# Emerging Contaminants in the Environment

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# Presentation Overview

- Emerging Contaminants Overview
- How contaminants in drinking water are regulated or otherwise assessed/addressed
- Emerging contaminant initiatives in NH
  - Summary of all activities
  - Detailed information on
    - Perfluorinated compounds
    - Cyanotoxins
    - Pharmaceuticals and Personal Care Products in groundwater discharges from health care facilities

# Emerging Substances of Concern

- Global Organic Contaminants
- Pharmaceuticals and Personal Care Products
- Endocrine Modulating Chemicals
- Nanoparticles
- Industrial Chemicals (new and recently recognized)

# Emerging Contaminants

- Perceived, potential, or real threat to human health or the environment
- Lack of published health standards
- New source or new pathway to humans has been discovered
- New detection method or treatment technology has been developed
- Often added to the Unregulated Contaminant Monitoring Rule (UCMR) under the Safe Drinking Water Act

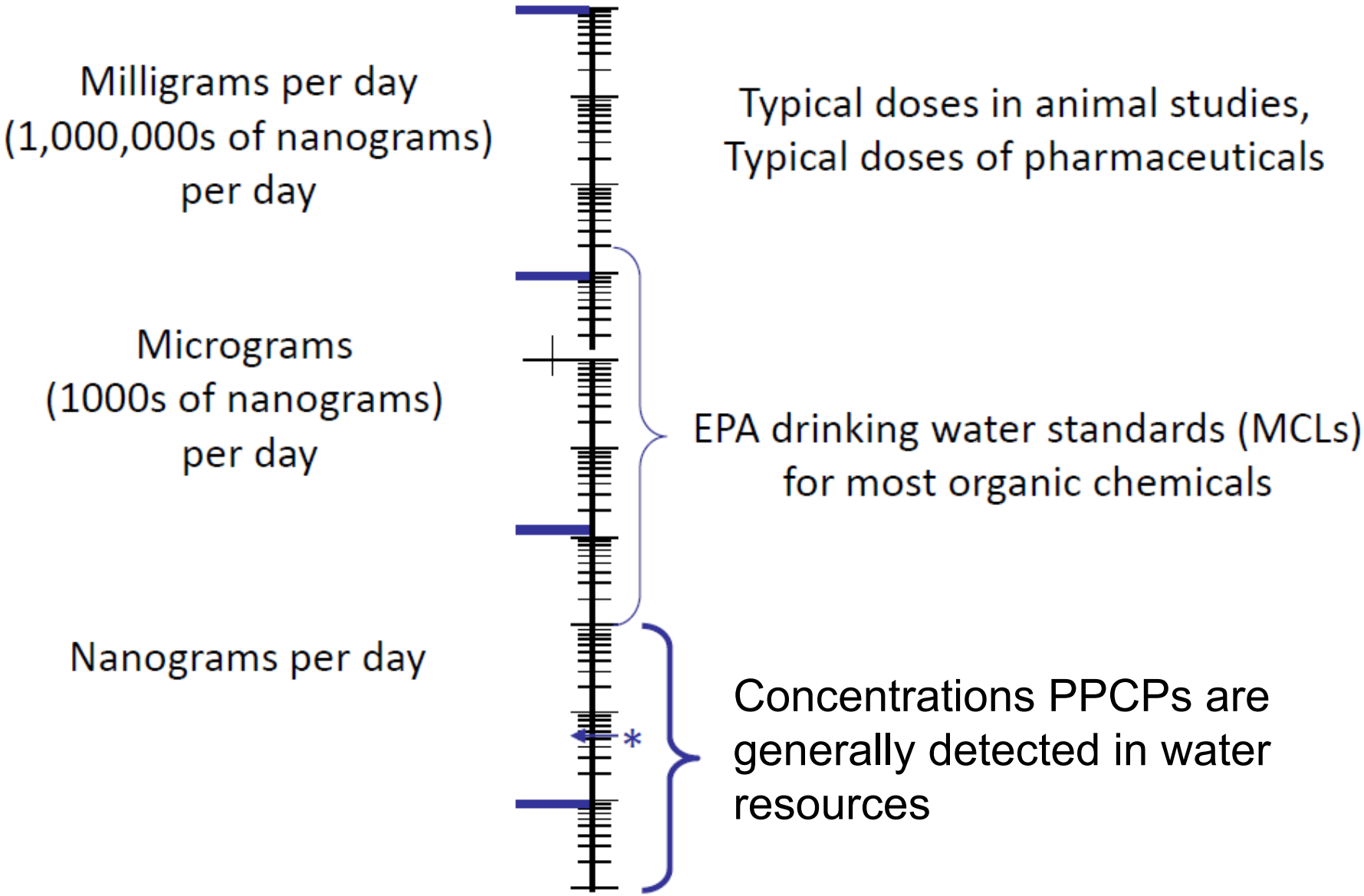
# PPCPs – DES Program Interest

- Drinking Water
- Wastewater - Surface Water Discharges
- Wastewater - Groundwater Discharges
- Watershed Management – Ecological Impacts
- Residuals Management
- Solid Waste Management
- Air – Incineration of Solid Waste
- Air emissions – Source of pollution in air and water
- Household Hazardous Waste Management
- Hazardous Waste Management
- Environmental Health Program

# Perspective

Ability to detect contaminants in water at the parts-per-trillion levels exceeds our understanding of the impact of these on health. But……

- **For some environmental exposures to emerging contaminants at lower concentrations are more dangerous than higher concentrations**
- Concern about long-term exposure to a cocktail of trace level of emerging contaminants
- If you add up the hundreds of emerging contaminants(and their degradates) that are detected, you can exceed ppb levels
- Many emerging contaminants were designed to cause a biological effect (unlike traditional contaminants)
- Other sources of emerging contaminants focused on less than drinking water:
    - Household products/personal care products
    - Food preparation/Food
    - Air
    - Dust
    - Dermal contact
    - Clothing




From Laurel Schaider, Silent Springs

# Presentation Overview

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- Emerging contaminant initiatives in NH

