



DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
CORONA DIVISION
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From: Commanding Officer, Naval Surface Warfare Center, Corona Division
To: Commanding Officer, Marine Corps Base, Quantico, VA

Subj: LASER RANGE SAFETY REPORT FOR MARINE CORPS BASE QUANTICO

Ref: (a) Commander, US Atlantic Fleet N4657908WR001LR
(b) OPNAVINST 5100.27B/MCO 5104.1C
(c) E-mail correspondences between CWO Woodfin, MCB Quantico and Mr. Neal Nakafuji, NSWC from 2009 August through 2009 September.

Encl: (1) Range Laser Safety Report for United States Marine Corps Base, Quantico, VA

1. In accordance with reference (a) tasking and funding, we conducted an on-site laser range safety survey for Marine Corps Base, Quantico (MCB) on 23-24 January 2008. The survey results are provided in enclosure (1). We determined that laser operations at MCB, Quantico to be in full compliance with reference (b). The MCB, Quantico Range Safety Department personnel provided comments and concurrence on the original draft by reference (c).
2. If additional information is required, please contact Mr. Neal Nakafuji (FT33) at (951) 273-4098 or DSN 933-4098.

A handwritten signature in cursive script, reading "Michael C. Gammon", is positioned above the typed name.

M. C. GAMMON
By direction

**NAVAL SURFACE WARFARE CENTER
CORONA DIVISION**

LASER RANGE SAFETY SURVEY REPORT

For

**MARINE CORPS BASE
QUANTICO**

15 September 2009

Prepared by:
Mr. Lorrie Agnew, TLSO/RLSS
Compiled by:
Lourdes Medina, Technical Writer

Enclosure (1)

1. INTRODUCTION

- 1.1 The on-site laser safety survey was performed for certification of the United States Marine Corps Base Quantico, VA Laser Range on 23-24 January 2008.
- 1.2 The next laser site survey for U. S. MCB Quantico Laser Range should be completed by no later than August 2012.
- 1.3 MCB Quantico is under the operational control of the United States Marine Corps.
- 1.4 This report is valid for three (3) years from the date of this report, 15 September 2012.

2. CONDITIONS, LIMITATIONS AND DISCLAIMERS

- 2.1 The safe lasing profiles discussed in this report are not to be construed as mandated aircraft flight paths, but rather as boundary limits at a given location that distinguish between safe and unsafe laser use conditions.
- 2.2 This evaluation addresses only those systems approved for general training scenarios by the Navy Laser Safety Review Board (LSRB). A separate evaluation should be done on a case-by-case basis by the Range Laser Safety Specialist (RLSS) on laser systems used in non-traditional modes, research, development applications, and prototype systems. The results of this report apply to Class 3B and Class 4 lasers.
- 2.3 Force-on-force scenarios are not evaluated in this report and should not be allowed without the expressed consent of the range Laser Systems Safety Officer (LSSO) using safety measures established by the LSRB.
- 2.4 Data for this report may have been sourced from multiple documents and geographic datums. Geographic datums may have included the North American Datums of 1927 (NAD27) & 1983 (NAD83), and the World Geodetic System of 1984 (WGS 84). Coordinates were converted using GEOTRANS V2.2.2 and/or CORPSCON. All graphical images shown in this report are based on WGS 84.
- 2.5 Bearings shown in the graphical images used to define the Lateral Limits are referenced to Magnetic North and True North.
- 2.6 A declination of 10° 17' West, from True North to Magnetic North was used for this report. The declination changes by 0° 0' West, per year from True North to Magnetic North.

3. SOURCE DOCUMENTS/REFERENCES

- 3.1 OPNAVINST 5100.27B/MCO 5104.1C.
- 3.2 Chief, BUMED ltr 5100 Ser 21/0225 of 29 Aug 2000.
- 3.3 NSWC Dahlgren Division ltr 8240.2 Ser G71/237 of 21 Jul 2003.
- 3.4 Commander, Dahlgren Division, NSWC ltr 8240.2 Ser G71/084 of 10 Jun 2002.
- 3.5 National Imagery and Mapping Agency, Quantico Military Installation MAP V734S (1:50,000 scale).
- 3.6 National Imagery and Mapping Agency, Quantico Military Installation MAP V834S (1:25,000 scale).

3. DESCRIPTION

- 4.1 **Location.** MCB Quantico Laser Range is located in the Western and Southwestern areas of the base range.
- 4.2 **MCB Quantico Restricted Airspace.** MCB Quantico restricted airspace is limited to R-6608 A/B/C below 10,000 ft.
- 4.3 **MCB Quantico Laser Target Areas (LTAs).** MCB Quantico Laser Range contains five (5) LTAs that are designated for ground and aerial lasing only. The areas are bounded as follows:

- 4.3.1 LTA R-7 area is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 31 27.5N | 77 31 12.8W | 18STH8030067000 |
| 38 31 26.3N | 77 32 06.4W | 18STH7900067000 |
| 38 31 58.7N | 77 32 07.6W | 18STH7900068000 |
| 38 31 59.9N | 77 31 13.9W | 18STH8030068000 |

- 4.3.2 LTA R-8 area is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 32 05.9N | 77 32 37.5W | 18STH7828068240 |
| 38 32 05.6N | 77 32 49.1W | 18STH7800068240 |
| 38 32 38.0N | 77 32 50.2W | 18STH7800069240 |
| 38 32 38.3N | 77 32 38.7W | 18STH7828069240 |

4.3.3 LTA R-15 area is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 20.2N | 77 31 49.8W | 18STH7950070500 |
| 38 33 19.7N | 77 32 10.4W | 18STH7900070500 |
| 38 33 36.0N | 77 32 11.0W | 18STH7900071000 |
| 38 33 36.4N | 77 31 50.3W | 18STH7950071000 |

4.3.4 LTA GP-44-1 area is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 26.0N | 77 32 22.2W | 18STH7871970701 |
| 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |
| 38 33 42.0N | 77 32 59.3W | 18STH7783571218 |
| 38 33 36.2N | 77 32 15.6W | 18STH7888971010 |

4.3.5 LTA GP-44-2 area is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 07.5N | 77 32 37.3W | 18STH7833870140 |
| 38 33 41.1N | 77 33 00.0W | 18STH7781771192 |
| 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |
| 38 33 16.5N | 77 32 28.9W | 18STH7855070413 |
| 38 33 08.6N | 77 32 34.3W | 18STH7841170172 |

4.4 **MCB Quantico Firing Lines (FLs).** MCB Quantico Laser Range contains six Firing Lines (FLs). The areas are bounded as follows:

4.4.1 FL R-7 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 31 14.9N | 77 32 05.9W | 18STH7900466648 |
| 38 31 13.8N | 77 32 05.1W | 18STH7902266615 |

4.4.2 FL R-8-1 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 32 25.1N | 77 33 04.6W | 18STH7764268850 |
| 38 32 24.2N | 77 33 04.0W | 18STH7765568823 |

4.4.3 FL R-8-2 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 32 24.1N | 77 33 03.3W | 18STH7767368819 |
| 38 32 22.2N | 77 33 02.1W | 18STH7770068759 |

4.4.3 FL R-15 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 39.4N | 77 32 05.2W | 18STH7914371103 |
| 38 33 36.5N | 77 32 09.1W | 18STH7904671015 |

4.4.5 FL GP-44-1 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |
| 38 33 42.0N | 77 32 59.3W | 18STH7783571218 |

4.4.6 FL GP-44-2 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 41.1N | 77 33 00.0W | 18STH7781771192 |
| 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |

4.5 **MCB Quantico Helicopter Firing Points (FPs).** MCB Quantico Laser Range contains three (3) Helicopter FPs. The areas are bounded as follows:

4.5.1 HFP 1 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 31 14.0N | 77 31 50.3W | 18STH7938066610 |

4.5.2 HFP 2 is defined by the following coordinates:

| Geodetic | | |
|------------------------|-------------------------|--------------------|
| <u>Latitude</u> | <u>Longitude</u> | <u>MGRS</u> |
| 38 33 40.6N | 77 32 04.5W | 18STH7916071140 |

4.5.3 HFP 3 is defined by the following coordinates:

| Geodetic | | |
|-----------------|------------------|-----------------|
| Latitude | Longitude | MGRS |
| 38 33 33.2N | 77 32 32.8W | 18STH7847070930 |

4.6 **MCB Quantico Helicopter Target Areas (TAs).** MCB Quantico Laser Range contains two (2) TAs. The areas are bounded as follows:

4.6.1 R-7 TA is defined by the following coordinates:

***See appendix D for coordinates.**

4.6.2 R-15 TA is defined by the following coordinates:

***See appendix D for coordinates.**

5. RANGE CERTIFICATION

5.1 **Survey.** Mr. Lorrie Agnew performed the physical site inspection, took all GPS readings, and provided all GIS support for MCB Quantico Laser Range during 23-24 January 2008. Mr. Lorrie Agnew is a representative of the Naval Surface Warfare Center Corona Division, Force Training Department, Range Sustainment and Geomatic Engineering Branch (FT33) in Corona, CA. He is a Technical Laser Safety Officer's (TLSO) and Range Laser Safety Specialist (RLSS). CWO Woodfin and Mr. Joe Pereira of the MCB Quantico Range Control were also present during the inspection and took active roles in the site surveys and provided Mr. Lorrie Agnew with details of the operations being conducted.

