

**Joint Base Cape Cod Cleanup Team
Building 1805
Camp Edwards, MA
10 July 2019
6:00 – 8:00 p.m.**

Meeting Minutes

Member:	Organization:	Telephone:	E-mail:
Shawn Cody	IAGWSP	508-968-5834	shawn.c.cody.mil@mail.mil
Rose Forbes	AFCEC/JBCC	508-968-4670 x5613	rose.forbes@us.af.mil
Phil Goddard	JBCC CT/Bourne	508-759-3043	Pag456@comcast.net
Ben Gregson	IAGWSP	508-968-5821	benjamin.p.gregson.nfg@mail.mil
Steve Hurley	MassWildlife		Steve.hurley@state.ma.us
Bob Lim	USEPA	617-918-1210	Lim.robert@epa.gov
Douglas Karson	AFCEC/JBCC	508-968-4678	douglas.karson@us.af.mil
Len Pinaud	MassDEP	508-946-2871	leonard.pinaud@state.ma.us
Bill Winters	JBCC CT/Falmouth	508-548-7365	Hydrates92@comcast.net
Tom Cambareri	JBCCT/Barnstable	508-364-2644	tomcambareri@gmail.com
Facilitator:	Organization:	Telephone:	E-mail:
Ellie Donovan	MassDEP	508-946-2866	ellie.donovan@state.ma.us
Attendees:	Organization:	Telephone:	E-mail:
Lori Boghdan	IAGWSP	339-202-9351	Lori.p.boghdan2.nfg@mail.mil
Jennifer DeAngelis	BB&E	508-968-4670	jennifer.deangelis.ctr@us.af.mil
Mark Hilyard	CH2M	508-968-4754	m.hilyard@ch2m.com
Elliot Jacobs	MassDEP	508-946-2786	elliott.jacobs@state.ma.us
Jennifer Martin Bouchard	EA	508-968-4754 x20	jmartin@eaest.com
Mary O'Reilly	CH2M	508-968-4754	moreilly@ch2m.com
Ed Pesce	Pesce Engineering	508-743-9206	epesce@comcast.net
Michael Cusack	Citizen	508-274-8848	Mike.cusack@comcast.net
Pamela Richardson	IAGWSP	339-202-9360	Pamela.j.richardson.nfg@mail.mil
Nigel Tindall	CH2M	508-968-4754	ntindall@ch2m.com
Kendall Walker	MassDEP	508-946-2846	kendall.walker@state.ma.us
Denis LeBlanc	USGS	508-490-5030	dleblanc@usgs.gov
Nicole Wagner	EA	412-977-3866	nwagner@eaest.com

Handouts Distributed at Meeting:

1. Draft of the 13 March 2019 Meeting Minutes and Responses to Action Items
2. Presentation: Military Munitions Response Program (MMRP) No Further Response Action Planned Decision Document for the Otis Target Butt Munitions Response Area
3. Joint Base Cape Cod Groundwater Plume Map, IRP and IAGWSP LUC Areas and IRP LUC Areas, and IRP PFAS Outreach Areas
4. Impact Area Groundwater Study Program 2019 Field Effort Weekly Progress Map
5. Massachusetts Department of Public Health Recreational Use of Waterbodies On or Near Joint Base Cape Cod
6. Massachusetts Department of Public Health Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water
7. USGS in Cooperation with the Air Force Civil Engineer Center Use of Numerical Model to Simulate the Hydrologic System and Transport of Contaminants New Joint Base Cape Cod
8. United States Environmental Protection Agency Technical Fact Sheet – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA)
9. Massachusetts Department of Environmental Protection Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water: Questions and Answers for Consumers

Agenda Item #1. Introductions, Late-Breaking News, Approval of 13 March 2019 JBCCCT Cleanup Team Meeting Minutes

Ms. Donovan, MassDEP, began the meeting and asked the team members to introduce themselves.

No late breaking news reported.

Ms. Donovan asked for comments on minutes from the 13 March 2019 JBCCCT meeting. No comments.

**Agenda Item #2. Presentation: Military Munitions Response Program (MMRP) Otis Target Butt–
Ms. Jennifer Martin-Bouchard, EA**

The Otis Target Butt site is proposed for No Further Response Action Planned (NFRAP) with a public comment period running from 21 June 2019 – 20 July 2019. The Air Force is conducting investigation and remediation at 10 Munition Response Areas (MRAs) including Otis Target Butt. The driver for this investigation is that the Department of Defense (DOD) is looking at historic training sites that may contain munitions and explosives of concerns (MEC), discarded military munitions (DMM), and/or munitions constituents (MC). Only MC of lead or associated metals was anticipated at the Otis Target Butt MRA.

The MMRP Program is different than the Impact Area Program for the operational range area and it follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process and the MMRP sites follow the Federal Facilities Agreement (FFA).

The MMRP process for Otis Target Butt MRA started with the Comprehensive Site Investigation (CSE) Phase I and was followed with the CSE Phase II. A decision for NFRAP was arrived at but because of the Federal Facilities Agreement (FFA) there needs to be a Proposed Plan for any decision document. The current status of the site is at the Proposed Plan/Record of Decision point.

