ASSESSING UPGRADIENT PFAS VULNERABILITY TO WATER SUPPLIES

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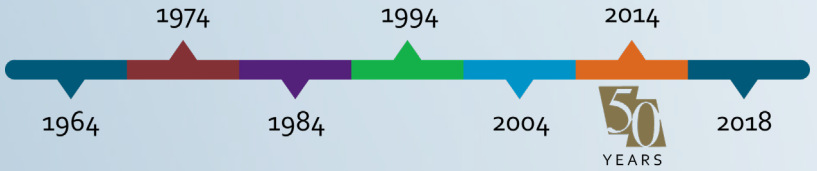
GZA GeoEnvironmental, Inc.
April 5, 2022

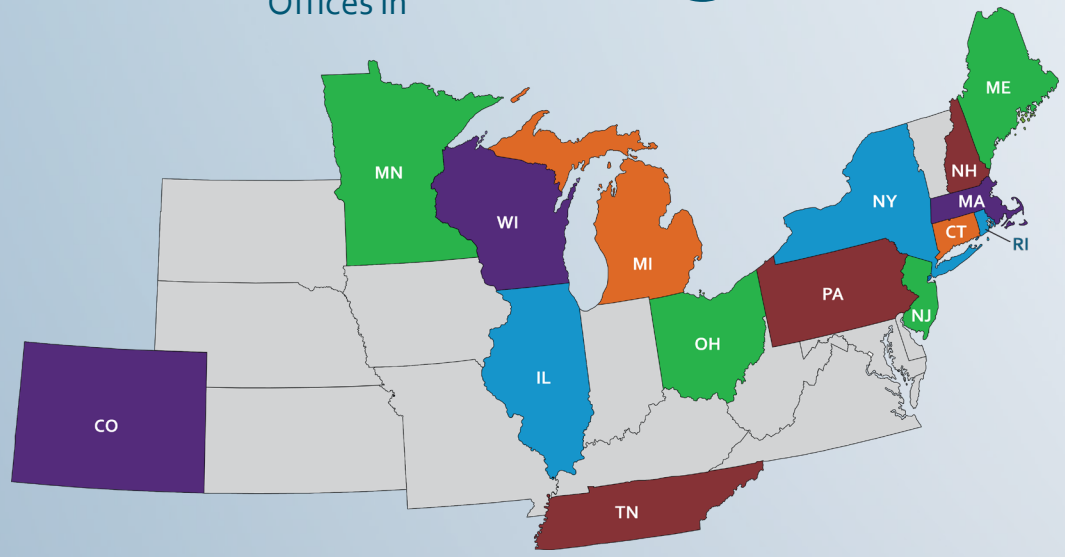
About GZA



57 Years

30 Offices in

15 States



Headquartered in Norwood, MA

Core Services

Engineers/Scientists

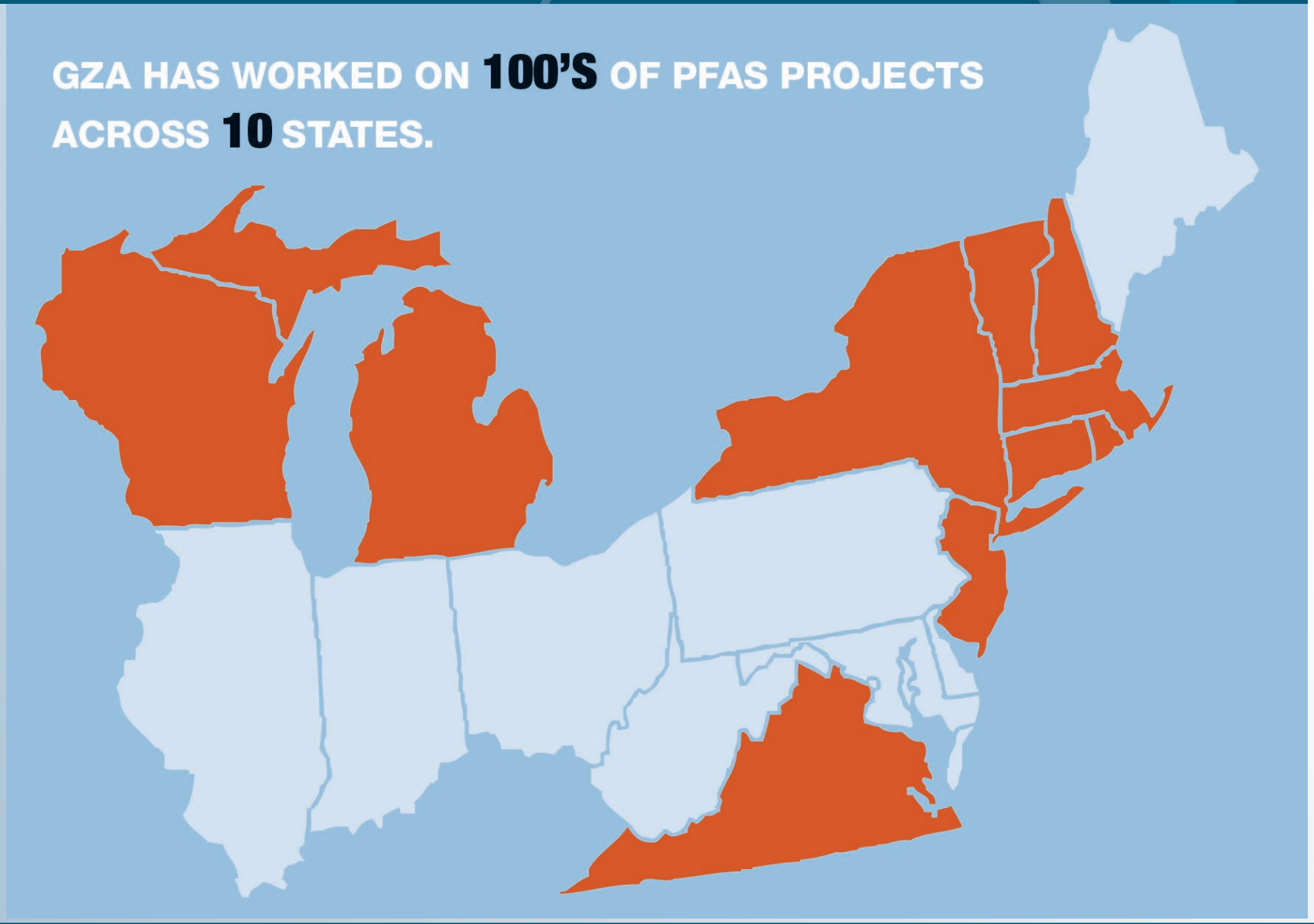
Extensive Training & Experience

700+ Staff

Employee-Owned

Known for excellence.
Built on trust.

GZA's PFAS Project Experience

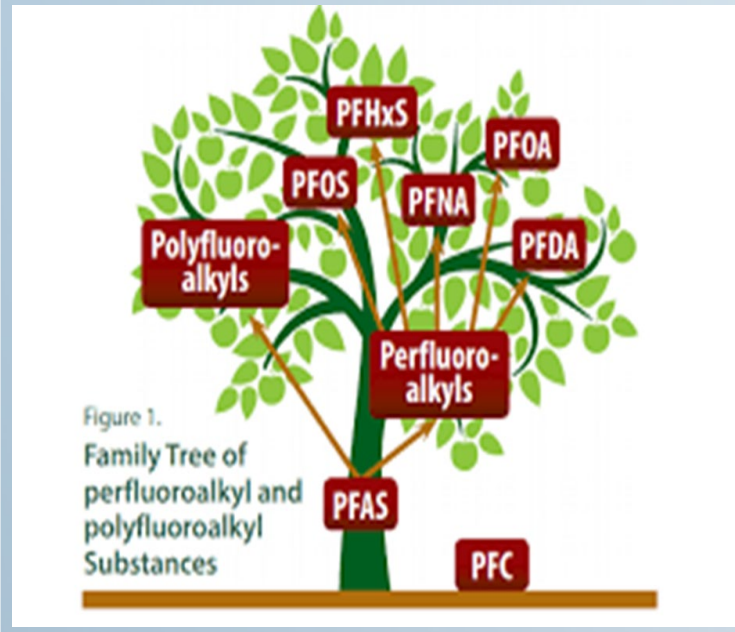


Outline

- ❑ PFAS Overview & Environmental Pathways
- ❑ Assess Potential Regional PFAS Impacts to Water Supplies
- ❑ Case Study - AFFF Releases within Area of Potable Water Supplies
- ❑ Questions and Discussion

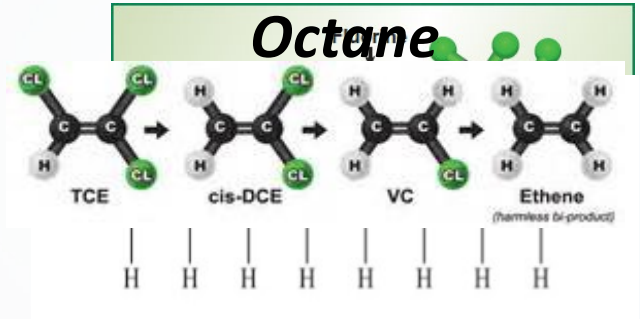
What Makes PFAS Different

PFAS = Per- and Poly-Fluoroalkyl Substances

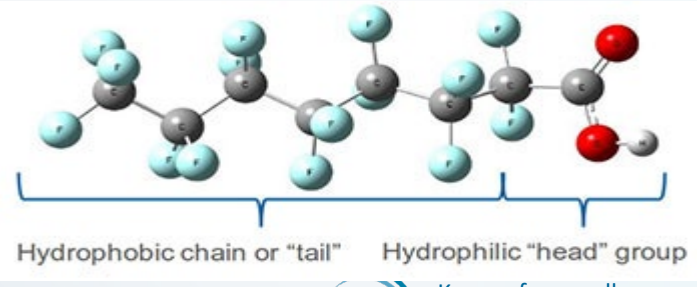


More than 6,000 PFAS compounds

- Man-made compounds (multiple C bonds)
  - Thermally stable (strong C - F molecular bond)
  - Chemically stable (low reactivity)
  - Unlike chlorinated solvents, No biodegradation



