APPENDIX A
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 B
LIST OF CONTACTS

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APPENDIX C
SMALL ARMS RANGE AND SOLDIER VALIDATION LANE INFORMATION

Operations Maintenance and Monitoring Activities

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
JULIET & KILO RANGE
TY 2021

Date	Juliet	Kilo
1 Oct 20	Maintenance: 70 gallons pumped (1 cm)	Maintenance: 110 gallons pumped (W 4 cm; E 6.5 cm)
13 Oct 20	Maintenance: 70 gallons pumped (0 cm)	Maintenance: 80 gallons pumped (W 2 cm; E 6.5 cm)
20 Oct 20	Maintenance: 410 gallons pumped (0 cm)	Maintenance: 600 gallons pumped (W 0 cm; E 0 cm)

Note: The STAPP™ bullet capture systems on Juliet and Kilo ranges was dismantled in Fall 2020. Juliet and Kilo Ranges are currently operationally inactive ranges.

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
SIERRA & INDIA RANGES
TY 2021

Date	Sierra	India
4 Oct 20	-----	Pre/post-fire inspection
15 Oct 20	-----	Pre/post-fire inspection
16 Oct 20	Pre/post-fire inspection	-----
17 Oct 20	Pre/post-fire inspection	Pre/post-fire inspection
23, 24 Oct 20	-----	Pre/post-fire inspection
24 Oct 20	Pre/post-fire inspection	-----
7, 8 Nov 20	Pre/post-fire inspection	Pre/post-fire inspection
14 Nov 20	Pre/post-fire inspection	Pre/post-fire inspection
4, 6 Feb 21	Pre/post-fire inspection	Pre/post-fire inspection
6, 7 Mar 21	Pre/post-fire inspection	-----
13 Mar 21	Pre/post-fire inspection	Pre/post-fire inspection
14 Mar 21	Pre/post-fire inspection	-----
18 Mar 21	Pre/post-fire inspection	
19, 21 Mar 21	-----	Pre/post-fire inspection
20, 21 Mar 21	Pre/post-fire inspection	-----
25 Mar 21	Pre/post-fire inspection	-----
26, 27 Mar 21	Pre/post-fire inspection	Pre/post-fire inspection
7, 9 Apr 21	Pre/post-fire inspection	Pre/post-fire inspection
10 Apr 21	Pre/post-fire inspection	-----
14, 15 Apr 21	Pre/post-fire inspection	-----
16, 17 Apr 21	-----	Pre/post-fire inspection
16-18 Apr 21	Pre/post-fire inspection	-----
19, 20 Apr 21	Maintenance: Bullet pocket repair on berms	Maintenance: Bullet pocket repair on berms
1 May 21	Pre/post-fire inspection	-----
14, 15 May 21	Pre/post-fire inspection	-----
14, 16 May 21	-----	Pre/post-fire inspection
19 May 21	Pre/post-fire inspection	-----
21, 23 May 21	Pre/post-fire inspection	Pre/post-fire inspection
5, 6 Jun 21	Pre/post-fire inspection	Pre/post-fire inspection
8 Jun 21	-----	Pre/post-fire inspection
9 Jun 21	Pre/post-fire inspection	-----
11 Jun 21	Pre/post-fire inspection	
11, 12 June	-----	Pre/post-fire inspection
12, 13 Jun 21	Pre/post-fire inspection	-----
20 Jun 21	-----	Pre/post-fire inspection
20, 23 Jun 21	Pre/post-fire inspection	-----
25, 27 Jun 21	Pre/post-fire inspection	-----
9 Jul 21	Pre/post-fire inspection	-----
12, 13 Jul 21	Pre/post-fire inspection	Pre/post-fire inspection
18 Jul 21	Pre/post-fire inspection	-----

Date	Sierra	India
24 Jul 21	Pre/post-fire inspection	-----
27, 29 Aug 21	Pre/post-fire inspection	-----
10, 12 Sep 21	-----	Pre/post-fire inspection
11 Sep 21	Pre/post-fire inspection	-----
24, 25 Sep 21	Pre/post-fire inspection	-----

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
LIMA RANGE
TY 2021

Date	Activity
19, 21 Oct 20	Pre/post-fire inspection
30 Apr 21	Pre/post-fire inspection
16 May 21	Pre/post-fire inspection
10 Jun 21	Pre/post-fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
ECHO RANGE
TY 2021

Date	Activity
17 Oct 20	Pre/post-fire inspection
24 Oct 20	Pre/post-fire inspection
9, 13 Nov 20	Pre/post-fire inspection
14, 15 Nov 20	Pre/post-fire inspection
5 Feb 21	Pre/post-fire inspection
14 Mar 21	Pre/post-fire inspection
25 Mar 21	Pre/post-fire inspection
27 Mar 21	Pre/post-fire inspection
14, 15 Apr 21	Pre/post-fire inspection
16, 17 Apr 21	Pre/post-fire inspection
30 Apr 21	Pre/post-fire inspection
4 May 21	Pre/post-fire inspection
15, 16 May 21	Pre/post-fire inspection
21, 22 May 21	Pre/post-fire inspection
5 Jun 21	Pre/post-fire inspection
10 Jul 21	Pre/post-fire inspection
23, 24 Jul 21	Pre/post-fire inspection
27 Aug 21	Pre/post-fire inspection
28 Aug 21	Pre/post-fire inspection
10, 11 Sep 21	Pre/post-fire inspection
11, 12 Sep 21	Pre/post-fire inspection

Lead Ammunition Use

Juliet, Kilo, Tango and Echo Ranges

LEAD AMMUNITION USE HISTORY ECHO RANGE			
Training Year	**.40 Cal Lead**	**9 mm Lead**	**Total**
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**	**74,568**	**73,919**

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 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	**78,044**	**2,120**	**1,993**	**344,026**	**474,910**	**949,135**	**1,846,203**

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.

LEAD AMMUNITION USE HISTORY JULIET RANGE								
Training Year	**.40 Cal Lead**	**9 mm Lead**	**7.62 mm Lead**	**5.56 mm Lead**	**.38 Cal Lead**	**.45 Cal Lead**	**.233 Cal Lead**	**Total**
TY 2020	0	7,690	0	0	0	0	0	7,690
TY 2019	0	17,774	0	12,315	0	0	0	30,089
TY 2018	0	12,781	0	23,802	0	0	0	36,583
TY 2017	0	26,108	0	25,789	0	0	0	51,897
TY 2016	0	9,200	0	51,852	0	0	0	61,052
TY 2015	2,500	24,828	0	36,938	0	1,000	0	65,266
TY 2014	2,400	18,874	9,000	6,663	0	0	0	36,937
TY 2013	2,450	9,260	0	27,286	0	0	1,200	40,196
TY 2012	750	12,819	0	14,457	0	0	3,000	31,026
TY 2011	0	16,911	0	46,630	0	0	0	63,541
TY 2010	0	7,311	0	27,060	0	0	0	34,371
TY 2009	0	4,780	0	11,482	0	0	0	16,262
TY 2008	0	0	0	0	0	0	0	0
TY 2007	0	0	0	0	0	0	0	0
TOTAL	**8,100**	**168,336**	**9,000**	**284,274**	**0**	**1,000**	**4,200**	**474,910**

Note: A STAPP™ bullet capture system was installed at Juliet Range in August/September 2008 and dismantled in Fall 2020. Juliet Range is currently an operationally inactive range; the range was not used in TY 2021.

LEAD AMMUNITION USE HISTORY KILO RANGE								
Training Year	**.40 Cal Lead**	**9 mm Lead**	**7.62 mm Lead**	**5.56 mm Lead**	**.38 Cal Lead**	**.45 Cal Lead**	**.233 Cal Lead**	**Total**
TY 2020	0	61,480	0	21,052	0	1,500	0	84,032
TY 2019	0	44,428	0	36,751	0	0	0	81,179
TY 2018	0	25,803	0	93,539	0	0	0	119,342
TY 2017	0	50,147	0	65,515	0	0	0	115,662
TY 2016	0	21,373	0	28,265	0	0	0	49,638
TY 2015	0	15,601	0	54,372	0	0	0	69,973
TY 2014	0	31,304	0	49,052	0	0	0	80,356
TY 2013	0	731	0	73,011	0	0	0	73,742
TY 2012	0	7,181	0	52,731	0	0	0	59,912
TY 2011	14,362	9,850	0	100,942	0	0	0	125,154
TY 2010	1,450	7,500	0	51,412	0	0	0	60,362
TY 2009	0	6,675	0	23,108	0	0	0	29,783
TY 2008	0	0	0	0	0	0	0	0
TY 2007	0	0	0	0	0	0	0	0
TOTAL	**15,812**	**282,073**	**0**	**649,750**	**0**	**1,500**	**0**	**949,135**

Note: A STAPP™ bullet capture system was installed at Kilo Range in August/September 2008 and dismantled in Fall 2020. Kilo Range is currently an operationally inactive range; the range was not used in TY 2021.

LEAD AMMUNITION USE HISTORY TANGO RANGE									
Training Year	**.40 Cal Lead**	**9 mm Lead**	**7.62 mm Lead**	**5.56 mm Lead**	**.38 Cal Lead**	**.45 Cal Lead**	**.233 Cal Lead**	**.22 Cal Lead**	**Total**
TY 2017	0	2,250	4,240	9,380	0	0	0	625	16,495
TY 2016	0	4,200	0	0	0	0	0	0	4,200
TY 2015	0	5,240	0	1,720	0	0	0	0	6,960
TY 2014	0	0	0	3,220	0	0	0	0	3,220
TY 2013	1,600	1,800	0	2,000	0	0	4,550	0	9,950
TY 2012	2,800	7,373	0	1,944	0	0	0	0	12,117
TY 2011	5,200	6,765	0	25,157	0	0	0	0	37,122
TY 2010	40,341	2,496	0	41,042	0	6,449	0	0	90,328
TY 2009	0	31,985	0	105,077	300	0	0	0	137,362
TY 2008	4,075	9,094	4,556	0	0	0	0	0	17,725
TY 2007	0	0	0	8,547	0	0	0	0	8,547
TOTAL	**54,016**	**71,203**	**8,796**	**198,087**	**300**	**6,449**	**4,550**	**625**	**344,026**

Note: A STAPP™ bullet capture system was installed at Tango Range in July 2006 and dismantled in October 2017. During TY 2021, Tango Range was reconfigured for use as a copper ammunition-only zeroing range.

Copper Ammunition Use

Sierra and India Ranges

COPPER AMMUNITION USE HISTORY SIERRA AND INDIA RANGES				
Training Year	**Sierra Range 5.56 Copper**	**India Range 5.56 Copper**	**India Range 7.62 Copper**	**Total**
TY 2021	221,756	73,400	0	295,156
TY 2020	131,274	90,849	0	222,123
TY 2019	98,426	71,098	0	169,524
TY 2018	98,393	105,143	0	203,536
TY 2017	95,905	105,099	4,793	205,797
TY 2016	80,747	60,571	0	141,318
TY 2015	66,086	12,947	0	79,033
TY 2014	46,804	27,872	0	74,676
TY 2013	34,493	10,918	0	45,411
TY 2012	34,359	6,601	0	40,960
TOTAL	**908,243**	**564,498**	**4,793**	**1,477,534**

Note: Firing of copper ammunition began at Sierra Range on July 8, 2012 and at India Range on September 15, 2012.

Small Arms Range Sampling Reports

Soil Sampling Results

Fall 2021

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Antimony	1.5	mg/kg	300	Y	J	0.8	1.6	2.2	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Calcium	780	mg/kg		Y		15	55	110	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW9056	9/22/2021 19:56	Chloride	33	mg/kg		N	UM	13	33	33	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Copper	1.2	mg/kg	10,000	Y	J	0.24	0.88	5.5	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Iron	57	mg/kg		Y	J	9.1	22	88	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/5/2021 8:23	Lead	14	mg/kg	3,000	Y	Q	0.34	0.88	0.99	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Magnesium	400	mg/kg		Y		8.7	22	33	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.3	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Potassium	1600	mg/kg		Y		45	180	330	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW6010C	10/4/2021 15:12	Sodium	1700	mg/kg		Y		32	110	550	mg/kg
Echo	SSERNG001_SEP21A-09132021	SW9056	9/22/2021 19:56	Sulfate	28	mg/kg		N	UM	10	28	55	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Antimony	2.2	mg/kg	300	N	U	1.1	2.2	2.9	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Calcium	840	mg/kg		Y		20	73	150	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW9056	9/22/2021 20:12	Chloride	48	mg/kg		N	U	19	48	48	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Copper	6.3	mg/kg	10,000	Y	J	0.31	1.2	7.3	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Iron	11000	mg/kg		Y		12	29	120	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/5/2021 8:26	Lead	19	mg/kg	3,000	Y	Q	0.45	1.2	1.3	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Magnesium	1000	mg/kg		Y		11	29	44	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.3	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Potassium	670	mg/kg		Y		59	230	440	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW6010C	10/4/2021 15:15	Sodium	60	mg/kg		Y	J	42	150	730	mg/kg
Echo	SSERNG001_SEP21B-09132021	SW9056	9/24/2021 18:22	Sulfate	40	mg/kg		N	U	15	40	81	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Antimony	1.8	mg/kg	300	N	U	0.86	1.8	2.3	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Calcium	680	mg/kg		Y		17	59	120	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW9056	9/22/2021 20:29	Chloride	33	mg/kg		N	UM	13	33	33	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Copper	5.3	mg/kg	10,000	Y	J	0.25	0.94	5.9	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Iron	9500	mg/kg		Y		9.7	23	94	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/5/2021 8:30	Lead	15	mg/kg	3,000	Y	Q	0.36	0.94	1.1	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Magnesium	880	mg/kg		Y		9.3	23	35	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.2	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Potassium	520	mg/kg		Y		48	190	350	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW6010C	10/4/2021 15:32	Sodium	48	mg/kg		Y	J	34	120	590	mg/kg
Echo	SSERNG001_SEP21C-09132021	SW9056	9/22/2021 20:29	Sulfate	27	mg/kg		N	UM	10	27	55	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Antimony	1.7	mg/kg	300	N	U	0.82	1.7	2.2	mg/kg
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Calcium	630	mg/kg		Y		16	56	110	mg/kg
Echo	SSERNG002_SEP21-09132021	SW9056	9/22/2021 20:45	Chloride	36	mg/kg		N	UM	14	36	36	mg/kg
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Copper	4.9	mg/kg	10,000	Y	J	0.24	0.9	5.6	mg/kg
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Iron	8600	mg/kg		Y		9.3	22	90	mg/kg
Echo	SSERNG002_SEP21-09132021	SW6010C	10/5/2021 8:33	Lead	13	mg/kg	3,000	Y	Q	0.35	0.9	1	mg/kg
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Magnesium	760	mg/kg		Y		8.9	22	34	mg/kg
Echo	SSERNG002_SEP21-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.3	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Potassium	480	mg/kg		Y		46	180	340	mg/kg
Echo	SSERNG002_SEP21-09132021	SW6010C	10/4/2021 15:35	Sodium	35	mg/kg		Y	J	32	110	560	mg/kg
Echo	SSERNG002_SEP21-09132021	SW9056	9/22/2021 20:45	Sulfate	30	mg/kg		N	UM	11	30	60	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Antimony	1.6	mg/kg	300	N	U	0.79	1.6	2.2	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Calcium	610	mg/kg		Y		15	54	110	mg/kg
Echo	SSERNG003_SEP21-09132021	SW9056	9/22/2021 21:02	Chloride	37	mg/kg		N	U	14	37	37	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Copper	5.5	mg/kg	10,000	Y		0.23	0.86	5.4	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Iron	8500	mg/kg		Y		8.9	22	86	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/5/2021 8:37	Lead	14	mg/kg	3,000	Y	Q	0.33	0.86	0.97	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Magnesium	820	mg/kg		Y		8.5	22	32	mg/kg
Echo	SSERNG003_SEP21-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.3	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Potassium	480	mg/kg		Y		44	170	320	mg/kg
Echo	SSERNG003_SEP21-09132021	SW6010C	10/4/2021 15:39	Sodium	32	mg/kg		Y	J	31	110	540	mg/kg
Echo	SSERNG003_SEP21-09132021	SW9056	9/22/2021 21:02	Sulfate	31	mg/kg		N	UM	11	31	62	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Antimony	1.7	mg/kg	300	N	U	0.81	1.7	2.2	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Calcium	660	mg/kg		Y		16	55	110	mg/kg
Echo	SSERNG004_SEP21-09132021	SW9056	9/22/2021 21:18	Chloride	35	mg/kg		N	UM	13	35	35	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Copper	5	mg/kg	10,000	Y	J	0.24	0.88	5.5	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Iron	8600	mg/kg		Y		9.1	22	88	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/5/2021 8:40	Lead	14	mg/kg	3,000	Y	Q	0.34	0.88	0.99	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Magnesium	870	mg/kg		Y		8.7	22	33	mg/kg
Echo	SSERNG004_SEP21-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.4	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Potassium	500	mg/kg		Y		45	180	330	mg/kg
Echo	SSERNG004_SEP21-09132021	SW6010C	10/4/2021 15:42	Sodium	33	mg/kg		Y	J	32	110	550	mg/kg
Echo	SSERNG004_SEP21-09132021	SW9056	9/22/2021 21:18	Sulfate	29	mg/kg		N	U	11	29	58	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Antimony	1.6	mg/kg	300	N	U	0.79	1.6	2.1	mg/kg
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Calcium	680	mg/kg		Y		15	54	110	mg/kg
Echo	SSERNG005_SEP21-09132021	SW9056	9/22/2021 21:35	Chloride	38	mg/kg		N	UM	15	38	38	mg/kg
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Copper	6	mg/kg	10,000	Y		0.23	0.86	5.4	mg/kg
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Iron	9600	mg/kg		Y		8.9	21	86	mg/kg
Echo	SSERNG005_SEP21-09132021	SW6010C	10/5/2021 8:43	Lead	16	mg/kg	3,000	Y	Q	0.33	0.86	0.97	mg/kg
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Magnesium	920	mg/kg		Y		8.5	21	32	mg/kg
Echo	SSERNG005_SEP21-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.4	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Potassium	560	mg/kg		Y		44	170	320	mg/kg
Echo	SSERNG005_SEP21-09132021	SW6010C	10/4/2021 15:45	Sodium	36	mg/kg		Y	J	31	110	540	mg/kg
Echo	SSERNG005_SEP21-09132021	SW9056	9/24/2021 18:37	Sulfate	32	mg/kg		N	U	12	32	64	mg/kg
Echo	SSERNG005_SEP21-09132021LR	SW9056	9/22/2021 21:51	Chloride	38	mg/kg		N	UM	15	38	38	mg/kg
Echo	SSERNG005_SEP21-09132021SD	SW9056	9/22/2021 22:24	Chloride	609	mg/kg		Y		14	36	36	mg/kg
Echo	SSERNG005_SEP21-09132021SD	SW9056	9/24/2021 19:22	Sulfate	553	mg/kg		Y	M	11	30	60	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Antimony	1.7	mg/kg	300	N	UJ1	0.83	1.7	2.3	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Calcium	690	mg/kg		Y	J1	16	57	110	mg/kg
Echo	SSERNG006_SEP21-09132021	SW9056	9/22/2021 23:13	Chloride	35	mg/kg		N	UM	13	35	35	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Copper	8.4	mg/kg	10,000	Y	J1	0.25	0.91	5.7	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Iron	8800	mg/kg		Y	J1	9.4	23	91	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/5/2021 9:00	Lead	17	mg/kg	3,000	Y	Q	0.35	0.91	1	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Magnesium	840	mg/kg		Y	J1	9	23	34	mg/kg
Echo	SSERNG006_SEP21-09132021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.4	pH units		Y	HF	0.1	0.1	0.1	pH units
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Potassium	470	mg/kg		Y	J1	47	180	340	mg/kg
Echo	SSERNG006_SEP21-09132021	SW6010C	10/4/2021 14:55	Sodium	60	mg/kg		Y	JJ1	33	110	570	mg/kg
Echo	SSERNG006_SEP21-09132021	SW9056	9/22/2021 23:13	Sulfate	29	mg/kg		N	UM	11	29	58	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Antimony	26.7	mg/kg	300	Y	J1	0.86	1.8	2.3	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Calcium	4050	mg/kg		Y		17	59	120	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Copper	74.9	mg/kg	10,000	Y		0.25	0.94	5.9	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Iron	9550	mg/kg		Y	4	9.7	23	94	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/5/2021 9:10	Lead	79.7	mg/kg	3,000	Y	Q	0.36	0.94	1.1	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Magnesium	4200	mg/kg		Y		9.3	23	35	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Potassium	3820	mg/kg		Y		48	190	350	mg/kg
Echo	SSERNG006_SEP21-09132021SD	SW6010C	10/4/2021 15:05	Sodium	3260	mg/kg		Y		34	120	590	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Antimony	1.7	mg/kg	300	N	U	0.84	1.7	2.3	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Calcium	1000	mg/kg		Y		16	57	110	mg/kg
India	SSIRNG001_SEP21-09152021	SW9056	9/23/2021 3:19	Chloride	13	mg/kg		Y	JM	13	33	33	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Copper	35	mg/kg	10,000	Y		0.25	0.92	5.7	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Iron	9600	mg/kg		Y		9.5	23	92	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Lead	90	mg/kg	3,000	Y	Q	0.36	0.92	1	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Magnesium	1300	mg/kg		Y		9.1	23	34	mg/kg
India	SSIRNG001_SEP21-09152021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.5	pH units		Y	HF	0.1	0.1	0.1	pH units
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Potassium	670	mg/kg		Y		47	180	340	mg/kg
India	SSIRNG001_SEP21-09152021	SW6010C	10/5/2021 10:04	Sodium	48	mg/kg		Y	J	33	110	570	mg/kg
India	SSIRNG001_SEP21-09152021	SW9056	9/23/2021 3:19	Sulfate	28	mg/kg		N	UM	10	28	56	mg/kg
India	SSIRNG001_SEP21-09152021LR	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.5	pH units		Y		0.1	0.1	0.1	pH units
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Antimony	1.9	mg/kg	300	N	U	0.91	1.9	2.5	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Calcium	1200	mg/kg		Y		17	62	120	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW9056	9/23/2021 3:03	Chloride	17	mg/kg		Y	JM	14	36	36	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Copper	11	mg/kg	10,000	Y		0.27	0.99	6.2	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Iron	9300	mg/kg		Y		10	25	99	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Lead	13	mg/kg	3,000	Y	Q	0.38	0.99	1.1	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Magnesium	1400	mg/kg		Y		9.8	25	37	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.5	pH units		Y	HF	0.1	0.1	0.1	pH units
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Potassium	690	mg/kg		Y		51	200	370	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW6010C	10/5/2021 10:01	Sodium	44	mg/kg		Y	J	36	120	620	mg/kg
Lima	SSLRNG001_SEP21-09152021	SW9056	9/23/2021 3:03	Sulfate	30	mg/kg		N	UM	11	30	60	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Antimony	1.9	mg/kg	300	N	U	0.91	1.9	2.5	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Calcium	1300	mg/kg		Y		18	62	120	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW9056	9/23/2021 2:46	Chloride	15	mg/kg		Y	JM	14	37	37	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Copper	23	mg/kg	10,000	Y		0.27	1	6.2	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Iron	9700	mg/kg		Y		10	25	100	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Lead	22	mg/kg	3,000	Y	Q	0.39	1	1.1	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Magnesium	1300	mg/kg		Y		9.9	25	37	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.8	pH units		Y	HF	0.1	0.1	0.1	pH units
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Potassium	570	mg/kg		Y		51	200	370	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW6010C	10/5/2021 9:58	Sodium	48	mg/kg		Y	J	36	120	620	mg/kg
Sierra	SSSRNG001_SEP21-09152021	SW9056	9/24/2021 23:06	Sulfate	31	mg/kg		N	UM	11	31	62	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Antimony	1.9	mg/kg	300	N	U	0.91	1.9	2.5	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Calcium	5500	mg/kg		Y		18	62	120	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW9056	9/22/2021 23:29	Chloride	33	mg/kg		Y	JM	14	37	37	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Copper	17	mg/kg	10,000	Y		0.27	0.99	6.2	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Iron	23000	mg/kg		Y		10	25	99	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/5/2021 9:17	Lead	29	mg/kg	3,000	Y	Q	0.38	0.99	1.1	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Magnesium	3600	mg/kg		Y		9.8	25	37	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	6.1	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Potassium	1500	mg/kg		Y		51	200	370	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW6010C	10/4/2021 15:49	Sodium	65	mg/kg		Y	J	36	120	620	mg/kg
Tango	SSTRNG001_SEP21A-09142021	SW9056	9/24/2021 20:07	Sulfate	89	mg/kg		Y	B	11	31	62	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Antimony	1.6	mg/kg	300	N	U	0.77	1.6	2.1	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Calcium	4000	mg/kg		Y		15	52	100	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW9056	9/22/2021 23:46	Chloride	19	mg/kg		Y	J	11	30	30	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Copper	12	mg/kg	10,000	Y		0.23	0.84	5.2	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Iron	18000	mg/kg		Y		8.7	21	84	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/5/2021 9:20	Lead	25	mg/kg	3,000	Y	Q	0.32	0.84	0.94	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Magnesium	2800	mg/kg		Y		8.3	21	31	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.8	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Potassium	1200	mg/kg		Y		43	170	310	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW6010C	10/4/2021 15:52	Sodium	51	mg/kg		Y	J	30	100	520	mg/kg
Tango	SSTRNG001_SEP21B-09142021	SW9056	9/24/2021 20:22	Sulfate	170	mg/kg		Y	B	9	25	49	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Antimony	1.6	mg/kg	300	N	U	0.79	1.6	2.2	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Calcium	4300	mg/kg		Y		15	54	110	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW9056	9/23/2021 3:52	Chloride	24	mg/kg		Y	JM	12	30	30	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Copper	13	mg/kg	10,000	Y		0.23	0.87	5.4	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Iron	20000	mg/kg		Y		8.9	22	87	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/5/2021 9:24	Lead	25	mg/kg	3,000	Y	Q	0.34	0.87	0.97	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Magnesium	3000	mg/kg		Y		8.6	22	32	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.9	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Potassium	1300	mg/kg		Y		44	170	320	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW6010C	10/4/2021 15:55	Sodium	51	mg/kg		Y	J	31	110	540	mg/kg
Tango	SSTRNG001_SEP21C-09142021	SW9056	9/24/2021 23:21	Sulfate	110	mg/kg		Y	B	9.2	25	50	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Antimony	1.7	mg/kg	300	N	U	0.82	1.7	2.2	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Calcium	1200	mg/kg		Y		16	56	110	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW9056	9/23/2021 0:02	Chloride	40	mg/kg		Y	M	12	33	33	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Copper	12	mg/kg	10,000	Y		0.24	0.9	5.6	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Iron	14000	mg/kg		Y		9.3	22	90	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Lead	33	mg/kg	3,000	Y	Q	0.35	0.9	1	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Magnesium	1700	mg/kg		Y		8.9	22	34	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.7	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Potassium	890	mg/kg		Y		46	180	340	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW6010C	10/5/2021 9:41	Sodium	68	mg/kg		Y	J	32	110	560	mg/kg
Tango	SSTRNG002_SEP21-09142021	SW9056	9/24/2021 20:37	Sulfate	26	mg/kg		Y	JB	9.9	27	54	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Antimony	1.6	mg/kg	300	N	U	0.8	1.6	2.2	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Calcium	1400	mg/kg		Y		15	55	110	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW9056	9/23/2021 0:19	Chloride	80	mg/kg		Y	M	14	37	37	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Copper	13	mg/kg	10,000	Y		0.24	0.87	5.5	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Iron	15000	mg/kg		Y		9	22	87	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Lead	33	mg/kg	3,000	Y	Q	0.34	0.87	0.98	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Magnesium	1900	mg/kg		Y		8.6	22	33	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.8	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Potassium	950	mg/kg		Y		45	170	330	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW6010C	10/5/2021 9:44	Sodium	79	mg/kg		Y	J	31	110	550	mg/kg
Tango	SSTRNG003_SEP21-09142021	SW9056	9/24/2021 20:52	Sulfate	35	mg/kg		Y	JB	11	31	61	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Antimony	1.7	mg/kg	300	N	U	0.81	1.7	2.2	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Calcium	1400	mg/kg		Y		16	55	110	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW9056	9/23/2021 0:35	Chloride	27	mg/kg		Y	JM	13	35	35	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Copper	13	mg/kg	10,000	Y		0.24	0.88	5.5	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Iron	15000	mg/kg		Y		9.1	22	88	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Lead	33	mg/kg	3,000	Y	Q	0.34	0.88	0.99	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Magnesium	1800	mg/kg		Y		8.7	22	33	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.7	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Potassium	920	mg/kg		Y		45	180	330	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW6010C	10/5/2021 9:47	Sodium	75	mg/kg		Y	J	32	110	550	mg/kg
Tango	SSTRNG004_SEP21-09142021	SW9056	9/24/2021 21:07	Sulfate	15	mg/kg		Y	JMB	11	29	58	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Antimony	1.7	mg/kg	300	N	U	0.83	1.7	2.3	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Calcium	1200	mg/kg		Y		16	57	110	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW9056	9/23/2021 0:52	Chloride	27	mg/kg		Y	JM	12	32	32	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Copper	12	mg/kg	10,000	Y		0.25	0.9	5.7	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Iron	13000	mg/kg		Y		9.3	23	90	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Lead	31	mg/kg	3,000	Y	Q	0.35	0.9	1	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Magnesium	1600	mg/kg		Y		9	23	34	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.7	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Potassium	860	mg/kg		Y		46	180	340	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW6010C	10/5/2021 9:51	Sodium	65	mg/kg		Y	J	33	110	570	mg/kg
Tango	SSTRNG005_SEP21-09142021	SW9056	9/24/2021 21:22	Sulfate	18	mg/kg		Y	JB	9.7	26	53	mg/kg
Tango	SSTRNG005_SEP21-09142021LR	SW9056	9/23/2021 1:08	Chloride	26.7	mg/kg		Y	JM	12	32	32	mg/kg
Tango	SSTRNG005_SEP21-09142021LR	SW9056	9/24/2021 21:37	Sulfate	17	mg/kg		Y	J	9.7	26	53	mg/kg
Tango	SSTRNG005_SEP21-09142021SD	SW9056	9/23/2021 1:41	Chloride	602	mg/kg		Y		13	34	34	mg/kg
Tango	SSTRNG005_SEP21-09142021SD	SW9056	9/24/2021 22:06	Sulfate	517	mg/kg		Y	M	10	28	56	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Antimony	1.7	mg/kg	300	N	U	0.85	1.7	2.3	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Calcium	1400	mg/kg		Y		16	58	120	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW9056	9/23/2021 2:30	Chloride	27	mg/kg		Y	J	15	38	38	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Copper	13	mg/kg	10,000	Y		0.25	0.92	5.8	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Iron	11000	mg/kg		Y		9.6	23	92	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Lead	31	mg/kg	3,000	Y	Q	0.36	0.92	1	mg/kg