5.2 **Analysis.** Mr. Lorrie Agnew conducted the analysis for MCB Quantico Laser Safety Report.

5.3 **Report.** Ms. Lourdes Medina compiled the MCB Quantico Laser Safety Report. Ms. Lourdes Medina is a Technical Writer representative of the Naval Surface Warfare Center Corona Division, Force Training Department, Range Sustainment and Geomatic Engineering Branch (FT33) in Corona, CA.

6. EVALUATION

6.1 **Aerial Lasing.** The allowed aerial lasing systems must be within 5 mrad for fixed-wing (fast movers) and 10 mrad for rotary (helo) in hover.

6.2 **Ground Lasing.** The allowed ground lasing systems must be within 10 mrad for stabilized hand-held systems.

- 6.3 Appendix A contains graphical images of each Ground Laser Hazard Danger Zone (LHDZ).
- 6.4 Appendix B contains graphical images of each Airborne Laser Hazard Danger Zone (LHDZ).
- 6.5 Appendix C contains an airborne-lasing profile in nautical miles (nmi) and feet (ft).
- 6.6 Appendix D contains all coordinates in UTM (easting/northing), Geodetic (Lat/Long), and MGRS formats.

7. RESULTS

- 7.1 **Ground Lasing.** Ground lasing designation is permitted on all LTAs listed in Appendix A provided the user operates the laser within the lateral limits referenced and within the LTA. Table 7-1 shows the available lateral limits (magnetic) for safe lasing on the LTAs.

Table 7-1: Laser Target Areas with Appropriate Lateral Limits

| <u>FL</u> | <u>LTA</u> | <u>Lateral Limits (Magnetic)</u> |
|------------------|-------------------|---|
| FL R-7 | R-7 | 040° clockwise to 056° |
| FL R-8-1 | R-8 | 073° clockwise to 087° |
| FL R-8-2 | R-8 | 073° clockwise to 087° |
| FL R-15 | R-15 | 144° clockwise to 191° |
| FL GP-44-1 | R-GP-44-1 | 110° clockwise to 128° |
| FL GP-44-2 | R-GP-44-2 | 146° clockwise to 162° |

- 7.2 **Aerial Lasing.** Aerial lasing designation is permitted on all LTAs referenced in Appendix B provided that the pilot adheres to the approved buffer calculations as stated in 6.1, and the laser flight profile for R-7 Fixed-wing contained in Appendix C. Table 7-2 shows available flight headings for the Helicopter Firing Positions (HFPs) and for the R-7 Fixed-wing contained in Appendix B. The safe lasing profile for R-7 Fixed-wing is contained in Appendix C.

Table 7-2: Laser Target Areas with Appropriate Headings

| <u>Laser Target Area (LTA)</u> | <u>Heading (Magnetic)</u> |
|---------------------------------------|----------------------------------|
| HFP 1 (R-7 Target Area) | 003° to 046° |
| HFP 2 (R-15 Target Area) | 122° to 222° |
| HFP 3 (R-15 Target Area) | 092° to 138° |
| R-7 Fixed Wing | 000° to 360° |

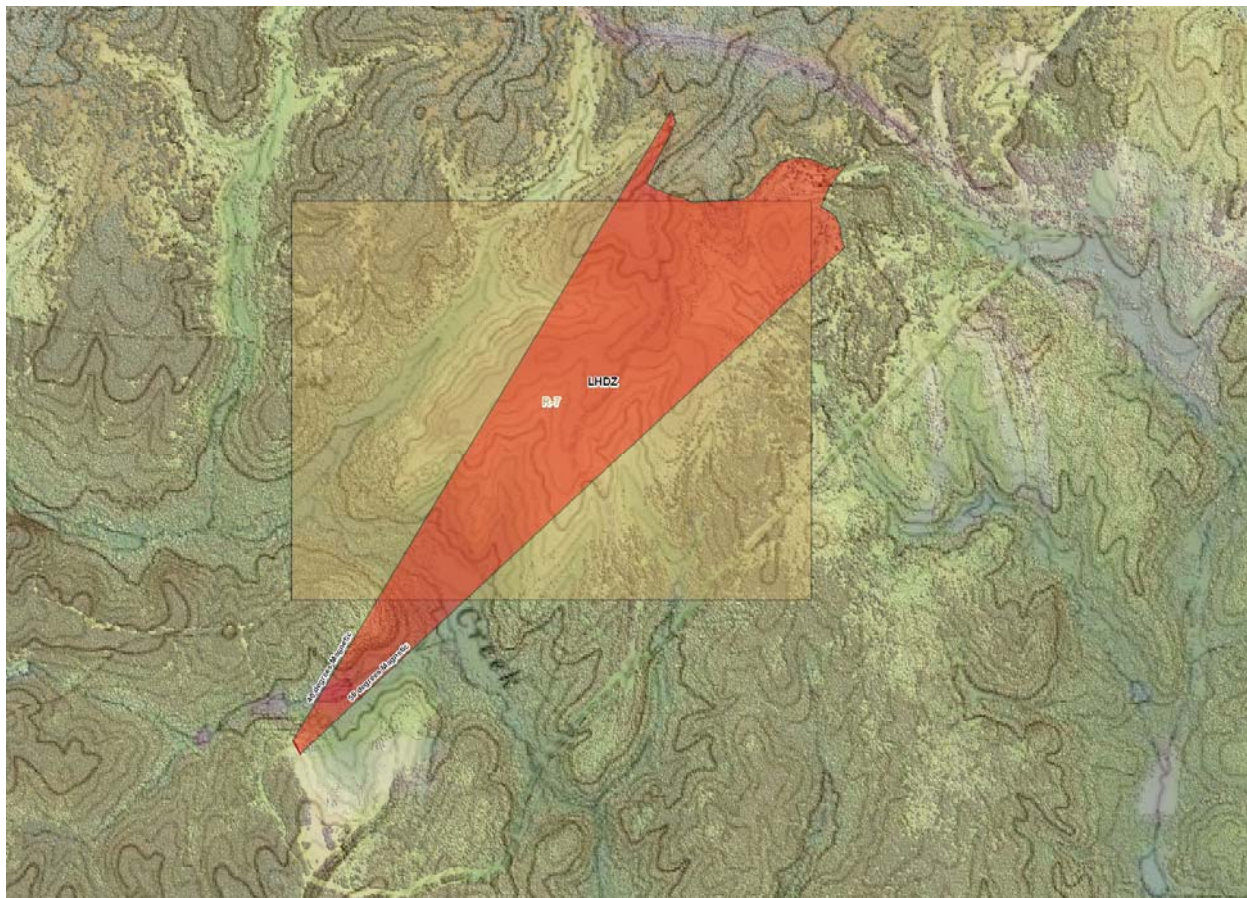
8. RECOMMENDATIONS & FINDINGS

- 8.1 For this report, natural terrain mitigation based on the laser system's platform was used. If the natural terrain of the range does not contain the laser energy, then it is the responsibility of the Range Laser Safety Officer to contact NSWC Dahlgren for specific information such as Nominal Ocular Hazard Distances (NOHD), Optical Densities (OD), and other laser weapon system parameters to determine whether the hazardous energy levels are within the limits of the range boundary. If an SOP for a certain exercise proscribes scenarios that are less restrictive than described in this report, then it will be the Range Safety Department's responsibility to ensure safe laser use.
- 8.2 MCB Quantico Laser Range has a laser safety program that is in compliance with OPNAVINST 5100.27B/MCO 5104.1C
- 8.3 All laser systems used on the MCB Quantico Laser Range are to be used only against targets located within the designated coordinates/training areas described in section 4.
- 8.4 Applicable Notice to Airmen (NOTAM) should be issued as required for any planned operations.
- 8.5 No adverse conditions to ground/aerial lasing were observed on the MCB Quantico Laser Range during the on-site inspection.
- 8.6 If standing water, glass, or any other reflective materials becomes present within or near any of the established LTA or LHDZ, then it will be the responsibility of the training facility LSSO to either suspend the exercise or ensure personnel are not within the Nominal Ocular Hazard Distance (NOHD) of the system in use.
- 8.7 All laser operators should meet the following minimum requirements:
- 8.7.1 Have received the appropriate laser range briefing from the training facility LSSO prior to use of any laser range, if deemed necessary by the LSSO.
 - 8.7.2 Are familiar in detail with the MCB Quantico Laser Safety Program and adhere to the procedures established therein.
 - 8.7.3 Communicate with the range safety/control during laser operations, if deemed necessary by the training facility LSSO.
 - 8.7.4 Fire laser only after positive identification of the approved targets.
- 8.8 The following are suggested general laser safety guidelines that apply to laser personnel during laser exercises:

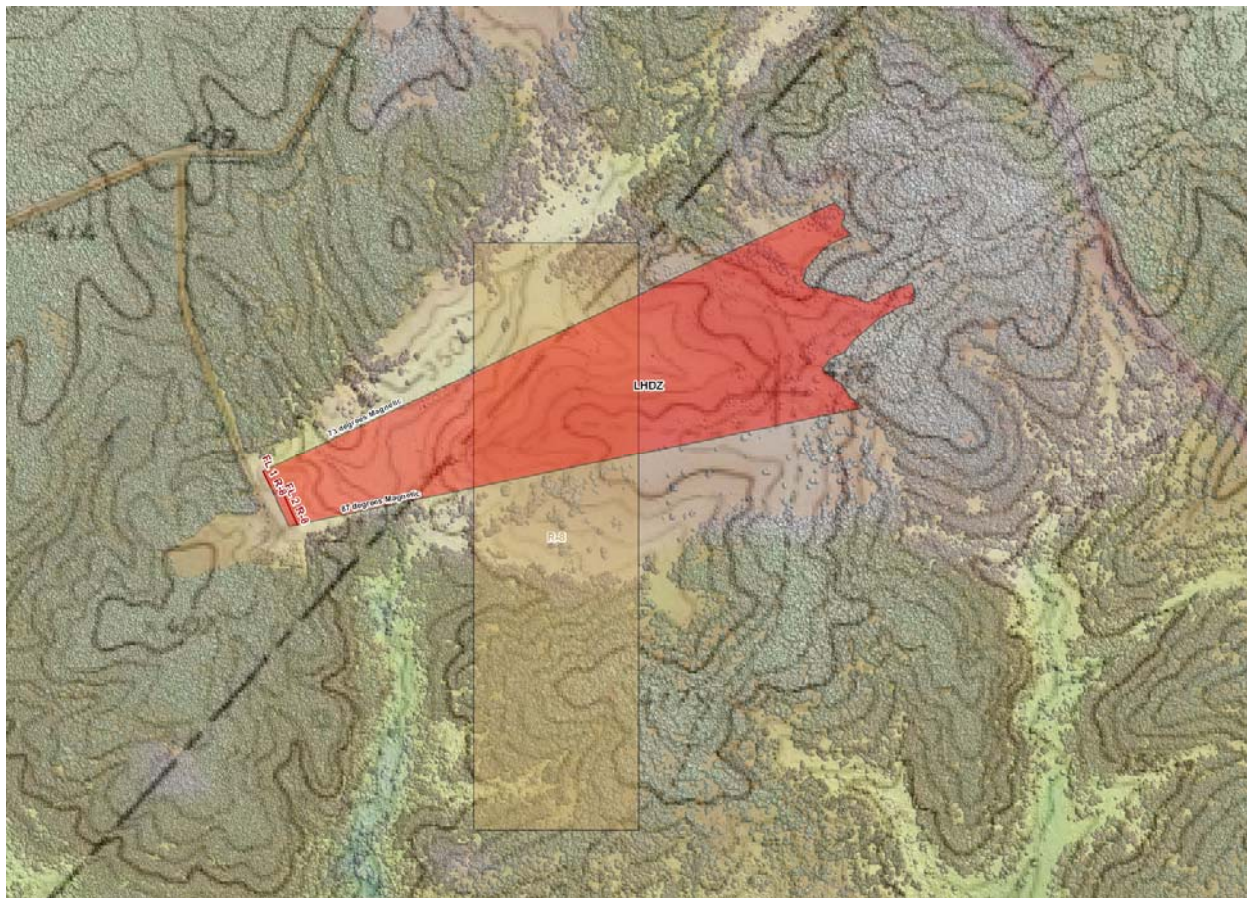
- 8.8.1 Prior to laser operations, pilots should make a 'cold pass' to ensure that the LTA and corresponding LHDZ are clear of unauthorized personnel.
- 8.8.2 The training facility LSSO should ensure that all personnel in the vicinity of the laser range remain outside the LTA and LHDZ during laser operations and/or wear the appropriate eye and skin protection.

Appendix A

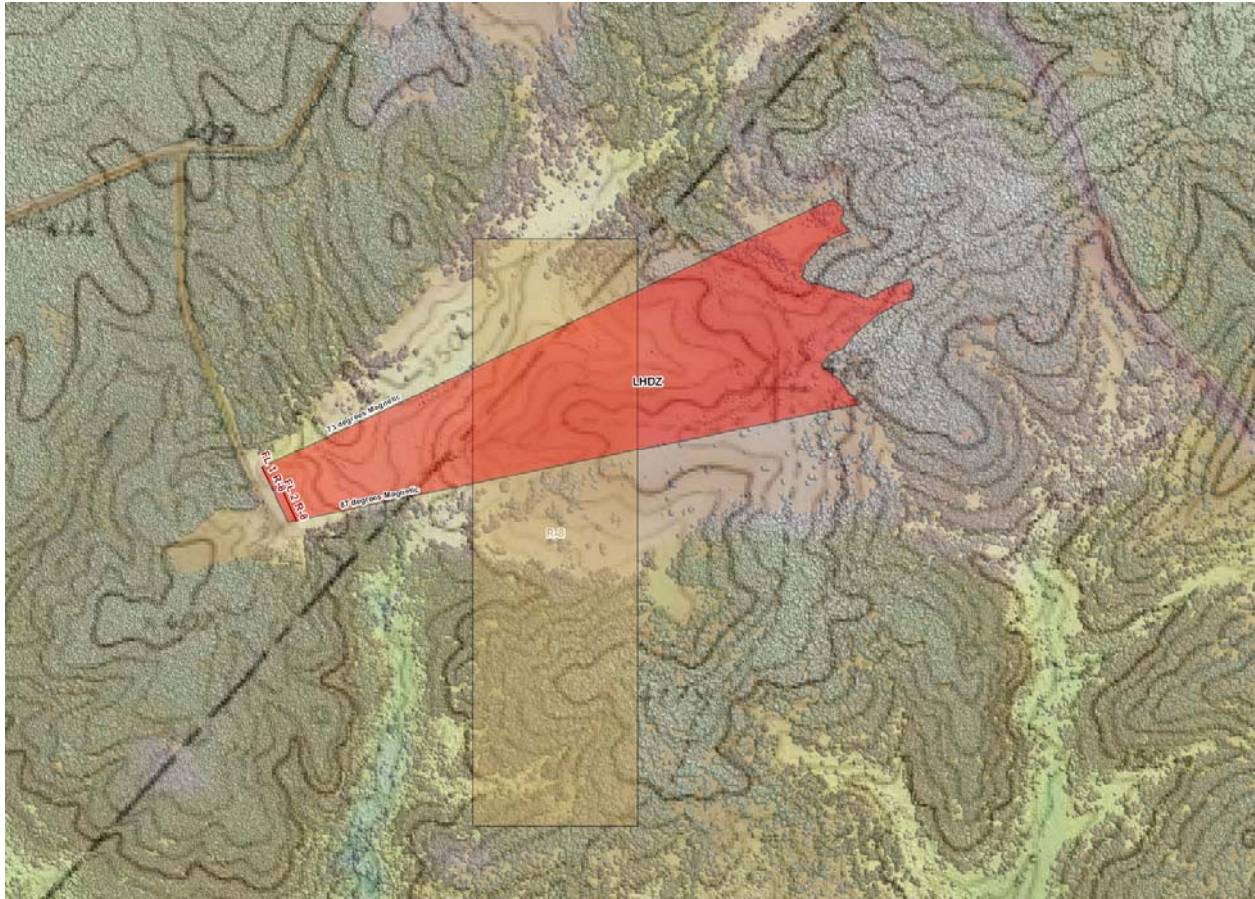
Ground Laser Hazard Danger Zones (LHDZ)