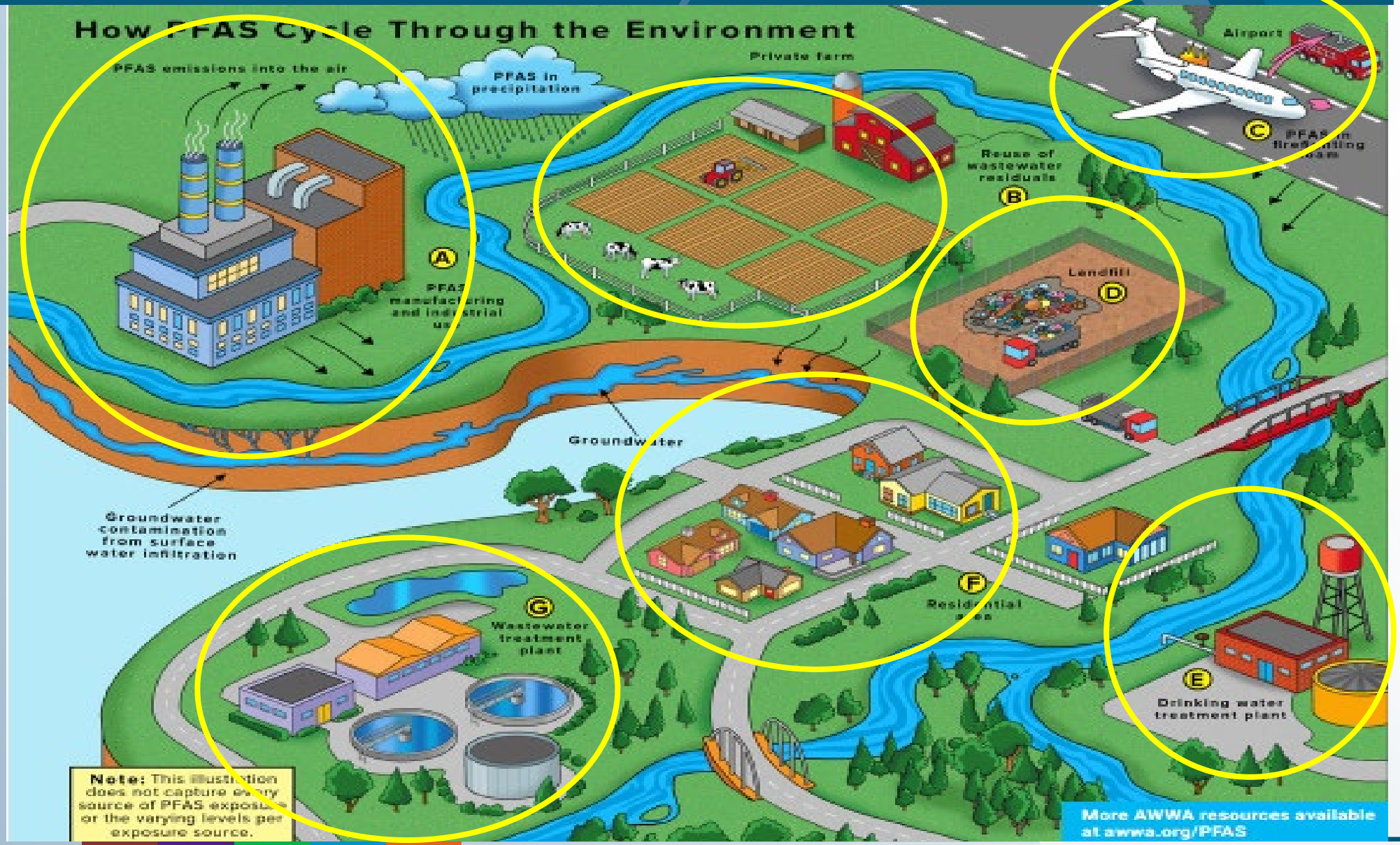
- Persistent in the environment
- Found worldwide in all environmental media (including human blood)
- Half-lives (2 to 8-years in humans) ****
- "Tail" end – Repels water (hydrophobic) and oil/fat (lipophobic)
- "Head" end - attracts/dissolves
  - water (hydrophilic)
  - Nonreactive, non-stick



Sources of PFAS

- Fire-fighting foams
  - Airports, training facilities, terminals
- Industrial facilities
  - Electroplating (mist suppressants)
  - Semiconductor manufacturing
  - Aerospace & electronic applications
  - Automobile
- Landfills
  - Leachate
  - Residential/commercial/industrial waste
- Wastewater treatment plants
  - Effluent discharges
  - Biosolids
- Consumer Products
  - Water Repellents
  - Stain-resistant - carpet/furniture/clothing
  - Teflon cookware
  - Cosmetics
  - Pesticides

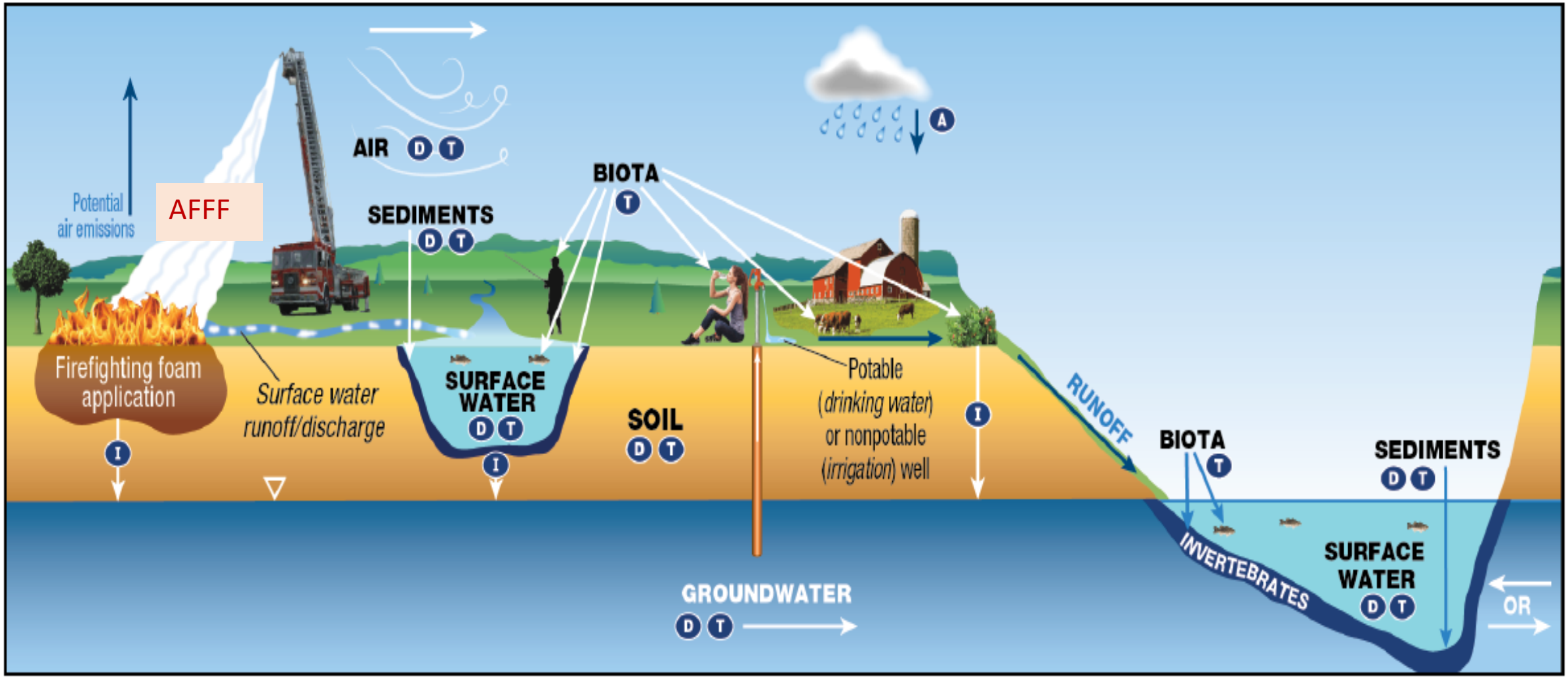
Sources and Transport Mechanisms of PFAS



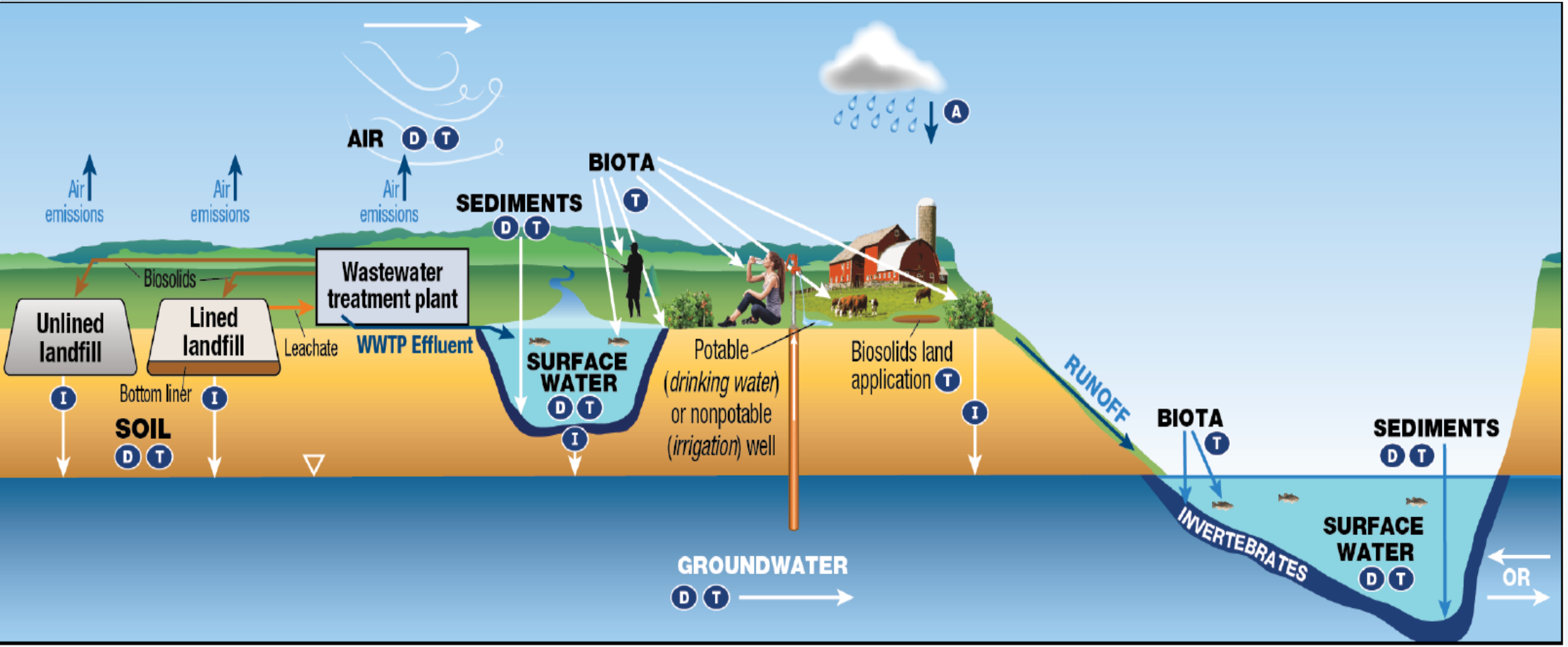
- Industrial Facilities
- Wastewater Plants
- Biosolid Applications
- Landfills
- Leaching Fields
- Water Supplies
- Airports/Fire Training

