

STATE OF THE RESERVATION REPORT

TRAINING YEAR 2021 • CAMP EDWARDS
FINAL



Final Annual State of the Reservation Report, Camp Edwards, Training Year 2021
April 2022



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PREFACE

The *Annual State of the Reservation Report* (the Annual Report), established by the Massachusetts Environmental Policy Act process and required by state law (Chapter 47 of the Acts of 2002), is the result of many years of environmental reviews and submissions by the Massachusetts Army National Guard.

The Annual Report describes the nature and extent of military training and other activities taking place in the Camp Edwards Training Area/Upper Cape Water Supply Reserve. In addition, it describes the status of the Massachusetts Army National Guard's compliance with environmental laws, regulations and the Environmental Performance Standards, a set of 19 standards established in Chapter 47 of the Acts of 2002 guiding military and civilian usage of the Camp Edwards Training Area/Upper Cape Water Supply Reserve (Training Area/Reserve). The Annual Report illustrates that military training can occur in the Camp Edwards Training Area/Upper Cape Water Supply Reserve in a manner that is compatible with the natural resources purposes of water supply and wildlife habitat protection.

The *Annual State of the Reservation Report* covers the Massachusetts National Guard's Training Year 2021, which ran from October 1, 2020 to September 30, 2021; therefore, information provided in this report generally encompasses an individual training year rather than calendar year. The report's primary focus is the review of the Massachusetts Army National Guard's environmental programs relative to compliance with applicable local, state, and federal regulations. Each year, the report provides information on military training levels, range area usage, resource management activities, environmental indicators for training activities, and coordination among other activities and projects, such as the regional water supply and the remediation program activities. Cape Cod Air Force Station and the US Coast Guard Communications Station are both located within the boundary of the Upper Cape Water Supply Reserve; however, they are not subject to Chapter 47 of the Acts of 2002 and the Environmental Performance Standards (Chapter 47 of the Acts of 2002, Section 15).

The report also provides information on environmental reviews for proposed Massachusetts National Guard and other projects within the Upper Cape Water Supply Reserve.

The Annual Report is structured as follows:

Section 1, Introduction, discusses the structure of Joint Base Cape Cod and the environmental management structure pertaining to activities in the northern training areas of Camp Edwards.

Section 2, Small Arms Ranges and Military Training Activities, provides an update on live fire at the Small Arms Ranges at Camp Edwards and associated activities. This section also provides information on military training that occurred in the Training Area/Reserve during Training Year 2021. Data is provided on the levels of training in the various training areas in the Training Area/Reserve and range usage, as well as at the various training support area facilities in the Cantonment Area on Camp Edwards.

Section 3, Environmental Program Management, focuses on environmental management programs operated by the Massachusetts Army National Guard in the Training Area/Reserve and program compliance with the Environmental Performance Standards for the Training Area/Reserve for the training year.

Section 4, Remediation Program Activities, provides a summary of remediation activities undertaken in the Training Area/Reserve during the training year by the Installation Restoration Program and the Impact Area Groundwater Study Program.

Section 5, Miscellaneous Military and Civilian Activities and Environmental Program Priorities, provides information on major activities undertaken during Training Year 2021 that may not be directly related to a

Massachusetts Army National Guard environmental management program, actions in the Training Area/Reserve, or specific Environmental Performance Standards for the Training Area/Reserve.

The Annual Report is the culmination of a year-long effort by the military and civilian employees of the Massachusetts Army National Guard, Training Site Camp Edwards, the Environmental & Readiness Center, the Natural Resource Program, and the Environmental Management Commission to provide valuable information on the state of the Training Area/Reserve to interested stakeholders and the community at large. In good faith, the Annual Report is provided to the Environmental Management Commission's Environmental Officer, and the Commission's Science Advisory Council and Community Advisory Council for their input.

Annual State of the Reservation Report Key Terms

Upper Cape Water Supply Reserve

The Upper Cape Water Supply Reserve was established by Chapter 47 of the Acts of 2002 as public conservation land dedicated to three primary purposes: water supply and wildlife habitat protection; the development and construction of public water supply systems, and the use and training of the military forces of the commonwealth; provided that, such military use and training is compatible with the natural resource purposes of water supply and wildlife habitat protection. It comprises—and for the purposes of this report, may be synonymous with—Camp Edwards' 14,886-acre northern training area. Cape Cod Air Force Station and US Coast Guard Communications Station Boston are both located within the boundary of the Upper Cape Water Supply Reserve; however, they are not subject to the Environmental Performance Standards.

Camp Edwards Training Area

The Massachusetts Army National Guard Camp Edwards Training Site (Camp Edwards Training Area) is the major training area for Army National Guard soldiers in the Northeast. It is approximately 14,886 acres located on the northern portion of Joint Base Cape Cod. At Camp Edwards, soldiers practice maneuvering exercises, bivouacking, and use the small arms ranges. The Upper Cape Water Supply Reserve also is located on the 14,886 acres of Camp Edwards. It comprises—and for the purposes of this report, may be synonymous with—Camp Edwards' 14,886-acre northern training area.

Environmental Performance Standards

The Environmental Performance Standards (Appendix A) are a list of requirements, or standards for performance, that guide both military and other users in the protection of Camp Edwards' natural and cultural resources and the groundwater beneath the Training Area/Reserve. The Environmental Performance Standards are based in large part on existing federal, state, and Department of Defense regulations. In some cases, the protections offered by the performance standards are more stringent than those offered by other regulations. These standards apply to the Upper Cape Water Supply Reserve within the Camp Edwards Training Area. Although Cape Cod Air Force Station and the US Coast Guard Communications Station are located within the boundary of the Upper Cape Water Supply Reserve, the Environmental Performance Standards do not apply to them as they were excluded by Chapter 47 of the Acts of 2002.

Training Year

A training year runs from October 1 to September 30 and is based on the federal fiscal year. Information found in the annual *State of the Reservation Report* is compiled by training year. This *Annual State of the Reservation Report* is for Training Year 2021 (October 1, 2020 – September 30, 2021).

Training Support Area

There are separate facilities and equipment that can simulate live military training; these are grouped under the Training Support Area. The majority of the training activities associated with these facilities are conducted in the Cantonment Area of Camp Edwards. Training Support Areas include Kelley Tactical Training Base, the Calero Mobile Military Operations on Urban Terrain Site, the Engagement Skills Trainer, and the Virtual Convoy Operations Trainer.

Small Arms Ranges

Small arms ranges allow live-fire qualification training with weapons of a small caliber, i.e., pistols, rifles and semi-automatic and automatic rifles. Small arms training is designed to train a soldier to be “qualified” in the use and maintenance of his or her assigned weapon. There are four operationally active small arms ranges on Camp Edwards, which the Massachusetts Army National Guard uses for weapons familiarization, weapons zeroing (essentially customizing it to give the soldier a more accurate shot) and qualification.

Impact Area

The 2,200-acre Impact Area is located in the center of the Upper Cape Water Supply Reserve/Camp Edwards Training Site. The small arms ranges are situated around the perimeter of the Impact Area, with range firing toward the Impact Area. The 330-acre Central Impact Area is located within the Impact Area; it was the primary target area for artillery, mortar, and other firing activities from the early 1900s until firing ceased in 1997.

Cantonment Area

The southern 7,200-acre developed area of Joint Base Cape Cod with roads, utilities, office and classroom buildings, training support areas, and housing. There are numerous federal, state and county entities located there.

Referenced Documents

The Annual *State of the Reservation* report encompasses a large amount of information and makes reference to many letters, reports and other documents that were developed over the course of Training Year 2021. Many of these are available on-line and any letter, document or report referenced in the *Annual State of the Reservation Report* is available by contacting Emily Kelly, Community Involvement Specialist, Massachusetts National Guard Environmental & Readiness Center, 339-202-9341, emily.d.kelly2.nfg@army.mil.

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ACRONYMS

AFCEC	Air Force Civil Engineer Center
AFS	Air Force Station
AgCS	Agassiz's Clam Shrimp (<i>Eulimnadia agassizii</i>)
AmCS	American Clam Shrimp (<i>Limnadia lenticularis</i>)
ANGB	Air National Guard Base
AR	Army Regulation
ATV	All Terrain Vehicle
BMP	Best Management Practice
BP	Battle Position
CAA	Clean Air Act
CAC	Community Advisory Council
CER	Camp Edwards Regulation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CIA	Central Impact Area
CMP	Conservation and Management Plan
CMR	Code of Massachusetts Regulations
CPMPP	Construction Period Monitoring and Protection Plan
CRREL	Cold Regions Research and Engineering Laboratory
CS	Chemical Spill
CSE	Comprehensive Site Evaluation
CSCRMP	Clam Shrimp Conservation and Roadway Maintenance Plan
DBH	Diameter at Breast Height
DCR	Department of Conservation and Recreation
DFG	Department of Fish and Game
DFW	Division of Fisheries and Wildlife
DoD	Department of Defense
E&RC	Environmental & Readiness Center
EMC	Environmental Management Commission
EPA	Environmental Protection Agency
EPS	Environmental Performance Standard
FS	Fuel Spill
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IAGWSP	Impact Area Groundwater Study Program
IED	Improvised Explosive Device
IMT	Individual Movement Techniques
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ITAM	Integrated Training Area Management

Acronyms, continued

JBCC	Joint Base Cape Cod
LQG	Large Quantity Generator
MANG	Massachusetts National Guard
MAANG	Massachusetts Air National Guard
MAARNG	Massachusetts Army National Guard
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MA SHPO	Massachusetts State Historic Preservation Office
MCP	Massachusetts Contingency Plan
MEC	Munitions and Explosives of Concern
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act
MGL	Massachusetts General Law
MIPAG	Massachusetts Invasive Plants Advisory Group
mm	millimeter
MMR	Massachusetts Military Reservation
MMRP	Military Munitions Response Program
MPMG	Multipurpose Machine Gun Range
NBC	Nuclear-Biological-Chemical
NEPA	National Environmental Policy Act
NHESP	Natural Heritage and Endangered Species Program
NLEB	Northern Long-eared Bat
OMMP	Operation, Maintenance and Monitoring Plan
P2	Pollution Prevention
PAVE PAWS	Precision Acquisition Vehicle Entry – Phased Array Warning System
ppb	parts per billion
ppm	parts per million
PFAS	Per- and polyfluoroalkyl substances
RDX	Royal Demolition Explosive
REC	Record of Environmental Consideration
RI/FS	Remedial Investigation/Feasibility Study
ROA	Record of Action
ROTC	Reserve Officers Training Corps
SAC	Science Advisory Council
SGCN	Species of Greatest Conservation Need
SR/ES	Source Registration/Emissions Statement
SVL	Soldier Validation Lane

Acronyms, continued

TA	Training Area
TSA	Training Support Area
TTB	Tactical Training Base
TY	Training Year
UAS	Unmanned Aerial System
URI	University of Rhode Island
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTES	Unit Training and Equipment Site
UTM	Ultimate Training Munition
WFPC	Wildland Fire Program Coordinator
WPA	Wetlands Protection Act
WWTP	Waste Water Treatment Plant

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SECTION 1

INTRODUCTION

1.0 INTRODUCTION

This section of the Annual *State of the Reservation Report* (Annual Report) provides information on Joint Base Cape Cod (JBCC) and the environmental management structure overseeing activities in the approximately 14,886-acre Camp Edwards Training Area/Upper Cape Water Supply Reserve (Training Area/Reserve). The Upper Cape Water Supply Reserve is located on, and is contiguous with, the 14,886 acres of the Camp Edwards Training Area. Excluded from the Upper Cape Water Supply Reserve are areas outside of the operational control of the Massachusetts National Guard (See Section 1.1 and Figure 1-1).

1.1 JOINT BASE CAPE COD STRUCTURE

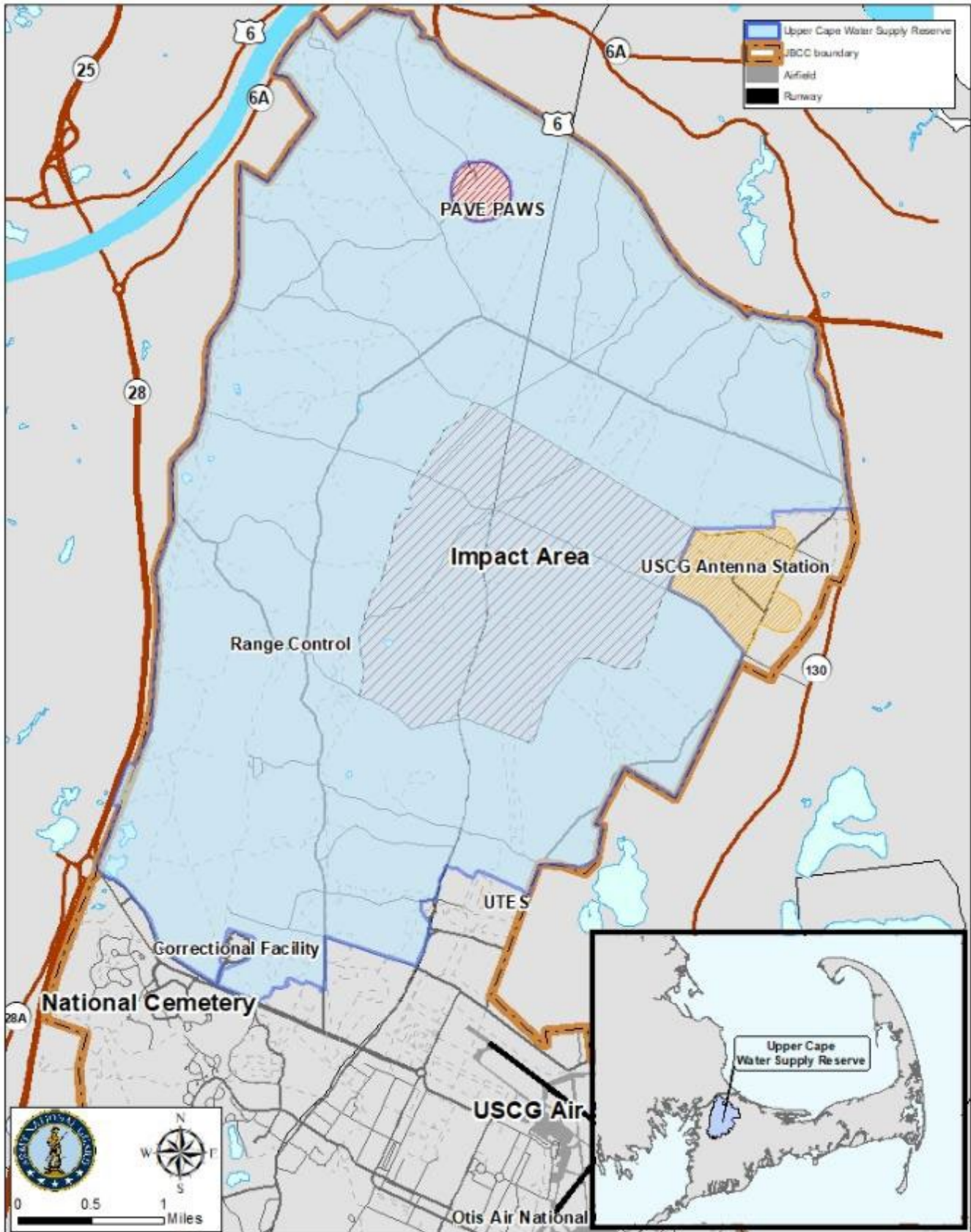
Joint Base Cape Cod is a multi-service military installation and is home to the Massachusetts Army National Guard's (MAARNG) Camp Edwards, the Massachusetts Air National Guard's (MAANG) Otis Air National Guard Base (ANGB), the United States Coast Guard's (USCG) Base Cape Cod, the U.S. Air Force's Cape Cod Air Force Station (AFS), and the Department of Veterans Affairs Cemetery. Joint Base Cape Cod is located in the upper western portion of Cape Cod, immediately south of the Cape Cod Canal in Barnstable County, Massachusetts. It includes parts of the towns of Bourne, Mashpee and Sandwich, and abuts the Town of Falmouth. Joint Base Cape Cod covers nearly 21,000 acres – approximately 30 square miles (Figure 1-1).

The Camp Edwards Training Area comprises 14,886 acres of the northern portion of JBCC. The remaining Camp Edwards military-controlled area of JBCC lies in the southern portion, or Cantonment Area. The Commonwealth of Massachusetts owns the land comprising Camp Edwards and leases the property to the Department of the Army, who in turn licenses the land to MAARNG for training.

The MAARNG and MAANG are part of the Commonwealth of Massachusetts Military Division. However, federal law largely dictates their activities, make-up, training, and functions. For example, most of the day-to-day activities conducted at JBCC by the National Guard, including annual and weekend training, are federal military activities funded by the federal government. In conducting federal military activities, the National Guard is required by federal law to follow Department of Defense (DoD) regulations, Army regulations, Air Force instructions, and applicable federal and state laws and regulations.

There are three major facilities in the northern portion of JBCC that are not on land under the operational control of the Massachusetts National Guard. Cape Cod AFS, which includes the PAVE PAWS ballistic missile early warning radar system, is located on an 87-acre parcel of land on the northwest corner of the Training Area/Reserve. The USCG's Communications Station is located on a 542-acre parcel along the northeastern side of the Training Area/Reserve. A Barnstable County Correctional Facility that opened in 2004 is located on a 29-acre parcel of land just north of Connery Avenue, just outside the southern edge of the Training Area/Reserve. The locations of these facilities are shown in Figure 1-1. Because these facilities are located on land not under the control of the Massachusetts National Guard, and because the Environmental Performance Standards (EPSs) (see Appendix A) established through Chapter 47 of the Acts of 2002 do not apply to these organizations and facilities, detailed information concerning activities at these facilities is not included in the Annual Report. Questions pertaining to activities at Cape Cod AFS, the Coast Guard Communications Station, and the Barnstable County Correctional Facility should be addressed to the persons listed in Appendix B of this report.

Figure 1-1 Map of Joint Base Cape Cod



The Commonwealth of Massachusetts has issued three utility easements on its state-owned property in the Training Area/Reserve: an electrical power line easement (Eversource), a natural gas pipeline easement (National Grid), and a natural gas pipeline easement (Algonquin - that partially overlays the National Grid easement). Additionally, there are easements issued to the Upper Cape Regional Water Supply Cooperative and to the Bourne Water District. The locations of the utilities and facilities are shown in Figure 1-2.

1.2 ENVIRONMENTAL MANAGEMENT STRUCTURE

1.2.1 Environmental Management Commission

Chapter 47 of the Acts of 2002 established the Environmental Management Commission (EMC), consisting of the Commissioner of the Department of Fish and Game (DFG), the Commissioner of the Massachusetts Department of Environmental Protection (MassDEP), and the Commissioner of the Department of Conservation and Recreation (DCR). The EMC oversees compliance with and enforcement of the EPSs in the Training Area/Reserve, coordinates the actions of environmental agencies of the Commonwealth in the enforcement of environmental laws and regulations in the Training Area/Reserve, as appropriate, and facilitates an open and public review of all activities in the Training Area/Reserve. The legislation also states that the environmental agencies on the EMC retain all their respective, independent enforcement authority.

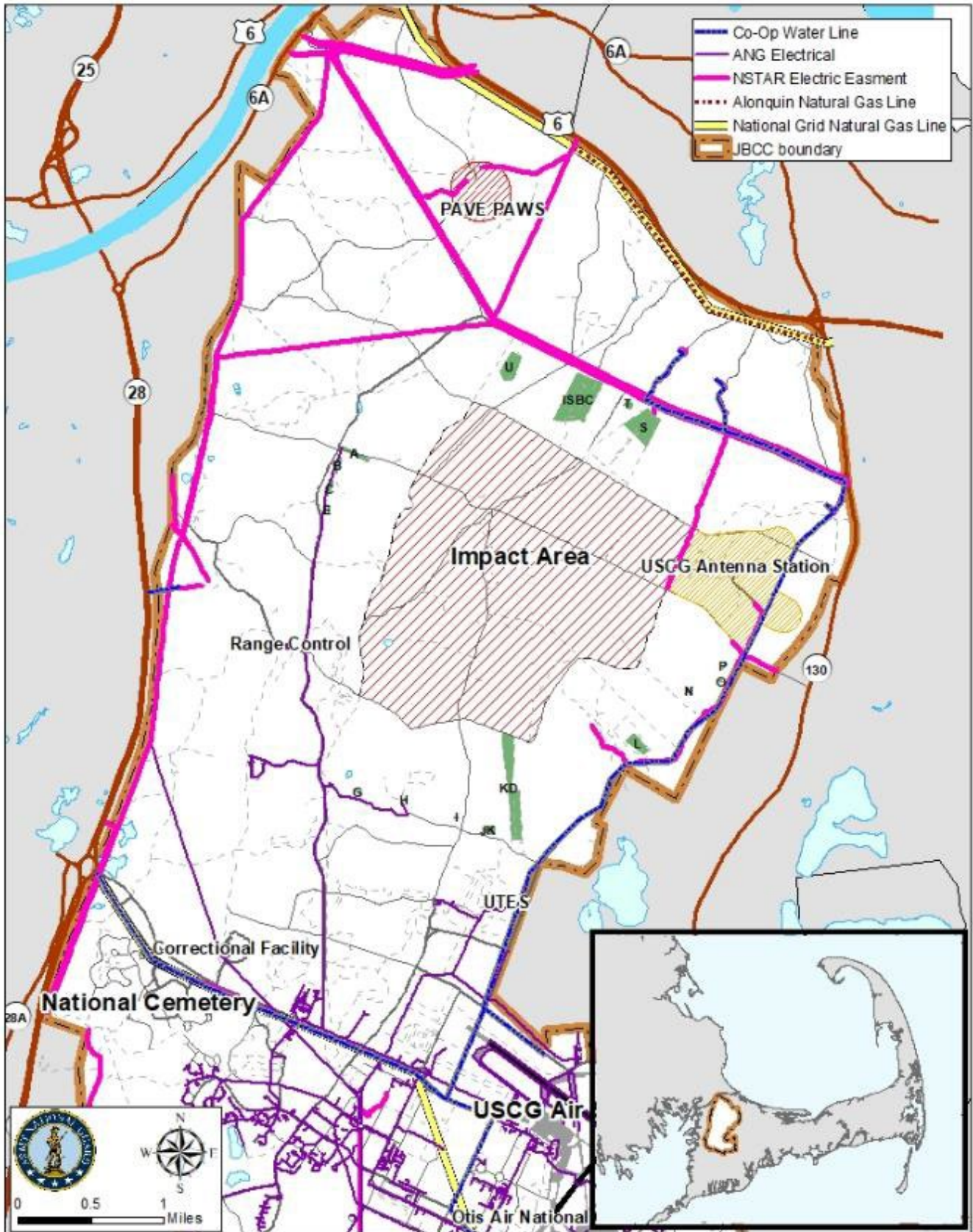
Chapter 47 of the Acts of 2002 also directed that the EMC be assisted by two advisory councils, appointed by the Governor of Massachusetts. The Community Advisory Council (CAC), consisting of 15 members, assists the EMC by providing advice on issues related to the protection of the water supply and wildlife habitat within the Training Area/Reserve. The Science Advisory Council (SAC), consisting of up to nine members, assists the EMC by providing scientific and technical advice relating to the protection of the drinking water supply and wildlife habitat within the Training Area/Reserve.

Chapter 47 of the Acts of 2002 also established an Environmental Officer for the Training Area/Reserve. Mr. Leonard Pinaud of MassDEP is the Environmental Officer. In this capacity, he provides monitoring of military and civilian activities on and uses of the Training Area/Reserve and the impact of those activities and uses on the water supply and wildlife habitat. Working directly for the EMC, the Environmental Officer has unrestricted access to all data and information from the various environmental and management programs in the Training Area/Reserve. He has full access to all points in the Training Area/Reserve and conducts inspections at any time in order to monitor, oversee, evaluate, and report to the EMC on the environmental impact of military training and other activities. His on-site monitoring occurs prior to, during, and immediately following training and other activities. The Environmental Officer's monitoring activities include but are not limited to: training sites, pollution prevention and habitat protection activities for both military and military contractors in the Training Area/Reserve, as well as coordinating with and consulting with the Massachusetts National Guard Environmental & Readiness Center (E&RC) on various projects, initiatives and issues.

The Environmental Officer acts as a liaison between the EMC, SAC, CAC, military, general public, and various state agencies. He identifies and monitors ongoing issues regarding training procedures and the environment in the Training Area/Reserve and keeps the EMC, SAC and CAC apprised of the progress of these issues in addition to bringing issues to the E&RC for resolution. He also participates in community outreach activities with the E&RC and facilitates the EMC, SAC and CAC public meetings under the legislation.

The SAC and CAC met jointly in October 2020 and the SAC met in June 2021. The EMC did not meet during TY 2021. The advisory councils discussed a number of topics, all of which are covered in this report. In November 2017, an Ad Hoc Committee to the Science Advisory Council was established. Please see Section 2.3 for further discussion. Minutes from the meetings may be found at https://www.massnationalguard.org/ERC/advisory_groups_minutes.htm

Figure 1-2 Utility Easements and Leases



SECTION 2

SMALL ARMS RANGES AND MILITARY TRAINING ACTIVITIES

2.0 INTRODUCTION

Section 2 of the Annual Report provides an update on actions associated with operationally active small arms ranges in the Training Area/Reserve including range maintenance, environmental sampling, and levels of military and civilian use of the ranges.

This section also provides information on the use of Training Areas, Training Support Areas (TSA) in the Cantonment Area of Camp Edwards, information on simulated munitions, the Soldier Validation Lane (SVL), and off-site training during TY 2021.

The Massachusetts National Guard (MANG) reports on some Cantonment Area training activities to provide context for why soldiers then move into the Training Area/Reserve to conduct the most realistic training possible to provide for trained and ready soldiers. In the words of the MAARNG trainers, soldiers are provided training in a “crawl, walk, run” scenario. The crawl phase is in the classroom where they learn theory and the basics of the training they are about to undertake; the walk phase is where soldiers can literally walk through the training event in a classroom setting, use simulators, or go into the field and walk through a scenario. Finally, the run phase is where the crawl and the walk phase are put into the most realistic field setting possible in the Training Area/Reserve.

2.1 CAMP EDWARDS TRAINING AREA/UPPER CAPE WATER SUPPLY RESERVE

2.1.1 Military and Civilian Use

The MAARNG has approximately 6,068 soldiers who train on average one weekend per month and one two-week cycle during a training year. The Training Area/Reserve is also utilized by other Department of Defense (DoD) and law enforcement agencies (i.e.: Marines, US Coast Guard, Barnstable County Sheriff's Department, and local police departments). Units start planning their training several years in advance of the year in which they actually conduct their training. The unit leadership assesses the strengths and limitations of its personnel and begins to schedule training sites and resources to best support the training their units require. During the year prior (TY 2020) to the year of execution (TY 2021) units confirm geographical areas and training sites within the Training Area/Reserve.

Military training activities in the Training Area/Reserve are tracked by Range Control based on individual training area use and the number of personnel participating in this use. This method records the number of times each training area is utilized and the number of personnel and vehicles utilizing the areas for each event. Figure 2-1 shows the locations of the major training areas and small arms ranges in the Training Area/Reserve.

Camp Edwards Range Control manages and tracks training area use. For example, Table 2-1 shows the overall utilization of the ranges, training areas and training support areas during TY 2021, while Table 2-2 shows their utilization for each of the past ten training years. For specific training area use for TY 2021 see Table 2-3 and for the ten year totals for training area use see Table 2-4. Range Control is operational 24 hours per day when units are training and, during the course of a training day, personnel from Range Control will observe units at various locations to ensure that they are following range, safety and environmental regulations.

Military training activities in the Training Area/Reserve are tracked by the number of times each training area is utilized per day and by the number of personnel and vehicles utilizing the areas for each use. In many cases personnel and vehicles utilize more than one training area per day. Figure 2-2 shows color-coded personnel use by training area for TY 2021. Figure 2-3 shows a color-coded personnel use by training area for each of the past ten training years. Figure 2-4 provides a color-coded ten year personnel use by training for the past ten training years. Figure 2-5 shows color-coded daily usage by training area for TY 2021. Figure 2-6 shows a color-coded daily usage by training area for each of the past ten training years with Figure 2-7 providing a color-coded ten year daily usage by training area for the past ten training years. For example, as seen in Figure 2-7, training areas B-8 was not used and B-9 was lightly used, and area B-11 shows a high use; this is a result of the closing and opening of the B-8 and B-9 training areas due to the proximity to the Monument Beach Sportsman’s Club’s (Club) firing range. These training areas are within the Surface Danger Zone (SDZ) for the Club’s rifle range and therefore are closed when the Club’s range is operational. An SDZ is a notional, undisturbed safety area extending out from a small arms range where there is a one-in-a-million chance that a bullet may land. The MAARNG and the Club coordinate schedules to ensure safety of Soldiers and Club members.

Graph 2-1 shows personnel use by training area for TY 2021 and the average personnel use by training area for TY 2012 to TY 2021; Graph 2-2 shows days used by training area for TY 2021 and the average days used by training area for TY 2012 to TY 2021. Use of specific training areas is dependent upon its capacity to hold Soldiers, its terrain to support a given training exercise, and restoration of training venues through the cleanup and the ITAM programs. Over the last several years training has focused on collective exercises where training areas that can support these training events are used.

As units become aware that the ranges and other training venues at Camp Edwards meet qualification standards, the use of the areas where these venues are located will increase. Fluctuations in training usage is also largely influenced by deployment cycles and changes to training doctrine and directives. In addition, over the past two decades, legacy contamination cleanup activities (managed by Air Force Civil Engineer Center/Impact Area Groundwater Study Program [See Section 4.0]) in the Training Area/Reserve have resulted in small arms ranges and other training venues being unavailable for use. However, as clean-up activities have been completed these training venues are again available for compatible military use. So, with new ranges, training venues, and eventual completion of the cleanup program, Training Area use and numbers will fluctuate accordingly.

In the Table 2-1 and Table 2-2, civilian use includes use of the ranges and training areas in the Training Area/Reserve and the Training Support Areas (TSA) in the Cantonment Area; civilian use ranges from unmanned aircraft systems ground operations and flight testing, to practicing land navigation, to training in the Calero Mobile Military Operations on Urban Terrain Site, to use of classrooms and other facilities. In addition, there were also public deer and turkey hunting seasons during TY 2021. Information on these activities is provided in Sections 3.5.4 and 3.5.5 of this report. Fluctuations in training days and event numbers from year to year is a result of differing unit training requirements, combined training needs, and deployment cycles.

