SECTION 11 83 02
GNSS & GIS MAPPING AND GEODATA

PART 1 - GENERAL

1.1 DESCRIPTION

A. The contractor shall collect GeoData with Global Navigation Satellite System (GNSS) coordinate locations and elevations for the work to be performed as part of this project. The collection of GNSS coordinates and elevations shall comply with the requirements of Section 11 83 00 GNSS.

B. The contractor shall collect the GeoData for the features indicated in Part 2 for the new work being performed as part of this project. The net result shall be a complete newly created collection of GeoData for the specific identified features within the developed portions of the cemetery at the end of the project.

C. The specific means and methods for collecting the GeoData shall be as described herein with the features being displayed as points, lines, polylines or closed polygons with the applicable symbology, line types, layers and colors in accordance with VA Geospatial Data Standards referenced below.

PART 2 - MATERIALS

2.1 GENERAL

A. For this specification section, the production of the electronic information that shall be provided as an ArcGIS File Geodatabase are referenced as materials.

1. GIS information from the contractor work areas for the project. The representation of the work constructed by the contractor as part of the project, is collected according to standards established herein, where the contractor shall produce detailed description and representation of the system for data collection, documentation and transfer to GIS format.

2. The various elements within the work area to be collected shall be represented using the VA Geospatial Data Standards. The data associated with the polyline elements shall be as indicated below for the respective elements constructed, with the date of installation, (month and year) being provided for all new work materials. The contractor shall coordinate the field collected data for assimilation and configuration into the GIS format. The contractor shall be responsible for providing the means and methods for achieving the end results for the data indicated herein.
2.2 DESCRIPTION OF DATA COLLECTION BY ELEMENT TYPE

A. The data collection for the new project work areas shall be consistent for the same types of entities in each location. The following paragraphs describe the site elements and the way they should be indicated in the GIS mapping, as well as indicating the information that should be included in the GeoData for the respective elements being represented.

1. GIS data for the contractor constructed areas in the project area. All facilities constructed in the project area shall be documented to the level required in Section 11 83 00. The information for the elements being represented shall be identified to the level of 1 centimeter and 2-centimeter accuracy for the horizontal and vertical coordinate, respectively. A geodatabase template for all required features and associated data will be provided to, and be used by, the contractor. Unless otherwise noted, all unique IDs needing to be generated must use the three-digit cemetery ID (AKA station number), followed by a hyphen, as a prefix for the ID (e.g. XXX-).

a. Points

1) Gravesite Grid Monuments– The features within the burial areas established to allow the staff to find their location within each burial section using taped measurements offset from reference lines between these monuments. A unique ID will be generated using the cemetery ID, burial section, “GGM” designation, and a sequential number starting at 1 for the monument closest to the street and left side of the section as viewed from the closest street (e.g. CEMETERYID-SECTION-GGM-X).

2) Burial Section Markers – Permanent above ground markers with the identification of the burial section number (typically two per burial section). A unique ID will be generated using the cemetery ID, burial section, “BSM” designation, and a sequential number starting at one (1) for the monument closest to the street and left side of the section as viewed from the closest street (e.g. CEMETERYID-SECTION-BSM-X). A digital photograph of the section marker shall be taken and attached as part of the data for the feature.

3) Trees and Shrubs – All trees six inch (6”) caliper or smaller, and shrubs two foot (2’) diameter and smaller, within the
developed portion of the cemetery. Data is to include genus, species, and common names. For larger trees and shrubs see the requirements for closed polygons.

4) Signs – All sign posts, pads, and panel assemblies shall be collected as a point feature. For pads and panel assemblies, the point is to be the center of the feature. Data is to include signage type, installation date, material, sign text, and reverse side text. Unique identification shall be provided. Each sign shall be digitally photographed at the completion of its installation and the image shall be attached as part of the data for the point. A unique ID will be generated using the cemetery ID, “SIGN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-SIGN-X).

5) Irrigation Structures – the actual locations for the installed sprinkler heads, valves, controls, fittings, quick couplers, flower watering spigots, and all other irrigation system components shall be collected. Information on the type, make, model, size, and material shall be included as installed. A unique ID will be generated using the cemetery ID, “IRR” designation, and a sequential number starting at 1 (e.g. CEMETERYID-IRR-X).

6) Flags Sleeves (A.K.A. Avenue of Flag Sleeves) – The installed sleeves for displaying flag for special days and events, located along the roadways throughout the cemetery. Unique identification shall be provided using the “FS” designation along with the cemetery ID (e.g. CEMETERYID-FS-X).

