

PFAS Results From Sampling at Biosolids Sites



Joshua Burns, Environmental Analyst
Vermont Department of Environmental Conservation
Residual Management & Emerging Contaminants Program



PFAS Results From Sampling at Biosolids Sites

Acknowledgements:

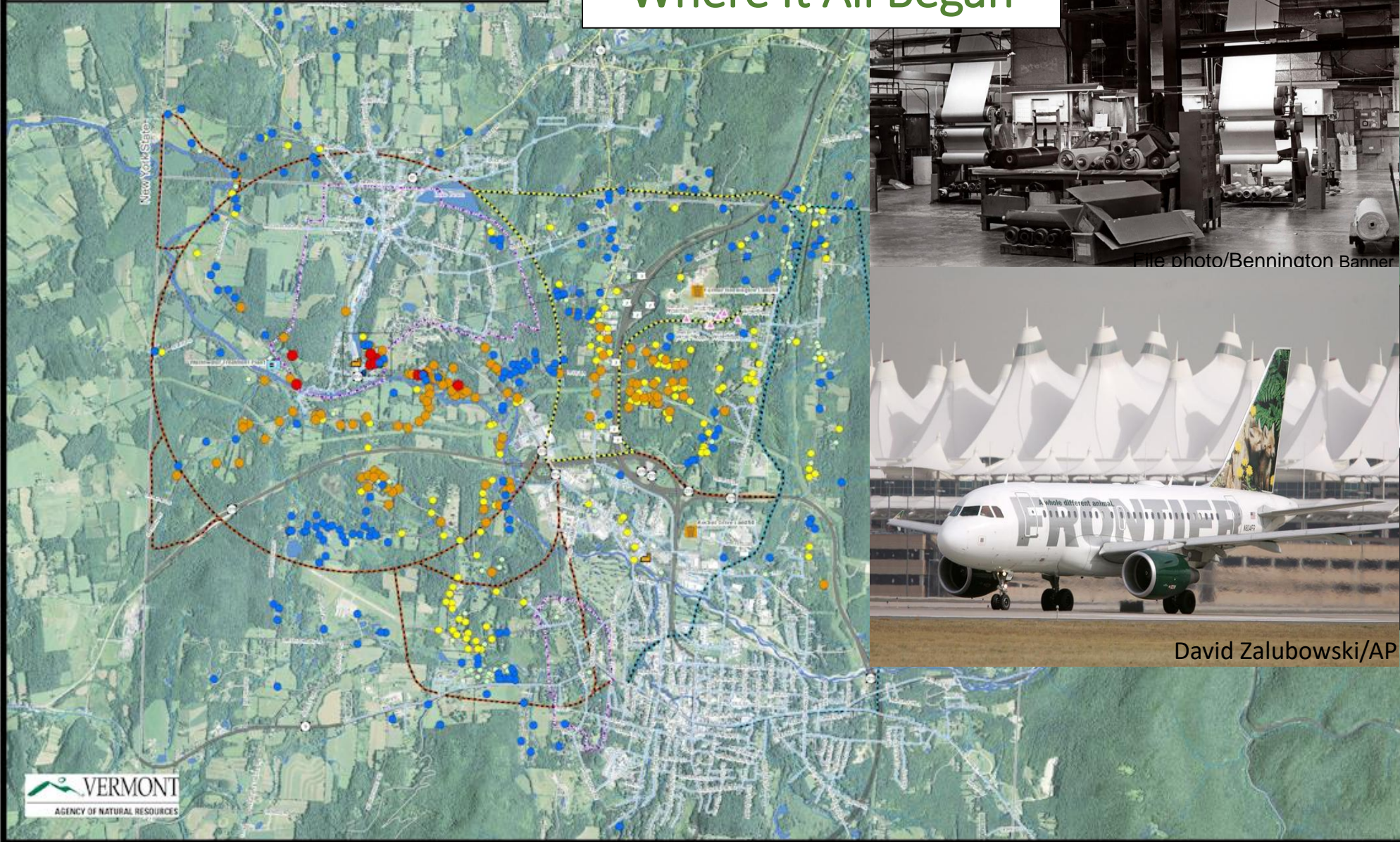
- Vermont Department of Environmental Conservation
 - The University of Vermont
 - Environmental Consulting Firms
- Vermont WWTF Operators & Municipal Managers