Reference-American Water Works Association

AFFF - Fate & Transport Conceptual Site Model

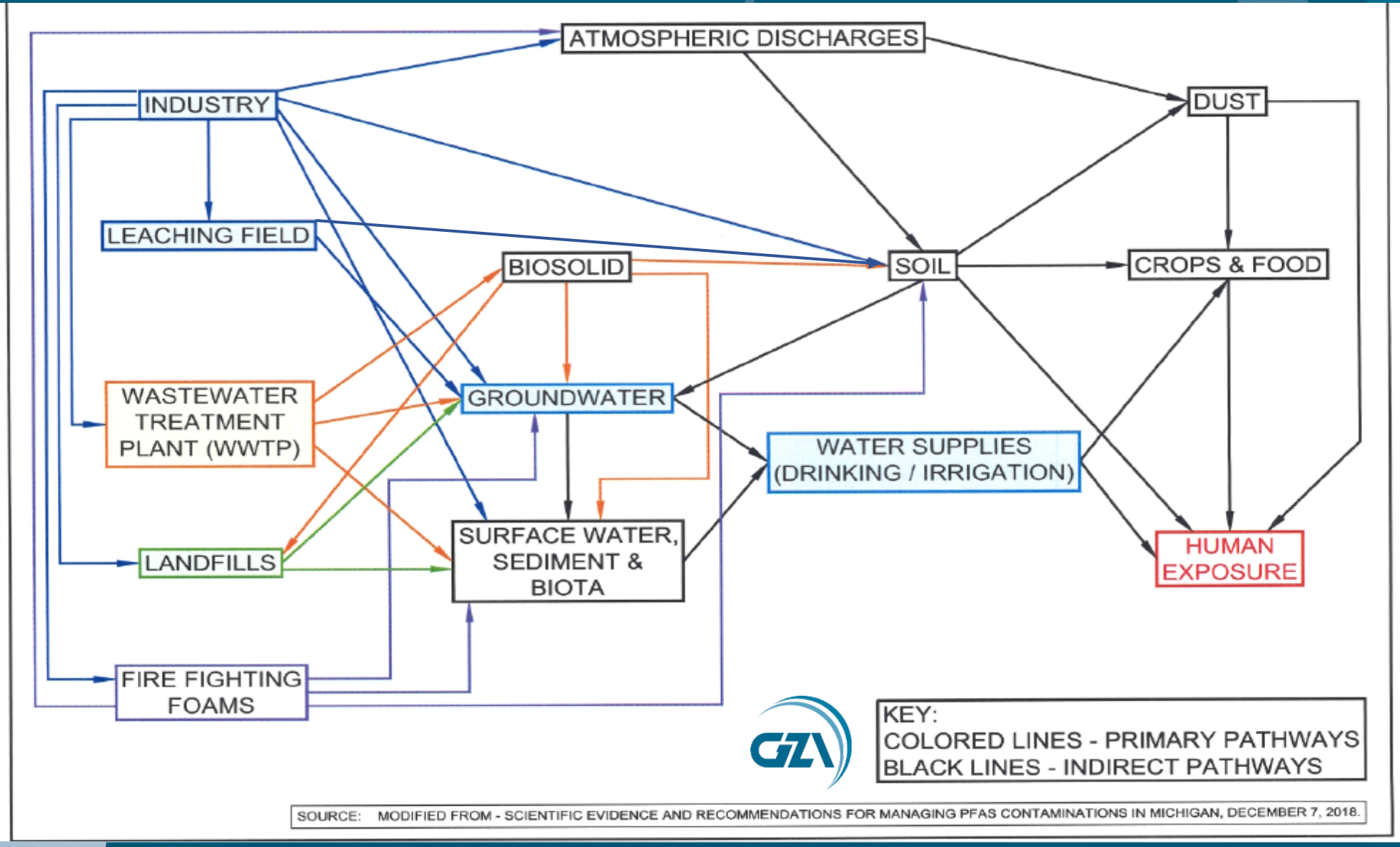


Landfill - Fate & Transport Conceptual Site Model

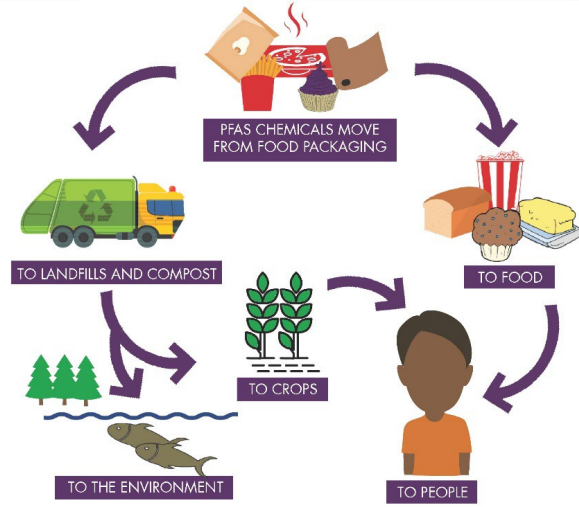


KEY A Atmospheric Deposition D Diffusion/Dispersion/Advection I Infiltration T Transformation of precursors (abiotic/biotic)

Exposure Pathways



SOURCE: MODIFIED FROM - SCIENTIFIC EVIDENCE AND RECOMMENDATIONS FOR MANAGING PFAS CONTAMINATIONS IN MICHIGAN, DECEMBER 7, 2018.

