



**Navy Case Study:
Occurrence of Two Emerging Contaminants (PFOA
& PFOS) at former NAS South Weymouth, MA**

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Presentation Outline



- **Perfluorinated Chemicals (PFCs)**
 - General Information
 - Fate and Transport
 - Additional PFCs
 - Available Criteria

- **Case Study – former NAS South Weymouth, MA**
 - Timeline
 - Results
 - Data Summary
 - Data Evaluation
 - Current Status
 - Summary

- **Questions**



• **Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS)**

–Fully fluorinated compounds that are man-made substances and not naturally found in the environment.

–Very stable chemicals that have both lipid- and water-repellent properties.

–Studies have shown they have the potential to bioaccumulate and biomagnify in wildlife.

–PFCs are used in a wide variety of industrial and commercial products

*textiles and leather products

*photographic industry

*paper and packaging

*cleaning products

*metal plating

*semi-conductors

*coating additives

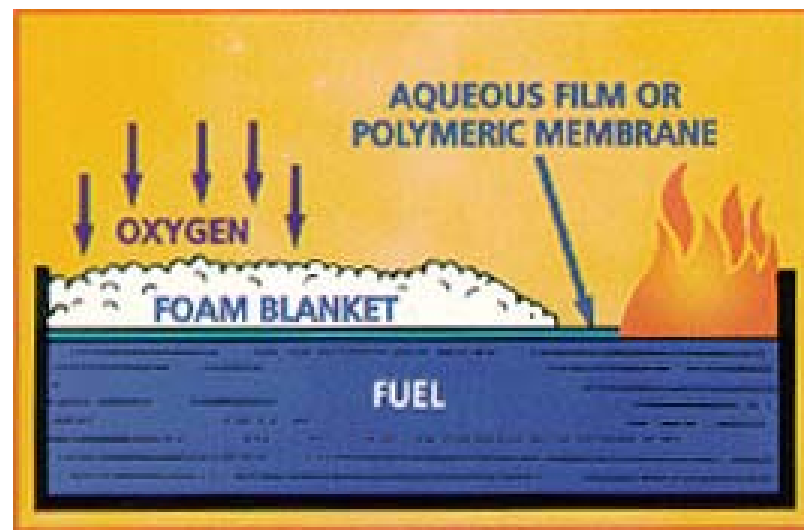
*pesticides

- **Components of Aqueous Film Forming Foam (AFFF)**

- has been widely used for fire-fighting by the military and municipal fire departments.

- complex mixtures of fluorocarbon surfactants, hydrocarbon surfactants, and solvents designed to spontaneously spread over hydrocarbon-fuel fires to extinguish flames and to prevent re-ignition.

- “Little is known about the chemistry of AFFF beyond that it is a complex mixture of fluorochemicals and surfactants that results in the generation of persistent fluorochemicals from partially-fluorinated precursors.” (Dr. Jennifer Field, Oregon State University, SERDP No. 11 ER-02-025)



- **Much is still unknown about these chemicals**
 - **Several research programs are currently attempting to answer some of these questions**

- **Chemicals are extremely stable**
 - **Do not hydrolyze, photolyze, or biodegrade under typical environmental conditions**

 - **Are extremely persistent in the environment**
 - For example the half-life (at 25° C) in water for PFOA and PFOS is > 92 years and > 41 years, respectively

 - **High potential to adsorb to substrates**

 - **Migration depends upon groundwater flow and the charge of the substrate**

- **There are other PFCs for which environmental media can be analyzed.**
- **Current Navy approach is to analyze media for PFOA and PFOS**
 - **EPA Office of Water Provisional short term Health Advisory**
 - Provides Sub chronic reference doses
 - **PFOA and PFOS can serve as potential indicator chemicals for other PFCs**
- **If additional criteria/toxicity information becomes available for other PFCs, then the current approach would need to be reevaluated**