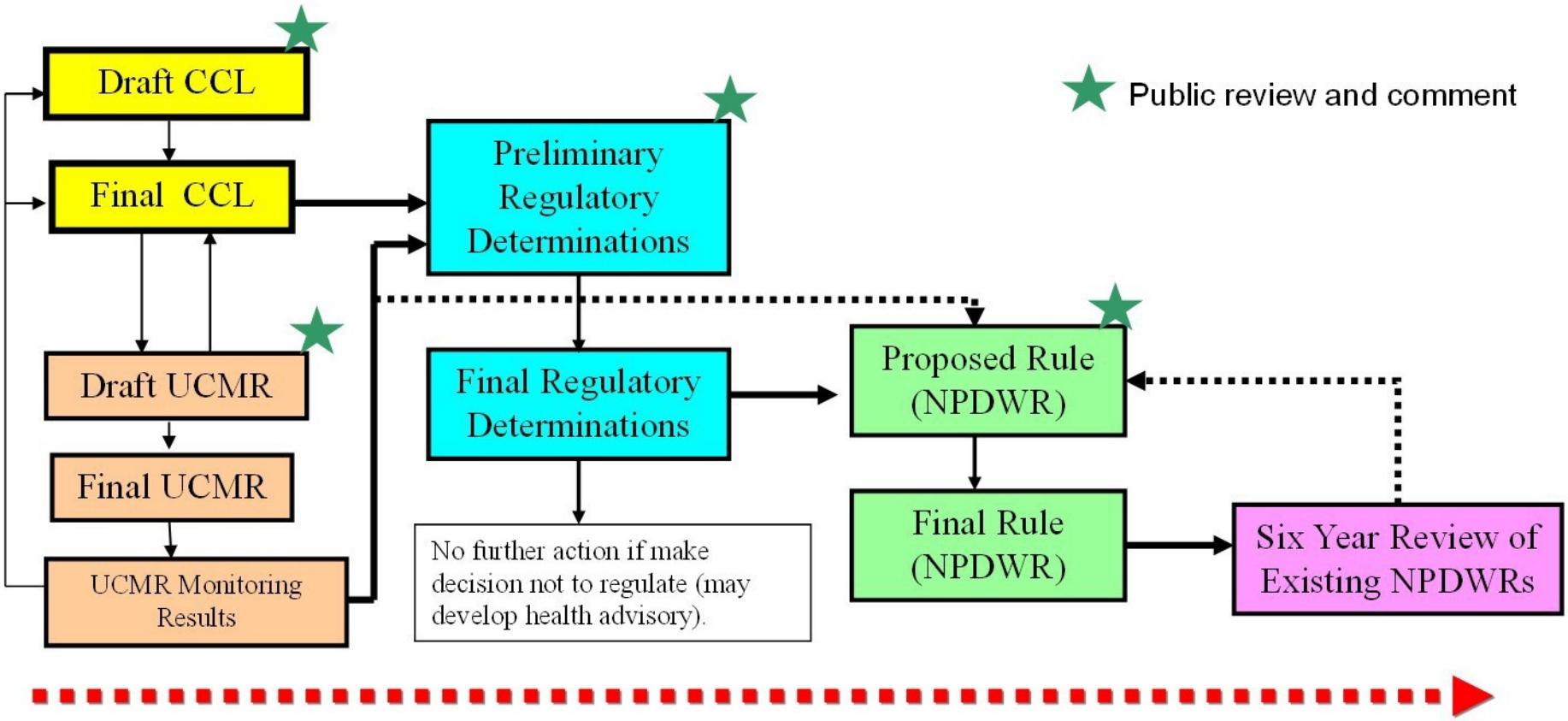
# How contaminants in drinking water are regulated or otherwise assessed/addressed

- Federal Government
  - Drinking Water Program
    - Safe Drinking Water Act - Drinking Water Standards
    - Emergency Authority
    - Reference Levels
    - Draft/Final Public Health Advisories
    - Unregulated Contaminant Monitoring Rule (UCMR)
  - Contamination Programs
- State Programs
  - Contamination/Waste Programs - Ambient Groundwater Quality Standards
  - Drinking Water Programs - Maximum Contamination Level

# Safe Drinking Water Act

- **Contaminant Candidate List (CCL)** – Every five years, the Administrator shall publish a list of contaminants which, at the time of publication, are not subject to any proposed or promulgated national primary drinking water regulation (NPDWR), which are known or anticipated to occur in public water systems, and which may require regulation.
- **Regulatory Determination –** Every five years, the Administrator shall, after notice of the preliminary determination and opportunity for public comment, for not fewer than five contaminants included on the CCL, make determinations on whether or not to regulate such contaminants. A determination to regulate a contaminant shall be based on specified criteria.
- **Regulation Development** – The Administrator shall propose the Maximum Contaminant Level Goal (MCLG) and NPDWR not later than 24 months after determination and promulgate within 18** months after proposal.
- **Unregulated Contaminant Monitoring** – Process to monitor up to 30 different unregulated contaminants every 5 years.
- **Six Year Review** – Every 6 years, review and (if appropriate) revise the standard. Any revision must maintain or improve public health protection.

# General Flow of SDWA Regulatory Processes




At each stage, need increased specificity and confidence in the type of supporting data used (e.g. health, occurrence, treatment).

# Three Regulatory Determination Criteria Specified by the 1996 SDWA* Amendments

A. requires EPA to publish a MCLG and promulgate an NPDWR for a contaminant if the Administrator determines that:

1) *The contaminant may have an adverse effect on the health of persons;*

2) *The contaminant is known to occur or there is substantial likelihood that the contaminant will occur in public water systems with a frequency and at levels of public health concern; and*

3) *In the sole judgment of the Administrator, regulation of such contaminant presents a meaningful opportunity for health risk reduction for persons served by public water systems.*

**SDWA Section 1412(b)(1)*

# Advisories/Screening/Other EPA Levels

- Public Health Advisory Data
  - Cyanotoxins
  - Perfluorinated Compounds (PFOS and PFOA – acute exposure) – will be updated very soon (chronic exposure)
  - Perchlorate
- Human health benchmarks for approximately 363 pesticides
- Administrative site-specific guidance – USEPA issued a public notice suggesting a chronic exposure level for PFOA
- UCMR Reference Levels

EPA

# Emergency Authority Safe Drinking Water Act Section 1431

- SDWA 1431 provides:
  - "Upon receipt of information that a contaminant is present in or is likely to enter an underground source of drinking water . . . which may present an imminent and substantial endangerment to the health of persons, and that appropriate State and local authorities have not acted to protect the health of such persons, [EPA Administrator] may take such actions as he may deem necessary in order to protect the health of such persons."

This law has been used to address emerging contaminants such as perfluorinated compounds and 1,4-dioxane in drinking water

# Status of the UCMRs

- UCMR3 is complete for NH
  - Only chlorate detected frequently at elevated levels in NH
  - PFCs and 1,4-dioxane detected in clustered areas of the country
    - Only detected at a few sites in NH

- UCMR 4 issued for public comment in 12/15 another iteration of the rulemakings to fill the occurrence data gaps in CCLs.
  - 10 cyanotoxins/groups (for surface water systems);
  - 2 metals (includes manganese);
  - 8 pesticides (plus one pesticide manufacturing by-product)
  - 3 brominated haloacetic acid groups of disinfection by-products
  - 3 alcohols; and
  - 3 semi volatile organic chemicals.