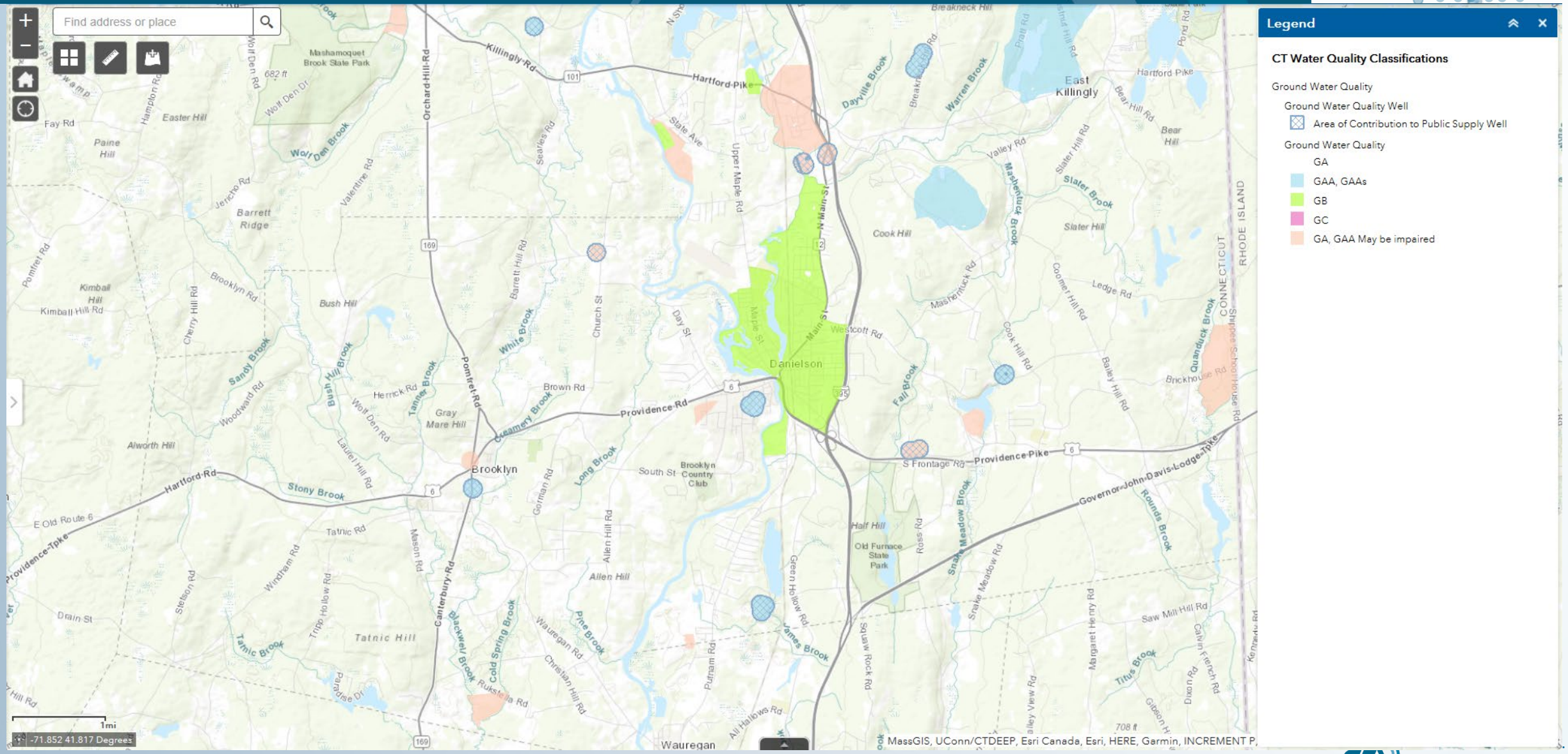


AFFF - Case Study

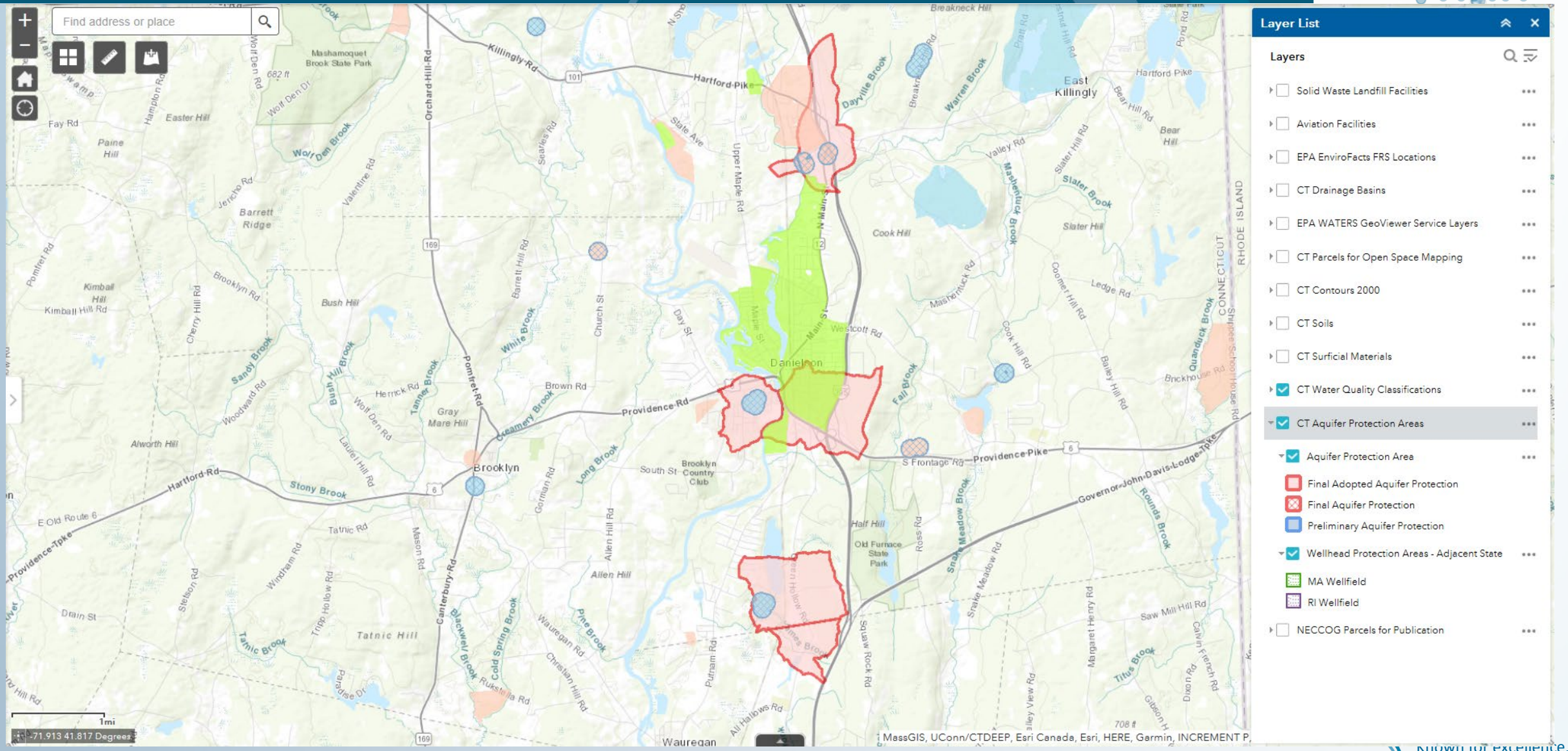
Assess Potential Regional

PFAS Impacts to Water Supplies

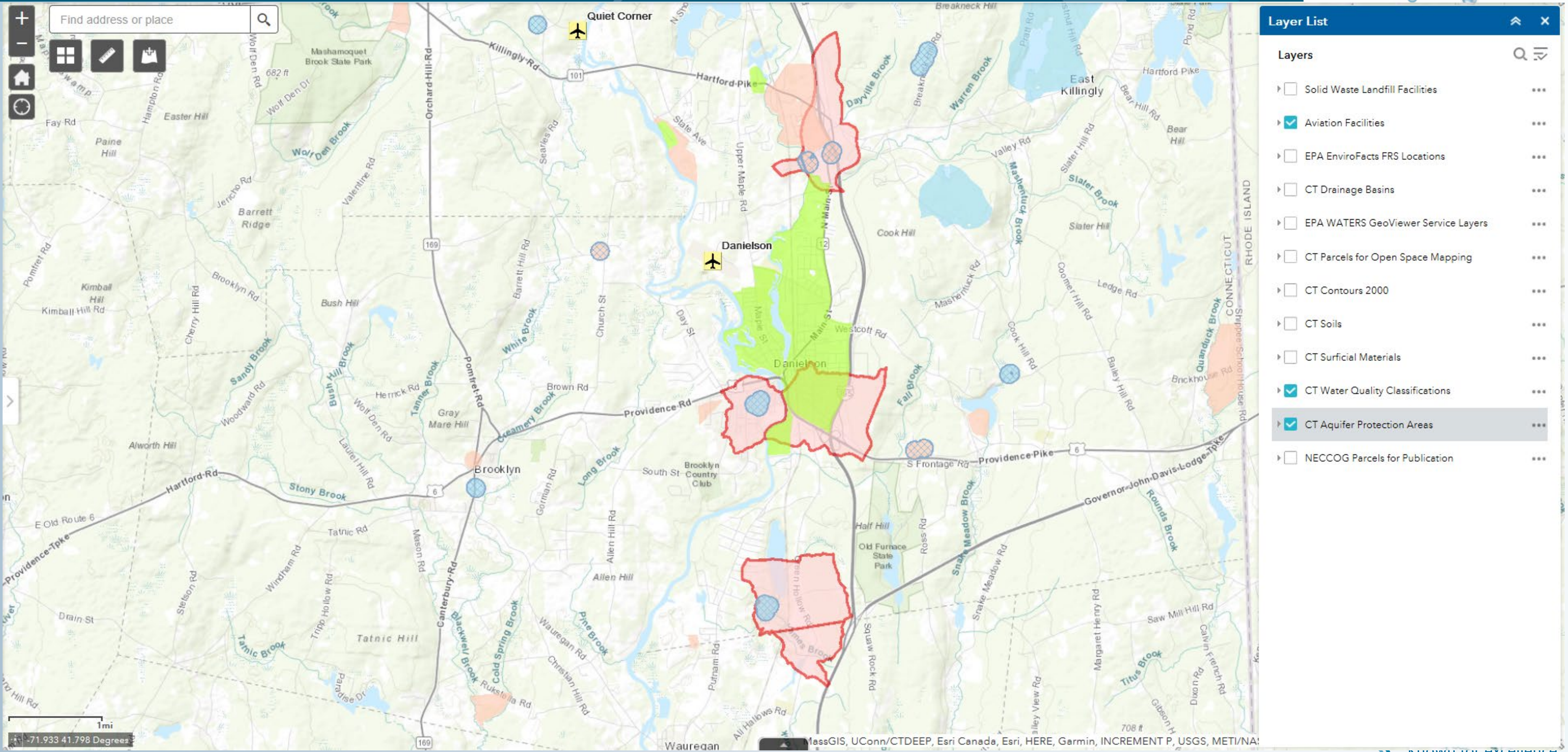
Groundwater Classifications



Aquifer Protection Areas



Airports


Find address or place
Quiet Corner
Danielson
Brooklyn
East Killingly
Layer List
Layers
Solid Waste Landfill Facilities
Aviation Facilities
EPA EnviroFacts FRS Locations
