metadata hosting:
NMFS Office of Science and Technology

6.2.1. If service is needed for metadata hosting, please indicate:

6.3. URL of metadata folder or data catalog, if known:
https://www.fisheries.noaa.gov/inport/item/49835

6.4. Process for producing and maintaining metadata
(describe or provide URL of description):
Metadata produced and maintained in accordance with the NOAA Data Documentation Procedural Directive: https://nosc.noaa.gov/EDMC/DAARWG/docs/EDMC_PD-Data_Documentation_v1.pdf

7. Data Access
NAO 212-15 states that access to environmental data may only be restricted when distribution is explicitly limited by law, regulation, policy (such as those applicable to personally identifiable information or protected critical infrastructure information or proprietary trade information) or by security requirements. The EDMC Data Access Procedural Directive contains specific guidance, recommends the use of open-standard, interoperable, non-proprietary web services, provides information about resources and tools to enable data access, and includes a Waiver to be submitted to justify any approach other than full, unrestricted public access.

7.1. Do these data comply with the Data Access directive?

7.1.1. If the data are not to be made available to the public at all, or with limitations, has a Waiver (Appendix A of Data Access directive) been filed?

7.1.2. If there are limitations to public data access, describe how data are protected from unauthorized access or disclosure:

7.2. Name of organization of facility providing data access:
NOAA Office for Coastal Management (NOAA/OCM)

7.2.1. If data hosting service is needed, please indicate:

7.2.2. URL of data access service, if known:
https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=4957
https://noaa-nos-coastal-lidar-pds.s3.amazonaws.com/laz/geoid18/4957/index.html

7.3. Data access methods or services offered:

This data can be obtained on-line at the following URL:

https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=4957;

7.4. Approximate delay between data collection and dissemination:

7.4.1. If delay is longer than latency of automated processing, indicate under what authority data access is delayed:

8. Data Preservation and Protection

The NOAA Procedure for Scientific Records Appraisal and Archive Approval describes how to identify, appraise and decide what scientific records are to be preserved in a NOAA archive.

8.1. Actual or planned long-term data archive location:

(Specify NCEI-MD, NCEI-CO, NCEI-NC, NCEI-MS, World Data Center (WDC) facility, Other, To Be Determined, Unable to Archive, or No Archiving Intended)

8.1.1. If World Data Center or Other, specify:

8.1.2. If To Be Determined, Unable to Archive or No Archiving Intended, explain:

8.2. Data storage facility prior to being sent to an archive facility (if any):

Office for Coastal Management - Charleston, SC

8.3. Approximate delay between data collection and submission to an archive facility:

8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?

Discuss data back-up, disaster recovery/contingency planning, and off-site data storage relevant to the data collection

9. Additional Line Office or Staff Office Questions

Line and Staff Offices may extend this template by inserting additional questions in this section.