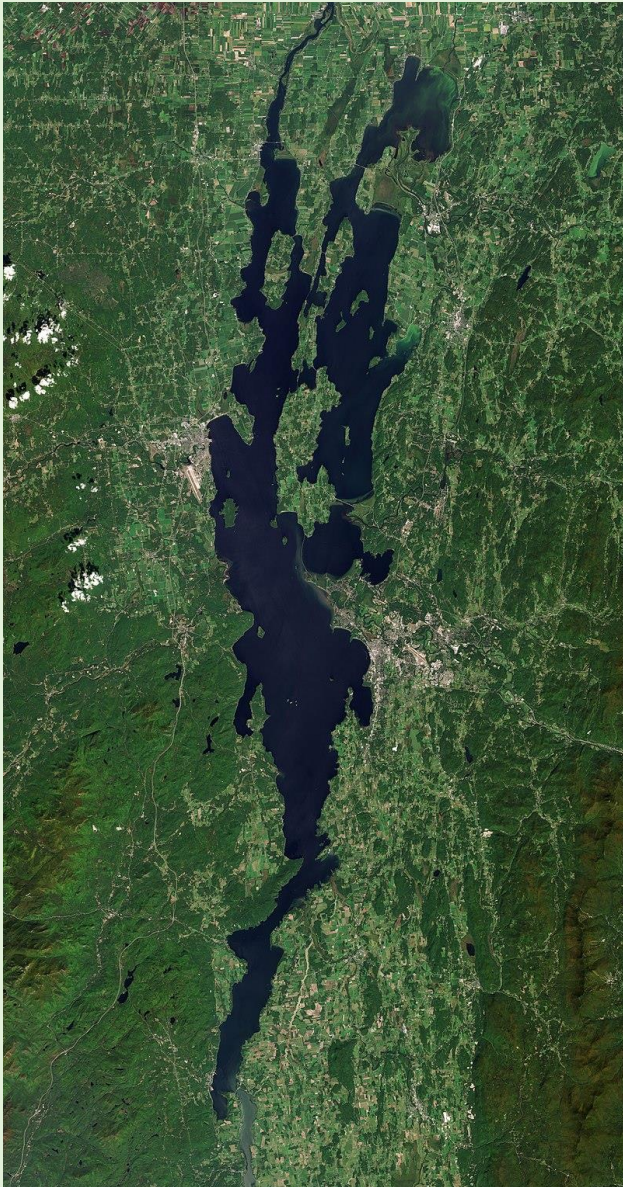
North Bennington/Bennington PFOA

Water Sampling Test Results - August 30, 2016

Where It All Began



- 700 samples collected from private wells
- >60% wells with PFOA detected
- ~ 50% wells with > 20 ppt PFOA
- POET systems installed
- New municipal water supply lines extended to ~400 homes



Vermont Standards for Per- and Polyfluoroalkyl Substances (PFAS)

PFAS Analytes	Health Advisory/MCL (ng/L)	Groundwater Enforcement Std (ng/L)	Residential Soil (mg/kg)
PFHxS (C6)	20 ppt (*)	20 ppt (*)	1.22 ppm (sum)
PFHpA (C7)			
PFOA (C8)			
PFOS (C8)			
PFNA (C9)			

*Sum of five regulated PFAS analytes.



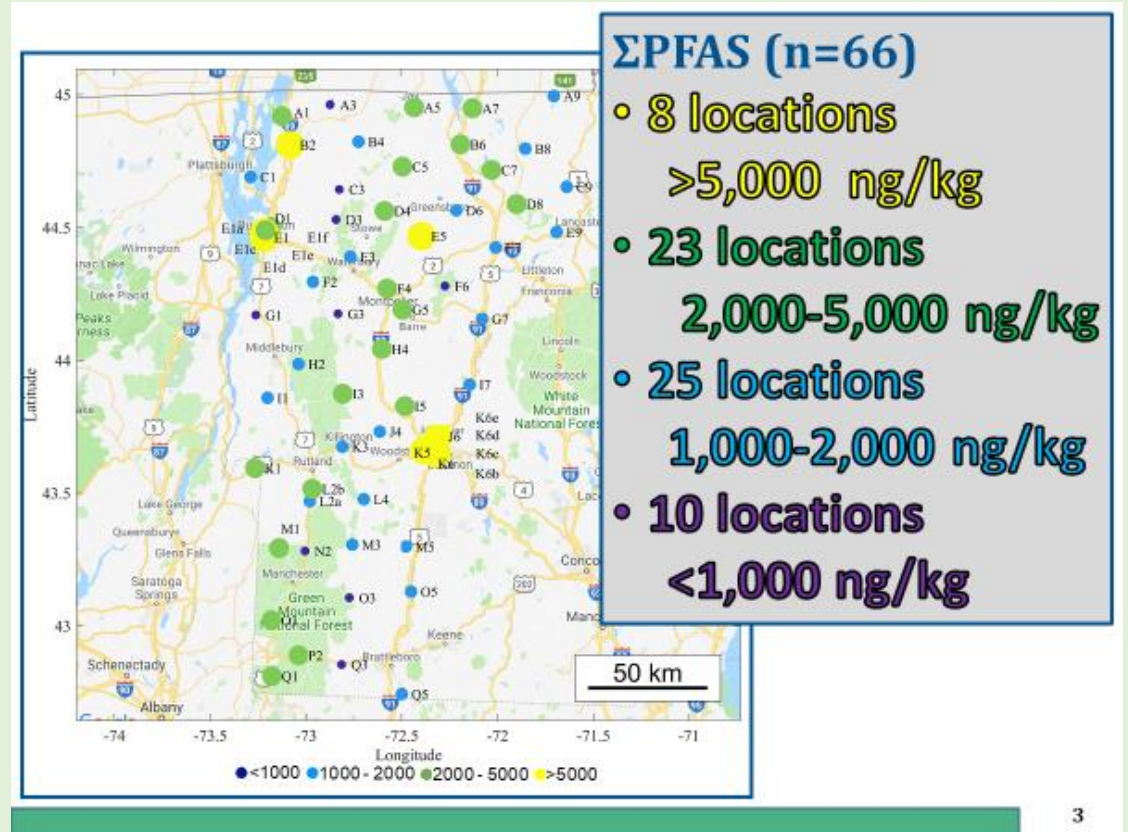
The University of Vermont

SANBORN HEAD

Per- and Polyfluoroalkyl Substances (PFAS) in Vermont Shallow Soils

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Department of Civil and Environmental Engineering
University of Vermont