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	OMMP Action Level Mg/Kg	Detection Flag	Qualifiers	Method Detction Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Magnesium	1400	mg/kg		Y		9.2	23	35	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW9045D	10/7/2021 13:41	pH adj. to 25 deg C	5.9	pH units		Y	HF	0.1	0.1	0.1	pH units
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Potassium	760	mg/kg		Y		47	180	350	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW6010C	10/5/2021 9:54	Sodium	73	mg/kg		Y	J	33	120	580	mg/kg
Tango	SSTRNG006_SEP21-09142021	SW9056	9/24/2021 22:21	Sulfate	15	mg/kg		Y	JMB	12	32	64	mg/kg

Notes:

µg/L = microgram(s) per liter

U = not detected

M = manual integrated compound

D = reported value is from a dilution

J = estimated value

H = Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Q = One or more quality control criteria failed.

B = Blank contamination: The analyte was detected above one-half the reportinglimit in an associated blank.

4 = MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.

JI = Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

Small Arms Range Sampling Reports

Lysimeter Sampling Results

Fall 2021

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
India	LYIRNG001_SEP21-09212021	SM2320B	9/29/2021 20:50	Alkalinity	10	ug/l	Y			3.1	6.4	10	ug/l
India	**LYIRNG001_SEP21-09212021**	**SW6010C**	**10/7/2021 3:43**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Calcium	1300	ug/l	Y			78	160	1000	ug/l
India	LYIRNG001_SEP21-09212021	SW9056	9/29/2021 17:15	Chloride	1.5	ug/l	Y	JM		1	2.5	3	ug/l
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Copper	7.9	ug/l	Y	J	1,300	4.2	10	15	ug/l
India	LYIRNG001_SEP21-09212021	SM5310B	10/4/2021 23:26	Dissolved Organic Carbon	3.4	ug/l	Y			0.35	0.8	1	ug/l
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Iron	29	ug/l	Y	J		22	85	100	ug/l
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Magnesium	420	ug/l	Y	J		26	60	500	ug/l
India	LYIRNG001_SEP21-09212021	E365.4	10/11/2021 13:10	Phosphates, Total as P	0.072	ug/l	Y	J		0.041	0.057	0.1	ug/l
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Potassium	990	ug/l	Y	J		240	940	3000	ug/l
India	LYIRNG001_SEP21-09212021	SW6010C	10/7/2021 3:43	Sodium	2300	ug/l	Y	J		370	1000	5000	ug/l
India	LYIRNG001_SEP21-09212021	SW9056	9/29/2021 17:15	Sulfate	1	ug/l	Y	J		1	2.5	5	ug/l
India	LYIRNG002_SEP21-09212021	SM2320B	9/29/2021 20:39	Alkalinity	17	ug/l	Y			3.1	6.4	10	ug/l
India	**LYIRNG002_SEP21-09212021**	**SW6010C**	**10/7/2021 4:00**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Calcium	14000	ug/l	Y			78	160	1000	ug/l
India	LYIRNG002_SEP21-09212021	SW9056	9/29/2021 17:32	Chloride	4.8	ug/l	Y	M		1	2.5	3	ug/l
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Copper	270	ug/l	Y		1,300	4.2	10	15	ug/l
India	LYIRNG002_SEP21-09212021	SM5310B	10/5/2021 0:11	Dissolved Organic Carbon	13	ug/l	Y			0.35	0.8	1	ug/l
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Iron	44	ug/l	Y	J		22	85	100	ug/l
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Magnesium	3800	ug/l	Y			26	60	500	ug/l
India	LYIRNG002_SEP21-09212021	E365.4	10/11/2021 13:40	Phosphates, Total as P	7.4	ug/l	Y	D		0.41	0.57	1	ug/l
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Potassium	2200	ug/l	Y	J		240	940	3000	ug/l
India	LYIRNG002_SEP21-09212021	SW6010C	10/7/2021 4:00	Sodium	4200	ug/l	Y	J		370	1000	5000	ug/l
India	LYIRNG002_SEP21-09212021	SW9056	9/29/2021 17:32	Sulfate	16	ug/l	Y			1	2.5	5	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SM2320B	9/29/2021 2:53	Alkalinity	35	ug/l	Y			3.1	6.4	10	ug/l
Juliet	**LYJRNG001_SEP21 FD-09212021**	**SW6010C**	**10/7/2021 4:03**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Calcium	6700	ug/l	Y			78	160	1000	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW9056	9/29/2021 17:48	Chloride	3.3	ug/l	Y	M		1	2.5	3	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Juliet	LYJRNG001_SEP21 FD-09212021	SM5310B	10/5/2021 0:26	Dissolved Organic Carbon	4.1	ug/l	Y			0.35	0.8	1	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Iron	85	ug/l	N	U		22	85	100	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Magnesium	3600	ug/l	Y			26	60	500	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	E365.4	10/11/2021 12:55	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW6010C	10/7/2021 4:03	Sodium	2600	ug/l	Y	J		370	1000	5000	ug/l
Juliet	LYJRNG001_SEP21 FD-09212021	SW9056	9/29/2021 17:48	Sulfate	2.5	ug/l	N	U		1	2.5	5	ug/l
Juliet	LYJRNG001_SEP21-09212021	SM2320B	9/29/2021 20:34	Alkalinity	36	ug/l	Y			3.1	6.4	10	ug/l
Juliet	**LYJRNG001_SEP21-09212021**	**SW6010C**	**10/7/2021 5:19**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Calcium	6700	ug/l	Y			78	160	1000	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW9056	9/30/2021 1:12	Chloride	3.3	ug/l	Y	M		1	2.5	3	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Juliet	LYJRNG001_SEP21-09212021	SM5310B	10/5/2021 5:25	Dissolved Organic Carbon	4.2	ug/l	Y			0.35	0.8	1	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Iron	85	ug/l	N	U		22	85	100	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Magnesium	3600	ug/l	Y			26	60	500	ug/l
Juliet	LYJRNG001_SEP21-09212021	E365.4	10/13/2021 12:35	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW6010C	10/7/2021 5:19	Sodium	2600	ug/l	Y	J		370	1000	5000	ug/l
Juliet	LYJRNG001_SEP21-09212021	SW9056	9/30/2021 1:12	Sulfate	2.5	ug/l	N	U		1	2.5	5	ug/l
Juliet	LYJRNG002_SEP21-09212021	SM2320B	9/29/2021 20:55	Alkalinity	32	ug/l	Y			3.1	6.4	10	ug/l
Juliet	**LYJRNG002_SEP21-09212021**	**SW6010C**	**10/7/2021 4:07**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Calcium	4700	ug/l	Y			78	160	1000	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW9056	9/29/2021 18:05	Chloride	2.5	ug/l	N	U		1	2.5	3	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Juliet	LYJRNG002_SEP21-09212021	SM5310B	10/5/2021 1:10	Dissolved Organic Carbon	3.6	ug/l	Y			0.35	0.8	1	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Iron	44	ug/l	Y	J		22	85	100	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Magnesium	3000	ug/l	Y			26	60	500	ug/l
Juliet	LYJRNG002_SEP21-09212021	E365.4	10/11/2021 13:11	Phosphates, Total as P	0.041	ug/l	Y	J		0.041	0.057	0.1	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW6010C	10/7/2021 4:07	Sodium	2400	ug/l	Y	J		370	1000	5000	ug/l
Juliet	LYJRNG002_SEP21-09212021	SW9056	9/29/2021 18:05	Sulfate	2.5	ug/l	N	U		1	2.5	5	ug/l
Juliet	LYJRNG003_SEP21-09212021	SM2320B	9/29/2021 21:01	Alkalinity	94	ug/l	Y			3.1	6.4	10	ug/l
Juliet	**LYJRNG003_SEP21-09212021**	**SW6010C**	**10/7/2021 4:24**	**Antimony**	**25**	**ug/l**	**Y**		**6**	**5.2**	**12**	**20**	**ug/l**
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Calcium	31000	ug/l	Y			78	160	1000	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW9056	9/29/2021 18:21	Chloride	1.4	ug/l	Y	JM		1	2.5	3	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Copper	5.3	ug/l	Y	J	1,300	4.2	10	15	ug/l
Juliet	LYJRNG003_SEP21-09212021	SM5310B	10/5/2021 1:25	Dissolved Organic Carbon	2.6	ug/l	Y			0.35	0.8	1	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Iron	590	ug/l	Y			22	85	100	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Magnesium	1800	ug/l	Y			26	60	500	ug/l
Juliet	LYJRNG003_SEP21-09212021	E365.4	10/11/2021 13:00	Phosphates, Total as P	0.053	ug/l	Y	J		0.041	0.057	0.1	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW6010C	10/7/2021 4:24	Sodium	3600	ug/l	Y	J		370	1000	5000	ug/l
Juliet	LYJRNG003_SEP21-09212021	SW9056	9/29/2021 18:21	Sulfate	3.7	ug/l	Y	J		1	2.5	5	ug/l
Kilo	LYKRNG001_SEP21-09222021	SM2320B	9/29/2021 20:44	Alkalinity	36	ug/l	Y			3.1	6.4	10	ug/l
Kilo	**LYKRNG001_SEP21-09222021**	**SW6010C**	**10/7/2021 4:27**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Calcium	7900	ug/l	Y			78	160	1000	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW9056	9/29/2021 20:00	Chloride	5.2	ug/l	Y	M		1	2.5	3	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Kilo	LYKRNG001_SEP21-09222021	SM5310B	10/5/2021 1:40	Dissolved Organic Carbon	4.1	ug/l	Y			0.35	0.8	1	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Iron	85	ug/l	N	U		22	85	100	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Magnesium	4200	ug/l	Y			26	60	500	ug/l
Kilo	LYKRNG001_SEP21-09222021	E365.4	10/11/2021 12:53	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Potassium	960	ug/l	Y	J		240	940	3000	ug/l
Kilo	LYKRNG001_SEP21-09222021	SW6010C	10/7/2021 4:27	Sodium	3300	ug/l	Y	J		370	1000	5000	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Kilo	LYKRNG001_SEP21-09222021	SW9056	9/29/2021 20:00	Sulfate	2.7	ug/l	Y	JM		1	2.5	5	ug/l
Kilo	LYKRNG002_SEP21-09222021	SM2320B	9/29/2021 2:48	Alkalinity	37	ug/l	Y			3.1	6.4	10	ug/l
Kilo	**LYKRNG002_SEP21-09222021**	**SW6010C**	**10/7/2021 4:31**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Calcium	10000	ug/l	Y			78	160	1000	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW9056	9/29/2021 20:16	Chloride	14	ug/l	Y	MJ1		1	2.5	3	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Kilo	LYKRNG002_SEP21-09222021	SM5310B	10/5/2021 1:57	Dissolved Organic Carbon	2.1	ug/l	Y			0.35	0.8	1	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Iron	48	ug/l	Y	J		22	85	100	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Magnesium	6800	ug/l	Y			26	60	500	ug/l
Kilo	LYKRNG002_SEP21-09222021	E365.4	10/11/2021 13:01	Phosphates, Total as P	0.06	ug/l	Y	J		0.041	0.057	0.1	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Potassium	730	ug/l	Y	J		240	940	3000	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW6010C	10/7/2021 4:31	Sodium	3000	ug/l	Y	J		370	1000	5000	ug/l
Kilo	LYKRNG002_SEP21-09222021	SW9056	9/29/2021 20:16	Sulfate	1.1	ug/l	Y	J		1	2.5	5	ug/l
Kilo	LYKRNG003_SEP21-09222021	SM2320B	9/29/2021 2:58	Alkalinity	28	ug/l	Y			3.1	6.4	10	ug/l
Kilo	**LYKRNG003_SEP21-09222021**	**SW6010C**	**10/7/2021 4:34**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Calcium	6400	ug/l	Y			78	160	1000	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW9056	9/29/2021 21:22	Chloride	2.1	ug/l	Y	JM		1	2.5	3	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Copper	4.2	ug/l	Y	J	1,300	4.2	10	15	ug/l
Kilo	LYKRNG003_SEP21-09222021	SM5310B	10/5/2021 2:12	Dissolved Organic Carbon	4.2	ug/l	Y			0.35	0.8	1	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Iron	4100	ug/l	Y			22	85	100	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Lead	3.8	ug/l	Y	J	15	2.7	9	15	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Magnesium	470	ug/l	Y	J		26	60	500	ug/l
Kilo	LYKRNG003_SEP21-09222021	E365.4	10/11/2021 13:02	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW6010C	10/7/2021 4:34	Sodium	1500	ug/l	Y	J		370	1000	5000	ug/l
Kilo	LYKRNG003_SEP21-09222021	SW9056	9/29/2021 21:22	Sulfate	1.1	ug/l	Y	J		1	2.5	5	ug/l
Kilo	LYKRNG004_SEP21-09222021	SM2320B	9/29/2021 20:24	Alkalinity	17	ug/l	Y			3.1	6.4	10	ug/l
Kilo	**LYKRNG004_SEP21-09222021**	**SW6010C**	**10/7/2021 4:38**	**Antimony**	**11**	**ug/l**	**Y**	**J**	**6**	**5.2**	**12**	**20**	**ug/l**
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Calcium	4300	ug/l	Y			78	160	1000	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW9056	9/29/2021 21:38	Chloride	1.1	ug/l	Y	JM		1	2.5	3	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Copper	7	ug/l	Y	J	1,300	4.2	10	15	ug/l
Kilo	LYKRNG004_SEP21-09222021	SM5310B	10/5/2021 2:27	Dissolved Organic Carbon	3.4	ug/l	Y			0.35	0.8	1	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Iron	640	ug/l	Y			22	85	100	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Magnesium	240	ug/l	Y	J		26	60	500	ug/l
Kilo	LYKRNG004_SEP21-09222021	E365.4	10/12/2021 11:41	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW6010C	10/7/2021 4:38	Sodium	1700	ug/l	Y	J		370	1000	5000	ug/l
Kilo	LYKRNG004_SEP21-09222021	SW9056	9/29/2021 21:38	Sulfate	1.4	ug/l	Y	J		1	2.5	5	ug/l
Lima	LYLRNG001_SEP21-09232021	SM2320B	9/29/2021 3:25	Alkalinity	6.4	ug/l	Y	J		3.1	6.4	10	ug/l
Lima	**LYLRNG001_SEP21-09232021**	**SW6010C**	**10/7/2021 5:13**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Calcium	1600	ug/l	Y			78	160	1000	ug/l
Lima	LYLRNG001_SEP21-09232021	SW9056	9/29/2021 23:49	Chloride	3.3	ug/l	Y	M		1	2.5	3	ug/l
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Copper	5.4	ug/l	Y	J	1,300	4.2	10	15	ug/l
Lima	LYLRNG001_SEP21-09232021	SM5310B	10/5/2021 4:55	Dissolved Organic Carbon	6.3	ug/l	Y			0.35	0.8	1	ug/l
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Iron	38	ug/l	Y	J		22	85	100	ug/l
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Magnesium	330	ug/l	Y	J		26	60	500	ug/l
Lima	LYLRNG001_SEP21-09232021	E365.4	10/13/2021 12:21	Phosphates, Total as P	0.085	ug/l	Y	J		0.041	0.057	0.1	ug/l
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Potassium	1100	ug/l	Y	J		240	940	3000	ug/l
Lima	LYLRNG001_SEP21-09232021	SW6010C	10/7/2021 5:13	Sodium	2200	ug/l	Y	J		370	1000	5000	ug/l
Lima	LYLRNG001_SEP21-09232021	SW9056	9/29/2021 23:49	Sulfate	1.4	ug/l	Y	J		1	2.5	5	ug/l
Lima	LYLRNG002_SEP21-09232021	SM2320B	9/29/2021 3:20	Alkalinity	73	ug/l	Y			3.1	6.4	10	ug/l
Lima	**LYLRNG002_SEP21-09232021**	**SW6010C**	**10/7/2021 5:16**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Calcium	27000	ug/l	Y			78	160	1000	ug/l
Lima	LYLRNG002_SEP21-09232021	SW9056	9/30/2021 0:06	Chloride	2.9	ug/l	Y	JM		1	2.5	3	ug/l
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Lima	LYLRNG002_SEP21-09232021	SM5310B	10/5/2021 5:10	Dissolved Organic Carbon	5.7	ug/l	Y			0.35	0.8	1	ug/l
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Iron	85	ug/l	N	U		22	85	100	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Magnesium	480	ug/l	Y	J		26	60	500	ug/l
Lima	LYLRNG002_SEP21-09232021	E365.4	10/13/2021 12:33	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Potassium	630	ug/l	Y	J		240	940	3000	ug/l
Lima	LYLRNG002_SEP21-09232021	SW6010C	10/7/2021 5:16	Sodium	2200	ug/l	Y	J		370	1000	5000	ug/l
Lima	LYLRNG002_SEP21-09232021	SW9056	9/30/2021 0:06	Sulfate	2.5	ug/l	N	U		1	2.5	5	ug/l
Sierra	LYSRNG001_SEP21-09222021	SM2320B	9/29/2021 3:03	Alkalinity	53	ug/l	Y			3.1	6.4	10	ug/l
Sierra	**LYSRNG001_SEP21-09222021**	**SW6010C**	**10/7/2021 4:41**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Calcium	18000	ug/l	Y			78	160	1000	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW9056	9/29/2021 21:54	Chloride	5.1	ug/l	Y	M		1	2.5	3	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Sierra	LYSRNG001_SEP21-09222021	SM5310B	10/5/2021 2:41	Dissolved Organic Carbon	7	ug/l	Y			0.35	0.8	1	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Iron	85	ug/l	N	U		22	85	100	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Magnesium	1700	ug/l	Y			26	60	500	ug/l
Sierra	LYSRNG001_SEP21-09222021	E365.4	10/13/2021 12:18	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Potassium	940	ug/l	N	U		240	940	3000	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW6010C	10/7/2021 4:41	Sodium	4300	ug/l	Y	J		370	1000	5000	ug/l
Sierra	LYSRNG001_SEP21-09222021	SW9056	9/29/2021 21:54	Sulfate	2.8	ug/l	Y	J		1	2.5	5	ug/l
Sierra	LYSRNG002_SEP21-09222021	SM2320B	9/29/2021 20:29	Alkalinity	6	ug/l	Y	J		3.1	6.4	10	ug/l
Sierra	**LYSRNG002_SEP21-09222021**	**SW6010C**	**10/7/2021 4:45**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Calcium	880	ug/l	Y	J		78	160	1000	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW9056	9/29/2021 22:44	Chloride	5.1	ug/l	Y			1	2.5	3	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
Sierra	LYSRNG002_SEP21-09222021	SM5310B	10/5/2021 2:56	Dissolved Organic Carbon	3.3	ug/l	Y			0.35	0.8	1	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Iron	30	ug/l	Y	J		22	85	100	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Magnesium	220	ug/l	Y	J		26	60	500	ug/l
Sierra	LYSRNG002_SEP21-09222021	E365.4	10/13/2021 12:22	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Potassium	3800	ug/l	Y			240	940	3000	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifier	OMMP Action Level	Method Detection Limit	Reporting Detection Limit	Quantitation Limit	Detection Limit Units
Sierra	LYSRNG002_SEP21-09222021	SW6010C	10/7/2021 4:45	Sodium	2900	ug/l	Y	J		370	1000	5000	ug/l
Sierra	LYSRNG002_SEP21-09222021	SW9056	9/29/2021 22:44	Sulfate	1.5	ug/l	Y	J		1	2.5	5	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SM2320B	9/29/2021 3:09	Alkalinity	6.6	ug/l	Y	J		3.1	6.4	10	ug/l
a Backgr	**LYSBGD01_SEP21-09232021**	**SW6010C**	**10/7/2021 5:09**	**Antimony**	**12**	**ug/l**	**N**	**U**	**6**	**5.2**	**12**	**20**	**ug/l**
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Calcium	3000	ug/l	Y			78	160	1000	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW9056	9/29/2021 23:33	Chloride	11	ug/l	Y	M		1	2.5	3	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Copper	10	ug/l	N	U	1,300	4.2	10	15	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SM5310B	10/5/2021 4:40	Dissolved Organic Carbon	4.5	ug/l	Y			0.35	0.8	1	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Iron	85	ug/l	N	U		22	85	100	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Lead	9	ug/l	N	U	15	2.7	9	15	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Magnesium	700	ug/l	Y			26	60	500	ug/l
a Backgr	LYSBGD01_SEP21-09232021	E365.4	10/13/2021 12:28	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Potassium	1100	ug/l	Y	J		240	940	3000	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW6010C	10/7/2021 5:09	Sodium	9300	ug/l	Y			370	1000	5000	ug/l
a Backgr	LYSBGD01_SEP21-09232021	SW9056	9/29/2021 23:33	Sulfate	7.1	ug/l	Y	M		1	2.5	5	ug/l

Notes:
µg/L = microgram(s) per liter

J = The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample as a result of associated QC criteria results. The data are valid for project use to achieve project DQOs.

J1 = Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

M = manual integrated compound

U = The analyte was analyzed for but was not detected at a level greater than or equal to the method and sample-specific detection limit.

