



## DEPARTMENT OF THE ARMY

OFFICE OF ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT  
U.S. ARMY FORT MONMOUTH  
P.O. 148  
OCEANPORT, NEW JERSEY 07757

23 February 2018

Mr. Ashish Joshi  
New Jersey Department of Environmental Protection  
Division of Remediation Management & Response  
Northern Bureau of Field Operations  
7 Ridgedale Avenue (2<sup>nd</sup> Floor)  
Cedar Knolls, NJ 07927-1112

**SUBJECT: Request for Unrestricted Use, No Further Action Approval  
Site Investigation Report for Parcel 105 (Former Pistol Range)  
Fort Monmouth, Monmouth County, Oceanport, New Jersey  
PI G000000032**

Dear Mr. Joshi:

The Fort Monmouth (FTMM) Team has prepared this Site Investigation (SI) Report to summarize recent sampling at Parcel 105 (Former Pistol Range; **Figure 1**) and to request an Unrestricted Use, No Further Action (NFA) determination for Parcel 105.

### **Parcel 105 Background**

**Attachment A** includes excerpts of a key historical report and other background information for Parcel 105 referred to as the Former Pistol Range (1935-1940 Pistol Range) in **Reference 1**. The Former Pistol Range as first identified on a 1935 map encompassed 0.42 acres, and consisted of a firing line and target berm, with firing occurring from east to west. The former Pistol Range was closed in 1940 to allow construction of the Sanitary Treatment Plant (also referred to as AOC-3 in Reference 1), which was built in 1941, closed in 1971, and demolished in 1983. The area is currently flat and grass covered. The berm was depicted on a 1935 map; however, it was not on a 1941 map that shows the Sanitary Treatment Plant; therefore, it is assumed that the berm was removed prior to the construction of the Sanitary Treatment Plant. No structures associated with the Former Pistol Range currently exist on-site. **Attachment A** also includes historical aerial photographs showing the redevelopment of the area of the Former Pistol Range.

The New Jersey Department of Environmental Protection (NJDEP) concurred with the Army's recommendation that no further action was needed for AOC-3 (**Reference 2**, provided in **Attachment A**). However, the berm area of the Former Pistol Range was not investigated. As described in **Reference 3**, further investigation of lead impacts were warranted at Parcel 105. Various historical documents indicate that small arms, using bullets comprised mainly of lead, were used at Fort Monmouth including the Parcel 105 Former Pistol Range (**Reference 1**). The August 2016 *Final Finding of Suitability to Transfer (FOST), Phase 2 Parcels* for Fort Monmouth identified Parcel 105 as a carve out area requiring additional information to fully characterize the site. Soil contamination associated with pistol range activities, if present, would most likely be in the backstop berm.

Contamination within the safety fan associated with use of the Former Pistol Range is unlikely, since any overshoot would likely be widely scattered and not resulting in significant deposition of bullets and bullet fragments (**Reference 3**). **Figure 2** shows the boundary of the Parcel 105 Former Pistol Range. The land in this area has been extensively re-worked since 1940.

### Recent Investigation Results

An investigation was performed in 2017 to determine if lead was present in the soil at the location of the backstop berm of the Former Pistol Range. Soil samples were collected from 3 Geoprobe boring locations (PAR-105-SB-01, PAR-105-SB-02, and PAR-105-SB-03; see **Figure 2**): 0 to 0.5 feet below ground surface (ft bgs), 1.25 to 1.75 ft bgs, and 2.5 to 3 ft bgs. Field notes and soil boring logs are provided in **Attachment B** and **Attachment C**, respectively. The samples were analyzed for lead by ALS Environmental (ALS). Lead was not detected in any of the soil samples at concentrations exceeding the NJDEP residential direct contact soil remediation standard (RDCSRS), non-residential direct contact soil remediation standards (NRDCSRS) or NJDEP Impact to Ground Water (IGW) Soil Screening Levels (SSLs) (**Table 1**).

Wood debris was observed at 3.0 to 3.5 feet bgs in boring PAR-105-SB-01, indicating that soil fill was encountered and sampled. Historical target supports were likely made of wood. Since the historic backstop berm was topographically higher than surrounding area (**Attachment A**), and since the berm was assumed to be removed prior to sewer plant construction (**Reference 1**), the sampled fill is considered representative of the backstop berm.

### Conclusions

In summary, Unrestricted Use, NFA approval is requested for Parcel 105. Thank you for reviewing this request; we look forward to your approval and/or comments. Our technical Point of Contact is Kent Friesen at (732) 383-7201; [kent.friesen@parsons.com](mailto:kent.friesen@parsons.com). I can be reached at (732) 380-7064; [william.r.colvin18.civ@mail.mil](mailto:william.r.colvin18.civ@mail.mil).

Sincerely,

  
William R. Colvin, PMP, CHMM, PG  
BRAC Environmental Coordinator

cc: Ashish Joshi (e-mail and 2 hard copies)  
William Colvin, BEC (e-mail and 1 hard copy)  
Joseph Pearson, Calibre (e-mail)  
James Moore, USACE (e-mail)  
Jim Kelly, USACE (e-mail)  
Joseph Fallon, FMERA (e-mail)  
Cris Grill, Parsons (e-mail)



**Figures:**

Figure 1 Parcel 105 Site Location

Figure 2 Parcel 105 Site Layout, Sampling Locations, and Results

**Tables:**

Table 1 –2017 Parcel 105 Soil Sampling Results – Comparison to NJDEP Soil Remediation Standards

**Attachments:**

- A. Key Historical Report and Background Information
- B. Field Notes
- C. Soil Boring Logs

**References:**

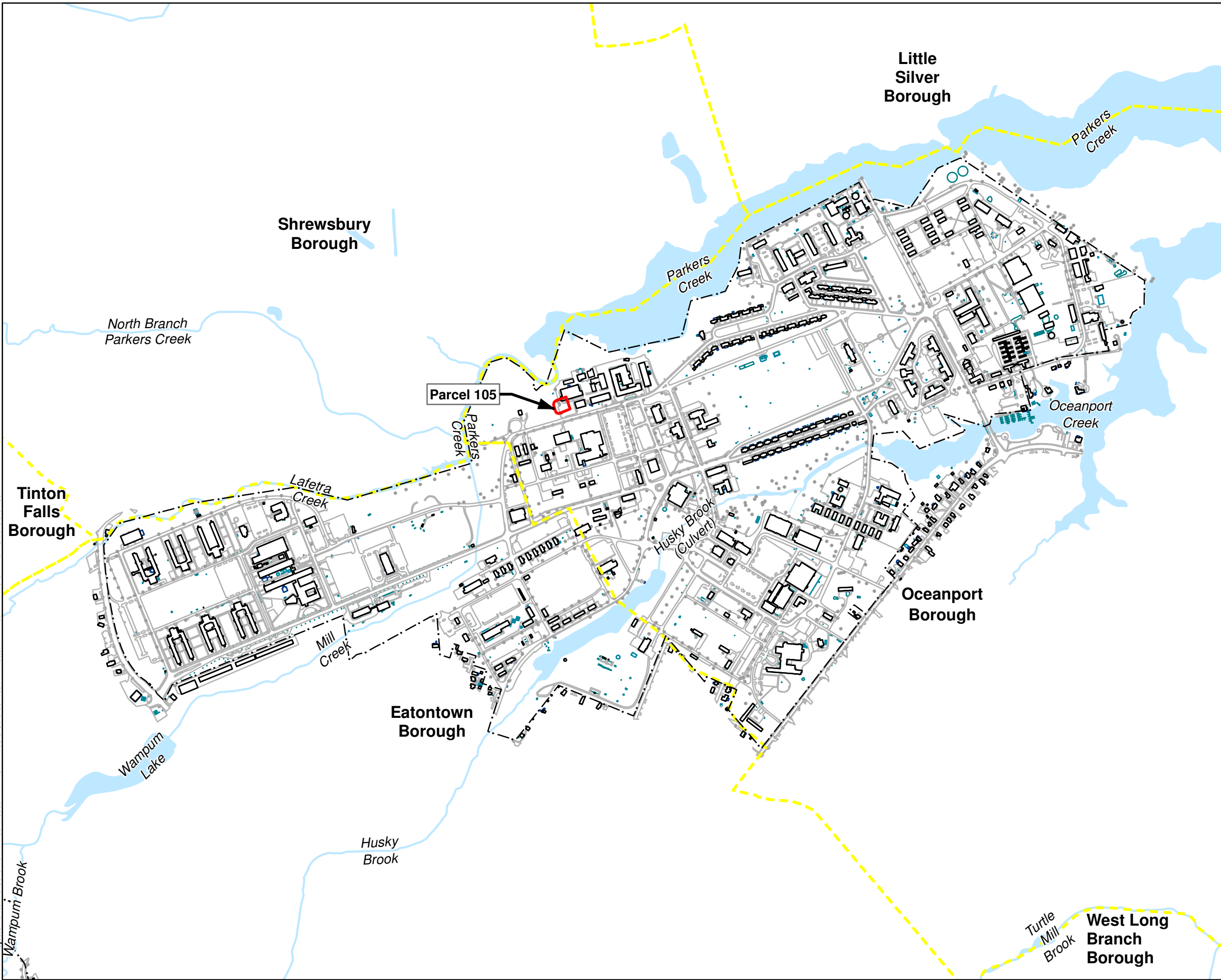
1. Malcolm Pirnie, Inc. 2006. *Final Historical Records Review, Fort Monmouth, Fort Monmouth, New Jersey*. Prepared for U.S. Army Corps of Engineers, Baltimore District. January.
2. New Jersey Department of Environmental Protection (NJDEP), letter dated 4 April 1996. NJDEP Comments on *Weston Remedial Investigation Report, DERA Sites – Fort Monmouth Army Base, Tinton Falls, Monmouth County*. Roy F. Weston, Inc., December 1995.
3. United States (US) Army Base Realignment and Closure (BRAC), 2007. *Environmental Condition of Property Report – Fort Monmouth, Monmouth County, New Jersey*. Final. January 29.

## **FIGURES**

**Figure 1 – Parcel 105 Location**

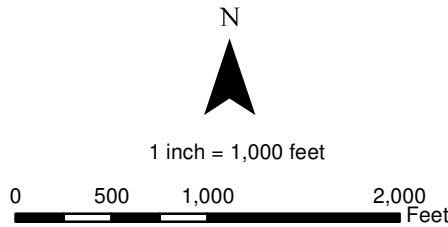
**Figure 2 – Parcel 105 Site Layout, Sampling Locations, and Results**

P:\PTT\Projects\Huntsville Cont W912DY-09-D-0062\FTMMCAD Files\GIS\Parcel 105\NFA Letter\PAR-105-NFA-FIG-01.mxd 1/8/2018 3:04:58 PM



**LEGEND:**

- Parcel Boundary
- Installation Boundary
- Municipal Boundary
- Surface Water Feature



Source: FTMM Supplied CAD, 2013; ESRI Data and Maps, 2011; USGS NHD, 2012.

**PARSONS**  
401 Diamond Drive NW,  
Huntsville AL

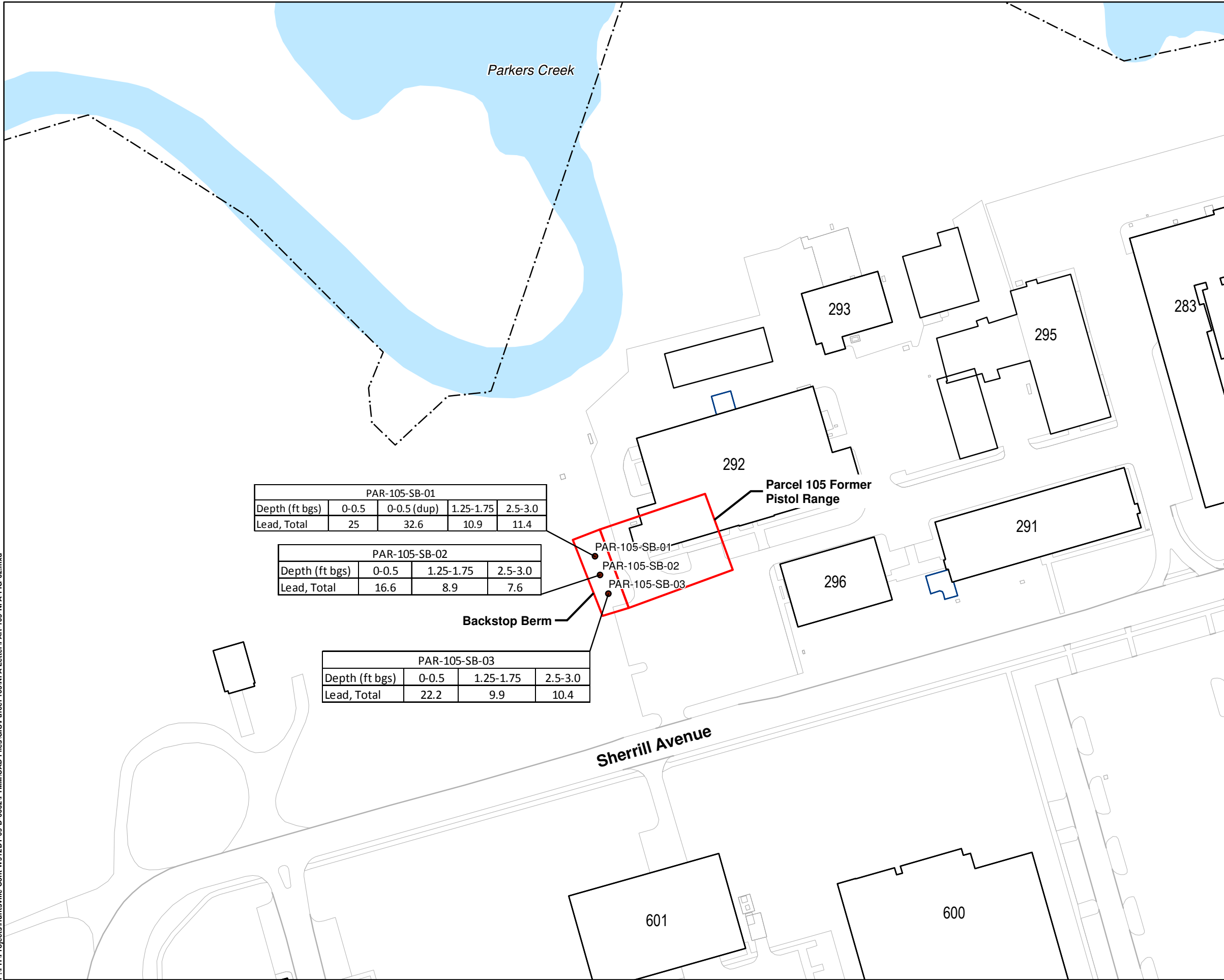
**Fort Monmouth**  
New Jersey

**PARCEL 105 SITE LOCATION**

|                                        |                                        |
|----------------------------------------|----------------------------------------|
| CREATED BY:<br><b>RR</b>               | REVIEWED BY:<br><b>AM</b>              |
| DATE:<br><b>JAN. 2018</b>              | FIGURE NUMBER:<br><b>FIGURE 1</b>      |
| PROJECT NUMBER:<br><b>748810-06031</b> | FILE:<br><b>PAR-105-NFA-FIG-01.mxd</b> |