Harrison Roakes, P.E.
Sanborn, Head & Associates



REPORT

January 30, 2020

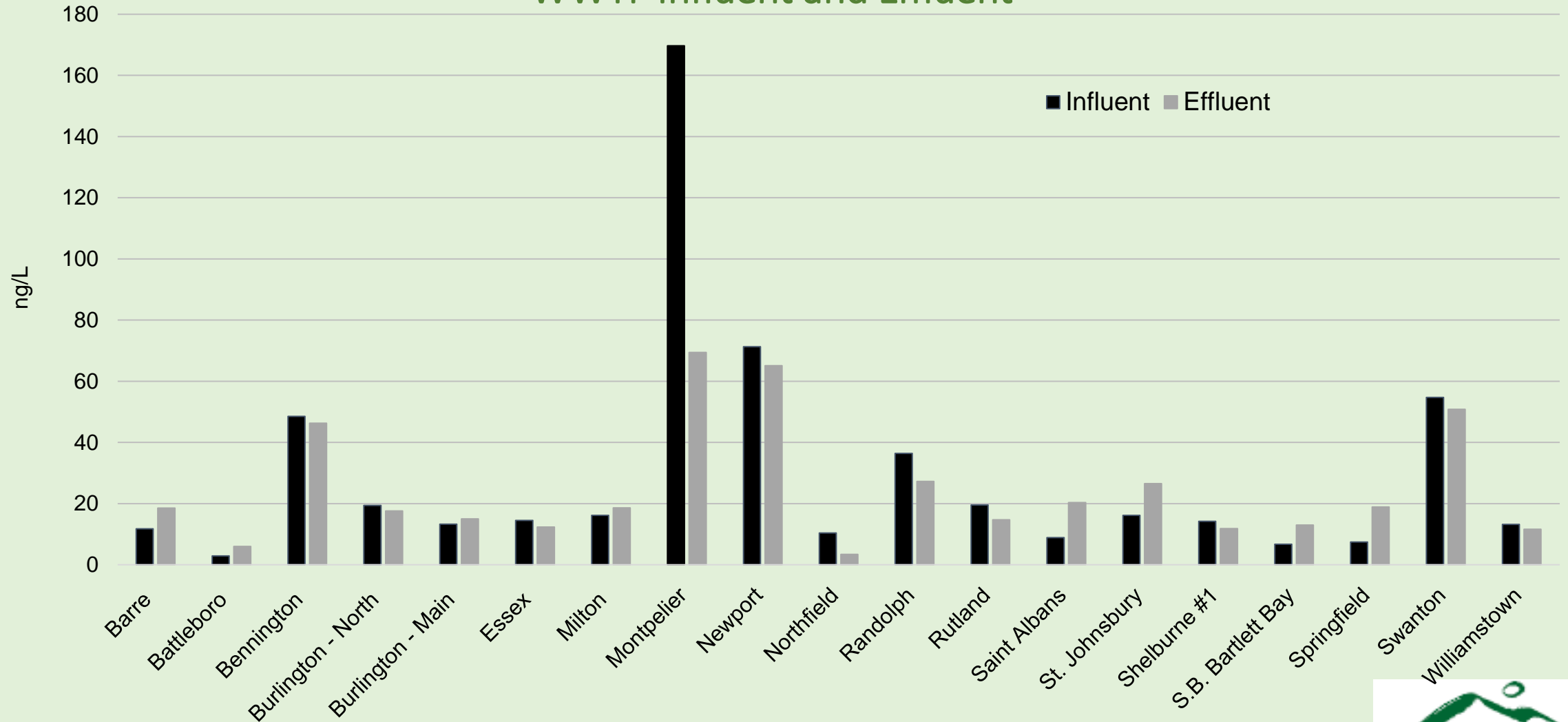
Poly- and Perfluoroalkyl
Substances at Wastewater
Treatment Facilities and Landfill
Leachate

2019 Summary Report

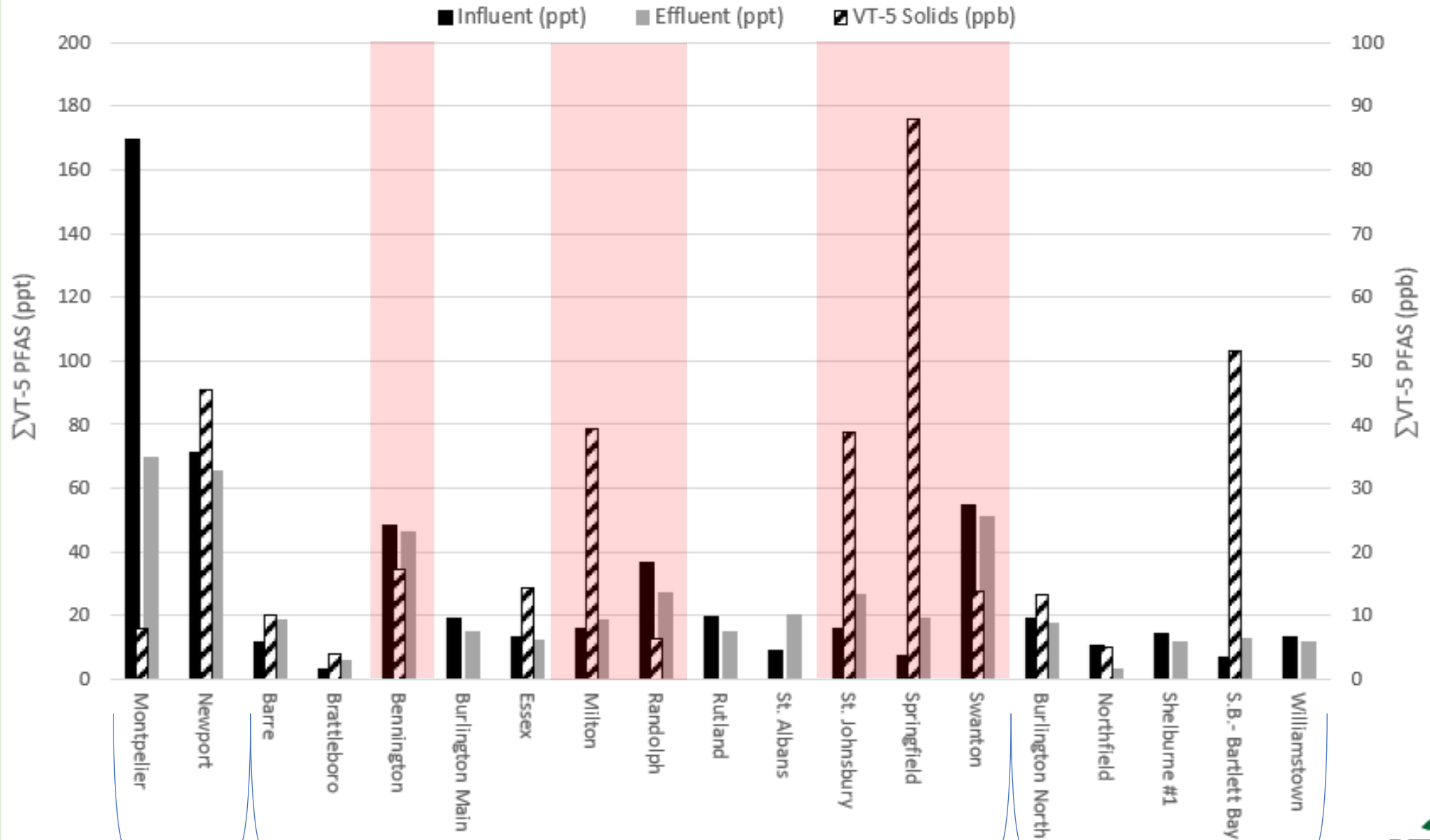
Statewide evaluation of PFAS in:

- ~400 samples. Analyzed for 24 PFAS. Modified 537.
 - Landfill leachates (4)
- WWTF influent, effluent (19) , sludges/biosolids (22)
 - Industrial discharges (2)

Average of Σ VT-5 PFAS (ppt) in Samples of WWTF Influent and Effluent



Average of Σ VT-5 PFAS in Samples of Influent, Effluent and Solids



Leachate Accepting

Known or Anticipated Industrial Users

No Suspected Industrial Inputs

Vermont Solid Waste Management Facilities

Type	Pathogen Reduction	Vector Attraction Reduction	Pollutant Limits	Management
Class A	Further Reduced (PFRP)	Required	Metals, PCBs, PFAS	Distributed under Permit
Class B	Significantly Reduced (PSRP)	Required	Metals, PCBs, PFAS	Land App at Permitted Sites
Sludge	None	None	Metals, % solids	Landfill, Transfer to Facility



Solid Waste Management Facility Certification #F2202 10 V.S.A. §6605

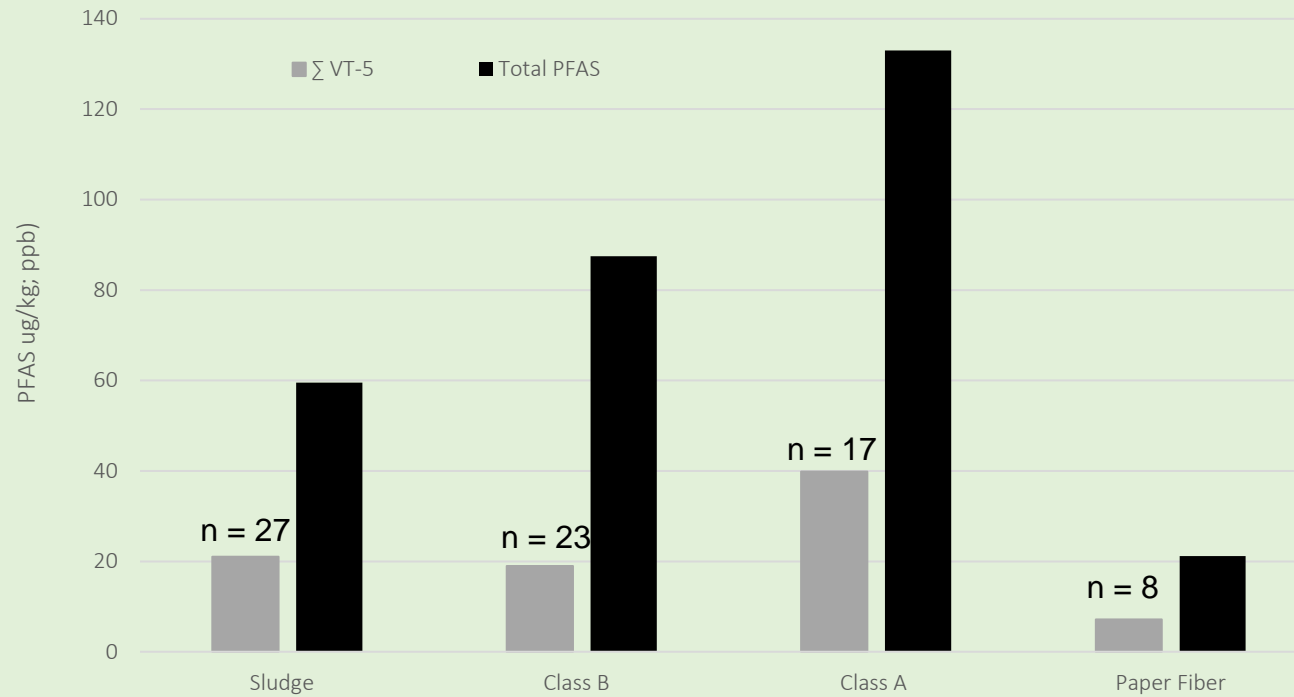
TABLE 2

REQUIRED SAMPLING AND TESTING FREQUENCIES

The Secretary may require the materials in Table 2 to be tested for additional parameters as determined to be necessary to prevent a threat to human health or the environment resulting from the application of materials.