- **Federal (drinking water)**

- **EPA Provisional short term Health Advisories**

- PFOA 0.4 ug/L
 - PFOS 0.2 ug/L

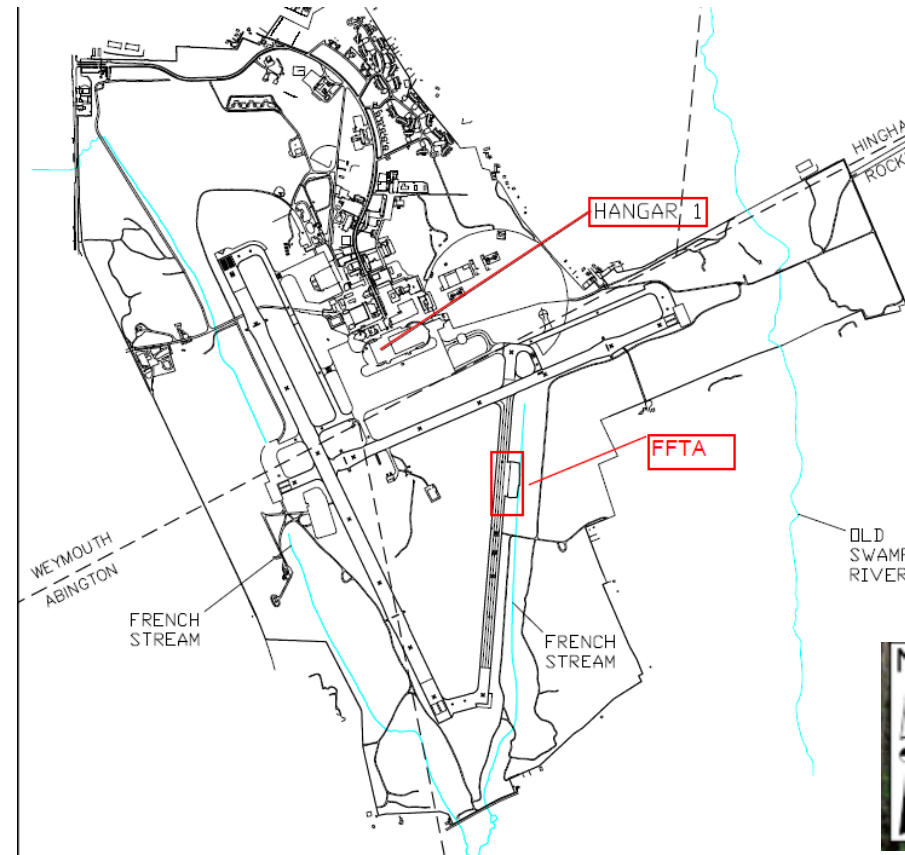
- **No existing Massachusetts Department Environmental Protection (MADEP) criteria**

Case Study – former NAS South Weymouth



• Overview

- Environmental investigations are ongoing to delineate the nature and extent of PFOA and PFOS at South Weymouth.
- Delineation of nature and extent of PFOA and PFOS contamination should be completed
- One site is at a critical decision point regarding whether to consider active remediation.
- Making the decision to actively remediate with uncertain criteria/toxicological data is difficult and not recommended until more certain information is available.



Case Study – former NAS South Weymouth



• Brief History

- Located 15 miles southeast of Boston
- Closed in 1997 under BRAC
- AFFF was stored in Hangar 1 in Above-ground Storage Tank (ASTs)
- AFFF was used during training exercises at Fire Fighting Training Area (FFTA)

• Releases

- 1987 an estimated spill of 5,000 to 10,000 gallons of AFFF
 - Reportedly contained in the oil-water separator connected to sanitary sewer
- Also several reported inadvertent releases from hose nozzles, ASTs, and pump room.
 - Likely directed to the outside floor drains which connect to storm water drainage system
- Fire fighting training exercises occurring at FFTA

- **In 1996, as part of the Environmental Baseline Survey (EBS), a Review Item Area was established to address these specific releases**
- **Regulatory Request**
 - **In 2005 MADEP commented that sites should be analyzed for fluorinated alkyl substances based on recent research**
 - **In 2009, Navy identified 2 fluorinated compounds likely present in AFFF that will serve as indicators for perfluorinated chemicals**
 - **PFOA and PFOS**