The final UCMR4 is anticipated to be published in late 2016 or early 2017. UCMR 4 monitoring is anticipated to start in 2018

# Status of New EPA Drinking Water Standards

- Continue to work on perchlorate (complete in 2017 or 2018)
- Continue to assess health impacts associated with strontium

# USEPA Waste Programs

- Contamination thresholds for contaminants without standards vary based on
  - USEPA Program
  - Site specific conditions

# State Drinking Water Regulations

# NH State Drinking Water Standards

**485:3 Drinking Water Rules. –**

I. The commissioner shall adopt under RSA 541-A, following public hearing, drinking water rules and primary drinking water standards which are necessary to protect the public health and which shall apply to all public water systems. Such rules shall include:

(a) identification of contaminants which may have an adverse effect on the health of persons;

(b) specification for each contaminant of either:

(1) a maximum contaminant level that is acceptable in water for human consumption, if it is feasible to ascertain the level of such contaminant in water in public water systems; or

(2) one or more treatment techniques or methods which lead to a reduction of the level of such contaminant sufficient to protect the public health, if it is not feasible to ascertain the level of such contaminant in water in the public water system..

# Legal Basis for Establishing NH Ambient Groundwater Quality Standards – Waste Division

**485-C:6 Ambient Groundwater Quality Standards. –**

I. The commissioner shall establish and adopt ambient groundwater quality standards for regulated contaminants which adversely affect human health or the environment. Ambient groundwater standards shall apply to all regulated contaminants which result from human operations or activities, but do not apply to naturally occurring contaminants. Where federal maximum contaminant level or health advisories have been promulgated under the Federal Safe Drinking Water Act or rules relevant to such act, ambient groundwater quality standards shall be equivalent to such standards. Where such standards are based upon cancer risks, **the ambient groundwater quality standards shall be equivalent to that exposure which causes a lifetime exposure risk of one cancer in 1,000,000 exposed population**. Where no federal maximum contaminant level or health advisory has been issued, the commissioner may adopt ambient groundwater quality standards on a basis which provides for an adequate margin of safety to protect human health and safety.

****Does not include financial or technical feasibility considerations****

# Ambient Groundwater Quality Standards Are Also Drinking Water Standards

**Env-Dw 707.02 Adjustments to Monitoring Requirements**

**(b) If sample results indicate the presence of contaminants for which MCLs are not listed in Env-Dw 702 through Env-Dw 706 but which are included in the ambient groundwater quality standards (AGQS) specified in Env-Or 603.03, the PWS shall comply with the AGQS specified in Env-Or 603.03.**

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# Emerging Contaminants & NH

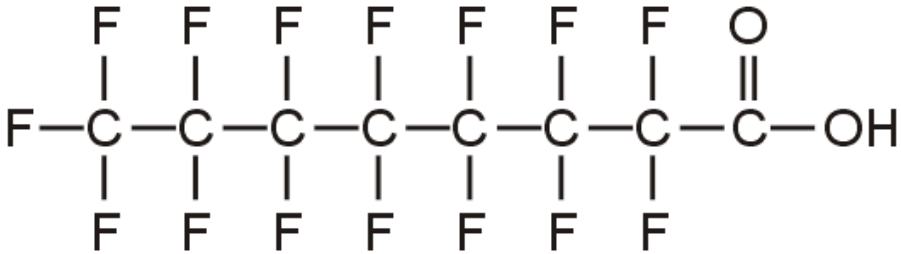
- Perfluorinated Compounds
  - Pease (covered earlier)
  - Saint-Gobain in Merrimack - Merrimack/Litchfield/Bedford/Londonderry/Manchester
  - New PFC site
- Cyanotoxins
- Groundwater quality downgradient of on-site wastewater disposal systems at two nursing homes
- Merrimack River Pharmaceutical and Personal Care Product Study
- 1,4-dioxane occurrence study
- Perchlorate
  - Occurrence study
  - Stakeholder group for the development of a public health goal
- Public Water Systems/Unregulated Contaminant Monitoring Rule
- High resolution study of pesticides in drinking water in schools/daycares
- n-propyl-bromide occurrence study
- Regional Emerging Contaminant Work Group
- Microbead concerns

NHDES

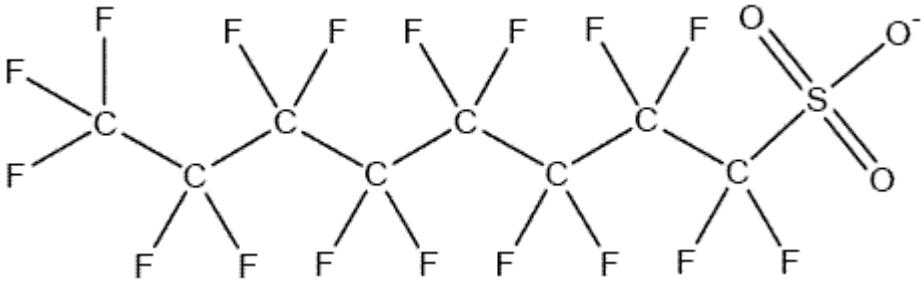
# Perfluorochemicals (PFCs) in NH

## What are Perfluorochemicals (PFCs)?

- Synthetic chemical family comprised of long chains of carbon and fluorine
- PFCs manufactured and used since the late 1940s
- Perflourooctanoic acid (PFOA or C8) primarily used as a surfactant



- Perfluorooctane sulfonate (PFOS) has variety of uses including surface treatments, paper coatings, firefighting foam



# The Expansive Use of PFCs

| Commercial Products | Industrial Uses |
|---|---|
| Cookware (Teflon®, Nonstick) | Photo Imaging |
| Fast Food Containers | Metal Plating |
| Candy Wrappers | Semiconductor Coatings |
| Microwave Popcorn Bags | Aviation Hydraulic Fluids |
| Personal Care Products (Shampoo, Dental Floss) | Medical Devices |
| Cosmetics (Nail Polish, Eye Makeup) | Firefighting Aqueous Film-Forming Foam |
| Paints and Varnishes | Insect Baits |
| Stain Resistant Carpet | Printer and Copy Machine Parts |
| Stain Resistant Chemicals (Scotchgard®) | Chemically Driven Oil Production |
| Water Resistant Apparel (Gore-Tex®) | Textiles, Upholstery, Apparel and Carpets |
| Cleaning Products | Paper and Packaging |
| Electronics | Rubber and Plastics |
| Ski Wax | |

# Fate and Transport of PFCs

- PFCs are found in water, soil, and sediments, and in the blood and tissue of wildlife throughout the world
- Nearly all people have some level of PFCs in their blood
- Potential health effects from exposure to low levels of PFCs are not well understood

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# PFOS and PFOA as Emerging Contaminants

- Widely distributed and persistent in environment
- Long half-life in body (2 – 9 years)
- Tendency to bioaccumulate
- Potential health effects from low level exposure
- Recent advances in analytical detection limits
- Not regulated under SDWA – but on UCMR list

# Public Health Advisories (PHA) Established for PFOS and PFOA

- A PHA is a health-based concentration, above which action should be taken to reduce exposure to a contaminant through drinking water
- 2009 - EPA established PHAs:
  - PFOS: 0.2 ug/l or 200 parts per trillion
  - PFOA: 0.4 ug/l or 400 parts per trillion
- These PHAs are based upon short-term exposure
- EPA is using a 0.1 ug/L value in Hoosick Falls, NY
- EPA is expected to establish and release lifetime health advisories in Spring of 2016