TABLE 2-1 OVERVIEW OF TRAINING USE - TY 2021

Area	Training Days/Events	PERSONNEL	
		Military Personnel	Civilian Personnel
Ranges	186	7,716	214
Training Areas	1,277	66,374	502
Training Support Areas	2,484	94,055	5,305
TOTAL	3,947	168,145	6,021

Figure 2-1 Camp Edwards Training Area and Ranges

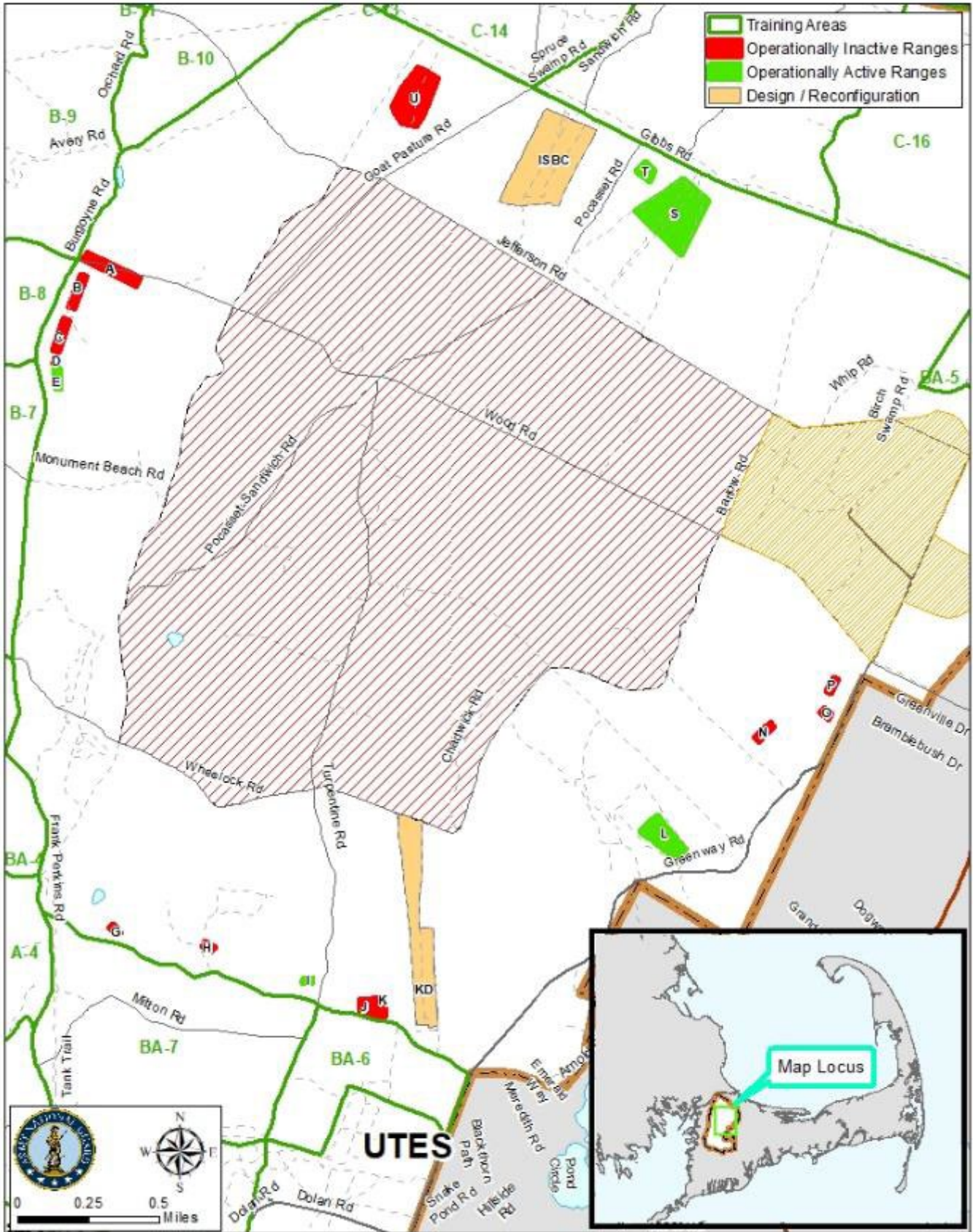


Figure 2-2 Personnel Usage by Training Area in the Training Area/Reserve, TY 2021

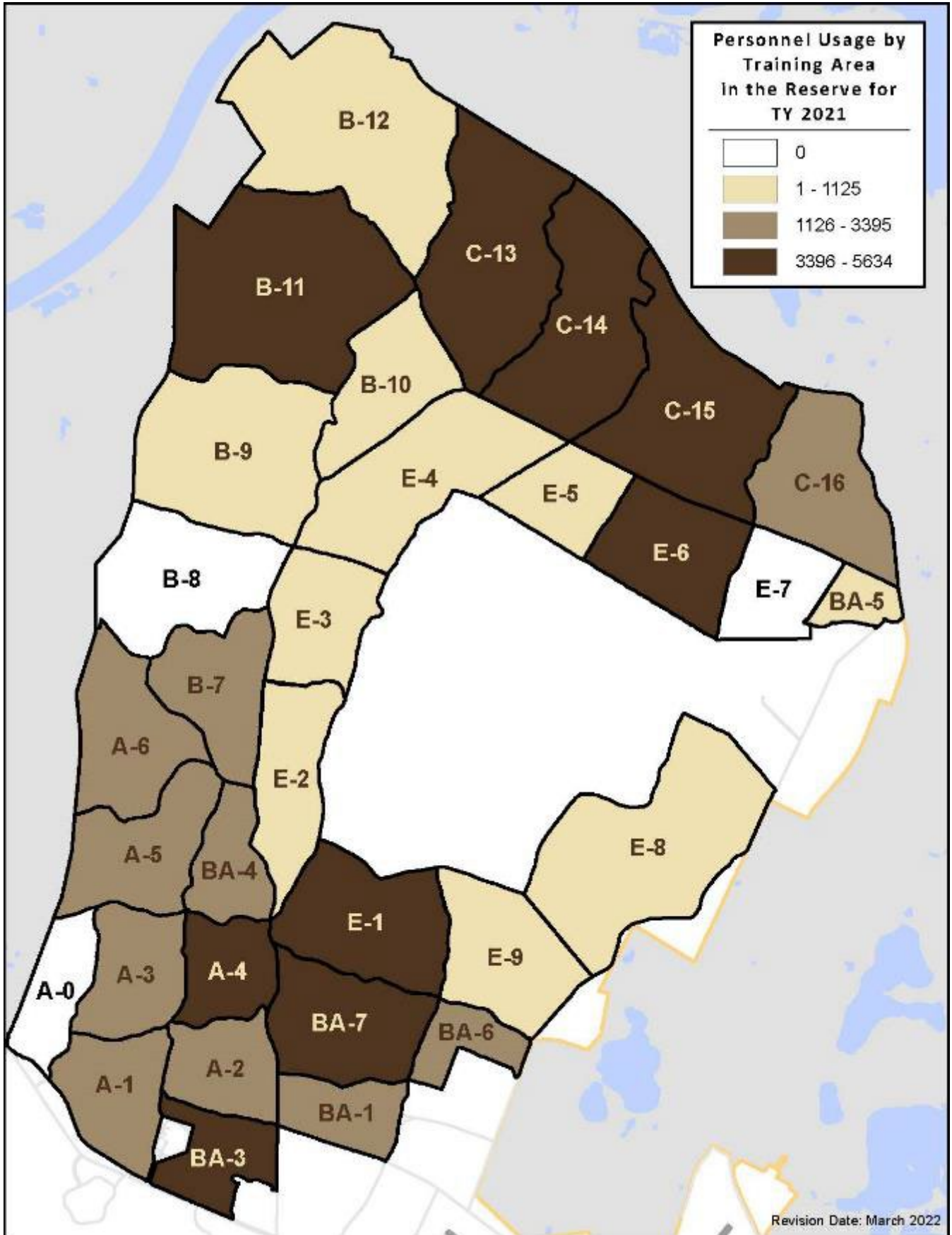
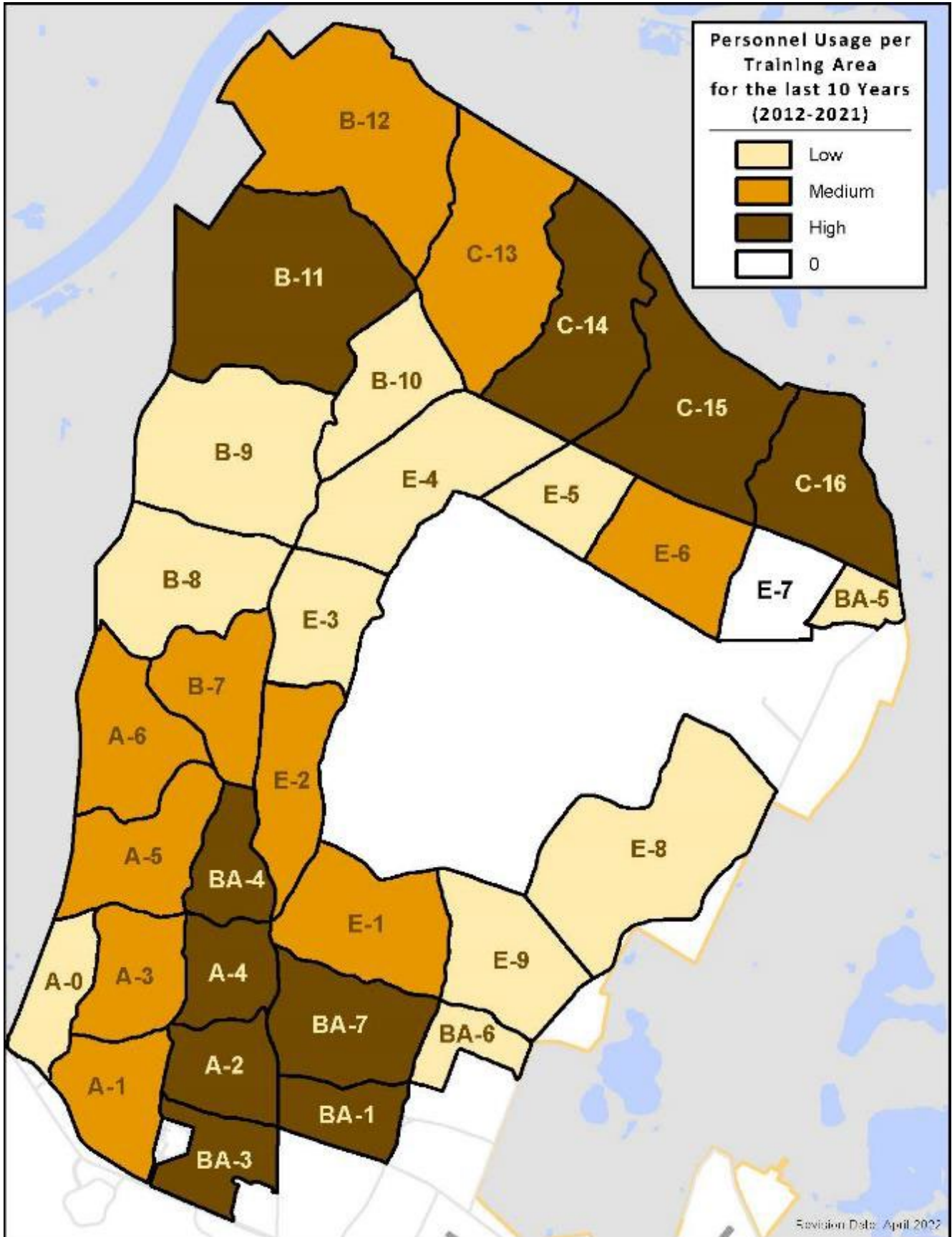
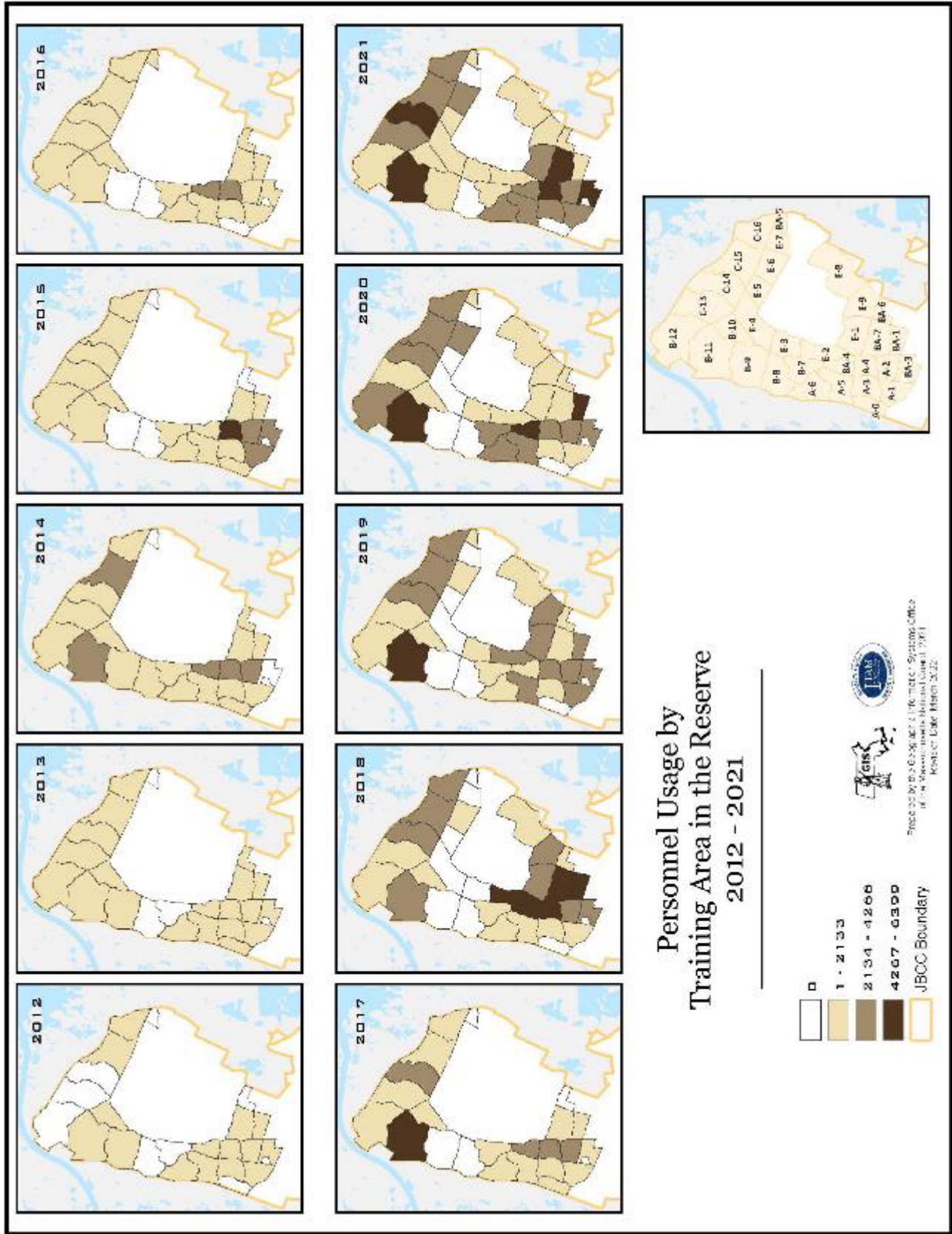


Figure 2-3 Personnel Usage by Training Area in the Training Area/Reserve, TY 2012 – TY 2021



Low=169-7,210 personnel; Medium=7,211-18,330 personnel; High=18,331-36,597 personnel

Figure 2-4 Ten Year Personnel Use by Training Area in the Training Area/Reserve, TY 2012 - TY 2021



Note: Prior to 2018, the E training areas were not available for use and are not delineated in the 2012 to 2017 graphics.

Figure 2-5 Daily Usage per Training Area in the Training Area/Reserve, TY 2021

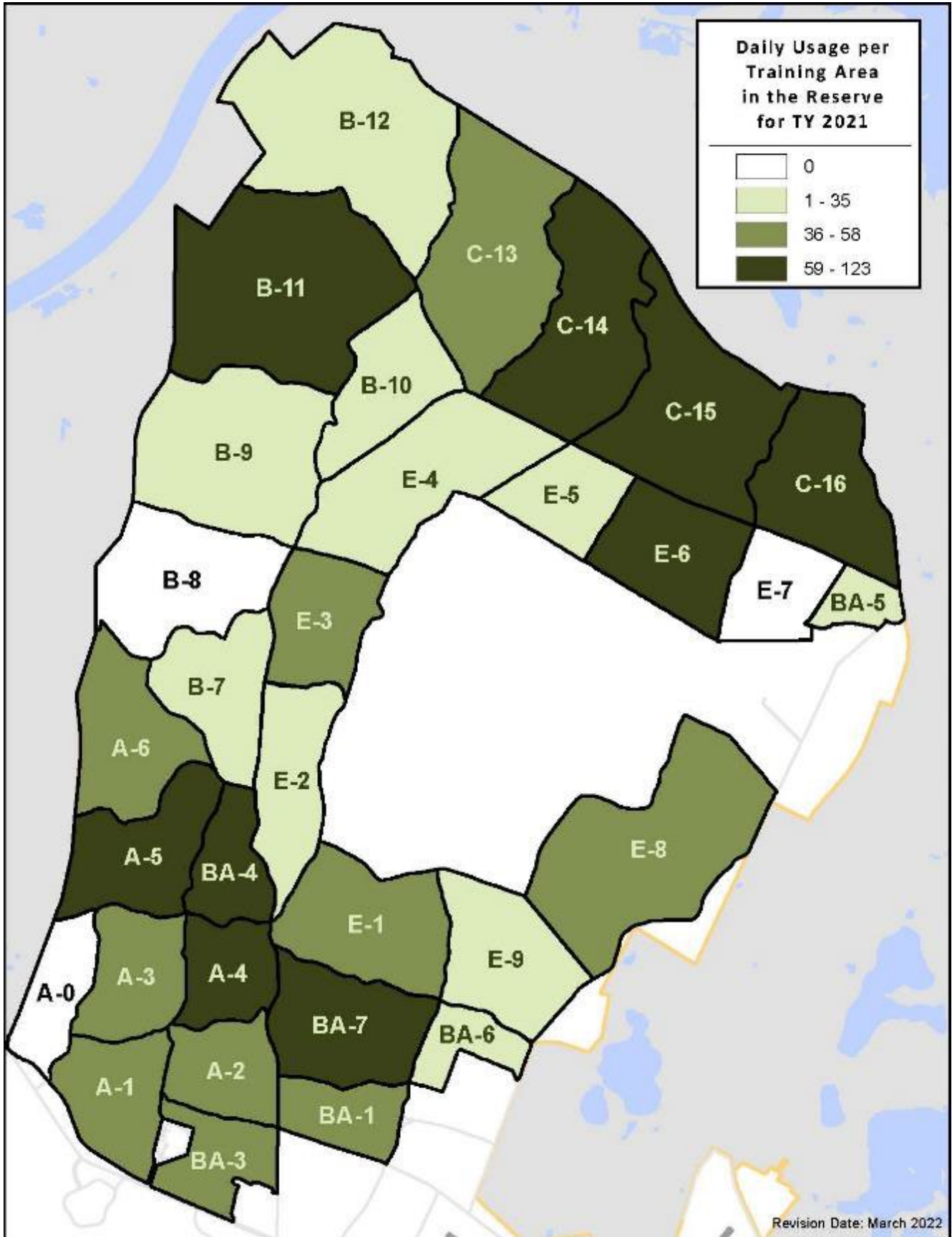
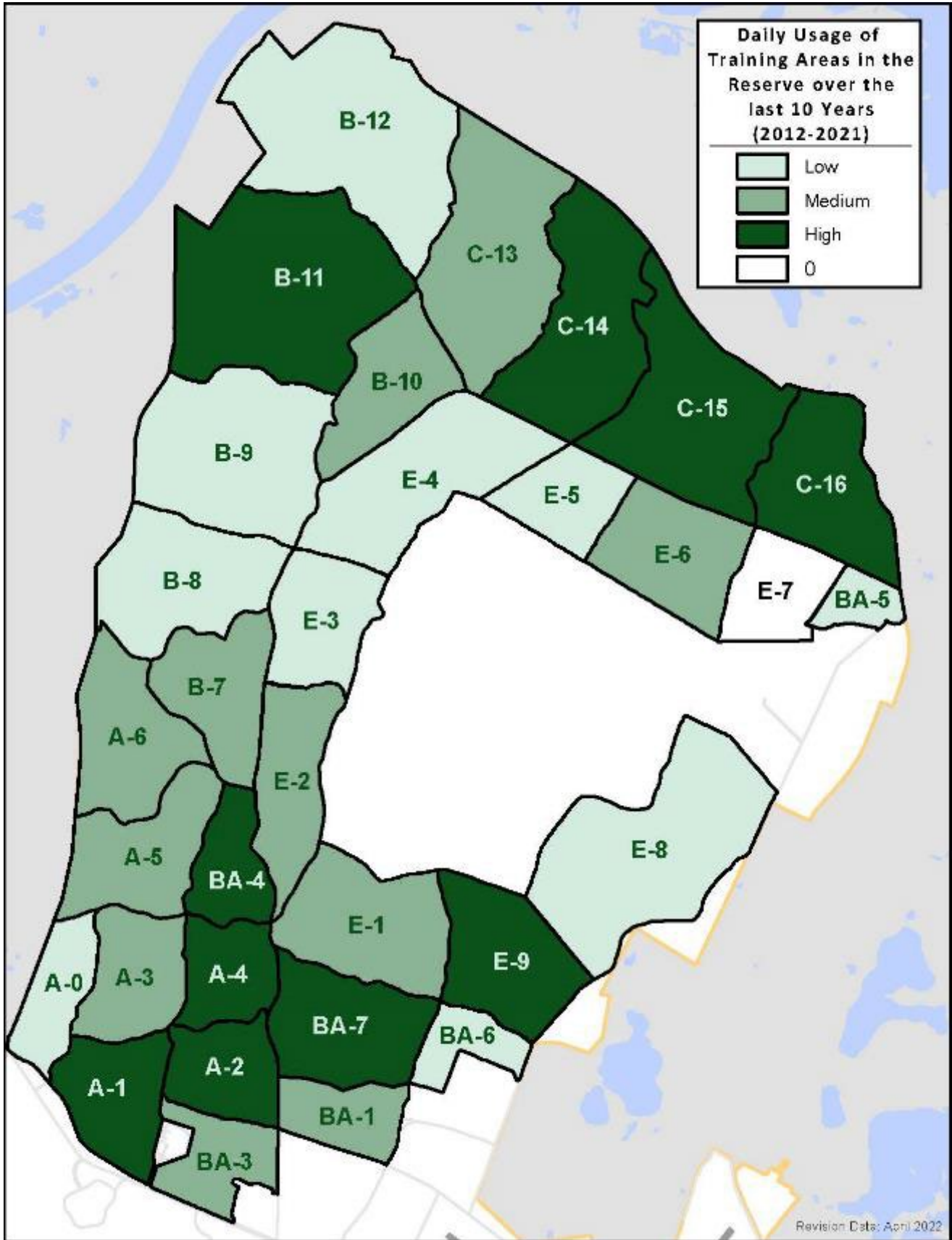
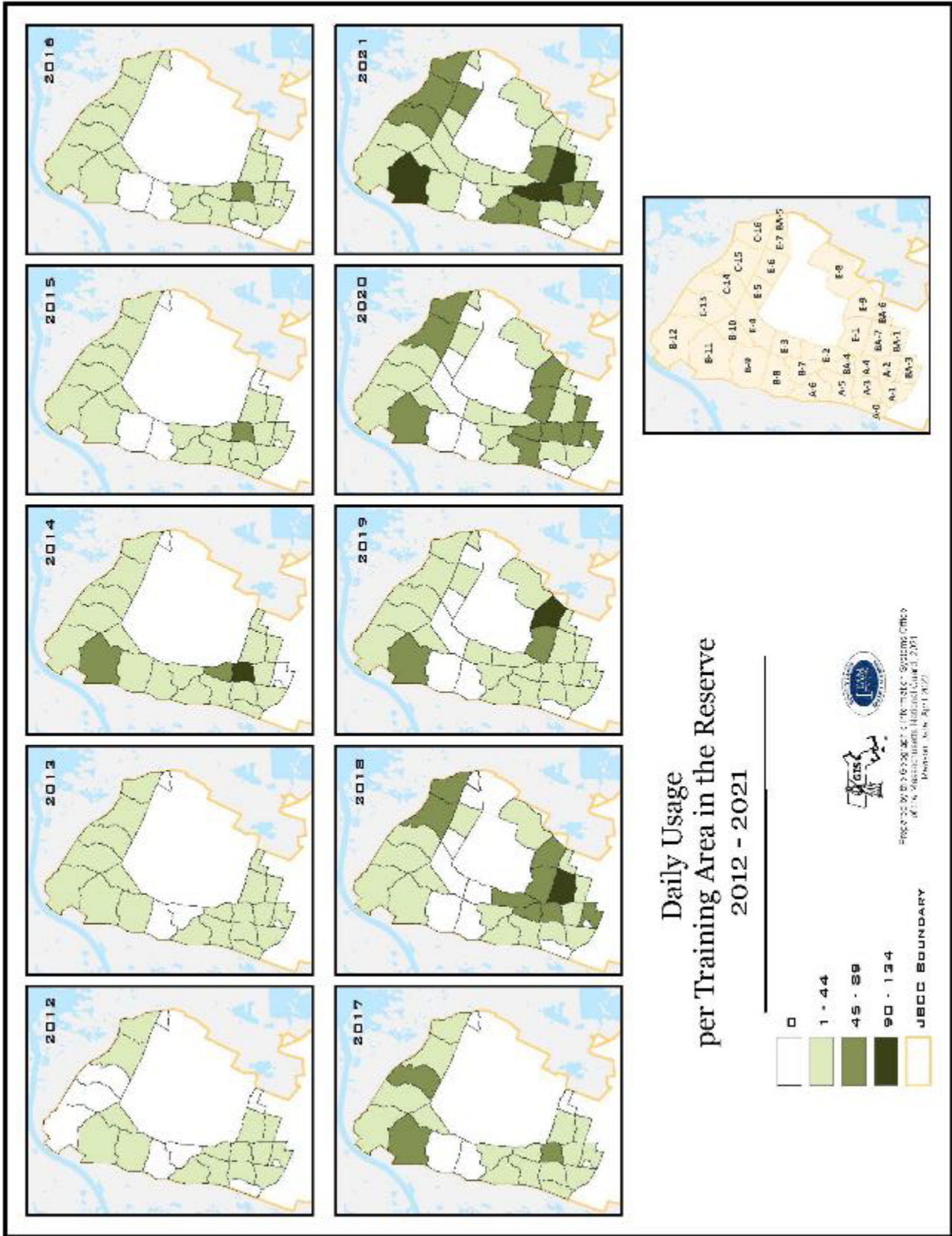


Figure 2-6 Daily Usage per Training Area in the Training Area/Reserve, TY 2012 – TY 2021



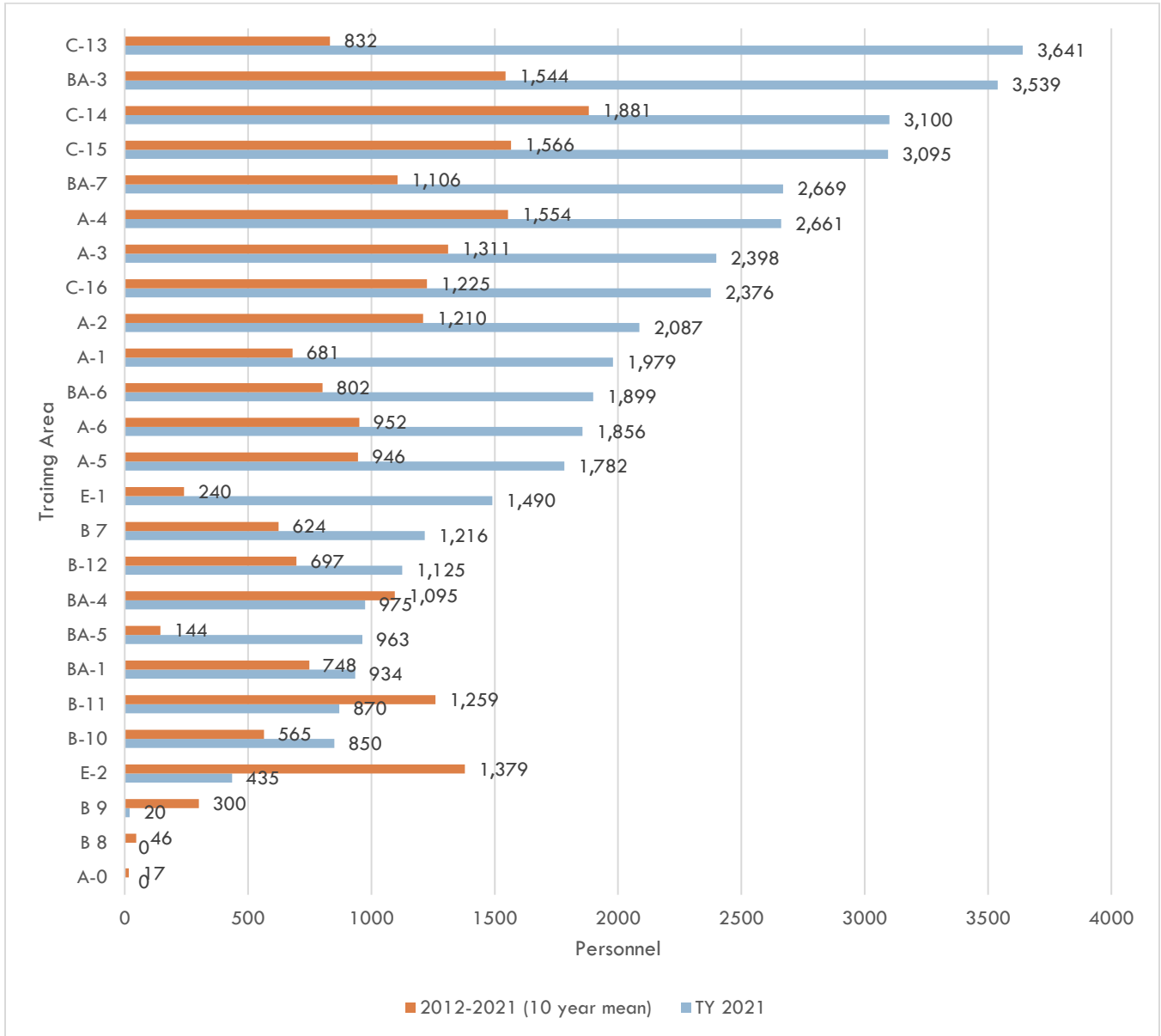
Low=4-85 days; Medium=86-267 days; High=269-616 days

Figure 2-7 Ten Year Daily Usage by Training Area in the Training Area/Reserve, TY 2012 – TY 2021



Note: Prior to 2018, the E training areas were not available for use and are not delineated in the 2012 to 2017 graphics.

Graph 2-1 Personnel Use by Training Area



Graph 2-2 Days Used by Training Area

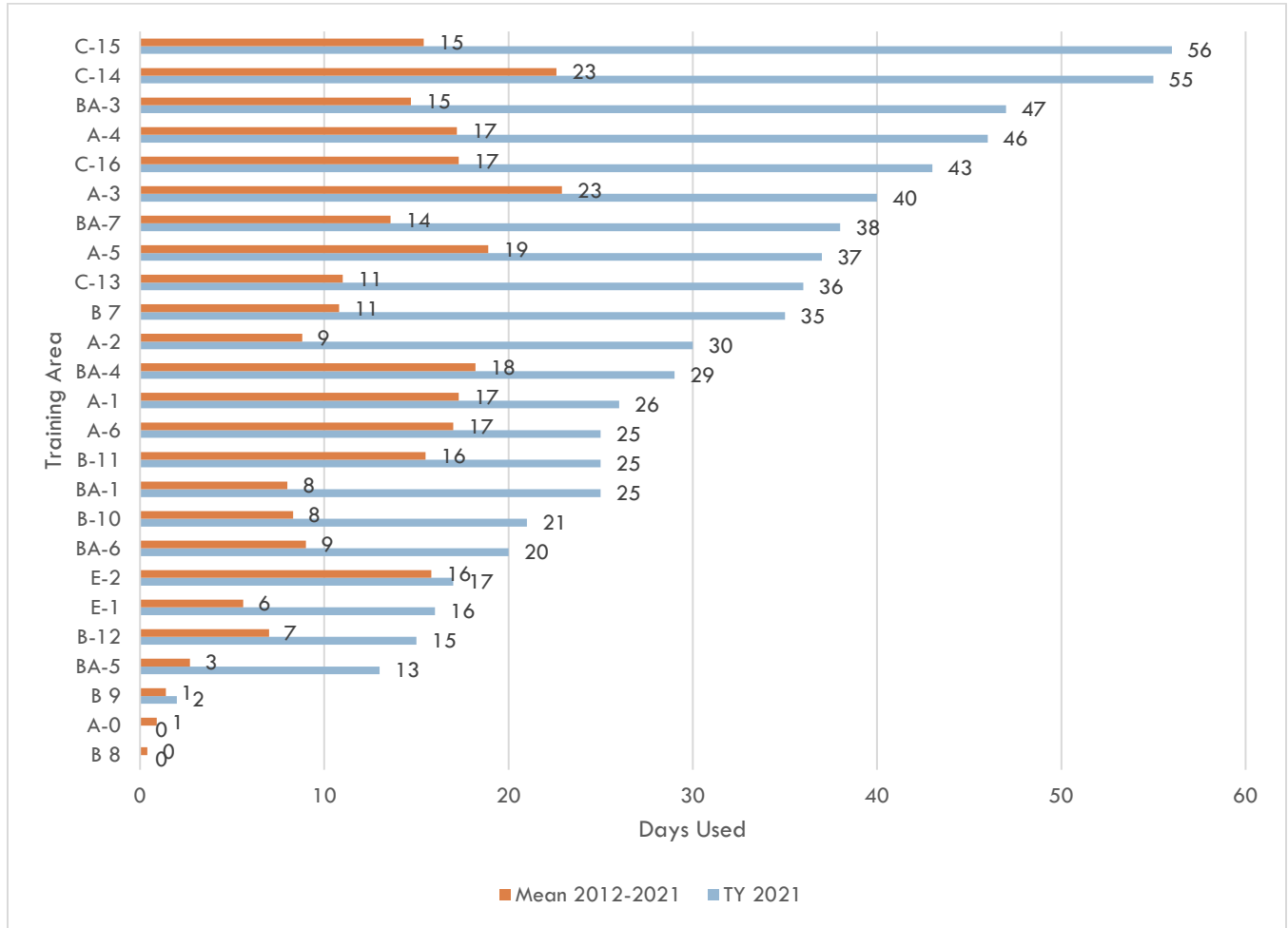


TABLE 2-2 TRAINING USE HISTORY

Training Year	Training Days/Events	Military Personnel	Civilian Personnel
TY 2021	3,947	168,145	6,021
TY 2020	3,041	138,474	6,828
TY 2019	2,481	94,874	12,424
TY 2018	2,118	103,864	1,673
TY 2017	2,268	144,671	3,450
TY 2016	2,065	92,083	2,271
TY 2015	2,105	122,645	2,691
TY 2014	1,845	121,740	2,050
TY 2013	1,052	46,361	1,650
TY 2012	1,117	78,745	866
TOTAL	22,039	1,111,602	39,924

In the table above, civilian usage numbers in TY 2019-2021 are higher than in past training years; this is due in part to the Cape Cod Police Academy's use of Camp Edwards facilities over the past three years as well as a Federal Emergency Management Agency training that took place in TY 2019.

2.2 RANGE UPDATE

The current operationally active small arms ranges on Camp Edwards are Sierra, India, Lima, and Echo ranges. Juliet and Kilo ranges are currently operationally inactive as their STAPP™ systems have been dismantled (see Section 2.4.2). The ISBC, KD and Tango ranges are undergoing rehabilitation. The locations of these ranges are shown in Figure 2-1.