The Otis Target Butt MRA is located within the "I" Gate of the Otis Air National Guard. It is a small site just over an acre in size and was used for aircraft machine gun testing. Historically, the planes were tied down on concrete pads and machine guns fired towards the southeast as represented in Figure 1 of the presentation. There is no evidence that MEC should be considered or anticipated at this site. The CSE Phase II was finalized in February 2018. Since there was no sand left at the site, a conservative approach was taken and test pits were dug around the berm of the back side of the building to make sure that lead had been removed from the building and had not deposited on the berms. By visual and analytical testing it was confirmed that no lead was on the site and determined there was no unacceptable risk to human health or the environment which led to the NFRAP decision.

The Draft Final NFRAP Decision Document (DD) Otis Target Butt MRA can be found on AFCEC's webpage and at the Bourne, Falmouth, Mashpee, and Sandwich public libraries. Any comments received during the public comment period will be considered and responded to and incorporated into the document. Next, the document will be signed by the US Air Force and USEPA. The NFRAP DD Otis Target Butt MRA will then be finalized and will include a concurrence letter from MassDEP, and the site will be closed.

Mr. Winters asked what was looked at analytically at the site. Ms. Bouchard responded that soil samples were collected in 100 increments across the bottom and walls of the test pit area and were analyzed for lead which is the primary constituent. Mr. Cambareri asked what happened to all of the sand. Ms. Bouchard responded that it is unknown what happened to the sand. Mr. Cambareri asked about historical cleanup at site to which Ms. Bouchard responded no cleanup has been done at the site.

Agenda Item #3. Presentation: Emerging Contaminants Update– Ms. Rose Forbes, AFCEC

Ms. Forbes began the update with an overview of the emerging contaminants work activities by AFCEC at JBCC.

One hundred and two private wells were sampled; currently three private wells have perfluorooctane sulfonate/perfluorooctanoic acid (PFOS/PFOA) greater than the Lifetime Health Advisory (LHA) of 0.07 µg/L. Mitigation for these residences includes supplying bottled water and installation of full-house filtration systems. None of these residences have exceedances of 1,4-dioxane.

Eight public/community water supply wells were sampled with 2 wells resulting in PFOS/PFOA detections above the LHA. The Mashpee Village Public Supply Well was shut down in February 2017 and AFCEC/USACE is currently installing a wellhead treatment system to remove PFOS/PFOA. The system is expected to be operating by the end of this summer. The 93 units at Lakeside Estates in Mashpee have been connected to the Mashpee Water District. A photo of the system being constructed was provided in the handout.

Three residences are receiving bottled water from AFCEC. MassDEP is also providing bottled to additional residences. Thirteen filtrations systems were installed with 4 removed when connections to municipal water were completed. Currently, a total of 108 connections were made to municipal water supply which include 93 connections at Lakeside Estates and 15 single-family residences.

The Ashumet Valley (AV) Final Supplemental Remedial Investigation (RI) Data Gap Work Plan dated January 2018, identified areas to investigate for 1,4-dioxane and PFOS/PFOA. This led to a Supplemental RI which is being conducted at the Ashumet Valley groundwater plume and infiltration trenches, source areas, and Ashumet and Johns Ponds which are kettle ponds. The field program is ongoing and includes sampling of soil, surface water, private wells, and plant sampling. Recent work was completed for further delineation of contamination in the area of the AV infiltration trenches and Source Areas.

Ms. Forbes referred to two figures in the handout which represent the Ashumet Valley 1,4-dioxane and PFOS/PFOA detections in groundwater. The red dots represent detections above standards, yellow dots depict detections below standards, and green dots represent non-detect. Ms. Forbes pointed out that the sewage treatment plant and fire training areas, located at the top of the figures, are both source areas for the Ashumet Valley Plume. Historically, the Ashumet Valley Plume was investigated for chlorinated solvents. The figures show the chlorinated solvents plumes for TCE and PCE which were above their respective Maximum Contaminant Levels (MCLs). Plumes for 1,4-dioxane and PFOS/PFOA have not been mapped yet. Ms. Forbes also pointed out Ashumet and Johns Ponds and where they are in relation to the source areas.

The area by the source area in the Ashumet Valley Plume 1,4-dioxane figure is surrounded by green dots which signifies that the 1,4-dioxane has detached from the source area and that the source area is no longer contributing to contamination in the groundwater. On the PFOS/PFOA figure, the highest concentrations of PFAS/PFOA are found at the source area. One of the highest concentrations is 130 µg/L which is significantly higher than the lifetime health advisory of 0.07 µg/L.

