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**Amicus brief/statement of testimony for the People's Permanent Tribunal on Fracking and  
Climate Change**

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**Submitted by Ceal Smith**



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*When one tugs at a single thing in nature, he finds it attached to the rest of the world.*

— John Muir

*The question is whether any civilization can wage relentless war on life without destroying itself, and without losing the right to be called civilized.*

— Rachel Carson

*Are you here to protect me, or arrest me?*

— Matine Jerome, Golden, CO (testimony for the Climate Bill of Rights & Protection)

*Personal statement/background for Ceal Smith:* I have been engaged in climate, energy, and conservation causes for much of my life. I was born and raised in rural northern California (Trinity County) on the shores of the south fork of the Trinity River that I watched slowly die from toxic releases legally emitted from an upstream lumber mill. Witnessing the death of a beloved watershed over the span of my childhood was hugely influential of my career decisions to pursue studies in Environmental Policy and Sustainability, later graduate work in Ecology and Evolutionary Biology and it continues to energize my ongoing work as a climate-energy policy expert, writer and scientist-activist.

I first learned of climate change as a student at UC Santa Cruz in the late 80's. While Bill McKibben's book, "The End of Nature" was one of the last books I read for my undergraduate degree in Environmental Studies, it affected me profoundly. Later, in the 90's, as a University of Arizona Ecology and Evolutionary Biology graduate student then as a biological consultant working in Mexico, Central America and the southern Arizona borderlands in the early 2000's, I began to see the increasing effects of climate change first-hand.

Thinking the arid southwest was no place for masses of people to live in a warming climate, I moved to rural southern Colorado in 2006. There I became involved in the early Fracktivist movement; first as a leader in a 5-year [Federal lawsuit](#) to stop drilling (and fracking) in the Baca National Wildlife Refuge adjacent to my community, and later worked with rural and urban communities confronting oil and gas development as the shale oil and gas boom exploded across the state. I co-founded the ad hoc [GrassRoots EnErgy activist Network](#) (GREEN), an early effort to unify Fracktivist groups in a statewide coalition.

In 2013 I moved to Alaska, the front lines of climate change in the US where I am now focused on building the [Alaska Climate Action Network](#) (AK CAN!), a statewide coalition of scientists, Alaskan Native leaders, renewable energy experts and advocates, artists, concerned citizens and grassroots groups working on climate and energy issues. Our efforts are currently focused on science and traditional knowledge-based climate and energy policy, developing a renewable energy roadmap for Alaska, ending fossil fuel subsidies, divestment of Alaska's Sovereign Wealth Permanent Fund and providing support to communities directly affected by climate

change and oil and gas development on the Kenai Peninsula and Alaskan Arctic Slope, including the Village of Nuiqsut.

We know the science (although it's still unfolding inevitably faster than most predicted). We have mountains of studies sitting on miles of shelves. Petitions, protests, manifestos, aside, I offer this mix of personal, professional and poetic testimony in the hopes that it serves the cause of justice to the affected people, communities, animals, ecosystems and the life-giving earth biome without which none could exist.

### *The first front*

Crestone, Colorado is a mecca for green builders and sustainability and spiritual seekers. In November 2006, a wildcat Canadian company announced plans to exercise its split-estate mineral rights and [drill and frack](#) two deep exploratory wells in the adjacent 100,000-acre Baca National Wildlife Refuge; the nation's newest, and largest (outside of Alaska) wildlife refuge in the US. That Baca NWR even existed was great testimony to the persistence and resolve of the local's whose diligent efforts to create the refuge through an act of Congress in the last days of the notoriously anti-environmental rein of George Bush Jr. and Dick Chaney was nothing short of a miracle.

Long a haven for spiritual seekers and zoning-free, solar energy and green-building innovators, Crestone's identity was locked onto a future where humans lived in relative harmony with nature. At just under 9000' elevation, Crestone sits in the shadows of multiple 14,000-foot peaks. The heart of the Sangre de Cristo Mountains. Known as Colorado's "Little Tibet", the community is home to more than 25 spiritual centers, spawned by Manitou Institute visionaries Hanne and Maurice Strong in 1988.

Within a month of moving to Crestone, I was hired as part of the technical-legal team to lead the effort to protect the refuge. The community was united against [Lexam Exploration's plan](#) to frack more than 14,000 feet deep in its quest for "black gold". However, that consensus didn't extend to the greater San Luis Valley. Conservative farmers, ranchers and other economically motivated interests pitted the community against Valley leaders. Even the local Nature Conservancy, in a private "off the record" meeting told me to back off.

