APPENDIX A
LIST OF CONTACTS

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Massachusetts National Guard Environmental & Readiness Center

Emily Kelly
Building 3468 Beaman Street
Camp Edwards, MA 02542
Telephone: 339-202-9341
emily.d.kelly2.nfg@army.mil

Impact Area Groundwater Study Program

Pamela Richardson
PB 0516 West Outer Road
Camp Edwards, MA 02542
Telephone: 339-202-9360
Pamela.j.richardson.nfg@army.mil

Air Force Center for Civil Engineering

Doug Karson
322 East Inner Road
Otis ANG Base, MA 02542
Telephone: 508-968-4678, ext. 2
douglas.karson@us.af.mil

Joint Base Cape Cod

Paul Rendon
Building 3468, Beaman Street
Camp Edwards, MA 02542
Telephone: 774-327-0643
paul.e.rendon2.nfg@army.mil

102d Intelligence Wing Massachusetts Air National Guard

Timothy Sandland
158 Reilly Street, 102d Intelligence Wing
Otis ANG Base, MA 02542
Telephone: 508-968-4697
timothy.d.sandland.civ@mail.mil

U.S. Coast Guard Base Cape Cod

Steven M. Simpson
USCG Base Cape Cod, MA 02542
Telephone: 508-968-6696
Steven.m.simpson@uscg.mil

6th Space Warning Squadron (PAVE PAWS)

Stephen R. Mellin
1 Flatrock Road
Sagamore, MA 02561-0428
508-968-3213
Stephen.mellin.1@spaceforce.mil

Massachusetts National Guard, Public Affairs Office

Donald Veitch
2 Randolph Road
Hanscom AFB, MA 01731
Telephone: 339-202-3950
donald.h.veitch.civ@army.mil

Environmental Management Commission Environmental Officer

Leonard Pinaud
Building 3468, Beaman Street
Camp Edwards, MA 02542
Telephone: 508-946-2871
leonard.Pinaud@mass.gov

Barnstable County Correctional Facility

Sheriff Donna D. Buckley
6000 Sheriff's Place
Bourne MA, 02532
Telephone: 508-563-4302
dbuckley@bsheriff.net

APPENDIX B
ENVIRONMENTAL PERFORMANCE STANDARDS AS AMENDED ON APRIL 6, 2017

ENVIRONMENTAL PERFORMANCE STANDARDS
APRIL 6, 2017

For Massachusetts National Guard Properties at the Massachusetts Military Reservation

CAMP EDWARDS TRAINING AREA GENERAL PERFORMANCE STANDARDS

None of the following banned military training activities shall be allowed in the Camp Edwards Training Areas:
-Artillery live fire
-Mortar live fire
-Demolition live fire training
-Artillery bag burning
-Non-approved digging, deforestation or vegetation clearing
-Use of 'CS', riot control, or tear gas for training outside the NBC bunkers
-Use of field latrines with open bottoms
-Vehicle refueling outside designated Combat Service Area and Fuel Pad locations
-Field maintenance of vehicles above operator level

Limitations on the use of small arms ammunition and live weapon fire fall into the following two categories:

- Live weapon fire is prohibited outside of established small arms ranges. Live weapon fire is not allowed on established small arms ranges except in accordance with Environmental Performance Standard 19, other applicable Performance Standards, and a range-specific plan approved through the Environmental Management Commission (EMC).

- Blank ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through by the Environmental & Readiness Center (E&RC) and the EMC.

Each user will be responsible for proper collection, management, and disposal of the wastes they generate, as well for reporting on those actions.

Use and application of hazardous materials or disposal of hazardous waste shall be prohibited except as described in the Groundwater Protection Policy.

Vehicles are only authorized to use the existing network of improved and unimproved roads, road shoulders, ranges and bivouac areas, except where necessary for land rehabilitation and management, water supply development, and remediation, or where roads are closed for land rehabilitation and management.

Protection and management of the groundwater resources in the Camp Edwards Training Area will focus on the following:

- Development of public and Massachusetts Military Reservation water supplies.
- Preservation and improvement of water quality and quantity (recharge).
- Activities compatible with the need to preserve and develop the groundwater resources.

All users of the Camp Edwards Training Area must comply with the provisions of the Groundwater Protection Policy and any future amendments or revisions to the restrictions and requirements. These will apply to all uses and activities within the overlays relative to Wellhead Protection, Zone II's within the Cantonment Area, and the Camp Edwards Training Areas.

Development of water supplies will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the Massachusetts Department of Environmental Protection, and the Massachusetts Division of Fish and Wildlife.

All phases of remediation activities will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the federal and state agencies who will have jurisdiction for remediation.

Pollution prevention and management of the Camp Edwards training ranges will focus on and include the following:

The Camp Edwards Training Area, including the Small Arms Ranges (SAR) and their associated "Surface Danger Zones," and any areas where small arms or other munitions or simulated munitions are used, shall be managed as part of a unique water supply area under an adaptive management program that integrates pollution prevention, and best management practices (BMP), including the recovery of projectiles. This will be done through individual range-specific plans that are written by the Massachusetts National Guard and approved for implementation through the EMC and any other regulatory agency having statutory and/or regulatory oversight. Adaptive, in this context, means making decisions as part of a continual process of monitoring, reviewing collected data, evaluating advances in range monitoring, design and technology, and responding with management actions as dictated by the resulting information and needs of protecting the environment while providing compatible military training within the Upper Cape Water Supply Reserve.

A range plan shall be designed and followed to reduce the potential for an unintended release to the environment outside of the established containment system(s) identified in the range-specific plans. All users must be aware of, and comply with, the Environmental Performance Standards that are applicable to all SAR activities. Any range specific requirements will be coordinated through the E&RC with the EMC, incorporating those specific requirements into the appropriate range-specific plans and range information packets. Camp Edwards SAR Pollution Prevention Plan shall be followed to prevent or minimize releases of metals or other compounds related to the normal and approved operation of each SAR. The adaptive SAR management program components required in each range-specific plan shall include:

- Consultation with applicable agencies with oversight of the training area before undertaking any actions that are subject to state and/or federal regulatory requirements.
- Specific recovery plans for the removal and proper disposition of spent projectiles, residues and solid waste associated with the weapons, ammunition, target systems, and/or their operation and maintenance.
- Reduction of adverse impacts to the maximum extent feasible, including consideration for the design/redesign and/or relocation of the activity or encouraging only those activities that result in meeting the goal of overall projectile and/or projectile constituent containment.
- Internal and external coordination of documentation for the Camp Edwards range management programs and other related Camp Edwards management programs including: the Integrated
- Training Area Management Program, Range Regulations, Camp Edwards Environmental Management System, Civilian Use Manual, and Standard Operating Procedures.
- Long-term range maintenance, monitoring and reporting of applicable parameters and analysis.

The Massachusetts National Guard shall ensure that all training areas where munitions or simulated munitions are used or come to be located, including range areas, range surface danger zones, and any other areas within the Upper Cape Water Supply Reserve that are operational ranges are maintained and monitored following approved management plans that include planning for pollution prevention, sustainable range use and where applicable, restoration.

Protection and management of the vegetation of the Camp Edwards Training Area for focus on the following:

- Preservation of the habitat for federal- and state-listed rare species and other wildlife.
- Preservation of the wetland resource areas.
- Activities compatible with the need to manage and preserve the vegetative resources.
- Realistic field training needs.
- Identification and restoration of areas impacted by training activities.

Goals for the Adaptive Ecosystem Management approach to management of the Camp Edwards properties will be as follows:

- Management of the groundwater for drinking water resources
- Conservation of endangered species.
- Management of endangered species habitat for continuation of the species.
- Ensuring compatible military training activities.
- Allowing for compatible civilian use.
- Identification and restoration of areas impacted by training activities.

The Environmental Performance Standards will be incorporated into the programs and regulations of the Massachusetts National Guard as follows. Those standards relating to natural resources management shall be incorporated as standards into each of the state and federal environmental management programs and attached as an appendix or written into the documentation accompanying the plan or program. All the Environmental Performance Standards will be attached to the Integrated Training Area Management Plan 'Trainer's Guide' and to the Camp Edwards Range Regulations. Modification of the Standards Operating Procedures will include review and conformance with the Environmental Performance Standards for trainers and soldiers at Camp Edwards.

SPECIFIC RESOURCE PERFORMANCE STANDARDS IN THE CAMP EDWARDS TRAINING AREA

1. Groundwater Resources Performance Standards

1.1. All actions, at any location within the Camp Edwards Training Areas, must preserve and maintain groundwater quality and quantity, and protect the recharge areas 1:0 existing and potential water supply wells. All areas within Camp Edwards Training Areas will be managed as State Zone U, and, where designated, Zone I, water supply areas.

1.2 The following standards shall apply to designated Wellhead Protection Areas:

- The 400-foot radius around approved public water supply wells will be protected from all access with signage. That protection will be maintained by the owner and/or operator of the well, or the leaseholder of the property.
- No new stormwater discharges may be directed into Zone I areas.

- No in ground septic system will be permitted within a Zone I area.
- No solid wastes may be generated or held within Zone I areas except as incidental to the construction, operation, and management of a well.
- Travel in Zone I areas will be limited to foot travel or to vehicles required for construction, operation, and maintenance of wells.
- No new or existing bivouac activity or area shall be located within a Zone I area.
- All other areas will be considered as Zone II designated areas and will be subject to the standards of the Groundwater Protection Policy.

1.3 Land-use activities that do not comply with either the state Wellhead Protection regulations (310 CMR 22.00 et seq.) or the Groundwater protection Policy are prohibited.

1.4 All activities will suppol1 and not interfere with either the Impact Area Groundwater Study and/or the Installation Restoration Program. All activities shall conform to the requirements of Comprehensive Environmental Response, Compensation and Liability Act, the Massachusetts Contingency Plan, and the Safe Drinking Water Act.

1.5 Extraction, use, and transfer of the groundwater resources must not de- grade [e.g. draw down surface waters] in freshwater ponds, vernal pools, wetlands, and marine waters, unless properly reviewed, mitigated, and approved by the managing and regulating agencies.

1.6 Land uses and activities in the Camp Edwards Training Areas will meet the following standards:

- Will conform to all existing and applicable federal, state and local regulations.
- Must be able to be implemented without interference with ongoing remediation projects.
- Allow regional access to the water supplies on the Massachusetts Military Reservation.

1.7 The following programs and standards will be used as the basis for protecting groundwater resources in the Camp Edwards Training Areas:

- Groundwater Protection Policy.
- Federal and Department of Defense environmental programs: Integrated Natural Resources Management Plan, Integrated Training Area Management Program, Range Regulations, Spill Prevention Control and Countermeasures Plan (or equivalent), Installation Restoration *Plan,* Impact Area Groundwater Study, or other remediation programs.
- State and federal laws and regulations pertaining to water supply.

2. Wetlands and Surface Water Performance Standards

2.1 Since there are relatively few wetland resources found at the Massachusetts Military Reservation, and since they are important to the support of habitat and water quality on the properties, the minimum standard will be no net loss of any of the wetland resources or their 100-foot buffers.

2.2 Land uses and activities will be managed to prevent and mitigate new adverse impacts and eliminate or reduce existing conditions adverse to wetlands and surface water resource areas. Impacts from remediation activities may be acceptable with implementation of reasonable alternatives.

2.3 Wetland area management priorities:

- Protection of existing; wetland resource areas for their contributions to existing and potential drinking water supplies.
- Protection of wetlands for rare species and their habitats.
- Protection of human health and safety.

2.4. Activities will be managed to preserve and protect wetlands and vernal pools as defined by applicable, federal, state, and local regulations. These activities will include replacement or replication of all wetland resource buffer areas, which are lost after completion of an activity or use.

2.5 All land altering activities within 100 feet of a certified vernal pool must be reviewed before commencement by the Massachusetts Department of Environmental Protection/Wetlands Unit and the Natural Heritage and Endangered Species Program within the Division of Fish and Wildlife for impacts to wildlife and habitat. The certification of vernal pools will be supported by the on site personnel and will proceed with the assistance of the appropriate state agencies.

2.6 All new uses or activities will be prohibited within the wetlands and their IOO-foot buffers, except those associated with an approved habitat enhancement or restoration program; those on existing improved and unimproved roads where appropriate sediment and erosion controls are put in place prior to the activity; or those where no practicable alternative to the proposed action is available. No new roads should be located within the 100-foot buffers. Existing roads within such buffers should be relocated provided that:

- The relocation does not cause greater environmental impact to other resources.
- There are funds and resources allocated for resource management and that those resources are approved and available for the relocation.

2.7 During the period of 15 February to 15 May, listed roads/trails within 500 feet of wetlands will be closed to vehicle access to protect the migration and breeding of amphibians. Emergency response and environmental management activities will not be restricted.

- Donnelly and Little Halfway Ponds maneuver trails (excluding the permanently closed section along the eastern edge of Donnelly Pond) from Frank Perkins Road north to Wood Road
- Red Maple Swamp trail from Wood Road north and east to Avery Road
- Orchard and Jefferson Roads (continuous) from Cat Road south and east to Burgoyne Road
- Maneuver trail(s) in powerline easement north of Gibbs Road from Goat Pasture Road west to the boundary of training areas C-13 and C-14
- Grassy Pond trail (side access to Sierra Range) from Gibbs Road south to Sierra Range
- Sandwich Road from the powerline easement north to the gas pipeline right of way
- Bypass Bog/Mike Range Road from entrance to Mike Range south and west to Greenway Road

2.8 No new bivouac area shall be located within 500 feet of any wetland. Any existing bivouac within a wetland buffer shall be relocated provided there are funds and resources allocated for the relocation.

3. Rare Species Performance Standards

3.1 As the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife has identified the entire Massachusetts Military Reservation as State Priority Habitat for state-listed species (version dated 2000-2001), all activities and uses must comply with the Massachusetts Endangered Species Act and its regulations.

3.2 Where activities and uses are not specifically regulated under the Camp Edwards Training Area Range and Environmental Regulations, including these Environmental Performance Standards, the MMR Environmental and Readiness Center must review the activities for conformance with the Integrated Natural Resource Management Plan, and shall- consult with the Natural Heritage and Endangered Species Program regarding potential impacts to state-listed species.

3.3 All activities impacting rare species habitat must be designed to preserve or enhance that habitat as determined by the MMR Environmental and Readiness Center in consultation with the Natural Heritage and Endangered Species Program.

3.4 Users are prohibited from interfering with state and federal listed species.

3.5 Users will report all sightings of recognized listed species, e.g. box turtles, within any area of the Massachusetts Military Reservation.

4. Soil Conservation Performance Standards

4.1 Activities and uses must be compatible with the limitations of the underlying soils. Limitations on uses and activities may be made where the soils or soil conditions would not support the activity.

4.2 Agricultural soil types will be preserved for future use.

4.3 Any perennial or intermittent stream identified by the Environmental & Readiness Center Office will be protected from siltation by retaining undisturbed vegetative buffers to the extent feasible.

4.4 Cultural resource evaluations must be completed before any earth-moving operation may take place in undisturbed areas with high potential for cultural resources, and earth moving may be limited to specific areas (See Cultural Resource Performance Standards).

4.5 An erosion control analysis will be made part of the land management programs (Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures) for the Camp Edwards Training Area, including appropriate mitigation measures where existing or potential erosion problems are identified.

4.6 For all improved and unimproved roads, ditches and drainage ways:

- All unimproved roads, ditches, roads and drainage ways identified for maintenance will be cleaned of logs, slash and debris.
- Unimproved roads and roads may not otherwise be improved unless approved for modification.
- Any trail, ditch, road, or drainage way damaged by activities will be repaired in accordance with the hazard and impact it creates.

4.7 Erosion-prone sites will be inspected periodically to identify damage and mitigation measures.

5. Vegetation Management Performance Standards

5.1 All planning and management activities impacting vegetation

- Will ensure the maintenance of native plant communities, and
- Shall be performed to maintain the biological diversity.

5.2 Revegetation of disturbed sites will be achieved by natural and artificial recolonization by native species.

5.3 Timber harvesting or clear-cutting of forested areas should not occur on steep slopes with unstable soils or with in the buffers to wetland resources.

5.4 Vegetation management will be subject to a forest management and fire protection program prepared by the users in accordance with federal standards, and carried out in a manner acceptable to the Massachusetts Military Reservation Committee and other state agencies or commissions, as may be designated by the Commonwealth of Massachusetts.

6. Habitat Management Performance Standards

6.l The Camp Edwards Training Area will be managed as a unique rare species and wildlife habitat area under n adaptive ecosystem management program that integrates ecological, socio-economic, and institutional perspectives, and which operates under the following definitions:

- Adaptive means making decisions as part of a continual process of monitoring, reviewing collected data, and responding with management actions as dictated by the resulting information and needs of the system.
- Ecosystem means a system-wide understanding of the arrangements of living and non-living things, and the forces that act upon and within the system.
- Management entails a multi-disciplinary approach where potentially competing interests are resolved with expert analysis, user and local interest considerations, and a commitment to compromise interests when the broader goal is achieved to manage the Camp Edwards Training Area as a unique wildlife habitat area.

6.2 The adaptive ecosystem management program will include:

- Coordinated documentation for the management programs, Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures.
- The Massachusetts National Guard Environmental and Readiness Center staff and necessary funding to support its ecosystem management plans, as related to the amount of training occurring.
- Cooperative agreements to create a management team of scientific and regulatory experts.
- Long-term land maintenance, monitoring of resources and trends, study and analysis.
- Recovery plans for species and habitats identified for improvement.
- Consultation with Federal and State agencies charged with oversight of the Endangered Species Program before any actions that may affect state and federal-listed species habitat.
- Reduction of adverse impacts to the maximum extent possible, including consideration for the relocation of the activity or encouraging only those activities that result in meeting a habitat management goal.
- Habitat management activities designed to promote protection and restoration of native habitat types.

7. Wildlife Management Performance Standards

7.1 Native wildlife habitats and ecosystems management will focus on the following:

- Protecting rare and endangered species, and,
- Maintaining biodiversity.

7.2 Hunting, recreation and educational trips must be approved, scheduled, planned, and supervised through Range Control.

7.3 Any activity or use will prioritize protection of life, property, and natural resource values at the boundaries of the Camp Edwards Training Area where wildlife interfaces with the surrounding built environment.

7.4 Wildlife management will include the following actions, specific to the species targeted for management:

- Development and implementation of a plan to monitor hunting of game species.
- Planning for multi-use objectives for recreation and hunting that incorporate public input and recommendations.
- Development of suitable monitoring programs for federal and state-listed species, and regular exchange of information with the Natural Heritage and Endangered Species Program.

8. Air Quality Performance Standard

8.1 All uses and activities will be responsible for compliance with both the State Implementation Plan for Air Quality and the Federal Clean Air Act.

8.2 Air quality management activities will include air sampling if required by regulation of the activity.

9. Noise Management Performance Standards

9.1 Noise management activities shall conform to the Army's Environmental Noise Management Program policies for evaluation, assessment, monitoring, and response procedures.

10. Pest Management Performance Standards

10.1 Each user will develop and implement an Integrated Pest Management Program to control pest infestations that may include outside contracting of services. Non-native biological controls should not be considered unless approved by federal and state agencies.

10.2 Each user will be held responsible for management of pests that threaten rare and endangered species, or are exotic and invasive species, Invasive plant species that may be considered pest species are those defined by the United States Fish and Wildlife Service and the Massachusetts Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife office. Site-specific analysis will be performed before implementation of any proposed pest management plans.

10.3 Pest vegetation control must be balanced against environmental impact and any proposed pest management activities, including the use of herbicides and mechanical methods, within rare species habitat areas must be approved by the Natural Heritage and Endangered Species Program, or in the case of federally listed species, by the United States Fish and Wildlife Service.

10.4 Only herbicide formulations approved by the United States Environmental Protection Agency, the Department of Agriculture, the agency managing the user, and the Commonwealth of Massachusetts may be applied.

10.5 Herbicides and pesticides will not be applied by aerial spraying unless required by emergency conditions and approved under applicable state and federal regulations.

11. Fire Management Performance Standards

11.1 All activities and uses shall manage, prevent, detect, and suppress fires on the Camp Edwards Training Area in coordination with the local and state fire services and natural resource managers in the Environmental & Readiness Center.

11.2 Prescribed bums will be used as a habitat management and fire prevention tool. Prescribed burns will be used to reduce natural fire potential and create or maintain diverse and rare species habitat.

11 .3 Pre-suppression activities will include strategic firebreaks and other management of vegetation in high risk and high-incidence areas. The Integrated Natural Resource Management Plan and Fire Management Plan will be consulted for proposed actions.

11.4 Other than the above, no open fires are allowed.

12. Stormwater Management Performance Standards

12.1 All stormwater facilities shall comply with the State Department of Environmental Protection Guidelines for Stormwater Management, including Best Management Practices and all other applicable standards for control and mitigation of increased storm water flow rates and improvement of water quality.

12.2 All increases in stormwater runoff will be controlled within the user's property.

12.3 No new stormwater discharges will be made directly into wetlands or wetland resource areas.

13. Wastewater Performance Standards

13.1 All wastewater and sewage disposal will be in conformance with the applicable Federal and Massachusetts Department of Environmental Protection agency regulations.

14. Solid Waste Performance Standards

14.1 All solid waste streams (i.e., wastes not meeting the criteria for hazardous wastes) will be monitored and managed to substitute, reduce, recycle, modify processes, implement best management practices, and/or reuse waste, thereby reducing the total tonnage of wastes,

14.2 All users will be held responsible for collection, removal and disposal outside of the Camp Edwards Training Areas of solid wastes generated by their activities.

14.3 All users must handle solid wastes using best management practices to minimize nuisance odors, windblown litter, and attraction of vectors.

14.4 No permanent disposal of solid waste within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15. Hazardous Materials Performance Standards

15.1 Where they are permitted, use and application of hazardous materials shall be otherwise minimized in accordance with pollution prevention and waste minimization practices, including material substitution.

15 .2 No permanent disposal of hazardous wastes within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15.3 Fuel Management

15.3.1 Spill Prevention, Control, and Countermeasure Plan, is in place to reduce potential for a release. Camp Edwards Spill Response Plan is in place to respond to a release if an event should occur. All users will comply with these plans at the Camp Edwards Training Area.

15.3.2 If found, non-complying underground fuel storage tanks will be removed in accordance with state and federal laws and regulations to include remediation of contaminated soil.

15 .3.3 No storage or movement of fuels for supporting field activities, other than in vehicle fuel tanks, will be permitted except in approved containers no greater than five gallons in capacity.

15.3.4 New storage tanks are prohibited unless they meet the following requirements:

- Are approved for maintenance heating, or, permanent emergency generators and limited to propane or natural gas fuels.
- Conform to the Groundwater Protection Policy and applicable codes.

15.4 Non-fuel Hazardous Material Storage

15.4 .1 No storage above those quantities necessary to support field training activities will be allowed within the Camp Edwards Training Area except where necessary to meet regulatory requirements, and where provided with secondary containment.

15.4.2 When required by applicable regulation, the user shall implement a Spill Prevention, Control and Containment/Emergency Response or other applicable response plan.

16. Hazardous Waste Performance Standards

16.1 All uses shall comply with applicable local, state, and federal regulations governing hazardous waste generation, management, and disposal (including overlays relative to Wellhead Protection, Zone II' s within the Cantonment Area) .

16.2 Accumulations of hazardous waste shall be handled in accordance with regulations governing accumulation and storage.

16.3 Existing facilities must implement pollution prevention and waste minimization procedures (process modifications, material substitution, recycling, and best management practices) to minimize waste generation and hazardous materials use.

16.4 Occupants and users will be held responsible for removing all solid or hazardous wastes generated during the period of use/tenancy/visitation upon their departure or in accordance with other applicable or relevant regulations.

16.5 Remedial activities undertaken under the Installation Restoration Program, the Impact Area Groundwater Study Program, the Massachusetts Contingency Plan, or other governing remediation programs are exempt from additional regulation (e.g., waste generation volume limits). Removal, storage, and disposal of contaminated material are required to comply with all state, and federal regulations.

16.6 Post-remedial uses and activities at previously impacted sites will be allowed in accordance with terms and conditions of the applicable regulations.

16.7 All hazardous wastes will be transported in accordance with federal Department of Transportation regulations governing shipment of these materials.

16.8 Transport shall reduce the number of trips for transfer and pick-up of hazardous wastes for disposal to extent feasible. Tills may include planning appropriate routes that minimize proximity to sensitive natural resource areas, and reducing internal transfers of material, including transfers from bulk storage tanks to drums, tankers, carboys, or other portable containers or quantities.

16.9 No permanent disposal of hazardous wastes within the Groundwater Protection Policy area/Camp Edwards field training areas will be permitted.

17. Vehicle Performance Standards

17.1 Vehicles within the Camp Edwards Training Area will be limited to the existing improved and unimproved road system except where required for natural resource management or property maintenance or where off-road activity areas are located and approved by the Environmental and Readiness Center in consultation with the Massachusetts Division of Fisheries and Wildlife.

17.2 Unimproved, established access ways will be limited to use by vehicles in accordance with soil conditions as described in the Soil Conservation Performance Standards.

17.3 The number of military and civilian vehicles within the Camp Edwards Training Area will be controlled using appropriate scheduling and signage.

18. General Use and Access Performance Standards

18.1 General User Requirements. Requirements that will apply to all users, both public and private, in the Camp Edwards Training Area include the following:

- All acts that pollute the groundwater supply are prohibited.
- No litter or refuse of any sort may be thrown or left in or on any property.
- All users will be held responsible for providing, maintaining, and re- moving closed-system, sanitary facilities necessary for their use and activity.
- No person shall wade or swim in any water body except for activities approved by the Massachusetts National Guard including remediation, scientific study, or research.
- Vehicles may only be driven on roads authorized and designated for such use and parked in designated areas, and may not cross any designated wetland.
- Public users may not impede the military training activities.

18.2. Civilian Use Manual. To guide public conduct on the Massachusetts Military Reservation, a Civilian Use Manual will be prepared and periodically updated. All civilian users will obtain and follow this Manual.

18.3. Siting and Design Performance Standards

18.3.1 New or expanded buildings should not be proposed within the Camp Edwards Training Areas, with the following exceptions:

- Buildings to support allowed training, operations and activities, including upgrading of those facilities currently in place,
- Buildings used for the purposes of remediation activities,
- Buildings used for the purposes of development, operation and maintenance of water supplies,
- Buildings used for the purpose of natural resource and land management.

19. Range Performance Standards

19.1. All operational ranges including but not limited to small arms ranges (SAR) shall be managed to minimize harmful impacts to the environment within the Upper Cape Water Supply Reserve. Range management at each range shall include to the maximum extent practicable metal recovery and recycling, prevention of fragmentation and ricochets, and prevention of sub-surface percolation of residue associated with the range operations. Camp Edwards shall be held responsible for the implementation of BMPs by authorized range users, including collection and removal of spent ammunition and associated debris.

19.2. Small arms ranges shall only be used in accordance with approved range plans. These plans shall be designed to minimize to the maximum extent practicable the release of metals or other contaminates to the environment outside of specifically approved containment areas/systems. Occasional ricochets that result in rounds landing outside of these containment areas is expected and every effort to minimize and correct these occurrences shall be taken. Failure to follow the approved range plans shall be considered a violation of this EPS.

19.3. All operational SARs shall be closely monitored by the Massachusetts National Guard to assess compliance of the approved range plans as well as the implementation and effectiveness of the range specific BMPs.

19.4. Camp Edwards/Massachusetts National Guard Environmental and Readiness Center shall staff and request appropriate funding to support its SAR management plans.

19.5. All users must use and follow Camp Edwards' Range Control checklists and procedures to:

- Minimize debris on the range (e.g. shell casings, used targets)
- Minimize or control residues on the ranges resulting from training (e.g., unburned constituents, metal shavings from the muzzle blast)
- Ensure the range is being used for the designated purpose in accordance with all applicable plans and approvals

19.6. Camp Edwards is responsible for following range operation procedures and maintaining range pollution prevention systems. Range BMPs shall be reviewed annually for effectiveness and potential improvements in their design, monitoring, maintenance, and operational procedures in an effort to continually improve them. Each year the annual report shall detail the range-specific activities including, but not limited to, the number of rounds fired, number of shooters and their organization, and the number of days the range was in use. The annual report will also detail active SAR groundwater well and lysimeter results, as well as any range maintenance/management activities that took place that training year and the result of such activities, i.e. lbs. of brass and projectiles recovered and recycled, etc. The Massachusetts National Guard shall provide regular and unrestricted access for the EMC to all its data and information, and will provide immediate access to environmental samples from the range, including range management and monitoring systems and any other applicable activities operating on the ranges.

19.7. Range plans and BMPs for training areas shall be reviewed and/or updated at least every three years. Management plans for new and upgraded ranges shall be in place prior to construction or utilization of the range. Range plans, at a minimum, will address long-term sustainable use, hydrology and hydrogeology, physical design, operation, management procedures, record keeping, pollution prevention, maintenance, monitoring, and applicable technologies to ensure sustainable range management. Range plans shall be integrated with other training area planning processes and resources.

19.8. The Massachusetts National Guard shall establish procedures for range maintenance and where applicable, maintenance and/or clearance operations to permit the sustainable, compatible, and safe use of operational ranges for their intended purpose within the Upper Cape Water Supply Reserve. In determining the frequency and degree of range maintenance and clearance operations, the Massachusetts National Guard shall consider, at a minimum, the environmental impact and safety hazards, each range's intended use, lease requirements, and the quantities and types of munitions or simulated munitions expended on that range.