P:\PTT\Projects\Huntsville Cont W912DY-09-D-0062\FTMMCAD Files\GIS\Parcel 105\NFA Letter\PAR-105-NFA-FIG-02.mxd



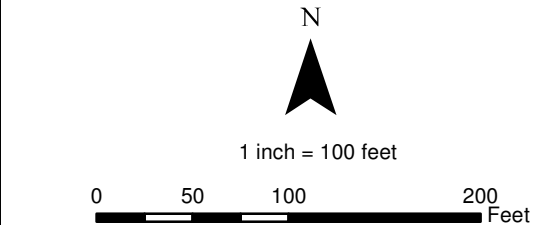
**LEGEND:**

- Soil Boring
- Surface Water Feature
- [ - - ] Installation Boundary

**NOTES:**

Results shown in milligrams/kilograms (mg/kg)

| Analyte     | NJDEP<br>RDCSRS<br>(mg/kg) | NJDEP<br>NRDCSRS<br>(mg/kg) | NJDEP<br>IGW<br>(mg/kg) |
|-------------|----------------------------|-----------------------------|-------------------------|
| Lead, Total | 400                        | 800                         | 90                      |



Source: FTMM Supplied CAD; ESRI Data and Maps 2011; USGS NHD.

|                                                                    |                                           |
|--------------------------------------------------------------------|-------------------------------------------|
| <b>PARSONS</b><br>401 Diamond Drive NW,<br>Huntsville AL           | <b>Fort Monmouth</b><br><b>New Jersey</b> |
| <b>PARCEL 105 SITE LAYOUT,<br/>SAMPLING LOCATIONS, AND RESULTS</b> |                                           |
| CREATED BY:<br><b>RR</b>                                           | REVIEWED BY:<br><b>KF</b>                 |
| DATE:<br><b>JAN. 2018</b>                                          | FIGURE NUMBER:<br><b>FIGURE 2</b>         |
| PROJECT NUMBER:<br><b>748810-06031</b>                             | FILE:<br><b>PAR-105-NFA-FIG-02.mxd</b>    |

## **TABLES**

### **Table 1 – 2017 Soil Sampling Results – Comparison to NJDEP Soil Remediation Standards**

TABLE 1  
2017 SOIL SAMPLING RESULTS - COMPARISON TO NJDEP SOIL REMEDIATION STANDARDS  
SITE PARCEL 105  
FORT MONMOUTH, NEW JERSEY

| Loc ID             | NJ<br>Residential<br>Direct<br>Contact SRS | NJ Non-<br>Residential<br>Direct<br>Contact SRS | NJ Impact to<br>GW Soil<br>Screening<br>Level | PAR-105-SB-01       |                      |                         |                       | PAR-105-SB-02       |                         |                       | PAR-105-SB-03       |                         |                       |
|--------------------|--------------------------------------------|-------------------------------------------------|-----------------------------------------------|---------------------|----------------------|-------------------------|-----------------------|---------------------|-------------------------|-----------------------|---------------------|-------------------------|-----------------------|
| Sample ID          |                                            |                                                 |                                               | PAR-105-SB-01-0-0.5 | PAR-105-SB-101-0-0.5 | PAR-105-SB-01-1.25-1.75 | PAR-105-SB-01-2.5-3.0 | PAR-105-SB-02-0-0.5 | PAR-105-SB-02-1.25-1.75 | PAR-105-SB-02-2.5-3.0 | PAR-105-SB-03-0-0.5 | PAR-105-SB-03-1.25-1.75 | PAR-105-SB-03-2.5-3.0 |
| Sample Date        |                                            |                                                 |                                               | 11/10/2017          | 11/10/2017           | 11/10/2017              | 11/10/2017            | 11/10/2017          | 11/10/2017              | 11/10/2017            | 11/10/2017          | 11/10/2017              | 11/10/2017            |
| Inorganics (mg/kg) |                                            |                                                 |                                               |                     |                      |                         |                       |                     |                         |                       |                     |                         |                       |
| Lead               | 400                                        | 800                                             | 90                                            | 25                  | 32.6                 | 10.9                    | 11.4                  | 16.6                | 8.9                     | 7.6                   | 22.2                | 9.9                     | 10.4                  |

Footnote:

- 1) All historical data collected prior to 2013 are reported as provided by others.
- 2) Number of Analyses is the number of detected and non-detected results excluding rejected results. Sample duplicate pairs have not been averaged.
- 3) NLE = no limit established.
- 4) ND = not detected in any background sample, no background concentration available.
- 5) Bold chemical detection
- 6) SS = Site Specific action level, see "Specific Chemical Class (or Parameter)" footnote for details.

7) Chemical result qualifiers are assigned by the laboratory and are evaluated and modified (if necessary) during the data validation.

|                                                                                                                                                           |                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| [blank] = detect, i.e. detected chemical result value.                                                                                                    | E (or ER) = Estimated result.                                                                                                                 |
| B =Compound detected in the sample at a concentration less than or equal to 5 times (10 times for common lab contaminants) the blank concentration.       | D = Results from dilution of sample.                                                                                                          |
| R = Rejected, data validation rejected the results.                                                                                                       | J-DL = Elevated sample detection limit due to difficult sample matrix.                                                                        |
| U = non-detect, i.e. not detected at or above this value.                                                                                                 | JN = Tentatively identified compound, estimated concentration.                                                                                |
| U-DL = Elevated sample detection limit due to difficult sample matrix.                                                                                    | UJ=The compound was not detected: however, the results is estimated because of discrepancies in meeting certain analyte-specific QC criteria. |
| U-ND = Analyte not detected in sample, but no detection or reporting limit provided.                                                                      | J+ = The result is an estimated quantity, but the result may be biased high.                                                                  |
| J = estimated detected value due to a concetration below the reporting limit or due to discrepancies in meeting certain analyte-specific quality control. | J- = The result is an estimated quantity, but the result may be biased low.                                                                   |

8) Specific Chemical Classes (or Parameters) comments or notes regarding how data is displayed, compared to Action Levels, or represented in this table.

9) Chemical results greater than or equal to the action level (depending on criteria) are highlighted based on the Criteria that are present.

- Cell Shade values represent a result that is above the NJ Residential Direct Contact Soil Remediation Standard.

There are no NJDEP soil standards for individual PCB Aroclors, therefore the total PCB NJDEP standards were used for individual Aroclors.
- Cell Shade values represent a result that is above the NJ Non-Residential Direct Contact Soil Remediation Standard.
- Cell Shade values represent a result that is above the NJ Impact to GW Soil Screening Level
- Cell Shade values represent a result that is above both the NJ Residential, Non-Residential, AND NJ Impact to GW Soil Screening Level Direct Contact Soil Remediation Standard.
- Cell Shade values represent a result that is above both the NJ Residential and Non-Residential Direct Contact Soil Remediation Standard.

|      |
|------|
| #### |
| ###  |
| ###  |
| ###  |
| ###  |

10) Criteria action level source document and web address.

- The NJ Residential Direct Contact Soil Remediation Standard refers to the NJDEP's Sept 18, 2017 Remediation Standards  
[http://www.nj.gov/dep/rules/rules/njac7\\_26d.pdf](http://www.nj.gov/dep/rules/rules/njac7_26d.pdf)
- The NJ Non-Residential Direct Contact Soil Remediation Standard refers to the NJDEP's Sept 18, 2017 Remediation Standards  
[http://www.nj.gov/dep/rules/rules/njac7\\_26d.pdf](http://www.nj.gov/dep/rules/rules/njac7_26d.pdf)
- The NJ Impact to GW Soil Screening Level criteria refers to the Development of Site Specific Impact to Ground Water Soil Remediation Standards - Nov 2013 revised  
[http://www.nj.gov/dep/srp/guidance/rs/partition\\_equation.pdf](http://www.nj.gov/dep/srp/guidance/rs/partition_equation.pdf)

**Attachment A**

- 1. Pistol Range (1935-1940) Excerpts from Historical Records Review**
- 2. 4 April 1996 NJDEP Letter**
- 3. 1935 Historical Drawing**
- 4. 1940 Aerial Photograph**
- 5. 1947 Aerial Photograph**
- 6. 2002 Aerial Photograph**



**FINAL  
HISTORICAL RECORDS REVIEW  
FORT MONMOUTH  
FORT MONMOUTH, NEW JERSEY**

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JANUARY 2006

Prepared for:

**UNITED STATES ARMY CORPS OF ENGINEERS, BALTIMORE DISTRICT**  
P.O. Box 1715  
Baltimore, Maryland 21203-1715

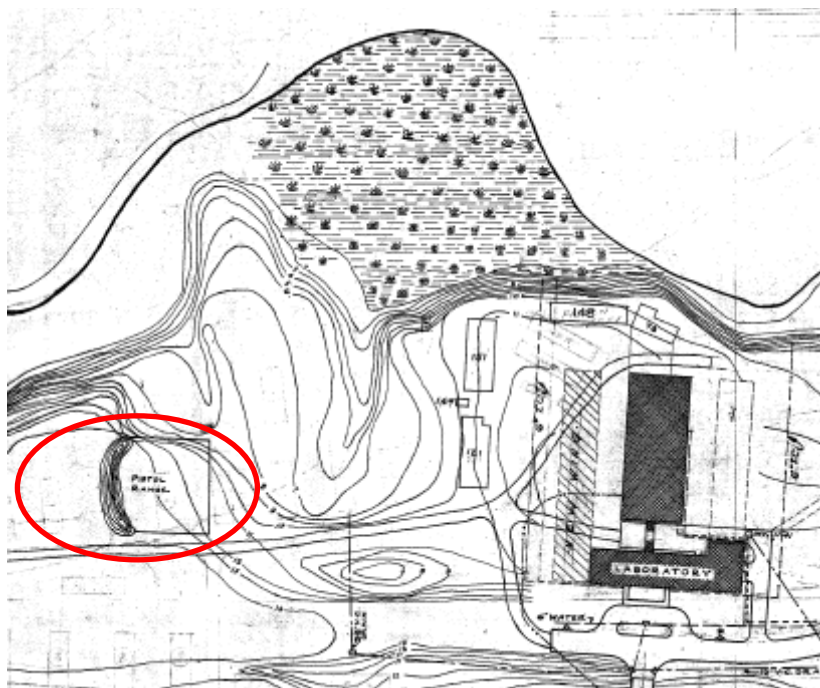
Prepared by:

**MALCOLM PIRNIE, INC.**  
824 Market Street  
Suite 820  
Wilmington, Delaware 19801

| <b>Document Number</b> | <b>Date</b>    | <b>Title</b>                                                                                     | <b>Source</b> | <b>General</b> | <b>Environmental</b> | <b>Munitions</b> |
|------------------------|----------------|--------------------------------------------------------------------------------------------------|---------------|----------------|----------------------|------------------|
| FTMM025                | December 1993  | Final Investigation of Suspected Hazardous Waste Site Fort Monmouth, New Jersey.                 | Installation  | X              | X                    |                  |
| FTMM026                | December 1995  | Final Site Investigation Fort Monmouth, New Jersey, Main Post and Charles Wood Areas.            | Installation  | X              | X                    |                  |
| FTMM027                | September 2003 | Final U.S. Army Closed, Transferring and Transferred Range/Site Inventory for Fort Monmouth, NJ. | AEC           | X              | X                    | X                |
| FTMM028                | July 2004      | Fort Monmouth 2004 Installation Action Plan.                                                     | Installation  | X              | X                    | X                |

#### **4.3.1 Former Pistol Range (1935-1940 Pistol Range) (MP)**

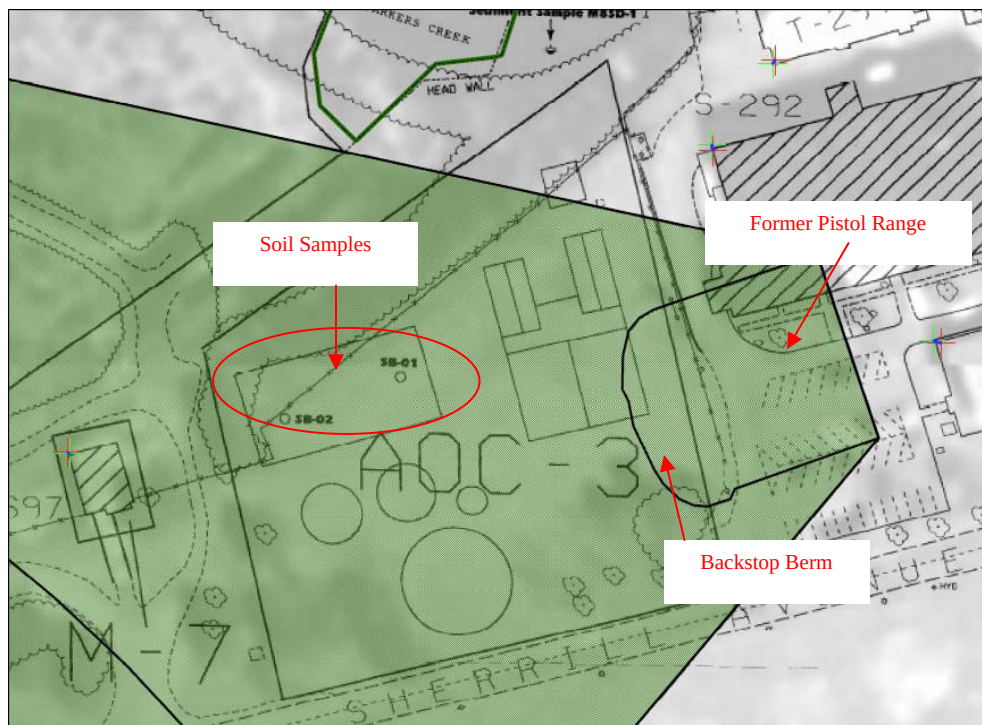
The Former Pistol Range (1935-1940 Pistol Range) was first identified on a 1935 map and encompassed 0.42 acres at the MP (FTMM015). The portion of the map depicting the Former Pistol Range and its berm is presented in Figure 4-15.. Historical documents indicate that small arms were on hand/inventoried at Fort Monmouth as early as 1925; however, historical mapping does not depict the presence of any small arms ranges until 1935 (FTMM013, FTMM014, and FTMM015).



**Figure 4-15: Former Pistol Range (1935-1940 Pistol Range) as identified in 1935 (FTMM015)**

In 1940, the Former Pistol Range (1935-1940 Pistol Range) was relocated to another site in preparation for the construction of the Sanitary Treatment Plant. The Sanitary Treatment Plant was built in 1941, closed in 1975, and demolished in 1983 (FTMM017, FTMM005, and FTMM008). Currently, the area is flat and grass covered. Soil sampling for metals was performed for the Sanitary Treatment Plant area (IRP Site Area of Concern [AOC] 3) in the vicinity of the Former Pistol Range (1935-1940 Pistol Range) (i.e., within the firing fan boundaries) in 1995 (FTMM026). Figure 4-16 depicts the Former Pistol Range (1935-1940 Pistol Range) and the sampling locations of the activities conducted in 1995. The green shading on Figure 4-16 indicates the boundaries of the Former Pistol Range (1935-1940 Pistol Range) and the firing fan area. No further action (NFA) was recommended for the Sanitary Treatment Plant area (IRP Site AOC 3) (FTMM026). No investigations of the Former Pistol Range (1935-1940 Pistol Range), including sampling activities, have been conducted within the former berm area (FTMM026). The berm was depicted on a 1935 map; however, the berm area was not depicted on the 1941 map that shows the Sanitary Treatment Plant. Therefore, it is assumed that the berm was removed/demolished prior to the construction of the Sanitary Treatment Plant

(FTMM015 and FTMM017). The primary MC of concern is lead. Other associated MC less likely to be of concern may include: antimony, arsenic, copper, magnesium, nickel, strontium, tin, zinc, and lead styphnate/lead azide.