Juliet and Kilo Ranges, STAPP bullet catcher system, Camp Edwards, Massachusetts
LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample

Tango Range with STAPP bullet catcher system, Camp Edwards, Massachusetts
LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample

India Range, Copper Ammunition Only, Camp Edwards, Massachusetts.
LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample

Small Arms Range Sampling Reports

Groundwater Sampling Results

Fall 2021

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifiers	OMMP Action Level	Method Detection Limit	Reporting Limit	QuantitationLimit	Detection Limit Units
Echo	MW-468S_SEP21-09162021	SM2320B	9/24/2021 19:57	Alkalinity	9.1	ug/l	Y	J		3.1	6.4	10	ug/l
Echo	**MW-468S_SEP21-09162021**	**SW6010C**	**9/28/2021 20:49**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Echo	MW-468S_SEP21-09162021	SW6010C	9/28/2021 20:49	Calcium	2300	ug/l	Y			78	160	1000	ug/l
Echo	MW-468S_SEP21-09162021	SW9056	9/26/2021 1:43	Chloride	9.8	ug/l	Y			1	2.5	3	ug/l
Echo	MW-468S_SEP21-09162021	SW6010C	9/28/2021 20:49	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Echo	MW-468S_SEP21-09162021	SM5310B	10/11/2021 13:40	Dissolved Organic Carbon	0.8	ug/l	N	U		0.35	0.8	1	ug/l
Echo	MW-468S_SEP21-09162021	SW6010C	9/28/2021 20:49	Iron	1200	ug/l	Y			22	85	100	ug/l
Echo	**MW-468S_SEP21-09162021**	**SW6010C**	**9/28/2021 20:49**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Echo	MW-468S_SEP21-09162021	SW6010C	9/28/2021 20:49	Magnesium	1500	ug/l	Y			26	60	500	ug/l
Echo	MW-468S_SEP21-09162021	E365.4	10/7/2021 12:18	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Echo	MW-468S_SEP21-09162021	SW6010C	9/28/2021 20:49	Potassium	730	ug/l	Y	J		240	940	3000	ug/l
Echo	MW-468S_SEP21-09162021	SW6010C	9/28/2021 20:49	Sodium	7400	ug/l	Y			370	1000	5000	ug/l
Echo	MW-468S_SEP21-09162021	SW9056	9/26/2021 1:43	Sulfate	4.7	ug/l	Y	J		1	2.5	5	ug/l
India	MW-639S_SEP21-09202021	SM2320B	9/24/2021 19:15	Alkalinity	7.2	ug/l	Y	J		3.1	6.4	10	ug/l
India	**MW-639S_SEP21-09202021**	**SW6010C**	**9/28/2021 20:37**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
India	MW-639S_SEP21-09202021	SW6010C	9/28/2021 20:37	Calcium	2000	ug/l	Y			78	160	1000	ug/l
India	MW-639S_SEP21-09202021	SW9056	10/8/2021 18:00	Chloride	8.3	ug/l	Y	M		1	2.5	3	ug/l
India	MW-639S_SEP21-09202021	SW6010C	9/28/2021 20:37	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
India	MW-639S_SEP21-09202021	SM5310B	10/11/2021 12:33	Dissolved Organic Carbon	0.35	ug/l	Y	J		0.35	0.8	1	ug/l
India	MW-639S_SEP21-09202021	SW6010C	9/28/2021 20:37	Iron	160	ug/l	Y			22	85	100	ug/l
India	**MW-639S_SEP21-09202021**	**SW6010C**	**9/28/2021 20:37**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
India	MW-639S_SEP21-09202021	SW6010C	9/28/2021 20:37	Magnesium	1500	ug/l	Y			26	60	500	ug/l
India	MW-639S_SEP21-09202021	E365.4	10/7/2021 12:17	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
India	MW-639S_SEP21-09202021	SW6010C	9/28/2021 20:37	Potassium	570	ug/l	Y	J		240	940	3000	ug/l
India	MW-639S_SEP21-09202021	SW6010C	9/28/2021 20:37	Sodium	6400	ug/l	Y			370	1000	5000	ug/l
India	MW-639S_SEP21-09202021	SW9056	10/8/2021 18:00	Sulfate	6.1	ug/l	Y			1	2.5	5	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SM2320B	9/24/2021 19:40	Alkalinity	11	ug/l	Y			3.1	6.4	10	ug/l
Juliet	**MW-471S_SEP21 FD-09172021**	**SW6010C**	**9/28/2021 20:30**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Juliet	MW-471S_SEP21 FD-09172021	SW6010C	9/28/2021 20:30	Calcium	2500	ug/l	Y			78	160	1000	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SW9056	10/8/2021 17:30	Chloride	6.1	ug/l	Y	M		1	2.5	3	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SW6010C	9/28/2021 20:30	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SM5310B	10/5/2021 6:10	Dissolved Organic Carbon	0.53	ug/l	Y	J		0.35	0.8	1	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifiers	OMMP Action Level	Method Detection Limit	Reporting Limit	QuantitationL imit	Detection Limit Units
Juliet	MW-471S_SEP21 FD-09172021	SW6010C	9/28/2021 20:30	Iron	130	ug/l	Y			22	85	100	ug/l
Juliet	**MW-471S_SEP21 FD-09172021**	**SW6010C**	**9/28/2021 20:30**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Juliet	MW-471S_SEP21 FD-09172021	SW6010C	9/28/2021 20:30	Magnesium	1900	ug/l	Y			26	60	500	ug/l
Juliet	MW-471S_SEP21 FD-09172021	E365.4	10/7/2021 12:33	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SW6010C	9/28/2021 20:30	Potassium	680	ug/l	Y	J		240	940	3000	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SW6010C	9/28/2021 20:30	Sodium	4900	ug/l	Y	J		370	1000	5000	ug/l
Juliet	MW-471S_SEP21 FD-09172021	SW9056	10/8/2021 17:30	Sulfate	5.4	ug/l	Y	M		1	2.5	5	ug/l
Juliet	MW-471S_SEP21-09172021	SM2320B	9/24/2021 19:21	Alkalinity	11	ug/l	Y			3.1	6.4	10	ug/l
Juliet	**MW-471S_SEP21-09172021**	**SW6010C**	**9/28/2021 20:13**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Juliet	MW-471S_SEP21-09172021	SW6010C	9/28/2021 20:13	Calcium	2600	ug/l	Y			78	160	1000	ug/l
Juliet	MW-471S_SEP21-09172021	SW9056	10/8/2021 17:15	Chloride	6	ug/l	Y	M		1	2.5	3	ug/l
Juliet	MW-471S_SEP21-09172021	SW6010C	9/28/2021 20:13	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Juliet	MW-471S_SEP21-09172021	SM5310B	10/5/2021 5:55	Dissolved Organic Carbon	0.55	ug/l	Y	J		0.35	0.8	1	ug/l
Juliet	MW-471S_SEP21-09172021	SW6010C	9/28/2021 20:13	Iron	44	ug/l	Y	J		22	85	100	ug/l
Juliet	**MW-471S_SEP21-09172021**	**SW6010C**	**9/28/2021 20:13**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Juliet	MW-471S_SEP21-09172021	SW6010C	9/28/2021 20:13	Magnesium	2000	ug/l	Y			26	60	500	ug/l
Juliet	MW-471S_SEP21-09172021	E365.4	10/6/2021 13:49	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Juliet	MW-471S_SEP21-09172021	SW6010C	9/28/2021 20:13	Potassium	740	ug/l	Y	J		240	940	3000	ug/l
Juliet	MW-471S_SEP21-09172021	SW6010C	9/28/2021 20:13	Sodium	5100	ug/l	Y			370	1000	5000	ug/l
Juliet	MW-471S_SEP21-09172021	SW9056	10/8/2021 17:15	Sulfate	5.1	ug/l	Y			1	2.5	5	ug/l
Juliet	**MW-472S_SEP21-09172021**	**SW6010C**	**9/28/2021 20:00**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Juliet	MW-472S_SEP21-09172021	SW6010C	9/28/2021 20:00	Calcium	2700	ug/l	Y			78	160	1000	ug/l
Juliet	MW-472S_SEP21-09172021	SW9056	10/8/2021 16:30	Chloride	6.3	ug/l	Y	M		1	2.5	3	ug/l
Juliet	MW-472S_SEP21-09172021	SW6010C	9/28/2021 20:00	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Juliet	MW-472S_SEP21-09172021	SM5310B	10/5/2021 5:40	Dissolved Organic Carbon	0.69	ug/l	Y	J		0.35	0.8	1	ug/l
Juliet	MW-472S_SEP21-09172021	SW6010C	9/28/2021 20:00	Iron	32	ug/l	Y	J		22	85	100	ug/l
Juliet	**MW-472S_SEP21-09172021**	**SW6010C**	**9/28/2021 20:00**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Juliet	MW-472S_SEP21-09172021	SW6010C	9/28/2021 20:00	Magnesium	2600	ug/l	Y			26	60	500	ug/l
Juliet	MW-472S_SEP21-09172021	E365.4	10/6/2021 13:51	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Juliet	MW-472S_SEP21-09172021	SW6010C	9/28/2021 20:00	Potassium	830	ug/l	Y	J		240	940	3000	ug/l
Juliet	MW-472S_SEP21-09172021	SW6010C	9/28/2021 20:00	Sodium	4400	ug/l	Y	J		370	1000	5000	ug/l
Juliet	MW-472S_SEP21-09172021	SW9056	10/8/2021 16:30	Sulfate	5.4	ug/l	Y			1	2.5	5	ug/l
Kilo	MW-474S_SEP21-09172021	SM2320B	9/24/2021 19:51	Alkalinity	11	ug/l	Y			3.1	6.4	10	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifiers	OMMP Action Level	Method Detection Limit	Reporting Limit	QuantitationLimit	Detection Limit Units
Kilo	**MW-474S_SEP21-09172021**	**SW6010C**	**9/28/2021 20:33**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Kilo	MW-474S_SEP21-09172021	SW6010C	9/28/2021 20:33	Calcium	1900	ug/l	Y			78	160	1000	ug/l
Kilo	MW-474S_SEP21-09172021	SW9056	10/8/2021 17:45	Chloride	7.2	ug/l	Y	M		1	2.5	3	ug/l
Kilo	MW-474S_SEP21-09172021	SW6010C	9/28/2021 20:33	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Kilo	MW-474S_SEP21-09172021	SM5310B	10/11/2021 11:47	Dissolved Organic Carbon	0.8	ug/l	N	U		0.35	0.8	1	ug/l
Kilo	MW-474S_SEP21-09172021	SW6010C	9/28/2021 20:33	Iron	85	ug/l	N	U		22	85	100	ug/l
Kilo	**MW-474S_SEP21-09172021**	**SW6010C**	**9/28/2021 20:33**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Kilo	MW-474S_SEP21-09172021	SW6010C	9/28/2021 20:33	Magnesium	2200	ug/l	Y			26	60	500	ug/l
Kilo	MW-474S_SEP21-09172021	E365.4	10/7/2021 12:34	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Kilo	MW-474S_SEP21-09172021	SW6010C	9/28/2021 20:33	Potassium	680	ug/l	Y	J		240	940	3000	ug/l
Kilo	MW-474S_SEP21-09172021	SW6010C	9/28/2021 20:33	Sodium	5700	ug/l	Y			370	1000	5000	ug/l
Kilo	MW-474S_SEP21-09172021	SW9056	10/8/2021 17:45	Sulfate	4.6	ug/l	Y	J		1	2.5	5	ug/l
Kilo	MW-474S_SEP21-09172021SD	SM5310B	10/11/2021 12:16	Dissolved Organic Carbon	26.8	ug/l	Y			0.35	0.8	1	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SM2320B	9/24/2021 20:02	Alkalinity	23	ug/l	Y			3.1	6.4	10	ug/l
Sierra	**MW-465S_SEP21 FD-09202021**	**SW6010C**	**9/28/2021 20:46**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Sierra	MW-465S_SEP21 FD-09202021	SW6010C	9/28/2021 20:46	Calcium	4100	ug/l	Y			78	160	1000	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SW9056	9/26/2021 1:29	Chloride	5.6	ug/l	Y			1	2.5	3	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SW6010C	9/28/2021 20:46	Copper	7.1	ug/l	Y	J	650	4.2	10	15	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SM5310B	10/11/2021 13:23	Dissolved Organic Carbon	0.8	ug/l	N	U		0.35	0.8	1	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SW6010C	9/28/2021 20:46	Iron	2800	ug/l	Y			22	85	100	ug/l
Sierra	**MW-465S_SEP21 FD-09202021**	**SW6010C**	**9/28/2021 20:46**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Sierra	MW-465S_SEP21 FD-09202021	SW6010C	9/28/2021 20:46	Magnesium	2000	ug/l	Y			26	60	500	ug/l
Sierra	MW-465S_SEP21 FD-09202021	E365.4	10/7/2021 12:43	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SW6010C	9/28/2021 20:46	Potassium	570	ug/l	Y	J		240	940	3000	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SW6010C	9/28/2021 20:46	Sodium	5900	ug/l	Y			370	1000	5000	ug/l
Sierra	MW-465S_SEP21 FD-09202021	SW9056	9/26/2021 1:29	Sulfate	5.3	ug/l	Y			1	2.5	5	ug/l
Sierra	MW-465S_SEP21-09202021	SM2320B	9/24/2021 19:10	Alkalinity	22	ug/l	Y			3.1	6.4	10	ug/l
Sierra	**MW-465S_SEP21-09202021**	**SW6010C**	**9/28/2021 20:43**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Sierra	MW-465S_SEP21-09202021	SW6010C	9/28/2021 20:43	Calcium	4100	ug/l	Y			78	160	1000	ug/l
Sierra	MW-465S_SEP21-09202021	SW9056	9/26/2021 0:05	Chloride	5.7	ug/l	Y			1	2.5	3	ug/l
Sierra	MW-465S_SEP21-09202021	SW6010C	9/28/2021 20:43	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifiers	OMMP Action Level	Method Detection Limit	Reporting Limit	QuantitationLimit	Detection Limit Units
Sierra	MW-465S_SEP21-09202021	SM5310B	10/11/2021 13:07	Dissolved Organic Carbon	0.8	ug/l	N	U		0.35	0.8	1	ug/l
Sierra	MW-465S_SEP21-09202021	SW6010C	9/28/2021 20:43	Iron	23	ug/l	Y	J		22	85	100	ug/l
Sierra	**MW-465S_SEP21-09202021**	**SW6010C**	**9/28/2021 20:43**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Sierra	MW-465S_SEP21-09202021	SW6010C	9/28/2021 20:43	Magnesium	2000	ug/l	Y			26	60	500	ug/l
Sierra	MW-465S_SEP21-09202021	E365.4	10/7/2021 12:36	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Sierra	MW-465S_SEP21-09202021	SW6010C	9/28/2021 20:43	Potassium	610	ug/l	Y	J		240	940	3000	ug/l
Sierra	MW-465S_SEP21-09202021	SW6010C	9/28/2021 20:43	Sodium	5900	ug/l	Y			370	1000	5000	ug/l
Sierra	MW-465S_SEP21-09202021	SW9056	9/26/2021 0:05	Sulfate	5.5	ug/l	Y			1	2.5	5	ug/l
Sierra	MW-466S_SEP21-09202021	SM2320B	9/24/2021 19:05	Alkalinity	23	ug/l	Y			3.1	6.4	10	ug/l
Sierra	**MW-466S_SEP21-09202021**	**SW6010C**	**9/28/2021 20:40**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Sierra	MW-466S_SEP21-09202021	SW6010C	9/28/2021 20:40	Calcium	4400	ug/l	Y			78	160	1000	ug/l
Sierra	MW-466S_SEP21-09202021	SW9056	10/8/2021 18:15	Chloride	5	ug/l	Y	M		1	2.5	3	ug/l
Sierra	MW-466S_SEP21-09202021	SW6010C	9/28/2021 20:40	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Sierra	MW-466S_SEP21-09202021	SM5310B	10/11/2021 12:50	Dissolved Organic Carbon	0.58	ug/l	Y	J		0.35	0.8	1	ug/l
Sierra	MW-466S_SEP21-09202021	SW6010C	9/28/2021 20:40	Iron	100	ug/l	Y			22	85	100	ug/l
Sierra	**MW-466S_SEP21-09202021**	**SW6010C**	**9/28/2021 20:40**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Sierra	MW-466S_SEP21-09202021	SW6010C	9/28/2021 20:40	Magnesium	1900	ug/l	Y			26	60	500	ug/l
Sierra	MW-466S_SEP21-09202021	E365.4	10/7/2021 12:35	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Sierra	MW-466S_SEP21-09202021	SW6010C	9/28/2021 20:40	Potassium	650	ug/l	Y	J		240	940	3000	ug/l
Sierra	MW-466S_SEP21-09202021	SW6010C	9/28/2021 20:40	Sodium	7300	ug/l	Y			370	1000	5000	ug/l
Sierra	MW-466S_SEP21-09202021	SW9056	10/8/2021 18:15	Sulfate	6.8	ug/l	Y			1	2.5	5	ug/l
Tango	MW-467S_SEP21 EB-09222021	SM2320B	9/29/2021 3:14	Alkalinity	15	ug/l	Y			3.1	6.4	10	ug/l
Tango	**MW-467S_SEP21 EB-09222021**	**SW6010C**	**10/7/2021 5:02**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Tango	MW-467S_SEP21 EB-09222021	SW6010C	10/7/2021 5:02	Calcium	4500	ug/l	Y			78	160	1000	ug/l
Tango	MW-467S_SEP21 EB-09222021	SW9056	9/29/2021 23:00	Chloride	18	ug/l	Y			1	2.5	3	ug/l
Tango	MW-467S_SEP21 EB-09222021	SW6010C	10/7/2021 5:02	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Tango	MW-467S_SEP21 EB-09222021	SM5310B	10/5/2021 4:11	Dissolved Organic Carbon	0.8	ug/l	N	U		0.35	0.8	1	ug/l
Tango	MW-467S_SEP21 EB-09222021	SW6010C	10/7/2021 5:02	Iron	26	ug/l	Y	J		22	85	100	ug/l
Tango	**MW-467S_SEP21 EB-09222021**	**SW6010C**	**10/7/2021 5:02**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Tango	MW-467S_SEP21 EB-09222021	SW6010C	10/7/2021 5:02	Magnesium	2000	ug/l	Y			26	60	500	ug/l
Tango	MW-467S_SEP21 EB-09222021	E365.4	10/13/2021 12:19	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l

Range	Sample Code	Method	Analysis Date	Analyte	Result	Units	Detection Flag	Qualifiers	OMMP Action Level	Method Detection Limit	Reporting Limit	QuantitationLimit	Detection Limit Units
Tango	MW-467S_SEP21 EB-09222021	SW6010C	10/7/2021 5:02	Potassium	880	ug/l	Y	J		240	940	3000	ug/l
Tango	MW-467S_SEP21 EB-09222021	SW6010C	10/7/2021 5:02	Sodium	13000	ug/l	Y			370	1000	5000	ug/l
Tango	MW-467S_SEP21 EB-09222021	SW9056	9/29/2021 23:00	Sulfate	5.8	ug/l	Y			1	2.5	5	ug/l
Tango	MW-467S_SEP21-09222021	SM2320B	9/29/2021 3:43	Alkalinity	22	ug/l	Y			3.1	6.4	10	ug/l
Tango	**MW-467S_SEP21-09222021**	**SW6010C**	**10/7/2021 5:06**	**Antimony**	**12**	**ug/l**	**N**	**U**	**3**	**5.2**	**12**	**20**	**ug/l**
Tango	MW-467S_SEP21-09222021	SW6010C	10/7/2021 5:06	Calcium	8700	ug/l	Y			78	160	1000	ug/l
Tango	MW-467S_SEP21-09222021	SW9056	9/29/2021 23:17	Chloride	5	ug/l	Y	M		1	2.5	3	ug/l
Tango	MW-467S_SEP21-09222021	SW6010C	10/7/2021 5:06	Copper	10	ug/l	N	U	650	4.2	10	15	ug/l
Tango	MW-467S_SEP21-09222021	SM5310B	10/5/2021 4:25	Dissolved Organic Carbon	0.65	ug/l	Y	J		0.35	0.8	1	ug/l
Tango	MW-467S_SEP21-09222021	SW6010C	10/7/2021 5:06	Iron	300	ug/l	Y			22	85	100	ug/l
Tango	**MW-467S_SEP21-09222021**	**SW6010C**	**10/7/2021 5:06**	**Lead**	**9**	**ug/l**	**N**	**U**	**7.5**	**2.7**	**9**	**15**	**ug/l**
Tango	MW-467S_SEP21-09222021	SW6010C	10/7/2021 5:06	Magnesium	3500	ug/l	Y			26	60	500	ug/l
Tango	MW-467S_SEP21-09222021	E365.4	10/13/2021 12:20	Phosphates, Total as P	0.057	ug/l	N	U		0.041	0.057	0.1	ug/l
Tango	MW-467S_SEP21-09222021	SW6010C	10/7/2021 5:06	Potassium	810	ug/l	Y	J		240	940	3000	ug/l
Tango	MW-467S_SEP21-09222021	SW6010C	10/7/2021 5:06	Sodium	8700	ug/l	Y			370	1000	5000	ug/l
Tango	MW-467S_SEP21-09222021	SW9056	9/29/2021 23:17	Sulfate	16	ug/l	Y			1	2.5	5	ug/l

Notes:
µg/L = microgram(s) per liter

J = The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample as a result of associated QC criteria results. The data are valid for project use to achieve project DQOs.

J1 = Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

M = manual integrated compound

U = The analyte was analyzed for but was not detected at a level greater than or equal to the method and sample-specific detection limit.

Mobility of Lead and Antimony in Shooting Range Soils:

Column Leaching Study

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February 2021

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

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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.

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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.

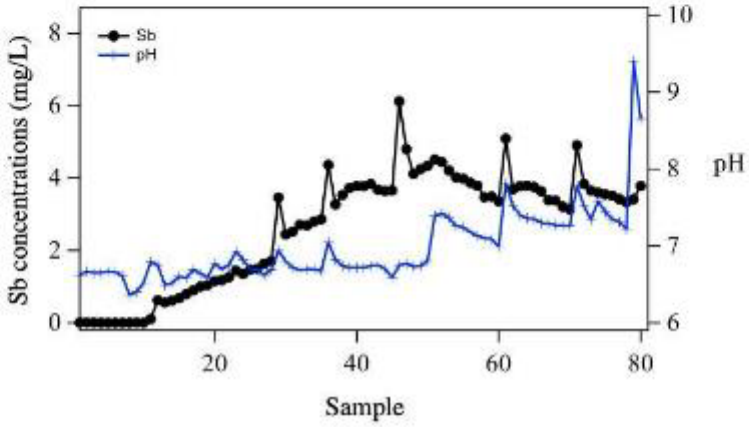
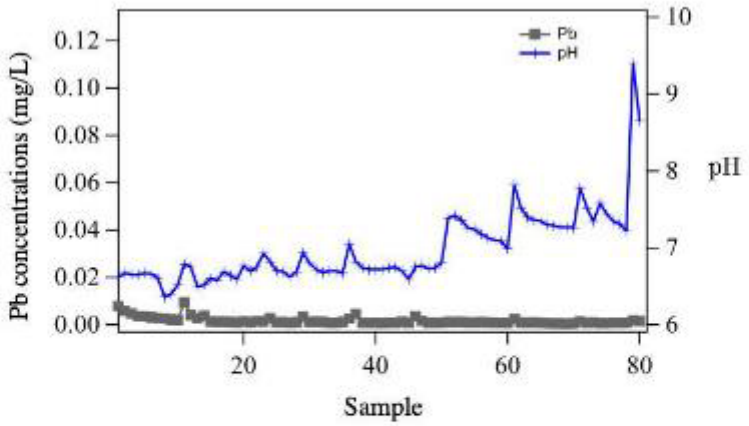


Figure 2. Concentrations of Pb as a function of pH for experiment A.



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.

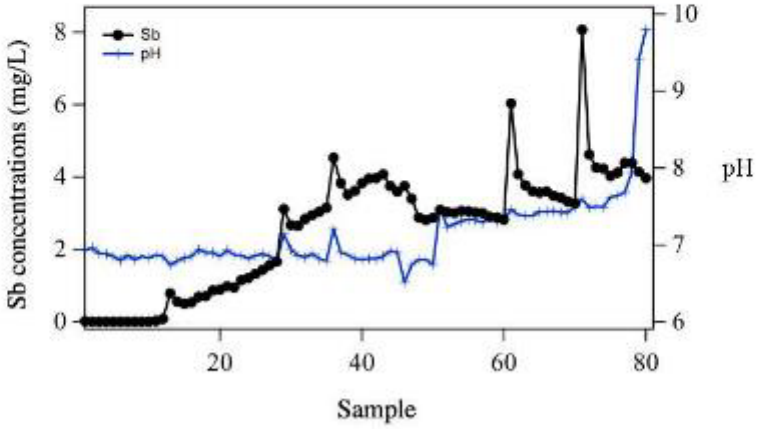
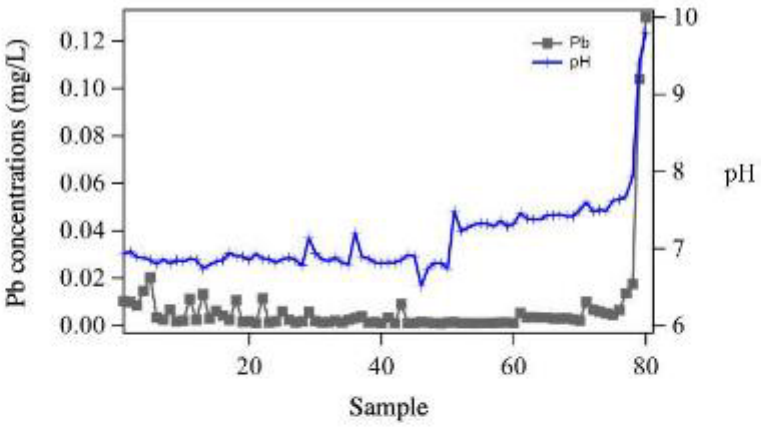


Figure 4. Concentrations of Pb as a function of pH for experiment B.



