

PFAS INTERAGENCY TASK FORCE

PFAS Solutions and Costs

Jeffrey Arps, LSP
James Collins, PE

INTRODUCTION

- **How do PFAS move**
- **Where do PFAS exist**
- **How can they be removed**
- **How much does this cost**
- **Who should pay**



HOW DO PFAS ENTER THE ENVIRONMENT

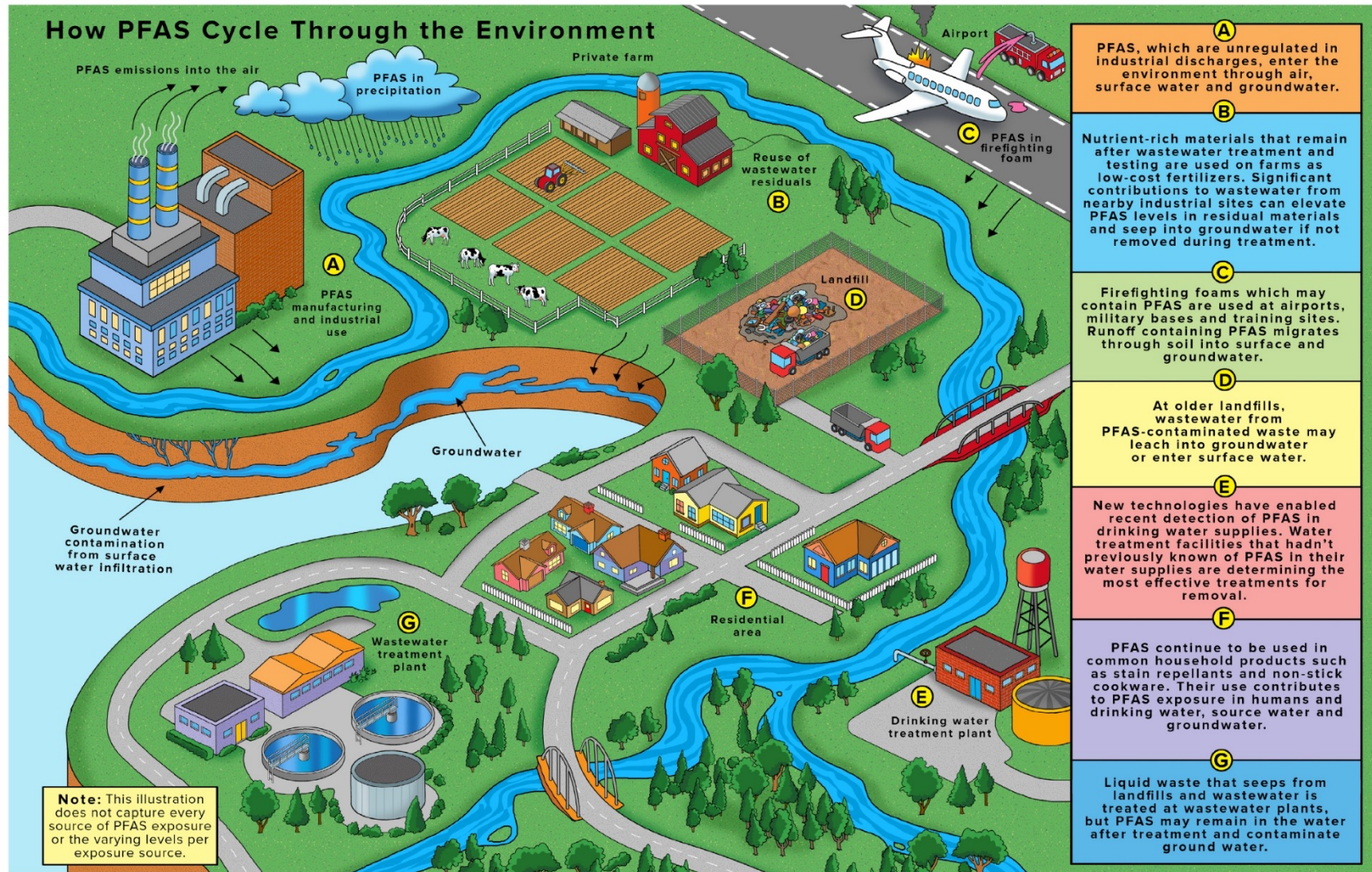
- **In firefighting runoff (and training and hose/tank rinsing)**
- **Discharge through:**
 - Manufacturing discharges
 - WWTP discharges
 - Land application of residuals
 - Residential septic systems
 - Landfills
 - Air deposition from manufacturing
- **Very soluble in water**
 - Readily dissolve into and flow with precipitation runoff
 - Migrate into and flow with groundwater and surface water
- **No biodegradation, only dilution**