Long story short, we prevailed in a five-year campaign that included a federal lawsuit against the U.S. Fish and Wildlife Service for failing to comply with the requirements of the National Environmental Policy Act. While the 9<sup>th</sup> Circuit judge ruled twice in our favor, sending FWS back to the EIS drawing board, the lawsuit ultimately incentivized the sale of Lexam's subsurface mineral rights back to the Federal Government, a step that many agreed should have been part of the original deal.

Breathing a long sigh of relief, I looked forward to returning to a normal life when I got a call from the other side of the mountain. A friend of a friend needed help. Little [La Veta, Colorado](#), a town of around 800 mostly artists, ranchers and back-to-the land hipsters was reeling with the news that its County Commissioners were on the verge of selling large quantities of water to Royal Dutch Shell for a massive shale gas fracking play.

When I arrived, the school auditorium was already overflowing with citizens concerned about the possible give-away of their water resources and large-scale buyout of subsurface mineral rights to their backyards, ranches, farms, fields, open-spaces, backroads, highways and waterways by Royal Dutch Shell.

After more than seven grueling hours of informed, passionate and coordinated testimony united *against* the sale, the elected county commissioners approved Shell's request. This shockingly undemocratic act ignited a war between the people (via [Citizens for Huerfano County](#)) and Royal Dutch Shell, their "elected" officials and the State. This same war was to spread like wildfire across Colorado as community after community was hit by big shale oil and gas plays in the late 2000's.

In a story that was to repeat the long, emotionally, physically and socially grueling work of organizing and running a community defense campaign, much like my community of Crestone had endured, [Longmont](#) was the first to ban fracking. Then came [Erie](#), [Broomfield](#), [Thornton](#), Lafayette, Ft. Collins. Other communities, such as Paonia, Rifle and Gunnison worked to strengthen local regulations rather than attempt an all-out ban.

The news reports alone would fill volumes. [Here](#), [here](#), and [here](#) are just a few.

The industry, Governor Hickenlooper and the State fought back viciously against local efforts to ban, regulate or in any way limit shale gas and oil development and high-volume, slick-water hydraulic fracturing (hereby referred to as "fracking") to the detriment of many people and communities and their rights as defined in the UN Covenant on Civil and Political Rights.

A coalition of groups working under the banner of [Local Control Colorado](#) have been working to pass a [ballot measure](#) to empower local governments in the state of Colorado to enact local charter amendments, laws, ordinances and/or regulations intended to protect the inalienable rights of its citizens and place restrictions on the time, place or method of oil-and-gas development, including but not limited to the use of hydraulic fracturing, that are intended to protect their communities and citizens.

Time after time the state worked to thwart and undermine these local efforts. Thus, leaving citizens no other choice but to keep fighting.

The battle, thus far, is captured in the passionate testimony of local citizens urging the Lafayette City Council to adopt a Climate Bill of Rights. Some clips are included below and the full Council hearing can be viewed [here](#).

*If the law is unjust, the people must stand up to it. We have a fundamental right to clean air and clean water.*

— Christine McClean, Lafayette, CO (testimony in favor of the Climate Bill of Rights)



*The CBR declares that the citizens do not want drilling in Boulder County under any circumstances. It is a violation of the land, the health of our families, and the well-being of our communities and climate. Any attempt to forcefully move fracking into Boulder County is a violation of our fundamental rights. The laws that seek to remove us from protecting the land, the local environment, the climate, and our right to self-govern are in every way immoral and illegitimate. We have the right and obligation to protect the environment, our families, and our communities. All government officials and staff will be asked to side with the people in every capacity, refuse to administer the destruction of the land and its climate, and enforce the will of the community to protect ourselves from any intrusive industry that fails to recognize these fundamental rights.*

This statement by [Merrily Mazza](#), member of the Lafayette City Council sums up the situation in Colorado quite well:

*No, we are not going to accept defeat. I am many others have been at this for five years. It started in 2012 with a group called Erie Rising which was a bunch of very active, very directed mothers in Erie who were dealing with the Encana well next to Red Rock Elementary School. Those women were ferocious, they did everything they could, but they failed, and they all moved. Is this what we're faced with? We all have to move when this happens? Is that the only alternative? I'm saying no.*

*In 2013 I was active, as were many in this room, getting the Lafette Community Bill of Rights onto the ballot. We petitioned, we got it on the ballot, it was overturned by the courts along with initiatives in Longmont, Ft. Collins and also effecting initiatives that were passed by the voters in Broomfield and Boulder County. In 2014 and 2016 we tried to get a state constitutional amendment on the ballot enforcing the right of local community self-governance, so we could protect ourselves from this industry. That was two times, 2014, 2016, that is a grueling, grueling undertaking.*

