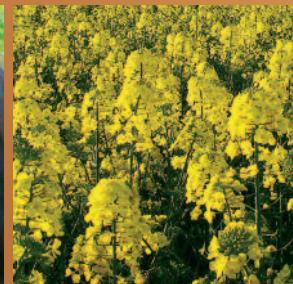
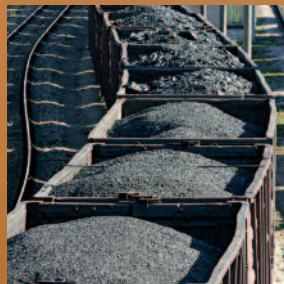
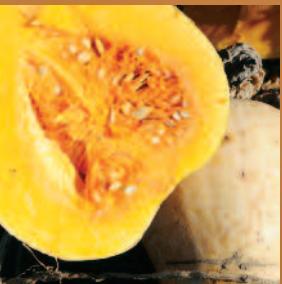


THE DNRC ECONOMY



A REPORT FOR MONTANA **2014**

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

Credits

Design and Layout: Luke Duran, Element L Design

Infographics, pages 18-19, 30-31: Lee Huber, Cinch Design

Photographs: Billings Gazette, Brenda Ahearn, Lisa Hensley, Walter Hinick, Larry Mayer, Mark Nanke, Craig Roberts

Lead writer / project manager: John Grassy

Writer / economic analysis: Jordan Larson

Thanks to the many people interviewed for sharing their time, expertise and enthusiasm for DNRC. Thanks to DNRC staff for contributing story ideas and contact persons, providing important data and timely reviews.

Printing and Distribution Notice

2,000 copies of this public document were produced at a cost of \$4.91 per copy, which includes \$4,697.00 for printing and distribution.

FOREWORD

FROM ITS VERY FOUNDING AS A TERRITORY in the 1860's, Montanans have recognized the important role that natural resources have played in our state and our economy. From our founding, when Montanans chose the phrase *Oro y Plata* (Gold and Silver) as our state's official motto, through the next 150 years, the natural resources industry has supplied jobs to Montanans and provided economic security to our communities.

Over the last 150 years a lot has changed in Montana. *Oro y Plata* have been replaced by a more diverse portfolio of natural resources, including oil, coal, timber, water and biomass. While we've seen a lot of changes, our commitment to using our resources responsibly, while protecting the untarnished beauty of Montana, remains as strong as ever.

For more than 40 years, the Montana Department of Natural Resources & Conservation (DNRC) has played an important role in supporting our natural resource industries, while ensuring the beauty of our state is passed down to the next generation. However, the work of DNRC goes well beyond the responsible management of our natural resources. DNRC programs and projects sustain thousands of jobs in these marketplaces through contracting, grants, loans and other business activities.

It's estimated that DNRC encourages private sector spending by a ratio of up to 3:1. This means that for every dollar DNRC invests in projects and programs, there is potential for three more dollars to be moving through regional economies.

The investments made by DNRC go to support projects to assist Montana's agricultural economy, grants for new and innovative wood products businesses, low-interest loans for water and sewer infrastructure improvements, fire suppression efforts and the responsible management of Montana's 5.2 million acres of school trust lands. These are investments not only in jobs today, but also in Montana's economic strength for decades to come.

Through the DNRC Economy you won't see the standard government report. Instead of pie charts, bar graphs and references to authorizing statutes, you'll see the real life impacts that the work of DNRC has on the lives of all Montanans. You'll see the stories of the business owners, farmers, ranchers, and local officials who work in partnership with DNRC. You'll learn about what they do, their challenges, and how DNRC makes a difference for their business or community.

Thank you for taking the time to learn more about the economic impact that DNRC has on Montana communities.

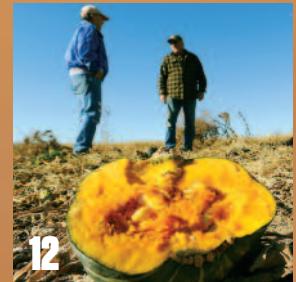


GOVERNOR STEVE BULLOCK



THE ECONOMY

In Search of a Bigger Boom Grant funds study of new oil recovery methods.....	2
The Underground Economy With SRF loans, towns large and small modernize infrastructure.....	8
Just Add Water Irrigation powers a \$22 million economy on the Tongue River.....	12
Fishing Econ 101 Montana's recreational fishing economy.....	18
When Minutes Count Initial Attack and the economics of fire suppression.....	20
Montana's Land Enterprise The legacy of the state trust endowment.....	26
The DNRC Economy DNRC works at the center of the public's vision for life, land and conservation.....	29
Cold Storage When summer heats up, Painted Rocks Reservoir plays a vital role to the Bitterroot fishery.....	32
Gauging Success Expertise and dedication drive water permitting.....	36
When the Levee Broke After record floods in 2011, DNRC helped communities rebuild.....	40
Boards and Biomass Grants grow innovation in a forest economy.....	44
A Blueprint for Change Water compact will bring new economic life to the Crow Indian Tribe.....	52



IN SEARCH OF A BIGGER BOOM

Grant funds study of new oil recovery methods

Conventional horizontal drilling and production methods in Montana's Bakken Oil Field extract 9 to 15 percent of available oil. The remainder—which is to say the great majority—is never touched. The Montana DNRC, through the Montana Board of Oil and Gas Conservation (BOGC), is funding research that could alter the recovery equation and take oil production to a new level.

