

Subject **Meeting #5 - Barnes Air National Guard Base (ANGB) Restoration Advisory Board (RAB)**

Prepared by Lisa David/Jacobs

Location Westfield State University
Scanlon Hall
Loughman Living Room and via
WebEx Meeting (v)

Date/Time October 26, 2023, 6:00 p.m.

RAB Members

Col David Halasi-kun/Barnes ANGB, Base Co-chair (v)
Kathleen Hillman, Community Co-chair
Chris Clark
Kristen Mello
Kelly Pease
Mark Messer for State Senator Velis (v)

Additional Meeting Participants

Marianne Babinski/RAB member candidate
Jennifer Baker/104th Fighter Wing (FW) Environmental Manager
Tom Barzyk/BB&E (v)
Amy Brand/Jacobs
Dr. David Boutt/ Technical Assistance for Public Participation (TAPP) Advisor
Jessica Britton/community member
Chris Brown/National Guard Bureau (NGB) Restoration Program Manager for Massachusetts
Lt. Col Peter Carr/104 FW Vice Wing Commander
Lisa David/Jacobs (v)
Keith Freihofer/ANG (v)
Wendy Heiger-Bernays (v)
Larisa Lawrence/NGB (v)
Mrs. McGregor (v)
Mary O'Connell/RAB member candidate
Jane Okscin/RAB member candidate
Johannah Phelan/Jacobs
Caprice Shaw/MassDEP
Maj Sarah Sinclair/104th FW
Col. Andrew St. Jean/104th FW
Dawn Thomas, RAB member candidate
Rebekah (no last name listed) (v)

The Barnes ANGB RAB Meeting No. 5 was held on October 26, 2023, at 1800 hours, at the Westfield State University, Scanlon Hall, Loughman Living Room and via WebEx. The following notes provide a summary of discussions during and after the presentation and are not intended to serve as a transcript or further explain information provided during the meeting. A copy of the presentation is attached in **Attachment A**.

- 1 Dawn Thomas asked if she could read the previous meeting's minutes. Amy Brand indicated they are located on the base website.

Meeting #5 - Barnes Air National Guard
Base (ANGB) Restoration Advisory
Board (RAB)
October 26, 2023, 6:00 p.m.

- 2 Amy Brand, RAB facilitator, began the meeting at 6:22 p.m. She welcomed participants, reviewed the agenda, provided directions for the WebEx platform, and reviewed the meeting guidelines. She invited the Base Co-chair and Community Co-chair to provide opening remarks.
- 3 Lt Col Carr, Deputy Wing Commander, made opening remarks on behalf of Base Co-chair Col Halasi-kun. Lt Col Carr introduced Col Andy St. Jean, who will be replacing him after his retirement in a couple months.
Kathleen Hillman, Community Co-Chair, gave opening remarks welcoming Base staff and thanking RAB members and community members for attending the meeting. She expressed appreciation for the site tour prior to the meeting and said it was helpful to see the sites in person.
- 4 Amy acknowledged RAB members and other attendees. She committed to emailing the July 2023 RAB meeting summary the following day and to posting the approved meeting summaries on the 104th FW website as soon as possible.
- 5 Amy introduced four RAB applicants, Jane Okscin, Mary O'Connell, Dawn Thomas, and Mary Babinski. RAB member Chris Clark asked for each applicant to speak on why they wanted to serve on the RAB before voting began and he requested RAB applications be distributed to RAB members prior to voting. Kathleen pointed out that the application indicates to send it to Jennifer Baker. The RAB voted in favor of accepting the four applicants.
- 6 Col David Halasi-kun/Barnes ANGB Base Co-chair joined the meeting online and said a few welcoming words.
- 7 Upcoming Barnes ANGB RAB 2024 meeting dates were presented. The next meeting is scheduled for January 25, 2024. Two meeting venues, the Westfield Athenaeum and Westfield State University, were discussed and Kathleen accepted the action item to poll RAB members' preference and let Amy know ASAP.
- 8 Amy reviewed general information about the Technical Assistance for Public Participation (TAPP) grant funded by the NGB and eligibility for additional TAPP grants. Kristen Mello gave an update about different options for future TAPP grants. Because the Uniform Federal Policy Quality Assurance Program Plan (UFP-QAPP) would not be ready in time for a technical assistance grant, she developed a proposal for a health implications TAPP grant. She indicated University of Massachusetts professors Dr. Wendy Heiger-Bernays (toxicologist) and Dr. Vello are available to help RAB community members understand health implications of site contaminants, exposure scenarios, and potential health implications of cleanup levels in preparation of the Remedial Investigation (RI) review. RAB members chose to designate Kristen Mello as the point of contact for the next TAPP grant application. Kelly Pease asked for clarification as to why the health implication TAPP grant was chosen over other options and Kristen explained that the RAB will better understand the health implications of exposure levels and remediation when reviewing and commenting on the UFP-QAPP.
Chris Brown reminded the RAB that the UFP-QAPP is the RI work plan and it includes the sampling plan that consists of about 31 worksheets. The UFP-QAPP is coordinated with the state regulatory agencies and is the guide for the RI.
Kristen proposed the third TAPP grant application be for reviewing the UFP-QAPP if the schedule and timing works. The group discussed focusing the TAPP grant on environmental versus health impacts. Kristen explained that she chose human health over ecological impacts and added that the first grant was awarded to Dr. David Boutt to brief the RAB

Meeting #5 - Barnes Air National Guard
Base (ANGB) Restoration Advisory
Board (RAB)
October 26, 2023, 6:00 p.m.

about previous documents and the Barnes Aquifer hydrogeology. She proposed the next grant focus on human health impacts. A RAB member commented that the next topic could be on ecosystem impacts and Kristen confirmed that yes, that was possible.

Amy moved for a vote on the proposed TAPP grant application and Kelly Pease requested further discussion on the vote. A vote of 8 in favor of Kristen's grant proposal to focus on human health impact passed.

- 9 Amy asked RAB members to share their questions about the site tour. Questions were held during the tour so all meeting attendees could hear their questions and the responses.

Q: Kathy Hillman asked whether the new fire station was built on soil that was already contaminated.

A: Chris Brown responded that when a building is constructed it goes through a permitting process including site history and environmental processes, but he would have to research records to fully answer the question.

Q: Kristen Mello asked that since PFAS is an emerging contaminant, isn't it unlikely that PFAS was investigated before construction?

A: Col Halasi-kun responded that yes, the fire station is more than 20 years old. PFAS investigations began in 2015.

Kristen commented that the site tour was really helpful and that she hopes they will be able to do it again as the site cleanup progresses.

- 10 Chris Brown presented the Environmental Restoration Program (ERP) history including the PFAS 2016 Preliminary Assessment (PA), 2018 Site Inspection (SI), reimbursement to the City of Westfield of \$1,350,917.26 in 2019, and the 2020 Expanded SI (ESI) which was conducted to address possible off-base contamination (slide 16). He reviewed the CERCLA process (slide 17) and indicated that initial RI field work is expected to begin in summer/ fall of 2024 (slide 18). He explained that the RAB will be able to review the UFP-QAPP whether or not it gets the TAPP grant.

Q: Chris Clark stated that he thought we were trying to move the RI along more quickly.

A: Chris Brown confirmed there was an effort to line up the TAPP grant with the UFP-QAPP. The RI follows the UFP-QAPP. During the RI, the nature and extent of the plume (vertically and horizontally) is determined and the conceptual model is refined.

Q: Kristen Mello asked what the city can do to be reimbursed for Wells 7 and 8 Granulated Active Carbon (GAC) filters. The city is \$31M in the hole, so what do we need to do?

A: Chris Brown said he would have to research the settlement agreement to find out.

Q: Chris Clark asked whether we lost some funding opportunities because of receiving that reimbursement?

A: Kristen Mello stated that the agreement with the NGB only covered those specific years and was a one-off agreement for \$1.35M. There was a non-disclosure agreement (NDA).

Q: A RAB member asked if Chris Brown could explain what was meant by RAB review?

A: Chris Brown replied that the RAB will review the UFP-QAPP and will get a chance to provide comments.

Amy provided some guidance for the new RAB members who had not participated in the RAB training. RAB members can review documents and provide comments; however, the RAB is not a decision-making body. Chris added that the RAB and NGB work together to keep the environmental cleanup process transparent. RAB comments are addressed sometimes, and sometimes they are merely noted in a Response to Comments. Amy added

Meeting #5 - Barnes Air National Guard
Base (ANGB) Restoration Advisory
Board (RAB)
October 26, 2023, 6:00 p.m.

that the timing of the TAPP grant is good so that the RAB can give feedback prior to RI fieldwork. Chris added that the feedback needs to fall within the scope of work.

Q. Kristen Mello indicated that the NGB said they would look into the agreement.

A. Amy responded that research into the city reimbursement will be taken as an action item.

- 11 Dr. Boutt introduced himself, thanked ANG staff and RAB members and appreciated the site tour. His presentation is attached in **Attachment B**.

Dr. Boutt's presentation is based on review of the PA, SI, ESI and PFAS data collected from private wells. He presented a cross-section, and talked about how glacial deposits can move water and contamination. The northern portion of the Barnes Aquifer flows toward East Hampton, around the Holy Oak Range, and the southern portion flows to the Westfield River. The aquifer is permeable, composed of mostly sand and gravel which are characteristic of this part of the Connecticut River Valley.

The Commonwealth of Massachusetts conducted an assessment to determine impacts of groundwater production on aquifers across the state, including the Barnes Aquifer.

The PA recommended eight areas of concern (AOCs) be further investigated as part of the SI. During the SI, Sites 1 and 8 were of particular interest for soil and Sites 4 – 7 for potential for groundwater contamination. Action levels during the SI were based on regulations at the time of the investigation.

The ESI provided soil and groundwater contamination information at seven sites. Sample were collected on base, on the airport property, and from downgradient areas. AOC 1 and AOC 8 are of particular concern. The extent of PFAS soil contamination is not as great as the extent of PFAS groundwater contamination; therefore, downgradient areas are of particular interest.

Groundwater flow in the aquifer has a strong downward component, so while it moves horizontally, it also moves downward. The data suggest that PFAS is in the bedrock below the Barnes Aquifer south of the base where some homeowner wells are in bedrock.

A 3-D model was developed showing the highest concentrations of PFAS near AOC 1, Former Fire Training Area (FTA). Dr. Boutt suggested defining the plume outside the current boundary because the plume goes off base, under the freeway and toward the Westfield River.

Q. Chris Clark asked if concentrations were in micrograms per kilogram (in soil) and parts per trillion (ppt) or parts per billion (groundwater)?

A. Concentrations in groundwater are shown in parts per billion (ppb).

Dr. Boutt suggested that moving forward it's important to consider the PFAS sources. He believes that previous studies were good, and that the geology of the aquifer needs to be further characterized, including the PFAS groundwater plume contouring outside the current boundary. The migration rates in the vadose zone seem to be high and the hydraulic system is dynamic. Dr. Boutt recommends focusing on how groundwater is moving into the bedrock and to extend the monitoring well (MW) network east of the runway. Dr. Boutt added that his students' have a project that will study the extent of groundwater flow this fall.

Q. An online participant commented that Dr. Boutt said we need a better conceptual model of the groundwater plume?

A. Dr. Boutt stated that the modeling is pretty good, but we need to better understand why the plume is moving so quickly to depth, to better understand the downward movement, and to understand what's happening in the sand and gravel.

Meeting #5 - Barnes Air National Guard
Base (ANGB) Restoration Advisory
Board (RAB)
October 26, 2023, 6:00 p.m.

- Q. Kristen Mello asked if Dr. Boutt's students would be interested in attending a RAB meeting.
- A. Dr Boutt replied they might be.
- Q. Chris Clark asked how transport to the bedrock relates to drinking water and sanitation?
- A. Dr Boutt replied that "mass flux" is how much water is moving multiplied by the concentration, so we look at the historic uses or events and we look at how much mass has reached different receptors. Each monitoring well has had high levels of PFAS concentrations.
- Q. Kristen Mello asked whether the sand and gravel pit has anything to do with moving the water faster?
- A. Dr Boutt replied that he didn't think so. He indicated that it looks like there is vertical infiltration into the deepest part of the sand and gravel in the aquifer and then into the bedrock. In some areas, the sediments on the delta, the flat part, might be 150' to 200' thick sand and gravel and the PFAS may be below that.
- Q. Kristen Mello asked what would happen to groundwater flow if 50 acres of trees were removed and replaced with an impervious surface for a new development? Trees hold and drink a lot of water; what would happen to the plume?
- A. Dr Boutt indicated that he would have to look at the area. It might be shallow sand and gravel. In some places, he has seen that cutting down trees increases groundwater infiltration.
- Q. Kristen asked if infiltration increases north of the plume and there's a dramatic removal of trees, wouldn't it affect the groundwater?
- A. Dr Boutt replied it's difficult to answer because there are so many factors involved.
- Q. A RAB member clarified that he is saying we need to expand the plume area investigation?
- A. Dr Boutt replied, while pointing at the figure, that filling out "this area" with additional groundwater monitoring wells in "this area" would help determine if there's additional mass that's adding to the contamination. He said yes, he would like to see the plume delineated better. The surface water and groundwater are connected and the water going into the pond, which is essentially aquifer discharge.
- Q. Chris Clark clarified he understands this PFAS contamination originated on the base and has it spread significantly outside the base?
- A. Dr Boutt replied that additional releases outside the base also interest him, to better understand the soil contamination in areas upgradient and outside the base are areas of concern.
- Q. Chris Clark state that, from a remediation perspective, we can't just remove the soil and problem solved. We cannot simply pump out millions of gallons of contaminated water out of the bedrock.
- A. Dr. Boutt replied that PFAS absorbs to organic material within the aquifer itself, so we can remove soil, pump and treat water and then the concentrations can come back. We also need to look into areas on base and off base of possible contamination.
- Q. A RAB member indicated that when you look at contour maps, it's hard to see the compounds.
- A. Dr. Boutt replied that the rationale for looking at these maps is to see the patterns.
- Q. Kristen Mello asked if the storm drainage system was addressed in any of the reports?

Meeting #5 - Barnes Air National Guard
Base (ANGB) Restoration Advisory
Board (RAB)
October 26, 2023, 6:00 p.m.

A. Dr. Boutt – replied that yes, that was a part of the sampling. Sediment samples came back pretty clean.

Q. Kristen clarified whether that was all over, in multiple areas? That was in the 2020 report?

A. Dr. Boutt replied yes.

12 Amy thanked Dr. Boutt and asked Chris Brown to share his recommendations and conclusions leading up to the UFP-QAPP and RI. Chris Brown replied that Dr. Boutt's recommendation to do some bedrock sampling is in the scope. Chris showed where additional monitoring wells are proposed and indicated that the work plan includes more sampling in bedrock, groundwater, and soil. The kickoff meeting with Battelle is in two weeks.

Q. Chris Clark asked whether they have a good hydrogeologist?

A. Chris Brown replied that he didn't know the team members yet but will know at the kickoff meeting.

Q. Kristen Mello asked Dr. Boutt if he could recommend someone?

A. Dr. Boutt replied that he thinks what is important is to understand the literature and to understand the (hydrogeological) system.

Chris Brown added there are multiple reviewers of the UFP-QAPP and RI, including the Army Corps of Engineers, other project managers, toxicologists, health risk assessors, and hydrogeologists. It is a large team of government and contractor personnel.

Q. A RAB member asked Chris Brown whether he is talking about federal levels at 70 ppt or state levels at 20 ppt when he discusses cleanup levels.

A. Chris Brown indicated that he was talking about federal clean up levels.

Comments were made for supporting and a preference for state cleanup levels.

Kristen Mello stated that she wanted to make sure that this presentation and recommendations are included in the UFP-QAPP.

A. Chris Brown replied that they can consider the recommendations, but he also has to make sure they are within the scope of the contract. The presentation and report would be shared with the contractor project managers.

Q. Kristen commented that a couple of RAB meetings ago, she asked if RAB members could sit in on the ANG and consultant meetings and someone was supposed to report back on that.

A. Chris Brown replied that he can share the meeting minutes with the RAB, but the technical planning meeting has to have a free flow of communication between the government, regulators, and contractors. He indicated that we can't have any undue influence when it comes to contracts. CERCLA offers multiple opportunities for public participation.

C. Kristen countered that it was open to RAB members in the past and she is just asking to watch the process for transparency.

A. Chris replied that there is a public participation process in place with many opportunities for comment on technical issues.

Q. A RAB member commented on installing more monitoring wells and spreading them out. For the residential pilot wells, are they still being monitored for fluctuations in concentrations? Who is responsible for that?

A. Caprice Shaw/MassDEP replied the State is monitoring them on a quarterly basis to ensure they are effective at removing PFAS at 20 ppt. The state installed point of entry

Meeting #5 - Barnes Air National Guard
Base (ANGB) Restoration Advisory
Board (RAB)
October 26, 2023, 6:00 p.m.

treatment systems, rather than a filter on faucet treatment. The filters are a double cylinder coal-based carbon treatment. Water is sampled at entry, at a mid-point between filters, and after the second filter. The second filter is there as a backup.

Q. The RAB member asked if these are the same as before?

A. Caprice replied that yes, they are the same since 2017.

Q. Tom Barzyk asked if there any off-base potential PFAS sources?

A. Dr. Boutt replied that there is an aircraft crash area and a soccer field that are two potential off-base sources of PFAS

- 13 Lt Col Carr made closing remarks, including thanking participants and presenters. Amy wrapped the meeting with final slides and adjourned the meeting at 8:13 pm.

Action Items

- 1 Amy Brand – Email July 2023 RAB meeting minutes to the RAB on October 27, 2023, and once approved, post on base website.
- 2 Kathleen – Poll RAB members about their preferred meeting location and report to Amy.
- 3 Chris – Research Barnes ANGB fire station site history and environmental processes prior its construction.
- 4 Chris Brown – Research the city's reimbursement agreement and report back to the RAB via email.