*We saw the state legislature, flooded by oil and gas lobbyists, do absolutely nothing to protect the people and the communities. We saw the industry and its minions in state government pour more millions into a 2016 ballot initiative, Ballot Initiative 71, cleverly eliminating the right of citizen initiative for all but the super wealthy. And now, right down the street in the Eggbarn, citizens in Anthem are dealing with a massive drilling site. They were told, and I watched their city council meeting, and I listened to all of them, that it would be approximately 20 wells, and it turns out Extraction Energy said, "we're sorry, we made a mistake, it's going to be 140. There were 300 people in that meeting. One man who got up to speak was a father and he started crying in a meeting with the city council, this is what we're dealing with, with this industry.*

*We have been left with no alternative. We gave up hope that the state and Federal environmental agencies would protect us, that the state was working on our behalf or that the courts would put the rights of real people over the rights of Corporate persons. We gave up hope that those who actually govern care about what happens to the people and the natural environment of our community. And and so we are told to, "except defeat and go away". And we will not.*

*We have to do what people in communities historically do when they come to grips with the failure of their own government to help them; they have to revoke their consent to be governed and take steps to govern themselves and that's what we're doing with this ordinance in Lafayette. We're saying that we have a right to a healthy environment and a climate. We're saying that we won't sell out our children and our families for the oil and gas industry profits.*

*The Climate Bill of Rights and Protections, if enacted will protect the people of Lafayette from the harms we now see in our neighboring communities as drilling heads towards our city and make no mistake it is heading towards our city. Equally important, it would also protect the community members from legal and physical harm should they need to conduct nonviolent civil disobedience to prevent drilling and the disposal of industrial waste in Lafayette.*

*We have a moral responsibility to break unjust laws, take action rather than waiting, potentially forever for justice to come to the legislature in the Supreme Court. In the words of Martin Luther King, "it is just wrong to use moral means to prevent immoral ends".*

In a protracted battle that resulted in [removal](#) of the Ordinance's direct action clause, Lafayette City Council [approved, in 4-2 vote](#), the Climate Bill of Rights and Protections in March 2017.

Daniel Glick and Kelsey Ray, report in [Fractured](#), an extensive three part series for the Colorado Independent, documents the deliberate, focused efforts of industry, including the "decline to sign" campaign, part of an orchestrated, multi-year effort by both Colorado-based and national energy giants. One of their front groups is Protect Colorado, which actively sought to thwart citizens from qualifying the two measures for the ballot.

I witnessed many [stories of people and animals getting sick](#), of clusters of rare cancers and other health ailments in communities adjacent to oil and gas operations. Efforts to assess [health impacts](#) from oil and gas have been widely politicized and thwarted.

As of 2015, more than [90,596 wells](#) had been drilled across the state of Colorado.

*The northern front: Alaska, climate changed*

Even the farthest reaches of the nation, Alaska is not immune to the fracking wars. The irony of Alaska's position as the nation's third largest oil producing state and the State most affected by climate change, cannot go unnoticed.

