

Fracking Our Future

Measuring Water
& Community Impacts

from Hydraulic Fracturing



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This report is a collaborative effort of Western Resources Advocates' Water and Lands programs. It was prepared by Laura Belanger, with invaluable input, editing, and advice from Mike Chiropolos, Bart Miller, Drew Beckwith, Jason Bane, Nicole Theerasantiankul, and Anita Schwartz. We are also grateful to Shane Davis of the Sierra Club for his thoughtful review.

This work was funded thanks to Western Resource Advocates' generous supporters.

Design by Jeremy Carlson

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Western Resource Advocates' mission is to protect the West's land, air, and water.

Our lawyers, scientists, and economists:

- 1) advance clean energy to reduce pollution and global climate change;
- 2) promote urban water conservation and river restoration; and
- 3) defend special public lands from energy development.

We collaborate with other conservation groups, hunters and fishermen, ranchers, American Indians, and others to ensure a sustainable future for the West.



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“Drilling and hydraulic fracturing are industrial operations that are not regulated by the federal government’s Clean Air or Clean Water Acts. We have found that these operations are impacting our ground and surface water with spills. We do not believe that these operations should be in such close proximity to our homes, schools, and playgrounds until more data is gathered to show if and how these practices can be conducted safely.”

– Wendy Leonard, co-founder of Erie Rising, pictured below with her children.





Executive Summary

We are entering a new era in oil and gas development in the West, and nowhere is that more evident than along the Front Range of Colorado. Increased drilling and production near communities and populated areas—much closer to population centers than in previous decades—are raising new questions about potential impacts to water supplies, air and water quality, noise levels, and property values. This report addresses one of the most important issues: that of water availability for new oil and gas development in Colorado. Specifically, it addresses the questions, “How much water is required for new production, and where will that water come from?”

Colorado is a semi-arid state with limited water resources that must be shared by a wide variety of water users. Western Resource Advocates (WRA)—along with communities, businesses, institutions, and citizens throughout the state—have concerns about water needs for oil and gas development and how that demand impacts our water resources. This report will inform elected officials, decision makers, communities, and families about oil and gas industry water needs and the potential impacts and tradeoffs that must be addressed. It provides specific recommendations that decision makers can use in creating policies to make sure that Colorado’s water resources are properly managed along with oil and gas development.

Key Findings

- We are in a new era of oil and natural gas development, in which drilling and hydraulic fracturing, or “fracking,” is increasingly occurring near highly populated areas and impacting more Coloradans than ever before. This creates new questions for industry, state, and local officials that must be answered as large-scale drilling intensifies in the Northern Front Range (in counties such as Weld, Boulder, Larimer, Broomfield, and Adams).
- Oil and gas development must be done in a deliberate and responsible manner that protects Colorado communities and the environment from the outset. Colorado cannot afford to continue developing new oil and gas wells without understanding the associated water needs in order to determine if the water is available or if we are over-allocating this resource.

Projected annual water needs for oil and gas drilling on the Front Range is enough to meet the residential water needs of the entire city of Lakewood (the fourth-largest in Colorado).



Photo: iStock

- The current volume of water required annually for new oil and natural gas well development in Colorado is enough to serve an estimated 44,200 to 79,000 Colorado households for an entire year. When reuse is considered, this increases to 66,400 to 118,400 homes or 166,000 to 296,100 people. On the low end, that's slightly more than the population of the city of Lakewood (Colorado's fourth-largest city). On the high end, that's similar to the entire population of either Douglas, Boulder, Larimer, or Weld counties.¹
- The volume of water needed to drill and hydraulically fracture ("frack") new wells each year is equivalent to the yield of a sizable water infrastructure project. For example, Denver Water's Gross Reservoir Expansion Project is designed to provide 18,000 acre-feet of water per year (or enough water for 54,000 households when reuse is included), approximately the amount of water the state of Colorado estimates is needed annually for fracking use.²
- Water demands for oil and gas development are significant compared to municipal use and local supplies. In Weld County, where more than 50% of all new Colorado wells were drilled in 2011, water used annually for drilling and fracking is estimated to equal one- to two-thirds of total public supply and domestic water use.
- Because so much new drilling is near populated areas, comparing water used for drilling and fracking to municipal use is a better yardstick than comparing it to agricultural use.
- Water used for fracking is 100% consumptive. Oil and gas wastewater is of such poor quality that it cannot be returned to streams. This differs from most other water uses, which create return flows that are used downstream and that benefit aquatic ecosystems along the way (this is the case for agricultural water use, for example).
- Colorado needs to plan and get it right *before* large-scale drilling continues unabated:
 - Colorado's oil and gas reserves are not going to disappear. If we do not plan and make informed, thoughtful choices now, we could find ourselves dealing with unintended consequences and difficult water use choices later.
 - More comprehensive and publicly available data on oil and gas water demands and water supplies are needed.

¹ These figures include water for residential use only.

² The state's estimate includes only water needed for hydraulic fracturing. It does not include water needed to drill new wells prior to fracking.

- Water resource planning must occur in advance of further development, to evaluate and balance oil and gas demands with municipal, environmental, agricultural, and other needs.
- Produced water, as well as drilling and fracking fluids, should be recycled as much as possible to minimize industry water needs.

Water Supply Recommendations

1. Improve data collection

The oil and gas industry should be required to submit well-specific data to the state, including the volume of water to be used for drilling and for hydraulic fracturing, recycled volume, and source and type of water supplies, among other data. Information should be made publicly available in a searchable format.³

2. Plan for oil and gas water needs

The state and impacted communities should undertake water resources planning to evaluate and plan for oil and gas development. Informed decisions—with input from the public and other stakeholders—should be made regarding the level of drilling that can be supported and which, if any, uses will be impacted as a result.



