Sources, Transport, Exposure & Effects of PFASs
UNIVERSITY OF RHODE ISLAND SUPERFUND RESEARCH PROGRAM

**STEEP 2021 Science Series**
**Let's Talk About PFAS**

# PFAS in private drinking water wells
# Preliminary findings from STEEP's private well water study on Cape Cod

Alyson McCann, University of Rhode Island

February 3, 2021

Private wells provide drinking water to:
- 15% of U.S. population
- 15% of Cape Cod population

- Private wells are not protected by the U.S. EPA under the Federal Safe Drinking Water Act
- States can adopt protection standards for private wells – check with you state and local board of health
- Private well owners are responsible for assuring the quality of their drinking water supply is safe for them and their family

Mass. Dept. of Environmental Protection
https://www.mass.gov/private-wells

# Goals of STEEP private well study

- Test 250 private wells for PFASs (25)
- Report results back to participants
- Evaluate potential sources of PFASs
- Support private well testing and treatment
- Inform residents and decision-makers about our findings

# STEEP Collaborators

Harvard University:

•Elsie Sunderland, Heidi Pickard, Prentiss Balcom

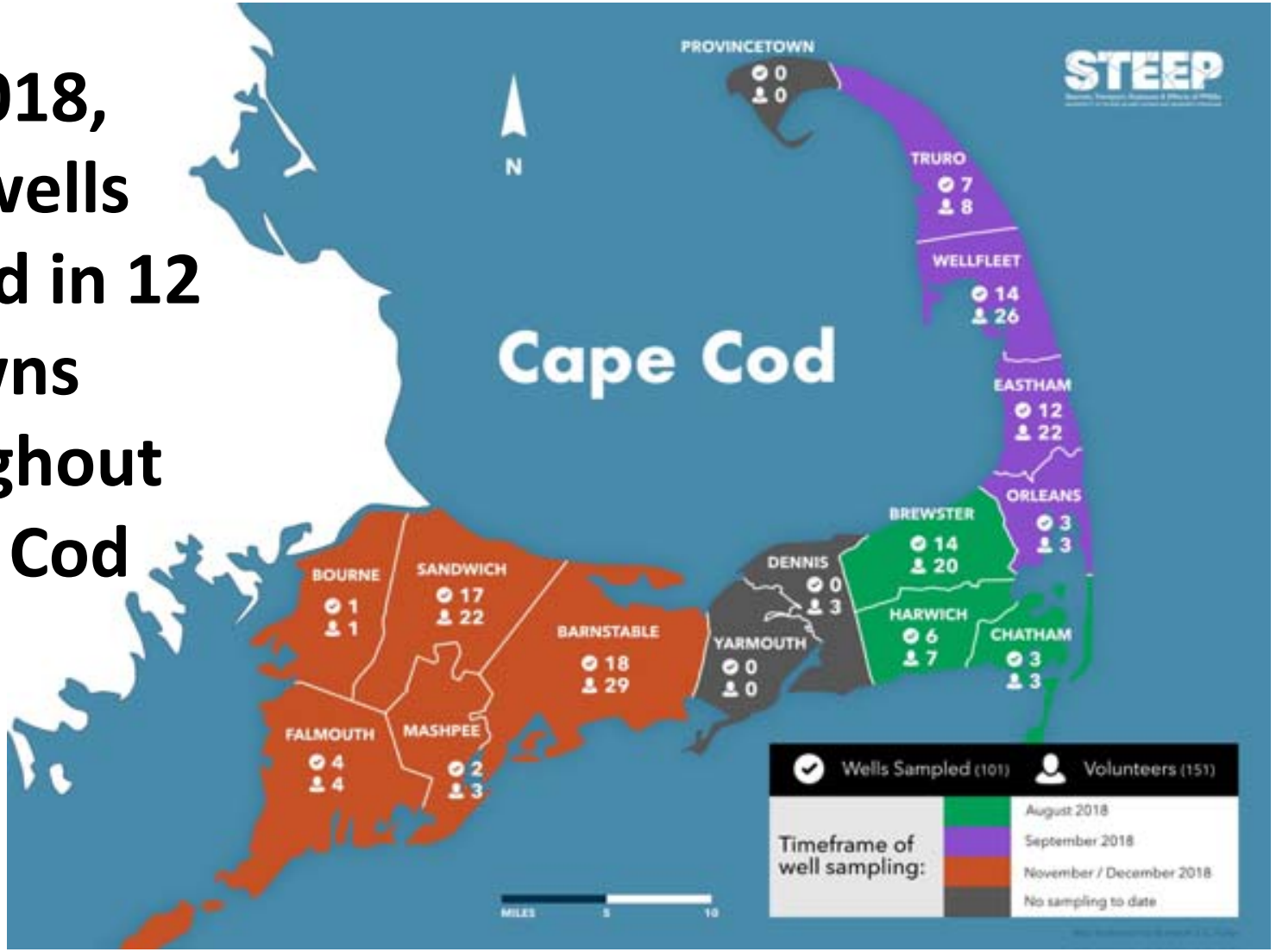
Silent Spring Institute:

•Amanda Hernandez, Katie Boronow, Erik Haugsjaa

And assistance with field sampling by:

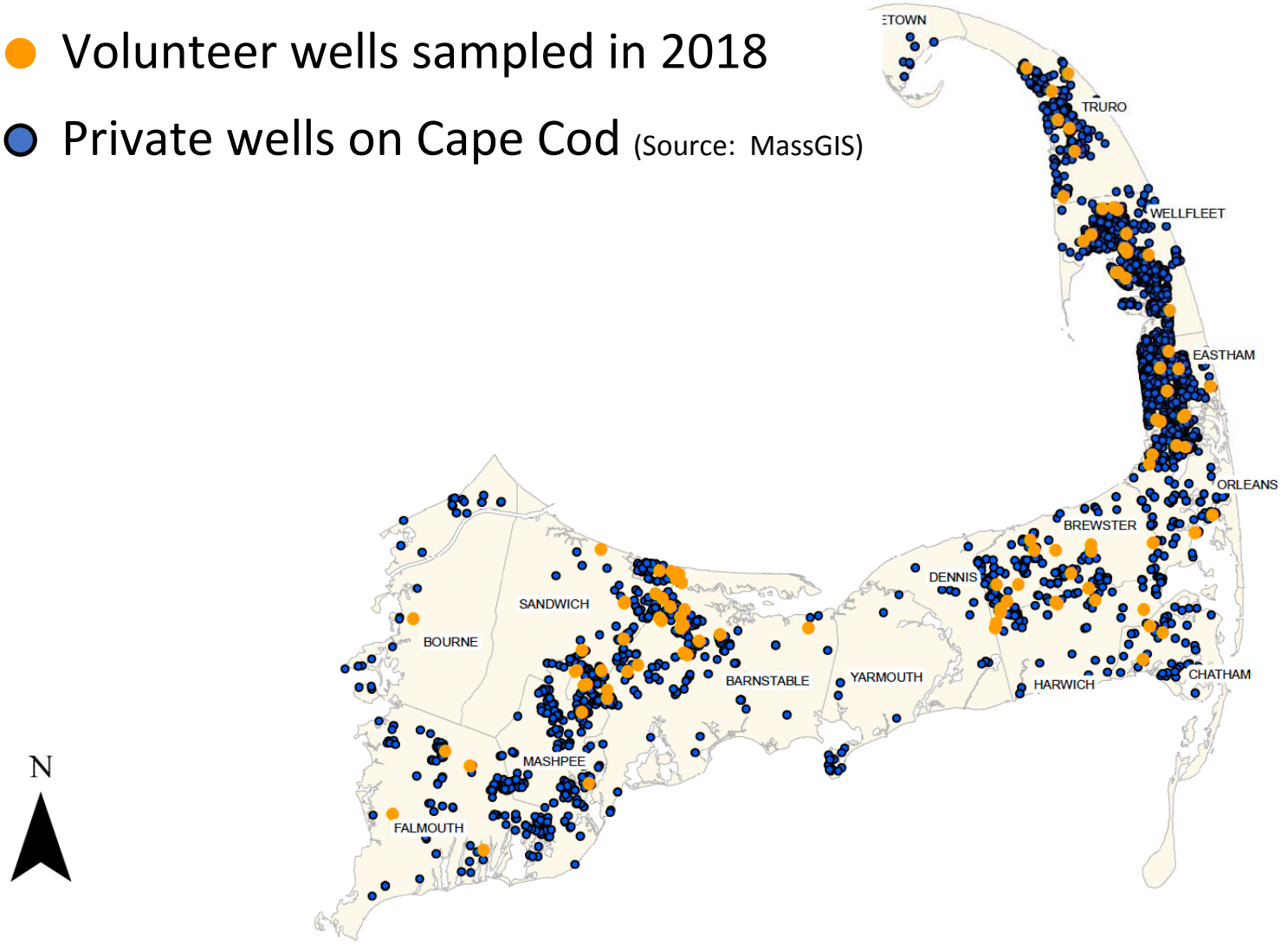
•Lauren Richter, Matt Dunn, Mike Federenko, Christine Gardiner