**Figure 4-16: Soil sample locations on the Former Pistol Range (1935-1940 Pistol Range) (IRP Site AOC 3) (FTMM026)**

The surface danger zone (SDZ) is defined as the ground and airspace designated within the training complex (to include associated safety areas) for vertical and lateral containment of ammunition, bullet fragments, target fragments, and debris resulting from the firing of small arms weapons. For small arms ranges, the SDZ represents the portion of the former range that included the area where the weapons, when fired from the firing arc/line, were a potential hazard to personnel. The SDZ was used to define the area that included the firing arc/line, target area(s), impact area(s) (e.g., shotfall zone, backstop berm), ricochet trajectory area, and secondary danger area.

Various historical documents indicate that small arms ammunition was used at Fort Monmouth, including the Former Pistol Range (1935-1940 Pistol Range) (FTMM013, FTMM014, FTMM016, and FTMM018 through FTMM023). Based on these documents, it is assumed that

.22-caliber, .30-caliber, and .45-caliber ammunition may have been used at the Former Pistol Range (1935-1940 Pistol Range). A 1942 archival document indicates a request for .50-caliber ammunition; however, further correspondence indicates that the request was not met and .22-caliber ammunition was supplied as an alternative (FTMM020).

According to Army Regulation (AR) Technical Manuals (TM) (referenced as AR 750-10 and TM 9-855), the maximum range for .22-caliber weapons is 4,500 feet with a muzzle velocity of 1,100 feet per second. The maximum range for .45-caliber weapons is 4,800 feet with a muzzle velocity of 802 feet per second. The SDZ for a .45-caliber pistol range extends downrange from each end of each firing line at a five-degree angle for 4,800 feet. An additional SDZ, also originating from each end of each firing line, extends downrange at a 25-degree angle for 3,600 feet. An example of a typical SDZ for a pistol range is provided in Figure 4-17. The SDZ for the Former Pistol Range (1935-1940 Pistol Range) is shown on Map 4-2 (based on the typical SDZ for a .45-caliber pistol range). A CSM for the Former Pistol Range (1935-1940 Pistol Range) is presented in Section 5.1.

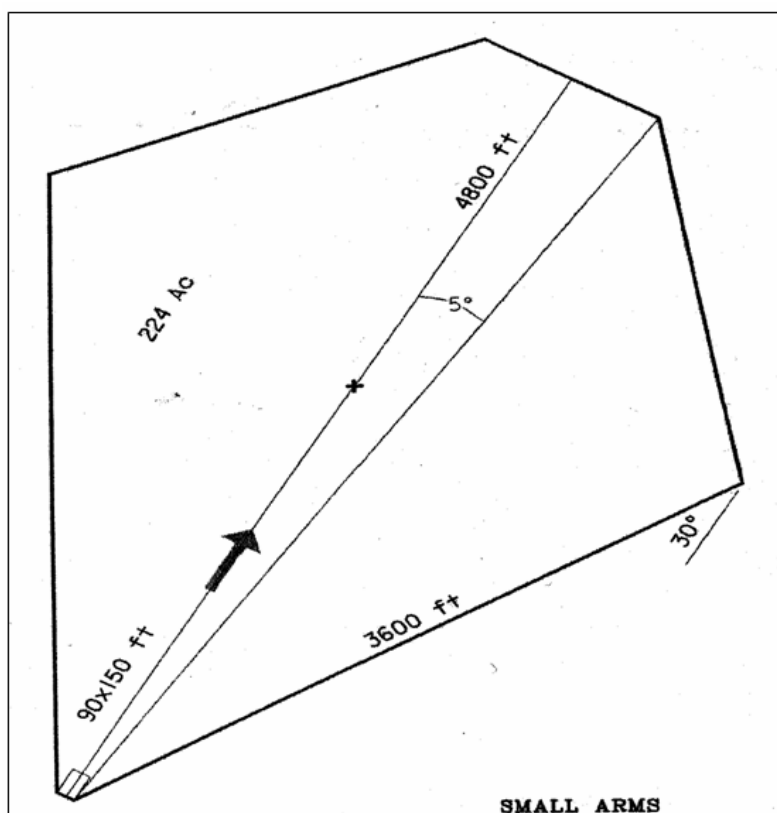


Figure 4-17: SDZ for a typical .45-caliber pistol range (AR 750-10 and TM 9-855)



# Historical Records Review Fort Monmouth, NJ



**MALCOLM  
PIRNIE**

**Map 4-2  
Ranges / Sites  
(Not Previously Identified)**

## Legend

-  Installation Boundary
-  Other Munitions Related Site

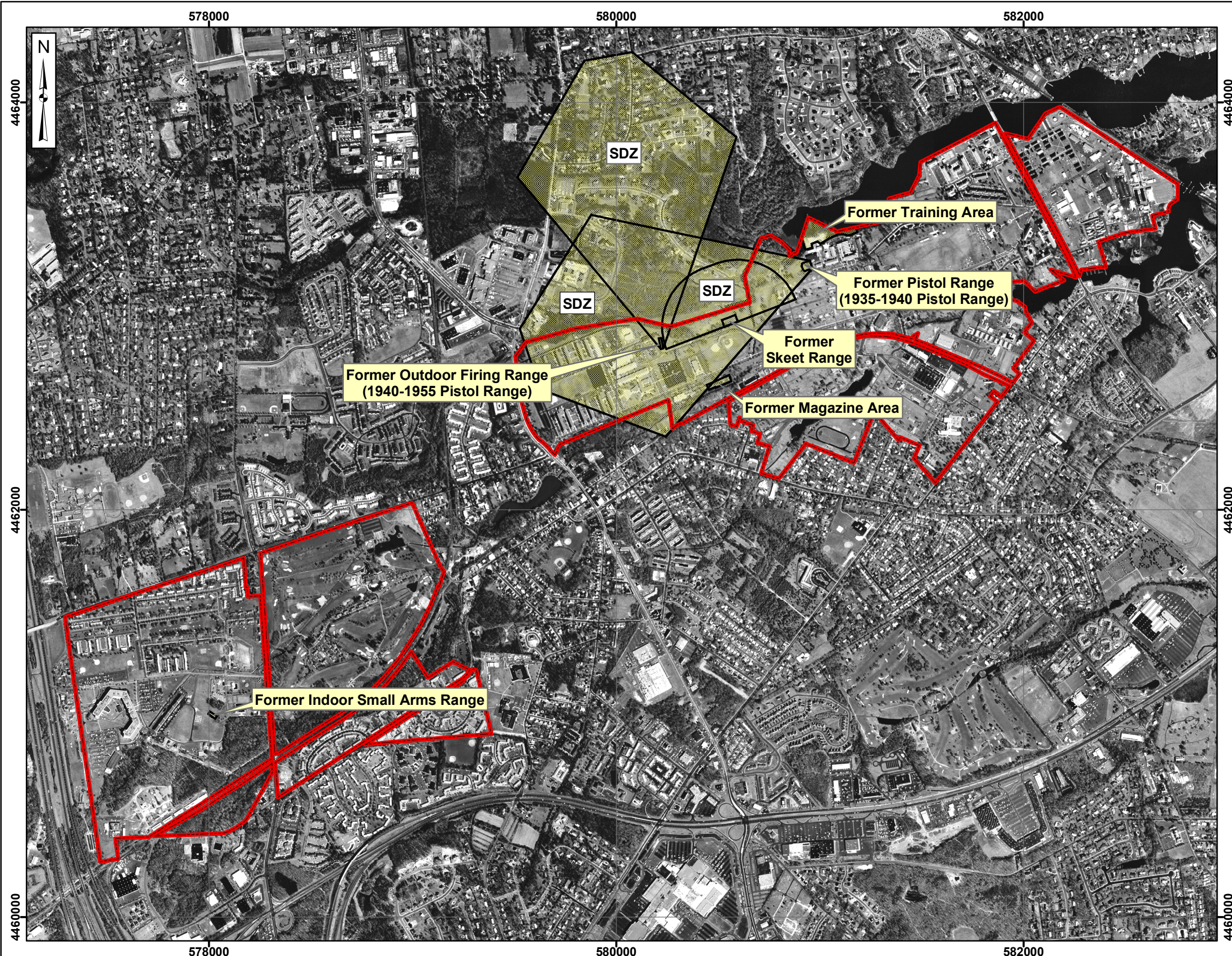
0 500 1,000 Meters



Data Source: USGS Teraserver Online,  
Digital Orthophoto,  
Downloaded 2005

Coordinate System: UTM Zone 18N  
Datum: NAD 1983  
Units: Meters

Contract: W912DR-05-D-0004  
Edition: Final  
Date: January 2006





| Document Number | Date           | Title                                                                                   | Source            | General | Environmental | Munitions /Storage |
|-----------------|----------------|-----------------------------------------------------------------------------------------|-------------------|---------|---------------|--------------------|
| FTMM038         | May 1980       | Installation Assessment Report No. 171.                                                 | Site Visit/ TIC   | X       | X             |                    |
| FTMM039         | 1981           | Fort Monmouth United States Geological Service Quad Map (1954 edited 1981).             | National Archives |         | X             |                    |
| FTMM040         | September 1985 | Installation Assessment Relook Program.                                                 | TIC               | X       | X             |                    |
| FTMM041         | May 1990       | Final Environmental Impact Statement for Fort Devens, Fort Monmouth, and Fort Huachuca. | TIC               | X       | X             |                    |
| FTMM042         | December 1999  | Final Integrated Natural Resources Management Plan Fort Monmouth, New Jersey.           | Site Visit        | X       | X             |                    |
| FTMM043         | Current        | <a href="http://www.monmouth.army.mil/C4ISR/">http://www.monmouth.army.mil/C4ISR/</a> . | Website           | X       |               |                    |

## 5.1 FORMER PISTOL RANGE (1935-1940 PISTOL RANGE)

### 5.1.1 Site Profile

#### 5.1.1.1 Area and Layout

The Former Pistol Range (1935-1940 Pistol Range) (hereinafter referred to as the Former Pistol Range) was approximately 550 feet to the west of the Squire Laboratory (FTMM015). The Former Pistol Range is shown in Map 5-1.

#### *5.1.1.2 Structures*

Review of the maps and historical documents collected during the archive search conducted for this HRR revealed that the Former Pistol Range was demolished for the construction of Sanitary Treatment Plant (IRP Site AOC 3), which was built in 1941, closed in 1975, and demolished in 1983 (FTMM017, FTMM005, and FTMM008). Currently, the area is flat and grass covered.

#### *5.1.1.3 Utilities*

A review of historical documents revealed that sewage piping was formerly located in the area of the Former Pistol Range (FTMM0036). This was removed with the demolition of the Sanitary Treatment Plant. Review of geographic information system (GIS) mapping layers provided by the installation during the site visit reveals that two water hydrants and one water well are currently within the boundary of the Former Pistol Range. The GIS mapping layers also indicate that within the firing fan of the Former Pistol Range there are currently several storm sewer inlets, several water wells, several water hydrants, communication duct bank lines, natural gas lines, and storm sewer headwall lines.

#### *5.1.1.4 Boundaries*

To the north and south of the Former Pistol Range are administrative buildings, to the east is the remaining portion of the Sanitary Treatment Plant, and to the west is undeveloped land (FTMM010 and FTMM012).

#### *5.1.1.5 Security*

Access to FTMM is restricted by guards and surveillance at every entrance. Access to the Former Pistol Range is not restricted once on the installation; however, based on historical mapping, a fence surrounds the former Sanitary Treatment Plant (FTMM008).

### **5.1.2 Physical Profile**

#### *5.1.2.1 Climate*

FTMM is located in the temperate zone of the middle Atlantic. The mean annual temperature at FTMM is 53 degrees Fahrenheit (°F). Summers are generally warm, with an average



temperature of 72°F, and winters are moderate, with an average temperature of 33°F. The average annual precipitation at FTMM is 45.18 inches. Thunderstorms generally occur in the summer and may combine high winds with heavy rainfall. The average seasonal snowfall is 25 inches, with the greatest amounts falling in December, January, and February (FTMM038)..

#### *5.1.2.2 Geology*

FTMM lies within the Outer Coastal Plain subprovince of the New Jersey section of the Atlantic Coastal Plain physiographic province, which generally consists of a seaward-dipping wedge of unconsolidated deposits of clay, silt, sand, and gravel. These formations were deposited on Precambrian and lower Paleozoic rocks and typically strike northeast-southwest, with a dip that ranges from 10 to 60 feet per mile. Coastal Plain sediments date from the Cretaceous through the Quaternary Periods and are predominantly derived from deltaic, shallow marine, and continental shelf environments. The formations record several major transgressive/regressive cycles. Regressive upward-coarsening deposits, such as Englishtown and Kirkwood formations and the Cohansey Sand, are usually aquifers, while transgressive deposits, such as the Merchantville, Marshalltown, and Navesink formations, act as confining units. The thicknesses of these units vary greatly, ranging from several feet to several hundred feet, and thicken to the southeast.

The Cretaceous Age Red Bank and Tinton Sands crop out at the MP. The Red Bank sand conformably overlies the Navesink Formation and dips to the southeast at a slope of 35 feet per mile. The upper member of the Red Bank sand (Shrewsbury) is yellowish-gray to reddish-brown clayey, medium- to coarse-grained sand that contains abundant rock fragments, minor mica, and glauconite. The lower member of the Red Bank sand (Sandy Hook) is a dark gray to black medium- to fine-grained sand with abundant clay, mica, and glauconite.

The Tinton sand conformably overlies the Red Bank sand and varies in color from dark yellowish-orange or light brown to moderate brown and from light olive to grayish brown. The Tinton sand ranges from a clayey medium to very coarse-grained feldspathic quartz and glauconite sand to a glauconitic coarse sand. The upper member of the Tinton sand may contain

60% to 80% glauconite. The upper member of the Tinton is often highly oxidized and iron-oxidized encrusted (FTMM037, FTMM038, and FTMM040).

#### *5.1.2.3 Topography*

The land surface at the MP is relatively flat and level, with the exception of short, steep slopes along streams and waterways. Elevations at the MP range from about 6 feet above mean sea level (amsl) at stream edges to 30 feet amsl near the center of MP. The elevation at the Former Pistol Range is 13 feet amsl (FTMM037, FTMM038, and FTMM040).