Ms. Forbes continued with the Fire Training Area (FTA) Source Area. In 1995/1996 a thermal desorption unit system was in operation to remove and treat the chlorinated solvents in the fuels that were contaminating the soil. The soil was dug up, sent through the thermal adsorption unit, and then put back in the ground. Since PFOS/PFOA were not known about at the time, the treatment system did not target that contamination and the temperatures in the thermal desorption unit were not high enough to destroy the PFOS/PFOA. The soil was homogenized and put back in the ground with PFOS/PFOA contamination still in it. The thermal desorption unit subsequently caught on fire, and the fire department responded using AFFF (aqueous film forming foam) to put out the fire. This resulted in two source areas: one from the

training that took place there, and the AFFF from the fire-fighting response. Ms. Forbes referred to the figure of the FTA-1 Source Area in the handout. A grid system is used for shallow soil sampling from borings in outer grids which included sampling with five samples taken from each grid cell. The PFOS/PFOA results will determine if further investigation is needed. 1,4-Dioxane was not detected in any of the soil samples.

The second source area, the former sewer treatment plant (STP) is located downgradient to FTA-1. The water from the STP went into sludge drying beds as shown in Figure 2-3. PFOS/PFOA have been detected in the new STP, so it stands to reason that there was PFOS/PFOA coming from AFFF that went into the sludge drying beds from the former STP. AFCEC is starting the investigation and collecting soil samples. An update with those results will be provided to the JBCCCT when completed.

Ms. Forbes referred to the Ashumet and Johns Ponds Area Sampling Locations figure. The source areas are located at the top of the figure with the ponds in the middle of the figure. Direct push work and vertical profiling are being done where samples are collected at the water table in ten foot increments until refusal. This gives a vertical profile that creates a 3D image that shows where the contamination is. The same color code system is used as in the Ashumet Valley Plume figures.

It has been confirmed that contamination is in the groundwater and soil and has impacted some private homes downgradient from the Tanker Truck Rollover Sites (TTRS). The RI is ongoing and includes groundwater, soil, and surface water sampling. Contamination has been identified from the Otis rotary and downgradient to Hen Cove. The figure on page 11 shows the TTRS and PFOS/PFOA detections in groundwater. The red outline depicts the draft plume that has been identified with detections above the LHA for PFOS/PFOA. It is discharging into Hen Cove, and AFCEC just completed a vertical profile to see if it is discharging to Red Brook Harbor also. Results are pending. The groundwater contamination extends from Connery Avenue/Otis Rotary to Hen Cove and possibly Red Brook Harbor.

Ms. Forbes referred to page 12 of the handout which shows sampling locations in Hen Cove. Four sampling locations are in the upper area where shellfishing is not allowed, which are indicated by red cross-hatches on figure. Sample were also collected where shellfishing is allowed and results confirmed that PFOS/PFOA in the groundwater are upwelling into the ocean.

Mr. Cusak, Mashpee resident, asked if the PFOS/PFOA at Hen Cove are attributed solely from the rollover as opposed to the prior figure of Ashumet and Johns Ponds. Ms. Forbes explained that there are two different source areas. She referred to previous figure and pointed out where two rollovers occurred. She stated that foam was used on those rollovers. The fuel was cleaned up, but PFOS/PFOA were unknown at the time, so it stayed on the soil. The fire department washed the residual foam off the roads and onto the soil. Overtime PFOS/PFOA dissolved into the groundwater with precipitation; however, the PFOS/PFOA also adsorbs to the soil. Once it dissolves into the water, it goes down the soil matrix until it gets to the water table. Once it gets to the water table, it flows off in the groundwater. Ms. Forbes reiterated that the red dots on page 11 refer to the groundwater sampling locations where results were above the LHA.

Ms. Forbes pointed out the soil sampling being performed on the Otis Rotary for TTRS #2 referring to the page 13 figure. The sampling being done will target areas of excavation if it is needed.

A Final Supplemental RI Report for Chemical Spill-10 (CS-10) was submitted in March of 2017. 1,4-Dioxane was detected at concentrations exceeding the EPA regional screening level (RSL). The Feasibility Study was completed in January 2018. The 1,4-dioxane contamination has been identified and the figure on page 14 depicts the concentrations above the Massachusetts Groundwater-1 (GW-1) standard of 0.3 µg/L. An Explanation of Significant Differences (ESD) for CS-10 is in regulatory review, and is a supplement to the Record of Decision (ROD) that was signed in 2009. The ESD's purpose is to make 1,4-dioxane a contaminant of concern (COC) for the CS-10 plume and includes a monitoring plan.

Chemical Spill-20 (CS-20) is another 1,4-dioxane site. A Supplemental RI was started but concentrations were relatively low, so AFCEC entered into an interim groundwater monitoring program for 1,4-dioxane at eight monitoring wells which were sampled several times and are shown in the figure on page 15. One well had detections above the GW-1 standard, but is likely screened within a low hydraulic conductivity zone and is limited in extent. There is no current complete exposure pathway to the 1,4-dioxane groundwater contamination. Therefore, the AFCEC recommendation is to finalize the Draft Supplemental RI Report with a fact sheet documenting that 1,4-dioxane should not be considered a COC at CS-20. This is in discussion with the regulators.