2.3 SCIENCE ADVISORY AD HOC COMMITTEE

On November 2, 2017, the EMC formed an Ad Hoc Committee to the SAC to review the current small arms range environmental monitoring process and aide in developing the most appropriate monitoring processes for those ranges. Committee members are SAC members Phil Gschwend and Jack Duggan, both geochemists, SAC member Denis LeBlanc, US Geological Survey, and Jay Clausen from the US Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL), who is a metals mobility expert. The committee had a sunset clause of two years, however based on the effectiveness of the body and emerging issues, such as pyrotechnics, the EMC voted to allow the Ad Hoc committee to continue.

The committee did not meet during TY 2021. When the committee last met in August 2020, members discussed the continuing work to research the movement of antimony in soil, which is being conducted by CRREL. The research was completed by CRREL with the results published February 2021 (Appendix C). The work determined that the previous use of phosphates for lead immobilization and pH amendments were the cause of increased antimony in porewater and that there is not a threat to the groundwater. Amendment use no longer occurs at the direction of the EMC.

2.4 TANGO, JULIET AND KILO RANGES

Between 2007 and 2009, STAPP™ systems were installed on these Tango, Juliet and Kilo ranges to capture and contain lead ammunition. The system is a multi-layer rubber sandwich framed by synthetic lumber, which consists of a bottom rubber membrane, a matrix of rubber granules, and a cover that permits bullets to pass through and be captured in the rubber granule matrix but minimizes precipitation getting into the system.

The Tango Range STAPP™ system was dismantled in November 2017 and has been reconfigured for use as a copper ammunition only zeroing range in support of weapons qualification at Sierra Range. The Juliet Range and Kilo Range STAPP™ systems were dismantled in Fall 2020 (see Section 2.4.2). The Department of Defense has been moving away from lead ammunition for approximately 10 years. As such, lead rifle ammunition is no longer authorized for most MAARNG units and it is not authorized for use at Camp Edwards, which is why Juliet, Kilo, and Tango ranges with their associated STAPP™ systems are no longer required.

2.4.1 Range Maintenance and Sampling

In September 2021, surface soil, porewater, and groundwater samples were collected from the ranges per the Operations, Maintenance and Monitoring Plan (OMMP) and guidance from the SAC Ad Hoc Committee. The samples were analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen where appropriate for the media being sampled. Results of the surface soil and groundwater analyses continue to show no trends or significant concentrations when compared to the Action Levels specified in the OMMPs and as compared to background levels. Porewater results indicate an exceedance of the Action Level (6 parts per billion [ppb]) for antimony in several lysimeters on these ranges. Figures showing lysimeter locations and data are available in Appendix C. Antimony is in lead alloy bullets and in bullet primers.

There are two causes of increased antimony in porewater:

- legacy range soils, where lead-antimony bullets were fired, were used for berm and range construction at Juliet, Kilo, and Tango ranges;
- phosphates added to range soils (1998-1999) and lime to adjust pH and to immobilize lead in legacy soils

Another finding of the Ad Hoc Committee through lab studies at CRREL in New Hampshire is that antimony is not threatening the groundwater. It has been determined that antimony mobility is influenced by pH and soil amendments. Soil amendments were halted several years ago at the direction of the SAC Ad Hoc committee until such time it could be determined what the effects of these amendments had on antimony mobility. It has also been determined through soil sampling that antimony mobility is limited to surface soils where amendments were applied.

Juliet and Kilo Ranges are now in operationally inactive status. Sampling of porewater on the ranges continued in 2021. Water removal from the STAPP™ systems is no longer required as the systems have been removed from the ranges. Water was last pumped from the ranges during the STAPP™ system removal process in October 2020. Throughout the month of October, 790 gallons were removed from the STAPP™ system on Kilo Range and 550 gallons were removed from the STAPP™ system on Juliet Range.

The Juliet Range and Kilo Range sampling results for TY 2021 are available in Appendix C. The Juliet Range and Kilo Range sampling results for TY 2021 are in Appendix C. Tango Range was redeveloped as an EPR (copper) zeroing range in 2021. All Tango Range sampling data for 2021 is for the reconfigured range and is the initial baseline sampling (see Appendix C). There were no action level exceedances for soil. For porewater there was one true action level exceedance on Juliet Range with several other numerical exceedances that the analyzing lab data flagged as non-detect for antimony. A non-detect is an analytical sample where the concentration is deemed to be lower than could be detected using the method employed by the laboratory. For groundwater there were numerical exceedances of the action levels for lead and antimony; however, the exceedances were data flagged as non-detect for both lead and antimony.

2.4.2 Tango, Juliet and Kilo Ranges STAPP™ Dismantling

Camp Edwards decommissioned and removed the STAPP™ system from Tango Range in November 2017. During TY 2021, the range was modernized to support a 32-lane zeroing range for copper ammunition. Soldiers will be able to zero their weapons at Tango Range and then move to the adjacent Sierra Range to conduct weapons qualification. The target and firing lines were moved 25 meters north, which moves them out of the SDZ of the adjoining Sierra Range, allowing both ranges to be used simultaneously. Construction began on Tango Range in Fall 2020 and was complete in May 2021. In TY 2022, the MAARNG will request that the EMC authorize its Environmental Officer to approve the redesign and Operations, Maintenance and Monitoring Plan for the range. If approved, the range will then become operational.



Photograph 2-1 A view of the modernized Tango Range showing the target frames and backstop berm.

Work to dismantle the STAPP™ systems on Juliet and Kilo ranges began on October 13, 2020 and was completed by November 3, 2020. Approximately 4,192 lbs. of lead were removed from the Juliet and Kilo STAPP™ systems during the cleanout.

2.5 SIERRA AND INDIA RANGES

Sierra Range is an automated 300-meter pop-up modified record of fire range using copper ammunition only and is used to qualify soldiers in marksmanship proficiency. The firing line is 200 meters long with 10 firing positions. There are nine stationary, pop-up targets in each firing lane. The targets are located at 50, 100, 150, 200, 250, and 300 meters, with two targets at the 50-meter distance and one each at the other distances. The following weapons are authorized for use on Sierra and India Ranges: the M16 and M4 rifles, the M249 machine gun with 5.56mm ammunition, and the M240 machine guns (India Range only) using 7.62mm ammunition.

India Range is a 25-meter small arms range using copper ammunition to train soldiers on the skills necessary to align the sights on their weapons and practice basic marksmanship techniques against stationary targets. It has 20 firing positions with one target in each firing lane. The range is also used for short-range marksmanship training and qualification.

2.5.1 Range Maintenance and Sampling

Maintenance activities during TY 2021 at Sierra Range included filling bullet pockets with screened loam. At India Range, maintenance activities included repairing and filling bullet pockets.

A list of Range Control's inspection and maintenance activities at Sierra and India ranges in TY 2021 is included in Appendix C.

In October 2021, groundwater, porewater, and surface soil samples were collected from Sierra Range and India Range as prescribed in the OMMP. The samples were analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen where appropriate for the media being sampled. Results of the soil and groundwater analyses continue to show no exceedance of the Action Levels specified in the OMMP. The Sierra Range and India Range sampling results for TY 2021 are in Appendix C. There were no action level exceedances for soil. For porewater there were several numerical action level exceedances that the analyzing lab data flagged as non-detect for antimony. A non-detect is an analytical sample where the concentration is deemed to be lower than could be detected using the method employed by the laboratory. For groundwater there were numerical exceedances of the action levels for lead and antimony however the exceedances were data flagged as non-detect for both lead and antimony.

2.6 LIMA RANGE

In 2012, the Environmental Protection Agency (EPA) Region 1 and the EMC approved returning to live firing on Lima Range using the M781 40mm Training Round.

The M781 is a practice grenade that is fired as a projectile composed of a hollow plastic "windshield" filled with Day-Glo-Orange marking powder. According to the Safety Data Sheet, the Day-Glo-Orange marking powder is considered to be non-toxic. The initial firing of the M781 40mm Training Round occurred in 2013.

Lima Range is used to train and test individual soldiers on the skills necessary to engage and defeat stationary target emplacements with the 40mm grenade launcher. The range has four self-contained stations and is 30-meters wide by 400-meters long. The stations consist of firing positions and targets of various types and distances, ranging from 100 to 350 meters. Station 1 consists of a prone fighting position with sandbags for support and two zeroing targets at 200 meters. Station 2 consists of an upright log or wall, a kneeling firing position about four feet high, and two point-type targets. The targets include a simulated window or door of a building at 100 meters and a small bunker or fighting position at 125 meters. Station 3 consists of a fighting position and two targets. The targets are a two person bunker at 175 meters and an automatic weapon position at 200 meters. The bunker represents a point target, while the automatic weapons position represents an area target. Station 4 consists of a prone fighting position with a log or sandbag support and two area type targets at 250 meters and 350 meters.

2.6.1 Range Maintenance and Sampling

In October 2021 porewater and surface soil samples were collected from Lima Range and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen, where appropriate for the media being sampled. There were no action level exceedances for soil. For porewater, there were several numerical action level exceedances that the analyzing lab data flagged as non-detect for antimony. A non-detect is an analytical sample where the concentration is deemed to be lower than could be detected using the method employed by the laboratory.

The Lima Range sampling results for TY 2021 are available in Appendix C.

Maintenance activities included installing supports to the posts holding the netting on the back of the range. A list of Range Control's inspection and maintenance activities Lima Range in TY 2021 is included in Appendix C.

2.7 ECHO RANGE

Echo Range, a dual-purpose range, is a Combat Pistol/Military Police Qualification Course, consisting of 15 firing lanes with seven pop-up targets per lane offset along the firing lanes at varying distances with one fixed Military Police target at the end of the lane. Shooters shift their pistol firing position to engage the targets at the varying distances. 9mm pistol ammunition is fired at pop-up targets, passes through, and strikes the backstop berm. The two courses of fire, on the same range, are referred to as an automated combat pistol/military police firearms qualification course.

The backstop berm is utilized as the primary projectile capture area. Single Individual Target frontal berms are the capture location for extreme low shot projectiles. The backstop berm was constructed on core material (native), landscape fabric as a demarcation line, a projectile capture medium that is 1/8th minus (road sand) and capped with topsoil that slows projectiles and allows for vegetation and slope stabilization.

Echo Range became operational in September 2019.

2.7.1 Range Maintenance and Sampling

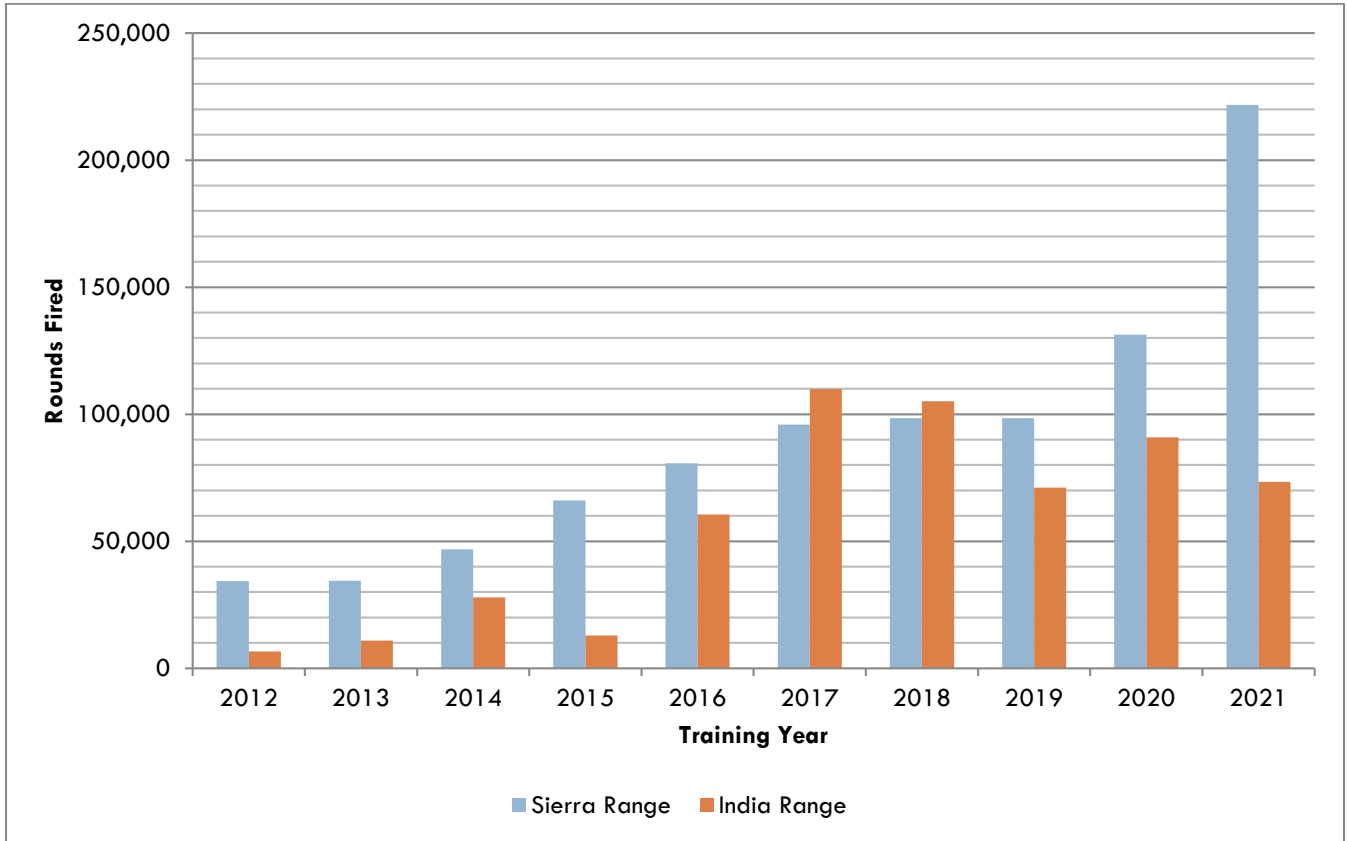
In October 2021, groundwater and surface soil samples were collected from Echo Range and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen, where appropriate for the media being sampled. There were no action level exceedances for soil. For groundwater, there were numerical exceedances of the action levels for lead and antimony; however, the exceedances were data flagged as non-detect for both lead and antimony. A non-detect is an analytical sample where the concentration is deemed to be lower than could be detected using the method employed by the laboratory. The Echo Range sampling results for TY 2021 are in Appendix C.

A list of Range Control's inspection activities at Echo Range in TY 2021 is included in Appendix C.

2.8 RANGE USAGE DATA

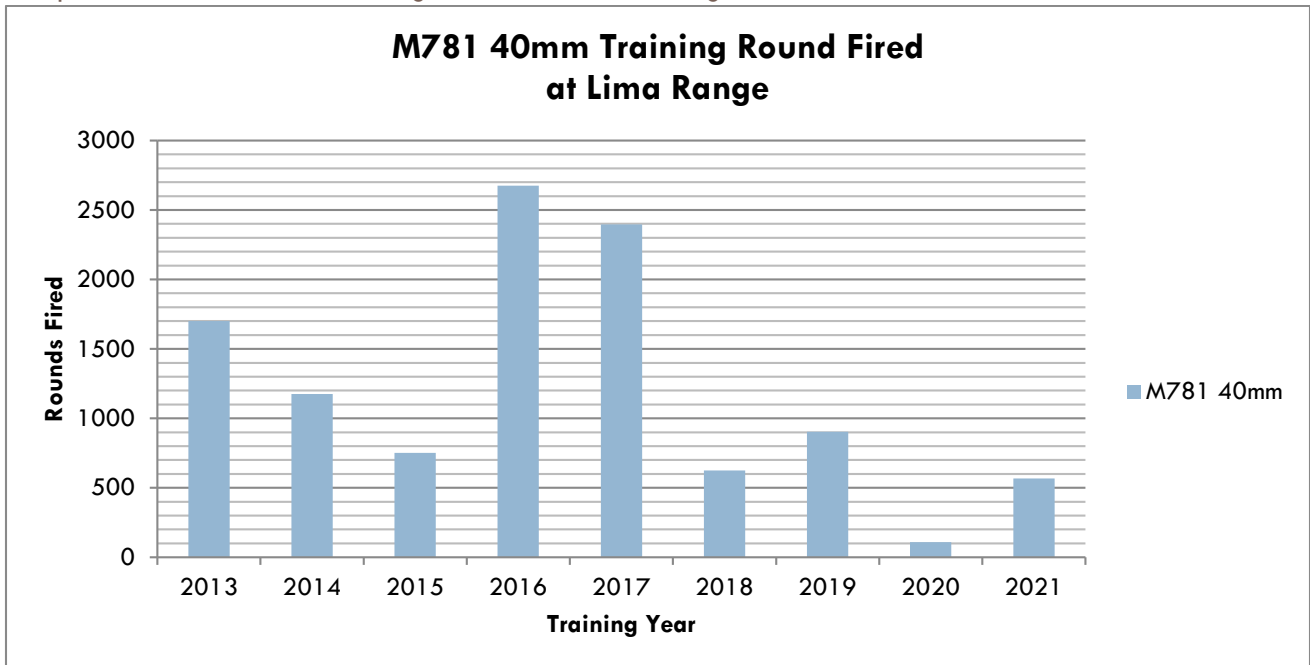
A total of 1,477,534 rounds of copper ammunition have been fired at Sierra and India ranges since its use was approved: 908,243 at Sierra Range and 569,291 at India Range. Graph 2-3 provides a summary of copper ammunition fired at Sierra and India ranges since use of copper ammunition was approved at them. The graph shows an upward trend in copper ammunition use. During TY 2020, the MAARNG transitioned to all copper-based rifle ammunition. Information on the number of copper ammunition fired on Sierra and India ranges each training year from 2012 through 2021 is provided in Appendix C.

Graph 2-3 Copper Ammunition Use – Sierra and India Ranges



A total of 10,905 M781 40mm Training Rounds have been fired at Lima Range since its use was approved. Graph 2-4 provides information on the number of M781 40mm Training Rounds fired at Lima Range. The graph reflects the cyclic requirement for qualification for grenadiers. Units that have grenadiers only have one to two soldiers with that requirement in the unit; not every soldier uses this weapon.

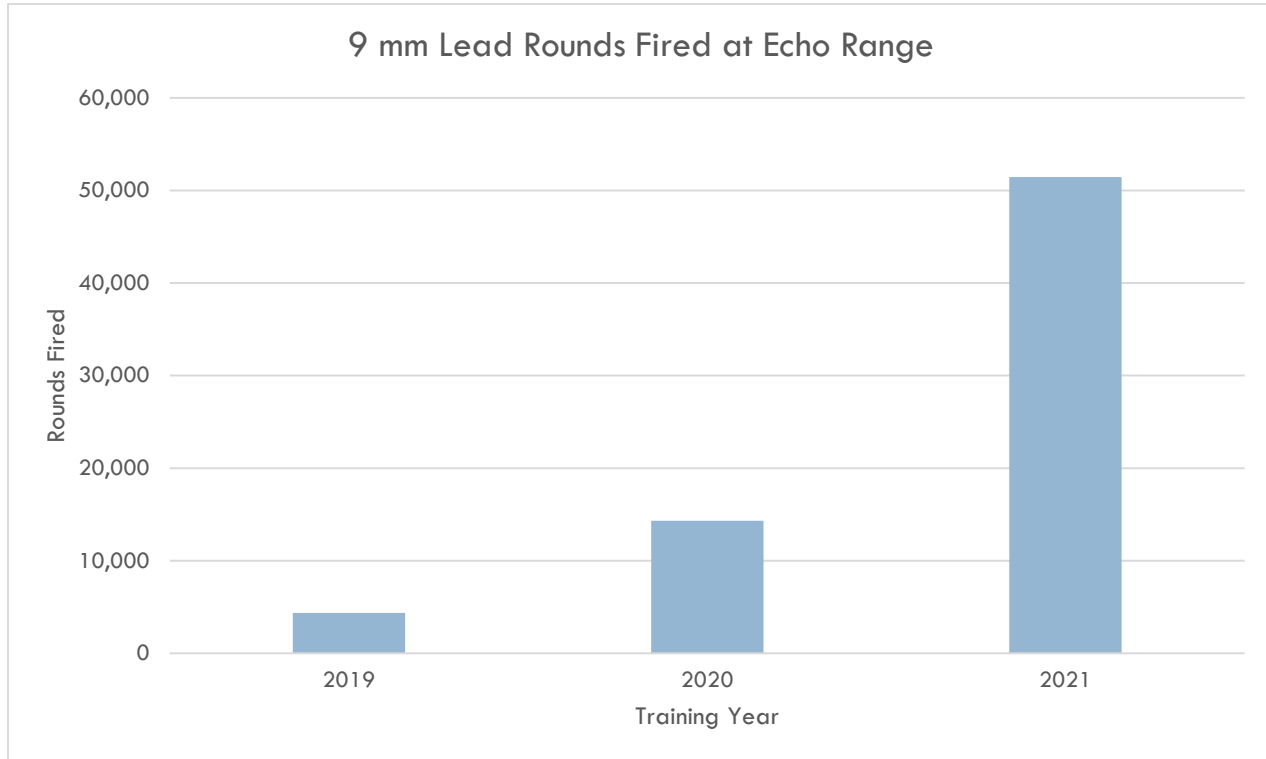
Graph 2-4 M781 40MM Training Round Use – Lima Range



Since TY 2019, a total of 70,543 rounds of 9mm lead ammunition has been fired at Echo Range. Graph 2-5 shows the number of 9mm rounds of lead ammunition fired on Echo Range. During TY 2021, 19,975 rounds of 5.56mm copper-only ammunition were fired on Echo range during two non-standard training events.

Information on lead ammunition fired from TY 2007 through TY 2021, including amounts and types, is provided in Appendix C.

Graph 2-5 9mm Lead Ammunition Round Use – Lima Range



The only civilian use of the small arms ranges during TY 2021 was by the Falmouth Police. They fired 2,975 5.56mm rounds of ammunition and 3,476 .40 cal. rounds of ammunition.

During TY 2021, some type of weapons firing was conducted on at least one of the ranges on 113 calendar days.

In accordance with the OMMP for each range, the MANG is required to capture, contain, and recover bullets/projectiles to the greatest extent practical. Recovery of projectiles is based on usage, time, and projectile density. The OMMPs define when this is required for each range.

2.8.1 Training Areas

Camp Edwards has numerous areas that support military training: training areas, battle positions, observation posts, training roads, etc. The training areas also support a variety of training activities including land navigation, bivouacs, Soldier Validation Lanes, meteorological data collection, engineer/infantry/artillery skills training, driver (day and night) training, and Reserve Officer Training Corps (ROTC) training.

Information on utilization of the training areas and major locations within them during TY 2021 is provided in Table 2-3. The total overall utilization of the training areas for the past 10 training years is included in Table 2-4. The variations over the years in training days and personnel numbers is a result of differing unit training requirements, combined training needs, and deployment cycles. During TY 2021, some type of training was conducted in at least one of the training areas on 218 calendar days. The numbers in Tables 2-3 and 2-4 do not include employees and vehicles from the remediation programs and private contracting firms. Also, hunters using

the Training Area/Reserve during the deer and turkey seasons are not tracked as they move through the various training areas. During TY 2021, hunter days in the Training Area/Reserve accounted for around 1.36 percent of the usage, and approximately 75% of the Training Area/Reserve was available to hunters during the deer hunting season. Please see Sections 3.5.4 and 3.5.5 for information about the deer and turkey hunting seasons.

Other military users of the training areas during TY 2021 included the US Army, the US Army Reserve, the US Coast Guard, the US Coast Guard Reserve, the US Navy, the US Marine Corps Reserve, New York ANG, and Army National Guard units from Rhode Island, New York, and Connecticut.

Civilian organizations using the training areas during TY 2021 included BAE Systems, the Falmouth Police Department, the Massachusetts Environmental Police, Massachusetts Institute of Technology-Lincoln Lab, Systems & Technology Research, the Department of Defense's Defense Innovation Unit, and environmental remediation and restoration contractors.

TABLE 2-3 TRAINING AREA USE - TY 2021

Location	Training Days	Personnel		Vehicles (Wheeled) #	Vehicles (Tracked) #
		Military	Civilian		
SVL-OBJ 1	60	2,059	56	0	0
SVL-OBJ 2	33	1,093	37	0	0
SVL-OBJ 3	14	737	0	0	0
SVL-OBJ 4	14	723	0	0	0
OP 1	17	435	0	0	0
OP 10	9	300	0	0	0
OP 11	8	285	0	0	0
BP 2	61	489	222	0	0
BP 6	14	357	0	0	0
BP 7	19	1,100	0	0	0
BP 8	21	408	24	0	0
BP 12	4	240	0	0	0
BP 14	27	390	0	0	0
BP 20	15	1,290	0	0	0
BP 24	26	1,539	0	0	0
BP 27	16	1,490	0	0	0
NBC 1	2	56	0	0	0
Training Roads	54	4,690	0	0	0
A 1	26	1,979	0	0	0
A 2	30	2,087	0	0	0
A 3	40	2,398	0	0	0
A 4	46	2,661	0	0	0
A 5	37	1,782	0	0	0
A 6	25	1,856	0	0	0
B 7	35	1,216	0	0	0
B 9	2	20	0	0	0
B 10	21	850	0	0	0
B 11	25	870	0	0	0

TABLE 2-3 TRAINING AREA USE - TY 2021, cont'd

Location	Training Days	Personnel		Vehicles (Wheeled) #	Vehicles (Tracked) #
		Military	Civilian		
B 12	15	1,125	0	0	0
BA 1	25	934	0	0	0
BA 3	47	3,539	0	0	0
BA 4	29	975	0	0	0
BA 5	13	963	0	0	0
BA 6	20	1,899	0	0	0
BA 7	38	2,669	0	36	0
C 13	36	3,641	0	0	0
C 14	55	3,100	0	0	0
C 15	56	3,095	0	0	0
C 16	43	2,376	0	0	0
Wheelock Hill	14	1,051	0	0	0
Land Nav 1	28	1,301	0	0	0
Land Nav 2	9	387	0	0	0
Land Nav 3	17	655	0	0	0
Land Nav 4 Alpha	9	344	27	0	0
Land Nav 4 Bravo	9	489	27	0	0
Land Nav 4 Charlie	11	381	27	0	0
Dig Site 1	13	1,007	0	0	0
Dig Site 2	20	1,810	0	0	0
Dig Site 3	14	850	0	0	0
Landing Zones	55	383	82	0	0
Total	1,277	66,374	502	36	0

TABLE 2-4 TRAINING AREA USE HISTORY

Training Year	Training Days/Events	Personnel		Vehicles (Wheeled)	Vehicles (Tracked)
		Military	Civilian		
TY 2021	1,277	66,374	502	36	0
TY 2020	898	59,994	294	110	0
TY 2019	702	49,716	1,920	618	0
TY 2018	893	69,652	238	530	12
TY 2017	688	42,478	1,344	1,244	12
TY 2016	551	24,344	1,858	2,805	0
TY 2015	681	33,219	1,909	2,198	0
TY 2014	642	39,137	370	4,129	0
TY 2013	247	11,164	181	1,484	7
TY 2012	232	13,532	122	2,037	5
TOTAL	6,811	409,610	8,738	15,191	36

2.8.2 Vehicle Use, Fueling and Maintenance

Vehicle use in the training areas during TY 2021 was 36 wheeled vehicles. No tracked vehicles were used. These numbers do not include vehicles from the Impact Area Groundwater Study Program (IAGWSP) program and contractors. Pumping fuel in the Training Area/Reserve has been prohibited by the EPSs since 2002. Currently, the fuel point and the secondary containment pads in the Tactical Training Base (TTB) area represent the designated location for units to refuel and park and store tanker trucks at Camp Edwards. Several exemptions to the EPS 15.3.3, Fuel Management, have been granted to the MAARNG by the EMC Environmental Officer to refuel in the Training Area/Reserve for training events and restoration work. Refueling activities in the Training Area/Reserve during these exemptions were all completed successfully.

The military does not conduct scheduled vehicle maintenance in the training areas. Personnel in the field are authorized only to check fluid levels, add small amounts, and repair flat tires or track sections that separate during training. Major repairs and other maintenance activities and training occur at the Unit Training Equipment Site (UTES) facility located in the Cantonment Area of Camp Edwards. The UTES facility is a vehicle and motor pool area; the Massachusetts National Guard has also designated the area as a Satellite Accumulation Point to store hazardous waste.

2.8.3 Training Support Areas (Simulators, Cantonment Area)

There are separate facilities and equipment that can simulate live military training; these are grouped under the Training Support Area (TSA). The majority of the training activities associated with these facilities are conducted in the Cantonment Area of Camp Edwards.

Table 2-5 presents the total number of training days/events and personnel that used each TSA during TY 2021. Overall historical use of the TSA for the past 10 training years is included in Table 2-6. Figure 2-8 shows TSA locations in the Cantonment Area. Because unit commanders maximize training time by rotating personnel through several different events or exercises in a given training cycle, this again presents an inflated figure for training days compared to calendar days. For example, the Cape Cod Police Academy Cadets and Cadre are counted as using the facility and areas on a daily basis.

Civilian organizations using the TSA in the Cantonment Area of Camp Edwards during TY 2021 included Allied Universal Security, Barnstable County Sheriff's Department, Brookline SRT, Cape Cod Police Academy, Cape Cod Regional Law Enforcement Council SWAT Team, Civil Air Patrol, Falmouth Police Department, FBI Boston, Leominster High School, the Massachusetts Environmental Police, Massachusetts Maritime Academy, the Massachusetts State Police, the Red Cross-Southeastern Massachusetts, the Sea Cadets, the South Eastern Massachusetts Law Enforcement Council SWAT team, the United States Geological Survey, and the Massachusetts National Guard Family Support Group.

TABLE 2-5 TRAINING SUPPORT AREA USE - TY 2021

Training Support Area	Training Days/Events	Personnel	
		Military	Civilian
1000 Training Area	8	960	0
1100 Training Area (Drivers Tng)	45	6,625	0
3400 Training Area/Rail Load Ramp	8	960	0
3500 Training Area	16	1,485	0
ACFT Running Track	35	3,434	0
Asymmetric Threat Classroom	8	40	0

TABLE 2-5 TRAINING SUPPORT AREA USE - TY 2021, Cont'd

Training Support Area	Training Days/Events	Personnel	
		Military	Civilian
Battle Simulation Ctr - Bldg. 1206	108	6,013	935
Battle Simulation Ctr - Rear Offices	60	2,440	0
Battle Simulation - Bldg. 1213, 1st Floor	57	1,595	600
Battle Simulation - Bldg. 1213, 2nd Floor	66	2,090	600
Battle Simulation - TOC Pads	24	1,372	0
Bldg. 3499 - IWQ	31	1,387	20
Call for Fire Trainer II 1:30	108	2,353	0
VBS3 Classroom - Bldg. 3494	51	833	0
Connery Field	33	3,342	0
Counter IED Visual Indicator Lane	16	547	0
Counter IED Search House (HME)/Site Exploitation	15	500	0
Engagement Skill Trainer 2000 - A	180	2,588	64
Engagement Skill Trainer 2000 - B	244	7,884	24
Engagement Skill Trainer 2000 - C	202	7,380	0
1243-High Risk Entry Facility-Control	32	220	772
1244-High Risk Entry Facility	32	220	772
Lee Field	1	300	0
MRAP	43	1,193	0
ODS - Operator Driving System	4	9	0
Shaw Field	12	2,166	0
Unstabilized Gunnery	4	27	0
Vault 1 - TSC	122	716	0
Vault 2 - TSC	260	731	0
Vault 3 - TSC	158	1,016	0
Virtual Convoy Opns Trainer #98 (VCOT - TSC)	27	261	0
Weapons Cleaning - Bldg. 3498	76	1,739	0
Welcome Center	91	2,399	302
YD Memorial Park	8	805	300
3600LZ - TTb	44	2,802	0
Obstacle Course	29	1,057	365
Calero Mobile MOUT	31	442	326
Kelley TTb	83	14,559	0
Leadership Reaction Course	37	1,196	225
Rappel Tower 1	4	239	0
Rappel Tower 2	2	30	0
Structural Collapse Site	2	90	0
Mobile Distance Learning Classroom	67	8,010	0
TY 2021 Total	2,484	94,055	5,305

TABLE 2-6 TRAINING SUPPORT AREA USE HISTORY

Training Year	Training Days/Events	Personnel		
		Military	Civilian	Total
TY 2021	2,484	94,055	5,305	99,306
TY 2020	1,931	71,586	5,833	77,419
TY 2019	1,554	39,888	10,223	51,665
TY 2018	1,061	39,619	4,285	43,904
TY 2017	1,299	96,783	1,150	97,933
TY 2016	1,224	50,463	282	50,745
TY 2015	1,313	73,678	627	75,618
TY 2014	1,132	77,516	1,541	79,057
TY 2013	742	42,654	1,404	44,058
TY 2012	824	63,210	691	63,901
TOTAL	13,564	649,452	31,341	683,606

2.9 OFF-SITE TRAINING

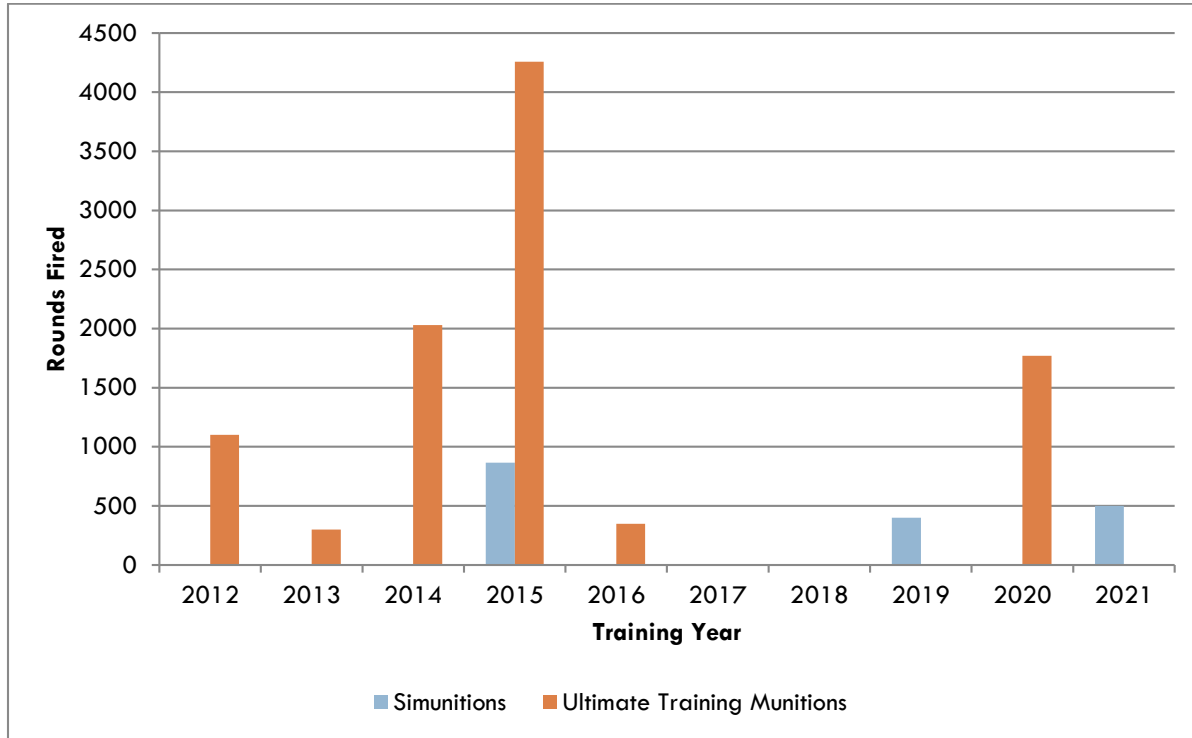
During TY 2021, the MAARNG had 77 units conduct their annual two-week training cycle. Of these, 73 units trained in Massachusetts, 47 of which trained solely at Camp Edwards (approximately 1,738 Soldiers). Two units trained in New Jersey, one unit trained in Montana, and one unit trained in Idaho. Eight units were mobilized and deployed in support of contingency operations; five units deployed overseas, and three units deployed to the continental United States.

