

**FOR PUBLICATION**

**UNITED STATES COURT OF APPEALS  
FOR THE NINTH CIRCUIT**

CALIFORNIA RIVER WATCH,  
*Plaintiff-Appellant,*

v.

CITY OF VACAVILLE,  
*Defendant-Appellee.*

No. 20-16605

D.C. No.  
2:17-cv-00524-  
KJM-KJN

OPINION

Appeal from the United States District Court  
for the Eastern District of California  
Kimberly J. Mueller, Chief District Judge, Presiding

Argued and Submitted June 14, 2021  
San Francisco, California

Filed September 29, 2021

Before: A. Wallace Tashima and Patrick J. Bumatay,  
Circuit Judges, and Douglas L. Rayes,\* District Judge.

Opinion by Judge Bumatay;  
Dissent by Judge Tashima

---

\* The Honorable Douglas L. Rayes, United States District Judge for the District of Arizona, sitting by designation.

---

**2 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE**

---

**SUMMARY\*\***

---

**Environmental Law**

The panel vacated the district court's summary judgment in favor of the City of Vacaville and remanded for further proceedings in a citizen suit brought by California River Watch under the Resource Conservation and Recovery Act.

River Watch claimed that the City's water wells were contaminated by a carcinogen called hexavalent chromium, which in turn was transported to the City's residents through its water distribution system. River Watch alleged that the City thus was contributing to the transportation of a solid waste in violation of RCRA. The district court concluded that the hexavalent chromium was not a "solid waste" under RCRA because River Watch did not show that it was a "discarded material."

The panel concluded that River Watch sufficiently raised before the district court, and therefore did not forfeit, the argument that the hexavalent chromium was "discarded material" that allegedly had migrated through groundwater from the "Wickes site," where it had been dumped by operators of wood treatment facilities.

The panel held that River Watch created a triable issue on whether the hexavalent chromium was "discarded material" by presenting evidence that when the hexavalent chromium was discharged into the environment after the

---

\*\* This summary constitutes no part of the opinion of the court. It has been prepared by court staff for the convenience of the reader.

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 3

---

wood treatment process, it was not serving its intended use as a preservative, and it was not the result of natural wear and tear. Instead, the hexavalent chromium was leftover waste, abandoned and cast aside by the facilities' operators.

The panel concluded that there also was a triable issue whether the City was a "past or present transporter" of solid waste. The panel held that RCRA does not require that the "transporter" of the solid waste must also play some role in "discarding" the waste.

Dissenting, Judge Tashima wrote that under *Hinds Investments, L.P. v. Angioli*, 654 F.3d 846 (9th Cir. 2011), the City was not liable because it had no involvement in the waste disposal process, and did not do anything to cause the contamination of its water. Judge Tashima wrote that he also would affirm based on waiver because River Watch raised an entirely new theory on appeal.

---

**COUNSEL**

Jack Silver (argued), Law Office of Jack Silver, Sebastpolo, California; David J. Weinsoff, Law Office of David J. Weinsoff, Fairfax, California; for Plaintiff-Appellant.

Gregory J. Newmark (argued) and Shiraz D. Tangri, Meyers Nave Riback Silver & Wilson, Los Angeles, California, for Defendant-Appellee.

4 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

**OPINION**

BUMATAY, Circuit Judge:

The Resource Conservation and Recovery Act seeks to minimize the dangers accompanying hazardous waste disposal. 42 U.S.C. § 6902(b). To that end, the Act enables any person to sue any entity that is contributing to the transportation of dangerous solid waste. *Id.* § 6972(a). In this case, a nonprofit organization called California River Watch claims that the City of Vacaville, California is violating the Act. River Watch claims that the City's water wells are contaminated by a carcinogen called hexavalent chromium. That carcinogen, River Watch says, is in turn transported to the City's residents through its water-distribution system. We must decide whether the hexavalent chromium is solid waste under the Act.

**I.**

Hexavalent chromium is a human carcinogen. When inhaled, consumed orally, or exposed to the skin, it is known to cause significant health risks, including cancer.

From about 1972 to 1982, companies like Pacific Wood Preserving and Wickes Forest Industries, Inc., operated wood treatment facilities in Elmira, California. It was common for waste products from these companies to contain hexavalent chromium. In particular, Wickes is known to

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 5

---

have dumped a massive amount of hexavalent chromium in the ground near Elmira, California (“the Wickes site”).<sup>1</sup>

As a result, the Wickes site was identified and listed as a federal hazardous waste site in 1980. Several years later, the site was found to have contaminated three drinking-water wells nearby, including one at Elmira Elementary School. Samples of groundwater taken from the site at the time revealed hexavalent chromium levels thousands of times greater than California’s stated public health goals.

River Watch contends that this hexavalent chromium has since migrated through groundwater from the Wickes site to the Elmira Well Field, where the City draws much of its water. In fact, eight of the City’s eleven wells are in the field. According to River Watch’s expert, testing of potable water from the City’s well-heads and resident taps reveals elevated concentrations of hexavalent chromium. River Watch’s expert believes that hexavalent chromium moves from the Wickes site to the Elmira Well Field and ultimately into the homes of residents through the City’s water-distribution system. Thus, River Watch charges that the City is “transporting and discharging water containing high amounts of hexavalent chromium” in a manner dangerous to residents.

River Watch sued the City under the Resource Conservation and Recovery Act (“RCRA”), alleging that the City is “contributing to” the “transportation” of hexavalent chromium, a “solid . . . waste which may present an imminent and substantial endangerment to health or the

---

<sup>1</sup> We take these background facts from River Watch’s expert witness report, which the district court assumed to be true for purposes of the summary judgment motion.

---

6 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

environment.” 42 U.S.C. § 6972(a)(1)(B). Because one definition of “solid waste” is “discarded material,” the central dispute here is whether the hexavalent chromium was discarded. *Id.* § 6903(27). To rebut River Watch’s claim, the City offered evidence that the hexavalent chromium is naturally occurring and thus not a “discarded material.”

The parties then cross-moved for summary judgment. The district court granted the City’s motion and denied River Watch’s motion because, as it explained, River Watch hadn’t demonstrated how the City’s water-processing activities could qualify as discarding “solid waste” under RCRA. Thus, the district court explained, RCRA’s “fundamental requirement that the contaminant be ‘discarded’” was not satisfied. River Watch appealed.

We review orders granting summary judgment *de novo*. *Jones v. Royal Admin. Servs., Inc.*, 887 F.3d 443, 447 (9th Cir. 2018). We review the evidence as a whole and in the light most favorable to River Watch as the party opposing summary judgment. *Id.* at 448.

## II.

River Watch’s argument on appeal is simple: because the hexavalent chromium originates from the Wickes site, it is “discarded material” under RCRA, and thus the City is liable for its transportation through its water-distribution system. Before turning to the merits, we consider whether River Watch has forfeited this argument.