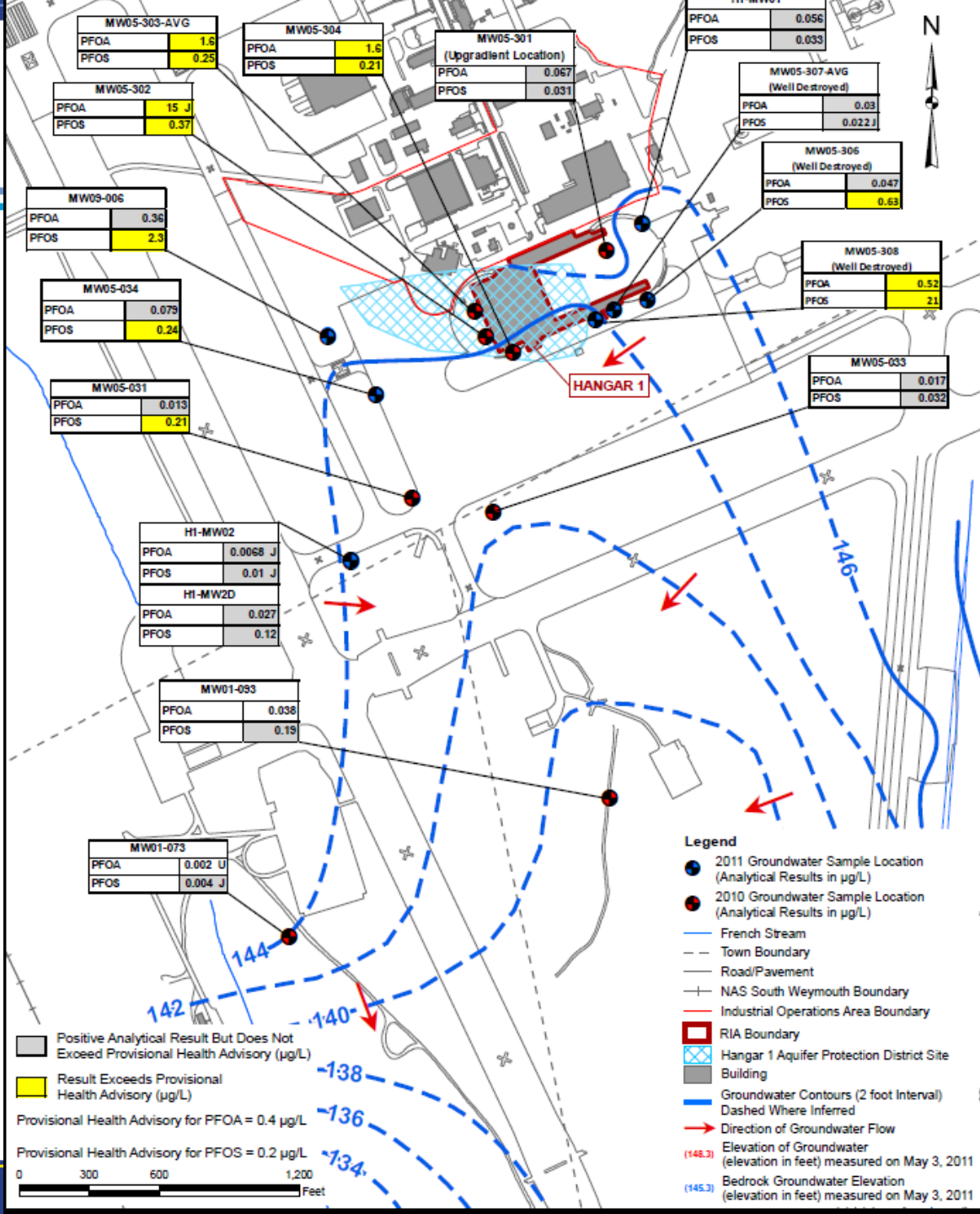
Case Study - Timeline



- **In 2010, available instructions and guidance on Emerging Contaminants were reviewed to determine an appropriate course of action**
 - DOD Emerging Contaminant (EC) Instruction 4715.18
 - Environmental Council Of the States “Resource Triggers” Paper (September 2008)
- **In 2009/2010, project team agreed that the path-forward called for the delineating the nature and extent of PFOA and PFOS at Hangar 1 and FFTA.**
- **In 2010-2011, the Navy sampled at Hangar 1 and FFTA areas to delineate the nature and extent of PFOA and PFOS**
 - 36 existing GW wells sampled
 - 50 SS/SB samples
 - 5 SW, 6 SD samples