WHERE DO PFAS EXIST

- **Typical CSM**

- Soil is impacted through air deposition, land application of biosolids, firefighting runoff
- PFAS dissolve into precipitation and migrate vertically to groundwater or runoff into surface water (groundwater also discharges to surface water)
- Exposure through water well withdrawal
- Contaminated well water discharged to septic system, impacting shallow groundwater
- PFAS can enter the food chain through food grown in contaminated soil, fish living in contaminated water, livestock consuming contaminated feed and/or water

PFAS CYCLE



A PFAS, which are unregulated in industrial discharges, enter the environment through air, surface water and groundwater.

B Nutrient-rich materials that remain after wastewater treatment and testing are used on farms as low-cost fertilizers. Significant contributions to wastewater from nearby industrial sites can elevate PFAS levels in residual materials and seep into groundwater if not removed during treatment.

C Firefighting foams which may contain PFAS are used at airports, military bases and training sites. Runoff containing PFAS migrates through soil into surface and groundwater.

D At older landfills, wastewater from PFAS-contaminated waste may leach into groundwater or enter surface water.

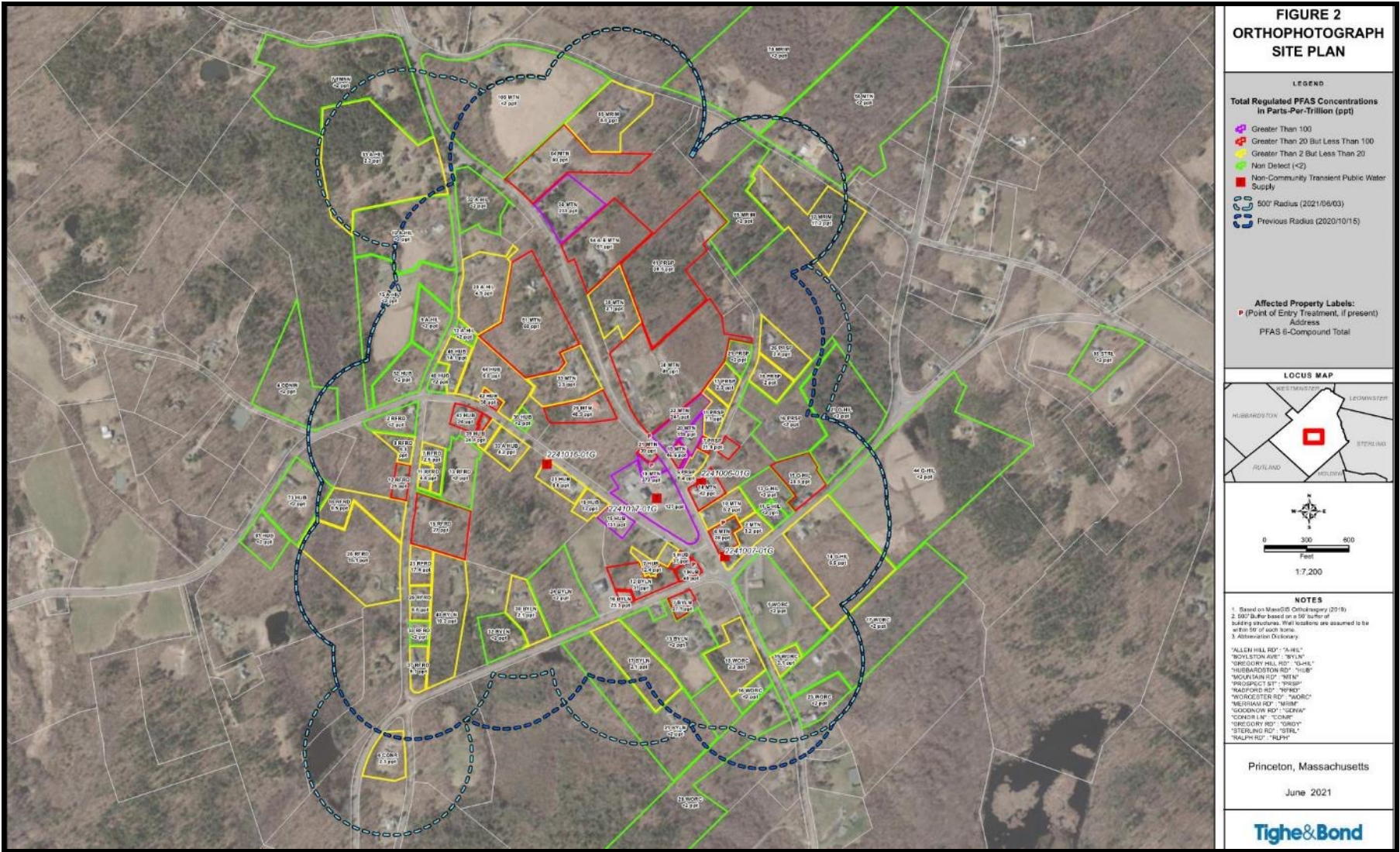