### A.

According to the City, River Watch has forfeited its argument that the hexavalent chromium is “discarded material” from the Wickes site because it did not raise that

theory in the district court. We agree that River Watch told the district court multiple times that the precise genesis of the hexavalent chromium was “irrelevant.” And we agree that, if River Watch never presented the theory that the hexavalent chromium originated from the Wickes site before the district court, it could not now claim that the substance was “discarded material” under its interpretation of RCRA. *See Baccei v. United States*, 632 F.3d 1140, 1149 (9th Cir. 2011) (holding that we do not generally consider arguments raised for the first time on appeal).

But that’s not the full story. Throughout its summary judgment papers, River Watch consistently maintained that the origin of the hexavalent chromium in the City’s water was “anthropogenic,” i.e., caused by humans. To be sure, River Watch did suggest that the hexavalent chromium could have come from multiple industrial or agricultural sources. But it also specifically highlighted the Wickes site as one of those sources. In fact, River Watch expressly contended that the Wickes facility was “likely” the source of the hexavalent chromium in the City’s wells. Mimicking its argument on appeal, River Watch argued that “if *any* of the hexavalent chromium in Vacaville’s wells is from an industrial source, th[e]n that hexavalent chromium is a solid waste.” In the next breath, River Watch suggested that the Wickes site was the source of the hexavalent chromium—especially by showing a decline in hexavalent chromium levels at the Elmira Well Field after the Wickes facility closed down.

So, before the district court, River Watch claimed that the hexavalent chromium was anthropogenic but that the substance’s exact origin was irrelevant. On appeal, River Watch now focuses on the Wickes site as the source of the chemical. That’s ok, because it has always maintained that Wickes was the likely cause of the hexavalent chromium in

---

8 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

the City’s water. Appealing only one of several alternative theories argued to the district court is hardly an uncommon practice and is not a basis to find forfeiture. *Cf. Hansen v. Morgan*, 582 F.2d 1214, 1217 (9th Cir. 1978) (relying on an alternative theory on appeal when the “essence” of the argument was “directed at the same concerns” as the theory argued below). River Watch has therefore not forfeited this argument. We proceed to the merits.

**B.**

RCRA creates a private cause of action for citizens to seek relief against present or future risks of “imminent harms” to health or the environment. *Ecological Rts. Found. v. Pac. Gas & Elec. Co.*, 874 F.3d 1083, 1089 (9th Cir. 2017) (simplified). Under what we’ve called RCRA’s “endangerment provision,” *id.*, “any person” may file suit against:

[A]ny person, including the United States and any other governmental instrumentality or agency, . . . and including any past or present generator, past or present transporter, or past or present owner or operator of a treatment, storage, or disposal facility, who has contributed or who is contributing to the past or present handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment[.]

42 U.S.C. § 6972(a)(1)(B). We’ve described these citizen suits as “expansive.” *Ecological Rts. Found.*, 874 F.3d at 1089.



From this text, we’ve gleaned three elements to establish RCRA liability: (1) that the defendant “ha[s] contributed to the past or [is] contributing to the present handling, treatment, transportation, or disposal” of certain material; (2) that this material constitutes “solid waste” under RCRA; and (3) that the solid waste “may present an imminent and substantial endangerment to health or the environment.” *Ctr. for Cmty. Action & Env’t Just. v. BNSF R. Co.*, 764 F.3d 1019, 1023 (9th Cir. 2014).

# 1.

We first consider whether River Watch has a cognizable legal theory that the hexavalent chromium in Vacaville’s water is “solid waste.” RCRA defines “solid waste” as:

[A]ny garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations[.]

42 U.S.C. § 6903(27). River Watch asserts that the hexavalent chromium is “solid waste” under the “discarded material . . . resulting from industrial, commercial, and agricultural operations” definition. *Id.*

We have discussed the meaning of “discarded material” before. We said “discard” means to “cast aside; reject; abandon; give up.” *Ecological Rts. Found. v. Pac. Gas & Elec. Co.*, 713 F.3d 502, 515 (9th Cir. 2013) (simplified) (“*Ecological Rts. Found. I*”). And therefore, we explained, whether a product has “served its intended purpose and is no longer wanted by the consumer” is a “key” consideration in

---

10 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

determining whether a substance constitutes solid waste. *Id.* (simplified); *see also No Spray Coal., Inc. v. City of New York*, 252 F.3d 148, 150 (2d Cir. 2001) (“[M]aterial is not discarded until after it has served its intended purpose.”).

In *Ecological Rights Foundation I*, an environmental organization complained of the discharge of a wood preservative used to treat utility poles. 713 F.3d at 515. The organization alleged that the preservative contained a biocide that leaked from the poles into the environment. *Id.* We held that the preservative was not “discarded material” because it was “being put to its intended use as a general biocide” on utility poles and only escaped into the environment through normal wear and tear. *Id.* at 515–16. Thus, the preservative was neither “manufacturing waste by-product” nor material that the consumer “no longer want[ed] and ha[d] disposed of or thrown away.” *Id.* at 515. Instead, the wood preservative had been “washed or blown away . . . by natural means, as an expected consequence of the preservative’s intended use, [and thus] ha[d] not been ‘discarded.’” *Id.* at 516.

This case presents the converse. Through its expert, River Watch established that hexavalent chromium was widely used in commercial wood preservation near the Elmira Well Field. And it was common practice at facilities like the Wickes site to drip dry wood treated with hexavalent chromium—allowing it to trickle directly into the soil. The expert also claimed that Wickes dumped a “massive amount” of hexavalent-chromium waste into the ground at the location.

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 11

---

If River Watch's expert is credited,<sup>2</sup> the hexavalent chromium meets RCRA's definition of "solid waste." When the hexavalent chromium was discharged into the environment after the wood treatment process, it was not serving its intended use as a preservative, and it was not the result of natural wear and tear. Instead, the hexavalent chromium was leftover waste, abandoned and cast aside by the facilities' operators. This means that under RCRA's plain meaning, River Watch created a triable issue on whether the hexavalent chromium is "discarded material."<sup>3</sup>

2.

The next question is whether the City is "contributing to the past or present . . . transportation" of the hexavalent chromium. 42 U.S.C. § 6972(a)(1)(B). We've already defined "contribution" to mean (1) to "lend assistance or aid to a common purpose," (2) to "have a share in any act or effect," or (3) "to be an important factor in; help to cause." *Hinds Invs., L.P. v. Angioli*, 654 F.3d 846, 850 (9th Cir. 2011) (citing dictionary definitions). And "transportation"

---

<sup>2</sup> We understand that the district court excluded the expert's testimony to the extent that the expert offered "vague or conclusory opinions." We leave it to the district court to determine in the first instance if it excluded testimony necessary to establish the City's RCRA liability.

<sup>3</sup> As the parties did, we assume that hexavalent chromium satisfies the "imminent or substantial danger to the environment or health" element of RCRA liability.