# Fate and Transport of PFOA

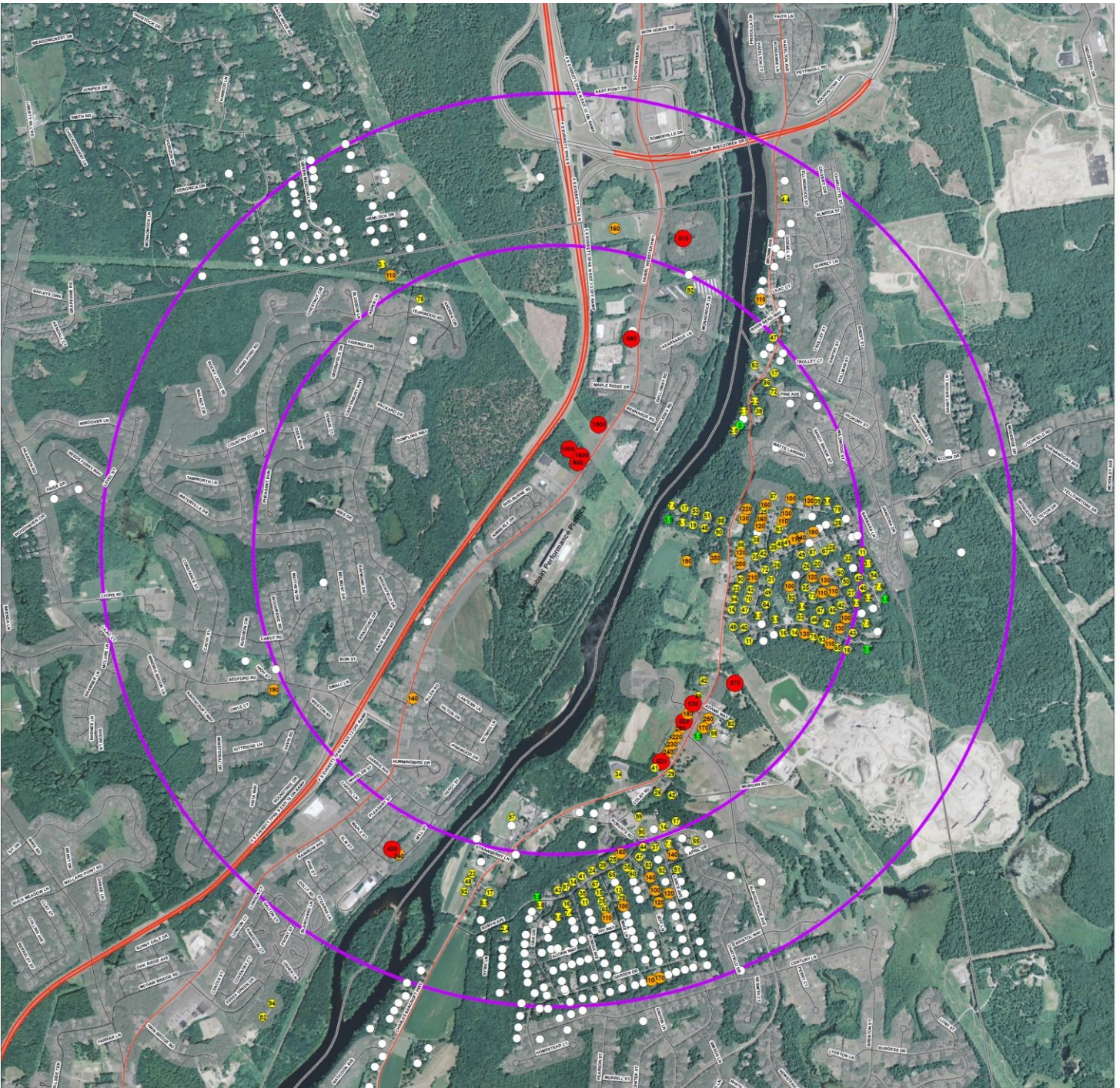
- Use of PFOA in manufacturing can result in releases to air, water, and soil
- PFOA released to the air as an aerosol or adsorbed to particles can travel distances and settle to the ground
- PFOA deposited into/onto the soil can be transported to and contaminate groundwater
- This airborn pathway significantly complicates efforts to identify impacted water supplies

# PFOA as an Emerging Contaminant in Southern New Hampshire

- Feb 2016 - Saint-Gobain Performance Plastics reported results of water tests at its Merrimack facility
- History of PFOA use at Merrimack; Hoosick Falls, NY; and North Bennington, VT facilities
- PFOA contamination of groundwater and drinking water at levels above the PHA near both the NY and VT facilities
- PFOA detected at 30 ppt in water supplied by Merrimack Village District Water System (MVD)

# PFOA as an Emerging Contaminant in Southern New Hampshire

- Sampled approx 475 private wells since March 2016 within 1.5 miles of Saint-Gobain
- Approx 200 results to date
  - 25% over 100 ppt for PFOA
  - 50% over 50 ppt for PFOA
- Providing bottled water to all residents on private wells within 1.5 miles
- Determining long-term solution
- Continue to expand the sampling area.



