Update: Emerging Contaminants of Concern in Groundwater at Brookhaven National Laboratory

BROOKHAVEN NATIONAL LABORATORY

Community Advisory Council Meeting
March 11, 2021
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U.S. DEPARTMENT OF ENERGY

Agenda

- Update on potable water supply well monitoring and treatment systems
- Current understanding of extent of Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-dioxane in groundwater
- Planned installation of two PFAS treatment systems
- Integration of PFAS and 1,4-dioxane remedial actions into the ongoing CERCLA program

Emerging Contaminants of Concern

PFAS

- From 1966-2008, BNL used firefighting foam that contained PFAS for training and fire suppression systems
  - PFAS can persist in soils and groundwater for long periods of time
  - PFAS contaminated water can be effectively treated by using standard granular activated carbon filters or ion exchange resins

1,4-Dioxane

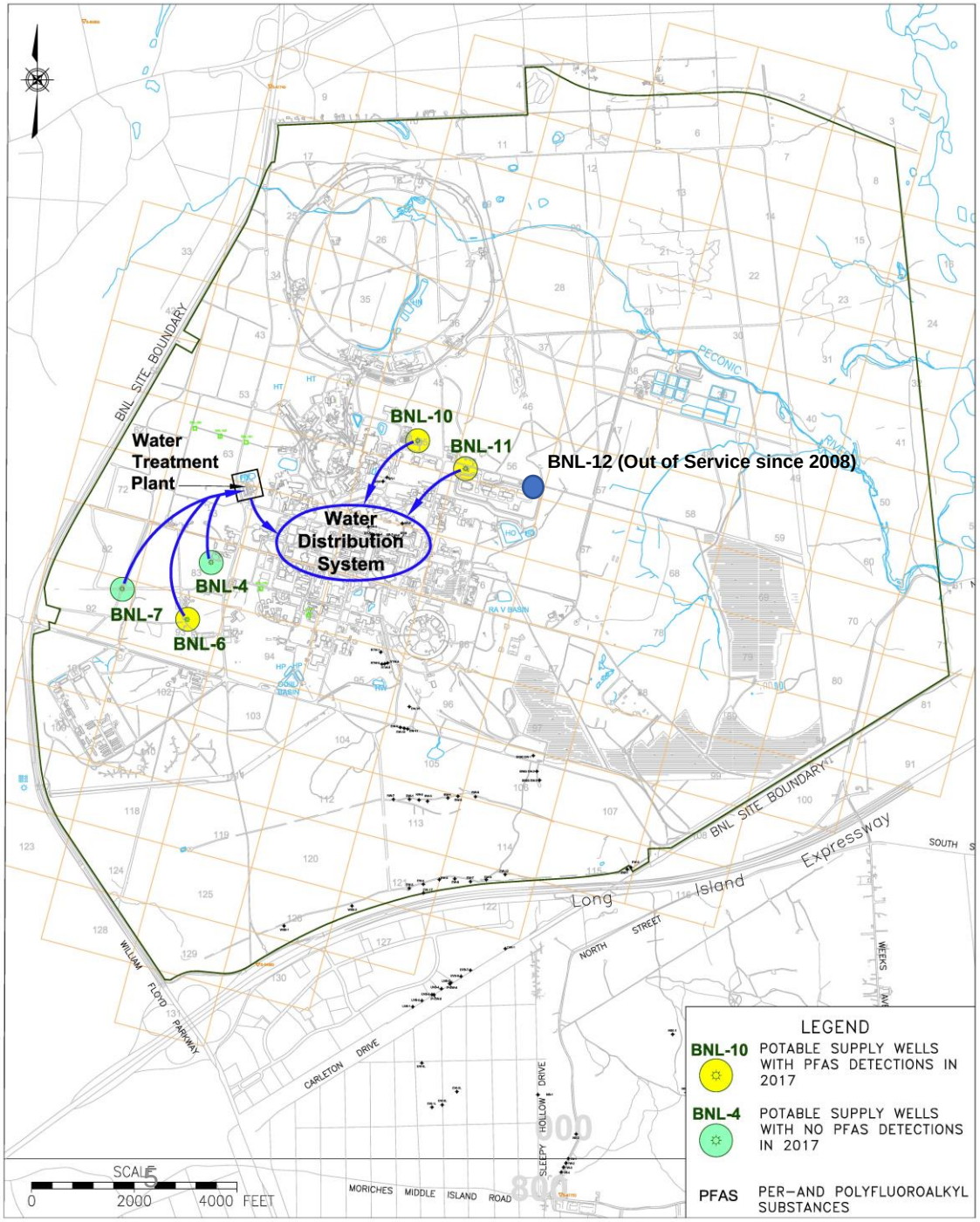
- 1,4-Dioxane was used as a stabilizing chemical for the solvent 1,1,1-Trichloroethane (TCA)
  - TCA has impacted groundwater quality at BNL and is being actively remediated
  - 1,4-Dioxane contaminated groundwater is difficult and expensive to treat
  - BNL's existing treatment systems are not effective for 1,4-dioxane

NYS Drinking Water Standards for PFAS and 1,4-Dioxane

- In August 2020, NYS established drinking water standards for:
  - PFOS (perfluorooctane sulfonate) at **10 ng/L**
    (nanograms per liter or parts per trillion)
  - PFOA (perfluorooctanoic acid) at **10 ng/L**
  - 1,4-Dioxane at **1 µg/L**
    (micrograms per liter or parts per billion)

BNL Water Supply Wells

- In March 2017, Suffolk County tested water samples from BNL's five operating potable water wells for PFAS
- PFAS were detected in three wells (BNL-6, BNL-10 and BNL-11)
    - PFOS detected at concentrations up to 23 ng/L



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Status of BNL Water Supply Wells

- BNL is now testing the supply wells for PFAS and 1,4-dioxane on a quarterly basis
  - PFOS concentrations are above 10 ng/L in supply wells BNL-6, BNL-10 and BNL-11
  - In June 2018, BNL placed restrictions on use of BNL-6 because the combined PFOS and PFOA concentrations were almost 70 ng/L*
  - BNL-4 will no longer be used due to its proximity to current firehouse PFAS source area and plume
  - 1,4-Dioxane is not impacting the wells
- 2019 – BNL started work to return to service granular activated carbon filters to remove PFOS and PFOA
  - Filters at BNL-11 were back in service in late 2020
  - Filters at BNL-10 will be back in service June 2021
    - NYSDOH granted a temporary "deferral" from the new standards while the work on the carbon filters continues. BNL must follow public notification and reporting requirements
  - BNL-12 will be back in service by October 2021