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	6.63	24	0.0069	0.0079		India soil packed and simulated rain
2	a	9/10/20 10:10 AM	4.35	145	6.63	22	0.0057	0.0039		
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	6.62	25	0.0025	0.0031		
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	25	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	0.0030		
11	a	9/10/20 12:20 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	0.0043		
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	6.53	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	0.0012		
17	a	9/11/20 10:40 AM	4.45	146	6.69	22	0.896	0.0012		
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	0.0012		
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	0.0012		
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	6.63	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	3.21	0.0043		
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	3.53	0.000772	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	6.73	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	0.0012		
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	6.73	16	4.80	0.0016		
48	a	9/17/20 10:20 AM	4.50	149	6.72	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	-5	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	0.000879	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	-161	7.83	-41	5.09	0.0034		
62	a	9/18/20 10:10 AM	10.03	-164	7.52	-25	3.69	0.0010		
63	a	9/18/20 10:20 AM	10.05	-161	7.40	-18	3.77	0.0009	Pb*	
64	a	9/18/20 10:30 AM	10.03	-164	7.36	-16	3.59	0.0010	Pb*	
65	a	9/18/20 10:40 AM	10.05	-161	7.35	-15	3.75	0.0008	Pb*	
66	a	9/18/20 10:50 AM	10.03	-164	7.30	-12	3.65	0.0009	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	10.03	-164	7.23	-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	10.03	-164	7.26	-10	3.14	0.000459	Pb*	
71	a	9/19/20 10:00 AM	10.99	-214	7.78	-29	4.90	0.0014		
72	a	9/19/20 10:10 AM	10.99	-214	7.52	-25	3.85	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 10:20 AM	10.99	-214	7.38	-28	3.80	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	11.35	-245	7.35	-15	3.51	0.0008	Pb*	
77	a	9/19/20 11:00 AM	11.35	-245	7.31	-13	3.42	0.0008	Pb*	
78	a	9/19/20 11:10 AM	11.35	-245	7.22	-8	3.35	0.000496	Pb*	0.15 g Ca(OH2) added directly to soil
79	a	9/19/20 12:10 PM	11.35	-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	11.35	-245	8.62	-87	3.36	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	0.0105		India soil packed and simulated rain
2	b	9/20/20 10:10 AM	4.49	144	6.96	6	0.0089	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	0.0052	0.0055		
7	b	9/20/20 11:00 AM	4.49	144	6.86	12	0.0036	0.0023		
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 12:00 AM	4.49	144	6.83	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	0.0135		
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	0.0065		
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	0.0025		
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	6.83	11	0.949	0.0119		
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	13	2.65	0.0015		
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	-2	4.58	0.0052		
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	6.83	11	3.51	0.0015		
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	0.0015		
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	3.05	0.0011		
53	b	9/27/20 1:20 PM	9.39	-126	7.23	-11	3.01	0.0011		
54	b	9/27/20 1:30 PM	9.39	-126	7.31	-15	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	0.0015		
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	0.0026		
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	0.0051		
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	7.43	-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	0.0049		
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	7.30	-25	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	4.05	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	4.59	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

February, 2022

(NHESP Tracking No.: 08-24210)

Soldier Validation Lane Use

No site composition changes occurred in FY21.

SVL Assessments after 2021 Training Season

All sites with containers were visited in February 2022 to evaluate training impacts during the 2021 training season. The assessment methodology matched the assessment performed in the Baseline Condition Assessment Report and FYs 12-19, 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 any sites during 2021 and management activity was limited to Roads and Grounds personnel mowing around existing infrastructure

Conclusion

All regulatory conditions were followed during use of the SVLs and BPs for training. Most erosion and rutting impacts have remained static on the lanes as expected with regular levels of vehicle use and regular stormwater runoff on dirt roads. MAARNG will continue to strive to minimize environmental impacts from these lanes by following the established guidelines.

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

2021 Long Term Monitoring Sentry Well Sampling Results
Upper Cape Regional Water Supply Cooperative

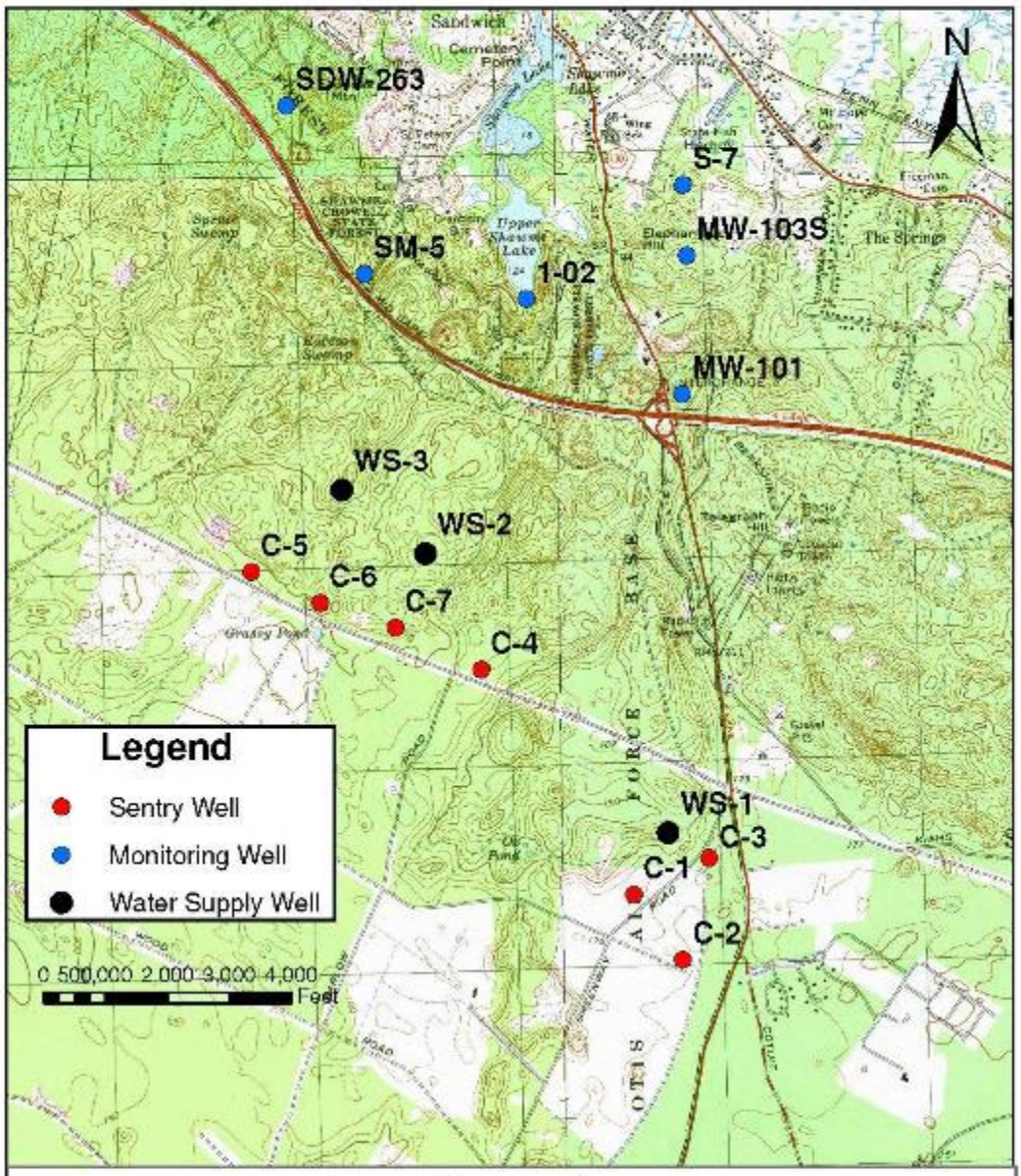


Figure 1
Long-term Monitoring Well Network
Upper Cape Regional Water Supply Cooperative
Cape Cod, Massachusetts

Watermark
175 Cabot Street • Lowell, MA 01854
Office 978.452.9696 Fax 978.453.9988

LETTER OF TRANSMITTAL

DATE:	06/29/2021	JOB NO:	17006-00
ATTENTION:	Mr. Richard Rondeau		
RE:	Sentry Well Sampling Results 2021 Sampling Round		
Upper Cape Regional Water Supply (UCRWS)			
Long-Term Monitoring, Sentry Well Sampling Results			

TO: MA Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

WE ARE SENDING YOU:

✓ Attached ____ Under separate cover via ☐ FedEx ☐ UPS ☐ USPS **the following items:**

____ Shop Drawings ____ Prints ____ Plans ____ Samples ✓ Reports

____ Copy of Letter ____ Change Order No. _____

NO.	ITEM	QUANTITY	DESCRIPTION
1	Hard Copy	1	UCRWS Long-Term Monitoring Sentry Well Sampling Results – 2021 Sampling Round

THESE ARE TRANSMITTED as checked below:

____ For approval ____ Approved as submitted ____ Resubmit ____ Copies for approval

✓ For your use ____ Approved as noted ____ Submit ____ Copies for distribution

____ As requested ____ Returned for corrections ____ Return ____ Corrected prints

____ For review and comment ____ For bids due _____ ____ Prints returned after loan to Watermark

REMARKS:

Hi Richard,

Attached are the results for the Upper Cape Regional Water Supply Cooperative 2021 Sentry Well Sampling Round of the shallow and deep screens. If you have any questions or require additional information, please give me a call at 978-452-9696.

Thank you,

Joe Spangenberger

COPY TO: Dan Mahoney – UCRWS, w/enc
File 17006-00/WLC3770

SIGNED: _____

If enclosures are not as noted, kindly notify us at once.

Thank You!

Form No. 032 (June 2009)

Watermark
Engineering • Construction • Operations

Environmental
Infrastructure
Buildings & Facilities

June 25, 2021

Mr. Dan Mahoney, Chair
Upper Cape Regional Water Supply (UCRWS) Cooperative
P.O. Box 373
Mashpee, MA 02649-0373

Subject: **Results of 2021 Sampling Round**
Long-Term Monitoring Well Sampling Services
UCRWS Cooperative – Long-Term Monitoring Plan

Dear Mr. Mahoney:

In accordance with our proposal dated July 29, 2015, and as authorized by the UCRWS on April 1, 2021, we are pleased to submit the results of the 2021 Sampling Round that was performed by Watermark Environmental, Inc. (Watermark) between May 18 and 20, 2021. During the 2021 Sampling Round, seven (7) shallow well screens (C-1S through C-7S) and seven (7) deep well screens (C-1D through C-7D) were sampled in accordance with the UCRWS Long-Term Monitoring (LTM) Plan, as amended on October 22, 2007. The groundwater sample analyses were performed by Envirotech Laboratories, Inc. of Sandwich, Massachusetts (Envirotech), Eurofins TestAmerica Laboratories, Inc. of Savannah, Georgia and its subsidiaries (Eurofins TestAmerica), and their subcontractor Alpha Analytical of Westborough, Massachusetts.

On May 25, 2021, Eurofins TestAmerica's subcontractor, Chemserve, Inc., who is the only Massachusetts Department of Environmental Protection (MassDEP)-approved lab that can analyze for perchlorate using EPA Method 314.0, informed Watermark they were unable to meet the detection limit of less than 2.0 micrograms per liter (µg/L). Typically this method has a detection limit of 0.30 µg/L. TestAmerica therefore suggested analyzing the perchlorate samples by EPA Method 332.0 to achieve a lower detection limit. In addition, fourteen groundwater samples (C-1S, C-1D, C-2S, C-2D, C3-S, C3-D, C4-S, C4-D, C5-S, C5-D, C6-S, C6-D, C7-S, and C7-D) submitted for explosives analysis, were received by the lab above 6.0 degrees Celsius (°C) due to a delay by the shipping company. Since the time that samples were above 6°C was limited, the potential for biological degradation was believed to be low by the laboratory.

Nevertheless, on May 26, 2021, Ms. Maura Callahan (Callahan Consulting, Inc.), spoke with Mr. James McLaughlin, Drinking Water Program Chief for the MassDEP Southeast Regional Office (SERO) regarding the possibility of using a new perchlorate method and if the results for the samples received above 6.0 °C would be accepted by MassDEP. Mr. McLaughlin verbally approved the use of EPA Method 332.0 and the data associated with the analysis of the samples that were received above 6.0 °C.

We have completed a review of the Sample Data Summary and Extended Data Packages provided by Eurofins TestAmerica and by Envirotech, and have confirmed that the quality control objectives established for field sampling and laboratory analyses efforts have been effectively met (with the qualifiers mentioned above). The laboratory results of the sampling effort have been tabulated in the attached 2021 Sampling Results Tables (Attachment A). Results for all volatile organic compounds (VOCs), 1,2-dibromoethane (EDB), and explosives compounds were non-detect, with the exception of chloroform and perchlorate.

175 Cabot Street • Lowell, MA 01854 • Office 978.452.9696 • Fax 978.453.9988 • www.watermarkenv.com

Chloroform was detected in all but one monitoring well (C-6S) and perchlorate was detected in monitoring wells C-2S, C-4D, and C-6S. Chloroform results are consistent with historical data. Since EPA Method 332.0 has a lower detection limit, perchlorate was detected in two wells (C-2S and C-6S) at concentrations below 0.30 µg/L. Perchlorate was detected in one well (C-4D) at a concentration of 0.304 µg/L. The chloroform and perchlorate detections were all below the Massachusetts Drinking Water Standards. Water quality results were below their respective standards.

Once again, we appreciate this opportunity to be of service to the UCRWS, and we look forward to working with you in the future. If you have any questions regarding this submittal, please do not hesitate to contact me at (978) 452-9696.

Sincerely,
WATERMARK

Olaf Westphalen, PG, LSP
Project Manager

Attachments:
Attachment A: 2021 Sampling Results Tables
Attachment B: Chain of Custody Forms, Low Flow Data – Field Results, 2021 Sampling Event

cc: J. Spangenberger (Watermark)
File 17006-00/WLC3770

Watermark

ATTACHMENT A

2021 Sampling Results Tables

Watermark

Table 1-1
Physical-Chemical Parameters
Shallow and Deep Screens at Sentry Wells
2021 Sampling Results, UCRWS, Massachusetts

Sample ID	Water Quality Standard Level[1]	Laboratory Reporting Limit	C-1S	C-1D	C-2S	C-2D	C-3S	C-3D	C-4S	C-4D	C-5S	C-5D	C-6S	C-6D	C-7S	C-7D
Sample Date			05/18/2021	05/20/2021	05/19/2021	05/19/2021	05/18/2021	05/20/2021	05/19/2021	05/19/2021	05/20/2021	05/20/2021	05/19/2021	05/19/2021	05/19/2021	05/19/2021
Physical-Chemical																
pH Method SM 4500 H-B	6.5 - 8.5[2]	NS	6.35	6.75	7.27	6.45	6.49	6.85	6.58	6.87	6.36	6.49	6.36	6.82	6.57	6.84
Alkalinity - Total, as $CaCO_3$ (mg/L) Method SM 2320 B	NS	2.5	6.4	30	8.8	10	7.2	14	5.8	17	11	6.8	20	9.3	6.8	11
Turbidity (NTU) Method SM 2130 B	TT	1.0	1.6	<1.0	1.5	1.9	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Specific Conductance (µmhos/cm @ 25 °C) Method EPA 120.1	NS	10.0	57	57	52	59	48	48	47	64	57	41	68	44	58	45

Notes:

[1] Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level (CMCL, 2020) unless otherwise noted.

[2] Water Quality Standard Levels are from the Secondary Maximum Contaminant Levels (SMCLs, 2020).

Samples were analyzed by Environtech Laboratories Inc. of Sandwich, Massachusetts.

NS = Not Established
TT = Treatment Technique
NTU = Nephelometric Turbidity Unit
µmhos/cm = Micromhos per Centimeter
°C = degrees Celsius
NA = Not Applicable
< = Less Than
mg/L = Milligrams per Liter

Prepared By: JG
Checked By: MM

Watermark

Table 1-2
Volatile Organic Compounds – EPA Method 524.2 (mg/L)
Shallow and Deep Screens at Sentry Wells
2021 Sampling Results, UCRWS, Massachusetts

Sample ID / Sample Date	Water Quality Standard Level(1) (mg/L)	Laboratory Reporting Limit* (mg/L)	C-1S 05/18/2021	C-1D 05/20/2021	C-2S 05/19/2021	C-2D 05/19/2021	C-3S 05/18/2021	C-3D 05/20/2021	C-4S 05/19/2021
VOCs									
Trans-1,3-Dichloropropene	0.0004(2)(4)(5)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	0.7	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichlorofluoromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Hexachlorobutadiene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Isopropylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
p-Isopropyltoluene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methylene chloride (Dichloromethane)	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Naphthalene	0.140(2)	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
n-Propylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Styrene	0.1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,1,2-Tetrachloroethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,2,2-Tetrachloroethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrachloroethylene	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Toluene	1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,3-Trichlorobenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,4-Trichlorobenzene	0.07	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,1-Trichloroethane	0.2	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,2-Trichloroethane	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichloroethene	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,3-Trichloropropane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,4-Trimethylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3,5-Trimethylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Vinyl chloride	0.002	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
o-Xylene	10(2)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
m-Xylene & p-Xylene	10(2)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromobenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromodichloromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromoform	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromomethane	0.010(2)	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Methyl tert-butyl ether (MTBE)	0.070(2)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
n-Butylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
sec-Butylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
tert-Butylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Carbon tetrachloride	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chlorobenzene	0.1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dibromochloromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chloroethane	NE	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	0.07(2)	0.0005	**0.00094**	**0.0017**	**0.0012**	**0.0019**	**0.0018**	**0.0011**	**0.00076**
Chloromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Chlorotoluene (o-Chlorotoluene)	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4-Chlorotoluene (p-Chlorotoluene)	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dibromomethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichlorobenzene (o-DCB)	0.6	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3-Dichlorobenzene (m-DCB)	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,4-Dichlorobenzene (p-DCB)	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dichlorodifluoromethane	1.4(2)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1-Dichloroethane	0.070(2)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichloroethane	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1-Dichloroethylene	0.007	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethylene	0.07	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trans-1,2-Dichloroethylene	0.1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichloropropane	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3-Dichloropropane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,2-Dichloropropane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1-Dichloropropene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
cis-1,3-Dichloropropene	0.0004(2)(4)(5)	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Butanone (MEK)	4(2)	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-Methyl-2-pentanone (MIBK)	0.35(2)	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bromochloromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Watermark

Table 1-2
Volatile Organic Compounds EPA Method 524.2 (mg/L)
Shallow and Deep Screens at Scutry Wells
2021 Sampling Results, UCRWS, Massachusetts

Sample ID	Water Quality Standard Level[1] (mg/L)	Laboratory Reporting Limit* (mg/L)	C-4D	C-5S	C-5D	C-6S	C-6D	C-7S	C-7D
Sample Date			05/19/2021	05/20/2021	05/20/2021	05/19/2021	05/19/2021	05/19/2021	05/19/2021
VOCs									
Trans-1,3-Dichloropropene	0.000[2][3][4]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	0.7	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichlorofluoromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Hexachlorobutadiene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Isopropylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
p-Isopropyltoluene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methylene chloride (Dichloromethane)	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Naphthalene	0.140[2]	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
n-Propylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Styrene	0.1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,1,2-Tetrachloroethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,2,2-Tetrachloroethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrachloroethylene	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Toluene	1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,3-Trichlorobenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,4-Trichlorobenzene	0.07	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,1-Trichloroethane	0.2	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,2-Trichloroethane	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichloroethene	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,3-Trichloropropane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,4-Trimethylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3,5-Trimethylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Vinyl chloride	0.002	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
o-Xylene	10[5]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
m-Xylene & p-Xylene	10[5]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromobenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromodichloromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromoform	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bromomethane	0.010[2]	0.001	< 0.001	<0.001	< 0.001	<0.001	< 0.001	<0.001	< 0.001
Methyl tert-butyl ether (MTBE)	0.070[2]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
n-Butylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
sec-Butylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
tert-Butylbenzene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Carbon tetrachloride	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chlorobenzene	0.1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dibromochloromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chloroethane	NE	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	0.07[2]	0.0005	**0.000145 J**	**0.000033 J**	**0.0029**	< 0.0005	**0.000137 J**	**0.002**	**0.00085**
Chloromethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Chlorotoluene (o-Chlorotoluene)	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4-Chlorotoluene (p-Chlorotoluene)	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dibromomethane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichlorobenzene (o-DCB)	0.6	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3-Dichlorobenzene (m-DCB)	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,4-Dichlorobenzene (p-DCB)	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dichlorodifluoromethane	1.4[2]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1-Dichloroethane	0.070[2]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichloroethane	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1-Dichloroethylene	0.007	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethylene	0.07	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trans-1,2-Dichloroethylene	0.1	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichloropropane	0.005	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3-Dichloropropane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,2-Dichloropropane	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1-Dichloropropene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
cis-1,3-Dichloropropene	0.000[2][3][4]	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Hexanone (MBK)	4[5]	0.01	< 0.01	<0.01	< 0.01	<0.01	< 0.01	<0.01	< 0.01
4-Methyl-2-pentanone (MIBK)	0.35[2]	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bromochloromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Watermark

Table 1-2
Volatile Organic Compounds – EPA Method 524.2 (mg/L)
Shallow and Deep Screens at Sentry Wells
2021 Sampling Results, UCRWS, Massachusetts

Notes:

Results in bold were detected above laboratory reporting limits.
Samples analyzed by TestAmerica Laboratories, Inc. of Savannah, Georgia.
a Limit of quantitation presented as detection limits.
(1) Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level (MMCL, 2020) unless otherwise noted.
(2) Water Quality Standard Levels are the Massachusetts Drinking Water Guidelines developed by the Office of Research and Development.
(3) Xylene Standard based on Total Xylene.
(4) Water Quality Standard listed is for 1,3-dichloropropene (i.e., the sum of cis-1,3-dichloropropene and trans-1,3-dichloropropene).

J = Result is less than the reporting limit but greater than or equal to the method detection limit. Concentration is approximate.
mg/L = Milligrams per Liter
< = Less Than
NE = Not Established

Prepared By: BG
Checked By: MM

Watermark

Table 1-3
Explosive Compounds – EPA Method SW8330 (mg/L)
Shallow and Deep Screens at Sentry Wells
2021 Sampling Results, UCRWS, Massachusetts

Sample ID	Water Quality Standard Level[1] (mg/L)	Laboratory Reporting Limit* (mg/L)	C-1S	C-1D	C-2S	C-2D	C-3S	C-3D	C-4S	C-4D	C-5S	C-5D	C-6S	C-6D	C-7S	C-7D
Sample Date			05/18/2021	05/20/2021	05/19/2021	05/19/2021	05/18/2021	05/20/2021	05/19/2021	05/19/2021	05/20/2021	05/20/2021	05/19/2021	05/19/2021	05/19/2021	05/19/2021
Explosives																
2,6-Diamino-4-nitrotoluene	NE	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,4-Diamino-6-nitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
HMX	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
RDX	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
Picric acid	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
1,3,5-Trinitrobenzene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
1,3-Dinitrobenzene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
Nitrobenzene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
Tetryl	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
Nitroglycerin	NE	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
2,4,6-Trinitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
4-Amino-2,6-dinitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
2-Amino-4,6-dinitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
2,6-Dinitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
2,4-Dinitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
2-Nitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
3-Nitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
4-Nitrotoluene	NE	0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025
PETN	NE	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Notes:

Samples analyzed by Eurofins TestAmerica Laboratories, Inc. of South Burlington, Vermont.

* Limit of quantitation generally or detection limits.

[1] Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level (MMCL, 2020) unless otherwise noted.

NE – Not Established < – Less Than mg/L – Milligrams per Liter Prepared By: BG Checked By: MM

Watermark

Table 1-4
Perchlorate – EPA Method 332.0 and EDB – EPA Method 504.1 (mg/L)
Shallow and Deep Screens at Sentry Wells
2021 Sampling Results, UCRWS, Massachusetts

Sample ID	Water Quality Standard Level[1] (mg/L)	Laboratory Reporting Limit (mg/L)	C 1S	C 1D	C 2S	C 2D	C 3S	C 3D	C 4S	C 4D	C 5S	C 5D	C 6S	C 6D	C 7S	C 7D
Sample Date			05/18/2021	05/20/2021	05/19/2021	05/19/2021	05/18/2021	05/20/2021	05/19/2021	05/19/2021	05/20/2021	05/20/2021	05/19/2021	05/19/2021	05/19/2021	05/19/2021
Perchlorate and EDB																
Perchlorate	0.002	0.00005	<0.00005	<0.00005	**0.00005**	<0.00005	<0.00005	<0.00005	<0.00005	**0.000504**	<0.00005	<0.00005	**0.000464**	<0.00005	<0.00005	<0.00005
1,2-Dibromoethane (EDB)	0.00002	0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018	< 0.000018

Notes:

Perchlorate analyzed by Alpha Analytical of Westboro, Massachusetts.

EDB analyzed by Eurofins TestAmerica Laboratories, Inc. of Savannah, Georgia

* Limit of quantitation presented as detection limits.

[1] Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level (MMCL, 2020) unless otherwise noted.