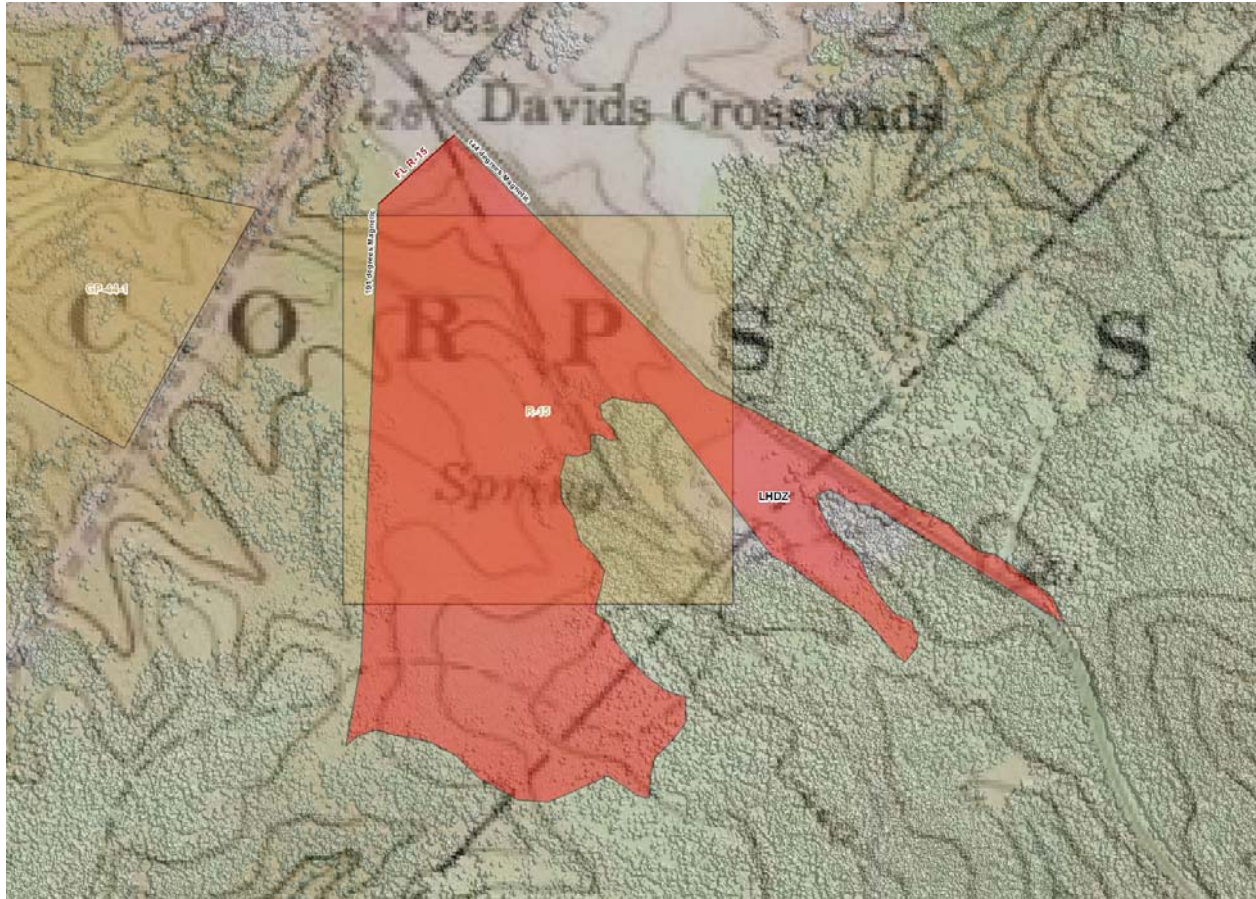
| <u>FL</u> | <u>LTA</u> | <u>Maximum Allowable Buffer</u> | <u>Lateral Limits (magnetic)</u> |
|--|------------|--|----------------------------------|
| R-7 | R-7 | 10 mrad | 040° clockwise to 056° |
| FL Coordinates (MGRS) | | 18STH7900466648 18STH7902266615 | |
| LTA Coordinates (MGRS) | | 18STH8030067000 18STH7900067000 18STH7900068000 18STH8030068000 | |
| <u>Approved Platforms</u> | | | |
| Tripod Mounted Systems, Stabilized Hand-Held Systems | | | |



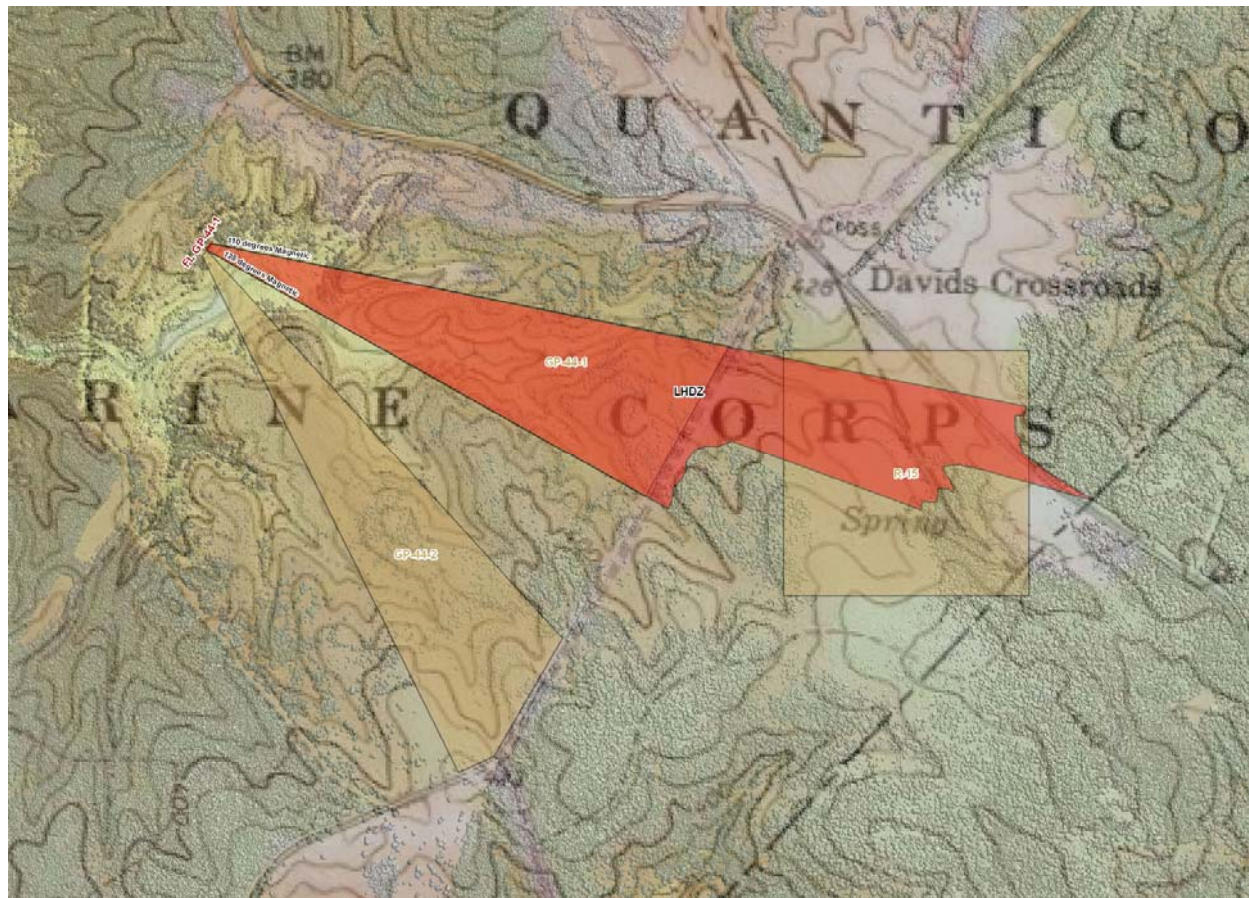
| <u>FL</u> | <u>LTA</u> | <u>Maximum Allowable Buffer</u> | <u>Lateral Limits (magnetic)</u> |
|--|--|---------------------------------|----------------------------------|
| R-8-1 | R-8 | 10 mrad | 073° clockwise to 087° |
| FL Coordinates (MGRS) | 18STH7764268850 18STH7765568823 | | |
| LTA Coordinates (MGRS) | 18STH7828068240 18STH7800068240 18STH7800069240 18STH7828069240 | | |
| <u>Approved Platforms</u> | | | |
| Tripod Mounted Systems, Stabilized Hand-Held Systems | | | |