Barnes Air National Guard (ANG) Base Restoration Advisory Board Meeting #5 October 26, 2023



Agenda



- 6:00 PM Agenda Review and Hybrid Meeting Logistics
- 6:05 PM Welcome and Introductions
- 6:10 PM RAB Business
- 6:25 PM Environmental Restoration Program Status Update
- 6:40 PM TAPP Presentation
- 7:10 PM Public Questions and Comments
- 7:25 PM Closing Remarks
- 7:30 PM Adjourn



Hybrid Meeting Logistics

Amy Brand

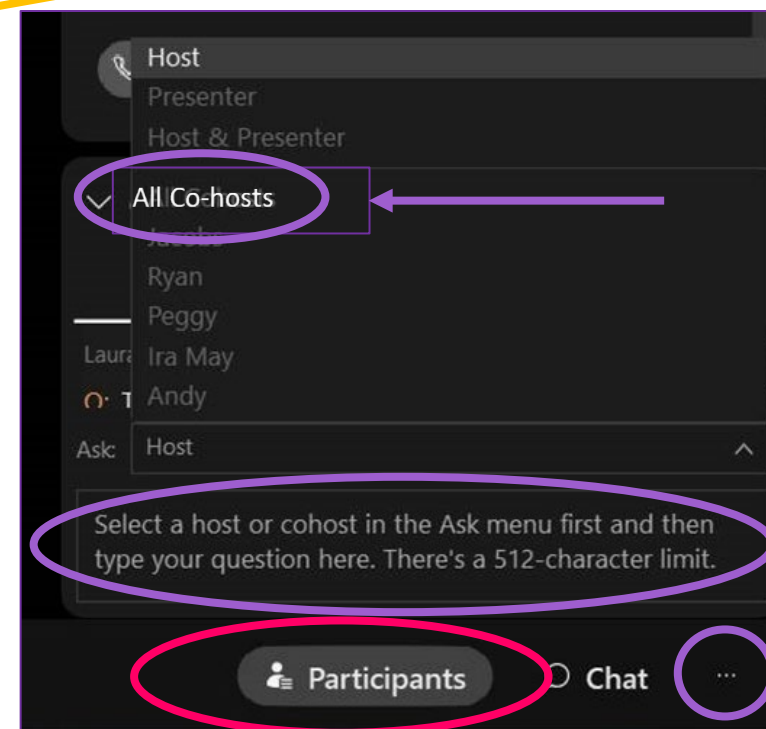
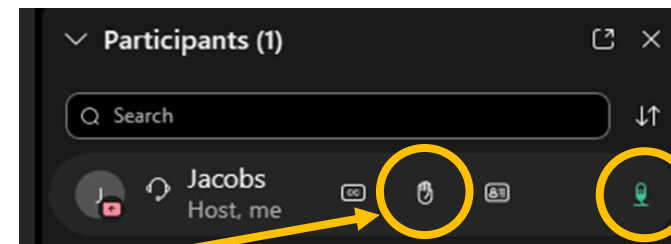
Jacobs

RAB Facilitator



Webex Basics – Computer

- Video – OFF except for presenters
- Open participants list
- To ask a question:
 - RAB Members - Raise hand to be called on to speak
 - Scroll over your name in the participant list and click on hand symbol
 - Unmute yourself when called on
 - Public participants - Type a question to “all co-hosts” in the Q&A panel
 - Click on 3 dots in lower right corner, choose Q&A
 - Select “all co-hosts” and type question
 - Questions will be answered at the end of the meeting





Webex Basics – Telephone Participants



- Follow along on slide presentation (emailed or download from 104th Fighter Wing website at <https://www.104fw.ang.af.mil/About/Restoration-Advisory-Board/>)
- Use your phone mute button when not speaking.
- Dial *3 to raise hand to be called on to speak after the presentation
 - Host will unmute you after seeing the raised hand
 - You will then receive a prompt to dial *6 on the phone to unmute yourself
 - Unmute and identify yourself when asking a question or making a comment.



Meeting Guidelines



- RAB Members
 - Ask questions at the end of each topic
 - Raise hand to be called on to speak
 - Introduce yourself so that everyone (in room and online) knows who is speaking
 - Please observe a 2-minute limit to enable other RAB members to participate.
- Public Participants
 - Submit questions in writing addressed to “all co-hosts”
 - Questions will be read and addressed at the end of the meeting
 - Public questions by phone may be asked verbally at the end of the meeting by pressing *3 to raise your hand



Welcome and Introductions

Col. David Halasi-kun

Kathleen Hillman



Welcome and Introductions



Air National Guard Team

Col. David Halasi-kun (Base Co-Chair)

Christopher Brown, National Guard Bureau

Jennifer Baker, 104th FW Environmental Coordinator

Contractors: BB&E, Jacobs (Amy Brand, RAB facilitator)

Community RAB Members

Kathleen Hillman, Community Co-Chair

Dr. David Boutt, TAPP Advisor

Chris Clark

Nabil Hannoush

Kristen Mello

Rachael Morin

Representative Kelly Pease

Senator John Velis

Regulatory Contact

Caprice Shaw, Massachusetts Department of Environmental Protection (MassDEP)



RAB Business

Amy Brand

Jacobs

RAB Facilitator



Meeting Summaries

- Draft meeting summary from RAB Meeting #4 (July 2023)
 - Emailed to the RAB – any comments?
 - Draft posted on the 104th FW website:
<https://www.104fw.ang.af.mil/About/Restoration-Advisory-Board/>



New RAB Members

- RAB members serve for a two-year term, but may continue if desired
 - All members began in August 2021
 - Eric Oulette resigned spring 2023
 - Do all current members want to continue?
- Process to add/replace members
 - Current RAB members are responsible for filling vacant or additional community RAB positions, up to a limit of 12 community members
 - Members should represent a cross-section of the Westfield community; members decide by majority vote to add a stakeholder interest not currently represented on the RAB
 - ANG advertised RAB membership opportunities and applications are available online
 - Three new applicants: Jane Okscin, Mary O'Connell, and Dawn Thomas
 - Vote by community members of the RAB



Upcoming Meetings

- Dates
 - Agreed on fourth Thursday of the month, every 3 months: January, April, July, October
 - Adjustments to be made when needed
 - Upcoming meetings: January 25, 2024
 April 25, 2024
 July 25, 2024
 October 24, 2024
- Meeting location
 - Westfield Athenaeum booked for Jan, April, and July meetings



Technical Assistance for Public Participation (TAPP) Grant

- Current TAPP awarded June 16 to University of Massachusetts Amherst to obtain technical support from Dr. David Boutt
 - Presentation tonight
 - Summary report submitted 26 October 2023
 - Grant period of performance ends 11 December 2023
- Next TAPP Grant?



RAB Member Discussion



- Please raise your hands and unmute yourself when recognized.
- Introduce yourself at the beginning of your question or comment.
- Please limit questions to 2 minutes to give other RAB members an opportunity to participate.



Environmental Restoration Program Status Update

Christopher Brown
National Guard Bureau



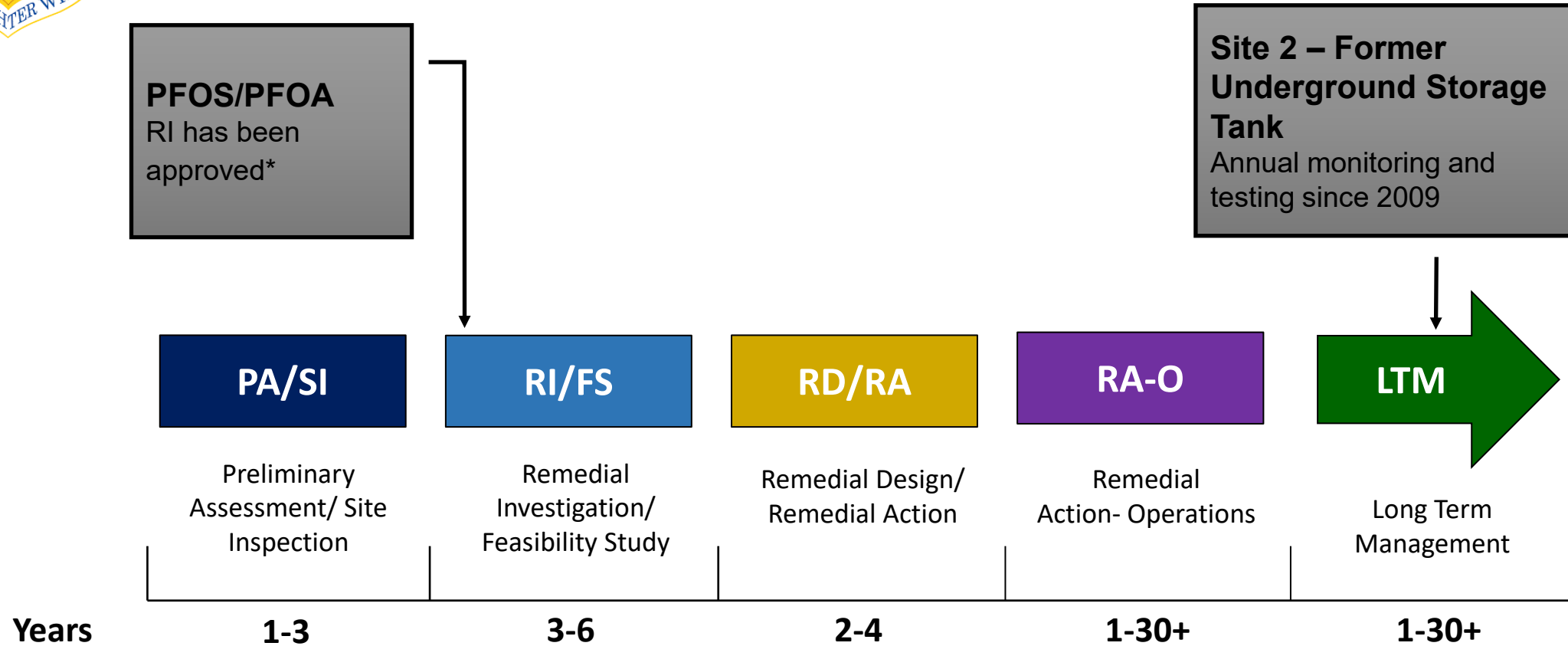
Environmental Restoration Program



- Environmental investigations/cleanup (Non-PFAS sites) has been ongoing at Barnes since 1987
 - Six sites have been cleaned up and closed by 2015
 - ERP Site 2 undergoing long-term monitoring
- PFAS Investigation
 - Preliminary Assessment 2016
 - Site Investigation 2018
 - September 2019 Intergovernmental Agreement to reimburse Westfield \$1,350,917.26 for costs incurred to install treatment on PWS Wells 7 & 8
 - Expanded Site Inspection 2020



CERCLA Process



- * Many factors are considered when moving an environmental project to the next phase of work, including available funding.
- ** DoD can take short-term action anytime during the process, if there are exceedances of the HA of 70ppt.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act



Next Steps



- Next step is the Remedial Investigation (RI)
 - RI will determine nature and extent of PFAS migration
- Status of Remedial Investigation
 - Project awarded 28 Sept 2023
 - Schedule Coming Soon
 - Kick off meeting next week
- Post Award
 - Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP), Date TBD (Summer/Fall 2024)
 - Initial Field Work (Summer/Fall 2024)





TAPP Presentation

Dr. David Boutt
University of Massachusetts - Amherst
Department of Earth, Geographic, and Climate Sciences



Technical Assistance for Public Participation Grant



- TAPP Advisor: Dr. David Boutt, Professor of Hydrogeology, UMass-Amherst
- Grant scope:
 - To conduct an independent review of completed reports associated with Westfield MA PFAS contamination
 - To provide the RAB with progress reports at regularly scheduled RAB meetings
 - To provide RAB members and the community a public presentation summarizing the conclusions, including a questions and answer period
 - To provide a summary report



Dr. Boutt's Presentation



RAB Member Discussion



- Please raise your hands and unmute yourself when recognized.
- Introduce yourself at the beginning of your question or comment.
- Please limit questions to 2 minutes to give other RAB members an opportunity to participate.



Public Questions and Comments



In person: Raise hand to be recognized

Online: Submit questions using the written Q&A feature



Contact Information



104th Fighter Wing, Barnes Air National Guard Base

Base Co-Chair
Commander
Col. David Halasi-kun

Environmental Manager
Ms. Jennifer Baker

Public Affairs Manager
SSgt Randall Burlingame
(413) 568-9151 x 698-1202
Randall.burlingame@us.af.mil

Community Co-Chair

Kathleen Hillman
khillman179@gmail.com

National Guard Bureau

Program Manager
Mr. Christopher Brown
(240) 612-7275
christopher.brown.261@us.af.mil

Massachusetts Department of Environmental Protection

Caprice Shaw
(413) 755-2222
Caprice.shaw@state.ma.us



Websites for More Information



Environmental Restoration Program at 104th Fighter Wing

- General and Links to PFOS/PFOA Information: <https://www.104fw.ang.af.mil/About/Environmental/>
- Restoration Advisory Board: <https://www.104fw.ang.af.mil/About/Restoration-Advisory-Board/>

Relative Risk Site Evaluation (RRSE)

- Barnes RRSE: https://www.104fw.ang.af.mil/Portals/5/Barnes_RRSE%20Fact%20Sheet%20and%20Scoring%20Summaries_211215.pdf
- RRSE Primer: https://www.denix.osd.mil/references/dod/policy-guidance/relative-risk-site-evaluation-primer/RRSE_Primer_Summer1997.pdf

104th Fighter Wing Environmental Administrative Record

- <https://ar.afcec-cloud.af.mil/Search.aspx> (Select ANG radio button, select Barnes, and click on search)

MassDEP PFAS Information

- <https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas>

Westfield Water Department PFAS Information

- <https://www.cityofwestfield.org/672/PFCs-Information-Updates>

RAB Rule Handbook and Information on Technical Assistance for Public Participation

- <https://www.denix.osd.mil/rab/home/>

Air Force Response to PFOS and PFOA

- <https://www.afcec.af.mil/WhatWeDo/Environment/Perfluorinated-Compounds/>

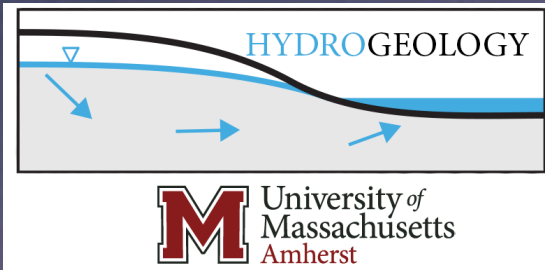


Closing Remarks

Kathleen Hillman
Col. David Halasi-kun



Adjourn



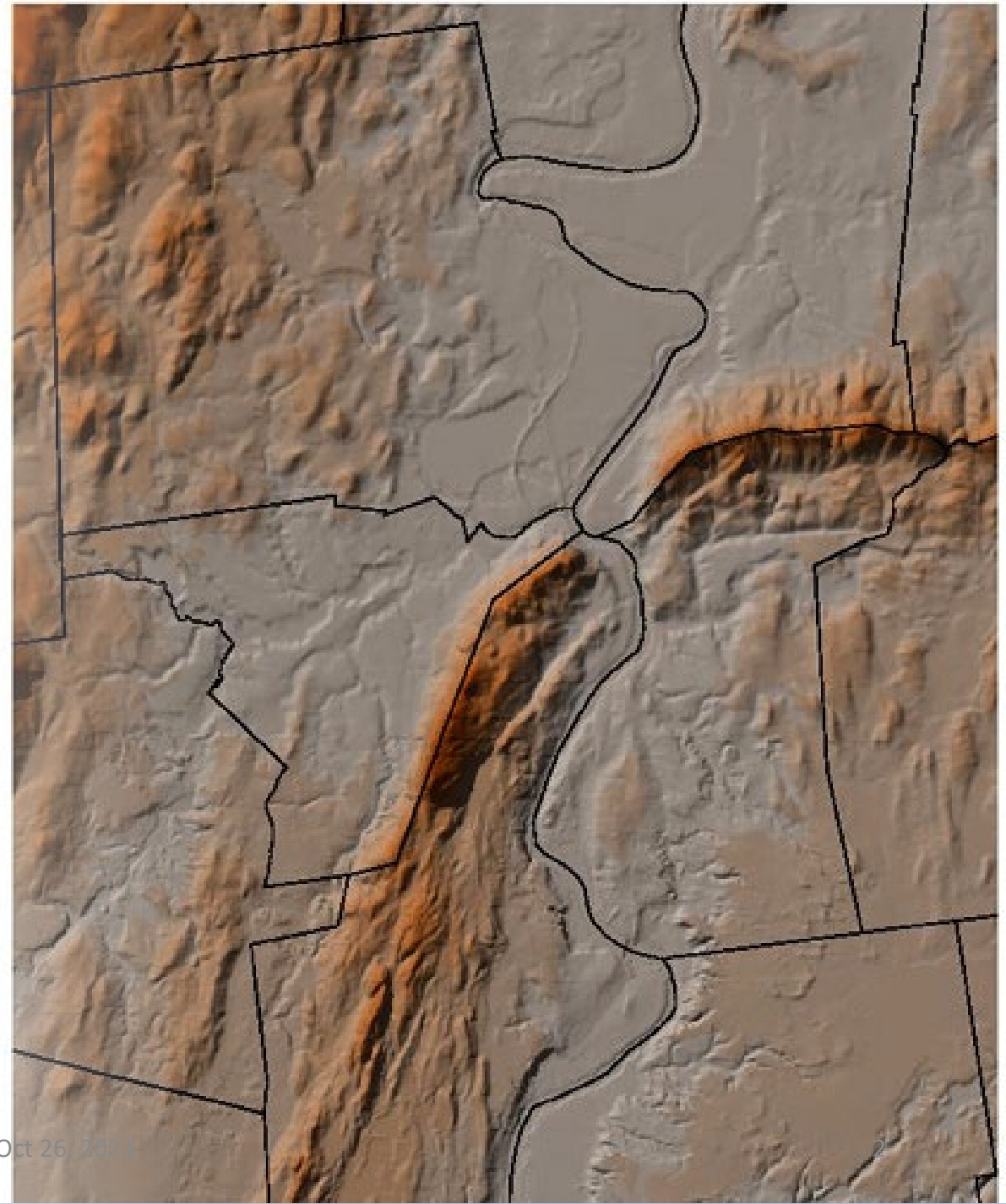
Review of Technical Documents Associated with PFAS Contamination