CT Drainage Basins
EPA WATERS GeoViewer Service Layers
CT Parcels for Open Space Mapping
CT Contours 2000
CT Soils
CT Surficial Materials
CT Water Quality Classifications
CT Aquifer Protection Areas
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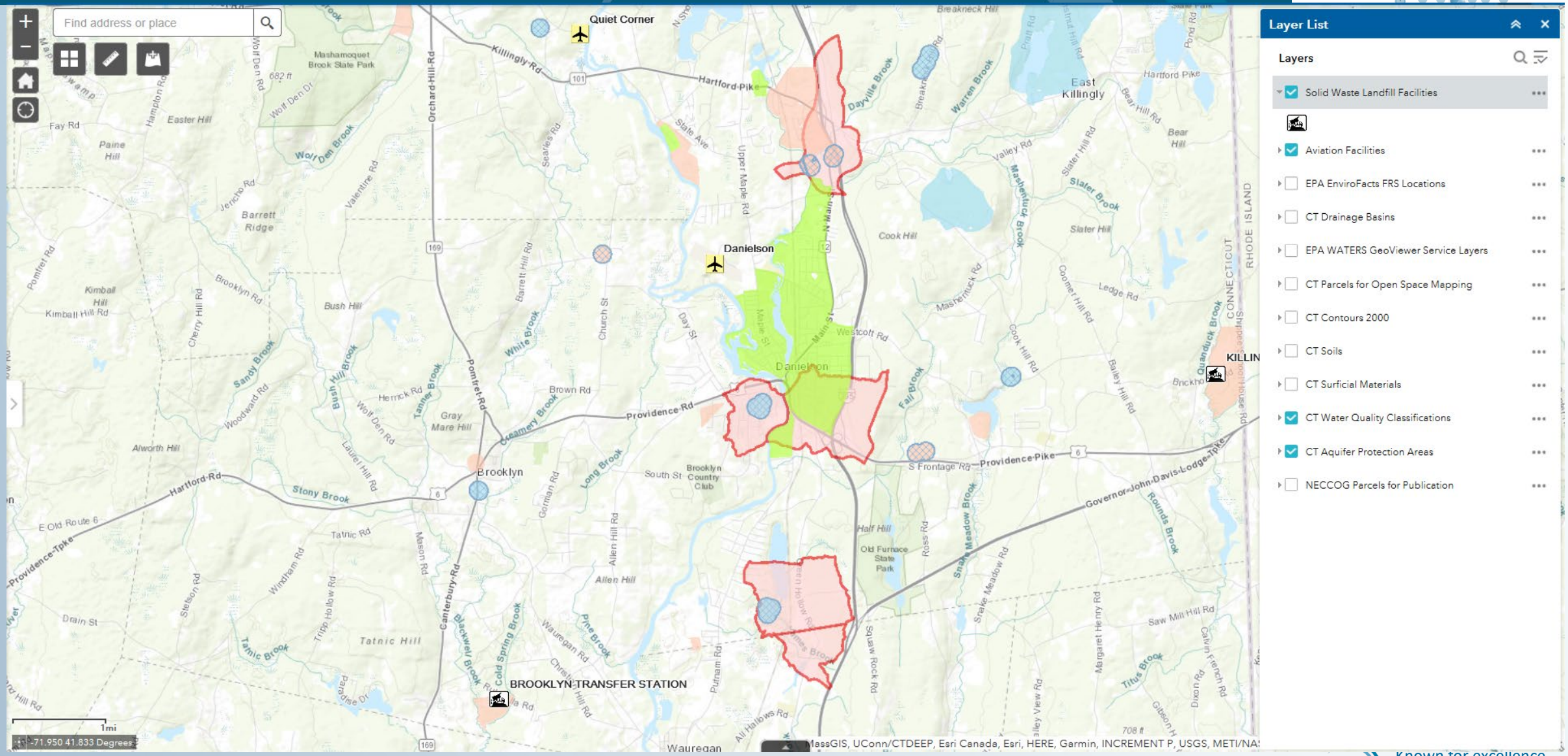
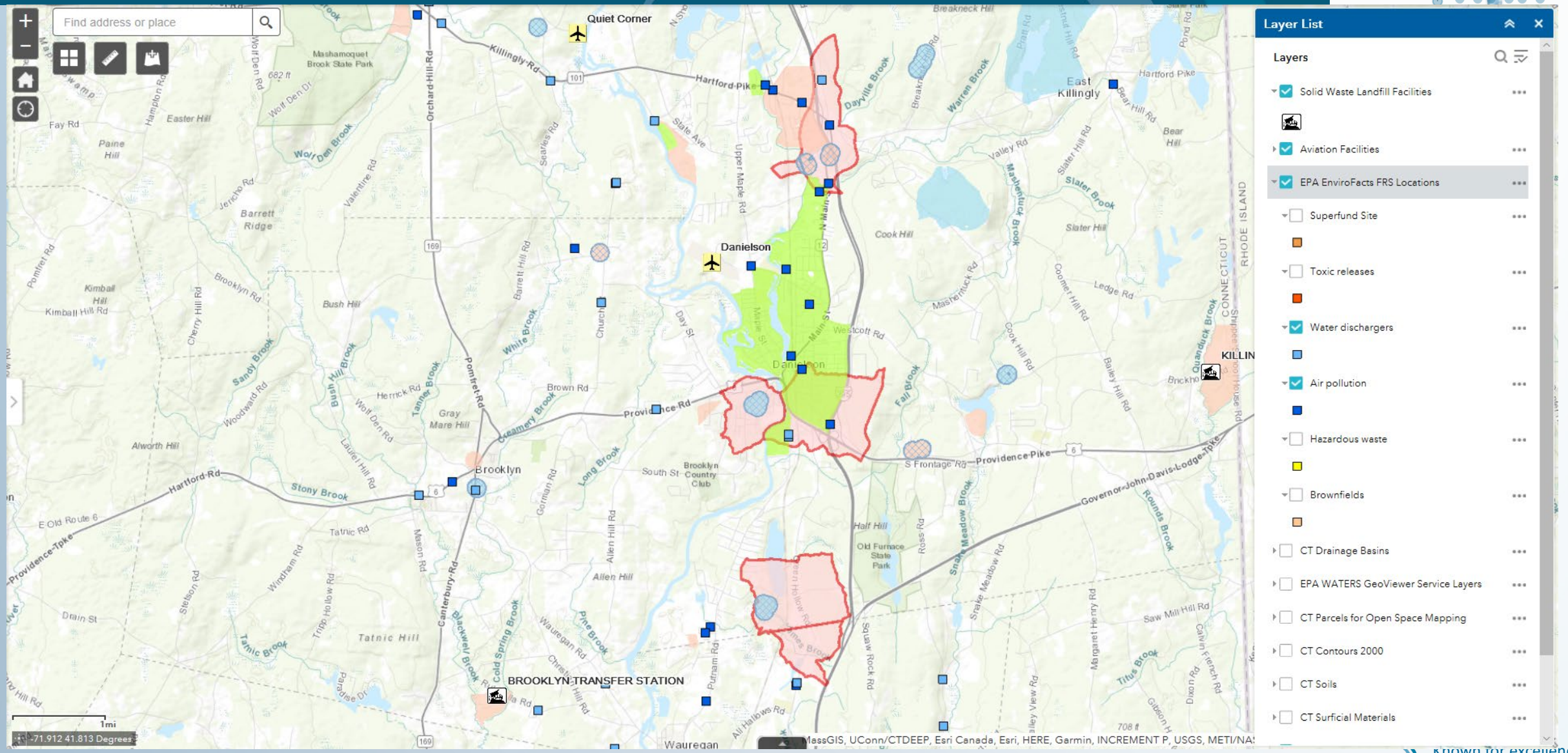
MassGIS, UConn/CTDEEP, Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NAS