7) Utility markers – The above ground markers indicating the location of a utility line, easement, or no dig areas around the underground utility lines. This is to include markers indicating locations of gas, water, sewer, telecommunication, and electric utilities.

8) Monument Points – Monuments, pins, or other markers set by surveyor to identify the cemetery boundary property line. Information about each point shall include type, designation and monument ID (if applicable), installation date, survey date, installation contractor name, northing, easting, and elevation in the local state plane coordinate system. Unique
identification shall be provided using the “SM” designation along with the cemetery ID (e.g. CEMETERYID-SM-X).

9) Cemetery Entrance – The point location of the main cemetery entrance within the cemetery boundary to be used as the geocode address point. The cemetery entrance point will hold all cemetery information including cemetery ID, cemetery name, mailing and physical addresses, phone numbers, and other administrative information.

10) Water Utility Structures – the actual locations for the installed water hydrants, fire hydrants, valves, fittings, wells, and all other water system components shall be collected. Information on the type, make, model, size, and material shall be included as installed when applicable. A unique ID will be generated using the cemetery ID, “WATER” designation, and a sequential number starting at 1 (e.g. CEMETERYID-WATER-X). Fire hydrant data should also include the configuration of the hydrant, including the threaded connections, an attached photograph and if available, fire flow test. A digital photograph of spigots shall be taken and attached to the data file that show the completed installation as well as the configuration of the piping with the materials identified prior to installation, so the operations staff can order replacements as needed in the future.

11) Sanitary Sewer Structures – the actual locations for the installed sanitary sewer or septic system manholes, cleanouts, pumps, and other sanitary sewer components shall be collected. Information on the type, make, model, size, elevations, and material shall be included as installed when applicable. A unique ID will be generated using the cemetery ID, “SAN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-SAN-X). A digital photograph of the interior of all manhole structures shall be taken and attached to the data file, with the outlet always at the bottom of the picture.

12) Storm Sewer Structures – the actual locations for all installed storm sewer junction boxes, catch basins, outlets, weir boxes, and other storm sewer components shall be collected. A digital photograph of headwalls, in addition to the interior of all junction boxes, inlets, and catch basins,
shall be taken and attached to the data file, with the outlet always at the bottom of the picture. Information on the type, make, model, size, elevations, and material shall be included as installed when applicable. A unique ID will be generated using the cemetery ID, “STORM” designation, and a sequential number starting at 1 (e.g. CEMETERYID-STORM-X).

13) Electrical Structures – the actual locations for all installed electrical transformers, duct banks, boxes, and other electrical features shall be collected. Information on the type, make, model, size, elevation, and material shall be included as installed. A unique ID will be generated using the cemetery ID, “ELEC” designation, and a sequential number starting at 1 (e.g. CEMETERYID-ELEC-X).

14) Gas Structures – the actual locations for all installed gas fittings, valves, meters and other gas features shall be collected. Information on the type, make, model, size, elevation, and material shall be included as installed. A unique ID will be generated using the cemetery ID, “GAS” designation, and a sequential number starting at 1 (e.g. CEMETERYID-GAS-X).

15) Flagpoles – Points representing the location of permanent flagpoles within the cemetery. The data associated shall indicate the type of flag flown, the size of the flag, the height of the pole, material of the pole, model, and the manufacturer for the pole. A unique ID will be generated using the cemetery ID, “FP” designation, and a sequential number starting at 1 (e.g. CEMETERYID-FP-X).

16) Lighting – the locations for all exterior lighting to include lighting for landscaping, signage, pathways, and streets within the cemetery. Attributes for each point shall include the lighting type, installation date, and a unique ID will be generated using the cemetery ID, “LIGHT” designation, and a sequential number starting at 1 (e.g. CEMETERYID-LIGHT-X).

17) Interment – Feature class to hold GNSS location records of each interment. Attributes fields shall include the name of the interred, interment date, section, row, wall, gravesite number, BOSSID (unique ID), position accuracy type, and observer name and notes. A photograph of the tag and remains
(casket/urn), once placed in their final resting place, will be associated with each interment.

18) Gravesite Marker – The GNSS location of each headstone installed. Attributes shall include installation date, marker type, section, row, wall, gravesite number, position accuracy type, and observer name and notes. Photographs of the front and back will be associated with each feature once installed after each interment. The GRAVESITE_ID is a combined key and will serve as the unique ID (CEMETERYID-SECTION-WALL-ROW GRAVESITE).

19) Benches – A point representing the GNSS location of each bench installed. The data for benches shall include one digital photo of one of the bench, as well as the manufacturer make and model number. A sequential unique ID shall be created for each bench (e.g. CEMETERYID-BENCH-X).