³ FracFocus (fracfocus.org), currently used to store some chemical and water use data, does not allow for data to be searched or downloaded.



Additional Safety Recommendations

1. Increase minimum residential setbacks from oil and gas facilities to protect public health. Colorado law currently requires oil and gas drilling operations to be only 350 feet away from residential areas or schools.
2. Increase riparian setbacks to protect streams, wildlife, and public water supplies.
3. Require comprehensive plans for development to identify and minimize adverse impacts to public health and the environment.
4. Adopt a mandatory statewide rule for baseline water quality testing, ongoing monitoring, and tracers to track the movement of chemicals and other fluids.
5. Implement Colorado State Review of Oil & Natural Gas Environmental Regulations (STRONGER) Report recommendations.
6. Prioritize energy efficiency and renewable energy in our state.

How Much Water Is Needed, Where Will It Come From?

Colorado is a semi-arid state with limited water resources that must be shared by a wide variety of water users. Recent increases in new oil and natural gas well development—much of which is in close proximity to populated areas—have raised questions and concerns about the volume of water that will be required and where it will come from.

Using available data and assuming development similar to present rates, we estimate the **water demand for new oil and gas development in Colorado will range from 22,100 to 39,500 acre-feet (AF)** annually, which captures some of the variability linked to the number of new wells;⁴ location, type, depth, and length of wells; re-fracturing (or re-completion) of existing wells; and other factors. Though recycling of fracking fluids and produced waters will likely decrease total water needs, data are not currently available to form a reliable estimate.

Our estimates are based on the following publicly available data:

- The state of Colorado recently released a report that looked at fracking water demands at the state level. The state's report projects 2015 fracking water demands of 18,700 AF.⁵ We estimate this increases to over 22,100 AF when water needed to drill wells is included.⁶ This is equivalent to the yearly water needs of about 44,200 families, and up to 66,400 families when reuse is included since up to half of the water used in households is returned into the system and can be used again.

Acre-Feet

One acre-foot (AF) is equal to 325,851 gallons (picture a football field—minus the end zones—covered in 1 foot of water). One AF is approximately the amount of water used by 2-4 families in a year. For the purposes of this report, we conservatively assume that 1 AF would meet the yearly needs of 2 families.

4 Annual well starts can vary widely. For example, in 2008, 2,053 new wells were drilled. The following year, 2009, well starts more than doubled to 4,419. Source: Colorado Oil and Gas Conservation Commission. 2012. "January 23, 2012 Staff Report." Accessed at <http://cogcc.state.co.us> on January 27, 2012.

5 Colorado Division of Water Resources, Colorado Water Conservation Board, and Colorado Oil and Gas Conservation Commission. 2012. *Water Sources and Demand for Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 through 2015*. http://cogcc.state.co.us/Library/Oil_and_Gas_Water_Sources_Fact_Sheet.pdf.

6 The state's estimates do not include water needed for drilling. Chesapeake Energy estimates it uses 300,000 gallons (0.92 AF) to drill each Niobrara well. Source: Chesapeake Energy, 2012. "Water Use in Niobrara Deep Shale Gas Exploration Fact Sheet." May 2012. http://www.chk.com/media/educational-library/fact-sheets/niobrara/niobrara_water_use_fact_sheet.pdf.

- A fact sheet by Chesapeake Energy about its Niobrara Formation⁷ gas operations states that, on average, each well in the Denver-Julesburg Basin requires 0.92 AF of water to drill and 12.3 AF to hydraulically fracture.⁸ Although water requirements vary by formation and well type, depth, and length, if the Chesapeake estimates are applied to the 2,992 new wells drilled in the state in 2011,⁹ that would result in an estimated statewide demand of 39,500 AF (or enough annual water for 79,000 families, or 118,400 when reuse is included).
- A fact sheet by the Colorado Oil and Gas Association (COGA) estimates that in 2012 up to 19,950 AF of water could be needed statewide for fracking.¹⁰ Our estimates show that this increases to around 22,250 AF when drilling is also included.¹¹

More comprehensive, consistent, and well-specific data collection is needed to enable the state and others to fine-tune water use estimates and better plan for oil and gas water needs.

“As we’ve seen in Colorado and in communities across the country, fracking is increasingly encroaching on homes and schools, and bringing with it serious health concerns.”

—Congressman Jared Polis (D-CO), calling on the Environmental Protection Agency to create new rules for fracking pollution, April 16, 2012.

⁷ In Colorado, the Niobrara Formation is located in the Denver-Julesburg (DJ) Basin in the northeast portion of the state. The Niobrara Formation and DJ Basin extend beyond Colorado’s boundaries.

⁸ Chesapeake Energy, 2012. “Water Use in Niobrara Deep Shale Gas Exploration Fact Sheet.” May 2012. http://www.chk.com/media/educational-library/fact-sheets/niobrara/niobrara_water_use_fact_sheet.pdf.

⁹ Colorado Oil and Gas Conservation Commission. 2012. “January 23, 2012 Staff Report.” Accessed at <http://cogcc.state.co.us> on January 27, 2012.

