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2023-06-02 the reinvention of owens lake

Programming note: In an effort to introduce an exciting new social aspect to Computers Are Bad (a functional necessity to appease early-stage investor demands for "engagement") I am launching a Matrix room for CAB readers. You can join it! Do whatever you do to join rooms in your client with #computer.rip:waffle.tech

A few months ago I found out (via the rare sort of mailing list I actually stay subscribed to) that the Center for Land Use Interpretation was holding a Memorial Day open house at their Swansea location. I always have a hard time describing CLUI, but most people that are interested in domestic military, telecom, or cold war history are probably at least peripherally aware of them. Their Land Use Database functions as a less SEO-driven (and somehow both more and less pretentious) version of Atlas Obscura, cataloging a huge number of unusual and historic sites.

I had a four-day weekend off work and, as I think I have said here before, I will drive twelve hours and several deserts over to the Mojave with the least excuse. The opportunity to see CLUI's Swansea facility and its subject, Owens Lake, certainly qualified. And so we set off, westbound into the sunset on I-40.

The drive west is always a bit shocking for the sharp change in tone on crossing the border into Arizona. I'm not sure why this happens, perhaps a difference in the economic history of the two states or an artifact of the very different politics today. It's obvious, though: as soon as you cross the border, dubious "Indian Crafts" shops become a major form of roadside gas station. "PP by the TP," one such stop advertises. The cultural connection between the area's Navajo, Hopi, and Pueblo people and the tipi is not especially strong, but that's not important. What is important here, or at least used to be, is the connection between the tipi and the "Indian" in the mind of a tourist from New York.

The crass commercial exploitation of these roadside attractions is fairly unusual in New Mexico today, but ubiquitous in Arizona. While some of these stops are Navajo-owned, they are a striking reminder of the region's history of settler colonialism. Fortunately, there is a more optimistic direction in freeway cultural relations. East of Flagstaff at Twin Arrows (a historic Route 66 "trading post"), the relatively new Navajo Blue travel plaza represents a new direction by its parent organization Navajo Gaming, a government-owned enterprise of the Navajo Nation. It sells a number of Navajo-made products including new ventures in food and beverage, and is decorated with recountings of Navajo culture (and signage in the Navajo language) rather than the "vaguely Indian" pastiche that is usually called "authenticity" in the region.

The cross-border difference may reflect the different histories of eastern Arizona and western New Mexico. Blessed with the Grand Canyon, Arizona has always been a hotspot of highway tourism. The Navajo of New Mexico, though, were more cursed with uranium. The mining and processing of uranium represented the dominant industry in many parts of the Navajo Nation during the Cold War. It has left towns like Gallup and Grants with a legacy of remediation sites, tailings containments, and cancer clinics, all funded by the Department of Energy. Just off the freeway in this area, New Mexico's customary billboards for personal injury lawyers are displaced by those for law firms specializing in the Radiation Exposure Compensation Act.

These people saw the largest radiation accident in United States history, surpassing Three Mile Island for the quantity of radiation released. In Church Rock, near Gallup, the dam containing a uranium mine's tailings pond failed. Over 1,000 tons of solid tailings and 90 million gallons of liquid slurry, all acidic and radioactive, flowed into the Rio Puerco. This was 1979, shortly after Three Mile, and no one cared. No one really cares today, and the government's reticence to pay out claims still keeps billboard lawyers busy. Church Rock, you must understand, is a sacrifice zone. As a matter of federal policy, both the land and the people were consumed by the uranium mills until the Cold War cooled a bit further down. After that, the federal government walked away. It took long court battles and legislation to bring the government back to the uranium mines of the Colorado plateau, now a disaster that can only be mitigated.