The Final Supplemental RI Report for Landfill-1 (LF-1) was submitted in January 2018. 1,4-Dioxane and PFOS/PFOA were detected. Referring to the figure on page 17, Ms. Forbes pointed out the red outline which represents the 1,4-dioxane plume where the water detections within the plume are above the GW-1 standard of 0.3 µg/L, and it is almost completely within the footprint of the existing LF-1 plume. PFOS/PFOA were detected above LHA of 0.07 µg/L in nine monitoring wells and two extraction wells at LF-1. The highest PFOS concentration of 0.37 µg/L was detected at 27MW1003 and the highest PFOA concentration of 0.24 µg/L was detected at 27MW1007B. All PFOS/PFOA detections were within the LF-1 plume. The Remedial Investigation has been completed, and the Draft Feasibility Study for evaluating alternatives for LF-1 is due in December 2019.

There are seven Flight Line Area sites that are being assessed as an ongoing source of PFOS/PFOA from soil to groundwater and to determine whether groundwater contamination has migrated off-base potentially impacting water supplies. The Final Expanded Site Inspection (SI) Work Plan was submitted in July 2018 for these sites. Ms. Forbes referred to the figure on page 20 to point out the sites and PFOS/PFOA detections. The sites include two coast guard hangars, a helicopter hangar in the lower ramp area, Building 122 which is a former fire department, Former Building 118 and Runway 32 which is an area of time and distance training, Fuel Spill-1 (FS-1) which has some detections of PFOS/PFOA above the LHA, ANG Motor Pool where a fuel truck was hit by a snowplow which caused a fuel release that was treated with AFFF by the responding fire department, and in the upper Northwest part of the base is the wastewater treatment plant (WWTP) infiltration beds which is associated with the new wastewater treatment plant.

Eight manholes at the new WWTP were sampled to determine the source of the PFOS/PFOA and it appears to be the former and current fire department buildings. Shallow soil samples were collected from four borings at Former Building 118 and additional soil and groundwater samples will be collected. Four monitoring wells were sampled at the FS-1 source area and four monitoring wells downgradient of the source area. Additional samples will be collected.

Former Building 122 is scheduled to be demolished. Three soil and groundwater borings were completed at Building 322. In addition, concrete and sediment samples were collected from inside the building and it was determined that the concrete in the floor is contaminated. The walls and roof will be taken down but the floor will be covered until AFCEC's investigation is completed and remedial action performed.

The path forward for sites with emerging contaminants is to continue the Flight Line Expanded SI field program, continue the TTRS RI field program along with the Valley Farm Road well sampling program, and submit a project note summarizing the results and path forward to finalize the Draft CS-20 Supplemental RI, and submit a Supplemental FS Report for 1,4-Dioxane and PFOS/PFOA at LF-1. AFCEC will also continue the AV Supplemental RI field program, private well sampling program, and outreach in Ashumet and Johns Ponds area. The path forward also includes continuing to provide bottled water to residences with exceedances of the LHA and evaluation filtration systems and/or municipal water connections as further mitigations. Sampling results and field program updates will be presented to the agencies at Tech Update Meetings and to the public at future JBCCC Meetings.

Mr. Pinaud, MassDEP, gave an update on standards that MassDEP has promulgated for PFAS. He pointed out the fact sheets that are available at this meeting including an EPA technical fact sheet on PFAS,

Massachusetts Department of Public Health (MassDPH) fact sheet on drinking water, and MassDEP question and answer sheet on PFAS and drinking water. Mr. Pinaud referred to the presentation by Mr. Paul Locke, MassDEP Assistant Commissioner of Bureau Waste Site Cleanup, at a previous JBCCCT meeting regarding the standards MassDEP has promulgated for PFAS compounds. In June 2018 MassDEP established a drinking water guideline of 70 parts per trillion (ppt) for the sum of five PFAS compounds. Those compounds share similar chemical structures and toxicological data. MassDEP is developing a Massachusetts MCL for drinking water. That number has not been published yet. Two stakeholder meetings were held – one in April and one in June, and there will be a public comment period as part of that regulation process. MassDEP's goal is to establish a Massachusetts MCL by the end of 2019.

Mr. Pinaud said that MassDEP has a Waste Site Cleanup revision to the Massachusetts Contingency Plan, which is the Waste Site Cleanup Regulations, and in that update MassDEP has standards for PFAS. MassDEP has developed a GW-1 standard of 20 parts per trillion (ppt) for the sum of six PFAS compounds including the five that are in the Office of Research and Standards (ORS) guideline and one additional compound. This is in a public comment period that ends July 19, 2019. People can submit comments by going to MassDEP's website at mass.gov or email them directly to Mr. Pinaud.

Mr. Pinaud spoke about the Take Back Program for legacy fire-fighting foam. AFFF is a source of PFAS compounds and was used by fire stations including the JBCC Fire Station. JBCC Fire Station participated in a Take Back Program that MassDEP which was coordinated with the Massachusetts Department of Fire Services (Mass DFS). MassDEP and Mass DFS took all of the AFFF that contained PFAS and disposed of it properly and replaced it with a different kind of foam that did not have PFAS or extremely low concentrations of PFAS. There are not a lot of effective alternatives of foam available currently.