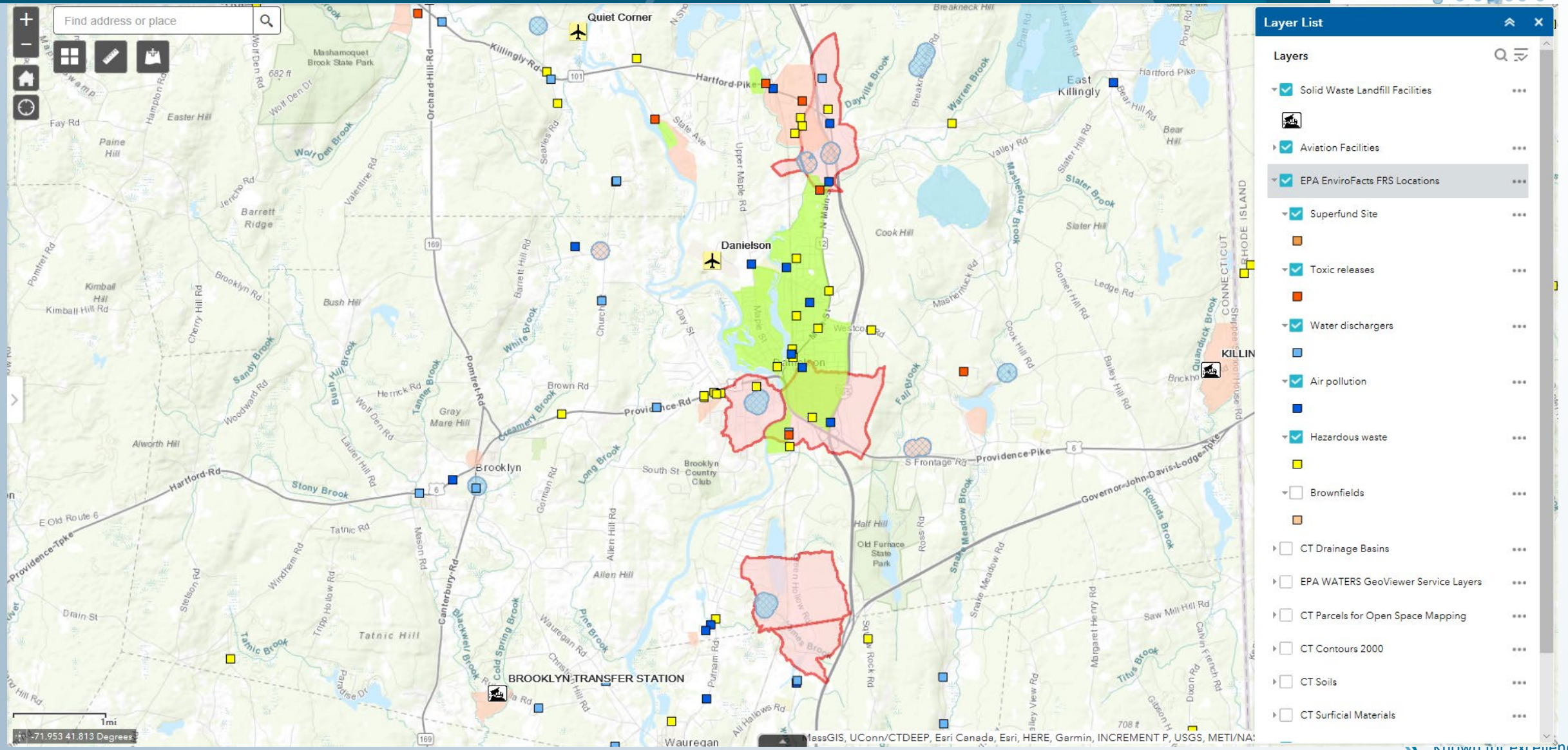
Solid Waste Facilities



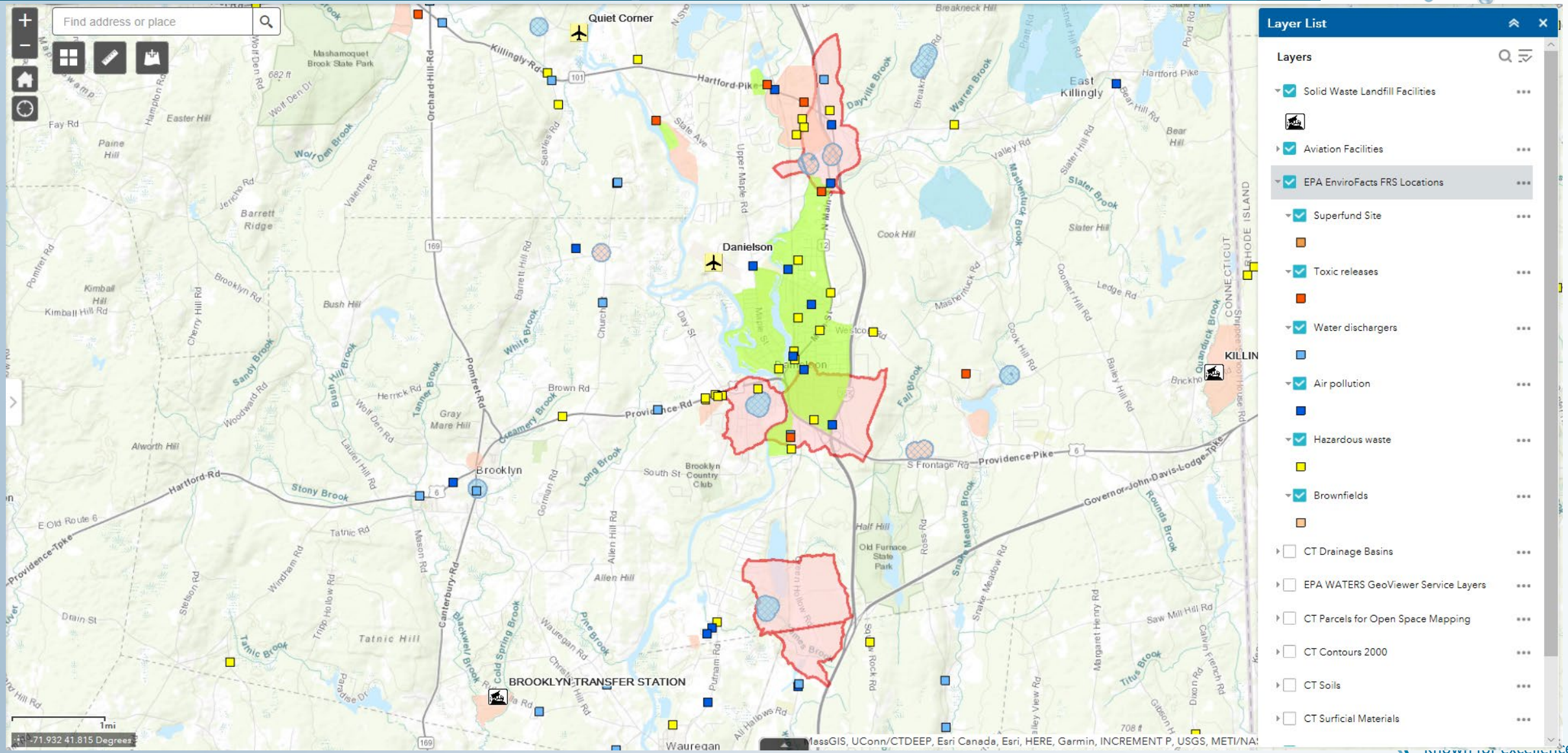
EPA (Water Dischargers & Air Pollution)



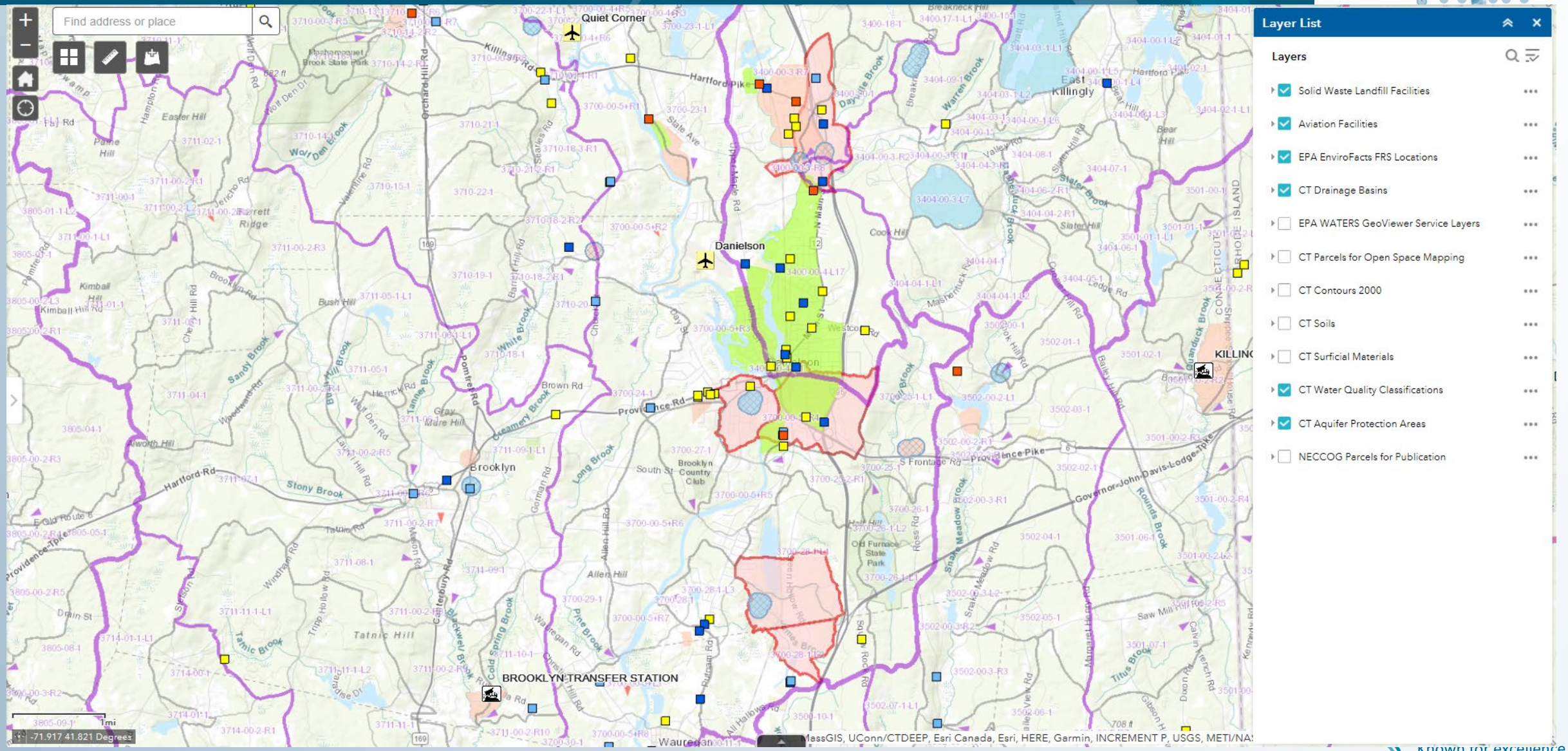
EPA (+ Superfund/Toxic Releases/Haz Waste)



EPA (+ Brownfield Sites)