Hangar 1 Results

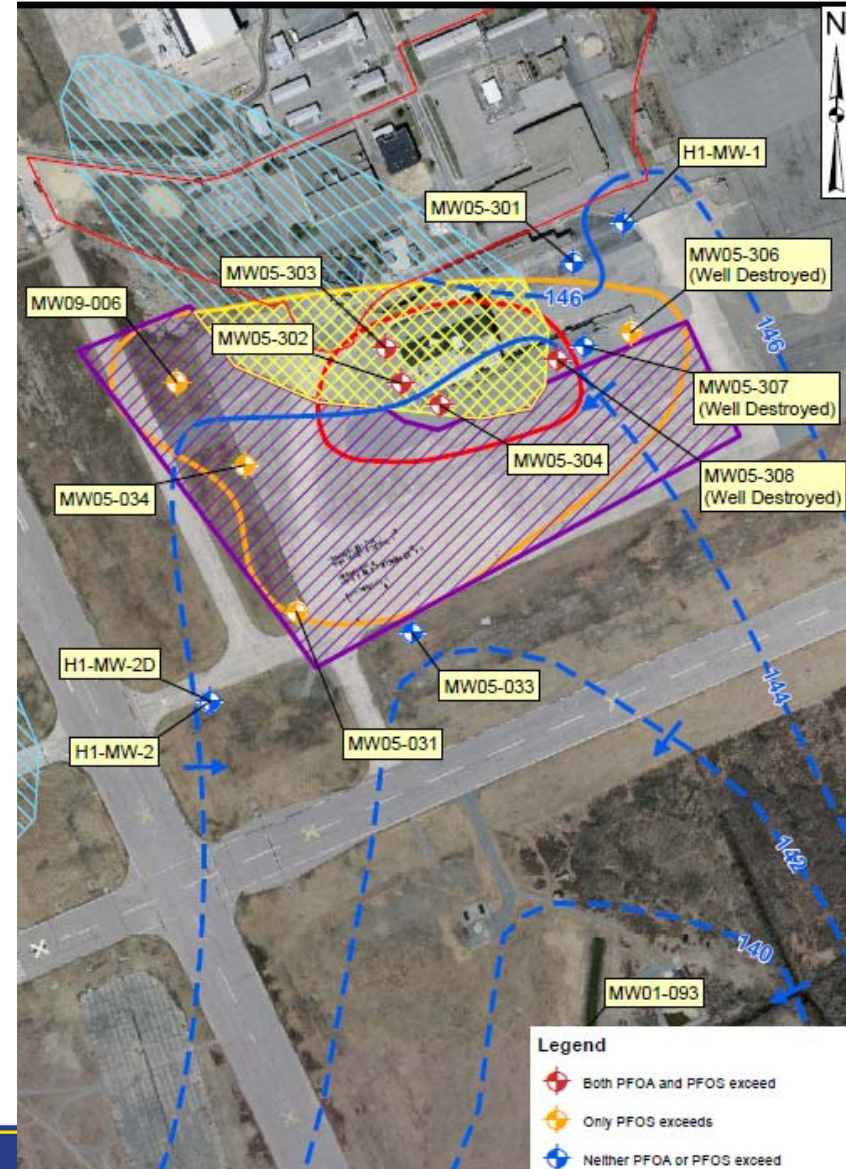
- Either PFOA and PFOS exceeded the Provisional short term Health Advisory at 8 wells
- Highest concentrations of PFOA were associated with location of former ASTs and Hangar 1
- High concentrations of PFOS seem more widespread