Ms. Donovan, MassDEP, referred to the number of private wells the Air Force is sampling in the outreach areas and how the detections are being based on the EPA Health Advisory of 70 ppt. Ms. Donovan said that the MassDEP Massachusetts Contingency Plan is proposing 20 ppt. MassDEP reviewed the data and worked with the Air Force and determined that there were ten residential homes that are over the 20 ppt but under 70 ppt. Starting in June, the MassDEP has provided bottled water to those residences to eliminate the exposure risk which includes two residences in Bourne, four in Falmouth, and four in Mashpee. Ms. Donovan added that the MassDPH has issued their annual fact sheet entitled, "Recreational Use of Waterbodies on or Near Joint Base Cape Cod" which addresses the safety of boating, fishing, swimming, and other recreational activities in local waters near JBCC with a revision to include specifically PFOS and PFOA and is available at this meeting.

Mr. Goddard asked that when treatment systems are designed to treat PFOS/PFOA compounds, will they also treat the entire family of compounds included in PFAS? Ms. Forbes responded that currently the focus is on PFOS/PFOA, and if the state MCL becomes promulgated, then AFCEC will be discussing with management about addressing the six compounds specified by MassDEP. Sampling is done for six PFAS compounds but does not include perfluorodecanoic acid (PFDA). The sampling results are represented mostly by PFOS and PFHxS (perfluorohexanesulfonic acid).

Mr. Goddard said he understood that the state is looking at the 5 or 6 because they are a broad spectrum to reduce risk in systems and the treatment effectiveness of those systems. He asked that as a future action item he would like a fact that states that the systems the Air Force puts in place to treat two of them will also treat the remaining three or four, so if two of the compounds are identified, then everything in between is covered. The Air Force would not have to go back and say there were three hundred compounds that were not captured. Ms. Forbes said that carbon does remove all six of the compounds. Mr. Goddard said that he would also like to see information as to where it goes after it is treated as it is difficult to break the fluorine/carbon bond. Ms. Forbes replied that the most of the current technologies are to destroy PFOS/PFOA by incineration.

Mr. Goddard asked if the Air Force is paying for management of the Mashpee Public Well including carbon change out, disposal management, etc.. Ms. Forbes replied that the agreement with the Mashpee Water District is that as soon as the Air Force has commissioned the system, the Mashpee Water District will take ownership of it and be responsible for all operations and maintenance. She explained that the concentrations going into the system are very low and it is estimated that the carbon will last for at least a year.

Mr. Goddard asked if the regime is changed for breakthrough rates and how often carbon is changed out at the other treatment plants with PFAS. Ms. Forbes responded that the legacy compounds' (TCE, PCE, EDB) concentrations are declining so that carbon is not being changed out as often due to those compounds, but eventually it may need to be changed out more frequently because of the PFOS and PFOA.

Mr. Goddard asked for the concentrations at the wastewater infiltration trenches at the Northern part of the base and does it hydraulically get pulled into the Canal. Ms. Forbes replied that they are slightly above the LHA and that the Air Force is in the Expanded Site Inspection phase and that discharge will be discussed in the future, but confirmed that it is close to the Canal.

Mr. Goddard asked the MassDEP if they could explain the difference between the proposed MCP and MCL and how they are related. Mr. Pinaud replied that the GW-1 standard is a cleanup standard for hazardous waste sites in groundwater where the groundwater is used for drinking water. The MCL is the maximum contaminant level which is the maximum level you can have in finished water which is water that goes to the end user. Mr. Pinaud said that generally MassDEP tries to harmonize the two standards, but in this case they do not know how well they will be in line with each other.

Mr. Winters asked if any of the PFOS contaminants can be absorbed through the skin from swimming or do they have to be ingested. Ms. Forbes referred him to the MassDPH handout and said that MassDPH has stated that it is an ingestion and not dermal issue, and that it is not a problem to swim in ponds or ocean. Ms. Donovan responded that it is the first question on the fact sheet by MassDPH and asks, "Can I safely swim?" and the answer is "Yes" and the fact sheet goes on to qualify why.

Mr. Cambareri thanked Ms. Forbes for the update and asked if the soil is available to be collected at the Fire Training Area. Ms. Forbes replied that some soil has been collected and there is soil sampling data, with the highest concentration for PFOS at 260 µg/kg. Ms. Forbes added that they are seeing a spread of contamination in the Fire Training Area around that number. Mr. Cambareri asked if they were seeing that in the surface samples zero to twenty-five feet. Ms. Forbes and Ms. O'Reilly, Jacobs Engineering, responded that levels were not as high as in the shallow part, and 0.5 and 0 to 3 feet weren't that high, but the 3-10 feet and 10-20 feet in some of the borings were much higher.

Mr. Cambareri asked about the scale of grid spacing on the page 7 figure to which Ms. Forbes and Ms. O'Reilly responded that the grid spacing is approximately 50ft by 50ft but the grids are not all the same size. Ms. Forbes added that it is an initial look and it likely will be refined, or if it is decided to dig up all of the soil, there is no reason for additional sampling.

