

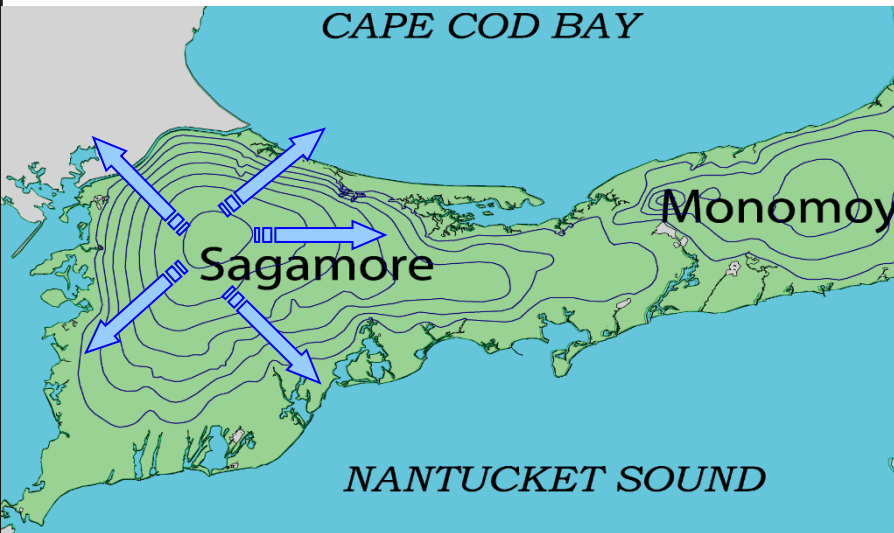
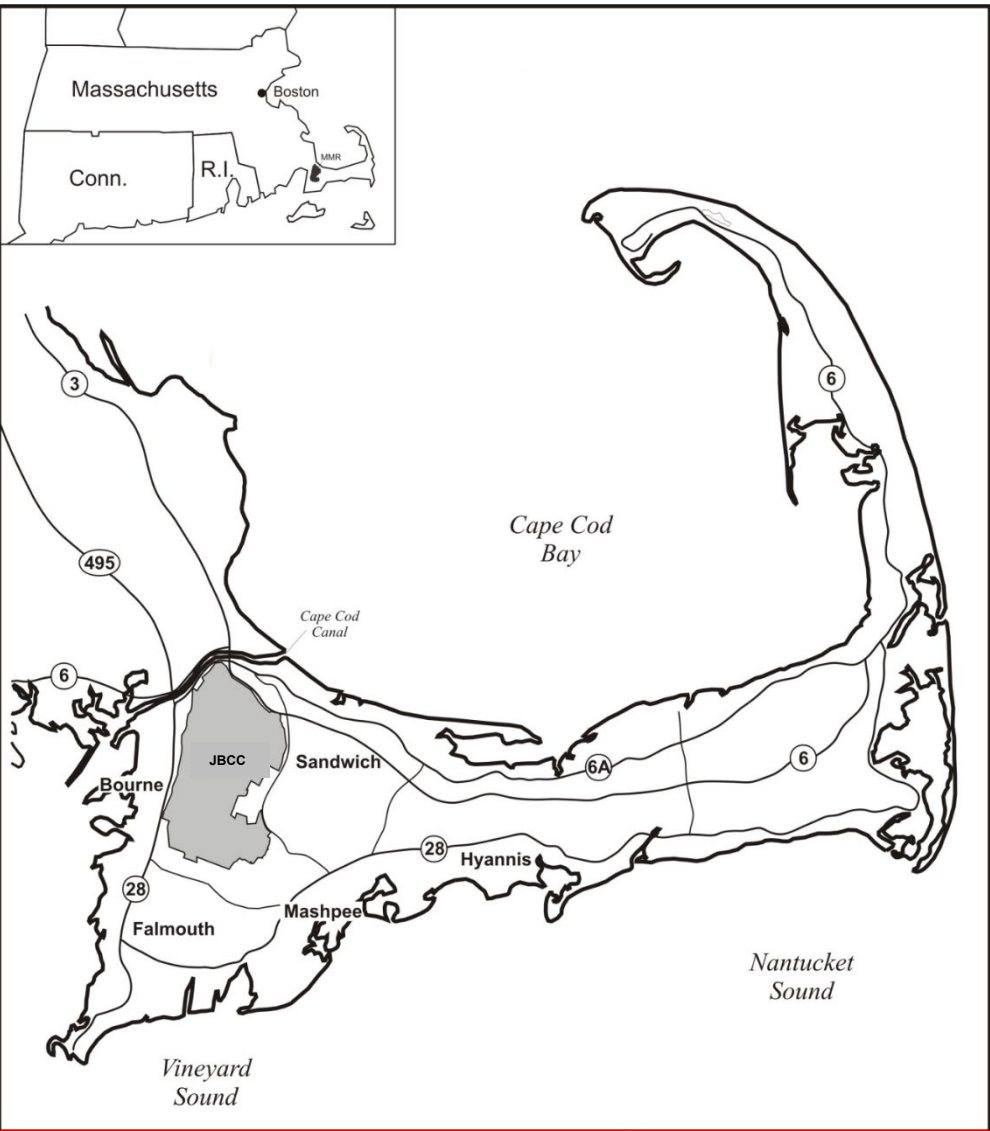