Case Study – Hangar 1 Groundwater Results

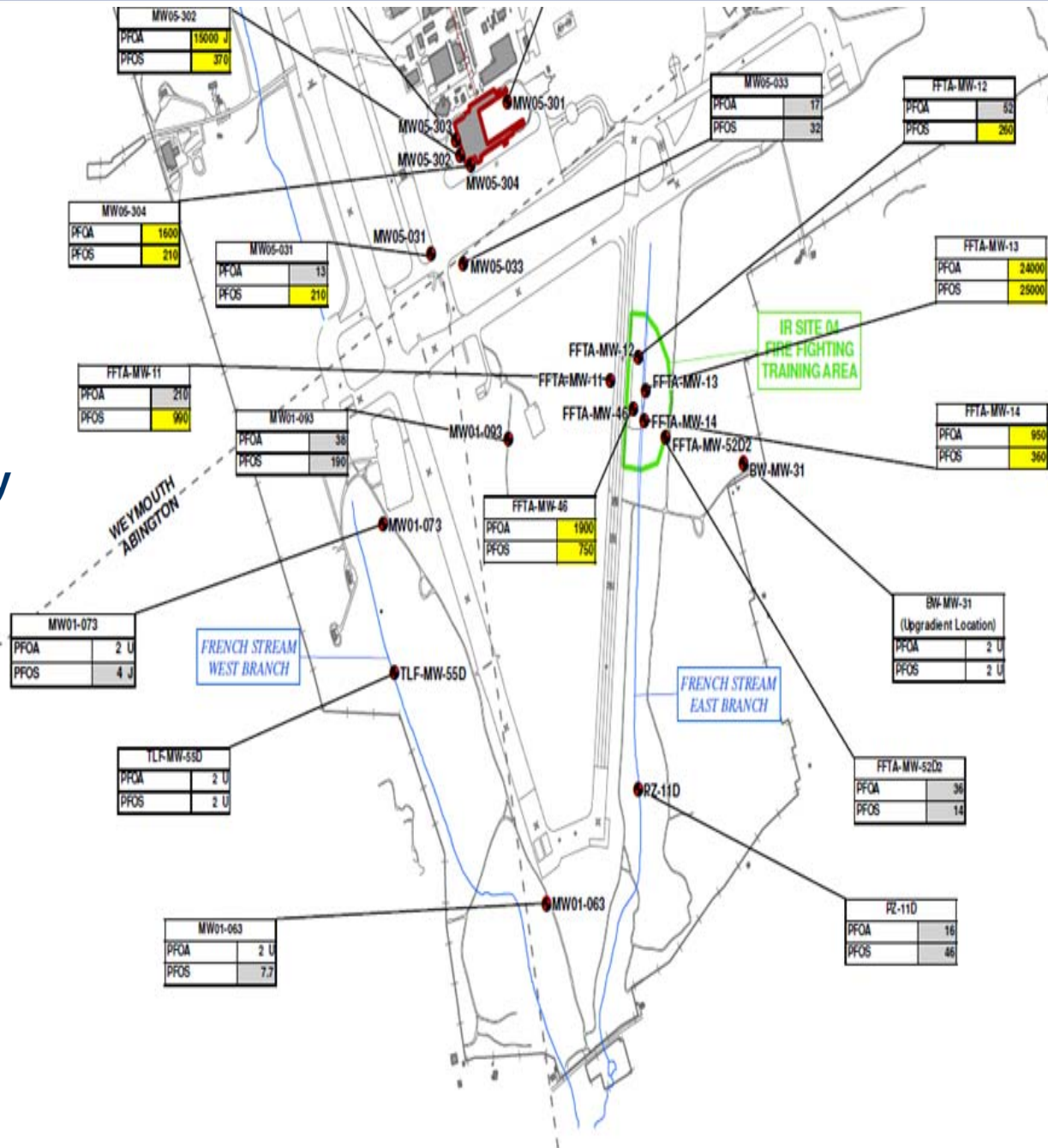


- PFOA and PFOS were detected at the highest concentrations in the areas where AFFF was used or released/spilled and decrease down gradient.
- Migration of PFOA and PFOS seem slightly different



