Air Force Civil Engineer Center (AFCEC) Emerging Contaminants Update

Rose Forbes, AFCEC

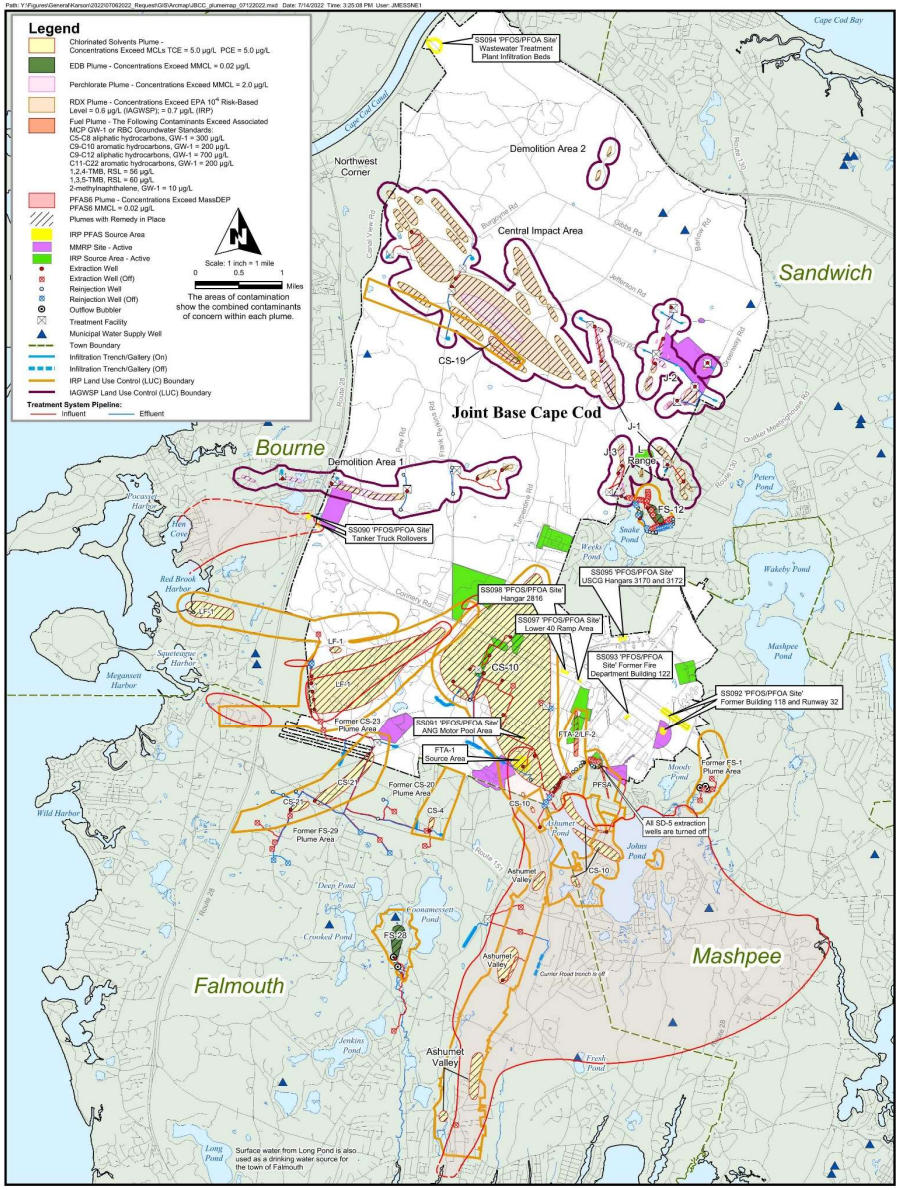
Mary O'Reilly, Jacobs

JBCC Cleanup Team Meeting

03 August 2022

Overview:

- Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane Standards
- Response Actions
- Fire Training Area-1 (FTA-1) – Supplemental Remedial Investigation/Supplemental Feasibility Study (RI/FS) for 1,4-Dioxane and PFAS
- Tanker Truck Rollover Sites (TTRS) – RI/FS for PFAS
- Landfill-1 (LF-1) – Supplemental FS for 1,4-Dioxane and PFAS
- Flight Line Area Operable Unit – RI for PFAS



Contaminant of Concern (COC)	Type of Contaminant	Risk-Based Level
TCE = trichloroethene	solvent	MCL = 5 µg/L
PCE = perchloroethene	solvent	MCL = 5 µg/L
CCl_4 = carbon tetrachloride	solvent	MCL = 5 µg/L
EDB = ethylene dibromide	fuel-related compound	MMCL = 0.02 µg/L
benzene	fuel-related compound	MCL = 5 µg/L
VC = vinyl chloride	solvent	MCL = 2 µg/L
1,1,2,2-TeCa = 1,1,2,2-tetrachloroethane	solvent	GW-1 = 2 µg/L
1,4-DCB = 1,4-dichlorobenzene	solvent	MMCL = 5 µg/L
Mn = manganese	metal	EPA Health Advisory = 300 µg/L
thallium	metal	MCL = 2 µg/L
lead	metal	15 µg/L (treatment technique action level for water distribution systems)
toluene	fuel-related compound	MCL = 1,000 µg/L
RDX - hexahydro-1,3,5-trinitro-1,3,5-triazine	explosive	HA = 2 µg/L GW-1 = 1 µg/L 10^{-6} = 0.6 µg/L (IAGWSP); = 0.7 µg/L (IRP)
perchlorate	oxidizer	HA = 15 µg/L MMCL = 2 µg/L
C5-C8 aliphatic hydrocarbons	fuel-related compound	GW-1 = 300 µg/L
C9-C10 aromatic hydrocarbons	fuel-related compound	GW-1 = 200 µg/L
C9-C12 aliphatic hydrocarbons	fuel-related compound	GW-1 = 700 µg/L
C11-C22 aromatic hydrocarbons	fuel-related compound	GW-1 = 200 µg/L
1,2,4-TMB	fuel-related compound	RSL = 56 µg/L
1,3,5-TMB	fuel-related compound	RSL = 60 µg/L
2-methylnaphthalene	fuel-related compound	GW-1 = 10 µg/L
1,4-dioxane	solvent	RG = 0.46 µg/L

Joint Base Cape Cod Groundwater Plume Map, and IRP and IAGWSP LUC Areas

Issued July 2022

Note: MCL – Maximum Contaminant Level
MMCL – Massachusetts Maximum Contaminant Level
HA – Federal Lifetime Health Advisory
PFAS - Per- and Polyfluoroalkyl substances
GW-1 – State default cleanup value to be used in lieu of site-specific risk-based level
10^{-6} - EPA level resulting in an excess cancer risk of one in a million
RG – Site Specific Risk Based Remediation Goal
RSL – Regional Screening Level

PFAS and 1,4-Dioxane Criteria for Drinking Water:

- May 2016 - EPA issued final Lifetime Drinking Water Health Advisory (HA) values for Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) of 70 nanograms per liter (ng/L) (0.07 micrograms per liter [µg/L]) for each and combined.