Carbon Filters at BNL-11

In the 1980's, carbon filters were installed on three supply wells to remove VOCs. They were taken out of service ~10 years ago

*EPA Health Advisory Level is 70 ng/L for combined concentrations of PFOS and PFOA

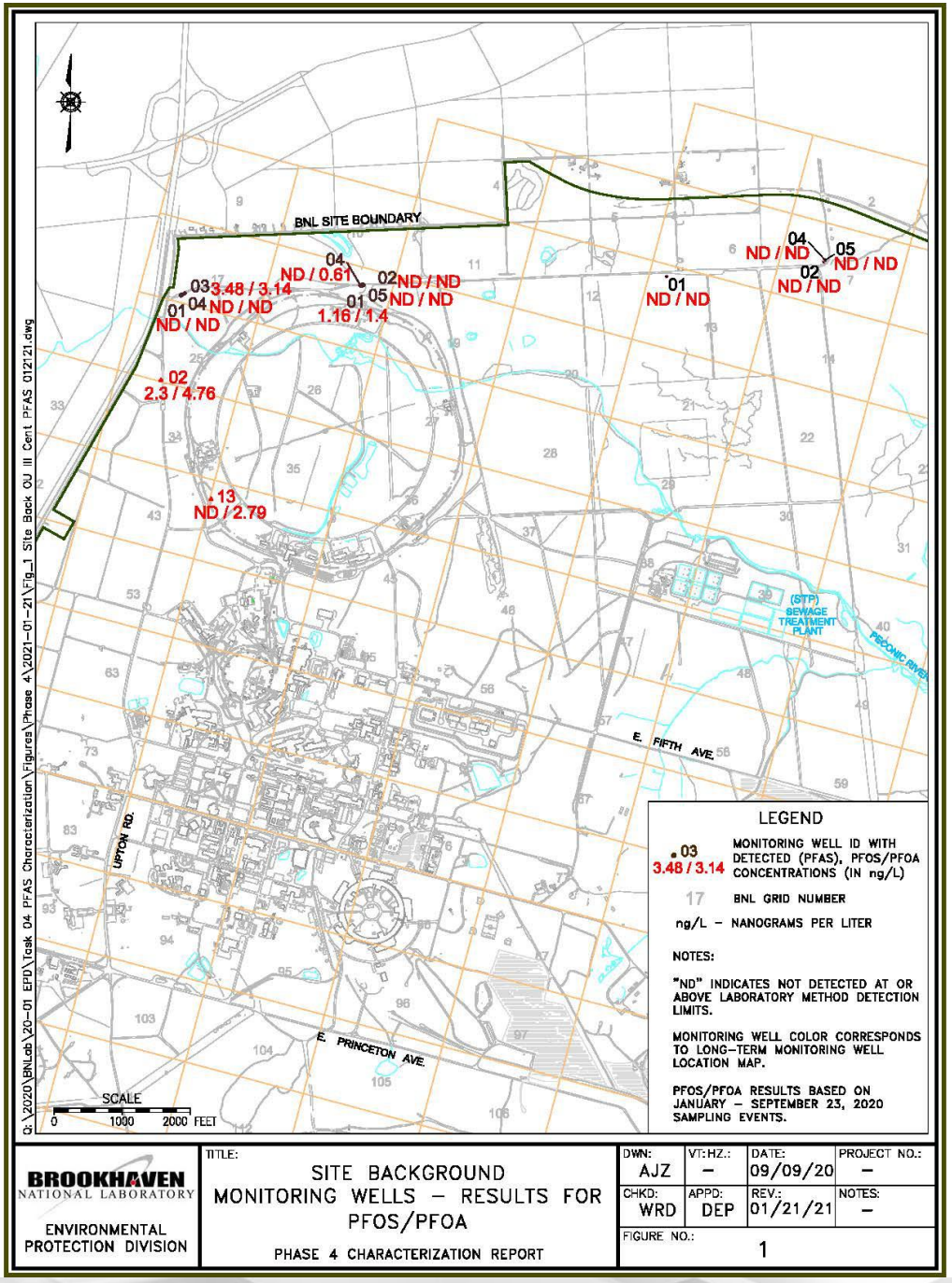
Understanding the Extent of PFAS and 1,4-Dioxane Contamination in Groundwater

- Phase 4 Project:
  - During 2020, BNL completed a comprehensive testing program for PFAS and 1,4-dioxane:
    - Sampled 360 on-site and off-site monitoring wells
      - Selected from a network of approximately 1,200 wells
    - Sampled on-site and off-site groundwater extraction wells and treatment system influent and effluent
    - Sampled Sewage Treatment Plant influent and effluent
- Phase 5/Time Critical Removal Action (TCRA) Project:
  - From July 2020-January 2021, BNL completed a detailed characterization of areas downgradient of the current and former firehouse facilities where high levels of PFAS are present
  - Results are being used to design two groundwater treatment systems