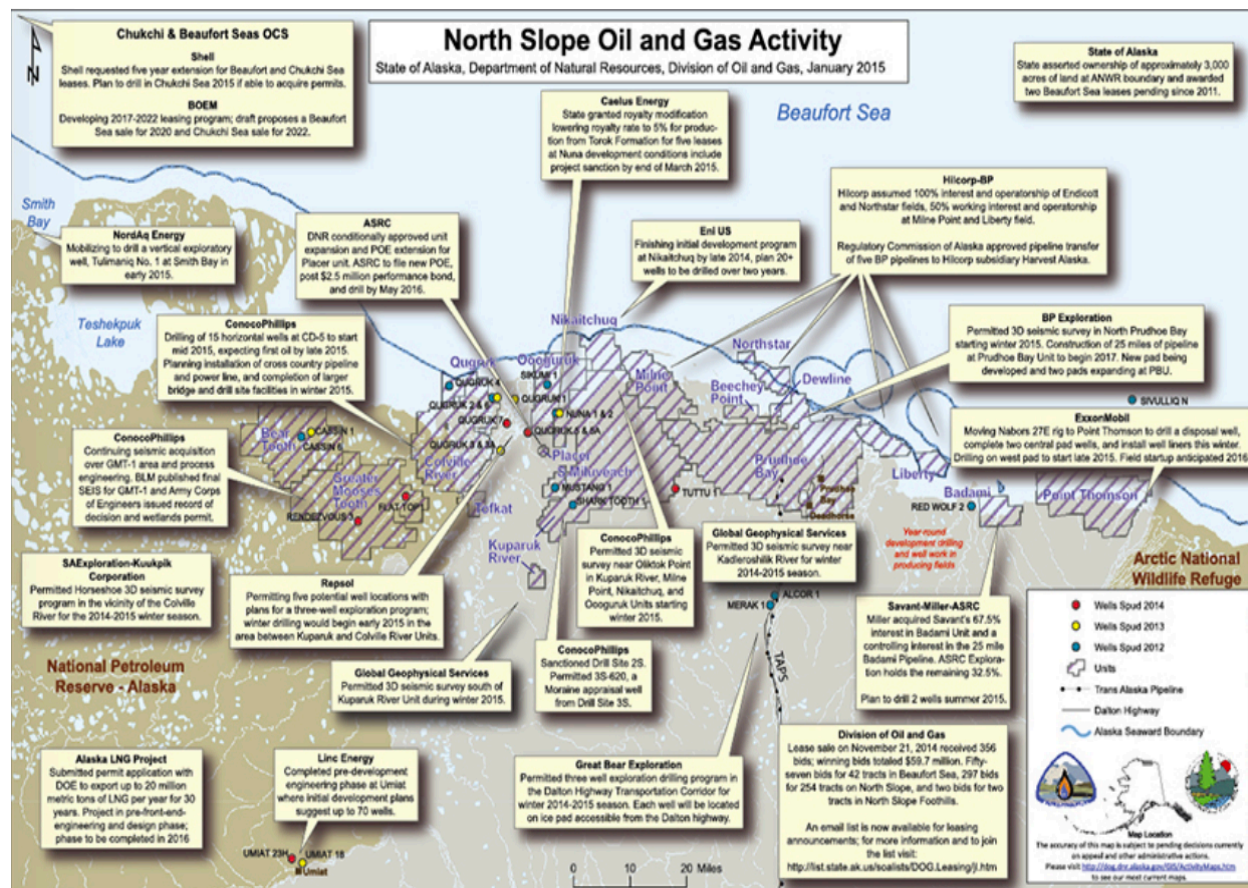
I arrived in Anchorage in the winter of 2013; four years after the release of the second of two General Accounting Office reports ([2003](#) and [2009](#)) that more than 30 Alaskan Native Villages are "eminently threatened" by coastal erosion resulting from climate change.

This month, and nearly 15 years later, the community of Newtok [is on track to receive \\$15 million](#) to aid efforts to relocate its village, now just a few storm surges away from being washed into the sea by coastal erosion resulting directly from climate change. These hard-won dollars are just a fraction of the estimated \$130 million cost of relocation. That it took more than 20

years after Newtok initially voted to move in 1996, to secure just a fraction of the cost of relocation, is not encouraging.

There are many details and nuances to this part of the story. Looking closely, we see climate change threatens, not only the buildings, roads and schools, and food security of people living in Alaska's coastal communities, but the very fabric that binds their culture. This fabric contains a deep understanding of the ways humans and the natural world are inexorably bound together. A knowing that could well be the key to navigating our way through the impending climate change bottleneck we now face as a species.

The Alaskan whaling community of Nuiqsut, Alaska is surrounded by oil and gas fields. To the east is Prudhoe Bay, Alaska's North Slope oil field covering more than 213,500 acres and containing more than 25 billion barrels of oil, the third largest oil field in the nation. To the west are ConocoPhillips Greater Moose's Tooth and Bear Tooth oil fields.



If the current administration has its way, fossil fuel industry tentacles are about to get much bigger and deeper.

