Preliminary Results: Challenges and Solutions for Small Drinking Water Systems and Private Well Owners Impacted by the Marshall Fire

PURDUE UNIVERSITY

University of Colorado Boulder

April 13, 2022

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Funded by: NSF 2214580 RAPID: Drinking Water System Contamination Response & Recovery Following the 2021 Colorado Fires

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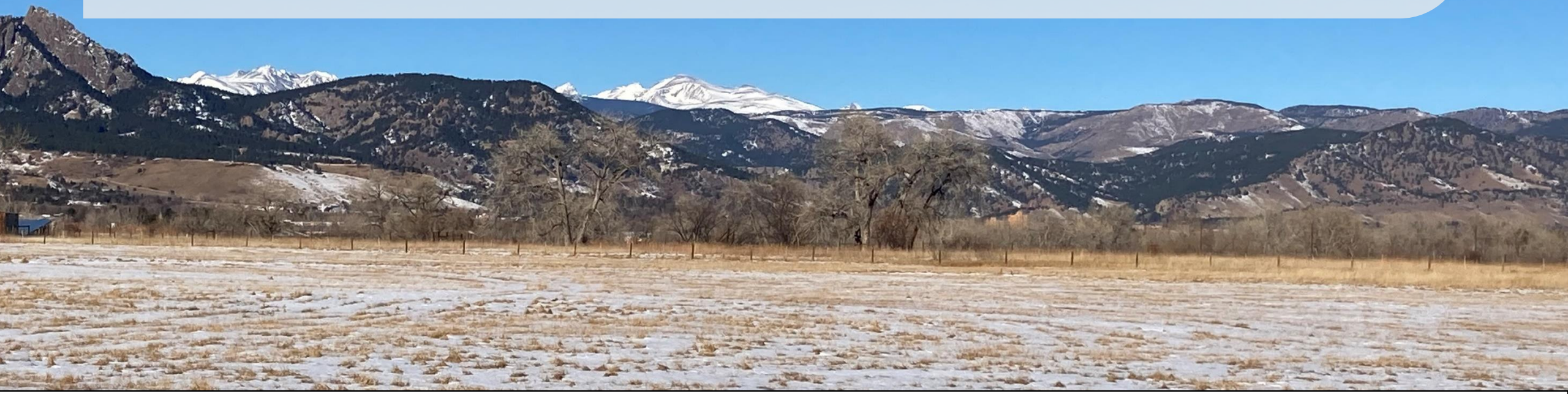
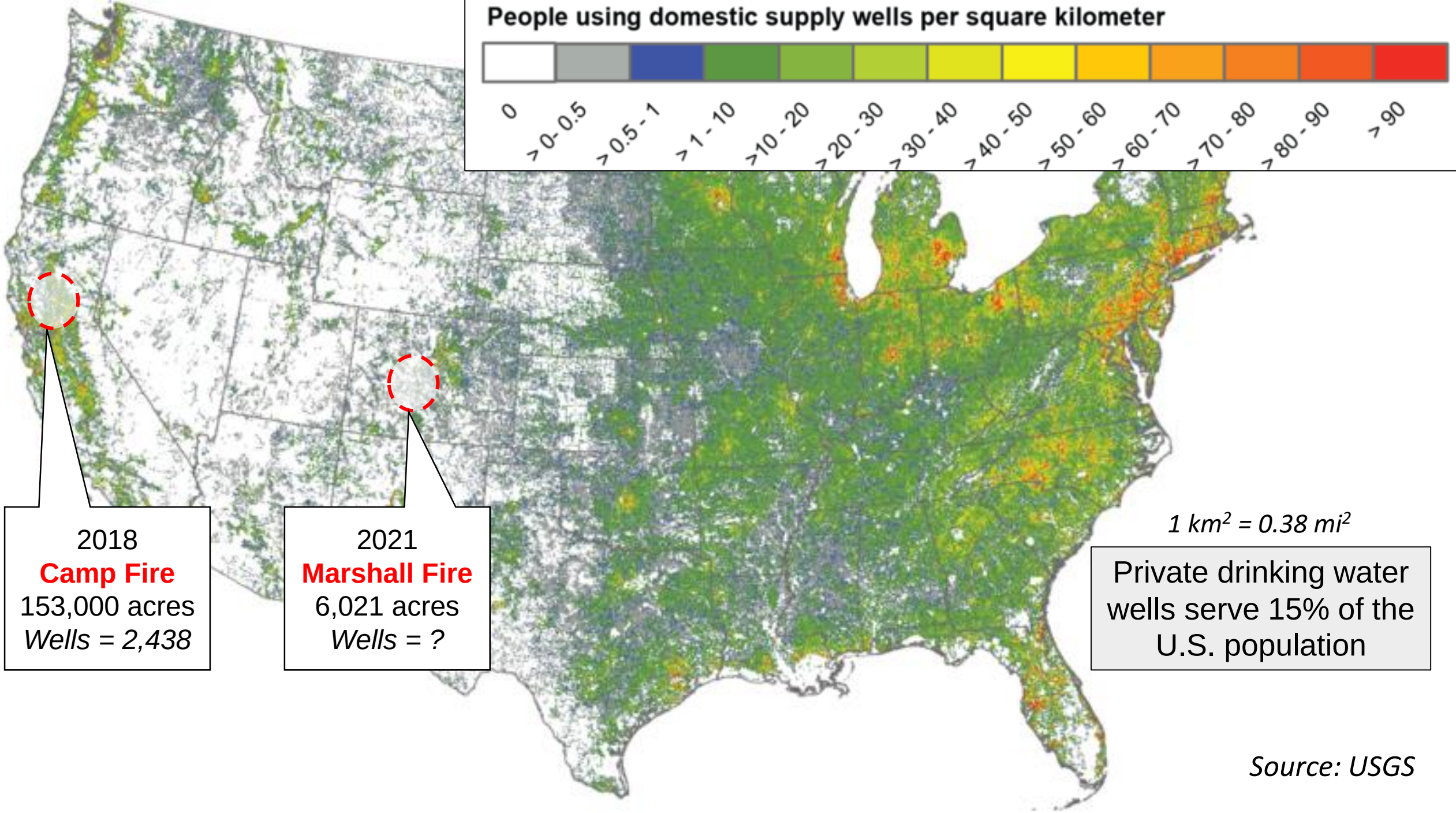
A PWS supplies >25 of the same people >6 months/year