NE – Not Established < – Less Than mg/L – Milligrams per Liter

Prepared By: BG
Checked By: MM

Watermark

ATTACHMENT B

Chain of Custody Forms, Low Flow Data – Field Results, 2021 Sampling Event

Eurofins TestAmerica, Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone: 912-354-7858 Fax: 912-352-0165

Chain of Custody Record

Boston #215

eurofins | Environment Testing America

Client Information	Sampler: Brian Granger	Lab PM: Jerry Lanier	Carrier Tracking No(s):	COC No: 680-125902-46580.2
Client Contact: ~~Amber Gamboa~~ Olaf Westphalen	Phone: 617-960-6476	E-Mail: jerry.lanier@Eurofinset.com	State of Origin:	Page: Page 1 of 2
Company: WaterMark Environmental Inc	PWSID:	Analysis Requested		Job #:
Address: 175 Cabot Street	Due Date Requested:			Preservation Codes: A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify), Other:
City: Lowell	TAT Requested (days): 14 Days			
State, Zip: MA, 01854	Compliance Project: ☐ Yes ☐ No			
Phone: 978-771-8626	PO #: ~~W12480548~~ W21-12464			
Email: ~~olaf.westphalen~~ ~~@watermarkenv.com~~ olaf.westphalen@watermarkenv.com	WO #:			
Project Name: Joint Base Cape Cod - 2021	Project #: ~~68014488~~ 17006-00			
Site: Upper Cape Regional Water Supply	SSOW#:			

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8011 - (NDD) Requested Analytes (EDB)	8242 Preserved - (NDD) Custom Subset Template (VOCs)	8330B - 8330 Routine (Explosives)	8242_Preserved - (NDD) Custom Subset Template	E314.0 - Perchlorate	Total Number of containers	Special Instructions/Note:
Preservation Code:							R	N	N	A			
TB-051821	5/18/21	0800	N/A	Water	N	N	X	X		X			Field EDB analysis if EDB is detected in any sample
C3-S-051821	"	1340	Grab	Water	N	N	X	X	X	X	X		Call PM to discuss
C1-S-051821	↓	1510	Grab	Water	N	N	X	X	X	X	X		* Perchlorate Samples
C2-S-051921	5/19/21	0830	Grab	Water	N	N	X	X	X	X	X		are field filtered
C2-D-051921	"	0845	Grab	Water	N	N	X	X	X	X	X		* Ship perchlorate Samples
C4-S-051921		1010	Grab	Water	N	N	X	X	X	X	X		to Chemserve, other
C4-D-051921		1010	Grab	Water	N	N	X	X	X	X	X		analysis to be shipped
C7-S-051921		1155	Grab	Water	N	N	X	X	X	X	X		to other Eurofins labs
C7-D-051921		1220	Grab	WATER	N	N	X	X	X	X	X		
C6-S-051921		1350	Grab	WATER	N	N	X	X	X	X	X		
C6-D-051921	↓	1400	Grab	WATER	N	N	X	X	X	X	X		

680-196232 Chain of Custody

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological	☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months
Deliverable Requested: I, II, III, IV, Other (specify)	Special Instructions/QC Requirements:
Empty Kit Relinquished by:	Date: Time: Method of Shipment:

Relinquished by:	Date/Time: 5/20/21 1511	Company: Watermark	Received by:	Date/Time: 5/20/21 1511	Company: ETA
Relinquished by:	Date/Time: 5/20/21 1722	Company: ETA	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time: 5/21/21 0815	Company: Marlow
Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:	0.2 (0.7) 2.7/2.8 13.4 (13.5) 16.4 (16.5)	

Ver: 11/01/2020

Eurofins TestAmerica, Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone 912-354-7858 Fax 912-352-0165

Chain of Custody Record

Boston #215

eurofins Environment Testing America

Field	Value
Client Information	
Client Contact	~~Amee Comeau~~ Olaf Westphalen
Company	WaterMark Environmental, Inc.
Address	175 Cabot Street
City	Lowell
State, Zip	MA, 01854
Phone	978-771-8426
Email	~~acomeau~~@watermarkenv.com
Project Name	Joint Base Cape Cod - 2021
Site	Upper Cape Regional Water Authority
Sampler	Brian Genger / Mike Moschu
Phone	617-460-6476
Due Date Requested	
TAT Requested (days)	14 Days
Compliance Project	☐ Yes ☐ No
PO #	~~1447-40540~~ W21-12464
WO #	
Project #	~~[illegible]~~ 17006-00
SSOW#	
PWSID	
Lab PM	~~Weinberg, Amy~~ Jerry Lanier
E-Mail	Jerry.Lanier@Eurofinset.com
COC No	680-125905-48799.1
Page	~~Page 1 of 2~~ 2 of 2
Job #	

Analysis Requested: Field Filtered Sample (Yes or No); Perform MS/MSD (Yes or No); 504.1 - (MOD) Requested Analyses EDB; 524.2_Preserved - (MOD) Custom Subset Template (VOCs); 8330B - 8330 Routine (Explosives); 524.2_Preserved - (MOD) Custom Subset Template; E314.0 Perchlorate; Total Number of containers

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix	Field Filtered	Perform MS/MSD	504.1 (R)	524.2 (N)	8330B (N)	524.2 (A)	E314.0	Special Instructions/Note
CS-S-052021	5/20/21	0805	GRAB	Water	N	N	X	X	X	X	X	See Page #1
CS-D-052021	" "	0805	GRAB	Water	N	N	X	X	X	X	X	
C3-D-052021	↓	0935	GRAB	Water	N	✓	X	X	X	X	X	
C1-D-052021	↓	1125	GRAB	Water	N	✓	X	X	X	X	X	
				Water								
				Water								
				Water								
				Water								
				Water								
				Water								
				Water								

Preservation Codes: A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2O3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - pH 4-5; Z - other (specify); Other:

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month): ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ___ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: ___ Date: ___ Time: ___ Method of Shipment: ___

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
[signature]	5/20/21 1511	Watermark	[signature]	5/20/21 1511	ETA
[signature]	5/20/21 1700				
			[signature]	5/21/21 1015	[illegible]

Custody Seals Intact: ☐ Yes ☐ No — Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks: 0.2 (0.7) 3.7 (2.8) 11.4 (10.5) 11.4 (10.5)

Ver: 11/01/2020

CHAIN OF CUSTODY FORM

ENVIROTECH LABS, INC.
8 Jan Sebastian Dr., Unit 12
Sandwich, MA 02563
(508)888-6460/1-800-339-6460
FAX (508)888-6446

Client: Watermark Environmental
175 Cabot St
Address: Lowell, MA 01854
cell: 617-960-6476
Phone#: 978-452-9696 ext. 213
brian.geringer@watermarkenv.com

roj. No. | **Project Name:** Upper Cape Regional Water Supply UCRWS-~~2019~~ BC 2021

ampler: Brian Geringer/ Mike Mosho

ib ID:	Date	Time	Comp	Grab	Sample location	container	Pres.	Analysis Requested
	5/18/21	1340		X	C3-S-051821	500 ml	ice	pH,Specific Conductance,Turbidity, Alkalinity
	5/18/21	1510		X	C1-S-051821	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity

clinquished:	Date/Time	Received:	Relinquished:	Date/Time	Received:
[signature]	5/18/21 1500	15:50 Elavarra 5/18/21			
elinquished:	Date/Time	Received:	Relinquished:	Date/Time	Received:

CHAIN OF CUSTODY FORM

ENVIROTECH LABS, INC.
8 Jan Sebastian Dr., Unit 12
Sandwich, MA 02563
(508)888-6460/1-800-339-6460
FAX (508)888-6446

Client: Watermark Environmental
175 Cabot St
Address: Lowell, MA 01854
cell: 617-960-6476
Phone#: 978-452-9696 ext. 213
brian.geringer@watermarkenv.com

roj. No. | **Project Name:** Upper Cape Regional Water Supply UCRWS-~~2018~~ BG 2021

ampler: Brian Geringer / Mike Mache

sb ID:	Date	Time	Comp	Grab	Sample location	container	Pres.	Analysis Requested
	5/19/21	0830		X	C2-S - 051921	500 ml	ice	pH,Specific Conductance,Turbidity, Alkalinity
	5/19/21	0845		X	C2-D - 051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/19/21	1010		X	C4-S - 051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/19/21	1010		X	C4-D - 051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/19/21	1155		X	C7-S-051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/19/21	1220		X	C7-D-051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/19/21	1350		X	C6-S-051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/19/21	1400		X	C6-D-051921	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity

Relinquished:	Date/Time	Received:	Reliquished:	Date/Time	Received:
Brian Geringer	5/19/21 1520	5/19/21 Forsea 15:20			
Relinquished:	Date/Time	Received:	Relinquished:	Date/Time	Received:

CHAIN OF CUSTODY FORM

Proj. No.	Project Name: Upper Cape Regional Water Supply UCRWS-~~2018~~ BG 2021
Sampler:	Brian Geringer / Mina Mosche

ENVIROTECH LABS, INC.
8 Jan Sebastian Dr., Unit 12
Sandwich, MA 02563
(508)888-6460/1-800-339-6460
FAX (508)888-6446

Client: Watermark Environmental
175 Cabot St
Address: Lowell, MA 01854
cell: 617-960-6476
Phone#: 978-452-9696 ext. 213
brian.geringer@watermarkenv.com

Lab ID:	Date	Time	Comp	Grab	Sample location	container	Pres.	Analysis Requested
	5/20/21	0805		X	C5-S-052021	500 ml	ice	pH,Specific Conductance,Turbidity, Alkalinity
	5/20/21	0805		X	C5-D-052021	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/20/21	0935		X	C3-D-052021	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
	5/20/21	1125		X	C1-D-052021	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity

Relinquished:	Date/Time	Received:	Reliquished:	Date/Time	Received:
Brian Geringer	5/20/21 1:28pm	[signature]			
Relinquished:	Date/Time	Received:	Relinquished:	Date/Time	Received:

Eurofins TestAmerica, Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone: 912-354-7858 Fax: 912-352-0165

Chain of Custody Record

L2128197

eurofins Environment Testing America

Client Information (Sub Contract Lab)	Sampler	Lab PM: Lanier, Jerry A	Carrier Tracking No(s):	COC No: 680-654993.1
Client Contact: Shipping/Receiving	Phone	E-Mail: Jerry.Lanier@Eurofinset.com	State of Origin: Massachusetts	Page: Page 1 of 2
Company: Alpha Analytical Inc		Accreditations Required (See note): DoD ELAP - A2LA; DoD ELAP - L-A-B; Federal - US Fish & ...		Job #: 680-199232-1
Address: 8 Walkup Drive,	Due Date Requested: 6/11/2021	Analysis Requested		Preservation Codes:
City: Westboro	TAT Requested (days):			A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2O3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - pH 4-5; Z - other (specify)
State, Zip: MA, 01581				
Phone:	PO #:			Other:
Email:	WO #:			
Project Name: Joint Base Cape Cod - 2017 - 2021	Project #: 68018167			
Site:	SSOW#:			

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (Water, Solid, Wastewater, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUB (EPA 332.0 Perchlorate) / EPA 332.0 Perchlorate	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
C3-S-051821 (680-199232-2)	5/18/21	13:40 Eastern		Water			X	1	
C1-S-051821 (680-199232-3)	5/18/21	15:10 Eastern		Water			X	1	
C2-S-051821 (680-199232-4)	5/19/21	08:30 Eastern		Water			X	1	
C2-D-051821 (680-199232-5)	5/19/21	08:45 Eastern		Water			X	1	
C4-S-051821 (680-199232-6)	5/19/21	10:10 Eastern		Water			X	1	
C4-D-051821 (680-199232-7)	5/19/21	10:10 Eastern		Water			X	1	
C7-S-051821 (680-199232-8)	5/19/21	11:55 Eastern		Water			X	1	
C7-D-051821 (680-199232-9)	5/19/21	12:20 Eastern		Water			X	1	
C6-S-051821 (680-199232-10)	5/19/21	13:50 Eastern		Water			X	1	

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to Eurofins TestAmerica.

Possible Hazard Identification: Unconfirmed	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month): ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:
Relinquished by:	Date/Time: 5-26-21 1551	Company: SAV	Received by: ACL
Relinquished by:	Date/Time:	Company:	Received by: Date/Time: 5/27/21 10:16 Company:
Relinquished by:	Date/Time:	Company:	Received by: Date/Time: Company:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Eurofins TestAmerica, Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone: 912-354-7858 Fax: 912-352-0165

Chain of Custody Record

L2128197

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Lanier, Jerry A	Carrier Tracking No(s):	COC No: 680-654993.2
Client Contact: Shipping/Receiving	Phone:	E-Mail: Jerry.Lanier@Eurofinset.com	State of Origin: Massachusetts	Page: Page 2 of 2
Company: Alpha Analytical Inc		Accreditations Required (See note): DoD ELAP - A2LA; DoD ELAP - L-A-E; Federal - US Fish & ...		Job #: 680-199232-1
Address: 8 Walkup Drive,	Due Date Requested: 6/11/2021	Analysis Requested		Preservation Codes:
City: Westboro	TAT Requested (days):			A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2O3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - pH 4-5; Z - other (specify); Other:
State, Zip: MA, 01581				
Phone:	PO #:			
Email:	WO #:			
Project Name: Joint Base Cape Cod - 2017 - 2021	Project #: 68016167			
Site:	SSOW#:			

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (w=water, s=solid, o=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUB (EPA 332.0 Perchlorate) EPA 332.0 Perchlorate	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
C6-D-051821 (680-199232-11)	5/19/21	14:00 Eastern		Water			X	1	
C5-S-052021 (680-199232-12)	5/20/21	08:05 Eastern		Water			X	1	
C5-D-052021 (680-199232-13)	5/20/21	08:05 Eastern		Water			X	1	
C3-D-052021 (680-199232-14)	5/20/21	09:35 Eastern		Water			X	1	
C1-D-052021 (680-199232-15)	5/20/21	11:25 Eastern		Water			X	1	

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to Eurofins TestAmerica.

Possible Hazard Identification: Unconfirmed	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month): ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months
Deliverable Requested: I, II, III, IV, Other (specify) — Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:
Relinquished by:	Date/Time: 5-26-21 1551	Company: SAV	Received by:	Date/Time: 5/27/21 1016	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Eurofins TestAmerica, Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone: 912-354-7858 Fax: 912-352-0165

Chain of Custody Record

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Lanier, Jerry A	Carrier Tracking No(s):	COC No: 680-654730.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Jerry.Lanier@Eurofinset.com	State of Origin: Massachusetts	Page: Page 1 of 2
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note): DoD ELAP - A2LA; DoD ELAP - L-A-B; Federal - US Fish & ...		Job #: 680-199232-1
Address: 530 Community Drive. Suite 11,	Due Date Requested: 6/10/2021	Analysis Requested		Preservation Codes:
City: South Burlington	TAT Requested (days):			
State, Zip: VT, 05403				
Phone: 802-660-1990(Tel) 802-660-1919(Fax)	PO #:			
Email:	WO #:			
Project Name: Joint Base Cape Cod - 2017 - 2021	Project #: 68018167			
Site:	SSOW#:			

Preservation Codes: A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2O3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - pH 4-5; Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	8330B/8330_P_SPE 8330 Routine	Special Instructions/Note:
C3-S-051821 (680-199232-2)	5/18/21	13:40 Eastern		Water	X	
C1-S-051821 (680-199232-3)	5/18/21	15:10 Eastern		Water	X	
C2-S-051821 (680-199232-4)	5/19/21	08:30 Eastern		Water	X	
C2-D-051821 (680-199232-5)	5/19/21	08:45 Eastern		Water	X	
C4-S-051821 (680-199232-6)	5/19/21	10:10 Eastern		Water	X	
C4-D-051821 (680-199232-7)	5/19/21	10:10 Eastern		Water	X	
C7-S-051821 (680-199232-8)	5/19/21	11:55 Eastern		Water	X	
C7-D-051821 (680-199232-9)	5/19/21	12:20 Eastern		Water	X	
C6-S-051821 (680-199232-10)	5/19/21	13:50 Eastern		Water	X	

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places t... maintain accreditation in the State of Origin listed above for analysis/tests/matrix being ana... TestAmerica attention immediately. If all requested accreditations are current to date, retu... ...subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently ...laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins ...a TestAmerica.

680-199232 Chain of Custody

Possible Hazard Identification: Unconfirmed

...isposal (A fee may be assessed if samples are retained longer than 1 month)
...urn To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Deliverable Requested: I, II, III, IV, Other (specify) | Primar... | ...structions/QC Requirements:

Empty Kit Relinquished by:	Date:		Method of Shipment:	
Relinquished by: [signature]	Date/Time: 052421 1700	Company:	Received by: Taylor Whitehouse	Date/Time: 5/25/21 1010	Company: ETA Bur
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

Ver: 11/01/2020

Page 96 of 102 6/15/2021

Eurofins TestAmerica, Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone: 912-354-7858 Fax: 912-352-0165

Chain of Custody Record

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Lanier, Jerry A	Carrier Tracking No(s):
Client Contact: Shipping/Receiving	Phone:	E-Mail: Jerry.Lanier@Eurofinset.com	State of Origin: Massachusetts
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note): DoD ELAP - A2LA; DoD ELAP - L-A-B; Federal - US Fish & ...	
Address: 530 Community Drive, Suite 11	Due Date Requested: 6/10/2021		
City: South Burlington	TAT Requested (days):		
State, Zip: VT, 05403			
Phone: 802-660-1990(Tel) 802-660-1919(Fax)	PO #:		
Email:	WO #:		
Project Name: Joint Base Cape Cod - 2017 - 2021	Project #: 68018167		
Site:	SSOW#:		

COC No: 680-654730.2
Page: Page 2 of 2
Job #: 680-199232-1

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	8330B/8330_P_BPE 8330 Routine	Special Instructions/Note:
C6-D-051821 (680-199232-11)	5/19/21	14:00 Eastern		Water	X	
C5-S-052021 (680-199232-12)	5/20/21	08:05 Eastern		Water	X	
C5-D-052021 (680-199232-13)	5/20/21	08:05 Eastern		Water	X	
C3-D-052021 (680-199232-14)	5/20/21	09:35 Eastern		Water	X	
C1-D-052021 (680-199232-15)	5/20/21	11:25 Eastern		Water	X	

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to Eurofins TestAmerica.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:		Time:	Method of Shipment:	
Relinquished by: [signature]	Date/Time: 05-24-21 1700	Company	Received by: Taylor Whittier	Date/Time: 5/25/21 1040	Company: ETABUR
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: △ Yes △ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

Ver: 11/01/2020

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1 2 3 4 5 6 7 8 9 10 11 12 13

Site I.D.: UCR45

Well I.D.: C1-S

Pump Start: 1420
Sample Time: 1510

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft

Static Water Level (WL) (from T.O.C.) = 106.05 ft

Well Depth (from T.O.C) = 150 ft

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 150 - 106.05
T = 43.95 ft

Well Volume: ≈ 7.2 Gallons ≈ 27.3 Liters

Date: 5/18/21

Well Diameter (d) = 2 inches

Screen Depth 110 to 150 Feet below grade

Sampler(s): B. Gerlinger

Low Flow: Yes / No

Purging Device: Dedicated Bladder Pump

Sampling Device: "

Pump Intake (depth below TOC): — Feet

Actual Purge Volume: ≈ 4.0 (Gallons) ≈ 15 Liters

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1425	10.9	6.03	63.4	1.26	10.66	146.3	300	106.05	Colorless/ Clear	No odor/sheen
1430	10.6	6.04	64.7	1.04	10.75	148.0	300	106.05	"	"
1435	11.0	6.00	64.9	0.88	10.66	153.2	300	106.05		
1440	11.1	5.97	65.4	0.31	10.53	157.1	300	106.05		
1445	11.0	5.97	65.2	0.26	10.48	160.4	300	106.5		
1450	10.9	5.97	64.9	0.21	10.37	162.1	300	106.5		
1455	10.9	5.96	64.9	0.19	10.33	164.3	300	106.5		
1500	10.9	5.96	65.1	0.17	10.34	164.4	300	106.5		
1505	10.9	5.96	65.1	0.16	10.34	164.5	300	106.5	↓	↓

Reach Stabilization, Collect Sample for VOCs, EDB, explosives, Perchlorate and general Chemistry parameters (pH, Alkalinity, Turbidity, Specific Conductance)

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: Ocean

Well I.D.: C1-D

Pump Start: 1035
Sample Time: 1125

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = ~ ft

Static Water Level (WL) (from T.O.C.) = 106.06 ft

Well Depth (from T.O.C.) = 250 ft

Date: 5/20/21

Well Diameter (d) = 2.4 inches

Screen Depth: 210 to 250 Feet below grade

Sampler(s): B Geiger / M. Mascho

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 250 - 106.06
T = 143.94 ft

Well Volume: ≈ 128 Liters ≈ 34 Gallons

Low Flow
Purging Device: Yes / Non Dedicated Bladder Pump
Sampling Device:
Pump Intake (depth below TOC): Feet
Actual Purge Volume: ≈ 5.0 (~~Gallons~~) Liters ≈ 1.3 Gallons

Time	Temp (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1035	Start Pump	Control Box @ 110 psi		CPM 2	18 sec Fill	12 sec discharge				
1040	10.1	5.91	65.1	0.62	10.20	234.0	80	106.06	Colorless/ Clear	NO odor / Sheen
1045	10.0	5.73	65.6	0.45	8.82	232.6	100	" "	" "	" "
1050	9.8	5.99	65.2	0.70	8.90	221.4	" "	" "	" "	" "
1055	9.8	6.02	65.1	0.94	9.23	219.2	" "	" "	" "	" "
1100	9.7	6.12	65.0	0.70	9.45	217.0	120	" "	" "	" "
1105	9.7	6.13	64.9	0.64	9.88	213.9	" "	" "	" "	" "
1110	9.7	6.14	65.0	0.88	10.06	212.8	" "	" "	" "	" "
1115	9.7	6.14	65.0	0.60	10.12	212.1	" "	" "	" "	" "
~~1120~~ 1120	9.6	6.16	65.1	0.58	10.16	211.7	" "	" "	" "	" "
	Reach Stabilization, Collect Sample for VOC, EDB, Perchlorate, Explosives									
			pH, Specific Conductance, Alkalinity, Turbidity							

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

2.4-inch = 0.235

Site I.D.: UCRUS

Well I.D.: C2-5

Pump Start: 0740
Sample Time: 0830

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft

Static Water Level (WL) (from T.O.C.) = 103.20 ft

Well Depth (from T.O.C) = 130.00 ft

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 130 - 103.20
T = 26.80 ft

Well Volume: ≈ 14.6 Liters ≈ 4.4 Gallons

Date: 5/19/21

Well Diameter (d) = 2 inches
Screen Depth = 90 to 130 Feet below grade
Sampler(s): B. Gettinger

Low Flow: Yes X No
Purging Device: Dedicated Bladder Pump
Sampling Device: " "
Pump Intake (depth below TOC): ≈ 50
Actual Purge Volume: (≈ 19 Liters) Feet (Gallons)

Time	Temp. (°C) (±3%)	pH (SU) (±0.1)	Specific Conductance (umhos/cm) (±3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (±10%)	ORP (mV) (±10)	Flow Rate (mL/min)	Static water Level	Color/ Clarity	Comments
0745	10.3	6.00	54.6	0.66	10.11	138.3	450	103.20	Colorless/ Clear	No odor/Sheen
0750	10.1	5.97	57.3	0.34	10.15	141.1	450	103.20	" "	" "
0755	10.0	5.96	57.7	0.26	11.45	145.7	" "	" "	" "	" "
0800	10.0	5.95	57.9	0.23	11.47	149.3	" "	" "	" "	" "
0805	10.0	5.93	58.0	0.19	11.42	155.5	" "	" "	" "	" "
0810	10.0	5.93	58.0	0.16	11.10	157.5	" "	" "	" "	" "
0815	10.0	5.93	57.8	0.19	11.24	157.3	" "	" "	" "	" "
0820	10.0	5.93	57.8	0.18	11.30	158.1	" "	" "	" "	" "
0825	10.0	5.94	57.7	0.16	11.33	158.4	" "	" "	" "	" "
	Reached Stabilization, Collect Sample for the Following analysis:									
	VOCs, Explosives, EDB, Perchlorate									
	pH, Specific Conductance, Turbidity, Alkalinity									

Volume in gallons/feet for common monitoring well sizes. 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: [illegible]

Well I.D.: C-20-05921

Pump Start: 0740

Sample Time: 0845

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL: — ft

Static Water Level (WL) (from T.O.C.): 103.1 ft

Well Depth: (from T.O.C.): 230.0 ft

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 230.0 - 103.1
T = 126.9 ft

Well Volume: ≈ 30 Gallons ≈ 114 Liters

Date: 5-19-21

Well Diameter (d): 2.5" inches

Screen Depth: 190 to 230 Feet below grade

Sampler(s): [illegible]

Low Flow

Purging Device: Bladder

Sampling Device:

Pump Intake (depth below TOC):

Actual Purge Volume: ≈ 5.4 Liters ≈ 1.4 Gallons

Time	Temp (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0740	Pump Start						40	103.1		
0745	11.3	6.46	78.1	-0.05	8.71	220.6			Light Cloudy	cloudy
0750	↓	6.42	74.8	0.19	8.48	218.7				
0755	11.4	6.39	72.3	0.10	8.47	217.7				
0800	↓	6.40	70.5	0.43	8.17	211.9				
0805	10.9	6.32	66.7	0.94	8.47	216.3				
0810	10.8	6.25	65.7	0.81	9.17	213.5	90			
0815	9.8	6.10	65.0	-0.40	9.26	213.0				
0820	9.7	6.16	65.9	0.14	9.23	209.9				
0825	9.4	5.80	66.7	0.21	9.58	229.5				
0830	9.5	5.95	66.7	0.52	9.57	220.9				
0835	9.5	6.04	66.9	0.37	9.72	214.1				
0840	↓	6.05	67.0	0.29	9.65	209.5	↓	↓	↓	↓

* 0845 collect Samples

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

2.4-inch = 0.235

Site I.D.: LCRW

Well I.D.: C-35

Pump Start: 1250
Sample Time: 1340

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft

Static Water Level (WL) (from T.O.C.) = 103.0 ft

Well Depth (from T.O.C) = 183.0 ft

Height of Water in Well (T):
T = depth (ft) 183.0 - Static Water Level (ft) 103.0
T = 79.0 ft

Well Volume: ≈ 49 Liters ≈ 13 (gallons)

Date: 5-18-21

Well Diameter (d) = 2" inches

Screen Depth 135 to 183 Feet below grade

Sampler(s): M. Moscho B. Gerwig

Low Flow: Yes ✓ No

Purging Device: Bladder dedicated

Sampling Device: SS 650 MDS

Pump Intake (depth below TOC): ≈ 9.6 Liters

Actual Purge Volume: ≈ 2.5 gallons

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (µmhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1250	Pump start						215	103.0		
1255	9.6	5.46	58.7	48.4	5.83	168.7			clear/colorless	odorless
1300	9.9	5.62	58.1	27.2	5.57	169.1				
1305	9.8	5.61	58.3	16.1	5.77	174.7				
1310	↓	↓	58.7	1.52	5.83	174.9				
1315	↓	5.63	↓	1.18	6.13	175.9				
1320	9.9	5.666	58.9	1.16	6.40	176.3				
1325	9.8	5.76	58.5	1.10	6.46	177.7				
1330	9.9	5.78	58.9	0.95	6.36	178.4	↓	↓	↓	↓
1335	9.7	5.79	57.5	0.83	6.86	183.4				
1340	X Collect	Samples								