# PFOA INVESTIGATION
## Updated: May 10, 2016

Results received through 05/09/2016

Most recent result shown for wells sampled on more than one occasion

1 0.5 Mile — Area of Investigation

**PFOA (PPT)**

- ≥400
- 100-399
- <100
- Non Detect (<2)
- Result Pending

**Public Water Supplies**

- Water Distribution

**Transportation**

- US/ NH Route
- Road
- Driveway

- Political Boundary

1:7,800
1 in = 650 feet

N W E S

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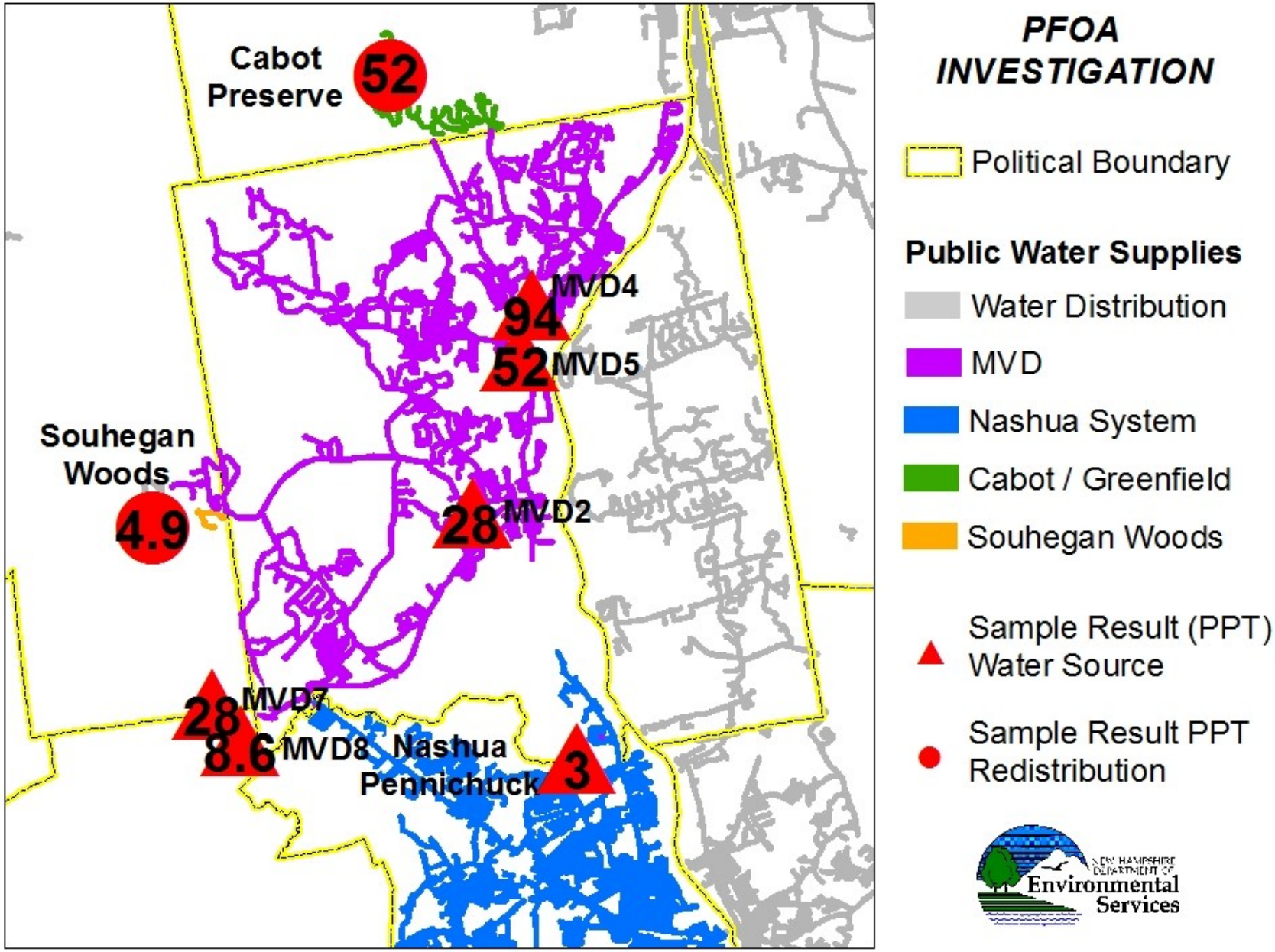


# Public Water Supply Testing Results

# Challenges for Citizens

- Uncertainty about health effects creates fear
- Disproportionate focus on PFCs versus other contaminants – Demands for “0” PFCs in water
- In a “post-Flint” environment, public confidence in local government and water authorities is low
- Without a clearly articulated standard, the messages about risk and an appropriate level of concern are necessarily muddled
- Questions about past exposures are often unanswerable
- Impacted residents also worry about property values

# Challenges for Water System Operators and Local Governments

- Lack of enforceable drinking water standard:
  - makes it difficult to know what level of response is appropriate
  - complicates communications and relationships with customers
  - can make it unclear how actions can or will be financed
- Being responsive is very resource-intensive and can significantly burden small communities and water systems

# Challenges for State Regulatory Agencies

- Lack of enforceable drinking water standard complicates:
  - Messaging to public
  - Regulation of water systems
  - Interactions with potentially responsible parties
- Inability to quantify or describe past exposures
- Airborne pathway significantly expands effort needed to characterize impacts to soil, groundwater, surface water, wildlife, and agricultural products
- Being responsive is very resource-intensive
- The next generation of PFCs that <u>are used now</u> have not been addressed

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# Summary

- Extremely durable and persistent in environment
- Ubiquitous distribution in the environment
- Long half-life in body
- Tendency to bioaccumulate
- Poorly understood potential health effects
- Airborne transport mechanism, coupled with speedy migration to and in groundwater
- Very low health guidelines (parts per trillion)
- More to come
  - Other sites with possible air emissions or spills
  - Sampling at select landfills is occurring

# Cyanobacteria
# AKA “blue-green algae”

- Photosynthetic bacteria
- May occur in all N.H. waterways
- <u>Sometimes</u> produce toxins
- Under certain conditions form “blooms”
  - HAB or CyanoHAB = harmful algae bloom
  - Floating scum, mats, flecks scattered in water
  - Can happen any time of year, but most reported late summer – early autumn
- Thousands of species

# Regulatory Status

- No MCL
- EPA actions:
  - Health Advisory -10-day exposure (June 2015)

| toxin | <6 yrs old | ≥6 yrs old |
|---|---|---|
| microcystins | 0.3 ug/L | 1.6 ug/L |
| cylindrospermopsin | 0.7 ug/L | 3 ug/L |

  - Methods established (ELISA, LC/MS/MS)
  - Proposed for UCMR 4 (December 2015)
    - Monitoring would begin January 2018
  - Developing management plan templates