A '*small*' PWS serves <10,000 people

Small systems serve 78% of the U.S. population




People using domestic supply wells per square kilometer
0
> 0 - 0.5
> 0.5 - 1
> 1 - 10
> 10 - 20
> 20 - 30
> 30 - 40
> 40 - 50
> 50 - 60
> 60 - 70
> 70 - 80
> 80 - 90
> 90
2018
Camp Fire
153,000 acres
Wells = 2,438
2021
Marshall Fire
6,021 acres
Wells = ?
1 km² = 0.38 mi²
Private drinking water wells serve 15% of the U.S. population
Source: USGS

Purpose

Support owners and users of small water systems and private drinking water wells in Boulder County after the Marshall Fire.

Goal

To better understand water infrastructure system damage and water contamination potential for small water systems and private well owners.

Objectives

(1) Document experiences of the small water systems and review system data

(2) Inspect private wells and conduct water testing to determine if *gross* volatile organic compound (VOC), semi-volatile organic compound (SVOC), or heavy metal contamination was present

(3) Identify scientific and policy-gaps that inhibit better public health protection

Audience

Small water system and well owners and government sectors for improving their decision-making processes during incident response and recovery

Name (population)	D/D Properties	Power Loss?	Chemical Contamination?	Mains, miles	Hydrants	Finished Water Storage, MG	Raw Water
EBCWD (300)	72 of 137	Yes	Yes	8	40	0.1	Lafayette
S.S. Mobile Home Park (150)	3, wind	Yes	No	<1	0	None	1 Well