- Oct 2020 - MassDEP issued a Massachusetts Maximum Contaminant Level (MMCL) drinking water standard of 20 ng/L (0.02 µg/L) for the sum of six PFAS (PFAS6) compounds: PFOS, PFOA, Perfluorononanoic Acid (PFNA), Perfluorohexane Sulfonic Acid (PFHxS), Perfluoroheptanoic Acid (PFHpA), and Perfluorodecanoic Acid (PFDA).

- May 2022 - EPA published updates to its Regional Screening Levels (RSLs) which include five PFAS; impacts to the JBCC program are being assessed and will be discussed at a future meeting.

- Jun 2022 - EPA issued Interim Updated Drinking Water HAs for PFOS and PFOA and Final HAs for Perfluorobutane Sulfonic Acid (PFBS) and GenX; EPA noted that Superfund sites should use updated RSLs since Interim HAs are still undergoing EPA Science Advisory Board review.

- EPA RSL of 460 ng/L (0.46 µg/L) for 1,4-dioxane.

1 µg = 1000 ng; multiply the µg/L concentrations by 1,000 to convert the concentrations to ng/L.

PFAS and 1,4-dioxane concentrations in this presentation are in both µg/L and ng/L.

EPA RSLs for PFAS - HQ = 0.1

		New PFOS	Old PFOS	New PFOA	Old PFOA	New PFNA	New PFHxS	New GenX	PFBS (no change)
Resident (ingestion + dermal)	Groundwater (µg/L)	0.00602	0.04	0.00401	0.04	0.00589	0.0394	0.00602	0.601
	Groundwater (ng/L)	6.02	40	4.01	40	5.89	39.4	6.02	601
Resident (ingestion + dermal)	Soil (µg/kg)	19	126	12.6	126	19	126	23.5	1,900
	Soil (ng/kg)	19000	126000	12600	126000	19000	126,000	23500	1900000
Recreator (Swimmer) (ingestion + dermal)	Surface Water (µg/L)	0.304	0.38	0.203	0.38	0.256	1.75	0.304	30.2
	Surface Water (ng/L)	304	380	203	380	256	1750	304	30200
Recreator (Swimmer) (ingestion + dermal)	Sediment (µg/kg)	88.5	737	59	737	88.5	590	110	8.85
	Sediment (ng/kg)	88500	737000	59000	737000	88500	590000	110000	8850

Notes:

Screening Values for resident potable use of groundwater, resident contact with soil, and recreator contact with sediment and surface water are based on an HQ of 0.1 and CR of 1E-06 and were obtained from EPA's RSL table or generated using the EPA RSL calculator (https://epaprgs.ornl.gov/cgi-bin/chemicals/csl_search).

Shaded values are the updated May 2022 RSL values.

Key:

CR = Cancer Risk
EPA = U.S. Environmental Protection Agency
GenX = HFPO-DA
HQ = Hazard Quotient
JBCC = Joint Base Cape Cod
ng/kg = nanogram per kilogram
ng/L = nanogram per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = Perfluorobutane Sulfonic Acid
PFHxS = Perfluorohexane Sulfonic Acid
PFNA = Perfluorononanoic Acid
PFOA = Perfluorooctanoic Acid
PFOS = Perfluorooctane Sulfonic Acid
RSL = EPA Regional Screening Level
µg/kg = microgram per kilogram
µg/L = microgram per liter

Response Actions (related to public/community water supply wells):

- Eight public/community water supply wells sampled by AFCEC; two had PFOS+PFOA concentrations greater than the HA.
  - Mashpee Village Public Water Supply Well (PWSW) was shut down in Feb 2017; AFCEC/USACE installed a wellhead treatment system to remove PFOS/PFOA which began operation on 14 Feb 2020.
  - Community Water Supply Well for a neighborhood in Mashpee was disconnected and 93 trailers were connected to municipal water supply in 2018.

- Two Mashpee PWSWs, Turner Road #2 and #5 PWSWs, have PFAS6 concentrations > the MMCL but below the HA; both wells have been taken offline (Feb 2019 and Jul 2020).
  - AFCEC is installing wellhead treatment on the two Mashpee PWSWs; scheduled for completion in Feb 2023.

- The Falmouth Fresh Pond PWSW had PFAS6 concentrations greater than the MMCL but below the HA in May 2019; well was taken offline in Apr 2017 for perchlorate.
  - AFCEC completed installation of wellhead treatment on the Falmouth PWSW and it was restarted on 16 Jun 2022.

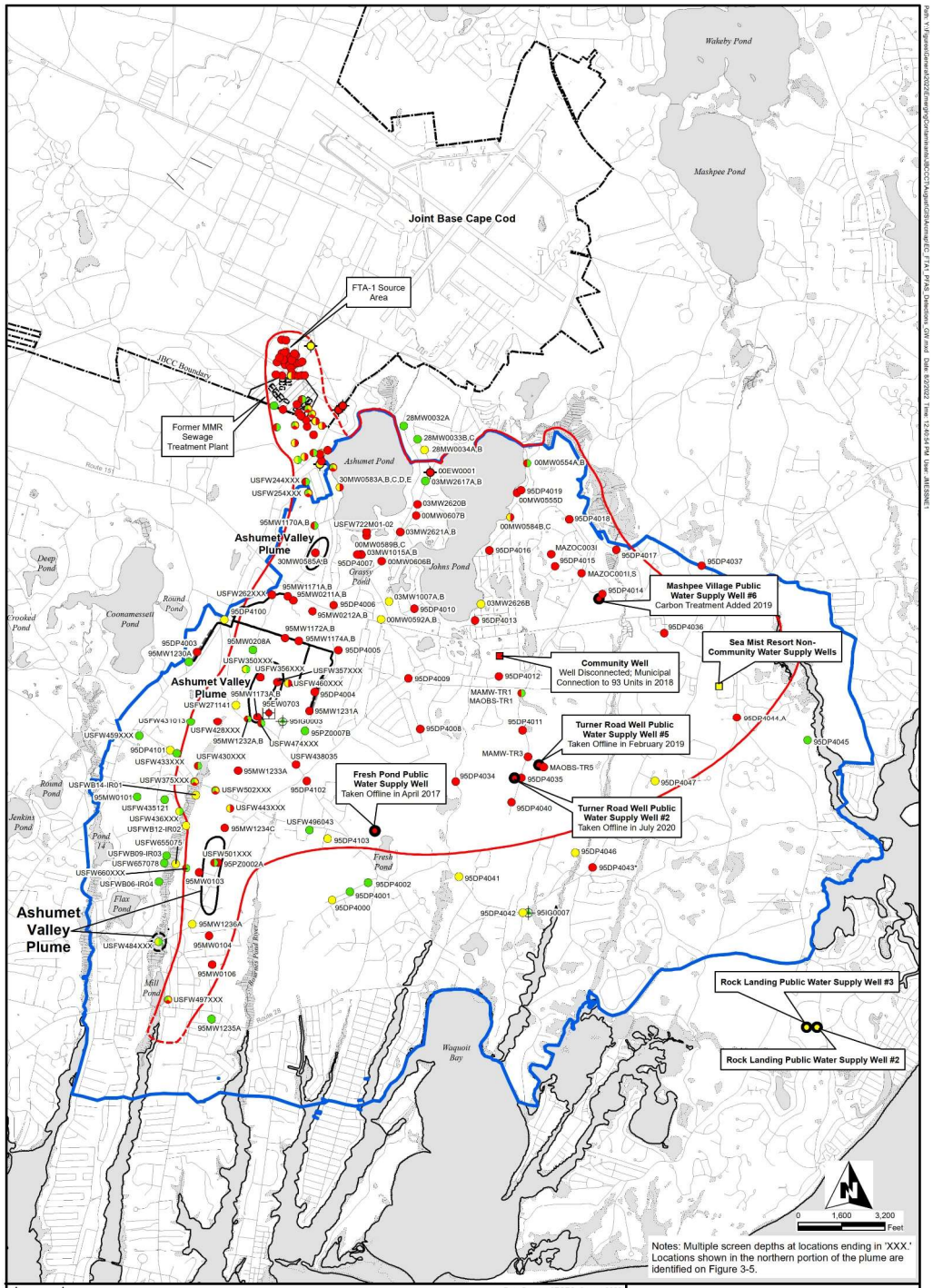
- An Engineering Evaluation/Cost Analysis (EE/CA) and Action Memo (AM) for wellhead treatment on the two Mashpee and the Falmouth PWSWs were finalized in Feb 2022.