Professor David F. Boutt, Ph.D.
University of Massachusetts-Amherst



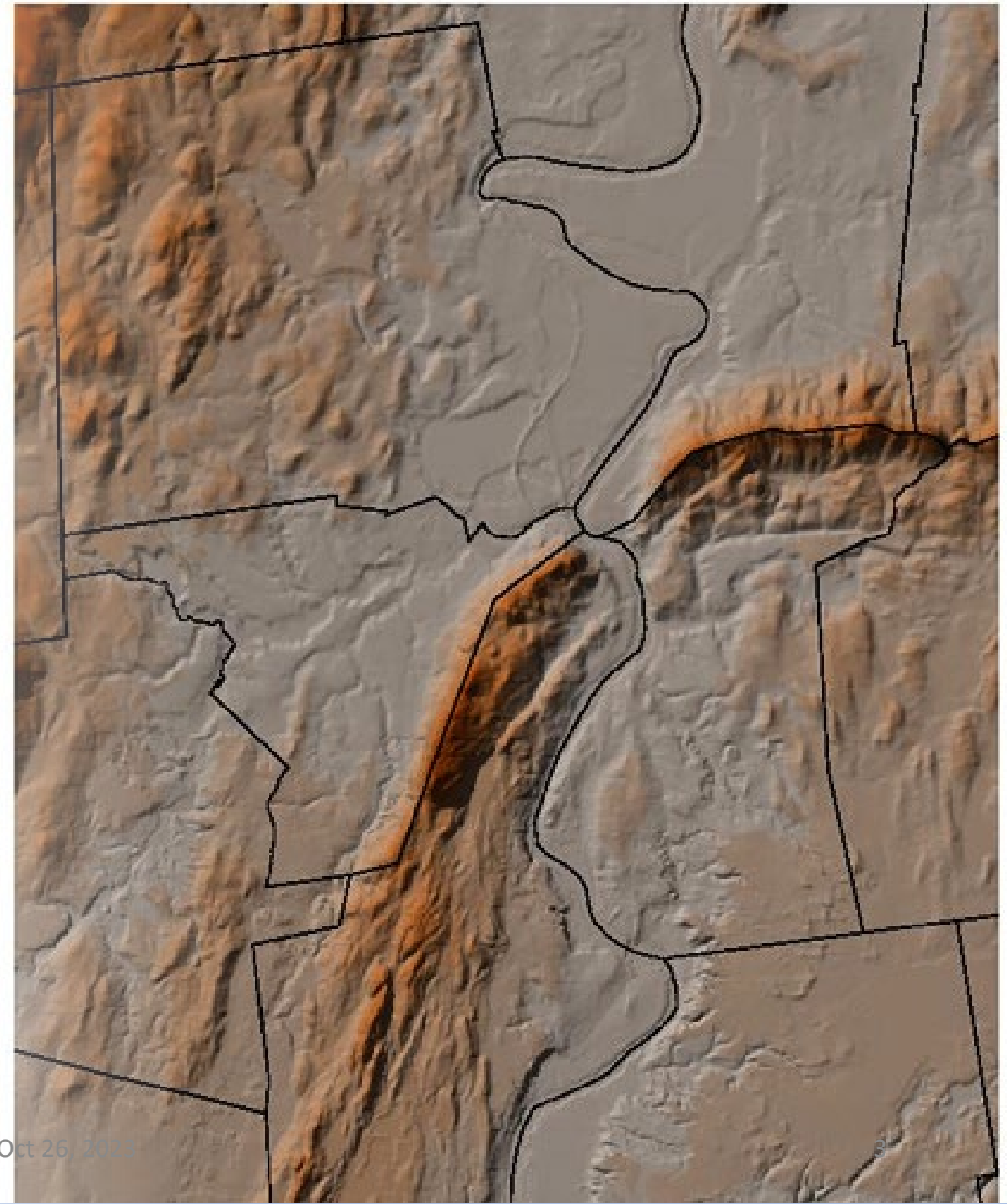
Presentation Overview

- Scope of Review and Presentation
- The Barnes Aquifer System
- Overview of Reports and Data
- PFAS Plume
 - Characteristics
 - Size
 - Migration
- Critical Findings/Concerns
- Recommendations



Presentation Overview

- Scope of Review and Presentation
- The Barnes Aquifer System
- Overview of Reports and Data
- PFAS Plume
 - Characteristics
 - Size
 - Migration
- Critical Findings/Concerns
- Recommendations

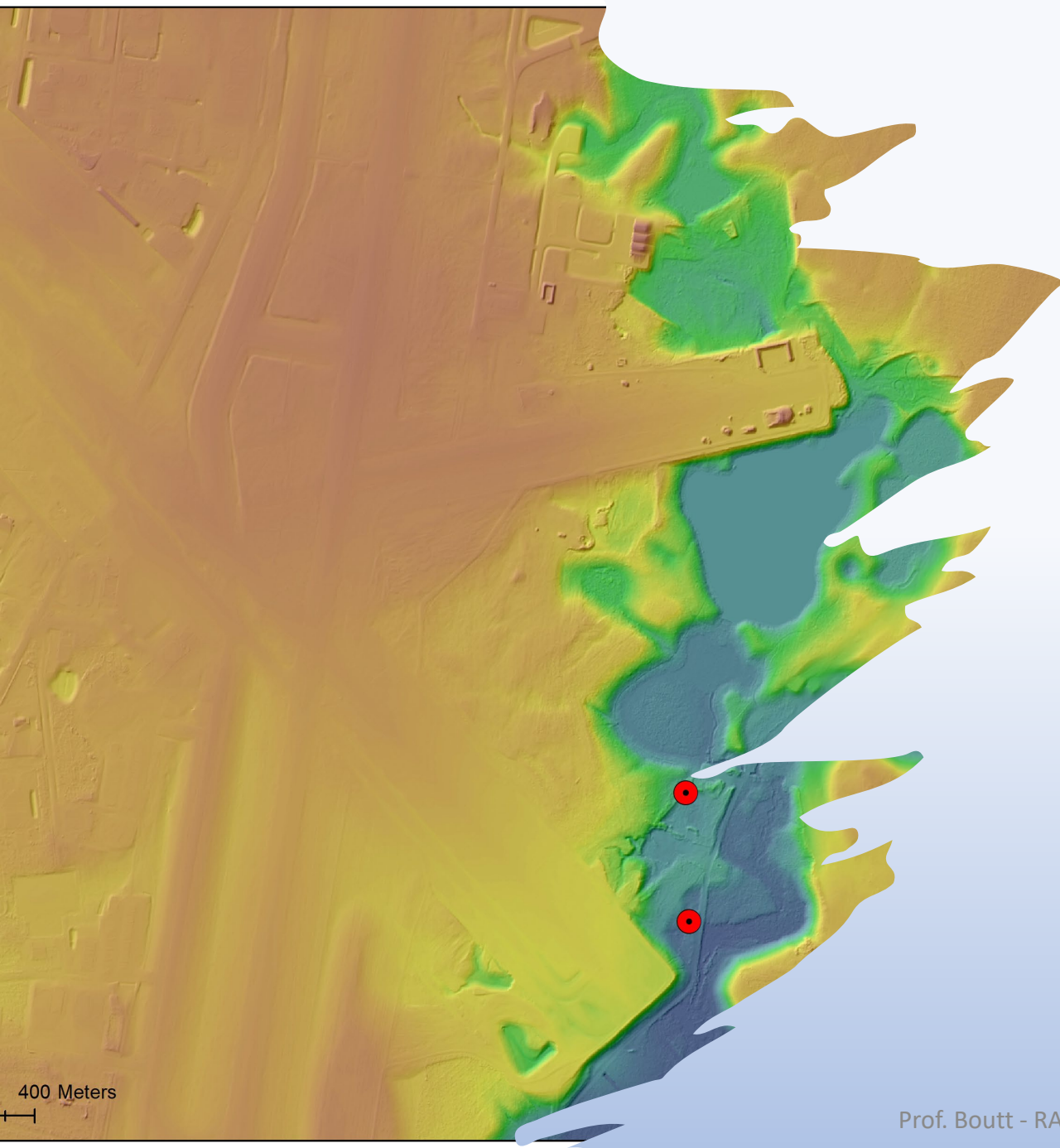


Scope of Review and Assessment

- Summarize the information gained from the reports in regard to the plume(s) associated with the PFAS contamination.
- Information assessed includes characteristics, size, migration, profile, fate, transport of the plume(s) as it relates to the municipal and private well water drinkers.
- This presentation is to help educate the RAB and Community to better understand all the technical documents completed at this time.

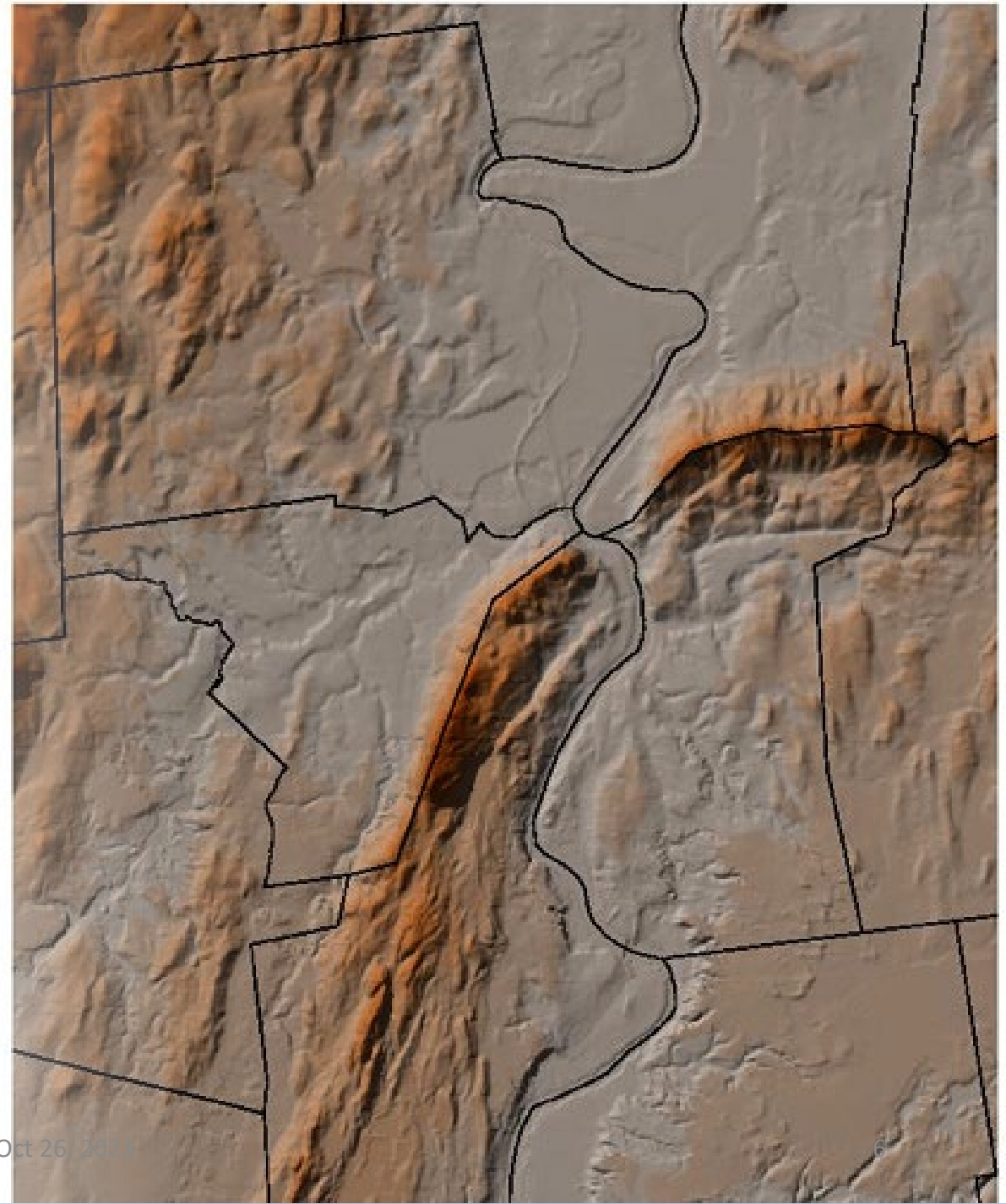
Reports Analyzed

- Final Perfluorinated Compounds Preliminary Assessment Site Visit Report (BB&E. 2016)
- MA DEP NOES & Private Well Sampling Results (2017- Present)
- Final Phase 1 Regional Site Inspection Report for Perfluorinated Compounds (AMEC. 2018)
- Final Expanded Site Inspection Report for PFAS. (Parsons. 2020)

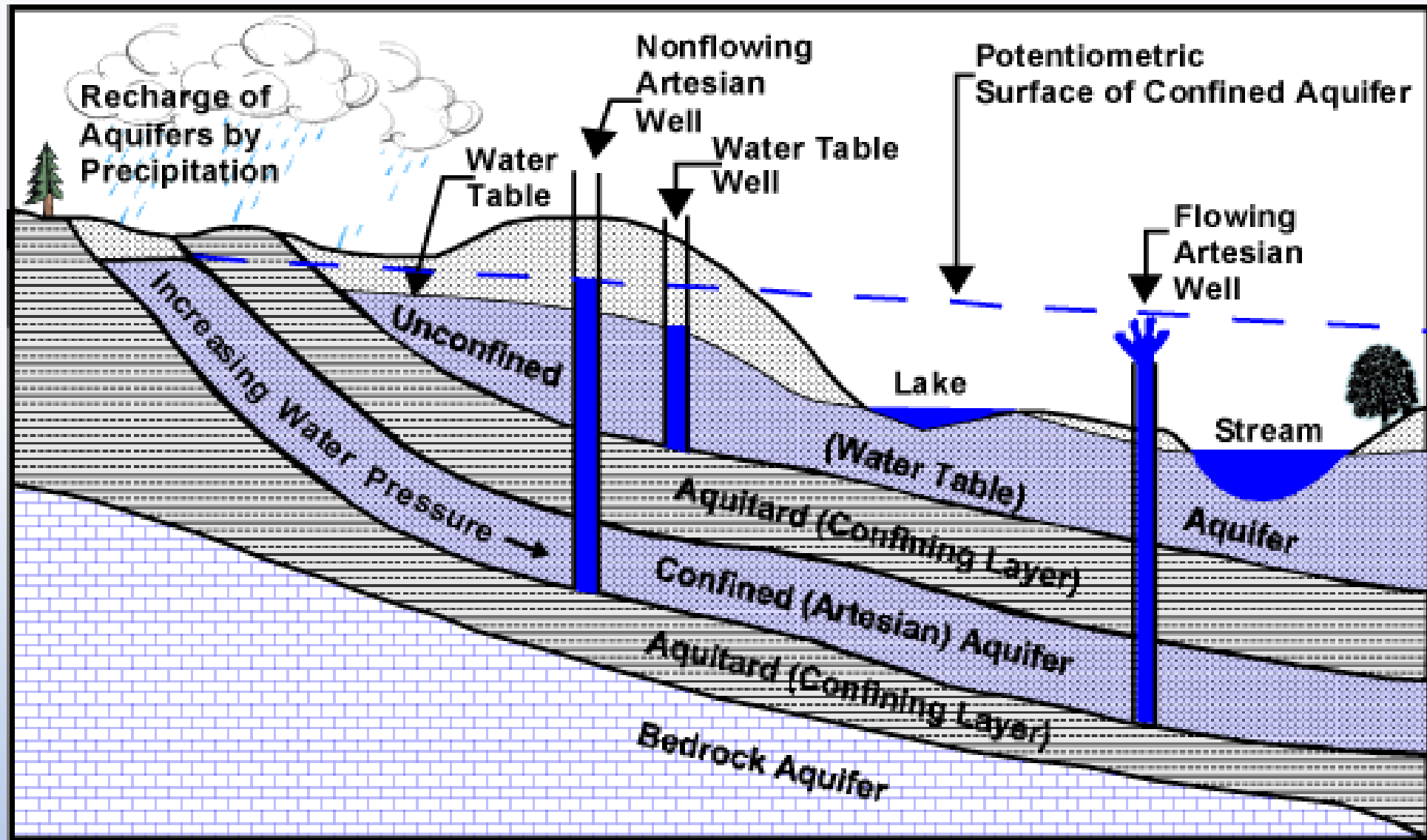


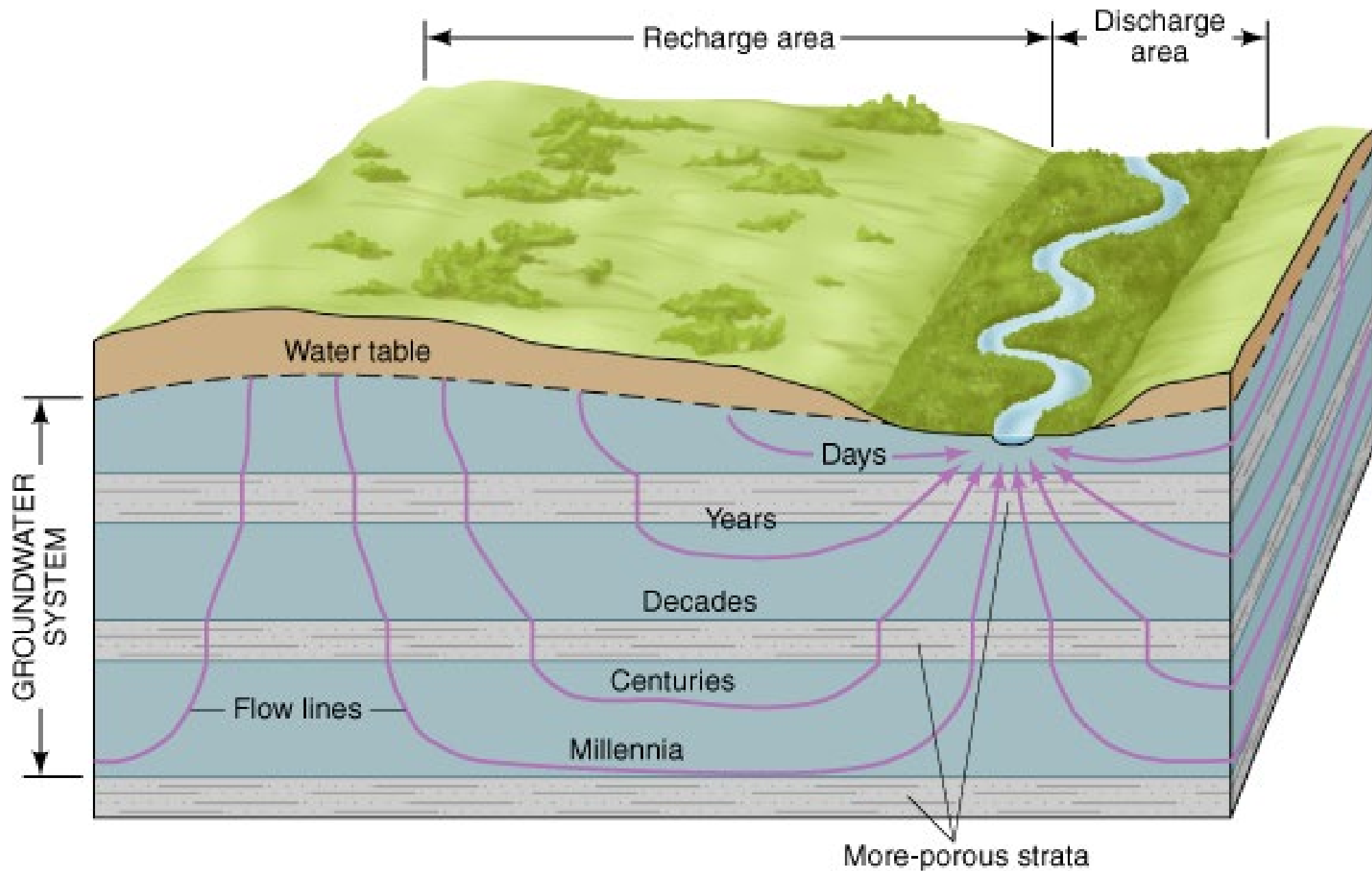
Presentation Overview

- Scope of Review and Presentation
- **The Barnes Aquifer System**
- Overview of Reports and Data
- PFAS Plume
 - Characteristics
 - Size
 - Migration
- Critical Findings/Concerns
- Recommendations