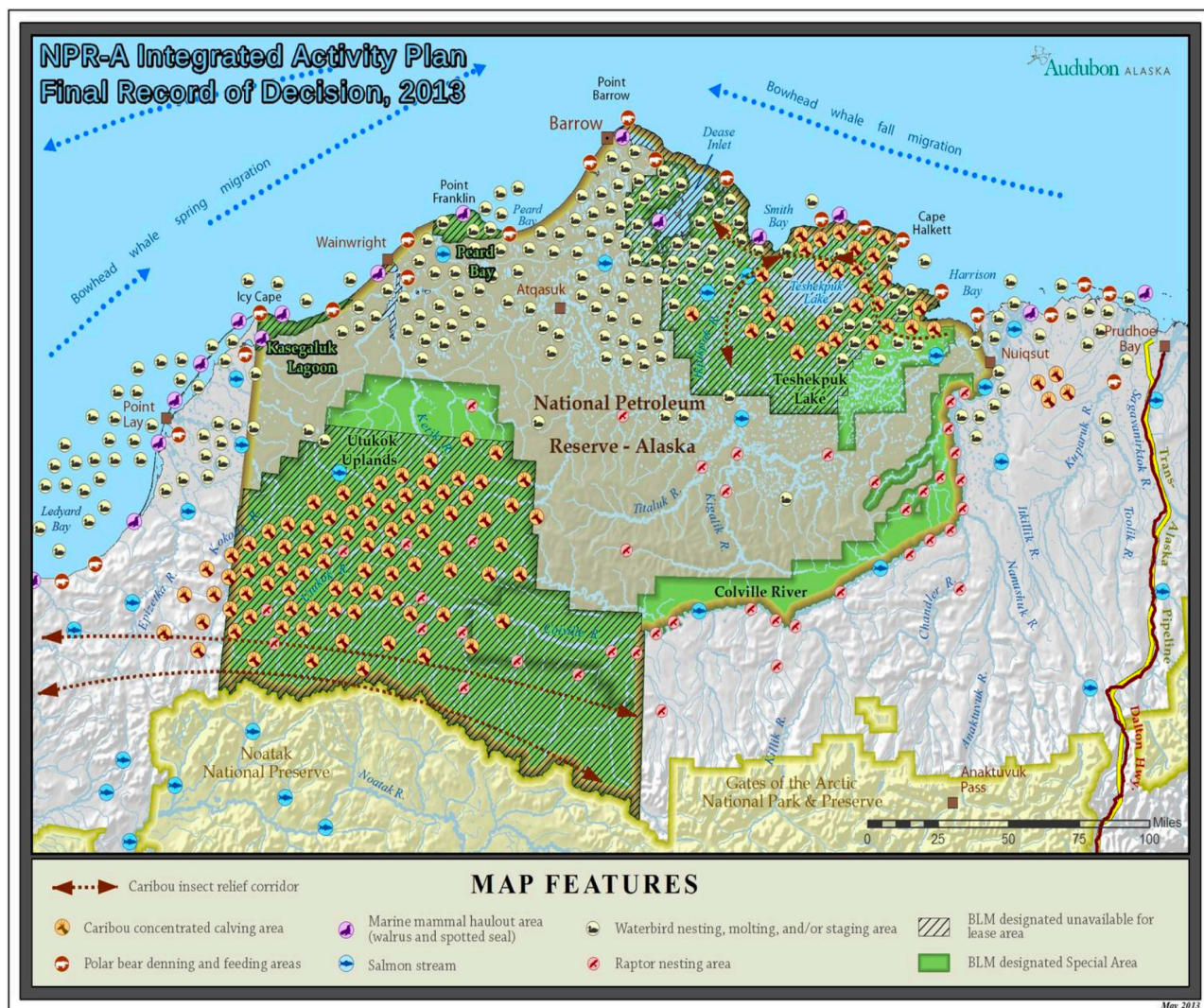
The State of Alaska is pushing to develop a \$45-65 billion Liquid Natural Gas pipeline to export natural gas from Prudhoe Bay to Nikiski on the Kenai Peninsula where it will be shipped by



tanker vessels to China. According to the State of Alaska's own [analysis](#), the project will likely have significant impacts on the subsistence resources of the ~ 400 residents of Nuiqsut.

Under Zinke's orders, the Department of Interior is pushing to expand oil and gas development in all directions; north to the Beaufort Sea, west to the Chukchi Sea and east into the Alaska National Wildlife Refuge. ConocoPhillips is pushing to expand the [Greater Moose's Tooth](#) oil field west along the Colville River to [Teshekpuk Lake](#) and Smith Bay, the nursery for Bowhead whale, the primary subsistence food for the Whaling people of Nuiqsut.

The following map from Audubon shows just a few of the places and marine and terrestrial species in the line of fire.



These [images from Skytruth](#) tell their own story.



As the Trump administration rolls out its plan to aggressively expand oil and gas development, reports of [record high](#) winter temperatures, escalating [permafrost melt](#) and [record low sea ice](#) maximums continue to roll in. The community of Nuiqsut, thus, faces the dual challenge of oil and gas development (a quick search on [FracFocus](#) reveals 85 wells were fracked by ConocoPhillips in Harrison Bay, Tyonek and Beechey Point between 2011-18 alone) and climate change.