This is a tangent, yes, but it is critically important that both advocates and critics of nuclear energy remember the plight of the Navajo Nation. While controversy over nuclear energy continues to revolve around the safe storage of nuclear waste, actually a problem of rather small scale, even the harshest opponents of nuclear energy and nuclear weapons seldom remember the destruction that uranium extraction wreaked on both a region and a people. The Department of Energy, through several of its national laboratories, has conducted exhaustive radiation surveys of the Navajo Nation both from aircraft and on the ground. Each time the surveys become more sensitive, the findings become more alarming. Large numbers of older structures in the Navajo Nation, many of them homes, were built with materials contaminated by uranium tailings. Tailings piles across the four corners region (largely coterminous with the Navajo Nation) will require permanent monitoring and maintenance to protect the engineered barriers, installed at great expense, that prevent wind and water spreading uranium and its daughter products further. Each one of these tailings piles easily exceeds the volume of fuel waste produced in the entire history of civilian nuclear energy.

Yes, the tailings are far less active and so easier to manage, but the scale of this easier problem is so much larger. Within sight of the gates of Arches National Park, one of the most important recreational areas in the region, the Moab Uranium Tailings Remedial Action Project (for some reason abbreviated UMTRA) has its own rail freight facility to ship away the more active waste. Primary cleanup activities started in 2001 and will continue until at least 2029. This site is not exceptional, there are many others like it, and yet it's the federally-funded medical clinics in each former mine town that most vividly tell this forgotten human story of the atomic age.

This has gotten a bit dark, hasn't it? But telephones, telephones are a lighter topic. Well into California now, we stopped at Ludlow, right on I-40 a bit west of the Mojave National Preserve. There's a fairly intact Whiting Brothers service station here, an artifact of historic Route 66 that I always enjoy seeing. What I am really hunting for, though, are indications of historic open-wire telephone routes. Immediately east of the old Whiting Brothers, a cluster of old "H-frame" telephone poles on both sides of the street strongly suggest a convergence of open-wire toll leads, if not a station of some kind.

Open-wire telephone leads mostly ran on multi-arm telephone poles. You've seen these before, for electrical distribution if nothing else: just an ordinary utility pole with as many as five crossarms on it. At points where toll leads ended, though, or at certain points when crossing rivers or where especially long spans are needed for another reason, you'll see an H-frame. This is a set of two poles, with the crossarms spanning between them, connected at both ends. They're sturdier and provide more resistance to movement in the lateral direction especially. Repeater stations usually have one or more H-frames around them that serve as sturdy anchor points for the leads heading off in each direction.

An abandoned building, in about the right position, has the vague shape of an open-wire repeater station but was at least more recently a house. It is possible that it was a repeater facility converted to a house by a later owner, this isn't very unusual, but I doubt it in this case. The house seems to be wood-framed. The analog electronics in open-wire repeater stations were sensitive to temperature, and so AT&T employed thick brick or concrete block walls as a way to minimize the diurnal temperature variation inside. It's possible that there wasn't a repeater station there at all, one H-frame has a perpendicular arm that makes me believe it could have just been a point where one of the toll lead pairs was broken off to serve a local exchange or, most likely, a toll station at the nearby railroad depot.

We spent the night on the edge of the Black Mountain Wilderness Area near Barstow, where a mineshaft plunged dramatically downwards with only a loose barbed-wire cattle fence around it. Almost everywhere in southern California was an active mining district at some point. There was gold and silver in many cases. Fortunately, there wasn't much in the way of uranium. The next morning, we finished the drive into the Owens valley.

As with much of the southern California desert, the Owens Valley is both untamed by humans and yet forever changed by human development. Owens Lake, at the center, was a large lake at the bottom of the valley fed by the Owens River and various streams. It was until 1913, when the City of Los Angeles took it.

One of the great controversies of the West is water. It is difficult to succinctly convey exactly how insane the history of water in the West is, and I will have to refer you to the classic book "Cadillac Desert" by Marc Reisner. Water was the subject of hostilities that ranged from intense political intrigue to outright armed combat, and the City of Los Angeles was one of the principal combatants. In a series of events now known as the California water wars, the Los Angeles Department of Water and Power employed persuasion, bribery, deception, and in some cases military force to claim every drop of water in the Owens Valley.