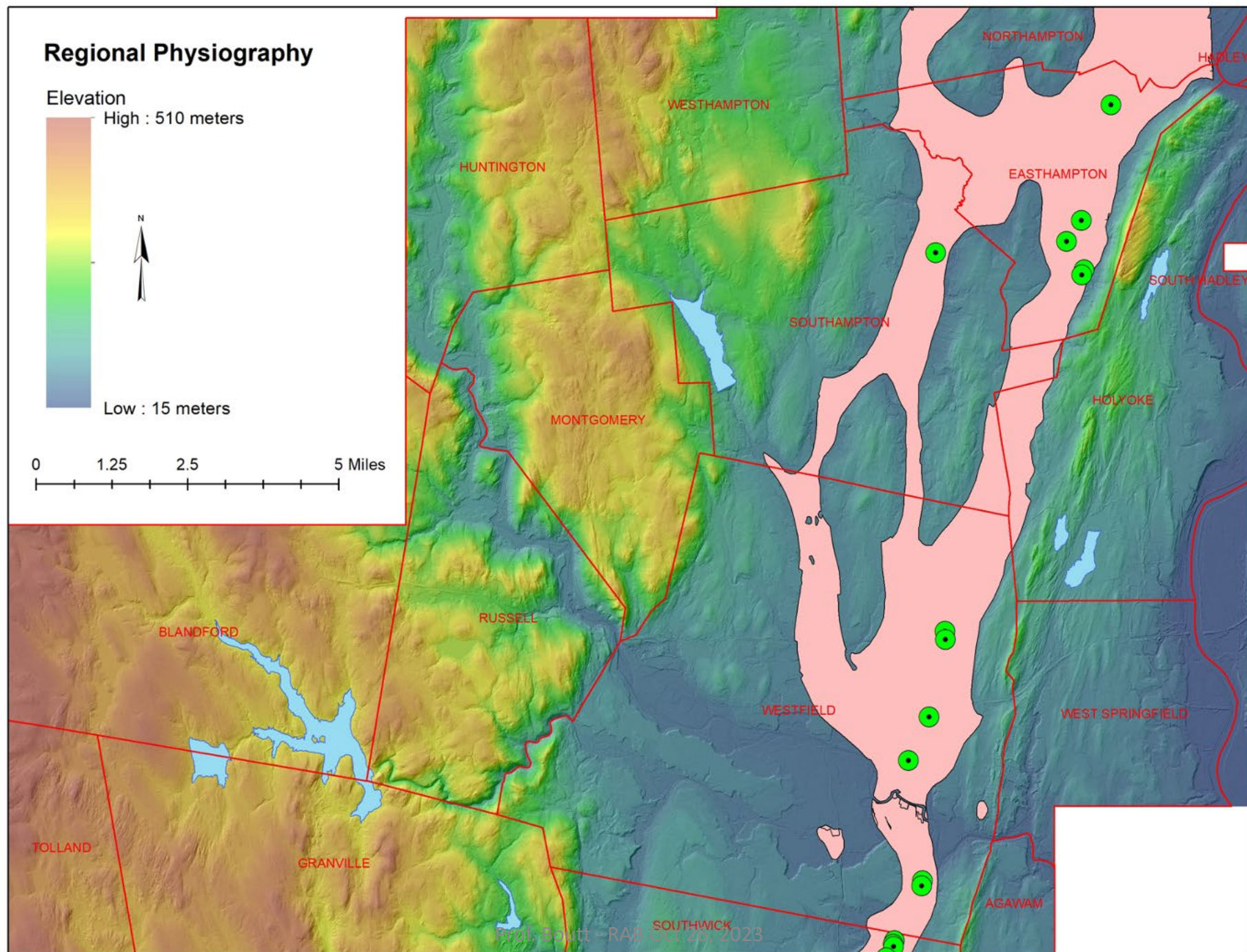
Groundwater Processes

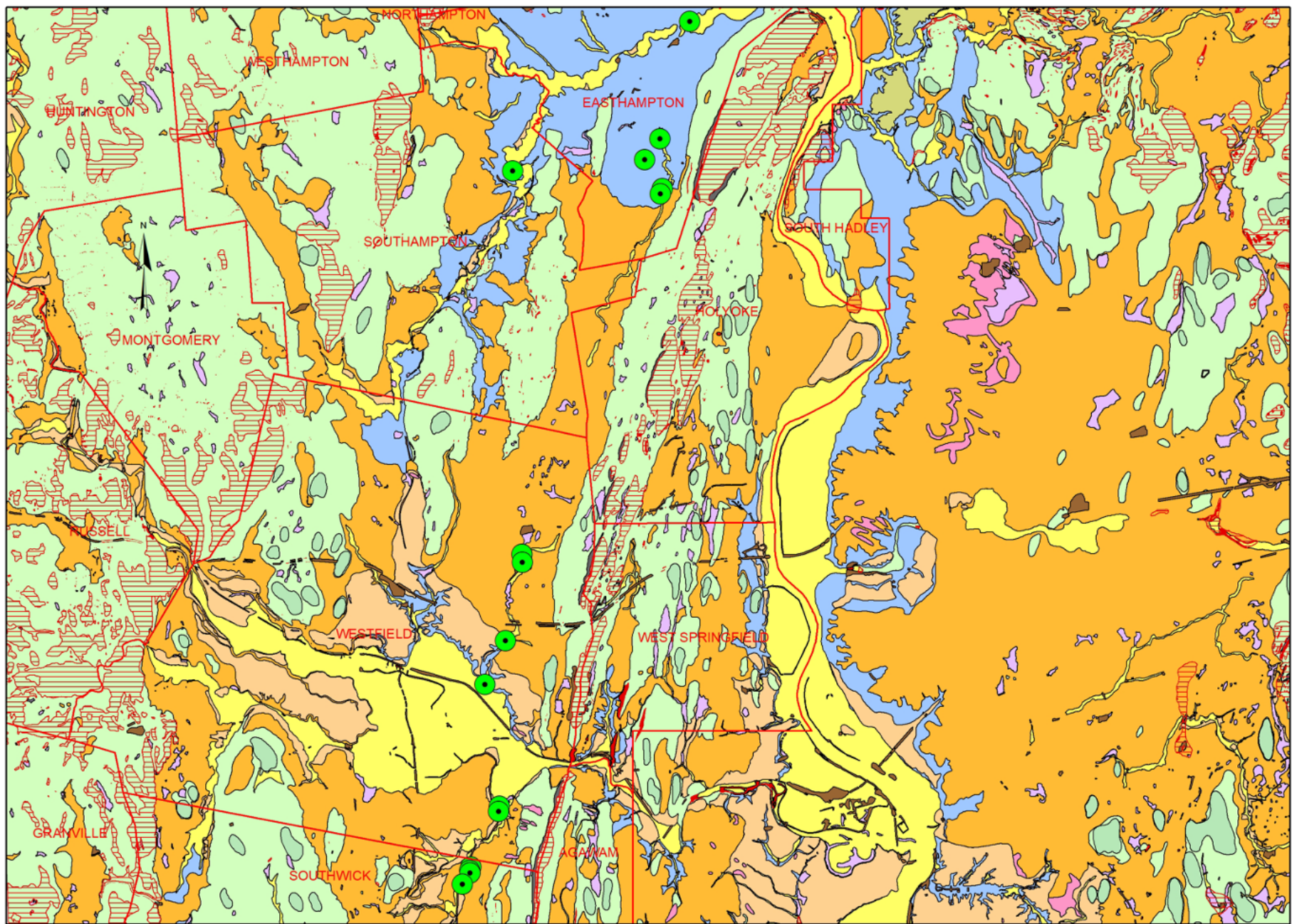




An aerial photograph of a glacial outwash plain. On the left, a steep, rocky mountain slope descends towards a wide, flat area covered in grey and brown sediment. A braided river system with multiple channels and sandbars flows through the center of the plain. In the background, a dense forest of evergreen trees covers a rising slope. The overall scene is a typical glacial landscape in a mountainous region.

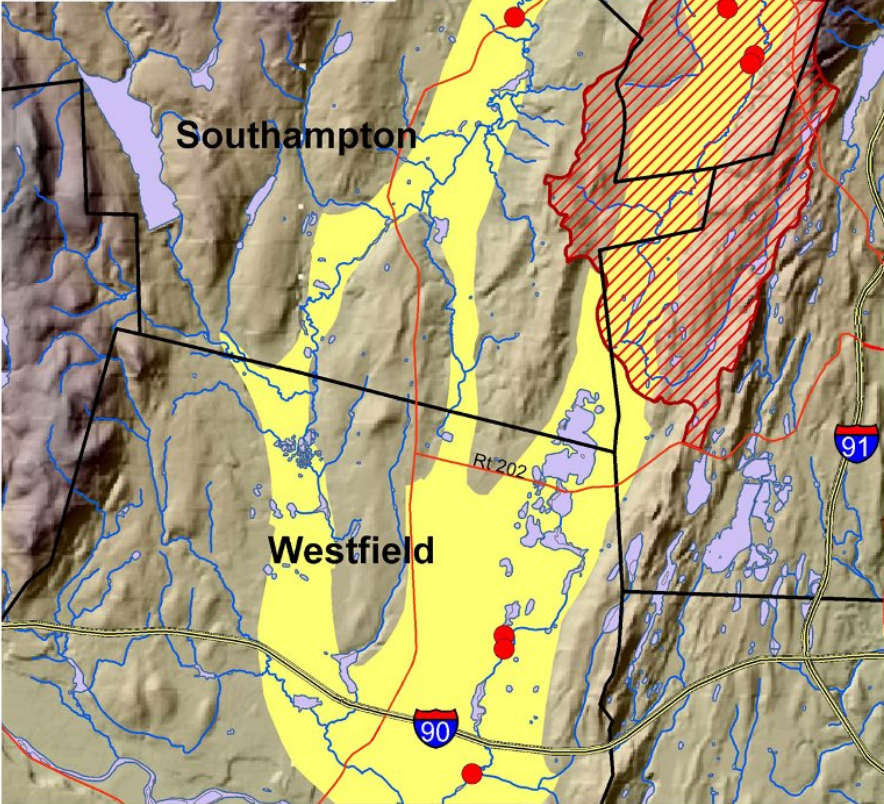
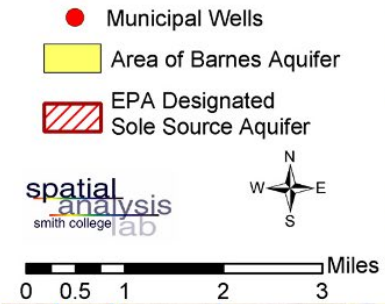
The Barnes Aquifer



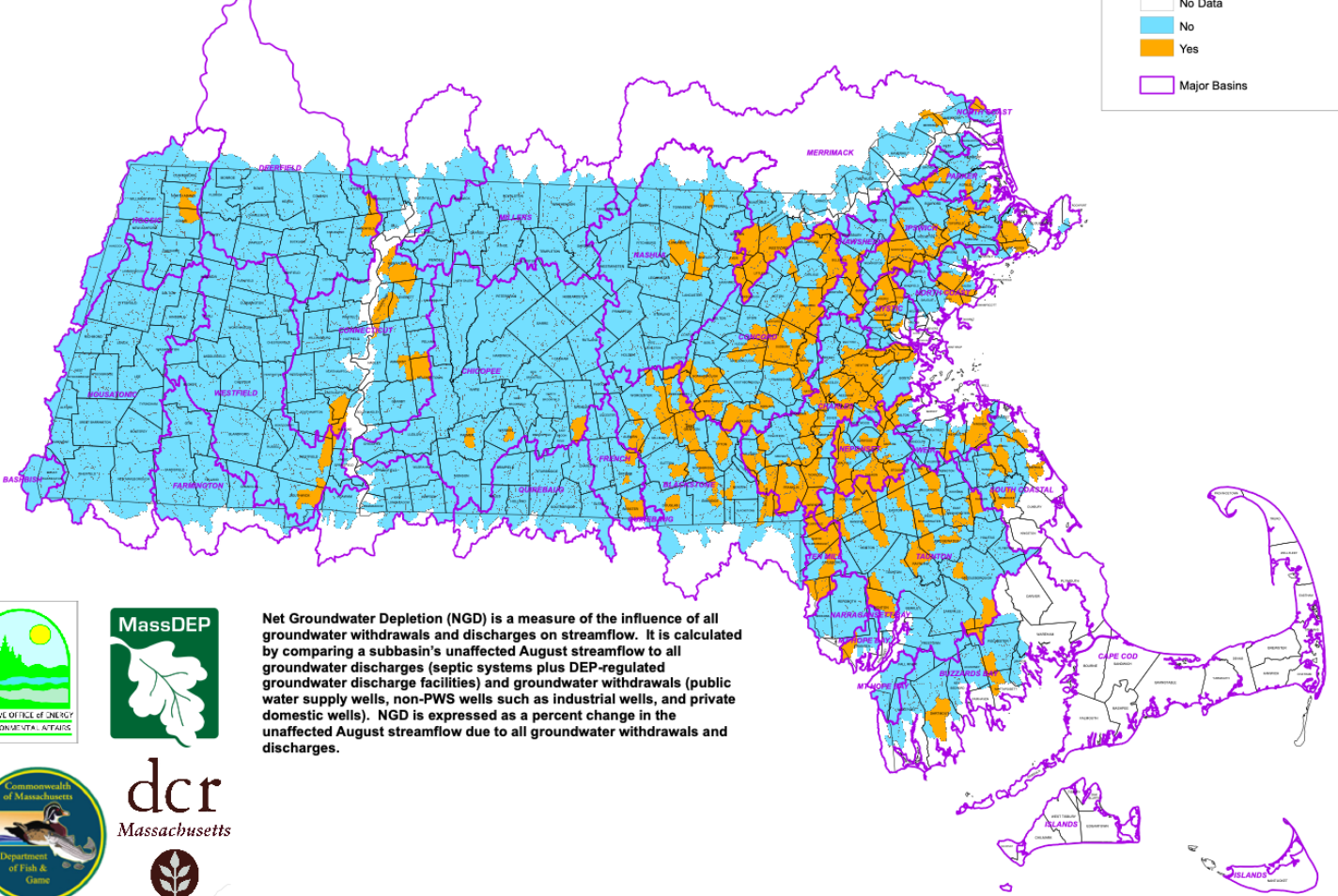
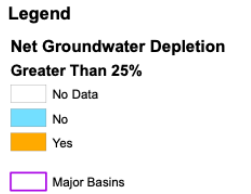


0 1.25 2.5 5 Miles
Prof. Boutt - RAB Oct 26, 2023

Map of the Barnes Aquifer



Net Groundwater Depletion (NGD) for the Sustainable Water Management Initiative (SWMI)



Net Groundwater Depletion (NGD) is a measure of the influence of all groundwater withdrawals and discharges on streamflow. It is calculated by comparing a subbasin's unaffected August streamflow to all groundwater discharges (septic systems plus DEP-regulated groundwater discharge facilities) and groundwater withdrawals (public water supply wells, non-PWS wells such as industrial wells, and private domestic wells). NGD is expressed as a percent change in the unaffected August streamflow due to all groundwater withdrawals and discharges.