**In 2018, 101 wells sampled in 12 towns throughout Cape Cod**




STEEP

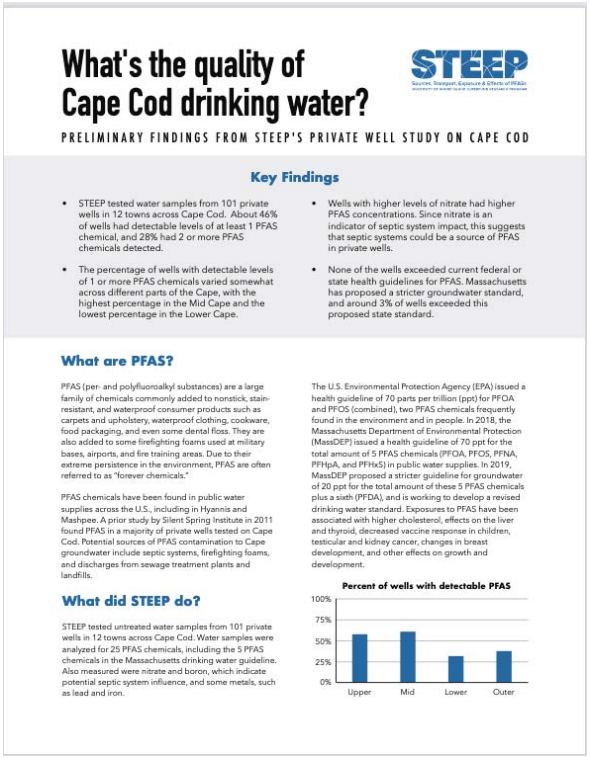
- Volunteer wells sampled in 2018
- Private wells on Cape Cod (Source: MassGIS)



# Preliminary findings of STEEP well water study

- PFAS chemicals were detected in 46% of wells tested
- 28% of wells had 2 or more PFAS detected
- Both legacy and newer alternative PFAS chemicals were present
- Some of those detected are included in MassDEP guideline, others detected lack guidelines
- No wells exceeded current EPA guideline of 70 ppt for PFOA and PFOS
- 3% of well tested in STEEP study exceeded MassDEP MCL of 20 ppt for 6 PFAS (adopted 10/20)

## Summary of preliminary findings on STEEP webpage:



# What's the quality of Cape Cod drinking water?

PRELIMINARY FINDINGS FROM STEEP'S PRIVATE WELL STUDY ON CAPE COD

### Key Findings

- STEEP tested water samples from 101 private wells in 12 towns across Cape Cod. About 46% of wells had detectable levels of at least 1 PFAS chemical, and 28% had 2 or more PFAS chemicals detected.
- The percentage of wells with detectable levels of 1 or more PFAS chemicals varied somewhat across different parts of the Cape, with the highest percentage in the Mid Cape and the lowest percentage in the Lower Cape.
- Wells with higher levels of nitrate had higher PFAS concentrations. Since nitrate is an indicator of septic system impact, this suggests that septic systems could be a source of PFAS in private wells.
- None of the wells exceeded current federal or state health guidelines for PFAS. Massachusetts has proposed a stricter groundwater standard, and around 3% of wells exceeded this proposed state standard.