There were farmers, ranchers, and industry in the Owens Valley that relied on Owens River and Owens Lake, but they had no influence on the City of Los Angeles. The LADWP built a pumping plant that diverted the entire flow of Owens river into an aqueduct, around the Sierras and into the city. The impact of LADWP's diversion on Owens Lake was a dramatic one: Owens Lake ceased to exist, and with it most of the industry of the Owens valley. With all the water of the Owens River diverted, there was no water left to fill the lake, and it slowly evaporated away. The ranches and farms of Owens Lake evaporated too, leaving only mineral extraction operations that didn't survive much longer.

The Natural Soda Products Company had their plant destroyed by impacts of LADWP's engineering works. They sued, and the LADWP paid the cost of rebuilding. 25 years later, the LADWP destroyed the plant again. Once again, it was forced to pay to rebuild. Natural Soda Products went out of business not long after. Quickly changing water levels and compositions in the lake, a result of LADWP's scattershot management of the

diversion, made it unprofitable to continue on the site. In 1941, LADWP was forced by court order to build a flood control dam higher up on the Owens river to prevent Owens lake unexpectedly flooding whenever there was a wet year. This provided enough assurance for the Pittsburgh Plate Glass Company to stand up their own soda plant. In the 1960s, it too closed, another victim of LADWP. Today the Natural Soda Products Company has been built over by an LADWP warehouse and equipment yard. The Pittsburgh Plate Glass plant remains abandoned on the west shore, behind a beautiful midcentury office building that can't have been built that long before the end.

Drying out a lake is, in general, a bad idea. As Owens lake evaporated, its mineral content settled on the former lakebed. Owens valley is rich in salt and several minerals that include heavy metals. These constituents form a dry crust across the lakebed, and whenever the wind kicks up, the top layer begins to blow away. Salt, heavy metals, and small particles combine with archae, single-celled organisms that thrive in the brine, to create an environmental disaster of tremendous scale. Everywhere downwind from Owens Lake has accumulated a fine layer of dust, carcinogenic to humans and animals because of the heavy metal content. The massive particulate loading of the air becomes downright dangerous, causing widespread respiratory illness in the valley's few remaining residents.

California contains another notable dry lakebed I have written about before, the Salton Sea. The situation is somewhat different there as the Salton Sea started out dry and was accidentally wetted. Owens Lake started out wet and was rather intentionally dried, but the adverse consequences of that drying were mostly ignored since the City of Los Angeles was making the decisions and it was on the other side of a mountain range. Private land owners in the Owens Valley had already been decimated by the LADWP's actions anyway, and for most of the 20th century the Owens Valley was abandoned as a sacrificial zone. We might chide the LADWP for their lack of care for the residents and businesses there, but that seems too generous. For a long time, some would say still today, the LADWP has been actively hostile to the valley's residents. They are, after all, the insurgent force left over after the LADWP won the water wars. Even so, the valley had its advocates. A few residents remained around the lake, the Alabama hills sustained a tourist operation at the nearby town of Lone Pine, and by the '90s environmental organizations and government agencies outside the control of Los Angeles gained power.

Owens Lake remains property of the LADWP to this day, but the times have changed. By the 1930s courts were already starting to side with land owners in the Owens Valley area rather than allowing Los Angeles carte blanche to do as it pleased. In practice, this has less to do with courts changing opinions than it does with the City of Los Angeles losing the above-the-law status it had held in the early 20th century through sheer power of will (and the general difficulty of administering the law in frontier California). Now, in the 21st century, Owens Lake has decidedly become property of the LADWP in the kind of way the LADWP had long tried to avoid: it is now Los Angeles's problem. And a problem it is.

The tide turned against the LADWP as the new millennium arrived. The Great Basin Unified Air Pollution Control District, a joint powers agreement between the region's three counties to administer air quality regulations, employed politics and lawsuits to force the LADWP into an agreement to address the dust. A 1999 memorandum of agreement between the LADWP and the Pollution Control District started a monumental industrial project that continues today, and will continue indefinitely into the future. LADWP has to stop the dust.