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRNS

Well I.D.: C3-D

Pump Start: 0840
Sample Time: 0935

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft

Static Water Level (WL) (from T.O.C.) = 103.34 ft

Well Depth (from T.O.C) = 310.0 ft

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 310 - 103.34
T = 206.66 ft

Well Volume: ≈ 182 Liters ≈ 49 Gallons

Date: 5/20/21

Well Diameter (d) = 2.4 inches
Screen Depth 270 to 310 Feet below grade
Sampler(s): B.Gerger / M. Mackie

Low Flow
Purging Device: Yes / No: Dedicated Bladder Pump
Sampling Device: " "
Pump Intake (depth below TOC): —
Actual Purge Volume: ≈ 3.0 ± 0.8 Gallons Feet (~~Gallons~~) Liters

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (+10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0840	Start Pump	- 115 psi,	CPM 2 17 sec	fill; 13 sec	discharge					
0845	9.4	6.02	57.6	1.05	10.41	246.6	220	103.34	Cloudy/ Clear	No odor/ sheen
0850	10.7	7.13	57.3	2.55	10.76	222.3	60	103.34	" "	" "
0855	11.5	6.60	57.1	3.16	15.84	221.4	60	" "	" "	" "
0900	10.4	6.47	57.3	5.61	14.84	222.2	60	" "	" "	" "
0905	10.4	6.41	56.1	4.04	14.80	224.8	60	" "	" "	" "
0910	10.6	6.49	55.8	2.89	13.00	222.4	60	" "	" "	" "
0915	10.8	6.50	55.3	2.81	13.67	218.0	60	" "	" "	" "
0920	10.6	6.52	54.5	2.86	13.50	217.4	60	" "	" "	" "
0925	10.6	6.50	54.2	2.83	13.40	216.3	60	" "	" "	" "
0930	10.7	6.50	55.3	2.76	13.36	214.2	60	" "	" "	" "
	Reach Stabilization, Collect Sample for VOCs, EDB, explosives, Perchlorate									
	pH, Specific Conductance, Alkalinity, Turbidity									

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468
2.4-inch = 0.235

Site I.D.: UCRWS

Well I.D.: C4-S

Pump Start: 0925
Sample Time: 1010

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = ___ ft

Static Water Level (WL) (from T.O.C.) = 132.05 ft

Well Depth (from T.O.C.) = 250 ft

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 250 - 132.05
T = 117.95 ft

Well Volume: = 79 Liters ≈ 21 gallons

Date: 5/19/21

Well Diameter (d) = 2 inches
Screen Depth 200 to 250 Feet below grade:
Sampler(s): B. Grange

Low Flow Yes No
Purging Device: Dedicated Bladder Pump
Sampling Device:
Pump Intake (depth below TOC):
Actual Purge Volume: ≈ 12 ≈ 3.0 gallons

Feet (Gallons) Liters

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm); (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (±10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0930	10.7	6.06	56.0	1.31	8.84	155.5	300	132.05	Colorless/ Clear	No odor/ Sheen
0935	10.7	6.12	55.6	0.44	8.61	159.0	300	"	"	"
0940	10.8	6.19	54.4	0.36	9.30	160.5	"	"	"	"
0945	10.8	6.20	54.1	0.30	9.26	158.4	"	"	"	"
0950	10.9	6.20	54.3	0.27	9.21	158.3	"	"	"	"
0955	10.9	6.20	53.0	0.23	9.19	156.4	"	"	"	"
1000	11.0	6.20	53.6	0.18	9.18	156.0	"	"	"	"
1005	11.1	6.20	53.4	0.19	9.14	155.7	"	"	"	"
	Reached Stabilization, Collect Sample for the Following analysis									
	VOCs, Explosives, EDB, Perchlorate									
	pH, Specific Conductance, Turbidity, Alkalinity									

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: U.C. R.C.W

Well I.D.: C-4D

Pump Start: 0925

Sample Time: 1010

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = ~ ft

Static Water Level (WL) (from T.O.C.) = 131.85 ft

Well Depth (from T.O.C) = 380.6 ft

Date: 5-19-21

Well Diameter (d) = 2.4" inches

Screen Depth 310 to 380 Feet below grade

Sampler(s): mandy

Low Flow Yes / No

Purging Device: Bladder pump collected

Sampling Device:

Pump Intake (depth below TOC): Feet

Actual Purge Volume: ≈ 9.2 Liters = ≈ 2.4 gallons

Height of Water in Well (1):

T = depth (ft) - Static Water Level (ft)

T = 380.0 - 131.85

T = 248.15 ft

Well Volume: ≈ 21 Liters ≈ 5.6 (gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (mmhos/cm) (± 3%)	Turbidity (NTUs) (≤10% if <1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0925	Pump Start						230	131.85		
0930	9.6	5.42	67.3	0.24	5.46	230.5	↓	↓	clear/colorless	odorless
0935	9.5	5.86	67.0	1.92	5.17	221.4	↓	↓	↓	↓
0940	9.3	6.28	64.0	1.95	5.97	209.8	↓	↓	↓	↓
0945	9.4	6.63	70.1	1.51	5.86	200.2	↓	↓	↓	↓
0950	↓	6.68	70.3	2.32	6.08	197.4	↓	↓	↓	↓
0955	↓	6.69	70.8	3.01	6.01	194.3	↓	↓	↓	↓
1000	↓	6.72	71.5	2.93	5.98	190.5	↓	↓	↓	↓
1005	9.5	6.73	71.5	3.41	6.09	189.5	↓	↓	↓	↓
1010	X Collect	Samples								

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRWS

Well I.D.: C5-S

Pump Start: 0720
Sample Time: 0805

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft

Static Water Level (WL) (from T.O.C.) = 135.83 ft

Well Depth (from T.O.C) = 180 ft

Date: 5/20/21

Well Diameter (d) = 2 inches

Screen Depth: 150 to 180 Feet below grade

Sampler(s): B. Geringer

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 180 - 135.83
T = 44.17 ft

Well Volume = ≈7.2 gallons = ≈27.4 Liters (gallons)

Low Flow: Yes ☒ No ☐
Purging Device: Dedicated Bladder Pump
Sampling Device: " "
Pump Intake (depth below TOC): ≈ 7.2 Feet
Actual Purge Volume: ≈ 12 Liters (Gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0715	10.3	6.00	56.3	1.12	10.03	138.4	300	135.83	Colorless/ Clear	No odor/ sheen
0730	10.2	6.02	58.9	0.83	9.86	140.6	" "	" "	" "	" "
0735	10.1	6.03	60.2	0.77	10.00	142.5	" "	" "	" "	" "
0740	10.0	6.04	61.3	0.75	9.70	144.6	" "	" "	" "	" "
0745	10.0	6.04	61.6	0.70	9.87	147.6	" "	" "	" "	" "
0750	10.0	6.04	62.1	0.64	9.88	150.1	" "	" "	" "	" "
0755	10.0	6.04	62.2	0.63	9.84	151.9	" "	" "	" "	" "
0800	10.1	6.04	62.1	0.60	9.78	152.5	" "	" "	" "	" "
	Reach Stabilization, Collect Sample for			UCC's EDB, explosives, perchlorate						
				PH, Specific Conductance, Alkalinity, Turbidity						

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: U.e.P.C.W

Well I.D.: C-5D

Pump Start: 0720

Sample Time: 0805

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL – ~ ft

Static Water Level (WL) (from T.O.C.) – 135.63 ft

Well Depth (from T.O.C) – 260.2 ft

Date: 5-20-21

Well Diameter (d) = 2/4 inches

Screen Depth 230 to 260 Feet below grade

Sampler(s): M. Martin

Low Flow Yes ☑ No ☐

Purging Device: Dedicated Bladder

Sampling Device:

Pump Intake (depth below TOC):

Actual Purge Volume: ≈ 5.2 Feet ( )

≈ 1.4 gallons Liters

Height of Water in Well (T):

T – depth (ft) – Static Water Level (ft)

T – 260.2 – 135.63

T – 124.57 ft Well Volume: ≈ 120 Liters ≈ 32 (gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0720	Purge start						130	135.63		
0725	9.3	5.74	51.0	-0.04	10.32	247.8			clear colorless	odorless
0730	9.4	5.89	49.7	-0.55	10.77	236.8				
0735	9.3	5.95	49.1	-0.37	10.98	236.2				
0740	9.4	5.98	48.9	-0.42	11.14	235.0				
0745	9.3	6.09	48.0	-0.41	11.47	231.7				
0750	↓	6.10	47.9	-0.17	11.45	231.0				
0755	9.3	6.14	47.6	-0.63	11.40	229.0				
0800	↓	↓	47.7	-0.58	11.36	228.7				
0805	*collect	Samples.								

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

2.4-inch = 0.235

Site I.D.: UCRIS

Well I.D.: C6-S

Pump Start: 1305
Sample Time: 1350

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = _____ ft

Static Water Level (WL) (from T.O.C.) = 142.56 ft

Well Depth (from T.O.C) = 183 ft

Date: 5/19/21

Well Diameter (d) = 2 inches

Screen Depth 153 to 183 Feet below grade

Sampler(s): B. Boehringer

Height of Water in Well (1):
T = depth (ft) - Static Water Level (ft)
T = 183 - 142.56
T = 40.44 ft

Well Volume: ≈ 25 Liters ≈ 6.5 gallons (gallons)

Low Flow Yes No
Purging Device: Dedicated Bladder Pump
Sampling Device:
Pump Intake (depth below TOC):
Actual Purge Volume: ≈ 14 Liters ≈ 3.7 gallons

Feet
(Gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (mmhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1310	10.8	5.98	66.9	1.21	10.24	185.2	350	142.56	Colorless/ Clear	No odor / Sheen
1315	10.8	5.98	78.6	0.91	10.09	185.1	" "	" "	" "	" "
1320	10.6	5.99	77.8	0.78	10.04	185.3	" "	" "	" "	" "
1325	10.4	5.99	77.2	0.64	9.98	185.4	" "	" "	" "	" "
1330	10.4	5.99	76.7	8.50	9.94	184.6	" "	" "	" "	" "
1335	10.4	5.99	76.4	6.47	10.06	183.4	" "	" "	" "	" "
1340	10.5	5.98	75.8	0.44	10.14	182.7	" "	" "	" "	" "
1345	10.6	5.99	75.5	0.36	10.01	183.6	" "	" "	" "	" "
	Reached Stabilization Collect Sample for the following:									
	VOCs, EDB, Explosives, Perchlorate.									
	Ph, Specific Conductance, Turbidity, Alkalinity									

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRW

Well I.D.: C-6D

Pump Start: 1305
Sample Time: 1400

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL: – ft

Static Water Level (WL) (from T.O.C.): 142.56 ft

Well Depth (from T.O.C): 280 ft

Height of Water in Well (T):
T = Depth (ft) – Static Water Level (ft)
T = 280 – 142.56
T = 137.44 ft

Well Volume: ≈ 35 (gallons) ≈ 132.5 Liters

Date: 5-19-21

Well Diameter (d): 2.4 inches
Screen Depth: 240 to 280 Feet below grade
Sampler(s): [illegible]

Low Flow: Yes ☑ No ☐
Purging Device: Dedicated Bladder
Sampling Device:
Pump Intake (depth below TOC):
Actual Purge Volume: ≈ 2.2 L Feet (Gallons) Liters
≈ 0.6 gallons

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1305	Pump Start							142.56		
1310	19.7	6.16	71.1	1.93	9.93	205.6	30	↓	clear colorless	odorless
1315	19.4	6.22	62.8	1.16	9.12	187.5	↓	↓	↓	↓
1320	18.5	6.21	69.2	0.69	9.85	186.1	↓	↓	↓	↓
1325	18.2	6.18	57.5	0.72	10.22	187.8	↓	↓	↓	↓
1330	17.3	6.09	56.5	1.70	10.32	187.8	↓	↓	↓	↓
1335	17.1	6.03	52.7	0.91	9.47	188.7	↓	↓	↓	↓
1340	10.8	6.00	51.1	0.79	9.72	88.0	↓	↓	↓	↓
1345	10.6	↓	51.3	0.85	10.00	186.6	↓	↓	↓	↓
1350	14.6	5.95	49.7	0.79	9.11	184.2	40	↓	↓	↓
1355	14.3	5.96	50.7	0.81	9.07	186.1	↓	↓	↓	↓
1400	* Collect Samples									

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

2.4-inch = 0.235

Site I.D.: UCRWS

Well I.D.: C7-S

Pump Start: 1105
Sample Time: 1155

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft

Static Water Level (WL) (from T.O.C.) = 156.72 ft

Well Depth (from T.O.C.) = 239.00 ft

Date: 5/19/21

Well Diameter (d) = 2 inches

Screen Depth: 199 to 239 Feet below grade

Sampler(s): B. Geringer

Height of Water in Well (T):
T = depth (ft) - Static Water Level (ft)
T = 239 - 156.72
T = 82.28 ft

Well Volume: = 51 Liters ≈ 13.5 Gallons

Low Flow: Yes ☒ No ☐
Purging Device: Dedicated Bladder Pump
Sampling Device: " "
Pump Intake (depth below TOC): —
Actual Purge Volume: ≈ 15 Feet (Gallons) Liters ≈ 4.0 gallons

Time	Temp. (°C) (±3%)	pH (SU) (±0.1)	Specific Conductance (umhos/cm) (±3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (±10%)	ORP (mV) (±10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1110	10.9	5.82	59.3	0.63	8.69	177.2	300	156.72	Colorless/ Clear	No odor/Sheen
1115	10.9	5.94	61.0	0.55	9.10	173.4	" "	" "	" "	" "
1120	10.8	6.05	64.4	0.50	9.35	168.8	" "	" "	" "	" "
1125	10.8	6.07	64.8	0.41	10.00	161.9	" "	" "	" "	" "
1130	10.8	6.07	65.1	0.34	10.16	154.5	" "	" "	" "	" "
1135	10.8	6.07	65.3	0.31	10.23	151.2	" "	" "	" "	" "
1145	10.7	6.08	65.5	0.34	10.20	151.3	" "	" "	" "	" "
1150	10.7	6.08	65.5	0.30	10.16	150.9	" "	" "	" "	" "

Reached Stabilization, Collect Sample for the Following analysis:
VOCs, EDB, Explosives, Perchlorate
pH, Specific Conductance, Turbidity, Alkalinity

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: Cactus Row
Well I.D.: C7-D
Pump Start: 1105
Sample Time: 1220

Watermark

GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = — ft
Static Water Level (WL) (from T.O.C.) = 156.83 ft
Well Depth (from T.O.C) = 335 ft

Date: 8-19-21
Well Diameter (d) = 2.4 inches
Screen Depth: 295 to 335 Feet below grade
Sampler(s): M. Mosher

Height of Water in Well (T):
T = depth (ft) 335 - Static Water Level (ft) 156.83
T = 178.17 ft

Well Volume: ≈ 172 liters ≈ 45 (gallons)

Low Flow: Yes
Purging Device: Dedicated Bladder
Sampling Device:
Pump Intake (depth below TOC): 323
Actual Purge Volume: ≈ 4.8 L ≈ 1.3 gallons

Feet
(~~Gallons~~) Liters

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1105	Pump Start							156.83	Clear	odors
1110	* Max throttle on		Control box	Skw	Purging		55		colorless	
1115	16.0	6.58	83.7	1.62	9.07	224.8	↓			
1120	15.4	6.15	61.2	7.63	8.31	208.4	30			
1125	13.1	6.08	52.5	8.51	9.74	210.3	70			
1130	12.7	6.06	51.8	5.14	9.99	216.8	80			
1135	12.2	5.88	51.3	9.91	9.15	213.1				
1140	12.1	↓	51.2	8.63	8.63	210.0				
1145	12.0	6.10	51.1	7.32	9.13	196.0				
1150	↓	6.20	51.0	1.10	8.60	190.0				
1155	12.1	6.23	51.2	0.98	8.65	190.6				
1200	↓	6.24	50.9	0.86	↓	189.4				
1205	↓	6.25	↓	1.04	9.02	187.8				
1210	12.2	6.26	↓	0.89	9.13	184.1				
1215	12.3	6.25	50.7	1.10	9.14	180.3	↓	↓	↓	↓

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.653, 6-inch = 1.468

1220 * Collect Samples

2.4-inch = 0.235

102nd Intelligence Wing
Water Quality Report

2020 Annual Water Quality Report
For
Otis Air National Guard Base
Joint Base Cape Cod, Massachusetts
MassDEP PWS ID #4096001

To comply with State regulations, Otis Air National Guard Base, will be annually issuing a report describing the quality of your drinking water. The purpose of this report is to raise your understanding of drinking water and awareness of the need to protect our drinking water sources.

PUBLIC WATER SYSTEM (PWS) INFORMATION:
Address: Otis Air National Guard Base on Joint Base Cape Cod, Massachusetts
Contact Person: Mr. Richard Souza
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.

Where Does My Drinking Water Come From?
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 connected 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

DRINKING WATER SOURCE:

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.

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 (800-126-4791).

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.

UNITS OF MEASUREMENT:

MFL	= Million Fibers per Liter
mrem/year	= millimrems per year (a measure of radiation absorbed by the body)
N/A	= Not Applicable
ND	= Not Detected
pCi/L	= picocuries per liter (a measure of radioactivity)
ppb	= parts per billion, or micrograms per liter (ug/L)
ppm	= parts per million, or milligrams per liter (mg/L)
ppt	= parts per trillion, or nanograms per liter (ng/L)

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.

Bacteria	MCL/TT	MCLG	Value	Date	Violation (Y/N)	Possible Source(s) of Contamination
Total Coliform Bacteria (TC)	0	0	Positive	8 Dec 2020	N	Human and animal fecal waste

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 actions to identify any problems that were found during these assessments.

During the past year, we were required to conduct one **Level 1 Assessment** due to one positive result in December. As a result, we were required to take the necessary corrective actions, which have all been completed.

-The PWS DW staff did not retrieve a message of a TC+ sample until a week later at the Water Tower (Otis)/RS Sampling Code: T-3.

-Due to corrosion and exposure to the elements, the sampling tap at T-3 had been determined to be unclean and unsuitable for sampling.

-Both Water Tower sampling taps have been replaced.

-The PWS DW staff collected repeat samples; all negative.

-The PWS DW staff took action to ensure emails and voicemails are checked on daily basis during sampling activity.

What About Lead Exposure?

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 two 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 at (800) 426-4791 or on the Internet, at the following link: http://www.epa.gov/safewater/lead

Substance (unit of measurement)	Date(s) Collected	90^{TH} Percentile	Action Level	MCLG	# of sites sampled	# of sites above Action Level	Possible Source(s) of Contamination
Lead (ppb)	2018	0.2	15	0	40	0	Corrosion of household plumbing systems; Erosion of natural deposits
Copper (ppm)	2018	0.448	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	Range Detected	MCL or MRDL	MCLG or MRDLG	Violation (Y/N)	Possible Source(s) of Contamination
Inorganic Contaminants							
Asbestos (MFL)	2013	N/A	ND	7	7	N	Decay of asbestos cement water mains; erosion of natural deposits
Barium (ppm)	2018	0.016	0.00-0.016	2	2	N	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium (ppb)	2013	0.51	0.00-0.51	100	100	N	Discharge from pulp mills; erosion of natural deposits
Fluoride (ppm)*	2020	0.00	0.00-0.25	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)	2020	0.31	0.00-0.31	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)	2020	ND	N/A	2	N/A	N	Rocket propellants, fireworks, munitions, flares, blasting agents

Radioactive Contaminants							
Radium 226 & 228 (pCi/L) (combined values)	2015	1.10	0.623-1.10	5	0	N	Erosion of natural deposits
Disinfectants and Disinfection By-Products							
Total Trihalomethanes (TTHMs) (ppb)	QTR3 (2020)	12.3	6.51-12.2	80	N/A	N	Byproduct of drinking water chlorination
Haloacetic Acids (HAA5) (ppb)	QTR3 (2020)	ND	N/A	60	N/A	N	Byproduct of drinking water disinfection
Chlorine (ppm)	Monthly in (2020)	1.86	0.03-1.86	4	4	N	Water additive used to control microbes

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(s) of Contamination
Bromodichloromethane	2019	6.73-8.61	7.67	N/A	N/A	Trihalomethane; by-product of drinking water chlorination
Bromoform	2019	2.24-2.92	2.58	N/A	N/A	Trihalomethane; by-product of drinking water chlorination
Chloroform (ppb)	2020	0.00-0.70	0.35	N/A	70	By product of drinking water chlorination (In non-chlorinated sources it may be naturally occurring)
Chromium-6	2015	0.0-0.29	0.145	N/A	N/A	Discharge from steel and pulp mills; Erosion of natural deposits
Dibromodichloromethane	2019	6.83-8.82	7.83	N/A	N/A	Trihalomethane; By-product of drinking water chlorination
Manganese* (ppb)	2020	<0.005	<0.005	N/A	300	Erosion of natural deposits
*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.						
Methyl tertiary butyl ether* or MTBE (ppb)	2016	0.63	0.315	20-40	70	Fuel additive; leaks and spills from gasoline storage tanks

Unregulated Contaminants	Date(s) Collected	Result or Range Detected	Average Detected	SMCL	ORSG	Possible Source(s) of Contamination
*EPA has established a lifetime Health Advisory (HA) of 0.3 mg/L and an acute HA at 1.0 mg/L.						
Sodium (ppm)	2019	5.1-5.6	5.3	N/A	30	Discharge from the use and improper storage of sodium-containing de-icing compounds or in water-softening agents, natural erosion, road salt

UPPER CAPE REGIONAL WATER SUPPLY COOPERATIVE 2020 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.

2020 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	2020	0.13 ppm	0.13 ppm	10 ppm	10 ppm	No	Runoff from fertilizer use; Leaching form septic tanks, sewage; Erosion of natural deposits
Unregulated and Secondary Contaminants	**Year Sampled**	**Amount Detected**	**Range of Detections**	**SMCL**	**ORSG**	**Violation**	**Possible Sources**
Chloroform	2020	2.19 ppb	1.46-2.19 ppb	NA	70 ppb	No	Trihalomethane by-product of drinking water chlorination. In non-chlorinated sources, chloroform may be naturally occurring
Chloride	2020	8.6 ppm	8.6 ppm	250 ppm	--	NO	Runoff and leaching from natural deposits; seawater influence
Copper	2020	0.014 ppm	0.014 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	2020	5.0 ppm	5.0 ppm	250 ppm	--	No	Runoff and leaching from natural deposits; industrial wastes

Does My Drinking Water Meet Current Health Standards?
We are committed to providing you with the best water quality available. We are proud to report that last year your drinking water met all applicable health standards regulated by the state and federal government.

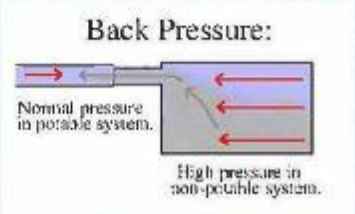
Health Effects Statements.
Total Coliform: Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems. However, we've complied with the Fecal Coliform/E.coli MCL.

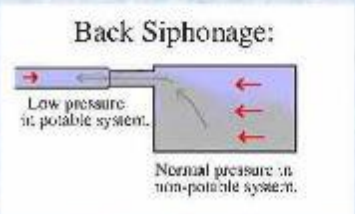
Fecal Coliforms and E.coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young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

CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION:
Otis Air National Guard Base makes every effort to ensure that the water delivered to your home and business is clean, safe and free of contamination. Our staff works very hard to protect the quality of the water delivered to our customers from the time the water is extracted via deep wells from underground aquifers or withdrawal point from a surface water source, throughout the entire treatment and distribution system. But what happens when the water reaches your home or business? Is there still a need to protect the water quality from contamination caused by a cross-connection? If so, how?

What is a cross-connection?
A cross-connection occurs whenever the drinking water supply is or could be in contact with potential sources of pollution or contamination. Cross-connections exist in piping arrangements or equipment that allows the drinking water to come in contact with non-potable liquids, solids, or gases (hazardous to humans) in event of a backflow.

What is a backflow?
Backflow is the undesired reverse of the water flow in the drinking water distribution lines. This backward flow of water can occur when the pressure created by equipment or a system such as a boiler or air-conditioning is higher than the water pressure inside the water distribution line (back pressure), or when the pressure in the distribution line drops due to routine occurrences such as water main breaks or heavy water demand causing the water to flow backward inside the water distribution system (back siphonage). Backflow is a problem that many water consumers are unaware of, a problem that each and every water customer has a responsibility to help prevent.





What can I do to help prevent a cross-connection?

Without the proper protection something as simple as a garden hose has the potential to contaminate or pollute the drinking water lines in your house. In fact over half of the country's cross-connection incidents involve unprotected garden hoses. There are very simple steps that you as a drinking water user can take to prevent such hazards, they are:

- NEVER submerge a hose in soapy water buckets, pet watering containers, pool, tubs, sinks, drains, or chemicals.
- NEVER attached a hose to a garden sprayer without the proper backflow preventer.
- Buy and install a hose bibb vacuum breaker in any threaded water fixture. The installation can be as easy as attaching a garden hose to a spigot. This inexpensive device is available at most hardware stores and home-improvement centers.
- Identify and be aware of potential cross-connections to your water line.
- Buy appliances and equipment with backflow preventers.
- Buy and install backflow prevention devices or assemblies for all high and moderate hazard connections.

If you are the owner or manager of a property that is being used as a commercial, industrial, or institutional facility you must have your property's plumbing system surveyed for cross-connection by your water purveyor. If your property has NOT been surveyed for cross-connection, contact your water department to schedule a cross connection survey.

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.