Mr. Cambareri asked Ms. Forbes to explain what was found in the concrete at the Former Building 122. Ms. Forbes responded that the Air Force sampled sediments and concrete near the drain in the center of the building. There was anecdotal evidence out of Colorado that PFOS/PFOA were adsorbing to concrete on the tarmac which led to the sampling which resulted in high concentrations sorbed to the concrete and the sediments inside the drain that go to the oil/water separator.

Mr. Cambareri asked about the investigation on pond sediments. Ms. Forbes replied that the pond sediments have not been sampled yet, but will be. She said there is a lot of carbon at the bottom of the pond and that could be a lingering secondary source.

Mr. Cambareri addressed MassDEP and asked if the GW-1 standard applies to surface water bodies on the Cape. Mr. Jacobs, MassDEP, responded that it is something they have to consider because they become secondary source areas. He continued and said that pond water cannot be pumped through carbon or you remove all of the essential nutrients and organic matter that supports the eco systems there. Mr. Jacobs said essentially the ponds are going to have to flush themselves out over time as there is no other possible scenario. The GW-1 standard applies only to groundwater and not to surface water body that is a flow-through ponds but it is a consideration when they recharge the aquifer.

Mr. Pesce, Design Team Member for VA Cemetery, stated that AFCEC is assisting the VA Cemetery on locations for future irrigation well sites and recently had a meeting with MassDEP about permitting those sites. One of the locations was in the Northwest corner of the VA property between the two ponds. He asked that Ms. Forbes go over the significance of the blue outline on the Tanker Truck Rollover Figure. Ms. Forbes replied that when an area of contamination is first looked at, an outreach area is identified, and the blue outline represents that area. Mr. Pesce asked when the surface and groundwater was sampled. Ms. Forbes responded it has been sampled over the last two years. Mr. Pesce publicly thanked AFCEC for agreeing to sample a monitoring well near extraction well 5 of the LF-1 plume that the VA Cemetery has on its property and is going to take over and repurpose as an irrigation well.

Mr. Cusak, Mashpee resident, stated that the PFOS/PFOA discussion taking place is likely taking place around the country, and asked if there is any idea of the order of magnitude of PFOS/PFOA incidents. Mr. Pinaud responded that MassDEP has an interactive map on its webpage as to where these sites are in Massachusetts. Ms. Donovan responded that she would send Mr. Cusak the link to the website.

A Bourne resident said his concern is the water quality in Hen Cove. He said that every weekend he sees people digging clams, quahogs, etc. He said that the Massachusetts Division of Fisheries is aware of this situation, but does anyone know what they are doing? Do they need sampling of the shellfish? Because every weekend there is 30-50 people digging quahogs and he is very concerned. Ms. Forbes responded that she has requested testing of the shellfish and the request is being considered by the Air Force. The resident interjected that there is not a protocol for testing and nobody knows how to test for it at the same time people are ingesting them. Ms. Forbes responded that there is a way to sample them and that AFCEC has sampled cranberries and there are ways to sample shellfish. She continued that it is treated like a solid for sampling purposes and then you extract the contaminants from the tissue. But what the concentrations means is something that needs to be determined. Mr. Pinaud added that MassDEP does not have any updates at this time. The resident said that he is surprised no one from Mass. Fisheries is at this JBCCCT meeting because this could be a tremendous health hazard from the oysters, the quahogs, and the soft-shell clams.

Mr. Goddard responded that shellfish were sampled in the Red Brook Harbor years ago and asked that an action item be to look back at the protocols in the past and if there is a different metabolic response in PFAS then with chlorinated solvents. It was determined safe to eat the shellfish in Red Brook Harbor in the past, and is there any correlating data that can be used with PFAS? The resident added that one of the areas of Hen Cove is closed by the state to shellfishing as shown in Ms. Forbes presentation. Why is it closed? Mr. Pinaud responded that the Department of Natural Resources in Bourne regulates the shellfish beds and to contact them.

Ms. Forbes referred to Mr. Goddard's comment regarding shellfish sampling at Red Brook Harbor and clarified that two rounds of sampling were done by MassDPH and they discovered that shellfish do not uptake or bioaccumulate solvents so there was no numbers to compare it to. PFOS/PFOA might be a different situation.

Agenda Item #4. Presentation: USGS Updated Groundwater Model– *Mr. Denis LeBlanc, USGS*

Mr. LeBlanc referred to the handouts of USGS Reports and journal articles on work that USGS has been performing on Western Cape Cod. Mr. LeBlanc began with the USGS report, "Use of a Numerical Model to Simulate the Hydrologic System and Transport of Contaminants Near Joint Base Cape Cod, Western Cape Cod Massachusetts". USGS, in cooperation with AFCEC, developed a numerical, steady-state regional model of the Sagamore lens on Western Cape Cod and evaluated the potential effects of future groundwater withdrawals on water levels, streamflows, hydraulic gradients, and advective transport near the JBCC.