#### *5.1.2.4 Soil*

The MP can be generally described as the Freehold-Urban Land Holmdel-Urban Land Complex association. Soils within the MP are primarily mapped as Udorhents, which consist of areas of soils that have been altered by excavating or filing. The soil types at the MP primarily include Freehold sandy loam, Downer sandy loam, and Kresson loam. Freehold and Downer soil types are somewhat well drained soils that occur on upland areas. Also found on upland areas is the Kresson soil type, which is a poorly drained soil. Both the Freehold and Downer soil types have slight limitations for dwellings and small commercial buildings and severe limitations for shallow excavations. The severe limitations of these soils are due to the tendency of excavation walls to cave in. The Kresson soil type has severe limitations for excavations, dwellings, and small commercial buildings. The severe limitations of the Kresson soil type are associated with wetness (FTMM042).

#### *5.1.2.5 Hydrogeology*

FTMM lies in the Atlantic and Eastern Gulf Coastal Plain groundwater region and is underlain by underformed unconsolidated to semi-consolidated sedimentary deposits. The chemistry of the water near the surface is variable with low dissolved solids and high iron concentrations. In areas underlain by glauconitic sediments, the water chemistry is dominated by calcium, magnesium, and iron (e.g., Red Bank and Tinton sands). The sediments in the vicinity of FTMM were deposited in fluvial-deltaic to nearshore environments.

The water table aquifer at the MP area is identified as part of the “composite confining units”, or minor aquifers, which include the Navesink Formation, the Red Bank sand, Tinton sand, Hornerstown sand, Vincentown Formation, the Manasquan Formation, Shark River Formation, Piney Point Formation, and the basal clay of the Kirkwood Formation.

Water in the upper hydrogeologic units of the Red Bank and Tinton sands is typically encountered at shallow depths (2 to 9 feet below ground surface [bgs]). The shallow water table conditions in the Tinton and Red Banks sands, and the similar composition of these sands within the Kirkwood Formation, suggest that the Tinton-Red Bank-Kirkwood sequence forms a single, laterally continuous aquifer. Water in this water table aquifer will flow east towards the Atlantic Ocean. Additionally, local topography will tend to deflect the flow toward local depressions.

Groundwater is not used as a potable water source/water supply at FTMM.

(Note: The hydrogeology information was obtained from FTMM037, FTMM038, and FTMM040.)

#### *5.1.2.6 Hydrology*

The MP is drained via several waterways that generally flow from west to east. Mill Brook enters FTMM along the southwest boundary and flows east and then north to Lafetra Creek. Lafetra Creek, originating off-post to the west, flows east along the northern boundary of the MP. Parkers Creek originates at the convergence of Lafetra Creek and Mill Brook and flows along the northern boundary of the MP until it discharges to the Shrewsbury River.

The southern portion of the MP is drained by Husky Brook. Husky Brook is a freshwater stream that originates southwest of the MP. A portion of the stream has been dredged, widened, and dammed to form the Husky Brook Lake, which is used for recreational purposes. Downstream from the lake, Husky Brook is piped for approximately 1,100 feet before it surfaces and flows east into Oceanport Creek. Oceanport Creek is a tidal stream that flows along a portion of the southern boundary of the MP before discharging into the Shrewsbury River. The Former Pistol Range is approximately 300 feet south of Lafetra Creek.

Surface water is used as a potable water source/water supply at FTMM. Site-specific hydrologic information was not available.

(Note: The hydrology information was obtained from FTMM037, FTMM038, and FTMM040.)

#### *5.1.2.7 Vegetation*

Plant communities at FTMM consist of mixed hardwood-pine forest, flood plain salt marshes and other wetlands. Lawns, ball fields, parade grounds, and roadside areas in the MP are planted in grass mixtures that may include Kentucky bluegrass (*Poa pratensis*), Merion bluegrass (*Poa sp.*), Chewings fescue (*Festuca sp.*), and perennial ryegrass (*Lolium perenne*). The Former Pistol Range is currently a grass covered field (FTMM037, FTMM038, FTMM040, and FTMM042).

### **5.1.3 Land Use and Exposure Profile**

#### *5.1.3.1 Current Land Use/Activities*

The Former Pistol Range is undeveloped (FTMM008 and FTMM010).

#### *5.1.3.2 Current Human Receptors*

Human receptors are limited to visitors/trespassers, contractors, and authorized installation personnel (FTMM008, FTMM010, and FTMM043).

#### *5.1.3.3 Potential Future Land Use*

The installation will be closed in accordance with BRAC protocols; however, the potential future land use is unknown.

#### *5.1.3.4 Potential Future Human Receptors*

As any change in land use is unknown at this time, the future human receptors of potential MC are assumed to include recreational users, residents (residential), construction/maintenance workers, and industrial/office workers who may contact the source medium or other media at the site that may be impacted.



#### *5.1.3.5 Zoning/Land Use Restrictions*

A review of historic documents reveals that historic buildings and potential archaeological sites are known to exist at FTMM. The MP has an historic district that contains buildings eligible for the National Register of Historic Places (NRHP). The majority of these buildings are residential. Potential archaeological sites have also been identified at FTMM; however, the NRHP determination of these sites is unknown (FTMM010 and FTMM037).

Wetland areas are considered to be environmentally sensitive and are recommended to be left in a natural state. Approximately 12.5 acres of wetlands occur on the MP. Most of these wetland areas are associated with Parkers Creek, Oceanport Creek, and Husky Brook (FTMM042). Based on review of the GIS mapping layers, no wetlands are located at the Former Pistol Range. The Former Pistol Range area is currently zoned as Research, Development and Testing, as well as Administrative (FTMM010). Land use restrictions specific to the Former Pistol Range were not identified.

#### *5.1.3.6 Beneficial Resources*

Wetlands are present at the MP; Parkers and Oceanport Creeks are classified as estuarine intertidal aquatic beds. The area of Parkers Creek northwest of Building 294 and the portion of Oceanport Creek/Husky Brook west of Murray Drive and east of Building 551 are classified as estuarine intertidal emergent wetlands. Lafetra Creek and Mill Creek, which are located 300 feet to the north and 1600 feet to the east, respectively, are classified as riverine lower perennial open water/unknown bottom. Husky Brook Lake is classified as palustrine open water/unknown bottom. All of these wetland types provide valuable habitat for a variety of species (FTMM039 and FTMM042).

No information was identified concerning beneficial resources specific to the Former Pistol Range.

#### *5.1.3.7 Demographics/Zoning*

FTMM lies entirely within Monmouth County, New Jersey. The 2004 U.S. Census listed the population of Monmouth County at 636,298 residents. A review of maps indicates that much of the land surrounding FTMM consists of administrative and residential subdivisions and the

associated commercial developments (FTMM008 and FTMM010). Approximately 7,000 military and civilian personnel are employed at FTMM. In addition, approximately 1,173 dependents live on the MP or the CWA in family housing, bringing the total combined installation population to over 8,000 (FTMM043).

#### 5.1.4 Ecological Profile

##### 5.1.4.1 Habitat Type

The natural areas at FTMM consist of oak, pine (*Pinus spp.*), honey locust (*Gleditsia triacanthos*), black locust (*Robinia pseudoacacia*), huckleberries (*Gaylussacia spp.*), and ferns in the genus *Aythia*. Along the banks of Oceanport Creek and Parkers Creek on the MP are reeds, sedges, and marsh grasses.

Mammals that are commonly seen at FTMM consist of the woodchuck (*Marmota monax*), eastern cottontail rabbit (*Sylvilagus floridanus*), and eastern gray squirrel (*Sciurus carolinensis*). Other mammals that are likely to be found at the installation include the raccoon (*Procyon lotor*), striped skunk (*Melephitis mephitis*), eastern chipmunk (*Tamias striatus*), muskrat (*Ondatra zibethica*), and Norway rat (*Rattus norvegicus*).

The installation provides bird habitat for a variety of birds, including songbirds, wading birds, and shorebirds. Bird species found in Monmouth County that are likely to occur at FTMM include the Canada goose (*Branta Canadensis Leucopareia*), herring gull (*Larus argentatus*), mallard (*Anas platyrhynchos*), blue jay (*Cyanocitta cristata*), European starling (*Sturnus vulgaris*), American robin (*Turdus migratorius*), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), northern mockingbird (*Mimus polyglottos*), house sparrow (*Passer domesticus*), red-winged blackbird (*Agelaius phoeniceus*), northern cardinal (*Cardinalis cardinalis*), house finch (*Carpodacus mexicanus*), and song sparrow (*Melospiza melodia*).

Parkers Creek and Oceanport Creek, located on the northern and southern boundaries of the MP, respectively, are brackish, tidally influenced creeks. Fish that are known to occur in these creeks include menhaden (*Brevoortia tyrannus*), blueback herring (*Alosa aestivalis*), and alewife

(*Alosa pseudoharengus*). Freshwater creeks on the MP include Mill Brook, Lafetra Creek, and Husky Brook. Fish species that may be found in these creeks include white perch (*Montone Americana*), carp (*Cyprinus carpio*), catfish (*Ictalurus spp.*), sunfish (*Lepomis spp.*), and crappie (*Pomoxis spp.*). Fish found in Husky Brook Lake include rainbow trout (*Oncorhynchus mykiss*) and largemouth bass (*Micropterus salmoides*).

(Note: The habitat type information was obtained from FTMM037, FTMM038, FTMM040, FTMM041, and FTMM042.)

A review of the above documents and the GIS mapping, as well as observation during the site visit indicate that the Former Pistol Range is currently grass covered.

#### *5.1.4.2 Degree of Disturbance*

The Former Pistol Range is currently undeveloped; therefore, the degree of disturbance in this area is low (FTM008 and FTMM010). Any future development of the area would create an additional degree of disturbance.

#### *5.1.4.3 Ecological Receptors*

Review of historic documents reveals that there are no federally or state listed or proposed threatened or endangered flora or fauna on FTMM (FTMM037, FTMM038, FTMM040, FTMM041, and FTMM042). As previously discussed, the Former Pistol Range is currently undeveloped; therefore, there is a potential for species to reside in this area.

### **5.1.5 Munitions/Release Profile**

#### *5.1.5.1 Munitions Types and Release Mechanisms*

This section describes the munitions or munitions related materials known or suspected to be at the site, including the types and estimated maximum penetration depths. This includes both MEC and non-hazardous munitions related debris (e.g., fragmentation, base plates, inert mortar fins). Potential ordnance concentration areas are presented along with a discussion on the

presence of any special consideration ordnance. Information on the SDZ for the range can be found in Section 4.3.1.

The data collection team was able to locate correspondence and reports that provide detail on the types of ammunition used at FTMM during the time period the Former Pistol Range was operational. (Note: Historical documents indicate that small arms were on hand/inventoried at Fort Monmouth in 1925; however, historical mapping does not depict the presence of any small arms ranges until 1935 [FTMM013, FTMM014 and FTMM015]). The following is a list of known/suspected types of ordnance used at the range based on the review of various historical documents (FTMM013, FTMM014, FTMM016, and FTMM018 through FTMM023).

- .22-caliber
- .30-caliber
- .45-caliber

Technical data sheets on these items are included in Appendix E. The Former Pistol Range is not suspected to contain CWM filled munitions, electrically fuzed munitions, or depleted uranium (DU) associated munitions. Since the Former Pistol Range was assumed to be used for small arms training only, MEC and non-hazardous munitions related debris are not known or suspected to have been present at the site.

#### *5.1.5.2 Maximum Probable Penetration Depth*

The depth to which munitions penetrate below the ground surface depends on many factors, including the type of soil, the angle of impact, the size of the munitions, the velocity at impact, and site-specific environmental conditions. Over the years, the DoD has studied and modeled munitions penetration depths and has issued various guidance and technical documents on the subject. However, these guidance documents do not apply to small arms since, by design, small arms ammunition is not intended to penetrate the ground surface. The ITRC guidance presents information on the general layout of small arms ranges, as well as information on the areas that may be impacted with MC and/or MEC as a result of range use and characteristics of the munitions used (FTMM033). According to the ITRC guidance, the penetration depth of small arms ammunition on the range floor is 1 foot or less (FTMM033). The document also states that

rounds that impact the range floor are typically a flat trajectory that fell short of the berm or those that resulted from ricochet, and these fragments are usually found within the top 6 inches of soil. Assuming that soil was not reapplied to the berm, penetration depths within the berm vary depending on the soil type, but are expected to be 1 foot or less. The bullet fragments found in the SDZ are almost exclusively the result of ricochet and, unless earth moving has been done, will be found on the surface of the soil.

According to the ITRC guidance, depending on the soil types present and specific soil characteristics, penetration depths may increase because of settlement and erosion (FTMM033). The ordnance items may slowly descend within the soil matrix if wind or water erosion is present. Information about specific soils types was not available for the Former Pistol Range. The location and dimensions of the berm were depicted on a 1935 map (FTMM015). The berm at the Former Pistol Range is no longer present; however, it is uncertain as to whether the berm was spread over the surface soil for the construction of the Sanitary Treatment Plant or the berm was removed.

Map 5-1 depicts the dimensions of the Former Pistol Range (FTMM015), the berm location/dimensions (FTMM005), the firing line location (assumed based on the known location of the berm), and the typical SDZ for a .45-caliber pistol range (AR 750-10 and TM 9-855).

#### *5.1.5.3 MEC Density*

No MEC are anticipated at the Former Pistol Range because only small arms ammunition was assumed to have been used on this range, and small arms ammunition is not considered MEC (FTMM013, FTMM014, FTMM016, and FTMM018 through FTMM023).

#### *5.1.5.4 Munitions Debris*

No munitions debris was observed at the Former Pistol Range during the site visit.

#### *5.1.5.5 Associated Munitions Constituents*

The primary MC of concern associated with the Former Pistol Range is lead. According to AR 750-10 and TM 9-855, small arms ammunition is mainly composed of lead (approximately 85%



by weight of the projectile). Metallic lead is insoluble in water, but in the geochemical environment of most ranges, it may slowly convert to other oxidized forms. Depending on the environment (e.g., soil characteristics, hydrogen ion concentration [pH], and organic matter present), oxidation products can become mobile. However, lead mobility is effectively controlled by adsorption under a majority of conditions found on small arms ranges. Based on studies conducted by ITRC and the USEPA on small arms ranges, an exponential decline in lead concentrations has been observed in very short vertical distances due to adsorption or exchange reactions with clay, metal oxides, or organic matter in soil. As such, lead mobility is not likely to be an issue at most ranges (FTMM033).

Other MC may include antimony, arsenic, copper, nickel, zinc, iron, strontium, magnesium, lead styphnate, lead azide, and constituents associated with black or smokeless powder. However, these constituents are present at the ammunition item in only minor amounts/concentrations (AR 750-10 and TM 9-855 and FTMM033).

Sampling conducted within the firing fan boundaries of the Former Pistol Range in 1995 (associated with the closure of the Sanitary Treatment Plan [IRP Site AOC 3]), indicated that no heavy metals were present at the site in the surface soil or sediment at concentrations above regulatory screening criteria and no further investigation of the site was warranted (FTMM026). However, further investigation is required due to the fact that prior sampling efforts may not have characterized the area of concern (not within the boundary of the Former Pistol Range or within the firing fan/SDZ) (FTMM027). Further investigation is also required because it is unclear as to whether the berm was spread over the surface soil when the Former Pistol Range was closed or the berm was removed (historical mapping and documents do not provide information regarding the berm removal/demolition).