APPENDIX C
SMALL ARMS RANGE AND SOLDIER VALIDATION LANE INFORMATION

Operations Maintenance and Monitoring Activities

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
TANGO RANGE
TY 2022

Date	Activity
25, 26 Mar 22	EMC/E&RC inspection
25, 26 Mar 22	Pre/post-fire inspection
09 Apr 22	Pre/post-fire inspection
07 May 22	Pre/post-fire inspection
13 May 22	EMC/E&RC inspection
13, 14 May 22	Pre/post-fire inspection
08, 09 Jun 22	Pre/post-fire inspection
09, 10 Jun 22	Pre/post-fire inspection
15 Jun 22	Pre/post-fire inspection
24 Jun 22	Pre/post-fire inspection
16 Jul 22	Pre/post-fire inspection
18 Jul 22	Pre/post-fire inspection
21, 24 Jul 22	Pre/post-fire inspection
11 Aug 22	Pre/post-fire inspection
06, 07 Aug 22	Pre/post-fire inspection
30 Aug 22	EMC/E&RC inspection
6 Sep 22	EMC/E&RC inspection
29 Sep 22	Pre/post-fire inspection
23, 24 Sep 22	Pre/post-fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
SIERRA RANGE
TY 2022

Date	Activity
02 Oct 21	Pre/post-fire inspection
03 Oct 21	Pre/post-fire inspection
04 Oct 21	Pre/post-fire inspection
08, 09 Oct 21	Pre/post-fire inspection
15, 16 Oct 21	Pre/post-fire inspection
17, 18 Oct 21	Pre/post-fire inspection
23 Oct 21	Pre/post-fire inspection
05, 07 Nov 21	Pre/post-fire inspection
13, 14 Nov 21	Pre/post-fire inspection
19, 20 Nov 21	Pre/post-fire inspection
07 Dec 21	Detailed Inspection
11 Jan 22	Detailed Inspection
08 Feb 22	Detailed Inspection
15 Mar 22	Detailed Inspection
18 Mar 22	Maintenance: hand filled minor erosion
24 Mar 22	Pre/post-fire inspection
26 Mar 22	Pre/post-fire inspection
27 Mar 22	Pre/post-fire inspection
02 Apr 22	Pre/post-fire inspection
09 Apr 22	Pre/post-fire inspection
15 Apr 22	Pre/post-fire inspection
18 Apr 22	Maintenance: filled minor bullet pocket and erosion
07 May 22	Pre/post-fire inspection
11 May 22	Pre/post-fire inspection
13, 14 May 22	Pre/post-fire inspection
20, 21 May 22	Pre/post-fire inspection
03 Jun 22	Pre/post-fire inspection
03 Jun 22	Pre/post-fire inspection
04 Jun 22	Pre/post-fire inspection
08 Jun 22	Pre/post-fire inspection
09, 10 June 22	Pre/post-fire inspection
10 Jun 22	Pre/post-fire inspection
11, 12 Jun 22	Pre/post-fire inspection
15 Jun 22	Pre/post-fire inspection
24 Jun 22	Pre/post-fire inspection
16, 17 Jun 22	Pre/post-fire inspection
18 Jul 22	Pre/post-fire inspection
22 Jul 22	EMC/E&RC inspection
21, 22 Jul 22	Pre/post-fire inspection
24 Jul 22	Pre/post-fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
SIERRA RANGE
TY 2022

Date	Activity
25 Jul 22	EMC/E&RC inspection
30, 31 Jul 22	Pre/post-fire inspection
05, 06 Aug 22	Pre/post-fire inspection
11 Aug 22	Pre/post-fire inspection
11 Aug 22	Pre/post-fire inspection
14 Aug 22	Pre/post-fire inspection
14 Aug 22	Pre/post-fire inspection
20 Aug 22	Pre/post-fire inspection
07 Sep 22	Pre/post-fire inspection
24, 25 Sep 22	Pre/post-fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
INDIA RANGE
TY 2022

Date	Activity
04 Oct 21	Pre/post-fire inspection
08, 09 Oct 21	Pre/post-fire inspection
15, 16 Oct 21	Pre/post-fire inspection
16 Oct 21	Pre/post-fire inspection
22 Oct 21	Pre/post-fire inspection
23, 24 Oct 21	Pre/post-fire inspection
05, 06 Nov 21	Pre/post-fire inspection
13 Nov 21	Pre/post-fire inspection
07 Dec 21	Monthly/Detailed Inspection
11 Jan 22	Monthly/Detailed Inspection
08 Feb 22	Monthly/Detailed Inspection
15 Mar 22	Monthly/Detailed Inspection
21 Apr 22	Monthly/Detailed Inspection/maintenance
11 May 22	Monthly/Detailed Inspection
09 Jun 22	Pre/post-fire inspection
10 Jun 22	Pre/post-fire inspection
18 Jul 22	Pre/post-fire inspection
21 Jul 22	Maintenance, berm maintenance
22 Jul 22	EMC/E&RC inspection
23 Jul 22	Pre/post-fire inspection
30, 31 Jul 22	Pre/post-fire inspection
19, 20 Aug 22	Pre/post-fire inspection
24, 25 Sep 22	Pre/post-fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
ECHO RANGE
TY 2022

Date	Activity
3 Oct 21	Pre/post-fire inspection
08, 09 Oct 21	Pre/post-fire inspection
16 Oct 21	Pre/post-fire inspection
23 Oct 21	Pre/post-fire inspection
05 Nov 21	Pre/post-fire inspection
14 Nov 21	Pre/post-fire inspection
07 Dec 21	Detailed inspection
11 Jan 22	Detailed inspection
10 Feb 22	EMC/E&RC inspection
08 Feb 22	Detailed inspection
15 Mar 22	Detailed inspection
26 Mar 22	Pre/post-fire inspection
31 Mar 22	EMC/E&RC inspection
31 Mar 22	Pre/post-fire inspection
05 Apr 22	Pre/post-fire inspection
16 Apr 22	Pre/post-fire inspection
21 Apr 22	Maintenance, bullet pocket repair
07 May 22	Pre/post-fire inspection
11 May 22	Pre/post-fire inspection
13 May 22	Pre/post-fire inspection
15 May 22	Pre/post-fire inspection
20 May 22	Pre/post-fire inspection
04 Jun 22	Pre/post-fire inspection
24 Jun 22	Pre/post-fire inspection
25 Jun 22	Pre/post-fire inspection
09 Jul 22	Pre/post-fire inspection
16 Jul 22	Pre/post-fire inspection
19 Jul 22	Pre/post-fire inspection
22 Jul 22	EMC/E&RC inspection
22, 23 July 22	Pre/post-fire inspection
24 Jul 22	Pre/post-fire inspection
6 Aug 22	Pre/post-fire inspection
10 Aug 22	Pre/post-fire inspection
14 Aug 22	Pre/post-fire inspection
09 Sep 22	Pre/post-fire inspection
10 Sep 22	Pre/post-fire inspection
24 Sep 22	Pre/post-fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
LIMA RANGE
TY 2021

Date	Activity
05, 06 Nov 21	Pre/post-fire inspection
17 Dec 21	Monthly inspection
11 Jan 22	Monthly inspection
08 Feb 22	Monthly inspection
15 Mar 22	Monthly inspection
12 Apr 22	Monthly inspection
14 Apr 22	Maintenance, putting up nets
20 May 22	Pre/post fire inspection
10 Jun 22	Pre/post fire inspection
23 Jul 22	Pre/post fire inspection
06 Aug 22	Maintenance, repaired bunkers
8 Sep 22	EMC/E&RC inspection
20 Sep 22	Monthly Inspection

Lead Ammunition Use

Echo Range

LEAD AMMUNITION USE HISTORY ECHO RANGE			
Training Year	**.40 Cal Lead**	**9 mm Lead**	**Total**
TY 2022	0	78,021	78,021
TY 2021	3,476	51,438	54,914
TY 2020	0	14,308	14,308
TY 2019	0	4,350	4,350
TY 2018	0	0	0
TY 2017	0	0	0
TY 2016	0	0	0
TY 2015	0	347[1]	347
TY 2014	0	0	0
TY 2013	0	0	0
TY 2012	0	0	0
TY 2011	0	0	0
TY 2010	0	0	0
TY 2009	0	0	0
TY 2008	0	0	0
TY 2007	0	100[1]	100
TOTAL	**3,476**	**148,564**	**152,040**

Notes: Echo Range became operational in Fall 2019.
[1]Firing at Echo Range in TY 2007 and TY 2015 were part of tests for reintroducing lead ammunition.

LEAD AMMUNITION USE HISTORY CUMULATIVE							
Training Year	**Echo Range**	**Sierra Range**	**KD Range**	**Tango Range**	**Juliet Range**	**Kilo Range**	**Total**
TY 2022	78,021	0	0	0	0	0	78,021
TY 2021	54,914	0	0	0	0	0	54,914
TY 2020	14,308	0	0	0	7,690	84,032	106,030
TY 2019	4,350	0	0	0	30,089	81,179	115,618
TY 2018	0	0	0	0	36,583	119,342	155,925
TY 2017	0	0	0	16,495	51,897	115,662	184,054
TY 2016	0	0	0	4,200	61,052	49,638	114,890
TY 2015	347[1]	0	1,993[3]	6,960	65,266	69,973	144,539
TY 2014	0	0	0	3,220	36,937	80,356	120,513
TY 2013	0	0	0	9,950	40,196	73,742	123,888
TY 2012	0	0	0	12,117	31,026	59,912	103,055
TY 2011	0	2,120[2]	0	37,122	63,541	125,154	227,937
TY 2010	0	0	0	90,328	34,371	60,362	185,061
TY 2009	0	0	0	137,362	16,262	29,783	183,407
TY 2008	0	0	0	17,725	0	0	17,725
TY 2007	100[1]	0	0	8,547	0	0	8,647
TOTAL	**152,040**	**2,120**	**1,993**	**344,026**	**474,910**	**949,135**	1,924,224

Notes: 1. Firing at Echo Range in TY 2007 and TY 2015 were part of tests for reintroducing lead ammunition.
2. Firing at Sierra Range in TY 2011 was part of a Line of Sight Analysis test.
3. Firing at KD Range in TY 2015 was part of a planning-level noise assessment.

Copper Ammunition Use

Sierra, India, and Tango Ranges

COPPER AMMUNITION USE HISTORY

Training Year	Sierra Range 5.56 Copper	India Range 5.56 Copper	India Range 7.62 Copper	Tango Range 5.56 Copper	ISBC Range 5.56 Copper	Echo Range 5.56 Copper	Total
TY 2022	251,672	41,041	0	56,946	14,098	0	363,757
TY 2021	221,756	73,400	0	0	0	19,975	315,131
TY 2020	131,274	90,849	0	0	0	0	222,123
TY 2019	98,426	71,098	0	0	0	0	169,524
TY 2018	98,393	105,143	0	0	0	0	203,536
TY 2017	95,905	105,099	4,793	0	0	0	205,797
TY 2016	80,747	60,571	0	0	0	0	141,318
TY 2015	66,086	12,947	0	0	0	0	79,033
TY 2014	46,804	27,872	0	0	0	0	74,676
TY 2013	34,493	10,918	0	0	0	0	45,411
TY 2012	34,359	6,601	0	0	0	0	40,960
TOTAL	**1,159,915**	**605,539**	**4,793**	**56,946**	**14,098**	**19,975**	**1,861,266**

Note: Firing of copper ammunition began at Sierra Range and India Range in TY 2012.
Tango Range became operationally active for copper ammunition in TY 2022.
Copper ammunition was used on the operationally inactive ISBC Range for two approved, non-standard training events during TY 2022.
Copper ammunition was used during two non-standard training event in TY 2021.

Small Arms Range Sampling Reports

Soil Sampling Results

Fall 2022

CAMP EDWARDS SMALL ARMS RANGE ANNUAL SOIL MONITORING 2022

NOTE: Data entered does not include third-party data validation qualifiers per the 2018 QAPP, if required.

Site/SLX List	Location ID	Field Sample ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value (mg/kg)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (mg/kg)	Sample Type	Remarks
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	EPA Moisture	--	% moisture	12.4		1.0	1.0	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.6		0.01	0.01	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	ND	U, F1	11	5.6	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	ND	U, F1	17	5.6	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U, F1	4.5	1.5	300	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	380		45	17	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	18	6.9	10,000	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Iron	7,700		18	5.6	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Lead	11		1.3	0.54	6,000	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	660		9.0	3.6	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	430		45	18	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	ND	U	90	36	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22A	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	570		67	34	--	N	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	EPA Moisture	--	% moisture	12.3		1.0	1.0	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.2		0.01	0.01	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	6.4	J	11	5.6	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	ND	U	17	5.6	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	5.4	1.5	300	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	390		54	17	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	22	6.9	10,000	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Iron	8,000		22	5.6	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Lead	12		1.6	0.54	6,000	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	630		11.0	3.6	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	400		54	18	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	ND	U	110	36	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22B	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	0.055		0.0070	34	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	EPA Moisture	--	% moisture	15.5		1.0	1.0	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.1		0.01	0.01	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	ND	U	11	5.7	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	7.1	J	17	5.7	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	4.8	1.6	300	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	430		48	18	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	19	7.4	10,000	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Iron	8,600		19	6.0	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Lead	12		1.4	0.58	6,000	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	720		9.6	3.8	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	440		48	20	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	ND	U	96	38	--	FR	100-pt MIS spl
E Range	SSERNG001	SSERNG001_OCT22C	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	500		72	36	--	FR	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	EPA Moisture	--	% moisture	16.5		1.0	1.0	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.0		0.01	0.01	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	7.9	J	12	5.9	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	7.4	J	18	5.9	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	4.2	1.4	300	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	410		42	16	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	1.7	0.7	10,000	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Iron	6,900		17	5.3	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Lead	9		1.3	0.51	6,000	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	650		8.5	3.4	--	N	100-pt MIS spl

Site/SLX List	Location ID	Field Sample ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value (mg/kg)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (mg/kg)	Sample Type	Remarks
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	380		42	17	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	37	J	85	34	--	N	100-pt MIS spl
E Range	SSERNG002	SSERNG002_OCT22	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	500		71	36	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	EPA Moisture	--	% moisture	11.7		1.0	1.0	--	N	100-pt MIS spl
E Range	SSJRNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.2		0.01	0.01	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	7.9	J	11	5.7	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	6.7	J	17	5.7	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	4.0	1.3	300	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	330		40	15	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	16	6.1	10,000	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Iron	5,300		16	4.9	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Lead	9.0		1.2	0.48	6,000	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	520		7.9	3.2	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	350		40	16	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	ND	U	79	32	--	N	100-pt MIS spl
E Range	SSERNG003	SSERNG003_OCT22	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	220		14	14	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	EPA Moisture	--	% moisture	11.5		1.0	1.0	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.0		0.01	0.01	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	9.2	J	11	5.7	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	6.4	J	17	5.7	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	5.3	1.8	300	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	480		53	20	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	21	8.1	10,000	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Iron	8,100		21	6.5	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Lead	13		1.6	0.63	6,000	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	680		11.0	4.2	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	460		53	22	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	ND	U	110	42	--	N	100-pt MIS spl
E Range	SSERNG004	SSERNG004_OCT22	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	540		68	34	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	EPA Moisture	--	% moisture	13.7		1.0	1.0	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	4.9		0.01	0.01	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	8.9	J	11	5.5	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	ND	U	17	5.5	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	4.7	1.6	300	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	480		47	18	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Copper	ND	U	1.9	0.73	10,000	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Iron	8,300		19	5.8	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Lead	15		1.4	0.57	6,000	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	730		9.4	3.8	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	410		47	19	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	39	J	94	38	--	N	100-pt MIS spl
E Range	SSERNG005	SSERNG005_OCT22	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	680		69	35	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	EPA Moisture	--	% moisture	14.4		1.0	1.0	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 9045D	Soluble	pH (S.U.)	5.4		0.01	0.01	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Chloride	7.4	J	11	5.6	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	EPA 300.0	Soluble	Sulfate	6.0	J	17	5.6	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Antimony	ND	U	4.1	1.4	300	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Calcium	510		41	15	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Copper	6.9		1.6	0.62	10,000	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Iron	7,600		16	5.0	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Lead	21		1.2	0.49	6,000	N	100-pt MIS spl

Site/SLX List	Location ID	Field Sample ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value (mg/kg)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (mg/kg)	Sample Type	Remarks
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Magnesium	710		8.1	3.2	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Potassium	410		41	17	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	SW846 6010D	Total	Sodium	36	J	81	32	--	N	100-pt MIS spl
E Range	SSERNG006	SSERNG006_OCT22	0	0.25	10/13/2022	EPA 365.1	Total	Total Phosphate	590		68	34	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	EPA Moisture	--	% moisture	28.1		1.0	1.0	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 9045D	Soluble	pH (S.U.)	4.9		0.01	0.01	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	EPA 300.0	Soluble	Chloride	19		14	6.9	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	EPA 300.0	Soluble	Sulfate	ND	U	21	6.9	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Antimony	ND	U	6.9	2.3	300	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Calcium	930		69	26	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Copper	6.8		2.8	1.1	10,000	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Iron	9,500		28	8.5	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Lead	48		2.1	0.83	6,000	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Magnesium	1,200		17	5.5	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Potassium	900		69	28	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Sodium	ND	U	140	55	--	N	100-pt MIS spl
I Range	SSIRNG001	SSIRNG001_OCT22	0	0.25	10/14/2022	EPA 365.1	Total	Total Phosphate	790		81	41	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	EPA Moisture	--	% moisture	30.5		1.0	1.0	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 9045D	Soluble	pH (S.U.)	5.0		0.01	0.01	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	EPA 300.0	Soluble	Chloride	16		14	6.9	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	EPA 300.0	Soluble	Sulfate	ND	U	21	6.9	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Antimony	ND	U	5.5	1.9	300	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Calcium	1,100		55	21	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Copper	2.0	J	2	0.84	10,000	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Iron	10,000		22	6.8	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Lead	12		1.6	0.65	6,000	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Magnesium	1,400		11.0	4.4	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Potassium	660		55	22	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	SW846 6010D	Total	Sodium	53	J	110	44	--	N	100-pt MIS spl
L Range	SSLRNG001	SSLRNG001_OCT22	0	0.25	10/14/2022	EPA 365.1	Total	Total Phosphate	530		85	43	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	EPA Moisture	--	% moisture	13.9		1.0	1.0	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 9045D	Soluble	pH (S.U.)	5.0		0.01	0.01	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	EPA 300.0	Soluble	Chloride	ND	U	12	5.8	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	EPA 300.0	Soluble	Sulfate	ND	U	17	5.8	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Antimony	ND	U	4.1	1.4	300	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Calcium	670	F2 F1	41	15	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Copper	7.3		2	0.63	10,000	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Iron	8,200	F2	16	5.0	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Lead	16	F2 F1	1.2	0.49	6,000	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Magnesium	910	F2 F1	8.1	3.2	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Potassium	470	F2 F1	41	17	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	SW846 6010D	Total	Sodium	39	J	81	32	--	N	100-pt MIS spl
S Range	SSSRNG001	SSSRNG001_OCT22	0	0.25	10/11/2022	EPA 365.1	Total	Total Phosphate	630		69	35	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	EPA Moisture	--	% moisture	15.4		1.0	1.0	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 9045D	Soluble	pH (S.U.)	6.1		0.01	0.01	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	EPA 300.0	Soluble	Chloride	9.6	J	12	5.9	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	EPA 300.0	Soluble	Sulfate	41		18	5.9	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Antimony	ND	U	4.3	1.5	300	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Calcium	15,000		43	16	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Copper	ND	U	2	0.66	10,000	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Iron	15,000		17	5.3	--	N	100-pt MIS spl

Site/SLX List	Location ID	Field Sample ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value (mg/kg)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (mg/kg)	Sample Type	Remarks
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Lead	15		1.3	0.51	6,000	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Magnesium	2,700		8.6	3.4	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Potassium	1,100		43	17	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	SW846 6010D	Total	Sodium	38	J	86	34	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22A	0	0.25	10/12/2022	EPA 365.1	Total	Total Phosphate	520	F1	73	37	--	N	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	EPA Moisture	--	% moisture	14.1		1.0	1.0	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 9045D	Soluble	pH (S.U.)	6.1		0.01	0.01	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	EPA 300.0	Soluble	Chloride	8.6	J	11	5.6	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	EPA 300.0	Soluble	Sulfate	27		17	5.6	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Antimony	ND	U	5.1	1.7	300	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Calcium	3,600		51	19	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Copper	ND	U	2.0	0.78	10,000	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Iron	1,700		20	6.3	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Lead	18		1.5	0.61	6,000	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Magnesium	2,700		10.0	4.0	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Potassium	1,200		51	21	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	SW846 6010D	Total	Sodium	45	J	100	40	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22B	0	0.25	10/12/2022	EPA 365.1	Total	Total Phosphate	1,500	F1	340	170	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	EPA Moisture	--	% moisture	17.1		1.0	1.0	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 9045D	Soluble	pH (S.U.)	5.7		0.01	0.01	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	EPA 300.0	Soluble	Chloride	6.9	J	12	6.0	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	EPA 300.0	Soluble	Sulfate	23		18	6.0	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Antimony	ND	U	5.1	1.7	300	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Calcium	2,000		51	19	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Copper	ND	U	2.0	0.78	10,000	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Iron	14,000		20	6.3	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Lead	24		1.5	0.61	6,000	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Magnesium	1,900		10.0	4.1	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Potassium	890		51	21	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	SW846 6010D	Total	Sodium	45	J	100	41	--	FR	100-pt MIS spl
T Range	SSTRNG001	SSTRNG001_OCT22C	0	0.25	10/12/2022	EPA 365.1	Total	Total Phosphate	1,100		71	36	--	FR	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	EPA Moisture	--	% moisture	24.0		1.0	1.0	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 9045D	Soluble	pH (S.U.)	5.6		0.01	0.01	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	EPA 300.0	Soluble	Chloride	14		13	6.4	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	EPA 300.0	Soluble	Sulfate	14	J	19	6.4	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Antimony	ND	U	6.2	2.1	300	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Calcium	910		62	23	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Copper	9.1		2.5	0.95	10,000	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Iron	10,000		25	7.6	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Lead	22		1.8	0.74	6,000	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Magnesium	1,200		12	4.9	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Potassium	690		62	25	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	SW846 6010D	Total	Sodium	ND	U	120	49	--	N	100-pt MIS spl
T Range	SSTRNG002	SSTRNG002_OCT22	0	0.25	10/12/2022	EPA 365.1	Total	Total Phosphate	960		80	40	--	N	100-pt MIS spl

Notes:

bgs = below ground surface
FR = field duplicate or replicate
ID = identifier
RL = reporting limit
Bold Results Value = ABOVE OMMP ACTION LEVEL

ND/U = non-detect UJ = non-detectable, estimated value
OMMP = Operation MDL = method detection limit
F1 = MS and/or MS mg/kg = milligram(s) per kilogram
Site/SLX List = Ra N = native sample
J1 = Estimated value is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Small Arms Range Sampling Reports

Lysimeter Sampling Results

Fall 2022

CAMP EDWARDS SMALL ARMS RANGE ANNUAL LYSIMETER 2022

NOTE: Data entered does not include third-party data validation qualifiers per the 2018 QAPP, if required.

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (µg/L)	Sample Type
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	EPA 300.0	FLDFLT	Chloride	3,300	J	7,500	3,000	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Antimony	4.7		1	0.21	6	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Calcium	3,100		100	52	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Copper	13		1	0.37	1,300	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Lead	3.0		0.52	0.073	15	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Magnesium	900	^2	52	16	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Potassium	1,400		210	67	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SW846 6020B	FLDFLT	Sodium	1,800		210	93	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SM 2320B-2011	FLDFLT	Alkalinity	10,000		8,000	2,600	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
I Range	LYIRNG001	LYIRNG001_OCT22	10/12/2022	SM 5310 C-2011	FLDFLT	DOC	3,400		1,000	500	--	N
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	EPA 300.0	FLDFLT	Chloride	3,100	J	7,500	3,000	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Antimony	4.6		1	0.21	6	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Calcium	3,600		100	52	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Copper	13		1	0.37	1,300	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Lead	3.2		0.52	0.073	15	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Magnesium	960		52	16	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Potassium	1,500		210	67	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Sodium	1,900		210	93	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SM 2320B-2011	FLDFLT	Alkalinity	10,000		8,000	2,600	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	FR
I Range	LYIRNG001	LYIRNG001_OCT22D	10/12/2022	SM 5310 C-2011	FLDFLT	DOC	3,500		1,000	500	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	EPA 300.0	FLDFLT	Sulfate	16,000		7,500	2,500	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	EPA 300.0	FLDFLT	Chloride	6,700	J	7,500	3,000	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Antimony	**7.8**		1	0.21	6	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Calcium	15,000		100	52	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Copper	330		1	0.37	1,300	N

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (µg/L)	Sample Type
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Iron	33	J	52	21	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Lead	0.26	J	0.52	0.073	15	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Magnesium	4,000	^2	52	16	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Potassium	2,200		210	67	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SW846 6020B	FLDFLT	Sodium	5,200	B ^2	210	93	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SM 2320B-2011	FLDFLT	Alkalinity	14,000		8,000	2,600	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	EPA 365.1	FLDFLT	Phosphate	39,000		310	250	--	N
I Range	LYIRNG002	LYIRNG002_OCT22	10/12/2022	SM 5310 C-2011	FLDFLT	DOC	16,000		1,000	500	--	N
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	EPA 300.0	FLDFLT	Sulfate	16,000		7,500	2,500	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	EPA 300.0	FLDFLT	Chloride	6,700	J	7,500	3,000	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Antimony	**7.8**		1	0.21	6	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Calcium	15,000		100	52	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Copper	320		1	0.37	1,300	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Iron	28	J	52	21	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Lead	0.32	J	0.52	0.073	15	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Magnesium	4,000	^2	52	16	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Potassium	2,200		210	67	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SW846 6020B	FLDFLT	Sodium	5,100	B ^2	210	93	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SM 2320B-2011	FLDFLT	Alkalinity	14,000		8,000	2,600	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	EPA 365.1	FLDFLT	Phosphate	40,000		3,100	2,500	--	FR
I Range	LYIRNG002	LYIRNG002_OCT22D	10/12/2022	SM 5310 C-2011	FLDFLT	DOC	16,000		1,000	500	--	FR
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	ND	U	7,500	3,000	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	0.9	J	1	0.21	6	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	5,900		100	52	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	3.3		1	0.37	1,300	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	0.25	J	0.52	0.073	15	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	2,800		52.00	16	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	620		210	67	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	2,100		210	93	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	ND	U	8,000	2,600	--	N
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (µg/L)	Sample Type
J Range	LYJRNG001	LYJRNG001_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	5,500		1,000	500	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	5,500	U	7,500	2,500	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	ND	U	7,500	3,000	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	1.4		1	0.21	6	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	11,000		100	52	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	3.8		1	0.37	1,300	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	0.17	J	0.52	0.073	15	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	6,500		52.00	16	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	1,500		210	67	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	2,500		210	93	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	58,000		8,000	2,600	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
J Range	LYJRNG002	LYJRNG002_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	4,700		1,000	500	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	4,700	J	7,500	3,000	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	0.35	J	1	0.21	6	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	8,800		100	52	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	1.1		1	0.37	1,300	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	34	J	52	21	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	ND	U	0.52	0.073	15	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	5,000	^2	52	16	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	1,100		210	67	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	3,200		210	93	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	4,300		8,000	2,600	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
K Range	LYKRNG001	LYKRNG001_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	2,800		1,000	500	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	3,600	J	7,500	3,000	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	0.28	J	1	0.21	6	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	13,000		100	52	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	0.83	J	1	0.37	1,300	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (µg/L)	Sample Type
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	ND	U	0.52	0.073	15	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	10,000	B	52	16	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	1,000		210	67	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	3,400		210	93	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	71,000		8,000	2,600	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
K Range	LYKRNG002	LYKRNG002_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	2,300		1,000	500	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	4,800	J	7,500	3,000	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	0.67	J	1	0.21	6	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	4,100		100	52	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	4.6		1	0.37	1,300	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	2,300		52	21	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	6.2		0.52	0.073	15	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	3,600		52	16	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	1,900		210	67	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	2,700		210	93	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	10,000		8,000	2,600	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
K Range	LYKRNG003	LYKRNG003_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	5,000		1,000	500	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	ND	U, F1	7,500	3,000	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	**11**		1	0.21	6	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	5,300		100	52	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	6.7		1	0.37	1,300	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	2.6		0.52	0.073	15	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	430		52	16	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	360		210	67	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	2,200		210	93	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	13,000		8,000	2,600	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
K Range	LYKRNG004	LYKRNG004_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	3,600		1,000	500	--	N

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (µg/L)	Sample Type
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	EPA 300.0	FLDFLT	Chloride	3,500	J	7,500	3,000	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Antimony	ND	U	1	0.21	6	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Calcium	2,200		100	52	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Copper	5.4		1	0.37	1,300	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Lead	0.61		0.52	0.073	15	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Magnesium	420		52	16	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Potassium	780		210	67	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SW846 6020B	FLDFLT	Sodium	2,300		210	93	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SM 2320B-2011	FLDFLT	Alkalinity	3,500	J	8,000	2,600	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
L Range	LYLRNG001	LYLRNG001_OCT22	10/13/2022	SM 5310 C-2011	FLDFLT	DOC	6,900		1,000	500	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	EPA 300.0	FLDFLT	Chloride	ND	U	7,500	3,000	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Antimony	ND	U	1	0.21	6	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Calcium	26,000		100	52	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Copper	0.76	J	1	0.37	1,300	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Iron	33	J	52	21	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Lead	ND	U	0.52	0.073	15	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Magnesium	560	^2	52	16	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Potassium	91	J	210	67	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SW846 6020B	FLDFLT	Sodium	3,000		210	93	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SM 2320B-2011	FLDFLT	Alkalinity	72,000		8,000	2,600	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
L Range	LYLRNG002	LYLRNG002_OCT22	10/13/2022	SM 5310 C-2011	FLDFLT	DOC	2,800		1,000	500	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	EPA 300.0	FLDFLT	Chloride	6,200	J	7,500	3,000	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Antimony	1.5		1	0.21	6	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Calcium	21,000		100	52	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Copper	4.4		1	0.37	1,300	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Iron	180		52	21	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Lead	0.55		0.52	0.073	15	N

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL	MDL	OMMP Action Levels (µg/L)	Sample Type
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Magnesium	2,000		52	16	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Potassium	190	J	210	67	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SW846 6020B	FLDFLT	Sodium	5,300		210	93	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SM 2320B-2011	FLDFLT	Alkalinity	58,000		8,000	2,600	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
S Range	LYSRNG001	LYSRNG001_OCT22	10/11/2022	SM 5310 C-2011	FLDFLT	DOC	8,100		1,000	500	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	EPA 300.0	FLDFLT	Sulfate	ND	U	7,500	2,500	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	EPA 300.0	FLDFLT	Chloride	11,000		7,500	3,000	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Antimony	ND	U	1	0.21	6	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Calcium	1,700		100	52	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Copper	1.8		1	0.37	1,300	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Iron	24	J	52	21	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Lead	0.14	J	0.52	0.073	15	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Magnesium	510	^2	52	16	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Potassium	2,700		210	67	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SW846 6020B	FLDFLT	Sodium	5,300	B ^2	210	93	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SM 2320B-2011	FLDFLT	Alkalinity	3,500	J	8,000	2,600	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N
S Range	LYSRNG002	LYSRNG002_OCT22	10/11/2022	SM 5310 C-2011	FLDFLT	DOC	3,000		1,000	500	--	N

Notes:

µg/L = microgram(s) per liter
bgs = below ground surface
FLDFLT = field filtered
FR = field duplicate or replicate
ID = identifier
SLX = location
MDL = method detection limit
N = native sample
ND/U = non-detectable value
OMMP = Operations, Maintenance and Monitoring Plan
RL = reporting limit
J = Estimated value, result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

Small Arms Range Sampling Reports

Groundwater Sampling Results

Fall 2022

CAMP EDWARDS SMALL ARMS RANGE ANNUAL GROUNDWATER MONITORING 2022

NOTE: Data entered does not include third-party data validation qualifiers per the 2018 QAPP, if required.