PARAMETER	Biosolids	SOIL	GROUNDWATER	PLANT TISSUE
Arsenic	Annual	EOC	Annual	EOC
Cadmium	Annual	EOC	Annual	EOC
Chromium	Annual	EOC	Annual	EOC
Copper	Annual	EOC	Annual	EOC
Lead	Annual	EOC	Annual	EOC
Mercury	Annual	EOC	Annual	EOC
Molybdenum	Annual	EOC	Annual	EOC
Nickel	Annual	EOC	Annual	EOC
Selenium	Annual	EOC	Annual	EOC
Zinc	Annual	EOC	None	EOC
Total Kjeldahl Nitrogen	Annual	Annual	None	None
Ammonia-Nitrogen	Annual	Annual	Annual	None
Nitrate-Nitrogen	Annual	Annual	Annual	None
Total Phosphorus	Annual	None	None	None
Total Potassium	Annual	None	None	None
Per- and polyfluoroalkyl Substances ¹ (PFAS)	Annual	Annual	Annual	EOC
Polychlorinated Biphenyls	None	EOC	None	None
Percent Solids	Annual	None	None	None
pH	Annual ²	Annual	Annual	None
Liming Requirement	None	Annual	None	None
Available Potassium	None	Annual	None	None
Available Magnesium	None	Annual	None	None
Available Phosphorus ³	None	Annual	None	None
Reactive Aluminum ³	None	Annual	None	None

Average PFAS (ppb) in Samples of Residual Materials



Waterbury, sludge drying beds



Swanton, Class B biosolids



Springfield, Class A biosolids



Short Paper Fiber

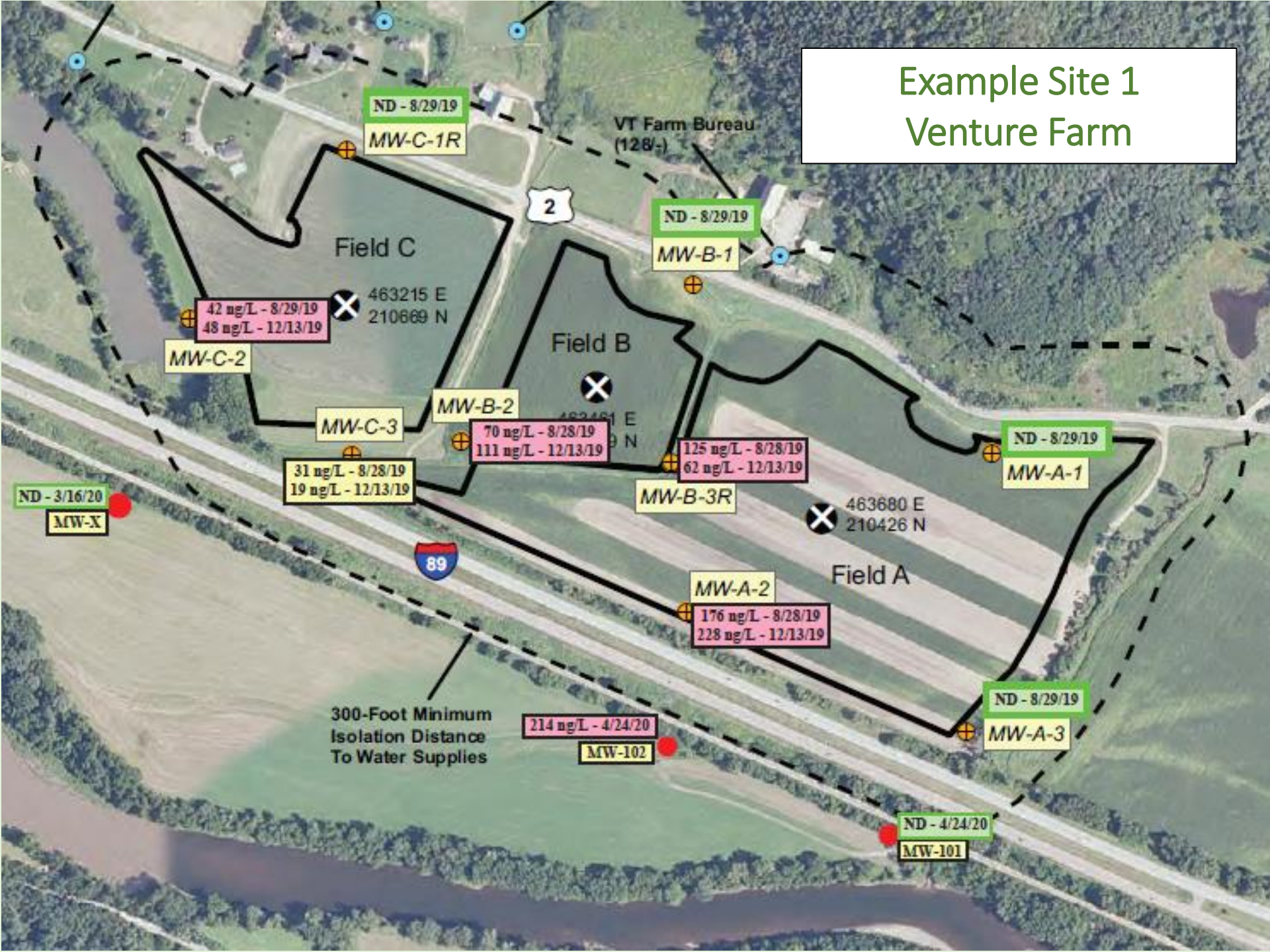
VTDEC Solid Waste Management Certification Investigative Study



- August – October 2019
- 4 Land App Sites (Class B biosolids, stabilized septage)
- Soil Sampling Cores at 0-6" and 24-30"
- Samples of Groundwater from Onsite Monitoring Wells (low flow)
- Drinking water supply wells within an approximate 0.25-mile radius

Example Site 1 Venture Farm

- Site used since the 1980's
- Stabilized septage and class B biosolids
- Applied annually
- PFAS exceeding GWES onsite and Compliance Points
- Land application on hold at this site