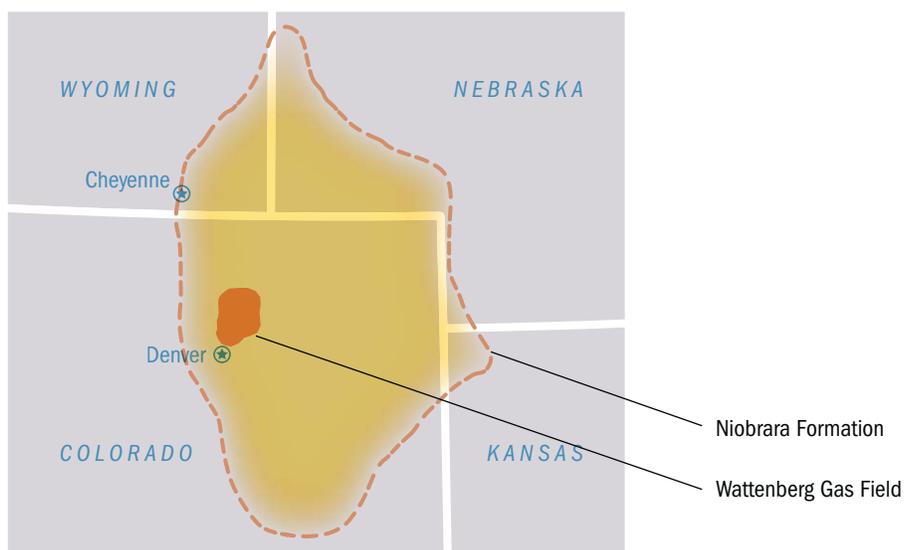
¹⁰ COGA calculations assume new 2,500 new wells in 2012. This estimate is likely low, based upon the 2011 drilling rate of 2,992 new wells. Source: Colorado Oil and Gas Association. 2011. “Water Use Fast Facts.” Accessed at http://www.coga.org/pdfs_facts/WaterUse_Fast_Fact.pdf on March 7, 2012.

¹¹ Using Chesapeake Energy drilling estimates. Source: Chesapeake Energy, 2012. “Water Use in Niobrara Deep Shale Gas Exploration Fact Sheet.” May 2012. http://www.chk.com/media/educational-library/fact-sheets/niobrara/niobrara_water_use_fact_sheet.pdf.



Figure 1. Niobrara Formation

In Colorado, the Niobrara Formation is located in the Denver-Julesburg (DJ) Basin in the northeast portion of the state. The Niobrara Formation and DJ Basin extend beyond Colorado's boundaries. The Wattenberg Field is one of the major natural gas deposits in the United States. It is where most of the wells in close proximity to the Front Range in Figure 3 are clustered.



Another recent study in Garfield County found that chemicals from the drilling and fracking processes pose a health risk, neurological or respiratory, to people living within a half-mile of a drilling site.

What is Fracking?

Advances in unconventional oil and gas extraction techniques are leading to the development of resources previously considered to be technically and economically unviable. Most new wells are hydraulically fractured or “fracked.” This is a technique that allows for oil and gas to be extracted from tight, or unconventional, formations where hydrocarbons are confined in the geologic formation and won’t flow to a traditional well. When a well is fracked, fluids are injected under high pressure into the formation surrounding the well, creating tiny fractures and opening pathways for oil and gas to flow to the well. Though fracking has been used in Colorado since the 1970s,¹ its use has recently accelerated. Furthermore, modern “horizontal fracking” (see diagram on following page) is a relatively new technology, leading to concerns about potential impacts on water supplies, air and water quality, noise levels, and property values.

As with any construction project above ground, everything does *not* always go as planned when wells are drilled and fracked thousands of feet below. A key concern is the potential for contaminants to enter groundwater as a result of problems with well casings² or fracking in deeper formations. The U.S. Environmental Protection Agency (EPA) is in the early stages of a comprehensive study to assess the safety level and environmental risks of modern fracking technologies. Final results and recommendations are expected in 2014.

In addition to water-related impacts, drilling and fracking also raise concerns about air quality. A recent study³ found that increases in Denver-Julesburg oil and gas well development are the most likely source of escalations in ozone-forming air pollutants and unusually high levels of hydrocarbon emissions along the Front Range. This only exacerbates an ongoing problem, because Colorado’s Front Range has not met EPA summer ozone pollution standards for several years (which results in summertime notices for the elderly, children, and people with health problems to remain indoors and refrain from exercising). Another recent study in Garfield County found that chemicals from the drilling and fracking processes pose a health risk, neurological or respiratory, to people living within a half-mile (2,640 feet) of a drilling site.⁴

1 Colorado Division of Water Resources, Colorado Water Conservation Board, and Colorado Oil and Gas Conservation Commission. 2012. *Water Sources and Demand for Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 through 2015*. http://cogcc.state.co.us/Library/Oil_and_Gas_Water_Sources_Fact_Sheet.pdf.

2 Well casing (metal tubes) and cementing of the sides of a newly drilled well strengthen the well and serve as a barrier to prevent fluids, oil, or gas from leaking out of the well.