### What are PFAS?

PFAS (per- and polyfluoroalkyl substances) are a large family of chemicals commonly added to nonstick, stain-resistant, and waterproof consumer products such as carpets and upholstery, waterproof clothing, cookware, food packaging, and even some dental floss. They are also added to some firefighting foams used at military bases, airports, and fire training areas. Due to their extreme persistence in the environment, PFAS are often referred to as "forever chemicals."

PFAS chemicals have been found in public water supplies across the U.S., including in Hyannis and Mashpee. A prior study by Silent Spring Institute in 2011 found PFAS in a majority of private wells tested on Cape Cod. Potential sources of PFAS contamination to Cape groundwater include septic systems, firefighting foams, and discharges from sewage treatment plants and landfills.

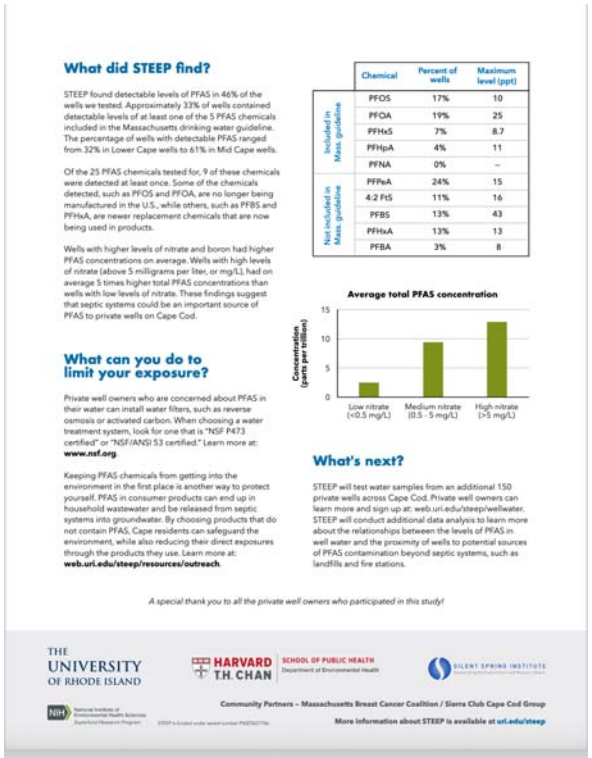
The U.S. Environmental Protection Agency (EPA) issued a health guideline of 70 parts per trillion (ppt) for PFOA and PFOS (combined), two PFAS chemicals frequently found in the environment and in people. In 2018, the Massachusetts Department of Environmental Protection (MassDEP) issued a health guideline of 70 ppt for the total amount of 5 PFAS chemicals (PFOA, PFOS, PFNA, PFHpA, and PFHxS) in public water supplies. In 2019, MassDEP proposed a stricter guideline for groundwater of 20 ppt for the total amount of these 5 PFAS chemicals plus a sixth (PFDA), and is working to develop a revised drinking water standard. Exposures to PFAS have been associated with higher cholesterol, effects on the liver and thyroid, decreased vaccine response in children, testicular and kidney cancer, changes in breast development, and other effects on growth and development.

### What did STEEP do?

STEEP tested untreated water samples from 101 private wells in 12 towns across Cape Cod. Water samples were analyzed for 25 PFAS chemicals, including the 5 PFAS chemicals in the Massachusetts drinking water guideline. Also measured were nitrate and boron, which indicate potential septic system influence, and some metals, such as lead and iron.

**Percent of wells with detectable PFAS**



### What did STEEP find?

STEEP found detectable levels of PFAS in 46% of the wells we tested. Approximately 33% of wells contained detectable levels of at least one of the 5 PFAS chemicals included in the Massachusetts drinking water guideline. The percentage of wells with detectable PFAS ranged from 32% in Lower Cape wells to 61% in Mid Cape wells.

Of the 25 PFAS chemicals tested for, 9 of these chemicals were detected at least once. Some of the chemicals detected, such as PFOS and PFOA, are no longer being manufactured in the U.S., while others, such as PFBS and PFHxA, are newer replacement chemicals that are now being used in products.