In 2011, three members of the Montana Tech Petroleum Engineering Department approached the Montana Board of Oil and Gas Conservation with a proposal to conduct a feasibility study of "Enhanced Oil Recovery" options for the Elm Coulee oil field in Eastern Montana.

Tom Richmond, recently retired as administrator of the BOGC, says board members understood the project could provide valuable data and analysis for private-sector companies, helping them make informed decisions about whether enhanced recovery was a viable option, and how to go about it.

"Enhanced oil recovery is an important step in the ongoing development of Montana's oil and gas resources," Richmond says. "We have several oil fields with good potential for new technologies to extract more oil."

Burt Todd, assistant professor of petroleum engineering and one of the Tech researchers, says "Even a small increase in recovery would translate into a substantial production increase. If we find there's an economically viable method for adding five percent, that's significant."

The BOGC approved a grant of \$863,905 for the five-year project.

Enhanced oil recovery efforts in other areas of the U.S. have been successful. But each oil field has its own unique geology, and what works in Texas doesn't necessarily work in Montana. "The Bakken is what geologists call a low

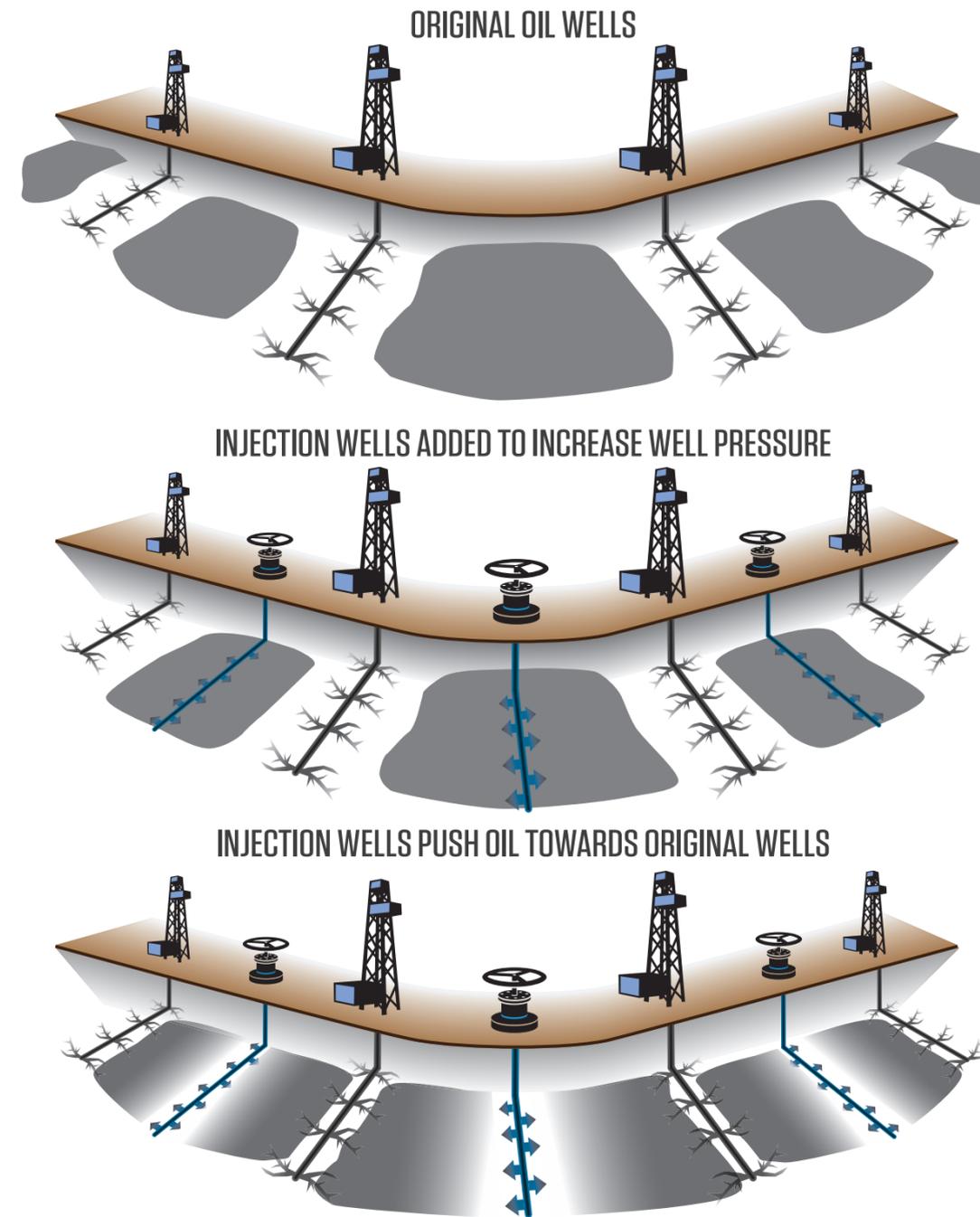
permeability formation," says Dr. Leo Heath, head of Tech's petroleum engineering program. "The challenge—our goal—is getting oil to flow out of its unconventional shale."