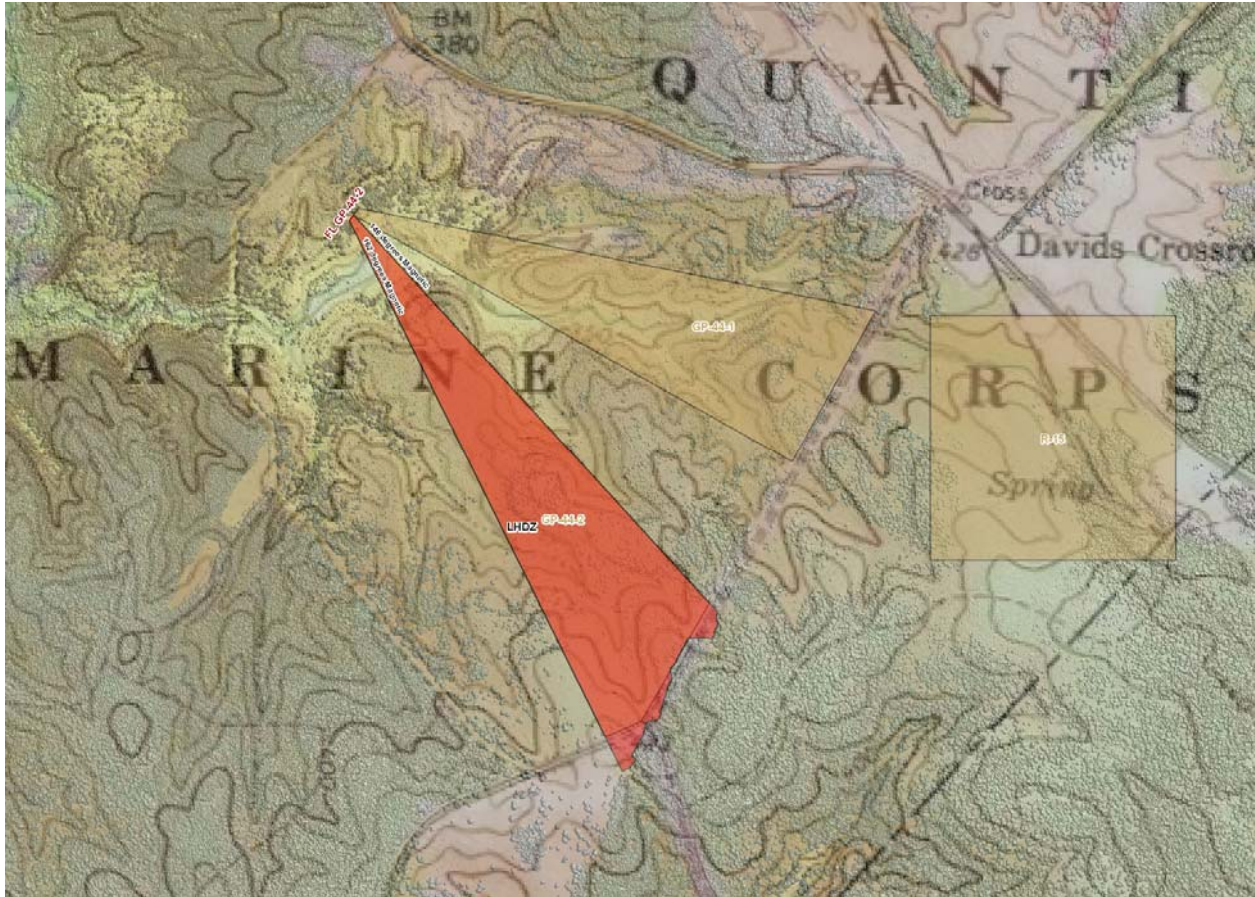
| <u>FL</u> | <u>LTA</u> | <u>Maximum Allowable Buffer</u> | <u>Lateral Limits (magnetic)</u> |
|--|------------|---------------------------------|--|
| R-8-2 | R-8 | 10 mrad | 073° clockwise to 087° |
| FL Coordinates (MGRS) | | | 18STH7767368819 18STH7770068759 |
| LTA Coordinates (MGRS) | | | 18STH7828068240 18STH7800068240 18STH7800069240 18STH7828069240 |
| <u>Approved Platforms</u> | | | |
| Tripod Mounted Systems, Stabilized Hand-Held Systems | | | |



| <u>FL</u> | <u>LTA</u> | <u>Maximum Allowable Buffer</u> | <u>Lateral Limits (magnetic)</u> |
|--|------------|---------------------------------|--|
| R-15 | R-15 | 10 mrad | 144° clockwise to 191° |
| FL Coordinates (MGRS) | | | 18STH7914371103 18STH7904671015 |
| LTA Coordinates (MGRS) | | | 18STH7950070500 18STH7900070500 18STH7900071000 18STH7950071000 |
| <u>Approved Platforms</u> | | | |
| Tripod Mounted Systems, Stabilized Hand-Held Systems | | | |



| <u>FL</u> | <u>LTA</u> | <u>Maximum Allowable Buffer</u> | <u>Lateral Limits (magnetic)</u> |
|--|------------|---------------------------------|--|
| R-GP-44-1 | R-GP-44-1 | 10 mrad | 110° clockwise to 128° |
| FL Coordinates (MGRS) | | | 18STH7782671205 18STH7783571218 |
| LTA Coordinates (MGRS) | | | 18STH7871970701 18STH7782671205 18STH7783571218 18STH7888971010 |
| <u>Approved Platforms</u> | | | |
| Tripod Mounted Systems, Stabilized Hand-Held Systems | | | |



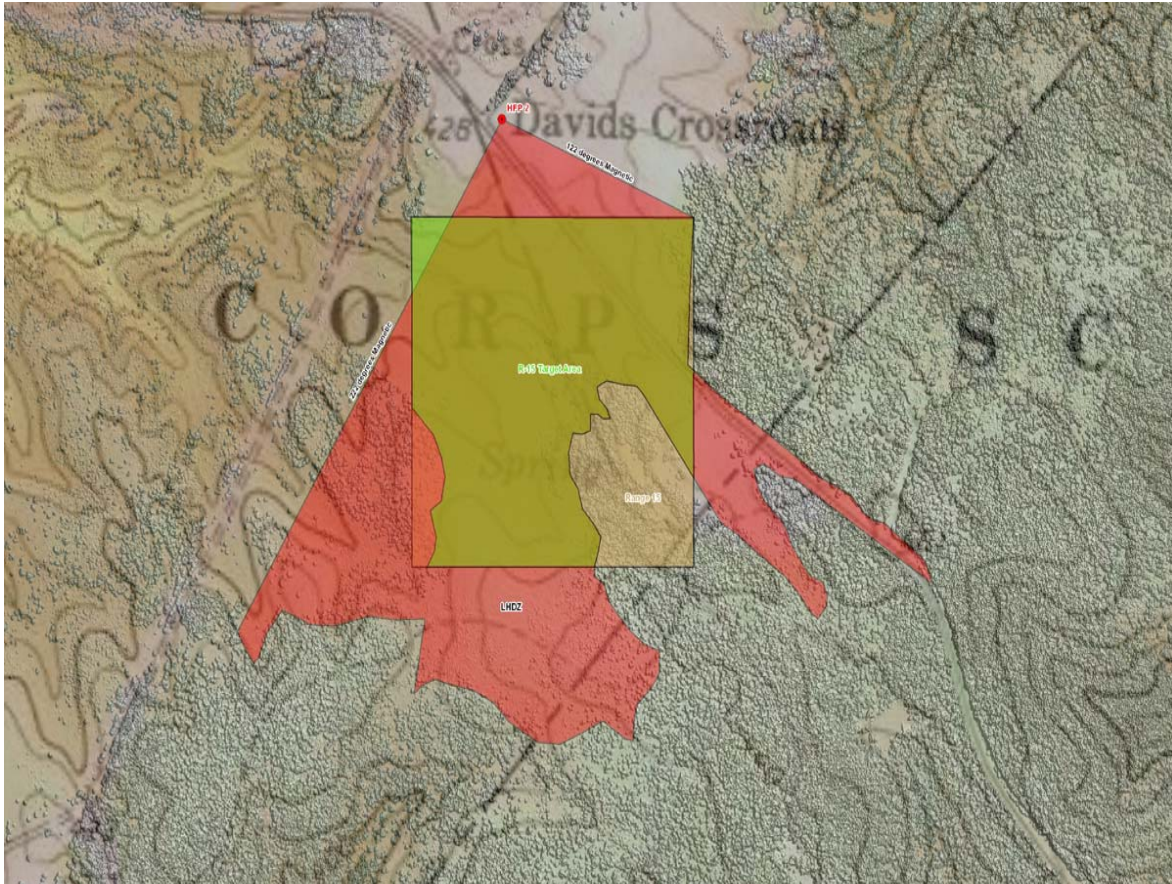
| <u>FL</u> | <u>LTA</u> | <u>Maximum Allowable Buffer</u> | <u>Lateral Limits (magnetic)</u> |
|--|-------------------|---|---|
| R-GP-44-2 | R-GP-44-2 | 10 mrad | 146° clockwise to 162° |
| FL Coordinates (MGRS) | | 18STH7781771192 18STH7782671205 | |
| LTA Coordinates (MGRS) | | 18STH7833870140 18STH7781771192 18STH7782671205 18STH7855070413 18STH7841170172 | |
| <u>Approved Platforms</u> | | | |
| Tripod Mounted Systems, Stabilized Hand-Held Systems | | | |