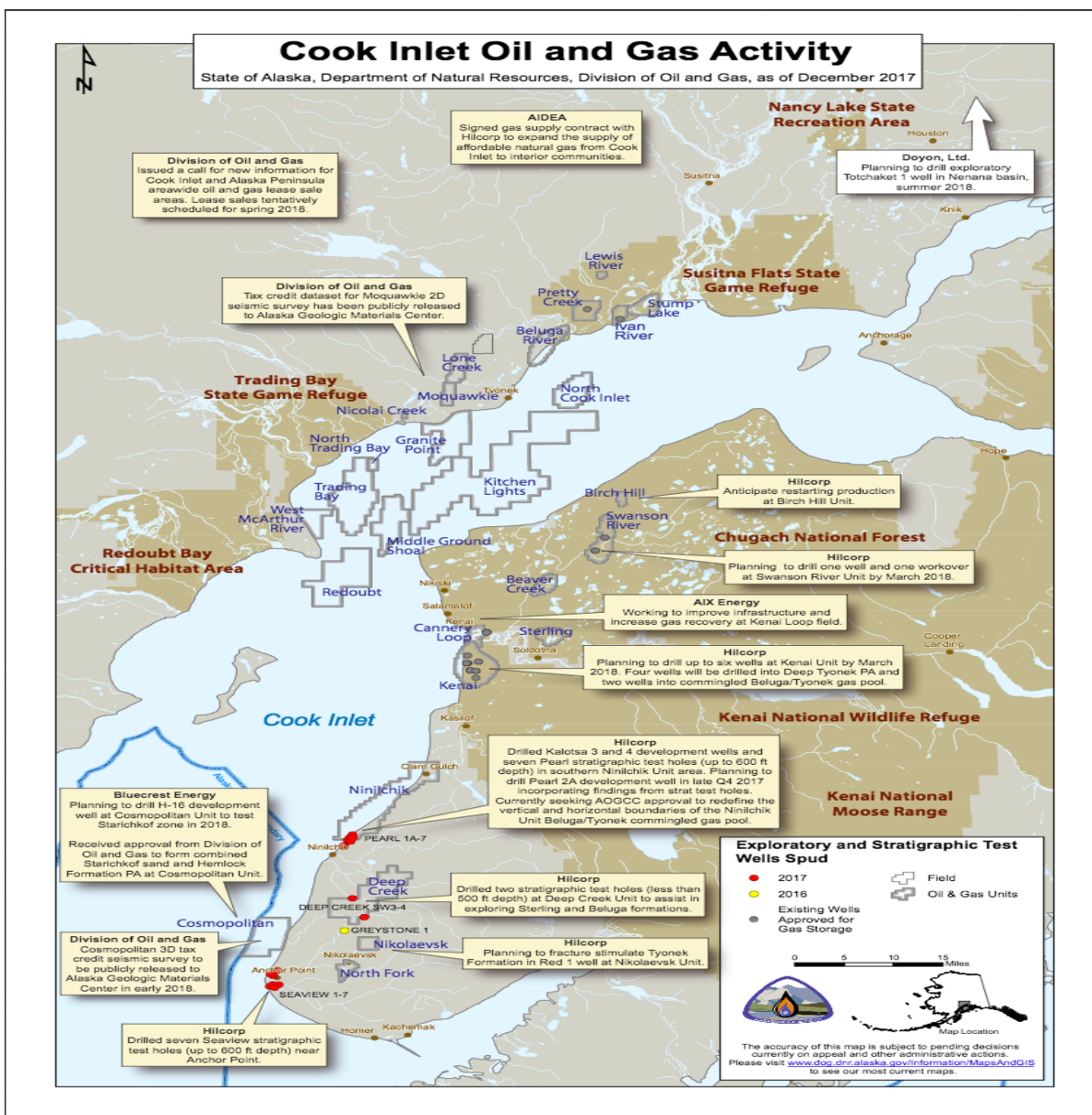
The Tribe has submitted its own testimony to the People's Permanent Tribunal. The Alaska Climate Action Network strongly supports Nuiqsut's filing and we are standing by to provide technical or administrative support should it be requested.

To the south, Alaska's Kenai Peninsula entered the fracking fight more recently. Alaska Climate Action Network has been engaged with and supports the affected Kenai communities. McKibben Jackinsky, author of [Too Close To Home: Living with "drill, baby" on Alaska's Kenai Peninsula](#) submitted the following for inclusion in our brief:

In 2015, residents of Alaska's Kenai Peninsula were caught off guard when they learned that BlueCrest Energy's plans for the company's Cosmopolitan project included hydraulically fracked wells that extended from shore to beneath Cook Inlet. As the volume of protest rose, there was even more surprise when the Alaska Oil and Gas Conservation Commission, the state agency charged with permitting fracking operations, made it known that 20 percent of the oil and natural gas wells in Alaska — both those in the Cook Inlet area and those on Alaska's North Slope — had been hydraulically fracked.



The first oil well in the Cook Inlet region was drilled in 1957, providing a giant step forward in providing Alaska the financial base it needed to move from territorial status to the nation's 49<sup>th</sup> state. While the North Slope has surpassed the Cook Inlet region in petroleum production, the Alaska Department of Natural Resources' 2017 map makes clear the strong presence of the petroleum industry in and around the inlet. How much of the activity in the area has involved or involves fracking is not known.