E New technologies have enabled recent detection of PFAS in drinking water supplies. Water treatment facilities that hadn't previously known of PFAS in their water supplies are determining the most effective treatments for removal.

F PFAS continue to be used in common household products such as stain repellants and non-stick cookware. Their use contributes to PFAS exposure in humans and drinking water, source water and groundwater.

G Liquid waste that seeps from landfills and wastewater is treated at wastewater plants, but PFAS may remain in the water after treatment and contaminate ground water.

Note: This illustration does not capture every source of PFAS exposure or the varying levels per exposure source.

JUNE 2021 PRINCETON RADIUS MAP



**FIGURE 2
ORTHOGRAPH
SITE PLAN**

LEGEND

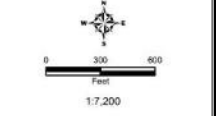
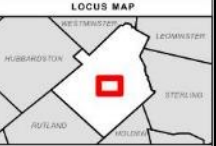
**Total Regulated PFAS Concentrations
in Parts-Per-Trillion (ppt)**

- Greater Than 100
- Greater Than 20 But Less Than 100
- Greater Than 2 But Less Than 20
- Non Detect (<2)
- Non-Community Transient Public Water Supply

- 500' Radius (2021/06/03)
- Previous Radius (2020/10/15)

Affected Property Labels:

- Point of Entry Treatment, if present
- Address
- PFAS 6-Compound Total



NOTES

1. Based on MassGIS Orthophotography (2019)
2. 500' Buffer based on a 50' buffer of building structures. What locations are assumed to be within 50' of each home.
3. Abbreviation Dictionary