Appendix B

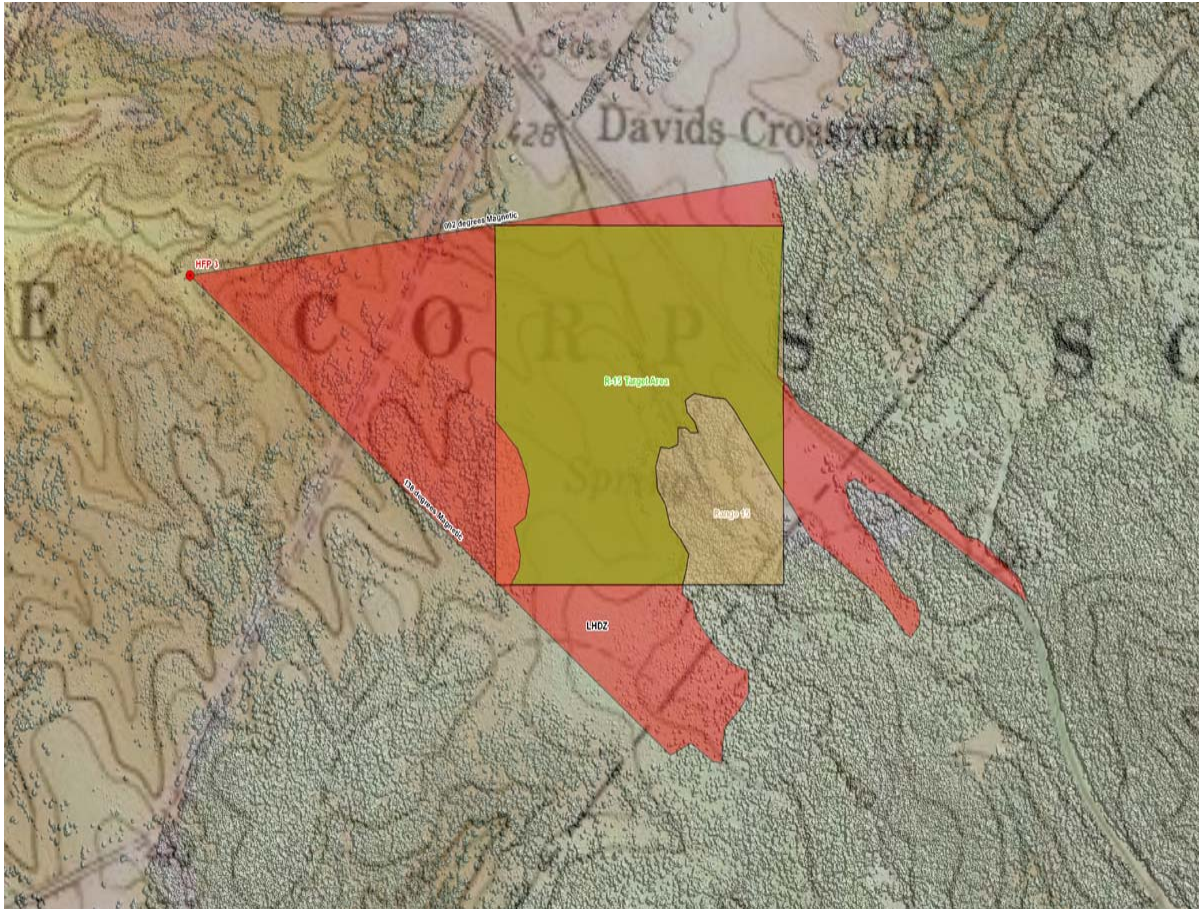
Airborne Laser Hazard Danger Zones (LHDZ)



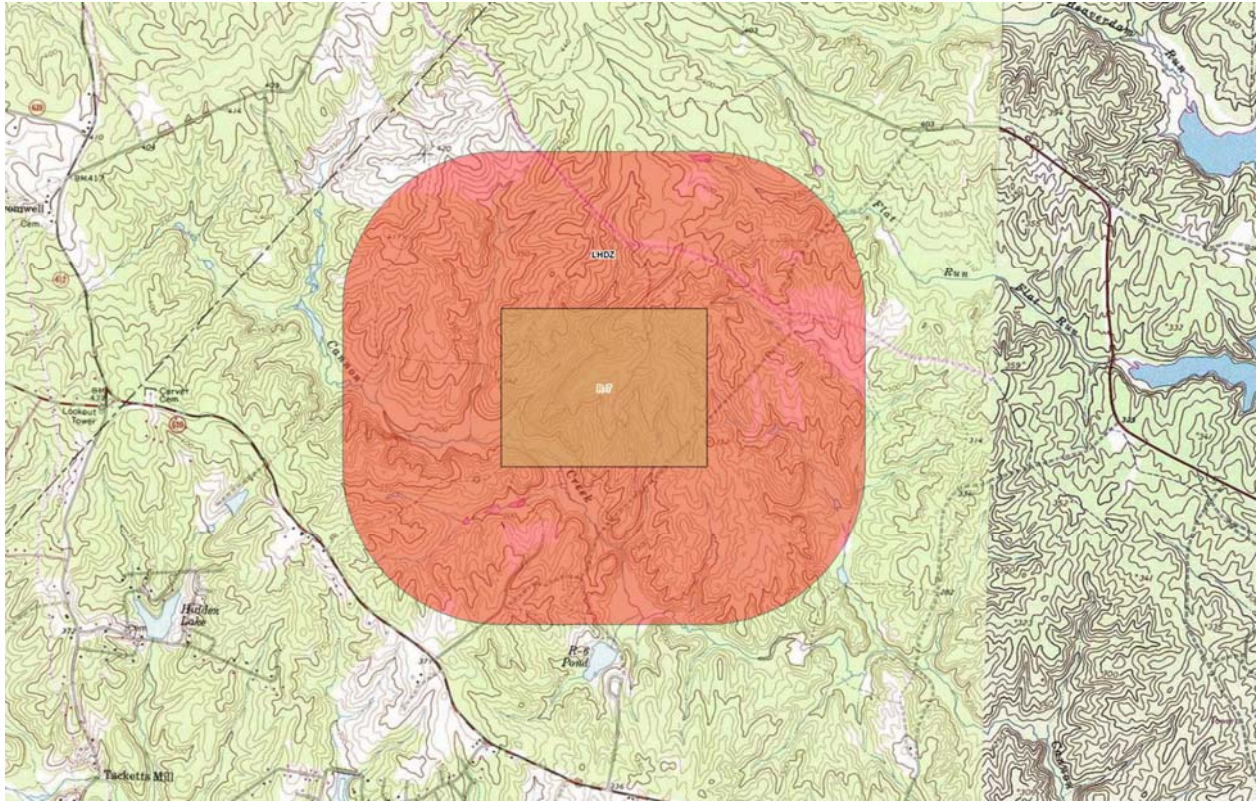
| | | | |
|--|------------------|---|--|
| FP HFP 1 | TA R-7 | Magnetic Heading: 003° to 046° | |
| FP Coordinates (Lat/Long): 38 31 14.0N 77 31 50.3W | | Maximum Buffer Angle: 10 mrad | |
| TA Coordinates (Lat/Long): * See appendix D for coordinates | | | |
| | | Minimum Altitude: 100' AGL | |
| | | Maximum Altitude: 2999' AGL | |
| | | Approved Platforms Rotary (Helo) hovering | |



| | | | |
|--|--------------------------|---|--|
| <u>FP</u> HFP 2 | <u>TA</u> R-15 | <u>Magnetic Heading:</u> 122° to 222° | |
| <u>FP Coordinates (Lat/Long):</u> 38 33 40.6N 77 32 04.5W | | <u>Maximum Buffer Angle:</u> 10 mrad | |
| <u>TA Coordinates (Lat/Long):</u> *See appendix D for coordinates | | | |
| <u>Minimum Altitude:</u> 50' AGL | | | |
| <u>Maximum Altitude:</u> 2999' AGL | | | |
| <u>Approved Platforms</u> Rotary (Helo) hovering | | | |



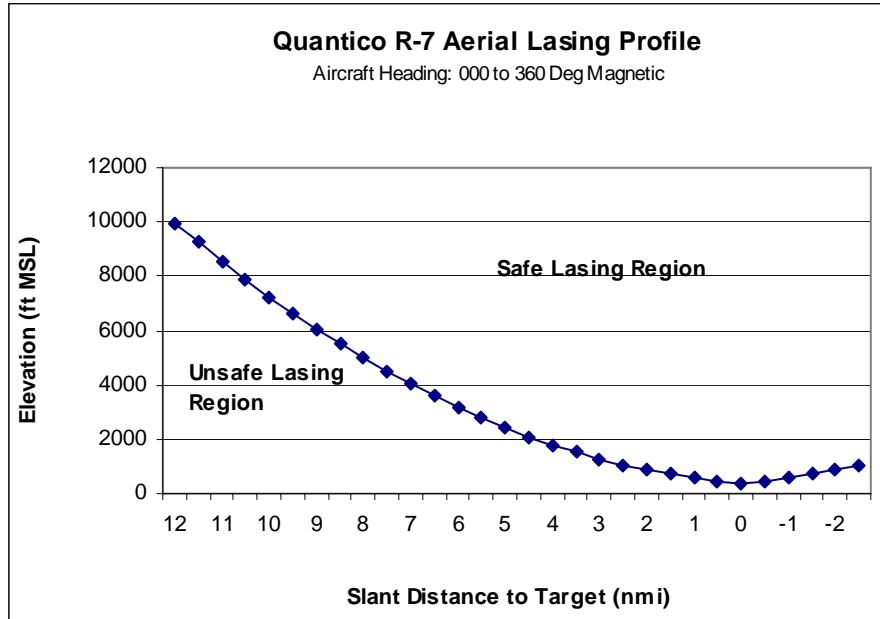
| | | | |
|---|-------------------|--|--|
| FP HFP 3 | TA R-15 | Magnetic Heading: 092° to 138° | |
| FP Coordinates (Lat/Long): 38 33 33.2N 77 32 32.8W | | Maximum Buffer Angle: 10 mrad | |
| TA Coordinates (Lat/Long): *See appendix D for coordinates | | | |
| Minimum Altitude: 50' AGL | | | |
| Maximum Altitude: 2999' AGL | | | |
| Approved Platforms Rotary (Helo) hovering | | | |



| | | |
|--|---|---|
| <p><u>LHDZ</u> R-7 Fixed Wing</p> | <p><u>Magnetic Heading:</u> 000° to 360°</p> | |
| <p><u>Coordinates: Lat/Long</u></p> <p>38 31 27.5N 77 31 12.8W</p> <p>38 31 26.3N 77 32 06.4W</p> <p>38 31 58.7N 77 32 07.6W</p> <p>38 31 59.9N 77 31 13.9W</p> | | <p><u>Maximum Buffer Angle:</u> 5 mrad</p> |
| <p><u>Approved Platforms</u> Fixed-Wing (Fast Movers)</p> | | |

