SECRETARY OF DEFENSE ENVIRONMENTAL AWARDS 2020

MASSACHUSETTS ARMY NATIONAL GUARD
ENVIRONMENTAL RESTORATION, INSTALLATION

Program Management
Technical Merit
Orientation to Mission
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At Camp Edwards, on Joint Base Cape Cod (JBCC), the Massachusetts Army National Guard (MAARNG) is improving and increasing military training and readiness through the successful restoration efforts of the Impact Area Groundwater Study Program (IAGWSP). The program's largest and final removal and restoration action is to remove 90% of the unexploded ordnance (UXO) and reduce unnecessary digs by 70% from the most heavily-used (per square foot) impact area within the US Army. Military training and testing activities had taken place for over 100 years at this site, New England's largest military reservation. To reestablish a robust training capacity, the MAARNG has been working to correct the legacy of contamination issues while simultaneously improving and increasing military training through the use of cutting-edge science and technology. Because Camp Edwards sits on top of the sole source aquifer for Cape Cod, virtually all restoration has been driven by groundwater protection and remediation, which includes pump and treat groundwater treatment systems and UXO removal. The sandy soil allows contaminants to leach quickly to the groundwater, which migrates at a rate of one to two feet per day. Therefore, contamination has the potential to impact public and private drinking water wells. To mitigate this threat and protect public health and the environment, an aggressive, long-term environmental restoration and remediation effort was undertaken. The MAARNG, the National Guard Bureau, Department of the Army, and US Army Corps of Engineers formed a team to capably execute this monumental and unprecedented project at a time when the future of the base was in jeopardy.

A snapshot of Camp Edwards today:

- 15,000 acres investigated; grouped into 14 operable units
- 1,400 monitoring wells in 700 locations
- 100,000 groundwater and soil samples collected
- 120,000 tons of soil excavated and treated
- 12 groundwater plumes (RDX & perchlorate)
- 17 treatment systems constructed for 7 groundwater plumes
- 4.1 million gallons of groundwater treated per day
- 12 billion gallons treated to date
- ~300 acres partially cleared of UXO
- 660 tons of munitions-related scrap recycled
- 131,188 anomalies investigated
- 56,087 anomalies excavated
- 1,591 UXO items excavated and destroyed
- 8,877 UXO-like items excavated and recycled
- 4,415 pounds of explosives removed
- Over $420 million invested to date

The history of the site lends context to the remarkable achievements in restoration over the past two years. Camp Edwards encompasses 15,000 acres of the 22,000-acre Joint Base Cape Cod. In 1996, the IAGWSP was established by Guard Bureau to examine the impacts of military training

and defense contractor testing activities at the installation. The following year, the Environmental Protection Agency (EPA) issued an Administrative Order under the Safe Drinking Water Act requiring the investigation of groundwater contamination linked to military use and emanating from Camp Edwards' Impact Area and training ranges. At this time, a comprehensive public outreach component for the project was also instituted. A second Administrative Order effectively halted all training related to artillery and mortar firing, required remediation of lead contamination, and called for the creation of a pollution prevention plan at all small arms firing ranges. A subsequent Order in 2000 required implementation of rapid response actions, feasibility studies, and remedial actions to address groundwater contamination, source areas, UXO, and munitions. At this point, the cleanup of Camp Edwards kicked into high gear, as 14 sites were identified as needing full delineation and remediation. The program set out not only to restore legacy impacts, but also to ensure that current and future training incorporated all safeguards necessary to protect the aquifer and the natural resources located on the installation. While the Army led this program for a number of years, in 2012, National Guard took over management of the IAGWSP and currently manages all compliance-related cleanup on Camp Edwards with onsite support from MAARNG.

In addition to the use pyrotechnics many live fire training activities are being conducted again at Camp Edwards to include day and night mounted and dismounted live fire. Above, soldiers conduct a mobile refueling exercise.