"ALLEN HILL RD." "AHL"
 "BOYLSTON AVE." "BYLN"
 "BREWSTER HILL RD." "BHR"
 "HUBBARDSTON RD." "HUB"
 "MOUNTAIN RD." "MTR"
 "PROSPECT ST." "PRSP"
 "WADFORD RD." "WADR"
 "WORKSHEETER RD." "WORC"
 "MERRIAM RD." "MERR"
 "MORNING RD." "MORN"
 "COKER LN." "COKR"
 "BREWSTER RD." "BHR"
 "STERLING RD." "STRL"
 "RALPH RD." "RALP"

Princeton, Massachusetts
 June 2021



HOW TO REMOVE PFAS

- **Typical contaminants have many remedial options**
 - Bioremediation
 - In-situ chemical oxidation (ISCO)
 - Soil Vapor Extraction (SVE)
 - Air sparging
 - Groundwater extraction and treatment
 - Soil excavation and off-site disposal
- **PFAS are not “typical”**
 - PFAS are not natural, no natural biological “predators,” no bioremediation options (yet)
 - PFAS will oxidize to terminal PFAS products, but are not destroyed (C-F Bond)
 - PFAS are not sufficiently volatile for SVE or air sparging

Only ex-situ options are currently feasible, but very costly

IMPLEMENTING REMEDIATION - SOIL

- **Soil Excavation**

- Access agreements
- Delineate extent of soil contamination through soil borings and lab analysis
- Soil samples cost \$325 each
- And soil disposal (incineration) costs around \$800/ton (1 cubic yard of soil weighs 1.5 tons)
- Landfilling of PFAS-contaminated soil is not recommended, just relocates the problem, long-term liability concerns



IMPLEMENTING REMEDIATION – GROUNDWATER

- **Groundwater Extraction**
 - PFAS readily removed with granular activated carbon and various ion exchange resins
 - GAC vessel size and lifespan depend on flow rates, infrastructure costs are also significant
 - Long GAC life at 100 ppt-levels, but groundwater geochemistry can reduce lifespan
 - Monitoring 3 points (influent, midfluent and effluent) plus trip and field blanks (5 samples @ \$250 ea)
 - MCP Reporting, LSP services, field staff are a significant additional cost



DRINKING WATER TREATMENT

- **System-wide vs Point-of-Entry**
 - Point-of-Entry Treatment (POET) GAC systems are \$3,500
 - Monitoring required, expensive (\$1,250/round)
 - GAC replacement/disposal not insignificant costs
- **Municipal-scale Treatment**
 - Same general concepts, much larger scale



PFAS CHALLENGES FOR WATER UTILITIES

New
contaminant

Conventional
treatment
technologies are
ineffective

Lack of
historical data

Complexities of
regulations

Source
identification

Funding

Public
communications

TREATMENT TECHNOLOGIES



Granular Activated
Carbon (GAC)