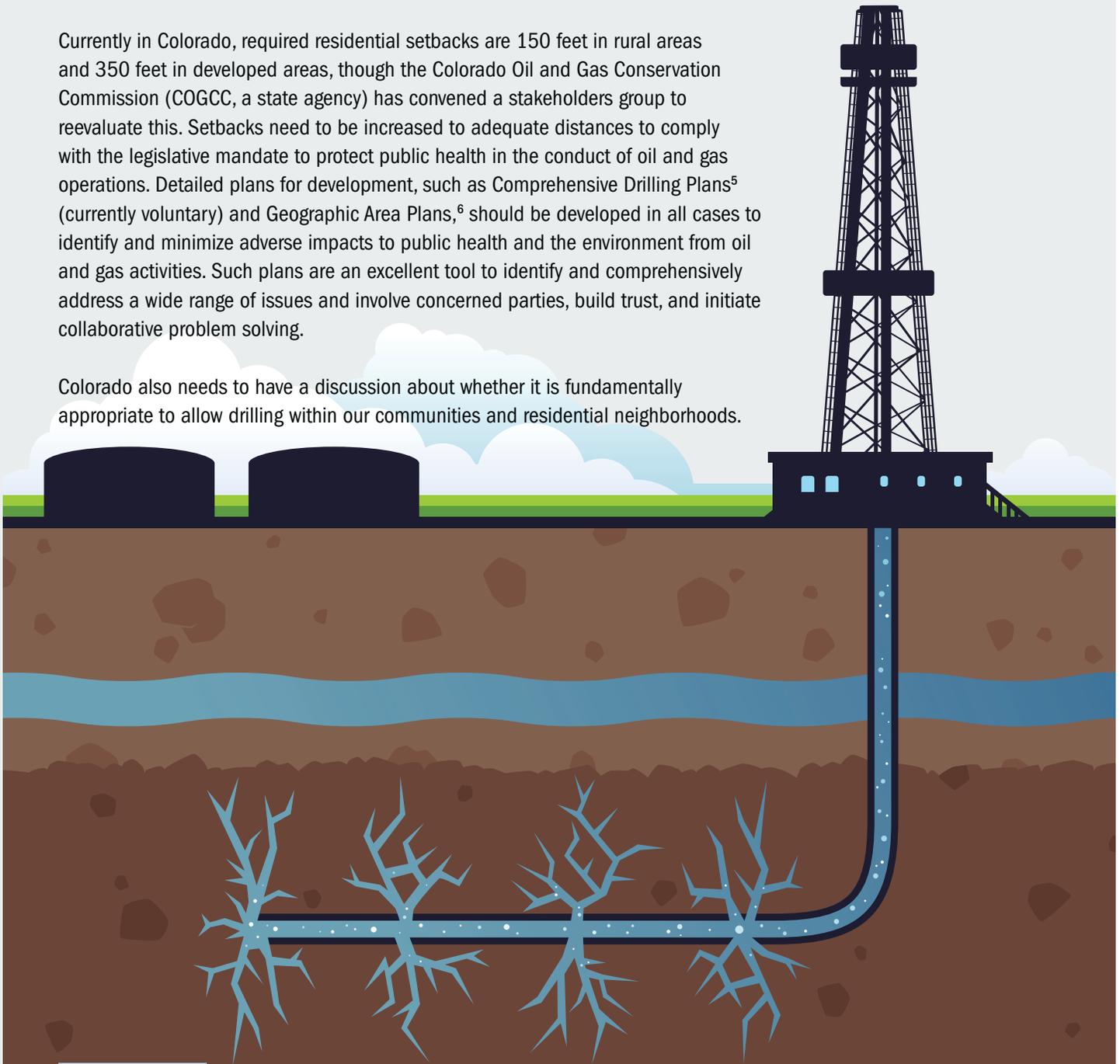
3 Pétron, G., et al. 2012. “Hydrocarbon Emissions Characterization in the Colorado Front Range: A Pilot Study.” *Journal of Geophysical Research* 117:D04304, doi:10.1029/2011JD016360.

4 McKenzie, L.M., Witter, R.Z., Newman, L.S., and Adgate, J.L. 2012. “Human Health Risk Assessment of Air Emissions From Development of Unconventional Natural Gas Resources.” *The Science of the Total Environment* May 1; 424:79–87, doi:10.1016/j.scitotenv.2012.02.018.

Keeping a Distance to Protect Public Health

Currently in Colorado, required residential setbacks are 150 feet in rural areas and 350 feet in developed areas, though the Colorado Oil and Gas Conservation Commission (COGCC, a state agency) has convened a stakeholders group to reevaluate this. Setbacks need to be increased to adequate distances to comply with the legislative mandate to protect public health in the conduct of oil and gas operations. Detailed plans for development, such as Comprehensive Drilling Plans⁵ (currently voluntary) and Geographic Area Plans,⁶ should be developed in all cases to identify and minimize adverse impacts to public health and the environment from oil and gas activities. Such plans are an excellent tool to identify and comprehensively address a wide range of issues and involve concerned parties, build trust, and initiate collaborative problem solving.

Colorado also needs to have a discussion about whether it is fundamentally appropriate to allow drilling within our communities and residential neighborhoods.



⁵ Per COGCC Rule 216, "Comprehensive Drilling Plans are intended to identify foreseeable oil and gas activities in a defined geographic area, facilitate discussions about potential impacts, and identify measures to minimize adverse impacts to public health, safety, welfare, and the environment, including wildlife resources, from such activities. An operator's decisions to initiate and enter into a Comprehensive Drilling Plan are voluntary."

⁶ Per COGCC Rule 513, "Geographic Area Plans shall cover an entire oil and gas field or geologic basin, likely encompassing the activities of multiple operators, in multiple sub-basins or drainages, over a period of ten (10) years or more."

Figure 2. Frack Water is Lost Water

When you take a shower or flush a toilet, most of that water returns to the system and is eventually reused in one form or another. But water used for fracking is too polluted to be reused and must be permanently disposed of, typically in special underground wells.