Response Actions (related to private wells):

- 119 private wells sampled in Mashpee, Falmouth, and Bourne; currently no private wells with PFOS+PFOA concentrations > HA.
- 10 private wells in Mashpee and Falmouth with PFAS6 concentrations greater than the MMCL but below the HA were recently receiving bottled water from AFCEC.
  - AFCEC connected eight of these locations to municipal water supply in May 2022.
  - Concentrations at remaining two locations are expected to decrease below the MMCL and sampling will continue until concentrations are consistently below the MMCL for at least one year.
- AFCEC completed installation of a water main and completed seven residential connections in Bourne in Jan 2022.
- 13 residential point-of-entry filtration systems were installed by AFCEC.
  - Seven removed when connections to municipal water were completed.
  - Six are no longer maintained by AFCEC since concentrations decreased below the HA and MMCL; these systems have been turned over to the property owners.
- 123 total connections made to municipal water supply.
  - 93 trailers where water was supplied by a private community water supply well and 30 residential properties.

FTA-1 Supplemental RI:

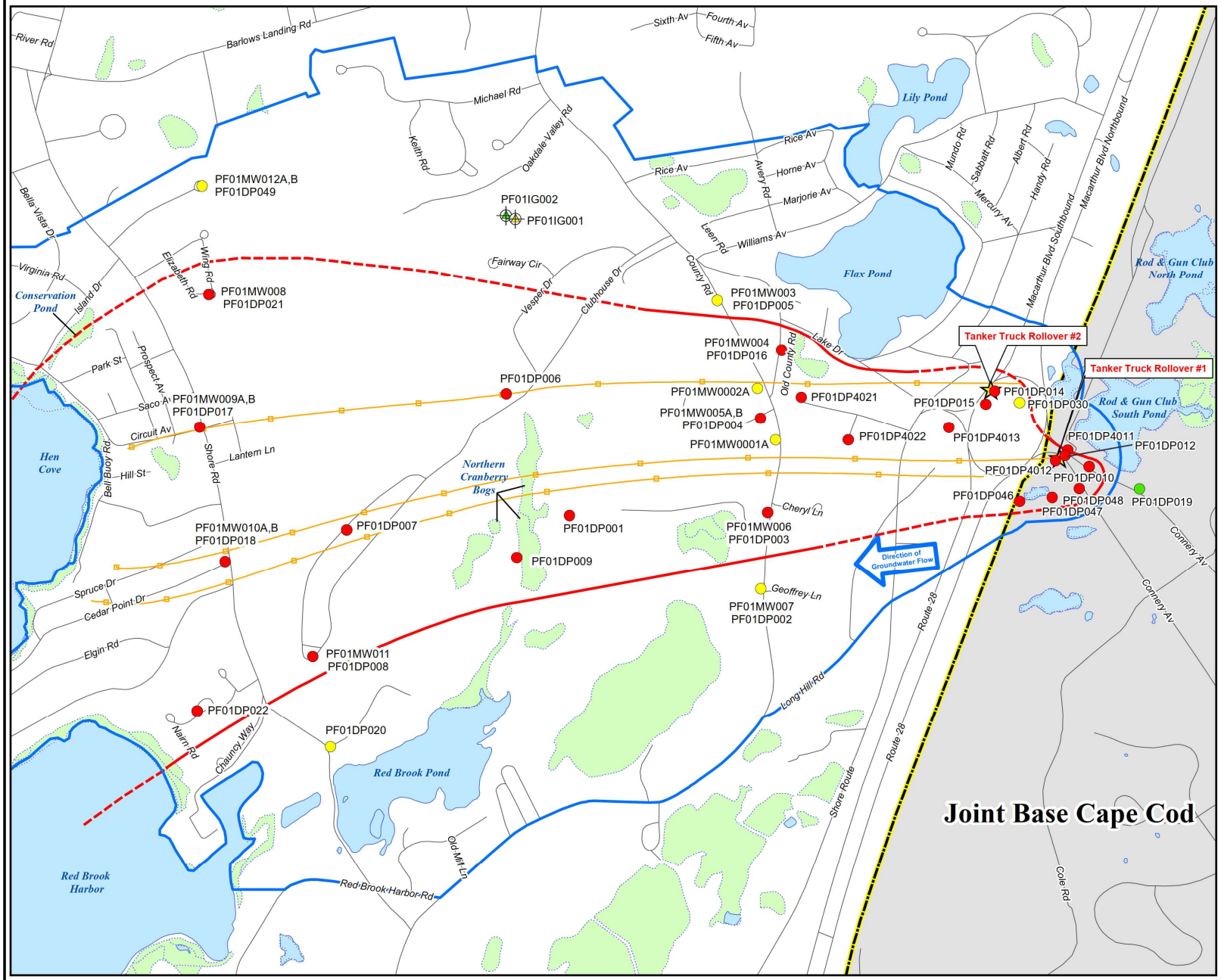
- The Supplemental RI field program was completed between 2015 and 2021 and included groundwater, soil, surface water, sediment, private well, public water supply well, and treatment system sampling.
- Previously referred to as Ashumet Valley, source areas include the former FTA-1 and former base Sewage Treatment Plant (STP); application of aqueous film-forming foam (AFFF) during fire training activities at FTA-1 is the primary source for the PFAS contamination.
- The *Draft Supplemental Remedial Investigation Report for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances at Fire Training Area-1* was submitted to the agencies for review on 29 Apr 2022.
  - Received EPA comments on 28 Jun 2022 requesting the Supplemental RI data be reassessed against the new RSLs and groundwater be sampled for GenX.
  - Received MassDEP comments on 29 Jul 2022.


