

Water

As with all endeavors in the American West, the future of unconventional oil may well depend on water. And if it doesn't, then it should. Will there be enough water mixed with d-limonene to separate bitumen from oil sands? Will there be enough water for Enefit to mine oil shale? Will there be enough water left in the White and Green Rivers to support native fish and riparian habitats? And what will be the quality of water that ranchers draw from their wells and we from our rivers?

My name is John Weisheit. My goal is to save the Colorado River.

John Weisheit, a boatman, established his non-profit Living Rivers in the year 2000. His organization actively opposes the extraction of bitumen within the Uinta Basin.

The reason why I'm concerned is this particular mining site is perched on three watersheds. Depending on where you are at, you could be in the White River Drainage, the Green River Drainage, or the Colorado River Drainage.

Weisheit is worried that polluted water from the PR Spring mine will seep into groundwater and contaminate the Green River.

It's like a time bomb. There's at least fifty miles of alluvium between P.R. Springs and the Green River, and so it's going to take a while for the pollution to get to the Green River. But behind that plume of groundwater that's slowly creeping toward the Green River is solvents and mining waste that was coming from the headwaters of these watersheds.

My main concern is that they're gonna obliterate the watershed.

Are we going to stop the damage that this is going to do to the Colorado River/Colorado Plateau? And the water scarcity issue in the Colorado River Basin is just going to get more severe. And I really believe that it will get severe enough to the point that the reservoirs would be completely exhausted, that hydropower would cease, and that ecosystems would crash.

I am quite sure that if these bulldozers start operating, that people are going to come here from all over the country to stop this.

Living River has orchestrated protests at the PR Springs mine site. Evan, an employee of US Oil Sands, is the college student who happened to be holed up in the company's office trailer during one of the protests. People were banging on the doors and windows, screaming at him, "Why you want to kill our unborn children?"

There are others who base their conclusions more on thermodynamics than eco-politics. Doctor Bill John is a professor in the geology department at the University of Utah.

I'm a hydrologist, geo-chemist, civil engineer, geologist, and so I work on basically contaminant transport in the environment, and I focus on groundwater on subsurface systems.

I'm not an activist, I'm a scientist.

Johnson has studied the interaction of solvents and hydrocarbons, and their potential entry into groundwater systems.

D-limonene--it's an extract from oranges and it's a byproduct from that industry that is finding its use as a solvent, and so they're proposing to use that as the solvent for extraction of bitumen compounds in the tar sands of Eastern Utah.

The solvent itself isn't a major concern. The solvent is simply a way for them to extract the bitumen compounds. And what's important is, you've changed the nature of those bitumen compounds by equilibrating with the solvent.

Will groundwater or runoff from storms carry bitumen and solvents into nearby drainages like Main Canyon? US Oil Sands holds permits and now has received financing that will allow it to soon start mining at PR Spring. D-limonene and water will be mixed with bitumen-bearing sandstone. Cameron Todd expects to extract 96 to 98% of the bitumen before backfilling with damp sand.

You remove 95% of what went down there. So is the 5% that remains a problem? It typically is still enough to continue to contaminate the groundwater.

For millennia, bitumen has been oozing out of the Green River Formation without causing environmental catastrophes. Johnson argues that the situation might change with the industrial addition of powerful solvents.

D-limonene is much more soluble in water than the tar compounds. So the tar compounds aren't very soluble in water. That's why they're still there. If they were soluble in water, they would have been washed out of there a long time ago. They are soluble to some very, very small extent, and so the question is, do we increase their solubility by having them equilibrated with the d-limonene? And we do. So if the d-limonene is in the water to an appreciable extent, then these compounds will also partition to the water by way of the d-limonene. And that's what the thermodynamics show.

In other words, bitumen and water may have been always present and stable in outcrops of the Green River Formation. But with the addition of d-limonene, the situation may change.

All the compounds in the bitumen are relatively compatible with d-limonene, regardless of whether they're carcinogenic or not. But there are particular compounds that are part of the bitumen mixture that are well-known carcinogens, things like benzpyrene. It's one of a class of compounds called the polycyclic aromatic hydrocarbons. Benzpyrene is a good example of compounds that have known carcinogenicity. I don't know, and I don't think anybody knows, whether there are compounds in the bitumen mixture that have higher carcinogenicities.