Appendix C

Airborne Safe Lasing Profile



| <u>Slant Distance</u> (nmi) | <u>Altitude</u> (feet) | <u>Slant Distance</u> (nmi) | <u>Altitude</u> (feet) |
|--------------------------------|---------------------------|--------------------------------|---------------------------|
| 12.0 | 9965 | 4.5 | 2092 |
| 11.5 | 9244 | 4.0 | 1791 |
| 11.0 | 8551 | 3.5 | 1519 |
| 10.5 | 7886 | 3.0 | 1275 |
| 10.0 | 7249 | 2.5 | 1059 |
| 9.5 | 6640 | 2.0 | 871 |
| 9.0 | 6059 | 1.5 | 711 |
| 8.5 | 5506 | 1.0 | 579 |
| 8.0 | 4981 | 0.5 | 476 |
| 7.5 | 4484 | 0.0 | 400 |
| 7.0 | 4015 | -0.5 | 476 |
| 6.5 | 3574 | -1.0 | 579 |
| 6.0 | 3161 | -1.5 | 711 |
| 5.5 | 2777 | -2.0 | 871 |
| 5.0 | 2420 | -2.5 | 1059 |

Appendix D

LTA Coordinates

FL Coordinates

FP Coordinates

TA Coordinates

MCB Quantico LTA Coordinate Table

| <u>ID</u> | <u>Zone</u> | <u>UTM</u> | | <u>Geodetic</u> | | <u>MGRS</u> | |
|-------------|-------------|-------------------|----------------|-----------------|-----------------|-------------|------------------|
| | | <u>Hemisphere</u> | <u>Easting</u> | <u>Northing</u> | <u>Latitude</u> | | <u>Longitude</u> |
| LTA R-7 | 18 | N | 280300 | 4267000 | 38 31 27.5N | 77 31 12.8W | 18STH8030067000 |
| | 18 | N | 279000 | 4267000 | 38 31 26.3N | 77 32 06.4W | 18STH7900067000 |
| | 18 | N | 279000 | 4268000 | 38 31 58.7N | 77 32 07.6W | 18STH7900068000 |
| | 18 | N | 280300 | 4268000 | 38 31 59.9N | 77 31 13.9W | 18STH8030068000 |
| LTA R-8 | 18 | N | 278280 | 4268240 | 38 32 05.9N | 77 32 37.5W | 18STH7828068240 |
| | 18 | N | 278000 | 4268240 | 38 32 05.6N | 77 32 49.1W | 18STH7800068240 |
| | 18 | N | 278000 | 4269240 | 38 32 38.0N | 77 32 50.2W | 18STH7800069240 |
| | 18 | N | 278280 | 4269240 | 38 32 38.3N | 77 32 38.7W | 18STH7828069240 |
| LTA R-15 | 18 | N | 279500 | 4270500 | 38 33 20.2N | 77 31 49.8W | 18STH7950070500 |
| | 18 | N | 279000 | 4270500 | 38 33 19.7N | 77 32 10.4W | 18STH7900070500 |
| | 18 | N | 279000 | 4271000 | 38 33 36.0N | 77 32 11.0W | 18STH7900071000 |
| | 18 | N | 279500 | 4271000 | 38 33 36.4N | 77 31 50.3W | 18STH7950071000 |
| LTA GP-44-1 | 18 | N | 278719 | 4270701 | 38 33 26.0N | 77 32 22.2W | 18STH7871970701 |
| | 18 | N | 277826 | 4271205 | 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |
| | 18 | N | 277835 | 4271218 | 38 33 42.0N | 77 32 59.3W | 18STH7783571218 |
| | 18 | N | 278889 | 4271010 | 38 33 36.2N | 77 32 15.6W | 18STH7888971010 |
| LTA GP-44-2 | 18 | N | 278338 | 4270140 | 38 33 07.5N | 77 32 37.3W | 18STH7833870140 |
| | 18 | N | 277817 | 4271192 | 38 33 41.1N | 77 33 00.0W | 18STH7781771192 |
| | 18 | N | 277826 | 4271205 | 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |
| | 18 | N | 278550 | 4270413 | 38 33 16.5N | 77 32 28.9W | 18STH7855070413 |
| | 18 | N | 278411 | 4270172 | 38 33 08.6N | 77 32 34.3W | 18STH7841170172 |

MCB Quantico FL Coordinate Table

| <u>ID</u> | <u>Zone</u> | <u>UTM</u> | | <u>Geodetic</u> | | <u>MGRS</u> | |
|------------|-------------|-------------------|----------------|-----------------|-----------------|-------------|------------------|
| | | <u>Hemisphere</u> | <u>Easting</u> | <u>Northing</u> | <u>Latitude</u> | | <u>Longitude</u> |
| FL R-7 | 18 | N | 279004 | 4266648 | 38 31 14.9N | 77 32 05.9W | 18STH7900466648 |
| | 18 | N | 279022 | 4266615 | 38 31 13.8N | 77 32 05.1W | 18STH7902266615 |
| FL R-8-1 | 18 | N | 277642 | 4268850 | 38 32 25.1N | 77 33 04.6W | 18STH7764268850 |
| | 18 | N | 277655 | 4268823 | 38 32 24.2N | 77 33 04.0W | 18STH7765568823 |
| FL R-8-2 | 18 | N | 277673 | 4268819 | 38 32 24.1N | 77 33 03.3W | 18STH7767368819 |
| | 18 | N | 277700 | 4268759 | 38 32 22.2N | 77 33 02.1W | 18STH7770068759 |
| FL R-15 | 18 | N | 279143 | 4271103 | 38 33 39.4N | 77 32 05.2W | 18STH7914371103 |
| | 18 | N | 279046 | 4271015 | 38 33 36.5N | 77 32 09.1W | 18STH7904671015 |
| FL GP-44-1 | 18 | N | 277826 | 4271205 | 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |
| | 18 | N | 277835 | 4271218 | 38 33 42.0N | 77 32 59.3W | 18STH7783571218 |
| FL GP-44-2 | 18 | N | 277817 | 4271192 | 38 33 41.1N | 77 33 00.0W | 18STH7781771192 |
| | 18 | N | 277826 | 4271205 | 38 33 41.5N | 77 32 59.7W | 18STH7782671205 |

MCB Quantico FP Coordinate Table

| <u>ID</u> | <u>Zone</u> | <u>UTM</u> | | <u>Geodetic</u> | | <u>MGRS</u> | |
|-----------|-------------|-------------------|----------------|-----------------|-----------------|-------------|------------------|
| | | <u>Hemisphere</u> | <u>Easting</u> | <u>Northing</u> | <u>Latitude</u> | | <u>Longitude</u> |
| HFP 1 | 18 | N | 279380 | 4266610 | 38 31 14.0N | 77 31 50.3W | 18STH7938066610 |
| HFP 2 | 18 | N | 279160 | 4271140 | 38 33 40.6N | 77 32 04.5W | 18STH7916071140 |
| HFP 3 | 18 | N | 278470 | 4270930 | 38 33 33.2N | 77 32 32.8W | 18STH7847070930 |