Joint Base Cape Cod
FTA-1 Source Area
JBCC Boundary
Former MMR Sewage Treatment Plant
Ashumet Valley Plume
Ashumet Valley Plume
Ashumet Valley Plume
Wakeby Pond
Mashpee Pond
Ashumet Pond
Johns Pond
Grassy Pond
Deep Pond
Round Pond
Coonamessett Pond
Crooked Pond
Jenkins Pond
Flax Pond
Mill Pond
Fresh Pond
Waquoit Bay
Route 151
Route 28
Mashpee Village Public Water Supply Well #6
Carbon Treatment Added 2019
Community Well
Well Disconnected; Municipal Connection to 93 Units in 2018
Sea Mist Resort Non-Community Water Supply Wells
Turner Road Well Public Water Supply Well #5
Taken Offline in February 2019
Turner Road Well Public Water Supply Well #2
Taken Offline in July 2020
Fresh Pond Public Water Supply Well
Taken Offline in April 2017
Rock Landing Public Water Supply Well #3
Rock Landing Public Water Supply Well #2
0
1,600
3,200
Feet
Notes: Multiple screen depths at locations ending in 'XXX.' Locations shown in the northern portion of the plume are identified on Figure 3-5.
Legend
Joint Base Cape Cod Boundary
Ashumet Valley PCE/TCE Plume Boundary
FTA-1 PFAS6 Plume Boundary (Dashed Where Inferred)
Treatment System Pipeline
Infiltration Trench
Abandoned Sewage Treatment Beds
Ashumet and Johns Ponds Private Well Outreach Area
Bog/Wetland
Public Water Supply Well
Extraction Well
Irrigation Well
Private Community Water Supply Well
Data Source: AFCEC, August 2022
JBCC Boundary from Massachusetts Air National Guard 2011
Sum of PFAS6 Detections in Groundwater:
No Detection
At or Below MassDEP PFAS6 MMCL
Above MassDEP PFAS6 MMCL
* Above MassDEP PFAS6 MMCL (Contamination Not Related To JBCC)
MassDEP PFAS6 MMCL (sum of PFOS, PFOA,PFHxS, PFNA, PFHpA, and PFDA) = 0.02 µg/L
MMCL = Massachusetts Maximum Contaminant Level
FTA-1 PFAS6 DETECTIONS IN GROUNDWATER (MASSDEP PFAS6 MMCL OF 0.02 µg/L)
AFCEC - Joint Base Cape Cod
03 August 2022 JBCCCT Meeting
ch2m:

TTRS RI/FS Summary:

- The RI field program was completed between 2018 and 2021 and included groundwater, soil, surface water, sediment, and private well sampling.
- The source of the PFAS contamination was the application of AFFF as part of an emergency response to two tanker truck rollovers at or near the Route 28 traffic rotary in 1997 and 2000.
- The *Draft Remedial Investigation Report for Per- and Polyfluoroalkyl Substances at Tanker Truck Rollover Sites* was submitted to the agencies on 07 Mar 2022; comments were received and the response to comment letter was submitted on 23 May 2022.
  - Received additional EPA comments on 14 Jun 2022 requesting the RI data be reassessed against the new RSLs and groundwater be sampled for GenX.
  - Additional comments were also received from MassDEP on 22 Jun 2022.
- The *Draft Feasibility Study Report for Per- and Polyfluoroalkyl Substances at Tanker Truck Rollover Sites* was submitted to the agencies on 29 Jul 2022.
  - Soil/Source Area Alternatives include: no action, capping, removal with off-site disposal, and an insitu barrier (i.e., colloidal carbon)
  - Groundwater Alternatives include: no action, monitored natural attenuation (MNA) and land use controls (LUCs), pump and treat with MNA and LUCs

Path: Y:\Figures\General\2022\EmergingContaminants\JBCCCT\August\GIS\Arcmap\EC_TTRS_PFAS_Detections_GW.mxd Date: 8/2/2022 Time: 12:40:54 PM User: JMESSNE1



Legend

- Outreach Area
- Tanker Truck Rollover Site
- Joint Base Cape Cod Boundary
- Particle Track With 1-Year Tiime Markers
- TTRS Plume Boundary (Dashed Where Inferred)
- Irrigation Well

Sum of PFAS6 Detections in Groundwater

- Sum of PFAS6 = 0
- Sum of PFAS6 greater than 0 and at or below the MMCL of 0.02 ug/L
- Sum of PFAS6 above the MMCL of 0.02 ug/L

MassDEP PFAS6 MMCL (sum of PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA) = 0.02 µg/L
MMCL = Massachusetts Maximum Contaminant Level

Note: PFAS6 concentrations reported following procedure in Massachusetts Drinking Water Program Regulations 310 CMR 22.00

0 400 800 Feet

Data Source:
AFCEC, August 2022
JBCC Boundary from Massachusetts Air National Guard 2011