20) Bollards – The GNSS location for each bollard and the elevation at the ground surface shall be provided. The data shall indicate the top elevation of the bollard, diameter, material, and paint manufacturer and color. A sequential unique ID shall be created for each bollard (e.g. CEMETERYID-BOLL-X). If the bollards are covered with plastic, the make and manufacturer shall also be indicated in the data.

b. Polylines

1) Water lines – Location of the waterlines, along the centerline on top of the pipe (maximum 50 foot intervals), with GNSS location and elevation shots at each change in direction or elevation, at all fittings, valves and any appurtenances. The data associated with the polyline should include the pipe material, size, and class of pipe. Each fitting, valve or appurtenance shall be identified in the data for the respective location and shall include the size, material, type of joint and class of the fitting, valve or appurtenance. A unique ID will be generated using the cemetery ID, “WATERLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-WATERLN-X). Lines are to be snapped to fittings.

2) Sanitary Sewer Lines – Location of sanitary sewer gravity lines and sanitary sewer force mains shall be provided along the top centerline of the pipes when outside of structures.
The data shall indicate the size, type and pressure class for the pipe installed, as well as the joint type. For the force mains, any changes in direction or elevation shall be location points for the installed pipe. Same information shall be provided for the data on the pipe. Provide upstream and downstream invert elevations at all junctions. A unique ID will be generated using the cemetery ID, “SANLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-SANLN-X). Lines are to be snapped to fittings.

3) Storm System Piping – Location of the storm drain pipe lines between structures, or between structures and daylight outlets, shall be located along the top of the pipe. Attributes shall include the installation date, size, material, and pressure rating for the pipe, and the joint type. Provide upstream and downstream invert elevations at all junctions. A unique ID will be generated using the cemetery ID, “STORMLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-STORMLN-X). Lines are to be snapped to fittings.

4) Electrical lines – direct bury electrical lines, electrical lines in conduit, direct bury control wiring, control wiring in conduit, ground wires, phone lines, or any other buried wiring. Along with the location and depth for these lines, the data should identify the type, size, purpose, conduit size, whether the information if for the conduit, wire, or encasement of the conduit. Any overhead lines and poles that are in or through the contract work area for the project shall also be located and identified. A unique ID will be generated using the cemetery ID, “ELECLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-ELECLN-X). Lines are to be snapped to fittings.

5) Gas lines – Location of all gas lines in the developed portion of the cemetery. Centerlines should be used for location. Installation date, depth, material, and size for the lines should be identified. A unique ID will be generated using the cemetery ID, “GASLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-GASLN-X). Lines are to be snapped to all fittings.
6) Fencing – All permanent fencing in the project construction area with the data regarding the type and details for the fencing being included.

7) Contour lines – The as constructed contour lines, major and minor, with elevation and creation date attributes at 1 foot contour intervals.

8) Streams – All perennial, intermittent, and ephemeral streams, creeks, and rivers within, or touching, the cemetery boundary will be provided. Included in this will be the stream type and local name if available. A unique ID will be generated using the cemetery ID, “HYDROLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-HYDROLN-X).

9) Expansion Joints – Lines representing the joints between individual pavement and sidewalk features. The data for the expansion joints shall indicate the materials used for the joint construction as well as the date of installation. A unique ID will be generated using the cemetery ID, “EXPANLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-EXPANLN-X).

10) Irrigation Lines – Cemetery layout of all irrigation lines with polylines snapped to and split at each irrigation structure and fitting. The data associated with the polyline should include the pipe material, size, depth, and class of pipe. A unique ID will be generated using the cemetery ID, “IRRLN” designation, and a sequential number starting at 1 (e.g. CEMETERYID-IRRLN-X).
c. Closed Polygons

1) Pavement– The roadways, sidewalks, paths, stairs, handicap access ramps, plazas, and curb areas within the developed site shall be documented with the GNSS equipment. When pavement areas can be differentiated by time of installation, they should be individually included as separate closed polygons, with the appropriate date of placement indicated in the data for the area. The entire roadway pavement, parking areas, maintenance yard, shall be documented with closed polygons that adjoin to provide a complete area for the entire pavement, when selected. Curbs shall be differentiated by changes in the curb type, age, etc. and the appropriate information differentiating the various areas shall be included in the data associated with the closed polygons. Sidewalks shall be done like curbs, with the different types, surfaces, ages, etc. being created as separate closed polygons. The closed polygons shall be created to adjoin each other, without breaks or overlaps so the selection of all will provide the cumulative square footage for the surface type. Individual closed polygons shall be created representing the distinct concrete elements of plazas surrounded by expansion joints or open sides to planter beds, lawn, etc. The closed polygons shall be created to differentiate differing materials used in the creation of the plaza. The data for the individual closed polygons shall indicate the date of construction and the material and finish for the specific closed polygons. A unique ID will be generated using the cemetery ID, “PAVEPOLY” designation, and a sequential number starting at 1 (e.g. CEMETERYID-PAVEPOLY-X).