---

12 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

means the “action or process of transporting; conveyance (of things or persons) from one place to another.”<sup>4</sup>

Again, in the light most favorable to River Watch, a triable issue exists as to whether the City is a “past or present transporter” of solid waste. 42 U.S.C. § 6972(a)(1)(B). River Watch’s expert demonstrated that water originating from the Elmira Well Field and pumped through the City’s water-distribution system contains hexavalent chromium. The expert also opined that this hexavalent chromium is likely from the Wickes site. Taken as true, these facts establish that the City is transporting solid waste through its water-distribution system.

Contrary to the district court’s order, nothing in RCRA’s text suggests that the “transporter” of the solid waste must also play some role in “discarding” the waste. While the City may be distributing groundwater contaminated by others, RCRA’s endangerment provision broadly applies to any “person,” including a “governmental instrumentality,” like the City, that “contribute[s]” to the “transportation” of “any” waste. *Id.* So, a “transporter” of waste need not also be the cause of the waste’s existence. *Id.* Indeed, the endangerment provision expressly lists “generator[s]” and waste disposal “operator[s]” and “owner[s]” as separate RCRA offenders. *See* 42 U.S.C. § 6972(a)(1)(B). Congress thus made “transporter[s]” independently liable even if not otherwise responsible for discarding or creating the waste in the first place. This conclusion is buttressed by the fact that the endangerment provision includes no mens rea

---

<sup>4</sup> *Transportation*, Oxford English Dictionary Online, <https://www.oed.com/view/Entry/205022?redirectedFrom=transportation#eid>.

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 13

---

requirement.<sup>5</sup> Thus, that the City may be innocent of the activity at the Wickes site does not preclude it from RCRA liability as a transporter. *See id.*<sup>6</sup>

The City also tries to distinguish between the transportation of solid waste and the transportation of

---

<sup>5</sup> The dissent suggests that RCRA doesn't apply to "innocent parties." Dissent at 23–24 (simplified). But when Congress wanted a RCRA provision to contain a mens rea requirement, it said as much. For example, § 6928 makes it a crime to "knowingly transport[] or cause[] to be transported any hazardous waste identified or listed under this subchapter to a facility which does not have a permit[.]" 42 U.S.C. § 6928(d)(1); *see also id.* § 6928(d)(5) (making it illegal to "knowingly transport[]" or "cause[] to be transported" hazardous waste without a manifest where one is required by the regulations). The endangerment provision contains no such element. Even if such an element would be commonsensical, we cannot rewrite RCRA.

<sup>6</sup> The dissent also relies on *Hinds* for the proposition that RCRA liability is limited to only "those involved in the waste disposal process." Dissent at 7[B]. But neither *Hinds* nor the text of RCRA supports such a reading. *Hinds* addressed the meaning of "contribution" in the specific context of "generator" liability. There, the plaintiffs argued that manufacturers of dry cleaners were liable under RCRA for aiding in the generation of waste by others through the design and improper use of their machines. *Hinds*, 654 F.3d at 848. We held that such a theory of liability was too attenuated because "'contributing to' the disposal of hazardous waste [requires] a measure of control over the waste at the time of its disposal or . . . active[] involve[ment] in the waste disposal process." *Id.* at 852. Designing machinery that might generate waste by others, we said, didn't fit the bill. *Id.* *Hinds* thus didn't purport to grant blanket RCRA immunity for anyone outside of the "waste disposal process," as the dissent contends. Nor did it address the meaning of "contribution" in the context of "transporter" liability. In fact, *Hinds* simply noted that RCRA liability can be established by having a "more active role with a more direct connection to the waste, *such as . . . transporting it[.]*" *Id.* at 851 (emphasis added). Such is the case here and, thus, *Hinds* doesn't require us to depart from RCRA's plain meaning.

14 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

groundwater contaminated by solid waste. In the City's view, RCRA applies to the former but not to the latter. But once again, nothing in the text of the statute creates a "groundwater" exception to RCRA. The endangerment provision applies to "transportation" of "*any* solid [waste]." 42 U.S.C. § 6972(a)(1)(B) (emphasis added). We take "any" to mean "any." It doesn't mean "any solid waste unless it's in groundwater." In fact, RCRA specifically contemplates liability for waste dispersed into groundwater. *See* 42 U.S.C. § 6903(3) (defining "disposal" to include the dumping of solid waste into any land so that such solid waste is "discharged into any waters, including ground waters").

### 3.

The City also invokes the "absurdity doctrine" to counter our straightforward reading of RCRA's text. It provides an example: if solid waste were dispersed into the air and landed on a private citizen's car, that motorist would then be subject to suit under our reading of RCRA. Similarly, the dissent hypothesizes that our reading of RCRA might impose liability on a homeowner who hands a glass of tap water to a friend or waters plants with a garden hose. Dissent at 22. These arguments fail.

We have explained before that the "absurdity doctrine will override the literal terms of a statute only under rare and exceptional circumstances." *United States v. Lucero*, 989 F.3d 1088, 1098 (9th Cir. 2021) (simplified). According to Justice Story, courts may only depart from the "plain meaning of a provision" when "the absurdity and injustice of applying the provision to the case would be so monstrous, that all mankind would, without hesitation, unite in rejecting the application." 1 Joseph Story, *Commentaries on the Constitution of the United States* § 427, at 303 (2d ed. 1851); *see also* Antonin Scalia & Bryan A. Garner, *Reading Law*:

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 15

---

*The Interpretation of Legal Texts* 237 (2012) (“The absurdity must consist of a disposition that no reasonable person could intend. Something that may seem odd is not absurd.” (simplified)). Otherwise, we risk “rewriting the statute rather than correcting a technical mistake.” *Lucero*, 989 F.3d at 1098 (simplified).

Here, we cannot say that interpreting RCRA based on its plain meaning would lead to absurd results. First, Article III standing places an important limitation on RCRA: a party must be injured by the purported violation. Second, merely transporting solid waste does not create RCRA liability; only the transportation of solid waste that may create an imminent and substantial danger does. *See* 42 U.S.C. § 6972(a)(1)(B). It is difficult to imagine who would be substantially endangered by the de minimis amount of solid waste on a traveling car, in a cup of water, or on a watered plant. We therefore doubt that the scenarios envisioned by the City and the dissent would be cognizable under our reading of RCRA. Moreover, the dissent’s hypotheticals prove too much—suggesting that agricultural businesses and municipal water authorities would be immune from RCRA liability for transporting contaminated, even toxic, water as long as they did not participate in its contamination. Dissent at 22–22. Nothing in the text of RCRA supports such a constrained reading. Indeed, such a reading eliminates “transporter” liability altogether. Even if narrowing RCRA liability as envisioned by the City and dissent “makes eminent sense,” *id.* at 21–22, that is a determination for Congress, not the courts.