TANKER TRUCK ROLLOVER SITES PFAS6 DETECTIONS IN GROUNDWATER

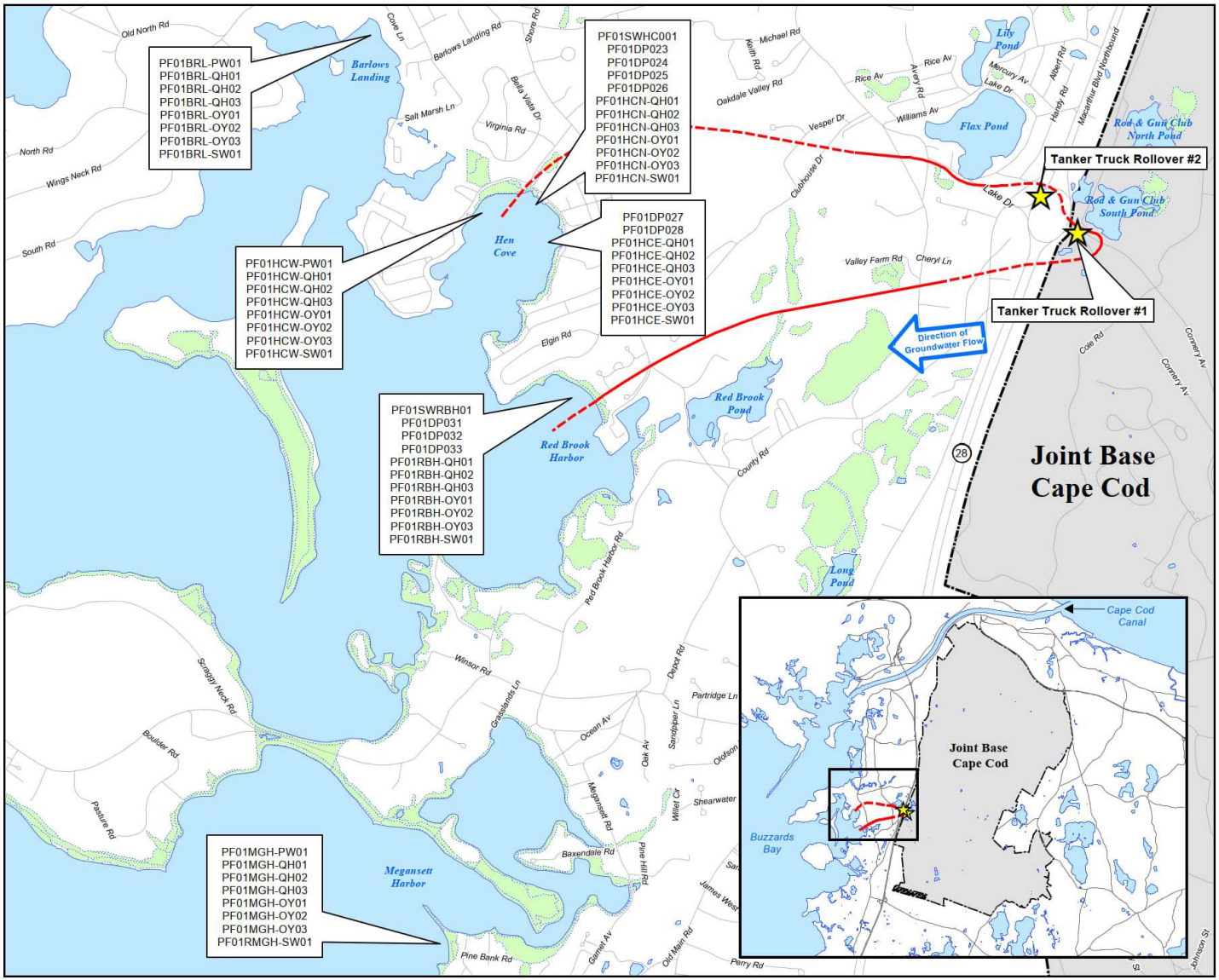
AFCEC - Joint Base Cape Cod
03 August 2022 JBCCCT Meeting

ch2m.

TTRS Additional RI Sampling – Shellfish Tissue:

- PFAS groundwater contamination extends from the TTRS source areas and discharges into surface water at Hen Cove and Red Brook Harbor.
- EPA requested AFCEC sample shellfish at Hen Cove to determine if PFAS are present in shellfish tissue at concentrations that present a potential health risk to consumers of shellfish from Hen Cove and Red Brook Harbor.
- Sampling was completed between 12 and 20 Apr 2022.
- Quahogs and oysters, the most prevalent shellfish in these areas, were collected for PFAS analysis from three locations at Hen Cove, one location at Red Brook Harbor, and from two reference locations not impacted by TTRS (Barlows Landing and Megansett Harbor).
- PFAS were not detected in any of the quahog samples collected.
- PFOS was detected in two composite oyster samples collected in Hen Cove; concentrations were 676J ng/kilogram (kg) (0.676J µg/kg) and 703J ng/kg (0.703J µg/kg).
  - These data will be assessed using shellfish consumption screening values updated with EPAs May 2022 RSLs.
- MassDEP also completed shellfish sampling at Hen Cove.

Path: Y:\Figures\General\2022\EmergingContaminants\TT\Shellfish_PN\GIS\Arcmap\EC_22TTRS_PN_Shellfish_Fig01-01_wLocIDs.mxd Date: 6/29/2022 Time: 12:43:47 PM User: JMESSNE1



HEN COVE AND RED BROOK HARBOR STUDY AREAS, AND BARLOWS LANDING AND MEGANSETT HARBOR REFERENCE LOCATIONS

AFCEC - Joint Base Cape Cod

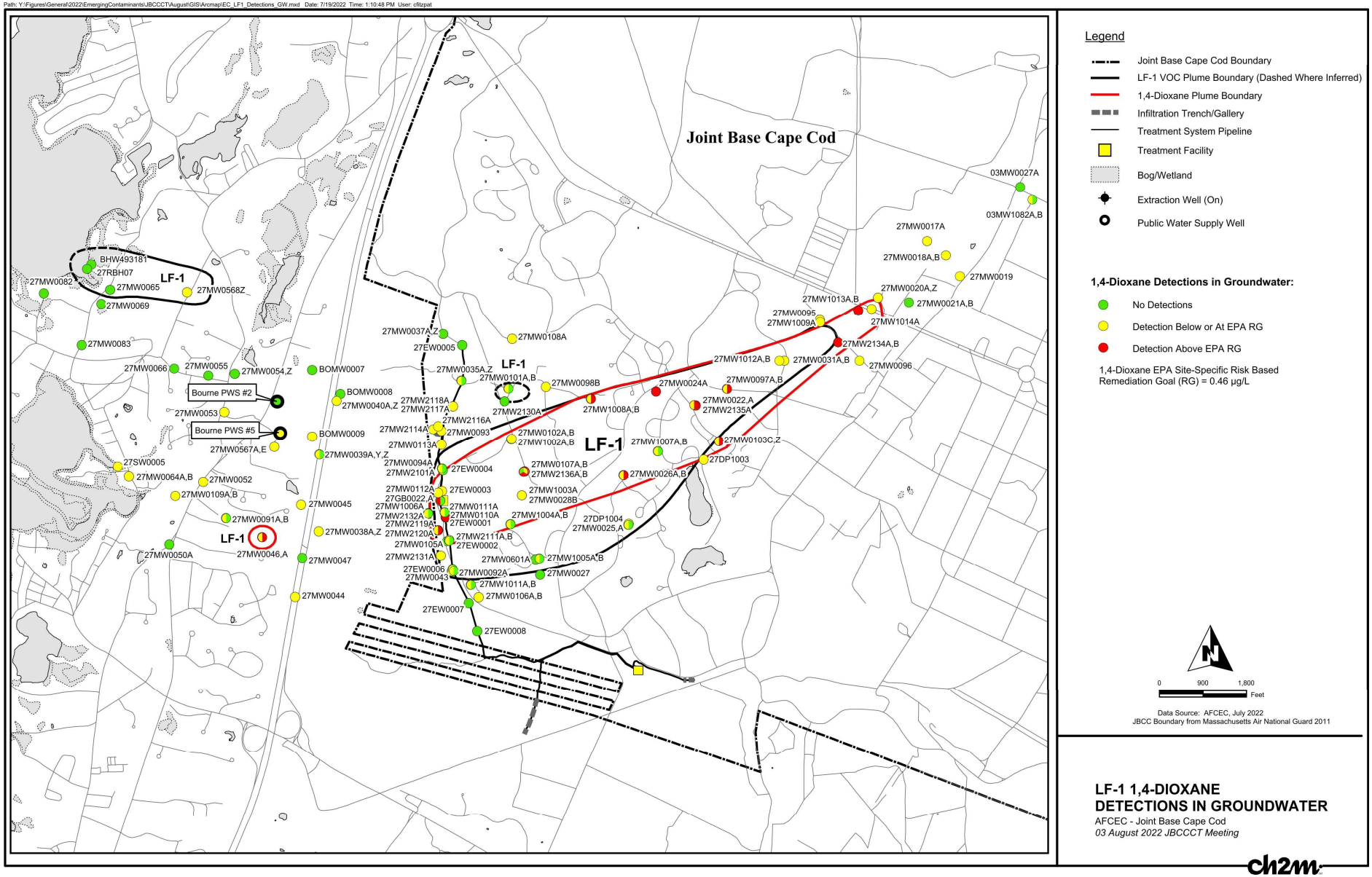
03 August 2022 JBCCCT Meeting

ch2m

LF-1 Supplemental FS:

- A Supplemental FS was prepared at LF-1 to evaluate remedial alternatives for groundwater for 1,4-dioxane and PFAS.
- Three alternatives were evaluated for PFAS and 1,4-dioxane: no additional action, existing remedial system, and existing system supplemented by two additional extraction wells in the main body of the plume.
- The Draft Supplemental FS report was submitted to the agencies on 12 Jan 2022, comments were received, and the response to comment letter was submitted on 11 May 2022.
- Received additional EPA comments on 14 Jun 2022 requesting LF-1 data be reassessed against the new RSLs and groundwater be sampled for GenX.
- Additional comments were also received from MassDEP on 08 Jul 2022.

Path: Y:\Figures\General\2022\EmergingContaminants\JBCCCT\August\GIS\Arcmap\EC_LF1_Detections_GW.mxd Date: 7/19/2022 Time: 1:10:48 PM User: cfitzpat



Legend

- Joint Base Cape Cod Boundary
- LF-1 VOC Plume Boundary (Dashed Where Inferred)
- 1,4-Dioxane Plume Boundary
- Infiltration Trench/Gallery
- Treatment System Pipeline
- Treatment Facility
- Bog/Wetland
- Extraction Well (On)
- Public Water Supply Well

1,4-Dioxane Detections in Groundwater:

- No Detections
- Detection Below or At EPA RG
- Detection Above EPA RG

1,4-Dioxane EPA Site-Specific Risk Based Remediation Goal (RG) = 0.46 µg/L

N

0 900 1,800 Feet

Data Source: AFCEC, July 2022
JBCC Boundary from Massachusetts Air National Guard 2011

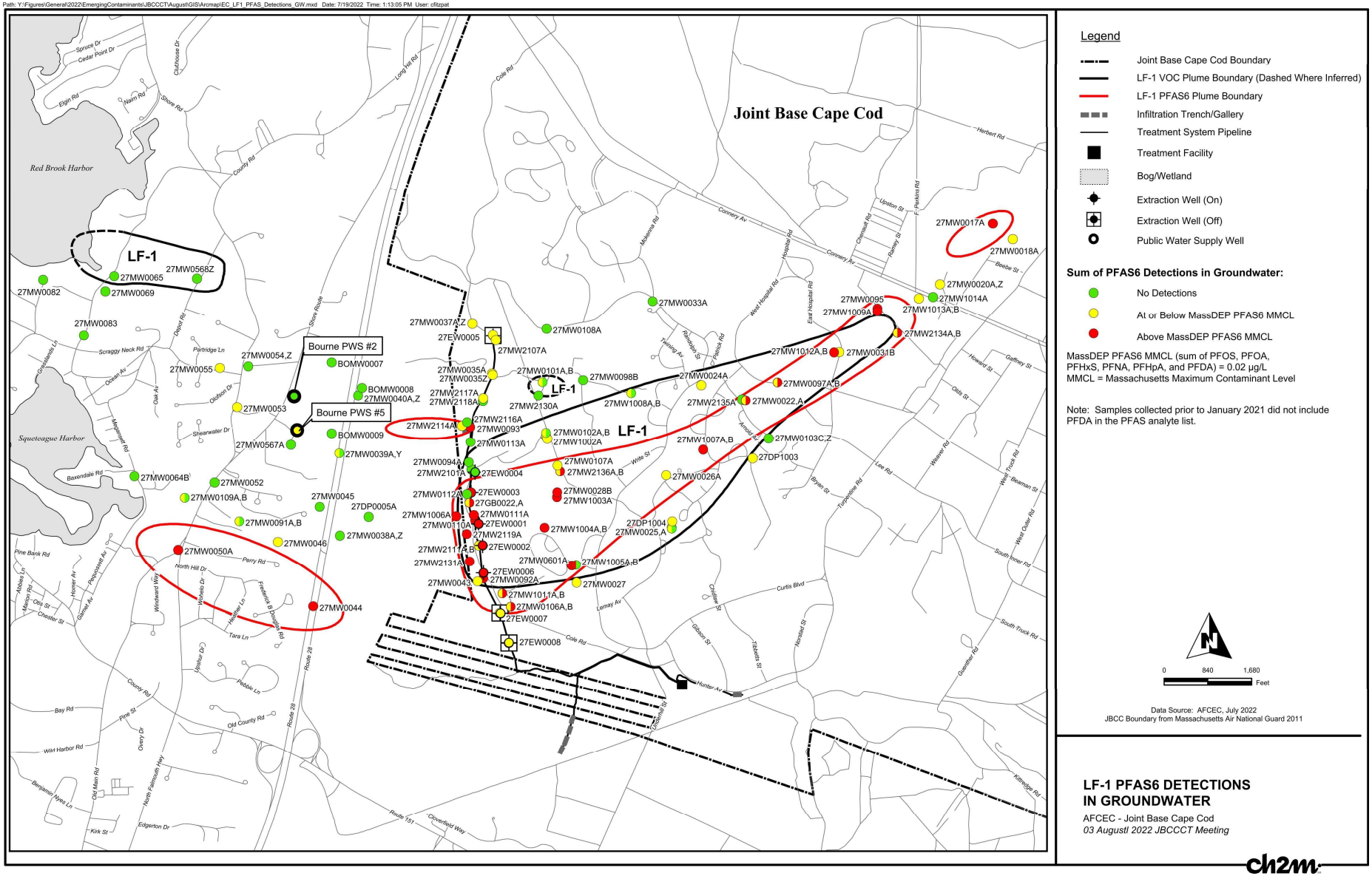
LF-1 1,4-DIOXANE DETECTIONS IN GROUNDWATER