Drainage Basins



AFFF - Case Study

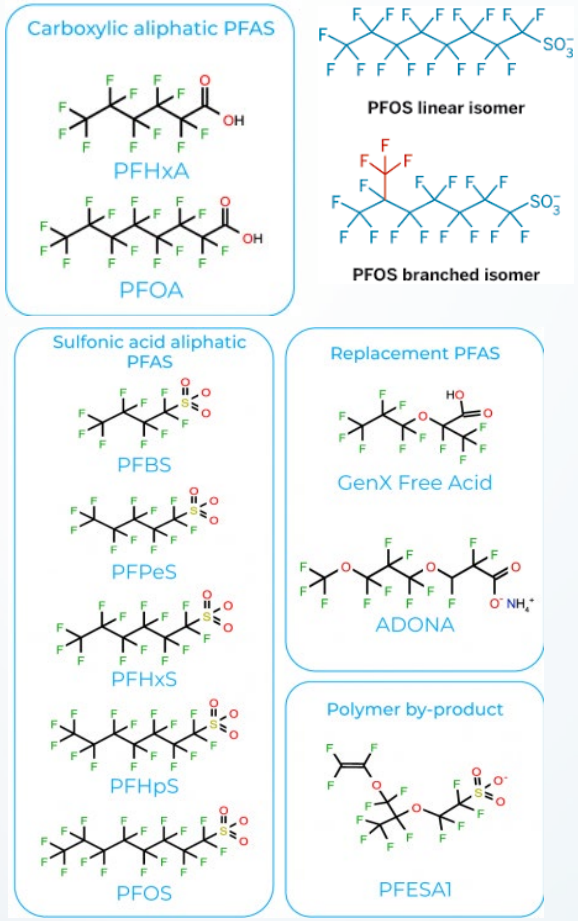
AFFF Releases

+

Potable Water Supply Wells

Identification of Potential Sources of AFFF

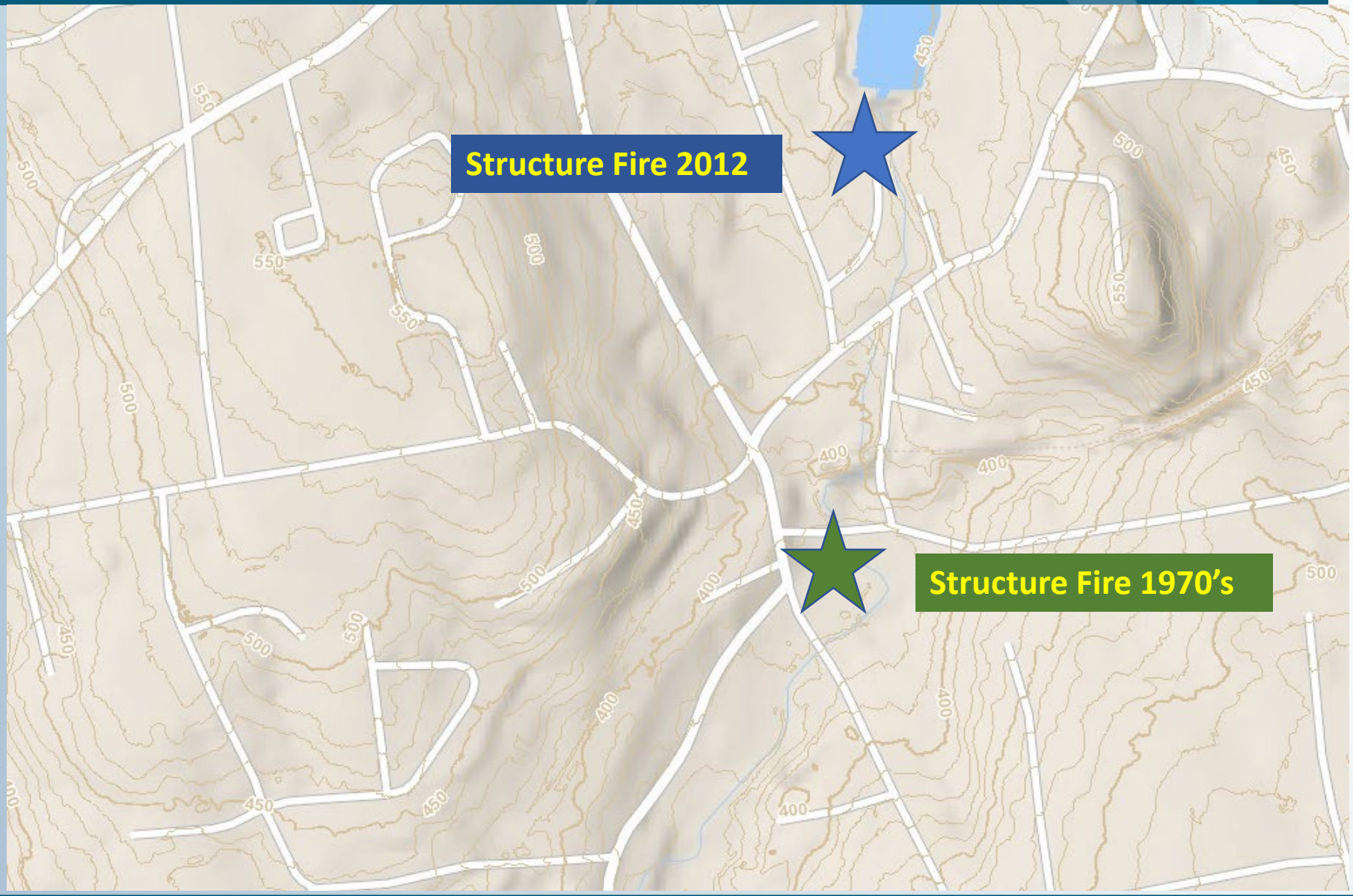
- Conceptual Site Model (CSM)
  - Geologic and hydrogeologic (assessment for fate & transport)
  - Source(s) and types of PFAS compounds released
  - What are the exposure routes (water supply, direct contact, biota)
- Chemical Analyses
  - Analysis targeting compounds and types of PFAS
    - Linear, branched
  - Graphically/statistical distribution of PFAS compounds
- Data Comparisons
  - Compare analytical data to sources
  - Identify unique constituents
  - Revisit CSM



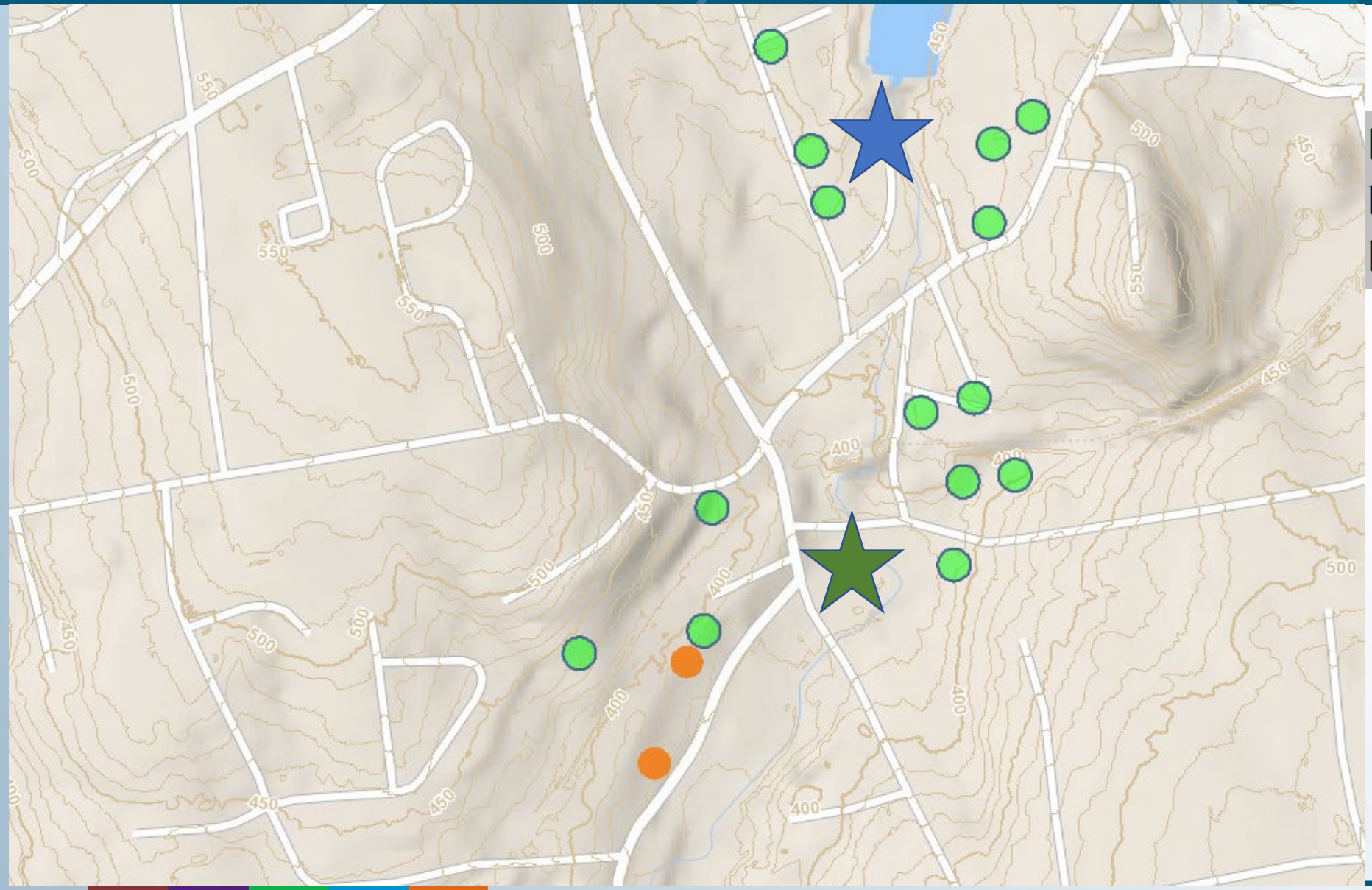
History of AFFF

- **Legacy PFOS AFFF**
  - ✓– Manufactured early 1960s until about 2002
  - ✓ - Primary PFAS Compounds – **PFOS & PFHxS**
- **Second Generation AFFF – Fluorotelomer Sulfonates (FTS)**
  - ✓ - Manufactured 1970s until about 2016
  - ✓ - Primary PFAS Compounds – **FTS (6:2, 8:2) + PFOA, PFHxA**
- **Today's FTS**
  - ✓ - Manufactured after 2010
  - ✓ - Primary PFAS Compounds - **FTS (6:2, 8:2)**