PFOS/PFOA and 1,4-Dioxane

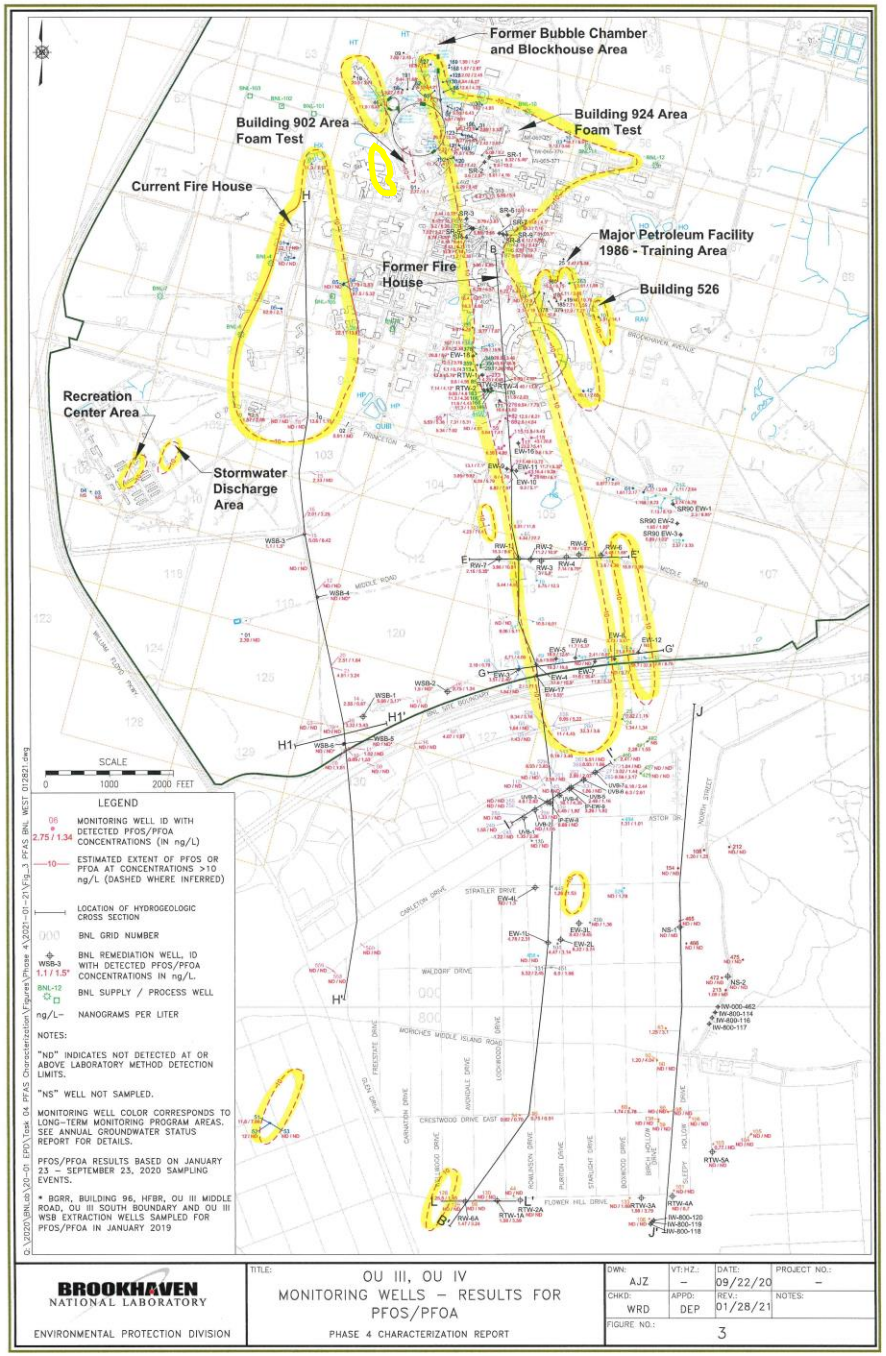
(Northern/Background Area)

- Several low-level detections of PFOS and PFOA (<5 ng/L)
  - Data gap in north-central area
- No detections of 1,4-dioxane



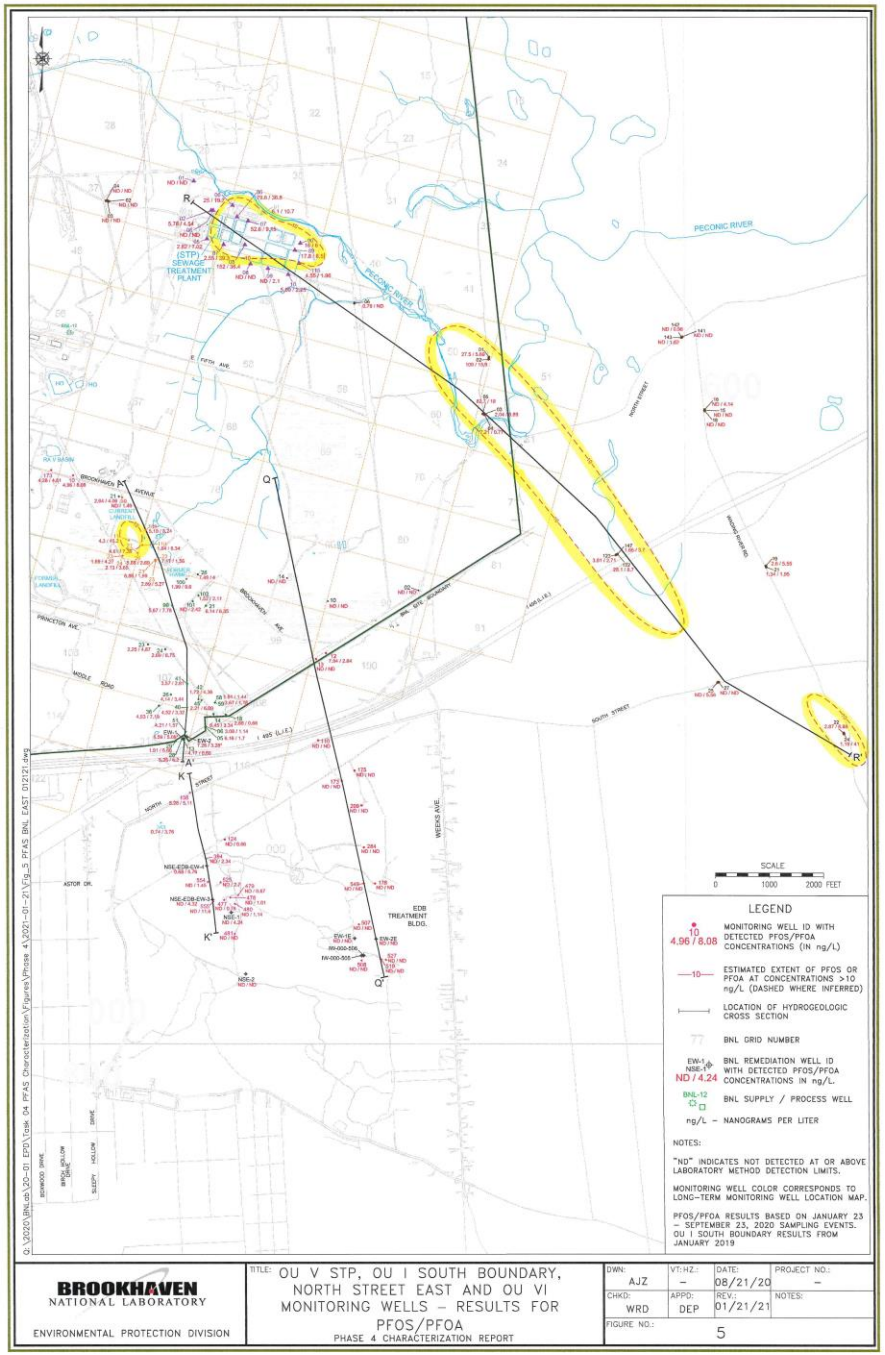
PFOS/PFOA
(West-Central Area)