This report was prepared by Otis Air National Guard Base
PWS ID# 4096001 Distributed: June 2021

Bourne Water District
Water Quality Report 2020

BOURNE WATER DISTRICT
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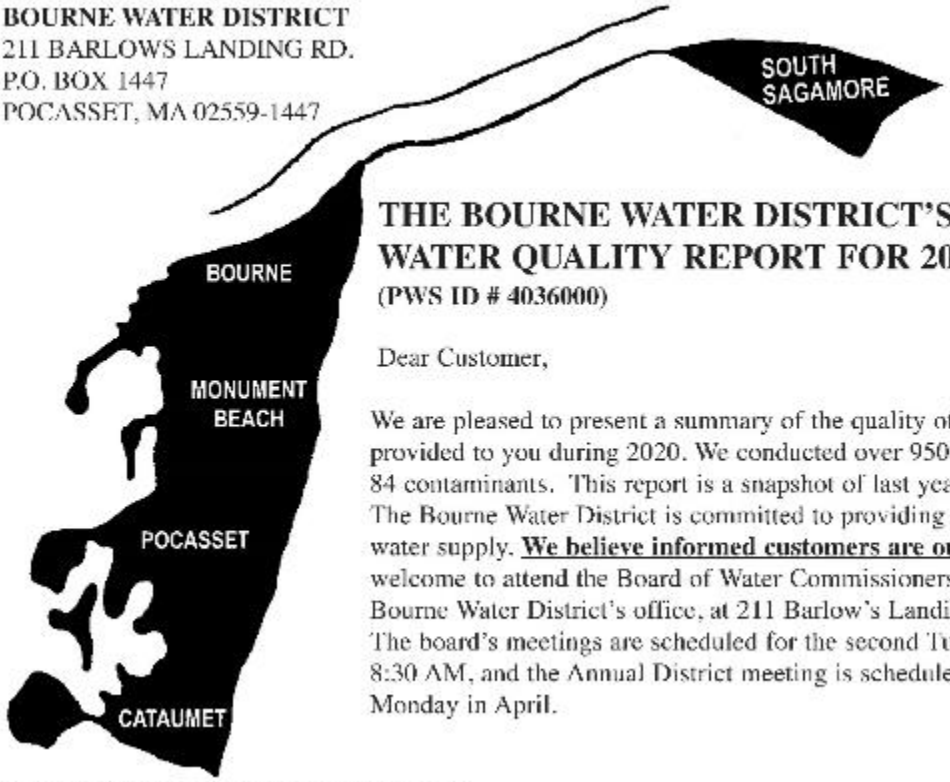
POCASSET, MA 02559-1447



THE BOURNE WATER DISTRICT'S WATER QUALITY REPORT FOR 2020

(PWS ID # 4036000)

Dear Customer,

We are pleased to present a summary of the quality of the drinking water provided to you during 2020. 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**	1	0-1	0	0	yes	Naturally present in the environment
Fecal Coliform or E. Coli	0	0	0	0	No	Human and Animal 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)	9/1/2020 to 10/1/2020	0.0057	15	0	30	0	No	Corrosion of household plumbing systems; Erosion of natural deposits
Copper (ppm)	9/1/2020 to 10/1/2020	0.311	1.3	1.3	30	0	No	Corrosion of household plumbing systems; Erosion of natural deposits

TESTING FOR LEAD: 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. Aquinnah Water Division 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 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.

	SUMMARY OF FINISHED WATER CHARACTERISTICS						
Regulated Contaminants	Date(s) collected	Highest Detect Value	Range Detected	MCL	MCGL	Violation	
Inorganic Contaminants:							
Barium (ppm)	2020	0.009	0.002-0.009	2	2	No	Discharge of drilling waste; discharge from metal refineries; erosion of natural deposits
Nitrate * (ppm)	2020	0.7	0.06-0.70	10	10	No	Run-off from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Perchlorate ** (ppb)	2020	0	0	2	-	No	Rocket propellant; fireworks; munitions; flame retarding agents* (see note below)
*Nitrate	Nitrate in drinking water at levels of 10 ppm or 10 mg/l is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should seek advice from your health care provider.						
**Perchlorate (Perchlorate Chemical Abstract Service Registry Number (CASRN) for different chemical forms	Perchlorate interferes with the normal function of the thyroid gland and thus has the potential to affect growth and development, causing brain damage and other adverse effects, particularly in fetuses and infants. Pregnant women, the fetus, infants and children up to the age of 12, and people with hypothyroid condition are particularly susceptible to perchlorate toxicity. *Values are required when the results are above the MDL (0.012) and below the MRL (2.06)						
Organic Contaminants							
Tetrachloroethylene (PCE) (ppb)	2020	1.64	0 -1.64	5	-	No	Discharge from factories and dry cleaners
chloroform (ppb	2020	1.75	0-1.75	ORSG 70	NA	No	By-product of drinking water chlorination
cis-1,2-Dichloroethylene (ppb)	2020	2.08	0-2.08	70	NA	No	Run-off from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits

Secondary Contaminants	Date(s) collected	Highest Detect Value	Range Detected	SMCL	ORSG	Possible Source of Contamination
Magnesium (ppm)	2020	3.6	1.1-3.6	-	-	Natural Mineral and Organic Matter
Chloride (ppm)	2020	40	7.2-40	250	NA	Natural Mineral, Road Salt
Calcium (ppm)	2020	6	2.5-6.0	-	-	Natural Mineral and Organic Matter
Iron (ppb)	2020	0.96	0-0.96	300	NA	Erosion of Natural Deposits and oxidation of iron components
Manganese (ppb)*	2020	0.034	0-0.034	50	NA	Erosion of Natural Deposits
Sodium(ppm)**	2020	28**	5.7-28	-	20	Road Salting; erosion of natural deposits
Potassium (ppm)	2020	1.3	0.7-1.3	-	-	Natural Mineral and Organic Matter
Sulfate (ppm)	2020	7.2	5.1-7.2	250	250	Natural Sources
Zinc (ppm)	2020	0.014	0-0.014	5	NA	Erosion of Natural Deposits and Industrial discharge

*EPA has established a lifetime health advisory (HA) for Manganese at 300ppb and an acute at 1000ppb

**Sodium is a naturally occurring element found in soil and water. It is necessary for the normal functioning of regulating fluids in human systems. Some people, however, have difficulty regulating fluid volumes as a result of several diseases, including congestive heart failure and hypertension. The guideline of 20mg/L for sodium represents a level in water that physicians and sodium sensitive individuals should be aware of in cases where sodium exposures are being carefully controlled. For additional information contact your health care provider, your local Board of Health or the Massachusetts Dept. of Public Health, Bureau of Environmental Health Assessment at 617 624-5757.

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 2020. **In August 2020 Bourne Water District had one detect of Total Coliform from a sample taken at the Bourne tank. Bourne Water District chlorinated the tank and rectified the issue. Bourne Water District completed the process with a Level 1 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.

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
2020 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.
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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.

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Unregulated and Secondary Contaminants	**Year Sampled**	**Amount Detected**	**Range of Detections**	**SMCL**	**ORSG**	**Violation**	**Possible Sources**
Chloroform	2020	2.19 ppb	1.46 -2.19 ppb	NA	70 ppb	No	Trihalomethane: by-product of drinking water chlorination. In non-chlorinated sources, chloroform may be naturally occurring
Chloride	2020	8.6 ppm	8.6 ppm	250 ppm	--	NO	Runoff and leaching from natural deposits; seawater influence
Copper	2020	0.014 ppm	0.014 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	2020	5.0 ppm	5.0 ppm	250 ppm	--	No	Runoff and leaching from natural deposits; industrial wastes

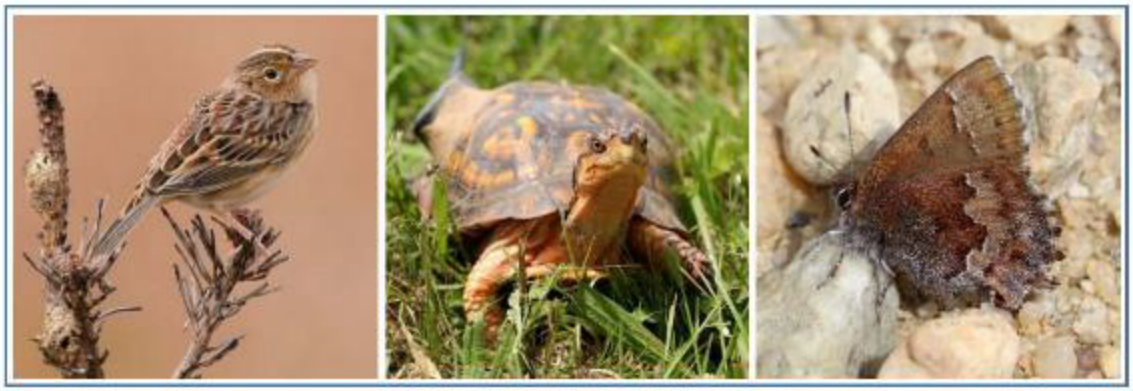
APPENDIX F
CONSERVATION AND MANAGEMENT PERMIT COMPLIANCE AND MITIGATION ACTIONS

Conservation and Management Permit Compliance and Mitigation Actions

Camp Edwards: Fiscal Year 2021

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 FY2021 period covering October, 2020, through September, 2021. 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); Federal FY: 01 October – 30 September)
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

The Pink Prominent Moth (*Hyparpax aurora*) is a stunning scrub oak (*Quercus ilicifolia*) associate that is rare throughout its range with very localized distribution in Massachusetts. This individual was observed during a MAARNG hosted Massachusetts Butterfly Club survey for Acadian Hairstreak Butterflies in Pine Barrens Mitigation Focal Area – North, with a high number of rare and state-listed species within a diverse barrens habitat mosaic, including powerline right of way, adjacent to a primary road and active soldier training features.

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

An initial CMP was developed in 2017 and 2018 to provide for localized road repair at Camp Edwards while providing for conservation of the Endangered Agassiz's Clam Shrimp (*Eulimnadia agassizii*, AgCS). Under that original permit two sites along Cat Road were repaired as *in situ* sites in Training Year (TY) 2020. Prior to that, in TY2019, one site was modified *in-situ* and five sites (Cat Road [3], Herbert Road [2]) were repaired and 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, were completed in TY 2020, but an additional year of monitoring was completed in TY21 due to the 2020 drought conditions and the focal conservation interest of the species for MAARNG.

Agassiz's Clam Shrimp survey and active relocation efforts supporting critical road maintenance.

Precipitation patterns were back to normal for the 2021 survey season. Natural Resources staff conducted repeated surveys following the standard approved protocol. In total, a subset of 12 puddles were surveyed. Four puddles were CMP mitigation puddles, five were puddles not surveyed previously, and five were known to support AgCS in previous years. From mid-May to October, puddles containing standing water were measured for area, depth, temperature and pH, and all aquatic life observed was recorded.

Clam shrimp were observed in seven of the twelve surveyed puddles, however, not all clam shrimp were identified to be AgCS. AgCS were encountered in five puddles with four puddles being new locations for AgCS records. American Clam Shrimp (*Limnadia lenticularis*, AmCS), a state-listed species of special concern, not previously confirmed on the base, were encountered in three puddles (two monitoring puddles contained both species). AmCS collected samples, along with AgCS, have been submitted to NHESP for verification of ID. Clam shrimp collected from one puddle were not able to be identified in the lab due to poor condition of the sample. This means that 50 percent of puddles surveyed in 2021 contained AgCS and/or AmCS, if we don't count the unknown clam shrimp species. This percent is up from 2019 and 2020 survey years in which approximately 30 percent of puddles surveyed contained AgCS. In 2018, the first year of monitoring, 25 puddles were surveyed and 80 percent of those contained clam shrimp. All data and results are provided separately to MassWildlife and observation reporting through Heritage Hub (https://www.mass.gov/ info-details/overview-of-the-heritage-hub). Additional FY21 monitoring results worth noting are that two of the four CMP puddles modified in-situ in TY2019 and TY2020 contained clam shrimp, one on Cat road contained AgCS and one on Canal View Road contained AmCS. The seven positive observations were distributed throughout Camp Edwards, occurring in all five training area zones. Zones are discussed below as part of the CMP amendment.

The primary effort for AgCS, other than ongoing monitoring, was collaboratively developing an amendment to the existing permit to provide for holistic AgCS conservation and road maintenance within the training area. The presence of AgCS within some larger puddles precluded necessary repairs, which led to the development of the original permit, relocation efforts, and repair of select features. The next step with MassWildlife was to apply lessons from the original effort to development of an overarching road maintenance strategy that could provide for both a sustainable and usable road network and sustainable and healthy AgCS 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 be critical to clam shrimp persistence as prolonged lack of maintenance quickly leads to exacerbation of puddles into unsuitable conditions for clam shrimp and eventually vegetation of the road bed and loss of roads and road puddles. Maintenance and use provides both roads and puddles.

Clam shrimp puddle signage is posted to protect known occupied sites – encourage driving and avoid filling.

Amendment of the original permit was completed in the summer of 2021. Both parties chose to amend the existing permit as it carries forward the framework of the original, including monitoring and Net Benefit through a combination of relocation and repair in place. The updated CMP establishes multiple categories of 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 ACS.

The priority action for FY21 was repair of the impact area perimeter roads (Jefferson, Barlow, Wheelock, and Crowell) and two key impact area access roads. These had become severely degraded and occasionally impassable, in large part due to prohibition on maintenance due to known ACS presence in puddles along the northern, western, and southern impact area boundary roads. These are key roads both for remediation activities and emergency response. The Clam Shrimp Conservation and Road Maintenance Plan (CSCRMP) establishes a Critical Road designation, which includes the existing paved roads, the impact area boundary and select access roads, and the primary access routes of Burgoyne and Gibbs Roads. These critical roads are intended to be frequently maintained and not intended for puddles, which will also serve to minimize box turtle risks on higher use roads. The impact area boundary repairs are ongoing currently through the Impact Area Groundwater Study Program (IAGWSP).

The permit amendment calls for an annual road maintenance and repair plan to be submitted to MassWildlife, which will include priority road and puddle repairs, current condition relative to repair standards in the CSCRMP, AgCS (and now AmCS) presence if documented, and impact on the zone puddle baseline. Additionally, the annual plan will outline mitigation requirements consistent with the described framework in the CSCRMP.

American Clam Shrimp from puddle 19a on July 9th, 2021. AgCS were successfully introduced to this puddle in 2019, though the introduction was incidental to repair and maintenance of the existing puddle to receive AgCS as mitigation. FY21 was the first year documenting AmCS.

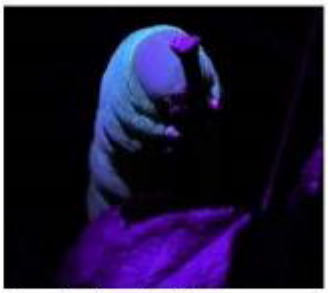
The CSCRMP and the Conservation and Management Permit were circulated through relevant stakeholders at Camp Edwards. However, two projects identified a need for more detailed training and internal communication. A troop labor road repair was implemented in September, 2021 on the western portion of Estey Road and southern portion of Fredrikson Road (Training Area A-3) without prior coordination. A previously developed engineering design was used and there were no existing puddles so no major issues occurred and no clam shrimp habitat was taken. However, it identified some communication and process gaps that have been addressed. Additionally, during the October/November road repairs implemented by IAGWSP, the working contractor graded a section of Wheelock Road without prior approval to facilitate material hauling. This section had received clam shrimp in three puddles as mitigation for the impact area boundary work and the puddles had been signed. Mitigation for this take is discussed in the annual road maintenance plan.

While the planning, preparation, and mitigation portions of the conservation plan are working well there are still weaknesses in communication and coordination that are being addressed. Two meetings have been held since the grading incident that included all potential road/trail maintenance and repair stakeholders. During these meetings, stakeholders were also able to identify roads and road sections in need of repair and planned for FY22. With this, required and/or voluntary mitigation was assessed based on potential impacts to available and known clam shrimp habitat, as well as other wildlife, and worked into the FY22 annual road work plan. This plan has been submitted to MassWildlife for review, coordination, and approval. A plan to mitigate for the loss of clam shrimp habitat and clam shrimp individuals from the Wheelock Road grading was also included in the work plan. It's the intent that these meetings involving all potential road/trail maintenance/repair stakeholders will occur on at least an annual basis for consensus on road work planning and clam shrimp habitat and mitigation requirements.

Agassiz's Clam Shrimp collected for identification confirmation of adults gathered for relocation to mitigation sites.

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



Slender Clearwing Moth larva feeding on Lowbush Blueberry. Detected and shown with ultra-violet light during rare caterpillar surveys at Sierra Range.

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. To support this master plan approach, a comprehensive mitigation plan was developed including establishing 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 location, Infantry Squad Battle Course at the formerly used Infantry Battle Course location, expansion of Tango and Sierra ranges, Cantonment modernization including a running track and classroom buildings, and potential future solar development. The mitigation plan combines project design/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.

Grass-leaved Ladies' tresses Orchid was newly documented for JBCC in the Grasslands Mitigation Focal Area in FY21.

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 1-4 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 of former parade field in cantonment. This transfer was included within the master CMP agreement. The parcel was transferred to Military Division in 2020 and will be fully transferred to MADFW with anticipated completion in 2022. MANG will receive a license to maintain overall access and use to meet perpetual habitat conversion and long-term management requirements under the mitigation agreement. There are no new updates for FY21 regarding real property actions. The MANG State Quartermaster has been in regular communication with the MA Department of Fish and Game General Counsel to develop Care, Custody, and Control agreements for the transferred parcels and to complete the transfer of Parcel H of Unit K.

Restored scrub oak shrubland pocket within Pine Barrens Mitigation Focal Area West (Training Area E-4, OP10); Sept. 2021. The original restoration (Nov. 2017); preceded mitigation, but it is an excellent reference site.

Construction Projects. Approval and construction of the flagship project – the MPMG Range – has been delayed and is pending resumption of the Environmental Management Commission process. However, the redevelopment of Tango Range, which was approved under the CMP in FY20, was completed at the end of FY21. Final reports are in development and near completion for Tango Range permit compliance. Additionally, the soil staging operation in partnership with Eversource was completed in FY21. Material from the redevelopment of the Bourne Switching station was accepted by Camp Edwards for clean fill material. The hauling and staging was permitted under the MAARNG CMP, including turtle protection provided by Eversource. The management of the turtle protection for the staged soil is being transferred to MAARNG in the late fall of 2021 and will persist until soil is used for the MPMG Range construction.

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 management, which itself is a subset within our 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.

Sum of Contract Cost	Fiscal Year			Grand
Project Type	2019	2020	2021	Total
Mitigation: Administrative	$6,020	$45,169	$11,262	$62,451
Mitigation: Construction support		$221,876		$221,876
Mitigation: Monitoring	$62,810	$103,248	$108,058	$274,116
Mitigation: Other				
Mitigation: Initial treatment, fire	$64,480			$64,480
Mitigation: Initial treatment, mechanical	$179,986	$88,458	$148,900	$417,344
Mitigation: Maintenance treatment, other		$55,950	$8,000	$63,950
Grand Total	**$313,295**	**$514,701**	**$276,220**	**$1,104,216**

Table 1. Contracted expenditure by federal fiscal year implementing the Master Plan CMP.

Sum of Mitigation Acreage	Fiscal Year				Grand
Project Type	2019	2020	2021	2022	Total
Pine Barrens	520	401	184.4	-155	950.4
Construction: Pine Barrens		-6		-412	-418
Mitigation: Initial treatment, fire	448			40	488
Mitigation: Initial treatment, mechanical	72	106	164	27	369
Mitigation: Maintenance treatment, fire			20	190	210
Mitigation: Maintenance treatment, other		40			40
Mitigation: Real Property		261			261
Sandplain Grassland	42	80	47	168	173
Construction: Sandplain Grassland				-36	-36
Mitigation: Initial treatment, fire	42			40	82
Mitigation: Initial treatment, mechanical		80			80
Mitigation: Maintenance treatment, fire			47		47
Mitigation: Maintenance treatment, other				14	14
Mitigation: Real Property				150	150
Grand Total	**562**	**481**	**231.4**	**13**	**1287**

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 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 PBFA West (Training Area A-5), Oct. 2021. The first mitigation project funded through the CMP has had strong results.

NR-ITAM personnel recording and applying radio-transmitters to two Eastern Box Turtles.

Mitigation investment for specific CMP implementation contracts and projects totaled $276,220. The primary difference from the previous year's higher investment was construction support for box turtles, which was contracted in 2020 to cover the entirety of the proposed Multi-Purpose Machine Gun (MPMG) Range construction. All requested funds for FY21 were received from National Guard Bureau to support proposed projects and all received funds were obligated within FY21. The breakdown by category of FY21 CMP expenditures is outlined in Table 1. This 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, state-listed species habitat restoration outside the focal areas, etc.). An additional $290,000 was spent on staff time and other state-listed species specific projects (i.e., where one or more state-listed species was the primary objective rather than general ecosystem or program).

Several major mitigation efforts were completed, ongoing, and/or initiated in FY21, addressing all the above-listed components of the master CMP. The mitigation actions implemented during FY21 totaled 231 acres of active habitat restoration. Prescribed fire remained limited in FY21, but was reinvigorated after FY20 did not have prescribed burning due to weather and the pandemic. Multiple trainings and four burn days occurred at Camp Edwards in FY21. Three prescribed burns were fully or partially within mitigation areas, though the Sierra Range barrens habitat 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 FY21 in addition to active habitat management. Projects undertaken in FY21 as part of mitigation efforts are summarized below. Note that projects and efforts that are programmatic in nature or otherwise not specifically meeting requirements of the Permits 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 develop a protective alternative for hibernating turtles.
  - **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 is in development and will be submitted to MADFW consistent with permit requirements with anticipated delivery by the end of 2021.

- **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. MEPA/MESA reviews and approvals are complete and notification will be made when funding is available to contract project implementation, including compliance with the CMP and turtle protection actions. Anticipated contracting is the middle of FY22.
- **ISBC Range –** Design consultation and internal review are ongoing. Anticipating environmental review of design in late FY22.

- **Species Protection**
  - **MPMG Range** – Intensive year 3 of Eastern Box Turtle surveys implementing the approved turtle protection plan. The FY20 report was submitted in February 2021 to NHESP, and the FY21 report will be submitted in early 2022. Additional pre-construction surveys were added to the plan given the delayed construction implementation. The protection plan and actions were amended given the lack of turtle exclusion barrier, which is part of the construction contract and requires unexploded ordnance support. A movement barrier was installed, with approval, by in-house personnel to provide an area of good hibernation habitat (based on observed density of use) near the proposed project site. Additional pre-construction surveys were completed in the fall of 2021. As winter approaches, turtles within the limits of work will be relocated behind the barrier to allow for winter installation of the silt fence and tree removal.
  - **Tango Range** – The preconstruction survey report was submitted in November 2020 and an interim, year-end report was submitted to NHESP in January 2021. In FY 2021, surveys during construction continued and oversight during silt fence removal was completed at the end of the project. The closeout report for turtle protection was submitted on 10-DEC-2021 and approved by NHESP on 14-DEC-2021.
  - **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** - Eversource completed a turtle protection project at the Dig Site to enclose the site, survey for turtles, and monitor. The Dig Site is being used as a stockpiling site for clean, tested on-site soil that will be used on future construction projects on base. The monitoring, maintenance and reporting for this site has been taken over by the MAARNG in FY22.

- **Species Monitoring (CMP focused)**
  - **Eastern Box Turtle (EBT)**
    - MAARNG NR-ITAM contracted the University of Illinois Wildlife Epidemiology Laboratory to implement an intensive box turtle health assessment. A total of 59 box turtles were sampled, the majority of which had physical assessments and blood samples taken multiple times through the summer to evaluate overall condition of the population and potential

influences leading to the prevalence of fly larvae, suspected sarcophagid, infestations and other potential health concerns. This project coordinated very closely with NR-ITAM, working from the same office, and others at Camp Edwards to gain efficiency from other ongoing turtle projects and opportunistic turtle observations from other site users. Oxbow Associates, working for on a turtle protection project for Eversource, tagged one turtle on Camp Edwards that was sampled and also escorted the veterinary student to sample 11 box turtles at their site in Sandwich. The veterinary student was also able to sample Spotted turtles captured during a Legacy funded project awarded to the Smithsonian. Sample analysis, data analysis, and reporting are ongoing. Updates from the field effort are available online from the veterinary student at: https://vetmed.illinois.edu/wel/author/capecodturtles/

- MAARNG applied radio transmitters and monitored previously transmittered turtles for an end of year total of 54 EBT during FY21 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.
- Preconstruction surveys referenced above led to the discovery of 5 new EBT (4 at the MPMG and one near Tango Range) and one previously tagged turtle that had lost a transmitter. Radiotransmitters were applied to all 6 individuals. Two mortalities were documented, including one road mortality in a nearby training area and one mortality from unknown causes. The signals for two turtles cannot be located, but one of the turtles was last heard coming from the Impact Area. Radio failure can also cause the loss of signal. Preconstruction survey and monitoring will continue for MPMG Range.
- 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. Seven (7) EBT were detected in FY21 as part of this effort and all individuals were outfitted with radio transmitters for long-term tracking.
- MAARNG, MADFW, and USFWS are coordinating with a graduate student at University of Massachusetts (UMass) Amherst's Massachusetts Cooperative Fish and Wildlife Research Unit (website) who plans to monitor and investigate the population of transmittered turtles at Camp Edwards.

Prairie Warbler is classified as a Species of Greatest Conservation Need and is locally relatively abundant and widespread at Camp Edwards, showing positive response to pine barrens habitat management.

- **Breeding Bird Point-counts**
  - Point-count surveys were conducted from 24 May through 24 June, 2021. 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 80 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 2020. This standard point-count methodology allows for analyzing both abundance and occupancy whereas the 1994-2013 methodology primarily supports occupancy analysis. Trends in occupancy were compared for the different periods and show positive or stable trends for nearly all Species of Greatest Conservation Need (SGCN) as identified by the State Wildlife Action Plan. Scarlet Tanager (*Piranga olivacea*) and Brown Thrasher (*Toxostoma rufum*) are two useful habitat indicators species, both of which were documented with significant increases over the 1994-2013 period (+2.6% and +2.0% per year, respectively) despite regional/rangewide declines for each (from -2% to -9% per year). Scarlet Tanager averaged over 76% occupancy at Camp Edwards from 2013-2020 with increasing occupancy trend similar to the previous period and a significantly increasing per point count trend, compared to a mean of 40% occupancy for the prior survey period. Additionally, Brown Thrasher averaged over 60% occupancy with increasing, but not statistically significant trends for both occupancy and count, compared to a mean of roughly 23% occupancy for the prior survey period. Likewise, species such as Field Sparrow (*Spizella pusilla*) and Prairie Warbler (*Setophaga discolor*) are showing notable, though not yet statistically significant, increases in the northern training area in response to expanded habitat restoration while concurrently declining within primary grassland habitat as expected with reduction in shrub cover through habitat restoration. A full report on the monitoring data analysis will be developed in 2022 and provided to MADFW and others.