Water Used for Fracking Is Fully Consumed

Unlike municipal, agricultural, and most other water uses, 100% of water used for drilling and fracking is fully consumed. Although fracking water may be recycled and reused for other wells, because of its poor quality, it is consumed or disposed of entirely rather than being returned to area streams.

To put this in perspective, each year the average home uses about half of its water indoors and half outdoors. Roughly 90–95% of water used indoors returns to a wastewater treatment plant and is ultimately released to streams or reused. A portion of water used for outdoor irrigation also returns to area streams (an estimated 17% in the South Platte Basin, for example),¹² although this occurs more slowly (Figure 2). Agricultural uses also have return flows. The United States Geological Survey (USGS) estimates that 45% of the water used in Colorado for agriculture returns to rivers.¹³

These return flows benefit aquatic and riparian ecosystems and are relied upon by downstream water users, providing multiple benefits from the same water.

In contrast, water used to develop new oil and gas wells does not provide the same reuse benefits. A portion of fluids injected during drilling and fracking never returns to the surface. Fluids that do resurface may be recycled to drill and frack other wells but, due to poor quality, are ultimately either injected underground into deep waste disposal wells, evaporated in waste pits, or disposed of in another way. As a result, there are no return flows available for other uses, greatly intensifying the impacts of oil and gas industry water use.

¹² “SPDSS [South Platte Decision Support System] Final Memorandum, Task 66.2 – Collect and Develop Municipal and Industrial Consumptive Use Estimates,” November 14, 2007, ftp://dwrftp.state.co.us/cdss/csu/tm/SPDSSTask66_2_20071114.pdf.

¹³ Ivahnenko, Tamara, and Flynn, J.L. 2010. *Estimated Withdrawals and Use of Water in Colorado, 2005*. U.S. Geological Survey Scientific Investigations Report 2010–5002. Prepared in cooperation with the Colorado Water Conservation Board. <http://pubs.usgs.gov/sir/2010/5002/pdf/SIR10-5002.pdf>.

Water Quality Impacts

Families and water providers are very concerned with protecting water quality—as well as quantity—in their communities. Drilling and fracking have the potential to impact water quality as a result of groundwater contamination from faulty well casings; polluted storm water runoff; surface spills (at the well pad or from pipelines or trucks); leaking pits; erosion and sedimentation caused by truck traffic; and improper waste disposal. Questions also remain regarding the potential for fracking of deep formations to unintentionally contaminate groundwater.

In 2011, the COGCC volunteered to have Colorado's hydraulic fracturing regulations reviewed by a collaborative group consisting of representatives from environmental, industry, and governmental organizations known as STRONGER (State Review of Oil & Natural Gas Environmental Regulations). The STRONGER Report¹ had several recommendations related to water quality and potential contamination:

- **Minimum surface casing depths**—More work is needed to ensure that this “critical” component of Colorado's regulations is “adequate to protect fresh water aquifers.” Casing depth refers to the extent of the pipe and casing inserted into the ground during drilling.²
- **Maximum surface casing depth**—Colorado currently lacks a standard for the maximum depth of surface casings. Establishing such a standard may be necessary in order to prevent well control or cementing problems.
- **Well completion reports**—There appear to be major gaps in reporting requirements that are essential to determining whether any problems with fracking

might threaten groundwater. The COGCC should revise completion report requirements “to include the identification of materials used, aggregate volumes of fracturing fluids and proppant used, and fracture pressures recorded.” All reports from oil and gas drilling operations should be uniform and include comprehensive data.

- **Evaluation of naturally occurring radioactive materials (NORM)**—The COGCC should evaluate NORM in wastes associated with hydraulic fracturing operations. A study should be completed to gather information on the occurrence and level of NORM to enable the state to develop an appropriate regulation program.³

Additional water-quality protections are needed in Colorado as oil and gas drilling expands closer and closer to residential neighborhoods and schools. Building on Colorado's comprehensive 2008 oil and gas rulemaking and the 2011 fracking disclosure rule—both approved by unanimous votes of the COGCC—WRA also recommends:

- A mandatory statewide rule providing for baseline water quality testing in advance of drilling.
- Ongoing monitoring during drilling operations, and tracers to track the movement of chemicals and other fluids employed in the process of hydraulic fracturing.
- Increasing riparian setbacks to protect public water supplies, streams, and wildlife.

1 State Review of Oil and Natural Gas Environmental Regulations, Inc. 2011. *Colorado Hydraulic Fracturing State Review*. October 2011. <http://www.strongerinc.org/documents/Colorado%20HF%20Review%202011.pdf>.

2 The minimum and maximum depth of surface casings is important to ensure that there is no potential for leakage from the well into any groundwater present in the area.

3 NORM is a term generally used for when human activity, such as oil and gas drilling, has increased the potential for exposure to radioactive materials.

Water Demands Are Significant and Require Planning

The amount of water needed to drill and frack new wells each year is significant: 22,100 to 39,500 AF. **This is enough water to serve an estimated 44,200 to 79,000 Colorado households for an entire year.**¹⁴ **When reuse of return flows is included, this increases to enough water for 66,400 to 118,400 families (or a maximum of 296,100 people).**¹⁵ **If new well development rates escalate, water needs could be even greater.**

Oil and gas industry water demands are so substantial that they are equal to the projected yield of several proposed water projects designed to meet municipal and industrial (M&I) demands, including:

- Northern Integrated Supply Project—yield of 40,000 AF. This plan by the Northern Colorado Water Conservancy District would build a \$490 million water supply project of reservoirs and pipelines for northeastern Colorado.
- Windy Gap Firming Project—yield of 33,000 AF. This project would divert water from the Colorado River into a new reservoir to provide more water for northeastern Colorado.
- Moffat Collection System Project (Gross Reservoir Expansion)—yield of 18,000 AF. This project proposes to increase Denver Water’s supply by expanding Gross Reservoir.