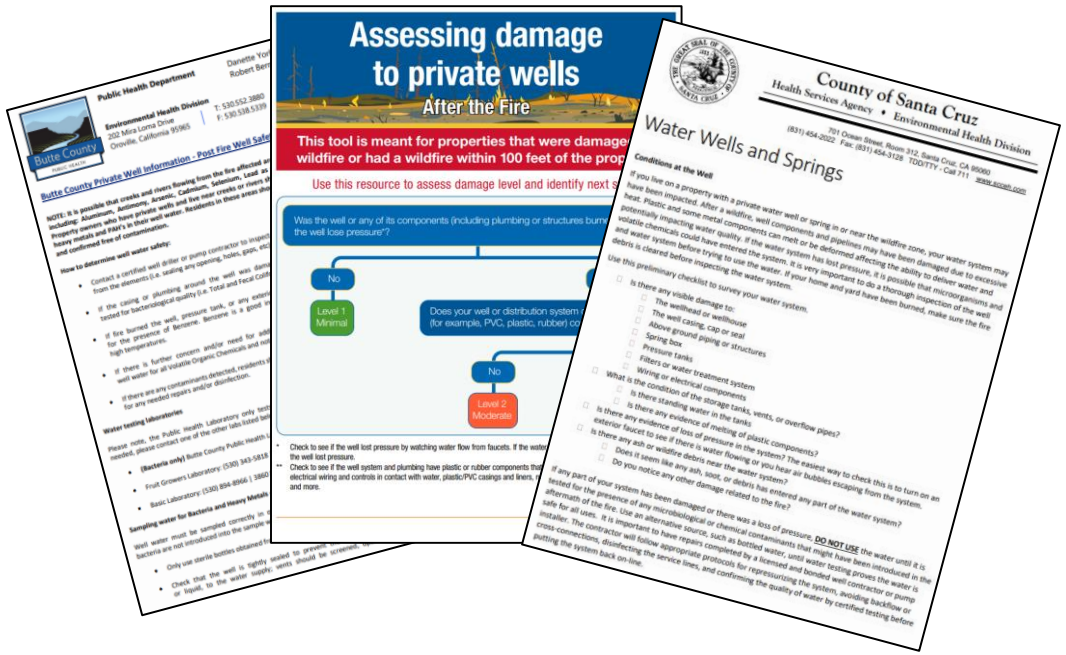
PWS until early 2000s

Post-fire:

- Inoperable since Dec 30
- FEMA denied funding

8 homes, not an HOA
1 well, 1 chlorinator, flow, pressure monitoring
2 concrete cisterns
780 ft HDPE (3”) water main
No hydrants
No water meters, no curb stops
1” HDPE service lines
160 ft max length

Private drinking water wells and the buildings they supply can be damaged by fire



BCHD: Bacteria, Al, As, Cd, Pb, Sb, Se, PAH's

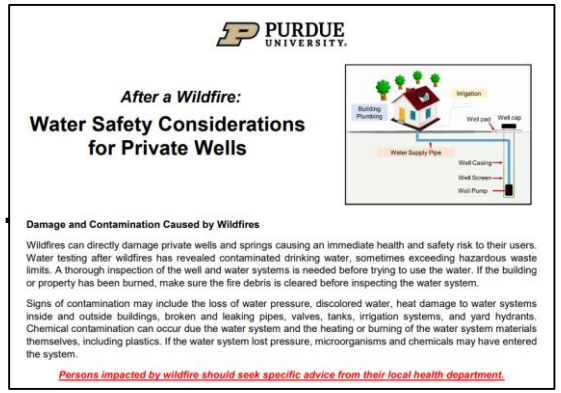
CDC: Bacteria, NO_3^-; BTEX; local contaminants

WaDOH: Coliform bacteria

SCCHD: Coliform bacteria, turbidity, pH, conductivity, color, NO_3^-; VOCs, SVOCs

OHA: Coliform bacteria, As, Pb, NO_3^-; BTEX

We Provided Support and Worked with the Boulder County Community and the Health Department



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After a Wildfire:

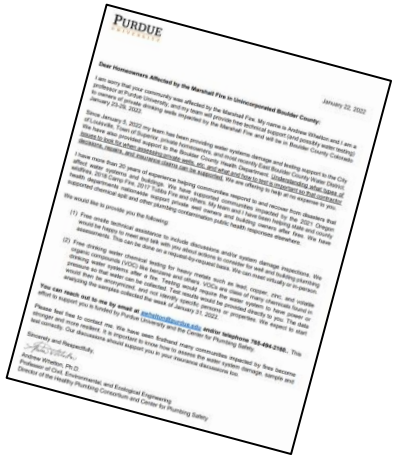
Water Safety Considerations for Private Wells

Damage and Contamination Caused by Wildfires

Wildfires can directly damage private wells and springs causing an immediate health and safety risk to their users. Water testing after wildfires has revealed contaminated drinking water, sometimes exceeding hazardous waste limits. A thorough inspection of the well and water systems is needed before trying to use the water. If the building or property has been burned, make sure the fire debris is cleared before inspecting the water system.

Signs of contamination may include the loss of water pressure, discolored water, heat damage to water systems inside and outside buildings, broken and leaking pipes, valves, tanks, irrigation systems, and yard hydrants. Chemical contamination can occur due the water system and the heating or burning of the water system materials themselves, including plastics. If the water system lost pressure, microorganisms and chemicals may have entered the system.