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL (µg/L)	MDL (µg/L)	OMMP Action Levels (µg/L)	Sample Type	Remarks
E Range	MW-468S	MW-468S_OCT22	10/14/2022	EPA 300.0	FLDFLT	Sulfate	NS	--	--	--	--	--	Not enough water to collect additoional jars
E Range	MW-468S	MW-468S_OCT22	10/14/2022	EPA 300.0	FLDFLT	Chloride	NS	--	--	--	--	--	Not enough water to collect additoional jars
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Antimony	ND	U	1	0.21	3	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Calcium	4,500		100	52	--	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Copper	7.1		1	0.37	650	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Iron	1,200		52	21	--	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Lead	4.6		0.52	0.073	7.5	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Magnesium	3,000		52	16	--	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Potassium	1,100		210	67	--	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SW846 6020B	FLDFLT	Sodium	7,500		210	93	--	N	Grab Sample, not enough water to sample
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SM 2320B-2011	FLDFLT	Alkalinity	NS	--	--	--	--	--	Not enough water to collect additoional jars
E Range	MW-468S	MW-468S_OCT22	10/14/2022	EPA 365.1	FLDFLT	Phosphate	NS	--	--	--	--	--	Not enough water to collect additoional jars
E Range	MW-468S	MW-468S_OCT22	10/14/2022	SM 5310 C-2011	FLDFLT	DOC	NS	--	--	--	--	--	Not enough water to collect additoional jars
S Range	MW-465S	MW-465S_OCT22	10/11/2022	EPA 300.0	FLDFLT	Sulfate	5,800	J	7,500	2,500	--	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	EPA 300.0	FLDFLT	Chloride	5,600	J	7,500	3,000	--	N	Grab Sample, not enough water to sample

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL (µg/L)	MDL (µg/L)	OMMP Action Levels (µg/L)	Sample Type	Remarks
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Antimony	ND	U	1	0.21	3	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Calcium	4,300	^2	100	52	--	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Copper	0.67	J	1	0.37	650	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Iron	22	J	52	21	--	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Lead	0.14	J	0.52	0.073	7.5	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Magnesium	2,100	^2	52	16	--	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Potassium	630		210	67	--	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Sodium	5,900		210	93	--	N	Grab Sample, not enough water to sample
S Range	MW-465S	MW-465S_OCT22	10/11/2022	SM 2320B-2011	FLDFLT	Alkalinity	NS	--	--	--	--	--	Not enough water to collect additoional jars
S Range	MW-465S	MW-465S_OCT22	10/11/2022	EPA 365.1	FLDFLT	Phosphate	NS	--	--	--	--	--	Not enough water to collect additoional jars
S Range	MW-455S	MW-465S_OCT22	10/11/2022	SM 5310 C-2011	FLDFLT	DOC	NS	--	--	--	--	--	Not enough water to collect additoional jars
S Range	MW-466S	MW-466S_OCT22	10/11/2022	EPA 300.0	FLDFLT	Sulfate	7,400	J	7,500	2,500	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	EPA 300.0	FLDFLT	Chloride	6,800	J	7,500	3,000	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Antimony	ND	U	1	0.21	3	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Calcium	6,600		100	52	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Copper	0.47	J	1	0.37	650	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Iron	ND	U	52	21	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Lead	ND	U	0.52	0.073	7.5	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Magnesium	3,000		52	16	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Potassium	730		210	67	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SW846 6020B	FLDFLT	Sodium	8,200		210	93	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SM 2320B-2011	FLDFLT	Alkalinity	2,600		8,000	2,600	--	N	Low Flow

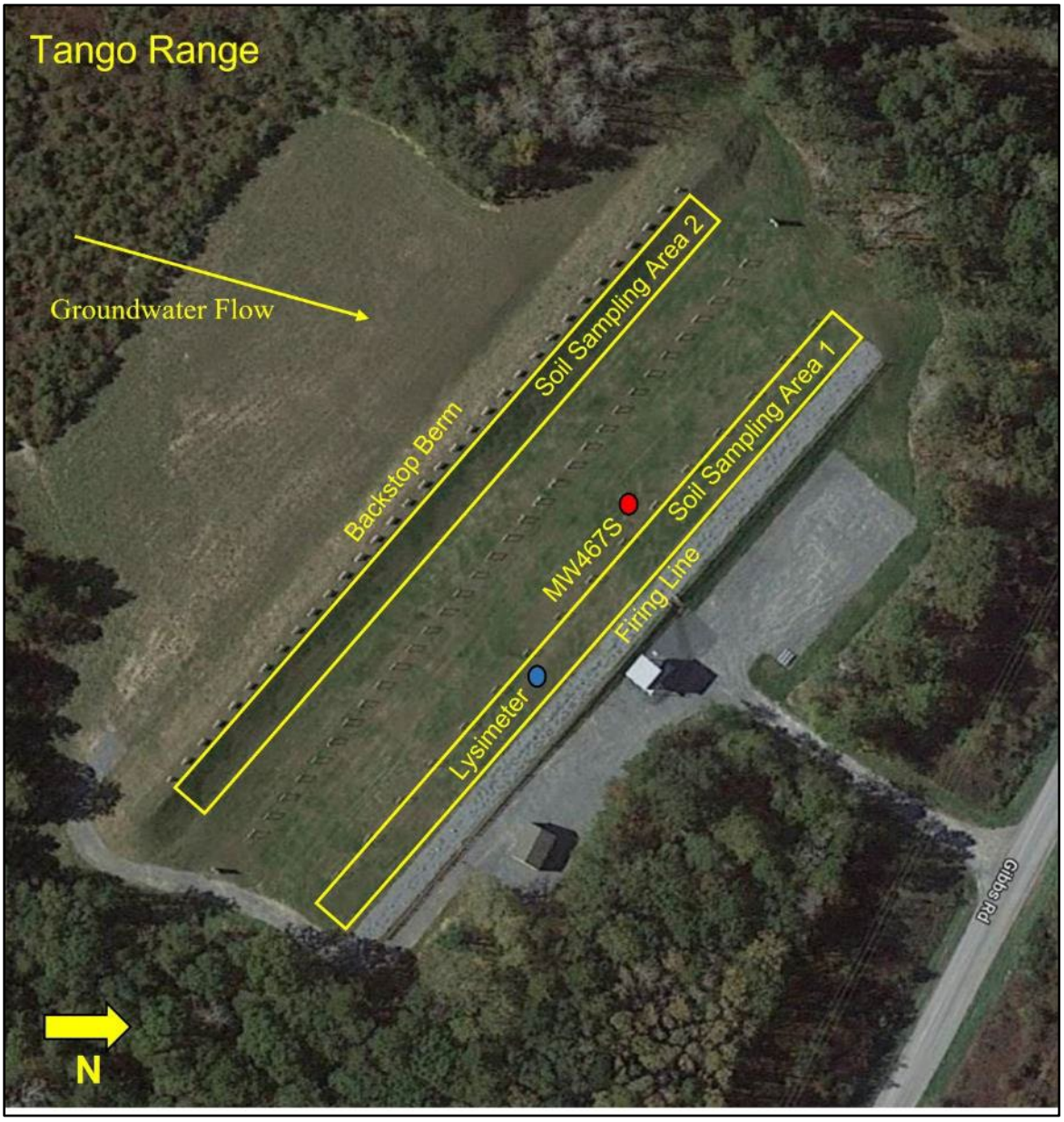
Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Method	Analyte	Result Value (µg/L)	Lab Report Qualifier	RL (µg/L)	MDL (µg/L)	OMMP Action Levels (µg/L)	Sample Type	Remarks
S Range	MW-466S	MW-466S_OCT22	10/11/2022	EPA 365.1	FLDFLT	Phosphate	ND	U	310	250	--	N	Low Flow
S Range	MW-466S	MW-466S_OCT22	10/11/2022	SM 5310 C-2011	FLDFLT	DOC	ND	U	1,000	500	--	N	Low Flow

Notes:

µg/L = microgram(s) per liter
bgs = below ground surface
FLDFLT = field filtered
FR = field duplicate or replicate
ID = identifier
SLX = location

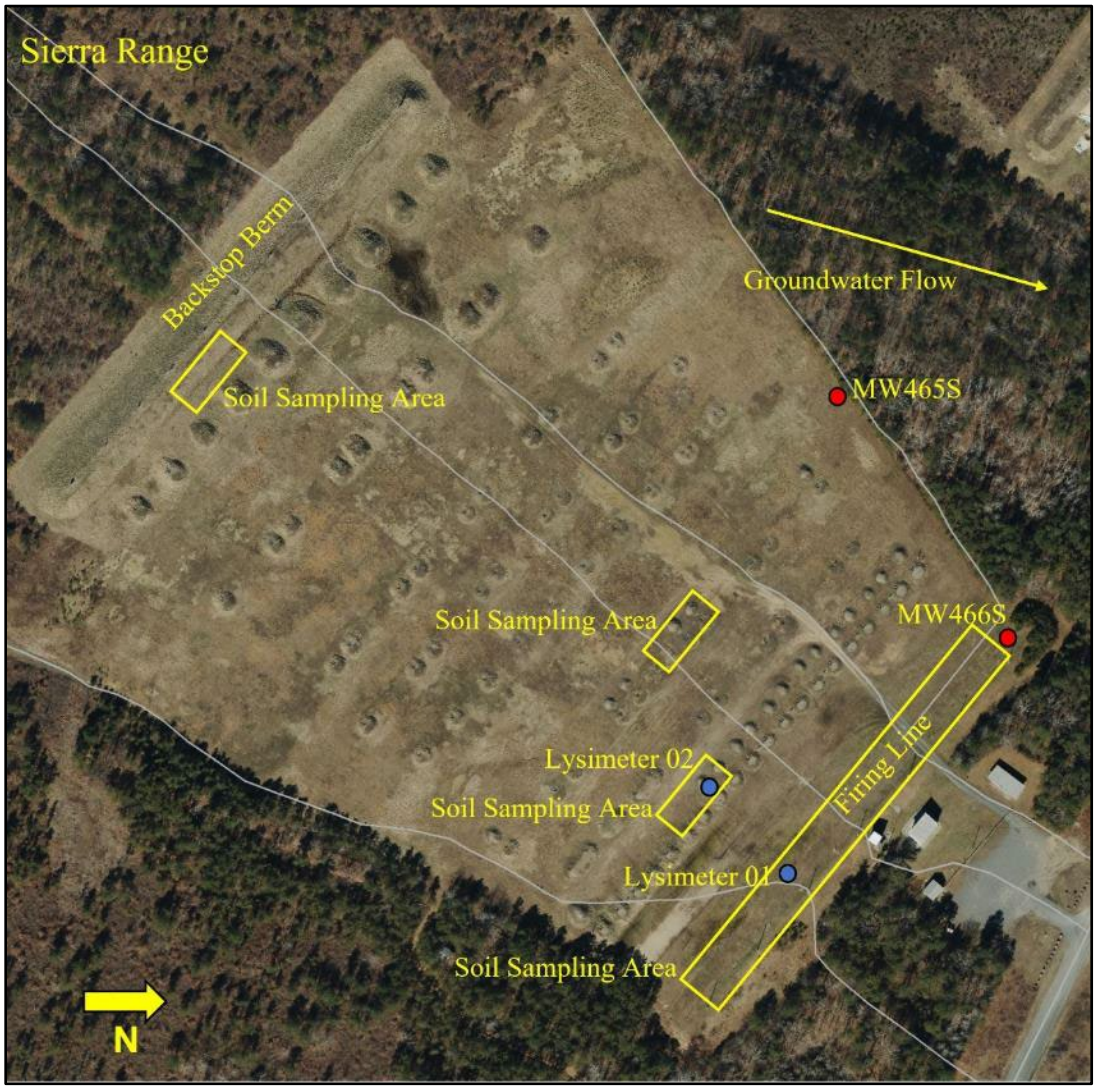
Bold Results Value = ABOVE OMMP ACTION LEVEL
DOC = Dissolved Organic Carbon
NS = No sample analyzed due to insufficient water
^2 = Calibration Blank (ICB andor CCB) is outside acceptance limits.

Small Arms Range Sample Area Figures

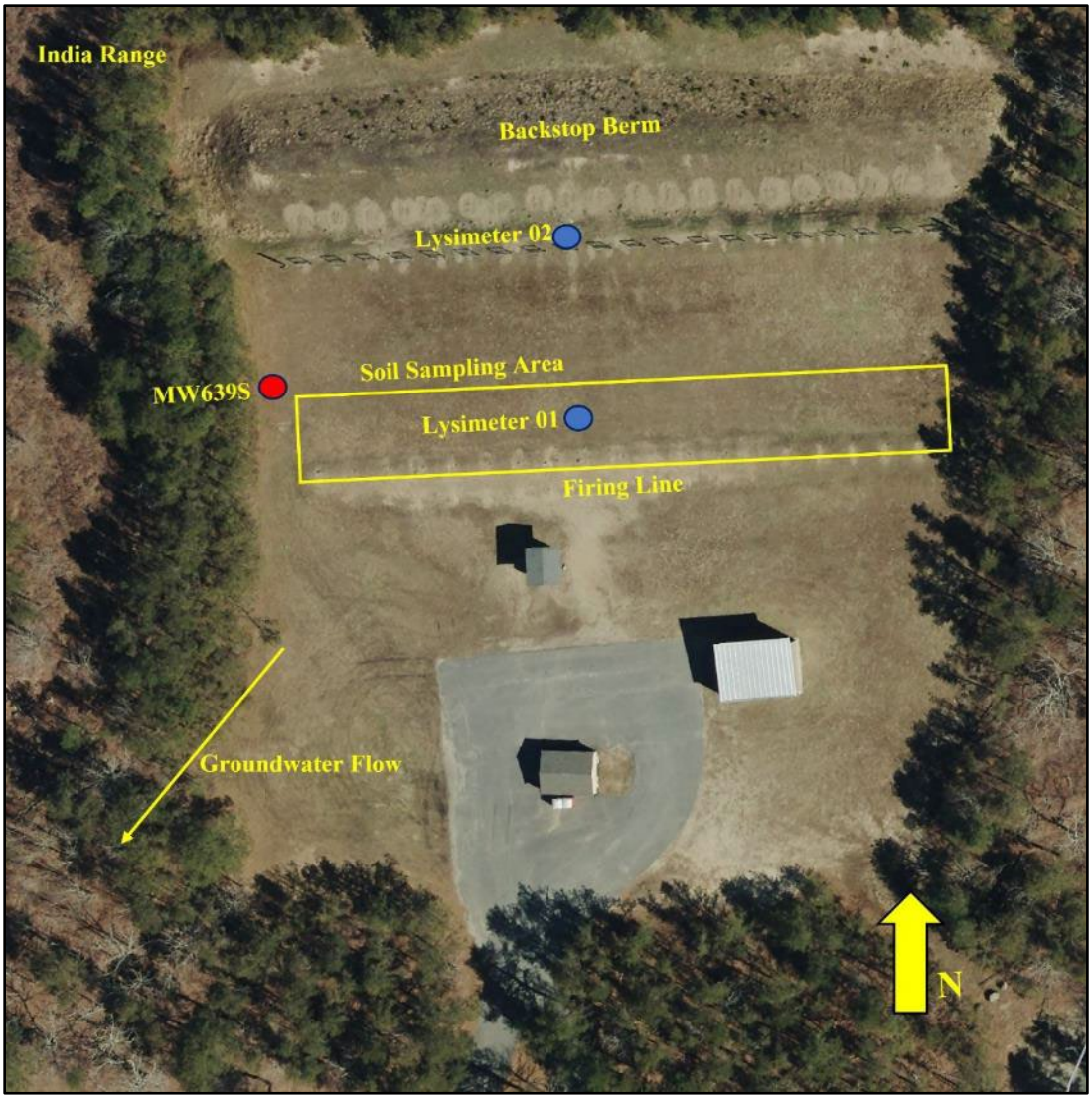


Tango Range (EPR copper only), Structures, and Sampling Areas
Camp Edwards, Massachusetts

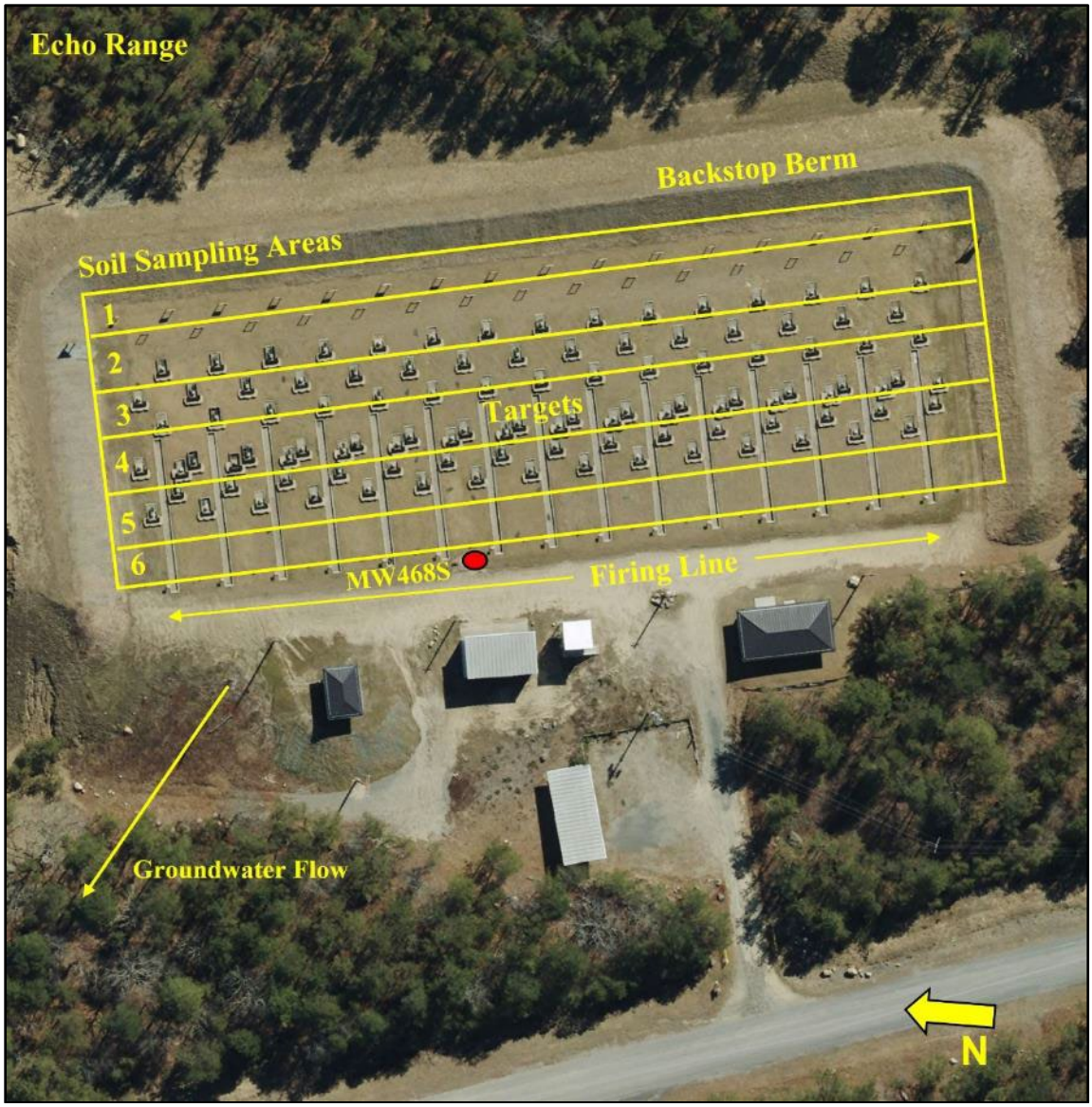
The lysimeter noted on the graphic above is planned to be installed in TY 2023.



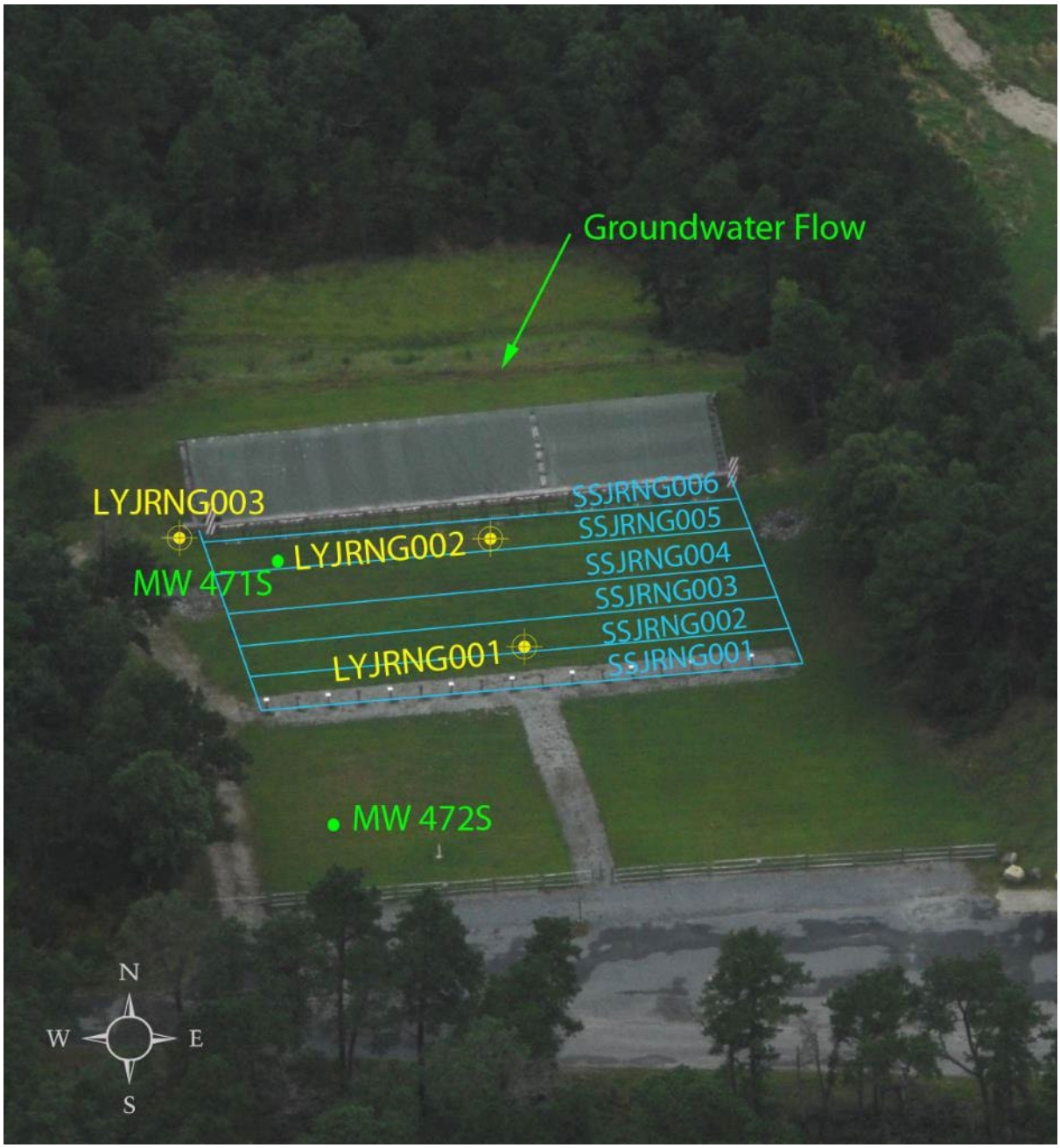
Sierra Range (EPR copper only) Sampling Areas
Camp Edwards, Massachusetts
MW=Monitoring Well



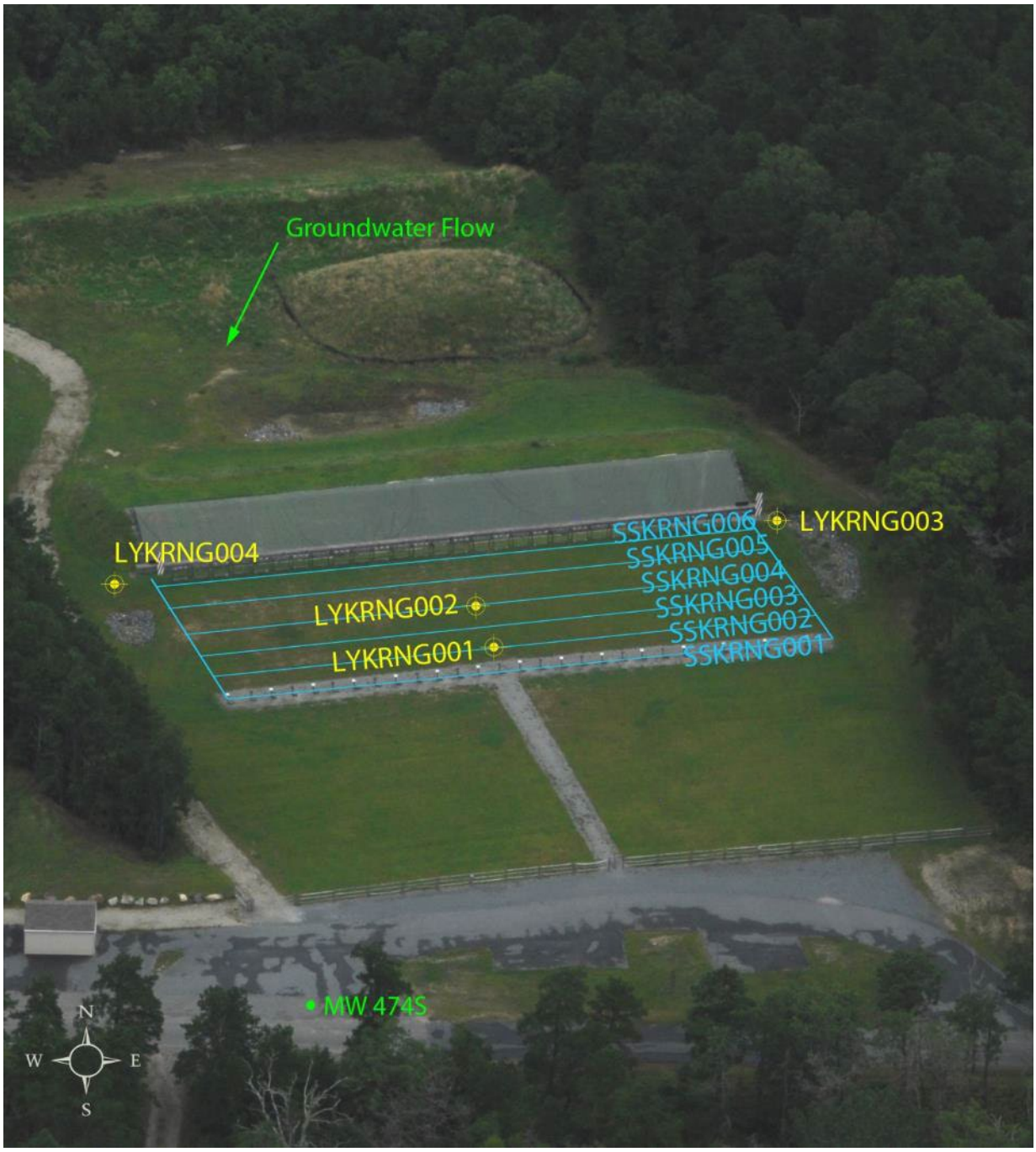
India Range (EPR copper only) Sampling Areas
Camp Edwards, Massachusetts
MW=Monitoring Well



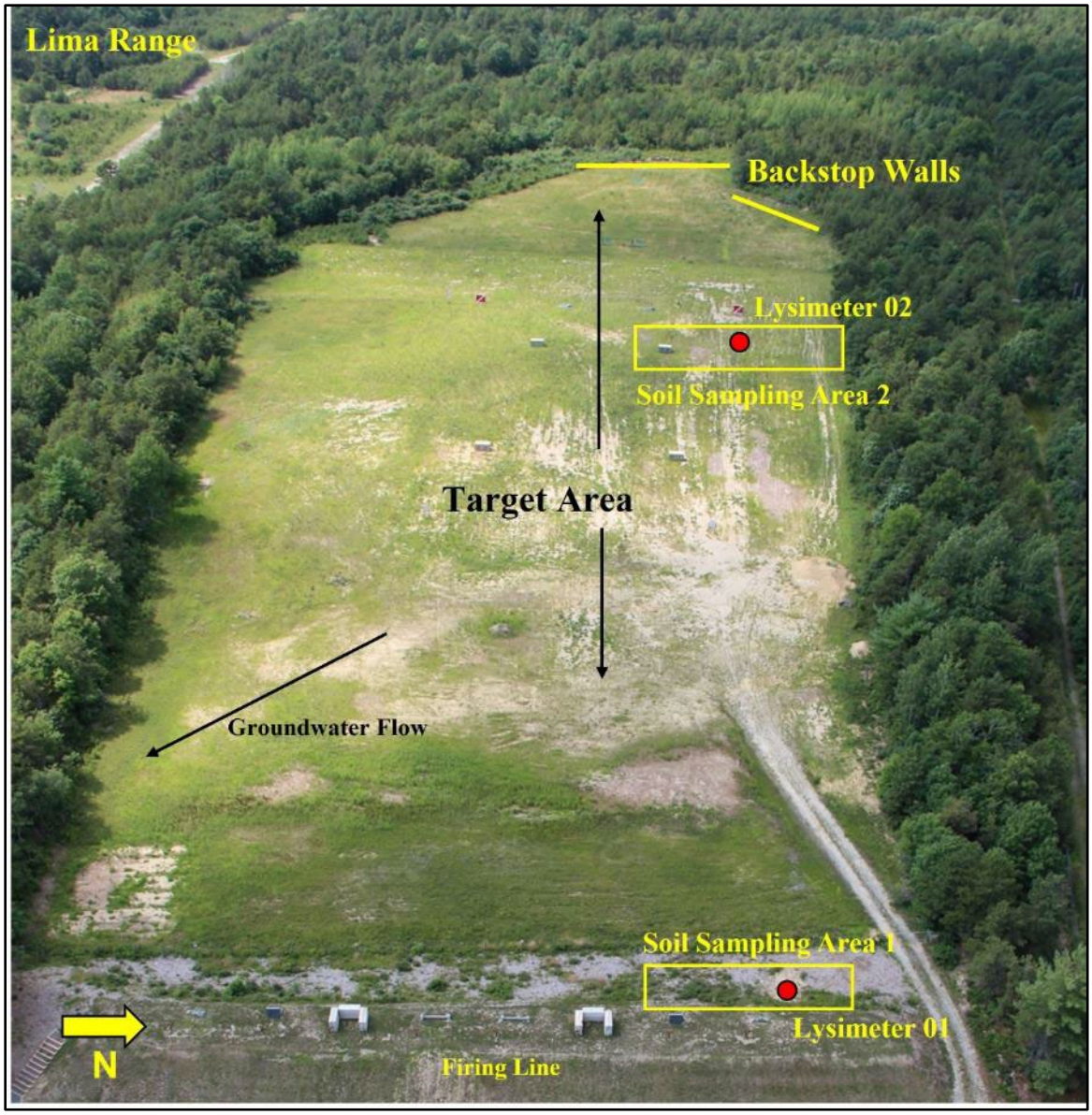
Echo Range Sampling Areas
Camp Edwards, Massachusetts
MW=Monitoring Well



Juliet Range
Camp Edwards, Massachusetts.
LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample



Kilo Range
Camp Edwards, Massachusetts.
LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample



Lima Range
Camp Edwards, Massachusetts.