#### ***5.1.5.6 Transport Mechanisms/Migration Routes***

The primary transport mechanisms identified for the Former Pistol Range are assumed to include (FTMM037, FTMM038, FTMM040, and FTMM042):

**Erosion:** The Former Pistol Range area may be disturbed periodically by flooding of Parkers Creek or Laftetra Creek and other nearby streams during storm events, which could result in erosion.

**Soil Disturbance:** The current degree of disturbance at the Former Pistol Range is low, as the area is currently undeveloped. As previously discussed, erosion due to flooding presents the most likely source of soil disturbance.

**Infiltration:** The potential exists for MC to migrate from one environmental medium to another (surface to subsurface soil to groundwater) through infiltration.

### 5.1.6 Pathway Analysis

#### 5.1.6.1 MEC

Based on historical documents and information obtained during the data collection process, there is no evidence of MEC at the Former Pistol Range as only small arms ammunition was assumed to have been used (FTMM013, FTMM014, FTMM016, and FTMM018 through FTMM023). Therefore, the entire Former Pistol Range is not suspected to contain MEC.

#### 5.1.6.2 MC

The pathway analysis for MC is shown in Figure 5-1. Potential current receptors include human receptors (authorized installation personnel, contractors, and visitors/trespassers) and ecological receptors (biota) who may contact the source medium or other media at the site that may be impacted. Potential future human receptors include recreational users, residents (residential), construction/maintenance workers, and industrial/office workers who may contact the source medium or other media at the site that may be impacted. Pathways are shown for each medium and are discussed below.

#### Groundwater

The New Jersey American Water Company supplies potable water to the installation (FTMM042). Since groundwater is not used as a source of potable water at the installation, the

groundwater exposure pathways are considered to be incomplete for current human and ecological receptors. Incomplete groundwater pathways exist for potential future human receptors (except for construction/maintenance workers who may experience incidental ingestion and dermal contact during any subsurface construction or maintenance work).

#### Surface Water/Sediment

During the years of operation of the Former Pistol Range, Parkers Creek was within 550 feet of the former range and within its firing fan (FTMM015 and Map 5-1). Munitions could have come in direct contact with Parkers Creek. Surface water/sediment impacts are considered to be potentially complete for current/potential future human receptors (except for industrial/office workers) and current ecological receptors due to the fact that previous sediment sampling activities were not conducted within the area of concern (FTMM026). Further investigation may be required within the boundaries of the Former Pistol Range and its firing fan/SDZ.

#### Food Chain

Since the Former Pistol Range is undeveloped, the likelihood of vegetation occurring at the site is high; therefore, the food web pathway via vegetation is considered to be potentially complete for biota (FTMM008 and FTMM010). Based on its former use as a Sanitary Treatment Plant and its current conditions, there are assumed to be no domestic animals on or near the Former Pistol Range location. Therefore, these exposure pathways are considered to be incomplete. To the north of the Former Pistol Range is a branch of Parkers Creek, which is located in a wildlife habitat; therefore, the game/fish/prey exposure pathways are considered to be potentially complete for all current human receptors and all ecological receptors (FTMM008, FTMM042 and as depicted on Map 5-1). Potentially complete pathways exist for potential future human receptors (recreational and residential).

#### Surface Soil

The Former Pistol Range was removed for the construction of the Sanitary Treatment Plant in 1940 (FTMM017 and FTMM005). This facility was in operation for over 40 years. It was demolished and removed in 1983 (FTMM008 and FTMM026). Soil sampling was conducted in the vicinity of the Former Pistol Range for the closure of the Sanitary Treatment Plant area (IRP

Site AOC 3), and no heavy metals were detected above NJDEP criteria. Previous sampling activities were not conducted in the area of the former the berm location (indicating that the presence/absence of MC is inconclusive); therefore, potentially complete exposure pathways exist for surface soil for all current and future human (excluding industrial/office workers) and ecological receptors.

#### Subsurface Soil

The potential for subsurface soil impacts at the Former Pistol Range area is considered to exist since previous sampling activities were not conducted in the area of the former berm location (FTMM026); therefore, potentially complete exposure pathways exist for subsurface soil if intrusive activities occur on-site (i.e., construction, excavation, or drilling activities) for current human receptors (installation personnel and contractors), as well as all ecological receptors. A potentially complete exposure pathway exists for subsurface soil for potential future human receptors (construction/maintenance workers).



# Historical Records Review Fort Monmouth, NJ



**MALCOLM  
PIRNIE**

## Map 5-1 Range/Site Details

### Legend

-  Installation Boundary
-  Firing Line
-  Berm
-  Former Range Area

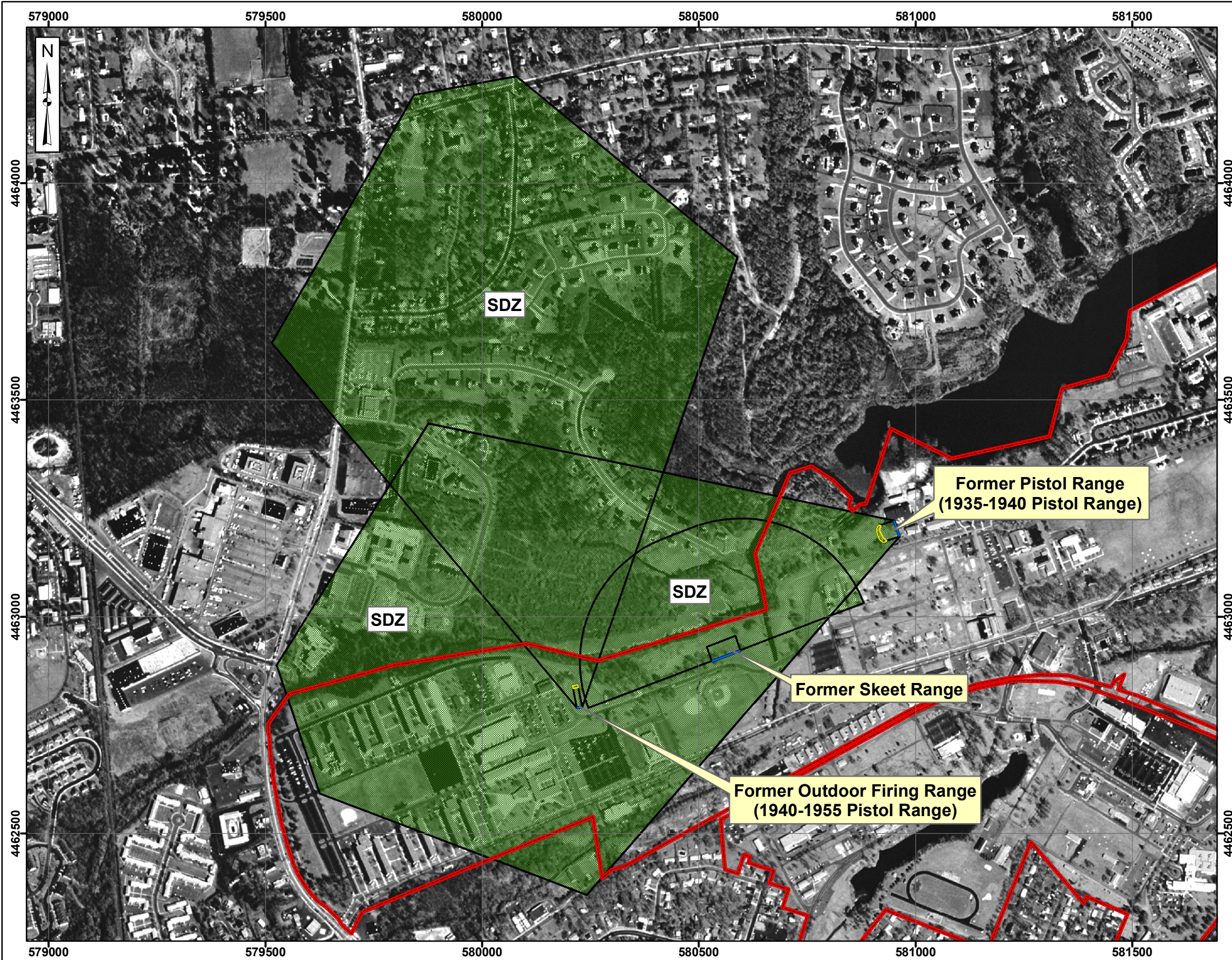
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Data Source: USGS Terraserver Online,  
Digital Orthophoto,  
Downloaded 2005

Coordinate System: UTM Zone 18N  
Datum: NAD 1983  
Units: Meters

Contract: W912DR-05-D-0004  
Edition: Final  
Date: January 2006





## **6.2 FORMER PISTOL RANGE (1935-1940 PISTOL RANGE)**

The Former Pistol Range was identified through the research for this HRR. It was used from approximately 1935 through 1940. Range structures and the backstop berm were assumed to have been removed/demolished in 1940 for the construction of the Sanitary Treatment Plant. Munitions associated with the Former Pistol Range are assumed to be small arms ammunition only; therefore, no MEC and limited MC are anticipated.

Small arms ammunition is mainly comprised of lead (approximately 85% by weight of the projectile). As such, the primary MC of concern associated with small arms ranges is lead. Other MC may include antimony, arsenic, copper, zinc, and constituents associated with black or smokeless powder. MC, if present, would likely be located in surface soils adjacent to the backstop berm, and possibly near the firing line. No investigations of the Former Pistol Range, including sampling activities, have been conducted within the berm area; therefore, further investigation of lead impacts may be warranted.

## **6.3 FORMER OUTDOOR FIRING RANGE (1940-1955 PISTOL RANGE)**

The Former Outdoor Firing Range was identified during the Phase 3 Inventory; however, based on the research for this HRR, the location identified during the Phase 3 Inventory was found to be incorrect. The Former Outdoor Firing Range was used from approximately 1940 through 1955. The small arms firing that occurred at the Former Pistol Range (1935-1940 Pistol Range) was relocated to the Former Outdoor Firing Range (1940-1955 Pistol Range) location around 1940 when the Sanitary Treatment Plant was constructed on the old range location. Range structures and the backstop berm at the Former Outdoor Firing Range are assumed to have been removed/demolished. Munitions associated with the Former Outdoor Firing Range are assumed to be small arms ammunition only; therefore, no MEC and limited MC are anticipated.

The primary MC associated with small arms ranges is lead. Other MC include antimony, arsenic, copper, tin, zinc, iron, strontium, magnesium, and lead azide. Sampling has not been conducted at the Former Outdoor Firing Range; therefore, further investigation of the site for MC impacts may be warranted.



# Historical Records Review Fort Monmouth, NJ



**MALCOLM  
PIRNIE**

## Map 6-1 Range/Site Conclusions

### Legend

-  Installation Boundary
-  Areas Requiring Further Investigation

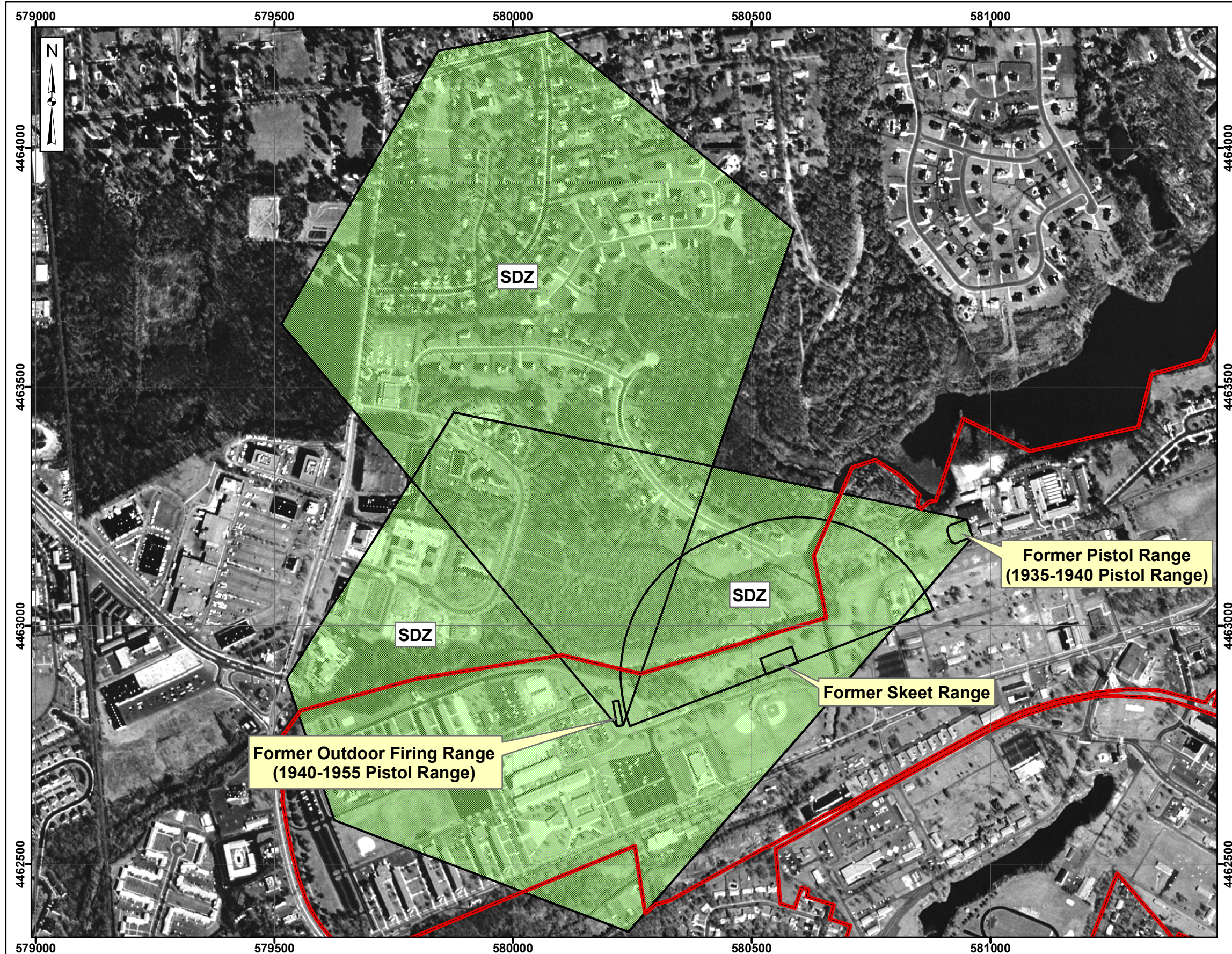
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Data Source: USGS Terraserver Online,  
Digital Orthophoto,  
Download 2005

Coordinate System: UTM Zone 18N  
Datum: NAD 1983  
Units: Meters

Contract: W912DR-05-D-0004  
Edition: Final  
Date: January 2006







## State of New Jersey

Christine Todd Whitman  
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.  
Commissioner

Mr. James Ott  
SELFM-EH-EV  
Department of the Army  
Headquarters CECOM Fort Monmouth  
Fort Monmouth, NJ 077703-5000

Dear Mr. Ott:

APR 04 1996

Re: Weston Remedial Investigation Report  
DERA Sites - Fort Monmouth Army Base  
Tinton Falls, Monmouth County

The NJDEP has reviewed the Site Investigation Report submitted by Roy F. Weston, Inc., dated December 1995 and our comments are stated below.