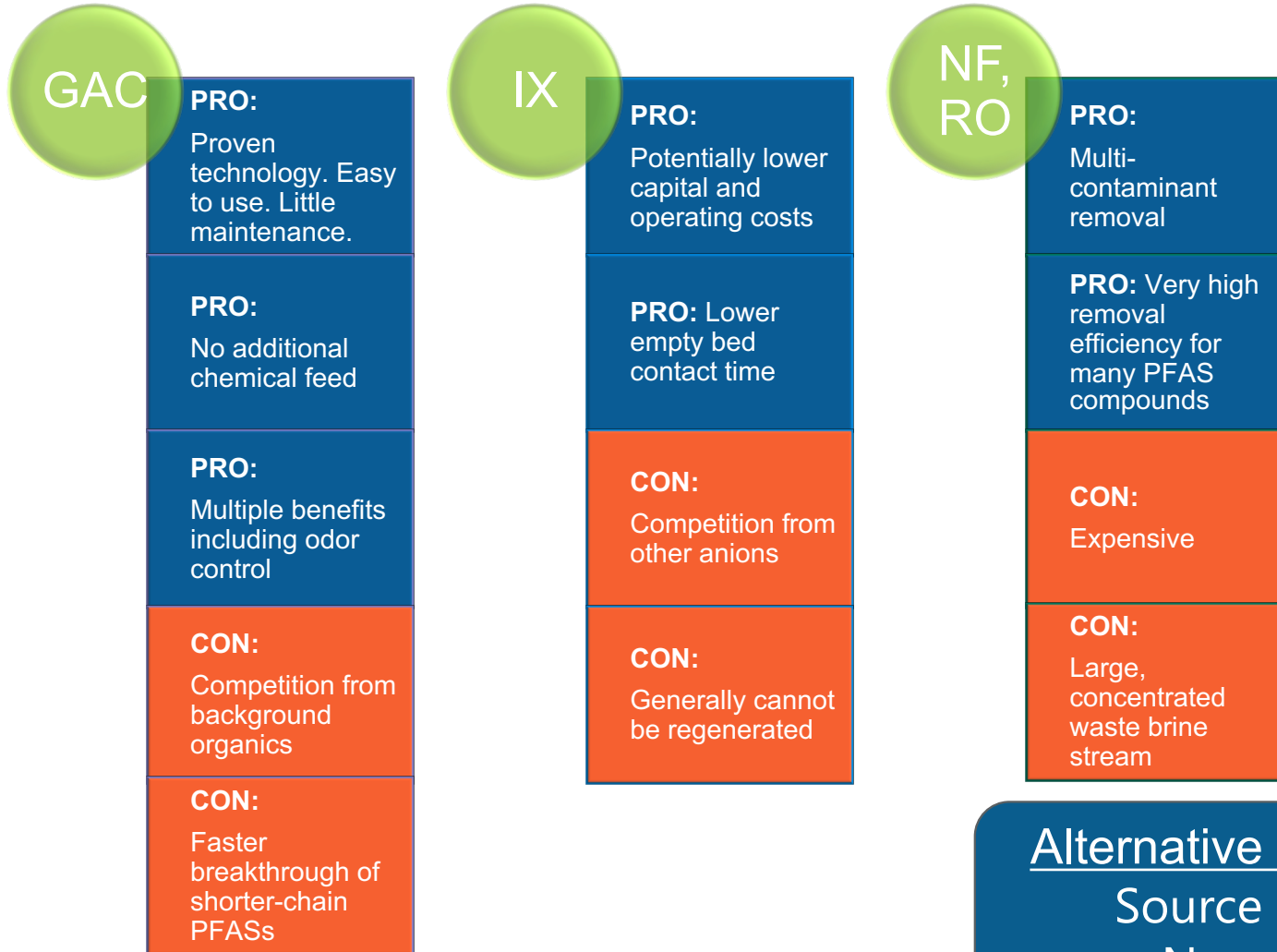


Ion Exchange (IX)