Mobility of Lead and Antimony in Shooting Range Soils:

Column Leaching Study

Engineer Research and Development Center

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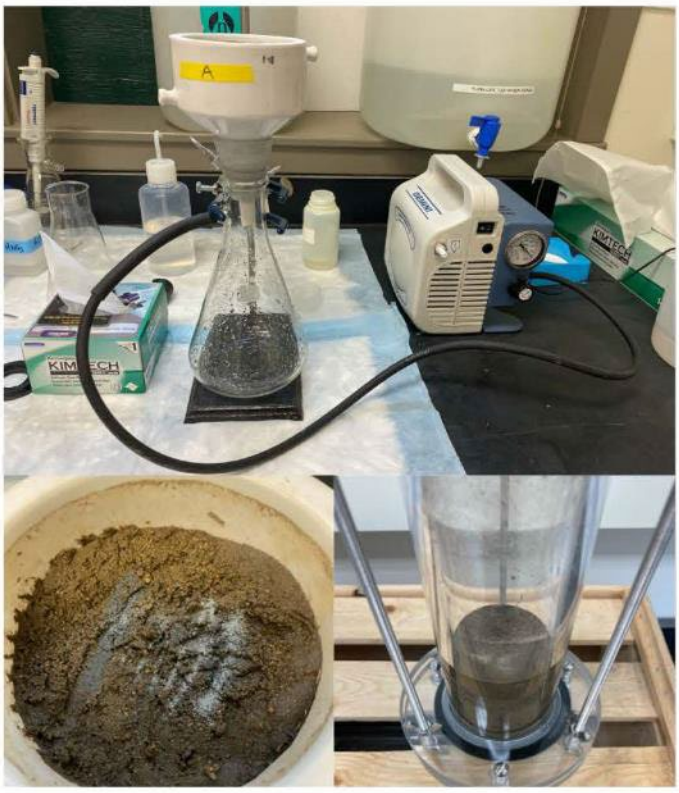
Mobility of Lead and Antimony in Shooting Range Soils: Column Leaching Study

Amanda J. Barker and Jay L. Clausen

February 2021



Mobility of Lead and Antimony in Shooting Range Soils: Column Leaching Study

Amanda J. Barker[1] and Jay L. Clausen[1]

Cold Regions Research and Engineering Laboratory (CRREL)
U.S. Army Engineer Research and Development Center
72 Lyme Road
Hanover, NH 03755

Final report

Abstract

The mobility of lead (Pb) and antimony (Sb) in shooting range soils was investigated in this report. We found Sb significantly more mobile than Pb in the systems studied. Previous efforts concluded that the dominant Sb species in the system is likely Sb(V) and therefore has increased mobility at pHs above 7-8, in general. The results from this effort show that the amendment additions lime and phosphate caused an increase in Sb concentrations and had little effect on mobilizing Pb in the same systems.

Contents

Figures and Tables

Figures

Tables

1 Introduction

Mobility of lead (Pb) and antimony (Sb) in India Berm from Joint Base Cape Cod, MA soil were investigated in September, 2020 using leaching runoff procedures. Previous field efforts have shown an increase in Sb concentrations in pore water samples in select berms and ranges, while Pb concentrations remain relatively stable and low. Legacy reports describe the addition of amendments including lime and phosphate additions to the berms in an effort to stabilize metal,. The pH values for pore water samples after these additions increased to approximately 8 and 9 and then have since decreased to circumneutral values. The current effort simulated conditions at Joint Base Cape Cod, including acidic rain water and soil samples, to investigate concentrations of Pb and Sb in select soil samples. Native soil (India Berm) was used and spiked with Pb and Sb mesh powders and simulated rain was flushed through columns of soil for a total of 160 runoff samples. Two amendments were used to mirror field conditions, calcium hydroxide (lime) and calcium phosphate. The report presents Pb and Sb concentrations as a function of amendment additions over time.

2 Methods

2.1 Experimental Setup

There were two separate experiments within the scope of this work, A and B. Experiment A used lime (calcium hydroxide) as an addition and Experiment B used calcium phosphate tribasic as an addition to investigate how they individually impacted Pb and Sb mobility in soil solution. Simulated rainwater was prepared using ultrapure DI water with a resistivity of 18.2 mΩ·cm at 25 °C and using reagent grade chemicals as follows: 0.13 mg/L potassium nitrate, 0.0012 mg/L sodium bicarbonate, 1 mL of ultrapure 6 M nitric acid was added per every 10 L of ultrapure DI water and 0.5 mL of 5 M sodium hydroxide was added per 10 L of ultrapure DI water.

Acrylic soil columns were originally loaded with India Range Berm Face soil and packed uniformly for pressurized flow experiments. However, the flow through the soils was extremely slow and we experienced leaks when the pressure was increased to increase flow velocity. Therefore, we switched to a gravity flush system using a ceramic holder with a vacuum pump. Approximately, 200 grams of soil previously collected from the India Range berm face was loaded for each of the experiments, A and B. We used Pb and Sb mesh powder <200 mesh size for each of the spikes for both experiments and 0.1 grams were loaded. For each sample, 150 mLs of simulated rain water were flushed through the system and collected. Samples were all filtered to less than 1.6 microns using Whatman filters and acidified with ultrapure nitric acid. Samples were stored at 4°C until analysis.

2.2 Sample Analysis

Leaching runoff samples were analyzed using inductively coupled plasma-mass spectrometry (ICP-MS) at the Environmental Laboratory in Vicksburg, MS.

3 Results and Discussion

In general, Sb was mobilized to a much greater extent than Pb throughout the entirety of the experiment. Concentrations of Pb and Sb are shown plotted in Figures 1 and 2 and results are tabulated in Tables 1 and 2. The pH values of the simulated rain and the pH values for the effluent runoff samples are shown in Tables 1 and 2.

Figure 1. Concentrations of Sb as a function of pH for experiment A.

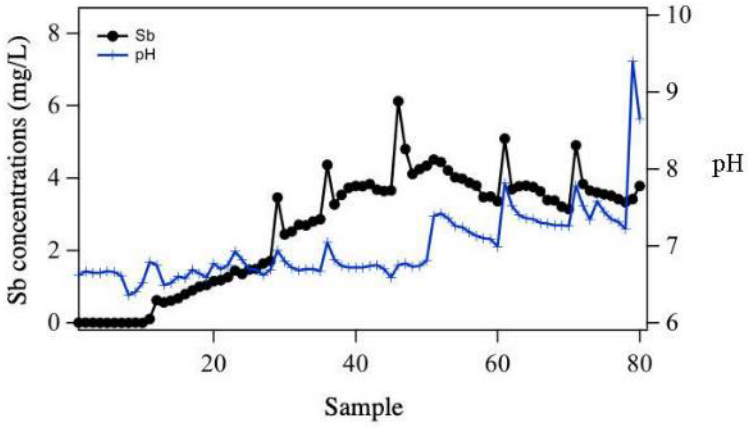
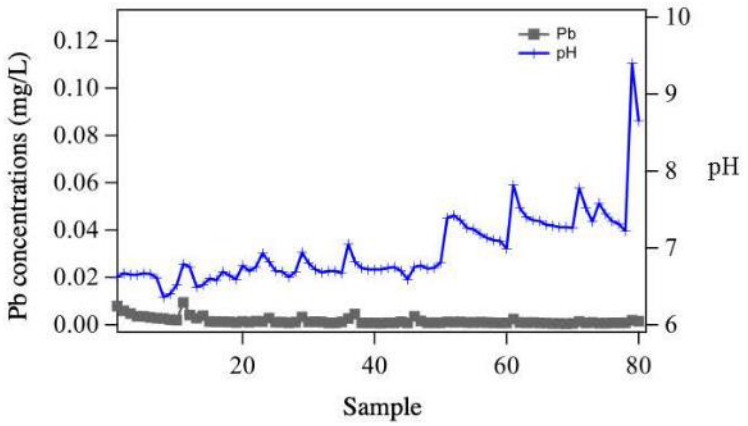


Figure 2. Concentrations of Pb as a function of pH for experiment A.



Once the soils in both experiments were spiked with Pb and Sb, concentrations of Sb were immediately mobilized to solution. Concentrations of Pb for the most part re-

mained relatively low and did not experience any mass release except at the end of Experiment B when concentrations increased significantly corresponding to a rise in pH above 9.

Figure 3. Concentrations of Sb as a function of pH for experiment B.

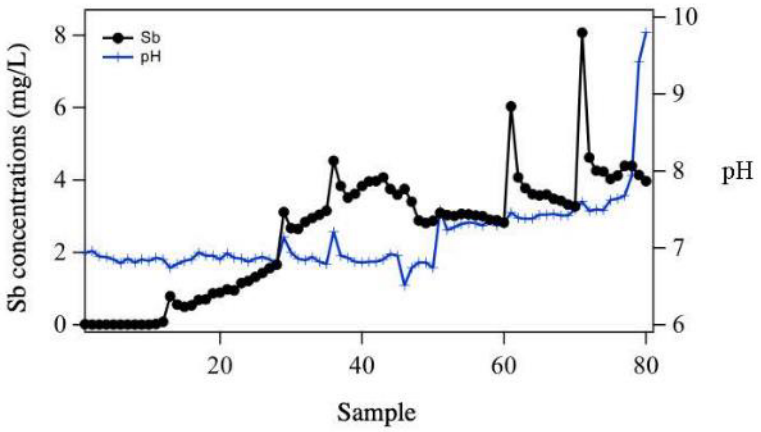
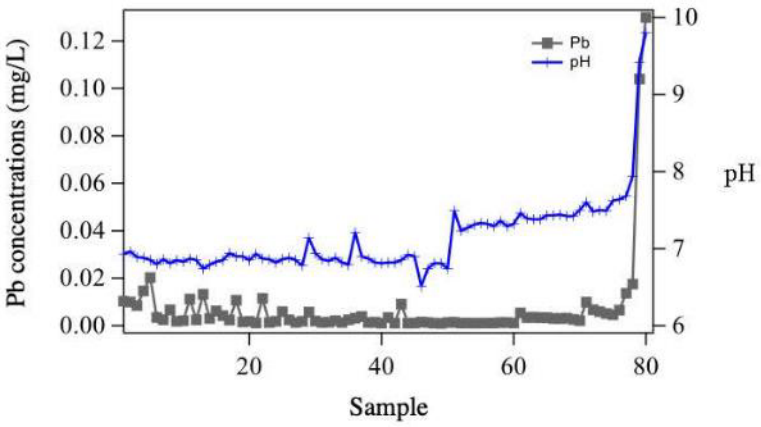


Figure 4. Concentrations of Pb as a function of pH for experiment B.



Antimony was particularly mobilized in soil solution after the addition of phosphate addition (Figure 4), reaching concentrations above 8 mg/L in solution. Based on previous efforts with the soils, it was determined that Sb was primarily present in the Sb(V) form (based on LC-MS/MS) therefore the slightly basic pH likely played a role in flushing Sb species into solution. Initial concentrations for Sb were low at the start with the simu-

lated acid rain flushes and began to rise upon addition of the spike. The phosphate addition mobilized Sb to a greater extent overall than the calcium hydroxide addition, indicating pH may not be the only factor in mobilizing Sb in these systems.

Table 1. Results for experiment A (calcium hydroxide addition). 'Pb*' indicates values are qualitative.

Sample		Date/Time	Simulated rain pH	Simulated rain ORP (mv)	Sample pH	Sample ORP (mV)	Sb (mg/L)	Pb (mg/L)	Estimate	Notes
1	a	9/10/20 10:00 AM	4.35	145	6.62	24	0.0069	0.0079		India soil packed and simulated rain
2	a	9/10/20 10:10 AM	4.35	145	6.67	22	0.0057	0.0059		
3	a	9/10/20 10:20 AM	4.35	145	6.65	23	0.0037	0.0048		
4	a	9/10/20 10:30 AM	4.35	145	6.65	23	0.0025	0.0037		
5	a	9/10/20 10:40 AM	4.35	145	6.67	22	0.0024	0.0035		
6	a	9/10/20 10:50 AM	4.35	145	6.66	23	0.0022	0.0032		
7	a	9/10/20 11:00 AM	4.35	145	6.61	25	0.0026	0.0028		
8	a	9/10/20 11:10 AM	4.35	145	6.36	39	0.0026	0.0026		
9	a	9/10/20 11:20 AM	4.35	145	6.40	37	0.0035	0.0022		
10	a	9/10/20 11:30 AM	4.35	145	6.52	30	0.0024	0.0020		
11	a	9/10/20 12:30 AM	4.35	145	6.79	15	0.103	0.0094		spiked with Pb/Sb powder
12	a	9/10/20 12:40 PM	4.35	145	6.75	18	0.625	0.0042		
13	a	9/11/20 10:00 AM	4.45	146	6.49	32	0.562	0.0028		
14	a	9/11/20 10:10 AM	4.45	146	6.52	31	0.609	0.0038		
15	a	9/11/20 10:20 AM	4.45	146	6.60	26	0.675	0.0014		
16	a	9/11/20 10:30 AM	4.45	146	6.58	27	0.791	0.0013		
17	a	9/11/20 10:40 AM	4.45	146	6.69	22	0.896	0.0013		
18	a	9/11/20 10:50 AM	4.45	146	6.64	24	1.00	0.0012		
19	a	9/11/20 11:00 AM	4.45	146	6.59	27	1.04	0.0010		
20	a	9/11/20 11:10 AM	4.45	146	6.77	17	1.15	0.0014		
21	a	9/11/20 11:20 AM	4.45	146	6.70	21	1.18	0.0011		
22	a	9/11/20 11:30 AM	4.45	146	6.75	18	1.26	0.0015		
23	a	9/11/20 11:40 AM	4.45	146	6.93	8	1.44	0.0014		
24	a	9/11/20 11:50 AM	4.45	146	6.82	14	1.35	0.0028		
25	a	9/11/20 12:00 PM	4.45	146	6.70	21	1.47	0.0011		
26	a	9/11/20 12:10 PM	4.45	146	6.69	21	1.49	0.0011		
27	a	9/11/20 12:20 PM	4.45	146	6.62	25	1.64	0.0009	Pb*	
28	a	9/11/20 12:30 PM	4.45	146	6.69	22	1.71	0.0011		
29	a	9/12/20 10:00 AM	4.45	146	6.94	7	3.46	0.0033		
30	a	9/12/20 10:10 AM	4.45	146	6.80	16	2.44	0.0012		
31	a	9/12/20 10:20 AM	4.45	146	6.72	19	2.52	0.0013		
32	a	9/12/20 10:30 AM	4.45	146	6.68	22	2.71	0.0012		
33	a	9/12/20 10:40 AM	4.45	146	6.70	21	2.69	0.0008	Pb*	
34	a	9/12/20 10:50 AM	4.45	146	6.70	21	2.80	0.0008	Pb*	
35	a	9/12/20 11:00 AM	4.45	146	6.67	22	2.86	0.0012		
36	a	9/13/20 10:00 AM	4.45	146	7.05	2	4.36	0.0026		
37	a	9/13/20 10:10 AM	4.45	146	6.82	14	3.27	0.0045		
38	a	9/13/20 10:20 AM	4.45	146	6.74	19	3.53	0.0008	Pb*	
39	a	9/13/20 10:30 AM	4.45	146	6.72	20	3.73	0.00077	Pb*	
40	a	9/13/20 10:40 AM	4.45	146	6.72	20	3.78	0.0008	Pb*	
41	a	9/13/20 10:50 AM	4.45	146	6.72	20	3.77	0.0007	Pb*	
42	a	9/13/20 11:00 AM	4.45	146	6.74	19	3.83	0.0009	Pb*	
43	a	9/13/20 11:10 AM	4.45	146	6.75	18	3.68	0.0008	Pb*	
44	a	9/13/20 11:20 AM	4.45	146	6.70	20	3.64	0.0013		
45	a	9/13/20 11:30 AM	4.45	146	6.59	27	3.66	0.0008	Pb*	
46	a	9/17/20 10:00 AM	4.48	147	6.75	18	6.12	0.0036		
47	a	9/17/20 10:10 AM	4.50	149	6.77	16	4.80	0.0016		
48	a	9/17/20 10:20 AM	4.50	149	6.73	19	4.11	0.0009	Pb*	
49	a	9/17/20 10:30 AM	4.50	149	6.74	18	4.25	0.0009	Pb*	
50	a	9/17/20 10:40 AM	4.50	149	6.81	15	4.34	0.0009	Pb*	
51	a	9/17/20 1:00 PM	9.45	-129	7.39	-17	4.51	0.0012		Ca(OH)2 solution added
52	a	9/17/20 1:10 PM	9.45	-129	7.42	-19	4.44	0.0011		
53	a	9/17/20 1:20 PM	9.45	-129	7.36	-16	4.21	0.0012		
54	a	9/17/20 1:30 PM	9.45	-129	7.26	-11	4.02	0.0010		
55	a	9/17/20 1:40 PM	9.45	-129	7.24	-9	3.98	0.0010	Pb*	
56	a	9/17/20 1:50 PM	9.45	-129	7.18	-6	3.87	0.0011		
57	a	9/17/20 2:00 PM	9.45	-129	7.13	-3	3.79	0.0010		
58	a	9/17/20 2:10 PM	9.45	-129	7.10	-1	3.47	0.0009	Pb*	
59	a	9/17/20 2:20 PM	9.45	-129	7.09	-1	3.49	0.00079	Pb*	
60	a	9/17/20 2:30 PM	9.45	-129	6.99	5	3.36	0.0008	Pb*	
61	a	9/18/20 10:00 AM	10.05	-164	7.82	-41	5.09	0.0024		
62	a	9/18/20 10:10 AM	10.05	-164	7.52	-25	3.69	0.0010		
63	a	9/18/20 10:20 AM	10.05	-164	7.40	-18	3.77	0.0009	Pb*	
64	a	9/18/20 10:30 AM	10.05	-164	7.36	-16	3.79	0.0010	Pb*	
65	a	9/18/20 10:40 AM	10.05	-164	7.35	-15	3.75	0.0008	Pb*	
66	a	9/18/20 10:50 AM	10.05	-164	7.30	-12	3.63	0.0007	Pb*	
67	a	9/18/20 11:00 AM	10.05	-164	7.29	-12	3.39	0.0006	Pb*	
68	a	9/18/20 11:10 AM	10.05	-164	7.27	-11	3.38	0.0006	Pb*	
69	a	9/18/20 11:20 AM	10.05	-164	7.27	-11	3.21	0.0005	Pb*	
70	a	9/18/20 11:30 AM	10.05	-164	7.26	-10	3.14	0.00059	Pb*	
71	a	9/19/20 10:00 AM	10.99	-214	7.78	-39	4.90	0.0014		
72	a	9/19/20 10:10 AM	10.99	-214	7.52	-25	3.83	0.0008	Pb*	
73	a	9/19/20 10:20 AM	10.99	-214	7.34	-15	3.65	0.0010	Pb*	
74	a	9/19/20 10:30 AM	10.99	-214	7.58	-28	3.60	0.0007	Pb*	
75	a	9/19/20 10:40 AM	10.99	-214	7.44	-20	3.55	0.0007	Pb*	
76	a	9/19/20 10:50 AM	11.55	-245	7.35	-15	3.51	0.0008	Pb*	
77	a	9/19/20 11:00 AM	11.55	-245	7.31	-13	3.42	0.0008	Pb*	
78	a	9/19/20 11:10 AM	11.55	-245	7.22	-8	3.33	0.00096	Pb*	0.15 g Ca(OH2) added directly to soil
79	a	9/19/20 12:10 PM	11.55	-245	9.40	-148	3.42	0.0019		0.15 g Ca(OH2) added directly to soil
80	a	9/19/20 1:10 PM	11.55	-245	8.65	-87	3.78	0.0015		

Table 2. Results for experiment B (phosphate addition). 'Pb*' indicates values are qualitative.

Sample		Date/Time	Simulated rain pH	Simulated rain ORP (mv)	Sample pH	Sample ORP (mV)	Sb (mg/L)	Pb (mg/L)	Estimate	Notes
1	b	9/20/20 10:00 AM	4.49	144	6.93	8	0.0177	0.0103		India soil packed and simulated rain
2	b	9/20/20 10:10 AM	4.49	144	6.96	6	0.0080	0.0100		
3	b	9/20/20 10:20 AM	4.49	144	6.89	10	0.0061	0.0084		
4	b	9/20/20 10:30 AM	4.49	144	6.88	10	0.0046	0.0147		
5	b	9/20/20 10:40 AM	4.49	144	6.85	12	0.0039	0.0203		
6	b	9/20/20 10:50 AM	4.49	144	6.80	15	0.0032	0.0035		
7	b	9/20/20 11:00 AM	4.49	144	6.86	12	0.0036	0.0025		
8	b	9/20/20 11:10 AM	4.49	144	6.81	15	0.0029	0.0067		
9	b	9/20/20 11:20 AM	4.49	144	6.85	12	0.0030	0.0018		
10	b	9/20/20 11:30 AM	4.49	144	6.83	13	0.0031	0.0022		
11	b	9/20/20 12:30 AM	4.49	144	6.87	11	0.0224	0.0112		spiked with Pb/Sb powder
12	b	9/20/20 12:40 PM	4.49	144	6.85	12	0.0806	0.0024		
13	b	9/21/20 10:00 AM	4.60	137	6.74	18	0.784	0.0133		
14	b	9/21/20 10:10 AM	4.60	137	6.79	15	0.559	0.0031		
15	b	9/21/20 10:20 AM	4.60	137	6.83	14	0.498	0.0063		
16	b	9/21/20 10:30 AM	4.60	137	6.85	12	0.536	0.0042		
17	b	9/21/20 10:40 AM	4.60	137	6.94	7	0.687	0.0023		
18	b	9/21/20 10:50 AM	4.60	137	6.90	10	0.706	0.0107		
19	b	9/21/20 11:00 AM	4.60	137	6.90	9	0.866	0.0016		
20	b	9/21/20 11:10 AM	4.60	137	6.85	12	0.891	0.0018		
21	b	9/21/20 11:20 AM	4.60	137	6.93	8	0.977	0.0012		
22	b	9/21/20 11:30 AM	4.60	137	6.87	11	0.949	0.0115		
23	b	9/21/20 11:40 AM	4.60	137	6.86	12	1.15	0.0013		
24	b	9/21/20 11:50 AM	4.60	137	6.82	14	1.21	0.0018		
25	b	9/21/20 12:00 PM	4.60	137	6.86	12	1.32	0.0059		
26	b	9/21/20 12:10 PM	4.60	137	6.88	11	1.43	0.0024		
27	b	9/21/20 12:20 PM	4.60	137	6.85	12	1.56	0.0013		
28	b	9/21/20 12:30 PM	4.60	137	6.78	16	1.66	0.0018		
29	b	9/22/20 10:00 AM	4.60	137	7.14	-4	3.11	0.0057		
30	b	9/22/20 10:10 AM	4.60	137	6.94	8	2.67	0.0019		
31	b	9/22/20 10:20 AM	4.60	137	6.86	12	2.65	0.0013		
32	b	9/22/20 10:30 AM	4.60	137	6.84	13	2.84	0.0014		
33	b	9/22/20 10:40 AM	4.60	137	6.88	11	2.95	0.0022		
34	b	9/22/20 10:50 AM	4.60	137	6.82	14	3.04	0.0013		
35	b	9/22/20 11:00 AM	4.60	137	6.79	15	3.15	0.0024		
36	b	9/23/20 10:00 AM	4.60	137	7.21	-7	4.53	0.0032		
37	b	9/23/20 10:10 AM	4.60	137	6.90	9	3.83	0.0038		
38	b	9/23/20 10:20 AM	4.60	137	6.87	11	3.51	0.0013		
39	b	9/23/20 10:30 AM	4.60	137	6.82	14	3.62	0.0014		
40	b	9/23/20 10:40 AM	4.60	137	6.81	15	3.83	0.0010	Pb*	
41	b	9/23/20 10:50 AM	4.60	137	6.82	14	3.96	0.0034		
42	b	9/23/20 11:00 AM	4.60	137	6.82	14	3.97	0.0010		
43	b	9/23/20 11:10 AM	4.60	137	6.85	12	4.07	0.0091		
44	b	9/23/20 11:20 AM	4.60	137	6.92	9	3.75	0.0010		
45	b	9/23/20 11:30 AM	4.60	137	6.90	10	3.59	0.0011		
46	b	9/27/20 10:00 AM	4.47	144	6.51	31	3.75	0.0015		
47	b	9/27/20 10:10 AM	4.47	144	6.74	19	3.40	0.0013		
48	b	9/27/20 10:20 AM	4.47	144	6.81	15	2.88	0.0010	Pb*	
49	b	9/27/20 10:30 AM	4.47	144	6.81	15	2.81	0.0009	Pb*	
50	b	9/27/20 10:40 AM	4.47	144	6.74	18	2.87	0.0013		
51	b	9/27/20 1:00 PM	9.39	-126	7.49	-23	3.09	0.0014		Ca3(PO4)2 solution added
52	b	9/27/20 1:10 PM	9.39	-126	7.23	-9	3.03	0.0011		
53	b	9/27/20 1:20 PM	9.39	-126	7.27	-11	3.01	0.0011		
54	b	9/27/20 1:30 PM	9.39	-126	7.31	-13	3.06	0.0010		
55	b	9/27/20 1:40 PM	9.39	-126	7.33	-14	3.05	0.0011		
56	b	9/27/20 1:50 PM	9.39	-126	7.32	-14	3.02	0.0011		
57	b	9/27/20 2:00 PM	9.39	-126	7.29	-12	3.00	0.0011		
58	b	9/27/20 2:10 PM	9.39	-126	7.36	-16	2.90	0.0013		
59	b	9/27/20 2:20 PM	9.39	-126	7.29	-12	2.89	0.0013		
60	b	9/27/20 2:30 PM	9.39	-126	7.32	-13	2.82	0.0012		
61	b	9/28/20 10:00 AM	10.00	-159	7.46	-21	6.03	0.0054		
62	b	9/28/20 10:10 AM	10.00	-159	7.39	-17	4.07	0.0035		
63	b	9/28/20 10:20 AM	10.00	-159	7.38	-17	3.77	0.0036		
64	b	9/28/20 10:30 AM	10.00	-159	7.38	-17	3.61	0.0034		
65	b	9/28/20 10:40 AM	10.00	-159	7.43	-19	3.57	0.0033		
66	b	9/28/20 10:50 AM	10.00	-159	7.43	-19	3.60	0.0031		
67	b	9/28/20 11:00 AM	10.00	-159	7.44	-20	3.48	0.0031		
68	b	9/28/20 11:10 AM	10.00	-159	7.42	-19	3.43	0.0032		
69	b	9/28/20 11:20 AM	10.00	-159	7.42	-19	3.32	0.0027		
70	b	9/28/20 11:30 AM	10.00	-159	7.50	-20	3.27	0.0022		
71	b	9/29/20 10:00 AM	10.97	-214	7.60	-29	8.07	0.0099		
72	b	9/29/20 10:10 AM	10.97	-214	7.48	-22	4.62	0.0068		
73	b	9/29/20 10:20 AM	10.97	-214	7.50	-23	4.26	0.0059		
74	b	9/29/20 10:30 AM	10.97	-214	7.49	-23	4.23	0.0051		
75	b	9/29/20 10:40 AM	10.97	-214	7.62	-30	4.03	0.0046		
76	b	9/29/20 10:50 AM	11.55	-246	7.64	-31	4.12	0.0065		
77	b	9/29/20 11:00 AM	11.55	-246	7.68	-33	4.39	0.0137		
78	b	9/29/20 11:10 AM	11.55	-246	7.94	-47	4.39	0.0175		
79	b	9/29/20 12:10 PM	12.32	-280	9.42	-129	4.14	0.104		0.01 mL 5 M NaOH added
80	b	9/29/20 1:10 PM	12.32	-280	9.80	-151	3.97	0.130		

4 Conclusions

Overall, the experiment showed that Sb becomes significantly more mobilized than Pb in the systems studied. The phosphate addition caused higher concentrations of Sb to become mobilized than the calcium hydroxide addition. Lead concentrations remained relatively low throughout the entirety of both experiments, indicating Pb has relatively low mobility in these systems, unless pH spikes to above 9.5. Previous efforts concluded that the dominant Sb species in the system is likely Sb(V) and therefore has increased mobility at pHs above 7-8, in general. We conclude that Sb(V) is also the dominant Sb species in the current experiments. Lead, on the other hand, tends to become mobilized in low pH systems (<4-5) and high pH systems (>10). The results from this effort show that amendment additions to the Joint Base Cape Cod berms for sequestering metals, like lime and phosphate, caused an increase in Sb concentrations. There was not the same increase in mobility for Pb as seen with Sb after the additions. Comparing the two amendments, the phosphate addition mobilized Sb to a greater extent than the lime addition, indicating there may be additional controls on Sb mobility than just pH, such as a more favorable complex formed between phosphate and Sb than the calcium hydroxide addition.

5 Recommendations

Current and previous work show that the aqueous Sb in the systems at Camp Edwards is fully oxidized $Sb(V)_{aq}$ and becomes mobilized to a greater extent than Pb in shooting range systems when calcium hydroxide or calcium phosphate are applied. Concentrations of Sb will likely decrease in aqueous systems (groundwater, soil pore water, etc.) when the source of Sb has been depleted. Further work on these samples would include (1) solid phase characterization of total Pb and Sb concentrations in the soils after the calcium hydroxide and calcium phosphate additions, and (2) synchrotron characterization as next logical steps. Each step is outlined below in further detail.

(1) Solid phase characterization of the total Pb and Sb concentrations in the test soils collected after the leaching experiment. From this, we can determine Pb and Sb partition coefficients.

(2) Speciation characterization of the test soils collected after the leaching experiment. Characterizing the solid phase Sb product that was produced when either calcium phosphate or calcium hydroxide were added to the test soils would yield insight into stability of the product over time and potential pathways for weathering/degradation. Currently, we know the addition of these two amendments mobilized Sb to a greater extent than Pb and it is likely linked to the rise in pH and formation of secondary mineral phases or complexes in soil and soil solution.

These two recommendations are further steps to understand the detailed transformation pathways of Sb (particularly) in the Camp Edwards soil system. This type of detailed work may not be needed for regulatory purposes of managing the site, but may yield insight into weathering rates and assist with any future remediation plans.

Soldier Validation Lane Annual Report

Camp Edwards --- Massachusetts Army National Guard

Soldier Validation Lane Annual Monitoring Report

January, 2023

(NHESP Tracking No.: 08-24210)

Soldier Validation Lane Use

No site composition changes occurred in FY22.

SVL Assessments after 2022 Training Season

All sites with containers were visited on January 20th, 2023 to evaluate training impacts during the 2022 training season. The assessment methodology matched the assessment performed in the Baseline Condition Assessment Report and FYs 12-21, to provide a means of comparison. The containers replicate buildings, and prop materials are utilized to create a more realistic setting, such as barrels, bicycles, grills, tires, wall sections, etc. No major changes were made to sites during 2022 and management activity was limited to Roads and Grounds personnel mowing around existing infrastructure. At BP-12 ITAM personnel mowed pitch-pine regen in the spring of 2023 to open the site for training (pictures included from 2020 and 2023).

Conclusion

All regulatory conditions were followed during use of the SVLs and BPs for training. Erosion and rutting impacts have remained static at most sites on the lanes as expected, with regular levels of vehicle use and regular storm water runoff on dirt roads. Some photos of the erosion and rutting have been included below. MAARNG will continue to strive to minimize environmental impacts from these lanes by following the established guidelines.

Photos (continued on next page)

Figure 1; SVL1 rutting and puddles on road leading to SVL3.

Figure 2: Erosion and rutting occurring on entry road 2 for BP24.

Figure 3: Rutting and erosion at SVL6.

Figure 4: Puddles formed at SVL6.

Figure 5: Rutting and puddling at BP20 (picture location 1).

Figure 6 and 7: Rutting and erosion at BP20 (picture location 2).

Figure 8: BP12 with limited pitch pine regen and mostly grasses.

Figure 9: BP12 in 2020 with limited growth of grass and pitch-pine regen.