Wells with higher levels of nitrate and boron had higher PFAS concentrations on average. Wells with high levels of nitrate (above 5 milligrams per liter, or mg/L) had on average 5 times higher total PFAS concentrations than wells with low levels of nitrate. These findings suggest that septic systems could be an important source of PFAS to private wells on Cape Cod.

| | Chemical | Percent of wells | Maximum level (ppt) |
|---|---|---|---|
| Included in Mass. guideline | PFOS | 17% | 10 |
| | PFOA | 19% | 25 |
| | PFHxS | 7% | 8.7 |
| | PFHpA | 4% | 11 |
| | PFNA | 0% | -- |
| Not included in Mass. guideline | PFPeA | 24% | 15 |
| | 4:2 FtS | 11% | 16 |
| | PFBS | 13% | 43 |
| | PFHxA | 13% | 13 |
| | PFBA | 3% | 8 |

**Average total PFAS concentration**




### What can you do to limit your exposure?

Private well owners who are concerned about PFAS in their water can install water filters, such as reverse osmosis or activated carbon. When choosing a water treatment system, look for one that is "NSF P473 certified" or "NSF/ANSI 53 certified." Learn more at: **www.nsf.org**.

Keeping PFAS chemicals from getting into the environment in the first place is another way to protect yourself. PFAS in consumer products can end up in household wastewater and be released from septic systems into groundwater. By choosing products that do not contain PFAS, Cape residents can safeguard the environment, while also reducing their direct exposures through the products they use. Learn more at: **web.uri.edu/steep/resources/outreach**.

### What's next?

STEEP will test water samples from an additional 150 private wells across Cape Cod. Private well owners can learn more and sign up at: web.uri.edu/steep/wellwater. STEEP will conduct additional data analysis to learn more about the relationships between the levels of PFAS in well water and the proximity of wells to potential sources of PFAS contamination beyond septic systems, such as landfills and fire stations.

*A special thank you to all the private well owners who participated in this study!*

THE UNIVERSITY OF RHODE ISLAND · HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH · SILENT SPRING INSTITUTE

Community Partners – Massachusetts Breast Cancer Coalition / Sierra Club Cape Cod Group

More information about STEEP is available at uri.edu/steep

https://web.uri.edu/steep/whats-the-quality-of-cape-cod-drinking-water-preliminary-findings-from-steeps-private-well-study-on-cape-cod/

| | Chemical | Percent of wells | Maximum level (ppt) | Method detection limit (ppt) |
|---|---|---|---|---|
| **Included in current Mass. MCL** | PFOA | 19% | 25 | 3.9 |
| | PFOS | 17% | 10 | 3.0 |
| | PFHxS | 7% | 8.7 | 3.1 |
| | PFHpA | 4% | 11 | 2.6 |
| | PFNA | 0% | -- | 6.0 |
| | PFDA | 0% | -- | 6.1 |
| **Not included in Mass. MCL** | PFPeA | 24% | 15 | 1.3 |
| | PFBS | 13% | 43 | 2.2 |
| | PFHxA | 13% | 13 | 3.3 |
| | 4:2 FtS | 11% | 16 | 3.4 |
| | PFBA | 3% | 8.0 | 3.3 |

# Summary of STEEP preliminary PFAS results

# For the private well owner, testing is the first step, then, it's important to:

- Understand test results
- Determine if treatment is necessary based on test results
  - Are there aesthetic concerns (staining, odor, taste)?
  - Are there health concerns?
  - Ask the lab for assistance in understanding your test results
- Identify type of treatment to effectively address the identified water quality issue

  Helpful resources:
  - riwelltesting.org for info on types of treatment technologies
  - nsf.org for treatment technologies that meet treatment standards
  - Check with your local or state department of health & environmental protection agency

On Cape Cod: Barnstable County Health Lab

https://www.barnstablecountyhealth.org/

Phone: 508-375-6605

# Identify effective home water treatment for PFAS

- Activated carbon
  - Filters: pitcher, faucet, fridge, single-stage under sink, 2-stage under sink, whole house (removal performance varies based on type)
  - Effective for PFOS, PFOA, and other long-chain PFAS
  - Short-chain PFAS not as well removed
  - Lower cost
  - Filters/media need to be changed/regenerated – how is waste disposed?
- Reverse osmosis (RO)
  - Can be very effective for long-chain and short-chain PFAS
  - More expensive option and generates stream of wastewater
  - Removed PFAS in wastewater – how is wastewater disposed?