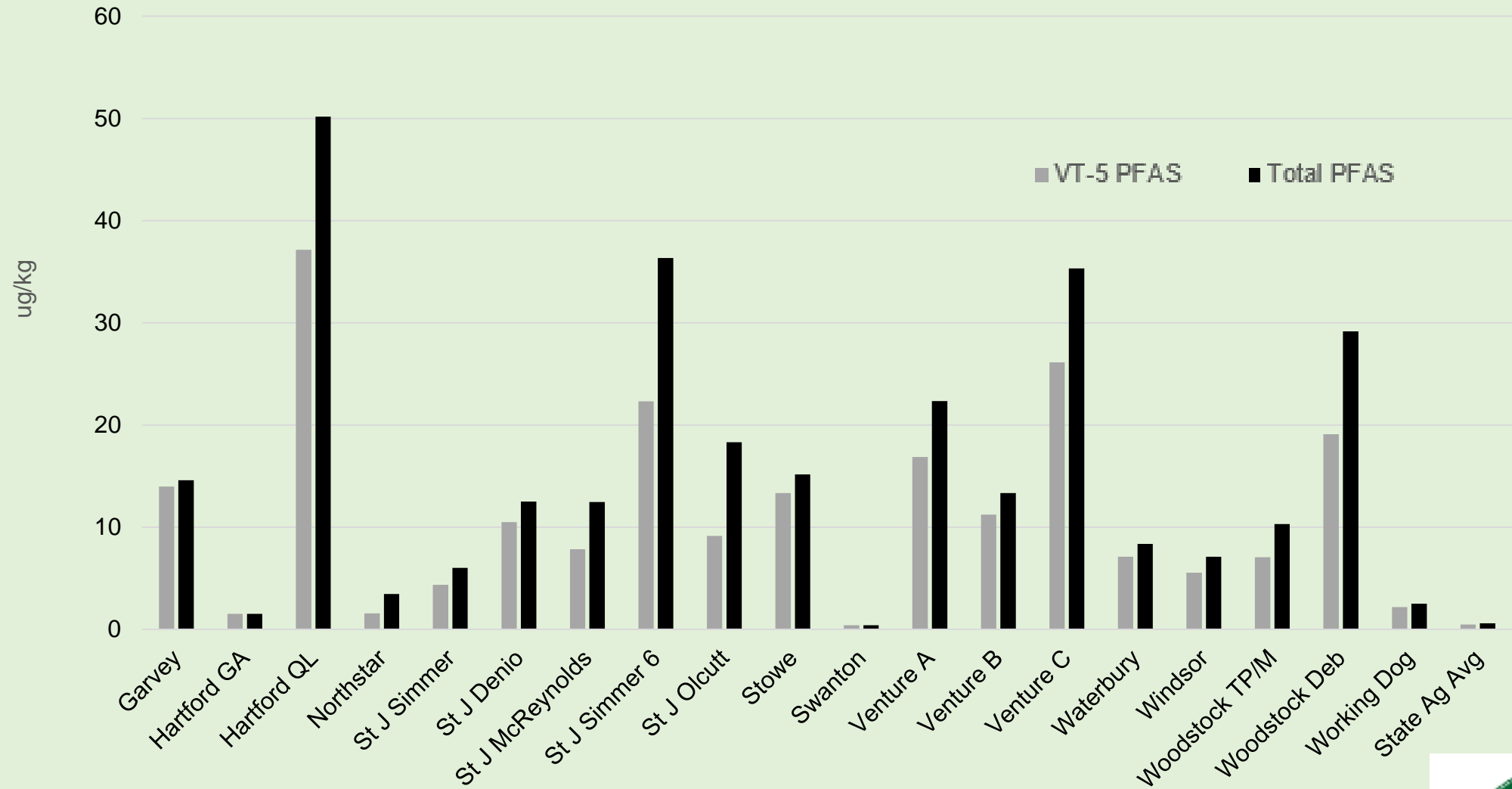


Responses By Vermont Department of Environmental Conservation

- DEC guidance issued to certifications to manage PFAS in onsite GW above standard.
 - Temporarily halt spreading
 - Additional monitoring of GW
 - Testing of DW supplies within ¼ mile of site.
- Issued directives to all certified land application facilities to sample groundwater and soil for PFAS.
- New Solid Waste Rules - October 2020
 - PFAS monitoring requirements for biosolids permittees.
 - Registry for imported Class A biosolids includes PFAS testing.