After eighteen months of data acquisition, computer modeling and analysis, the researchers have identified a six-square-mile area of the Elm Coulee oil field with the right geology for their pilot project. Elm Coulee in 2012 produced just over ten million barrels of oil, or about 38 percent of all oil production in Montana.

There they will drill a series of "injection wells" in close proximity to existing oil wells that are no longer producing. In its undisturbed state, oil exists under pressure. The drilling and fracturing of a new well releases that pressure, a bit like unscrewing the cap on a soda bottle. As production continues, the natural pressure dissipates and oil recovery slows, until it reaches a point where it's no longer economically viable to continue. By most estimates, that process takes 20 to 40 years.

"The challenge—our goal—is getting oil to flow out of its unconventional shale."

—Dr. Leo Heath



**A BIGGER BOOM
BY THE NUMBERS:**

UP TO 45,000
Potential Oil & Gas industry jobs already in Montana Today

3X
Oil & Gas production returns up to 3 times its economic value

UP TO 20
20 jobs created per \$1 Million spent in oil production

\$35
National average wage for oil & gas production jobs

“It would look very different than the boom we’re seeing now. The workforce and communities would be more stable—long-term blue-collar and engineering jobs with much more emphasis on technical abilities.” —Burt Todd



Above: Montana Tech Petroleum Engineering Department faculty discuss enhance oil recovery. Left to right: Burt Todd, Dr. Leo Heath, John Evans, David Reichhardt. Photo by Walter Hinick

The enhanced recovery concept involves restoring underground pressure in and around depleted wells to the level that existed when the wells were first drilled. They will inject gas—either carbon dioxide or natural gas—into the surrounding shale in hopes of getting the unrecovered oil to move.

So is it going to work? It’s already been demonstrated that injection technology can cause oil to migrate and pool; the unknown for Montana is whether it can be done in a way that’s economically feasible. This is the cornerstone of the pilot project. Heath says the work they do will culminate in a detailed cost-benefit analysis, which they’ll make available to the private sector.



“Enhanced oil recovery is an evolving field, and we’re only dealing with the technical side of it,” he says. “What happens with the price of oil? What happens with the price of natural gas, which is very low right now? What happens if

government decides to give preferential tax treatment to companies doing enhanced recovery? Any of these factors could sway the economics one way or the other.”

Todd notes that the jobs and economic impacts of enhanced oil recovery would be significant.

“It would look very different than the boom we’re seeing now. Companies would be here for the long term. It would be a slower, more measured output. The workforce and communities would be more stable—long-term blue-collar and engineering jobs with much more emphasis on technical abilities.”

With 85 to 90 percent of Bakken oil just sitting there, it makes sense to investigate. 



Left: Enhanced oil recovery works by drilling a series of injection wells in close proximity to existing oil wells that are no longer producing.

Above: Horizontal drilling rig in the Elm Coulee oil field, Richland County. Photo by Don Thompson

THE UNDERGROUND ECONOMY

With SRF loans, towns large and small modernize infrastructure

People rarely talk about drinking water and wastewater treatment systems; faucets run and toilets flush with absent-minded consistency. A highway improvement project, a new interchange—infrastructure like this gets the occasional headline. But the other stuff? Drinking water and wastewater treatment systems are buried underground and hidden on the edge of town.

They are a feat of engineering and technology, a cornerstone of modern civilization, but in reality they're invisible.

Until something breaks. Or wears out. Or when a community experiences rapid growth.

When one of the above happens, people notice something right away: fixing a drinking water or wastewater treatment system is expensive. And when one or both systems need to be modernized or expanded, there's no getting around it. Homes, businesses, schools—without this kind of infrastructure, everything comes to a halt.