•FFTA Results

- Either PFOA and PFOS exceeded the Provisional short term Health Advisory at 7 wells
- Highest concentrations of PFOA were associated with training area
- High concentrations of PFOS seem more widespread

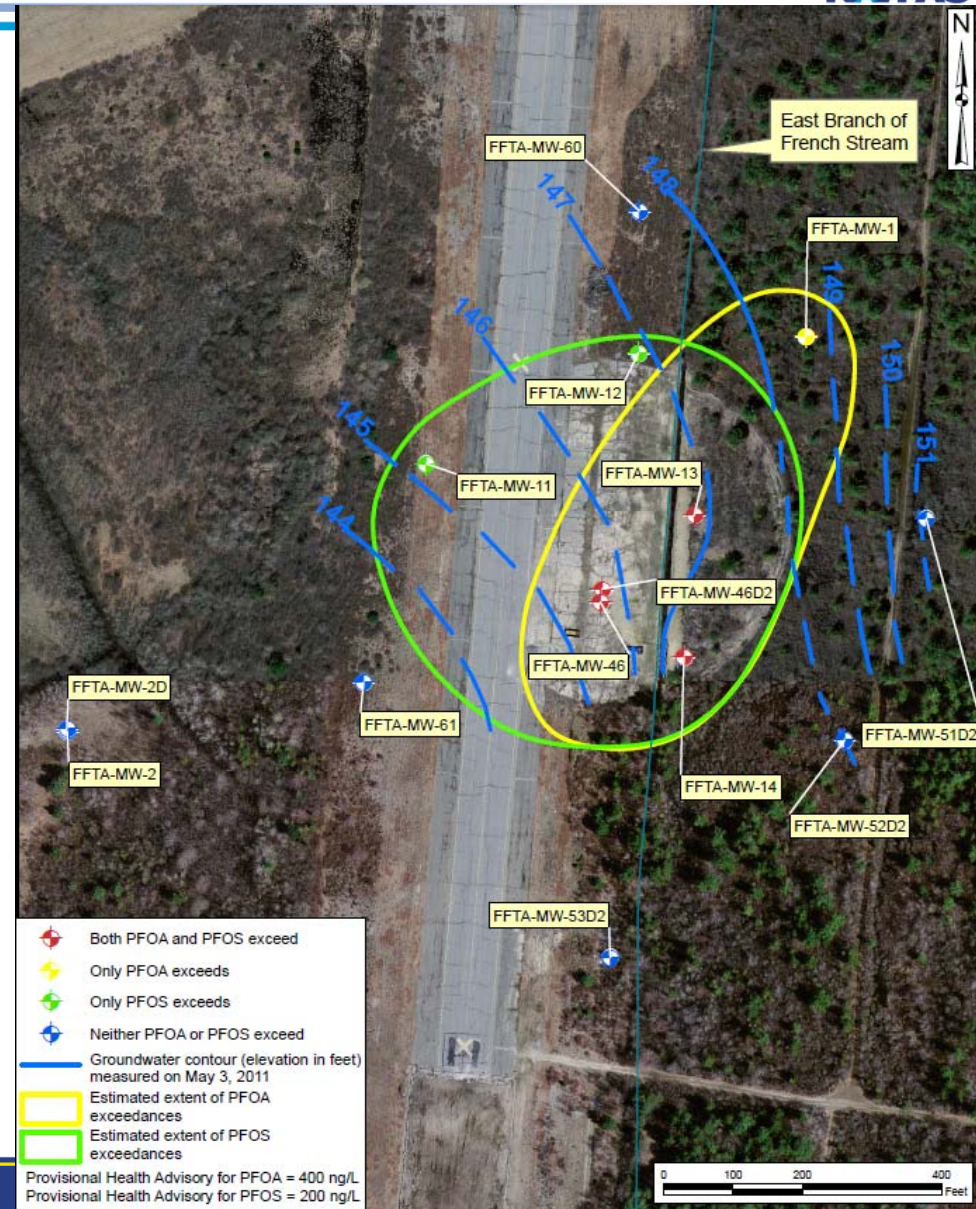


Case Study – FFTA Groundwater Results



- PFOA and PFOS were detected at the highest concentrations in the areas where AFFF was used or released/spilled and decrease down gradient