This partnership has not been an especially happy one. The LADWP has decidedly drug its feet, seeking to extend timelines and reduce the area over which they are required to

implement dust control measures. The Pollution Control District has sued the LADWP and won several times since, leading to a series of settlements and injunctions that define the LADWP's obligations today. The requirement to tame the dust has evolved into a complex set of numerical performance standards, and a regime of air sampling stations and modeling to evaluate compliance.

There are multiple approaches to reducing the dust emitted by the dry lakebed, and each comes with drawbacks. Collectively, methods accepted under agreements with the Pollution Control District are called Best Available Control Measures or BACM. They include shallow flooding, managed vegetation, and gravel. There are also three alternative forms of shallow flooding, referred to as tillage, brine, and dynamic water management, which basically entail shallow flooding with optimizations to reduce water consumption. We'll discuss each of these in more detail, but this is the first important thing to know about Owens Lake. There are multiple dust control methods, and each comes with advantages and drawbacks. A key part of the dust control project is the selection of different control measures for different parts of the lake.

Shallow flooding is the most widely used, and as of 2019 about 36 square miles are managed by shallow flooding. The concept is simple: areas of lake bed are flooded with just enough water to keep mineral deposits wet. Much of the central, low-elevation part of the lake is controlled by shallow flooding, which surprisingly gives it a somewhat normal appearance from a distance. The most obvious part of the lake is a large water surface. Only on closer inspection do you realize that, first, this area is far smaller than the total size of the lakebed, and second, it is extremely shallow. It's more of a reflecting pool than a lake.

Shallow flooding is almost completely effective in preventing windblown dust, but it consumes water... 2-3 feet per year for conventional shallow flooding, although some of the alternate methods like tillage reduce this. The whole problem was created by LA's need for water, and the LADWP considers water use for dust control undesirable since it reduces the portion of Owens River water that can be sent on to the city. The water also has to be pumped and other control works have to be built and maintained. Conventional shallow flooding costs around \$30 million per square mile to install and a third of a million per square mile annually to maintain.

Another option is managed vegetation, used for 5.4 square miles in 2019. It's pretty much the gardening option. In areas of the lake with good soil, irrigation is installed to support plant cover. Apparently in the interest of keeping costs low, irrigation is kept to the absolute minimum, and so round green areas form around each water jet. Managed vegetation is similar to shallow flooding in terms of cost and can use just as much water, but it adds valuable animal habitat to the Owens valley.

Finally, gravel is the most expensive option, but also completely effective and fairly easy to maintain. Another 5.4 square miles of dry lakebed are simply covered in a layer of gravel, preventing fast-moving air directly over the mineral deposits. Gravel comes out to \$37 million per square mile to install, but it's effective immediately unlike managed vegetation that takes some time to grow in.

A number of other methods are being investigated. For example, precision surface wetting relies on the same basic concept as shallow flooding (keeping the lake bed wet) but uses sprinkler heads to distributed the water instead of flooding. This can be more efficient, but also requires more complex infrastructure.

Perhaps most interesting experimental techniques are the broad category of "artificial roughness." Part of the dust problem is the very flat nature of the lakebed, which allows

for very fast wind at low altitudes. By making the terrain of the lakebed more complex, the wind is slowed and turbulence is introduced that makes it harder for dust particles to travel outside of the lake area. The question is how to practically introduce such roughness. The largest experiment so far has made use of hay bales scattered in a somewhat regular grid. The hay bales demonstrated as much as 92% efficacy in reducing dust, which is less than that of the three primary techniques but still quite high, especially considering the low water consumption of artificial surface roughness.

Smaller scale roughness experiments have used weighted tubs and frames covered in snow fencing to slow and disrupt wind. The efficacy of these methods is not well established, since a fairly large area is required to see the full benefits of surface roughness.