APPENDIX D
ENVIRONMENTAL LAWS AND REGULATIONS

ENVIRONMENTAL LAWS AND REGULATIONS GOVERNING MAARNG ACTIVITIES IN THE TRAINING AREA/RESERVE			
Reserve EPS	**Federal Law / Regulation**	**State Law / Regulation**	**DoD Regulation**
Groundwater Resources	Clean Water Act Safe Drinking Water Act	Drinking Water Quality Standards (310 CMR 22.00) State Wellhead Protection (310 CMR 22.21) Water Management Act (310 CMR 36.00)	AR 200-1 AR 200-2 Camp Edwards Regulation (CER) 385-63
Wetlands and Surface Water	Clean Water Act Coastal Zone Management Act Floodplains Management (EO 11988) Protection of Wetlands (EO 11990) Rivers and Harbors Act of 1899 Sikes Act Wetlands Management (EO 11990)	Massachusetts Wetlands Protection Act (M.G.L. c. 131, s40; 310 CMR 100.00)	AR 200-2 CER 385-63
Rare Species	Federal Endangered Species Act Sikes Act	Massachusetts Endangered Species Act (M.G.L. c. 131A, 321 CMR 10.00)	AR 200-1 AR 200-2 AR 200-3 CER 385-63
Soil Conservation	Sikes Act Soils and Water Conservation Act Use of Off-Road Vehicles on Public Lands (EO 11989)		AR 200-1 AR 200-2 AR 200-3 CER 385-63
Vegetation Management	American Indian Religious Freedom Act Environmental Justice (EO 12898) Exotic Organisms (EO 11987) Sikes Act		AR 200-1 AR 200-2 AR 200-3 CER 385-63
Habitat Management	Sikes Act	Massachusetts Endangered Species Act (M.G.L. c. 131A, 321 CMR 10.00)	AR 200-1 AR 200-2 AR 200-3 CER 385-63
Wildlife Management	Fish and Wildlife Conservation Act Migratory Bird Conservation Act Migratory Bird Treaty Act Sikes Act		AR 200-1 AR 200-2 AR 200-3 CER 385-63
Air Quality	Clean Air Act	State Air Quality Regulations (310 CMR 4.00)	AR 200-1 AR 200-2 CER 385-63

ENVIRONMENTAL LAWS AND REGULATIONS GOVERNING MAARNG ACTIVITIES IN THE TRAINING AREA/RESERVE			
Reserve EPS	**Federal Law / Regulation**	**State Law / Regulation**	**DoD Regulation**
Noise Management	Federal Interagency Committee Land Noise Control Act Occupational Safety & Health Act Use Planning Standards on Urban Noise, Guidelines for Considering Noise in Land Planning and Control (June 1990)		AR 200-1 AR 200-2
Pest Management	Animal Damage Control Act Federal Insecticide, Fungicide, and Rodenticide Act Noxious Weed Act Resource Conservation and Recovery Act Sikes Act Toxic Substances Control Act		DoD 4150.7 AR 200-1 AR 200-2 AR 200-5 AR 420-47
Fire Management	Clean Air Act Sikes Act The National Fire Code Uniform Fire Code	State Air Quality Regulations (310 CMR 4.00)	AR 200-1 AR 200-2 AR 200-3 AR 420-90 CER 385-63
Storm Water Management	Clean Water Act NPDES discharge permitting and limitations	Massachusetts Wetlands Protection Act (M.G.L. c. 131 s.40, 310 CMR 10.00.)	AR 200-1 AR 200-2
Wastewater	Clean Water Act	Title V (310 CMR 15.00)	AR 200-1 CER 385-63
Solid Waste	Resource Conservation and Recovery Act Toxic Substances Control Act	State Solid Waste Handling and Disposal (310 CMR 16.00/19.00)	AR 200-1 AR 200-2 AR 420-47 CER 385-63
Hazardous Materials	Asbestos Hazard Emergency Response (40 CFR 763) Federal Insecticide, Fungicide and Rodenticide Act Hazard Communication Standard Program (29 CFR 1910.1200) Lead Contamination Control Act OSHA (29 CFR 1910, 29 USC 91-596) Poison Prevention Packaging Act Toxic Substances Control Act	Hazardous Substances Labeling Law (105 CMR 650.00)	AR 200-1 AR 200-2 CER 385-63

ENVIRONMENTAL LAWS AND REGULATIONS GOVERNING MAARNG ACTIVITIES IN THE TRAINING AREA/RESERVE			
Reserve EPS	**Federal Law / Regulation**	**State Law / Regulation**	**DoD Regulation**
Hazardous Waste	Clean Air Act Clean Water Act Emergency Preparedness and Community Right-To-Know Act Federal Facilities Compliance Act Hazardous Waste Operations and Emergency Response Medical Waste Tracking National Fire Code Oil Pollution Act Pollution Prevention Act Resource Conservation and Recovery Act The National Contingency Plan Underground Storage Tank Program (RCRA, Title I) Uniform Building and Fire Codes Comprehensive Environmental Response, Compensation, and Liability Act	Department of Transportation regulations regarding shipping and transportation, Hazardous Waste Management and Transportation (310 CMR 30.000) Management of Medical Waste (105 CMR 480) Pesticide use (333 CMR 1.00 – 12.00) Solid waste facilities management (310 CMR 16.00/19.00) State right-to-know requirements (105 CMR 670.00) Title V (310 CMR 15.00) Toxic use reduction (310 CMR 5.00) Underground storage tanks standards (527 CMR 4.00 and 9.0) Massachusetts Contingency Plan (310 CMR 40.00)	AR 200-1 AR 200-2 AR 420-47 CER 385-63
Vehicle	Use of Off-Road Vehicles on Public Lands (EO 11989)		AR 200-2 CER 385-63
General Use And Access	Use of Off-Road Vehicles on Public Lands (EO 11989)		AR 200-1 AR 200-2 CER 385-63

ENVIRONMENTAL LAWS AND REGULATIONS GOVERNING MAARNG ACTIVITIES IN THE TRAINING AREA/RESERVE			
Reserve EPS	**Federal Law / Regulation**	**State Law / Regulation**	**DoD Regulation**
Cultural Resources (This EPS refers to archeological resources only; the list of regulations cited here has therefore been restricted to those that pertain to protection of archeological resources)	Antiquities Act of 1906 Archeological and Historic Preservation Act of 1974 Archeological Resources Protection Act of 1979 Consultation and Coordination with Indian Tribal Governments (Executive Order 13175) Curation of Federally Owned/Administered Archeological Collections Executive Memorandum of April 19, 1994 – Government-to-Government Relations with American Tribal Governments National Environmental Policy Act of 1966, as amended Native American Graves Protection and Repatriation Act of 1990	Massachusetts General Laws, Chapter 9, sections 26-27C as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00) Massachusetts Environmental Policy Act (MEPA) Massachusetts General Laws Chapter 30, sections 61 through 62H, inclusive (301 CMR 11.00) Massachusetts General Laws, Chapter 38, section 6B: Chapter 9, sections 26A and 27C; Chapter 7, section 38A; Chapter 114, section 17; as amended by Chapter 659 of the Acts of 1983 and Chapter 386 of the Acts of 1989	AR 200-2 AR 200-4 DA PAM 200-4 Office of the Secretary of Defense, Annotated Policy Document for the American Indian and Alaska Native Policy (27 October 1999)

DOD Regulations include all regulations and directives of the Department of Defense, Department of the Army, and National Guard Bureau.
AR = Army Regulation
CER – Camp Edwards Regulation
CFR – Code of Federal Regulations
CMR - Code of Massachusetts Regulations
DA PAM = Department of Army Pamphlet
EO – Executive Order
M.G.L – Massachusetts General Laws
RCRA – Resource Conservation and Recovery Act

APPENDIX E
WATER SUPPLY INFORMATION

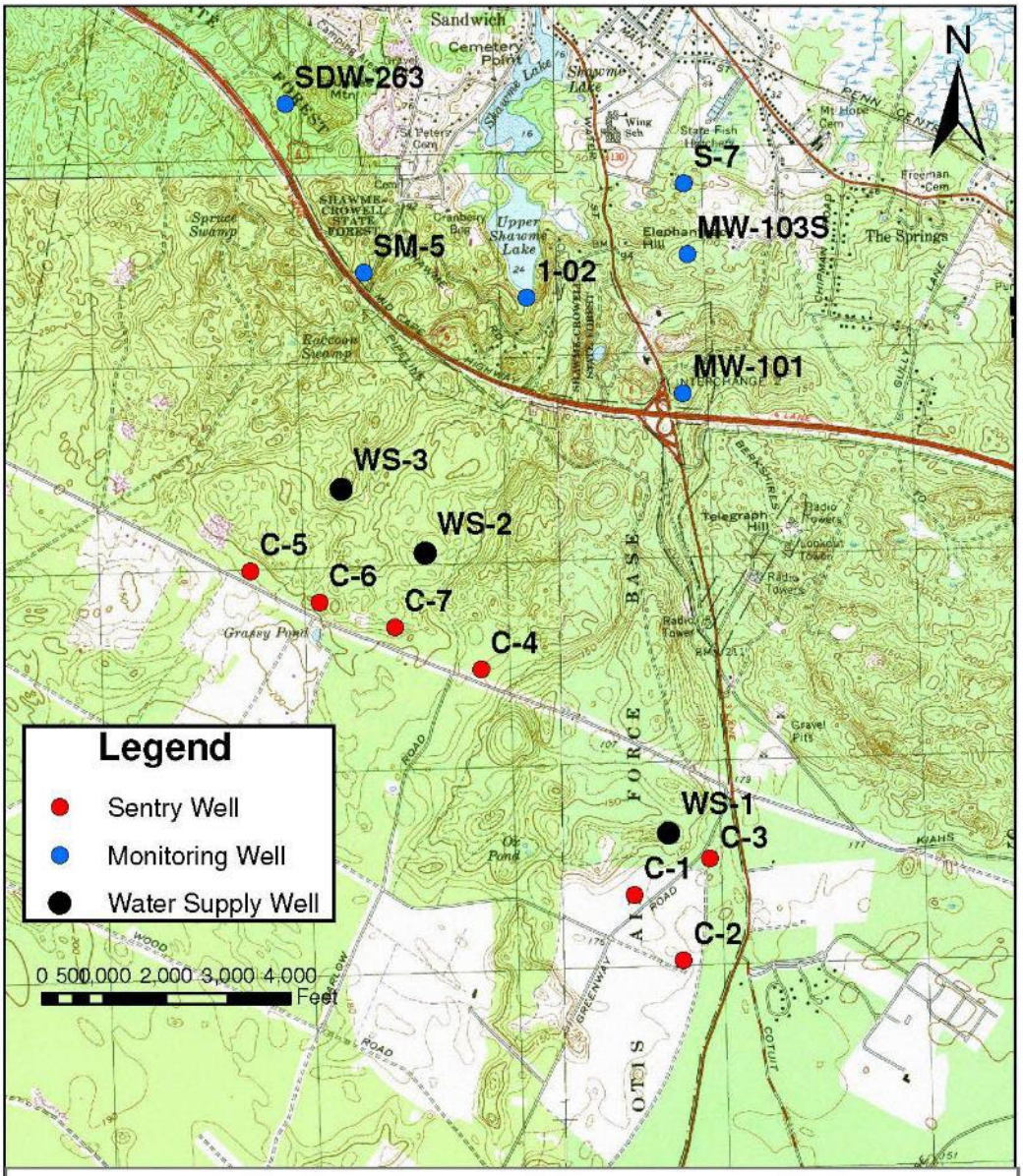


Figure 1
Long-term Monitoring Well Network
Upper Cape Regional Water Supply Cooperative
Cape Cod, Massachusetts

102nd Intelligence Wing
2021 Consumer Confidence Report

2021 Consumer Confidence Report
For
Otis Air National Guard Base
Otis ANGB, Massachusetts
MASSDEP PWS ID #*4096001*

This report is a snapshot of the drinking water quality that we provided last year. Included are details about where your water comes from, what it contains, and how it compares to state and federal standards. We are committed to providing you with this information because informed customers are our best allies.

PUBLIC WATER SYSTEM INFORMATION

Address: 156 Reilly St., Box 12 Otis Air National Guard Base on Joint Base Cape Cod, Massachusetts

Contact Person: Mr. Duarte Corte-Real

Telephone #: (508) 968-4102

Water System Improvements
Our water system is routinely inspected by the Massachusetts Department of Environmental Protection (MassDEP). MassDEP inspects our system for its technical, financial, and managerial capacity to provide safe drinking water to you. To ensure that we provide the highest quality of water available, your water system is operated by a Massachusetts certified operator who oversees the routine operations of our system. As part of our ongoing commitment to service, the MassDEP Drinking Water Program has determined that the public water supply system at Otis Air National Guard Base is compliant with all national Primary Drinking Water Standards and MassDEP Drinking Water Regulations.

Opportunities for Public Participation
If you would like to participate in discussions regarding your water quality, you may attend the following meetings or educational events: *Please see the Otis Notice for any future meetings.*

YOUR DRINKING WATER SOURCE

Where Does My Drinking Water Come From?
Your water is provided by the following sources listed below:

Our drinking water supply is provided entirely by groundwater. J-Well (4096001-01G), which is located on Herbert Road, is our primary pumping station. We are also interconnected to the Upper Cape Regional Water Supply Cooperative. The Cooperative's water sources come from three wells located in the northeastern corner of Joint Base Cape Cod. On average, we provide up to 300,000 gallons of high-quality water every day. All of the Otis public water supply is drawn from the Sagamore Lens of the Cape Cod single-source aquifer. This lens runs from the Cape Cod Canal eastward into the town of Yarmouth. To learn more about our watershed on the Internet, go to the U.S. Environmental Protection Agency's (EPA) "How's My Waterway" website at the following link: https://www.epa.gov/waterdata/hows-my-waterway.

Source Name	MassDEP Source ID#	Source Type	Location of Source
J-Well	4096001-01G	Groundwater	Herbert Road

Is My Water Treated?
Our water system makes every effort to provide you with safe and pure drinking water. To improve the quality of the water delivered to you, we treat the system with potassium carbonate, sodium fluoride, and sodium hypochlorite. The water in this geographic area is naturally acidic, with an average pH of 5.9 (7.0 is neutral). Acidic water can be harmful to the distribution system. Potassium carbonate is used to buffer the water to as close to a neutral pH as possible. At the request of the U.S. Coast Guard, which is the owner and operator of the family housing area, sodium fluoride is added to the water. This compound has proven effective in strengthening teeth. Finally, sodium hypochlorite is used to disinfect the water supply by killing bacteria. The water quality of our system is constantly monitored by us and MassDEP to determine the effectiveness of existing water treatment

and to determine if any additional treatment is required. We add a disinfectant to protect you against microbial contaminants.

How Are These Sources Protected?
The Source Water Assessment and Protection (SWAP) Program, established under the federal Safe Drinking Water Act, requires every state to inventory land uses within the recharge areas of all public water supply sources; to assess the susceptibility of drinking water sources to contamination from these land uses; and to publicize the results to provide support for improved protection. MassDEP has prepared a SWAP Report for the water supply source(s) serving this water system. The SWAP Report assesses the susceptibility of public water supplies.

What is My System's Ranking?
A susceptibility ranking of HIGH was assigned to this system due to the absence hydrogeological barriers (i.e., clay) that can prevent contaminant migration.

Where Can I See The SWAP Report?
Information on obtaining the complete SWAP Report is available by contacting the Water Supply Superintendent at (508) 968-4102. To access the SWAP Report on the Internet, go to the Source Water Assessment & Protection (SWAP) Program Website at the following link: *https://www.mass.gov/service-details/the-source-water-assessment-protection-swap-program.*

Members can help protect sources by:
• practicing good septic system maintenance
• proper disposal of hazardous chemicals and materials
• limiting pesticide and fertilizer use, etc.

SUBSTANCES FOUND IN TAP WATER

Sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals, and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

Microbial contaminants -such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants -such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial, or domestic wastewater discharges, oil and gas production, mining, and farming.

Pesticides and herbicides -which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

Organic chemical contaminants -including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive contaminants -which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the Department of Environmental Protection (MassDEP) and U.S. Environmental Protection Agency (EPA) prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration (FDA) and Massachusetts Department of Public Health (DPH) regulations establish limits for contaminants in bottled water that must provide the same protection for public health.

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More

information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and some infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control and Prevention (CDC) guidelines on lowering the risk of infection by cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Otis Air National Guard Base is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at *http://www.epa.gov/safewater/lead*.

IMPORTANT DEFINITIONS

Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal (MCLG) –The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Action Level (AL) – The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

90th Percentile – Out of every 10 homes sampled, 9 were at or below this level.

Secondary Maximum Contaminant Level (SMCL) – These standards are developed to protect the aesthetic qualities of drinking water and are not health based.

Unregulated Contaminants
Unregulated contaminants are those for which EPA has not established drinking water standards. The purpose of unregulated monitoring is to assist EPA in determining their occurrence in drinking water and whether future regulation is warranted.

Massachusetts Office of Research and Standards Guideline (ORSG) – This is the concentration of a chemical in drinking water, at or below which, adverse health effects are unlikely to occur after chronic (lifetime) exposure. If exceeded, it serves as an indicator of the potential need for further action.

Treatment Technique (TT) – A required process intended to reduce the level of a contaminant in drinking water.

Running Annual Average (RAA) – The average of four consecutive quarter of data.

Maximum Residual Disinfectant Level (MRDL) -- The highest level of a disinfectant (chlorine, chloramines, chlorine dioxide) allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Residual Disinfectant Level Goal (MRDLG) -- The level of a drinking water disinfectant (chlorine, chloramines, chlorine dioxide) below which there is no known expected risk to health.
MRDLG's do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Level 1 Assessment - A Level 1 assessment is a study of the water system to identify potential problems and determine (if possible) why total coliform bacteria have been found in our water system.

Level 2 Assessment - A Level 2 assessment is a very detailed study of the water system to identify potential problems and determine (if possible) why an *E. coli* MCL violation has occurred and/or why total coliform bacteria have been found in our water system on multiple occasions.

ppm = parts per million, or milligrams per liter (mg/l)
ppb = parts per billion, or micrograms per liter (ug/l)
ppt = parts per trillion, or nanograms per liter
pCi/l = picocuries per liter (a measure of radioactivity)
NTU = Nephelometric Turbidity Units
ND = Not Detected
N/A = Not Applicable
mrem/year = millimrems per year (a measure of radiation absorbed by the body)

WATER QUALITY TESTING RESULTS

What Does This Data Represent?
The water quality information presented in the table is from the most recent round of testing done in accordance with the regulations. All data shown was collected during the last calendar year unless otherwise noted in the table (within the last 5 years).

	Date(s) Collected	90TH percentile	Action Level	MCLG	# of sites sampled	# of sites above Action Level	Possible Source of Contamination
Lead (ppb)	28-30 Sep 2021	0.0016	15	0	**40**	**0**	Corrosion of household plumbing systems; Erosion of natural deposits
Copper (ppm)	28-30 Sep 2021	0.44	1.3	1.3	**40**	**0**	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives

Regulated Contaminant	Date(s) Collected	Highest Result or Highest Running Average Detected	Range Detected	MCL or MRDL	MCLG or MRDLG	Violation (Y/N)	Possible Source(s) of Contamination
Inorganic Contaminants							
Barium (ppm)	2021	0.028	0.00-0.028	2	2	N	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Cyanide (ppb)	2021	<0.10	N/A	200	200	N	Discharge from metal factories; discharge from plastic and fertilizer factories
Fluoride (ppm) ■	2021	0.15	0.00-0.15	4	4	N	Erosion of natural deposits; water additive which promotes strong teeth; discharge from fertilizer and aluminum factories
■ Fluoride also has a secondary contaminant level (SMCL) of 2 ppm.							
Nitrate (ppm)	2021	1.90	0.00-1.90	10	10	N	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Nitrite (ppm)	2020	0.44	0.00-0.44	1	1	N	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Perchlorate (ppb)	2021	ND	N/A	2	N/A	N	Rocket propellants, fireworks, munitions, flares, blasting agents

Regulated Contaminant	Date(s) Collected	Highest Result or Highest Running Average Detected	Range Detected	MCL or MRDL	MCLG or MRDLG	Violation (Y/N)	Possible Source(s) of Contamination
PFAS6 (ppt)	2020	2.1	0.00-2.1	20	N/A	N	Discharges and emissions from industrial and manufacturing sources associated with the production or use of these PFAS, including production of moisture and oil resistant coatings on fabrics and other materials. Additional sources include the use and disposal of products containing these PFAS, such as fire-fighting foams.
Radioactive Contaminants							
Gross Alpha (pCi/l) (minus uranium)	2021	-.461 +/-1.15	N/A	15	0	N	Erosion of natural deposits
▲The MCL for beta particles is 4 mrem/year. EPA considers 50 pCi/L to be the level of concern for beta particles.							
Radium 226 & 228 (pCi/L) (combined values)	2021	-.178 +/-.296	-.000 to -.178	5	0	N	Erosion of natural deposits
Disinfectants and Disinfection By-Products							
Total Trihalomethanes (TTHMs) (ppb)	QTR 3 (2021)	12.1	6.86-12.1	80	N/A	N	Byproduct of drinking water chlorination
Haloacetic Acids (HAA5) (ppb)	QTR 3 (2021)	ND	N/A	60	N/A	N	Byproduct of drinking water disinfection
Chlorine (ppm) (free, total or combined)	Monthly in (2021)	2.2	0.01-2.2	4	4	N	Water additive used to control microbes

Unregulated and Secondary Contaminants

Unregulated contaminants are those for which there are no established drinking water standards. The purpose of unregulated contaminant monitoring is to assist regulatory agencies in determining their occurrence in drinking water and whether future regulation is warranted.

Unregulated Contaminants	Date(s) Collected	Result or Range Detected	Average Detected	SMCL	ORSG	Possible Source
Bromodichloromethane (ppb)	2021	1.13-3.38	2.25	N/A	N/A	Trihalomethane; by-product of drinking water chlorination
Bromoform (ppb)	2021	0.00-1.20	0.60	N/A	N/A	Trihalomethane; by- product of drinking water chlorination
Chloroform (ppb)	2021	3.39-4.77	4.08	N/A	70	By-product of drinking water chlorination (In non-chlorinated sources it may be naturally occurring)
Dibromodichloromethane (ppb)	2021	0.96-4.16	2.56	N/A	N/A	Trihalomethane; By-product of drinking water chlorination
Manganese* (ppb)	2020	<0.005	<0.005	50	300	Erosion of natural deposits

Unregulated Contaminants	Date(s) Collected	Result or Range Detected	Average Detected	SMCL	ORSG	Possible Source
* US EPA has established a lifetime health advisory (HA) value of 300 ppb for manganese to protect against concerns of potential neurological effects, and a one-day and 10-day HA of 1000 ppb for acute exposure.						
Sodium (ppm)	2021	18	0.00-18	N/A	20	Discharge from the use and improper storage of sodium-containing de-icing compounds or in water-softening agents

COMPLIANCE WITH DRINKING WATER REGS

Does My Drinking Water Meet Current Health Standards?

We are committed to providing you with the best water quality available. However some contaminants that were tested last year did not meet all applicable health standards regulated by the state and federal government. Due to contaminant violations of Total Coliform and *E. coli* during the period(s) of 14-16 September 2021, our system took the following corrective actions.

- *We collected additional samples.*
- *We announced public notification 17 September 2021 by e-mail, posting notices etc.*
- *We disinfected and flushed the distribution system to eliminate coliform bacteria.*
- *All repeat samples returned absent of coliform; boil water order was terminated on 24 September 2021.*

Our water system and MassDEP monitor and record the effectiveness of actions taken in response to contaminant violations. The health effect statement(s) for this contaminant are listed below.

Drinking Water Violations

We had an *E. coli*-positive repeat sample following a total coliform-positive routine sample.

Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, waterborne pathogens may be present or that a potential pathway exists through which contamination may enter the drinking water distribution system. We found coliforms indicating the need to look for potential problems in water treatment or distribution. When this occurs, we are required to conduct assessments to identify any problems that were found during these assessments.

E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Human pathogens in these wastes can cause short-term effects such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely compromised immune systems. We found *E. coli* bacteria, indicating the need to look for potential problems in water treatment or distribution. When this occurs, we are required to conduct assessments to identify problems and to correct any problems that were found during these assessments.

Bacteria	MCL / TT	MCLG	Value	Date	Violation (Y/N)	Possible Sources
E. coli	MCL	0	Positive (*E. coli*)	14-16 Sep 2021	Y	Human and animal fecal waste
9/14/2021 - Site 001/Bldg. 149 ANG Medical Group E. coli present 9/16/2021 - Site 001/Bldg. 149 ANG Medical Group E. coli present 9/16/2021 - Site UR/Bldg. 162 ANG PMEL/COM E. coli present						

During the past year, we were required to complete a Level 2 Assessment because we found E. coli in our water system. In addition, we were required to take all four previously listed corrective actions and we completed all of these actions.

Bacteria	MCL / TT	MCLG	Value	Date	Violation (Y/N)	Possible Sources
Total Coliform Bacteria	MCL	0	Positive	14-16 Sep 2021	Y	Human and animal fecal waste
On Mon., Tues., Wed., (9/20, 9/21, 9/22), collect RW, PT, all RS sites, including tanks, and the UR/DR repeat location for Site 001. All repeat samples returned absent of coliform.						

Health Effects Statements

Total Coliform: Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems.

Fecal coliforms and E.coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely-compromised immune systems.

Inadequately treated water may contain disease-causing organisms. These organisms include bacteria, viruses, and parasites, which can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.

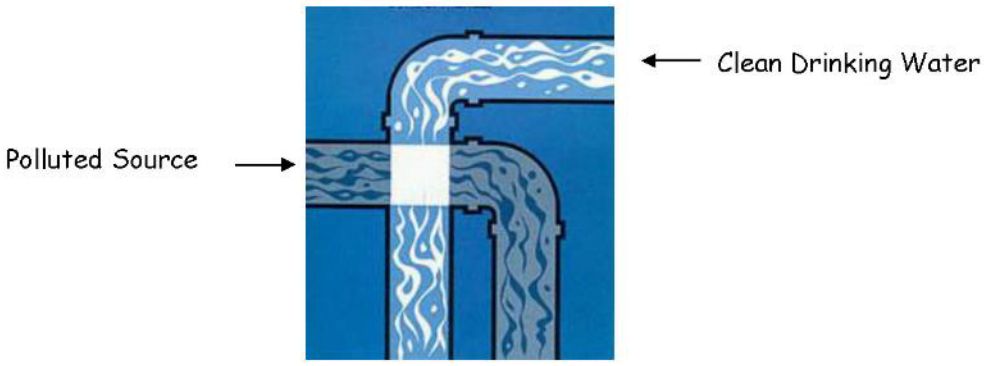
EDUCATIONAL INFORMATON

Do I Need To Be Concerned about Certain Contaminants Detected in My Water?

Sodium sensitive individuals, such as those experiencing hypertension, kidney failure, or congestive heart failure, should be aware of the sodium levels where exposures are being carefully controlled.

Cross-Connection Control and Backflow Prevention

What is a Cross Connection and what can I do about it?



A cross connection is a connection between a drinking water pipe and a polluted source. The pollution can come from your own home. For instance, you're going to spray fertilizer on your lawn. You hook up your hose to the sprayer that contains the fertilizer. If the water pressure drops at the same time you turn on the hose, the fertilizer may be sucked back into the drinking water pipes through the hose. This problem can be prevented by using an attachment on your hose called a backflow-prevention device.

The Water Superintendent recommends the installation of backflow prevention devices, such as a low cost hose bib vacuum breaker, for all inside and outside hose connections. You can purchase this at a hardware store or plumbing supply store. This is a great way for you to help protect the water in your home as well as the drinking water system on base! For additional information on cross connections and on the status of your water systems cross connection program, please contact your respective Environmental Management Office.

ADDITIONAL INFORMATION

Brown, Red, Orange, or Yellow Water.
Brown, red, orange, or yellow water is usually caused by rust. The different colors can be attributed to varying chemical oxidation states of the iron (rust) and by varying concentrations of the rust in the water. There are two major sources that can cause water to be rusty:

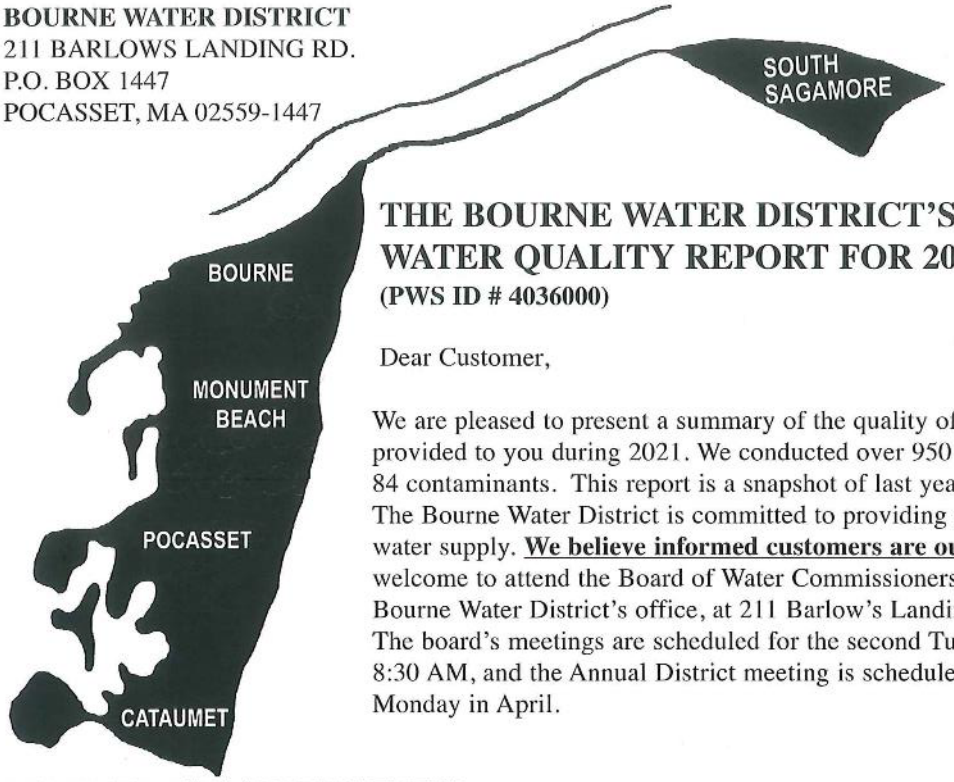
•The water mains, or
•The water pipes in your building

Rusty water occurs from sediment or rust from the inside walls of the water mains. The rust can be disturbed and temporarily suspended in water with unusual water flows from water main breaks or maintenance or by *flushing of a hydrant*. This discolored water is not a health threat.

When the water is discolored it is recommended to either not wash laundry or to use a rust stain remover or regular detergent but not chlorine bleach as it will react with the iron to form a permanent stain. The other major cause of brown, red, orange or yellow water is rusty water pipes in your building. Water that is being discolored by rusty pipes is not a health hazard.

Bourne Water District
2021 Consumer Confidence Report

BOURNE WATER DISTRICT
211 BARLOWS LANDING RD.
P.O. BOX 1447
POCASSET, MA 02559-1447



THE BOURNE WATER DISTRICT'S WATER QUALITY REPORT FOR 2021

(PWS ID # 4036000)

Dear Customer,

We are pleased to present a summary of the quality of the drinking water provided to you during 2021. We conducted over 950 tests for more than 84 contaminants. This report is a snapshot of last year's water quality. The Bourne Water District is committed to providing you with a reliable water supply. **We believe informed customers are our best allies.** You are welcome to attend the Board of Water Commissioners meetings held at the Bourne Water District's office, at 211 Barlow's Landing Road in Pocasset. The board's meetings are scheduled for the second Tuesday of the month at 8:30 AM, and the Annual District meeting is scheduled on the fourth Monday in April.