- Migration of PFOA and PFOS seem slightly different



Case Study - Data Summary



- **Groundwater**

- PFOA – 0.002 U ug/L to 25 ug/L
- PFOS – 0.002 U ug/L to 27 ug/L

- **Surface Soil/Subsurface Soil**

- PFOA – 0.21 J ug/kg to 130 ug/kg
- PFOS – 0.23 J ug/kg to 1200 ug/kg

- **Surface Water**

- PFOA – 0.014 J ug/L to 0.84 ug/L
- PFOS – 0.016 J ug/L to 1.3 J ug/L

- **Sediment**

- PFOA – 0.6UJ ug/kg to 425J ug/kg
- PFOS – 2.1J ug/kg to 685J ug/kg



• Human Health Risk Assessment

- EPA Office of Water developed noncancer toxicity values which can be used to estimate risk-based screening levels
- No cancer toxicity values are currently available
- There is significant uncertainty associated with the toxicity values
 - These are considered “Tier 3” toxicity values and they are based on subchronic rather than chronic exposure.

Site-specific screening criteria	Groundwater ($\mu\text{g/L}$)		Soil (mg/kg)	
	PFOA	PFOS	PFOA	PFOS
Residential screening level	3.1	1.3	12	4.9
Industrial screening level	NA	NA	123	49

•Ecological Risk Assessment

- There is some literature available on the ecotoxicology.
- For installations in EPA Region 1, ten papers were reviewed to try to determine the toxicity of PFOS and/or PFOA to aquatic organisms. Preliminary review showed:
 - Acute toxicity occurs in the range of about 10-300 mg/L.
 - Chronic toxicity was observed at concentrations as low as 10 ug/L in fish larvae and about 90 ug/L in midge larvae
- Approach used at South Weymouth**
 - Relied on site-specific toxicity test data that was previously conducted as part of the RI
 - Results showed no site-specific toxicity
 - Also, all surface water sample results were less than the conservative chronic level identified in literature review.

• Hangar 1

– Divided in to **Aquifer Protection District (APD)** and **non-APD aquifers** by **Local Reuse Authority (LRA)** and **State**

– Hangar 1 Non-APD

- 2011 Explanation of Significant Difference (ESD) established a LUC prohibiting use as drinking water,
- Hangar 1 non-APD area has been transferred (Dec 2011)

– Hangar 1 APD

- State has a Certified State Groundwater Protection Plan (CSGWPP) therefore EPA will assert that GW has to be cleaned up to its beneficial use (drinking water)
- Various options being discussed as how to proceed
 - Necessary to proceed through the CERCLA process in order to get to a decision point.
 - Remedial alternatives are being considered but not finalized until more technical literature/science is provided.

• **FFTA**

- **Tried similar approach to that used at Hangar 1 non-APD,**

- **MADEP and EPA requested a broader groundwater restriction that prevents any use of the PFC impacted water.**

- **Completed the FFTA ESD**
 - **Includes broader groundwater restriction language with a Long Term Monitoring (LTM) component (annual groundwater sampling and 1 or 2 rounds of surface water sampling).**

- **Environmental investigations are ongoing to delineate the nature and extent of PFOA and PFOS at South Weymouth.**
- **ESDs establishing LUC restricting uses of groundwater have been completed for two sites.**
 - Hangar 1 non APD
 - FFTA
- **Hangar 1 APD site is at a critical decision point regarding whether to consider active remediation.**
 - Where applicable, based on the conceptual site model, the current Navy position is to delineate the nature and extent of contamination for PFOA and PFOS.
 - Making the decision to actively remediate with uncertain criteria/toxicological data is difficult and not recommended until more certain information is available.

Questions