The scale of these efforts is hard to comprehend. After learning about the effort at CLUI's small installation, we headed out one of the many service roads into the lake proper. One wouldn't usually drive into a lake, but Owens Lake today feels more like a quarry or salt operation. In order to separate areas for different dust control measures and to make shallow flooding more manageable, much of the lake near shore is divided into rectangular areas by high berms topped by gravel roads.

Access to the lake from the west side involves first driving past an interpretive kiosk, apparently installed in an effort to explain the strange landscape that is locally being called a lake. Driving from the historic shore into the lakebed proper, you are struck first by how incredibly flat it is, and second by how the entire surface ahead of you is punctuated not just by the separating berms but also by electrical enclosures and valve boxes. We left our car by a small pumping plant with a maze of insulated pipes, and walked past one of the many tank filling stations found around the lake to support the water trucks used for surface wetting during construction.

Within sight were several different control measures. To one side, two large rectangles were being flooded by standpipes. Near a corner, both a corner of the rectangular cell and an intersection of the access roads, a plastic pipe of perhaps 6" diameter sticks a short distance above the shallow water. Each of these standpipes emits many gallons per minute from one of the pumping plants, and the water coming out of them has a somewhat unsettling pink tinge. This is apparently a result of both the salt content and the archae that feeds on it. Depending on the salinity and soil conditions of the individual area, some flooding is done with salt brine recirculated from other parts of the lakebed. Other areas must be flooded with the LADWP's precious freshwater to avoid worsening the already severe salinity problems on the lake.

We stopped for a moment next to one of these standpipes, taking a few photos, and were amused at its apparent shyness: shortly after we approached, the flow stopped. The complexity of shallow flooding is not just in the piping, but control. Electrical cabinets all over the lake have log periodic antennas pointed back towards the LADWP operations building, typical of radio SCADA communications. Flooded areas receive water based on several factors, and water is pumped to different areas throughout the day. Sensor input, weather conditions, and a schedule all factor into control logic that starts and stops water delivery to different cells of the lake.

On the other side of the berm, there is another area of shallow flooding demonstrating a different approach to delivery. Smaller plastic pipes stick up in a grid across the cell, each ending in a T-fitting with a small stream of water pouring out of each side. This type of water application can be more efficient since less water depth is required to achieve full coverage. It also involves a lot more piping, and so higher installation cost.

Further away, past one of the flooded areas, we can see some managed vegetation. Clumped grasses and small plants surround each of the irrigation heads. It's far from natural, but it's also perhaps the most lush greenery we have seen in the valley. This vegetation forms a key part of Owens lake's bird habitat, along with areas of shallow flooding planted to function as wetlands.

The entire time we spend walking around, the quiet of the lakebed is periodically interrupted by an LADWP dump truck making trips back and forth on a nearby service road. Even on a weekend, construction is ongoing. Rocks are being moved to the north end of the lake for whatever reason, probably to build up rock-covered berms in a small-scale dust control measure called cobbling. Workers in pickup trucks are seen elsewhere around the lake, and when the wind blows the right direction there's a faint sound of heavy equipment, somewhere out there.

Standing somewhere in what is technically a lake and taking in the view, it is hard not to think of some of the land art I have visited. The smell of salt and overall atmosphere of an evaporating (or here, evaporated) lake make an obvious connection to the Great Salt Lake, which increasingly looks to be headed for a similar fate. The Spiral Jetty, a 1970 work of land art found on the Salt Lake's shores, would fit right in to Owens lake.

This similarity between dust control and land art is a developing part of the Owens lake management strategy. During my visit I spoke with Alex Robinson, a professor of landscape architecture and principal of the Landscape Morphology Lab. Robinson's work includes the "Rapid Landscape Prototyping Machine," a sort of 3D printer that uses a robotic arm to perform small-scale earth-moving on a tray of sand. The resulting model landscapes fit into his machine "Greetings from Owens Lake," which allows visitors to explore the artificial landscape as it would appear under the real conditions of Owens Lake---including under different dust control measures.