Impact Area Groundwater Study Program at Camp Edwards Program History and Overview

Mr. Shawn Cody
IAGWSP Program Manager
December 7, 2022

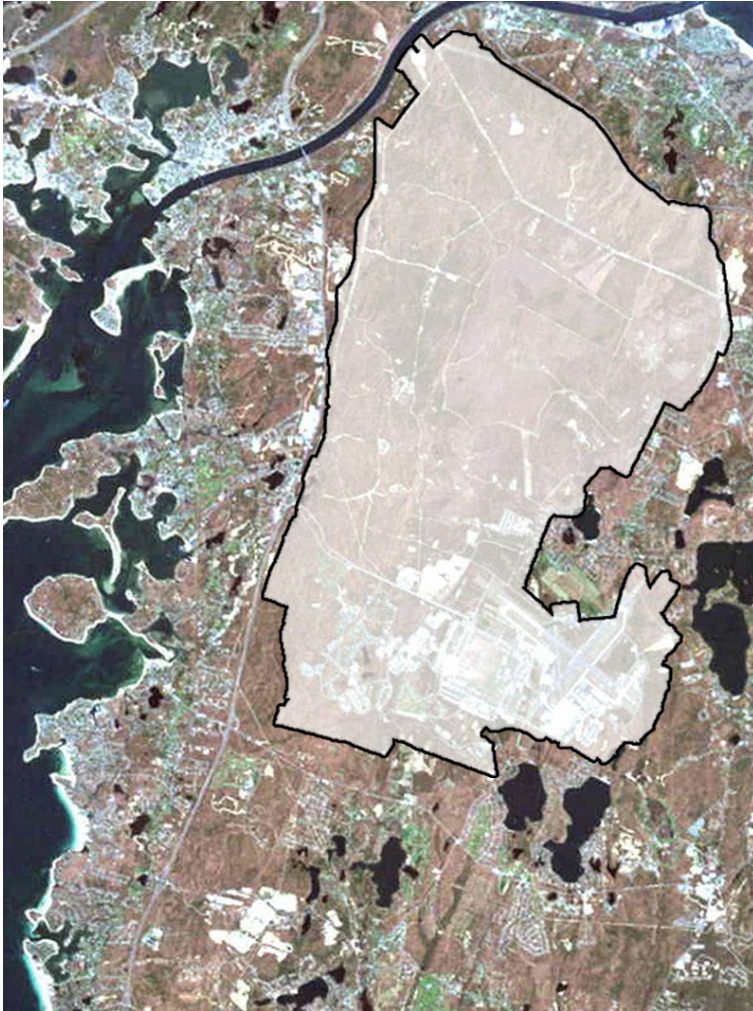


Area of Operations





MMR/JBCC Background



- ◆ **21,000 total acres: largest Army training site in New England**
- ◆ **Largest piece of undeveloped land on Cape Cod**
 - ~10%
- ◆ **Sits atop a sole-source aquifer**
- ◆ **Home to a globally threatened habitat**