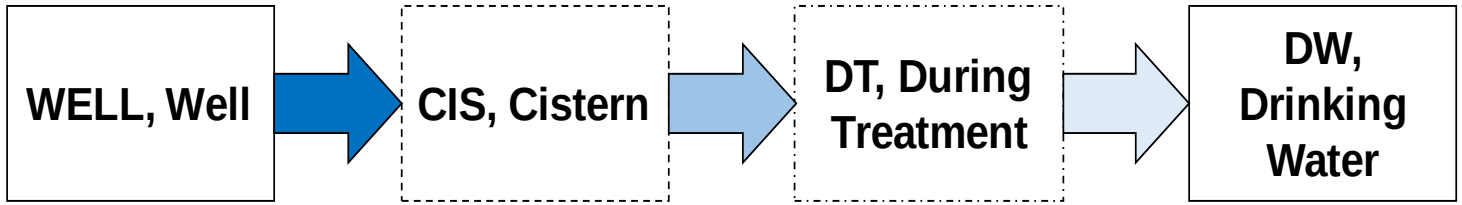
Persons impacted by wildfire should seek specific advice from their local health department.



January 26 to 31, 2022 visits: 17 property contacts

Limitations discovered while onsite: Lack of power, sampling faucet, access, component condition

Complexity of in-home treatment was wide ranging




mL 0
±5%
300 mL
±5%
400 mL
PYREX®
Made in Germany
50
250
100
200
150
50
200
100
No. 1000
250

Other wells had structures that were destroyed, debris was blown into them for more than 12 hr

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SVOCs

Contaminant	W7 (surface)	W7 (3-4 ft)	W13	W5
Azobenzene	-	-	-	0.3
2-Nitrophenol	0.15	0.11	-	-
1,2,3-Trichlorobenzene	0.14	0.16	-	-
Naphthalene	0.15	0.19	-	-
2-Methylnaphthalene	0.10	0.08	-	-
1-Methylnaphthalene	0.16	0.18	-	-
2-Nitroaniline	-	0.10	-	-
Acenaphthylene	0.19	0.23	-	-
1,2-Dinitrobenzene	0.14	0.11	-	-
Fluorene	0.10	0.13	-	-
4-Nitroaniline	0.10	-	-	-
Phenanthrene	0.14	0.25	-	-
Di-*n*-butylphthalate	5.9	0.48	-	-
Fluoranthene	0.13	1.0	0.19	-
Pyrene	0.14	0.19	-	-
Bis(2-ethylhexyl)adipate	9.3	4.9	-	-
Chrysene	0.12	0.12	-	-
Bis(2-ethylhexyl)phthalate	3.6	3.0	-	-
Anthracene	-	-	0.11	-