# Cyanotoxins – NHDES Actions

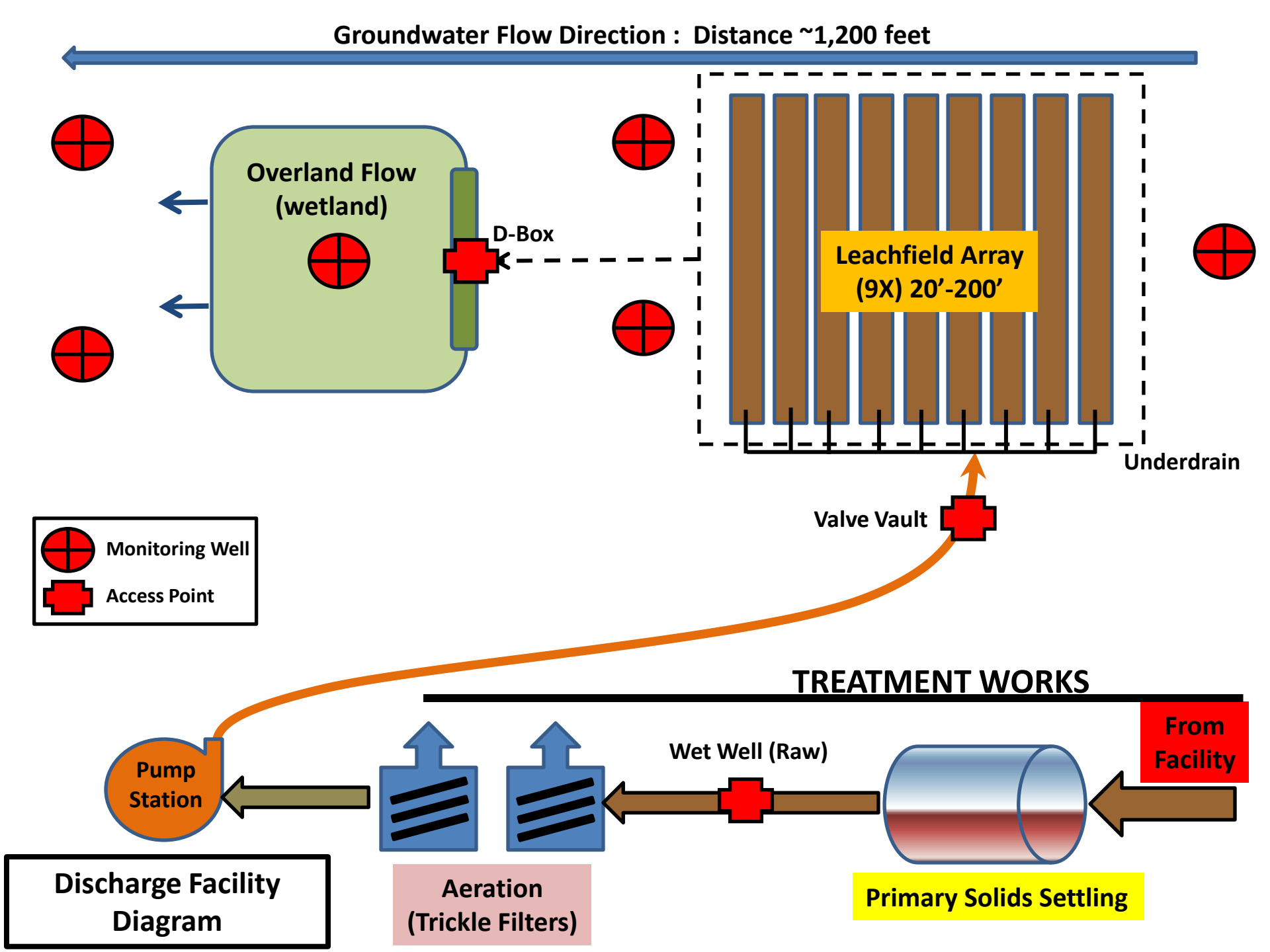
- Guidance fact sheet for PWSs
- Funding monitoring by interested PWSs
- Developing internal DW response protocol
- Developing analytical capability (2016)
  - Quick ELISA in Limnology Center
  - Precision toxin analysis in PHL

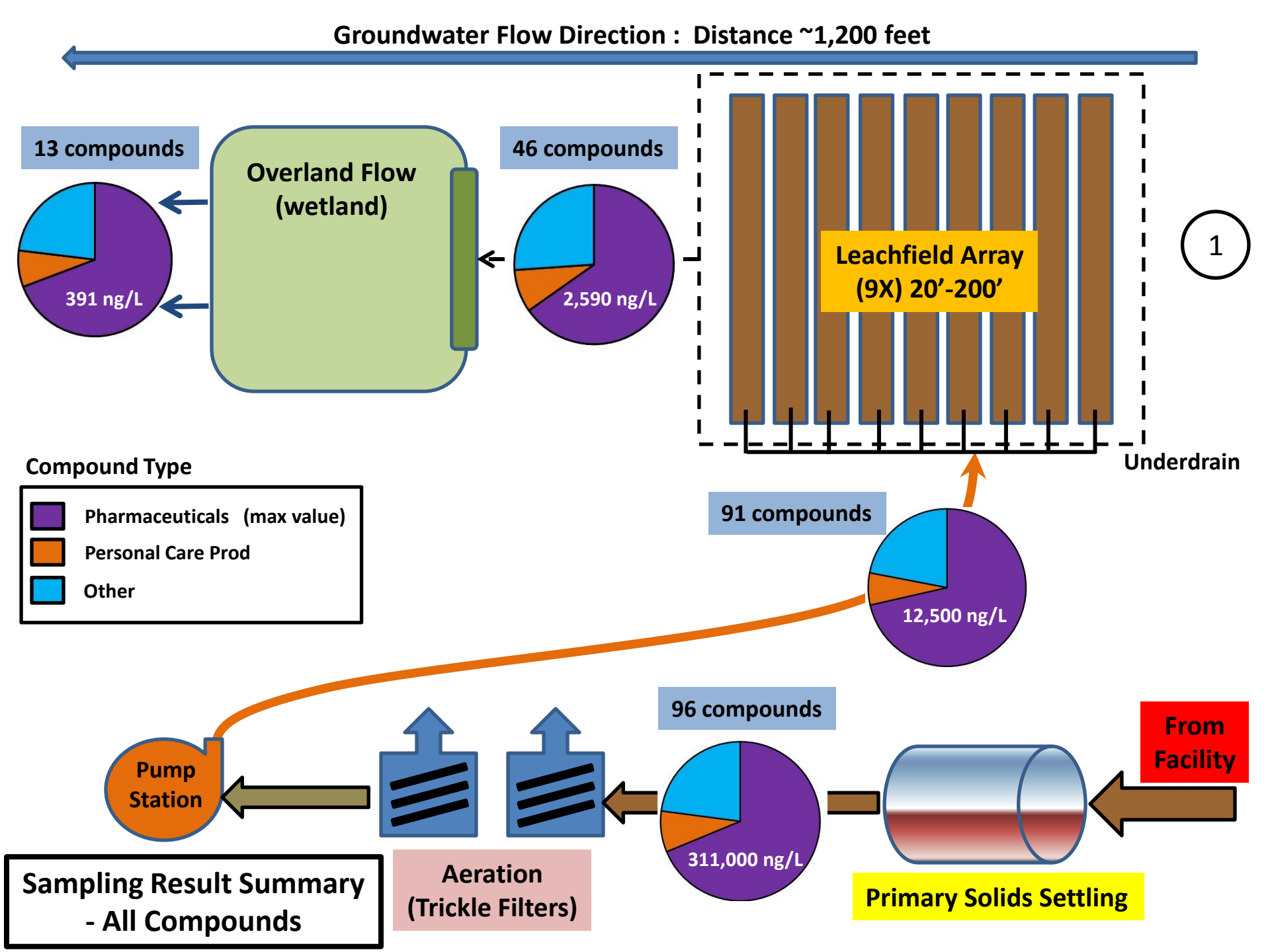
# What can water systems do?