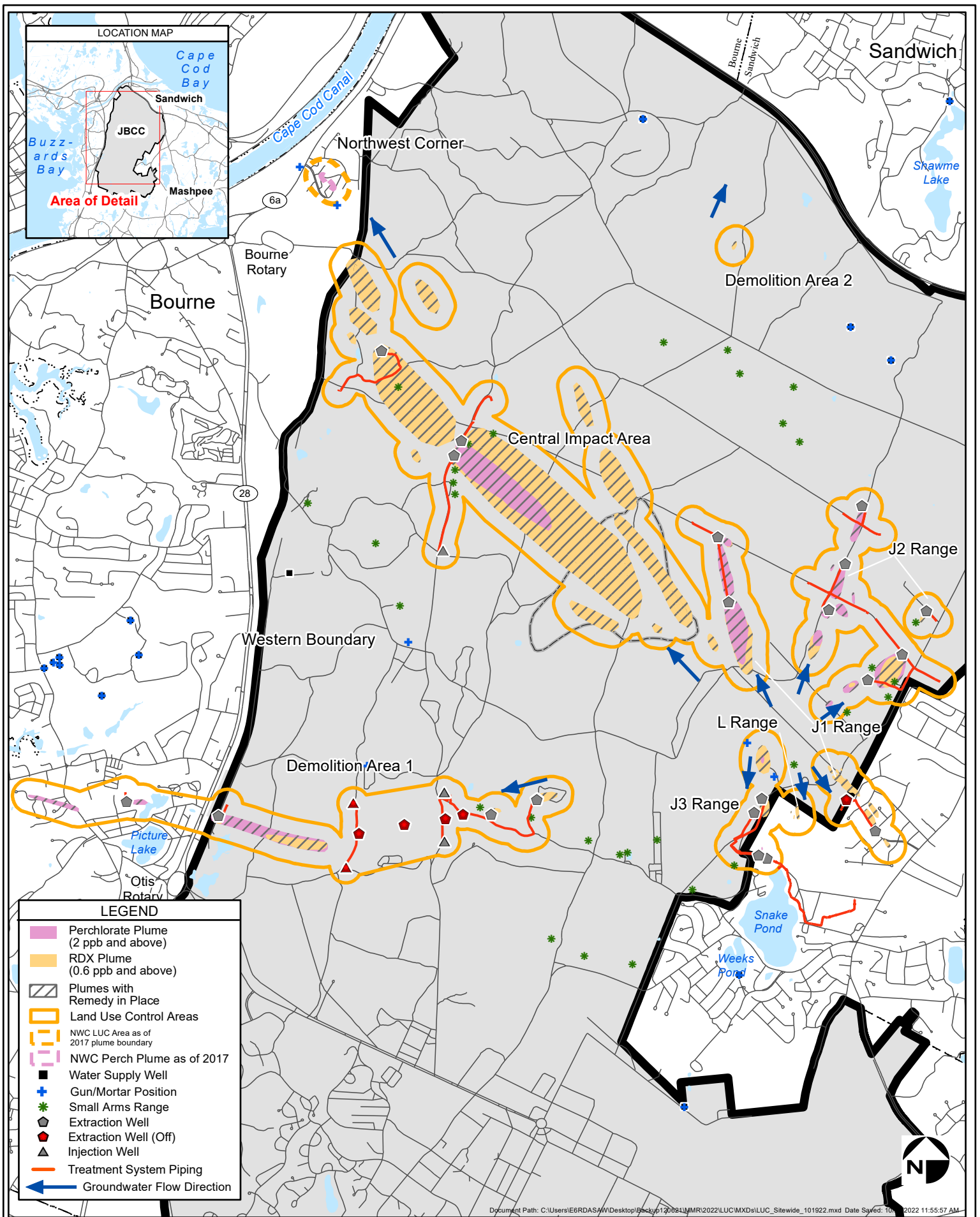
Background

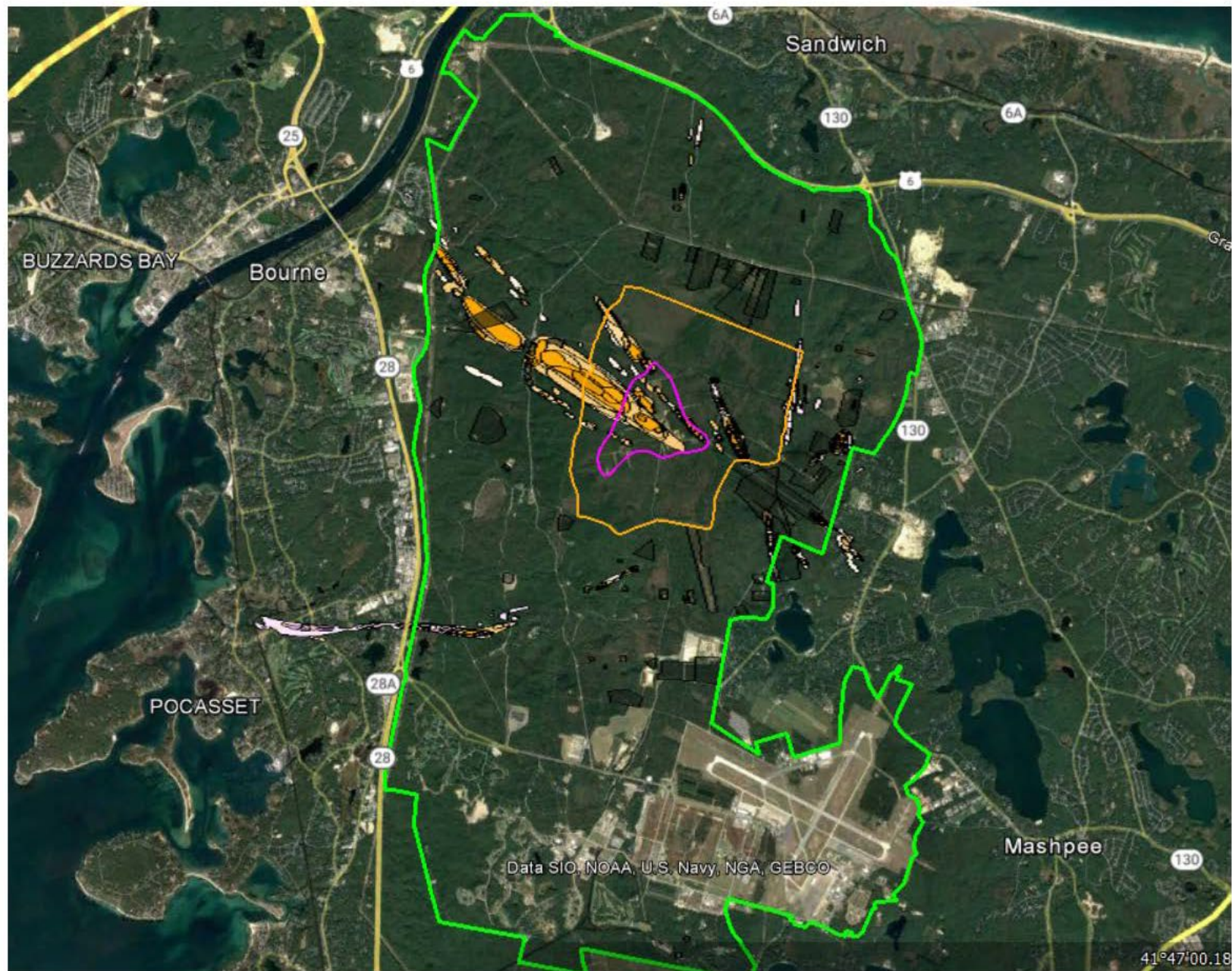
- ◆ **1911 Military training begins**
- ◆ **1917 World War I - Yankee Division (YD)**
- ◆ **1940's World War II build up and heavy training**
- ◆ **1950's Korean War build up and heavy training**
- ◆ **1953 Contractor activities begin on leased ranges**
- ◆ **1975 OTIS AFB turned over to MAANG**
- ◆ **1989 JBCC listed as Superfund Site**
- ◆ **1991 Federal Facility Agreement signed**
- ◆ **1997 through 2001 EPA issues four Administrative Orders (AOs):**
 - Three under Safe Drinking Water Act and 1 under Resource Conservation and Recovery Act were issued to MANG, NGB, DA
 - Stops all live fire training and requires investigation and cleanup of contamination
 - Military agrees to comply with AOs (formally establishes Impact Area Groundwater Study Program and E&RC)