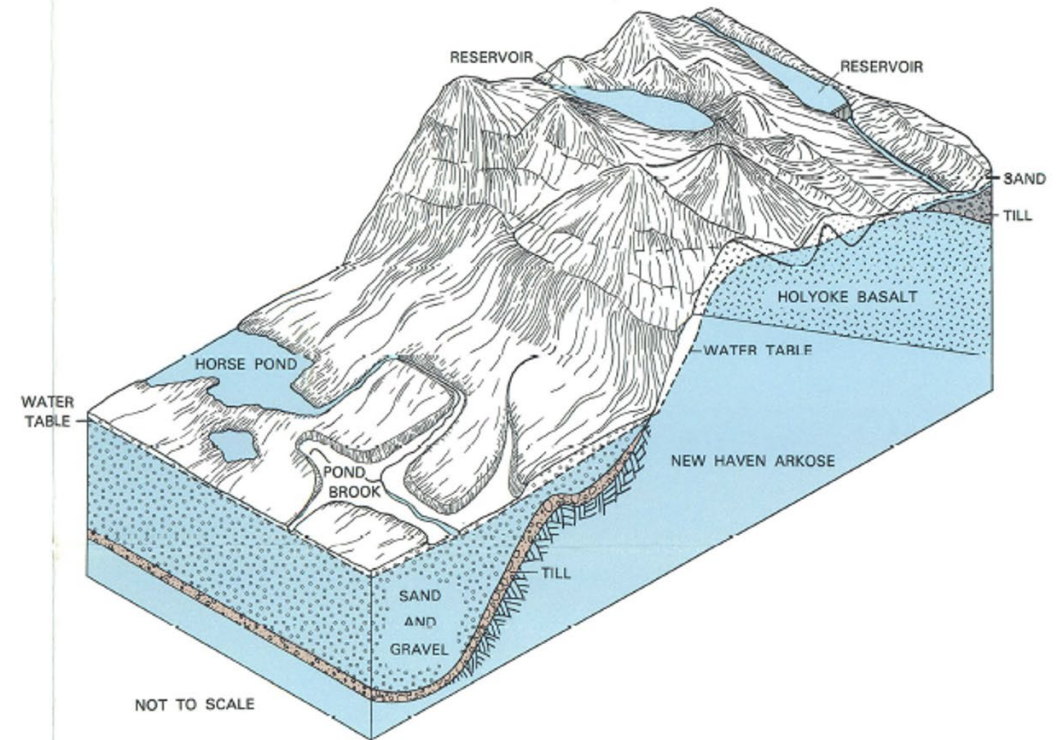
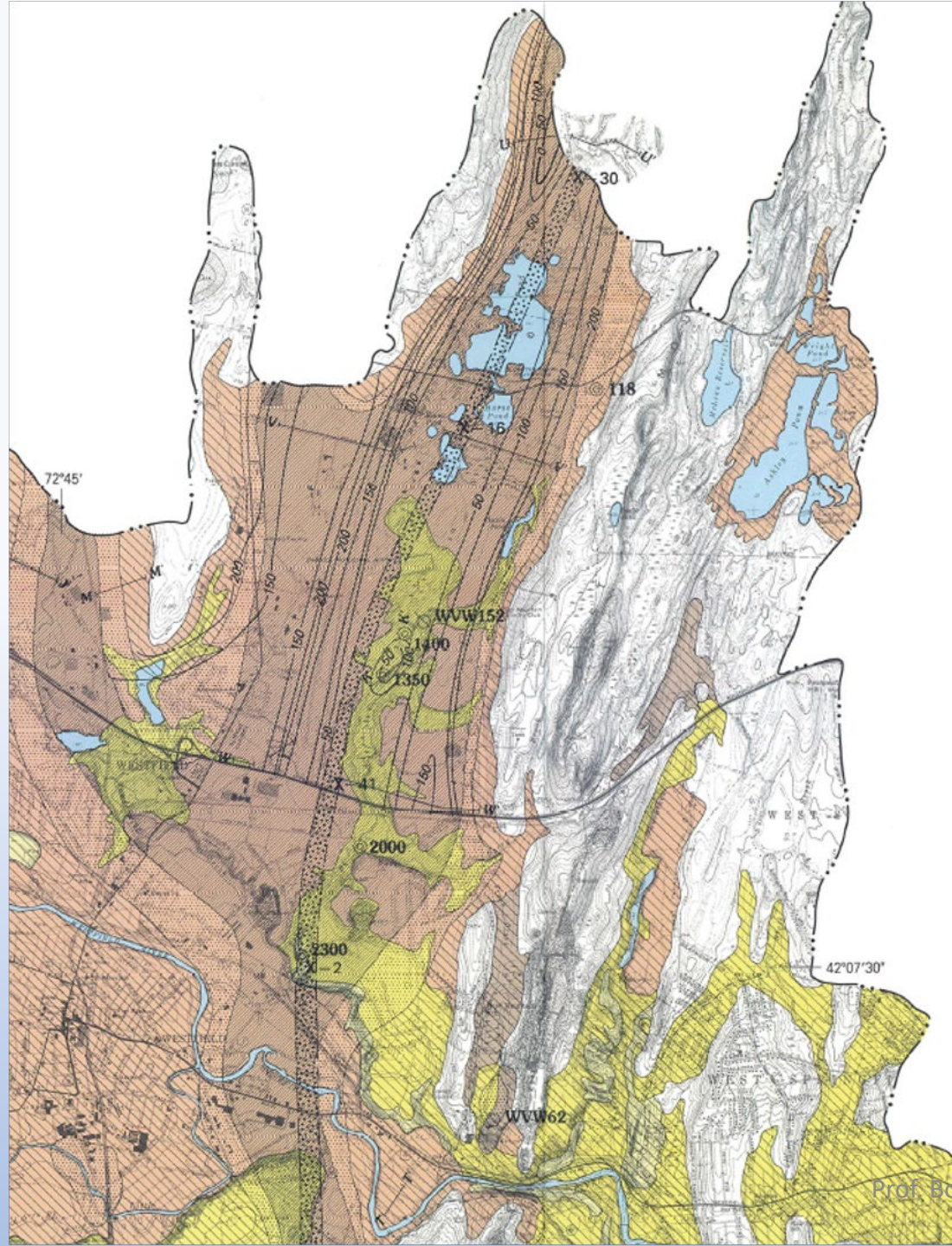
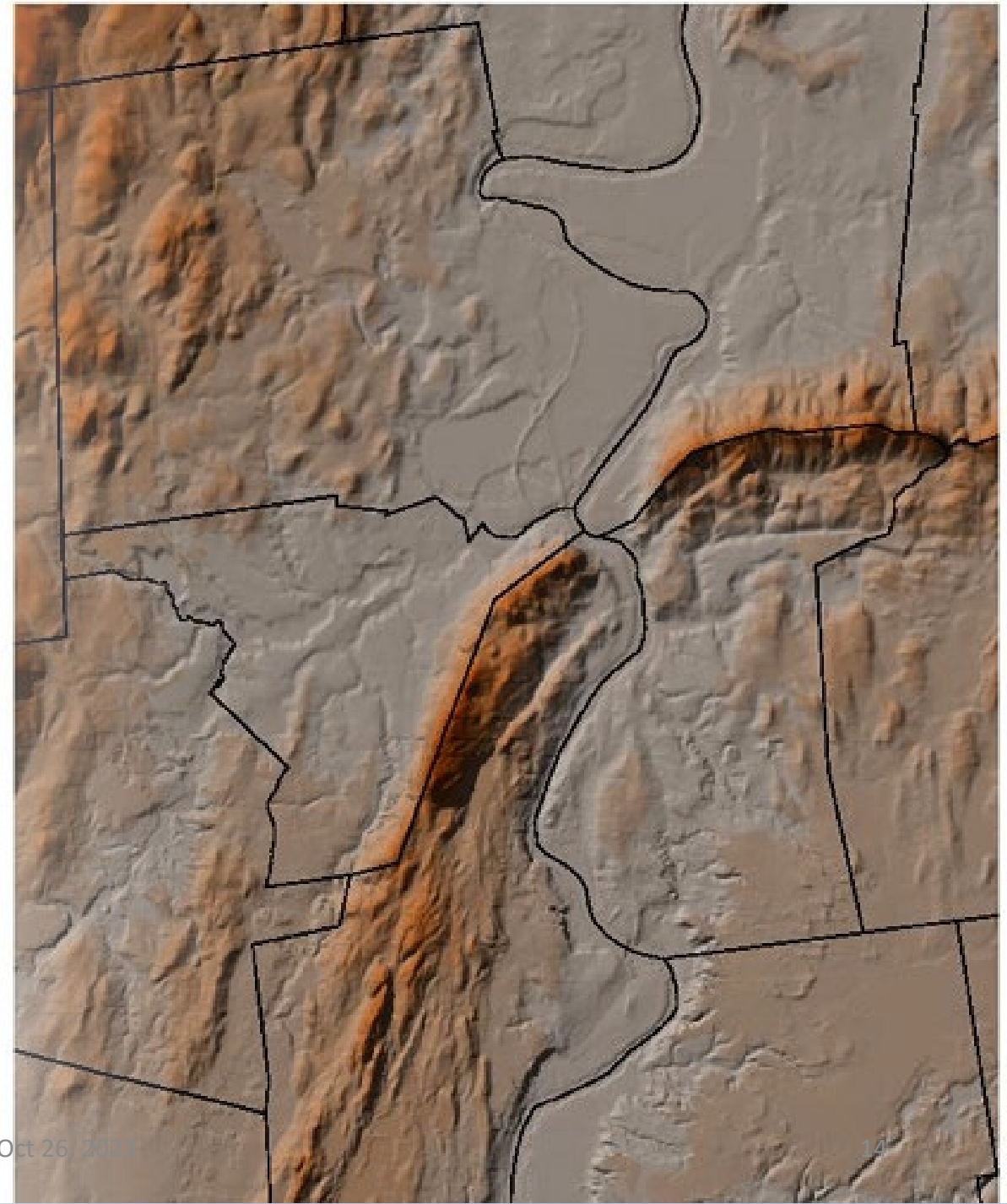


FIGURE 4.—Idealized section of the Pond Brook aquifer.

Presentation Overview

- Scope of Review and Presentation
- The Barnes Aquifer System
- Overview of Reports and Data
- PFAS Plume
 - Characteristics
 - Size
 - Migration
- Critical Findings/Concerns
- Recommendations



FINAL

**PERFLUORINATED COMPOUNDS PRELIMINARY ASSESSMENT
SITE VISIT REPORT**

**BARNES AIR NATIONAL GUARD BASE
WESTFIELD, MASSACHUSETTS**



Prepared For:

**Headquarters Air National Guard
Joint Base Andrews, Maryland**

January 2016

Prof. Boutt - RAB Oct 26, 2023

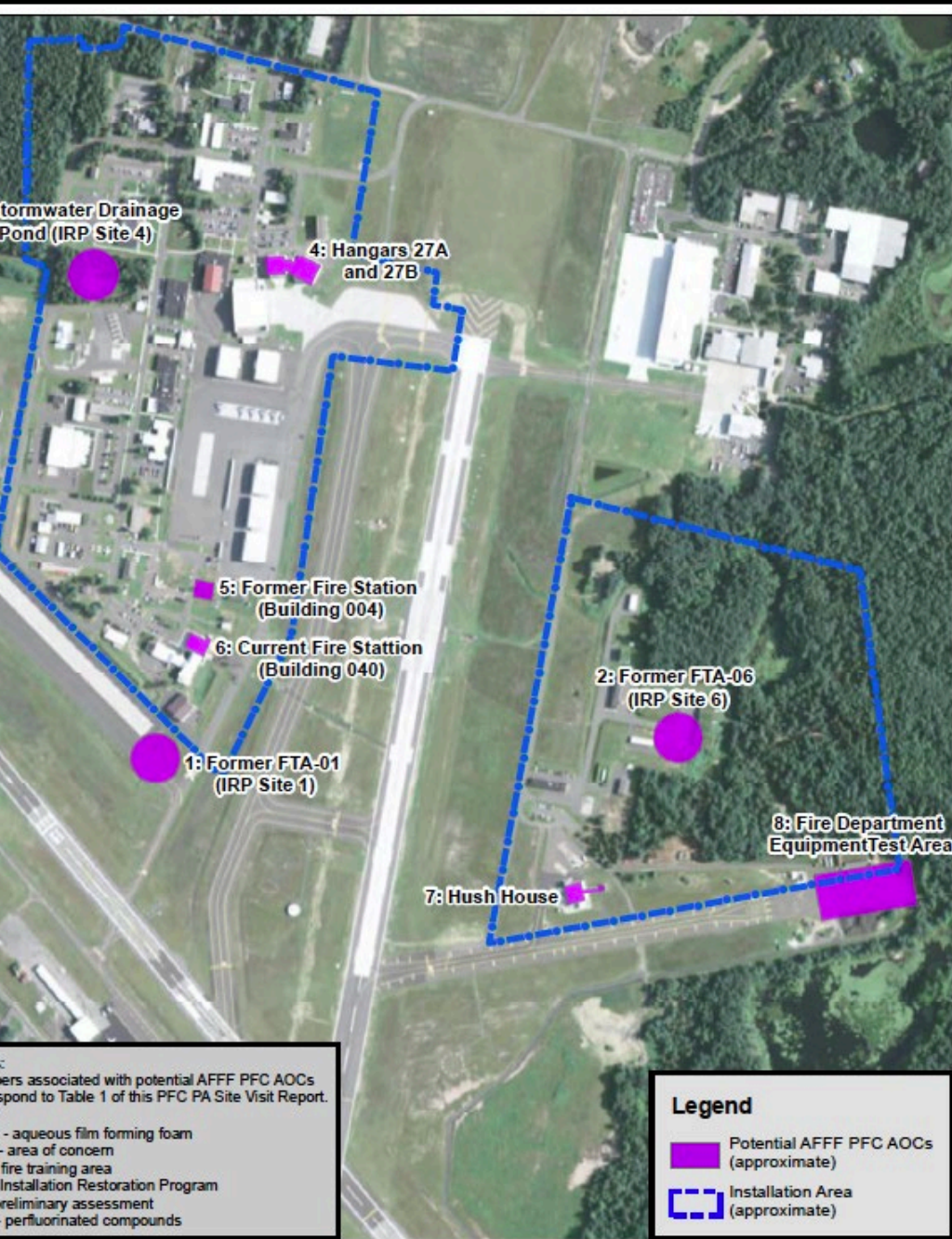


Figure 2
Site Features and Potential AOCs

Table 1: Preliminary Assessment Report Summary and Recommendations

No.	Potential AFFF PFC AOC	GPS Coordinates		Rationale	Recommendation
		Latitude	Longitude		
1	Former FTA-01 (ERP Site 1)	42.163943°	-72.718612°	AFFF likely utilized at this FTA located on or just south of ANG boundary, exact footprint unclear. FTA activities appear to have extended onto current ANG installation.	Proceed to SI, focus on soil and groundwater.
2	Former FTA-06 (ERP Site 6)	42.164233°	-72.709567°	AFFF likely not utilized due to age of FTAs.	NFA
3	Stormwater Drainage Basin (ERP Site 4)	42.170343°	-72.719542°	Received AFFF discharges from the flight line area and from former floor and trench drains located in the hangars and buildings on the flight line.	Proceed to SI, focus on sediments and groundwater.
4	Hangars 27A and 27B	42.170529°	-72.716208°	No documented AFFF releases.	Proceed to SI, focus on soil and groundwater.
5	Former Fire Station – Building 004	42.166498°	-72.718292°	Floor drains in former station likely went to drywell associated the former facility. Facility used from the 1940s to approximately 1990.	Proceed to SI, focus on soil and groundwater.
6	Current Fire Station – Building 040	42.165504°	-72.717890	No documented AFFF releases. No floor drains.	Proceed to SI, focus on soil and groundwater.
7	Hush House	42.162205°	-72.711083°	One potential documented release likely from original fire suppression test. Any releases would have gone to the sanitary sewer.	Proceed to SI, focus on soil and groundwater.
8	Fire Department Equipment Test Area	42.162271°	-72.705777°	At least three AFFF foam tests conducted; possible earlier use as fire equipment test area in early 1990s.	Proceed to SI, focus on soil and groundwater.



**FINAL REPORT
FY16 PHASE 1 REGIONAL SITE INSPECTIONS
FOR PERFLUORINATED COMPOUNDS**

**MASSACHUSETTS AIR NATIONAL GUARD
104TH FIGHTER WING
BARNES AIR NATIONAL GUARD BASE
WESTFIELD, MASSACHUSETTS**

Contract #: W9133L-14-D-0002
Delivery Order 0006

Amec Foster Wheeler Project #: 2-9133-0006

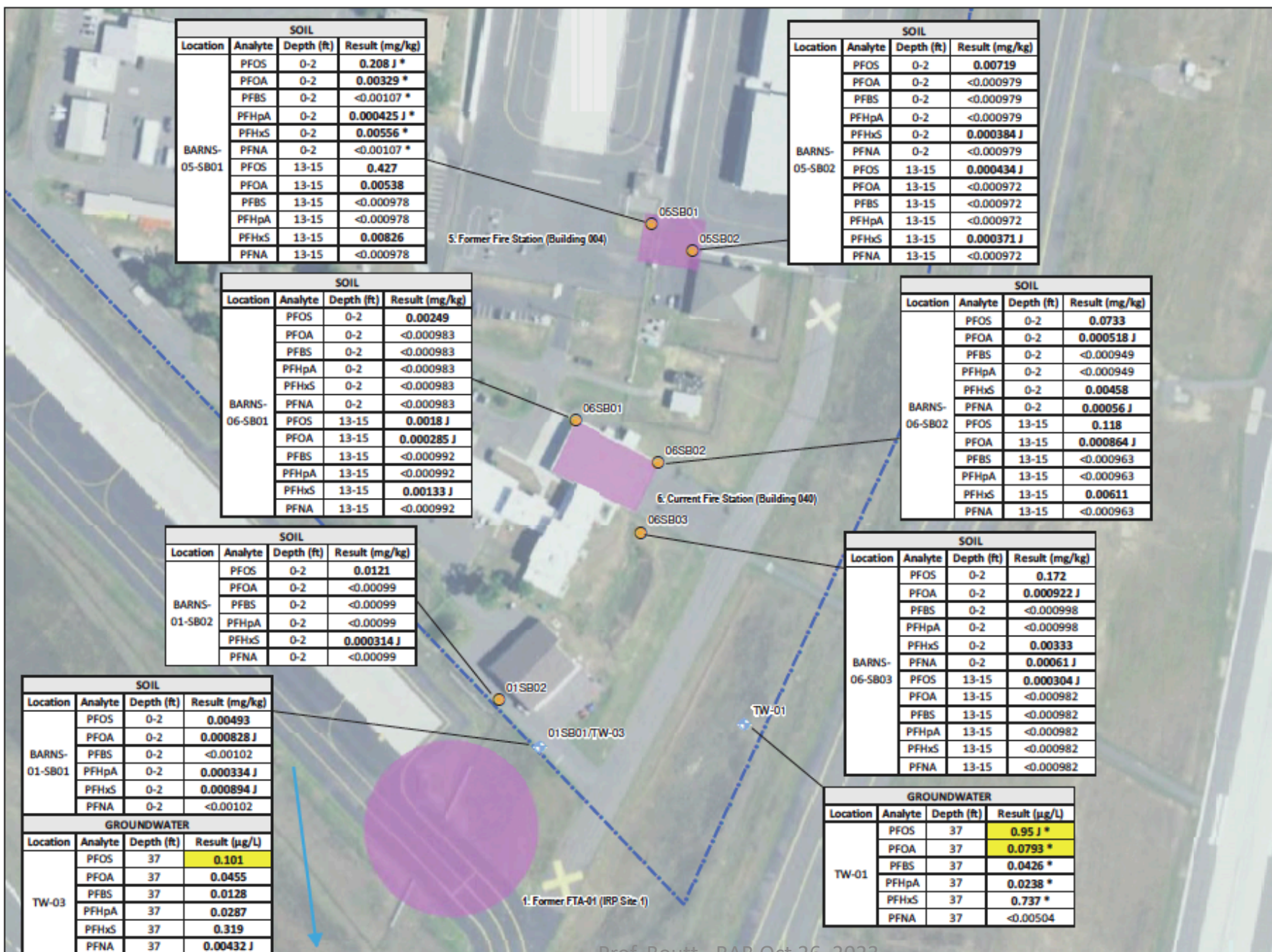
Prof. Boutt - RAB Oct 26, 2023

March 13, 2018

The following SI field activities were completed:

PRL Name	Analyzed Parameters	Soil Borings	Soil Samples	Groundwater Samples Existing Wells	Groundwater Samples Temporary Wells	Surface Water Samples	Sediment Samples
1. Former FTA-01 (IRP Site 1)	PFCs	2	2	0	1	0	0
3. SW Drainage Basin (IRP Site 4)	PFCs	0	0	1	0	0	2
4. Hangars 27A and 27 B	PFCs	3	6	0	1	0	0
5. Former Fire Station (bldg. 004)	PFCs	2	4	0	0	0	0
6. Current Fire Station (Bldg. 040 S)	PFCs	3	6	0	1	0	0
7. Hush House	PFCs	2	4	0	1	0	0
8. Fire Department Equipment Test Area	PFCs	2	2	0	1	0	0

PRL	Screening Criteria Exceedance		Recommendation
	Soil	GW	
PRL 1: Former FTA (IRP Site 1);	Inc.	X	Soil investigation to determine if PFCs exceed screening criteria off-Base. Groundwater (GW) investigation to determine the nature and extent of the confirmed release.
PRL 3: Stormwater Drainage Basin;			NFA
PRL 4: Hangars 27A & 27B;		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 5: Former Fire Station, Bldg. 004;		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 6: Current Fire Station, Bldg. 040;		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 7: Hush House		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 8: Fire Department Equipment Test Area.	Inc.	Inc.	Soil and GW investigation to determine if PFCs exceed screening criteria off-Base.