### III.

Because the district court’s reading of RCRA is at odds with the statute’s plain text, we vacate the grant of summary

---

16 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

judgment and remand for further proceedings consistent with this decision.<sup>7</sup>

**VACATED AND REMANDED.**

---

TASHIMA, Circuit Judge, dissenting:

Defendant City of Vacaville (the “City”) draws groundwater from wells and distributes it to City residents. Although the City’s water complies with federal and state drinking water standards, the water contains hexavalent chromium, which Plaintiff California River Watch (“River Watch”) contends is a danger to human health. River Watch does not assert that the City did anything to cause the contamination. On the contrary, River Watch concedes that the City is the victim here: the alleged source of the hexavalent chromium is a former wood treatment plant located a mile or more from the City’s wells. Nevertheless, River Watch contends that, by drawing water from its wells, the City is “contributing to the . . . handling, storage, treatment, transportation, or disposal of . . . solid . . . waste,” in violation of the Resource Conservation and Recovery Act of 1976 (“RCRA”), 42 U.S.C. § 6972(a)(1)(B).

I reject River Watch’s argument. In *Hinds Investments, L.P. v. Angioli*, 654 F.3d 846, 851 (9th Cir. 2011), we held that § 6972(a)(1)(B) “requires that a defendant be actively involved in or have some degree of control over the waste disposal process to be liable under RCRA.” Here, it is

---

<sup>7</sup> We decline to reach the City’s contention that RCRA’s anti-duplication provision bars River Watch’s suit. The City is free to re-argue this issue before the district court.



---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 17

---

conceded that the City had no involvement whatsoever in the waste disposal process. Accordingly, under *Hinds*, the City is not liable under RCRA. Because the majority holds otherwise, I respectfully dissent.

**I.**

The City supplies water to residential and commercial customers. This water comes from two sources: surface waters and wells. The City operates a total of eleven wells, including eight lying within the Elmira Well Field. The City draws water from these wells, processes it, and delivers it to its water customers.

The City's water complies with all federal and state drinking water standards, including Safe Drinking Water Act standards promulgated by the U.S. Environmental Protection Agency ("EPA"). EPA's maximum contaminant level for total chromium in drinking water is 0.1 milligrams per liter or 100 parts per billion. California's maximum contaminant level for total chromium is 0.05 milligrams per liter or 50 parts per billion. The City complies with both standards. The federal and California drinking water standards contain no separate standard for hexavalent chromium.

River Watch contends that the source of the hexavalent chromium in the City's drinking water is the Wickes site, a former wood treatment facility that, from 1972 to 1982, conducted lumber treatment operations using wood preservatives that contained arsenic, chromium, and copper. The Wickes site is located between 1.4 and 3.3 miles from the Elmira Well Field. River Watch asserts that hexavalent chromium from the Wickes site migrated via groundwater to the Elmira Well Field, where it contaminated the City's wells. The City disputes River Watch's contention that the

---

18 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

Wickes site is the source of the hexavalent chromium found in the City's wells, but on summary judgment we view the evidence in the light most favorable to the nonmoving party. *Nolan v. Heald Coll.*, 551 F.3d 1148, 1154 (9th Cir. 2009).

Although the City's water complies with federal and state drinking water standards, River Watch believes those standards are too lenient and that the City's water poses a danger to human health. River Watch, however, has not challenged the EPA's standards through the normal course. The Safe Drinking Water Act requires EPA to "review and revise, as appropriate, each national primary drinking water regulation" at least once every six years, 42 U.S.C. § 300g-1(b)(9), and, if EPA fails to discharge this duty, "any person may commence a civil action . . . against the [EPA] Administrator," *id.* § 300j-8(a)(2). Rather than pursuing relief under the Safe Drinking Water Act, River Watch commenced this action against the City under RCRA, a statute focused not on drinking water standards, but on "the treatment, storage, and disposal of solid and hazardous waste." *Meghrig v. KFC W., Inc.*, 516 U.S. 479, 483 (1996).<sup>1</sup> The district court granted summary judgment to the City, and River Watch appealed. The majority holds that the district court erred. For the reasons set forth below, I disagree.

---

<sup>1</sup> Because the majority does not address the City's contention that River Watch is precluded from seeking relief under RCRA because the City's drinking water is regulated under the Safe Drinking Water Act, *see* 42 U.S.C. § 6905(a) (precluding RCRA's application with respect to "any activity or substance which is subject to" four other federal statutes, including the Safe Drinking Water Act, but only to the extent that such application would be "inconsistent with" the requirements of those statutes); *see* Maj. Op. 16 n.7, I also refrain from addressing it.

## II.

RCRA authorizes a civil action against any person “who has contributed . . . to the . . . handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment.” 42 U.S.C. § 6972(a)(1)(B).<sup>2</sup> To establish a violation under this provision, a plaintiff must prove three elements:

(1) the defendant has been or is a generator or transporter of solid or hazardous waste, or is or has been an operator of a solid or hazardous waste treatment, storage or disposal facility; (2) the defendant has “contributed” or “is contributing to” the handling, storage, treatment, transportation, or disposal of solid or hazardous waste; and, (3) the solid or hazardous waste in question

---

<sup>2</sup> Under § 6972(a)(1)(B),

any person may commence a civil action on his own behalf . . . (B) against any person, including the United States and any other governmental instrumentality or agency, to the extent permitted by the eleventh amendment to the Constitution, and including any past or present generator, past or present transporter, or past or present owner or operator of a treatment, storage, or disposal facility, who has contributed or who is contributing to the past or present handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment.

42 U.S.C. § 6972(a)(1)(B).

---

20 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

may present an imminent and substantial endangerment to health or the environment.

*Ecological Rts. Found. v. Pac. Gas & Elec. Co.*, 713 F.3d 502, 514 (9th Cir. 2013).

In *Hinds*, we considered the second of these elements. The case involved groundwater contaminated by perchloroethylene (“PCE”), a hazardous substance used in dry cleaning. 654 F.3d at 849. The defendants were the manufacturers of dry cleaning equipment. *Id.* at 848. The plaintiffs argued that the defendants had contributed to the disposal of PCE, in violation of RCRA, “by the design of machines that generated waste and by the instructions they gave on use of these machines.” *Id.* The plaintiffs alleged, for instance, that the defendants’ design manuals “instructed users that they should dispose of contaminated waste water in drains or open sewers.” *Id.* at 849.

We examined the statutory text, but recognized that RCRA’s text “does not itself define what acts of contribution are sufficient to trigger liability.” *Id.* at 850. We looked to the dictionary definition of the word “contribute” but refused “to give wide breadth to this definition.” *Id.* We said:

We decline to give such an expansive reading to the term “contribute.” Instead, . . . we decide that the statutory language permitting suits against “any person . . . who has contributed or who is contributing” to the handling, storage, treatment, transportation or disposal of hazardous waste, § 6972(a)(1)(B), requires that a defendant be actively involved in or have some degree of control over the waste disposal process to be liable under RCRA.

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 21

---

*Id.* at 851 (second alteration in original). Applying this standard to the facts of the case, we held that the manufacturers were not liable under RCRA for contributing to the disposal of PCE:

We hold that to state a claim predicated on RCRA liability for “contributing to” the disposal of hazardous waste, a plaintiff must allege that the defendant had a measure of control over the waste at the time of its disposal or was otherwise actively involved in the waste disposal process. Mere design of equipment that generated waste, which was then improperly discarded by others, is not sufficient.

*Id.* at 852.