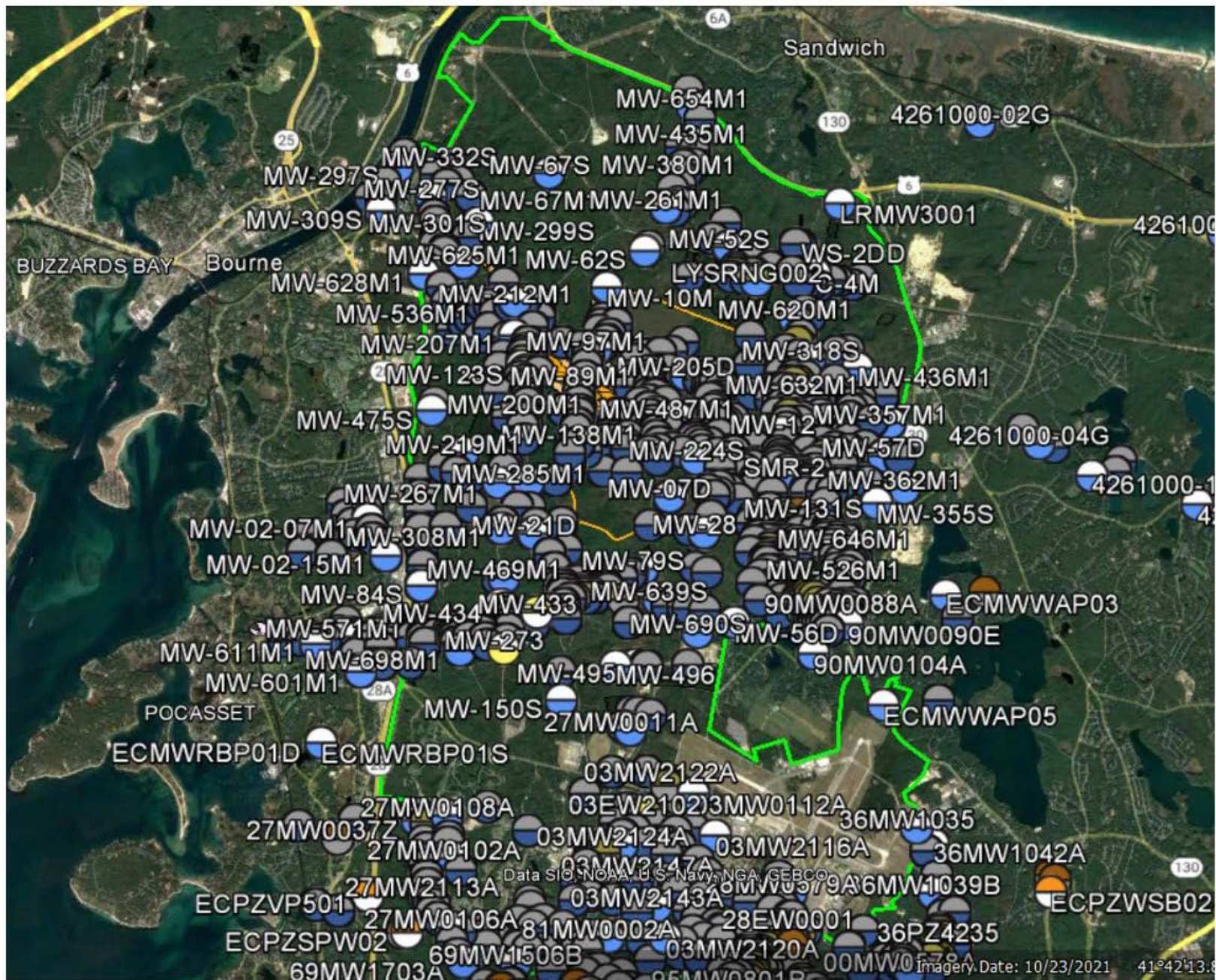


Investigation, Findings and Cleanup

- ◆ **15,000 acres investigated**
 - Grouped into 14 operable units (sites)
- ◆ **1,400 monitoring wells in over 700 locations**
- ◆ **100,000 groundwater and soil samples collected**
- ◆ **125,000 tons of soil excavated and treated**
- ◆ **12 groundwater plumes (RDX & perchlorate)**
- ◆ **17 treatment systems constructed for 7 groundwater plumes**
- ◆ **3.8 million gallons of groundwater treated per day**
- ◆ **17 billion gallons treated to date**
- ◆ **~300 acres partially cleared of Unexploded Ordnance**
 - Over 90 Acres 90%+ cleared within the CIA
- ◆ **4 tons of explosives removed and safely destroyed**
- ◆ **700 tons of munitions-related scrap recycled**
- ◆ **20,500 cubic yards (~47 million pounds) of range soil removed and disposed**