- Numerous detections of PFOS or PFOA >10 ng/L
  - Associated with firefighting foam training areas and foam releases from fire suppression systems
  - Yellow outlines represent estimated extent of PFOS or PFOA >10 ng/L
  - Additional characterization is required in several areas
- High concentration areas downgradient of the current and former firehouse facilities were characterized in more detail during the Phase 5/TCRA project
- Several off-site detections may be due to other sources



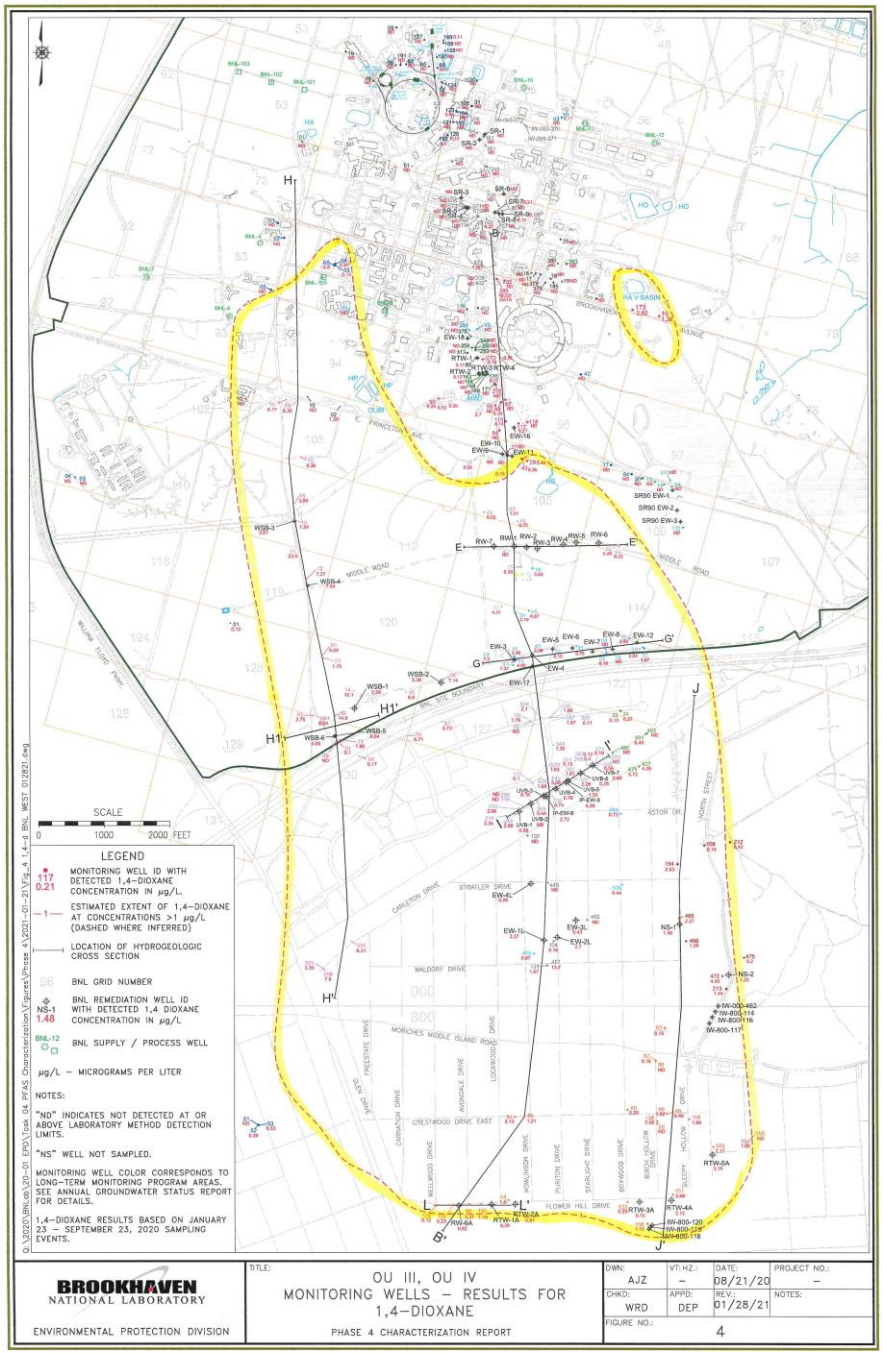
PFOS/PFOA
(Eastern Area)

- PFAS were detected in several areas not used for firefighter training
  - Current Landfill
    - PFOA up to 45 ng/L
  - Former STP filter bed area
    - PFOS up to 154 ng/L
  - Former OU V VOC monitoring area
    - Site boundary - PFOS up to 109 ng/L
    - Off-site – PFOS up to 28 ng/L. PFOA up to 41 ng/L
- PFAS discharged to the sanitary system impacted groundwater at the STP and downgradient areas
  - Potable water that contained PFAS was used for sanitation.
  - Possible foam discharges to floor drains at the current firehouse
  - PFOS and PFOA in STP effluent is currently <10 ng/L