WATER SOURCES AND TREATMENT

The Bourne Water District is supplied by 10 different sources, 7 of our own gravel packed well sites and 3 gravel packed well sites from the Upper Cape Regional Water Supply Cooperative. Four of our well sites are in the Monument Beach area of the Town Forest. The other two wells are in the Cataumet area of the Town of Bourne. One well is on Joint Base Cape Cod and we have one transfer station on Connery Ave. The Bourne Water District treats all supplies with lime slurry for corrosion control. The lime slurry is used to raise the pH of the water. This makes the water less aggressive to the copper pipe and lead joints in your homes to prevent exposure to lead and copper.

WHAT DOES THE FOLLOWING TABLE MEAN?

Action Level (AL) The concentration of a contaminant which if exceeded triggers treatment or other requirements.
Maximum Contaminant Level (MCL) The highest level of a contaminant that is allowed in the drinking water. The MCL is set as close to the MCLG as feasible using the best available treatment technology.
Maximum Contaminant Level Goal (MCLG) The level of a contaminant in the drinking water below which there is no known or expected risk to health. The MCLG allow for a margin of safety.
90th Percentile Out of every 10 houses sampled, 9 were below this level.

KEY TO TABLE

AL = Action Level
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MFL = million fibers per liter
Mrem/year = millirems per year (a measure of radiation absorbed by the body)
NTU = Nephelometric Turbidity Units
pci/l = picocuries per liter (a measurement of radioactivity)
ppm = parts per million, or milligrams per liter (mg/l)
ppb = parts per billion, or micrograms per liter (ug/l)
ppt = parts per trillion, or nanograms per liter
ppq = parts per quadrillion, or picograms per liter
TT = Treatment Technique

	DISTRIBUTION SYSTEM WATER QUALITY This report summarizes only those items detected during Sampling-not all contaminants that are monitored					
Microbial Results	Highest Detected	Range Detected	MCL	MCLG	Violation	Possible Source of Contamination
Total Coliform Bacteria**	3	0-3	0	0	yes	Naturally present in the environment
Fecal Coliform or E. Coli	0	0	0	0	No	Human andAnimal Fecal Waste
*Compliance with the Fecal Coliform/E.Coli MCL is determined upon additional repeat testing						
**Total Coliform:Coliform are bacteria that are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present						

Lead and Copper	Dates collected	90th Percentile	Action Level	MCGL	# of sites sampled	# Sites above Action Level	Violation	Possible Source of Contamination
Lead (ppb)	9/1/2021 thru 12/31/2021	0.0018	15	0	30	0	No	Corrosion of household plumbing systems: Erosio of natural deposits
Copper (ppm)	9/1/2021 thru 12/31/2021	0.1	1.3	1.3	30	0	No	Corrosion of household plumbing systems: Erosio of natural deposits

TESTING FOR LEAD - If present, elevated levels of lead can causse serious health problems,especially for pregnant women and young childern. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing .Bourne Water District is responsible for providing high quality drinking water,but cannot control the variety of materials used in plumbing components.When you water has been sitting for several hours,you can minimize the potental for lead exposure by flushing you tap for 30 seconds to 2 minutes before using water for drinking or cooking.If you are concerned about lead in your water,you may wish to have your water tested. Information about lead in drinking water,testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

Regulated Contaminants	Date(s) collected	Highest Detect Value	Range Detected	MCL	MCGL	Violation	
			Inorganic Contaminants:				
Barium (ppm)	2021	0.009	0-0.009	2	2	No	Discharge of drilling waste; discharge from metal refineries;erosion of natural deposits
Nitrate * (ppm)	2021	0.92	0.03-0.92	10	10	No	Runoff from fertilizer use;leaching from septic tanks;sewage;erosion of natural deposits
Perchlorate ** (ppb)	2021	0	0	2	-	No	Rocket propellants,fireworks,munitions ,flares,blasting agents* (see note below)
			Radioactive contaminants				
Gross Alpha Particle	2021	1.01pci/L	0.89-1.01pci/L	15 pci/L		No	
Radium 226 & 228	2021	1.22 pci/L	.42-1.22 pci/L	5 pci/L combined		No	
Organic Contaminants							
Tetrachloroethylene(PCE)(ppb)	2021	1.27	0-1.27	5	-	No	Discharge from factories and dry cleaners
Chloroform (ppb	2021	1.68	.66-1.68	ORSG 70	NA	No	By-product of drinking water chlorination
CIS-1,2 Dichloroethylene (ppb)	2021	1.86	0-1.86	70	NA	No	Runoff from fertilizer use;leaching from septic tanks;sewage;erosion of natural deposits

Secondary Contaminents	Date(s) collected	Highest Detect Value	Range Detected	SMCL	OSRG	Possible Source of Contamination
Magnesium (ppm)	2021	3.1	1.0-3.1	-	-	Natural Mineral and Organis Matter
Chloride (ppm)	2021	46	7.3-46	250	NA	Natural Mineral, Road Salt
Calcium (ppm)	2021	25	6.1-25	-	-	Natural Mineral and Organis Matter
Iron (ppb)	2021	0	0	300	NA	Erosion of Natural Deposits and oxidation of iron components
Manganese (ppb)*	2021	0.008	0-.008	50	NA	Erosion of Natural Deposits
Sodium(ppm)**	2021	28**	6.6-28	-	20	Road Salting;erosion of natural deposits
Potassium (ppm)	2021	0.9	.4-.9	-	-	Natural Mineral and Organis Matter
Sulfate (ppm)	2021	8.2	5.1-8.2	250	250	Natural Sources
Zinc (ppm)	2021	0	0	5	NA	Erosion of Natural Deposits,and industrial discharge
Aluminum	2021	0.078	.017-.078		0.2	
			PER and POLYFLUOROALKYL			
PFOS total of 6 (ppt)	2021	3.31	0-3.31	20 ppt		

NATIONAL PRIMARY DRINKING WATER REGULATION COMPLIANCE

The Total Coliform rule requires water systems to meet a stricter limit for Coliform bacteria. Coliform bacteria are harmless, but the presence in water can be an indication of disease-causing bacteria. When Coliform bacteria is found, special follow up tests are done to determine if harmful bacteria are present in the water supply. Over 500 Coliform samples were taken throughout the Bourne Water District in the year 2021. In September 2021 Bourne Water District had one detect of Total Coliform from a sample taken at the South Sagamore glass tank. Bourne Water District chlorinated the tank and rectified the issue. Bourne Water District completed the process with a Level 2 Assessment of the site and has not had any other Total Coliform hits anywhere in the system.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead and copper in drinking water is primarily from materials and components associated with service lines and home plumbing. The Bourne Water District is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead and copper exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead and copper in your water, you may wish to have your water tested. Information on lead and copper in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

Sodium; ORSG = 20 Sodium sensitive individuals, such as those experiencing hypertension, kidney failure or congestive heart failure, should be aware of the levels of sodium in their drinking water where exposures are carefully being controlled.
Massachusetts Office of Research and Standard Guidelines (ORSG): This is the concentration of a chemical in drinking water, at or below which, adverse health effects are likely to occur after chronic (lifetime) exposure, with a margin of safety. If exceeded, it serves as an indicator of the potential need for further action.

If you are interested in a more detailed report, contact Robert Prophett at 508-563-2294.

PER and POLYFLUOROALKYL SUBSTANCES (PFA's and PFOA's)
Bourne Water District has been sampling for Per and Polyfluoroalkyl contaminants since the start of the Unregulated Contaminant Monitoring Rule (UCMR) in 2013 and reporting the detections in our yearly CCR. Bourne Water District has a small detect at 3.31 ppt at one of our well sites in Cataumet. As slight as it may be, Bourne Water has been and will continue to monitor and rectify the cause. Along with this CCR please find MASS Dep's Quick Reference Guide and feel free to contact Robert Prophett at 508-563-2294 with any questions and concerns.

REQUIRED ADDITIONAL HEALTH INFORMATION:
To insure that tap water is safe to drink, Department of Environmental Protection (DEP) and Environmental Protection Agency (EPA) prescribes limits on the amounts of certain contaminants in water provided by public water systems. Food and Drug Administration (FDA) and the Massachusetts Department of Public Health regulations establish limits for contaminants in bottled water. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency Safe Drinking Water Hotline (1-800-426-4791).The sources of drinking water (both tap and bottled) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and radioactive material and can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in the sources include:

(A) Microbial contaminants such as viruses and bacteria which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.

(B) Inorganic contaminants such as salts and metals which can be naturally-occurring or result from urban storm runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.

(C) Pesticides and herbicides, which may come from a variety of sources such as agriculture, storm water runoff and residential uses.

(D) Organic chemical contaminants, including synthetic and volatile organics which are by-products of industrial processes and petroleum production and can also come from gas stations, urban storm water runoff and septic systems.

(E) Radioactive contaminants, which can be naturally occurring or be the results of oil and gas production and mining activities. In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. FDA regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infections by Cryptosporidium are available from the Safe Drinking Water Hotline (1-800-426-4791).

SOURCE WATER ASSESSMENT
The Bourne Water District had a source water assessment performed by the MA. Department of Environmental Protection in 2002. The Source Water Assessment and Protection (SWAP) program, established under the Federal Safe Drinking Water Act requires every state to:

- Inventory land uses within the recharge areas of all public water supply sources.
- Assess the susceptibility of drinking water sources to contamination from these land uses.
- Publicize the results to provide support for improved protection.

A susceptibility ranking of high was assigned to the Bourne Water District using the information collected during the assessment by the DEP. The high ranking was due to the potential contamination from land uses such as auto repair shops, truck terminal, furniture refinishing, auto salvage operation, an industrial park and activities in the recharge area (Zone II's)of some of the wells. The complete SWAP report is available at the Bourne Water District's office. For more information contact Robert Prophett at 508-563-2294.

CROSS CONNECTION

A cross connection is a connection between a drinking water pipe and a polluted source. The pollution can come from your own home. For instance, you're going to spray fertilizer on your lawn, and you hook up your hose to the sprayer that contains the fertilizer. If the water pressure drops (say because of a fire hydrant being used or water main break) when the hose is connected to the fertilizer sprayer, the fertilizer may be sucked back into the drinking water pipes through your hose. Using an anti-siphon backflow-prevention device on your sprayer or hose bib can prevent this problem.
The Bourne Water District recommends using devices with an anti-siphon feature or equipping hose bibs with hose bib vacuum breakers to prevent against back flow. For additional information on cross connections and on the status of your water system's cross connection program, please contact Robert Prophett at 508-563-2294.

UPPER CAPE REGIONAL WATER SUPPLY COOPERATIVE
2021 Consumer Confidence Report (PWS ID # 4261024)

The Upper Cape Regional Drinking Water Supply Cooperative consists of three groundwater supply wells located in Sandwich, MA on Joint Base Cape Cod (JBCC). A Board of Managers representing four-member public water supply systems manages the Cooperative. The Cooperative has the capacity to provide a supplemental supply of water to its member public water systems, which include the Town of Falmouth, the Bourne Water District, the Mashpee Water District and the Sandwich Water District. The Cooperative also supplies water to the Otis Air National Guard public water system on JBCC and the Barnstable County Jail.
Wells #1, #2 and #3 are located in a forested area of the northeastern portion of the JBCC. In July 2004, the Department of Environmental Protection completed a source water assessment (SWAP) report for the Cooperative water supply wells. A SWAP report is a planning tool to support local and state efforts to improve water supply protection by identifying land uses within water supply protection areas that may be potential sources of contamination. The report identifies potential sources of contamination including a gas station, a medical facility and a military facility, and helps focus protection efforts on appropriate Best Management Practices. A susceptibility ranking of high was assigned to the Cooperative using information that was collected during the assessment. A copy of the report is available, upon request, from the Cooperative. JBCC has adopted a Groundwater Protection Plan to prohibit inappropriate activities on JBCC property within the Zone II areas of community public water supply wells. In addition, the Environmental Management Commission provides oversight over activities on the northern portion of the JBCC. For questions regarding SWAP or other information contained within this document call Marisa Picone-Devine at 508-888-7262.
Our system, out of an abundance of caution and concerns about PFAS, sampled for PFAS compounds (PFBS, PFHpA, PFHxS, PFNA, PFOA, and PFOS) at all three wells in 2019 and 2020; there were no detections of any of the analytes in any of the samples.

2021 WATER QUALITY DATA

Listed below are the substances detected in water samples collected during the most recent sampling period from the three (3) wells that comprise the Upper Cape Drinking Water Supply Cooperative.

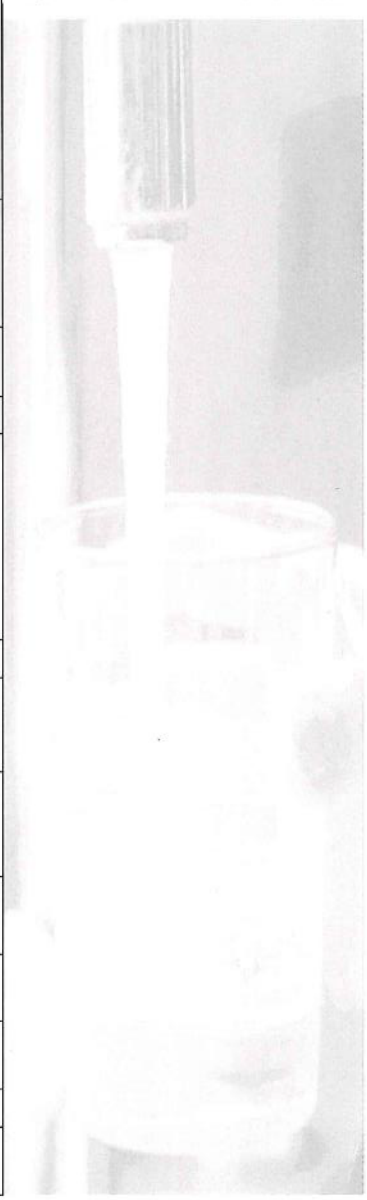
2021 WATER QUALITY DATA

Listed below are the substances detected in water samples collected during the most recent sampling period from the three (3) wells that comprise the Upper Cape Drinking Water Supply Cooperative.

Inorganic Contaminants	Year Sampled	Highest Result	Range of Detections	MCL	MCLG	Violation (Y / N)	Possible Sources
Barium	2020	0.002 ppm	0.002 ppm	2 ppm	2 ppm	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Nitrate	2021	0.11 ppm	0.07 ppm – 0.11 ppm	10 ppm	10 ppm	No	Runoff from fertilizer use; Leaching form septic tanks, sewage; Erosion of natural deposits
Radioactive Contaminants	**Year Sampled**	**Highest Result**	**Range of Detections**	**MCL**	**MCLG**	**Violation (Y / N)**	**Possible Sources**
Gross Alpha	2021	-.210 (+- .331) pCi/l	-.210 (+- .331) pCi/l	15 pCi/l	0	No	Erosion of Natural Deposits
Radium 226 & 228	2021	0.377 pCi/L	0 – 0.377 pCi/l	5 pCi/l	0	No	Decay of natural and manmade deposits
Unregulated and Secondary Contaminants	**Year Sampled**	**Amount Detected**	**Range of Detections**	**SMCL**	**ORSG**	**Violation**	**Possible Sources**
Chloroform	2021	1.81 ppb	1.39 -1.81 ppb	NA	70 ppb	No	Trihalomethane: by-product of drinking water chlorination. In non-chlorinated sources, chloroform may be naturally occurring
Chloride	2021	9.3 ppm	7.4 - 9.3 ppm	250 ppm	–	NO	Runoff and leaching from natural deposits; seawater influence
Copper	2021	0.041 ppm	0.022-.041 ppm	1 ppm	–	No	Internal corrosion of household plumbing; erosion of natural deposits
Sodium	2020	5.4 ppm	5.4 ppm	–	20 ppm	No	Natural erosion, road salt
Sulfate	2021	5.5 ppm	4.7 – 5.5 ppm	250 ppm	–	No	Runoff and leaching from natural deposits; industrial wastes
Zinc	2021	0.017 ppm	ND – 0.017 ppm	5ppm	–	No	Corrosion of household plumbing systems; erosion of natural deposits

Per- and Polyfluoroalkyl Substances (PFAS) Drinking Water Regulations Quick Reference Guide

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Overview of the Rule	
Title	Per- and Polyfluoroalkyl Substances (PFAS) compliance requirements for Public Water Systems (PWS) - 310 CMR 22.07G
Purpose	Increase public health protection through the reduction of chemicals that have been linked to a variety of health risks, particularly for sensitive subgroups including pregnant women, nursing mothers and infants.
General Description	The amended Massachusetts Drinking Water Regulations establish a Maximum Contaminant Level (MCL) of 0.000020 milligrams per liter (mg/l) or 20 ng/l (also called parts per trillion or ppt) for the sum of six PFAS compounds (PFOS, PFOA, PFHxS, PFNA, PFHpA and PFDA), known as PFAS6. The regulations detail the sampling requirements and corrective actions that PWS must take when the MCL is exceeded, as well as the provisions for public education and notice of exceedances so that communities can be educated and proactive in protecting their drinking water quality.
Utilities Covered	The PFAS6 MCL applies to Community PWS and Non-transient, Non-community PWS. Transient Non-community PWS must collect a PFAS sample under the regulations and would be subject to a site-specific health assessment for elevated levels.

- This document provides a summary of MassDEP drinking water requirements; to ensure full compliance, please consult the regulations at 310 CMR 22.07G.

Public Health Benefits

Implementation of the PFAS regulations will result in:

- Monitoring for and identifying any elevated PFAS levels in public drinking water.
- Corrective actions that reduce drinking water exposures to PFAS6 to below the levels that may cause a variety of health effects to sensitive subgroups, including developmental effects in fetuses and infants, effects on the liver, blood, immune system, thyroid, and may elevate the risk of certain cancers..

Critical Dates and Deadlines

October 2, 2020	MassDEP published its PFAS regulations establishing an MCL of 0.000020 milligrams per liter (mg/l) or 20 ng/l (also called parts per trillion or ppt) for the sum of PFAS6.
January 1, 2021	Large Community (COM) and Non-transient Non-community PWS (NTNC) (schools, workplaces, etc.) serving more than 50,000 people will begin regulatory compliance monitoring.
April 1, 2021	COM and NTNC PWS serving between 10,000 and 50,000 people will begin regulatory compliance monitoring.
October 1, 2021	Small COM and NTNC PWS serving 10,000 or fewer people will begin regulatory compliance monitoring.
September 30, 2022	Transient Non-community PWS (such as hotels and restaurants) must collect, analyze and report sampling results by this date.

Federal Drinking Water Standards

There are currently no federal PFAS drinking water standards. However, USEPA has a health advisory of 70 ppt for the sum of PFOA and PFOS.

What are the Major Provisions?

Sampling Locations

- PWS must sample at every entry point to the distribution system.
- PWS that draw water from more than one source, where the sources are combined before distribution, must collect samples that are representative of all such combined sources after treatment during periods of normal operating conditions.
- Consecutive PWS are exempt from conducting compliance monitoring for PFAS for the purchased portion of water when the PWS from which the water is obtained has conducted the required monitoring.

Initial Monitoring (First Year)

- Four consecutive quarterly samples must be collected.
- Each sample shall be collected in the first month of every quarter during initial monitoring.
- The PWS may ask MassDEP to substitute previously conducted quarterly sampling.
- If no PFAS is detected in the first two quarters of monitoring, the PWS may request to have MassDEP waive the third and fourth quarters of monitoring.

Routine Monitoring

- If initial monitoring does not identify any PFAS a PWS may monitor during one year of each subsequent three-year Compliance Period.
- PWS serving more than 3,300 individuals must collect two quarterly samples in that year.
- PWS serving fewer than or equal to 3,300 individuals must collect one sample in that year.

Monitoring Waivers

- After January 1, 2023, a PWS on routine monitoring may request a monitoring waiver from MassDEP.
- Waivers cover a single three-year Compliance Period and must be renewed each Compliance Period.
- Sampling under an approved waiver shall occur at least once during the first Compliance Period of each successive nine-year Compliance Cycle.

Confirmatory Sampling Requirements

- Initial Monitoring: The first detection of PFAS during initial monitoring, not just the detection of PFAS6, triggers confirmation sampling.
- Initial Monitoring: After first detection, subsequent PFAS6 detection greater than 10 ppt triggers confirmation sampling.
- Routine Monitoring: Confirmatory sampling is required when PFAS6 is detected greater than 10 ppt during routine monitoring unless MassDEP determines that the location is Reliably and Consistently below the MCL.
- The confirmatory sample must be collected as soon as possible after receipt of result requiring confirmation and no later than two weeks from receipt of such result (unless granted a MassDEP extension).
- A detection is defined as any PFAS contaminant level greater than the lab's minimum reporting level (MRL). All certified labs must achieve an MRL of 2 ppt or lower for the six PFAS covered by the MCL.

Increased Monitoring if PFAS is detected

Monthly monitoring	• If the average of a PFAS6 result and its associated confirmatory sample is greater than 10 ppt, the sampling location must be sampled monthly. • Monthly sampling continues until the source is shown to be Reliably and Consistently Below the MCL.

Quarterly monitoring	• A PWS that has installed PFAS treatment and is thereby Reliably and Consistently Below the MCL will be put on quarterly monitoring.
Annual monitoring	• If the initial monitoring is complete and PFAS is detected but PFAS6 is confirmed less than 10 ppt, the location must be sampled annually. • A PWS that is determined by MassDEP to be Reliably and Consistently Below the MCL without having to install PFAS treatment may be put on annual monitoring.

Public Education

- Any PWS where there has been a PFAS6 detection, and the average of such detection and an associated confirmatory sample exceeds the PFAS6 MCL, shall provide public education materials regarding the exceedance, as described by MassDEP. These should be provided as soon as possible, but within 30 days.
- Until the PWS obtains a monitoring result at or below the PFAS6 MCL at such locations, public education should be updated quarterly.

Compliance and Violations

- MCL compliance is calculated using the average of the monthly samples over a quarter.
- If any one sampling point location is in violation, then the PWS shall be considered in violation.
- If any sample result would cause the quarterly average to exceed the PFAS6 MCL, the PWS is immediately in violation and begins compliance actions.

Public Notice

- A violation of the MCL requires a Tier 2 Public Notice.
- Monitoring & testing procedure violations require Tier 3 Public Notice.

Seasonal System Provisions

If a PWS reactivates an existing source or opens a seasonal system after the applicable commencement date of this regulation, it shall commence initial monitoring of such locations within the first month of delivering water to the public.

MassDEP Technical Assistance and Grants

- Free testing is available until June 30, 2021 for PWS to sample drinking water for PFAS.
- The Commonwealth provided grant funding in October 2020 to assist PWS in the planning and design of treatment systems to remove PFAS Another round of grant funding is anticipated.
- MassDEP has made PFAS-reducing drinking water projects a priority in the 2021 State Revolving Fund (SRF) Loan Program. PFAS mitigation projects may be eligible to receive an additional subsidy in the form of a 0% interest rate loan. The additional subsidy is contingent on the availability of funds and approval of the Massachusetts Clean Water Trust Board of Trustees. For more information: https://www.mass.gov/doc/drinking-water-program-updates-2-13-2020/download

Key Point for PWS to Remember

- All confirmed detections of PFAS6 > 20 ppt require public education.

For additional information on the PFAS6: Visit the MassDEP website at https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas; email the MassDEP Drinking Water Program at program.director-dwp@mass.gov; or call the MassDEP Drinking Water Program at 617-292-5770.

THIS DOCUMENT CONTAINS IMPORTANT INFORMATION FOR YOUR SYSTEM. HAVE SOMEONE TRANSLATE IT FOR YOU OR SPEAK WITH SOMEONE WHO UNDERSTANDS IT.

If you need this document translated, please contact MassDEP's Diversity Director, Michelle Waters-Ekanem, Diversity Director/Civil Rights: 617-292-5751 TTY# MassRelay Service 1-800-439-2370. You may also contact the Drinking Water Program at program.director-dwp@mass.gov.

APPENDIX F
CONSERVATION AND MANAGEMENT PERMIT COMPLIANCE AND MITIGATION ACTIONS

Conservation and Management Permit Compliance and Mitigation Actions

Camp Edwards: Fiscal Year 2022

The Massachusetts Army National Guard maintains two Conservation and Management Permits (CMPs) under the Massachusetts Endangered Species Act (MESA, 321 CMR 10.00). The CMPs were developed within the framework of the Integrated Natural Resources Management Plan (INRMP) for Camp Edwards consistent with the Sikes Act and all implementing regulations for the MA Division of Fisheries and Wildlife (MADFW) and MA Army National Guard (MAARNG), including the Upper Cape Water Supply Reserve. The CMPs provide a collaborative and progressive path forward for training and operations at Camp Edwards while ensuring Net Benefit for state-listed species and their habitats at Joint Base Cape Cod (JBCC) directly through CMP associated actions as well as overall natural resources conservation and training lands management at JBCC.

The CMPs are held and administered by MAARNG and the MA Military Division and focus primarily on Camp Edwards' lands and operations. However, the "master plan" CMP was developed collaboratively with MA Air National Guard and includes both past mitigation commitments and implementation, as well as providing for potential future facilities actions for both services. This report includes updates and accomplishments for the FY2022 period covering October, 2021, through September, 2022. Reportable actions include facilities maintenance and development as provided by the permits, construction support actions, mitigation efforts, program administration, and planned activities for the coming fiscal year(s).

Acronyms and Definitions

This report uses many acronyms and abbreviations, as well as specific terms and titles. The majority are included here for clarity.

Acronym	Term
AgCS	Agassiz's Clam Shrimp (MESA fact sheet, NatureServe)
AmCS	American Clam Shrimp (MESA fact sheet, NatureServe)
CMP(s)	Conservation and Management Permit(s) (CMP overview)
CS	Clam Shrimp
CSCRMP	Clam Shrimp Conservation and Road Maintenance Plan
EBT	Eastern Box Turtle (MESA fact sheet)
EMC	Environmental Management Commission
EWPW	Eastern Whip-poor-will MESA overview)
FCRA	Forest Canopy Reserve Area
FY(xx)	Fiscal Year (xx is two digit year); 01 OCT – 30 SEP
IAGWSP	Impact Area Groundwater Study Program (website)
INRMP	Integrated Natural Resources Management Plan (2021 INRMP)
JBCC	Joint Base Cape Cod (JBCC overview)
MA	Massachusetts
MAANG	Massachusetts Air National Guard (website)
MAARNG	Massachusetts Army National Guard (website)
MADFW	Massachusetts Division of Fisheries and Wildlife (website)
MANG	Massachusetts National Guard (joint) (website)
MEPA	Massachusetts Environmental Policy Act (website)
MESA	Massachusetts Endangered Species Act (MESA overview)
MPMG	Multi-Purpose Machine Gun (Range)
NEPA	National Environmental Policy Act (website)
NHESP	Natural Heritage and Endangered Species Program (website)
PBMFA	Pine Barrens Mitigation Focal Area
SGCN	Species of Greatest Conservation Need (State Wildlife Action Plan)
SMRC	Special Military Reservation Commission
UCWSR	Upper Cape Water Supply Reserve
UMass	University of Massachusetts
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet

Cover photos

Top (from left): Hognose Snake (*Heterodon platyrhinos*) by *Evan Grimes (UMass Amherst)*; Unexpected Cycnia Moth (*Cycnia collaris*) at light sheet by *Jake McCumber*; Upland Sandpiper (*Bartramia longicauda*) by *Peter Trimble*. Bottom: Soldiers conducting approved training within the Wheelock Overlook restoration area during the 2022 Combined Arms Exercise by *Rob Crevey*.

A note on photos:

All photos in this report are by MAARNG Natural Resources and Training Lands staff in 2022 unless otherwise specified. Photographer credits are in italics following captions.

The Plain Prominent moth (*Coelodasys apicalis*; formerly genus *Schizura*) is closely tied to xeric barrens habitats. It is both rare and declining throughout the eastern United States. Though not state-listed, it is classified in NatureServe as a G3S1 (Global: Vulnerable; MA: Critically Imperiled). Populations are increasingly isolated, but maintenance of early and mid-successional habitats is helping preserve this species in southeastern Massachusetts. The Plain Prominent has been observed annually over the last few years in managed barrens habitats at Camp Edwards. *Jake McCumber*

Agassiz's Clam Shrimp and Training Area Roads Conservation and Management Permit

Conservation Permit #: 018-327.DFW
NHESP Files #: 17-37184
Project: Road Repair and Clam Shrimp Relocation
Date: 08-NOV-2018; amended 14-JUL-2021

Background. A CMP was developed and issued to the MAARNG in 2018 to provide for localized road repair at Camp Edwards while providing for conservation of the Endangered Agassiz's Clam Shrimp (*Eulimnadia agassizii*, AgCS). The original permit allowed for the repair of specific sites (i.e., road puddles) that were known AgCS habitat but required road repair. Three sites were modified *in situ* to improve the road condition, while still providing habitat for clam shrimp, and five sites were repaired and the habitat replaced through active construction or repair of vernal pool or road puddle sites and relocation of clam shrimp or sediment. Three years of monitoring, as required by the CMP, were completed for FY18, FY19, and FY20. An additional fourth year of monitoring was completed in FY21 due to the previous year drought conditions and the focal conservation interest of the species for MAARNG.

Surveying a puddle in a two-track road for Agassiz's Clam Shrimp. *Erin Hilley*

During the FY21 monitoring MAARNG confirmed American Clam Shrimp (*Limnadia lenticularis*, AmCS), a state-listed species of special concern, not previously identified on the base. AmCS were encountered in three monitoring puddles (see FY21 CMP and Mitigation Actions report for more details on this finding).

MAARNG coordinated with MassWildlife in 2021 to amend the CMP to widen the scope of the permit and develop a plan for ongoing necessary road repairs in the Training Area while preserving habitat for rare clam shrimp species long-term. The backbone of the CMP Amendment is the Clam Shrimp Conservation and Road Maintenance Plan (CSCRMP) which carries forward elements of the original CMP, including monitoring and Net Benefit through a combination of clam shrimp relocation and in-place site repair. The updated CMP establishes multiple categories of roads (Critical Roads, Impact Area Interior Roads, and Training Area Roads) and establishes processes and standards for road puddle repair. Additionally, it establishes five zones of the northern training area for supporting a baseline number of puddles within each zone as primary habitat for AgCS and AmCS.

The two primary recurring efforts of the CMP Amendment are annual clam shrimp monitoring and development of annual or semi-annual road work plans submitted to MassWildlife for review and approval. FY22 highlights for both efforts are discussed below.

Annual Monitoring. The fifth consecutive year of annual monitoring was completed in FY22. Due to a shortage of seasonal field technicians, SWCA Environmental Consultants was contracted to carry out the formal monitoring and report observations through MassWildlife's Heritage Hub. SWCA conducted repeated surveys following the standard approved protocol at a subset of 12 puddles. Three puddles

were 2021 CMP mitigation puddles, six were puddles not surveyed previously, and three were known to support AgCS in previous years. The 2021 mitigation puddles were not known to contain clam shrimp prior to intentional introduction of clam shrimp adults and puddle sediment thought to contain CS eggs. Adults and sediment were collected from puddles on the impact area perimeter roads (Jefferson, Barlow, Wheelock, and Crowell) that required repair. These roads had become severely degraded and occasionally impassable, in large part due to a prohibition on maintenance due to known AgCS presence.