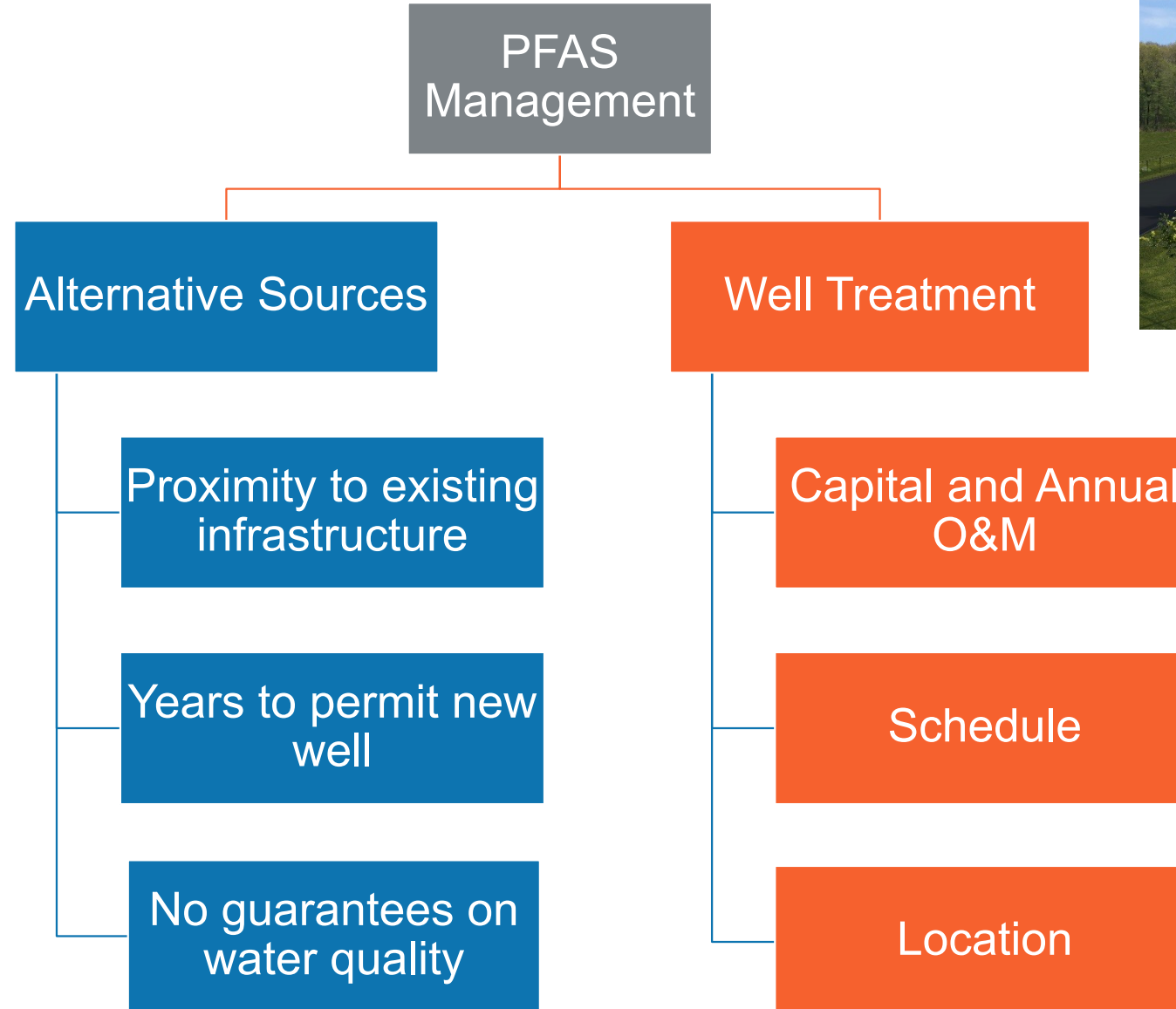
High Pressure
Membranes

TREATMENT TECHNOLOGIES



Alternative to Treatment
Source Blending
New Source

PFAS MANAGEMENT APPROACH



FUNDING IS OFTEN THE BIGGEST OBSTACLE

Public concern over funding clean-up of man-made contamination

Lawsuits take years with no guarantee of success

Treatment often not included in budgeting

SRF and other funding can assist with capital costs

Annual O&M costs can be high

- Media replacement
- Water quality sampling (\$300+/sample)
- Ancillary costs for new infrastructure (HVAC, building maintenance, etc)



COSTS FOR TREATMENT ARE SITE SPECIFIC

Land
Acquisition

Transmission
Mains

Building
Design

Pre-treatment
Needs

Treatment
Flow Rate

**0.5 MGD
Facility**

- Capital = \$2 – \$7M
- Annual O&M (0.2 mgd ave flow) = \$40k – \$150K

**3 – 4 MGD
Facility**

- Capital = \$6 – \$14M
- Annual O&M (1 mgd ave flow)= \$100k - \$400k



WHO PAYS?