Impact Area Groundwater Study Program

Plumes and Treatment Systems- June 2022
Currently Treating 4 Million Gallons per Day
Treated 16.5 Billion Gallons to Date

Central Impact Area



Treatment Startup: 2013
Primary Contaminants: RDX & Perchlorate
Number of Extraction Wells: 3
Treatment Rate: 1.08m Gallons/Day

Demolition Area 1



Treatment Startup: 2004
Primary Contaminants: RDX & Perchlorate
Number of Extraction Wells: 5
Treatment Rate: 346,000 Gallons/Day

J-1 Northern Plume



Treatment Startup: 2013
Primary Contaminants: RDX
Number of Extraction Wells: 2
Treatment Rate: 372,000 Gallons/Day

J-2 Northern Plume



Treatment Startup: 2006
Primary Contaminants: RDX & Perchlorate
Number of Extraction Wells: 3
Treatment Rate: 684,000 Gallons/Day

J-2 Eastern Plume



Treatment Startup: 2008
Primary Contaminants: RDX & Perchlorate
Number of Extraction Wells: 3
Treatment Rate: 712,800 Gallons/Day

J-1 Southern Plume



Treatment Startup: 2007
Primary Contaminants: RDX
Number of Extraction Wells: 2
Treatment Rate: 180,000 Gallons/Day

Demolition Area 1
Base Boundary and Off-base



Treatment Startup: 2011/2016
Primary Contaminants: RDX & Perchlorate
Number of Extraction Wells: 2
Treatment Rate: 238,000 Gallons/Day

J-3 Range

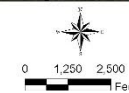


Treatment Startup: 2004
Primary Contaminants: RDX & Perchlorate
Number of Extraction Wells: 4
Treatment Rate: 367,200 Gallons/Day

LEGEND

- JBCC Boundary
- Groundwater Flow Direction
- Perchlorate Plume (2 ppb and above)
- RDX Plume (0.6 ppb and above)
- Extraction Wells
- Reinjection Wells
- Treatment System Piping
- Water Supply Well
- Gun/Mortar Position
- Small Arms Range
- Treatment Facility

Extraction Wells: 22
Treatment Systems: 3
MTUs: 14
Groundwater Plumes: 12



Impact Area
Groundwater Study Program



Current Projects/Status

- ◆ **Central Impact Area:** Source removal work is finishing up for the season in the CIA. Phase IV Area 2 (ten acres) will be completed during the 2022 field season. Work includes investigation and removal of anomalies, the off-site disposal of munitions debris, and demolition operations in a structure specially designed to reduce noise and contain metal debris and explosive residue.
- ◆ **Long-term monitoring and Sampling:** Sampling crews are continually performing annual groundwater monitoring. Crews rotate through our groundwater sites throughout the year to complete the necessary sampling.
- ◆ **Third Five Year Review:** The third Five Year Review Report for the program is underway in 2022. These reports evaluate the implementation and performance of site remedies to determine if the remedies remain protective of human health and the environment. The report will be posted to the IAGWSP web site when it is final.
- ◆ **Operations and Maintenance:** O&M duties and monthly sampling at all groundwater treatment facilities continues. This work monitors treatment plant performance to ensure that they are removing contaminants as designed.
- ◆ **Per- and Polyfluoroalkyl Substances (PFAS) sampling:** Follow up sampling is being performed at a J-3 Range facility where the melting/pouring or pressing of plastic bonded explosives occurred and J-2 Range where the disposal and burning of the explosives occurred.



PFAS Sampling History/Overview

- ◆ **IAGWSP began sampling for PFAS in 2019 at Open Burning/Open Detonation (OB/OD) munitions disposal sites**
 - IAGWSP has collected 231 samples from 169 wells and 20 of those samples exceeded regulatory criteria. IAGWSP also regularly sample for PFAS at 17 points along the treatment systems and none of those samples have exceeded regulatory criteria
- ◆ **Results are compared to MassDEP's MCP GW-1 Standard/Massachusetts Maximum Contaminant Level (MMCL) (for the sum of the concentrations of six specific PFAS: PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA aka PFAS6) of 20.0 nanograms/liter (ng/L) (0.07 micrograms/liter [ug/L]).**
- ◆ **In 2022, EPA updated their Regional Screening Levels (RSLs) and Health Advisories (HAs) to:**

PFAS Compound	Regional Screening Level (RSL) (ng/L)	Health Advisory (HA) ng/L
PFOS	4	0.02 (Interim)
PFOA	6	0.004 (Interim)
PFNA	5.9	-
PFHxS	39	-
PFBS	600	2000 (Final)
GenX	6	10 (Final)