Roughly 85.5% of water used each year in Colorado is for agricultural purposes, and 7.4% is for M&I purposes¹⁶—but M&I use is increasing and straining supplies. As a result, state and municipal water providers spend significant time and money evaluating and planning for M&I water needs and potential supply projects.

¹⁴ Based on a range of 22,100 AF to 39,500 AF and assuming annual household use equals 0.50 AF.

¹⁵ Number of people calculated using U.S. Census data, which shows an average of 2.5 people per home in Colorado in 2006–2010. Source: U.S. Census Bureau. 2012. “State & County Quickfacts.” Last modified January 17, 2012. <http://quickfacts.census.gov/qfd/states/08000.html>.

¹⁶ Colorado Division of Water Resources, Colorado Water Conservation Board, and Colorado Oil and Gas Conservation Commission. 2012. *Water Sources and Demand for Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 through 2015*. http://cogcc.state.co.us/Library/Oil_and_Gas_Water_Sources_Fact_Sheet.pdf.

Oil and gas industry publications tend to discuss water needs by comparing them to agricultural uses, which makes their percentage use appear much smaller. But because much of the new oil and gas drilling on the Front Range is tied to municipal water supplies and is occurring in and around populated areas, water use comparisons should be made with municipal uses—not agricultural uses.

Just as they would for municipal planning, the state and impacted communities should undertake a water resources planning initiative to evaluate and plan for oil and gas development. Informed decisions—with input from the public and other stakeholders—should be made regarding what level of drilling can be supported and what other uses will be impacted as a result.



Active well pads in Erie, Colo. State law in Colorado requires only a 350-foot minimum setback in residential areas.

Local Impacts

Oil and gas development must be evaluated not only at the state level, as Colorado has done, but also at the local level, where impacts are most direct. In 2011, the majority of new wells (82%) were concentrated in two counties, Weld and Garfield.¹⁷ In Weld County and other Front Range communities, there is increased potential for competition between municipal and oil and gas water needs (Figure 3). The Colorado Oil and Gas Association (COGA) notes, “The Niobrara formation is still a relatively new play in the exploration phase.”¹⁸ As this formation in northeastern Colorado is explored and defined, it is likely that local communities—many of which already have stressed domestic water supplies—will be faced with ever-increasing demands for water as they compete with oil and gas needs.

As an illustration of local impacts, utilizing water use data from the state, COGA, and Chesapeake Energy, WRA estimates that 2011 drilling and fracking water use in Weld County was between 9,600 and 20,900 AF. According to the USGS, in 2005 (the last year for which data are available) total public supply and domestic (self-supplied) water use in Weld County was 30,200 AF.¹⁹ That means that **water used for new oil and gas well development in 2011 was equal to one- to two-thirds of Weld County public and domestic water use.** That’s enough water to serve an estimated 19,200 to 41,900 Weld County families—28,800 to 62,800 families when reuse is included. This is several times more water than every town in Weld County uses annually, with the exception of Greeley (Figure 4). If oil and gas drilling needs this much water, where will it come from and how will it impact both existing residents and future residential and business development? How will water supplies be allocated in drought years?

If oil and gas drilling needs this much water, where will it come from and how will it impact both existing residents and future residential and business development?

¹⁷ 53% of 2011 new well starts were in Weld County and 28.5% were in Garfield County. Source: Colorado Oil and Gas Conservation Commission. 2012. “January 23, 2012 Staff Report.” Accessed at <http://cogcc.state.co.us> on January 27, 2012.

¹⁸ Colorado Oil and Gas Association. 2011. “Niobrara Fast Facts.” Last modified June 14, 2011. http://www.coga.org/pdfs_facts/Niobrara_fastfacts.pdf.

¹⁹ Ivahnenko, Tamara, and Flynn, J.L. 2010. *Estimated Withdrawals and Use of Water in Colorado, 2005*. U.S. Geological Survey Scientific Investigations Report 2010-5002. Prepared in cooperation with the Colorado Water Conservation Board. <http://pubs.usgs.gov/sir/2010/5002/pdf/SIR10-5002.pdf>.