- **Eastern Whip-poor-will (EWPW)**
  - MAARNG NR-ITAM personnel conducted EWPW point-count transect surveys on 19 May, 2021. 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 4.3 birds, continuing a long-term stable to increasing trend from 2013 through 2021. Surveys are completed in coordination with MADFW and follow the Northeastern 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 and these efforts provided consistent results. A full report on the effort has been sent to MADFW. Notably, in a 2021 publication (online access) researchers at Fort Drum Army Installation found that managed forest stands were preferred by EWPW reaching peak occupancy at a basal area of approximately 60 square feet per acre. This is very similar to the 80 square feet per acre or less target for southern pine beetle preparedness and shaded fuel break maintenance.

Grapholita tristrigana is a common barrens specialist moth at Camp Edwards with hostplant of Baptisia. It has a highly localized distribution in the eastern US.

- **Lepidoptera (Moths and Butterflies)**
  - Pine Barrens Moths: Development of a statistically robust and comprehensive moth monitoring protocol continued through a contract from MAARNG NR-ITAM with Western EcoSystems Technology, Inc. (WEST). The protocol and

supporting elements were completed and delivered at the end of November 2021. The initial round of vegetation surveys under the new protocol was completed during the summer of 2021. The overall protocol has a foundation of vegetation surveys that will evaluate change in structure and composition. In addition, protocols have been developed for nocturnal moth sampling and targeted diurnal sampling. The initial nocturnal UV trapping effort is anticipated during the summer of 2022.

- 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 of the survey units is within the Sandplain Grassland Mitigation Focal Area (Primary) while another is within the Sierra Range barrens habitat mitigation area (not part of the CMP mitigation). The third location is in the powerline right of way along Gibbs Road in Training Area C-13. Frosted Elfins were detected as adults at all three locations and appear to be expanding, especially in the grasslands sampling area. Follow-up larval surveys were completed with ultraviolet (UV) flashlights, which is particularly effective for Frosted Elfins, Slender Clearwing Moths (*Hemaris gracilis*), Barrens Buck Moth (*Hemileuca maia*) and other listed or otherwise rare Lepidoptera. Three nights of caterpillar surveys were completed in June and July 2021 covering the three sample sites with Frosted Elfins documented foraging on *Baptisia tinctoria* at all three. Slender Clearwing Moth was again documented with multiple individuals at the Sierra Range barrens habitat and new locations documented with a caterpillar at the northwestern elfin survey location and an adult photographed in the central grasslands of the SGMFA (Primary) for a total of four sites at Camp Edwards for this likely under-surveyed and secretive low blueberry specialist.
- General Moths: More opportunistic moth survey and documentation has continued forward from 2019. During FY21 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, many informal diurnal photography efforts by Jake McCumber led to documentation of rare barrens associated species, including multiple new species documented for Barnstable County and one new species for the Commonwealth (*Ptycerata buskella*). Of particular management interest is documentation of many rare barrens habitat specialists that are poorly represented in New England or throughout their ranges. The growing suite of online identification aids and digital photography are significant facilitators allowing for better documentation, in particular, of microlepidoptera.

- **State- listed Plants**
  - Frost bottom associates: 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. For FY21 broad-scale monitoring was not implemented. Effort focused on installation of a wooden "buck and pole" style fence around a frost bottom location for both species. It anecdotally appeared to eliminate

browsing by deer while having the benefit of being wooden and temporary fencing without soil impacts or digging.

- New listed species: A new MESA-listed species for JBCC was discovered in FY21 in two separate locations, both of which are within a mitigation focal area. Grass-leaved Ladies'-tresses Orchid is listed as Threatened in Massachusetts with similar threats as most other JBCC species, including development and habitat succession. This is a fairly expected species on-site and at the locations found. It is expected to respond positively to ongoing management efforts to expand and maintain suitable habitat. Location information is excluded here, but full reporting will be provided through Heritage Hub, MassWildlife's rare species reporting online database.

- **Habitat Management and Planning**
  - **Planning** – A comprehensive prescribed burn plan was developed for Training Areas BA-7 and BA-1 within PBMFA-South. This facilitates prescribed burn treatment following the completed mastication work described below and the BA-7 prescribed burns completed in 2013 with strongly positive rare species response.
  - **Pine Barrens Mechanical Restoration**
    - Implementation was completed for the previously (FY20) contracted mechanical treatment in BA-7, which involved mowing dead trees across 157 acres to facilitate reentry with prescribed fire. This was a critical restoration step and included patchy mowing of shrub vegetation to introduce more heterogeneity in shrub layer structure.
    - In-house scrub oak and other shrub mowing (7.4 acres) was ongoing in Training Area B-6 (PBMFA-South) as part of a small-scale and long term patch mowing to diversify age and structure composition in a good pitch pine – scrub oak area that is more challenging to burn and has needed maintenance after last having prescribed fire in 2009.
    - A whole-tree harvest project was contracted in FY21 for winter 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 will expose an overgrown kettle hole depression and its "airshed" with intent of restoring frost bottom ecological function with scrub oak shrubland 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 may be implemented and the project area will transition into the previously restored OP9/OP10 area (shown above).

Grassland unit GLU04a two months after prescribed fire and 1.5 years after brush mowing. The area had a vigorous response of important host plants followed by flush of little bluestem. Many rare habitat specialists were documented post burn including the rare *Sitochroa dasconalis* and *Pococera baptisiella*.

  - **Prescribed Burning**
    - A grassland habitat maintenance burn of 47 acres was completed in subunit GLU04a within SGMFA-Primary (Parcel H of Unit K) as part of the ongoing restoration and maintenance of that

150-acre parcel. The burn followed major restoration effort to remove trees from 2018, followed by brush mowing in 2021. Resprouting exotic shrubs were treated with herbicide in early FY22. This habitat area has been very effectively restored to functioning and diverse grassland and the burned area was the location for numerous rare moth observations this summer (Baptisia and heath specialists) along with an expansion area for both butterfly milkweed (*Asclepias tuberosa*) and one of its obligates – the state-listed Unexpected Cycnia Moth (*Cycnia inopinatus*).

- A pine barrens habitat maintenance prescribed burn of approximately 20 acres was conducted in Training Area E-3 (PBFA-West) in the OP-01 area on 14-APR-2021 as follow-up maintenance to the 2017 harvest and burn. The entire intended unit was not completed due to fire behavior more active than anticipated and the remainder of the unit will likely be completed in 2022. The partial burn provides good habitat heterogeneity and had excellent vegetative response– especially heath species.
- A pine barrens habitat management burn of 25 acres was conducted at the Sierra Range pine barrens mitigation zone, which is not part of this CMP, but is continuation of past completed mitigation commitment. This habitat burn was completed on 25-MAY-2021 and well met habitat objectives in a zone that has become high profile for habitat specialists such as the Slender Clearwing Moth and Frosted Elfin along with a high density of other listed species including Barrens Buckmoth and Eastern Whip-poor-will.

Sierra Range barrens habitat being treated with prescribed fire. This habitat area, its history, our management, and some of the species found there were highlighted by the US Fish and Wildlife Service Northeast Region in an April post titled Conservation Targets based on the successful restoration from open small arms range to focal conservation area with many rare species (https://medium.com/usfishandwildlifeservicenortheast/conservation-targets-72a068e6b103).

Fiscal Year 2022 Planning and Implementation

Army National Guard budgets have been substantially reduced in FY22, impacting facilities and environmental programs throughout the country. However, $134,000 has been funded specifically for state-listed species conservation projects between dedicated mitigation under the master development plan CMP ($57,000; MA175180002) and other state-listed species projects ($77,000; MA175150003), much of which supports the mitigation implementation. Additionally, extra funds are anticipated as we get further into the fiscal year. 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/management targets, resource monitoring, and data analysis.

Central-western portion of the Sandplain Grassland Mitigation Focal Area within a Frosted Elfin monitoring plot and following 2019 prescribed fire. This habitat supports high species diversity and this location had a new state record moth, Ptycorata buskella, documented June, 2021.

Mechanical implementation of habitat mitigation is expected to be minimal for FY22 as extensive mechanical work has occurred over the last three years of implementation. Significant focus has gone into planning for more active prescribed burning after challenges posed by COVID-19 and weather conditions. 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.

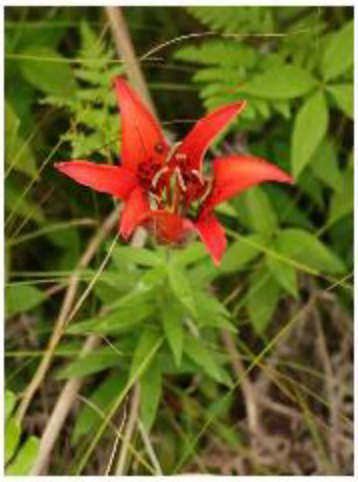
Monitoring and research efforts will be focal for FY22 with the first year of the long-term moth monitoring protocol and two developing box turtle research projects in partnership with UMass Amherst, MassWildlife, and US Fish and Wildlife Service.

- **Project Scoping, Design Minimization, and NHESP Review**
  - **MPMG Range** – Completion of the Environmental Management Commission process will hopefully be completed during the winter of FY22 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.
  - **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 FY22. 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 FY22 or FY23. Submission and completion of all pre-Work required information and tasks will be completed as appropriate and able 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.
  - **Track and Field** – Initiation and compliance of turtle protection plan consistent with approval if construction project is funded and awarded.

- **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, which will focus 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) –** Finalizing robust monitoring plan. Implementation of monitoring plan, including vegetation surveys, UV trap sampling, and pilot larval surveys for Barrens buckmoth, depending on resources.



The Wood Lily (Lilium philadelphicum) is not state-listed, but is an early successional habitat associate. It is a good indicator of barrens habitat condition at Camp Edwards and responds well to fire and restoration efforts.

- **Habitat Management and Planning (see map below)**
  - **Prescribed Fire –** Priority prescribed burn areas for mitigation include:
    - PBMFA (North): up to approximately 170 acres of the southern portion of Training Area C-14 including previously harvested area and scrub oak shrubland
    - PBMFA (West): Training Area E-2 of which approximately 200 acres of pitch pine – scrub oak habitat is unburned in recent history and 61 acres is previously burned (2019).
    - PBMFA (South): Training Areas B-6 and B-7 maintenance fires for pitch pine – scrub oak and pitch pine – heath habitat up to approximately 260 acres.

- SGMHA (Primary): approximately 61 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.

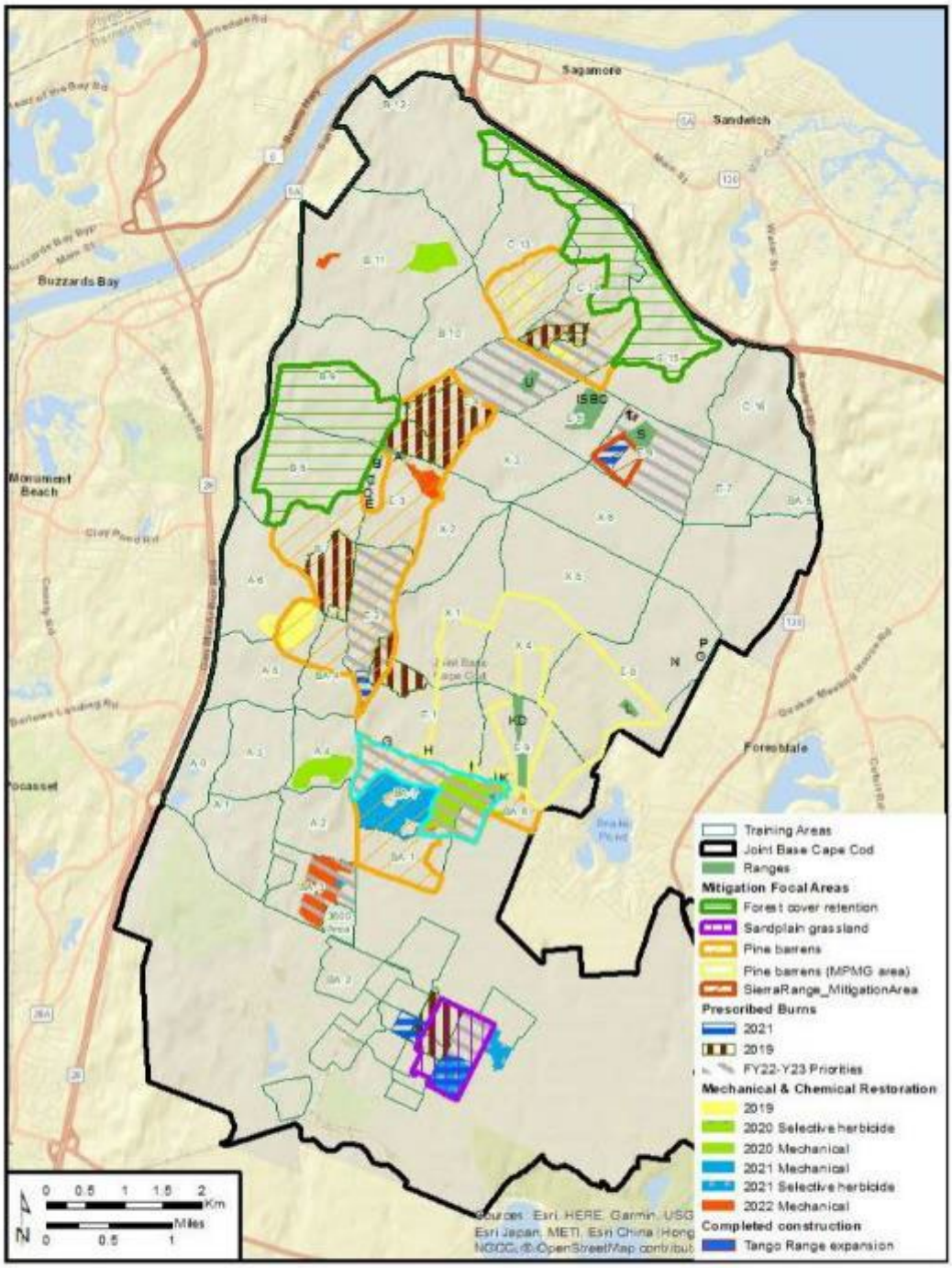
- **Mechanical Restoration** –
  - Completion of the 27 acre RAW3 harvest contracted in FY21. As described above this project focuses on restoration of a large kettle hole frost bottom system and surrounding pitch pine – scrub oak savannah.
  - Long-term and small scale patch mowing of understory shrubs and small trees will continue in Training Area BA-6 to provide complex structural diversity in support of both training and habitat objectives. Approximately 7 acres will be mowed in FY22.

- **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 foci, including extensive discussion of rare species, habitat needs, ongoing mitigation efforts under the CMP. These tours have garnered notable interest in listed fauna including listed moths and other early successional species. These tours, which were held from August through December, are expected to begin again in the spring and will continue to emphasize endangered species and habitat conservation.

Jake McCumber presenting a tracked Eastern Box Turtle during a Camp Edwards public tour. This old male was opportunistically found on the firing line of Sierra Range during the tour and provided an excellent and popular educational opportunity.

  - **Grassland Bird Tours** – These annual tours were halted for two years due to the pandemic, but will start again in FY22 focusing on localized specialties of sandplain grassland habitat at Camp Edwards. These have long been productive outreach with the public and bird enthusiasts for both grasslands habitat conservation and military conservation.
  - **Public presentations** – MAARNG personnel have already given a presentation in FY22 focused on the Barrens Buck Moth to the Upper Cape Naturalist Club. Additional talks and field trips for this group and others (MA Butterfly Club, etc.) are planned for the year highlighting rare species and habitat restoration fundamental to the mitigation efforts of the Permit.

All photos taken 2021 at Camp Edwards; MAARNG Natural Resources and Training Lands Program
Cover photos – Top: Barrens Buck Moth (*Hemileuca maia*) female. Bottom (from left): Grasshopper Sparrow (*Ammodramus savannarum*), Eastern Box Turtle (*Terrapene carolina*) with radio-transmitter, Frosted Elfin (*Callophrys irus*)



Map of Camp Edwards prescribed fires and mechanical pine barrens and training lands restoration projects from 2019 forward, including upcoming priorities. Designated mitigation areas are also shown.

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

Appendix F - 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 2012**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**
BIRDS												
Grasshopper Sparrow[13] *(Ammodramus savannarum)*	-	T	27	19	26	23	16	15	16	20	34	36
Northern Harrier[1] *(Circus cyaneus)*	-	T	5	8	12	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper[13] *(Bartramia longicauda)*	-	E	3	5	2	4	9	8	7	12	6	2
Eastern Meadowlark[13,16] *(Sturnella magna)*	-	SC	2	3	1	0	8	3	2	7	14	17
Long-eared Owl[1] *(Asio otus)*	-	SC	0	0	1	0	0	0	0	0	0	0
Vesper Sparrow *(Pooecetes gramineus)*	-	T	1	3	1	0	0	0	0	0	0	0
Whip-poor-will[2] *(Antrostomus vociferous)*	-	SC	201	51	156	96	87	52	110	53	99	136
Bald Eagle[1] *(Haliaeetus leucocephalus)*	-	SC	0	0	0	3	0	0	0	0	0	0
REPTILES and AMPHIBIANS												
Eastern Box Turtle *(Terrapene carolina carolina)*	-	SC	13	1	15	13	38	42	43	58	45	83
Eastern Hog-nosed Snake *(Heterodon platirhinos)*	-	SC	0	0	0	0	2	3	8	9	1	2

Individuals Reported												
Common/Scientific Names	**Fed Status[14]**	**State Status**	**TY 2012**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**
ODONATES												
Comet Darner[3] *(Anax longipes)*	-	-	4	0	5	0	N/A	N/A	N/A	N/A	N/A	N/A
Spatterdock Darner[3] *(Aeshna mutata)*	-	-	14	0	9	0	N/A	N/A	N/A	N/A	N/A	N/A
PLANTS												
Adder's Tongue Fern[4,6] *(Ophioglossum pusillum)*	-	T	84	542	1467	256	98	247	0	25	646	N/A
Spring Ladies Tresses *(Spiranthes vernalis)*	-	T	0	0	0	0	0	0	0	0	0	3
Broad Tinker's Weed[5,6] *(Triosteum perfoliatum)*	-	E	332	1230	297	N/A	113	127	0	200	6	N/A
American Arborvitae[9] (*Thuja occidentalis*)	-	E	0	0	0	0	4	N/A	N/A	N/A	N/A	N/A
BEES												
Walsh's Anthophora[15] *(Anthophora walshii)*	-	E	0	0	0	0	0	5 (1)	0	32 (9)	4	N/A
BUTTERFLIES and MOTHS[11]												
Buck Moth (*Hemileuca maia*)	-	SC	0	0	4	13	90	95	0	4	2	74
Pine Barrens Speranza *(Speranza exonerata)*	-	SC	0	0	0	0	44	13	0	0	0	0
Sandplain Euchlaena *(Euchlaena madusaria)*	-	SC	0	0	0	0	3	7	0	0	1	0
Heath Metarranthis *(Metarranthis pilosaria)*	-	SC	0	0	0	0	1	1	0	0	0	0
Melsheimer's Sack Bearer *(Cicinnus melsheimeri)*	-	T	0	0	0	0	2	0	0	0	7	0

Individuals Reported												
Common/Scientific Names	**Fed Status[14]**	**State Status**	**TY 2012**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**
Gerhard's Underwing *(Catocala herodias)*	-	SC	0	0	0	0	33	10	0	0	2	0
Pine Barrens Zale *(Zale lunifera)*	-	SC	0	0	0	0	13	8	0	0	0	0
Barrens Dagger Moth *(Acronicta albarufa)*	-	T	0	0	0	0	1	0	0	0	0	0
Chain-dotted Geometer *(Cingilia catenaria)*	-	SC	0	0	0	0	0	0	0	1	0	0
Drunk Apamea *(Apamea inebriata)*	-	SC	0	0	0	0	1	0	0	0	0	0
Pink Sallow *(Psectraglaea carnosa)*	-	SC	0	0	0	0	9	*5*	0	0	0	0
Pink Streak *(Dargida rubripennis)*	-	T	0	0	0	0	25	0	0	0	3	1
Collared Cycnia *(Cycnia collaris)*	-	T	0	0	0	0	0	1	0	11	33	200
Coastal Heathland Cutworm *(Abagrotis benjamini)*	-	SC	0	0	0	0	0	1	0	0	0	0
Woolly Gray *(Lycia ypsilon)*	-	T	0	0	0	0	0	2	0	0	0	0
Water-willow Stem Borer *(Papaipema sulphurata)*	-	T	0	0	0	0	0	1	0	0	0	0
Waxed Sallow Moth *(Chaetaglaea cerata)*	-	SC	0	0	0	0	0	2	0	0	0	0
Frosted Elfin[12] *(Callophrys irus)*	-	SC	0	0	0	0	*5*	*5*	*5*	TBD	25	*57*
Slender Clearwing Sphinx *(Hemaris gracilis)*	-	SC	0	0	0	0	0	0	0	0	*5*	3

Individuals Reported												
Common/Scientific Names	**Fed Status[14]**	**State Status**	**TY 2012**	**TY 2013**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**
CRUSTACEANS												
Agassiz's Clam Shrimp[10] *(Eulimnadia agassizii)*	-	E	0	0	0	1	0	6	38	9	3	5
American Clam Shrimp ^ *(Limnadia lenticularis)*	-	SC	0	0	0	0	0	0	0	0	0	3
MAMMALS												
Northern Long-Eared Bat[7,8] *(Myotis septentionalis)*	T	E	0	0	8	22 (2)	15 (1)	2	1	3	1	TBD
Little Brown Bat[7] *(Myotis lucifugus)*	UR	E	0	0	4	40	22	4	2	6	2	TBD
Tricolored Bat[7] (Perimyotis subflavus)	UR	E	0	0	11	11	7	3	2	3	1	TBD
Eastern Small-Footed Bat[7] *(Myotis leibii)*	UR	E	0	0	0	0	0	0	0	1	1	TBD

[1] NHESP is only accepting reports of nesting raptors, rather than opportunistic observations of individuals. Reports are provided as relevant, but common wintering birds or migrants are not individually tracked or reported (e.g., Northern Harrier).

[2] As of TY 2016, quantities only reflect the results of annual survey routes during May, after totaling the minimum number (between two observers) heard at each site. In prior years, the number shown reflects the quantity reported to NHESP, which may include multiple survey windows and repeated counts. Due to Covid-19 concerns, 2020 routes were not run in duplicate, and the number represents the total number of individual birds heard calling throughout the routes.

[3] Comet and Spatterdock Darner are no longer on NHESP's rare species list. Also, Odonate surveys were suspended after TY 2015.

[4] Several known *Ophioglossum* sites could not be surveyed in TY 2016 due to a lack of cease-fire agreement with the off-base Monument Beach Shooting Club. 2019 numbers are likely under representative, as surveys occurred late in the season. In 2020 *Ophioglossum* was surveyed earlier in the year in order to get an accurate count.

[5] Actual 2019 numbers may be as few as 82, MAARNG staff is now studying the genetics of *Triosteum perfoliatum* and *T. aurantiacum* due to difficulty in accurately differentiating the two species. Once the genetics project is completed, 2020 numbers will be reported.

[6] In 2018, only sites with historic records and no recent records were surveyed, and this should not be interpreted as a loss of rare plants between 2017 and 2018.

[7] Acoustic monitoring collects "call sequence" data and the true number of individuals is unknown. Numbers in the table reflect the number of survey sites with acoustic detections confirmed through manual call vetting. Numbers are reported to NHESP, but not tracked by them due to current uncertainty in using acoustic identifications. TY 2020 data is still being processed, these numbers are to be determined at a later date (TBD).

[8] Number in parentheses is captured individuals trackable by NHESP due to species identification confirmation versus acoustic data.

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

[10] Numbers represent only locations where species was found and ID confirmed by either NHESP Aquatic Ecologist or trained MAARNG staff.

[11] Moths were extensively surveyed under contract with the Lloyd Center for the Environment between 2016 and 2017. There were no surveys in 2018, and MAARNG staff is not recording flight records of Barrens Buckmoth, as they are ubiquitous around the Training Area/Reserve. 2019 quantities represent individuals or groups of individuals (a group of Barrens Buckmoth caterpillars on a single leaf is counted as one, as are a pair of Unexpected Cycnia caterpillars sharing the same butterflyweed plant).

[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] 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.

[14] "UR" indicates a species is currently under review for listing on the federal Endangered Species Act.

[15] 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.

[16] Species added to MA Endangered Species List in TY 2020. Observation quantities included for prior years, but would not have been officially reported to NHESP.

APPENDIX H
ENVIRONMENTAL PERFORMANCE STANDARDS VIOLATIONS HISTORY

EPS VIOLATIONS HISTORY			
TRAINING YEAR	REPORTED VIOLATION	EXPLANATION OF VIOLATION	CORRECTIVE ACTION
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	-----	-----

EPS VIOLATIONS HISTORY			
TRAINING YEAR	REPORTED VIOLATION	EXPLANATION OF VIOLATION	CORRECTIVE ACTION
TY 2012	Small Arms Range EPS (EPS 19)	On November 7, 2011, the EMC issued a notice for failure to remove water from bullet traps on all three operationally active small arms ranges within the prescribed time periods on multiple occasions during TY 2011. The EPA also cited the MAARNG for a violation for the same failure.	The MAARNG submitted a Response Packet to the EMC in early December 2011 which included: 1) a Notification Protocol should it not be able to comply with a requirement of the OMMPs; 2) a STAPP™ Range Tarp Cover Project Description; 3) Water Removal Contracting and Budgeting provisions; 4) creation of a Camp Edwards Sustainable Range Program Working Group; and 5) a Standard Operating Procedure for STAPP™ System Range Maintenance Procedures and Inspections.