Bill Johnson testified on behalf of Living Rivers when US Oil Sands' permit was challenged in 2012. His testimony focused on solvent interactions with bitumen. He has subsequently become concerned about a separate but related issue: the presence of groundwater that may or may not be available to transport carcinogens beyond the PR Spring mine site.

The question that needed to be asked was whether or not significant concentrations of these compounds would end up in the water? The expert witnesses speaking on behalf of U.S. Oil Sands made a convincing argument—at least convincing to the judge—that there would be no contact with water.

US Oil Sands drilled its 240 shallow exploratory wells between 2010 and 2012. All were dry. Based on those results, the Utah Department of Water Quality issued a *de minimus* finding that no groundwater was present, so no groundwater transport would be possible. Case closed. Bill Johnson isn't so sure. He looked a little deeper.

What I found is that in Main Canyon you have many springs. You can drop down over the edge, right from the mining processing disposal site, down into Main Canyon. But as is never mentioned in the testimony, there's a ranch down there. They rely on the groundwater.

Burt DeLambert and his wife Christine live at their ranch in Main Canyon, five hundred feet below and three miles west of the PR Spring mine site.

We bought this to run cattle, and that's what we've done; permitted for 668 cows.

We had a little ranch up there at Eden—still got it. When we got married, then we kind of had to go to work to support somebody besides the horse. October 14, 1977, I moved down here. Just lookin' for someplace to go, so this where we wound up.

Burt and Christine have relied on the springs in Main Canyon for almost four decades. Few people know groundwater of the southern Uinta Basin better.

Them springs are scattered all the way up there, I don't know, three or four miles up this canyon. There's a big spring right over here that's right down to nothin'. There was a big spring there runnin' out, but it must not have quit too long ago but that spring is totally dry. And I never even looked at it much for volume, but it had a lot of it, probably, oh, fifty, sixty gallons a minute. You know, it run a stream of water out there and just boiled right up out of this place.

You know, most of these canyons have water in 'em. They have springs come out, and right now they're low, and like I say, you can't judge it by now, because this is maybe the worst drought anybody alive remembers.

It's been off and on for, I don't know, ten or twelve years. (Christine: This is the fourteenth year.) You know, it's been dry, but the last two years has really been dry.

Andrew Dutson is an engineer with Utah's Division of Water Rights in Vernal. He understands that US Oil Sands drilled its exploratory wells during the worst drought seen here in decades.

Dutson explained that the company followed the letter of the law when they demonstrated that no groundwater was present. No groundwater; no vehicle to transport pollutants. Case closed.

I don't know where they got that idea of no groundwater. Anybody that thinks there's no groundwater has never been here, because they haven't looked. Maybe if you stay right up on top, you probably didn't see any water comin' out, but if you get down in these canyons, there's water. All these canyons have water in 'em. I've never seen any that didn't.

So for them claimin' there's no water, they're at the best time of the cycle that I can see. They'll claim there never was no water. But there was. That's what bothered me. Well, I don't want to lose my irrigation water, and I don't want to lose my house water, and I don't want to lose anything.

Like all ranchers, though, Burt remains optimistic.

I don't know if it's gonna change or not, but I think it's in a cycle, and maybe next year it'll come up and we'll get our share. We need some good winters with a lot of snow.

What happens when the rain returns? Springs will freshen in Main Canyon as groundwater seeps down from the mesas and mine sites above. But what chemicals will arrive with that water? Burt is in his seventies and stoically assumes that something besides carcinogens from bitumen will be his downfall. But he wonders about his grandchildren who want to continue ranching in here.

No, I'm sure this is gonna wreck the country maybe, but I don't know, maybe it isn't. This was very remote, nobody here, and now all of a sudden if this comes like they say, man, there'll be people all over it. But it seems to be no place that they can leave not used. If there's anything in it worth a nickel, they're gonna get it. Does it all need to change? And maybe it does, I don't know.