PRLs 1, 5 & 6 SAMPLE RESULTS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:
 AFFF - aqueous film forming foam
 PRL - potential release location
 PFC - perfluorinated compounds
 PFOA - Perfluorooctanesulfonic acid
 PFOA - Perfluorooctanoic acid
 PFBS - Perfluorobutanesulfonic acid
 PFHpA - Perfluorohexanesulfonic acid
 PFHxS - Perfluorohexanoic acid
 PFNA - Perfluorononanoic acid

BOLD text indicates a detection.

YELLOW highlighted cells indicate 0.07 µg/L Health Advisory Exceedance.

* Field duplicate value exceeded primary sample.

Sources: Potential AFFF PFC PRLs and Installation Area are datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150
Feet



Amec Foster Wheeler
Environment & Infrastructure, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090



FIGURE



FINAL EXPANDED SITE INSPECTION REPORT FOR PER- AND POLY-FLUOROALKYL SUBSTANCES (PFAS) AT THE BARNES

The NGB/A4VR performed a Preliminary Assessment (PA) (BB&E, 2016) and Site Inspection (SI) (Amec Foster Wheeler, 2018) at the Barnes ANGB in accordance with the CERCLA process for PFAS in soil, surface water, sediment, and groundwater. The USEPA identifies the SI as the on-site investigation to determine what hazardous substances are present and if they are being released to the environment. The previous SI activities were confined to seven on-Base previously identified areas, now called Areas of Concern (AOCs), on or near Base (**Figure 1**). The SI recommended additional investigation at the seven AOCs (Amec Foster Wheeler, 2018). Therefore, the ESI was conducted to augment the data collected in the SI and determine if there are off-Base upgradient sources and/or downgradient impacts to off-Base receptors. Two AOCs (AOCs 1 and 8) were identified as requiring further investigation during this ESI because they are located off-Base and were not fully investigated during the SI.



OCTOBER 2020

PREPARED BY:
PARSONS
75 W TOWNE RIDGE
PARKWAY, SUITE 200
SANDY, UTAH, 84070

Table 1
Expanded Site Inspection Sampling Summary
Expanded Site Inspection Report for PFAS
Barnes ANGB, Westfield, Massachusetts

AOC	AOC Name	Media Impacted above PALs per SI	Number of SBs	Number of Monitoring Wells		Number of Samples				
				Existing	New	SO	GW	SW	SD	ST
1	Former FTA-01 (IRP Site 1)	GW and SO	5	3	5	11	18	0	0	1
3	Stormwater Drainage Basin (IRP Site 4)	None	2	0	1	4	2	0	0	0
4	Hangars 27A and 27B	GW and ST	0	0	2	0	4	0	0	1
5	Former Fire Station (Building 004)	GW and ST	0	0	2	0	4	0	0	1
6	Current Fire Station (Building 040)	GW and ST	0	0	2	0	4	0	0	3
7	Hush House	GW and ST	0	0	2	0	4	0	0	1
8	Fire Department Equipment Test Area	GW, SO, and ST	6	0	2	13	4	0	0	1
Upgradient	Not applicable	GW	0	0	4	0	10	0	0	2
Downgradient	Not applicable	GW, SW, and SD	0	0	35	0	74	13	13	0

Notes:

GW - groundwater

SW - surface water

SB - soil boring

SO - soil

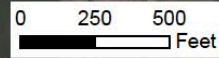
SD - sediment

ST - storm water

4671500
4671000
4670500



Prof. Boutt - RAB Oct 26, 2023



Legend

- Area of Concern (AOC)
- Installation Boundary



DATA SOURCES
-Image: ESRI, 2016
-ANG Base: Installation Boundary, AOC Boundary

PARSONS		NATIONAL GUARD BUREAU OPERATIONS DIVISION RESTORATION BRANCH (NGB/A4VR)	
DESIGNED BY: RGS	Expanded Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations		
DRAWN BY: RGS			
CHECKED BY: TM	SCALE: AS SHOWN	CONTRACT NUMBER: G500Q140A DU127	
SUBMITTED BY: TM	DATE: 3/5/2020	DELIVERY ORDER NUMBER: W9133L-18-F-0052	
Coordinate System: WGS 1984 UTM Zone 18N			

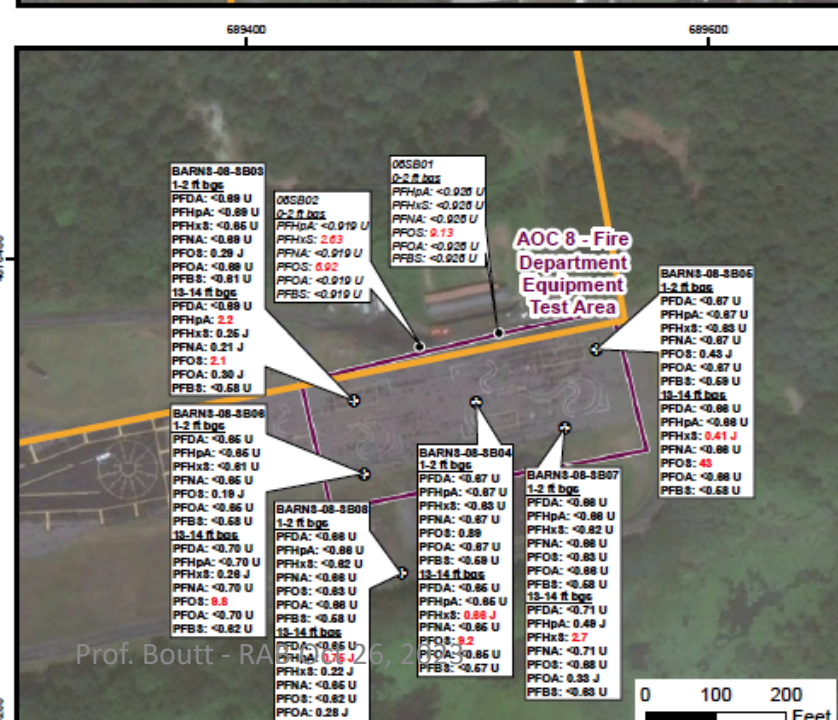
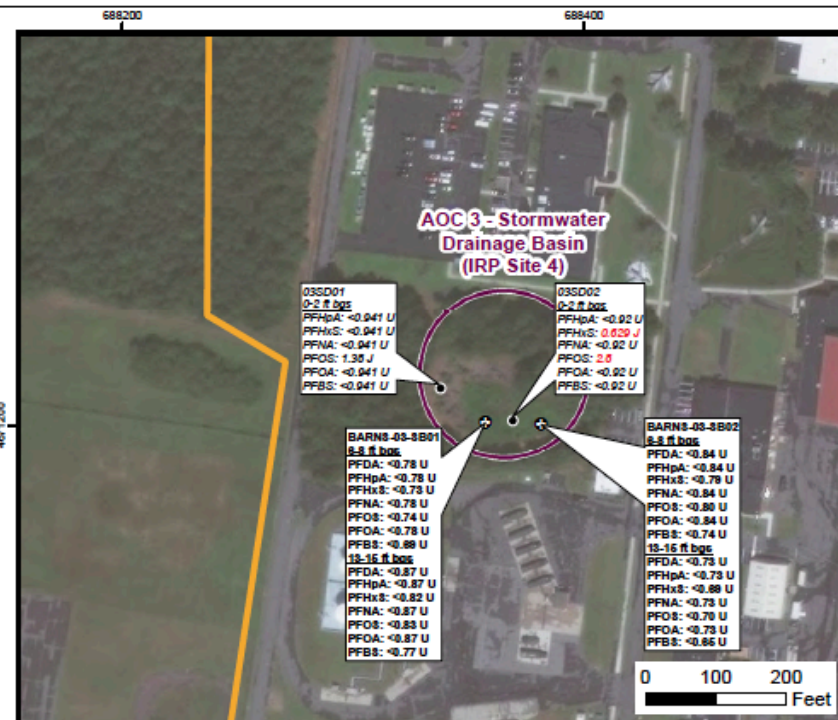
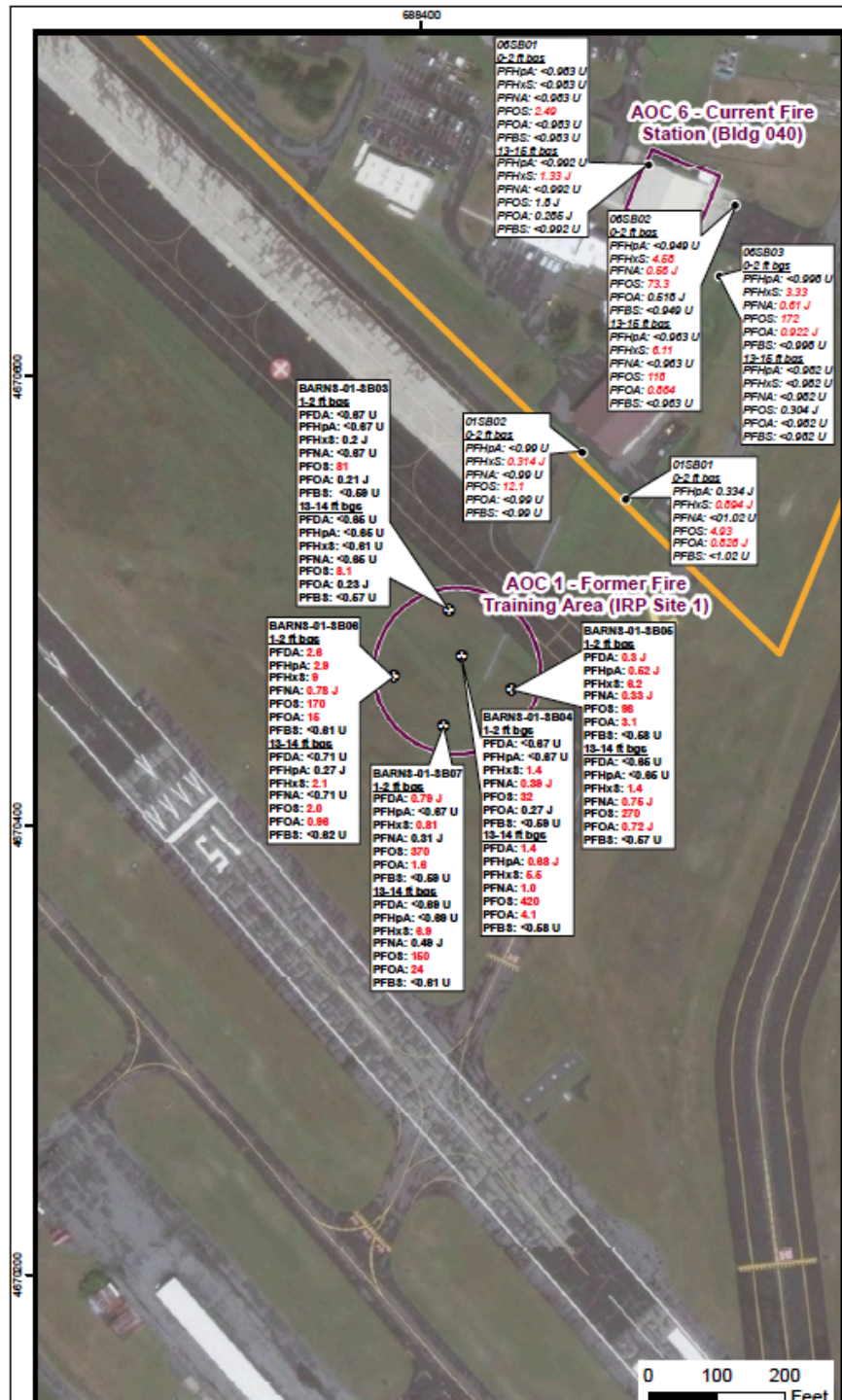


Figure 9
Soil Analytical Results
Barnes Air National Guard Base

Legend

Samples (Red value if exceedance):

- ESI Soil Boring
- SI Soil Sample

- Area of Concern (AOC)
- Installation Boundary

-Italicized labels are from the SI Report (Amec Foster Wheeler, 2018).
-Bold labels are from current ESI fieldwork.

-Values shown as ng/g.

ESI Project Action Limits

-PFDA = 0.30 ng/g

-PFHpA = 0.50 ng/g

-PFHxS = 0.30 ng/g

-PFNA = 0.32 ng/g

-PFOA = 0.72 ng/g

-PFOS = 2.0 ng/g

-PFBS = 1,260,000 ng/g

ESI = Expanded Site Inspection

U = Analyte not detected. Result report as < Limit of Detection.

J = Analyte detected, estimated concentration

ng/g = nanograms per gram

PFDA = perfluorodecanoic acid

PFHpA = perfluoroheptanoic acid

PFHxS = perfluorohexanoic acid

PFNA = perfluorononanoic acid

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

PFBS = perfluorobutanesulfonic acid

ft bgs = feet below ground surface



DATA SOURCES

-Image: ESRI, 2016

-ANG Base: Installation Boundary, AOC Boundary, SI Samples

-Parsons: Proposed Samples

PARSONS		NATIONAL GUARD BUREAU OPERATIONS DIVISION RESTORATION BRANCH (NGB/A4VR)	
DESIGNED BY: RGS	Expanded Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations		
DRAWN BY: RGS	SCALE: AS SHOWN	CONTRACT NUMBER: GS00Q140A DU127	
CHECKED BY: TM	DATE: 3/5/2020	DELIVERY ORDER NUMBER: W9133L-18-F-0052	
SUBMITTED BY:			



Figure 10
Groundwater Analytical Results
AOCs and Upgradient Wells, Round 2
Barnes Air National Guard Base

Legend

Samples (Red value if exceedance):

- Groundwater Monitoring Well
- Approximate Groundwater Flow Direction
- Area of Concern (AOC)
- Installation Boundary

- *Italicized labels are from the SI Report (Amec Foster Wheeler, 2018).*
 - **Bold labels are from current ESI fieldwork.**

- Project Action Limit = 20 ng/L

- Value shown for **ESI** Groundwater Samples is the Sum of PFDA+PFHpA+PFHxS+PFNA+PFOA+PFOS (ng/L)

- Value shown for *SI* Groundwater Samples is the Sum of PFHpA+PFHxS+PFNA+PFOA+PFOS (ng/L)

ESI = Expanded Site Inspection

J = Analyte detected, estimated concentration

ng/L = nanograms per liter

PFDA = perfluorodecanoic acid

PFHpA = perfluoroheptanoic acid

PFHxS = perfluorohexane sulfonic acid

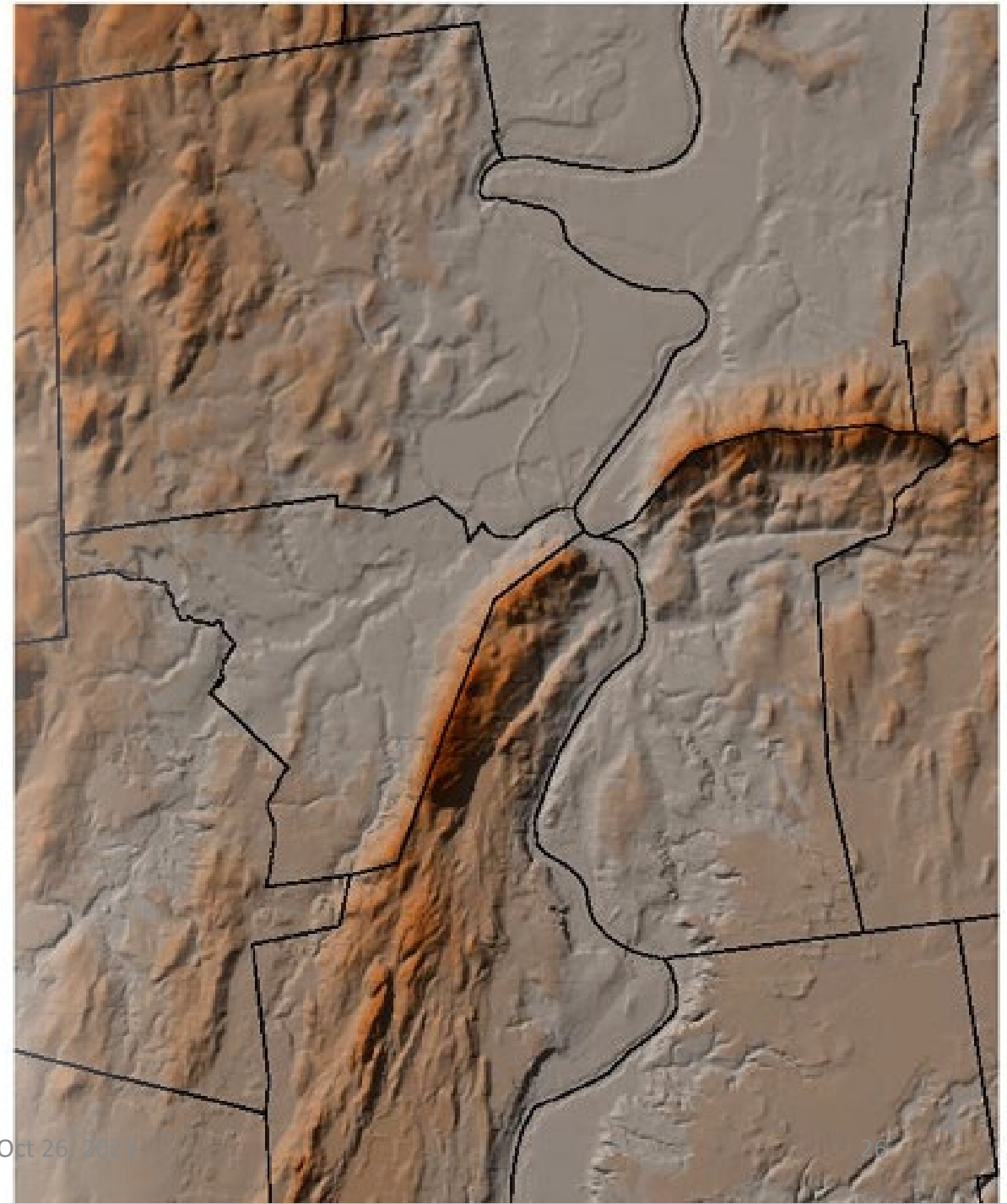
PFNA = perfluorononanoic acid

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

Presentation Overview

- Scope of Review and Presentation
- The Barnes Aquifer System
- Overview of Reports and Data
- PFAS Plume
 - Characteristics
 - Size
 - Migration
- Critical Findings/Concerns
- Recommendations