PFAS Sampling History – J-2 Range

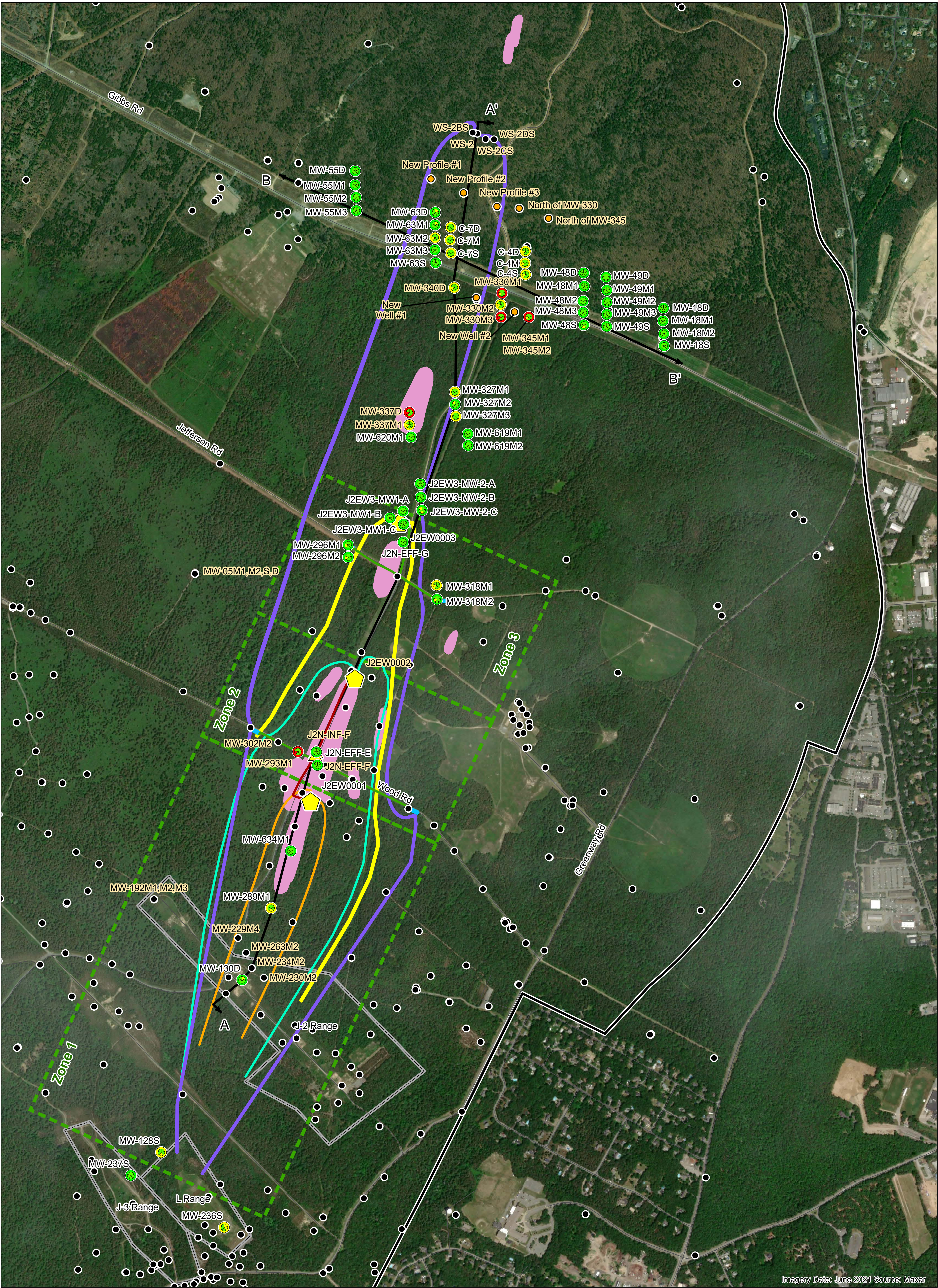
Sample Date(s)/Events	Sample Locations	Goal	Work Plan/Project Note
June 2019	J2EW0001, J2EW0002, Influent at MTUs E, F, and G and 3 monitoring well screens.	Identify PFAS associated with J-2 ETR systems.	Final Sampling Work Plan for PFAS (EDMS 191273)
August/September 2020	J2EW0002 and 30 monitoring well screens.	Presence/absence of PFAS from extracted groundwater and associated with former OB/OD activities.	May 2020 Project Note (EDMS 205769)
August/September 2021	J2EW0002 and 42 monitoring well screens.	Presence/absence of PFAS from extracted groundwater and associated with former OB/OD activities.	Final J-2 Range Northern 2020 EMR (EDMS 220765) & Accompanying MOR (220617)
December 2021 / January 2022	Effluent at MTUs, E, F, and G and 59 monitoring well screens.	Refine working CSM and determine nature and extent.	December 2021 Project Note (EDMS 227822)
August 2022	Post-IX Sample Port from MTU-F	Determine if MTU-F IX resin removes PFAS post treatment.	IAGWSP Direction



PFAS Recent Results – J-2 Range Fall 2022

◆ **Based on previous PFAS detections , samples for PFAS analyses were collected in October 2022 from extraction well J2EW0002, eight monitoring wells and the influent/effluent at Mobile Treatment Unit F.**