AFCEC asked USGS to evaluate how might future water supply development and wastewater disposal that goes with that, along with the changes in disposal of wastewater effect the plume treatment systems that are currently operating. Could actions taken by towns to develop water supplies or changes in wastewater disposal effect plumes for example? The plumes are eventually going to diffuse at some point in time even though some vestigial low level of contaminants (TCE, PCE for example) would remain. Could the paths of that contamination change or could they be projected with confidence along the same paths as they ultimately discharge into the ocean.

USGS developed a groundwater model focused on the area that JBCC is on - the Sagamore Lens. The objective of USGS was to prepare a regional modeling tool to examine the sensitivity of flow paths to potential hydrologic changes to assess the effects of future proposed changes. Mr. LeBlanc noted the current debates Cape-wide regarding wastewater solutions. The USGS team took an existing USGS regional model that covers the entire Sagamore Lens and refined it as more data became available and the modeling tool became more sophisticated, and created the updated tool. The fourth slide in the presentation showed the model grid of the Sagamore Lens starting at Buzzards Bay and ending in Bass River. The slide also showed the slice view of the model.

Traditionally, groundwater flow models are calibrated by constructing it in three dimensions, putting in the estimated aquifer properties, pumping rates, recharge rates, and then run the simulation to see if it matches the observed water levels. If it doesn't match, it must be manually adjusted by the statistical method by adjusting aquifer parameters, boundaries, flows, etc., to get a good map of observed water levels or observed streamflows and the ones the model simulated, and that is when the model is considered calibrated. This has been done by adjusting to water levels in wells represented by circles on the page 5 slide and streamflows represented by triangles on the same slide. The page 5 slide represents the available water level and streamflow data for the Sagamore Lens when USGS began the new modelling effort.

With the development of tools since then, USGS took an innovative approach to develop new methods. If you match water levels and streamflows, how well can you match plume paths? At JBCC there are large numbers of plumes that the USGS can use as data that says we know the groundwater flow goes in a specific direction and the time it takes to go in that direction based on the mapping of these plumes. USGS added to the modeling calibration methods by not only matching water levels and streamflows, but actually modeling plume paths and comparing them to observed plume paths.

Mr. LeBlanc used as an example the Demo 1 Plume which originates in the Impact Area and heads off towards Buzzards Bay. By using a cross-section plume map of Demo 1, USGS designated the approximate center of the plume and attempted to make a particle path through the center or make a particle of water end up at the center. The closer to the center of Demo 1, the better the model is. This is an example of a formal observation USGS used in a statistical calibration method.

Another type of observation USGS used was groundwater dating. This is a data set developed by piggy-backing onto the various drilling programs over the years at JBCC – largely in the Impact Area. The figure on the seventh slide of the presentation shows circles which represent where USGS has collected groundwater samples and performed groundwater age dating. By using chemical tracers that typically exist

in precipitation, USGS can map out how long the water has spent in the aquifer from the water down to where it was sampled. The two main tracers used for groundwater age dating are radioisotopes (helium and tritium) and chlorofluorocarbons (CFCs). This left USGS with age dates of the water which shows how long ago water charged an aquifer.

Mr. LeBlanc continued by discussing tritium. The figure on the right of the seventh slide shows a black line which represents a profile of the concentration of tritium in the groundwater. In 1963 before the Nuclear Test-End Treaty, the Americans and Russians tested as many nuclear weapons as they could which put a huge amount of tritium into the atmosphere which then came down as rain thus classifying the 1963 water high in tritium. This is called "bomb tritium" and the bomb peak can be found throughout the country as a time mark of 1963 water.

The eighth slide displays two figures. The top figure shows a cross section that runs from East to West from West Falmouth Harbor through Popponesset Bay. USGS took the calibrated model and looked to see how old the water was everywhere in the aquifer in three dimensions. The purple area represents the groundwater system, and the area above the white line represents groundwater that has been in the aquifer for less than 50 years. Most of the water in the aquifer is less than 50 years old. Modeling confirms that plumes are so extensive on the Cape because the groundwater moves readily through the aquifer, plumes occupy large thicknesses of the aquifer, and the groundwater is young relative to when contamination sources started being seen.

Hanging silts are silt bodies which are present in the coarse sand and gravel lithology. Determining if silt layers are continuous or patchy is important to the predictions of fate and transport of contaminants. Mr. LeBlanc referred to the Demo 1 Plume figure, which shows the plume displayed by gray color and the silty zone above it – it changes the geometry of the silty zone. In the modeling analysis, USGS took the model and tried different variations of the silt zones connections in the boreholes and determined how the variations of connected or not connected silt zones affect the flow path. The USGS determined in a regional scale, it does not affect the flow path very much. The locations of the silty zones is imperative to know when designing a pump and treat system or stressing the aquifer which is the purpose of drilling.