AOGCC has not been required to notify the public when an application to frack was submitted or when the agency awarded a permit. Notifying the public, including those living in close proximity to planned fracking operations, has been left to the discretion of the operator. Had BlueCrest not announced their plans, neighbors and the general public would never have known what was to occur.

With his water well little more than 1,000 feet from the nearest well, Herff Keith has been subjected to noise, vibrations, lights and natural gas flaring for the past three years. He settled on this picturesque location on a bluff overlooking Cook Inlet with plans to enjoy his retirement. BlueCrest's activities are making that impossible, however, and Herff has put his house up for sale.

Ken Lewandowski lives near Herff. It is the second home Ken has built in the area. He left the first one after Enstar Natural Gas constructed a pressure-reduction station for a nearby natural gas pipeline and the resulting noise, vibration and concerns for his safety forced him to relocate. No sooner had he built his second residence a few miles to the north than BlueCrest began developing the Cosmopolitan project and Ken is once again considering relocating.

Hilcorp, the largest natural gas producer in the Cook Inlet area, continues to spread its operations with no word to the public about the wells it has or plans to hydraulically frack. However, in a conversation with a neighbor to one of its well pads, a Hilcorp landman offhandedly mentioned that some wells have indeed been fracked.

In addition to possible impacts of fracking on water, noise and air quality, peninsula residents are concerned about the impacts of fracking on wildlife. Razor clams have been a source of food for Kenai Peninsula residents for hundreds of years, but in 2010, an unusual event occurred: thousands of the bivalves, most of them two-years old, washed up along an eight-mile stretch of beach. Although there are studies on the negative impact of oil and gas activity on clams, the Alaska Department of Fish and Game blamed the die-off on a storm.

In 1969, the Alaska Department of Fish and Game reported clam diggers made 8,600 visits to Cook Inlet beaches, harvesting 279,500 clams. In the mid-1980s, the annual harvest was about 1 million clams. In 2006, the allowable daily limit per clam digger was 60 clams. In 2013, three years after the storm ADFG blames for the die-off, it was reduced to 25 per day. In 2014 a 90-mile stretch of once-popular razor clam-digging beach was closed to digging and it remains closed.

A valuable, local food source has been wiped out, destroyed.

Not many years ago, beluga whales could be spotted with some frequency traversing Cook Inlet. By 1998, their numbers had declined approximately 50 percent. Over-hunting was blamed, and harvest levels were reduced, but the decline has continued. A 2016 National Marine Fisheries Service recovery plan lists noise, catastrophic events such as spills and the cumulative effects of multiple stressors as threats of the highest concern.

The inlet also is home to schools of salmon and halibut that are fished by commercial, sport and personal-use fishermen. Recreationists flock to the beaches in the summer to camp and enjoy the Alaskan outdoors.

In addition, Cook Inlet is a seismically active region. Faults crisscross the bottom of Cook Inlet and in 2000 the U.S. Geological Survey warned oil and gas producers of potential damage from earthquakes measuring 6 or more on the Richter Scale. With regard to fracking-caused

earthquakes, one seismologist said industry is being allowed to expand in the inlet too fast for science to keep pace, much less get ahead. Then there's the string of five volcanoes on the inlet's west side: Douglas, August, Iliamna, Redoubt and Spur. Redoubt's eruption in 2009 forced the evacuation of personnel at an oil storage terminal, as well as the removal of oil and water.

In a remote part of Southwest Alaska, Pebble Limited Partnership, a wholly owned subsidiary of Northern Dynasty Inc., has entered the permitting phase for developing a one-mile wide, quarter-mile deep, open-pit copper-gold-molybdenum porphyry mine. The mining operation will be powered by natural gas from the Kenai Peninsula, provided by Hilcorp, according to PLP's project description. It is unknown what that will mean for the widespread use of fracking in order to provide the natural gas that will be needed.

Hundreds of Alaskans have written letters, testified, attended meetings and called elected officials in an effort to change [AOGCC's notification process](#) with regard to fracking. We've asked to be told when applications are received, to be allowed to comment so our concerns can be part of the decision-making process, and that we be notified when permits are awarded. In the closing days of 2017, the commission announced it would begin posting applications for fracking on its web site. Left out of the change is the opportunity for public involvement, for people like Herff and Ken to be part of the decision-making process that puts at risk their lives, their homes, their food, and the land where they've chosen to live.