- **Massachusetts Contingency Plan (MCP)**

Notices of Responsibility state:

“This liability is “strict,” meaning it is not based on fault, but solely on your status as an owner, operator, generator, transporter or disposer. It is also joint and several, meaning that each person who falls within one of these categories may be held liable for all response action costs incurred at the site, regardless of the existence of any other liable parties.”

And...

“You should be aware that you might have claims against third parties for damages, including claims for contribution or reimbursement for the costs of cleanup.”

What they don't say:

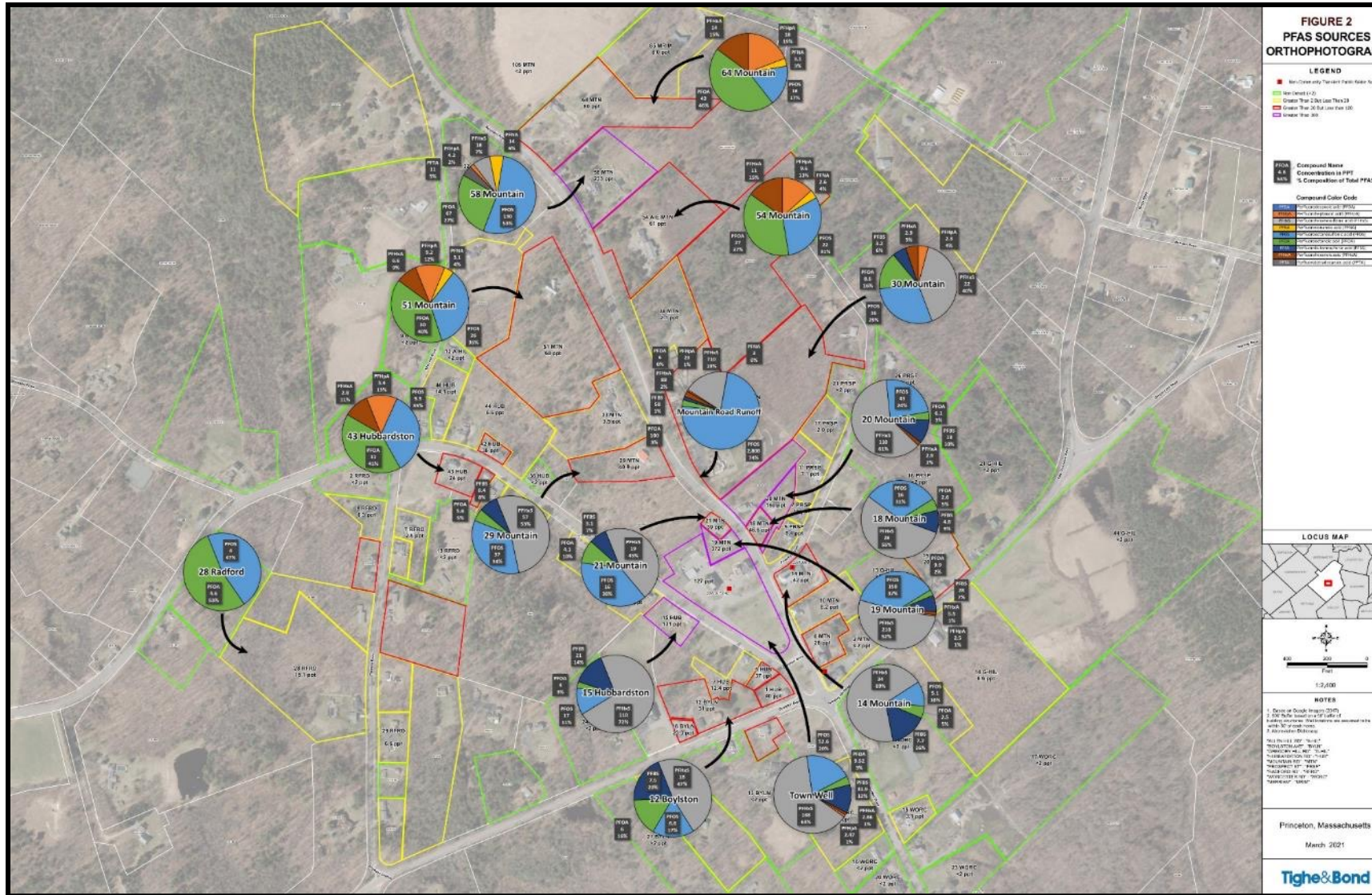
“Response actions to address the identified site conditions need not be performed until such time as third-party claims have been successfully resolved and payments received.”