*Hinds* controls here. Like the plaintiffs in *Hinds*, River Watch has not shown that the City “had a measure of control over the waste at the time of its disposal or was otherwise actively involved in the waste disposal process.” *Id.* On the contrary, the City had nothing to do with the waste disposal process at issue here. That process involved a single step: the operators of the Wickes facility discarded hexavalent chromium on site. Subsequent events—the alleged migration of the contaminant to the Elmira Well Field, the contamination of the City’s wells, and the City’s drawing of groundwater from its wells—were not, under any conceivable theory, part of that process. Just as the defendants’ actions in *Hinds* preceded the waste disposal process, here the City’s actions postdated that process.

*Hinds*’ reading of the statutory text—limiting liability to those involved in the waste disposal process—makes eminent sense. Indeed, any other reading of RCRA would

---

22 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

produce nonsensical results. If the City is transporting solid waste, then so too is the Vacaville homeowner watering plants with a garden hose or handing a glass of tap water to a friend. And so too is a motorist who picks up a few grains of soil while driving on a dirt road near the Wickes site. Under River Watch's reading of the statute, as the City explains, "an entire aquifer contaminated by a solid waste site becomes one gigantic mass of solid waste." Although aquifers vary in shape and size, some are enormous. The Ogallala Aquifer, for example, is a vast, 174,000 square-mile groundwater reservoir that supplies almost one-third of America's agricultural groundwater and drinking water for more than 1.8 million people. <https://www.livescience.com/39625-aquifers.html> (last visited Aug. 31, 2021). If the City is transporting solid waste, then so too is every homeowner, farmer, rancher, municipal water authority, or agricultural irrigation district drawing groundwater or water from a contaminated aquifer.

The majority distinguishes *Hinds* on the ground that the plaintiffs in that case were seeking to hold the defendant manufacturers liable for contributing to the *disposal* of hazardous waste, whereas here River Watch is attempting to hold the City liable to contributing to the *transportation* of solid waste. Maj. Op. 13 n.6. *Hinds*, however, clearly applies to this case. This is apparent from the plain language of our decision in *Hinds*:

[W]e decide that the statutory language permitting suits against "any person . . . who has contributed or who is contributing" to the handling, storage, treatment, *transportation* or disposal of hazardous waste, § 6972(a)(1)(B), requires that a defendant be actively involved in or have some degree of

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 23

---

control over the waste disposal process to be liable under RCRA.

*Hinds*, 654 F.3d at 851 (emphasis added) (quoting 42 U.S.C. § 6972(a)(1)(B)). It is also apparent from our mode of analysis. Our holding was based on the meaning of the word “contribute,” which modifies both “disposal” and “transportation.” *Id.* at 850–51. Like *Hinds*, this case too is a “contribution” case. Finally, the principle underlying *Hinds*—that RCRA liability must have some sensible outer limit—applies at least as strongly to those accused of transporting waste as it does to those accused of disposing of it. *Hinds*, it bears emphasizing, is the law of this circuit. In addition, it is grounded in the statutory text, places sensible limits on RCRA liability, is readily administrable, and reaches the correct result in this case.

Nothing in RCRA’s legislative history or in the case law supports River Watch’s, and the majority’s, unduly broad interpretation of the statute. Looking to legislative history, there is no question that Congress, in adopting RCRA, was concerned about the problem of solid waste contaminating groundwater. *See* H.R. Rep. No. 94-1491, at 4, 18, 20, 73, 89 (1976), *reprinted in* 1976 U.S.C.C.A.N. 6238, 6242, 6255–56, 6258, 6312, 6325; H.R. Rep. No. 98-198, at 20, 31, 63 (1984), *reprinted in* 1984 U.S.C.C.A.N. 5576, 5578, 5589–90, 5622. But Congress was focused on entities that *caused* contamination of groundwater, not the victims of such contamination. *See id.* River Watch’s reliance on case law fares no better. As the City points out, the authorities River Watch cites “were cases against the defendant entities that allegedly disposed of solid waste in the first instance.” River Watch cites no case in which “innocent parties whose products or property were allegedly affected by the industrial defendants’ waste disposal,” and who had no involvement in

---

24 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

the waste disposal process, were subject to RCRA liability. And neither does the majority. Extending RCRA to this case is as unprecedented as it is unwarranted.

The majority suggests that its overly expansive reading of the statute is reasonable because we can rely on other legal principles—in particular, standing doctrine and the statute’s requirement that the defendant’s conduct “may present an imminent and substantial endangerment to health or the environment,” 42 U.S.C. § 6972(a)(1)(B)—to constrain RCRA liability. Maj. Op. 15. This empty assurance offers no solace to the City, or to the countless other victims who will be adversely affected by the majority’s decision, like all those who draw water from contaminated aquifers, or a Vacaville restaurant serving tap water to its customers. The majority also tells us that its interpretation of the statute is correct because, otherwise, “agricultural businesses and municipal water authorities would be immune from RCRA liability for transporting contaminated, even toxic, water as long as they did not participate in its contamination.” Maj. Op. 15. The majority’s opinion, however, does not uniformly affect agricultural businesses and municipal water authorities transporting contaminated water; it affects them arbitrarily. If the source of the contamination is anthropogenic, as River Watch contends it is here, then the defendant would be covered by RCRA; if the contamination is naturally occurring, as the City contends here, RCRA would not apply. The majority creates an arbitrary patchwork of RCRA drinking water regulation, as an overlay to the EPA’s Safe Drinking Water regulations.<sup>3</sup>

---

<sup>3</sup> And under that judicially imposed regulatory regime, presumably it is the district court—not the EPA—that will set the “safe” level of hexavalent chromium in the City’s drinking water.



---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 25

---

This should be a simple case. This case is controlled by *Hinds*' holding that § 6972(a)(1)(B) "requires that a defendant be actively involved in or have some degree of control over the waste disposal process to be liable under RCRA." 654 F.3d at 851. Here, the City had no involvement in or control over that process. Summary judgment, therefore, should be affirmed.

### III.

Even if that were not the case, I would affirm based on waiver. In the district court, the key question was whether the hexavalent chromium in the City's water system is "solid waste" within the meaning of RCRA, 42 U.S.C. § 6903(27). River Watch argued that it was, on two legal theories: (1) it is a useless byproduct of the City's water production process (the byproduct theory); and (2) the City is using its water distribution system to dispose of the hexavalent chromium contaminating its wells (the disposal theory). The district court properly rejected each of these theories and, solely on that basis, granted summary judgment to the City. River Watch appealed, and on appeal it has abandoned those flawed theories and offered an entirely new one—the theory that the hexavalent chromium in the City's water is "solid waste" within the meaning of RCRA because it was discarded by the operators of the Wickes facility (the Wickes theory).