In an essay on Owens Lake, Robinson writes that "the lesson of Owens Lake is that, increasingly, there is no such thing as an environmental fix. There is only reinvention." This is what brought me here. Environmental remediation, particularly in the public eye, focuses mostly on "fixing," putting things back the way they were. A fix, though, may not be feasible, or even possible. I often think of my visit to the Asarco copper mine south of Tucson where our remarkable tour guide proclaimed that, after mining was complete, they would "put sheep in it." Another member of the tour asked about the future form of the enormous hole. Would they fill it in?

No, our tour guide explained. That would be incredibly costly, create its own environmental problems, and besides, the stepped sides look a bit like Table Mountain (she was referring, I think, to the one in California) and people seem to like that. "The sheep, they love it," she told us, although I have recycled this through my head so many times that I can't honestly remember if she actually delivered this line with the cadence of Donald Trump.

Environmental changes made on the scale of an entire valley lake or a huge copper mine cannot simply be put back the way they were. Explaining the concept behind "Greetings from Owens Lake," which not only renders the user's future lakebed landscape but prints the predicted vista onto a postcard, Robinson emphasized that "we have to choose." There is no "natural" in the Owens Valley any more, not since 1913. The dust control project is less restoration than it is remaking. Robinson writes:

Whether the setting is California's rapidly shrinking Salton Sea or the wave-lapped shoreline of the Eastern Seaboard, global warming and the needs of

civilization dictate that there is no going back, only futures we might choose to design. To reinvent landscapes to rival the ones we have lost will require broader, more synthetic and imaginative forms of authorship than problem-solving paradigms can provide.

In this view, perhaps the best possible future for Owens Lake is as a monumental work of land art, on the scale (if hopefully not the timeline) of Michael Heizer's "City." This approach has received some official endorsement. In the mid-2010s, a large section of the east side of the lake was reworked by landscape architecture firm Nuvis. The goal was to create an outdoor recreational area and wildlife habitat, not at all unlike the nation's many wildlife refuges except that the land itself had to be designed anew. The topology is treated as sculpture, with a series of wedge-shaped berms built up to provide aesthetic interest---along with surface roughness, required to meet the land art area's strict dust control requirements.

As we drove further north through Owens lake and past the land art area, we neared the north edge where the Owens River is diverted towards LA. The snowpack was high this year and so there is a much appreciated excess of water; the portion of Owens river beyond that needed for LA's water supply is allowed to flow over a low flood wall into the lakebed, supplementing the shallow flooding operations. The main road around the lake just fords the river over this floodwall, it's not typical for much of any water to be flowing. The rarity of the steady flow is underscored by the ford's depth gauge: a standard measuring tape, pulled out a couple of feet and taped to a bollard by some worker.

Continuing around the north side of the lake towards its west edge, we are joined on the access road by a half dozen side-by-sides. One flies a Trump flag, the other "Let's Go Brandon." We had seen them earlier in the day as well, traveling in a pack up and down the access roads on the east side. It's hard for me to interpret Owens lake as an OHV attraction, given its near perfect flatness and the fact that nearly every part of it that isn't flooded has been graveled to resemble some of the region's better roads. As we reach the west edge, though, they all turn into the lake's sole remaining RV park. Surrounded by (presumably irrigated) trees, it looks far more inviting than the lake around it. The RZR seems to be the golf cart of our day, and so I suppose it's a fitting mode of transportation in this desolate imitation of a lakeside resort.

At CLUI's installation on the east shore, besides "Greetings from Owens Lake" and a clever interpretive activity in which the visitor attempts to understand the various legal jurisdictions by assembling them as a puzzle, we took in Robinson's interpretive art installation "The Fountains of Owens Lake." The darkened room presents the standpipes and sprinklers that wet the flooded sections as art objects, neatly framed in videos. With perhaps eight of these videos playing around you, the sound from the speakers above each screen combines into something that sounds like an actual river flowing into a lake.