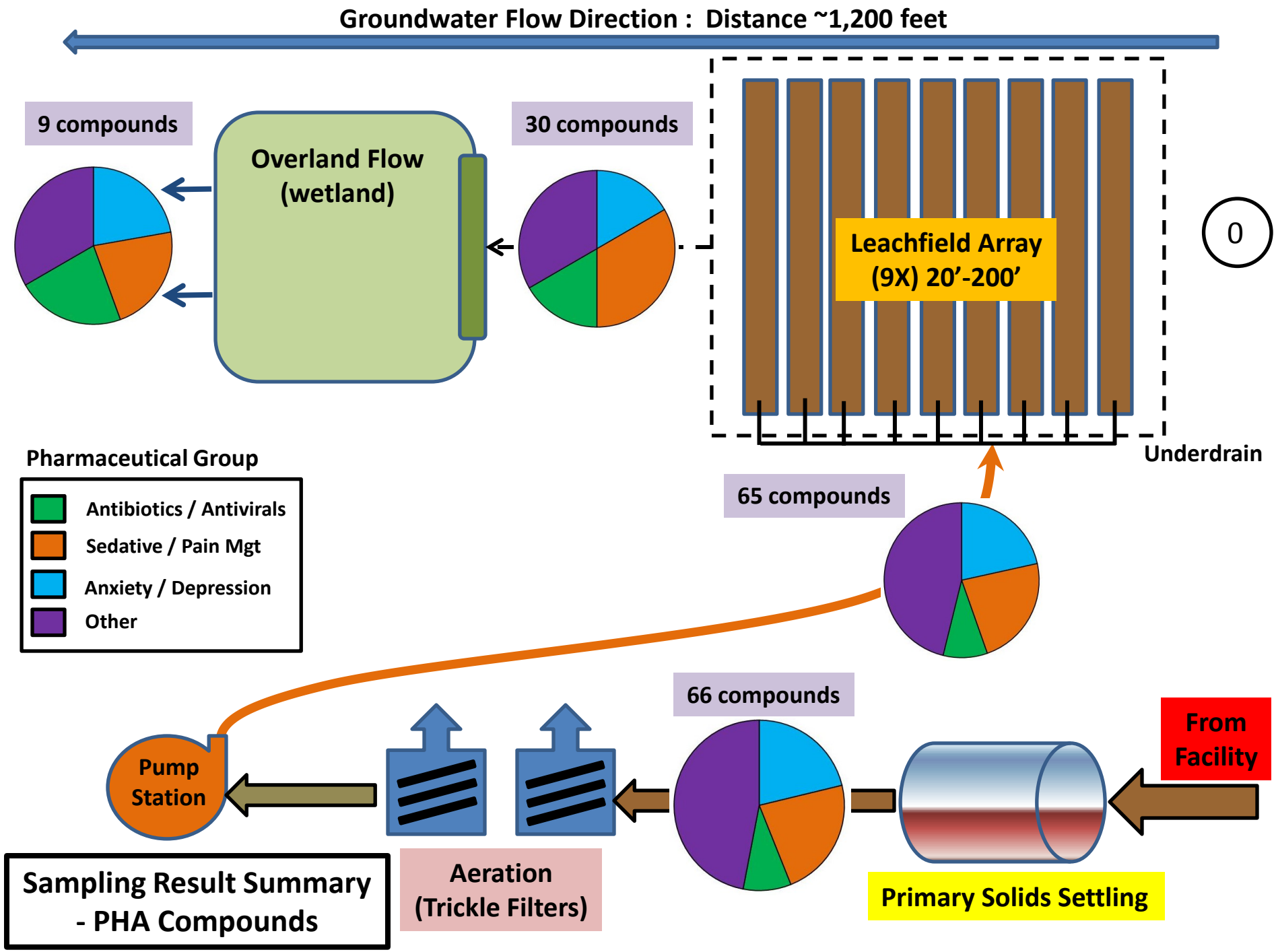
- Source water protection
- Monitoring
- Develop response protocol (see EPA guidance)
  - Tiered response (observation, monitoring, etc.)
  - In-reservoir strategies
    - Selection of intake location/depth
    - Destratification (mixing), aeration, sediment removal
    - Algaecide *prior to bloom formation*
  - Adjust treatment processes

# PPCP Study at a Health Care Facility that Discharges Wastewater to Groundwater

## Case Study 1

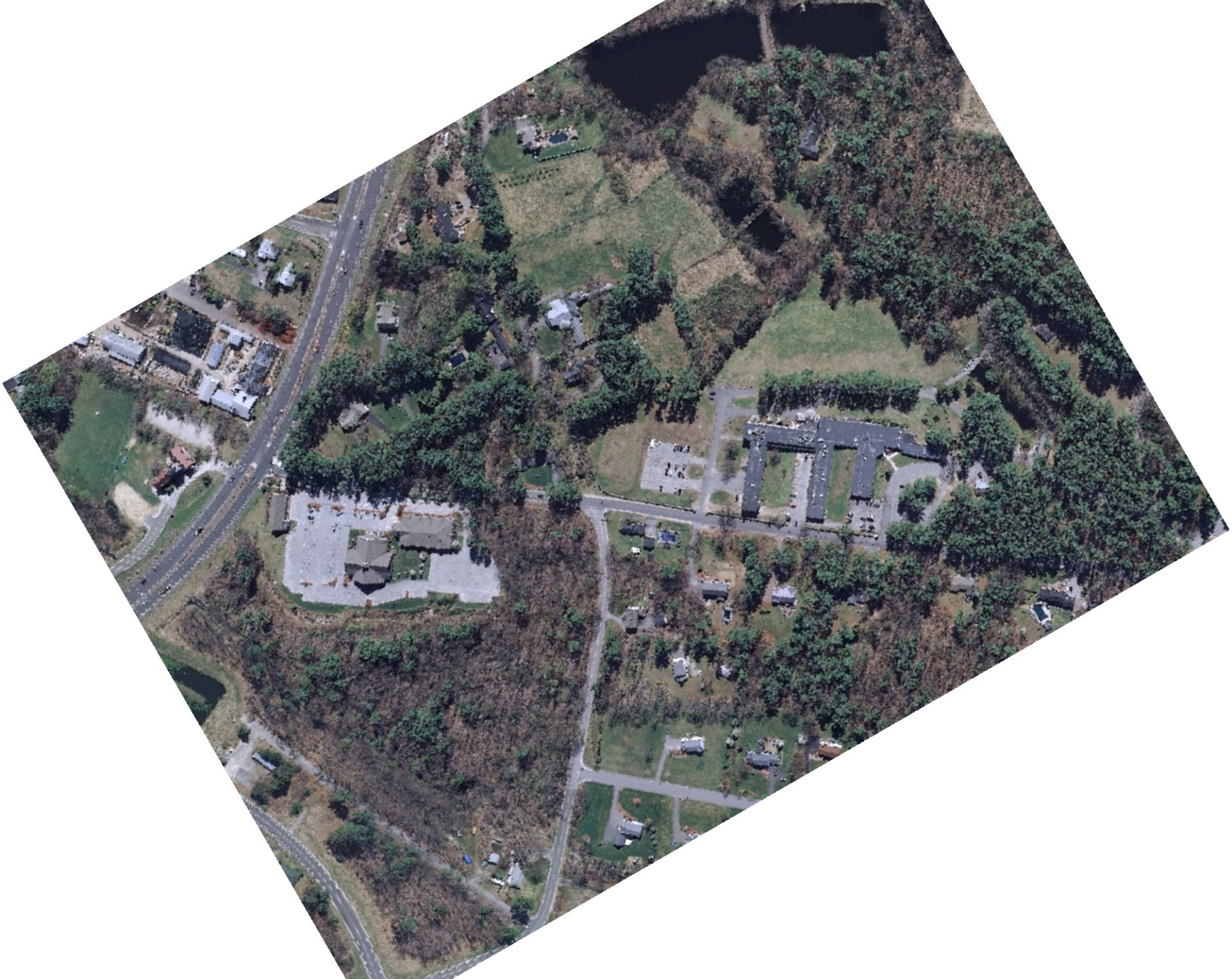

Groundwater Flow Direction : Distance ~1,200 feet
Overland Flow (wetland)
D-Box
Leachfield Array (9X) 20'-200'
Underdrain
Valve Vault
Monitoring Well
Access Point
TREATMENT WORKS
From Facility
Wet Well (Raw)
Pump Station
Aeration (Trickle Filters)
Primary Solids Settling
Discharge Facility Diagram