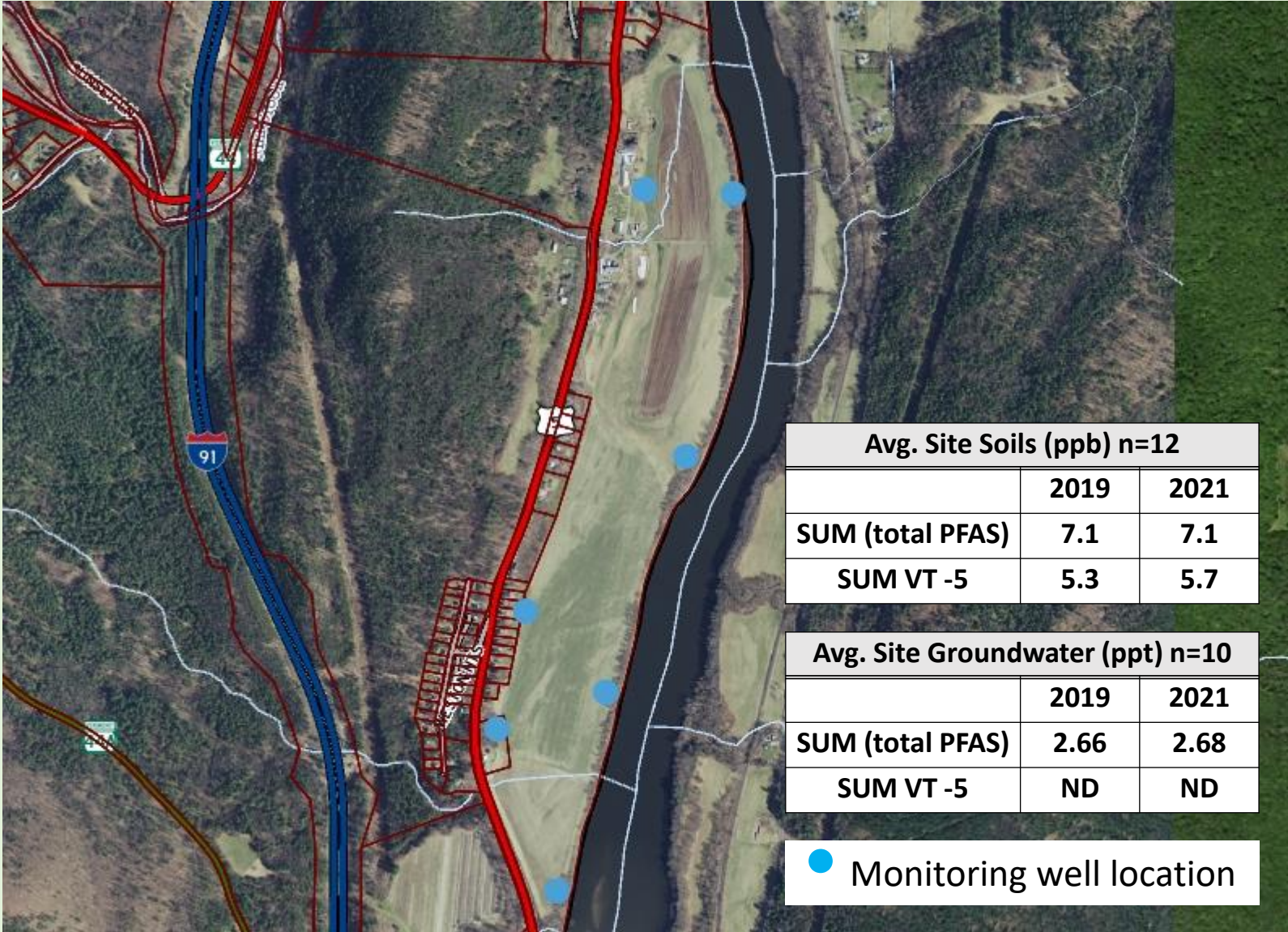
Results from Permittee Sampling “Directive”: PFAS (ppb) in Shallow Soil Samples



Average PFAS in Shallow Soils (ppb)		
Analyte	SWMF	VT-SS
PFHxA	0.487	0.52
PFHpA	0.34	0.26
PFOA	1.48	0.52
PFNA	1.01	0.27
PFDA	2.2	0.31
PFUnDA	0.9	0.15
PFBS	0.28	0.23
PFHxS	0.21	0.2
PFOS	9.97	1.1
PFDS	1.98	0.14
Avg. Σ VT-5	13.01	2.35

SWMF: VTDEC Solid Waste Management Facility Soil Data
VT-SS: PFAS Background in Vermont Shallow Soils Study





Example #2 Windsor, VT

- Site permitted records since 2000
- Class B Biosolids -
 anerobic digestion/dewatered
- Applied biannually
- Average 3.2 dry tons/ac/yr
- No residential supply wells



Example Site 3 Swanton, VT

- Site permitted since 2001
- Class B Biosolids
(lime stabilized/dewatered)
- Applied biennially
- Average 6.5 dry tons/ac/yr
- 2019 & 2021 PFAS in GW monitoring wells (6) all ND
- Residential supply wells sampled without exceedances in standards

Avg. Site Soils (ppb) n=12		
	2019	2021
SUM (total PFAS)	.6	.9
SUM VT -5	.6	.9
Avg. Site Groundwater (ppt) n=8		
	2019	2021
SUM (total PFAS)	ND	ND
SUM VT -5	ND	ND