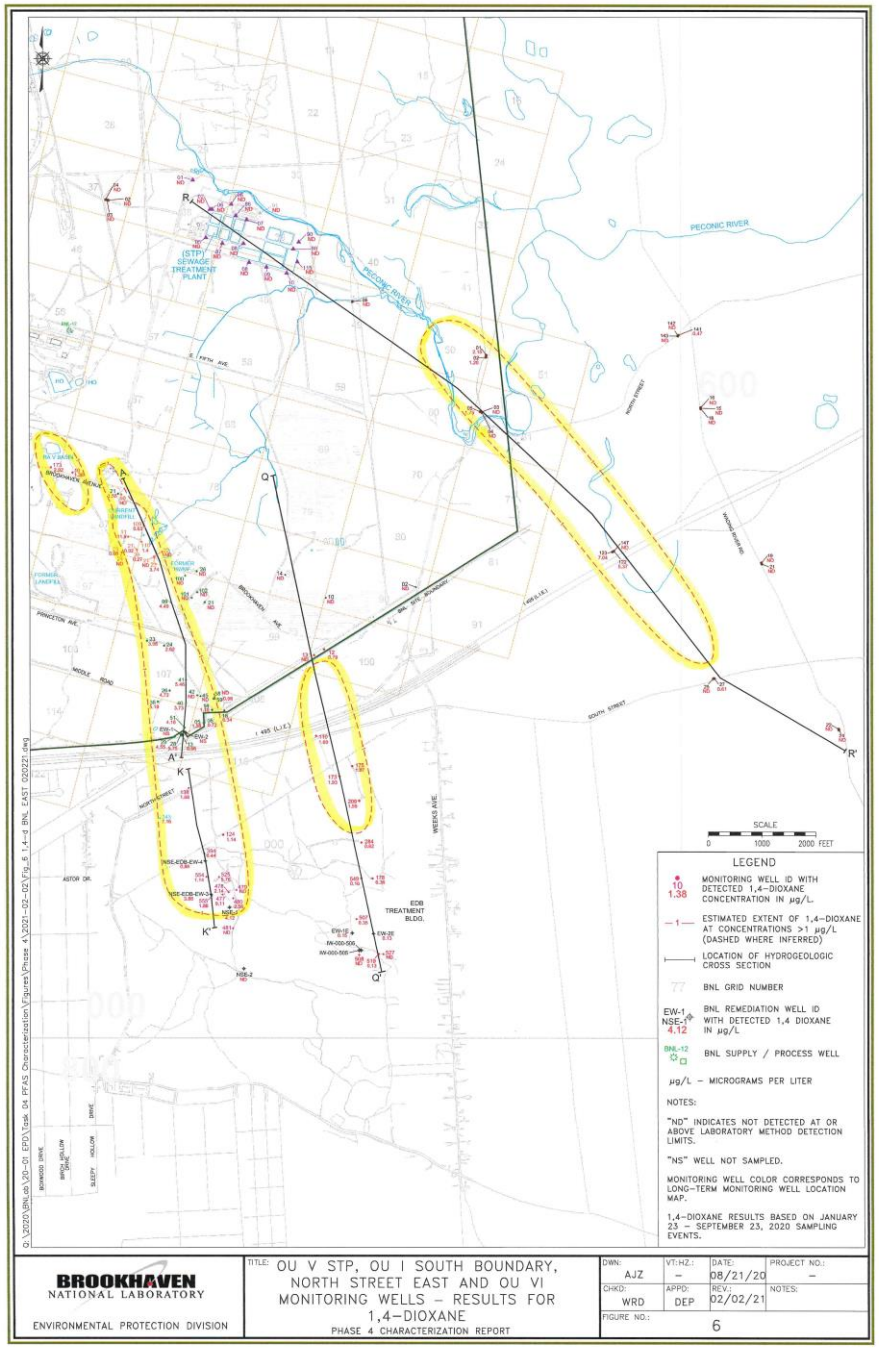
1,4-Dioxane
(West-Central Area)

- 1,4-Dioxane detected >1.0 µg/L in many wells, from the south-central area of the site to the Airport treatment system
  - Yellow outlines represent estimated extent of 1,4-dioxane >1.0 µg/L
  - There are data gaps that need to be filled during future work
- Concentrations generally <10 µg/L. Highest was ~25 µg/L in a Western South Boundary monitoring well
- Concentrations >1 µg/L in on-site and off-site groundwater extraction wells and treatment system effluent
  - Effluent is discharged to basins or injection wells
  - Possible impacts from these discharges detected at several basins



1,4-Dioxane
(Eastern Area)

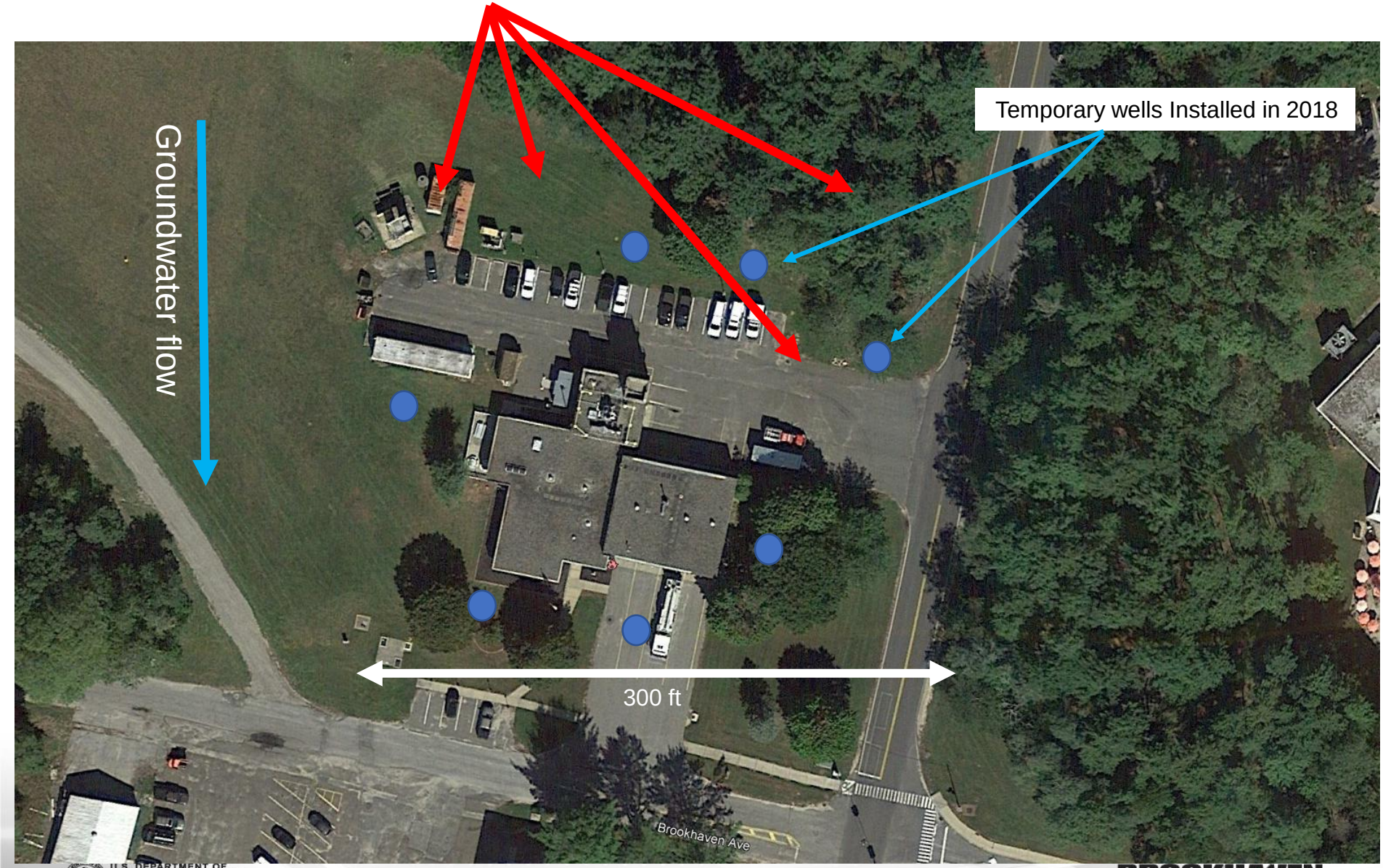
- 1,4-Dioxane detected in areas previously impacted by TCA releases:
  - Current Landfill and former Waste Management Facility, downgradient to North Street East area
    - Detected up to ~12 µg/L
    - Detected in extraction wells and system effluent up to ~3 µg/L
  - Detected in groundwater downgradient of former research agricultural fields up to ~2 µg/L
  - STP and downgradient areas
    - Not detected in groundwater near the STP
    - Site boundary and off-site detected up to ~7 µg/L