**Follow up testing is IMPORTANT to ensure treatment is effective**

# National Sanitation Foundation's treatment standards: nsf.org

- Listing of NSF/ANSI standards for water treatment systems

https://www.nsf.org/knowledge-library/standards-water-treatment-systems

NSF standards: NSF P473 certification, and NSF/ANSI 53 standard for activated carbon filters and NSF/ANSI 58 standard for RO. ** To comply with these standards, a treatment device must reduce PFOA and PFOS to concentrations in water below the 70 ppt health advisory level set by the US EPA. Note: this is different from MA standard

# Treatment for PFAS in Drinking Water

- U. S. Environmental Protection Agency

  https://www.epa.gov/sciencematters/epa-researchers-investigate-effectiveness-point-usepoint-entry-systems-remove-and

  •Recent study from Duke University concluded that “Not all in-home drinking water filters completely remove toxic PFAS”.

  https://pubs.acs.org/doi/pdf/10.1021/acs.estlett.0c00004

# Activated Carbon

Pitcher filter

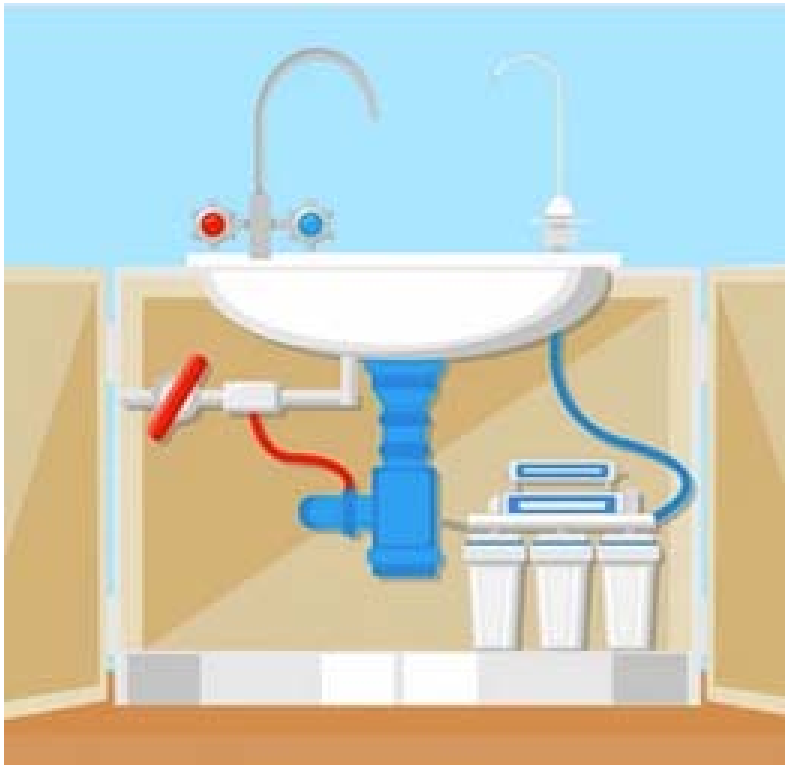
2-stage under-the-sink filter

# Activated Carbon

Whole-house Activated Carbon

# Reverse Osmosis

Point of Use



Whole house – plumbed in basement

**Thank you!**

**web.uri.edu/steep**

**To sign up for our private well study, visit: web.uri.edu/wellwater**


Alyson McCann
Water Quality Coordinator, URI Cooperative Extension
Department of Natural Resources Science
University of Rhode Island
Kingston, RI 02881
401.874.5398
alyson@uri.edu
web.uri.edu/safewater

Laurel Schaider, PhD
Research Scientist
Silent Spring Institute
Newton, MA 02460
(617) 332-4288 ext 224
schaider@silentspring.org
www.silentspring.org


THE UNIVERSITY OF RHODE ISLAND

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH Department of Environmental Health

SILENT SPRING INSTITUTE Researching the Environment and Women's Health

NIH National Institute of Environmental Health Sciences Superfund Research Program


STEEP is funded under award number P42ES027726.
More information about STEEP is available at: https://web.uri.edu/steep/


STEEP