### GENERAL COMMENTS

**Landfills.** All Base landfills must comply with NJ Solid Waste Management Act N.J.A.C. 7:26-2A et seq. If Fort Monmouth is able to document that the appropriate solid waste closure procedures were followed, no additional action is required other than the DEP approved monitoring. However, if an approved closure was not performed at the landfill, it is recommended that a minimum soil cover of one foot be extended over all areas of documented disposal activities. Also, the approximate boundaries must be established and annotated in the Declaration of Environmental Restriction (DER).

**Soil.** Soils determined to be contaminated above Residential Direct Contact Soil Cleanup Criteria will either have to be remediated or, where appropriate (i.e. consistent with the Industrial Site Recovery Act/Hazardous Discharge Site Remediation Act 58:10B-1 et seq.), DERs will have to be established.

**Ground Water.** Where determined appropriate, remedial actions consistent with the Ground Water Quality Standards (N.J.A.C. 7:9-6 et seq.) must be implemented. As stated in the report, natural remediation may be the most viable option. In these instances remedial alternatives such as those stated in Section 6.6, Classification Exemption Areas (CEA), must be applied for in all areas in which ground water has been found to contain one or more constituent standard for the given classification which is not being met or will not be met in the localized area.

**TICs.** As agreed to in the Work Plan for these investigations, specific analysis of TAL/TCL plus 30 (TAL/TCL +30) TICs were to be performed. Reference graphs/tables for the TICs could not be located, particularly within the text. Please provide this information.

**Background.** Use of background samples to compare likely regional or indigenous compound levels with those found at each site are acceptable practice. However, the NJDEP does not consider "Maximum Monmouth County background" concentrations to be applicable to an area where other samples taken only feet away showed minimal compound concentrations. Where necessary and appropriate, DERs and CEAs will have to be applied to all areas where compounds are detected above NJDEP criteria.

**Averaging Concentrations.** Future reports must provide 95% confidence limits in place of average concentrations found.

**Data Package.** The attached data package (Appendix D) is confusing and appears to be incomplete and indistinct. For instance, cross-referencing samples and respective concentrations was often difficult to impossible. Samples which are shown in the text tables to be highly concentrated in some compounds appear to be reported as being at the detection limits in the Appendix. While this may be a referencing problem, it is much to difficult and time consuming. An explanation or additional will have to be provided. If the NJDEP determines that the data truly is inaccurately referenced in the Appendix, another, more readable format will have to be provided.

In addition, several samples appear to be missing (MP:MW-1, background sediment samples).

There is also a question regarding why the Contract Required Detection Limits were often higher than the applicable criteria. All such data would be concluded to potentially contain contaminants above the applicable criteria. Please explain these discrepancies. Future analytical methods must be capable of detecting to at least the applicable criteria.

**Holding Times.** There were numerous exceedences of required compound analysis holding times. Since future sampling will have to be performed in these areas anyway, the NJDEP will not require a resubmission of the data. The Technical Regulations for Site Remediation require that certain restrictions be placed on this data. Future exceedences will result in outright denial of data.

**Data Analysis.** Future analysis must reliably detect compound concentrations below the more stringent of Federal or State action levels/requirements.

The report has stated that all of the surface water and ground water samples which were determined to have detection limits which exceed the most stringent NJDEP criteria are recommended to be re-sampled. This is acceptable to the NJDEP.

**Soil Averaging.** In several instances it appears as though soil averaging was performed on samples from the same depths but different sites. This is not appropriate. Please refer to the guidance for all of the required parameters. Note that when the required parameters were followed, the averaged contamination was determined to be within acceptable limits.

#### **SPECIFIC COMMENTS**

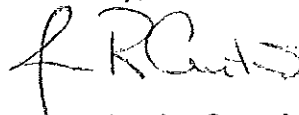
- 1) Page 4.1-18, Line 25. Landscaping fill is not generally considered as indigenous, and therefore would not be considered as a representative background sample. Please provide some discussion as to why samples taken in landscaping fill should be considered background, if no appropriate reasoning can be provided, resampling may be required.

- 2) Site M-2. Page 4.2-16, Line 24. The Report states that monitor wells MW-2 and MW-3 are down-gradient of the M-2 area. With respect to figure 4.2-4, and the suggested flow of ground water in the direction of Mill Creek, monitor wells M-2 and M-3 appear to be more side gradient than down gradient of the M-2 Landfill. Clarification is required.
- 3) Site M-2. Page 4.2-21, Line 10. It is stated that the lead concentration exceeded the criteria in the filtered sample but was not detected above criteria in the unfiltered sample. Since this seems to be an odd occurrence, please explain how this can arise.
- 4) Site M-2. Page 4.2-23, Recommendations. The recommendation for long term monitoring of ground water at Site M-2 Landfill is appropriate, however DEP does not agree that the existing monitoring wells are positioned properly to intercept contaminated ground water emanating from the landfill. DEP recommends that either one additional well be added between M-2 and M-3 or as an alternative, the ground water discharging to Mill Creek must be sampled directly from beneath the stream bed utilizing either a series of stream piezometers or seepage meter sampling devices.
- 5) Site M-3. Page 4.2-40, Recommendations. Prior to implementing formal landfill closure procedures, it is recommended that Fort Monmouth conduct a series of borings or test pits within the suspected historical disposal area in order to determine whether soil contamination actually exists and if so, to what extent it may be acting as a source to ground water contamination. Soil samples should be collected and biased to stained or obviously contaminated soils. Laboratory analysis should include full TCL and TAL parameters plus 30 TICs.
- 6) Site M-4. Page 4.2-67, Line 2. The NJDEP does not recognize MW-11 as an "upgradient" well. Furthermore, the fact that the well had PCE contamination as high as 109 ppb (GWQC 1 ppb) is disturbing at the least. Such contaminant levels alert us to the fact that we have picked up an unknown source. Sources of ground water contamination other than the site landfills must be investigated and fully delineated. In order to assist in the placement of additional ground water monitoring wells, the collection of ground water samples may be conducted by use of either hydropunch or geoprobe sampling devices. Please provide some explanation and remedial action consistent with NJDEP regulations and policy.
- 7) Site M-4. Page 4.2-67, Line 18. The NJDEP recognizes the argument that since there are no human receptors, remedial action priority is not automatically required. However, no discussion as to the amount of risk posed to environmental receptors is mentioned or discussed. Please provide comment.
- 8) Site M-4. Page 4.2-67, Recommendations. As previously discussed in the General Comments section, appropriate landfill closure requirements should be addressed. Also stream sampling devices (piezometer, seepage meter sampling devices) are recommended for monitoring ground water from beneath the stream bed.
- 9) Site M-6. NJDEP concurs with the remedial actions proposed.
- 10) Sites M-8, M-12, and M-14. Each of these sites has contamination in excess of the NJDEP criteria (particularly M-8). Each landfill must meet landfill closure requirements. Hydropunch and geoprobe devices may be useful technologies in placing wells designed for long-term monitoring.

- 11) Sites M-15, M-16, and M-18. The NJDEP concurs with the remedial actions proposed.
- 12) Site AOC-3. The NJDEP concurs with the recommendation for no further action.
- 13) Pre-1941 Sanitary Treatment Plant (STP). Page 4.2-172, Table 4.2-21. The sediment data for STPSD-1 should be compared to both the ERL and the ERM criteria, in order to determine the severity of the sediment contaminant data within the range of sediment guidance values. Discussion and results should be provided as appropriate.
- 14) Site CW-1, CW-2, CW-3 and CW-3A. NJDEP concurs with the recommendations for these areas. However, it is suggested that Fort Monmouth consider the use of a geoprobe or hydropunch ground water sampling method rather than the soil gas approach.
- 15) Page 4.3-69, Line 7; Page 4.3-83, Line 11. See general comment "soil averaging".
- 16) Site CW-4, CW-5, CW-6, and CW-9. NJDEP concurs with the recommendations proposed for these areas.
- 17) Page 4.3-88, Line 22. Please explain why samples were not taken at the surface, but rather from intervals ranging from 8-14 feet below ground surface. The NJDEP approves the no further remedial action proposal for site AOC-7.
- 18) Page 4.3-94, Table 4.3-16. Sample CW07-TR01 showed soil contamination above the impact to ground water soil cleanup criteria. Remedial actions proposed for the Charles Wood PCB Transformers should take impact to ground water potential into account when soil removal is performed. Ground water monitor wells are not necessarily required unless further investigations dictate. The proposed remedial actions are acceptable to the NJDEP.
- 19) Page 5-18, Lines 7 to 10. As confusing as these sentences were, the NJDEP has determined that 59% of the soil duplicate results were within 10% of the routine sample. This is in no way "reasonable agreement". Please provide an explanation and comment.
- 20) Appendix D, Page 12. Excessive holding times for analysis are noted in this table. A discussion on the effects that this will have on the results should be provided.

As we have discussed in the past, I would like to review these comments with you prior to getting a formal response. If you should have any questions or require any additional information, please do not hesitate to contact me at (609) 633-7232.

Sincerely,

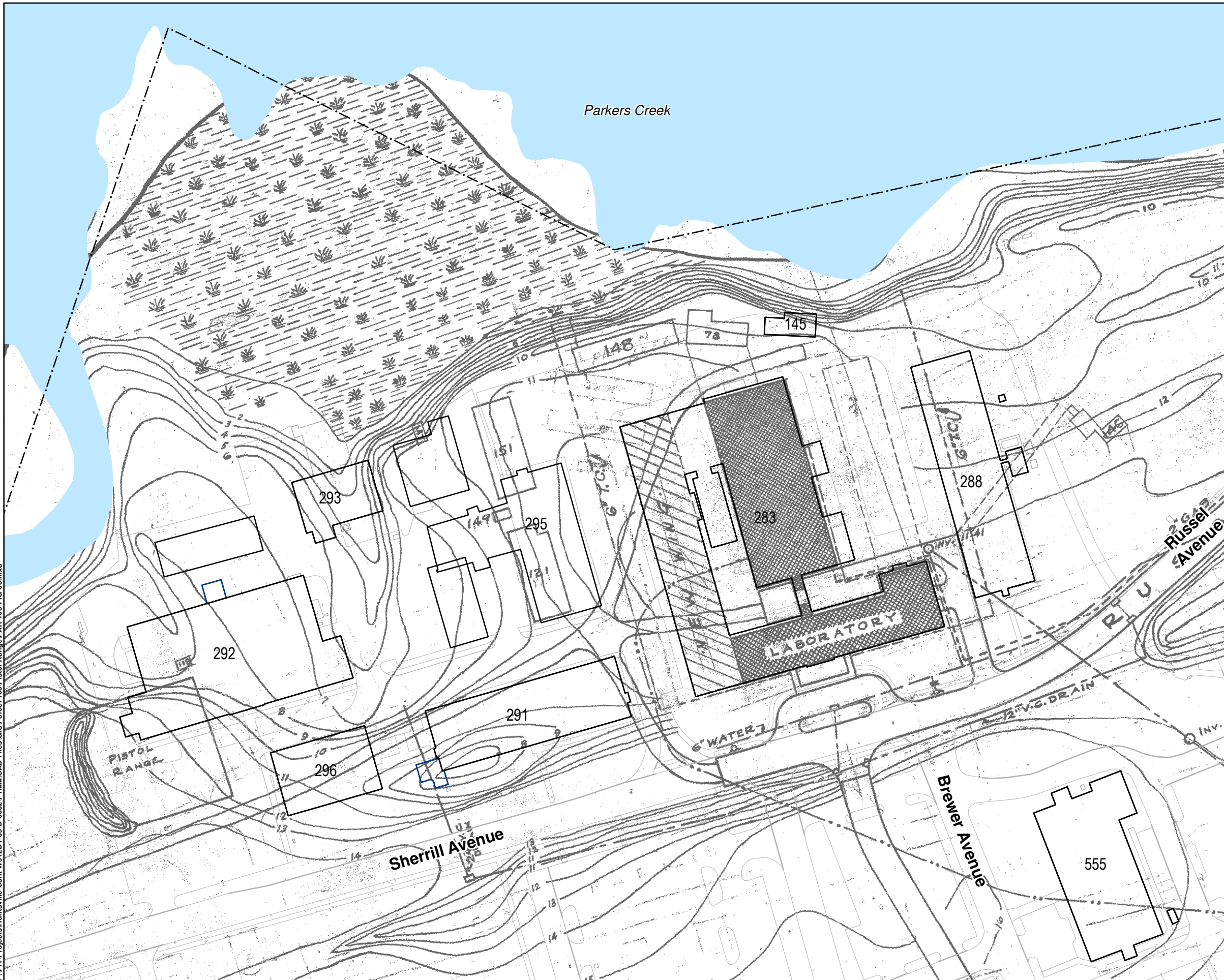


Ian R. Curtis, Case Manager  
Bureau of Federal Case Management

c. John Prendergast, BEERA

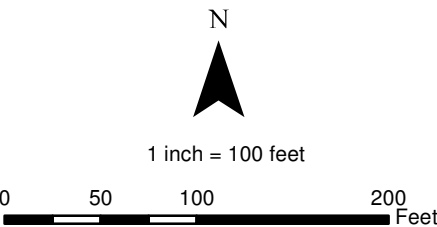


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**LEGEND:**

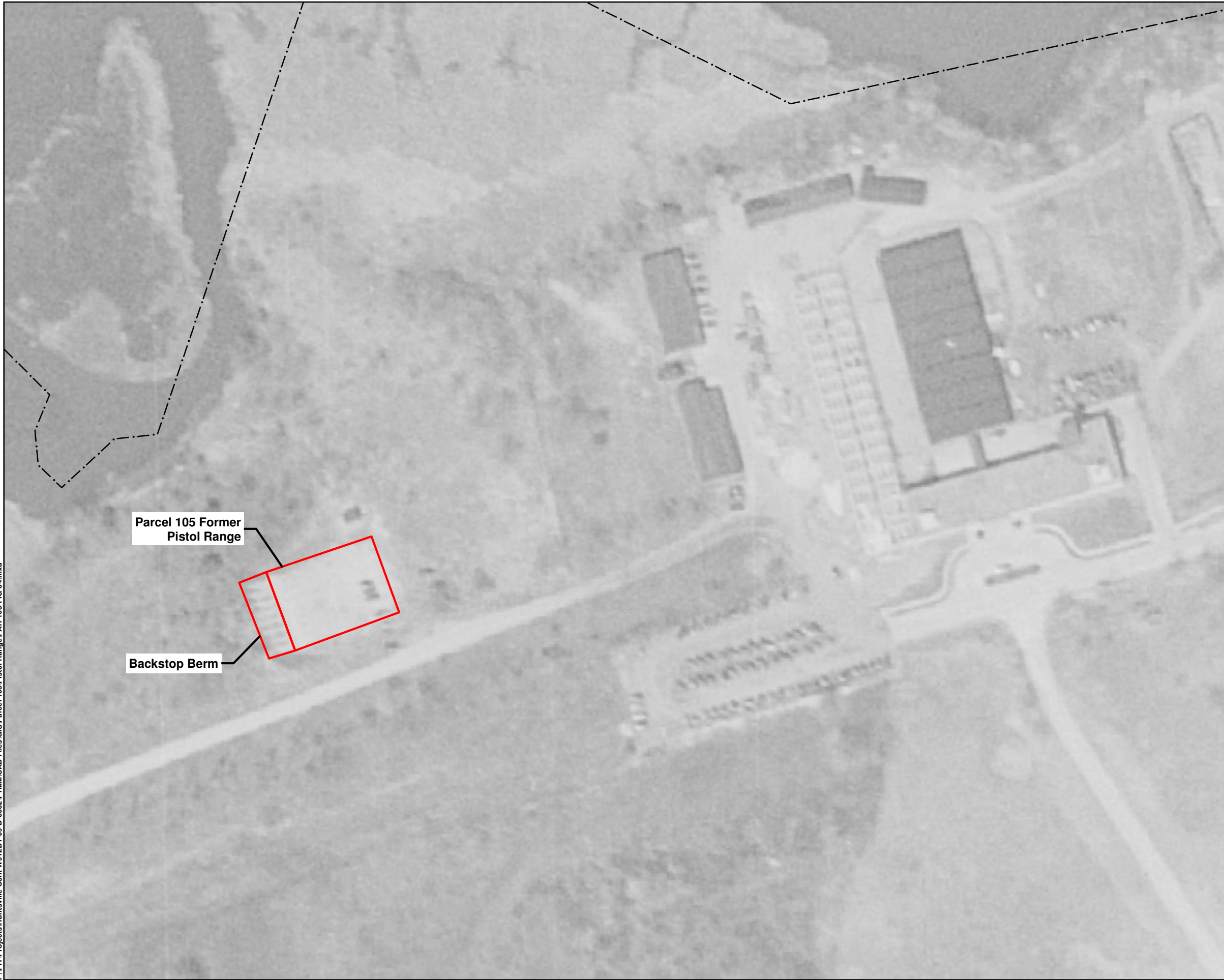
- Surface Water Feature
- Installation Boundary



Source: FTMM Supplied CAD; ESRI Data and Maps 2011; USGS NHD.