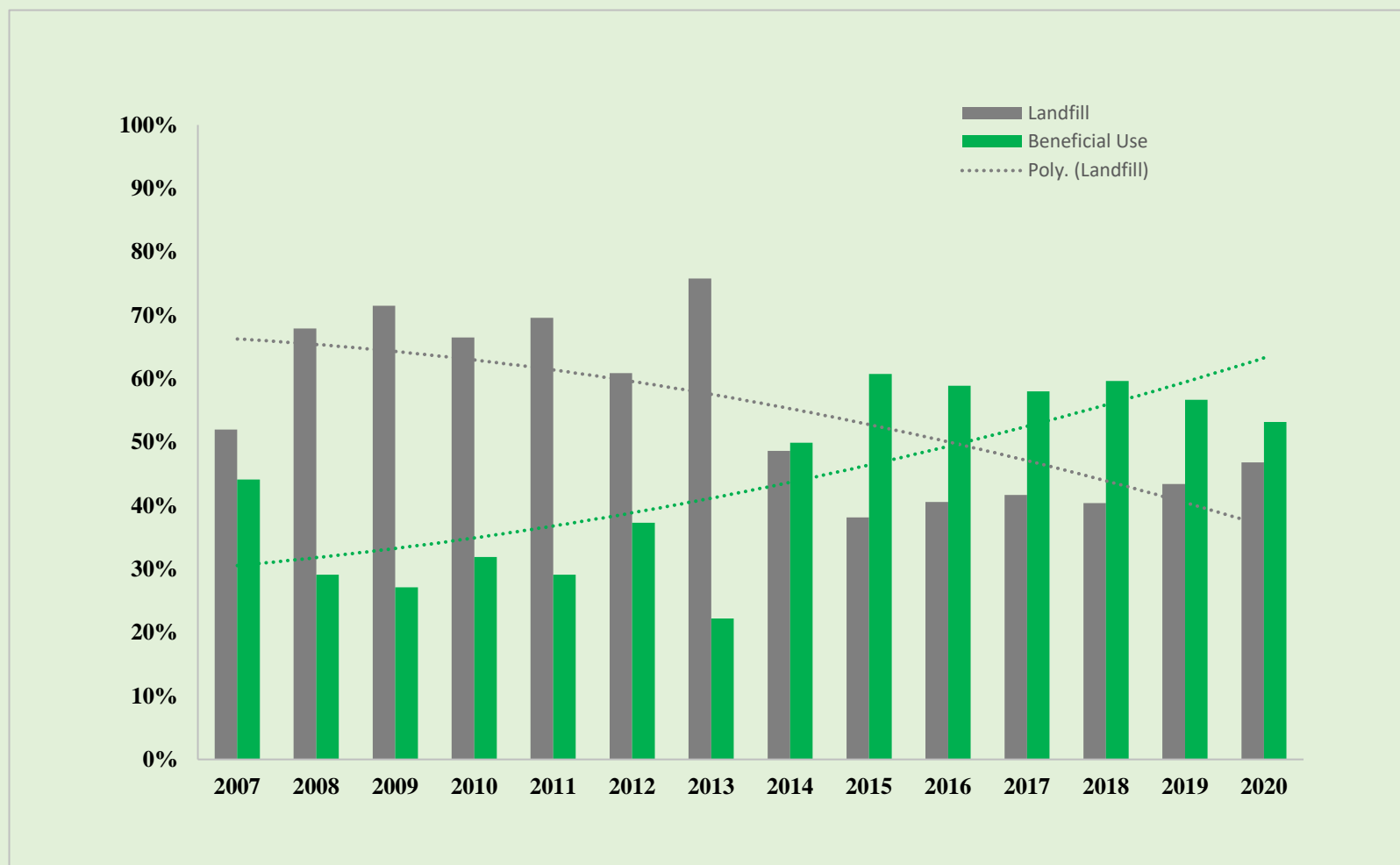
PFOS		
Media	2019	2021
Biosolids	29.8	5.94
Soil 1	0.484	NS
Soil 2	0.723	NS
Soil 3	ND	0.681
PFOA		
Media	2019	2021
Biosolids	ND	0.981
Soil 1	ND	NS
Soil 2	ND	NS
Soil 3	ND	0.29

Investigation Results

- **PFAS found to be ubiquitous in the environment**
 - All VT background soils
 - All VT WWTP influent/effluent tested
 - All VT biosolids tested (unless DL's are > 5ppb)
 - All VT land application site soils (range from background to ~5x)
 - Shallow soils greater than at depth
 - ~20% of shallow GW wells at land app sites above GW standard
 - Testing of DW supplies within ¼ mile of site displayed no impacts to receptors.



Vermont Sludge/Biosolids Management Trends

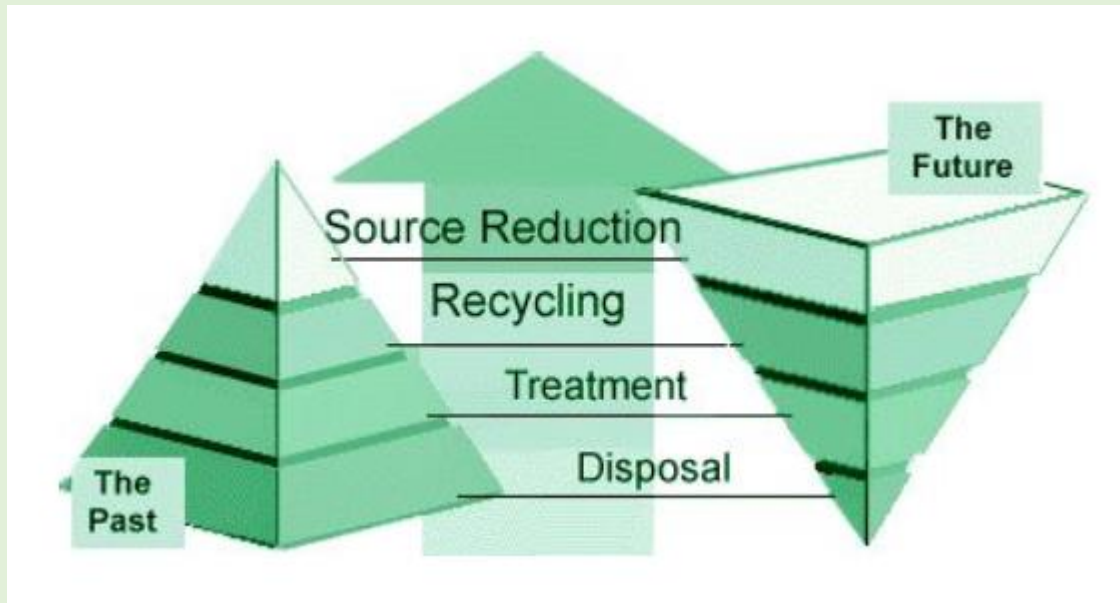


- National Biosolids Data Project: biosolidsdata.org



Why Source Reduction and P2?

- **Pollution prevention or P2 or “Source Reduction”:**
- Practice that reduces, eliminates, or prevents pollution at its source.
 - Reducing the amount of pollution produced means less waste to control, treat, or dispose of; and
 - Less pollution means less hazards posed to public health and the environment.



Typical practices:

- Equipment or technology modifications;
- Process or procedure modifications;
- Reformulation or redesign of products;
- Substitution of raw materials; and
- Improvements in housekeeping, maintenance, training or inventory control.

- Vermont PFAS Investigation and Response

<https://dec.vermont.gov/pfas>

- Vermont Environmental Research Tool

<https://anrweb.vt.gov/DEC/ERT/>

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Thank you.