It's all constructed, though, and spread so far apart in the lakebed as to be more of an ambient phenomenon than the confluence of two bodies of water. One of the videos loops, starting back from the beginning, when the pump turned on: a plastic pipe jutting out of a salt-covered embankment gurgles and then lets out a spurt of water, frightening off the birds that had been stalking insects around it. As it settles into a steady flow, the birds seem to settle back as well.

Here is an industrial project that, for reasons mostly of history, we call a lake. Somewhere on its shores, a Modbus command goes into an IP packet into an ethernet frame into a 900MHz FHSS data radio. It passes by a cabinet on the side of a gravel road on

one of the berms that make up the lake's organized structure. Decoded, it reaches a PLC, which pulls in a contactor, or these days perhaps sends a few bytes to a VFD. An electric motor starts, and water flows into the lake once again... at least until 70-85% coverage of the dry bed is achieved and the motor shuts off again. This is an ecosystem, or at least part of one; it is the water cycle of the Owens valley. It is not a temporary solution, not a remediation project, but the permanent engineered environment. The birds have had to get used to it.

"We have to choose," a remark that Robinson made several times. This captures, I think, the most frightening part of today's major environmental projects. We have destroyed things so completely that we cannot "fix" them, we cannot "restore." Instead, we have to choose what we want them to be.

"Greetings from Owens Lake" has, as just part of its logic, a bit of an optimization game. As the user changes the dust control method applied to the synthetic landscape, the display shows a row of bar graphs. It shows how well the landscape performs against various traditional purposes of a lake. Aesthetics are hard to state objectively, but with wildlife biology the quality of the lake as bird habitat can be. One can play the "Breeding shorebird" bar nearly to the top, but then the huge water consumption and cost required to maintain so much habitat looms on the other side of the screen. There are numerous options for dust control because there is no one correct choice. Depending on the specific conditions of each part of the lake, some methods are more viable than others. Depending on the type of bird and season, some methods present better habitat than others. Some look better than others, and provide better recreational opportunities. Others are much cheaper.

We like to let nature solve these problems. But in the Owens valley, we tore nature out about a hundred years ago. Now we have to choose.

We only had a long weekend for this trip, and so we turned around for Albuquerque the next day. On the way back we visited the Salton Sea State Recreational Area, a formerly popular state park now consisting mostly of dusty campsites on the dustier shore. The size of the visitor center's parking lot is incomprehensible given the number of actual visitors, even on this holiday weekend. The boat ramp has long been out of the water. That it exists at all now seems like a bit of a joke.

We pass through Trona, a town dominated both physically and culturally by the plant of the Searles Valley Mineral Company. We visit the Trona Pinnacles, an unusual set of jutting rocks that give some alien landscape appeal to the dry lake bed of the Searles valley---this one natural. Passing through Joshua Tree National Park, I chuckle at a sign warning tourists that cacti are pointy and take a group photo for some visitors from India.

We stop by the old GWEN station near Essex. It was in use for Coast Guard DGPS into the 2000s, but has since been demolished thoroughly. There are some wires sticking out of the ground that I think might be remaining evidence of the ground screen. As much as 100' of coaxial cable are wrapped around a bush, and I spend a while inspecting a perforated pipe bolted to a nicely machined piece of metal. I can't even guess at its purpose. It's hard to say if either of these are artifacts of the GWEN equipment or have blown over from the adjacent junkyard. The GWEN station was built on the site of a CAA intermediary airfield. The junkyard looks more like an abandoned gas station but may have been an airport office. A structure right next to it was clearly the generator shed from an airmail route beacon, you can still just make out the orange paint on the roof. I didn't see any signs of the beacon's foundation, I suspect the generator shed had been moved for use as storage.