As a result of the dedication of these partners, Camp Edwards has been extraordinarily successful not only in restoring groundwater resources and addressing UXO, but also in reintroducing training capabilities and creating new training assets, particularly over the past two years. Previously, the installation had been supporting between 22,000 and 24,000 man-days per year. In FY18-19 that rate has doubled to nearly 50,000 man-days of training each year. Newly-restored ranges have been reintroduced to the training inventory, new copper-based ammunition has been introduced, and pyrotechnic training has been successfully reestablished.

Camp Edwards is the only operational range that has ever had training stopped due to an EPA environmental enforcement action. It is through the dedication and rigor of the remediation response team that the installation has reemerged as not just a functional training site, but one of the premier training resources in the region. The installation continues to treat groundwater contamination with 17 systems onsite, processing over 4 million gallons of groundwater every day. Source removal of contamination is virtually complete, and the installation is working now in a more preventive vein, targeting UXO and munitions before the components of those items deteriorate and leach into groundwater or create a new source of contamination. Over the past two

years, the installation has adopted cutting edge electromagnetic induction sensor technology ("metal mapper") to reduce the cost of the source cleanup while enhancing accuracy. Instead of having to clear and sift through every inch of every acre, the metal mapper is able to identify targets of interest, which reduces the number of items that need to be dug up. Initial estimates indicated it would cost $1 million per acre to clear the Camp Edwards Impact Area of UXO using conventional techniques, but with the use of metal mapper, costs are cut by up to 70%. Altogether, this technology will be used to clear approximately 100 acres on Camp Edwards; of which nearly 70 acres have been cleared with this electromagnetic induction sensor application.

Metal mapper has provided a tremendous cost savings. Significantly reducing the number of anomalies that actually are excavated unnecessarily saves both time and money. The ARNG has ensured that future budget requirements are incorporated into the Program Objectives Memorandum (POM) embedded into contractor operations. In fiscal year 2018 the contractor hired to execute metal mapper operations did not meet the objectives of their scope and the data produced was insufficient for supporting the Army's program objectives of recovering 90% of all UXO/grid and reduce digging up to 70% for non-UXO/grid. Per the contract, essential requirements were not met by the contractor and they were held accountable for this failure. This resulted in the contractor needing to re-map and dig the entire 10 acres (40 grids) at their own expense (~ $2.1 million). So for this current FY, the contractor will be executing 15 acres (60 grids) and redoing the previous 10 acres (40 grids), for a total of 25 acres (100 grids). Effectively, this attention to detail has saved the ARNG from losing any time, money, or training readiness.

Because of the explosive hazard at least 10 acres a year must be manually cut by EOD/UXO Technicians or by utilizing robotics. After an area is cut, a UXO surface clearance must be conducted utilizing a method commonly referred to as "Mag and Flag." Each flag is a UXO or MEC item the must be investigated, removed, and properly disposed of.

Daily restoration operations are managed by MAARNG restoration staff, with US Army Corps of Engineers (USACE) serving as general contractor and National Guard Bureau as the oversight agency. The project is federally-funded per the terms of the EPA orders, mandating that the program costs are covered by the Army's operations and maintenance budgets. EPA serves as the key regulatory agency, and the Massachusetts Department of Environmental Protection also reviews and advises on actions. The installation has emphasized transparency and communication from the onset, 20 years ago and, as a result has built tremendous credibility and trust with regulatory agencies and citizen stakeholders. Adhering to the restoration plans generated by the installation's feasibility studies and decision documents has kept the project fully compliant. Restoration staff also work closely with the MAARNG's regulators, trainers, and range control to prioritize cleanup activities in areas that are most urgently needed for

training, as well as to ensure that no new environmental risks are introduced as a result of that training.

Camp Edwards is the only place worldwide to put the metal mapper technology into operation at an industrial scale. The metal mapper, however, does not represent all the innovation in techniques used at Camp Edwards.

The UXO remediation process actually begins with light detection and ranging (LiDAR) scans of the restoration parcel, which allows the project team to see depressions, divots, and holes in the ground that may indicate some sort of munitions impact. Using LiDAR in this way is a new investigative component, which was introduced this past year. The geometry of those depressions can also be analyzed to predict what kind of munition and the density of munitions that created those surface anomalies. With this information, an estimate can be generated of how many rounds might not have exploded, providing a much more accurate projection of the volume of materials likely to be found. Eventually, the metal mapper technology is deployed to confirm those projections and minimize unnecessary excavation. First, however, the surface vegetation must be cleared.