Figure 3. Denver-Julesburg Basin Oil and Gas Facilities

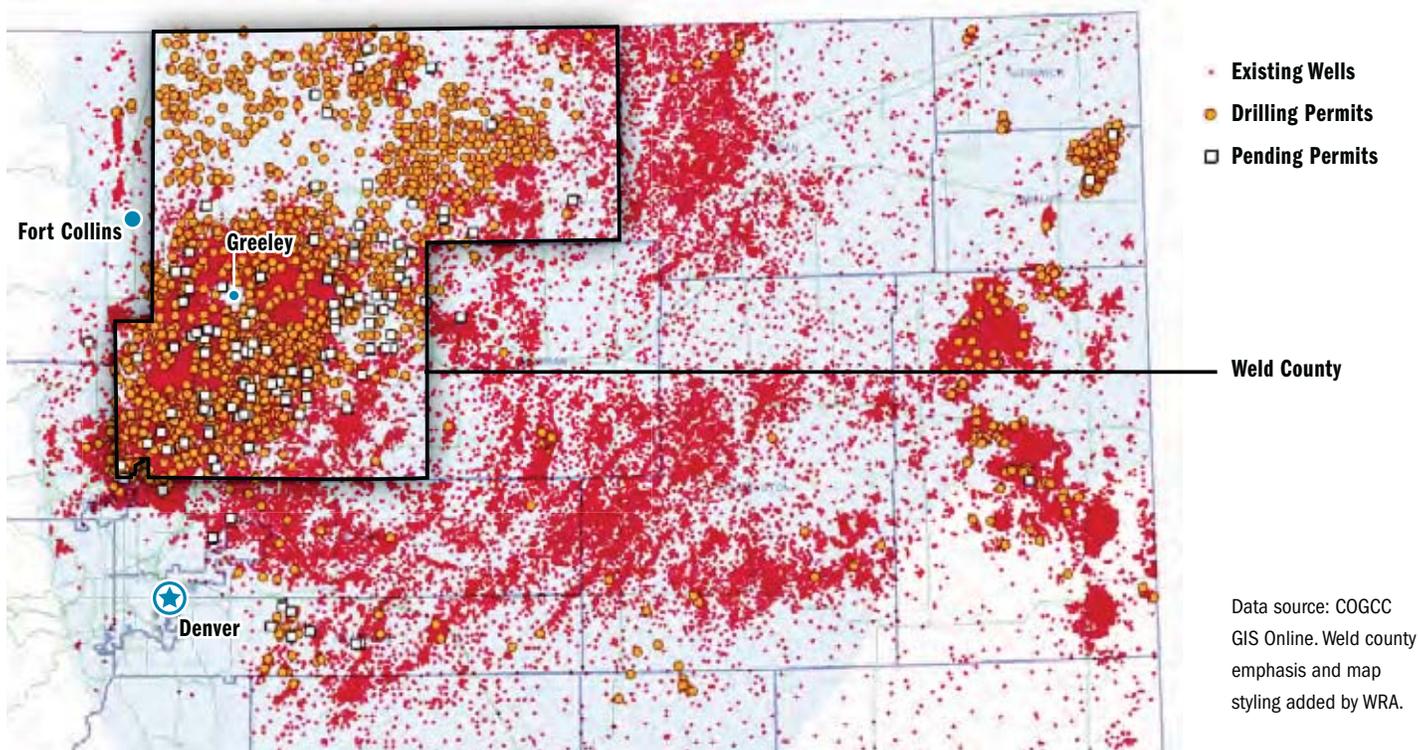
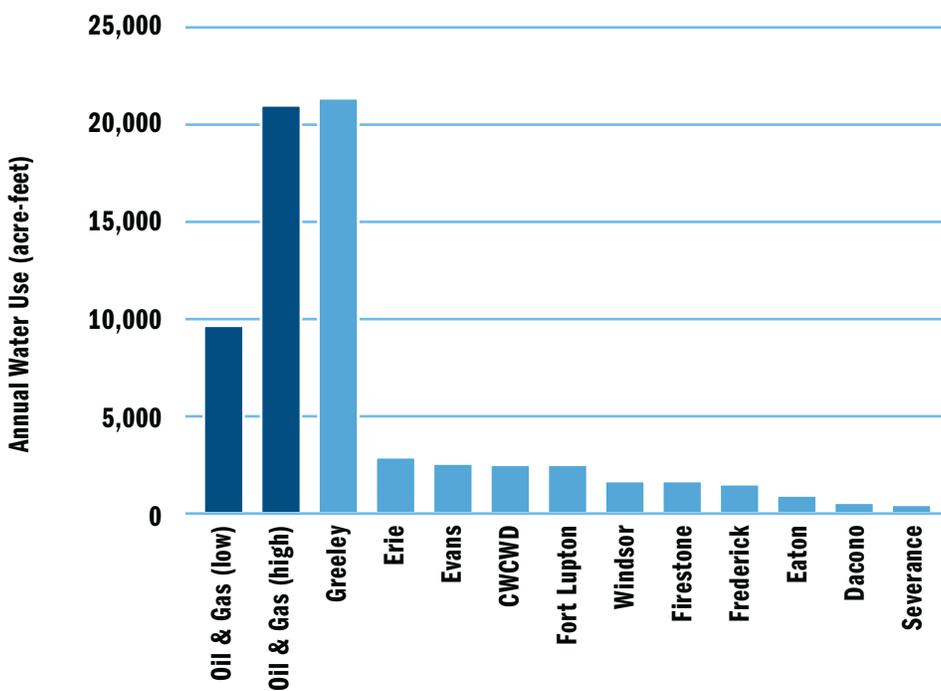


Figure 4. Water Use in Weld County (Oil and Gas and M&I)



2011 Oil and Gas water use estimates as compared to example towns' and water providers' 2009 use. Note that 2009 was a wet year, resulting in somewhat lower than average water use for most providers.

Data sources: Greeley, personal communication on March 29, 2012; "Water Supplies & Demands for Participants in the Northern Integrated Supply Project," Harvey Economics, 2011.

Your Water Is Driving Away

The Bureau of Land Management's Roan Plateau Resource Management Plan Amendment and Environmental Impact Statement estimates that 1,160 truck visits are required to develop each well.