###

### *A tentative summary*

Looking back over these past 12 years the toll I have seen extracted from peoples' lives, the health and safety of their communities and the natural systems and species we are all inextricably dependent upon, is immeasurable and growing as well after well, drilling plan after drilling plan continues to be green-lighted.

On a personal level, the fracking-climate change fight has been grueling; hundreds of hours of unpaid time, our physical and mental health and the health and stability of our families is under constant stress. The relentless demands of organizing, attending endless meetings, commenting on agency documents, preparing litigation, fund-raising, navigating leadership in a traumatized and intentionally divided communities, trips to the Capital and court and council appearances collectively extract a tremendous toll.

Even as many of us worked for "low" or pro-bono, it ultimately cost more than \$100,000 to protect the Baca NWR from fracking, for example. That's just one of hundreds, perhaps thousands of community-based battles being waged across the state, nation and world, in our collective, grassroots global campaign to stop the dual threats of fracking and climate change.

The lessons learned run deep. We learned our people and communities have no right to clean air, water and a safe climate. We learned our people and communities have no right to determine their future. We learned our people and communities have no right to create a sustainable society and economy where the land we live on and natural processes we depend



upon are valued and sacred if that right interferes in any way with the interests of the fossil fuel industry.

We learned our people and communities have no right to protect the very ground beneath their feet; that the earth is divided into surface and subsurface, that “split-estate” rights give Anadarko, British Petroleum, Caerus, Chesapeake, Chevron, Conoco Phillips, Encana, Hilcorp, Kinder Morgan, Koch, Marathon, Noble, Royal Dutch Shell the right to plow, bulldoze, pave, fence, gate, drill, extract, vent, flare, emit, evaporate to open air, dump, spill, fracture, pollute, quake and shake our lives and communities as long and hard as they want to.

We learned that a slew of wildcat operations, named (ironically) for the things they, in fact would destroy: Antelope, Beartooth, Black Raven, Coral, Crimson, Diamondback, Eagle, Earthstone, Elm, Fountainhead, Grayhorse, Ironhorse, Kestrel, Lone Mountain, Magpie, Mustang, Nighthawk, Noble, Oxbow, Pronghorn, Ram, Red Hawk, Red River, Renegade, Rockies, Rosewood, Shawnee, Slate River, Thunder River, Timberline, Ursa...even Tabula Rasa, have rights that supersede the rights of real people, communities, Tribes, species and ecosystems.

Through our system of “laws”, these companies have been granted the supreme right to pull the rug out from under the places we call “home”. We learned that property landowners, farmers, ranchers, citizens, whole communities have no right to protect our land, the wildlife, the rivers, aquifers, forest, wetlands, meadows, grasslands, even high deserts under state and federal law. The rights of private, for-profit corporations, the oil and gas industry trump all others.

Under George Bush Jr’s. watch, the Halliburton loophole, part of Dick Chaney’s Energy Team’s 2005 omnibus Energy Act, excluded high-volume, slick-water hydraulic fracturing from the Clean Water Act; just one of [many exclusions](#) the oil and gas industry is exempt from, including key provisions of the Safe Drinking Water Act, Clean Water Act, Clean Air Act and other laws including RCRA, CERCLA, EPCRA and NEPA.

*In closing, but certainly not the end of the story...*

Due to many time and resource constraints and the demands of critical, breaking issues this testimony is of necessity preliminary and incomplete. An initial rough draft, a sketch that lightly touches the vast landscape of abuses of human rights that I have directly experienced and been witness to in 12 years of working with people, communities, species and natural ecosystems increasingly and profoundly impacted by fossil fuel development, fracking and climate change. This doesn’t begin to do justice to the people, places and issues, but it’s all I could muster in the short time available.

Colorado is ground zero in the oil and gas/fracking war.

Warming at [twice the rate](#) of any other state in the US, Alaska is ground zero for climate change.

Nuiqsut and the Kenai are at the epicenter of fossil energy development and climate change.

Our work continues.

Thank you for considering our testimony.

Sincerely,

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Still to be answered...

***The 4 questions:***

1. Under what circumstances do fracking and other unconventional oil and gas extraction techniques ***breach substantive and procedural human rights protected by international law as a matter of treaty or custom?***
2. Under what circumstances do fracking and other unconventional oil and gas extraction techniques ***warrant the issuance of either provisional measures, a judgment enjoining further activity, remediation relief, or damages for causing environmental harm?***
3. What is the extent of ***responsibility and liability of States and non-state actors for violations of human rights and for environmental and climate harm caused by these oil and gas extraction techniques?***
4. What is the extent of ***responsibility and liability of States and non-state actors, both legal and moral, for violations of the rights of nature related to environmental and climate harm caused by these unconventional oil and gas extraction techniques?***