From mid-May to October, puddles containing standing water were measured for area, depth, temperature and pH, and all aquatic life observed was recorded. AgCS were observed in seven of the twelve surveyed puddles or 67 percent of monitored puddles. This percentage is an increase from recent years (Chart 1). The seven positive observations were spatially distributed throughout Camp Edwards, occurring in all five training area zones. Zones are discussed below as part of the CMP amendment. Notably, three puddles are new locations for AgCS records. Also, it is significant that AgCS introductions to mitigation puddles continues to be successful. AgCS persisted and were observed in all three 2021 mitigation puddles that received adult AgCS and sediment. SWCA did not observe AmCS during their monitoring with all specimens identified as AgCS. All data and results are provided separately to MassWildlife and observation reporting through Heritage Hub will be completed in FY22 by SWCA (https://www.mass.gov/info-details/overview-of-the-heritage-hub).

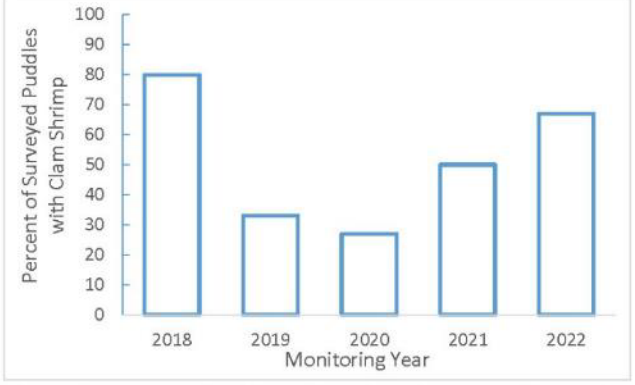


Chart 1. Percentage of puddles with confirmed presence of Agassiz's Clam Shrimp during formal annual monitoring. Each year a set of puddles is selected for iterative surveys following a mutually developed protocol that accounts for mitigation sites, novel sites, and return visits through long-term annual monitoring.

In addition to the 12 formal monitoring sites, MAARNG provided a list of additional puddles for SWCA to monitor in the event that formal sites were either consistently dry during monitoring visits or were confirmed to contain AgCS. SWCA visited 10 of these additional puddles throughout the monitoring period. Despite prolonged summer drought that left most sites dry, clam shrimp were observed at four of the puddles. Clam shrimp in three of the puddles were identified as AgCS but the clam shrimp from the fourth puddle were too small to positively identify to species, although AgCS is suspected. AgCS had been observed in two of the puddles previously, one in 2018 and the other in 2021, and two had not been monitored before. FY22 was a productive monitoring year resulting in eleven AgCS observations (1 site = 1 observation) with five of those being new clam shrimp puddles that will be marked with protective signage.

Road Work Plans. The overarching CS conservation strategy is to provide for both a sustainable road network and sustainable clam shrimp population throughout Camp Edwards. A well maintained road network is fundamental to supporting all operations on Camp Edwards, including groundwater monitoring, active remediation, natural resources management, and, critically, soldier training. A usable

and maintained road network appears to also support suitable clam shrimp habitat and their persistence throughout the Training Area. This can be seen in the annual monitoring efforts and results and the success of retaining clam shrimp on sites after road and puddle maintenance work.

In December 2021, MAARNG submitted Road Work Plan Proposal 2 to MassWildlife. The Plan was approved in January and included road work projects put forth by various Camp Edwards stakeholders such as Facilities Engineering, Impact Area Ground Water Supply Program (IAGWSP), and Natural Resources & Training Lands. Most road projects were standard road grading to repair rutting from storm water runoff. A few projects involved more hardened repairs to roads, such as re-paving and gravelling, these occurred on "Critical Roads", a CSCRMP designation. Critical Roads are technically outside the scope of the CSCRMP.

Agassiz's Clam Shrimp in various size classes in a sampling tray dipped from puddle SPSW1 during FY22 monitoring. Upper scale in millimeters. *Jonathan Schuster, SWCA*

One standout project put forth by Natural Resources & Training Lands includes in-place improvements to a known AgCS puddle on Fredrickson Road. This puddle, called FRED, triggers the CSCRMP Repair Threshold because it has caused road widening and is greater than 8-inches deep over most of its footprint. In-place improvements involve hardening the bottom of the puddle with rock and sand to raise the elevation and reduce the puddle size. The in-place improvements will improve the road condition and use while maintaining the clam shrimp habitat. A similar project was completed successfully during FY19 as part of the original CMP. While not completed during FY22, the FRED project is underway as of December 2022.

A second stand out project is the creation of three clam shrimp habitat sites to replace impacts to AgCS due to unauthorized road grading that resulted in the filling of three clam shrimp puddles. The road grading occurred in fall 2021 during road repairs permitted under the Road Work Plan #1 –July 2021, implemented by IAGWSP. However, the working contractor additionally graded a section of Wheelock Road to facilitate material hauling, which was outside the work scope and without prior approval. This section had received clam shrimp in three puddles as mitigation for the impact area boundary work and the puddles had been marked with rare species habitat signage. The graded over puddles are re-forming and will be observed by MAARNG during the FY23 clam shrimp active season.

The 2022 Work Plan was amended with MassWildlife in June to include two add-itional projects. One project, implemented by IAGWSP, was grading and gravelling a section of Barlow Road that accesses the Impact Area from Gibbs Road and is classified as a Critical Road. The second, proposed by Natural Resources & Training Lands is for repairs to a deep, wide, and often impassible puddle on Pocasset Road. This project is in the planning stage and may require more innovative solutions than other sites.

While the CSCRMP process has been successful, communication and process gaps, such as the grading described above, continue to come to light and are addressed as they do. Unforeseen situations are not surprising given the complex and multi-use needs of Camp Edwards and resilience to such complexity is

built in the conservation strategy. The only incident that occurred during FY22 was the unauthorized grading of two short road sections which resulted in the filling of two puddles. Fortunately, they were not known habitat to clam shrimp and the remaining number of puddles in the effected Zone remained above the established puddled density. It was later determined that a third party was improving access to two separate water supply wells and was not a known stakeholder for road repair.

Natural Resources staff preparing for in-situ modifications to FRED puddle. Work will improve conditions for both vehicles and clam shrimp. After draining, fine sediment will be scraped away and the bottom raised and hardened by compacting layers of sand over gravel. Finally, some scraped sediment containing clam shrimp eggs will be returned. *Erin Hilley*

FY23 and Planned Activities. In December FY23, The Natural Resources & Training Lands Program met with representatives from Camp Edwards programs that plan and implement road work in the Training Area to identify roads and road sections in need of repair and planned for the fiscal year. These projects will be evaluated for potential impacts to available and known clam shrimp habitat, as well as other wildlife, and required and/or voluntary mitigation needs will be proposed. The culmination of the meeting and evaluation will be worked into the FY23 annual Road Work Plan and submitted to MassWildlife for review, coordination, and approval. Meanwhile, the Final Conditions report for completed projects approved in the Road Work Plan 2 is being developed for submission to MassWildlife.

MA National Guard Master Development Plan Conservation and Management Permit

Conservation Permit #: 020-358.DFW
NHESP Files #: 18-37434
Project: Camp Edwards Multi-Purpose Machine Gun (MPMG) Range and Master Development Plan
Date: 29-SEP-2020

Frosted elfin larva feeding on Wild Indigo. This state-listed and federal At-risk Species thrives in fire maintained grassland, heath, and shrub habitats at Camp Edwards, including mitigation areas. *Jake McCumber*

Background. The Massachusetts Army National Guard received a Conservation and Management Permit in 2020 that established a master planning framework for projects implemented at Joint Base Cape Cod by both Air and Army National Guard. A comprehensive mitigation plan was developed, including an on-site mitigation bank covering multiple habitats. The primary projects incorporated into the master planning mitigation strategy include MPMG Range at the current KD Range, Infantry Squad Battle Course at the formerly used Infantry Battle Course, expansion of Tango and Sierra ranges, cantonment modernization including a running track and classroom buildings, and potential solar development. The mitigation plan combines project design and impact minimization, take avoidance, land transfers, extensive habitat improvement, and long-term monitoring to provide for Net Benefit of a large number of state-listed species. It also establishes a framework for ongoing site development (including additional or modified projects) and land use planning while providing for proactive mitigation and demonstrable net benefit for state-listed species.

White-tailed Deer caught licking its lips while at a frost bottom in a pine barrens mitigation zone. Deer exclusion fencing is an effective protection measure for listed plants.

The mitigation plan focuses on species guilds (pine barrens and sandplain grassland) for the majority of species with similar habitat condition needs and/or threats (e.g., loss of open canopy condition through forest closure). The Eastern Box Turtle (*Terrapene carolina*, EBT) is treated separately as it has differing needs and threats compared to the other species. Mitigation focal areas, tied to the guilds, have been identified to localize various mitigation actions for maximized benefit. Standards for mitigation have been developed for each type of guild and focal area to ensure sufficient conservation commitments are included in the plan and to provide assurances to MADFW for net benefit. For example, pine barrens mitigation will require 20% to 40% of habitat improvement work to be in the form of mechanical forestry, as the majority of the pine barrens guild species are threatened and declining due to tree encroachment and canopy closure where suitable and protected habitat exists. In addition to pine barrens and grassland focal areas, forest canopy retention areas are identified for box turtle hibernation and these areas are prioritized for maintenance of later successional forest condition and closed tree canopy.

Real Property Actions. Extensive land protection through real property actions was a fundamental component of the master CMP. One parcel (Special Military Reserve Commission [SMRC] Tract 5) that had already been transferred to MADFW was included in this agreement, as it had been transferred for a project that did not occur and the transfer was specified as mitigation. Additionally, SMRC Tracts 1 through 4 were transferred to MADFW as mitigation through this agreement in 2020. Tracts 1-5 total 260 acres and are directly adjacent to Crane Wildlife Management area; these tracts represent a significant expansion to this public conservation area. Another parcel previously identified for mitigation land transfer was Parcel H of Unit K, which is 150 acres within the cantonment area. This transfer was included within the master CMP agreement. The parcel was transferred to Military Division in 2020. MANG will receive a license to maintain overall access and use to meet habitat conversion and perpetual long-term management requirements under the mitigation agreement. There are no other updates for FY22 regarding real property actions. The MANG State Quartermaster has been in regular communication with the MA Department of Fish and Game General Counsel and Department of Capital Asset Maintenance and Management to develop Care, Custody, and Control agreements for the transferred parcels and to complete the transfer of Parcel H of Unit K with estimated completion now in 2023.

Butterfly Milkweed (fore), Common Milkweed (background), and Wild Indigo (center) responding vigorously in early summer following a spring 2022 grassland prescribed fire and fall 2021 invasive plant herbicide treatment. *Jake McCumber*

Construction Projects. Approval and construction of the flagship project – the MPMG Range – remains delayed and is pending resumption of the Environmental Management Commission approval process. The redevelopment of Tango Range, approved in the CMP, was completed at the end of FY21 with minor troop labor improvements approved and completed in FY22. The final compliance report is in development for Tango Range. In early FY22 the management of the turtle protection for the staged soil at Dig Site 3 (source: Eversource's Bourne switching station) was transferred to MAARNG. In coordination with Natural Heritage, silt fence was removed from the site until major construction projects commence.

Mitigation Implementation. The framework of the CMP was erected to encourage early and abundant investment in monitoring and active mitigation efforts supporting the overall mitigation bank and evaluation of long-term monitoring results. MAARNG has consistently, effectively, and extensively managed for and monitored state-listed species, their habitats, and overall ecosystem health. CMP reportable and funded actions are a specific subset of MESA-related conservation, which itself is a subset of overall natural resources management and ecosystem sustainability efforts. All of these efforts are guided by and captured within the Camp Edwards Integrated Natural Resources Management Plan (2021; https://www.massnationalguard.org/ERC/publications/Natural_Cultural/Final-INRMP-21.pdf) and frequent coordination with Sikes Act partner agencies (MADFW, US Fish and Wildlife Service), multiple other partner agencies, conservation collaboratives, universities, and others. CMP mitigation actions are implemented within mitigation focal areas (Pine Barrens, Sandplain Grassland, Forest Canopy Reserves). They also meet specified objectives of the CMP, associated plans, and interagency coordination (e.g., annual review meetings). The master development plan CMP effectively doubled the NR-ITAM project budget for active conservation efforts, including monitoring and habitat restoration and management.

Contract Cost	Fiscal Year				
Mitigation Project Type	2019	2020	2021	2022	Grand Total
Administrative	$48,020	$45,169	$11,262	$32,557	$137,008
Construction support		$221,876		$540	$222,416
Monitoring	$62,810	$103,248	$123,739	$146,600	$436,396
Other		$9,700			$9,700
Initial treatment, fire	$64,480				$64,480
Initial treatment, mechanical	$179,986	$88,458	$148,900		$417,344
Maintenance treatment, other		$55,950	$8,000	$118,840	$182,790
Grand Total	**$355,295**	**$524,401**	**$291,900**	**$298,537**	**$1,470,133**

Table 1. Direct contract expenditure on mitigation projects per federal fiscal year implementing the Master Plan CMP. An estimated additional $80,000 per year is spent on internal staff time developing, overseeing, and implementing mitigation projects under this CMP.

Mitigation Acreage	Fiscal Year					Grand
Project Type	2019	2020	2021	2022	2023	Total
Pine Barrens	520	401	184	188.5	191	1,484.5
Construction: Pine Barrens		-6		-1	-412	-419
Mitigation: Initial treatment, fire	448			77.5		525.5
Mitigation: Initial treatment, mechanical	72	106	164	27	49	418
Mitigation: Maintenance treatment, fire			20	85	524	629
Mitigation: Maintenance treatment, other		40			30	70
Mitigation: Other						
Mitigation: Real Property		261				261
Sandplain Grassland	42	80	47	79	230	478
Construction: Sandplain Grassland					-36	-36
Mitigation: Initial treatment, fire	42			65		107
Mitigation: Initial treatment, mechanical		80				80
Mitigation: Maintenance treatment, fire			47		66	113
Mitigation: Maintenance treatment, other				14	50	64
Mitigation: Real Property					150	150
Grand Total	**562**	**481**	**231**	**267.5**	**421**	**1962.5**

Table 2. Acreage totals for mitigation banking under the Master Plan CMP by federal fiscal year and project type. Maintenance actions meet the perpetual maintenance requirement. Negative numbers represent Take under MESA and draw against the "account" with a coefficient to account for mitigation ratios. Acres for mitigation projects are frequently counted the year after funding where a project is planned and funded from one FY, but implemented during the following winter due to conservation best management practices.

Wheelock Overlook harvest area in Pine Barrens Mitigation Focal Area West (Training Area A-5), August, 2022. The first CMP-funded mitigation project supports a robust natural community, including a variety of rare species. *Jake McCumber*

State-listed species conservation includes education and collaboration such as this interagency Eastern Box Turtle training hosted at Camp Edwards. *Jake McCumber*

Mitigation investment for specific CMP implementation contracts and projects totaled $298,537. An estimated additional $96,500 was invested in internal staff salary supporting mitigation projects within the CMP with primary emphasis on monitoring and overseeing monitoring contracts. All requested funds for FY22 were proposed mitigation projects. One project (RAW3 forestry, habitat restoration) was delayed in contracting and has become a FY23 project, but based on supplemental investment from other funds we were able to meet expected financial investment in mitigation for FY22. The breakdown by category of FY22 and prior years' CMP expenditures is outlined in Table 1. Table 1 does not include staff time and salary nor does it include other state-listed species projects not directly associated with the CMP (e.g., bat monitoring, clam shrimp, state-listed species habitat restoration outside the focal areas, etc.).

Several major mitigation efforts were completed, ongoing, and/or initiated in FY22, addressing all the above-listed components of the master CMP. The mitigation actions implemented during FY22 totaled 268.5 acres of active habitat restoration. Prescribed fire implementation was significantly increased compared to the previous two years and accounted for 85% of mitigation acres for the year. Multiple trainings and thirteen burn days occurred at Camp Edwards in FY22. Seven prescribed burns were fully or partially within mitigation areas. An additional burn was within the Sierra Range barrens habitat that is associated with an earlier mitigation agreement, not the master development plan CMP and is not counted in this report. Extensive resource monitoring, including many in-house efforts, were completed or underway in FY22 in addition to the active habitat management. Projects undertaken in FY22 as mitigation efforts are summarized below. Projects and efforts that are programmatic in nature or otherwise not specifically meeting requirements of the Permit are not included, but are reported in both the Annual State of the Reservation Report and Camp Edwards INRMP Annual Review.

- **Project Scoping, Design Minimization, and NHESP Review**
  - **MPMG Range** – NHESP review and approval was completed in September 2020, preceded by completion of the MA Environmental Policy Act (MEPA) process in July 2020; followed by finalization of the National Environmental Policy Act (NEPA) process in April 2021. Project implementation is pending final approval from the Environmental Management Commission. Turtle protection plans were amended in coordination with MADFW to address the delayed implementation and will continue to be amended as needed with coordination. Note there is no change in status relative to the permit on this project since the last annual report.
  - **Tango Range** – Construction and turtle protection actions were completed in September 2021. The preconstruction survey report was submitted in November 2020 and an interim, year-end

report was submitted to NHESP in January 2021. The closeout report for turtle protection was submitted on 10-DEC-2021 and approved by NHESP on 14-DEC-2021. The closeout and compliance report for the overall construction was delayed, but is anticipated for submittal in January 2023 with request for certificate of compliance.

- **Track and Field (1800 area)** – MADFW reviewed and approved final plans, turtle protection plan, and Net Benefit for the project design and consistency with the CMP January 12th, 2021. The project, including minimal land clearing and development of a track and field to support soldier fitness and training adjacent to the gymnasium, has been indefinitely put on hold pending funding. Notification will be made when funding is available to contract project implementation, including compliance with the CMP and turtle protection actions. Anticipated contracting is early FY23, but may include only the track and retain the grass field.
- **ISBC Range –** Design is still ongoing. Formal environmental review is anticipated in FY23.

- **Species Protection**
  - **MPMG Range** – Intensive year 4 of Eastern Box Turtle surveys implementing the approved turtle protection plan. The FY21 report was submitted on 7 April 2022. and an update was sent on 6 June 2022 detailing the spring work in FY22. In accordance with the Addendum to the CPMPP submitted and approved by NHESP on 6 August 2021, a movement barrier was installed in the fall of 2021 by in-house personnel to provide an area of good hibernation habitat (based on observed density of use) near the proposed project site. and turtles within the limits of work were relocated behind the barrier to allow for winter installation of the silt fence and tree removal. Given project delays, construction did not start in 2022 and is not anticipated in the winter of 2022-2023. Since no additional work was done in 2022 aside from continued turtle monitoring and transmitter attachments, no additional report will be sent in FY22.
  - **Tango Range** – On 12 July 2022, the Natural Resources Office submitted a project write-up for additional work at Tango Range, which included turtle protection measures. Consistent with the approved plan, the Natural Resources Office staff provided education to equipment operators, monitoring of transmittered turtles, and sweeps of the work area each morning for the troop labor project completed at Tango Range. One new turtle was discovered in the vicinity of the project, and another new turtle was added to the transmittered population when soldiers reported a turtle in the road on the way to the construction site.
  - **Track and Field (1800 area)** – The turtle protection plan was developed and approved by NHESP during project design and design submission. No action has been taken as the project was put on hold pending funding. If funding becomes available turtle protection implementation will be part of the construction contract and confirmation will be made with NHESP of compliance with turtle protection and all other permit requirements.
  - **Soil Stockpiling at Dig Site** - In TY 2022, the Natural Resources Office took over turtle protection from Eversource at Dig Site 3. The soil from the Bourne Switching Station will be used on future construction projects on base. Silt fence enclosure was removed in the spring of 2022 due to construction project delays. Approvals was obtained from NHESP and a report was submitted June 2022. Silt fence will be reinstalled and maintained for turtle protection prior to the start of major construction projects requiring material removal.

- **Species Monitoring (CMP focused)**
  - **Eastern Box Turtle (EBT)**
    - In FY21, MAARNG NR-ITAM contracted the University of Illinois Wildlife Epidemiology Laboratory to implement an intensive box turtle health assessment. In FY22, the Wildlife Epidemiology Lab provided results and a report on the findings. The findings were also presented at the American Association of Zoo Veterinarians (AAZV) conference in September of 2022. In TY 2023, the Wildlife Epidemiology Lab is planning to submit a manuscript for publication in the Journal of Zoo and Wildlife Medicine entitled "Prevalence of cutaneous myiasis during disease surveillance of eastern box turtles (*Terrapene carolina carolina*) in Cape Cod, Massachusetts."

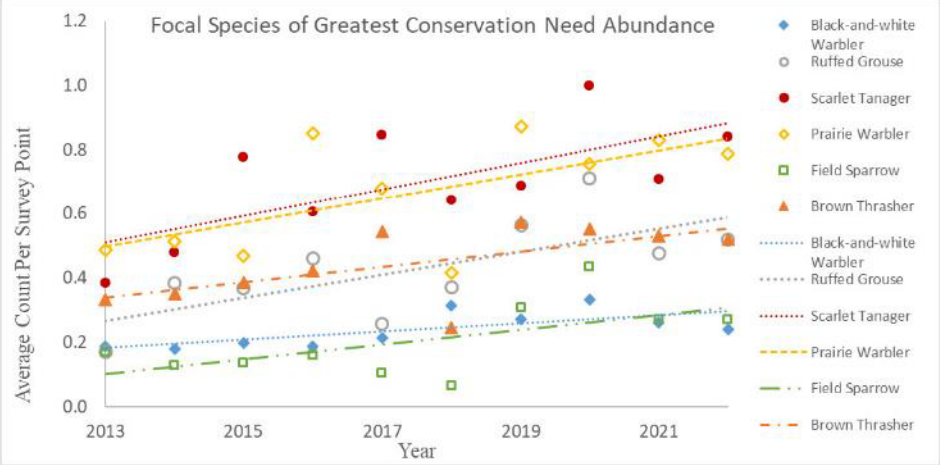
One of many Eastern Box Turtles tracked at Camp Edwards in 2022. *Nicole Madden*

    - MAARNG applied radio transmitters and monitored previously transmittered turtles for an end of year total of 63 EBT during FY22 as part of the long-term box turtle monitoring requirement. This includes opportunistic turtle observations from a number of programs, including NR-ITAM, Camp Edwards Range Control, IAGWSP, other site users, soldiers within training units, and the following projects. The signals for two turtles cannot be located. Radio failure, damage to a radio or antenna, large turtle movements, turtle collection, or poor signal conditions can cause the loss of signal.
    - Although data is still being compiled from the several researchers doing EBT work on base, at least 16 mortalities (including 2 turtles without transmitters) were documented in FY22. Three of these were during a prescribed fire (two were not tagged turtles), two were road mortalities, and the remainder (11) are unknown. Two of the unknown mortalities were discovered by other researchers and the NR-ITAM Office is awaiting details on any apparent cause of death. Given multiple years of monitoring, the NR-ITAM Office is planning to compile the mortality rates and the proportion of mortalities attributable to typical causes (vehicle, prescribed fire) and unknown.
    - MAARNG NR-ITAM contracted a "planning level survey" effort targeted at providing baseline data on box turtle presence and approximate density in a variety of training areas and habitat conditions distributed throughout Camp Edwards. Eight (8) EBT were detected in FY22 as part of this effort and seven (7) individuals were outfitted with radio transmitters for long-term tracking.
    - A graduate student at University of Massachusetts (UMass) Amherst's Massachusetts Cooperative Fish and Wildlife Research Unit (website), in coordination with MAARNG, MADFW, and USFWS, monitored the population of transmittered turtles at Camp Edwards for fly larva infestations and impacts.
    - A PhD student at the University of Massachusetts (UMass) Amherst's Massachusetts Cooperative Fish and Wildlife Research Unit was selected to begin studying EBT's influenced by prescribed fire on Camp Edwards.

- **Breeding Bird Point-counts**
  - Point-count surveys were conducted from 23 May through 28 June, 2022. Three surveys were conducted at each of 79 points throughout Camp Edwards, including 14 grassland (cantonment) points and 65 points in the northern training area. A total of 74 species were documented at point-count locations during the month of surveys.
  - Long-term trend analysis was completed for the newer point-count protocol covering data collected from 2013 through 2022. Trends in occupancy and abundance show positive or stable trends for nearly all Species of Greatest Conservation Need (SGCN) as identified by the State Wildlife Action Plan.

Field Sparrows rapidly establish within restored shrubland habitat at Camp Edwards leading to significant population increases. *Jake McCumber*

- Development of a full white-paper report has been delayed by inclusion of additional years of data (2021, 2022) to provide a full ten-year set, but such should be completed in 2023.
- The longer dataset provides much greater statistical significance with 10 of the 16 species of SGCN with regular breeding occurrence having significant trends for abundance. All but one of those are increasing trends and four also have statistically significant increases in occupancy.

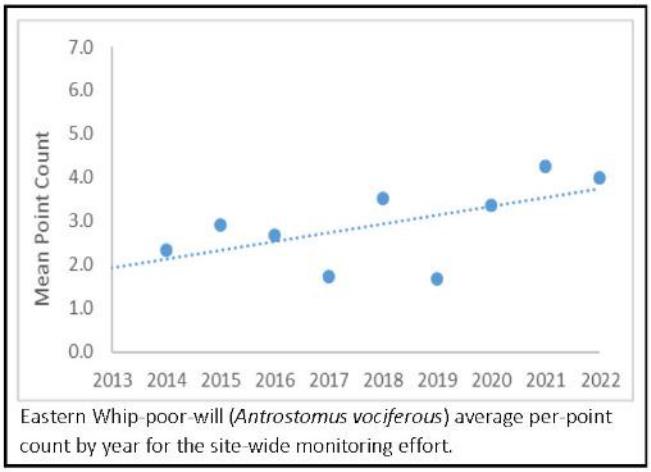


- The one species showing a declining trend with statistical significance at Camp Edwards is Upland Sandpiper, which is only declining when looking at the MAARNG managed grasslands alone. This species is showing significantly positive trends in both occupancy and abundance documented in the 2017-2022 point counts conducted on the airfield by the US Coast Guard. With this context the overall trends at JBCC are positive and reflect a selection for the current mowing regime at the airfield and scale

of available habitat. This additional data will be incorporated with the MAARNG analysis for reporting.

- The figure above presents species that all have statistical significance in abundance trends and represent a wide variety of habitat associations from mature forest to open shrub/savannah. Additionally, species such as the Eastern Meadowlark are showing strong and significant increases.
- How many of these trends are sustainable in the long-term given broader regional trends is uncertain, but these trends continue those seen with other long-term bird monitoring conducted annually from 1994 through 2013 at Camp Edwards. The scale of property combined with the extent and diversity of habitat restoration and maintenance provides a critical refugia and source population for a diverse assemblage of fauna. Such is only possible with the concentrated conservation effort of Department of Defense in support of the military mission.
- These broadly positive trends underscore the importance of restoration and stewardship even within forested habitats to address historic land use from hundreds of years. Forestry and prescribed fire are critical tools to provide diversity in structure, age, and species in all habitats, including working to develop older-growth forest characteristics in homogenous, dense regrowth woodlands. These bird population trends also indicate the alignment of goals and methods for addressing long-term climate targets and climate resilience with biodiversity and healthy ecosystems.

- **Eastern Whip-poor-will (EWPW)**
  - MAARNG NR-ITAM personnel conducted EWPW point-count transect surveys on 15 May, 2022. Three transects were conducted concurrently on one night covering 32 point-count locations throughout the northern training area. Whip-poor-wills were detected at all 32 locations for 100% occupancy. The mean per-point count was 4.0 birds, continuing a long-term stable to increasing trend from 2013 through 2021. Surveys are completed in coordination with MADFW and follow the North-eastern Nightjar Survey protocol. Additional, more opportunistic point-count surveys were conducted prior to the formal survey window and main survey night to provide greater confidence in results. A full report on the effort has been sent to MADFW. The first publication stemming from migration research conducted at Camp Edwards, in part, was published in 2022 by Bakermans, et al (https://ace-eco.org/vol17/iss2/art17/).



Eastern Whip-poor-will (*Antrostomus vociferous*) average per-point count by year for the site-wide monitoring effort.

- **Lepidoptera (Moths and Butterflies)**
  - Pine Barrens Moths: In early FY 2022, Western EcoSystems Technology, Inc. (WEST) completed a statistically robust and comprehensive moth monitoring protocol continued through a contract from MAARNG NR-ITAM. The overall protocol has a foundation of vegetation surveys that will evaluate change in structure and composition at a large number of sites. A subset of sites will be monitored with the protocols developed for nocturnal moth sampling and targeted diurnal sampling. Davey Resource Group was contracted to complete the second year of vegetation sampling in September of 2022. GZA completed the initial nocturnal UV trapping effort in the summer of 2022, and their contract includes a second year of sampling in 2023. The first sampling year included documentation of a new state-listed species for the site, *Heterocampa varia*. Diurnal sampling for Barrens Buckmoth (*Hemileuca maia*) caterpillars is anticipated to start in 2023.

Barrens Buckmoth had a strong year in FY22 for both larva and adult flight. The larva is well protected by elaborate spines that can deliver a painful sting. ***Jake McCumber***

  - Frosted Elfin Butterfly and Slender Clearwing Moth: The Frosted Elfin Butterfly (*Callophrys irus*) is state-listed and being considered for federal listing. MAARNG NR-ITAM completed three formal surveys in May through July following the range-wide protocol developed by USFWS including a multi-step protocol covering vegetation, adults, and larvae. One survey unit is within the Sandplain Grassland Mitigation Focal Area (Primary) while another is within the Sierra Range barrens habitat mitigation area (Training Area E-6, not part of the CMP mitigation). The third location is in the powerline right of way along the western edge of the base (Training Area B-9). Frosted Elfins were detected as adults at all three locations and appear to be expanding, including presence in a new portion of the Sierra Range area following 2021 prescribed fire. Larval surveys were completed with ultraviolet (UV) flashlights in the grasslands. This technique is particularly effective for Frosted Elfins, Slender Clearwing Moths (*Hemaris gracilis*), Barrens Buckmoth and other listed or otherwise rare Lepidoptera. Three nights of caterpillar surveys were completed in June and July 2022 covering two of the three sample sites with Frosted Elfins documented foraging on Wild Indigo (*Baptisia tinctoria*) at all three. Slender Clearwing Moth was again documented at both nocturnal survey locations (Tango Range and grasslands). Of particular note for both of these rare habitat specialists is their dramatic and quick response to a spring grassland prescribed burn. The June 16th and June 29th nocturnal surveys documented abundant larvae of both Frosted Elfin and Slender Clearwing Moth centrally within a 65 acre prescribed burn conducted on April 11th. Only brief surveys were conducted each night to avoid disturbance, but relatively high densities of both species demonstrates the success and importance of patch-burning to maintain habitat. Sufficient surrounding habitat produced adults to rapidly take advantage of widespread sprouting host plants.

- General Moths: More opportunistic moth survey and documentation has continued forward from 2019. During FY22 a continued partnership with Teá Kesting-Handly, a graduate student from UMass Boston, led to multiple UV-light moth surveys with the two primary locations situated within mitigation focal areas SGMFA (Primary) and PBMFA (West). These efforts have led to documentation of several listed species and other species of significant conservation concern. Additionally, informal diurnal photography efforts by Jake McCumber continue to document rare barrens species. Of particular management interest is documentation of many barrens specialists that are poorly represented in New England or throughout their ranges, but persisting in fire maintained habitat at Camp Edwards. The growing suite of online identification aids and digital photography are significant facilitators allowing for better documentation, in particular, of microlepidoptera. The most significant result of these efforts in 2022 was the observation and life history documentation of a new species for New England. *Anacampsis lupinella* is a micromoth that appears to be somewhat abundant, though patchily distributed, in the grasslands and similar habitats such as the Gibbs powerline right-of-way. It is typically associated with Sundial Lupine (Lupinus perennis), but, apparently like the Frosted Elfin, also uses Wild Indigo as a host plant. This species has likely existed here and throughout scattered barrens habitat in the region as a native species, but was overlooked due to secretive habits. Significant assistance was provided by the US Department of Agriculture Animal and Plant Health Inspection Service (Hannah Nadel and Steven Passoa) and a manuscript is in development with the life history information.