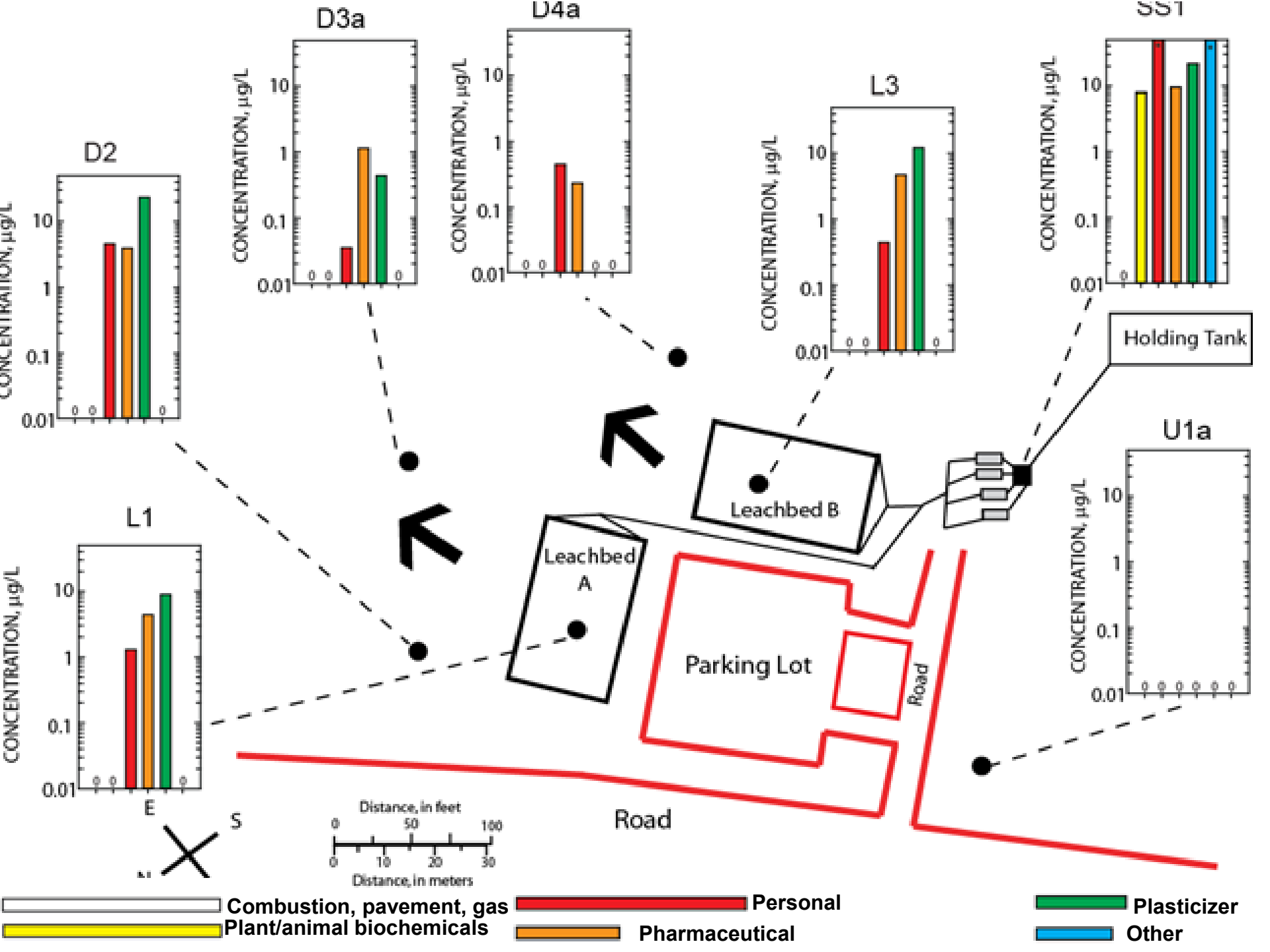

Groundwater Flow Direction : Distance ~1,200 feet
13 compounds
391 ng/L
Overland Flow (wetland)
46 compounds
2,590 ng/L
Leachfield Array (9X) 20'-200'
1
Underdrain
Compound Type
Pharmaceuticals (max value)
Personal Care Prod
Other
91 compounds
12,500 ng/L
96 compounds
311,000 ng/L
From Facility
Pump Station
Aeration (Trickle Filters)
Primary Solids Settling
Sampling Result Summary - All Compounds


Groundwater Flow Direction : Distance ~1,200 feet
9 compounds
Overland Flow (wetland)
30 compounds
Leachfield Array (9X) 20'-200'
0
Underdrain
Pharmaceutical Group
Antibiotics / Antivirals
Sedative / Pain Mgt
Anxiety / Depression
Other
65 compounds
66 compounds
From Facility
Pump Station
Aeration (Trickle Filters)
Primary Solids Settling
Sampling Result Summary - PHA Compounds

# PPCP Study at a Health Care Facility that Discharges Wastewater to Groundwater

## Case Study 2




D2
D3a
D4a
L3
SS1
L1
U1a
CONCENTRATION, µg/L
10
1
0.1
0.01
Holding Tank
Leachbed B
Leachbed A
Parking Lot
Road
Road
E
S
N
Distance, in feet
0
50
100
0
10
20
30
Distance, in meters
Combustion, pavement, gas
Plant/animal biochemicals
Personal
Pharmaceutical
Plasticizer
Other

CONCENTRATION, ug/L

# Compounds detected >0.1 μg/L

## Personal Care/ Domestic Use

HHCB
Acetaphenone
Benzophenone
*para*-Nonylphenol
Chloroxylenol

## Plasticizers

TPP
TBEP
TCEP
TDCP

## Pharmaceuticals

Butalbital
Carbamazepine
Carisoprodol
Celecoxib
Lidocaine
Phenobarbital
Phenytoin
Temazepam
Tramadol

# TBEP Represents Most of Plasticizer in Wells

# Questions??

**Suggested resources:**

http://www.environmentalhealthnews.org/

http://silentspring.org/