The total number of Massachusetts soldiers trained during annual training for TY 2021 was 4,047 out of 6,068. Twenty-two units conducted year-round annual training consisting of 1,570 Soldiers, while 1,008 served on Title 32 orders for the Covid-19 and National Capitol Region response in lieu of annual training. The number of MAARNG soldiers that completed a two-week annual training cycle by general geographical locations is: 3,808 in Massachusetts and 239 in other states.

2.10 SIMULATED MUNITIONS

The MAARNG uses two types of simulated munitions at Camp Edwards: an Ultimate Training Munitions (UTM) Man Marker Round and a Simunitions FX Marking Round. The EMC required that the Annual Report include steps taken by the National Guard and progress associated with converting to the use of lead-free primer in simulated munitions. The Massachusetts National Guard monitors the activities of the U.S. Army Environmental Command in its efforts working with private industry development of alternate munitions; currently no new information has been provided. Simulated munitions are best used in concert with other simulators to be effective for most units; therefore, their effective training use is currently limited. Graph 2-6 provides the number of UTM and Simunitions FX Marking Rounds fired in the Training Area/Reserve since 2012.

Graph 2-6 Simulated Munitions Use



2.11 PYROTECHNICS

The M116A1 Hand Grenade Simulator was approved for use at Camp Edwards in March 2010. Thirty were used in the Training Area/Reserve during TY 2021. Graph 2-7 shows the number used each training year since TY 2012. M116A1 hand grenade simulator use increased because the MAARNG has been conducting more collective training versus individual unit training. The M116A1 is used primarily during collective unit training and is used to simulate battlefield conditions during training events. Due to the MAARNG's deployment to Washington D.C. in January 2021, training was canceled in the month of August due to funding issues with the deployment. Pyrotechnic use was lower during TY 2021.

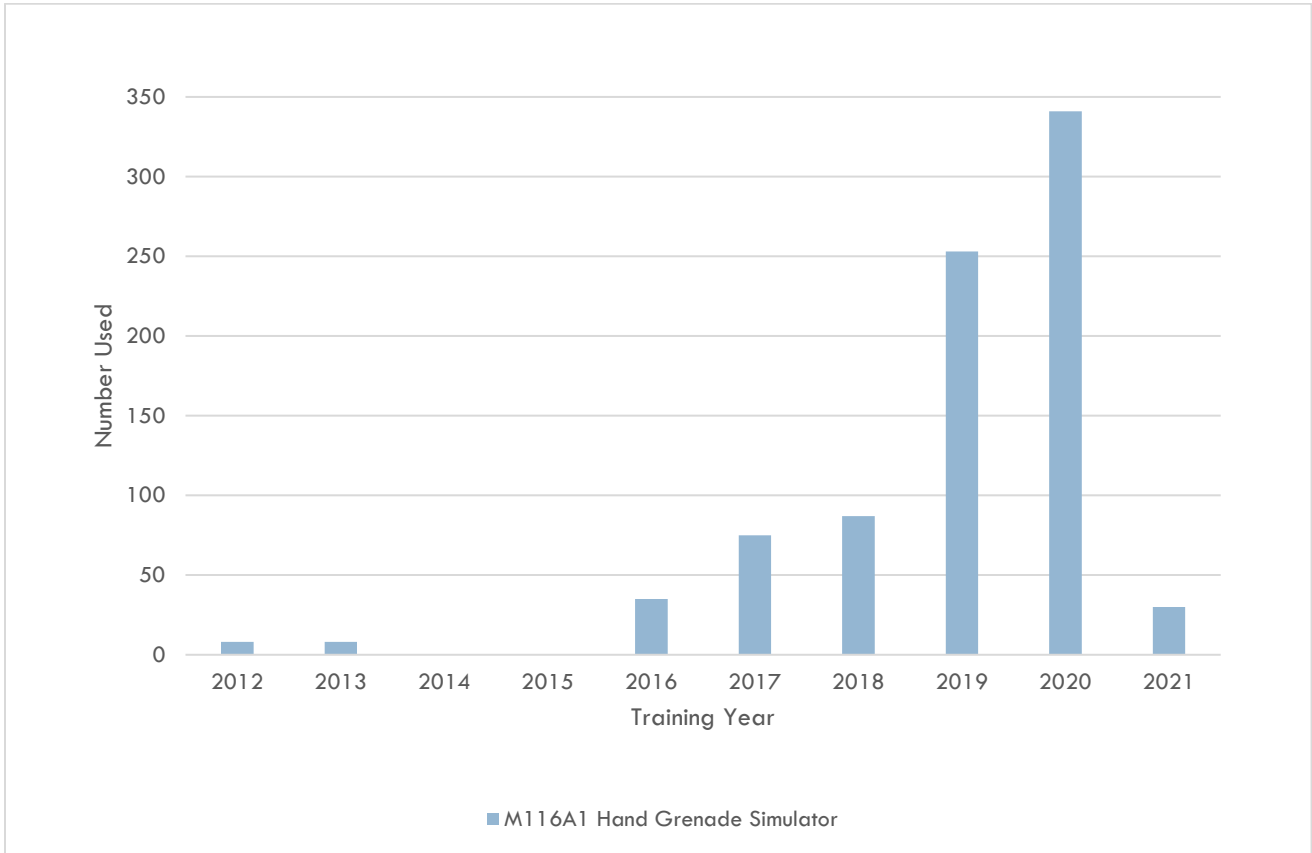
2.12 M69 HAND GRENADE SIMULATOR

In 2013, EPA Region 1 and the EMC approved the use of the M69 Hand Grenade Simulator on Camp Edwards.

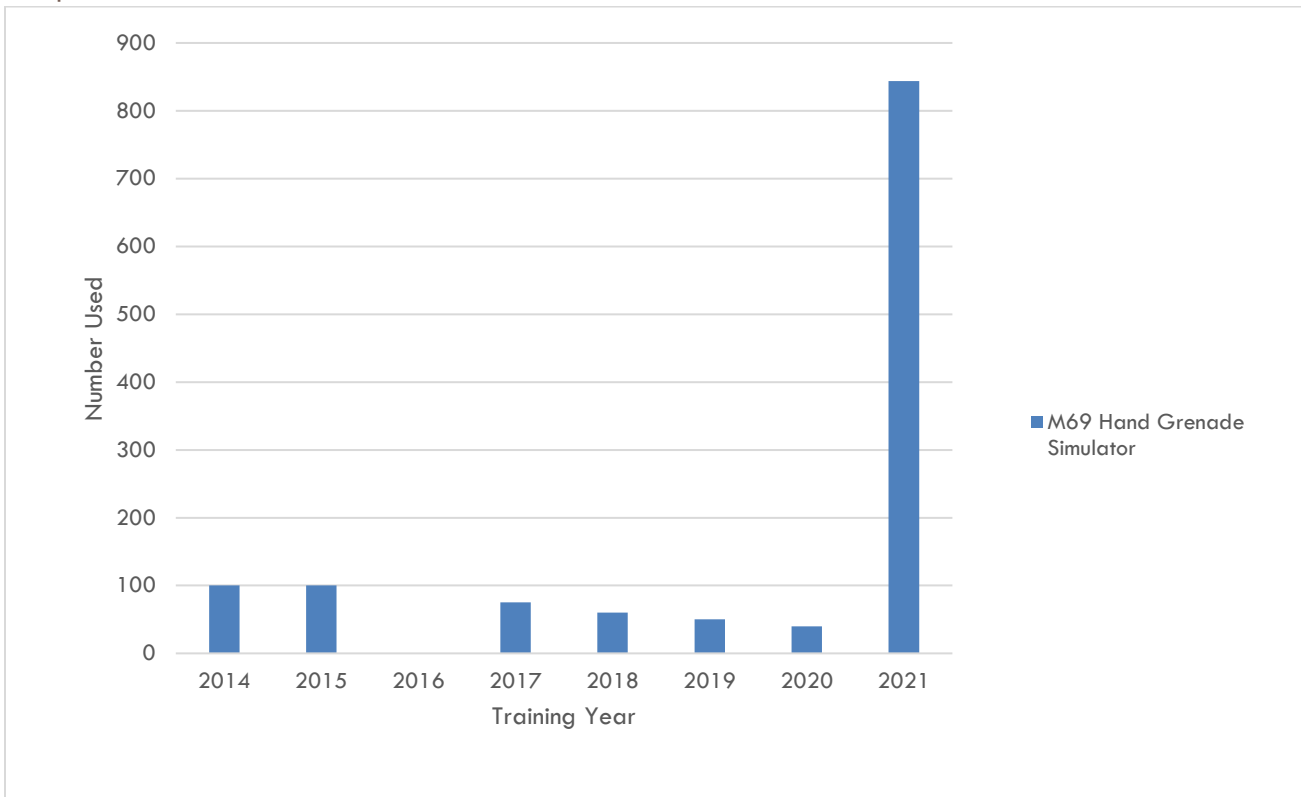
The M69 provides realistic training and familiarizes soldiers with the functioning of a fragmentation hand grenade. The average Soldier can throw the M69 approximately 40 meters (131 feet). After a delay of four to five seconds, the M69 emits a small puff of white smoke and makes a popping noise. The grenade bodies are reused repeatedly by replacing the fuse assembly.

Camp Edwards developed a Standard Operating Procedure and Course Management Plan for the M69 Hand Grenade Simulator, approved by the EMC in 2014. The plan allows for maximum effective use of the M69 Hand Grenade Simulator with the M288 Fuse in the Camp Edwards training areas and on the Hand Grenade Qualification Course while abiding by training and environmental guidelines. Use of the M69 Hand Grenade Simulator began in September 2014. Eight-hundred-forty-four were used in the Training Area/Reserve in TY 2021. Graph 2-8 shows the number of M69 Hand Grenade Simulators used since TY 2014. M69 Hand Grenade Simulator use shows an increase during TY 2021. The nature of required M69 grenade training is cyclical; however, if there is a collective training event, the usage numbers will go up.

Graph 2-7 M116A1 Hand Grenade Simulator Use



Graph 2-8 M69 Hand Grenade Simulator Use



2.13 SOLDIER VALIDATION LANE

The SVL uses conex-like shipping containers as training aids, which can be reconfigured to mimic small villages and used for Improvised Explosive Device (IED) training. The containers are located in open or previously cleared, historically used training areas including training and bivouac sites within the Training Area. The ability to periodically reconfigure the portable training aids within the Training Area will critically enhance the ability to adapt scenarios to the most current combat situations, ultimately helping to save the lives of soldiers on the battlefield.

Four SVL locations (called objectives) were used during TY 2021 to meet military training needs: Objective 1 in Training Area A-4; Objective 2 in Training Area BA 4; Objective 3 in Training Area B 11, and Objective 4 in Training Area C-14. Graph 2-9 shows the use of all four SVL Objectives since TY 2012. The locations of the SVL Objectives are shown in Figure 2-9.

The Natural Heritage and Endangered Species Program (NHESP) requires a yearly monitoring report be submitted documenting the locations and numbers of containers and the approximate dates of placement within these locations, as well as documenting any cutting of trees or leveling of sites that were required for container placement. The Soldier Validation Lane Annual Monitoring Report for TY 2021 is in Appendix C.

Graph 2-9 Soldier Validation Lane Use

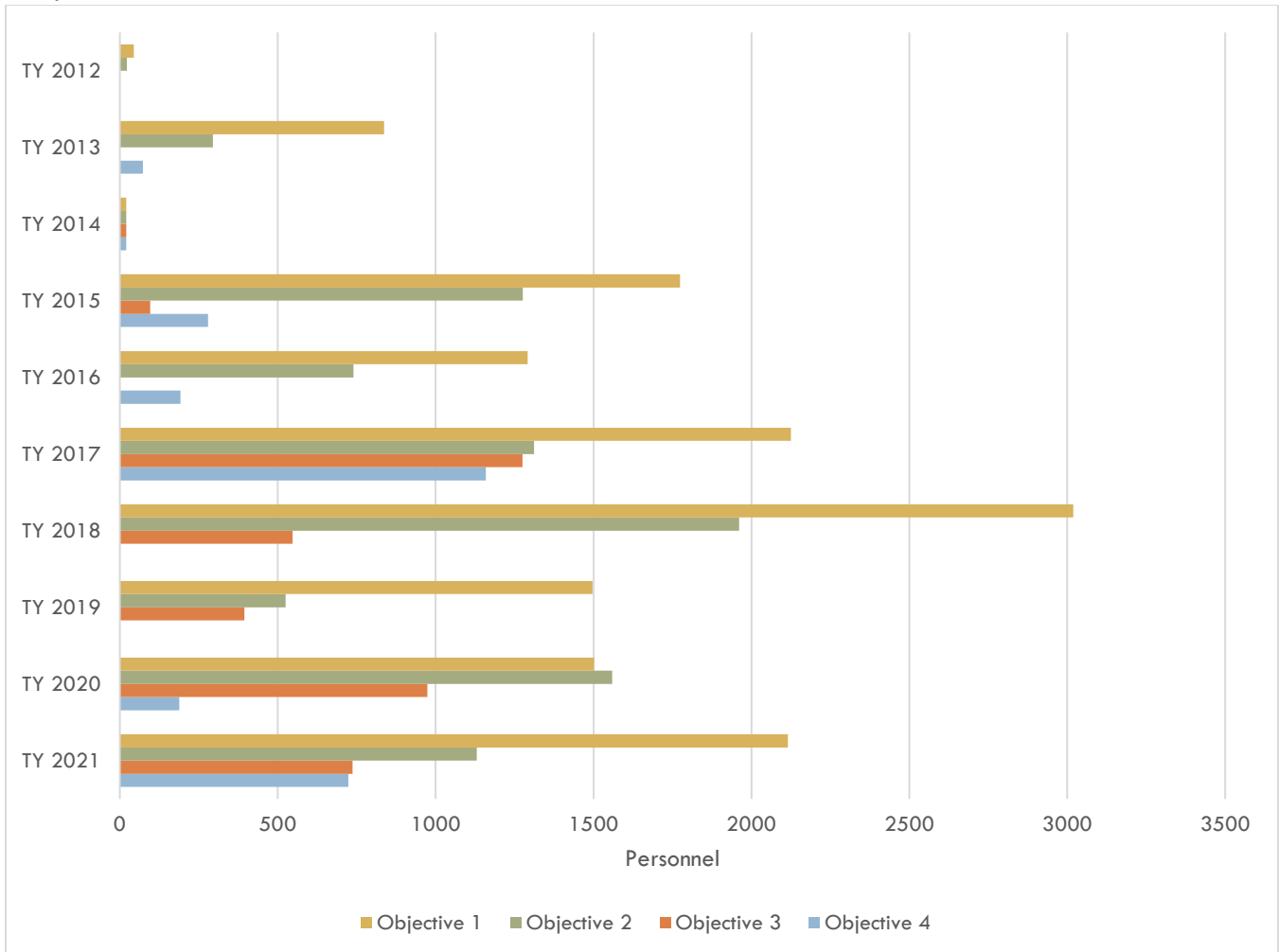
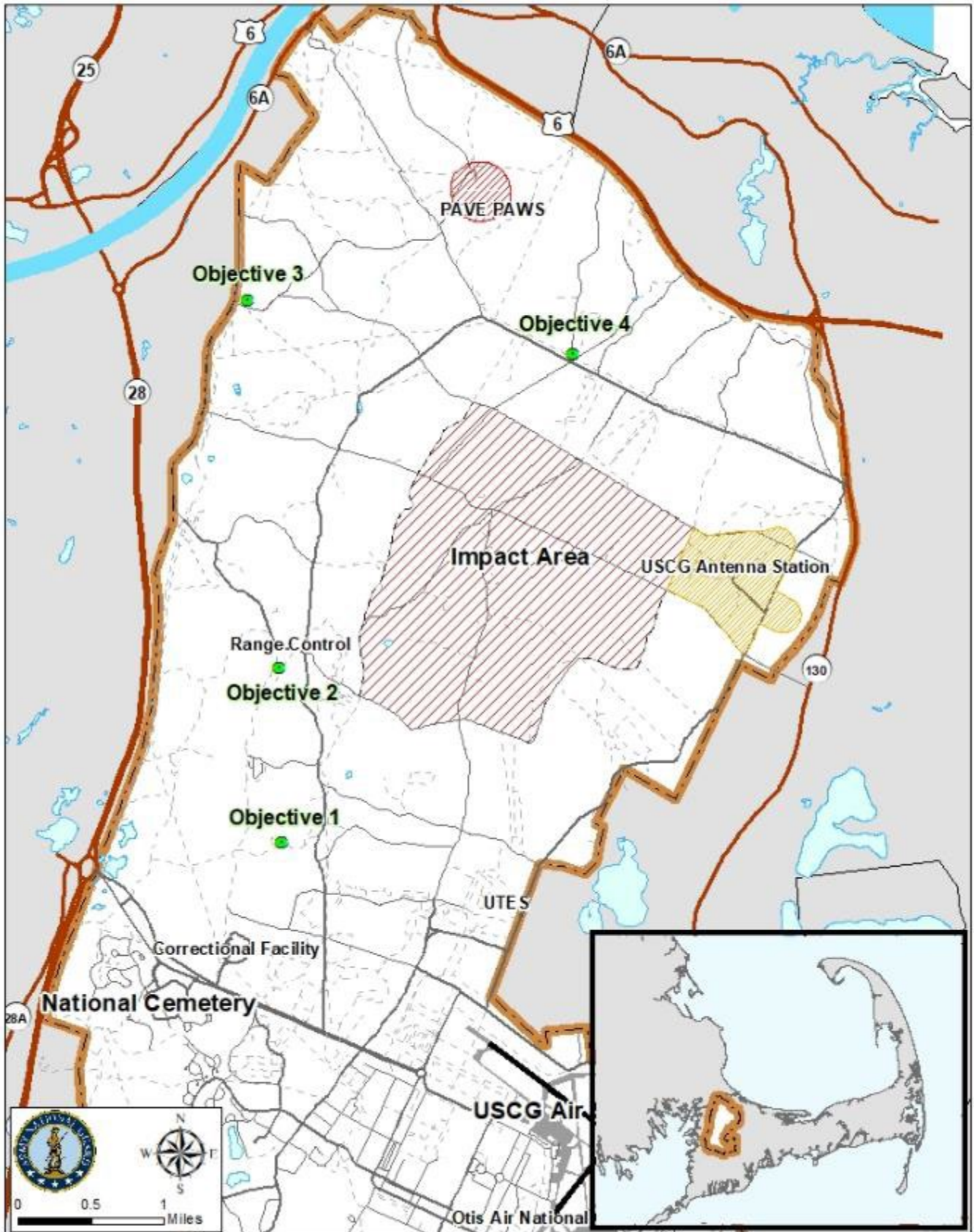


Figure 2-9 SVL Objective Locations



2.1.4 MULTI-PURPOSE MACHINE GUN RANGE

During TY 2015, the MAARNG's MILCON (Military Construction) project submission to construct a Multi-Purpose Machine Gun Range (MPMG) in 2020 on Camp Edwards at the current KD Range was funded by Congress. An MPMG is where soldiers train and qualify with automatic weapons. KD Range is a 600-yard Known Distance Range that is currently divided into two subparts with two distinct firing line/target configurations and training uses.

The approximately \$11.5 million project consists of \$9.7 for range construction and \$1.8 million for targetry. Environmental contracting and review of the project began in May 2018 and includes review under both the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA).

As part of the preliminary planning process, Camp Edwards conducted a test fire at KD Range on August 14, 2015, to simulate noise from the proposed MPMG range. The results of the test fire showed noise levels did not exceed MassDEP levels for nuisance noise and met the Army's criteria for considering a range in this area. Other surveys included an Archeological Survey in 2016 (no "finds" reported); Flora/Fauna Planning/Impact Assessment Surveys; Federal species: Bats surveyed in 2015 and 2016 (project area); Frosted elfin surveyed in 2017, and the Rusty-patched bumble bee, which was surveyed in 2017; State species: Eastern Whip-poor-will surveyed annually, including adjacent to project area; updated base-wide Moth survey, and then under the Migratory Bird Treaty Act, base-wide annual bird monitoring including in and near the project area.

Over the past six years, the MAARNG has coordinated with multiple state and Federal agencies including DFW's NHESP to ensure that adverse impacts to natural resources (including state-listed rare species) were avoided or mitigated.

For the MEPA process, a Notice of Project Change was filed in February 2020 with a 30-day public comment period. The Secretary of the Executive Office of Energy and Environmental Affairs determined that a Supplemental Environmental Impact Report (SEIR) should be completed. The MAARNG submitted the SEIR on June 11, 2020, with a 30-day comment period. The MAARNG received a certificate signed by the Secretary on July 17, 2020, which determined the SEIR submitted for the project adequately and properly complies with MEPA and its implementing regulations.

For the NEPA process, the Environmental Assessment was completed in August 2020 and a 30-day public comment period was held from August 8, 2020 to September 7, 2020. Approximately 367 comment letters, with approximately 917 comments and questions (many same statements and questions), were received from state and local agencies, environmental groups, and members of the public. The primary concerns from these comment letters were: why is the range needed; will the range cause increased traffic; will the range cause noise issues; was habitat, rare species and carbon sequestration considered; and will the range impact groundwater. In April 2021, the MAARNG provided responses to those comments in the "*Public Comment Summary Report for the Multi-Purpose Machine Gun Range at the Known Distance Range Environmental Assessment.*" After comprehensive review of the project, on April 30, 2021, National Guard Bureau determined the Environmental Assessment met the "Finding of No Significant Impact." The Public Comment Summary Report and the "Finding of No Significant Impact" are both available on the publications page of the E&RC's website:

<https://www.massnationalguard.org/ERC/publications.htm>.

In August 2021, the EPA elected to conduct a Sole Source Aquifer review of the proposed MPMG range. EPA is evaluating information related to the project and plans to release a draft determination in Spring 2022 to include opportunity for public comment and a public hearing.

In addition to environmental review under MEPA and NEPA, the MAARNG must receive the EMC's approval for both the MPMG range design and its OMMMP.

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SECTION 3

ENVIRONMENTAL PROGRAM MANAGEMENT

3.0 INTRODUCTION

Chapter 47 of the Acts of 2002 requires the Annual Report to contain information describing the range of resource management activities conducted by the MAARNG in the Training Area/Reserve and to report on activities associated with the EPSs for the Training Area/Reserve. Sections 3.1 through 3.16 include information for each EPS where there were associated activities. Section 3.17 provides similar information for the generic Cultural Resources EPS that also applies to MAARNG activities in the Training Area/Reserve. In addition to meeting this requirement, Section 3 provides information on required mitigation measures undertaken by the MAARNG and information on any noncompliance with the EPSs or other laws and/or regulations.

Chapter 47 of the Acts of 2002 also requires the Annual Report to describe long-term trends in the major areas of resource management and activities. Data is provided in this report back through TY 2012, when available, or longer when appropriate to illustrate long-term trends. Additional information on environmental management activities performed in the Training Area/Reserve can be found on the Publications page of the E&RC web site at: <https://www.massnationalguard.org/ERC/publications.htm>

During TY 2021, seven Records of Environmental Consideration (RECs) were reviewed for natural and cultural resources for proposed actions in the Training Area/Reserve. RECs are an internal environmental review document based on NEPA. The RECs reviewed were for fence and gate repair projects, trail, firebreak and road maintenance, and habitat and training area restoration projects.

Appendix D identifies the relevant federal, state, DoD, and U.S. Army environmental regulations governing MAARNG activities in the Training Area/Reserve.

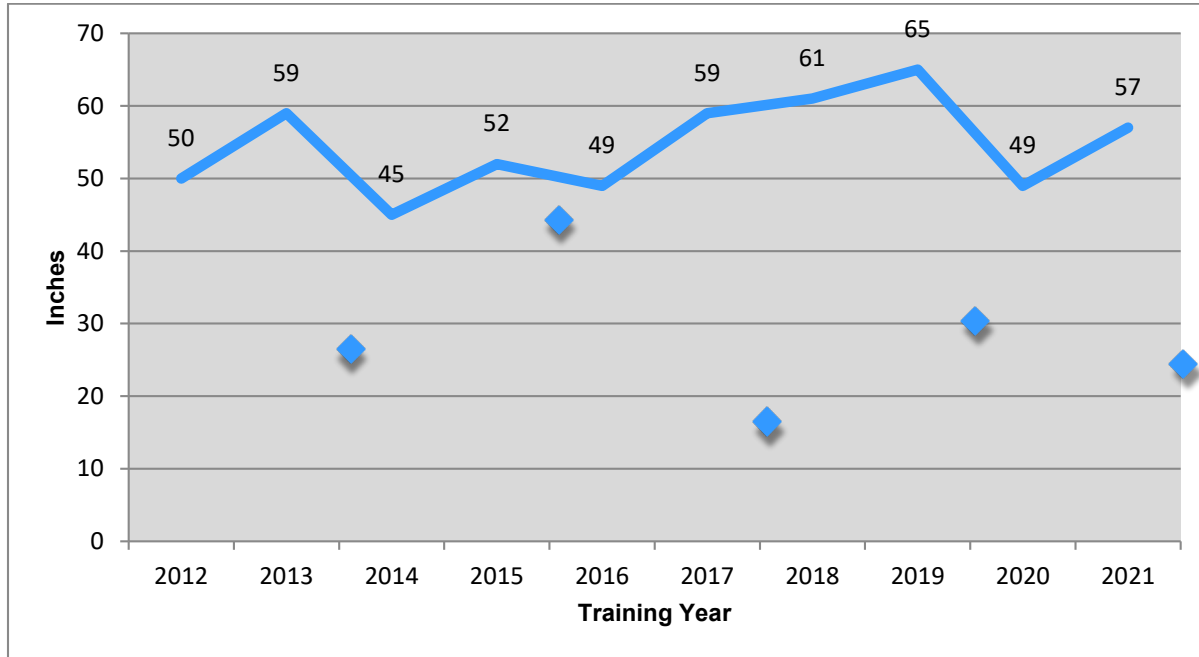
3.1 GROUNDWATER RESOURCES MANAGEMENT

The MAARNG complied with the Groundwater Environmental Performance Standard during TY 2021. Travel in Zone 1 Wellhead Protection Areas was limited to foot travel or to vehicles required for construction, operation, or maintenance of wells. The Upper Cape Water Supply Cooperative continues to have fencing around its three water supply wells and appropriate signage around the wells' 400-foot radius in the Training Area/Reserve. Both the Upper Cape Water Supply Cooperative and the 102nd Intelligence Wing operated within the water withdrawal limits of their respective MassDEP issued permit or registration. The Bourne Water District has a well in the Training Area/Reserve that became operational in TY 2014 as part of its overall water supply system. Groundwater quality reports for the Upper Cape Water Supply Cooperative, the 102nd Intelligence Wing, and the Bourne Water District are available in Appendix E. The JBCC Groundwater Protection Policy is available on the Publications page of the E&RC website at: <https://www.massnationalguard.org/ERC/>.

3.1.1 Precipitation

Precipitation information included in the Annual Report is obtained from the Northeast Regional Climate Center at Cornell University in Ithaca, New York, based on recordings from a station in East Sandwich, Massachusetts. That station reported a total of 56.79 inches of precipitation for TY 2021 (Graph 3-1).

Graph 3-1 Precipitation Recorded



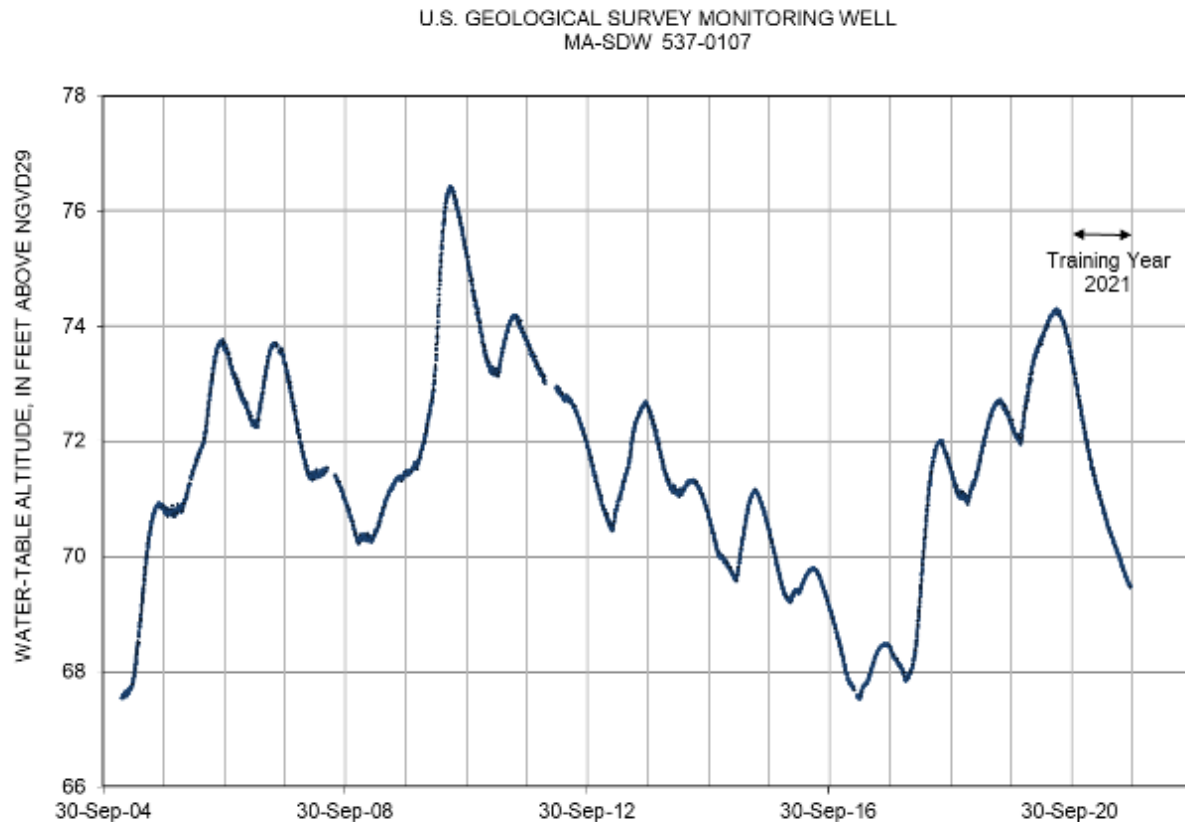
3.1.2 Groundwater Level

During the early part of TY 2005, the U.S. Geological Survey (USGS) installed a monitoring well (USGS number MA-SDW 537-0107) on Camp Edwards to record the altitude of the water table in the Cape Cod aquifer. The well is located west of Greenway Road on the J-1 Range of the Reserve and is about 107 feet deep. A recording device in the well electronically transmits a continuous record of the water level near the top of the water-table mound that forms the Sagamore groundwater-flow system on western Cape Cod. The well's location is shown in Figure 3-1 at the end of this section.