- Four wells had exceedances of the RSL for PFNA. These were MW-330M1 (6.4 ng/L), MW-330M3 (11 ng/L), MW-340D (7.1 ng/L) and MW-345M2 (6 ng/L). No other RSL exceedances were observed during the fall 2022 sampling event.
- Wells MW-330M1 (25.4 ng/L), MW-330M3 (27.0 ng/L) and MW-345M1 (21.8 ng/L) all yielded lower PFAS6 concentrations in October 2022 than in December 2021 but remained above the MMCL.
- PFAS6 results at MW-293M1 were 34.0 ng/L in January 2022 but 11 ng/L in October.
- Well MW-337D (19.7 ng/L) was below the MMCL in October after reporting 42.0 ng/L in December 2021.
- The influent sample collected at MTU F (21.1 ng/L) in October exceeded the MMCL for the first time (out of five samples) since sampling began in 2019.
- A sample collected in August 2022 from the exit port of the ion exchange (IX) treatment vessel at MTU F reported 0.0 ng/L of PFAS6, as did the effluent sample in October. This demonstrates that the IX treatment media (designed for treatment of perchlorate) effectively removes the reported PFAS from influent water.



Imagery Date: June 2021 Source: Maxar

Treatment System Capture Zones

Well

- J2EW0001
- J2EW0002
- J2EW0003

Water Supply Well Capture Zone

- Predicted WS-2 Capture Zone

PFAS Sample thru 2022

PFBS (600 ng/L - RSL)

PFOS (4 ng/L - RSL)

PFNA (5.9 ng/L - RSL)

PFHxS (39 ng/L - RSL)

PFOA (6 ng/L - RSL)

PFAS6 (outer ring) (20 ng/L)

PFAS6 - Mass MMCL - October 2020 (20 ng/L)

PFOS/PFOA/PFBS/PFHxS/PFNA - EPA 2022 RSL (values above)

GenX Excluded - Substitute for PFOA in 2009

LEGEND

Red = Result above limit

Yellow = Result below limit with detection

Green = No detection

JBCC Boundary

Range Boundary

Zone Boundary

Perchlorate Plume (shown to 2 µg/L) (2021)

J-2N Extraction Well (operational)

New Vertical Profile/Monitoring Well

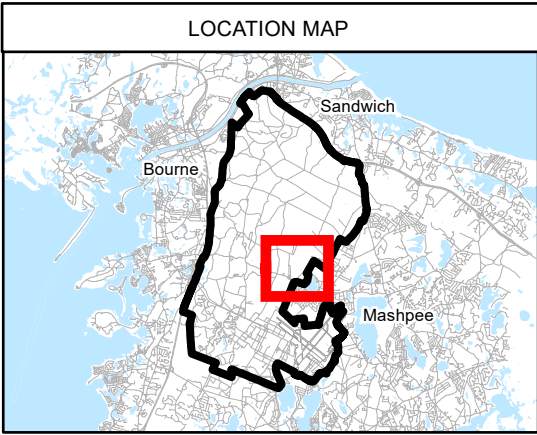
Monitoring Well Wells Proposed for PFAS Sampling