AFFF – Initial CSM



AFFF – Initial Potable Water Well Sampling



GREEN SHADING INDICATES PROPERTY WITH TEST RESULT LESS THAN 20 PPT

BLUE SHADING INDICATES PROPERTY WITH TEST RESULT BETWEEN 20 AND 70 PPT

ORANGE SHADING INDICATES PROPERTY WITH TEST RESULT GREATER THAN 70 PPT

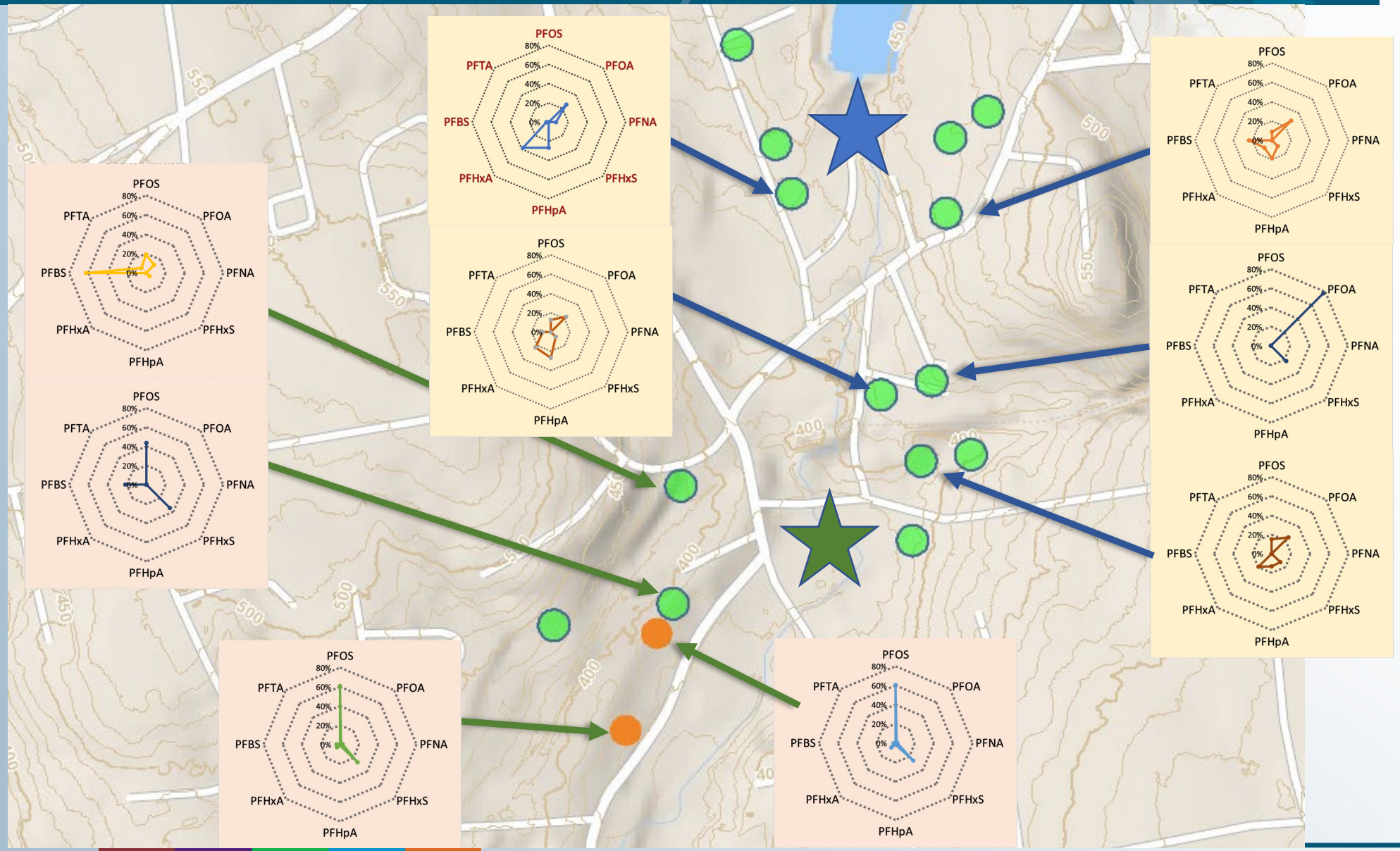
Potential Use of AFFF 2012

(Potentially Second Generation or Today's AFFF)

Potential Use of AFFF 1970s

(Legacy or Second Generation AFFF)

AFFF –Analytical Graphical Distribution



AFFF used 2012

(Potentially Second Generation or Today's AFFF)

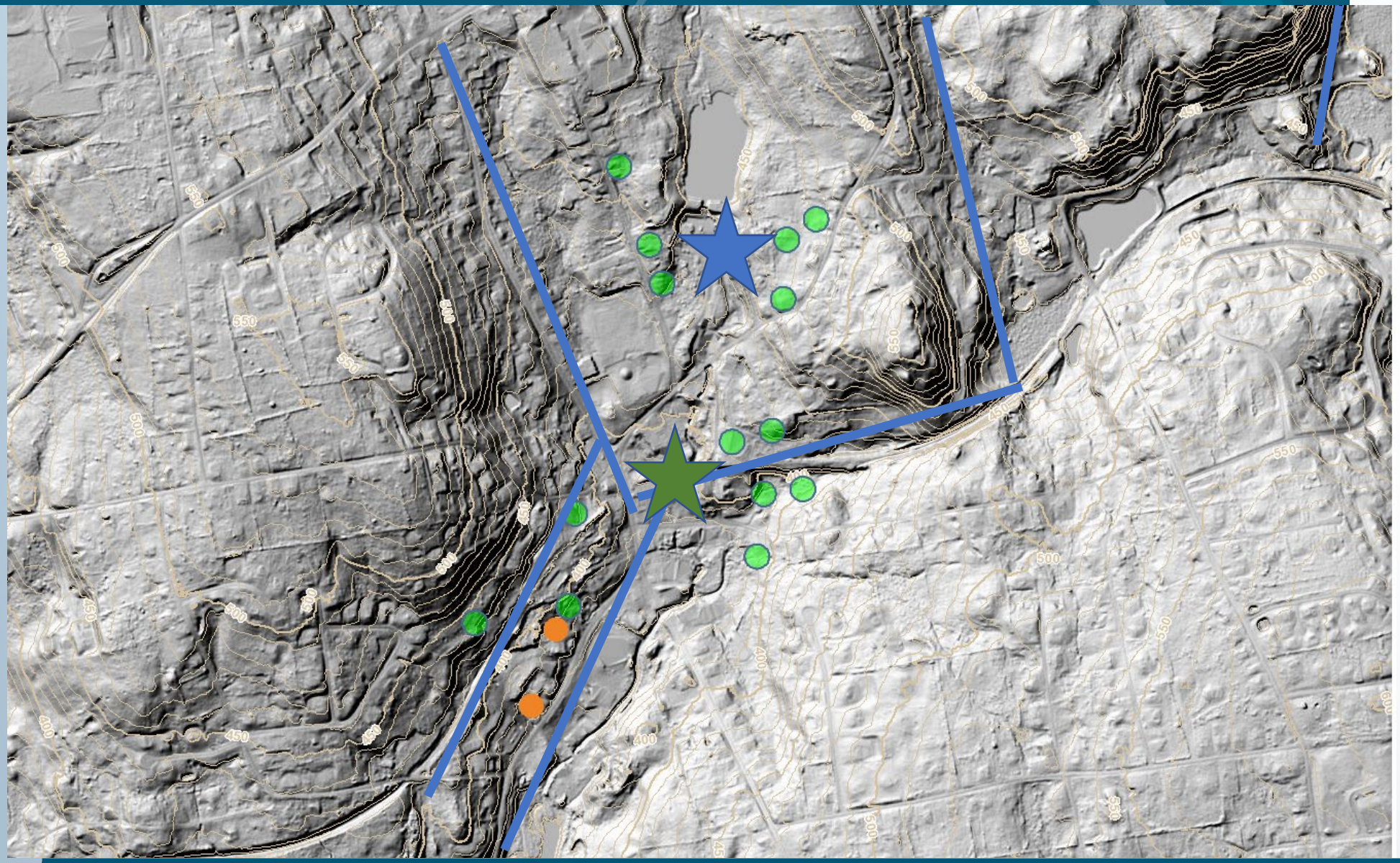
PFOA, PFHxA

AFFF used 1970s

(Legacy or Second Generation AFFF)

PFOS, PFHxS

Update CSM – Bedrock Lineaments



Potential Bedrock Fracture Lineament

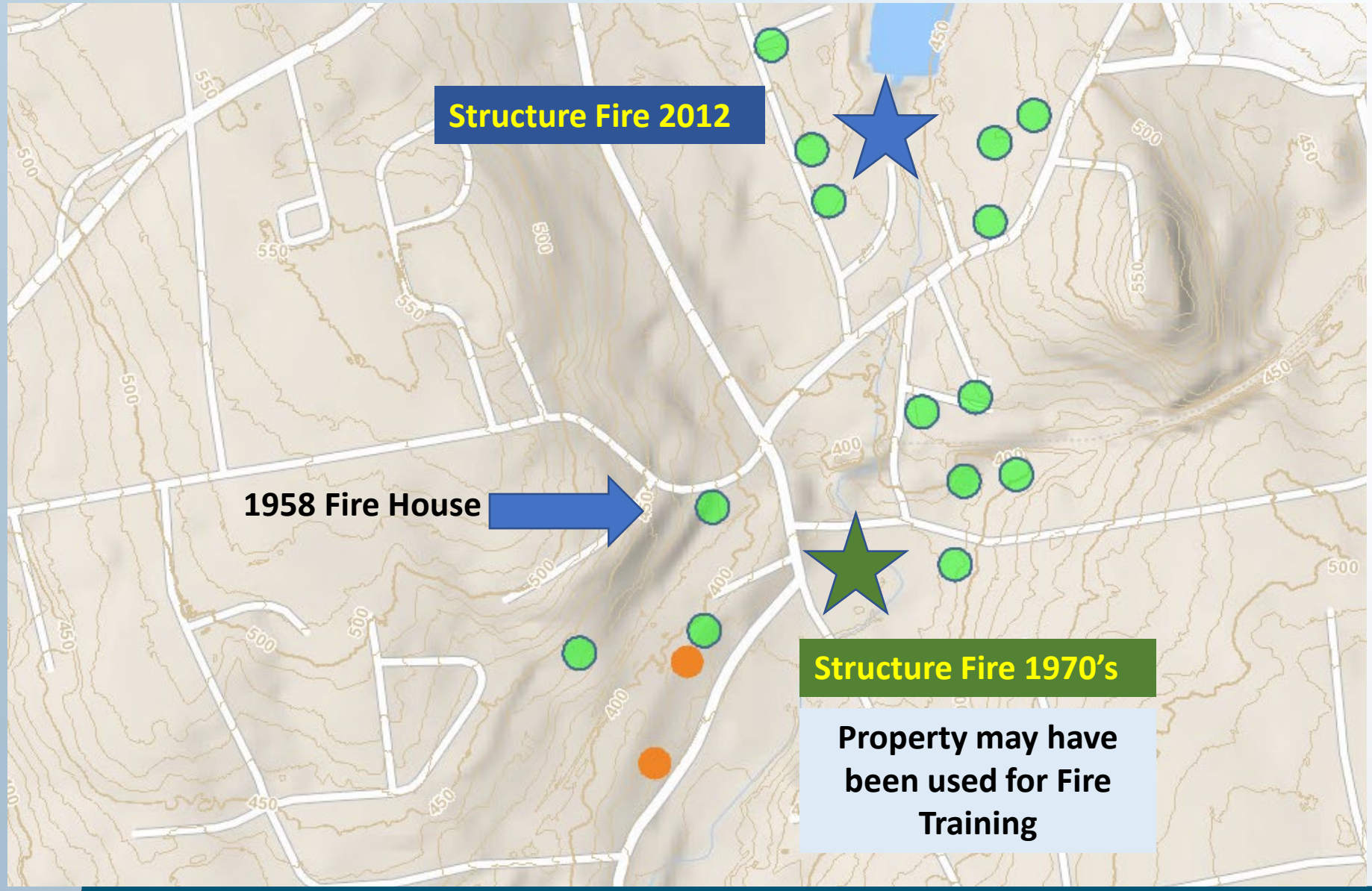
AFFF used 2012

(Potentially Today's AFFF)

AFFF used 1970's

(Legacy or Second Generation AFFF)

AFFF – Initial Water Supply Sampling



Next Steps

- Refine CSM
- Additional Sampling to Define the EXTENT of PFAS Impact
- POE Treatment
- Identify/Remediate Source(s)

Question and Discussion

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