The City persuasively argues that "River Watch may not change its legal theory on appeal." River Watch is raising a new argument on appeal, it is doing so on a key issue in the case, and it is doing so after having consciously declined, for strategic reasons, to raise the Wickes theory in the district

---

26 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

court.<sup>4</sup> I would not reward River Watch's gamesmanship.<sup>5</sup> As we explained in *Baccei v. United States*, 632 F.3d 1140, 1149 (9th Cir. 2011), "[a]bsent exceptional circumstances, we generally will not consider arguments raised for the first time on appeal." Although we have discretion to consider such arguments in exceptional circumstances, "we will not reframe an appeal to review what would be in effect a different case than the one decided by the district court." *Id.* That is the case here. River Watch argues that the district court erred, but it did no such thing. It properly granted summary judgment to the City based on the arguments the parties actually presented to it. The district court should not be faulted for failing to address the merits of a legal theory

---

<sup>4</sup> As the City explains:

River Watch was attempting to impose liability for all City wells with hexavalent chromium, not just those in the Elmira Well Field. . . . Because River Watch was attempting to impose liability for wells even if no associated solid waste disposal site could be alleged, it came up with its "byproduct theory" of liability (which has been abandoned on appeal). . . . It was precisely because River Watch was seeking to impose RCRA endangerment liability even if hexavalent chromium in City wells was not allegedly associated with any solid waste site like Wickes that the district court had to confront the issue of whether Vacaville's domestic water supply operations alone could implicate RCRA's solid waste regulation rules.

<sup>5</sup> Such gamesmanship also is unfair to the conscientious district court, leading to the reversal of its judgment on a theory never argued to that court.

---

CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE 27

---

that River Watch expressly disclaimed below.<sup>6</sup> This is the necessary corollary to the party presentation rule recently announced by the Supreme Court. *See United States v. Sineneng-Smith*, 140 S. Ct. 1575, 1579 (2020).

The majority finds no waiver, but it does so by asking the wrong question. *See* Maj. Op. 7–8. The question is not whether River Watch has preserved its factual argument that the Wickes site is a source of the hexavalent chromium; River Watch has done so. The question is whether River Watch is raising a new legal theory to meet the statute’s definition of “solid waste.” Because River Watch raises this legal theory for the first time on appeal, waiver applies.

---

<sup>6</sup> As the district court explained:

In order to properly resolve the parties’ competing summary judgment motions, it is important to accurately frame the nature of River Watch’s claim. . . . River Watch is *not* claiming Vacaville is participating in the hazardous waste disposal and *transportation* process as, for example, a hazardous waste disposal company would; rather, River Watch claims that in the process of creating potable water, Vacaville is *generating* high concentrations of hexavalent chromium, which is then incorporated into the potable water and distributed to city residents. . . . This understanding is crucial to determining what is and is not “discarded material” within the statutory meaning of “solid waste,” and whether hexavalent chromium qualifies as such, as relevant here.

(Emphases added.)

28 CALIFORNIA RIVER WATCH V. CITY OF VACAVILLE

---

**IV.**

I would affirm the judgment of the district court on the two grounds discussed above. I therefore respectfully dissent.

# Oxford English Dictionary | The definitive record of the English language

## transportation, *n.*

**Pronunciation:** <sup>2</sup> Brit. /trɑːnsˈpɔːtɪʃən/, /trənsˈpɔːtɪʃən/, /trɑːnsˈpæːtɪʃən/, /trənsˈpæːtɪʃən/,  
U.S. /,træn(t)spərˈteɪʃən/

### Frequency (in current use):

**Etymology:** noun of action < TRANSPORT *v.* + -ATION *suffix*. Compare Latin (post-Aug.) *transportātiōn-em* transmigration, and French *transportation* (1519 in Hatzfeld & Darmesteter).

### 1.

#### a. The action or process of transporting; conveyance (of things or persons) from one place to another.

Much used in 17th cent. down to c1660; afterwards gradually given up for *transport*, probably to avoid association with penal transportation, sense 2c.

- 1540 *Act 32 Hen. VIII* c. 14 §2 For the freight transportation conveyance or cariage of anny warres.
- 1583 G. PECKHAM *True Rep. Newfound Landes* iv. sig. E.ijv By reason of the transportation of rawe Wooll of late dayes, more excessiue then in tymes past.
- 1607 S. HIERON *Spirituell Sonne-ship* in *Wks.* (1620) I. 371 Looke how the case stood with their transportation out of Ægypt into Canaan.
- 1615 G. SANDYS *Relation of Journey* 26 Here is a Ferry for transportation into Asia.
- a1656 J. USSHER *Ann. World* (1658) vi. 131 Finding no ships there, for his transportation, he divided his army.
- 1679–88 in J. Y. Akerman *Money's Secret Services Charles II & James II* (1851) 16 To the Bishop of London, for transportac'on of three Chaplains to the Leward Islands..60 o o.
- 1707 J. CHAMBERLAYNE *Angliæ Notitia* (ed. 22) I. vii. 63 Upon the Three Articles of Exportation, Transportation or Re-exportation, and Importation, no Kingdom or State in the World can any ways match us.
- 1827 H. STEUART *Planter's Guide* (1828) 264 It must make the Tree..more troublesome to be balanced during the transportation.
- 1855 W. H. PRESCOTT *Hist. Reign Philip II of Spain* I. i. vii. 227 The transportation of the troops was going..on.
- 1890 *Wisconsin Hist. Soc. Prospectus* Upon any gift to the Society, transportation will be cheerfully paid.

#### b. *Geology.* The movement of land-waste by rivers, ocean-currents, glaciers, wind, etc.

- 1830 C. LYELL *Princ. Geol.* I. 81 A geologist, who..sees the decomposition of rocks, and the transportation of matter by rivers to the sea.
- 1877 J. LE CONTE *Elements Geol.* (1879) III. v. 516 The general direction of the scorings corresponds with that of transportation of the boulders.

### 2. *spec.*

**a. Scottish Church.** The translation of a minister from one charge to another.

1562 in J. Row *Hist. Kirk Scotl.* (Wodrow Soc.) 24 Transportation declared lawfull where there is reason for it.

a1666 R. BLAIR *Life* (1848) (modernized text) ii. 46 That assembly sets a note upon the act of my transportation.

1717 T. BOSTON in A. Thomson *Life* (1895) 129 In a time wherein there is so little need of transportations.

**b. Scottish Ecclesiastical Law. *transportation of a church*,** removal of the site of the church to a different part of the parish.

1838 W. BELL *Dict. Law Scotl.* (at cited word) *Transportation of Churches*, The form of applying for transportation is by a summons raised before the Teind Court, concluding for authority to transport, and to have the new church declared the regular parish church.

**c. Removal or banishment, as of a criminal to a penal settlement; deportation.**

1669 in *10th Rep. Royal Comm. Hist. MSS* (1885) App. v. 95 If..the said Rice Havard [a condemned felon] doe give in security for his transportacion as before mentioned.

1678 S. BUTLER *Hudibras: Third Pt.* III. ii. 105 Neither Chains nor Transportation, Proscription, Sale, nor Confiscation.

1728 J. GAY *Beggar's Opera* I. xiii. 17 Were you sentenced to Transportation?

1879 J. MCCARTHY *Hist. our Own Times* II. xviii. 33 The sentence of death was changed into one of transportation for life.