Key Report Findings

- Hydraulic gradient across site are incredibly steep – leading to very rapid groundwater flow
- This flow has quickly moved PFAS across the site – up to perhaps 200 ft per year!
- Groundwater flow has a strong downward component across most of the site
- Extent of soil contamination not extensive – primarily in the AOC1 and AOC8 areas
- Multiple sources and pathways of PFAS into the Aquifer system
- A large plume distributed across the whole aquifer at all depths
- Downgradient surface waters impacted by PFAS
- Downgradient groundwater impacted by PFAS

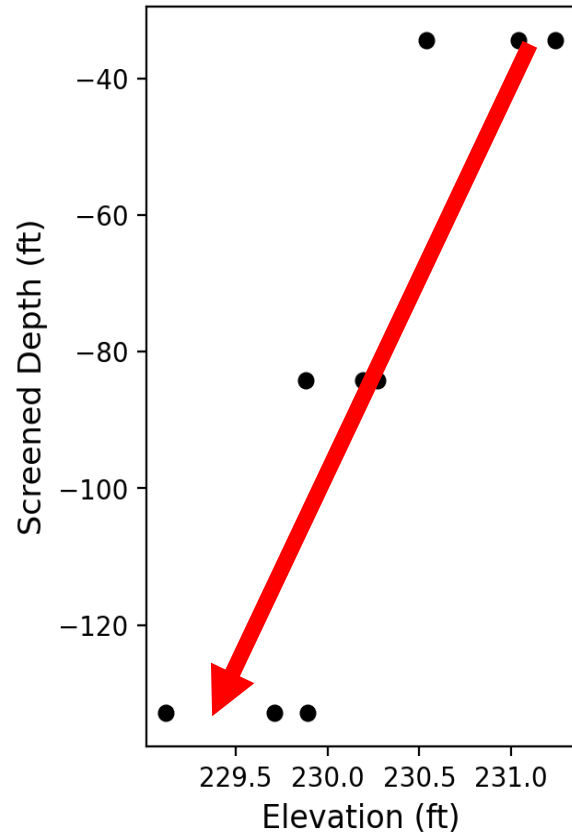


Key Report Findings

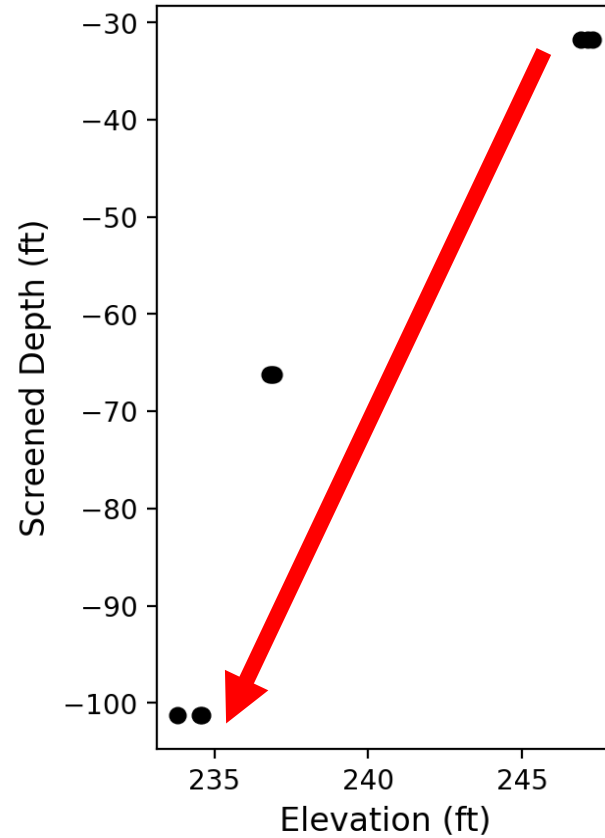
- Hydraulic gradient across site are incredibly steep – leading to very rapid groundwater flow
- This flow has quickly moved PFAS across the site – up to perhaps 200 ft per year!
- Groundwater flow has a strong downward component across most of the site
- Extent of soil contamination not extensive – primarily in the AOC1 and AOC8 areas
- Multiple sources and pathways of PFAS into the Aquifer system
- A large plume distributed across the whole aquifer at all depths
- Downgradient surface waters impacted by PFAS
- Downgradient groundwater impacted by PFAS

Aquifer Hydrogeology

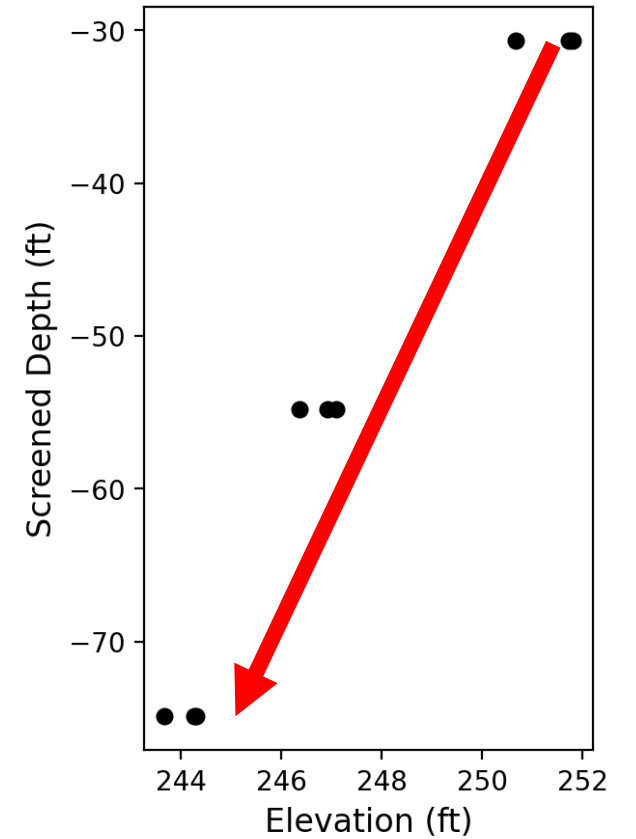
Groundwater Elevation Well:BARNS-DN-MW10



Groundwater Elevation Well:BARNS-DN-MW11



Groundwater Elevation Well:BARNS-DN-MW12



Key Report Findings

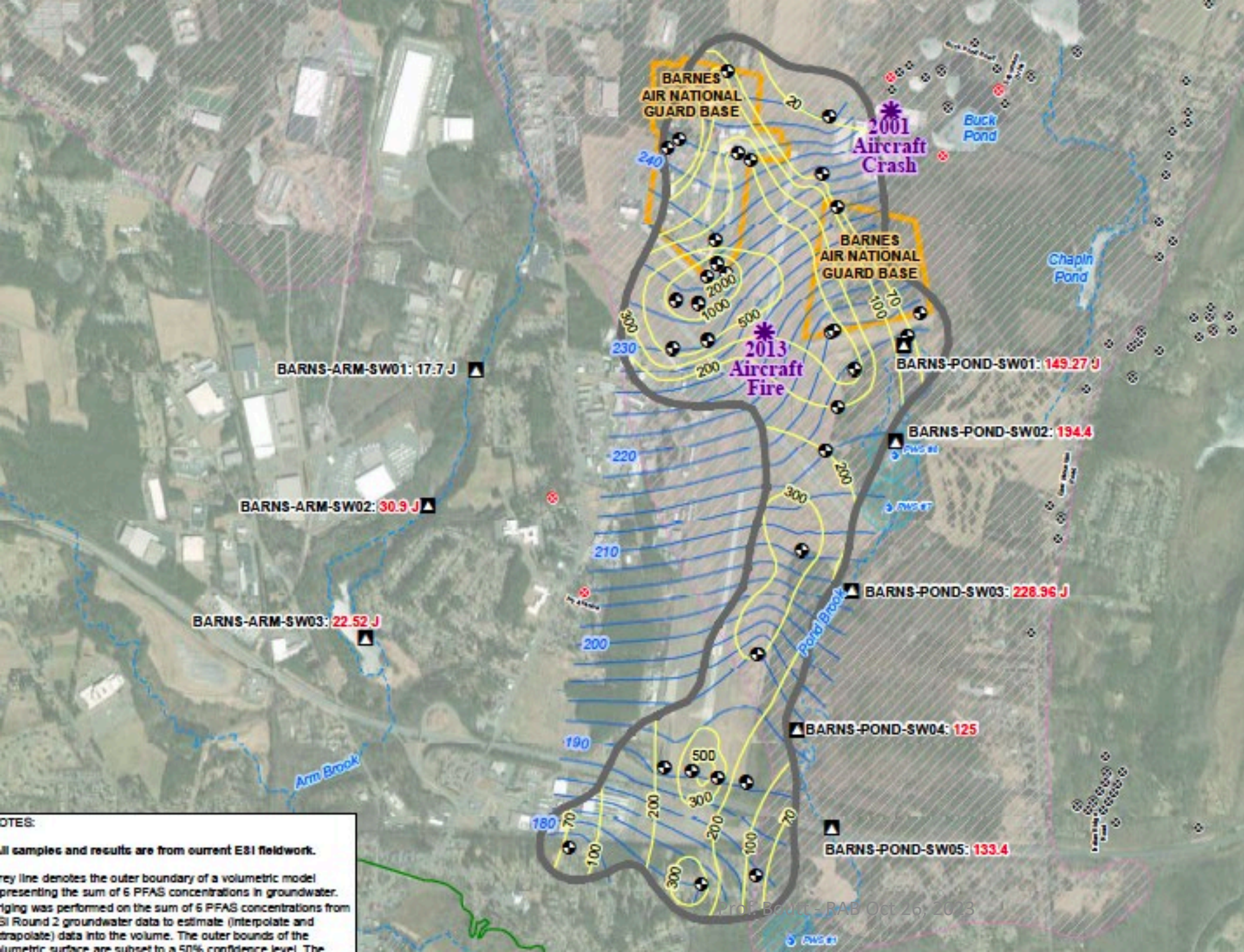
- Hydraulic gradient across site are incredibly steep – leading to very rapid groundwater flow
- This flow has quickly moved PFAS across the site – up to perhaps 200 ft per year!
- Groundwater flow has a strong downward component across most of the site
- Extent of soil contamination not extensive across site – primarily in the AOC1 and AOC8 areas
- Multiple sources and pathways of PFAS into the Aquifer system
- A large plume distributed across the whole aquifer at all depths
- Downgradient surface waters impacted by PFAS
- Downgradient groundwater impacted by PFAS

Figure 18
Receptor Survey and PFAS
Groundwater Plume
Barnes Air National Guard Base

Legend

- Groundwater Monitoring Well
- Surface Water Sample
- Private Drinking Water Well in MassDEP Sampling Program (symbol in red indicates well with MassDEP Interim Response Action)
- Suspected Non-Potable Well (Industry)
- Suspected Public Water Supply Well (Private School)
- Public Water Supply Well
- Potential non-ANG PFAS Sources
- Groundwater Plume Contours (ng/L), Sum of Six PFAS Compounds (see Notes)

- Groundwater Plume Extent (see notes)
- Intermediate Groundwater Elevation Contour - 2 Foot Interval
- Top of Topographic Scarp
- Surface Water
- Zone I Well Head Protection Area
- Zone II Well Head Protection Area
- Installation Boundary



NOTES:

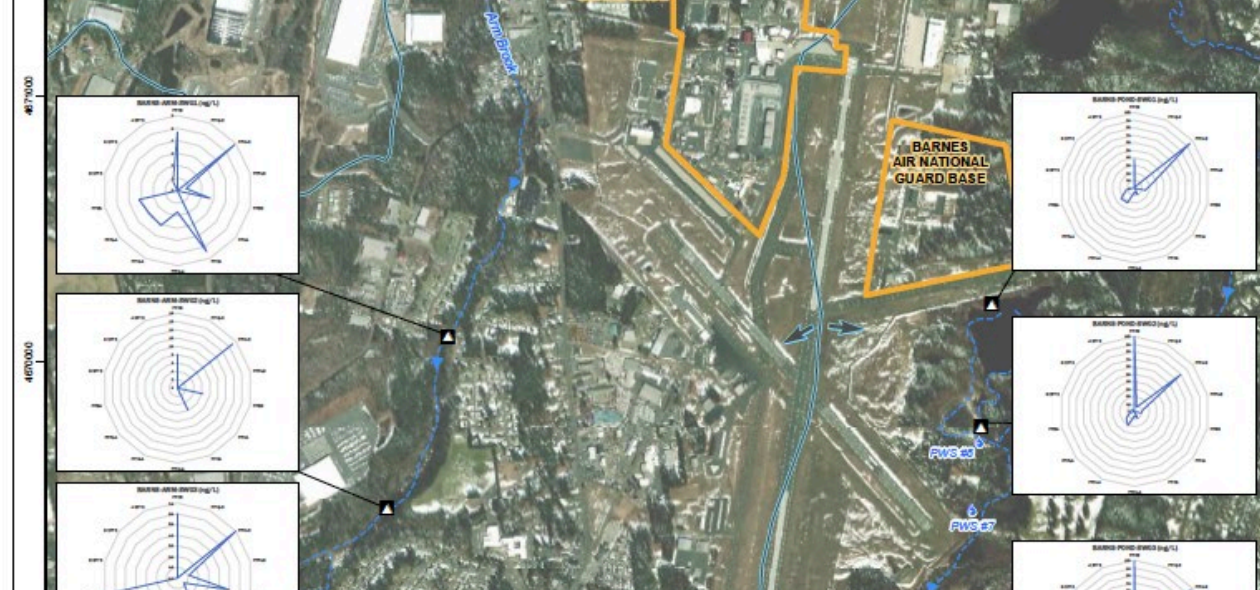
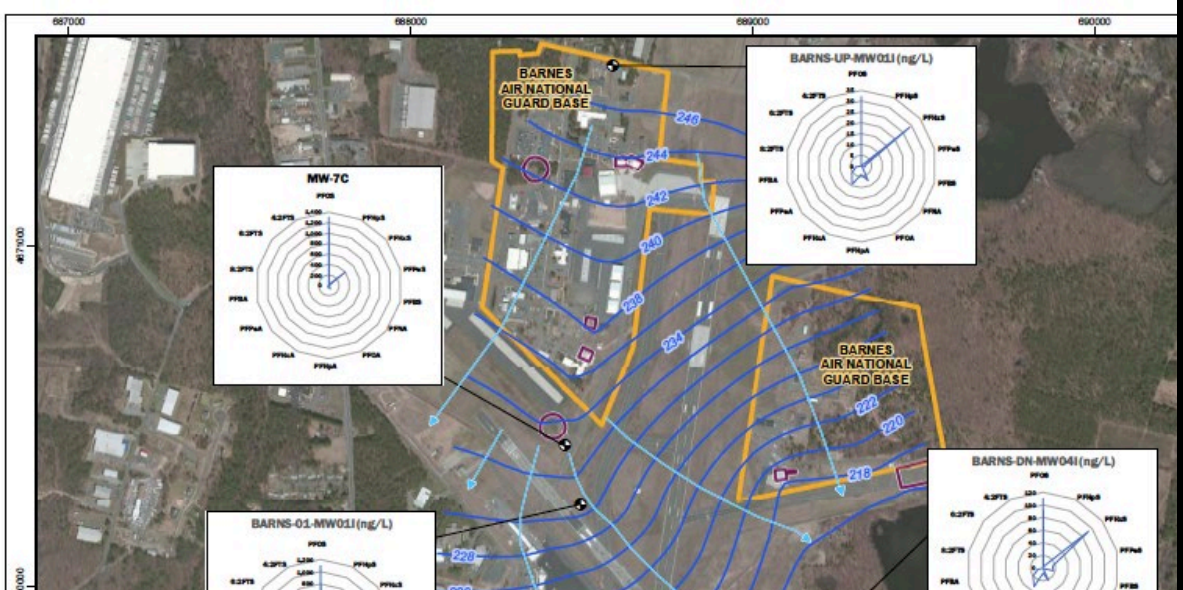
All samples and results are from current E81 fieldwork.