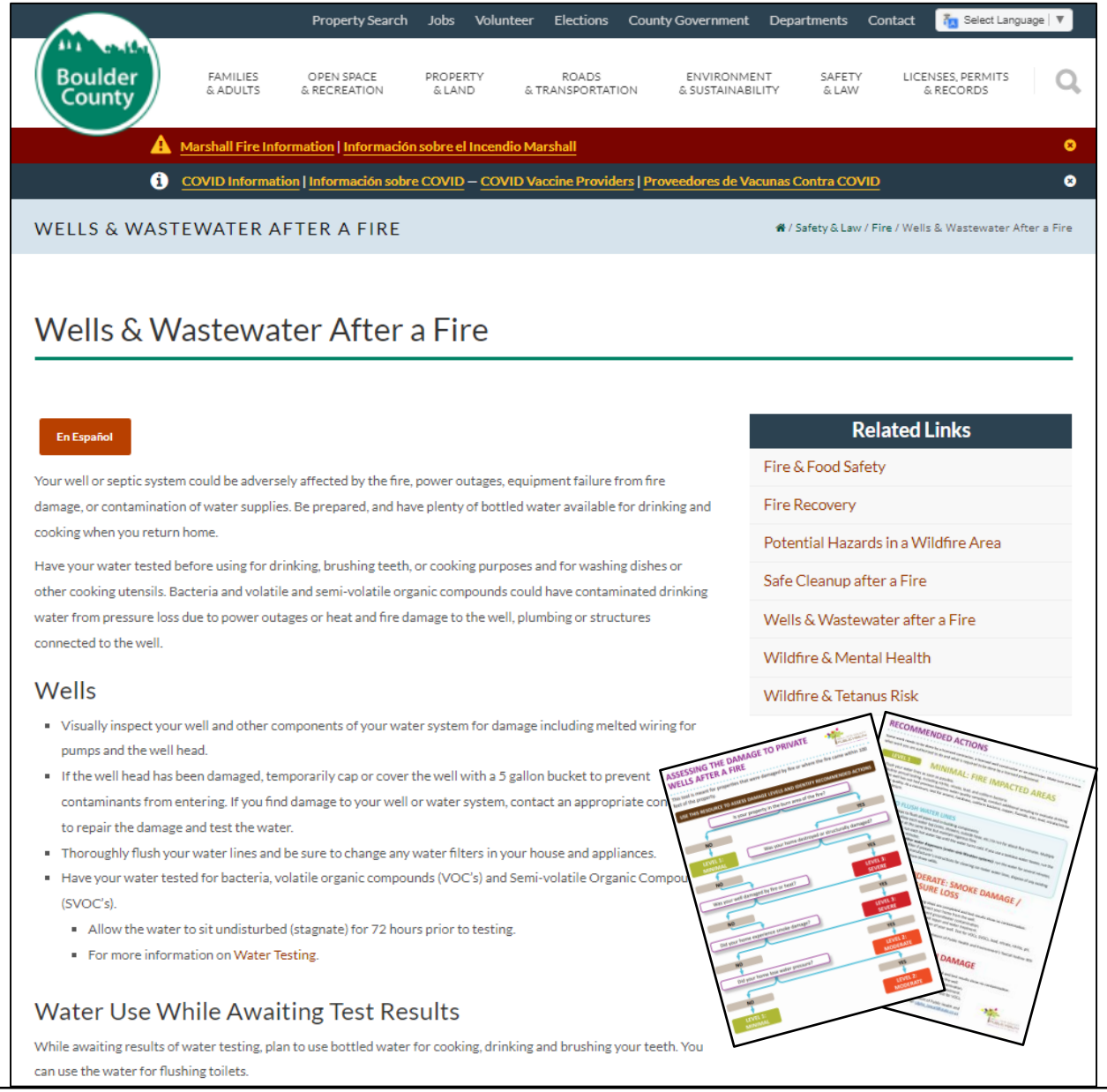
Inorganics

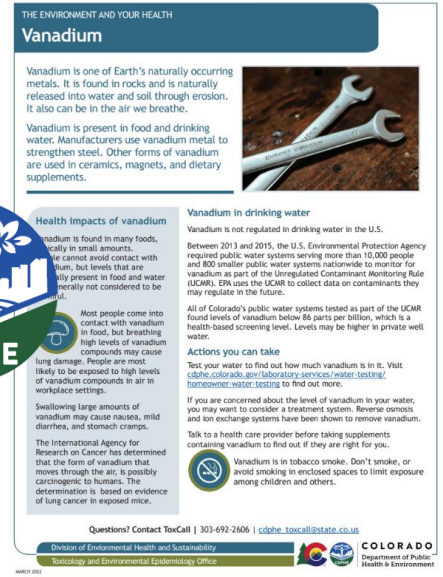
Data Description	Min	Max	Mean ± Stdev
Wells & Cisterns – Marshall Fire (14)	12.4	105	42 ± 26
Faucet – Marshall Fire (8)	4.2	89.3	34.8 ± 25.1
PWS UCMR3 – Colorado (108)	0.9	1,700	20.3 ± 54.1
PWS UCMR3 – Marshall Fire area (108)	1.6	131	25.8 ± 23.7

USEPA Li Screening Level: 10 ppb

Data Description	Min	Max	Mean ± Stdev
Wells & Cisterns – Marshall Fire (14)	9.3	243	69.4 ± 73
Faucet – Marshall Fire (8)	15.5	86.5	59.3 ± 30.4
PWS UCMR5 – ongoing	tbd	tbd	tbd

USEPA V Screening Level: 86 ppb





CDPHE

1. Assessing well damage
2. Permit requirements for well repair
3. Water testing
4. CDPHE Factsheets: Lithium and vanadium
5. Testing laboratories for VOCs, SVOC, and heavy metals
6. Home water filtration systems
7. Resources for well owners
8. Resources for onsite wastewater treatment system owners

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1958	Subdivision founded
1960	Well drilled and 3 houses constructed
1960s/1970s	6 lots more developed, cistern and water mains installed
1970s	Classified as a regulated PWS
1974	House fire destroyed all records
Early 2000s	Homeowner disconnected water system (drops below legal PWS definition)
2009	Realized not legally in possession of water rights assumed since 1960. Through law, property owners transferred water rights to the system

<u>3.5 Months Post-wildfire</u>

FEMA says they do not qualify for support

CDHPE says their well is inactive and they were an HOA

Depressurized since December 30, 2022

Unclear if there's mechanical damage or chemical contamination

Waiting for debris removal before fixing the water system