Lines of Cross Section

Influent Piping

Effluent Piping

Infiltration Trench



0 500 Feet

TITLE

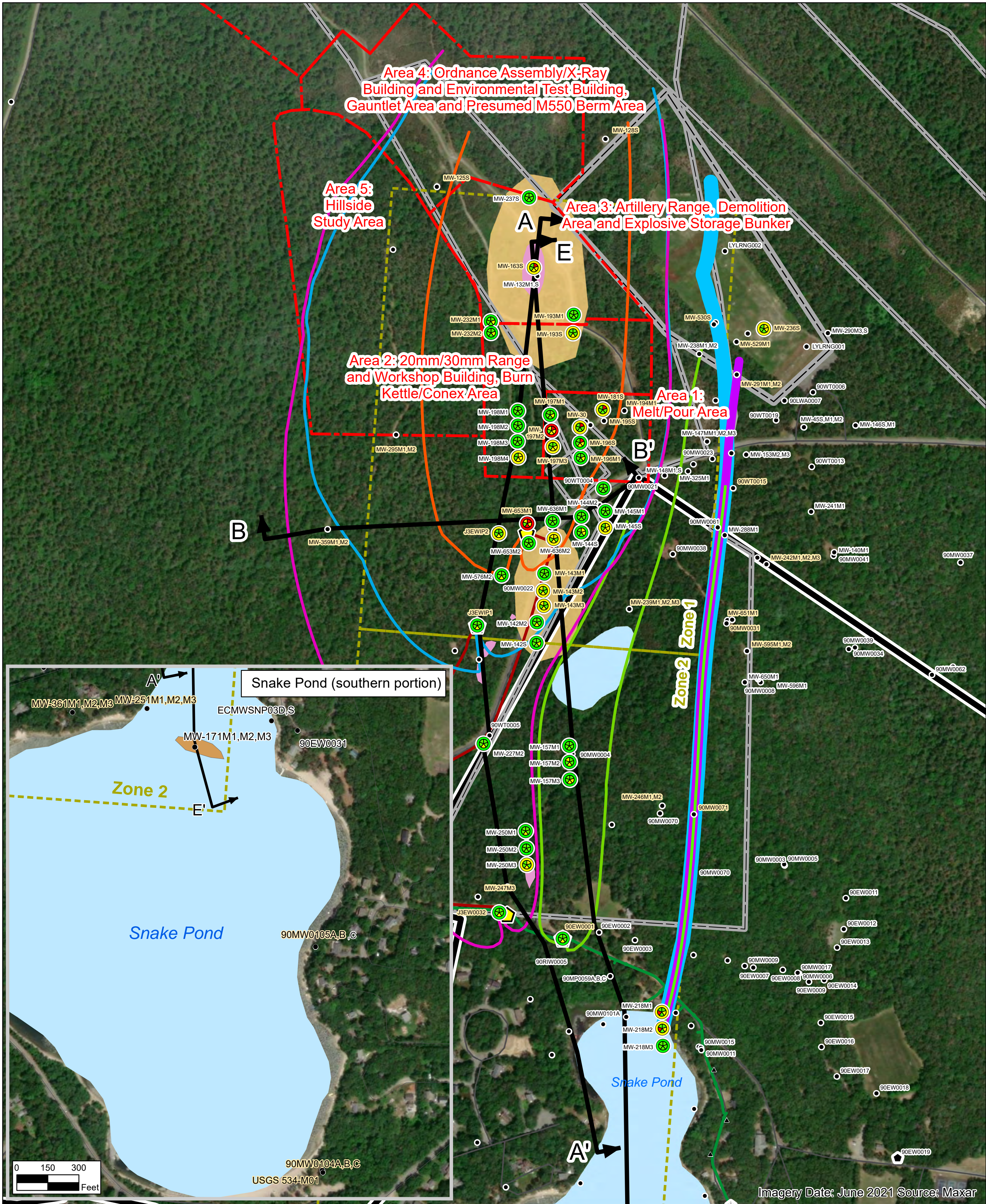
J2N Range Environmental Monitoring

PFAS Confirmatory Sampling



PFAS Sampling History – J-3 Range

Sample Date(s)/Events	Sample Locations	Goal	Work Plan/Project Note
June/July 2019	J-3 Range treatment influent and effluent and 3 monitoring well screens.	Presence/absence of PFAS associated with former open burning/open detonation (OB/OD) activities.	Final Sampling Work Plan for PFAS (EDMS 191273)
July 2020	18 monitoring well screens.	Develop CSM.	Project Note May 2020 (EDMS 205769)
July/August/September 2021	J-3 Range treatment influent and effluent. 4 extraction wells. 31 monitoring well screens.	Refine working CSM and determine nature and extent.	Project Note, dated June 2021 (EDMS 221930)
2022 Quarterly	J-3 Range treatment influent and effluent.	Monitoring impact and O&M performance of treatment if PFAS present.	Project Note, June 2021 (EDMS 221930)
August 2022	Post-IX Sample Port from MID-1 Sample Port	Determine if IX resin removes PFAS, and potential PFAS concentration entering lead GAC.	IAGWSP Direction



Capture Zone Particle Tracks
90EW0001
J3EW0032
J3EWIP1
J3EWIP2

Reverse Particle Pathlines
2020 Operational Conditions
MW-218M1
MW-218M2
MW-218M3

PFAS Sample thru 2022

PFBS (600 ng/L - RSL) PFOS (4 ng/L - RSL)
PFNA (5.9 ng/L - RSL) PFOA (6 ng/L - RSL)
PFHxS (39 ng/L - RSL)
PFAS6 (outer ring) (20 ng/L)

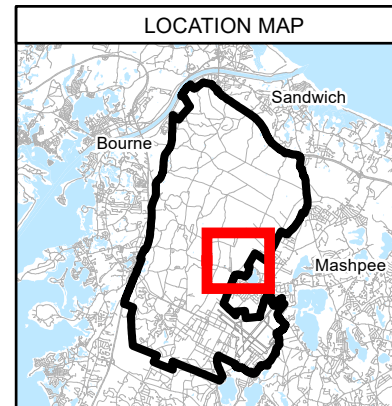
LEGEND

Red = Result above limit
Yellow = Result below limit with detection
Green = No detection

PFAS6 - Mass MMCL - October 2020 (20 ng/L)
PFOS/PFOA/PFBS/PFHxS/PFNA -
EPA 2022 RSL (values above)
GenX Excluded - Substitute for PFOA in 2009

JBCC Boundary
L Range
J3 Study Area
Perchlorate Plume (shown to 2 µg/L)
RDx Plume (shown to 0.6 µg/L)
FS-12 Extraction Well (operational)
J-3 Extraction Well (operational)
Reinjection Well (operational)
Monitoring Well Wells Proposed for 2022 PFAS Sampling

Influent Piping
Effluent Piping
Treatment System
Cross Section



0 300
Feet

TITLE

J-3 Range - PFAS6 and EPA RSLs
Sample Results PFAS



Look Ahead

- ◆ **PFAS sampling follow-up. IAGWSP working with EPA and MassDEP to finalize workplans for additional sampling at both the J-2 and J-3 Ranges**
 - Including installation of new monitoring wells at the J-2 Range.
 - Expanded list of wells at J-3 Range.
 - All JBCC tenants will be meeting in January to discuss base-wide PFAS sampling investigations and sampling results.
- ◆ **Complete 2022 field season CIA source removals**
- ◆ **Long-term monitoring and sampling**
- ◆ **Operations & Maintenance**