Current and Former Firehouse PFAS Plumes

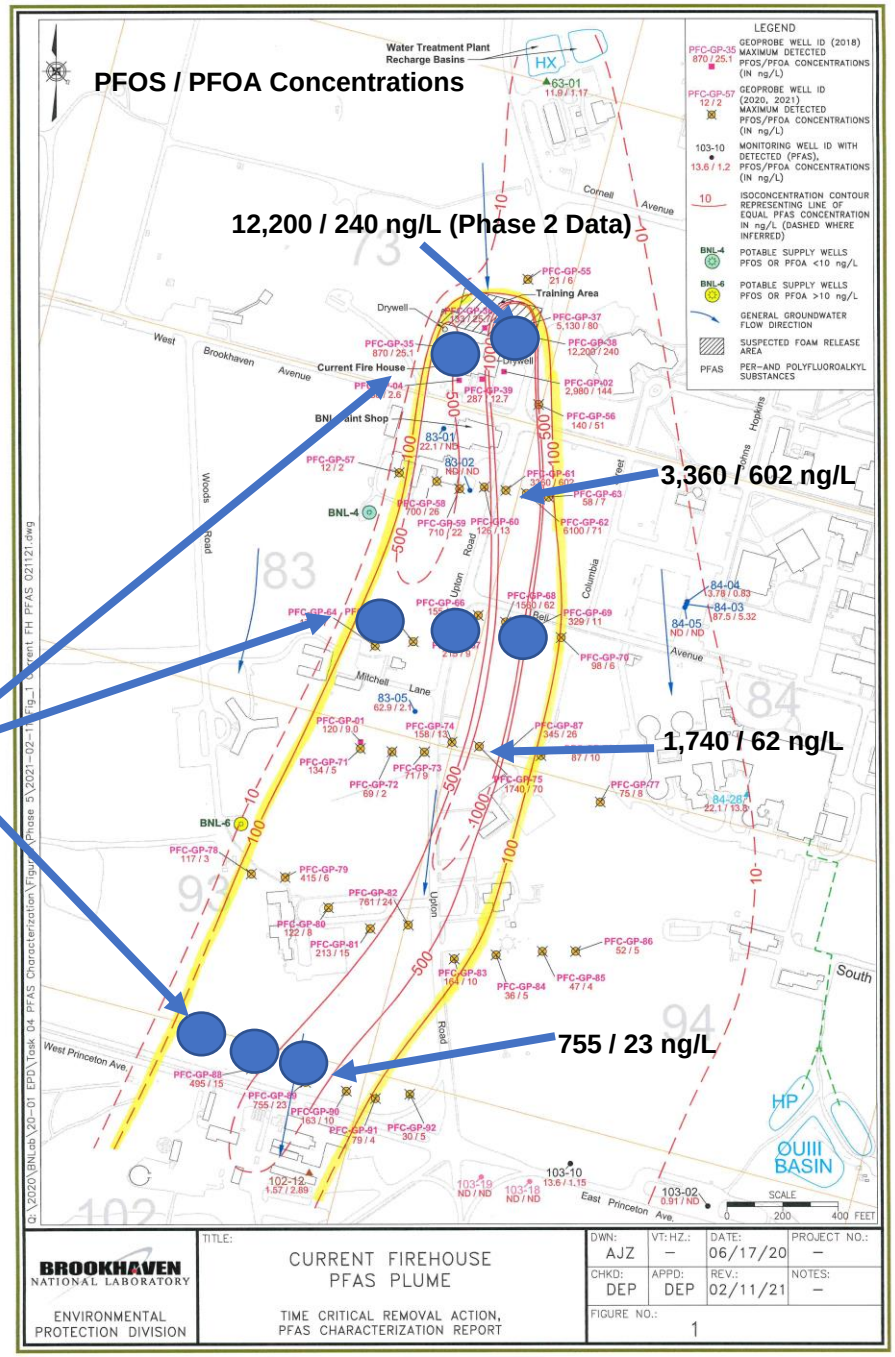
- DOE has provided $10.9M in funding to install remediation systems for the high concentration plume segments associated with the two source areas
  - BNL conducted detailed characterization of high concentration portions of the plumes (July 2020 – January 2021)
  - Currently preparing design documents for the treatment systems
    - Contaminated groundwater will be pumped out of the ground using a series of new extraction wells
    - Water will be treated using granular activated carbon filters
      - BNL will reuse infrastructure for several inactive groundwater treatment systems. Will result in significant time and cost savings
    - Treated water will be discharged into two existing recharge basin areas

Current Firehouse Foam Release Areas (1986-2008)