### 3.

**a. *transferred*.** Means of transport or conveyance. *U.S.*

1853 J. L. McCONNEL *Western Characters* 163 He furnished his own 'transportation', and selected his own encampment.

1861 *Times* 29 July We captured..all the enemy's camp equipage and transportation.

1869 T. W. HIGGINSON *Army Life* (1870) 236 There was no transportation to take us. At last, a boat was notified.

1890 *Cent. Mag.* Feb. 564/1 A lot of miscellaneous transportation, composed of riding horses, ambulances, and other vehicles.

1894 *Outing* 24 234/2 Transportation is furnished for the horses of mounted officers.

**b. A ticket or pass for travelling by a public conveyance. *U.S.***

1909 in *Cent. Dict.* Suppl.

1909 *Webster's New Internat. Dict. Eng. Lang.* *Transportation*,...4., a ticket, pass, or the like, required to secure transportation on a public conveyance. It does not include checks, etc., for special accommodation.

#### †4. Transport (of feeling), rapture, ecstasy. *Obsolete.*

- 1617 S. COLLINS *Epphata to F. T.* II. vii. 286 Not onely in extasie and transportation..but in the daily forme of prayer.
- 1660 T. STANLEY *Hist. Philos.* III. I. 45 A soul disturbed with anger or pleasure, or any other unbefitting transportation.
- 1690 N. LUTTRELL *Diary in Brief Hist. Relation State Affairs* (1857) II. 68 Which those poor people received with great transportations of joy.

---

#### COMPOUNDS

*attributive*, mostly in sense 1, as **transportation agent**, **transportation company**, **transportation money**, **transportation rate**, **transportation sentence**, **transportation system**, **transportation-wagon**, etc.

- 1573-4 in *Acts Privy Council* (1894) VIII. 212 To aunswer the conduct, transportacion money and wages according to her Majesties usuall entertainment.
- 1819 J. A. QUITMAN in J. F. H. Claiborne *Life J. A. Quitman* (1860) I. 36 I went to the agent of a train of transportation-wagons.
- 1825 in T. L. McKenney *Memoirs* (1846) I. 299 I was appointed transportation agent for the United States at St. Louis.
- 1844 R. W. EMERSON *Young Amer.* 17 The Post Office is likely to go into disuse before the private transportation shop.
- 1866 'M. TWAIN' *Lett. from Hawaii* (1907) 274 Her transportation wagons will be the freight cars of the Pacific Railroad.
- 1879 *Constit. Calif.* in J. Bryce *Amer. Commonw.* (1888) II. App. 670 All railroad, canal, and other transportation companies are declared to be common carriers.
- 1883 G. B. GOODE *Rev. Fishery Industries U.S.* 67 The construction of refrigerating transportation cars.
- 1891 *Athenæum* 26 Dec. 862/3 There is not much in it about Siberia,..and the work is, in fact, one on the Russian transportation system.
- 1897 'P. WARUNG' *Tales Old Regime* 148 Her home record was bad, and most likely her transportation-sentence was life.

---

#### DERIVATIVES

**transpor'tational** *adj.* of, belonging or pertaining to transportation.

- 1888 J. T. GULICK in *Linn. Soc. Jrnl., Zool.* 20 230 Transportational segregation, caused by activities in the environment that distribute the organism in different districts.

**transpor'tationist** *n.* one who favours the transportation of criminals.

1840 T. P. THOMPSON *Let.* 6 May in *Exercises* (1842) V. 26 On the whole, we seem to have flurried the transportationists.

---

This entry has not yet been fully updated (first published 1914; most recently modified version published online March 2021).

Copyright © 2021 Oxford University Press. All rights reserved.

cited in California River Watch v. City of Vacaville  
No. 20-16605 archived on September 24, 2021



LIVE

Subscribe

TRENDING

COVID-19 News

Forum

Life's Little Mysteries

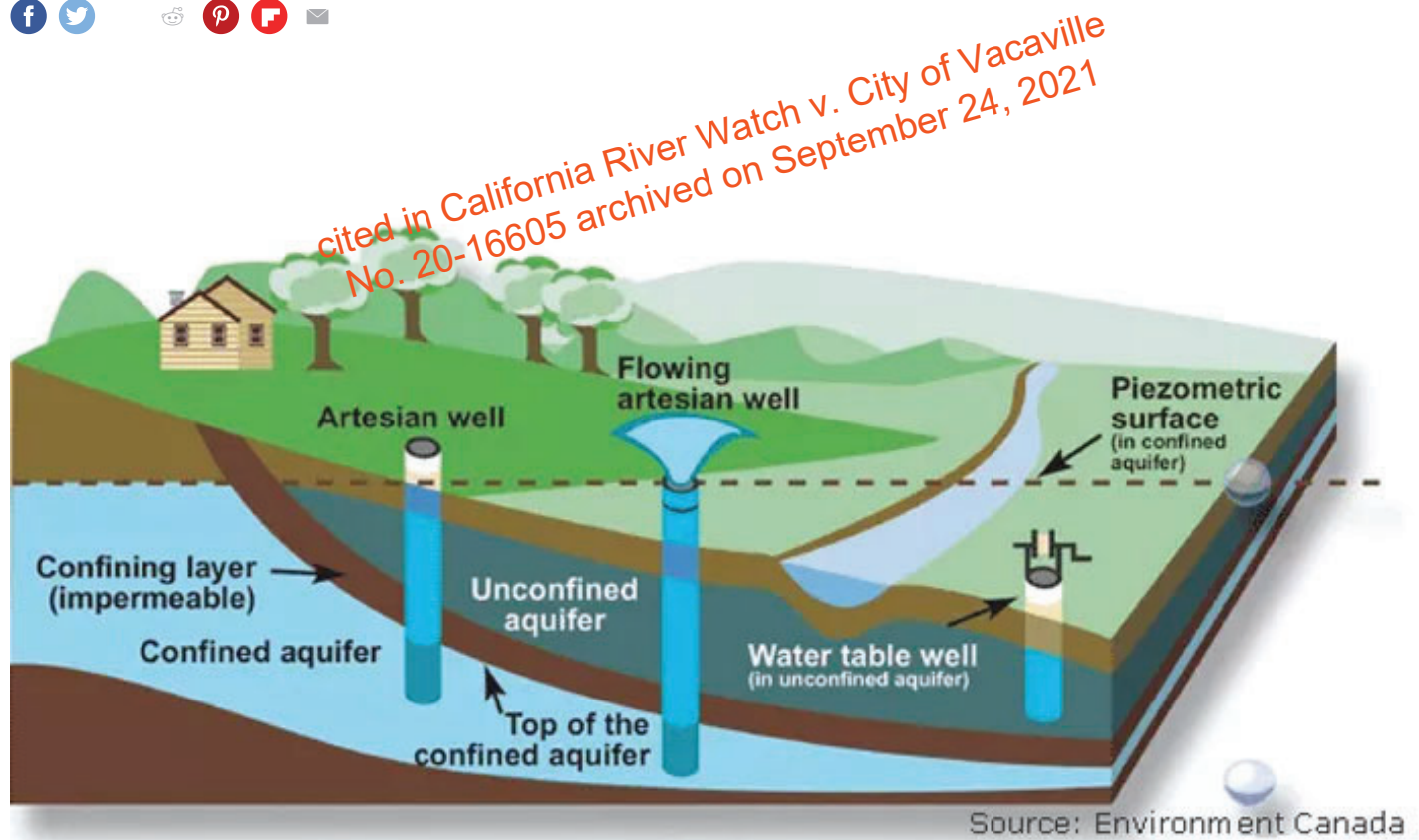
Reference

Live Science newsletters

Live Science is supported by its audience. When you purchase through links on our site, we may earn an affiliate commission. [Learn more](#)