Remarkably close by, to the north, is another landing strip. This one, labeled "Fenner air strip" on maps, seems to have been two parallel runways with six pads at each end, separated from the runways by individual 500' taxiways. I'm guessing Fenner airstrip was a military training field, and these pads might have been for loading or arm/dearm. They tend to separate those pads onto independent taxiways like this so that one accidental detonation should only kill one airman. It's all in surprisingly good shape considering it has apparently been abandoned since WWII. Not that that's very good shape, but still, I think a light aircraft with a backcountry kit and an adventurous pilot could probably manage landing and takeoff. We drive around the site for a while, but I can't find any artifacts more substantial than a 55 gallon drum. There is a desert tortoise sunning on a taxiway, a reminder that something lives on. Driving back out to the highway, we realize that we had missed the actual road to the landing strip and driven up an old wash instead. OpenStreetMap has made the same mistake, the actual road is in better condition but somehow harder to see.

Hours further east on I-40, the freeway has been put right over one of the runways of what I assumed to be a former Army Air Station. Research shows that it was an auxiliary field of Kingman AAF, but what I assumed to be old base housing was actually built by the El Paso Natural Gas Company as a work camp for their pipeline. The airfield was disused by the '50s and the work camp, along with the freeway, were built on top of it. Today the site is still used by EPNGCO to support the nearby pipeline compressor station, and part of it is an Arizona DOT yard. In the DOT yard is a row of three houses, mostly abandoned, and foundations for more. These presumably date back to when Arizona DOT provided housing for its field crews, a practice that seems to have been particularly common in Arizona compared to other states (most Arizona rest stops have a caretaker's house on site, for example). One of the three, looking only a bit less abandoned, is signed as an office of the Arizona Department of Public Safety.

Hours further east on I-40, we venture into some ranchland to find the Devil's Hole, also called Dante's Descent. This dramatic sinkhole in an otherwise unremarkable desert is property of the Arizona State Land Trust, which has put up a fence around it and posted it as no trespassing. I am sure they have liability concerns about people falling into the hole, my husband and I found ourselves unable to get close enough to see the bottom. But still, it seems like a sad lack of effort to display this rather unusual natural feature. Arizona tends to be like that, with many fine historic and natural attractions that can be found only by driving up pipeline access roads and climbing over fences.

Hours further east on I-40, I pull off to visit an AT&T microwave station. Sometimes this feels more like paying respects, as these are invariably in poor condition in the Southwest. This one, a bit east of Flagstaff, is better than most. The outhouse has been moved to accommodate a modern concrete modular shelter in the fenced back lot. Two KS-15676 antennas remain on a tower that once held four. There are ring mounts left over from conical horns, and a number of modern microwave antennas, apparently backhaul for what look like two or three cellular base stations sharing this tower. An FAA GATR is just a short distance behind it, and another microwave site with the look of MCI, but it's hard to say for sure. AT&T had a unique verve for dramatic microwave installations (or at least the dual needs of tube-based equipment and nuclear hardening forced them into one). Most other microwave sites are unremarkable and indistinguishable, just a bolt-together lattice tower and a portable shelter they pushed off the back of a flatbed truck.

Finally, we make it back to New Mexico, crossing the border at which the Indian Crafts billboards largely end. Owens lake is a sacrifice zone. LADWP knowingly destroyed the lake, its surrounding valley, and the economy of the region in order to serve what they believed to be the greater good. The Navajo Nation has been sacrificed as well, to many

causes, but among them to the nation's (more perceived than actual) need for vast stockpiles of uranium. I'm not sure how much we can learn from this comparison, but I have always seen the stabilized tailings as land art. Some future archaeologist could easily wonder at a ceremonial purpose for these huge black forms, geometrically precise in their measurements but randomly placed wherever uranium was found.

Many years ago I saw the Cahokia mounds, built by indigenous people centuries ago. They are an ancient work of landscape architecture, although the people that built them may not yet have understood them that way. We are still building mounds today: in the four corners to contain dangerous tailings, in Owens valley to contain dangerous dust. We are only now beginning to understand them as landscape architecture. The idea that they are art---that we might build them not just out of necessity but also according to our desires---is one that we are being made to come to terms with. There is, after all, no natural disposition to the problems we've created. There is only a future we might choose to design.