AFCEC - Joint Base Cape Cod

03 August 2022 JBCCCT Meeting

ch2m

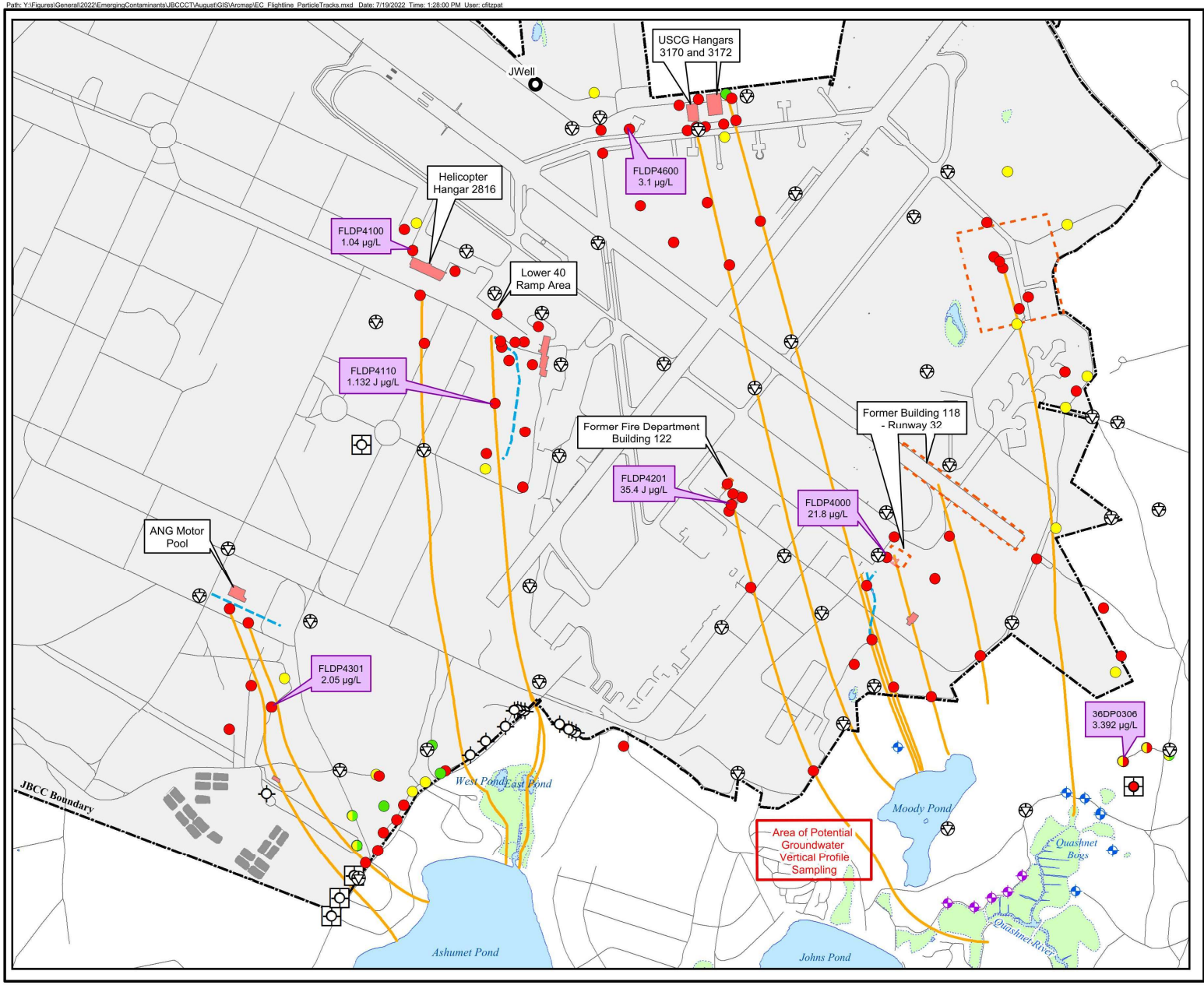
Path: Y:\Figures\General\2022\EmergingContaminants\JBCCCT\August\GIS\Arcmap\EC_LF1_PFAS_Detections_GW.mxd Date: 7/19/2022 Time: 1:13:05 PM User: cfitzpat



Flight Line Area RI:

- An RI is in process at six Flight Line Area sites as a Flight Line Area Operable Unit.
  - Air National Guard Motor Pool
  - Former Building 118 - Runway 32
  - Former Fire Department Building 122
  - Coast Guard Hangars 3170 and 3172
  - Lower 40 Ramp Area
  - Army Helicopter Hangar 2816
- The Draft RI Work Plan for the PFAS at the Flight Line Area Operable Unit was submitted to the agencies on 12 Jan 2022; comments were received and the response to comment letter was submitted on 28 Apr 2022.
  - Received additional EPA comments on 20 Jul 2022 requesting the Work Plan be updated to reflect the new EPA PFAS RSLs and to include limited groundwater sampling for GenX.
  - Additional comments from MassDEP were also received on 25 May 2022.
- A No Further Remedial Action Planned (NFRAP) Decision Document (DD) for the Wastewater Treatment Plant (WWTP) infiltration bed site was submitted to the agencies on 04 Feb 2022; comments were received and the response to comment letter was submitted on 09 Jun 2022.
  - Received EPA comments on 19 Jul 2022 and MassDEP comments on 25 Jul 2022.

Path: Y:\Figures\General\2022\EmergingContaminants\JBCCCT\August\GIS\Arcmap\EC_Flightline_ParticleTracks.mxd Date: 7/19/2022 Time: 1:28:00 PM User: cfitzpat



Legend

- Groundwater Model Particle Track
- Storm Drainage Ditch
- Approximate Site Boundary
- Joint Base Cape Cod Boundary
- Existing Structure
- Former Structure
- Abandoned Cranberry Bog/Wetland
- Abandoned Sewage Treatment Beds
- Public Water Supply Well
- Extraction Well (On)
- Extraction Well (Off)
- Reinjection Well (On)
- Reinjection Well (Off)
- Existing AFEC Monitoring Well To Be Sampled
- USGS Multiport Well (2020 USGS PFAS Data Available)
- Proposed Direct Push Boring
- 3.1 µg/L — Highest PFOS + PFOA Concentration in Groundwater (µg/L) Detected During SI/Expanded SI

Sum of PFAS6 Detections in Groundwater:

- No Detections
- At or Below MassDEP PFAS6 MMCL
- Above MassDEP PFAS6 MMCL

MassDEP PFAS6 MMCL (sum of PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA) = 0.02 µg/L
MMCL = Massachusetts Maximum Contaminant Level

N

0 625 1,250 Feet

Data Source:
AFCEC, July 2022
JBCC Boundary from Massachusetts Air National Guard 2011