Mr. LeBlanc said as the USGS was going to come up with elaborate scenarios of pumping and recharge so they went to a town and discovered that within that town there is no way to come up with those scenarios, So, the USGS took the MassDEP's projected estimates of water pumping of the different towns in the Western Cape. They looked at 2010 and the projection for 2030 and applied it evenly to all the wells throughout the towns. USGS ran two simulations with the newly calibrated model. One with the 2010 pumping and one with the 2030 projection. USGS looked at how that change the water table gradients – how much it changed the slope of the water table and the direction of the water table. The results were in the areas that where this is a lot of pumping going on, the extra pumping and redistribution of water will change groundwater flow directions.

USGS took the 2010 and 2030 scenarios and started particles (contamination or tracers), and projected the flow path for both of the scenarios. With only a few exceptions where there was a lot of influence of surface water bodies, the tracks basically laid on top of each other. The conclusion was that in a regional sense, unless you move a tremendous amount of water from a water supply and/or put wastewater everywhere, the flow paths are going to be pretty stable. Mr. LeBlanc said links to the model and graphs are available to the public on the USGS webpage.

In additional work, the USGS continues with several projects. USGS continues to monitor groundwater levels for the Army National Guard. USGS is currently setting up a mobile laboratory model for PFAS exposure experiment with fish to see if it bio accumulates and do they affect organisms (National Institute of Environmental Health and Safety). USGS and Harvard are working on lake/groundwater interactions, plume paths and contaminant transformations. The USGS is assisting the USEPA in coming up with methodology for reducing and removing nitrogen loads to surface waters. University of New Hampshire

and the USGS are starting a project on predicting and monitoring of algal blooms. And, the USGS performed a tap water quality sampling project in the Maravista area of Falmouth and should have results shortly.

Mr. Goddard thanked Mr. LeBlanc for all his work and asked if looking at the age of water is called "archeogeology"? Mr. LeBlanc replied that the term used is "groundwater dating". Mr. Goddard asked how old is the oldest water? Mr. LeBlanc replied that the majority of the aquifer flushes itself out within 50-100 years and the majority in less than 10 years.

Mr. Goddard asked if the results from fish experiment in 2018 were available regarding mortality rates and exposure. Mr. LeBlanc replied that there was methods development that needed to be done to figure out the measure concentrations in some of the fish tissue. He continued and said the data are coming in now and there is definitely accumulation of PFOS in the fish but that the fish do live in the water so they are constantly taking it in. The important question is does it matter? The toxicological data is estimated which is why they are running the same experiment this year just using better analytical methods.

Mr. Cambareri asked Mr. LeBlanc to describe some of the nitrogen reduction work. Mr. LeBlanc responded that the handout has a report on hydrologic methods for assessing sites with permeable reactive barriers (PRB) and is one project being done with USEPA. A project just completed was helping towns figure out where to put the PRB. The town of Falmouth recently converted the Maravista neighborhood in Teaticket from septic systems to sewers and USGS is testing to see how long it takes nature to clean up and get rid of the high nitrate levels; 2500 µg/l of nitrate is being found in the groundwater there. This results of this project are being tracked and available to the public on the USGS website. USGS is working with USEPA on looking at the rivers and the uptake of nitrate. USGS is also working in the three bays area with the Office of Research and Development on a new project where they are going to be testing alternative septic systems in a variety of methods and will be providing monitoring of how well they work.

Agenda Item #5. Presentation: Update on Central Impact Area– *Mr. Benjamin Gregson, USGS*

Mr. Gregson began by reminding the team of the Central Impact Area (CIA) presentation he gave at the March meeting. He showed an aerial map that depicted two areas, totaling 58 acres, which were investigated in 2018. Metal Mapper, an advanced geophysical technique, was used and 15,091 items were recovered with over 4500 lbs. of explosives.

Mr. Gregson noted that were some issues with the 2018 investigations, which came to light with a QA/QC procedure that called for 100% anomaly removal in one grid for every size acres investigated. It was determined that some UXO items and some "seed" items were missed. Mr. Gregson explained that "seed" items are intentionally placed items in the investigations areas to test the efficiency and effectiveness of the technology and the operators. Because of this oversight, it was concluded that there had been incomplete clearance of the dig holes and inadequate review of the geophysical data. Corrective actions, which included a redig of all anomalies in Phase III, Area One (ten acres), are underway. As of now, 67% is complete with 4,652 of the 6,943 required redigs. To date, 14 81mm mortars were found at depth. The crews are being extra vigilant, digging deeper than required.

Phase III, Area Two will be completed next with a focus on the transects moving away from the targets to verify if/how much density drops off away from the targets. Crews will clear vegetation, plant seed items, perform an EM-61 Survey and use metal mapper. A figure showing the progress of the technology (EM-61 and Metal Mapper) was displayed.

Mr. Gregson reported that a report about the 2018 work and the redigs will be issued later this year. A transects findings report will be issued in February 2020.

Mr. Goddard asked if this was the same area that had been a fire-adapted habitat and if Dr. Ciaranca from the Environmental and Readiness center (E&RC) would be involved with restoration of the area. Mr. Gregson replied that they do not like crews to go into the impact area for safety reasons and noted that the scrub oak pine is desirable and the goals would be to continue to reduce the pitch pines.