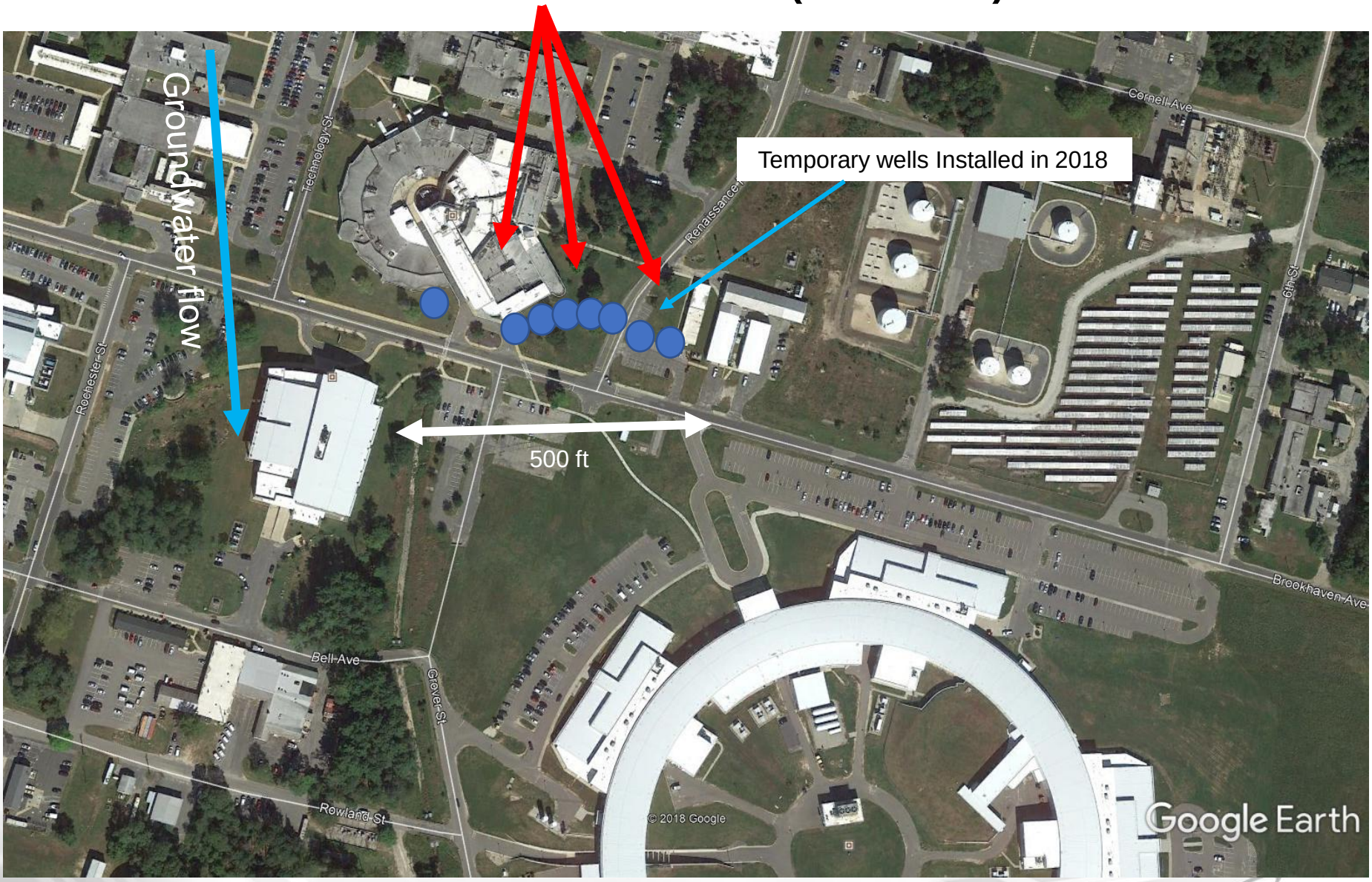


Current Firehouse Plume Characterization and Treatment System Design

- Installed 38 temporary wells to characterize the high concentration areas of the PFAS plume
  - 360 sample intervals
- Treatment system design
  - Establish a capture goal of 100 ng/L for PFOS or PFOA
  - Planning to install up to eight extraction wells
  - Groundwater modeling will be used to determine final extraction well locations, depths and pumping rates
    - Complicated area of the site due to operations of water supply wells and water recharge basins

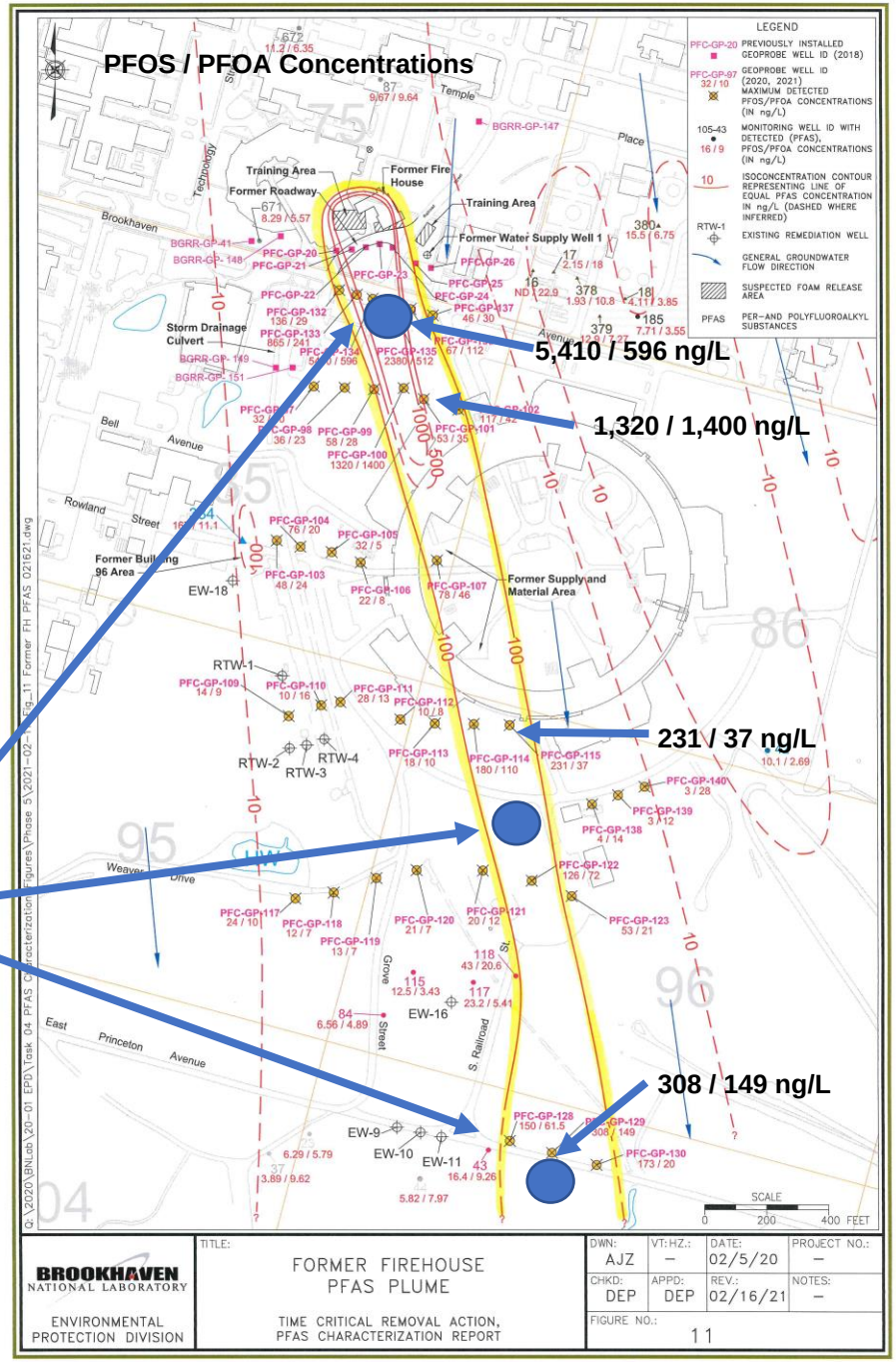


Former Firehouse Foam Release Areas (1966-1985)