The impact area is characterized by pitch pine and scrub oak; all this must be cut down so that the surface can be cleared. The vegetation removal is executed to achieve multiple goals, however, beyond purely providing site access. The surface treatments are planned with input from the installation natural resources program. Removing certain swaths of vegetation creates desirable breaks in the ecosystem that encourages biodiversity and foraging habitats, so these elements are integral in determining the priority of treatment sites over the course of the overall project. Removal of vegetation also reduces fuel loads that would increase wildfire risk, which is essential as new training, pyrotechnic training, and training intensity is introduced on post. For some sites where use has been entirely restricted for the past 20 years, the UXO remediation is also the means by which those areas are restored to their original conditions for training operations.

The IAGWSP has identified and destroyed over 1,591 UXOs, recovered more than 8,877 UXO Like anomalies. Photo of the IAGWSP staging area before they perform the required 2nd and final Safety certification for each piece of munitions related scrap, so that it can be recycled.

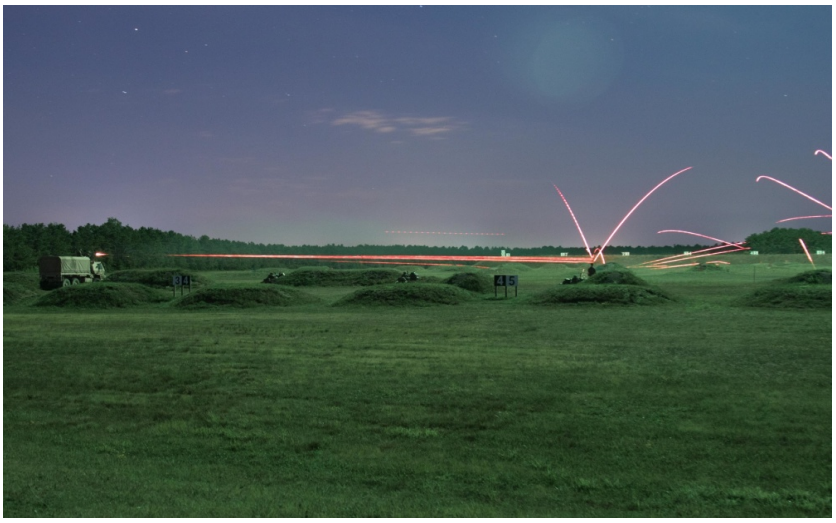
Following vegetation clearance, the remediation site is then scanned with EM61 geophysical metal detectors to confirm metal dispersal and break down target areas for the metal mapper to be used. The combination of LiDAR with conventional geophysical tools and the metal mapper ultimately allow the installation to more accurately assess the amount of UXO present--as

well as confidently assert that the full scope of UXO has been located--while also reducing the number of metallic anomalies that actually need to be addressed. The MAARNG will likely excavate around 25,000 targets by the end of FY19, without these technologies, they would have been dealing with excavation of an additional 50,000 to 75,000 targets that would not have turned out to be UXO at all.

The project scope requires UXO removal of at least ten acres each year. With roughly 25 acres remediated as of the end of FY19, the MAARNG projects that the entire impact area will meet the UXO clearance requirements in about seven - ten years. All of the metal debris recovered during UXO removal actions is recycled as scrap metal with more than 500 tons of scrap recycled over the past two years. The proceeds of recycling offset costs associated with the project and recycling eliminates an additional project waste stream.

Camp Edwards has removed all lead-contaminated soil on the small arms ranges to a level which allows for unrestricted use. Surface removal of spent rounds and excavation of berms has been completed on all of the ranges. New berms have been constructed to reopen those ranges for use this year. The training site was the first in the National Guard to introduce enhanced-performance rounds made of pure copper, which provides a more desirable metal for recycling, and a markedly improved return-on-investment over lead.