Bright late-summer fruit of Broad Tinker's-weed within a glacial frost bottom. *Sophia Roemer*

  - **State- listed Plants** – The CMP does not have specific state-listed plant monitoring requirements, but does reference monitoring and reporting will be done. How best to monitor these plants, particularly Adder's Tongue Fern (*Ophioglossum pusillum*) and Broad Tinker's-weed (*Triosteum perfoliatum*), while minimizing disturbance is still a topic of mutual interest and discussion with MassWildlife. Six rare plant sites (frost bottoms) were surveyed for Triosteum in 2022 with five having presence and one without continuing a decline at that site. Additional effort went to monitoring the effectiveness of the corral style fence at a frost bottom rare plant site. Game cameras and brows surveys show that browse and deer access are eliminated while the fence has the benefit of being wooden and temporary without soil impacts or digging that may present a safety hazard. The technique may be warranted elsewhere. Ophioglossum was only observed at one of four sites surveyed for that species showing a similar pattern as the state-wide population.

- **Habitat Management and Planning**
  - **Planning** – Planning effort has primarily focused on updating the Camp Edwards Integrated Wildland Fire Management Plan. This important guiding document will facilitate long-term success of the mitigation and other conservation efforts at Camp Edwards.
  - **Pine Barrens Mechanical Restoration** – A whole-tree harvest project was contracted in FY21 for winter (FY22) implementation in Training Area E-3 (Burn Unit RAW3, PBMFA-West). Due to increased costs of implementation the project was scaled down to the highest priority 27 acres,

which exposed an overgrown kettle hole depression and its "airshed" with intent of restoring frost bottom ecological function. This project is restoring scrub oak shrubland habitat transitioning into pitch pine – scrub oak habitat at the transition from glacial moraine to the impact area. This is the highest priority type of restoration effort as it restores impact area type habitat in areas where habitat maintenance actually can be implemented and this project was adjacent to the previously restored OP9/OP10 area. The harvest was completed December 29th, 2021 and initial results look promising for a functional frost bottom. The remainder of the originally planned harvest was contracted in November, 2022, and is ongoing.

- **Other Habitat Maintenance/Restoration**
  - An invasive shrub treatment was contracted for fall 2021 that included 14 acres of Grassland Unit (GLU) 04a, which is the southeastern portion of SGMFA-Primary. This treatment targeted Honeysuckle (*Lonicera japonica*), Autumn Olive (*Eleagnus umbellata*), Multiflora Rose (*Rosa multiflora*), and other priority invasive plants. It was successfully completed November 3rd, 2021. Herbicide application is a critical piece of habitat conservation and restoration and is implemented with numerous best management practices and use minimization.

Ongoing habitat restoration in Training Area C-14 (PBMFA-North). The area to the left (south) has been treated with prescribed fire and selective removal of tree oak sprouts. At the time of the photo (October 2022) the north side had received neither following the 2018 thinning. Selective treatment of tree oak sprouts is critical to restoration of pitch pine – scrub oak natural communities. *Jake McCumber*

  - An invasive plant management project, contracted in FY22 and completed in the beginning months of FY23 (Oct-Nov) included 50 acres of low woody invasive shrubs and vines in Grassland Unit 04a and 04d. Fourteen acres was follow-up treatment to persistent and overlooked plants from the 2021 treatment (04a) and the remaining acreage followed prescribed burns carried out in the spring 2021 (04a) and spring 2022 (04d).
  - Hand-pulling of Spotted Knapweed (*Centauria stoebe*) was implemented across approximately 5 acres at Demo-2 (PBMFA-North) and Wheelock Overlook (PBMFA-West) to reduce encroachment into restored areas by this aggressive invasive plant.
  - Targeted spot-treatment with Glyphosate was used to control the invasive grass Calamagrostis epigejos within SGMFA-Primary (central grasslands), PBMFA-North (Training Area C-14), and PBMFA-South (Training Area B-6) to treat early detections and hopefully avoid broad habitat loss. This grass is a high priority for MassWildlife and MAARNG due to its tendency to create monocultures and expand rapidly – eliminating habitat value and use.
- **Prescribed Burning**
  - Seven prescribed burns were conducted within mitigation areas in FY2022. Programmatic rebuilding following the impacts of the pandemic on fire programs led to a very successful prescribed burning year that is planned to continue building. We well met annual targets

(100 acres of pine barrens, 40 acres of grassland) and successfully burned 227.5 acres in mitigation areas during FY2022.

- A spring grassland prescribed burn was conducted in SGMFA-Primary, GLU4C and GLU4D (northern 2/3 of the western half of the mitigation area). This 65 acre burn was conducted on April 11, 2022, and led to significant rare species observations including the above described influx of Frosted Elfin Butterflies and Slender Clearwing Moths. Continuing a relatively high return frequency (every 3 years) on rotation with the surrounding units will be important to maintain and improve the grassland/heathland habitat conditions of this unit. In balancing conditions for grassland birds and species like Frosted Elfin the scattered mature tree canopy should be maintained, but this leads to continual maintenance to reduce heavy encroachment from younger woody plants.
- A significant effort of planning and implementation went into a complex set of units on the moraine ridge in PBMFA-West (Training Area E-2). Four burn operations were conducted within quick succession (22, 24, 25, and 30 April, 2022) to set up the more complicated units by effective managing downwind fuels and other challenges with the burn scheduling. These four units totaled 99.5 acres of high priority habitat. One subunit was burned for the third time and is now likely in "maintenance mode" allowing for longer return intervals. The second subunit was burned for the second time as a critical stage in its restoration. The two northern subunits were each burned for their first time, which was greatly facilitated by the strategic scheduling and implementation.
- Two subunits were burned with growing season fire in PBMFA-South (Training Area B-6) to both allow for safe operations with the density and height of scrub oak in the unit and provide for habitat diversity through fire effects. The two operations (06 and 15 June, 2022) totaled 63 acres in high priority pitch pine – scrub oak habitat. Much like in grasslands, patchwork burning with diverse fire treatments (seasonality, intensity, etc.) is critical to meeting habitat and rare species conservation objectives.

Grassland Unit GLU04D in July, 2022, following an April prescribed burn. In 2022 the foreground of this image supported Walsh's Digger Bee (*Anthophora walshii*), Frosted Elfin Butterfly, and Slender Clearwing Moth among many other species. Transitions from open sandy blowout to lush grass/forb regeneration are essential to support species diversity in barrens habitats. Dynamic, early successional mosaics support a rich and resilient community of species, many of which are very uncommon regionally or globally and are highly localized within such habitat. *Jake McCumber*

Fiscal Year 2023 Planning and Implementation

Army National Guard budgets have again been substantially reduced in FY23, impacting facilities and environmental programs throughout the country. However, $341,000 has been funded specifically for state-listed species conservation projects between dedicated mitigation under the master development plan CMP ($118,000; MA175180002), other state-listed species projects ($47,000; MA175150003), and an additional $176,000 that has been funded through supplemental sources to cover the primary mechanical restoration project for FY23 (RAW3 forest thinning). Other monitoring and habitat restoration funding supports the mitigation implementation requirements. The robust and proactive structure of the master plan CMP was specifically developed to minimize or eliminate negative impacts from low funding years as extensive mitigation has been completed, as reported above, while minimal construction implementation has occurred under the Permit. As the initial mitigation requirements are met for actions such as major monitoring plan development and primary MILCON acreage requirements, the perpetual requirements funding will predominantly shift to the state-listed species funding tied to the CMP similar to the FY22 funding. Annual expenses after the first five or so years will decrease significantly as MAARNG shifts to focus on annual maintenance and management targets, resource monitoring, and data analysis.

Eastern Box Turtles have been and remain a major investment of funds and time, including research collaborations. MAARNG has been working on several fronts to better understand their ecology, land use history effects on their response to management, parasite impacts, and fire ecology. *Jake McCumber*

Mechanical implementation of habitat mitigation is expected to be similar to FY22 with one primary, high priority restoration effort. Significant focus has gone into planning and facilitation to continue increasing prescribed fire implementation. As mapped and described below numerous prescribed burn priorities are planned throughout the training site in various mitigation focal areas to continue restoration and maintenance of pine barrens and sandplain grassland mosaic conditions.

Monitoring and research efforts will be focal for FY23 with the continued implementation of the long-term moth monitoring protocol and ongoing box turtle research in partnership with UMass Amherst, MassWildlife, and US Fish and Wildlife Service.

- **Project Scoping, Design Minimization, and NHESP Review**
  - **MPMG Range –** Completion of the Environmental Management Commission process will hopefully be in 2023 along with approval and contracting for construction. Submission and completion of all pre-Work required information and tasks will be completed as appropriate and able prior to construction along with any adjustments to turtle protection plans or schedules.
  - **Tango Range –** Final reporting is in development and preparation for submission to NHESP to close out the construction phase of the project and move into long-term maintenance and use.

- **Track and Field (1800 area) –** Depending on funding the contracting of this project is anticipated during FY23. Contracting and implementation of the approved turtle protection plan and all other pre-Work requirements will be submitted for approval and completed as appropriate and able prior to construction.
- **ISBC Range –** Design consultation and internal review are ongoing with external reviews pending. It is anticipated that the CFMO will contract the turtle protection plan and other required support (e.g., permit compliance letter) given current funding if the project is slated to move forward in FY23. Submission and completion of all pre-Work required information and tasks will be completed as required prior to construction, to include approval and implementation of turtle protection, design review, etc.

- **Species Protection**
  - **MPMG Range** – Resumption of turtle protection efforts including silt fence installation and construction support consistent with approved turtle protection plan. This will include replacing the silt fence at the soil staging site and continued monitoring.
  - **Track and Field** – Initiation and compliance of turtle protection plan consistent with approval if construction project is funded and awarded.

The Acadian Hairstreak Butterfly is increasingly rare in MA, but appears to be faring well in barrens habitat at Camp Edwards. While not state-listed, listing has been proposed. A more dedicated survey for this species may be implemented in 2023 along with investigating the potential hosts. *Jake McCumber*

- **Species Monitoring**
  - **Eastern Box Turtles** – Ongoing in-house monitoring of box turtles found both opportunistically and during targeted surveys in 2019, 2020, and 2021 near future construction projects as well as those found during planning level surveys. Support for two graduate research projects focusing on efforts related to fly larval impacts and prescribed fire impacts. Review of health assessment results and continued coordination with university veterinarians.
  - **Bird Surveys** – Cantonment and training area point count surveys and Eastern Whip-poor-will surveys.
  - **Lepidoptera (Moths and Butterflies) –** Implementation of moth monitoring plan, including vegetation surveys, UV trap sampling, and pilot larval surveys for Barrens Buckmoth, depending on resources. Formal Frosted Elfin surveys will be conducted along with supplemental larval surveys for Frosted Elfin and Slender Clearwing Moth.

- **Habitat Management and Planning (see map below)**
  - **Prescribed Fire** – Priority prescribed burn areas for mitigation include:
    - PBMFA-West: Training Areas A-5, B-7, and BA-4 maintenance fires for pitch pine – scrub oak and pitch pine – heath habitat up to approximately 617 acres.
    - PBMFA-South: Training Areas B-6 and B-7 maintenance fires for pitch pine – scrub oak and pitch pine – heath habitat up to approximately 502 acres.

- SGMFA-Primary: Approximately 58 acres are prioritized for the more wooded northeastern portion of the mitigation area to facilitate slower conversion to savannah conditions suitable for frosted elfin and similar species while maintaining soil-disturbance sensitive plants. Approximately 16 acres are prioritized for the southwestern portion to maintain open grassland habitat.

- **Mechanical and Other Restoration** –
  - Phase two of the RAW3 (Training Area E-3, PBMFA-North) frost bottom restoration and surrounding forest thinning. This phase facilitates air-flow for frost bottom ecological function, which also will provide high quality pitch pine – scrub oak natural community outside the impact area. Phase two is 47 acres of thinning with a patchy distribution of treatment being implemented in the winter of 2022/2023.
  - Long-term and small scale patch mowing of understory shrubs and small trees will continue in Training Area BA-6 (PBMFA South) to provide complex structural diversity in support of both training and habitat objectives. Approximately 7 acres will be mowed in FY23.
  - A 30-acre coppice treatment of tree oak regeneration in the C-14 restoration area (PBMFA-North) was contracted in FY22 for completion in October and November 2022 (FY23). These coppice treatments are strongly recommened by MassWildlife and are critical to restoring functioning pitch pine – scrub oak natural community and similar habitats. Selective methods are used including cutting all resprout stems from some stumps and sponge-wiping cuts with herbicide while other stumps will have all but one stem cut and no herbicide applied. These treatments facilitate long-term habitat development, coupled with prescribed fire.
  - Completion of a 50-acre invasive shrub treatment (described above) within SGMFA-Primary that was contracted in FY22 for fall 2022 completion.

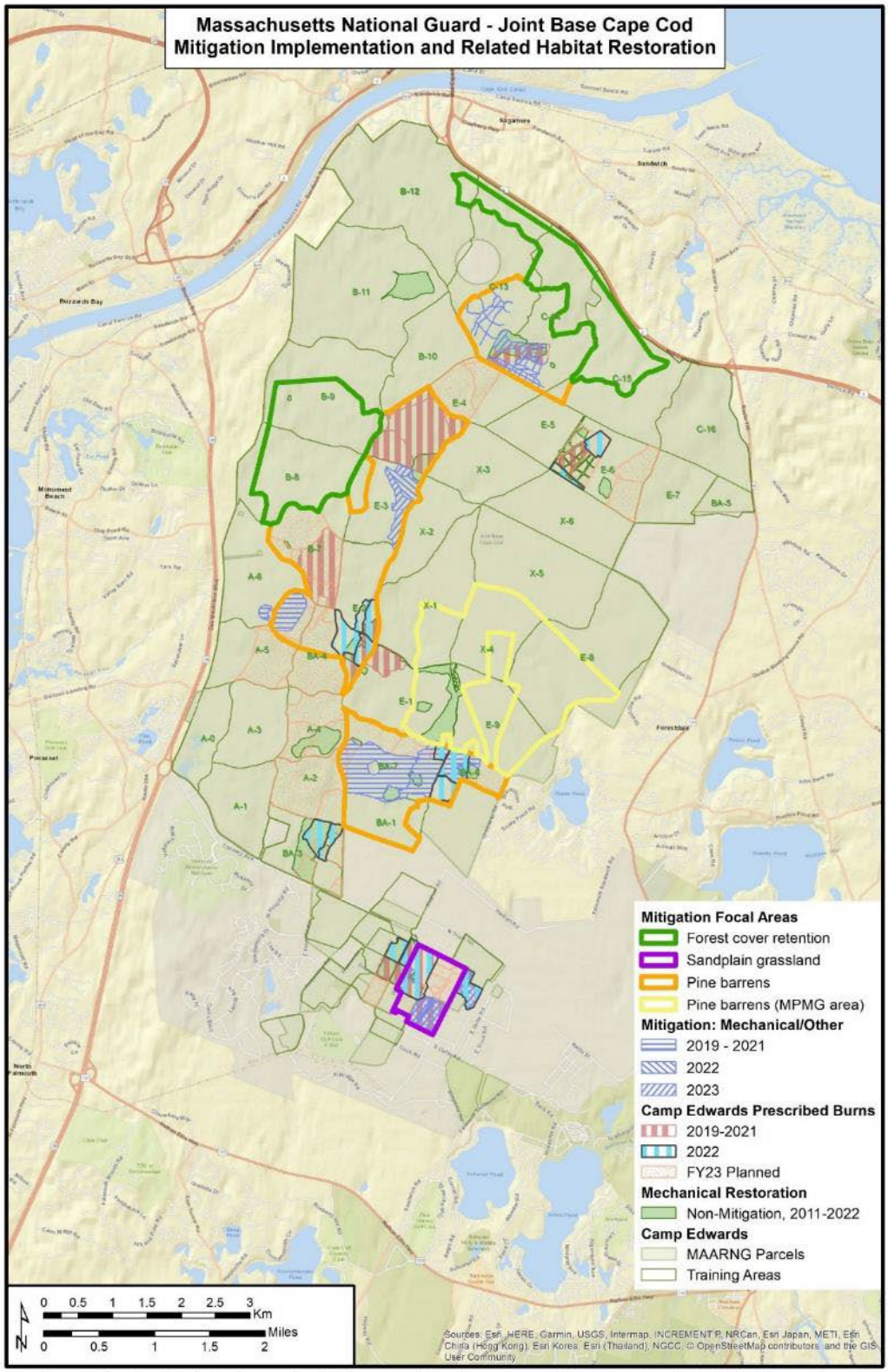
- **Rare species and mitigation outreach:** while outreach for rare species is not required or discussed in the CMP, other than contractor education, public outreach on rare species is important for long-term support of conservation efforts at Camp Edwards and elsewhere, including mitigation efforts.
  - **Camp Edwards Tours** – Base-wide tours of Camp Edwards have been well attended and popular with the public. Mission activities and habitat conservation are the primary topics, including extensive discussion of rare species, habitat needs, and ongoing mitigation efforts under the CMP. These tours have garnered notable interest in listed fauna and early

Grassland bird tours at Camp Edwards are highly popular with bird enthusiasts and the general public. They are an exceptional outreach opportunity to engage about rare species and habitat management, including the keys to grassland management of fire, mowing, and herbicide. These tours are often people's first introduction to fire ecology, habitat management concepts, and species like the Grasshopper Sparrow. *Kathleen Kolva*

successional habitat. FY22 tours averaged two per month from October through December and April through September.

- **Grassland Bird Tours** – MAARNG hosted five public tours in May and June focusing on localized specialties of sandplain grassland habitat at Camp Edwards. These have long been productive out-reach with the public and bird enthusiasts for both grasslands habitat conservation and military conservation. Everyone was particularly enthusiastic for the return of the tours after two years off and they were all fully attended with 20 participants each.
- **Public presentations** – MAARNG personnel, particularly Jake McCumber, gave multiple other public or wide audience outreach presentations focused on state-listed species and rare habitat management during FY22. Multiple evening presentations were given to the Upper Cape Naturalist Club including ones on Barrens Buckmoth (with guided tour at Crane WMA), grassland birds of Camp Edwards (associated with tours), and a Camp Edwards overview. We hosted a MA Butterfly Club tour and discussion of Camp Edwards management, including a survey for Acadian Hairstreak Butterflies (*Satyrium acadica*), which is proposed for state-listing, and other barrens specialties. We also presented an hour-long webinar to US Fish and Wildlife Service At-risk Species conservation stakeholders regarding state-listed and At-risk Species conservation efforts. Two community television interviews were aired that included discussions of rare species and habitat conservation at Camp Edwards, in addition to a variety of special group and public presentations including MA Maritime Academy, USDA-APHIS, Bourne Newcombers, Cape Cod Masons, Mashpee seniors, and others. All such outreach events focused on the importance and benefits of rare species conservation and habitat management with particular focus on pine barrens and sandplain grasslands.

Frosted Elfin Butterfly (left) and Eastern Box Turtle with radio transmitter (right). *Jake McCumber*



Map of Camp Edwards mitigation implementation (habitat restoration and management) from 2019 through 2022, including ongoing and planned 2023 efforts. Designated mitigation areas from the Conservation and Management Permit are also shown, as are Camp Edwards Training Areas for reference.

APPENDIX G
RARE SPECIES REPORTED TO NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM

Appendix G - LIST OF RARE SPECIES REPORTED TO NHESP												
Quantities shown[1] are not simply results of standardized surveys and do not represent population trends. Only observed species are listed[2].												
			Individuals Reported									
Common/Scientific Names	**Fed Status[3]**	**State Status[4]**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**	**TY 2022**
BIRDS												
Grasshopper Sparrow[5] *(Ammodramus savannarum)*	-	T	19	26	23	16	15	16	20	34	36	29
Northern Harrier[6] *(Circus cyaneus)*	-	T	8	12	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper[5] *(Bartramia longicauda)*	-	E	5	2	4	9	8	7	12	6	2	1
Eastern Meadowlark[5,7] *(Sturnella magna)*	-	SC	3	1	0	8	3	2	7	14	17	9
Long-eared Owl[6] *(Asio otus)*	-	SC	0	1	0	0	0	0	0	0	0	0
Vesper Sparrow *(Pooecetes gramineus)*	-	T	3	1	0	0	0	0	0	0	0	0
Whip-poor-will *(Antrostomus vociferous)*	-	SC	51	156	96	87	52	110	53	99	136	137
Bald Eagle[6] *(Haliaeetus leucocephalus)*	-	SC	0	0	3	0	0	0	0	0	0	0
REPTILES and AMPHIBIANS												
Eastern Box Turtle *(Terrapene carolina carolina)*	-	SC	1	15	13	38	42	43	58	45	83	62
Eastern Hog-nosed Snake *(Heterodon platirhinos)*	-	SC	0	0	0	2	3	8	9	1	2	6
PLANTS												
Adder's Tongue Fern[8] *(Ophioglossum pusillum)*	-	T	542	1467	256	98	247	0	25	646	N/A	225

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			Individuals Reported									
Common/Scientific Names	**Fed Status[3]**	**State Status[4]**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**	**TY 2022**
Spring Ladies Tresses *(Spiranthes vernalis)*	-	T	0	0	0	0	0	0	0	0	3	0
Broad Tinker's Weed[8] *(Triosteum perfoliatum)*	-	E	1230	297	N/A	113	127	0	200	6	N/A	1883
American Arborvitae[9] (*Thuja occidentalis*)	-	E	0	0	0	4	N/A	N/A	N/A	N/A	N/A	N/A
BEES												
Walsh's Anthophora[10] *(Anthophora walshii)*	-	E	0	0	0	0	5 (1)	0	32 (9)	4	N/A	1
BUTTERFLIES and MOTHS[11]												
Buck Moth (*Hemileuca maia*)	-	SC	0	4	13	90	95	0	4	2	74	133
Pine Barrens Speranza *(Speranza exonerata)*	-	SC	0	0	0	44	13	0	0	0	0	4
Sandplain Euchlaena *(Euchlaena madusaria)*	-	SC	0	0	0	3	7	0	0	1	0	0
Heath Metarranthis *(Metarranthis pilosaria)*	-	SC	0	0	0	1	1	0	0	0	0	0
Melsheimer's Sack Bearer *(Cicinnus melsheimeri)*	-	T	0	0	0	2	0	0	0	7	0	0
Gerhard's Underwing *(Catocala herodias)*	-	SC	0	0	0	33	10	0	0	2	0	35
Pine Barrens Zale *(Zale lunifera)*	-	SC	0	0	0	13	8	0	0	0	0	0
Barrens Dagger Moth *(Acronicta albarufa)*	-	T	0	0	0	1	0	0	0	0	0	0
Sandplain Heterocampa *(Heterocampa varia)*	-	T					0	N/A	N/A	N/A	N/A	1

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Quantities shown[1] are not simply results of standardized surveys and do not represent population trends. Only observed species are listed[2].												
			Individuals Reported									
Common/Scientific Names	**Fed Status[14]**	**State Status**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**	**TY 2022**
BUTTERFLIES and MOTHS[11]												
Chain-dotted Geometer *(Cingilia catenaria)*	-	SC	0	0	0	0	0	0	1	0	0	0
Drunk Apamea *(Apamea inebriata)*	-	SC	0	0	0	1	0	0	0	0	0	0
Pink Sallow *(Psectraglaea carnosa)*	-	SC	0	0	0	9	5	0	0	0	0	0
Pink Streak *(Dargida rubripennis)*	-	T	0	0	0	25	0	0	0	3	1	1
Collared Cycnia *(Cycnia collaris)*	-	T	0	0	0	0	1	0	11	33	200	7
Coastal Heathland Cutworm *(Abagrotis benjamini)*	-	SC	0	0	0	0	1	0	0	0	0	0
Woolly Gray *(Lycia ypsilon)*	-	T	0	0	0	0	2	0	0	0	0	0
Water-willow Stem Borer *(Papaipema sulphurata)*	-	T	0	0	0	0	1	0	0	0	0	0
Waxed Sallow Moth *(Chaetaglaea cerata)*	-	SC	0	0	0	0	2	0	0	0	0	0
Frosted Elfin *(Callophrys irus)*	-	SC	0	0	0	5	5	5	TBD	25	57	13
Slender Clearwing Sphinx *(Hemaris gracilis)*	-	SC	0	0	0	0	0	0	0	5	3	26
ODONATES												
Scarlet Bluet				N/A	N/A	N/A	N/A			6		

Appendix G - LIST OF RARE SPECIES REPORTED TO NHESP												
Quantities shown are not resulting of standardized surveys, and should not be interpreted as population trends												
			Individuals Reported									
Common/Scientific Names	**Fed Status[14]**	**State Status**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**	**TY 2022**
CRUSTACEANS												
Agassiz's Clam Shrimp[12] *(Eulimnadia agassizii)*	-	E	0	0	1	0	6	38	9	3	*5*	N/A
American Clam Shrimp[12] *(Limnadia lenticularis)*	-	SC	0	0	0	0	0	0	0	0	3	N/A
MAMMALS												
Northern Long-Eared Bat[13] *(Myotis septentionalis)*	T	E	0	8	22 (2)	15 (1)	2	1	3	1	TBD	N/A
Little Brown Bat[7] *(Myotis lucifugus)*	UR	E	0	4	40	22	4	2	6	2	TBD	N/A
Tricolored Bat[7] (Perimyotis subflavus)	UR	E	0	11	11	*7*	3	2	3	1	TBD	N/A
Eastern Small-Footed Bat[13] *(Myotis leibii)*	UR	E	0	0	0	0	0	0	1	1	TBD	N/A

[1] Reported quantities are variable dependent upon survey effort, area/species of focus in a given year, opportunistic observations, and other influences. MAARNG reports all state-listed species observations consistent with the Environmental Performance Standards, with some caveats noted below.

[2] A full state-listed species list is included in the INRMP.

[3] Federal Status: E = Endangered, T = Threatened, UR = Under Review (status assessment or listing determination ongoing)

[4] State Status: E = Endangered, T = Threatened, SC = Special Concern

[5] 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.

[6] 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).

[7] 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.

[8] In 2018 only sites with historic records and no recent records were surveyed.

[9] NHESP is not interested in tracking this population, as it is likely of anthropogenic origin (pers. comm. with State Botanist, Bob Wernerehl).

[10] MAARNG contracted a targeted survey for *Anthophora walshii* 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.

[11] Caterpillar clusters are reported as a single observation. Barrens Buckmoths received dedicated flight count attention in 2021 and 2022, thus the large increase in reported observations. Caterpillar clusters are reported as a single observation. Barrens Buckmoths received dedicated flight count attention in 2021 and 2022, thus the large increase in reported observations.

[12] MAARNG staff did not perform surveys for *Callophrys irus* in 2019, but facilitated USFWS surveys. Results are pending, but USFWS staff found Frosted Elfins across a wider area than was previously known.

[13] Numbers represent occupied locations with confirmed identification.

[14] 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).

APPENDIX H
ENVIRONMENTAL PERFORMANCE STANDARDS VIOLATIONS HISTORY

EPS VIOLATIONS HISTORY			
TRAINING YEAR	REPORTED VIOLATION	EXPLANATION OF VIOLATION	CORRECTIVE ACTION
TY 2022	General Performance Standard	There was unauthorized use of yellow and white smoke grenades outside of the approved non-standard training plan. White smoke grenades were not approved for use; yellow smoke grenades were used in an unapproved location. The MAARNG reported the nonconformance to the EMC on March 31, 2022.	Full-time range and civilian staff were counseled on their failure to follow established processes for consultation and approval for any non-standard training event; staff were directed that only written non-standard training plans, signed by the EMC EO and the MAARNG representative will be executed, and no verbal authorizations will be authorized. Refresher training was conducted with part-time staff to ensure compliance.
TY 2021	Range Performance EPS (EPS 19)	Additional targets were placed on the 25-meter line on Sierra Range. Transition firing was conducted on Echo Range. No consultation for approval was conducted with Camp Edwards Plans and Training, the Environmental & Readiness Center and the EMC's Environmental Officer. The MAARNG reported the nonconformance to the EMC on February 18, 2021.	Full-time Range Control staff were counseled on the importance of following established processes of consultation and approval for any non-standard training event; the Range Control maintenance manager was directed that he shall not alter or install additional targets 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; OIC formalized non-standard training requests (exceptions to policy) in a Standard Operating Procedure; full-time Range Control staff was retrained; and those personnel involved in approving the non-standard training were given written counseling. 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.
TY 2020	Training Area Fire Management EPS (EPS 11)	Three burn barrels (55-gallon drums) were found at SVLs 1 and 2. The MAARNG reported the nonconformance to the EMC on October 25, 2019.	All full-time and Mobilization Day staff are instructed to review Training Area Clearing processes and be re-briefed on guiding regulations and standards that apply to the Training Area/Reserve. Clear and obvious signage stating that open burning is prohibited has been posted at Range Control. The Camp Edwards Operations and Training Regulation 350-2 has been updated to clearly state the

			requirement for clearing training areas and that open burning is prohibited on Camp Edwards.
TY 2019	General Performance Standard	Three L600 M119 whistling booby trap simulators were used; they are not on the approved munitions list and were not authorized for use. The MAARNG reported a nonconformance to the EMC on September 17, 2019.	All levels: command, units training and the ASP will be provided a list of items permanently and temporarily authorized for a particular training event. The ASP will make a change in their ammunition reservation program that will not allow unauthorized ammunition or simulators to be reserved. Camp Edwards Range Control will do a final munition check as units check in for their reserved training area or venue.
TY 2018	Rare Species EPS (EPS 3)	A road puddle containing state-listed Agassiz clam shrimp was filled by a unit training at Dig Site 1. The MAARNG forwarded a formal notice of violation to the EMC on May 16, 2018.	Camp Edwards will, after relocation of the clam shrimp and in concert with the CMP, fill the puddles, use signage to avoid infilling of relevant puddles, and educate users as to how they are supposed to coordinate with Camp Edwards before taking actions outside of their training plan while in the Training Area/Reserve.
TY 2017	None	-----	-----
TY 2016	General Performance Standard	Eight thousand paintball rounds were fired by a unit on the IMT range (Dig Site 3) without permission or prior coordination. The MAARNG forwarded a formal notice of violation to the EMC on November 9, 2015.	Unit soldiers cleaned and cleared the area of debris, discussion of the seriousness of the violation with the Unit Commander and told of actions needed for compliance when wanting to train with any unapproved munition. Camp Edwards staff conducted a Range Officer in Charge and Range Safety brief audit to validate content and effectiveness. Range Control staff will conduct assessments of units while they are training in the Training Area/Reserve to ensure activities are within established performance standards.
TY 2015	Vehicle Performance Standard EPS (EPS 17)	A pickup truck was driven into, off road, and placed in Training Area BA-7 as a temporary training aid. The MAARNG forwarded a formal notice of violation to the EMC on June 5, 2015.	Camp Edwards staff conducted a Range Officer in Charge and Range Safety brief audit to validate content and effectiveness. Range Control staff will conduct assessments of units while they are training in the Training Area/Reserve to ensure activities are within established performance standards.
TY 2014	None	-----	
TY 2013	None	-----	-----