2) Turf Grass – The closed polygons for the lawn areas shall be created based upon the different types of lawn area (seeded, sod, different times for installation, differing mixes, etc.). A unique ID will be generated using the cemetery ID, “TURFPOLY” designation, and a sequential number starting at 1 (e.g. CEMETERYID-TURFPOLY-X). The closed polygons shall be created to adjoin each other, without breaks or overlaps so the selection of all will provide the cumulative square footage for the lawn area.
3) Landscape Beds – Closed polygons shall be created for each individual planter bed. Each Planter bed shall be assigned a unique identification designation using the cemetery ID, “BEDPOLY” designation, and a sequential number starting at 1 (e.g. CEMETERYID-BEDPOLY-X).

4) Gravesites – Gravesite plots shall have individual closed polygons that have been created to the nominal size for the plot in the specific area. Example, the crypt field burial plots shall be created as standard size of (3’ x 7’-8” or 3’ x 8’-0”) and the oversized crypt plots shall be created (4’ x 10’). Each burial plot shall also be provided with a unique identification (CEMETERYID-SECTION-WALL-ROW-GRAVESITE) stored in the Gravesite ID field. The same closed polygon feature shall be created for each in-ground cremains plot, columbarium wall niche, memorial plot, and memorial wall marker. Text fields associated with burial plots shall be provided for the following: section, row, wall, gravesite number, and comment. Domain fields associated with burial plots shall be provided for the following: position source, gravesite type, gravesite size, gravesite status.

5) Burial Sections – The burial sections should be represented as closed polygons delineating the area for each section with the burial section attributed as the unique ID (e.g. CEMETERYID-SECTION).

6) Site Walls – The site walls shall be located with the GNSS equipment at the top of the caps (or for the base, if the wall does not have any caps), at the edges of the caps at the center of the joints between the caps. The joints between the caps shall be indicated as lines or polylines as separate elements, so they can be evaluated as to length for replacement (see expansion joints lines). The date of installation of the products as well as the identification (Manufacturer and model) and color of the product shall be included in the data for the element. A unique ID will be generated using the cemetery ID, “WALL” designation, and a sequential number starting at 1 (e.g. CEMETERYID-WALL-X). Site walls are to include for all wall types to be found at the site, including, seat walls, retaining walls, decorative walls
and any other types not listed. The GNSS location information for the walls shall provide accurate position for the walls within the cemetery, and shall provide accurate location for the visible top of the walls. The elevation information shall be for the finished grade below the points indicated for the tops of the walls.

7) Buildings and Structures – Provide closed polygons representing the exterior wall lines for the buildings as they exist at the ground surface including any decking, exterior stairs, or platforms. For new and existing buildings, provide a set of exterior photos with views of each of the exterior walls that can be accessed as data for the closed polygon. Include the date of completion for work completed as part of the project, original construction date for existing buildings, building type, and a sequential unique ID for each building (e.g. CEMETERYID-BLDG-X).

8) Fuel Storage Tank/Dispenser – The closed polygon shall indicate the footprint for the tank and fuel dispenser system. Data shall indicate the size, type, number and size of chambers, manufacturer, contact for servicing, as well as photo(s) of the tank system. A unique ID shall be created for each tank (e.g. CEMETERYID-FUELPOLY-X).

9) Materials Storage Bins – The footprint for the storage bins shall be delineated, with each bin being a separate closed polygon. Data shall identify the date of construction, and shall include digital photo(s) of the installation. A unique ID shall be created for each bin (e.g. CEMETERYID-BIN-X).

10) Easements – Closed polygons shall be created to identify the best known location for any easements. Data shall indicate what the easement is for.

11) Cemetery Boundary – Closed polygon(s) representing the legal property line(s) of the cemetery.

12) Sanitary Sewer Polygon – Closed polygon(s) representing larger sanitary sewer features such as septic leach field or septic tank. The piping into the leach field or absorption bed shall be included in an overall closed polygon of the outside of the area of the system. Data will include the piping configuration of the system, number size and length of laterals installed,
in addition to photo(s) of the installation prior to backfill, with the pipes indicated. A unique ID will be generated using the cemetery ID, “SANPOLY” designation, and a sequential number starting at 1 (e.g. CEMETERYID-SANPOLY-X). Septic tank features shall indicate the footprint for the septic tank and the elevation at each of the corners on the top. The finished grade elevation above the corners shall be included. The data shall include digital photographs of the installation, prior to backfill showing the pipe routing, the access opening(s), and interior photos of the inlet and outlet pipe configuration. Coating information and date of installation shall be included in the data.