Groundwater treatment continues on the installation, and with virtually all source contamination removed, the remediation of groundwater plumes is nearing completion after nearly two decades of effort. The program's pump and treat systems treat 4.1 million gallons of groundwater per day and over 12 billion gallons have been treated to date. Additional sampling and monitoring wells have helped the MAARNG to demonstrate that levels of the emerging contaminant PFAS meet both EPA and Massachusetts EPA standards.



For the first time in 20 years at Camp Edwards pyrotechnics and night fire is conducted thanks to the work of the IAGWSP. Soldiers from the 1058th Transportation Company, Massachusetts National Guard, conduct a night base defense live-fire exercise under the illumination of a green flare during the Combined Arms Exercise: Patriot Crucible, Joint Base Cape Cod, Massachusetts, August 1st, 2019.

On the largest tract of undeveloped land on Cape Cod, Camp Edwards is the only ARNG-owned and operated major training site in all of New England. Camp Edwards is essential to the ARNG's mission, as well as an important staging and training area for the Region 1 Homeland Response Force (HRF) 1st Civil Support Team (CST) and a multitude of partnering civilian first responders throughout the Northeast. Camp Edwards is arguably the greatest success story in the nation for environmental stewardship and preservation of training, an achievement all the more remarkable for how dire a situation the training site once was. At the onset of the restoration effort, training was effectively halted completely. By contrast today, Camp Edwards is one of the most

active training sites in the New England region. Most recently, the installation has successfully reintroduced pyrotechnics training, which was banned in 1997. The restoration staff were able to prove that these training aides do not pose a risk to groundwater. The concurrent introduction of enhanced performance rounds (copper-based) has helped to create a training environment that prevents future training-related impacts to groundwater. In many ways, the need for sustainable training resources has driven restoration to a degree that would not have been achieved in the absence of military land use. Because Camp Edwards is so essential to the MAARNG's readiness, all operations on the installation have shifted to protect groundwater and promote every greater degrees of environmental awareness and stewardship while enhancing training and readiness. Working collaboratively the restoration team and the installation command continues to open new ranges and maneuver areas where both traditional and innovative training can be conducted.

Camp Edwards has long been an example for other installations to follow when embarking upon a remediation project. The training site's transparency and outreach have been exemplary, and this openness has helped the MAARNG to reestablish trust and credibility in its community. The trajectory of the restoration has been reflected at each step with comprehensive planning and documentation, and the cleanup team has worked with its internal and external stakeholders and all project contractors to ensure that activities adhere to those plans and to compliance standards set by EPA.

Camp Edwards has pioneered and validated new technologies and techniques, which is critical for other military installations addressing UXO. The metal mapper is perhaps the best example of this, as that equipment was fostered by the Impact Area Groundwater Study Programs team and its effectiveness was proven in action on the post. This equipment is already being expanded to serve UXO remediation at other DoD sites around the world. Camp Edwards also proved that this technology is appropriate and effective on an industrial scale and could benefit other installations as well. Camp Edwards provides the model for layering technologies to be ever more effective and efficient in managing remediation and accurately predicting scope and duration.

Community outreach has been a cornerstone of Camp Edwards restoration efforts from the very beginning. In 2001, The Environmental and Readiness Center (EandRC) was established by the MAARNG to serve as the point of contact for the public for all environmental issues. This dedicated outreach resource also provides the expertise and materials necessary to follow through on compliance with all Environmental Performance Standards (EPS) to ensure compatible, realistic training, while protecting the natural and cultural resources at Camp Edwards. There are multiple levels of community and municipal engagement with the training site and program staff continue to meet with these stakeholders regularly. These include the Environmental Management Commission, the Science Advisory Council, the Community Advisory Council, the Joint Oversight Group, and the Joint Cleanup Team, all of which were formed in response to, and over the course of, the Camp Edwards' restoration program. Dozens of public meetings are held each year, along with briefings provided to local leadership. The restoration program also hosts site visits and tours of the training site to encourage visibility of efforts with the public. In recognition of the installation's excellence in community engagement, the restoration program was awarded the Army Chief of Staff for Installation Management Installations Partnership Award for Fiscal Year 2018.