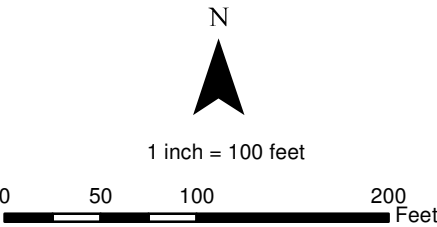
|                                                          |  |                                           |  |
|----------------------------------------------------------|--|-------------------------------------------|--|
| <b>PARSONS</b><br>401 Diamond Drive NW,<br>Huntsville AL |  | <b>Fort Monmouth</b><br><b>New Jersey</b> |  |
| <b>1935 HISTORICAL DRAWING</b>                           |  |                                           |  |
| CREATED BY:<br><b>RR</b>                                 |  | REVIEWED BY:<br><b>KF</b>                 |  |
| DATE:<br><b>OCT. 2017</b>                                |  | FIGURE NUMBER:<br><b>FIGURE 3</b>         |  |
| PROJECT NUMBER:<br><b>748810-06031</b>                   |  | FILE:<br><b>PAR-105-FIG-03.mxd</b>        |  |

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**LEGEND:**

[---] Installation Boundary

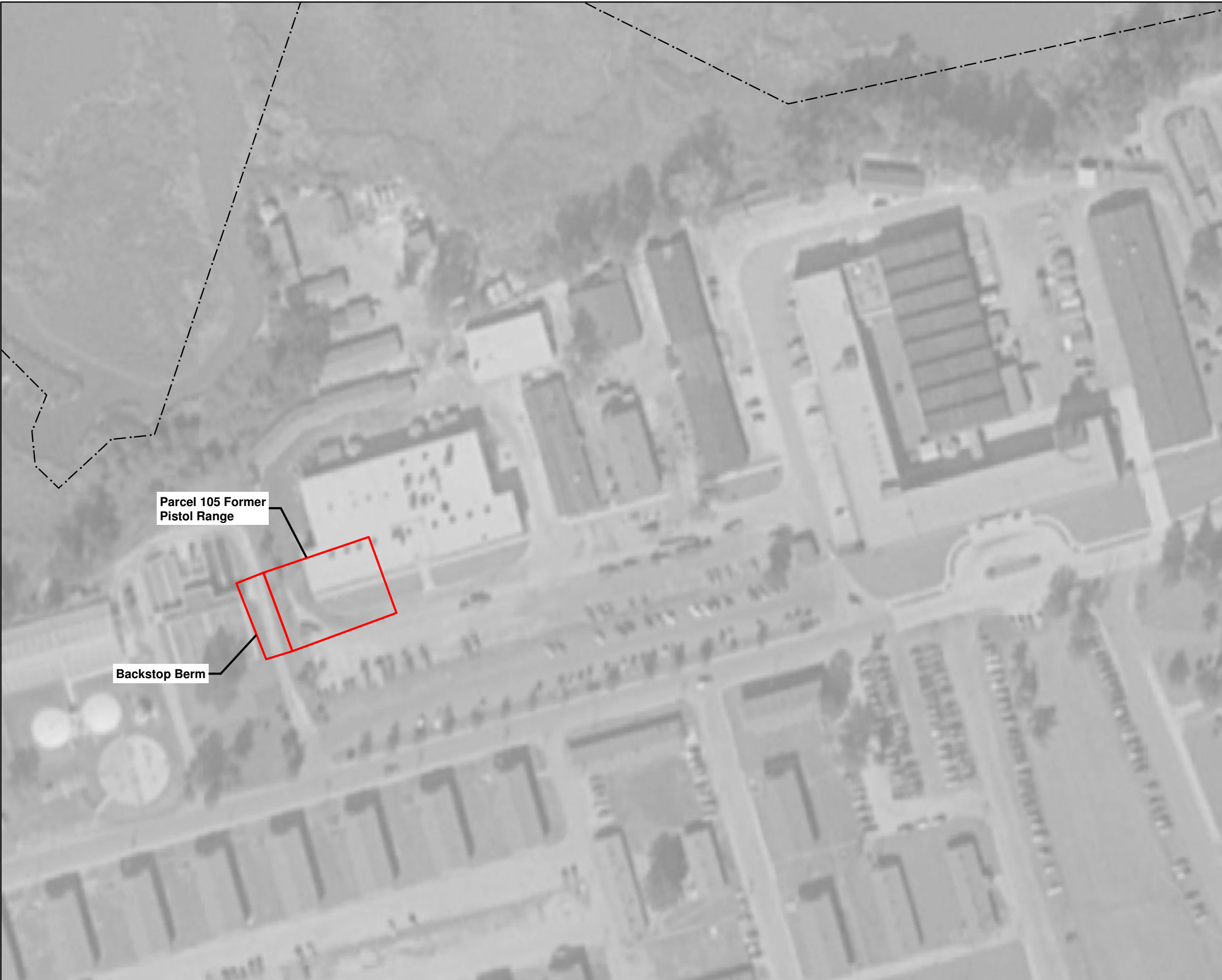


Source: FTMM Supplied CAD; ESRI Data and Maps 2011; USGS NHD.

|                                                          |                                           |
|----------------------------------------------------------|-------------------------------------------|
| <b>PARSONS</b><br>401 Diamond Drive NW,<br>Huntsville AL | <b>Fort Monmouth</b><br><b>New Jersey</b> |
| <b>1940 AERIAL PHOTOGRAPH</b>                            |                                           |
| CREATED BY:<br><b>RR</b>                                 | REVIEWED BY:<br><b>KF</b>                 |
| DATE:<br><b>OCT. 2017</b>                                | FIGURE NUMBER:<br><b>FIGURE 4</b>         |
| PROJECT NUMBER:<br><b>748810-06031</b>                   | FILE:<br><b>PAR-105-FIG-04.mxd</b>        |

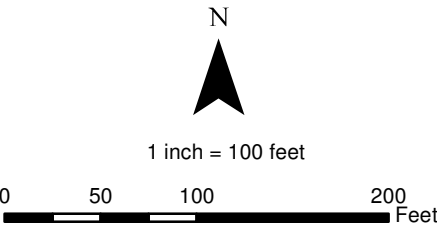


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**LEGEND:**

[---] Installation Boundary

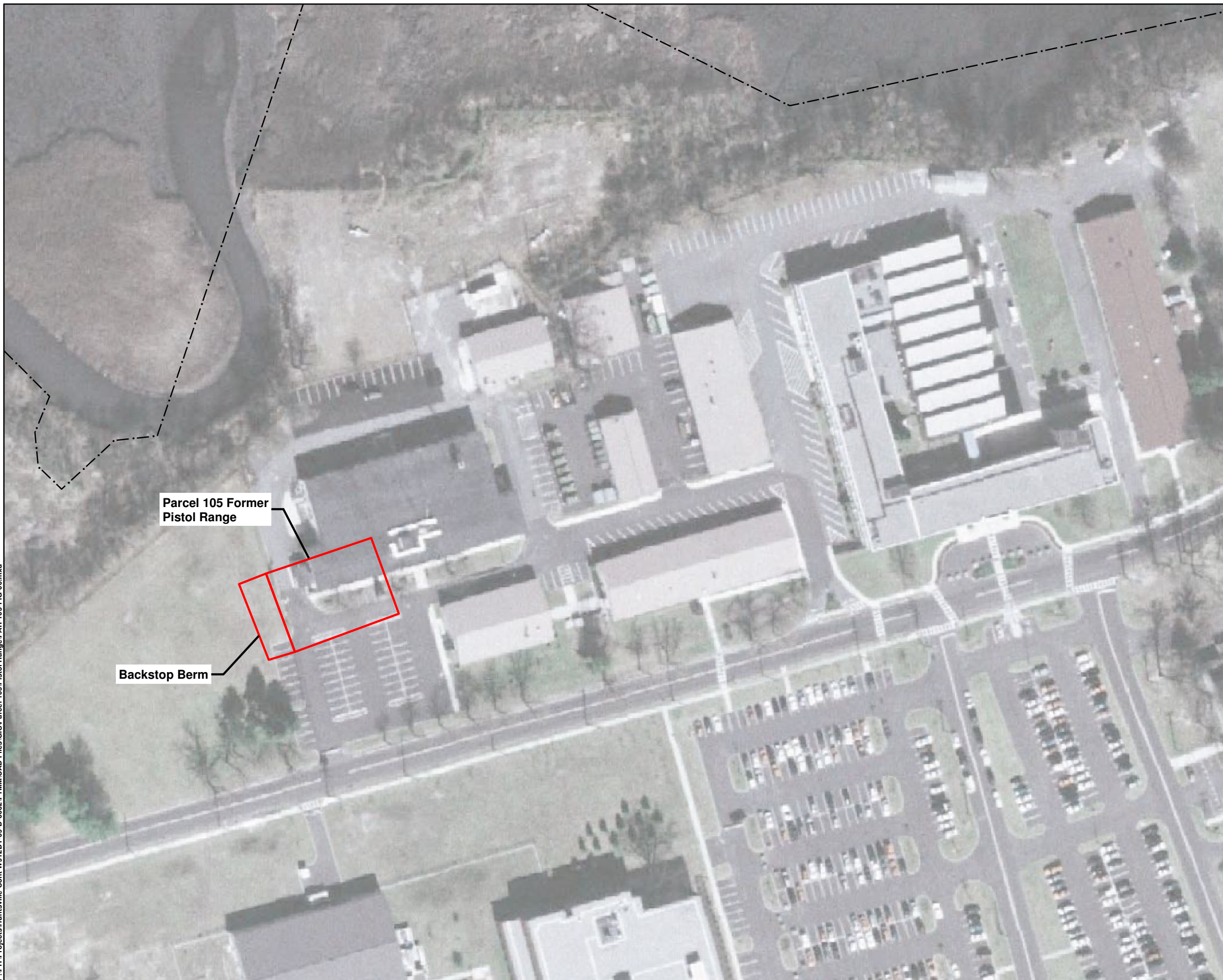


Source: FTMM Supplied CAD; ESRI Data and Maps 2011; USGS NHD.

|                                                          |                                           |
|----------------------------------------------------------|-------------------------------------------|
| <b>PARSONS</b><br>401 Diamond Drive NW,<br>Huntsville AL | <b>Fort Monmouth</b><br><b>New Jersey</b> |
| <b>1947 AERIAL PHOTOGRAPH</b>                            |                                           |
| CREATED BY:<br><b>RR</b>                                 | REVIEWED BY:<br><b>KF</b>                 |
| DATE:<br><b>OCT. 2017</b>                                | FIGURE NUMBER:<br><b>FIGURE 5</b>         |
| PROJECT NUMBER:<br><b>748810-06031</b>                   | FILE:<br><b>PAR-105-FIG-05.mxd</b>        |

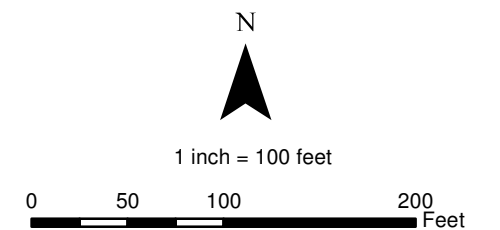


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**LEGEND:**

[---] Installation Boundary



Source: FTMM Supplied CAD; ESRI Data and Maps 2011; USGS NHD.

**PARSONS**  
401 Diamond Drive NW,  
Huntsville AL

**Fort Monmouth**  
**New Jersey**

**2002 AERIAL PHOTOGRAPH**

|                                        |                                    |
|----------------------------------------|------------------------------------|
| CREATED BY:<br><b>RR</b>               | REVIEWED BY:<br><b>KF</b>          |
| DATE:<br><b>OCT. 2017</b>              | FIGURE NUMBER:<br><b>FIGURE 6</b>  |
| PROJECT NUMBER:<br><b>748810-06031</b> | FILE:<br><b>PAR-105-FIG-06.mxd</b> |



**Attachment B**  
**Field Notes**

Location FTMM Date 11-10-17

Project / Client USACE

RSR-79-MW-01

1245 CREW TRANSFERS DRUM OF CONTAINER  
FROM PAR 79 - MW-01 LOCATION TO  
PLACE AT STAGING AREA

1380 CREW RETURNS TO COMPLETE THE RAD

1350 HEAD TO PAR 105 LOCATIONS PAR  
SOIL BORING SAMPLING. GUST FB AT 1405

144C PJSM-AT 105-SB-01 0-5

1420 P311 A+ 105-SB-48 0-5

1430 PUSH AT 105-53-03 0-5

1425 COLLECTS SAMPLES AND COMPLETES  
BOEING LOG FOR ABOVE THREE RUNS.

1450 CREW LEADS EQUIPMENT AND DEPARTS  
FOR THE DAM.

1510 HEAD TO THE OFFICE TO PREPARE  
COCS AND RECD NOTE SCANS.

1630 TERMINATE PINE RENTAL FOR  
ONE PID AND ONE WATER LEVEL METER  
THE PINE CONFIRMATION # IS KCG15726.  
THEY ARE SCHEDULED TO PICK-UP THE  
EQUIPMENT 11/13/17.