The pattern of water-level changes observed at the monitoring well is caused by natural seasonal and year-to-year variations in recharge from precipitation. Graph 3-2 shows the trend in the water-table altitude at the USGS monitoring well for the 2005-2021 training years. The water-table altitude declined about 4.1 feet during TY 2021 (October 1, 2020, to September 30, 2021). Similar declining water levels were observed this year elsewhere on Cape Cod and in southeastern Massachusetts (<https://www.usgs.gov/centers/new-england-water/data-tools>).

The IAGWSP of the Army National Guard provides part of the funding for the operation of the monitoring well because the water-level data are used in that program. The well became operational in January 2005. Information about the well and the observed groundwater levels is publicly available on the following USGS website: <http://groundwaterwatch.usgs.gov/AWLSites.asp?S=414159070310501&ncd=>

Graph 3-2 U.S. Geological Survey Monitoring Well



3.1.3 Water Supply Systems

Upper Cape Regional Water Supply Cooperative

The Upper Cape Regional Water Supply Cooperative provided 398,989,000 gallons of water (a daily average of 1,093,121) from its three wells to the six public water supply systems it services during TY 2021: Bourne Water District, Mashpee Water District, Sandwich Water District, the Town of Falmouth water system, the Barnstable County Correctional Facility, and the Otis ANGB water supply system. The Cooperative is authorized to withdraw up to 3.0 million gallons per day. Graph 3-3 shows the daily average pumping rate of the Cooperative since TY 2012. The locations of the Cooperative's three water supply wells (WS-1, WS-2, WS-3) and its seven sentry monitoring wells (C-1 through C-7) are shown in Figure 1 in Appendix E. The Cooperative's 2021 Long Term Monitoring Sentry Well Sampling Results are available in Appendix E.

Otis ANGB Public Water Supply System

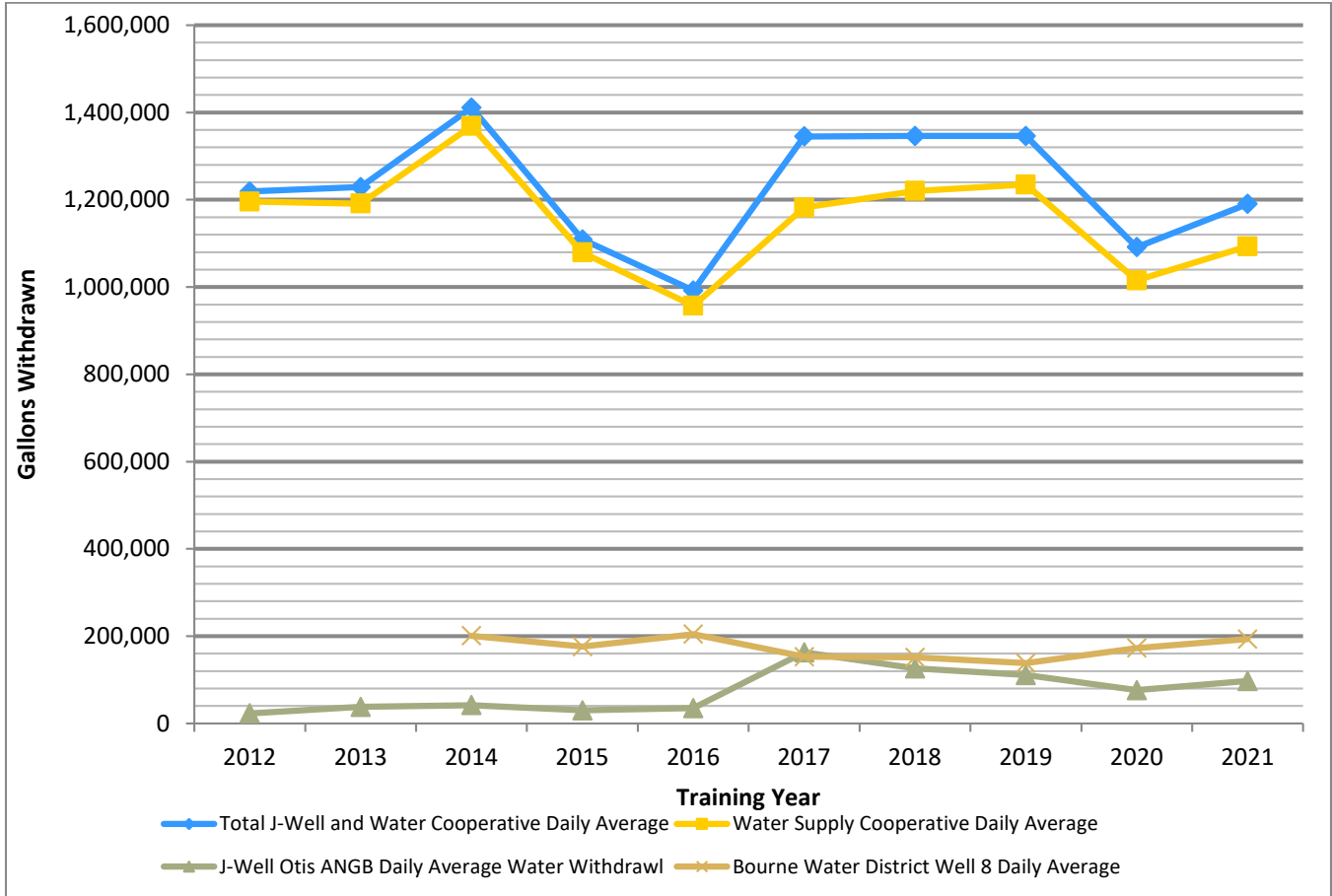
The Otis ANGB system pumped an average of 97,233 gallons of water per day and a total of 35,490,000 gallons of water from its well, known as J-Well (located in the Cantonment Area), during TY 2021. It also received 17,815,000 gallons from the Cooperative during TY 2021; a daily average of 48,808 gallons. Graph 3-3 shows the daily average pumping rate of the Otis system since TY 2012.

A copy of the calendar year 2020 Water Quality Report published by the 102nd Intelligence Wing in June 2021 is provided in Appendix E.

Bourne Water District Water Supply Well

Bourne Water District Well 8 became operational in May 2014. During TY 2021 a total of 70,538,600 gallons were pumped, with a daily average of 193,256 gallons pumped. Graph 3-3 shows the daily average pumping rate of Well 8 for TY 2014 through TY 2021. The well’s location is shown in Figure 3-1. A copy of the calendar year 2020 Bourne Water District’s Water Quality Report is provided in Appendix E.

Graph 3-3 Daily Water Withdrawal, J-Well and Water Cooperative



Note: Bourne Water District Well 8 began production on May 30, 2014.

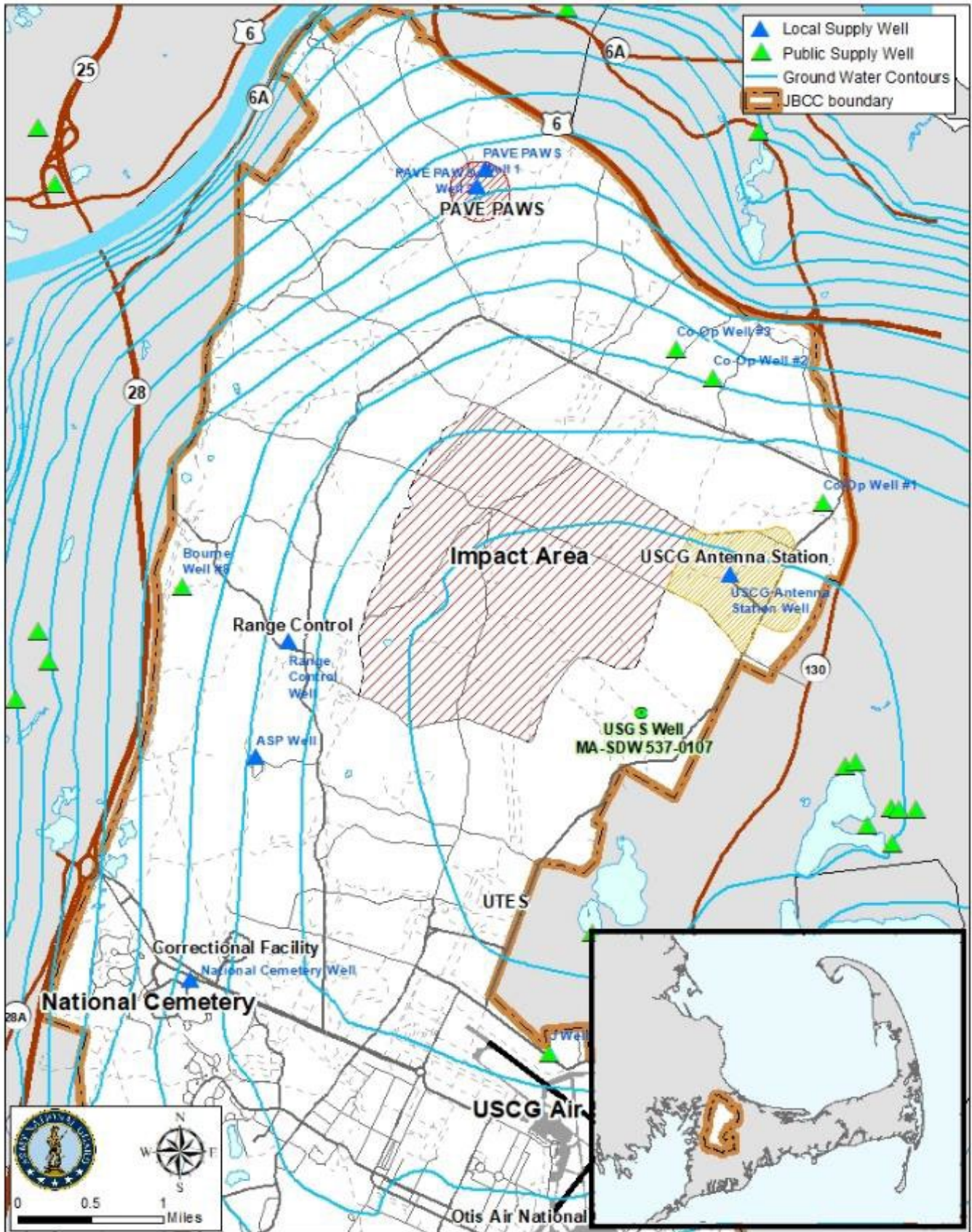
Other Water Wells

There are two water supply wells located within the boundary of the Training Area/Reserve, which are not subject to Chapter 47 of the Acts of 2002 and the EPSs. These are located at Cape Cod AFS (PWS# 4036008) and the USCG Communications Station. Further information on water supply wells is available on MassDEP’s website: <https://www.mass.gov/service-details/well-database>.

3.2 WETLANDS AND SURFACE WATER MANAGEMENT

The MAARNG did not take any actions during TY 2021 that resulted in the loss of any wetland resources or their 100-foot buffer areas. No new bivouac areas were created in the Training Area/Reserve during the year within 500 feet of any wetland and no land alteration activities were conducted by the MAARNG within 100 feet of a certified vernal pool during the year. Representatives of the E&RC routinely attended numerous coordination meetings held by various parties (e.g., Camp Edwards, IAGWSP) to stay abreast of the activities in the Training Area/Reserve and to ensure appropriate coordination occurred and impacts were avoided or permitted.

Figure 3-1 Well Locations



Three dirt road puddles, in the northwest training area, one on Jefferson Road and two on Orchard Road, which had been creating conservation concerns by attracting breeding amphibians and box turtles, were filled in January 2021. Due to the vernal pool function that the puddles were providing, MAARNG submitted a letter to the Town of Bourne Conservation Agent to notify of the proposed work and request an opinion on wetland jurisdiction. The Conservation Agent responded that the Conservation Department would not apply wetland jurisdiction based on the training area road's "important governmental purpose" for a state agency. As described in previous reports and SAC/CAC/EMC meetings, the majority of roadway puddles present a population sink that is attractive to a variety of species but does not allow for successful amphibian reproduction and presents a direct mortality risk.

In TY 2021, MAARNG amended the 2018-issued Conservation and Management Plan (CMP) for Agassiz's Clam Shrimp (*Eulimnadia agassizii*), a state listed endangered species that is documented primarily in roadway puddles. The amendment provides a long-term process that allows for necessary road maintenance and repair of road puddles in the training area while preserving suitable puddle habitat for clam shrimp populations. Details on the CMP amendment and mitigation and monitoring carried out during TY 2021 are in Section 3.3.4 and Appendix F.

In TY 2020, two significant efforts were made to help further wetlands priorities on base. First, Conservation Agents from the towns of Bourne and Sandwich both participated in a Stakeholder Task Force meeting for the development of the Integrated Natural Resource Management Plan (INRMP) Update. This allowed for input from the town's wetland specialists on priorities for conservation projects on the base going forward. The INRMP was sent out for signatures in December 2020. The document is now final, with the final signature received on February 8, 2021. In addition, in TY 2020, the Natural Resources Office hired a Conservation Biologist to focus on wetlands and vegetation priorities. Both of these 2020 efforts facilitated increased planning and focus on wetland and vernal pool resources in TY 2021, including review and coordination with the EMC and Air Force Civil Engineering Center (AFCEC) regarding remediation and restoration planning for the Otis Rod and Gun Club site.

3.2.1 Vernal Pools

In TY 2021, the Natural Resources Office contracted SWCA Environmental Consultants to locate sites in the training area, using GIS analysis and field verification, for vernal pool creation and to provide construction plans and specifications for a handful of locations. Budgeting for this project comes from the funds set aside in the event the Conservation Department had required mitigation in the form of vernal pool creation for the filling of the Jefferson and Orchard roads puddles. Mitigation was not needed, thus this project, in good faith, seeks to create habitat that is overall in short supply on the base. This contract does not include construction that would be carried out by MAARNG and would only be completed if the puddle locations are found not to interfere with the military mission. This project is in progress. A developing vernal pool wetland feature, created accidentally as a result of training use and ITAM restoration in TY 2020 in TA C-14, is providing habitat for vernal pool breeding amphibians. This wetland feature was monitored for vernal pool function and clam shrimp presence during TY 2021 and reflective Siebert stakes were placed along the perimeter to mark this sensitive area off-limits. No vernal pools were officially surveyed during TY 2021. This is intended to function similarly to the planned vernal pool creation, opportunistically identifying a feature providing a habitat benefit that can coexist adjacent to military training and created by training and training lands rehabilitation.

3.3 RARE SPECIES MANAGEMENT

The Natural Resources Office and their contractors observed and reported on floral and faunal species listed under the Massachusetts Endangered Species Act (MESA) on Camp Edwards in TY 2021. The office observed 16 species and is reporting the sightings to NHESP in early TY 2021 (Table 3-1). Three field technicians hired for TY 2021 were primarily involved in observing and reporting these rare floral and faunal species in the Training

Area/Reserve with supplementary observations from others. The Natural Resources Office is also reporting observations of “Tracking List” species to NHESP as a standard condition of scientific collection permits for reptiles and amphibians. Perhaps most notably two new listed species were identified by Natural Resources personnel with the documentation of Spring Ladies’-Tresses (*Spiranthes vernalis*) in the Cantonment grasslands and American Clam Shrimp (*Limnadia lenticularis*) documented in multiple road puddles in the Training Area/Reserve.

The Natural Resources Office formally and informally reviewed proposed military and civilian activities in the Training Area/Reserve to ensure that adverse impacts to natural resources (including state-listed endangered species) were avoided or mitigated. No projects required informal or formal consultation with the US Fish and Wildlife Service under Section 7 of the Endangered Species Act. Under MESA, consultation and coordination was primarily limited to ongoing project planning and support under the existing Conservation and Management Permits discussed in more detail in Appendix F. This included implementation and completion of the Tango Range redevelopment, implementation and completion of the Eversource switching station soil stockpile, and review and species protection planning for the proposed track and field (outside the Training Area/Reserve). Two natural resources and training lands habitat restoration projects were reviewed through the Forest Cutting Act process and approved by NHESP including a kettle hole frost bottom restoration in Training Area E-3 and an understory maintenance and grassland opening project in Training Area BA-3.

Multiple contracts were developed or continued in TY 2021 for surveying and managing rare species. Tetra Tech, a contractor for the MAARNG, manually vetted bat acoustic data from TY 2020, uploaded past data into the MAARNG bat acoustic database, performed a power analysis on all the acoustic data, and created a scope of work to analyze trends in bat data on base over the last seven years. The results of the power analysis will be used in Fiscal Year 23 for a contract to analyze the past data for spatial and temporal trends and occupancy analysis. The power analysis specifically will be used to guide the recommendations for future work that come from looking at the whole data set. Biodiversity Research Institute (BRI) was contracted to confirm identification of a bat roosting in a bunker on Knot Hollow Road in early February 2021. They identified the bat as a silver-haired bat (*Lasiurus noctivagans*), which is not a state-listed species. Federal biologists indicated that this is likely the first record of the species hibernating in New England. BRI is also going to vet past acoustic data calls to determine whether this species has been active on base or other nearby locations during the winter season. Their report will be completed in TY 2022.

See Section 3.3.5 for information on TY 2021 contracts and other in-house work regarding Eastern Box Turtles.

The Smithsonian Conservation Biology Institute received a DoD Legacy grant to conduct a status assessment of spotted turtles, a species under review for federal listing, at nine military installations. Camp Edwards, along with Camp Curtis Guild, was among the sites chosen. On Camp Edwards, the surveyors performed one demographic assessment, which entails trapping for 12 nights over three four-night (five day) survey periods, at a site spotted turtles have been found before. The surveyors also performed one rapid assessment (one four-night trapping event) at a site with unknown occupancy. Results from Camp Edwards and other military installations are being analyzed together to better inform best management practices for spotted turtles on military sites. The Natural Resources Office facilitated this effort through project coordination, technician help in the field, and the collection of blood samples by a veterinary student. The results and recommendations from this effort will be received in TY 2022.

See Section 3.3.1 for details on a contract regarding the state-listed plant *Triosteum perfoliatum*.

In Fiscal Year 2021, the Natural Resources Office took samples for snake fungal disease surveys when snakes were opportunistically discovered.

Although two field crew members were hired for the summer, both left early in either early or late summer to attend graduate school. This lack of field staff meant that some efforts could not be implemented. It also meant less staff in the field opportunistically observing rare species. The Natural Resources-ITAM office compensated for some of this lack of staff by extending a contract with Western EcoSystems Technology Inc. (WEST) to complete vegetation surveys for mitigation monitoring and by working with a volunteer to perform Monarch caterpillar surveys.

3.3.1 Rare Species Reporting

Table 3-1 identifies the rare species sightings reported to NHESP for the past five years (See Appendix G for sightings reported for the past 10 years). The fluctuation in numbers reported is attributed to a variety of factors, including but not limited to: the time and length of surveys, locations where surveys are conducted (the same locations are not necessarily visited each year), intensity of the surveys, the number and experience of summer field crew personnel, weather conditions during the times available for surveys, locations where soldiers may train during the training year, familiarity of individual soldiers and others utilizing the various training areas and training support areas on Camp Edwards with rare species, etc. With these limitations and the varied associated counting procedures and efforts, the numbers contained in Table 3-1 do not reflect changes or trends in populations. These are raw number counts that are reported to NHESP based on sightings.

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP

Quantities shown are not resulting of standardized surveys, and should not be interpreted as population trends

Common/Scientific Names	Fed Status ¹⁴	State Status	Individuals Reported				
			TY 2017	TY 2018	TY 2019	TY 2020	TY 2021
BIRDS							
Grasshopper Sparrow ¹³ (<i>Ammodramus savannarum</i>)	-	T	15	16	20	34	36
Northern Harrier ¹ (<i>Circus cyaneus</i>)	-	T	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper ¹³ (<i>Bartamia longicauda</i>)	-	E	8	7	12	6	2
Eastern Meadowlark ^{13,16} (<i>Sturnella magna</i>)	-	SC	3	2	7	14	17
Long-eared Owl ¹ (<i>Asio otus</i>)	-	SC	0	0	0	0	0
Vesper Sparrow (<i>Pooecetes gramineus</i>)	-	T	0	0	0	0	0
Whip-poor-will ² (<i>Antrastomus vociferous</i>)	-	SC	52	110	53	99	136
Bald Eagle ¹ (<i>Haliaeetus leucocephalus</i>)	-	SC	0	0	0	0	0

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP, cont'd

Quantities shown are not resulting of standardized surveys, and should not be interpreted as population trends

Common/Scientific Names	Fed Status ¹⁴	State Status	Individuals Reported				
			TY 2017	TY 2018	TY 2019	TY 2020	TY 2021
REPTILES and AMPHIBIANS							
Eastern Box Turtle (<i>Terrapene carolina carolina</i>)	-	SC	42	43	58	45	83
Eastern Hog-nosed Snake (<i>Heterodon platirhinos</i>)	-	SC	3	8	9	1	2
PLANTS							
Adder's Tongue Fern ^{4,6} (<i>Ophioglossum pusillum</i>)	-	T	247	0	25	646	N/A
Spring Ladies Tresses (<i>Spiranthes vernalis</i>)	-	T	0	0	0	0	3
Broad Tinker's Weed ^{5,6} (<i>Triosteum perfoliatum</i>)	-	E	127	0	200	6	N/A
American Arborvitae ⁹ (<i>Thuja occidentalis</i>)	-	E	N/A	N/A	N/A	N/A	N/A
BEEES							
Walsh's Anthophora ¹⁵ (<i>Anthophora walshii</i>)	-	E	5 (1)	0	32 (9)	4	N/A
BUTTERFLIES and MOTHS¹¹							
Buck Moth (<i>Hemileuca maia</i>)	-	SC	95	0	4	2	74
Pine Barrens Speranza (<i>Speranza exonerata</i>)	-	SC	13	0	0	0	0
Sandplain Euchlaena (<i>Euchlaena madusaria</i>)	-	SC	7	0	0	1	0
Heath Metarranthis (<i>Metarranthis pilosaria</i>)	-	SC	1	0	0	0	0
Melsheimer's Sack Bearer (<i>Cicinnus melsheimeri</i>)	-	T	0	0	0	7	0
Gerhard's Underwing (<i>Catocala herodias</i>)	-	SC	10	0	0	2	0
Pine Barrens Zale (<i>Zale lunifera</i>)	-	SC	8	0	0	0	0
Barrens Dagger Moth (<i>Acronicta albarufa</i>)	-	T	0	0	0	0	0

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP, cont'd

Quantities shown are not resulting of standardized surveys, and should not be interpreted as population trends

Common/Scientific Names	Individuals Reported						
	Fed Status ¹⁴	State Status	TY 2017	TY 2018	TY 2019	TY 2020	TY 2021
BUTTERFLIES and MOTHS¹¹							
Chain-dotted Geometer (<i>Cingilia catenaria</i>)	-	SC	0	0	1	0	0
Drunk Apamea (<i>Apamea inebriata</i>)	-	SC	0	0	0	0	0
Pink Sallow (<i>Psectraglaea carnosae</i>)	-	SC	5	0	0	0	0
Pink Streak (<i>Dargida rubripennis</i>)	-	T	0	0	0	3	1
Collared Cynia (<i>Cynia collaris</i>)	-	T	1	0	11	33	200
Coastal Heathland Cutworm (<i>Abagrotis benjamini</i>)	-	SC	1	0	0	0	0
Woolly Gray (<i>Lycia ypsilon</i>)	-	T	2	0	0	0	0
Water-willow Stem Borer (<i>Papaipema sulphurata</i>)	-	T	1	0	0	0	0
Waxed Sallow Moth (<i>Chaetoglaea cerata</i>)	-	SC	2	0	0	0	0
Frosted Elfin ¹² (<i>Callophrys irus</i>)	-	SC	5	5	TBD	25	57
Slender Clearwing Sphinx (<i>Hemaris gracilis</i>)	-	SC	0	0	0	5	3
CRUSTACEANS							
Agassiz's Clam Shrimp ¹⁰ (<i>Eulimnadia agassizii</i>)	-	E	6	38	9	3	5
American Clam Shrimp ^ (<i>Limnadia lenticularis</i>)	-	SC	0	0	0	0	3
MAMMALS							
Northern Long-Eared Bat ^{7,8} (<i>Myotis septentrionalis</i>)	T	E	2	1	3	1	TBD
Little Brown Bat ⁷ (<i>Myotis lucifugus</i>)	UR	E	4	2	6	2	TBD
Tricolored Bat ⁷ (<i>Perimyotis subflavus</i>)	UR	E	3	2	3	1	TBD

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP, cont'd

Quantities shown are not resulting of standardized surveys, and should not be interpreted as population trends

Common/Scientific Names	Fed Status ¹⁴	State Status	Individuals Reported				
			TY 2017	TY 2018	TY 2019	TY 2020	TY 2021
MAMMALS							
Eastern Small-Footed Bat ⁷ (<i>Myotis leibii</i>)	UR	E	0	0	1	1	TBD
<p>¹ NHESP is only accepting reports of nesting raptors, rather than opportunistic observations of individuals. Reports are provided as relevant, but common wintering birds or migrants are not individually tracked or reported (e.g., Northern Harrier).</p> <p>² As of TY 2016, quantities only reflect the results of annual survey routes during May, after totaling the minimum number (between two observers) heard at each site. In prior years, the number shown reflects the quantity reported to NHESP, which may include multiple survey windows and repeated counts. Due to Covid-19 concerns, 2020 routes were not run in duplicate, and the number represents the total number of individual birds heard calling throughout the routes.</p> <p>³ Comet and Spatterdock Darner are no longer on NHESP's rare species list. Also, Odonate surveys were suspended after TY 2015.</p> <p>⁴ Several known <i>Ophioglossum</i> sites could not be surveyed in TY 2016 due to a lack of cease-fire agreement with the off-base Monument Beach Shooting Club. 2019 numbers are likely under representative, as surveys occurred late in the season. In 2020 <i>Ophioglossum</i> was surveyed earlier in the year in order to get an accurate count.</p> <p>⁵ Actual 2019 numbers may be as few as 82, MAARNG staff is now studying the genetics of <i>Triosteum perfoliatum</i> and <i>T. aurantiacum</i> due to difficulty in accurately differentiating the two species. Once the genetics project is completed, 2020 numbers will be reported.</p> <p>⁶ In 2018, only sites with historic records and no recent records were surveyed, and this should not be interpreted as a loss of rare plants between 2017 and 2018.</p> <p>⁷ Acoustic monitoring collects "call sequence" data and the true number of individuals is unknown. Numbers in the table reflect the number of survey sites with acoustic detections confirmed through manual call vetting. Numbers are reported to NHESP, but not tracked by them due to current uncertainty in using acoustic identifications. TY 2020 data is still being processed, these numbers are to be determined at a later date (TBD).</p> <p>⁸ Number in parentheses is captured individuals trackable by NHESP due to species identification confirmation versus acoustic data.</p> <p>⁹ NHESP is not interested in tracking this population, as it is likely of anthropogenic origin (pers. comm. with State Botanist, Bob Wernerehl).</p> <p>¹⁰ Numbers represent only locations where species was found and ID confirmed by either NHESP Aquatic Ecologist or trained MAARNG staff.</p> <p>¹¹ Moths were extensively surveyed under contract with the Lloyd Center for the Environment between 2016 and 2017. There were no surveys in 2018, and MAARNG staff is not recording flight records of Barrens Buckmoth, as they are ubiquitous around the Training Area/Reserve. 2019 quantities represent individuals or groups of individuals (a group of Barrens Buckmoth caterpillars on a single leaf is counted as one, as are a pair of Unexpected Cynia caterpillars sharing the same butterflyweed plant).</p> <p>¹² MAARNG staff did not perform surveys for <i>Callophrys irus</i> in 2019, but facilitated USFWS surveys. Results are pending, but USFWS staff found Frosted Elfins across a wider area than was previously known.</p> <p>¹³ Grassland bird numbers represent individual territories observed in a given year rather than the total number of birds observed throughout repeated surveys as was reported in past years (prior to the TY 2019 SOTRR). Upland Sandpiper counts exclude known females, but include unknown birds. Also, the numbers reported in annual reports TY 2015 and earlier included birds found on the Coast Guard airfield, which is not reported by MAARNG Natural Resources. Due to these changes, past year quantities may be different from prior versions of Appendix F, but now reflect the population more accurately.</p> <p>¹⁴ "UR" indicates a species is currently under review for listing on the federal Endangered Species Act.</p> <p>¹⁵ MAARNG contracted a targeted survey for <i>Anthophora walshii</i> in 2019 after an exploratory bee survey in 2017. The first number represents the number of flying/foraging records, and in parentheses the records of nesting activity. Unconfirmed nests were not counted.</p> <p>¹⁶ Species added to MA Endangered Species List in TY 2020. Observation quantities included for prior years, but would not have been officially reported to NHESP.</p>							

Efforts are ongoing to collect rare species and management data in a way that allows for trends analysis that will better inform management decisions and meet the intent of Chapter 47 of the Acts of 2002. The data currently reported in the table are gross observations only and not interpretable for trends. State-listed species such as the Whip-poor-will lend themselves to data collection for trends analysis (annual point-count transects) and

cooperation with statewide or national efforts (Section 3.3.7). Likewise, grassland bird monitoring standardization will allow for long-term trends analysis and better integration with broader conservation initiatives. The Natural Resources Program staff are working with statewide and regional efforts to coordinate monitoring, including participating in the annual Northeastern Nightjar Survey.

State-listed plant surveys annually focus on *Ophioglossum pusillum* and *Triosteum perfoliatum* at Camp Edwards. Based on concerns for separation of the latter species from its congener, *Triosteum aurantiacum*, the Natural Resources Office contracted a genetic and hybridization study, which started in TY 2020. A report was expected December 2021, however, findings, as conveyed preliminarily to MAARNG staff, suggest that, despite morphological features used to distinguish the two species, the dominant or sole *Triosteum* species encountered on Camp Edwards is *T. perfoliatum*. This will have implications for future monitoring which the Natural Resources Office plans to discuss with the state Botanist and botanist Bryan Connolly. This is an interesting study with potentially significant findings.



Photograph 3-1 A Natural Resources field technician with equipment used during acoustic monitoring for bats.

Rare plant sites were not formally surveyed in TY 2021 for a combination of reasons, but largely to await the results of the *Triosteum* genetics study, which is likely to inform future survey methods and to reduce the human impact at rare plant sites (e.g., soil compaction, trail formation, and possible trampling of plants), including those that continue to support *O. pusillum*. In TY 2021, MAARNG staff experimentally fortified one rare plant site (RP05), located in the southern training area with buck fencing to exclude previously observed deer browse on *T. perfoliatum* and *O. pusillum*. Observations of rare plants at RP05 versus other rare plant sites without buck fencing will continue through TY 2022.

In TY 2021, acoustic monitoring for bats continued. Tetra Tech was contracted to perform manual vetting and database upload, and results will be received in TY 2022. Confirmed detections will be reported to NHESP. All vetted bat data from 2014-2020 was entered by Natural Resources staff into the federal database, NABat, to inform the ongoing US Fish and Wildlife Service (USFWS) status assessment of *Myotis lucifugus*, *M. septentrionalis*, and *Perimyotis subflavus*. In TY 2021, Tetra Tech vetted data from 2020, produced a report on the findings, performed a power analysis of the larger dataset, and created a scope of work for the analysis of the long term data set. The results of the power analysis will be used in Fiscal Year 23 for a contract to analyze the past data for spatial and temporal trends and occupancy analysis. The power analysis specifically will be used to guide the recommendations for future work that come from looking at the whole data set.

Starting in TY 2019, grassland bird numbers represent individuals (not double counting the same bird) observed in a given year rather than the total number of birds observed throughout repeated surveys as was reported in past years. This will better represent the number of active territories in a given year.

Harrier sightings were not counted as the species is constant and conspicuous throughout the non-breeding season with much uncertainty to individuals, and NHESP no longer accepts non-nesting reports of this and other raptor species.

3.3.2 State and Federally Listed Bats

The Northern Long-eared Bat (NLEB) was federally listed as threatened in May 2015. The listing is primarily due to the severe population crashes (estimated greater than 95%) caused by white-nose syndrome. The extent of population loss drives concerns for impacts on individuals and maternal roost sites throughout the eastern United States. Recent survey efforts have suggested that NLEB are persisting better in coastal areas of the Northeast than any of the rest of their range. Because of this, there is a strong focus on surveys and conservation on Cape Cod and the Islands, Long Island, and coastal New Jersey. A NLEB was discovered on Martha's Vineyard in February 2016 with successively more found hibernating. Acoustic hits for NLEB on base in March and November suggest bats may be overwintering on Cape Cod, as well. If they are utilizing a different type of hibernacula than the caves utilized inland, it could have huge implications for the recovery of the species. Caves allow the spread and growth of white-nose, but a different type of hibernacula or less densely inhabited hibernacula may be allowing coastal bats to avoid white-nose syndrome leading to the greater numbers of bats in coastal areas.