PARTICLE TRACKS FROM FLIGHT LINE AREA OPERABLE UNIT SITES

AFCEC - Joint Base Cape Cod

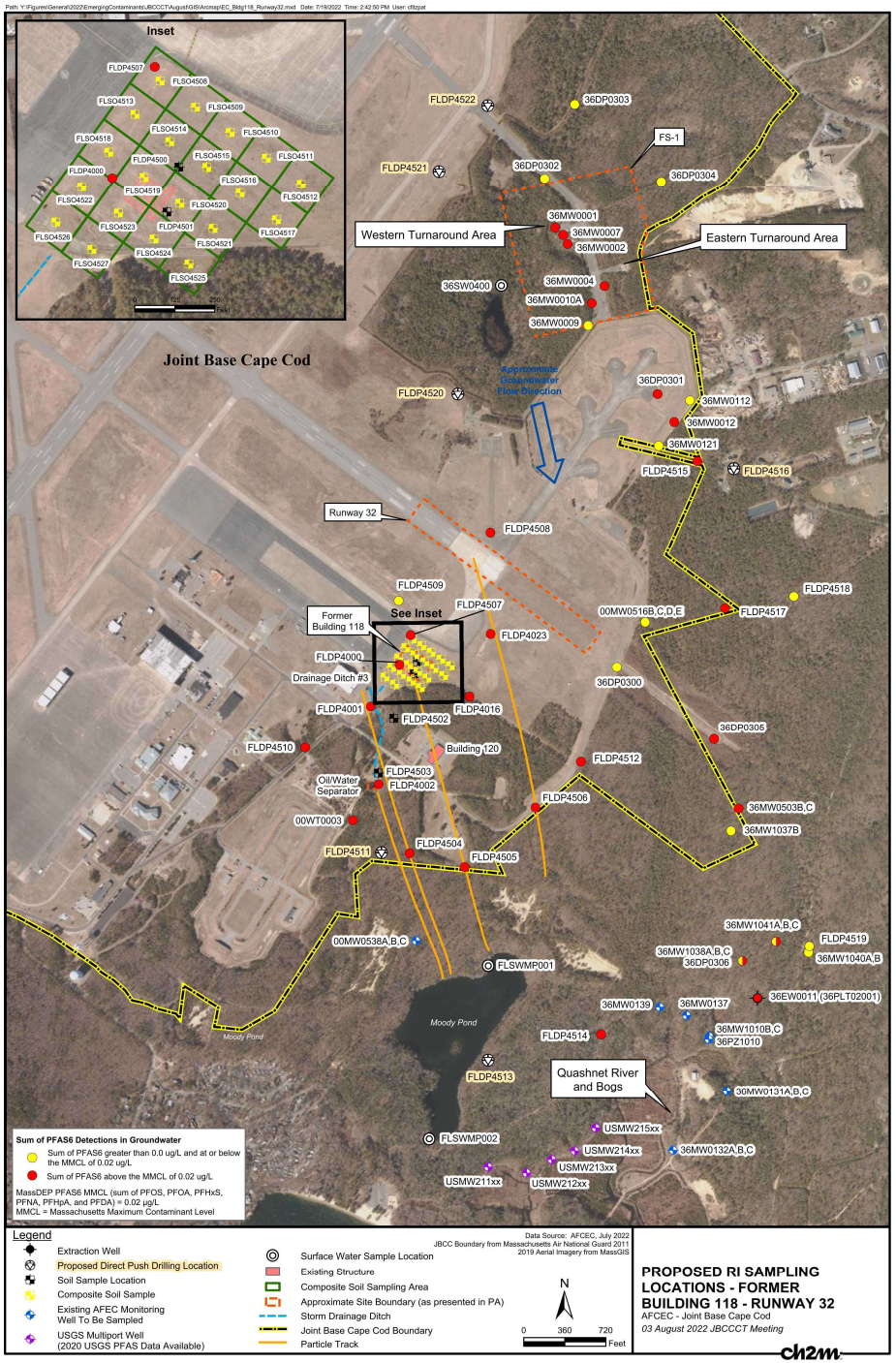
03 August 2022 JBCCCT Meeting

ch2m.

Flight Line Area Operable Unit RI:

- The Flight Line Area Operable Unit RI field program is ongoing, and groundwater vertical profile borings have been completed at several sites.
- Former Fire Department Building 122 – Completed five RI groundwater vertical profile borings to date (FLDP4206 to FLDP4210); highest PFAS6 groundwater concentration is 41,360 J ng/L (41.36 J µg/L) in a boring located in the source area.
- Lower 40 Ramp Area – Completed six RI groundwater vertical profile borings to date (FLDP4115 to FLDP4120); highest PFAS6 groundwater concentration is 17,270 ng/L (17.27 µg/L) in a boring located to the east of the Fire Station.
- PFAS samples were collected during completion of the two Fuel Spill-13 (FS-13) groundwater vertical profile borings (38DP0001 and 38DP0002) in relation to detections at Chemical Spill (CS-10) In-Plume PFAS extraction well data.
  - Note that the FS-13 release was an underground pipeline leak discovered in 1972 so it was not an incident where the fire dept would have responded with an application of fire fighting foam. While monitoring for the legacy FS-13 contaminants, AFCEC took the opportunity to collect samples for PFAS analysis.
  - PFAS6 concentrations exceeded the MMCL in one boring and highest concentration was 75 J ng/L (0.075 J µg/L).
- Former Building 118 - Runway 32 – Completed twelve RI groundwater vertical profile borings; some data are pending receipt.

Flight Line Area Operable Unit RI - Former Building 118 and Runway 32:



- Time and distance testing was conducted annually for 10 years, and area was used to flush out hoses containing residual AFFF after responding to emergencies; area has been expanded to include PFAS contamination to the east.
- Collected groundwater samples from 25 monitoring wells and 29 borings to date, highest PFAS6 groundwater concentration is 24,230J ng/L (24.23J µg/L) at source area boring FLDP4000; groundwater contamination extends past the base boundary.
- Surface water samples were collected from Moody Pond, a pond to the north, and the Quashnet River and former bogs; highest PFOS and PFOA concentrations were 170 and 40 ng/L (0.17 and 0.04 µg/L).
- Soil samples were collected from four borings and 20 grid cells across the source area; highest PFOS 37,000 J ng/kg (37 J µg/kg) and PFOA 1,000 J ng/kg (1 J µg/kg) concentrations were detected at FLSO4518 which is located along the western boundary of the source area.

Path Forward:

- Continue FTA-1 area private well monitoring program.
- Complete installation of wellhead treatment on the two Mashpee Turner Road PWSWs.
- Resolve agency comments on the Draft Supplemental RI Report for 1,4-Dioxane and PFAS at FTA-1 and submit final report.
- Resolve agency comments on the Draft RI Report for PFAS at TTRS and submit final report.
- Resolve agency comments on the Draft Supplemental FS Report for 1,4-Dioxane and PFAS at LF-1 and submit final report.
- Continue the Flight Line Area Operable Unit RI field program.
- Resolve agency comments on the Draft RI Work Plan for PFAS at the Flight Line Operable Unit and submit final report.
- Resolve agency comments on the Draft NFRAP DD for the WWTP infiltration bed site.
- Receive agency comments on the Draft FS Report for PFAS at TTRS.
- Present sample results and field program updates to the agencies at Technical Update Meetings and to the public at future JBCC Cleanup Team Meetings.