MCB Quantico TA Coordinate Table

| <u>ID</u> | <u>Zone</u> | <u>UTM</u> | | <u>Geodetic</u> | | <u>MGRS</u> | |
|-----------------|-------------|-------------------|----------------|-----------------|-----------------|-------------|------------------|
| | | <u>Hemisphere</u> | <u>Easting</u> | <u>Northing</u> | <u>Latitude</u> | | <u>Longitude</u> |
| Target Area R-7 | 18 | N | 280167 | 4267684 | 38 31 49.5N | 77 31 19.0W | 18STH8016767684 |
| | 18 | N | 279933 | 4267361 | 38 31 38.8N | 77 31 28.3W | 18STH7993367361 |
| | 18 | N | 279899 | 4267326 | 38 31 37.7N | 77 31 29.7W | 18STH7989967326 |
| | 18 | N | 279883 | 4267385 | 38 31 39.6N | 77 31 30.4W | 18STH7988367385 |
| | 18 | N | 279873 | 4267453 | 38 31 41.8N | 77 31 30.9W | 18STH7987367453 |
| | 18 | N | 279873 | 4267504 | 38 31 43.4N | 77 31 31.0W | 18STH7987367504 |
| | 18 | N | 279833 | 4267485 | 38 31 42.8N | 77 31 32.6W | 18STH7983367485 |
| | 18 | N | 279831 | 4267430 | 38 31 41.0N | 77 31 32.6W | 18STH7983167430 |
| | 18 | N | 279772 | 4267379 | 38 31 39.3N | 77 31 35.0W | 18STH7977267379 |
| | 18 | N | 279801 | 4267316 | 38 31 37.3N | 77 31 33.7W | 18STH7980167316 |
| | 18 | N | 279788 | 4267250 | 38 31 35.1N | 77 31 34.2W | 18STH7978867250 |
| | 18 | N | 279741 | 4267287 | 38 31 36.3N | 77 31 36.2W | 18STH7974167287 |
| | 18 | N | 279727 | 4267239 | 38 31 34.7N | 77 31 36.7W | 18STH7972767239 |
| | 18 | N | 279682 | 4267178 | 38 31 32.7N | 77 31 38.5W | 18STH7968267178 |
| | 18 | N | 279640 | 4267215 | 38 31 33.8N | 77 31 40.3W | 18STH7964067215 |
| | 18 | N | 279622 | 4267316 | 38 31 37.1N | 77 31 41.1W | 18STH7962267316 |
| | 18 | N | 279616 | 4267385 | 38 31 39.3N | 77 31 41.4W | 18STH7961667385 |
| | 18 | N | 279640 | 4267414 | 38 31 40.3N | 77 31 40.5W | 18STH7964067414 |
| | 18 | N | 279637 | 4267440 | 38 31 41.1N | 77 31 40.6W | 18STH7963767440 |
| | 18 | N | 279553 | 4267406 | 38 31 40.0N | 77 31 44.1W | 18STH7955367406 |
| | 18 | N | 279510 | 4267414 | 38 31 40.2N | 77 31 45.8W | 18STH7951067414 |
| | 18 | N | 279476 | 4267340 | 38 31 37.8N | 77 31 47.2W | 18STH7947667340 |
| | 18 | N | 279434 | 4267332 | 38 31 37.5N | 77 31 48.9W | 18STH7943467332 |
| | 18 | N | 279431 | 4267374 | 38 31 38.8N | 77 31 49.1W | 18STH7943167374 |
| | 18 | N | 279386 | 4267353 | 38 31 38.1N | 77 31 50.9W | 18STH7938667353 |
| | 18 | N | 279309 | 4267313 | 38 31 36.7N | 77 31 54.0W | 18STH7930967313 |
| | 18 | N | 279289 | 4267293 | 38 31 36.1N | 77 31 54.8W | 18STH7928967293 |
| | 18 | N | 279278 | 4267370 | 38 31 38.5N | 77 31 55.4W | 18STH7927867370 |
| | 18 | N | 279296 | 4267382 | 38 31 39.0N | 77 31 54.6W | 18STH7929667382 |
| | 18 | N | 279336 | 4267414 | 38 31 40.0N | 77 31 53.0W | 18STH7933667414 |
| | 18 | N | 279357 | 4267491 | 38 31 42.5N | 77 31 52.2W | 18STH7935767491 |
| | 18 | N | 279428 | 4267573 | 38 31 45.3N | 77 31 49.4W | 18STH7942867573 |
| | 18 | N | 279495 | 4267641 | 38 31 47.5N | 77 31 46.7W | 18STH7949567641 |
| | 18 | N | 279561 | 4267705 | 38 31 49.7N | 77 31 44.1W | 18STH7956167705 |
| | 18 | N | 279619 | 4267729 | 38 31 50.5N | 77 31 41.7W | 18STH7961967729 |
| | 18 | N | 279672 | 4267729 | 38 31 50.5N | 77 31 39.5W | 18STH7967267729 |
| | 18 | N | 279780 | 4267745 | 38 31 51.2N | 77 31 35.1W | 18STH7978067745 |
| | 18 | N | 279902 | 4267739 | 38 31 51.1N | 77 31 30.0W | 18STH7990267739 |
| | 18 | N | 280079 | 4267726 | 38 31 50.8N | 77 31 22.7W | 18STH8007967726 |
| | 18 | N | 280119 | 4267718 | 38 31 50.6N | 77 31 21.1W | 18STH8011967718 |

MCB Quantico TA Coordinate Table

| <u>ID</u> | <u>Zone</u> | <u>UTM</u> | | <u>Geodetic</u> | | <u>MGRS</u> | |
|------------------|-------------|-------------------|----------------|-----------------|-----------------|-------------|------------------|
| | | <u>Hemisphere</u> | <u>Easting</u> | <u>Northing</u> | <u>Latitude</u> | | <u>Longitude</u> |
| Target Area R-15 | 18 | N | 279027 | 4270500 | 38 33 19.8N | 77 32 09.3W | 18STH7902770500 |
| | 18 | N | 279031 | 4270508 | 38 33 20.0N | 77 32 09.1W | 18STH7903170508 |
| | 18 | N | 279040 | 4270523 | 38 33 20.5N | 77 32 08.8W | 18STH7904070523 |
| | 18 | N | 279043 | 4270543 | 38 33 21.2N | 77 32 08.7W | 18STH7904370543 |
| | 18 | N | 279032 | 4270581 | 38 33 22.4N | 77 32 09.2W | 18STH7903270581 |
| | 18 | N | 279052 | 4270594 | 38 33 22.8N | 77 32 08.4W | 18STH7905270594 |
| | 18 | N | 279059 | 4270630 | 38 33 24.0N | 77 32 08.1W | 18STH7905970630 |
| | 18 | N | 279052 | 4270658 | 38 33 24.9N | 77 32 08.4W | 18STH7905270658 |
| | 18 | N | 279039 | 4270688 | 38 33 25.9N | 77 32 09.0W | 18STH7903970688 |
| | 18 | N | 279000 | 4270728 | 38 33 27.1N | 77 32 10.7W | 18STH7900070728 |
| | 18 | N | 279001 | 4270891 | 38 33 32.4N | 77 32 10.8W | 18STH7900170891 |
| | 18 | N | 278998 | 4271000 | 38 33 36.0N | 77 32 11.1W | 18STH7899871000 |
| | 18 | N | 279071 | 4271001 | 38 33 36.1N | 77 32 08.0W | 18STH7907171001 |
| | 18 | N | 279500 | 4270999 | 38 33 36.4N | 77 31 50.3W | 18STH7950070999 |
| | 18 | N | 279493 | 4270887 | 38 33 32.7N | 77 31 50.5W | 18STH7949370887 |
| | 18 | N | 279490 | 4270789 | 38 33 29.6N | 77 31 50.5W | 18STH7949070789 |
| | 18 | N | 279502 | 4270780 | 38 33 29.3N | 77 31 50.0W | 18STH7950270780 |
| | 18 | N | 279499 | 4270776 | 38 33 29.1N | 77 31 50.1W | 18STH7949970776 |
| | 18 | N | 279501 | 4270627 | 38 33 24.3N | 77 31 49.9W | 18STH7950170627 |
| | 18 | N | 279411 | 4270747 | 38 33 28.1N | 77 31 53.7W | 18STH7941170747 |
| | 18 | N | 279400 | 4270758 | 38 33 28.5N | 77 31 54.2W | 18STH7940070758 |
| | 18 | N | 279374 | 4270761 | 38 33 28.5N | 77 31 55.3W | 18STH7937470761 |
| | 18 | N | 279345 | 4270766 | 38 33 28.7N | 77 31 56.5W | 18STH7934570766 |
| | 18 | N | 279329 | 4270757 | 38 33 28.4N | 77 31 57.1W | 18STH7932970757 |
| | 18 | N | 279333 | 4270740 | 38 33 27.8N | 77 31 56.9W | 18STH7933370740 |
| | 18 | N | 279345 | 4270728 | 38 33 27.4N | 77 31 56.4W | 18STH7934570728 |
| | 18 | N | 279352 | 4270712 | 38 33 26.9N | 77 31 56.1W | 18STH7935270712 |
| | 18 | N | 279339 | 4270712 | 38 33 26.9N | 77 31 56.7W | 18STH7933970712 |
| | 18 | N | 279330 | 4270719 | 38 33 27.1N | 77 31 57.0W | 18STH7933070719 |
| | 18 | N | 279317 | 4270719 | 38 33 27.1N | 77 31 57.6W | 18STH7931770719 |
| | 18 | N | 279317 | 4270695 | 38 33 26.4N | 77 31 57.5W | 18STH7931770695 |
| | 18 | N | 279303 | 4270690 | 38 33 26.2N | 77 31 58.1W | 18STH7930370690 |
| | 18 | N | 279286 | 4270691 | 38 33 26.2N | 77 31 58.8W | 18STH7928670691 |
| | 18 | N | 279278 | 4270664 | 38 33 25.3N | 77 31 59.1W | 18STH7927870664 |
| | 18 | N | 279281 | 4270632 | 38 33 24.3N | 77 31 59.0W | 18STH7928170632 |
| | 18 | N | 279295 | 4270612 | 38 33 23.6N | 77 31 58.4W | 18STH7929570612 |
| | 18 | N | 279303 | 4270583 | 38 33 22.7N | 77 31 58.0W | 18STH7930370583 |
| | 18 | N | 279322 | 4270563 | 38 33 22.1N | 77 31 57.2W | 18STH7932270563 |
| | 18 | N | 279335 | 4270543 | 38 33 21.4N | 77 31 56.6W | 18STH7933570543 |
| | 18 | N | 279331 | 4270523 | 38 33 20.8N | 77 31 56.8W | 18STH7933170523 |
| | 18 | N | 279325 | 4270502 | 38 33 20.1N | 77 31 57.0W | 18STH7932570502 |
| | 18 | N | 279325 | 4270500 | 38 33 20.0N | 77 31 57.0W | 18STH7932570500 |