In TY 2021, five sites in the Training Area/Reserve were acoustically monitored for bats using programs targeting the foraging and echolocation characteristics of NLEB and *Perimyotis subflavus*. Two of these are considered long-term monitoring sites, having been recording at some of our highest-activity NLEB sites year-round since 2015. In TY 2019-2020 and part of TY 2021, program staff aimed to acoustically monitor the state-listed species *Perimyotis subflavus* (also being considered for federal listing), as it is a high-flying species that may require different methods than those used to monitor NLEB. Two of the acoustic sites were set up above the forest canopy to survey specifically for them. These sites were monitored through the winter of 2020-2021 and were then lowered for the rest of the year. *P. subflavus* and NLEB were each recorded at 3 of the 19 acoustic sites monitored in TY 2019, including one site where they were both found, site 15_35, along the southeastern boundary of the Training Area. *P. subflavus* was recorded at one of the two sites targeting the species in TY 2019, though equipment and insect noise issues were prevalent. In TY 2021, the discovery of a silver haired bat (*Lasionycteris noctivagans*) in a bunker on base during the winter (details below), prompted the installation of the fifth station to monitor for winter activity.

In TY 2021, Tetra Tech, a contractor for the MAARNG, manually vetted bat acoustic data from TY 2020, performed a power analysis on the past data, and created a scope of work to analyze trends in bat data on base over the last seven years. Tetra Tech is currently working to manually vet bat acoustic data from TY 2021 and upload the data into the MAARNG bat acoustic database. The results of the power analysis will be used in Fiscal Year 23 for a contract to analyze the past data for spatial and temporal trends and occupancy analysis. The power analysis specifically will be used to guide the recommendations for future work that come from looking at the whole data set.

BRI was contracted to identify a bat roosting in a bunker on Knot Hollow Road in early February of 2021. They identified the bat as a silver haired bat (*Lasionycteris noctivagans*), which is not a state or federally listed species. Federal biologists indicated that this is likely the first record of the species hibernating in New England. BRI is also going to vet past acoustic data calls to determine whether this species has been active on base or other nearby locations during the winter season. Their report will be completed in TY 2022.

The Army National Guard completed a programmatic informal consultation for NLEB addressing small projects implemented by MAARNG at all managed locations to include actions less than 5 acres and incorporating conservation measures. The USFWS concurred with the Army National Guard determination on October 8, 2015 and small projects are kept within the scope of that agreement. Larger projects are scoped to avoid impacts to bats to the extent possible while utilizing the 4(d) rule exemption under the Endangered Species Act as appropriate for habitat management actions. Investment in equipment, personnel training, and collaboration continued in TY 2021 to address concerns both over avoiding impacts to bats and minimizing bat impacts on ongoing actions such as pine barrens habitat management.

AFCEC and Cape Cod Space Force Station manage four 1.5 megawatt (MW) wind turbines in the Training Area/Reserve. Turbine operation is curtailed for the NLEB from July 15 to October 15, 30 minutes before sunset to 30 minutes after sunrise for wind speeds less than 4.5 meters per second. There were no observed bat or bird strikes during TY 2021. Equipment maintenance personnel are the primary observers and perform weekly operations and maintenance checks. Acoustic surveys conducted at Cape Cod Space Force Station, including turbine sites, found relatively low levels of activity, which was dominated by Big Brown Bat.

3.3.3 New England Cottontail Rabbit Study

The Natural Resources Office began a study in TY 2010 on the New England cottontail rabbit (*Sylvilagus transitionalis*), at the time a candidate species for federal listing. Original study objectives were to determine the home range and habitat preferences of the species. This information can be used regionally to influence effective management efforts for this species. Current and future efforts are transitioning more from research into population monitoring, though with a strong emphasis on evaluating the effects of habitat management on cottontails. New England cottontails occur throughout suitable scrub oak habitat across Camp Edwards.

In 2015, the USFWS removed New England cottontail from the federal candidate list. The finding was based upon the conservation implementation enacted and future commitments by the large regional partnership, including MAARNG and Camp Edwards. Continued habitat management and monitoring are critical to New England cottontail success and keeping the species from being federally listed.

In TY 2016, contracted wildlife detection dogs readily found pellets at off-base locations and at two on-base sites located along power lines. At several sites on base that had previously had rabbits, the dogs did not find rabbit sign or not in all repeated surveys at the site. This data could suggest a lower density of rabbits or a higher extinction rate at more interior sites. More interior sites tend to have more native habitat. To further explore the factors driving this, the Natural Resources Office sent fecal samples for diet analysis in TY 2017 and 2018. The low diversity of food resources at interior base sites with more native vegetation may be limiting the density of rabbits on base. In TY 2019, the Natural Resources Office assisted a Harvard graduate student correlating our diet analysis data with availability of vegetative resources through stem density counts. In TY 2020, the graduate student completed his thesis (available here: <https://dash.harvard.edu/handle/1/37365622>). His findings on preferred forage species and management techniques to encourage diverse forage species will be examined in TY 2022 along with the following effort and used in planning management activities for the species.

The Natural Resources Office continued active participation on the Technical Committee, working with partners to prioritize and develop actions and efforts to implement the conservation strategy for the species. The Natural Resources Office performed pellet searches in regional plots in TY 2021. In Fiscal Year 2021, the Natural Resources Office contracted the USFWS working with the University of Rhode Island to perform statistical analysis and reporting for the New England cottontail data compiled thus far.

3.3.4 Agassiz's Clam Shrimp

Clam shrimp were discovered in roadway puddles on base in TY 2015. Initial attempts at identification indicated the clam shrimp could be two state listed species, Agassiz's Clam Shrimp (*Eulimnadia agassizii*, [AgCS]) and American Clam Shrimp (*Limnadia lenticularis*, [AmCS]). In TY 2018, the NHESP Aquatic Ecologist confirmed Agassiz Clam Shrimp in multiple roadway puddles along with the non-listed Mattox Clam Shrimp (*Cyzicus gynecea*). In TY 2018, NHESP visited Camp Edwards, viewed some of the known clam shrimp locations, and trained MAARNG staff in proper identification of the species likely to be encountered in the Training Area/Reserve. The Natural Resources Office also received a collection permit, which has been renewed annually, to sample clam shrimp on MAARNG lands or any lawfully entered lands in Massachusetts.

Clam Shrimp occur in roadway puddles on the base. These sites are most often heavily trafficked, unvegetated puddles created by roadway compaction. Several puddles along Herbert and Cat roads had become large enough to impede use for training. In TY 2018, the Natural Resources Office worked with NHESP and Oxbow Associates to create a Conservation and Management Plan (CMP) to address the necessary road repairs and provide net benefit for the species. The plan included several components: habitat creation, experimental treatments, and monitoring. Requirements and activities specific to the CMP, including new puddle creation, *in-situ* modification to improve puddles, relocation of egg-bearing sediment, and three years of monitoring, were completed in TY 2020. A fourth year of monitoring, not required, was completed in TY 2021. A fourth year of monitoring was carried out because the 2020 drought conditions resulted in often dry puddles with fewer opportunities to observe clam shrimp and because clam shrimp are of strong focal conservation interest for MAARNG. Despite the drought and lack of favorable conditions, AgCS were still found in three of the 11 puddles monitored in 2020. Surveys in TY 2020 also documented for the first time AgCS and Mattox Clam Shrimp existing in the same pool at the same time.

In TY 2021, precipitation was back to normal during the clam shrimp monitoring season. Natural Resources staff conducted repeated surveys from mid-May to October at a subset of 12 puddles. Pools were measured for area, depth, temperature and pH, and all aquatic life observed was recorded. In total, clam shrimp were observed in seven puddles, an increase from the previous two years. However, not all observations were identified to be AgCS. AmCS, a state-listed species of special concern, not previously confirmed on the base, were encountered in three puddles (two monitoring puddles contained both species but not necessarily at the same time). AmCS collected samples, along with AgCS have been submitted to MassWildlife for verification of ID. Clam shrimp collected from one puddle were unable to be identified to species due to poor condition of the sample. Details on the CMP monitoring carried out during TY 2021 are in Appendix F. Annual survey data and samples collected are submitted directly to the MassWildlife Aquatic Ecologist and positive observations of state-listed clam shrimp are submitted electronically using Heritage Hub, MassWildlife's reporting and filing system. 2021 monitoring clam shrimp samples and collected data have been submitted. 2021 positive observations are in the process of being uploaded to Heritage Hub.

In TY 2021, Natural Resources staff coordinated with MassWildlife to amend the CMP permit to allow for long term road repairs. The CMP amendment, called Clam Shrimp Conservation and Roadway Maintenance Plan (CSCRMP), borrows on elements from the original CMP, such as habitat creation and improvement and annual monitoring, brings in new elements, such as road category designations and their associated treatments, and provides for a net conservation benefit to AgCS. The original CMP allowed for location specific improvements to training roads and clam shrimp puddles. The amended permit establishes a long-term protocol that allows for regular road maintenance and repair of road puddles in the Camp Edwards training area while preserving a network of suitable and available puddle habitat for clam shrimp populations.

A significant component of the CSCRMP is the submission of annual road work plans developed by MAARNG for NHESP review and approval. Road work plans include all road work planned to occur in the Training Area for the coming year. This involves planning meetings with participants from Natural Resources-ITAM, the IAGWSP, Camp Edwards troop labor projects, and Facilities and Engineering. Potential impacts to clam shrimp and clam shrimp habitat, as well as other wildlife and natural resources concerns, are evaluated by Natural Resources staff. Required and voluntary mitigation, based on evaluated impacts and a Net Benefit standard, is proposed and included in the road work plan. The first road work plan proposal was submitted for NHESP review concurrently with the CMP amendment request. The approved road work plan was specifically for necessary repairs to severely degraded Impact Area perimeter roads. This included the boundary portion of Jefferson and Barlow Road and impacted 12 puddles with occupied status, meaning AgCS had been documented in previous years. Approved mitigation for this work was carried out in TY 2021 and included relocation of adult clam shrimp and/or transfer

of egg-bearing sediment from the impacted puddles to existing surrounding puddles not known to contain clam shrimp. Additional details on the CMP amendment are in Appendix F.

3.3.5 Eastern Box Turtle

In support of the MPMG proposed project, AECOM was contracted to create an Eastern Box Turtle Construction Period Monitoring and Protection Plan (CPMPP) and to complete initial canine-assisted surveys around the MPMG range in the fall of 2019. Once NHESP approved the plan, the plan implementation was contracted to AECOM to provide canine-assisted pre-construction turtle surveys and construction period monitoring, including tracking turtles around the project area using radiotelemetry. The CPMPP included silt fence installation followed by the required hours of turtle surveys inside the wildlife barrier completed before October 31. The construction contract was not awarded in TY 2020, which meant the silt fence could not be installed. The agreed upon survey hours and turtle tracking was still completed. A report on all efforts was submitted to NHESP on February 2, 2021 and additional survey effort in 2021 was proposed to account for surveys inside the silt fence once installed. Due to permitting delays, the silt fence was not installed in 2021. In August 2021, the Natural Resources Office submitted “Addeundum: Turtle Protection Pre-surveys Camp Edwards Multipurpose Machine Gun Range” to NHESP to complete the agreed upon survey hours in an open system, to track turtles prior to hibernation, and to relocate turtles to a known hibernation location near the project area. This plan provides protection for turtles during winter silt fence installation and tree removal activities. This plan is being implemented in the fall of 2021. Eversource also completed a similar turtle protection project at Dig Site 3 to enclose the site, survey for turtles, and monitor. The Dig Site is being used as a stockpiling site for soil that will be used on future construction projects on base. The monitoring, maintenance and reporting for this site will be taken over by the Natural Resources Office and Facilities Engineering in Fiscal Year 2022. Eversource also completed surveys on the power line traversing east-west across the northern portion of the base. The contractor for Eversource coordinated with the Natural Resources Office on their activities on base.



Photograph 3-2 A Natural Resources Program field technician holds an Eastern Box Turtle.

In September and October 2020, AECOM completed a similar project for Tango Range including creating an approved CPMPP, completing surveys inside a wildlife barrier, obtaining approval from NHESP for construction to proceed, and completing construction monitoring during the turtle active season. The report for 2020 activities was submitted to NHESP on 12 January 2021. In TY 2021, surveys during construction continued and oversight during silt fence removal was completed at the end of the project. A final report will be submitted to NHESP in TY 2022.

In-house turtle searching and telemetry efforts focused on tracking turtles from C-14, Sierra and Tango Ranges and around the MPMG, which are areas with future construction projects or areas with previously tagged turtles. In addition, the Natural Resources Office contracted AECOM to perform detection dog-assisted surveys to find box turtles and place radio transmitters on them in a variety of habitats on base. This broad landscape level approach will allow monitoring of turtles in management areas receiving a variety of treatments. Periodic monitoring of these turtles over time will provide a broad-scale look at impacts from both the range development

activities and mitigation activities on base. This contract will contribute towards the long-term box turtle monitoring requirement in the CMP for the MPMG range.

Fifty-four turtles were being tracked by the end of the fiscal year.

In response to the Dipteran larval infestations observed in past years, the Natural Resources Office contracted the University of Illinois' Wildlife Epidemiology Lab to conduct health assessments, take blood samples and swabs to explore the impacts from the larval infestations and potential causes. A veterinary student spent 12 weeks on base taking 109 samples from Eastern box turtles. She also took samples from Spotted turtles and painted turtles that were captured during a Legacy funded effort. Blood samples for lead were taken from painted turtles in the Rod and Gun wetlands and other wetlands for comparison given the history of skeet shooting and planned clean up by AFCEC at that site. The veterinarian from the Wildlife Epidemiology Lab also spent a day on base examining the Dipteran larval infestations. Results and a report from this effort is expected in Fiscal Year 2022.

Dipteran larval infestations were again observed in TY 2021, but appeared less severe than the previous year. Two turtles were found dead and taken for necropsy at Tufts Wildlife Clinic. The two turtles that had overwintered at Tufts Wildlife Clinic were returned to their original locations. Natural Resources Office staff are continuing to coordinate with the State Herpetologist, the veterinarian at Tufts, and the University of Illinois' Wildlife Epidemiology Lab on this threat to turtles on base.

In addition, the Natural Resources Office is collaborating with researchers from UMass Amherst, the US Geological Survey, NHESP, and USFWS to facilitate two graduate research projects on Camp Edwards focused on the threats to Eastern box turtles. An intern working for the Environmental Management Commission also used historical data on box turtle locations to create home ranges.

During the summer of 2020, a turtle mortality was discovered on Echo Range in one of the firing lanes. It is assumed that the turtle fell in the firing lane and was unable to escape. Given the heat in the summer and lack of shade, Range Control conducted twice daily checks of the lanes to prevent another mortality event. In TY 2021 Range Control completed the installation of ramps in each lane to provide a means of egress for turtles and preclude the need for monitoring during the turtle active season. The Natural Resources Office tested the ramps with a live turtle to ensure their suitability. Monitoring was completed until all ramps were installed.

In response to road mortalities, near misses, and increased sightings on roads this year, the Natural Resources Office has made efforts to increase awareness and education this year. To minimize the potential for unintentional impacts to Eastern box turtles and snakes on base, technicians placed wildlife crossing signs displaying a turtle and snake on them at all the likely entrances to the training areas. In the fall of TY 2022, the Natural Resources Office conducted a training on box turtles for the Roads and Grounds crew, some of the mowing crew from the Coast Guard, Coast Guard environmental personnel, and a project manager from the IAGWSP. The Range Control Office also regularly briefs units on box turtles.

3.3.6 Lepidoptera

The creation of the MPMG, the associated fire control measures, and the required pine barrens management will increase the amount of fire on the landscape. Many of the Lepidoptera species on base are expected to greatly benefit from the reintroduction and increased frequency of fire. The monitoring component of the CMP requires long-term Lepidoptera surveys. The monitoring component needs to evaluate effects of the overall range development, the fire hazard reduction actions, and mitigation actions (short and long term) on the Lepidoptera community. Monitoring of moth and butterfly species will guide adaptive management for the use of fire (e.g., seasonality, intensity, return interval). The Natural Resources Office has contracted WEST to provide a robust analysis of sampling designs to make the most use of the monitoring data. In TY 2021, the Natural Resources Office has been working with WEST to develop protocols to monitor Lepidoptera populations on base. After

consulting the state's invertebrate biologist, the team decided to broadly sample sites using a vegetation protocol to monitor for improved habitat conditions, a UV light trapping protocol to monitor moths at a smaller subset of sites, and a daytime caterpillar survey protocol to sample Barrens buckmoth, a species believed to indicate improved conditions for state listed moths on base. The development of these protocols is expected to be complete in early TY 2022, but the vegetation sampling protocol was able to be implemented at 20 sites in TY 2021. The Natural Resources Office plans to implement the full sampling design in TY 2022.

In TY 2019, 2020, and 2021 the Natural Resources Office collaborated with a PhD student from the University of Massachusetts Boston Stevenson Lab in monitoring Lepidopteran diversity at Camp Edwards. The focus of the student's research is Lepidopteran diversity across urban/rural gradients, and the Training Area/Reserve fits the rural category. While a general moth expert, the student also specializes in the Sphingidae, a declining group. Her studies have expanded our knowledge of Sphingid moths at Camp Edwards and has added to our list of moth species found at Camp Edwards. She introduced staff to multiple surveys methods with notable results and renewed emphasis on moth documentation. Her work at Camp Edwards will continue in TY 2022. Her work in TY 2021 continued to document frosted elfin and also documented another state-listed species, pink streak (*Dargida rubripennis*) which was known to occur in the grasslands. Natural Resources staff also performed additional night surveys using UV flashlights to search for Frosted Elfin and Slender clearwing sphinx moth caterpillars in areas of known past occurrences. Discoveries from these surveys will be reported to NHESP.

The USFWS "Frosted Elfin Habitat and Butterfly Survey Protocol" was implemented at three locations on Camp Edwards with an abundance of their host plant. Adults of this species were detected at each survey location and followed by supplemental caterpillar surveys mentioned above. Data from this survey will be submitted to USFWS to aid in their regional survey efforts.

A volunteer, Elise Leduc, completed Monarch surveys in the grasslands for larval Monarchs using the Monarch Larva Monitoring Project protocol developed through a partnership of the Monarch Joint Venture and the University of Wisconsin-Madison Arboretum. This data will be entered into their online database and the volunteer effort was extremely helpful to supplement short staffing and continue monitoring this at-risk species.

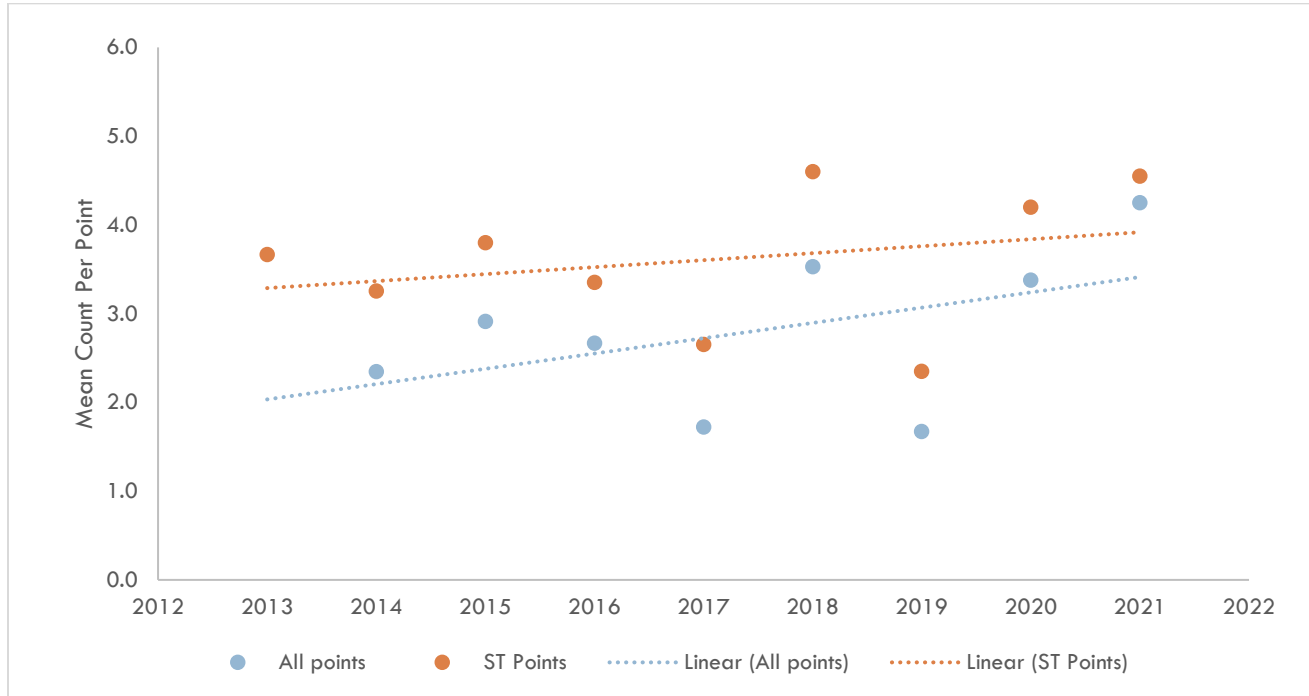
3.3.7 Eastern Whip-poor-will

Annual implementation of the Northeastern Nightjar Survey, as mentioned above, facilitates the evaluation of population trends throughout Camp Edwards and the Training Area/Reserve using a standardized protocol implemented throughout the eastern United States. A subset of 10 points originally set by MassWildlife has been surveyed annually since 2013 and an average of over 34 sites has been surveyed along three routes starting in 2014 providing a site-wide assessment. The Eastern Whip-poor-will is likely a strong indicator of pine barrens habitat health and management condition given its sensitivity and decline throughout the region and close association with dense, but open woodland and shrubland habitat condition that is important to the vast majority of species of conservation concern in southeastern Massachusetts.

The TY 2021 Whip-poor-will surveys were completed on May 19, 2021 following a week of shorter point-counts following the same protocol to provide background context and greater confidence in formal survey night results compared to prior years. The TY 2021 surveys documented Whip-poor-wills at all 32 survey locations for an occupancy rate of 100% and a mean count of 4.3 birds per point. This is compared to the long-term mean of 2.8 birds per point. Overall, Whip-poor-wills show an increasing, but not statistically significant, trend for abundance. Trends in occupancy are stable due to near saturation and a long-term mean of 0.9 (90%) for occupancy. Graph 3-4 presents the summary annual mean counts and trend lines. Given that the state assigned points are placed at higher quality habitat than the more randomly assigned site-wide points, the state (ST) points have consistently higher mean count of birds per point, but the subset and overall set are highly consistent through time.

The lower count years in 2017 and 2019 are likely outliers based on survey conditions and attempting to find a quality survey night meeting the restrictive protocol while meeting other program priorities (e.g., prescribed fire, nocturnal research efforts, etc.). As mentioned above, the Natural Resources Office accounted for this in TY 2021 by implementing more opportunistic surveys prior to the formal survey night focusing on the very brief calling period displayed by Whip-poor-wills in lower lunar illumination. This first year’s effort found very consistent results between the preliminary efforts and the formal survey as a quality night for combining lunar and weather conditions was available in TY 2021. In successive years it is hoped that when staffing is available to complete these preliminary surveys they may help identify if low count results are consistent and indicate a representative result or an artifact of survey night conditions.

Graph 3-4 Camp Edwards Site-wide Eastern Whip-poor-will Monitoring



Graph 3-4: Annual results of Camp Edwards Whip-poor-will monitoring using the Northeastern Nightjar Survey protocol. The orange (ST) points are a subset of 10 points originally set by MassWildlife based on habitat associations and the blue points are the overall site-wide monitoring points (mean 34 per year).

Both focal research efforts (previous migration studies in the Training Area/Reserve) and longer-term trends from annual monitoring suggest that the overall population is healthy at Camp Edwards. Likewise, the response to management actions including prescribed burning and mechanical forestry appears to be overall positive from targeted research, long-term monitoring, and anecdotal observation.

Prior to TY 2016, Whip-poor-will numbers shown in Table 3-1 and in Appendix G have included multiple surveys, and likely repeated counts. From TY 2016 onward, the number reported reflects the lowest number (between two observers) heard per site during a single round of surveys to remain conservative in reporting, while keeping detections over negative site records (sites are only considered negative records if surveyors mark paired zeroes).

3.4 SOIL CONSERVATION MANAGEMENT

All military and civilian uses and activities in the Training Area/Reserve during the year were reviewed by the Natural Resources Office to ensure that they were compatible with the limitations of the underlying soils. All users were instructed to report evidence of soil erosion to Range Control so that potential repairs to roads, bivouac

areas and well pads could be identified in a timely manner. None of the existing unimproved roads in the Training Area/Reserve were made into improved roads as a result of IAGWSP remediation activities during the year. Additionally, any maintenance on unimproved roads during the year did not involve paving the roads. An Army National Guard Engineering unit graded, cut drainage ditches for, and used gravel to rebuild the westernmost portion of Estey Road, repairing the intersection with Fredrikson Road. Repairs consisting of graveling significantly degraded road segments were funded and initiated, although not completed, by the IAGWSP, coordinated with the EMC's Environmental Officer, on Jefferson Road, Wheelock Road, and Crowell Road. IAGWSP coordinated closely with Natural Resources to minimize impact on the Agassiz's clam shrimp, coordinate the project with NHESP through permit amendment, implement mitigation measures, and ensure provision of abundant clam shrimp habitat while maintaining an effective road network that supports training, remediation, natural resources management, and emergency response.

3.4.1 Erosion

The Integrated Training Area Management Program (ITAM) worked with Camp Edwards Facilities Engineering to conduct limited erosion maintenance on established maneuver trails. No significant projects were conducted.

3.5 VEGETATION, HABITAT AND WILDLIFE MANAGEMENT

The Natural Resources Office manages for a diversity of natural communities, plants, and animals. This supports a sustainable military training site and high-quality habitat for rare species (Table 3-1) as well as common ones. Particular emphasis is on maintenance or expansion of earlier successional habitats (e.g., grasslands, shrublands, and young forests) due to the conservation value of these habitats and rapidity at which they are lost to trees or other influences. Mechanical restoration, prescribed fire, resource monitoring, invasive plant management and others are important tools used here. During TY 2021, two larger restoration projects were implemented along with several smaller, focal projects – all of which are discussed in much greater detail in Section 3.5.6. Table 3-2 provides an overview list of the projects. A mastication project restored the area surrounding the NBC Site to more open woodland conditions. One hardwood coppice management project was conducted in-house, experimenting with mechanical alternatives to chemical strategies. Two training areas received in-house mastication treatment to clear midstory vegetation and reestablish lines of sight and maneuverability while improving habitat conditions. Prescribed burns implemented for habitat and vegetation management are discussed in Section 3.6.1.

Table 3-2 Training Area Management Projects

Training Area	Acres Treated	Primary Objective	Treatment Method
A-4 (NBC Site)	42	Training site rehabilitation	Mastication of vegetation \leq 6" DBH
BA-7	157	Training site rehabilitation	Targeted mastication of standing dead trees
BA-6	4	Training site rehabilitation	Mastication of mid- and understory vegetation

Management and conservation planning for holistic ecosystem health are fundamental to Department of Defense conservation and efforts at Camp Edwards within and outside the Training Area/Reserve. Rare species habitat management integrates climate resilience, carbon sequestration, risk minimization (e.g., fire and southern pine beetle), military training objectives, habitat diversity, and other considerations. Monitoring and research continue to develop and support informed management and integration of these multiple objectives. Rigorous vegetation and moth study designs were developed in TY 2021 for long-term monitoring supporting the master development

plan Conservation and Management Permit. Breeding bird surveys continue to show positive or stable trends for Species of Greatest Conservation Need while more targeted efforts such as Eastern Whip-poor-will monitoring and research continue to show a strong association with both small arms range areas and habitat management zones. Climate resilience planning and assessment is ongoing for Camp Edwards with the Woodwell Climate Research Center, having been contracted in TY 2021. A critical outreach element for TY 2021 was communicating through public tours and other venues that the entirety of Camp Edwards, especially within the Upper Cape Water Supply Reserve, is managed for wildlife habitat – including small arms ranges and other military training venues that provide critical open field habitat for a wide variety of pollinators and other fauna.

3.5.1 Vegetation Surveys

Primary effort for vegetation surveys in TY 2021 was focused on vegetation composition and structure pilot surveys linked to the long-term moth monitoring protocol. This long-term effort will provide valuable response and trend data for a variety of habitat to inform management activities and strengthen interpretation of faunal survey results.

3.5.2 Invasive and Nuisance Vegetation Management

Invasive plants are non-native species that have spread into natural, minimally managed, or disturbed plant systems in Massachusetts. They can cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. As defined here, “species” includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation. Invasive species are primarily from the Massachusetts Invasive Plants Advisory Group (MIPAG) lists, but also include emerging invasive species as coordinated with partner agencies.

Nuisance species are more selectively or situationally defined and may include native plants under certain conditions. Several native species have displayed such aggressive establishment and regeneration that they require targeted management in order to preserve the training and preferred habitat value of some training venues. Although not exotic, these species, under certain conditions, can display the same dominant and disruptive characteristics normally associated with invasive species. Pitch pine in particular has historically taken advantage of neglected training sites to create impenetrably dense, overstocked monocultures that provide little habitat value, produce unhealthy trees, present significant fire hazard, prevent training, and suppress all other vegetation. Other native, desirable species that may situationally present a nuisance condition from a habitat perspective include bayberry and sweetfern due to tendencies towards monoculture through chemical defenses.

Exotic invasive plants are a management concern both in the Training Area and within the Cantonment area. Effective management of these species, primarily autumn olive (*Elaeagnus umbellata*), Oriental bittersweet (*Celastrus orbiculatus*), and shrub honeysuckles (*Lonicera spp.*), is both labor and cost intensive. Natural Resources-ITAM has two trained and licensed Massachusetts core pesticide applicators on staff. With this capability, Natural Resources-ITAM conducted in-house herbicide treatment to control the spread of *Calamagrostis epigejos*, an aggressive and exotic invasive grass. Crew used a backpack sprayer and a motorized UTV-mounted pump to spray a Glyphosate solution on clumps of the grass along Richardson Road, in Demo 2, on Sierra Range, and in Training Area BA-6. All spraying was precisely targeted with wands rather than boom or broadcast spraying. A total of 3.3 pounds of active ingredient were applied across these sites, over the course of the summer. ITAM also conducted hand pulling to remove spotted knapweed (*Centaurea stoebe*) from restored training sites on BP-1, Demo-2, and Wheelock Overlook, covering 7 acres.

Many rare plant sites are being encroached by invasive species or overshadowed by native species. In TY 2017, the Natural Resources Office contracted Wilkinson Ecological Design to complete a Vegetation Management Plan for invasive species treatment in rare plant sites and complete the associated MESA permitting. In 2017, Wilkinson completed the site visits and prepared a Vegetation Management Plan, which has since been approved

by NHESP. In TY 2018, Wilkinson performed chemical treatment of all invasive plants found at rare plant sites. Natural Resources Office staff performed follow-up treatments where necessary and monitored the sites from 2019-2021. No major invasive species problems remain at sites where rare plants still exist, but several of the bowls where rare species have disappeared over the years still have high numbers of invasive shrubs and small trees. The Natural Resources-ITAM Office plans to remedy this through targeted tree removal in order to return frost bottom effects to these bowls.

3.5.3 Bird Surveys

This is the ninth year that point counts were conducted along a bird survey route through the Training Area/Reserve to determine differences in bird activity in a variety of military training areas and habitat types. The routes consisted of 65 sites that were each visited three times to reduce the likelihood of species being undetected. The calculation of detection probabilities for species of survey concern were not completed in TY 2021 due to other priorities; although the data were provided to a graduate student at the University of Massachusetts for potential future analysis. Additionally, with the completion of nine years, the Natural Resources Office has been evaluating trend data as able, prioritizing species of significant conservation interest (e.g., Species of Greatest Conservation Need as defined in the State Wildlife Action Plan). The State Wildlife Action Plan is available at <https://www.mass.gov/service-details/state-wildlife-action-plan-swap>.

Eastern Whip-poor-wills (*Antrostomus vociferus*) are discussed in more detail in Section 3.3.7. The annual surveys in TY 2021 continued a gently increasing trend in Eastern Whip-poor-will abundance. Additionally, Whip-poor-wills were detected at all 32 survey locations with an average of 4.3 birds per point.

For the seventh year, a point-count methodology was implemented in continuation of a state-wide survey of grassland birds coordinated with the DFW and Mass Audubon, which has been incorporated into the overall bird survey effort. This method is intended to be continued to evaluate trends in grassland bird populations and response to management. State-listed species were reported to NHESP (Table 3-1), including Grasshopper Sparrows (*Ammodramus savannarum*) and Upland Sandpipers (*Bartramia longicauda*). The Eastern Meadowlark (*Sturnella magna*) was also listed as a Species of Special Concern in TY 2020, and will now be reported in Table 3-1.

Twenty-two Species of Greatest Conservation Need (SGCN), as categorized by the State Wildlife Action Plan, were observed during breeding bird point counts in TY 2021 (See Table 3-3). Three species were not included due to the birds being flyovers not using habitat (Great Black-backed Gull, Common Loon, Herring Gull). Additionally, the Blackpoll Warbler and Nashville Warbler are migrants here and not included in analysis or conservation planning. Additional SGCN are frequently observed at Camp Edwards, but are not readily detected through diurnal point counts, including American Woodcock (occasional focal surveys conducted) and Eastern Whip-poor-will (discussed above). Many of the SGCN reported below are notable in their degree of occupancy (survey sites with detection) at Camp Edwards and several show significantly positive response to habitat management, especially including Brown Thrasher and Field Sparrow, but somewhat surprisingly also species such as Scarlet Tanager. The overall proportion of occupied survey sites is shown in Table 3-3, but most of the species are more distinctly associated with habitat of either the Training Area/Reserve or Cantonment grasslands and are reported separately. A total of 65 training site points and 14 grassland sites were surveyed in TY 2021.