## Aquifers: Underground Stores of Freshwater

By [Becky Oskin](#) October 17, 2018



(Image credit: Environment Canada / USGS)

LIVE

Subscribe

surface through natural

The groundwater contained in aquifers is one of the most important sources of water on Earth: About 30 percent of our liquid freshwater is groundwater, according to the [National Oceanic and Atmospheric Administration \(NOAA\)](#). The rest is found at the surface in streams, lakes, rivers and wetlands. Most of the world's freshwater — about 69 percent — is locked away in glaciers and ice caps. The U.S. Geological Survey website has a [map of important aquifers](#) in the contiguous United States.

[Groundwater](#) can be found in a range of different types of rock, but the most productive aquifers are found in porous, permeable rock such as sandstone, or the open cavities and caves of limestone aquifers. Groundwater moves more readily through these materials, which allows for faster pumping and other methods of extracting the water. Aquifers can also be found in regions where the rock is made of denser material — such as granite or basalt — if that rock has cracks and fractures.

PLAY SOUND

cited in California River Watch v. City of Vacaville  
No. 20-16605 archived on September 24, 2021

"Aquifers come in many shapes and sizes, but they are really a contained, underground repository of water," said Steven Phillips, a hydrologist with the U.S. Geological Survey (USGS) in Sacramento, California.

Dense, impermeable material like clay or shale can act as an "aquitard," i.e., a layer of rock or other material that is almost impenetrable to water. Through groundwater might move through such material, it will do so very slowly (if at all). Faults or mountains can also block the movement of fresh groundwater, as can the ocean, Phillips said.

An aquitard can trap groundwater in an aquifer and create an artesian well. When groundwater flows beneath an aquitard from a higher elevation area to a lower elevation, such as from a mountain slope to a valley floor, the pressure on the groundwater can be enough to force the water out of any well that's drilled into that aquifer. Such wells are known as [artesian wells](#), and the aquifers they tap into are called artesian aquifers or confined aquifers.

## How groundwater moves

When new surface water enters an aquifer, it "recharges" the groundwater supply. Recharge primarily happens near mountains, and groundwater usually flows downward from mountain slopes toward streams and rivers by the force of gravity, Phillips said. Depending on the density of the rock and soil through which groundwater moves, it can creep along as

LIVE

Subscribe

the rock and soil are looser

The water in an aquifer can be held beneath the Earth's surface for many centuries: Hydrologists estimate that the water in some aquifers is more than 10,000 years old (meaning that it fell to the Earth's surface as rain or snow roughly 6,000 years before Egypt's Great Pyramid of Giza was built). The [oldest groundwater ever found](#) was discovered 2 miles (2.4 km) deep in a Canadian mine and trapped there between 1.5 and 2.64 billion years ago.

But the deeper one digs for water, the saltier the liquid becomes, Phillips said. "Groundwater can be very, very deep, but eventually it's a brine," he said. "For freshwater, the depths are very limited."

Much of the drinking water on which society depends is contained in shallow aquifers. For example, the Ogallala Aquifer — a vast, 174,000 square-mile (450,000 square kilometers) groundwater reservoir — supplies almost one-third of America's agricultural groundwater, and more than 1.8 million people rely on the Ogallala Aquifer for their drinking water.

Similarly, Texas gets almost 60 percent of its water from groundwater; in Florida, groundwater supplies more than 90 percent of the state's freshwater. But these important sources of freshwater are increasingly endangered.





LIVE

Subscribe



Agriculture and a growing human population place significant demands on dwindling aquifers. (Image credit: Shutterstock)

## Threats to aquifers

By 2010, about 30 percent of the Ogallala Aquifer's groundwater had been tapped, according to a [2013 study from Kansas State University](#). Some parts of the Ogallala Aquifer are now dry, and the water table has declined more than 300 feet in other areas. More than [two-thirds of this Ogallala aquifer groundwater](#) could be drained in the next several decades, the study found.

"The water levels have just been going down, down, down," Phillip said. "A lot of that system was recharged 10,000 years ago during the most recent glacial period, and what we're doing now is mining the water. We're taking out old water that isn't being replenished."

The same problem is increasingly found throughout the world, especially in areas where [a rapidly growing population is placing greater demand on limited aquifer resources](#) — pumping can, in these places, exceed the aquifer's ability to recharge its groundwater supplies.

When pumping of groundwater results in a lowering of the water table, then the water table can drop so low that it's below the depth of a well. In those cases, the well "runs dry" and no water can be removed until the groundwater is recharged — which, in some cases, can take hundreds or thousands of years.

When the ground sinks because of groundwater pumping, it is called [subsidence](#). In California's southern San Joaquin Valley, where farmers rely on wells for irrigation, the land surface settled 28 feet (8.5 meters) between the 1920s and the 1970s, [according to NASA](#), which uses satellite data to track subsidence.

"Land subsidence is a threat to aquifers and also to infrastructure on the surface," Phillips said.

In addition to groundwater levels, the quality of water in an aquifer can be threatened by saltwater intrusion (a particular problem in coastal areas), biological contaminants such as manure or septic tank discharge, and industrial chemicals such as pesticides or petroleum products. And once an aquifer is contaminated, it's notoriously difficult to remediate.

### Additional resources:

- The U.S. Water Monitor is a daily ["water health" report](#) that summarizes federal water information.
- The USGS provides information on [water quality](#) in U.S. aquifers.
- The USGS National Water Information System's [interactive map of nationwide water data](#).

*This article was updated on Oct. 17, 2018 by Live Science Associate Editor, Tia Ghose.*



Becky Oskin 

Becky Oskin covers Earth science, climate change and space, as well as general science topics. Becky was a science reporter at Live Science and The Pasadena Star-News; she has freelanced for New Scientist and the American Institute of Physics. She earned a master's degree in geology from Caltech, a bachelor's degree from Washington State University, and a graduate certificate in science writing from the University of California, Santa Cruz.

LIVE

Subscribe

igrate site.

About Us

Terms and conditions

Privacy policy

Cookies policy

Accessibility Statement

Topics

Advertise with us

Web notifications

Do not sell my info

© Future US, Inc. 11 West 42nd Street, 15th Floor, New York, NY 10036.

cited in California River Watch v. City of Vacaville  
No. 20-16605 archived on September 24, 2021