700 SIGN COC FORMS, REFRIGERATE SAMPLES

1750 0225 NE

12-10-17

Location \_\_\_\_\_ Date \_\_\_\_\_

Project / Client \_\_\_\_\_

**Attachment C**  
**Soil Boring Logs**

## Soil Boring Log

| CLIENT: USAGE                                       |                                                     |                 |              |                                                                                                         | INSPECTOR: <u>TOM HORN</u>                                                            |        | BORING/WELL ID: <u>PAR-105-SB-01</u> |  |
|-----------------------------------------------------|-----------------------------------------------------|-----------------|--------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------|--------------------------------------|--|
| PROJECT NAME: FTM                                   |                                                     |                 |              |                                                                                                         | DRILLER: <u>J. BARNEK</u>                                                             |        | LOCATION DESCRIPTION                 |  |
| PROJECT LOCATION: <u>PAR-105</u>                    |                                                     |                 |              |                                                                                                         | WEATHER: <u>38° CLR.</u>                                                              |        | GRASSY AREA                          |  |
| PROJECT NUMBER: 748810-                             |                                                     |                 |              |                                                                                                         | CONTRACTOR: <u>Cascade ECDI</u>                                                       |        |                                      |  |
| GROUNDWATER OBSERVATIONS                            |                                                     |                 |              |                                                                                                         | RIG TYPE: <u>Geoprobe(R) 7822DT 66/00T</u>                                            |        | LOCATION PLAN                        |  |
| WATER LEVEL: <u>      </u>                          |                                                     |                 |              |                                                                                                         | DATE/TIME START: <u>11-10-17</u>                                                      |        | Oceanport, New Jersey                |  |
| DATE: <u>      </u>                                 |                                                     |                 |              |                                                                                                         | DATE/TIME FINISH: <u>11-10-17</u>                                                     |        |                                      |  |
| TIME: <u>      </u>                                 |                                                     |                 |              |                                                                                                         | WEIGHT OF HAMMER: <u>N/A</u>                                                          |        |                                      |  |
| MEAS. FROM: <u>      </u>                           |                                                     |                 |              |                                                                                                         | DROP OF HAMMER: <u>N/A</u>                                                            |        |                                      |  |
| TYPE OF HAMMER: <u>N/A</u>                          |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| DEPTH<br>(feet)                                     | SAMPLE<br>I.D.                                      | BLOWS<br>per 6" | ADV/<br>REC. | PID<br>(ppm)                                                                                            | FIELD IDENTIFICATION OF MATERIAL                                                      | STRATA | COMMENTS                             |  |
| <u>0</u>                                            |                                                     |                 | <u>60/60</u> | <u>0.0</u>                                                                                              | <u>DRY</u><br><u>WOOD LOOSE DK REDDISH-BROWN SILTY SAND, w/</u><br><u>GRASS ROOTS</u> |        |                                      |  |
| <u>*</u>                                            | <u>PAR-105</u><br><u>SB-01-</u><br><u>0-0.5</u>     |                 |              | <u>0.0</u>                                                                                              | <u>DRY VERY DENSE SILTY SAND. MICACIOUS</u><br><u>DK REDDISH BROWN</u>                |        |                                      |  |
| <u>1</u>                                            |                                                     |                 |              | <u>0.0</u>                                                                                              |                                                                                       |        |                                      |  |
| <u>*</u>                                            | <u>PAR-105</u><br><u>SB-01-</u><br><u>1.25-1.75</u> |                 |              | <u>0.0</u>                                                                                              |                                                                                       |        |                                      |  |
| <u>2</u>                                            |                                                     |                 |              | <u>0.0</u>                                                                                              |                                                                                       |        |                                      |  |
| <u>*</u>                                            | <u>PAR-105</u><br><u>SB-01-</u><br><u>2.5-3.0</u>   |                 |              | <u>0.0</u>                                                                                              |                                                                                       |        |                                      |  |
| <u>3</u>                                            |                                                     |                 |              | <u>0.0</u>                                                                                              |                                                                                       |        |                                      |  |
|                                                     |                                                     |                 |              | <u>0.0</u>                                                                                              | <u>WOOD DEBRIS DRY</u>                                                                |        |                                      |  |
| <u>4</u>                                            |                                                     |                 |              | <u>0.0</u>                                                                                              | <u>DRY, VERY STIFF REDDISH BROWN</u><br><u>SANDY SILT.</u>                            |        |                                      |  |
|                                                     |                                                     |                 |              | <u>0.0</u>                                                                                              |                                                                                       |        |                                      |  |
| <u>5</u>                                            |                                                     |                 |              |                                                                                                         | <u>END OF BORING @ 5'</u>                                                             |        |                                      |  |
| <u>6</u>                                            |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| <u>7</u>                                            |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| <u>8</u>                                            |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| <u>9</u>                                            |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| <u>0</u>                                            |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| Remarks: <u>* SAMPLE SUBMITTED FOR LAB ANALYSIS</u> |                                                     |                 |              |                                                                                                         |                                                                                       |        |                                      |  |
| Sample Types                                        |                                                     |                 |              | Consistency vs. Blowcount / Foot                                                                        |                                                                                       |        |                                      |  |
| S -- Split-Spoon                                    |                                                     |                 |              | Granular (Sand & Gravel)                                                                                |                                                                                       |        |                                      |  |
| U -- Undisturbed Tube                               |                                                     |                 |              | Fine Grained (Silt & Clay)                                                                              |                                                                                       |        |                                      |  |
| C -- Rock Core                                      |                                                     |                 |              | V. Loose: 0-4    Dense: 30-50    V. Soft: <2    Stiff: 8-15                                             |                                                                                       |        |                                      |  |
| A -- Auger Cuttings                                 |                                                     |                 |              | Loose: 4-10    V. Dense: >50    Soft: 2-4    V. Stiff: 15-30                                            |                                                                                       |        |                                      |  |
|                                                     |                                                     |                 |              | M. Dense: 10-30    M. Stiff: 4-8    Hard: >30                                                           |                                                                                       |        |                                      |  |
|                                                     |                                                     |                 |              | and - 35-50%<br>some - 20-35%<br>little - 10-20%<br>trace - <10%<br>moisture, density, color, gradation |                                                                                       |        |                                      |  |



## Soil Boring Log

| CLIENT: USACE                       |                               |                 |              |              | INSPECTOR: <u>TOM HORN</u>                                  |  | BORING/WELL ID: <u>PAR-105-SB-02</u> |          |
|-------------------------------------|-------------------------------|-----------------|--------------|--------------|-------------------------------------------------------------|--|--------------------------------------|----------|
| PROJECT NAME: <u>FTMM</u>           |                               |                 |              |              | DRILLER: <u>J. BARNEK</u>                                   |  | LOCATION DESCRIPTION                 |          |
| PROJECT LOCATION: <u>PARCEL 105</u> |                               |                 |              |              | WEATHER: <u>CLEAR, 38°F, WINDY</u>                          |  | <u>GRASSY AREA</u>                   |          |
| PROJECT NUMBER: <u>748810-</u>      |                               |                 |              |              | CONTRACTOR: <u>Cesede ECDI</u>                              |  |                                      |          |
| GROUNDWATER OBSERVATIONS            |                               |                 |              |              | RIG TYPE: <u>Geoprobe(R) <del>7020DT</del> 6610 DT</u>      |  | LOCATION PLAN                        |          |
| WATER LEVEL: _____                  |                               |                 |              |              | DATE/TIME START: <u>11-10-17</u>                            |  | Oceanport, New Jersey                |          |
| DATE: _____                         |                               |                 |              |              | DATE/TIME FINISH: <u>11-10-17</u>                           |  |                                      |          |
| TIME: _____                         |                               |                 |              |              | WEIGHT OF HAMMER: <u>N/A</u>                                |  |                                      |          |
| MEAS. FROM: _____                   |                               |                 |              |              | DROP OF HAMMER: <u>N/A</u>                                  |  |                                      |          |
|                                     |                               |                 |              |              | TYPE OF HAMMER: <u>N/A</u>                                  |  |                                      |          |
| DEPTH<br>(feet)                     | SAMPLE<br>I.D.                | BLOWS<br>per 6" | ADV/<br>REC. | PID<br>(ppm) | FIELD IDENTIFICATION OF MATERIAL                            |  | STRATA                               | COMMENTS |
| 0                                   |                               |                 | 60/60        | NA           | DRY DK OLIVE-BROWN SILTY SAND AND<br>GRAVEL                 |  |                                      |          |
| * 1                                 | PAR-105<br>SB-02<br>0-0.5     |                 |              |              | DRY<br>DK-REDDISH ORANGE MOD DENSE<br>SANDY SILT            |  |                                      |          |
| * 2                                 | PAR-105<br>SB-02<br>1.25-1.75 |                 |              |              | ↓                                                           |  |                                      |          |
| * 3                                 | PAR-105<br>SB-02<br>2.5-3.0   |                 |              |              | DRY<br>V. DENSE DK REDDISH-BROWN<br>SILTY SAND, TR F GRAVEL |  |                                      |          |
| 4                                   |                               |                 |              |              | DRY<br>DK GREEN-OLIVE BROWN VSTIFF<br>SANDY SILT. ↓         |  |                                      |          |
| 5                                   |                               |                 |              |              | END OF BORING @ 5'                                          |  |                                      |          |
| 6                                   |                               |                 |              |              |                                                             |  |                                      |          |
| 7                                   |                               |                 |              |              |                                                             |  |                                      |          |
| 8                                   |                               |                 |              |              |                                                             |  |                                      |          |
| 9                                   |                               |                 |              |              |                                                             |  |                                      |          |
| 10                                  |                               |                 |              |              |                                                             |  |                                      |          |

Remarks:

\* SAMPLE SUBMITTED FOR LAB ANALYSIS

| Sample Types         | Consistency vs. Blowcount / Foot |                            |                                     |
|----------------------|----------------------------------|----------------------------|-------------------------------------|
| S - Split-Spoon      | Granular (Sand & Gravel)         | Fine Grained (Silt & Clay) | and - 35-50%                        |
| U - Undisturbed Tube | V. Loose: 0-4 Dense: 30-50       | V. Soft: <2 Stiff: 8-15    | some - 20-35%                       |
| C - Rock Core        | Loose: 4-10 V. Dense: >50        | Soft: 2-4 V. Stiff: 16-30  | little - 10-20%                     |
| A - Auger Cuttings   | M. Dense: 10-30                  | M. Stiff: 4-8 Hard: > 30   | trace - <10%                        |
|                      |                                  |                            | moisture, density, color, gradation |

## Soil Boring Log

| CLIENT: USACE<br>PROJECT NAME: FTMM - ECP<br>PROJECT LOCATION: <del>FTMM</del> PARCEL 105<br>PROJECT NUMBER: 748810- |                         |                            |                 |              | INSPECTOR: Tdm Horn<br>DRILLER: J. BARNEK<br>WEATHER: CLEAR 38°F WINDY<br>CONTRACTOR: Geoside ECDI<br>RIG TYPE: Geoprobe(R) 7022DT-6610DT<br>DATE/TIME START: 11-10-17<br>DATE/TIME FINISH: 11-10-17<br>WEIGHT OF HAMMER: N/A<br>DROP OF HAMMER: N/A<br>TYPE OF HAMMER: N/A                                                                                                                                                                                                                                                           |        | BORING/WELL ID: PAR-105-SB-03<br>LOCATION DESCRIPTION: GRASSY AREA<br>LOCATION PLAN: Oceanport, New Jersey |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
|----------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------|-----------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------|--------------------------|--|----------------------------|--|---------------|--------------|-------------|-------------|-------------|---------------|-----------|-----------------|-----------------|--|---------------|-----------|---------------------------------------------------------------------------------------------------------|--|
| GROUNDWATER OBSERVATIONS<br><br>WATER LEVEL: —<br>DATE: —<br>TIME: —<br>MEAS. FROM: —                                |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| DEPTH<br>(feet)                                                                                                      | SAMPLE<br>I.D.          | BLOWS<br>per 6"            | ADV/<br>REC.    | PID<br>(ppm) | FIELD IDENTIFICATION OF MATERIAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | STRATA | COMMENTS                                                                                                   |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 0                                                                                                                    |                         |                            | 60/60           | NA           | DR BROWN MOD DENSE SILTY SAND, DRY<br>GRASS ROOTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| * 1                                                                                                                  | PAR-105-SB 03-0.5       |                            |                 |              | DRY V. <del>STIFF</del> STIFF DR GRAY-BROWN SILT, LITTLE VF SAND<br>LITTLE CLAY, MICACIOUS                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 1                                                                                                                    | PAR 105 SB 03 1.25-1.75 |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 2                                                                                                                    |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| * 3                                                                                                                  | PAR 105 SB 03 2.5-3.0   |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 3                                                                                                                    |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 4                                                                                                                    |                         |                            |                 |              | MOD DENSE REDDISH GRAVEL BROWN SILTY SAND, DRY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 5                                                                                                                    |                         |                            |                 |              | END OF BORING @ 5'                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 6                                                                                                                    |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 7                                                                                                                    |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 8                                                                                                                    |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 9                                                                                                                    |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| 10                                                                                                                   |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| Remarks: * SAMPLE SUBMITTED LAB ANALYSIS                                                                             |                         |                            |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| Sample Types<br>S - Split-Spoon<br>U - Undisturbed Tube<br>C - Rock Core<br>A - Auger Cuttings                       |                         |                            |                 |              | Consistency vs. Blowcount / Foot<br><table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="2">Granular (Sand &amp; Gravel)</th> <th colspan="2">Fine Grained (Silt &amp; Clay)</th> </tr> <tr> <td>V. Loose: 0-4</td> <td>Dense: 30-50</td> <td>V. Soft: &lt;2</td> <td>Stiff: 8-15</td> </tr> <tr> <td>Loose: 4-10</td> <td>V. Dense: &gt;50</td> <td>Soft: 2-4</td> <td>V. Stiff: 15-30</td> </tr> <tr> <td>M. Dense: 10-30</td> <td></td> <td>M. Stiff: 4-8</td> <td>Hard: &gt;30</td> </tr> </table> |        |                                                                                                            | Granular (Sand & Gravel) |  | Fine Grained (Silt & Clay) |  | V. Loose: 0-4 | Dense: 30-50 | V. Soft: <2 | Stiff: 8-15 | Loose: 4-10 | V. Dense: >50 | Soft: 2-4 | V. Stiff: 15-30 | M. Dense: 10-30 |  | M. Stiff: 4-8 | Hard: >30 | and - 35-50%<br>some - 20-35%<br>little - 10-20%<br>trace - <10%<br>moisture, density, color, gradation |  |
| Granular (Sand & Gravel)                                                                                             |                         | Fine Grained (Silt & Clay) |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| V. Loose: 0-4                                                                                                        | Dense: 30-50            | V. Soft: <2                | Stiff: 8-15     |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| Loose: 4-10                                                                                                          | V. Dense: >50           | Soft: 2-4                  | V. Stiff: 15-30 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |
| M. Dense: 10-30                                                                                                      |                         | M. Stiff: 4-8              | Hard: >30       |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                                                                            |                          |  |                            |  |               |              |             |             |             |               |           |                 |                 |  |               |           |                                                                                                         |  |