A tremendous number of truck trips are required to deliver water, chemicals, and equipment to each fracked well, though estimates of these numbers vary and are likely to be site-specific. A recent report completed for Douglas County¹ estimates that for one well pad with six wells,² 11,040 loaded truck trips (and an equal number of return trips) over 265 days will be required to drill and complete the wells. Of those trips, 6,000 are to haul fracking water and 3,000 are for wastewater disposal. The U.S. Bureau of Land Management's Roan Plateau Resource Management Plan Amendment and Environmental Impact Statement estimates that 1,160 truck visits are required to develop each well.³

Recycling, water pipelines, and other well-specific details may decrease water demands, but vehicle trips are still necessary to haul equipment, chemicals, and other materials and to dispose of waste. Impacts include traffic congestion, emissions, noise, dust, erosion, and damage to roads and adjacent areas, which may include streams and riparian zones.



Truck convoy on I-79 near Washington, Pa. Photo courtesy of Bob Donnan.

- 1 Felsburg Holt & Ullevig and BBC Research & Consulting. 2012. *Douglas County Oil & Gas Production Transportation Impact Study*. Prepared for Douglas County, Colo. January 24, 2012.
- 2 Advances in directional drilling and other technologies now allow for multiple wells being drilled from the same well pad, which decreases the footprint of surface disturbances. Source: Colorado Oil and Gas Conservation Commission. 2012. "January 23, 2012 Staff Report." Accessed at <http://cogcc.state.co.us> on January 27, 2012.
- 3 U.S. Bureau of Land Management, Glenwood Springs Field Office. 2006. *Final Roan Plateau Planning Area (Including Naval Oil Shale Reserves Numbers 1 & 3) Resource Management Plan Amendment and Environmental Impact Statement*. August 2006. <http://www.oilandgasbmps.org/docs/C032-RoanPlateauRMPandEISVolumel.pdf>.



Plan for It Now — and Get It Right

Western Resource Advocates commends the state of Colorado for having some of the most comprehensive oil and gas regulations in the nation, and for recently passing new regulations regarding disclosure of chemicals used in fracking that are a model for other states. We recognize the need for new energy supplies but are mindful of the resource costs.

Colorado is fortunate to have an abundance of natural resources, including oil and gas reserves, as well as solar, wind, and geothermal energy potential. Just as important, however, are Colorado's world-class environmental resources that create billions of dollars in revenue through tourism and recreation activities: rushing rivers, trout-filled streams, snowy mountains, dense forests, and rolling plains. These need to be protected if Colorado is to maintain its high quality of life and the attractiveness of the state to a wide range of businesses, for both current and future generations.

Some communities are already looking ahead to the potential water conflicts stemming from oil and gas development. In May 2012, the town of Windsor passed two ordinances relating to water and drilling. One ordinance limits monthly bulk water purchases, and a second raises the cost of water by 50% for large water users.

Kelly Arnold, Windsor's town manager, has called selling water for fracking a "phenomenon" and acknowledges that such sales, while providing revenue for the town, are raising questions. "Do we want to limit sales of water to this industry? I would define it as an emerging issue."¹

Water availability is a particularly pressing issue in periods of drought, bringing new urgency to these questions: How will water shortages be allocated? Will water providers ask customers to decrease their use while continuing to sell water to oil and gas companies at a higher rate? Or will the industry find itself struggling to access water in these years?

Collaborative planning now, rather than allowing oil and gas development to proceed without the involvement of impacted communities, will increase our ability to get it right.

¹ "For Sale: Excess Municipal Water." *The Coloradoan*, March 10, 2012. Accessed at <http://www.coloradoan.com/article/20120311/NEWS01/120310012/For-sale-Municipal-water-rights?odyssey=tab|topnews|text|FRONTPAGE> on March 13, 2012.



Recommendations

In order to ensure that the impacts of oil and gas development on our water supplies are understood and that we carefully decide how to allocate our resources, WRA has developed the following recommendations.

Water Supply Recommendations

1. Improve data collection

Data regarding water used to develop new oil and gas wells is limited. Similar to the requirements in Colorado House Bill 10-1051, which standardizes and centralizes water conservation data from municipal water utilities, water use data for each well should be submitted to the state by the oil and gas industry and made publicly available. This includes information on the volume of water used for drilling (including well type and depth/length), hydraulic fracturing, well recompletion, and other measureable uses. Recycling and use of produced waters should occur to the maximum extent feasible and water data should be broken down so that these volumes can be quantified. The water supply (source) and type should also be identified. If water is leased, information regarding the lessor should be provided. Information should be provided regarding the volume and fate of waste fluids. Importantly, all of this data should be made available in a standard format that enables the user to search, select, and download data sets, as this is essential to evaluating water use.²⁰

2. Plan for oil and gas water needs

Similar to municipal planning, water resources planning should be undertaken by state and impacted communities to evaluate and plan for oil and gas development. Informed decisions—with input from the public and other stakeholders—should be made regarding the level of drilling that can be supported and which uses will be impacted as a result. Local communities

²⁰FracFocus (fracfocus.org), currently used to store some chemical and water use data, does not allow for data to be searched or downloaded.



should have input regarding the type and amount of development, including oil and gas development, that occurs within and adjacent to their boundaries.

Additional Safety Recommendations

1. Increase minimum residential setbacks from oil and gas facilities to protect public health. Colorado law currently requires oil and gas drilling operations to be only 350 feet away from residential areas or schools.
2. Increase riparian setbacks to protect streams, wildlife, and public water supplies.
3. Require comprehensive plans for development to identify and minimize adverse impacts to public health and the environment.
4. Adopt a mandatory statewide rule for baseline water quality testing, ongoing monitoring, and tracers to track the movement of chemicals and other fluids.
5. Implement Colorado State Review of Oil & Natural Gas Environmental Regulations (STRONGER) Report recommendations.
6. Prioritize energy efficiency and renewable energy in our state.







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