Former Firehouse Plume Characterization and Treatment System Design

- Installed 37 temporary wells to characterize the high concentration portions of the PFAS plume
  - 390 sample intervals
- Treatment System Design
  - Establish a capture goal of 100 ng/L for PFOS or PFOA
  - Planning to install three extraction wells
  - Groundwater modeling will be used to determine final extraction well locations, depths and pumping rates

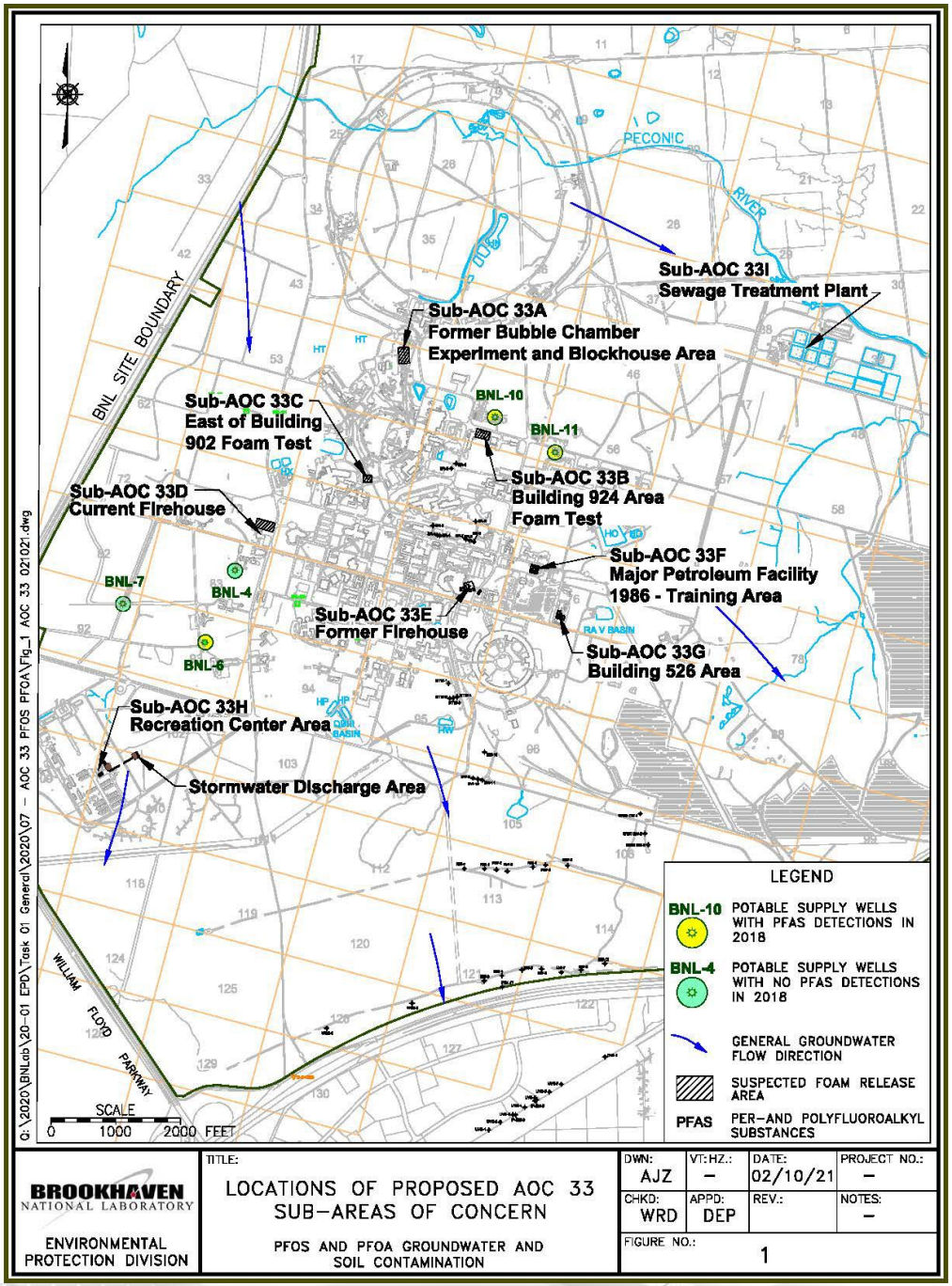


Integrate response to PFAS and 1,4-Dioxane into CERCLA program

- Under the Federal Facilities Agreement, DOE is under a continuing obligation to notify EPA and NYSDEC of any additional potential Areas of Concern which DOE becomes aware
- DOE and BSA are working with EPA and NYSDEC to integrate future investigations and remedial responses into the CERCLA program
  - Including the planned remediation of the current firehouse and former firehouse PFAS plumes as a Time Critical Removal Action

BSA/DOE Recommendations

- Establish Operable Unit (OU VIII) that covers PFOS, PFOA and 1,4-dioxane remedial investigation and remedial actions
- Establish new Areas of Concern 33 and 34
  - AOC 33 – PFOS and PFOA with 9 sub-areas (33a through 33i)
  - AOC 34 – 1,4-Dioxane



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Next Steps

- DOE recently submitted the recommendations to the regulatory agencies to incorporate the new OU and AOCs
  - Also provide target dates for submittal of the TCRA documents for the current firehouse and former firehouse plumes
    - Characterization report
    - Treatment system design plans
- New carbon filters for the current firehouse plume remediation system were delivered to BNL and will be installed in March
- Expect to start construction work on the treatment systems by early summer (e.g., install extraction wells and piping)