13) Storm Sewer Polygon - Closed polygon(s) representing drainage areas such as retention or detention ponds. Data shall include capacity, top elevation, and bottom elevation. A unique ID will be generated using the cemetery ID, “STORMPOLY” designation, and a sequential number starting at 1 (e.g. CEMETERYID-STORMPOLY-X).

14) Water Feature Areas - shall include closed polygons of natural and manmade lakes, ponds, and wetlands, except for storm water ponds, located in or touching the boundary of the property. A unique ID will be generated using the cemetery ID, “HYDROPOLY” designation, and a sequential number starting at 1 (e.g. CEMETERYID-HYDROPOLY-X).

15) Tree Areas - Closed polygons representing wooded areas within the cemetery property boundary and solitary trees greater than six inch (>6”) caliper not within a wooded area. Data is to include diameter (in inches), genus and species, and common name for individual trees, in addition to providing a sequential unique ID (e.g. CEMETERYID-TREE-X). Except for the diameter and ID, the same is to be included for the dominant species of wooded areas.

2.3 AERIAL PHOTOGRAPHY

A. The GIS configuration shall include georeferenced and orthorectified aerial imagery, with a pixel size no greater than 4 inch, of the cemetery project areas under this contract. The contractor shall demonstrate a sample of the imagery to VA for approval prior to purchasing. The imagery dataset shall include an image depicting the
baseline cemetery conditions, prior to this project. Upon completion of the project, during the 11 months following acceptance of the work, the contractor shall have the entire developed portion of the cemetery flown as a second image, with leaf off conditions and no snow on the ground. All imagery shall be flown with survey ground control so images can display the work installed as part of this project, with 1 centimeter accuracy GPS coordinate “As-Built” drawings overlaid.

PART 3 - EXECUTION

3.1 GENERAL

A. The required GNSS/GIS work shall result in a fully integrated GIS/GNSS system with covering entire developed portion of the cemetery. The GIS elements that are created by the contractor as part of this work shall be sufficient to allow the display of the cemetery with improvements visible on ArcGIS mapping software.

B. The various elements that will be used to depict the site using the GIS mapping are to be made up of points, polylines and closed polygons that shall be created and displayed by the contractor.

C. A/E shall provide CAD files to contractor at NTP for use in building the GIS maps. The contractor shall populate the maps with geodata per Geospatial standards as work progresses. The early turn over area must be completed when the area is transferred to the cemetery so the cemetery may start collecting interments and marker points with the GPS equipment provided in Section 11 83 00.

D. The contractor shall provide the graphical representation of the location and elevation, as well as the data information for the geographically displayed information, for the elements in the provided ArcGIS Geodatabase format. The source for the graphical portion of the GIS shall be from the “As-Built” AutoCAD data supplemented with the field collected data. The geographic coordinate and elevation information for the elements being added to the GIS system, whether points, polylines or closed polygons, shall be collected and represented in the GIS based upon the accuracy level for the GNSS equipment being provided for the project.

3.2 DEMONSTRATION

A. Both specification sections included as part of the GNSS/GIS, Section 11 83 00 Global Navigation Satellite System (GNSS) and Section 11 83 02 GNSS & GIS Mapping and Geodata, require complete demonstration as part
of the GNSS equipment and GIS data being furnished and made fully functional.

B. The demonstration shall be sufficient to show all the GNSS/GIS facilities provided perform as approved during the submittal and review process for the project, and that the completed system, including all hardware, facilities, equipment, software, and appurtenances are completely operational and perform as specified.

C. The GNSS/GIS facility demonstration shall be performed to the satisfaction of the RE and the A/E prior to proceeding with the training.

3.3 TRAINING

A. After construction is complete and the contractor has verified that the system is operating as intended through the demonstration, the submittal of the training materials and methods shall be completed and accepted through the submittal process, prior to the training. The contractor shall notify the Resident Engineer when he is ready to schedule the cemetery staff training.

1. Provide two (2) eight hour training days, and follow-up two (2) eight hour training days, providing staff training on the system operation, field procedures and maintenance.

2. Training may or may not be consecutive days, but should be scheduled in close proximity.

3. All training sessions shall be digitally video recorded and such recordings turned over to the Government for future use.

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