Table 3-3 compares TY 2021 point count results to the 2015-2020 occupancy, which is the proportion of surveyed sites with recorded detections of a species. Occupancy is correlated with abundance and both measures are being analyzed and prepared for a more thorough reporting. Results that are more than 20% different from the period mean are shown in either green or red for increase or decrease, respectively. However, such differences should be evaluated along with overall trends, which will be contextualized in the overall report. While not strongly apparent in the simplified table, a notable trend is response of shrubland associated species (e.g., Prairie Warbler,

Field Sparrow, Brown Thrasher) to the combination of restoration management in both grassland and pine barrens habitats which is seen in decreasing trends in the smaller grasslands area offset by increases in occupancy and abundance in the training area. Another notable trend for grassland obligate species is those associated with low grass (e.g., Horned Lark) and very open field/prairie habitat (e.g., Upland Sandpiper) were much less detected in cantonment grasslands. However, those species were more densely populated in nearby JBCC habitats such as the capped landfill and airfield.

TABLE 3-3 BREEDING BIRD POINT COUNTS – SPECIES OF GREATEST CONSERVATION NEED

	Species	TY 2021 Sites	Proportion of Sites (total n=14)	2015-2020 Mean Proportion
	Grassland Subset	American Kestrel	4	0.29
Brown Thrasher		11	0.79	0.60
Chimney Swift		7	0.50	0.12
Eastern Meadowlark		11	0.79	0.42
Eastern Towhee		11	0.79	0.90
Field Sparrow		5	0.36	0.40
Grasshopper Sparrow		13	0.93	0.76
Horned Lark		0	0.00	0.05
Prairie Warbler		12	0.86	0.75
Purple Finch		2	0.14	0.19
Upland Sandpiper		1	0.07	0.50
	Species	TY 2021 Sites	Proportion of Sites (total n=65)	2015-2020 Mean Proportion
Training Area Subset	Black-and-white Warbler	30	0.46	0.37
	Black-billed Cuckoo	13	0.20	0.19
	Brown Thrasher	36	0.55	0.6
	Eastern Towhee	65	1.00	1
	Field Sparrow	23	0.35	0.22
	Prairie Warbler	34	0.52	0.43
	Purple Finch	9	0.14	0.14
	Ruffed Grouse	50	0.77	0.71
	Scarlet Tanager	52	0.80	0.79

In the table above, results that are more than 20% different from the period mean are shown in either green or red for increase or decrease, respectively.

3.5.4 Deer Hunt

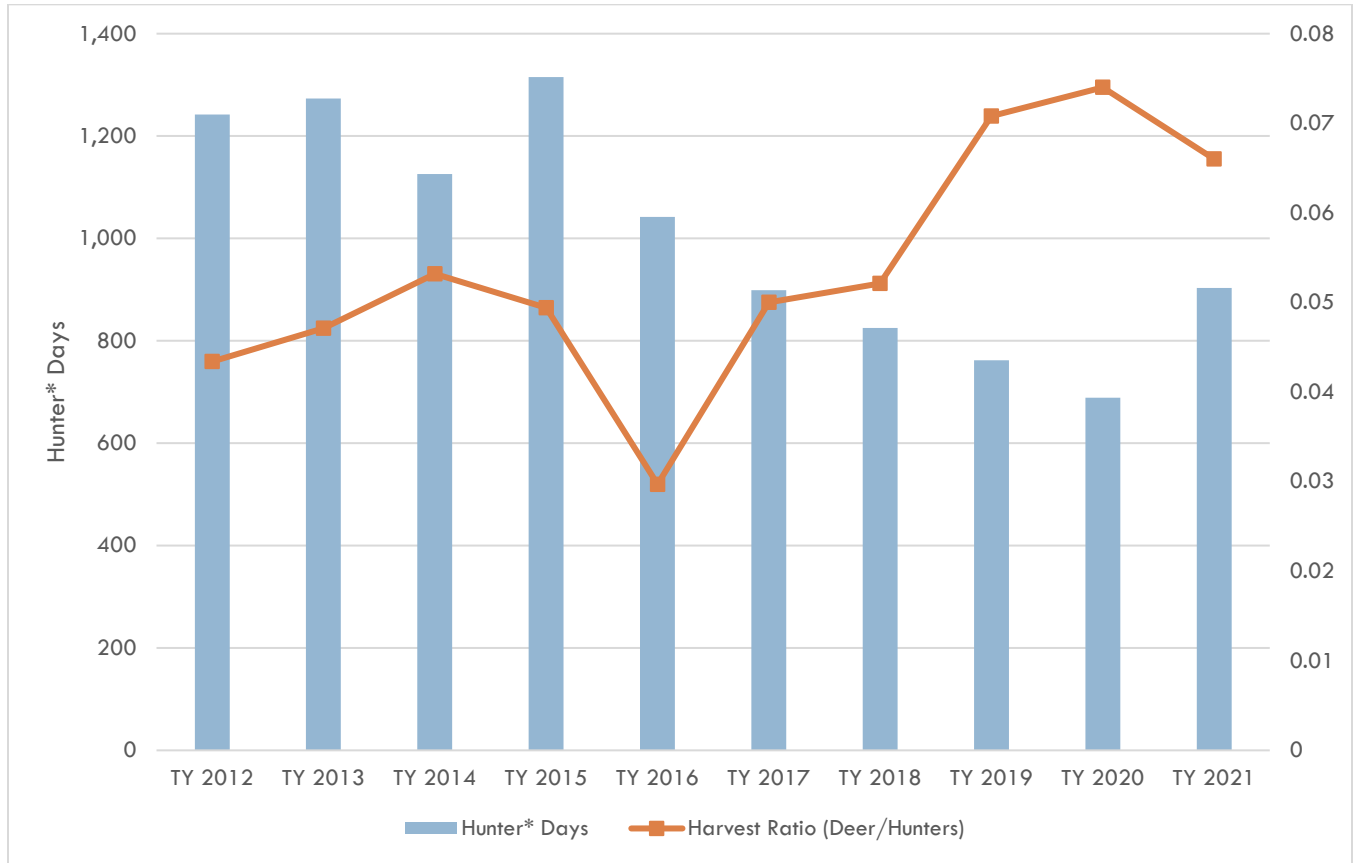
There was a deer hunting season in the Training Area/Reserve during TY 2021 in which 60 deer were taken during 903 hunter days. The Natural Resources Program supports a hunt sufficient to maintain a harvest level that is compatible with a healthy deer herd and healthy ecosystem. MAARNG and DFW generally feel that the recent average of 60 deer per year meets the overall objective. Browse surveys have been conducted every few to several years. DFW primarily relies on the biological data collected at the deer check to adjust the number of tags that are available each year. The 2017 browse survey indicated little to no browse pressure.

The Natural Resources Program continues to provide a variety of hunting opportunities to best engage the hunting community and encourage new hunters through events such as the youth day, archery, and military sportsmen

hunt. Hunting during TY 2021 included a three-day hunt for paraplegic sportsmen (October 29-31, 2021), a one-day youth hunt (October 3, 2021), a two-day opening for archery scouting (November 16-17, 2021), a three-day archery season (November 19-21), a one-day hunt for military sportsmen (December 5, 2021), a six-day shotgun season (December 7-12, 2021), and a two-day primitive (muzzleloader) season (December 17-18, 2021). Graph 3-5 shows the hunter days and deer harvest ratio since TY 2012.

During TY 2020, the Natural Resources Office and the Division of Fisheries and Wildlife conducted hunter surveys to determine hunter preferences, to better respond to queries and requests from hunters, and to determine the success of our advertising efforts. The hunter surveys were not conducted in TY 2021 due to safety protocols to prevent the spread of Covid-19. The hunter surveys are planned to continue in TY 2023.

Graph 3-5 Camp Edwards Deer Harvest



Note: Hunter Days is the sum of the number of hunters each day for each day of the annual hunt.

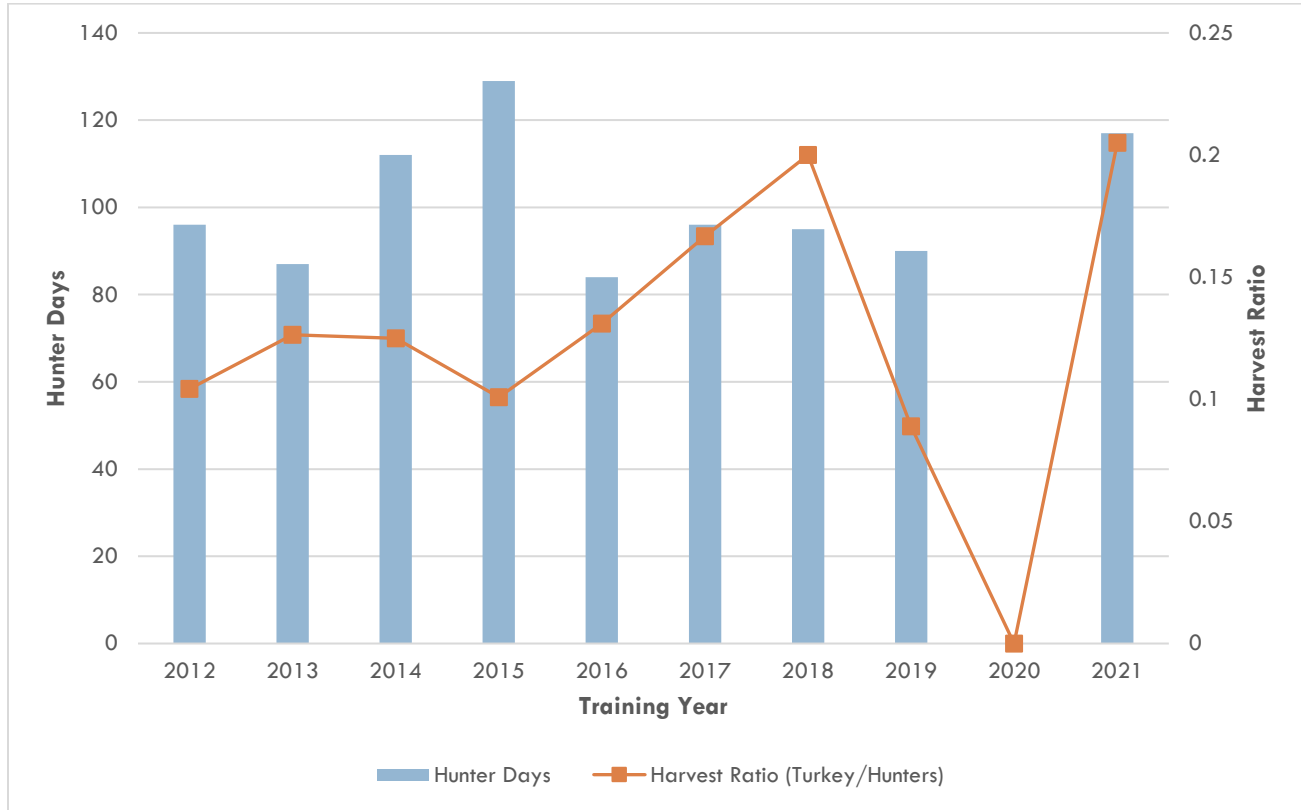
The goal of the hunt program is to provide recreational opportunities to the public and military and to harvest deer for the health of the herd and for ecosystem management. Deer harvests on base have been close to the 60 deer per year goal. Casual observations of browse on site do not indicate excessive browsing, except on specific species. These species are being preferentially browsed and are often state-listed plants. The Natural Resources Office has begun efforts to exclude deer from sites where this species-specific browse has been observed. The Natural Resources Office, Range Control, and the Southeast District of DFW have continued to make as many days and acres available to hunting as is possible given safety concerns and staff resources. Efforts to advertise the hunt were also aimed at increasing harvest as well as recreational use of the site.

3.5.5 Wild Turkey Hunt

There was a five-day wild turkey hunting season in the Training Area/Reserve from May 3-7, 2021 during which 115 hunters took 23 turkeys. In addition, a one-day youth turkey hunt was held on April 26, 2021 in which 2

youths participated with one turkey taken. Graph 3-6 provides information on the wild turkey hunts conducted in the spring since TY 2012.

Graph 3-6 Camp Edwards Turkey Harvest



Note: Hunter Days is the sum of the number of hunters each day for each day of the annual hunt. In TY 2020, the turkey hunt was canceled due to the statewide shutdown for the Covid-19 pandemic.

3.5.6 Restoration Activities

The Natural Resources/ITAM Program completed significant restoration work on two training sites and in-house maintenance on an additional two training sites and habitat patches throughout the base. These projects were conducted in Training Areas A-4, BA-3, BA-6, and BA-7.

3.5.6.1 – NBC Mastication

ITAM conducted a project devised in accordance with military requests to increase tactical training options at the NBC (Nuclear, Biological, Chemical) site in training area A-4. This site was chosen because it is a popular training venue with a variety of structural training aides and is conveniently located near major roads. The woods surrounding the site had increasingly overstocked understory and midstory, occluding lines of sight and hindering maneuver. Prescribed fire in this training area in 2004 provided exceptional relief visible in tree rings and overall forest health. Since that burn, white oak, in particular, has densely regrown reducing habitat quality for a variety of species, reducing training value, and reducing overall forest health through competition and shading.

This project masticated (mechanically mowed/mulched) trees $\leq 6''$ DBH (diameter at breast height) in 42 acres surrounding the current perimeter of the site. All material resulting from this project was left on the ground for future consumption by prescribed fire. The project did not impact mature trees and opened the midstory to permit vision into and out of the site for perimeter defense training while also improving dismounted maneuver around the site, permitting infiltration training. The treatment unit before mastication had approximately 250 trees per acre, counting everything greater than 4" DBH as a tree. After treatment this was reduced to approximately 103

trees per acre, restoring functionally to the conditions immediately post-fire after prescribed burn operations in 2004. Basal area was reduced from 85 square feet per acre down to 62.5.

Following this treatment and future prescribed fire, this treatment will approach stand conditions more similar to 20 or 30 years ago, based on past forestry assessment, vegetation structure (e.g., very high density of small diameter trees in the understory and midstory), and anecdotal tree ring assessment. The structure of this stand and known fire history show more open, spaced overstory of comparatively robust trees heavily encroached by young trees moving into the midstory and shading out understory conditions for wildlife such as Eastern Whip-poor-will and plants such as Lowbush Blueberry. Understory mastication of brush and young trees facilitates further management with fire and restores previously more healthy ecosystem conditions and stand resilience.

3.5.6.2 – BA-7 Snag Mowing

Natural Resources conducted a snag (standing dead tree) mowing contract in training area BA-7, removing hazardous snag trees on 157 acres. This project involved pushing over and breaking up standing dead trees that posed risks for both soldier and natural resources personnel as well as prohibiting habitat maintenance using prescribed fire. This was a highly targeted approach to lay down decaying trees to allow reopening training area BA-7 for prescribed fire management and troop maneuver. The project was designed to leave an average of three snags standing per acre, to preserve habitat value for cavity nesters and bark dwellers. Bark dweller includes a whole host of taxa including birds (e.g., Brown Creeper), bats, a wide variety of invertebrates, and other species. Opportunistic understory patch mowing was incorporated only for access to snags being removed, which provided significant habitat benefit by introducing structural diversity in a mosaic, irregular pattern that also facilitates reentry with prescribed fire.

3.5.6.3 – In-House Management

ITAM conducted in-house mastication of 6 acres of mid and understory vegetation in BA-3 and BA-6. The mowing in BA-6 was a continuation of a multi-year effort to reduce snag risks to soldier safety, to stimulate a grassy and ericaceous understory, remove dangerous ladder fuels that posed a serious torching hazard, and to increase suitability for soldier training and bivouacking. The site has greatly varied conditions based on its decades of intense use for training and bivouacs. Mastication is primarily managing encroaching young trees and dense scrub oak, both filling in the midstory canopy and densely shading the understory conditions and providing ladder fuels for wildfire. As such, it is not a significant change to overstory stem density (e.g., primary trees), but opening the midstory and exposing the understory plants to sunlight and restoring habitat for a variety of barrens specialists. All material generated by this activity is left on-site for future consumption by prescribed fire.

3.5.6.4 – Pending Projects for Fiscal Year 2022

The following two projects were conceived and funded in TY 2021 but are scheduled for execution in TY 2022.

BA-3 Training Area Management

This project was devised in accordance with military requests for a suitable training area to conduct Artillery Table VII evaluations. This site was chosen because of its historic intensive training use, its proximity to TTB Kelley and a well-established trail network, and need for habitat maintenance and restoration. The project entails creating a 7-acre area field in similar condition to restored battle positions and designed to meet the spatial requirements of a Field Artillery Battery conducting Table VII qualifications. Table VII does not include Artillery live fire. The site will be seeded with native warm and cool seasons grasses plus a mix of pollinator-friendly flowers for long term resilience.

This project also involves masticating vegetation ≤ 6 " DBH in 68 acres surrounding the proposed artillery training site. This portion of the project will produce superb habitat for listed moths and an array of birds while significantly reducing what is a currently dangerous level of midstory fuels. This is already a focal area for

Barrens Buck Moth and many other rare species, but with degrading condition from high density regrowth in the understory and midstory. The project will also conduct a 50% harvest of trees > 5" DBH on 11 acres adjacent to the central artillery training site. This portion of the project will create a stable trail for towed artillery, increase lines of sight, facilitate dismounted maneuver, reduce potential vehicle impacts on trees, and reduce wildland fire fuel loading.

RAW3 Frost Bottom Restoration

This project aims to restore a natural functioning and self-maintaining frost bottom along the western boundary of the Impact Area. Frost bottoms are rare and focal habitats for a large number of habitat specialists within a pine barrens matrix, including state-listed plants. This project is part of the NHESP-approved mitigation efforts under the Conservation and Management Permit for the upcoming MPMG Range development and other projects. The habitat restoration efforts are focused on restoring a variety of "pine barrens" habitat conditions from scrub oak shrubland through pitch pine - scrub oak natural community, which are some of the rarest natural communities in the region and are of global conservation concern. Restoring these conditions outside the Impact Area, as mitigation under the CMP, provides a host of benefits for flora and fauna, while providing the opportunity to implement regular habitat maintenance for ecosystem health. All woody material and debris from this project will be removed from the base. The prime focus of this project is an 8-acre depression that is overgrown and lacks airflow for frost bottom ecological function. This portion of the harvest will remove all trees within the depression to reinvigorate the shrubby understory and restore growing season frost conditions.

Immediately west of the central clearing, this project will thin 14 acres of woods extending from the frost bottom to the top of the moraine. This thinning is intended to reduce fuels, invigorate the understory and facilitate the flow of cold air into the frost bottom. The final portion of this project is a 5-acre thinning to the north of the frost bottom. This will permit additional airflow to the frost bottom and will tie into a 2017 harvest conducted at OPs 9 and 10, creating contiguous habitat improvement and fuel reduction along the Impact Area.

3.6 FIRE MANAGEMENT

3.6.1 Prescribed Burn Program

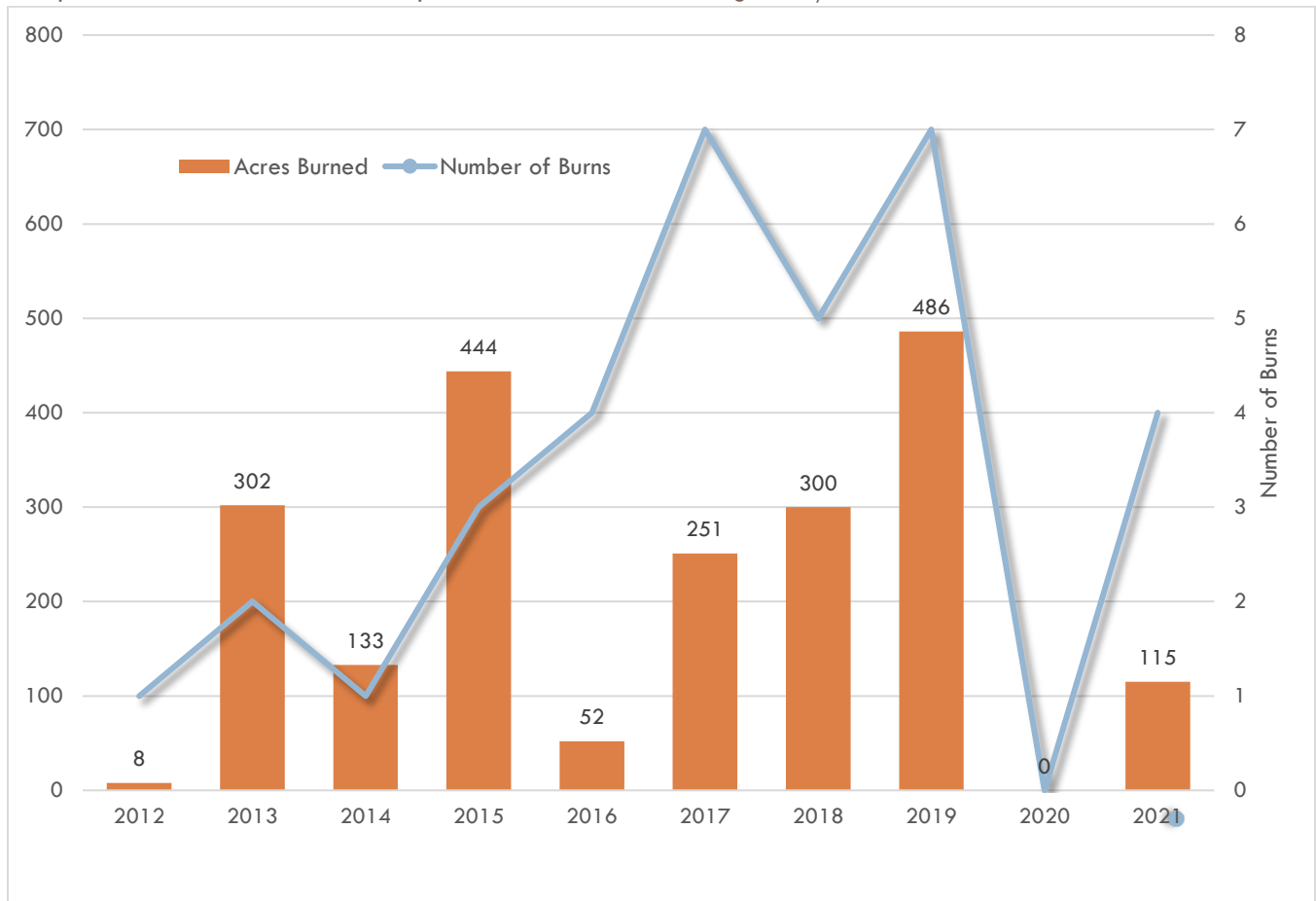
The Natural Resources Office utilizes a prescribed burn program to manage habitat, reduce fuel loads and help prevent wildfires. The prescribed burns are targeted to meet the multiple objectives of fuel reduction, habitat improvement, firefighter training, and soldier training support. The mix of those targets changes by operation, but each is met to varying degrees. The program is outlined in the Camp Edwards Fire Management Plan which is available on the E&RC's website: <https://www.massnationalguard.org/ERC/publications.htm>. The Camp Edwards smoke management permit (#4F02008) was renewed November 4, 2020, and is valid through December 31, 2022.

Limited prescribed burning was conducted within the Training Area/Reserve in TY 2021. Weather conditions were unusually wet during this year, creating limited opportunities to conduct prescribed burns. The Covid-19 pandemic that began in TY 2020 continued to have impacts on prescribed burn operations, however to a lesser degree as a result of vaccinations and procedural controls that were established to help mitigate risk associated with Covid-19 transmittal during prescribed burn operations. A significant transition related to planning and implementation occurred during TY 2021. The availability of local contractors to conduct fire management projects no longer exists. This has created a need to rely to a greater extent on Natural Resource Office staff, other Camp Edwards program staff, Joint Base Cape Cod Fire Department, and partner agencies to accomplish prescribed burns and fire trainings.

During TY 2021 a total of four prescribed burns were conducted, two within the pine barrens (training area) and two within the grasslands for a total of 115 acres. The ten-year prescribed fire accomplishment within the Training Area/Reserve is shown in Graph 3-7.

Prescribed fire goals for TY 2022 are to increase the operational burn days to 25, with an average burn size of 25 acres, take advantage of a larger burn window, and burn approximately 600 to 1,000 acres of pine barrens (550+ acres) and grassland habitat (40-60 acres). This is a good balance of objectives to meet primary habitat and training lands management objectives while building capacity, experience, and programmatic structure. Significant emphasis has been placed on burning units in the Impact Area buffer and immediately outside this buffer zone. This serves to maximize the mutual benefits and objectives of every operation – improving and maintaining pine barrens habitat, reducing hazardous fuel loading and wildfire potential, and improving training lands for soldiers. The primary limiting factor for wildland fire has recently been weather/climate with more extreme fluctuations in conditions (e.g., extended drought broken by extreme rain events) and more frequently shifting weather conditions – particularly with respect to precipitation.

Graph 3-7 Prescribed Fire Accomplishment within the Training Area/Reserve



Note: Training Year acreage is graphed on the left and the number of burns is graphed on the right axis. In TY 2020, no prescribed burns were conducted due to weather conditions in the fall and the Covid-19 pandemic in the spring.

Wildland fire efforts for TY 2021 were focused on building the wildland fire program and planning efforts for future years. Approximately 1.9 miles of fire break was improved along Jefferson Road on the north side of the central impact area, increasing safety and improving the ability to implement prescribed burns. During fall 2021 monthly wildland fire management meetings were initiated and helped to facilitate discussions with and between key leadership elements at Camp Edwards. A new 300 gallon wildland skid unit replaced a unit that was taken out

of service and was mounted on an exiting truck to make a Type 6 wildland engine. Two prescribed burn plan updates were contracted, covering approximately 525 acres. Colorado State University was contracted to begin the Integrated Wildland Fire Management Plan update for Camp Edwards with an anticipated completion date in late 2022.

The Natural Resources office provided assistance to multiple partner agencies. All of this assistance was outside the Upper Cape Water Supply Reserve, but these partnership actions are critical to supporting habitat and ecosystem management within the Reserve. Various assistance for planning and active wildland fire was provided to the Massachusetts Division of Fisheries and Wildlife, DCR, Maine Army National Guard, New Hampshire Army National Guard, and others.

3.6.2 Fire Management Training

Wildland fire training remains a critical component of natural resources management and interagency partnerships. During the past twelve months limited training took place as a result of Covid-19 and lack of contractors capable of conducting trainings. Several trainings were still able to be held using in house and partner agency capacity but were scaled back to better address the situation and needs. Approximately fifteen Army National Guard Firefighting Detachment firefighters were provided wildland fire training. Three Natural Resources Office staff were provided Firefighter Training (S-130) and Introduction to Wildland Fire Behavior (S-190), enabling them to become part of the prescribed burn team. Twelve of the Camp Edwards prescribed burn team received first aid, CPR, and AED training to meet newly established Army prescribed burn crew training requirements. Fourteen people from Camp Edwards and partner agencies were provided Firefighter Type 1 (S-131) training. One Natural Resources Office burn crewmember became agency qualified as a Fire Fighter Type 1/Incident Commander Type 5. Over six individuals initiated work on their Fire Fighter Type 1/Incident Commander Type 5 or Fire Effects Monitor Position Task Books. The Wildland Fire Program Coordinator has started the processes of tracking trainings and qualifications in the Incident Qualification System (IQS).

Planning has begun for a fall 2022 wildland fire training academy to be held at Camp Edwards.



Photograph 3-3 A wildland firefighter provides ignition during a prescribed burn in the Cantonment Area grasslands.

3.7 PEST MANAGEMENT

During TY 2021, Natural Resources and ITAM conducted limited herbicide applications, limited to in-house control of *Calamagrostis epigejos*, an aggressive and exotic invasive grass. Crew used a backpack sprayer and a motorized UTV-mounted pump to spray a Glyphosate solution on clumps of the grass along Richardson Road, in Demo 2, on Sierra Range, and in Training Area BA-6. All spraying was precisely targeted with wands rather than boom or broadcast spraying. A total of 3.3 pounds of active ingredient were applied across these sites, over the course of the summer. ITAM also conducted hand pulling to remove spotted knapweed (*Centaurea stoebe*) from restored training sites on BP-1, Demo-2, and Wheelock Overlook, covering 7 acres.

3.8 AIR QUALITY MANAGEMENT

3.8.1 Air Quality Permits

Potential air emissions from stationary sources at Camp Edwards are below the established federal and state thresholds for the designated primary air pollutants (carbon monoxide, nitrogen oxide, particulate matter, sulfur dioxide, and volatile organic compounds); therefore, Camp Edwards does not require an air quality control permit for stationary source emissions under the provisions of the Clean Air Act (CAA) or to measure and report actual emissions from its stationary sources.

The prescribed burn program requires an air quality control permit. The MassDEP Southeast Regional Office renewed the Camp Edwards smoke management and prescribed burn permit (#4F02008) on November 4, 2020. The permit is valid through December 31, 2022.

3.8.2 Air Quality Reports

310 CMR (Code of Massachusetts Regulations) 7.12(2)(b) requires that any person having control of a fuel burning facility or facilities with a maximum energy input capacity of 10,000,000 Btu/hr of natural gas report certain information to MassDEP once every three years. Because of the number of facilities at Camp Edwards, the MAARNG is required to submit a Source Registration/Emissions Statement (SR/ES) report for Camp Edwards every three years on or before the date established by the MassDEP. The Camp Edwards SR/ES report was submitted March 31, 2021 using calendar year 2020 data.

The only MAARNG stationary source emissions locations in the Training Area/Reserve on Camp Edwards are Range Control and the Ammunition Supply Point.

Biennial smoke management reports administered by MassDEP require reporting and renewal submission at the end of each two-year period. The Camp Edwards smoke management permit (#4F02008) was renewed November 4, 2020 and is valid through December 31, 2022. The biennial smoke management report was submitted May 15, 2019. Information on prescribed burn activities within the Training Area/Reserve for TY 2020 is provided in Section 3.6.

3.9 NOISE MANAGEMENT

The MAARNG published a Statewide Operational Noise Management Plan in December 2007 that provides a strategy for noise management at MAARNG facilities, including Camp Edwards. The plan includes a description of noise environments, including levels from small arms and aircraft training activities. Elements of the plan include education, complaint management, possible noise and vibration mitigation, noise abatement procedures, and land use management. Specific procedures are provided for noise complaints and protocols are provided for providing public notification for detonation of unexploded ordnance in place and for other unusual noise events.

3.10 STORMWATER MANAGEMENT

There were no new stormwater runoff increases in the Training Area/Reserve due to military training activities, and no new stormwater discharges from military training activities were made directly into wetland resource areas in the Training Area/Reserve.

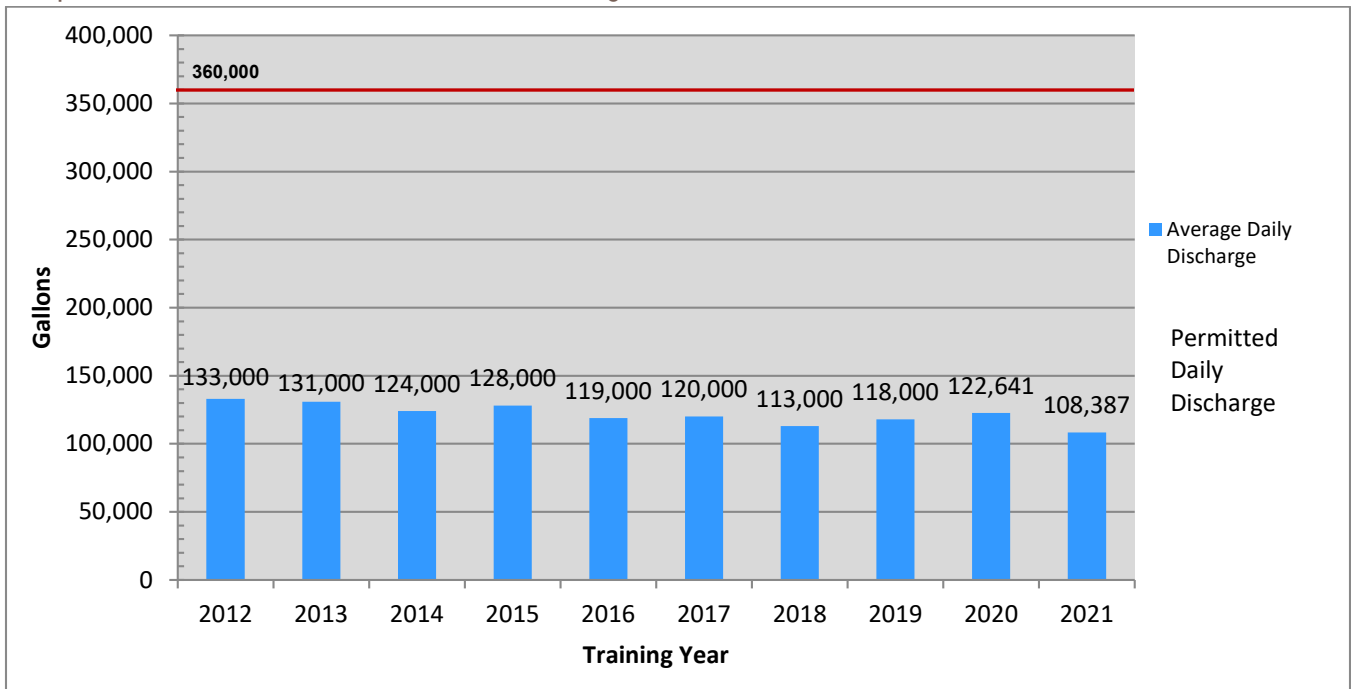
3.11 WASTEWATER MANAGEMENT

Depending on the location of facilities, wastewater and sewage from MAARNG training activities in the Training Area/Reserve was pumped from portable toilet facilities and hauled off base for disposal at licensed disposal facilities or discharged through the normal operation of existing septic systems (1,000 gallon) at Range Control and the Ammunition Supply Point that are regulated by MassDEP. (Note: There is a septic system at the former Otis Fish & Game Club located on Camp Edwards in the southwestern corner of the Training Area/Reserve; it is not in use at this time because the building is out of service. There are septic systems within the boundary of the Training Area/Reserve, at Cape Cod AFS and the USCG Communications Station, that are not subject to Chapter 47 of the Acts of 2002 and the EPSs, but which are regulated by MassDEP.)