Grey line denotes the outer boundary of a volumetric model representing the sum of 6 PFAS concentrations in groundwater. Modeling was performed on the sum of 6 PFAS concentrations from SI Round 2 groundwater data to estimate (interpolate and extrapolate) data into the volume. The outer bounds of the volumetric surface are subset to a 50% confidence level. The

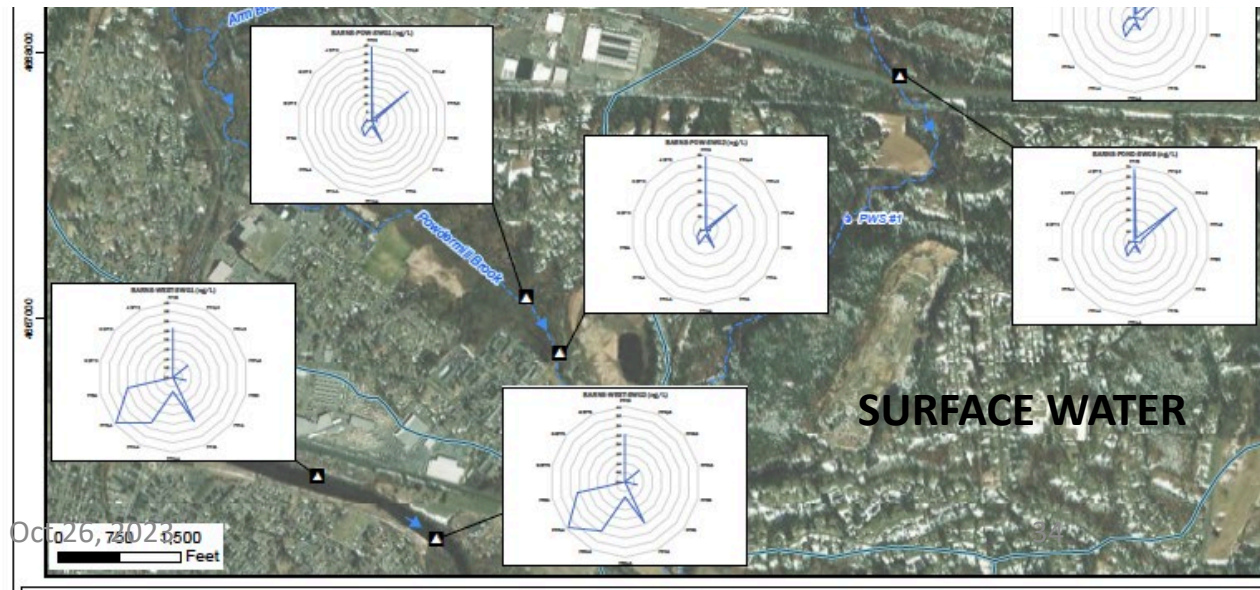
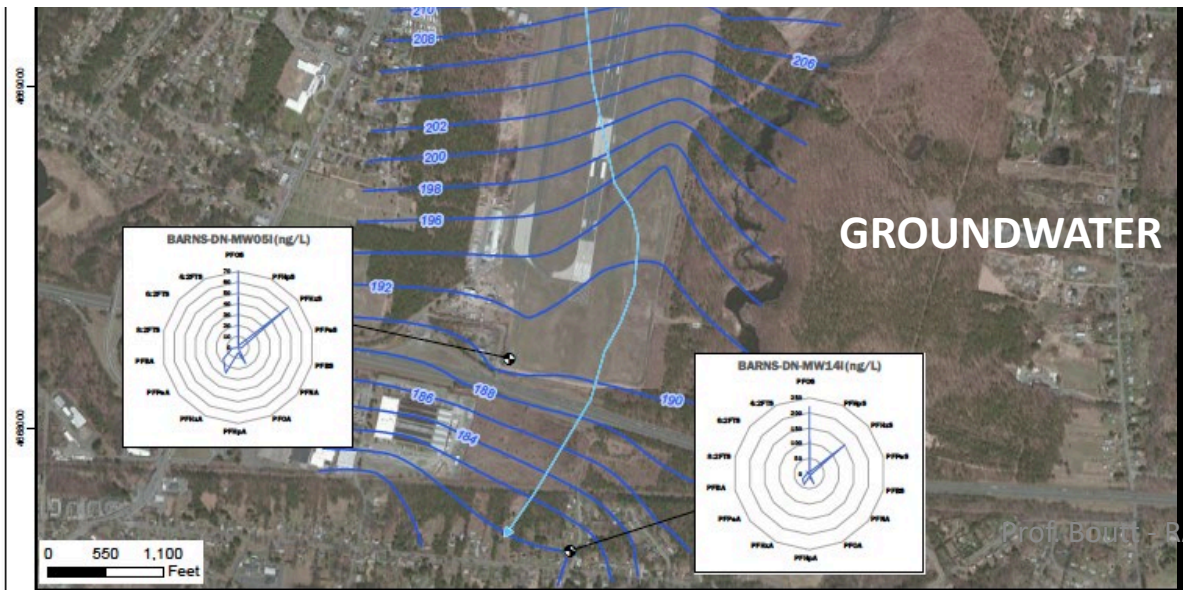
Prof. Bevil - RAB Oct 26, 2023

Key Report Findings

- Hydraulic gradient across site are incredibly steep – leading to very rapid groundwater flow
- This flow has quickly moved PFAS across the site – up to perhaps 200 ft per year!
- Groundwater flow has a strong downward component across most of the site
- Extent of soil contamination not extensive across site – primarily in the AOC1 and AOC8 areas
- Multiple sources and pathways of PFAS into the Aquifer system
- A large plume distributed across the whole aquifer at all depths
- Downgradient surface waters impacted by PFAS
- Downgradient groundwater impacted by PFAS



- Primary source AOCs with history of routine AFFF storage, handling, or use exhibit a characteristic PFAS signature dominated by PFOS and PFHxS at relatively elevated concentrations.



PFAS in Soil Compared to Groundwater

“It is noteworthy that soil concentrations reported for PFAS at contaminated sites are often orders-of-magnitude higher than typical groundwater concentrations, ranging up to parts-per-million levels. Thus, research studies, site investigations, and modeling efforts characterizing PFAS transport in soil and the vadose zone need to be implemented with this in mind. The concentrations encountered at any given site will of course depend upon the nature of the PFAS source, the timeframe of contamination, site conditions, and many other specific factors.”

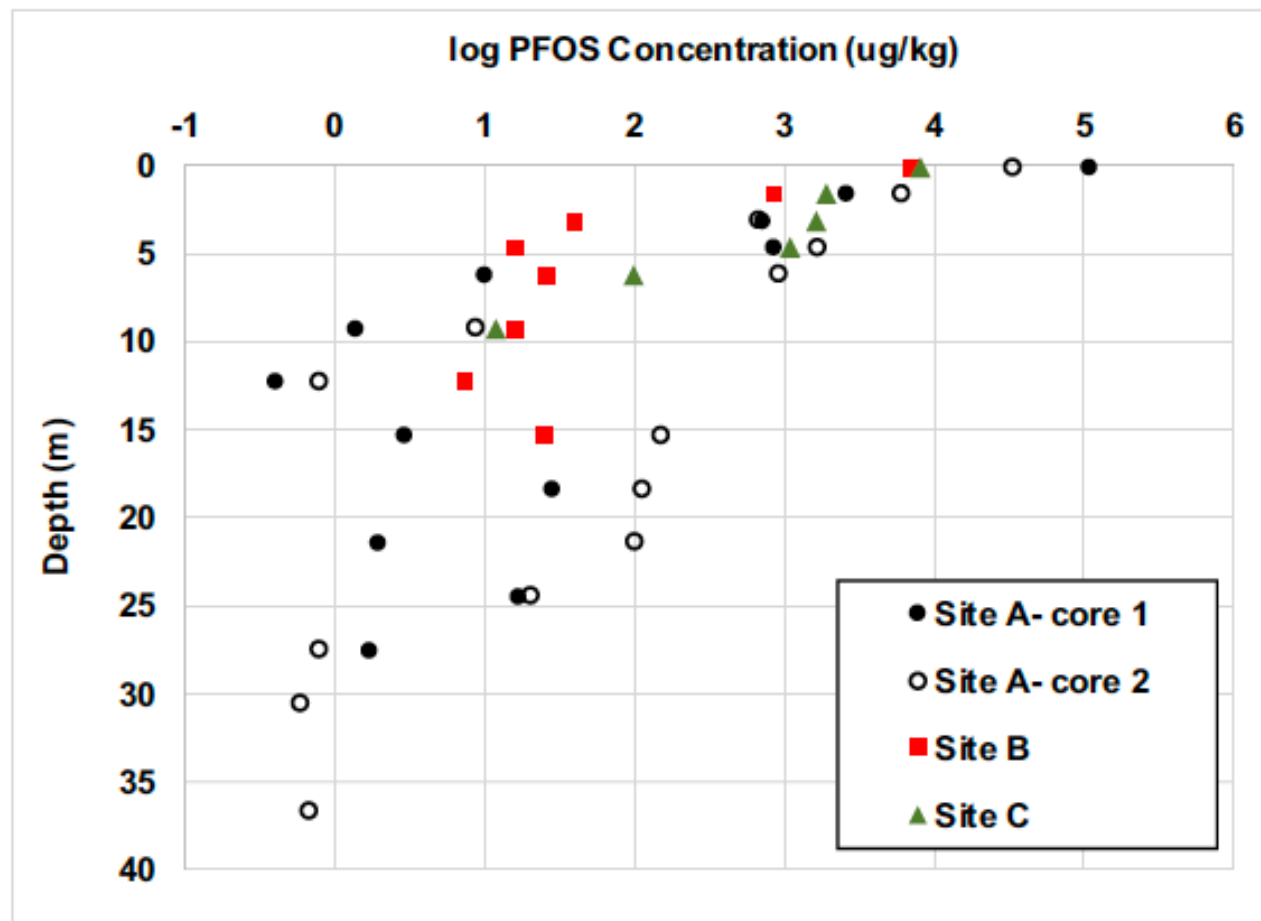


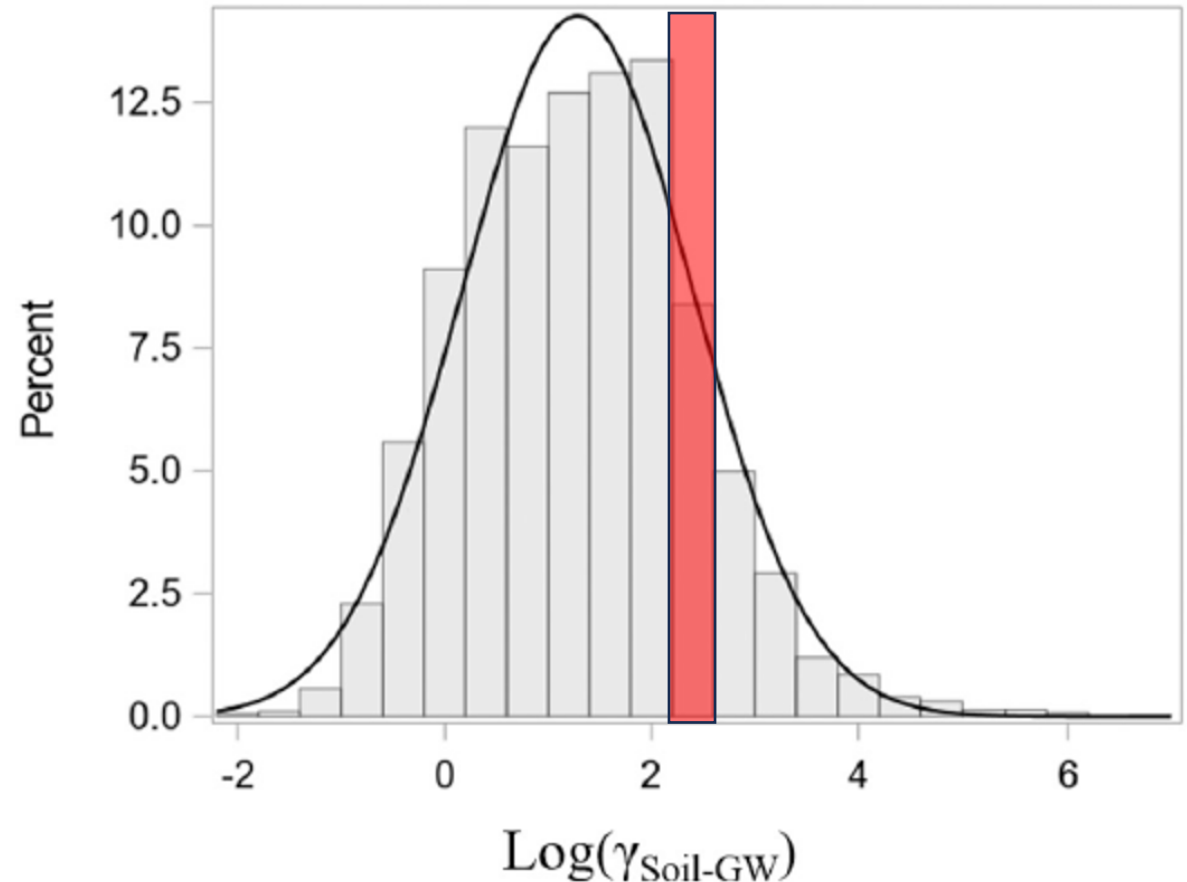
Fig. 2. Example depth profiles of PFOS soil concentrations developed using data from the U.S. Air Force AFFF Impacted-Site database.

Groundwater Concentrations

- “Vertically, the PFAS concentrations were found throughout the aquifer (shallow, intermediate, and deep zones). Generally, near AOC sources the highest PFAS concentrations were found in the shallow wells screened at the water table, whereas farther downgradient of the AOCs, the highest PFAS concentrations were predominantly found in the intermediate groundwater zone.”
- Its not clear that the magnitude of soil contamination across the aquifer system is consistent with the concentrations and extent of the groundwater plume

Comparison of Soil and GW PFAS concentrations

- The plot to the right shows the ratio of soil PFAS concentration to groundwater concentrations for airport sites across the US
- Barnes on this scale falls around a value of 2-3 (a sitewide ratio of ~200)
- This suggests that the soils on site are consistent with the magnitude of groundwater contamination in most of the plume



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Journal of Contaminant Hydrology

journal homepage: www.elsevier.com/locate/jconhyd



Partitioning of poly- and perfluoroalkyl substances from soil to groundwater within aqueous film-forming foam source zones

R. Hunter Anderson^{a,*}, Dave T. Adamson^b, Hans F. Stroo^c



Concerns/Observations (1)

- Geology of the aquifer is poorly characterized nor conceptualized - disappointed that not a single cross-section or 3-dimensional map of the contaminant distribution presented
- The widespread distribution of PFAS through the aquifer is a major finding in the report and contrasts strongly with this statement from the 2016 report
- “In general, groundwater contamination associated with historic contaminated sites at the Base does not migrate significantly either vertically or horizontally. Based on this, potential releases of AFFF to groundwater also may not migrate significantly.”
- This suggests that the ANG and/or the consultants don't truly understand the aquifer and its complexities

Findings/Concerns/Observations (2)

- Migration rates through vadose zone are high
- The lack of focus on bedrock flow and transport is a major issue and an indication of the bias in the conceptual understanding of these systems
- The analysis of the hydraulic data needs to be expanded beyond what is presented in the reports
- Plume contour maps should be extended to samples from private and public wells outside of the existing area
 - The description of the contouring and presentation of the 3D volume is not adequate
- MW should be installed to the west of the runway
- The analysis assumes a certain amount of stationarity in the system – which is not warranted
 - Correlating sources to current GW observations is not appropriate since clearly migration rates in the aquifer are extremely high
- There are likely additional sources of PFAS into the system

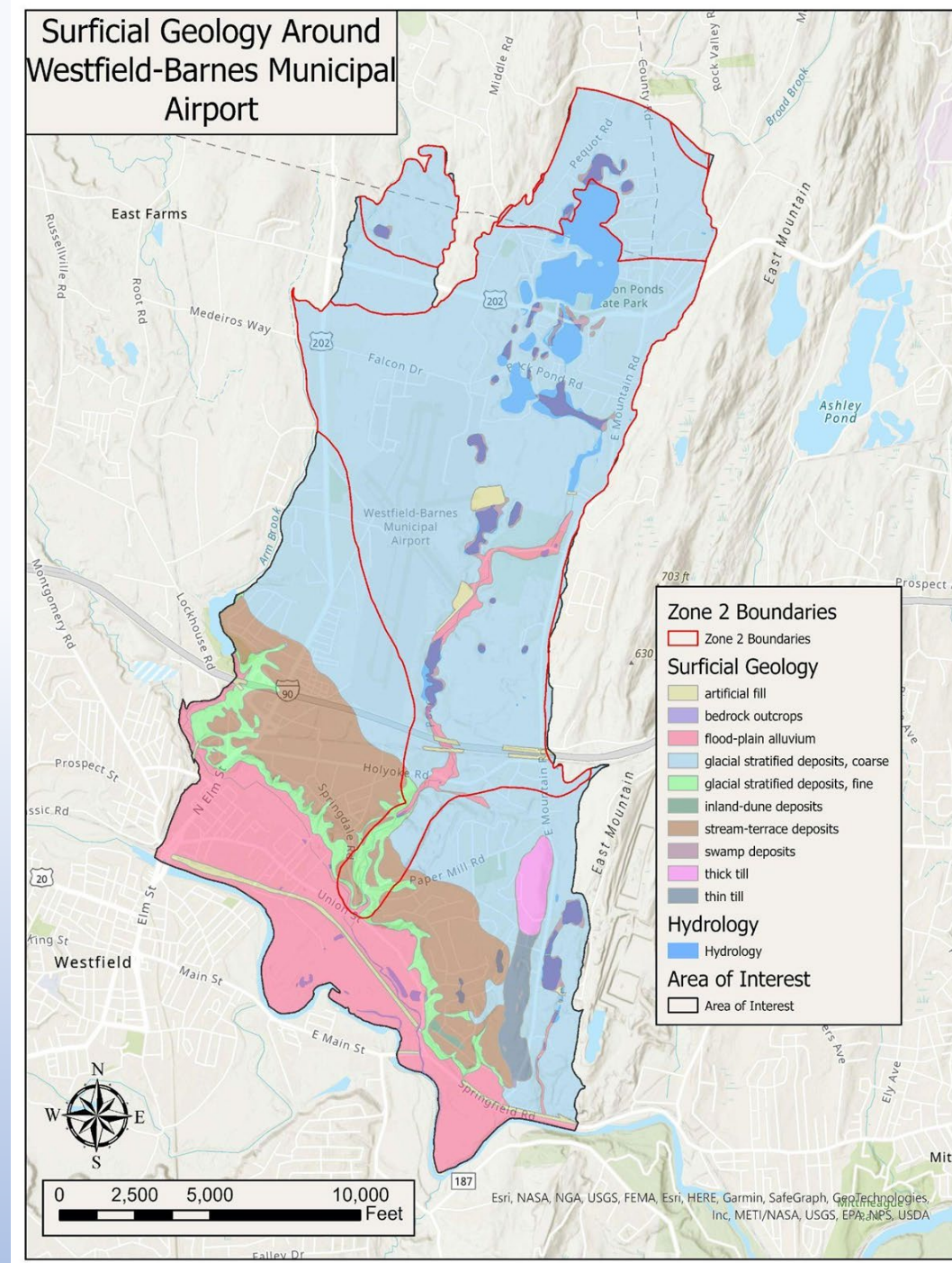
Recommendations – Site Conceptualization

- Full scale geological investigation including geophysical surveys (incl. Airborne EM and depth to bedrock mapping) – develop 3-dimensional solid model of aquifer and upper bedrock units
- An aquifer scale hydrogeological flow and transport model needs to be developed to understand the feasibility of transport scenarios and source pathways
- Environmental tracers should be collected to test the age distribution of the PFAS (see Bennington study) and source distribution
- A systematic soil sampling across site and upgradient locations should be undertaken
- No remediation strategies should be developed without this information
- Bedrock aquifer needs to be sampled, characterized, and modeled.

UMass Westfield-Barnes Airport: Groundwater Flow Model

- *Motivation:* Municipal and private wells in Westfield, MA have been found to have significant PFAS contamination .
- *Objective:* To model groundwater flow around the Westfield-Barnes Municipal Airport to assist in determining the extent and directionality of groundwater flow.
- *Resources:*
 - USGS data layers (surficial geology, hydrology, elevation, zone 2 boundaries)
 - Bore hole data
 - Air national Guard Site Inspection report

Advanced Hydrogeology Course Fall 2023



Questions?