IMMEDIATE RESPONSE ACTIONS (IRA) require the responsible party to take action **IMMEDIATELY**

WHO PAYS (CONT.)?

- For PFAS detections in a drinking water well, IRAs typically involve discontinuation of well water use/provision of bottled water, and installation of POETs for affected wells
- Other detections (soil, surface water) are less urgent, but no less expensive
- Multi-District Litigation is pending in South Carolina against PFAS manufacturers
- Resolution will not be quick but could result in significant settlements
- But affected parties and communities cannot wait for a potential settlement to act
- Municipal Fire Departments should not be held responsible for fire response costs and resulting contamination
- PFAS forensics can help identify sources and possibly responsible parties

MARCH 2021 PFAS DISTRIBUTION MAP



WHO PAYS.....

In 1999, USEPA fined DuPont \$16.5M for failing to report the health risks related to C8 exposure

- At the end of *The Devil We Know*, Ken Cook, President of the Environmental Working Group, states:
“\$16M? Really? This is a company at the time that was selling \$25B worth of products every year. I’m not sure what the right fine would be for contaminating humanity, contaminating the living world, but I’m pretty sure it’s not \$16M.”



RECOMMENDATIONS

- **USEPA should be leading the charge on PFAS for a uniform response to risks and liability; varying state programs and standards not helpful**
- **Make significant federal funding available to states, recoup through litigation/penalties on responsible parties**
- **Expedite USDoD funding for communities affected by PFAS from military installations**
- **Federal/state ban on importation and domestic manufacture of all PFAS-containing products, possible exemptions for critical uses**
- **“Operation Warp Speed” type response to develop SAFE PFAS alternatives, especially firefighting foam, amend FAA regulations that require AFFF at airports**

RECOMMENDATIONS (CONT.)

- **Make deployment of AFFF a MassDEP “reportable release” to track date, brand and volume of AFFF deployed**
- **Educate fire departments on locations of Potentially Productive Aquifers and drinking water supply areas within their towns/cities**
- **Develop interim measures for fire departments to safely handle and dispose of old foam, and tank/hose rinsates**
- **Suggest Fire Departments ask retired firefighters, others about historical applications of AFFF (car fires, brush fires, training areas, “snow parties”)**



RECOMMENDATIONS (CONT.)

- **Develop state-wide “background” study to establish “ubiquitous” PFAS levels across the Commonwealth**
- **Make accommodations for homeowners within the MCP framework to expedite and simplify Downgradient Property Status (DPS) filings for off-property PFAS sourced contamination detected on residential properties**
- **MCP (310 CMR 40.0317(8)(c)) currently exempts releases of herbicides and pesticides if applied “in a manner consistent with their labelling.” Should this apply to AFFF?**
- **Consider adding PFAS associated with septic systems to list of exemptions from MCP reporting, don’t add these residences to the MassDEP “sites” database**

THANK YOU

- **To Senator Spilka for appointing me to this Task Force**
- **To Senator Cyr and Speaker Hogan for chairing the Task Force**
- **To Griffin Tighe (no relation) and Seamus Corbett for their organization and managing of these meetings, arranging speakers, etc.**
- **To all of the Task Force members for committing the time and energy to these meetings and making sure the Task Force's final report is the watershed document it needs to be**