3.11.1 Wastewater Treatment Plant Discharge

The Otis ANGB wastewater treatment plant operated within the discharge volume limits of its wastewater discharge permit during TY 2021. The plant discharged 39,561,077 gallons of sewage into the sand filtration beds in the Training Area/Reserve; a daily average of 108,387 gallons versus its permitted twelve-month moving average flow of 360,000 gallons. Graph 3-8 shows the daily average pumping rate of the Otis system since TY 2012.

Graph 3-8 Wastewater Treatment Plant Discharge



3.12 SOLID WASTE MANAGEMENT

The Camp Edwards Ammunition Supply Point did not turn in any ammunition casings for recycling to the Defense Logistics Agency office in Groton, Connecticut, during TY 2021. Casings are turned in periodically when economical.

The MAARNG published a Statewide Integrated Solid Waste Management Plan for all of its Army National Guard facilities in August 2010. The plan establishes MAARNG policy, responsibilities, goals, and objectives for compliance with statutory requirements for waste minimization, recycling, and solid waste disposal. Chapter 8 of the plan includes solid waste management procedures specific to Camp Edwards, as well as identifying potential future solid waste management alternatives.

3.13 HAZARDOUS MATERIALS MANAGEMENT

Camp Edwards has appropriate protocols in place to respond to oils or hazardous materials releases, such as fuel spills, in the Training Area/Reserve. These protocols include the Soldiers Field Card that outlines how Training Area/Reserve users respond if a spill occurs, and Camp Edwards has trained staff to initiate all required spill response actions. All users of the Camp Edwards training lands, including civilians, are required to complete a series of Range Control briefings. Users are directed via verbal instruction, as well as in training videos, to report spills and/or releases of any size to Range Control immediately.

There was one small spill in the Training Area/Reserve during Ty 2021 below the reporting levels established in the Massachusetts Contingency Plan. Approximately 4 ounces of hydraulic fluid leaked from an excavator doing work in the Central Impact Area. The spill was cleaned up with any contaminated soil or cleanup materials disposed of in accordance with applicable federal and state environmental regulations.

3.14 HAZARDOUS WASTE MANAGEMENT

The MAARNG complied with its policy of not performing maintenance activities on military vehicles in the Training Area/Reserve throughout the year. Thus, hazardous wastes normally associated with vehicle maintenance and repair facilities were not generated or stored in the Training Area/Reserve. Vehicle maintenance is completed at the UTES facility, which is outside of the Training Area/Reserve. In instances where the Installation Restoration Program (IRP) or IAGWSP use the EPA identification number of the MAARNG to dispose of wastes generated by remediation activities in the Training Area/Reserve, MAARNG Environmental tracks the procedure to ensure compliance with applicable regulations.

Upon the completion of an internal review of the Camp Edwards hazardous waste program, it was determined that the Satellite Accumulation Area located within the Range Control complex was no longer necessary. Wastes generated within the Training Area/Reserve are now managed within the existing accumulation area located UTES, which is located outside of the Training Area/Reserve.

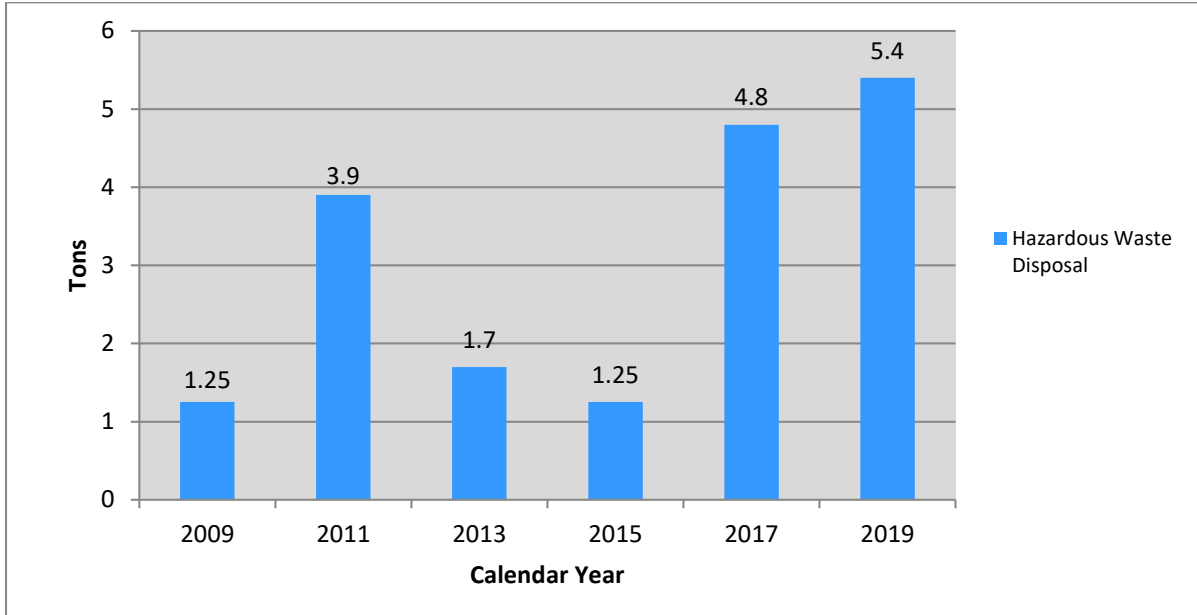
3.14.1 Hazardous Waste Disposal and Reporting

A biennial Hazardous Waste Report must be prepared and submitted to the EPA and MassDEP in March of even-numbered years reporting on hazardous waste generated by large quantity generators (LQG) during the preceding odd-numbered year. The last report for Camp Edwards was in February 2020 for hazardous waste disposed of during calendar year 2019. Graph 3-9 provides information on the volumes of hazardous waste disposal reported for the past six biennial reports. In general, the majority of the reported waste is generated from the repair and maintenance of military vehicles, aircraft, and equipment. These wastes include vehicle fuels, oils, antifreeze and associated rags and clean-up materials. The quantities of waste disposed of will fluctuate year to year based on the operational tempo of the MA ARNG within that year. In addition to the amounts generated and reported in the biennial report, the MAARNG removed approximately 4,400 tons of lead-contaminated soil as part of the IAGWSP cleanup effort in 2017. This material was not reported as part of the biennial report as it was exported to Canada and hazardous waste exported outside the US is not required to be reported in the biennial report.

3.15 VEHICLE MANAGEMENT

Unauthorized All Terrain Vehicle (ATV) and dirt bike access to the Training Area continued to be a problem in TY 2021. Range Control officials provided information to the Environmental Police as to locations and times such use was identified to help them adjust their patrols accordingly. As the level of unauthorized ATV and dirt bike access increases, continued coordination with the Environmental and local police takes place. Current efforts including sign posting, cameras, Camp Edwards Range Control inspections and Environmental and State Police patrols, have seemed to slow the illegal use of the Training Area/Reserve for ATV and dirt bike riding. However, this will be an ongoing effort. The entire Training Area/Reserve is now posted as off limits. This should help with public awareness and the enforcement of no trespass laws.

Graph 3-9 Hazardous Waste Disposal – Camp Edwards



3.16 GENERAL USE AND ACCESS MANAGEMENT

Public access to Camp Edwards is limited; however, under certain circumstances public access to Camp Edwards may be available such as hunting during the deer and turkey seasons (See Section 3.5.4 and 3.5.5).

3.17 CULTURAL RESOURCES MANAGEMENT

All MAARNG actions in the Training Area/Reserve are reviewed by the MAARNG Cultural Resource Manager to ensure compliance with all applicable federal, state, and local cultural resource regulations. The MAARNG consults regularly with the Massachusetts State Historic Preservation Office (MA SHPO) ensuring actions are in compliance with Section 106 of the National Historic Preservation Act. In addition to the MA SHPO, the MAARNG consults regularly with the Wampanoag Tribe of Gay Head (Aquinnah) and the Mashpee Wampanoag Tribe on undertakings that may affect historic properties that the Tribe has attached religious and cultural significance.

3.18 EPS VIOLATIONS

On February 18, 2021, the MAARNG reported to the EMC a noncompliance with EPS 19, or more specifically, with the OMMP for defined and approved use of a range. A unit conducted non-standard range use at Sierra Range on February 11, 2021, and at Echo Range on February 12 and February 13, 2021. The unit was found to have placed weapons zero targets on Sierra Range's 25 meter line because snowfall had made accessing the usual

25 meter zeroing targets difficult. The unit fired 700 5.56mm copper-only rounds of ammunition at those targets. On Echo Range, the unit conducted transition firing (transitioning between 5.56mm copper-only rifle and 9mm pistol fire) standing at 10 yards from stationary targets. A total of 17,000 5.56mm copper-only rounds were fired on Echo Range.

As is required for nonstandard range usage, the Officer in Charge and the Noncommissioned Officer in Charge did not seek approval for the nonstandard training from Camp Edwards Plans and Training, the Environmental & Readiness Center, and the EMC's Environmental Officer.

Corrective actions included counseling full-time Range Control staff on the importance of following established processes of consultation and approval for any non-standard training event; directing the Range Control maintenance manager that targets shall not be altered or additional targets installed on a range unless there is an approval in writing or the range is being prepared for an approved proof of concept for a future training event; the Officer in Charge formalizing non-standard training requests (exceptions to policy) in a Standard Operating Procedure; retraining full-time Range Control staff; and written counseling for those personnel involved in approving the non-standard training.

In a letter dated March 16, 2021, the EMC determined that the "placement of additional targets and the use of the 5.56mm M855A-1 EPR ammunition at the range is inconsistent with the current OMMP for Echo Range and is a violation of EPS 19.0." The EMC also determined "that the placement of the 25-meter zero targets between lanes 6-7 is inconsistent with the current OMMP for Sierra Range and is considered a violation of EPS 19.0." Additionally, the "failure of the Range Control OIC and NCOIC to follow the approved OMMP for Sierra and Echo ranges constitutes a violation of Range Performance Standard EPS 19.0."

In addition to corrective actions instituted by the MAARNG, the EMC required that the full-time Range Control staff undergo annual training on EPS 19.0 and the BMPs and OMMPs; newly assigned Range Control staff undergo training on EPS 19.0 and the BMPs and OMMP prior to being given authority for operational control of the small arms ranges; documenting the corrective actions and additional EMC requirements in Camp Edwards Operations and Training Regulation 350-2, and forwarding that to the EMC for review.

In a September 28, 2021, letter to the EMC, the MAARNG confirmed they completed the corrective actions and additional EMC requirements listed above and provided the EMC with a copy of Regulation 350-2 and documentation of the required EPS/OMMP training.

Appendix H lists violations reported since TY 2012.

3.19 MITIGATION

Details of mitigation requirements and actions for TY 2021 may be found in the *Conservation and Management Permit Compliance and Mitigation Actions* in Appendix F.

SECTION 4

REMEDIATION PROGRAM ACTIVITIES

4.0 INTRODUCTION

This section of the Annual Report provides summaries on remediation activities in the Training Area/Reserve during TY 2021.

4.1 INVESTIGATION AND REMEDIATION PROGRAMS

There are two independent cleanup programs operating at JBCC: the Installation Restoration Program and the Impact Area Groundwater Study Program.

The IRP was initially established at the installation in 1982 under Air National Guard management. Oversight of the program was transitioned to the Air Force Center for Environmental Excellence, now known as the Air Force Civil Engineer Center (AFCEC), in 1996. The program operates under the regulatory guidance of the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The majority of the activity of the IRP has been focused in the Cantonment Area and in off-installation plumes emanating from the Cantonment Area. AFCEC is responsible for two IRP sites in the Training Area/Reserve: Chemical Spill-19 (CS-19) and Fuel Spill-12 (FS-12) and three Military Munitions Response Program (MMRP) sites: Old K Range, former Mock Village, and former Otis Gun Club. The MMRP addresses potential threats to human health and the environment from munitions and munitions constituents in non-operational range areas.

The IAGWSP is being managed by the Army National Guard. Investigation of the environmental impacts of legacy training in the upper 14,886 acres of JBCC began in 1996 and cleanup of groundwater contamination began in 2004. Seventeen treatment systems are currently operating on seven groundwater plumes to clean more than 4.1 million gallons of groundwater per day. More than 16 billion gallons of groundwater have been treated to date. While no public or private drinking water supplies are affected by the groundwater contamination being addressed by the IAGWSP, the contamination is being addressed to prevent any possible future exposures. Information on the IAGWSP can be obtained on its website: <http://jbcc-iagwsp.org>.

Both the IRP and IAGWSP have active regulatory participation and community involvement programs. The communities surrounding the installation are kept informed through neighborhood notices and meetings, media releases, community updates, fact sheets, publication and distribution of plans and reports, websites, and information repositories at local libraries.

The programs meet regularly with EPA Region 1 and MassDEP to discuss findings and determine appropriate response actions. Public comment periods are held, as necessary, to present and solicit input on proposed actions. The programs also provide updates on their activities to public meetings of the joint citizens' advisory team, the JBCC Cleanup Team. The JBCC Cleanup Team includes representatives from the surrounding communities and the regulatory agencies.

The IRP and IAGWSP each operate under different regulatory directives and mostly address different contaminants of concern. However, they share sampling results, equipment, technical innovations, and even a treatment facility. Figure 4-1 shows the areas under remediation by the IRP and the IAGWSP in the Training Area/Reserve. The map in Figure 4-1 is available at http://jbcc-iagwsp.org/community/facts/jbcc_plume_map_121421.pdf

4.2 INSTALLATION RESTORATION PROGRAM ACTIVITIES IN THE TRAINING AREA/RESERVE

In TY 2020, AFCEC finalized the Comprehensive Site Evaluation (CSE) Phase II (similar to a Site Inspection) investigation at 10 MMRP sites, including the three sites that are located in the Training Area/Reserve. A Streamlined Remedial Investigation/Feasibility Study (RI/FS) was prepared for the former World War II Mock Village and has been finalized. A RI was completed in TY 2019 at the World War II-era Old K Range and an FS was drafted and submitted for review in TY 2021. Numerous 2.36-inch rockets and other ordnance were discovered at the Old K Range during the CSE Phase II and RI field work. Because some of the rockets contained high explosives, this site is currently off limits. A RI was also completed for the former Otis Gun Club and an FS was drafted but identified data gaps; therefore, a Supplemental RI is planned to collect additional data. The MMRP sites in the Training Area/Reserve are all former training sites. In addition to the MMRP sites, AFCEC manages two groundwater plumes in the Training Area/Reserve (CS-19 and FS-12). AFCEC closed a former site referred to as CS-18, which was also located in the Training Area/Reserve.

In TY 2021, groundwater monitoring was conducted at CS-19 where the contaminant of concern is RDX. RDX was detected above the EPA risk-based level of 0.97 µg/L in one of three monitoring wells sampled. The highest RDX concentration was 1.4 µg/L.

AFCEC also manages three 1.5 MW wind turbines at JBCC, two of which are located in the Training Area/Reserve. The turbines offset the energy use in the IRP by 100% (approximately \$1.5 million per year). The turbine operation is curtailed for the Northern Long-Eared Bat from July 15 to October 15, 30 minutes before sunset to 30 minutes after sunrise for wind speeds less than 4.5 meters per second. There were no reported bat or bird strikes during TY 2021.

4.3 IMPACT AREA GROUNDWATER STUDY PROGRAM ACTIVITIES

During TY 2021, the IAGWSP operated groundwater treatment systems for plumes associated with the former Demolition Area 1, former J-3 Range, former J-2 Range (northern and eastern), the former J-1 Range (southern and northern), and the former Central Impact Area (CIA). These systems are treating approximately 4.1 million gallons of water per day.

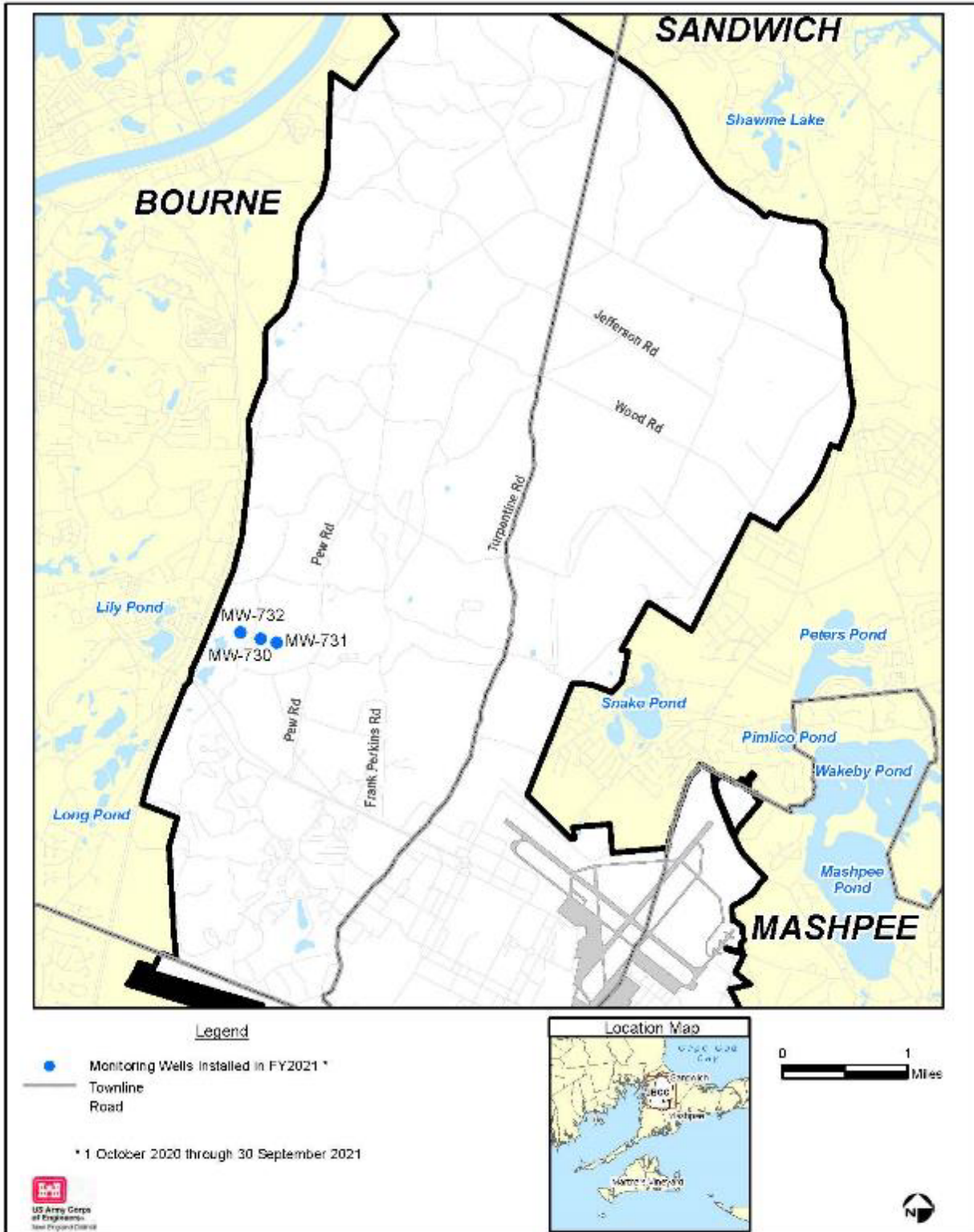
Removal of munitions from the source of the CIA groundwater plume continued in TY 2021. Work on Phase IV Area 1 (10 to 15 acres) of the CIA long-term source area response continued throughout the year. In the Central Impact Area, 93 acres have been cleared to 90%. Teams from the Army Corps of Engineers used Metal Mapper, a multi-sensor electromagnetic detection technology, for the removal efforts. This geophysical technology is designed to discriminate between munitions and scrap metal in the subsurface. Use of the Metal Mapper allows the program to increase the efficiency of unexploded ordnance removal while reducing impacts to the surface soil and vegetation when compared to traditional excavation techniques.

The IAGWSP conducted sampling at the former J-3 Range as follow-up to detections from previous sampling done to evaluate whether Per- and polyfluoroalkyl substances (PFAS) are present in the groundwater from sites where open burning/open detonation is known to have occurred. Groundwater sampling conducted in TY 2021 was conducted as follow-up to detections from 2020 PFAS sampling. Wells with the highest PFAS concentrations are located within and east of the former J-3 Range Demolition Area and in the vicinity of the former melt/pour building (where the melting/pouring or pressing of plastic bonded explosives occurred). Review of the data is ongoing and any recommendations for sampling of additional wells and further investigations will be developed for Agency review and approval.

Three new groundwater monitoring wells were added in TY 2021 (Figure 4-2) in support of groundwater investigations at the Demolition Area 1 plume. The wells were installed co-located and adjacent to the groundwater

monitoring well that had the highest detection of perchlorate during the 2020 reporting period. The wells will be used to further define the extent of perchlorate and RDX contamination in this area.


Figure 4-2 IAGWSP Wells Installed During TY 2021



Impact Area Groundwater Study Program
Monitoring Wells Installed in FY2021

FIGURE
1

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 Impact Area
Groundwater Study Program

SECTION 5

MISCELLANEOUS MILITARY AND CIVILIAN ACTIVITIES AND ENVIRONMENTAL PROGRAM PRIORITIES

5.0 MISCELLANEOUS MILITARY ACTIVITIES

5.0.1 Camp Edwards Tours

Camp Edwards hosted 10 tours of the training area open to community members from August to November. MAARNG soldier training venues, including simulated training and small arms ranges, the Natural Resources Program, and groundwater treatment conducted by IAGWSP were the subjects of the tours. MAARNG training requirements, habitat conservation and mitigation efforts were among the items discussed by the tour leaders. The tours were advertised in the Enterprise newspapers and on the E&RC's website. Approximately 200 members of the community attended the tours.

5.1 PROJECTS AT CAMP EDWARDS

A multiple-year effort to replace the roofs on the barracks at Camp Edwards with modern metal roofs was completed through the MAARNG's Construction and Facilities Office and the Directorate of Facilities Engineering. All eight barracks received sloped metal roofs that better safeguard the barracks, reduce the likelihood of roof leaks, and extend the useful life of the buildings for at least another 50 years. Initially, the roofs were funded out of Operations and Maintenance funding, but additional funds were competed for and ultimately awarded. The \$4.38 million dollars' worth of additional funds allowed for the last three barracks roofs to be completed. In future years, the MAARNG will continue to use this model to fix the envelopes of the barracks to include repairing masonry and replacing windows and doors.



Photograph 5-1 Two of Camp Edwards's barracks with new, metal roofs.

5.2 JOINT BASE CAPE COD EXECUTIVE DIRECTOR

The Adjutant General of the Massachusetts National Guard established the position of the Executive Director of JBCC in late TY 2012. The primary roles of the position are to ensure inter-agency communication and coordination are implemented and practiced, and that government and community stakeholders are kept informed. Additionally, the Executive Director is responsible for looking at efficiencies that might be gained through consolidation and cost-sharing of base operations and activities.

The Executive Director serves as the Adjutant General's representative to the Joint Oversight Group that considers items of mutual concern. The Executive Director also serves on the Commonwealth of Massachusetts's Military Asset and Security Strategy Task Force helping to secure the military bases of the Commonwealth. Brigadier General (ret) Christopher Faux was appointed JBCC Executive Director in June 2018.

5.3 MISCELLANEOUS CIVILIAN ACTIVITIES

5.3.1 Eversource Projects

As part of the Mid Cape Reliability Project, Eversource is upgrading an existing Eversource switching station (Bourne Switching Station #917) located on an easement in the Training Area/Reserve (Figure 5-2). Eversource evaluated several sites for minimal loss of training land and impact to state priority habitat. Eversource is siting the switching station southwest of the current substation (Figure 5-1). The property transfers between Eversource and the state leaves a net benefit of approximately 2.51 acres for the MAARNG for training. Because the Training Area/Reserve is land protected under Article 97 Articles of Amendment to the Constitution of the Commonwealth of Massachusetts, legislation was required to be passed to change the use of the property. Governor Charlie Baker signed the bill to change its use in August 2018. Eversource submitted an Environmental Notification Form to the MEPA office on December 17, 2018. For this project, all review and permitting is complete. Completion of the project is anticipated for 2023.

Figure 5-1 Eversource Switching Station Area



As part of the construction, approximately 68,000 cubic yards of soil was removed from the site. Eversource had the soil sampled with samples being tested for the following characterization parameters: PFAS, PFOA, volatile organic compounds, semi-volatile organic compounds, total petroleum hydrocarbons, polychlorinated biphenyls, Massachusetts Contingency Plan (MCP; 310 CMR 40.0000) 14 metals, conductivity, corrosivity, ignitability, reactivity, pH, pesticides, herbicides, perchlorate, and explosives. All samples were below or within regulatory guidelines, specifically MassDEP S1 standards. The MAARNG will be able to repurpose most of the material for use on Camp Edwards at Dig Site 3 to be used for repair and maintenance as needed and for engineering training within the dig site. Over the last nine years, the EMC and the MANG at Camp Edwards have been involved stakeholders in Eversource's proposal to replace the switching station. Other partner agencies include MEPA, NHESP and DFW, the Cape Cod Commission, and the four Upper Cape Cod towns surrounding JBCC.

In TY 2019, Eversource came to the MAARNG with a new reliability project for another utility line from the switching station running down Cape to the Town of Barnstable. This will create a redundant line that will help ensure the Cape has reliable power. Eversource will use its current easement for the project.

5.3.2 Cape Cod Canal Area Transportation Improvement Program

The Canal Area Transportation Improvement Program, led by the Massachusetts Department of Transportation (MassDOT), covers areas in Bourne and Sandwich and west along Route 25 into Wareham. According to presentations given by MassDOT, the program will likely include replacing the Bourne Bridge and Sagamore Bridge, improvements to the approach roadway network, multimodal improvements, and utility relocations. MassDOT released the final Cape Cod Canal Transportation Study in October 2019, which recommended various improvements and upgrades to infrastructure around the Canal Area including to the rotaries near the Bourne Bridge and adding an additional Route 6 eastbound travel lane from the Canal to approximately Exit 59 (the old Exit 2). Some changes could have potential impacts to JBCC and specifically the Camp Edwards Training Site. The final report is available online at <https://www.mass.gov/lists/cape-cod-canal-study-documents#cape-cod-canal-transportation-study:-final-report->.

Data collection continues and will inform future alternatives analysis. The information will be used to determine impacts to property, local and regional traffic patterns, environmental resources, cultural, historical, and archeological resources and economic development. MassDOT held virtual public update meetings in June 2021 and November 2021. Documents and meeting materials related to the program may be found at: <https://www.mass.gov/lists/documents-meeting-materials-cape-cod-canal-area-transportation-improvement-program>.

5.4 ENVIRONMENTAL PROGRAM PRIORITIES

5.4.1 TY 2021 Environmental Program Priorities

The following subsections provide a list of the environmental program priorities established for TY 2021 as published in the TY 2020 Annual Report for its activities associated with the Training Area/Reserve and the status of achieving them..

Natural Resources and ITAM Management

- Finalize Sikes Act signatures on updated INRMP and implement annual review. (Completed)
- Implement projects and planning identified in the Conservation and Management Permit that established an onsite mitigation bank and long-term habitat management and resource monitoring requirements. (Accomplished for TY 2021 and ongoing)

- Continue to address potential federal status changes to species at Camp Edwards through interagency consultation, planning, and partnership. (Ongoing)
- Further develop supplemental plans for Natural Resources/ITAM long-term budgets and implementation, including invasive species, wildland fire, and land rehabilitation. (Ongoing)
- Continue implementation and refinement of management focused monitoring of rare species, habitat management, and training capabilities. (Ongoing; completed some target plans such as moth and vegetation monitoring)
- Continue to update wildland fire planning and program opportunities after hiring dedicated Wildland Fire Program Coordinator, including updating Integrated Wildland Fire Management Plan and planning for increased range usage. (Ongoing)
- Continue upscaling of habitat and land management actions, including mechanical work and prescribed burning, through internal actions and partnerships, to increase long-term ecosystem health and resilience. (Ongoing)
- Develop water feature conservation plans that provide for ephemeral features (e.g., vernal pools) while minimizing impacts to wildlife and training. (Ongoing)
- Continue and further develop interagency partnerships with Massachusetts Division of Fisheries and Wildlife, NHESP, US Fish and Wildlife Service, EMC, DCR, MassDEP, and others through active engagement to seek mutual benefit. (Ongoing)

Cultural Resources Management

- Conduct applicable reviews of all IAGWSP, IRP and MAARNG proposed activities in the Training Area/Reserve for potential cultural resources impacts. (Ongoing)
- Document any new occurrences of identified cultural resources. (Ongoing)

Other E&RC Environmental Management Programs

- Coordinate required soil, lysimeter and groundwater sampling at operationally active small arms ranges in accordance with approved range management plans. (Accomplished)
- Provide appropriate support to Camp Edwards for small arms range development. (Accomplished)
- Continue to support Camp Edwards through the environmental process for proposed training venues in the Training Area/Reserve. (Accomplished)
- Provide support as needed to the JBCC Executive Director Office with regards to community involvement and environmental and training issues. (Accomplished)
- Attend all scheduled EMC, CAC and SAC meetings, both internally and externally, that may involve activities within and surrounding the Training Area/Reserve. (Accomplished)
- Provide information on environmental program activities regarding the Training Area/Reserve. (Accomplished)
- Work closely with Camp Edwards, the Natural Resources Office, and the EMC to ensure training is compatible with the EPSs. (Accomplished)
- Provide support for the EMC and its advisory councils as required in Chapter 47 of the Acts of 2002. (Accomplished)
- Publish the final TY 2020 *State of the Reservation Report*. (Accomplished)

5.4.2 TY 2022 Environmental Program Priorities

The following subsections provide a list of environmental program priorities for Camp Edwards for activities associated with the Training Area/Reserve in TY 2022.

Natural Resources and ITAM Management

- Implement projects and planning identified in the Conservation and Management Permit that established an onsite mitigation bank and long-term habitat management and resource monitoring requirements. Annual and ongoing for TY 2022 with primary emphasis on prescribed burning and monitoring/research.
- Continue to address potential federal status changes to species at Camp Edwards through interagency consultation, planning, and partnership. Ongoing with particular emphasis on the proposed change of the Northern Long-eared Bat from Threatened to Endangered under the Federal Endangered Species Act.
- Further develop supplemental plans for Natural Resources/ITAM long-term budgets and implementation, including invasive species, wildland fire, and land rehabilitation. Ongoing with particular emphasis on growing prescribed fire implementation.
- Continue implementation and refinement of management focused monitoring of rare species, habitat management, and training capabilities. Ongoing with TY 2022 emphasis on continuing long-term efforts and initiating the robust moth and vegetation long-term monitoring effort.
- Continue to update wildland fire planning and program opportunities after hiring dedicated Wildland Fire Program Coordinator, including updating Integrated Wildland Fire Management Plan and planning for increased range usage. Ongoing with Integrated Wildland Fire Management Plan completion planned for this year.
- Continue upscaling of habitat and land management actions, including mechanical work and prescribed burning, through internal actions and partnerships, to increase long-term ecosystem health and resilience. Ongoing with emphasis on strengthening prescribed fire program and monitoring of habitat effects.
- Develop water feature conservation plans that provide for ephemeral features (e.g., vernal pools) while minimizing impacts to wildlife and training. Ongoing with emphasis on more detailed planning of two new vernal pools based on ongoing siting plan.
- Continue and further develop interagency partnerships with Massachusetts Division of Fisheries and Wildlife, NHESP, US Fish and Wildlife Service, EMC, DCR, MassDEP, and others through active engagement to seek mutual benefit. Ongoing.

Other E&RC Environmental Management Programs

- Coordinate required soil, lysimeter and groundwater sampling at operationally active small arms ranges in accordance with approved range management plans.
- Provide appropriate support to Camp Edwards for small arms range development.
- Continue to support Camp Edwards through the environmental process for proposed training venues in the Training Area/Reserve.
- Provide support as needed to the JBCC Executive Director Office with regards to community involvement and environmental and training issues.
- Attend all scheduled EMC, CAC and SAC meetings, both internally and externally, that may involve activities within and surrounding the Training Area/Reserve.
- Provide information on environmental program activities regarding the Training Area/Reserve.

- Work closely with Camp Edwards, the Natural Resources Office, and the EMC to ensure training is compatible with the EPSs.
- Provide support for the EMC and its advisory councils as required in Chapter 47 of the Acts of 2002.
- Publish the final TY 2021 *State of the Reservation Report*.