The Montana Legislature established two State Revolving Fund (SRF) Loan Programs—one for wastewater and the other for drinking water projects. Both programs provide at- or below-market interest rate loans to eligible Montana communities. They are funded with capitalization grants from the U.S. Environmental Protection Agency and are matched by 20 percent with state-issued general obligation bonds. When communities borrow from the fund, their payments “revolve” to finance loans for future projects.

The program is administered jointly by DNRC and the Montana Department of Environmental Quality (DEQ). The DEQ oversees the technical aspects of each water or sewer project. DNRC issues the general obligation bonds and administers the loans.

The SRF program delivers economic benefits in several ways. Communities that face expensive upgrades get the cheapest possible financing, mitigating impacts to ratepayers. Contracts for improvement projects generate hundreds of jobs for Montana-based engineering and construction firms every year. Substandard wastewater treatment systems can negatively impact valuable natural resources, including soils, groundwater and surface water; protecting these resources maintains their productivity for other services, and avoids costly remediation efforts if they're impaired. Finally, a city or town with sufficient water and sewer capacity is equipped to attract new growth and development, which means new jobs and economic opportunities on Main Street.

Tom Jentz and his colleagues saw it coming: Kalispell was going to grow—and grow—and grow. Jentz, Planning and Building Director for the City of Kalispell, was hard at work beginning in the late 1990s along with the Parks and Public Works departments, developing plans for city parks, stormwater systems, and water and sewer infrastructure.

“We weren't reacting. We were anticipating,” he says.

Between 2000 and 2009, Kalispell grew at a rate of 42.5 percent, according to Census figures

cited by Flathead County. To keep pace, the city invested heavily in its water and sewer infrastructure, obtaining five SRF loans worth \$19.4 million. The loans financed four new wells to supply drinking water and a 2-million-gallon water storage tank, along with upgrades to the sewage treatment plant, which boosted its daily processing capacity from 3 million gallons to 5.2 million gallons.

“We were actually building capacity to accommodate future growth,” says Jentz. “We were able to absorb the boom.”

With a short pause for the Great Recession, Kalispell’s growth has continued. The city added 120 new homes in 2013. Cabela’s opened a store in November; by next year there will be eight more businesses in the same area, 150,000 square feet of retail space and more new jobs. The investment in water and sewer infrastructure pays dividends every time a developer walks into Jentz’s office.

“Economic development is very time-sensitive.

“We were actually building capacity to accommodate future growth. We were able to absorb the boom.” —Tom Jentz



Above: Aerial view of the Kalispell Wastewater Treatment Plant

If we can’t accommodate a developer, he’ll go someplace else,” says Jentz. “The last thing you want to do is bring a developer into your office, and he’s talking about a new commercial development that’ll generate 150 jobs, or a new subdivision, and you have to tell him, ‘we just don’t have the capacity to serve you.’ They want it now, and if you don’t have it, they won’t come again.”

Having water and sewer service in place “adds tremendous predictability. We have hard facts. We can tell a new business what lines they can hook up to, what the costs will be, what the user rates are. Businesses don’t want to get involved in the logistics of new infrastructure.”

In 1992, Kalispell’s wastewater treatment system ranked among the most technologically-advanced in the U.S., and went on to win EPA and Flathead Basin awards for exceeding the most stringent discharge limits. The upgrades financed in 2007 maintained those high standards. At the time of discharge, Kalispell’s treated wastewater is just short of drinking water quality.

In 2013, the city needed to fix a problem with the treatment system and came back to DNRC for financing. In addition to authorizing a \$1.3 million SRF loan for the project, DNRC was able to refinance the city’s five previous loans at a lower interest rate, providing \$2.3 million in debt forgiveness.

Jentz says the city’s stringent water-treatment standards reflect community values.

“Clean water is paramount for us. It’s a community image, a marketing image, but also an environmental reality. We discharge into watersheds with very high water quality. We have a responsibility there.”

SRF LOANS AUTHORIZED IN FY 2013:

	\$27.1M	Drinking Water Projects
	\$34.1M	Wastewater Projects

In Fairfield, (population 718), 2004 was a year to remember. Mayor Lillian Alfson still has the photographs: A row of portable toilets lined up outside Fairfield High School, at strategic locations along Main Street, gas stations and other businesses.

Alfson laughs. “There was practically one on every street corner. They got us through until the water table came back up again.”

Portable toilets don’t belong in Fairfield, well-kept and prosperous, the malting barley capital of Montana. Anheuser-Busch operates a 225,000-bushel storage and transfer facility here; its’ tall metal silos are the town’s skyline, with the Rocky Mountain Front beyond. The Sun River Electric Cooperative, Teton Banks, and Three Rivers Telephone Cooperative are all based here. Fairfield has what all small towns want—a stable employment base.

What Fairfield didn’t have was a dependable water system.

Built in the 1940s and expanded several times, it consisted of eight wells, five well houses with chlorination equipment, and two elevated storage tanks, along with a network of service lines and sewer mains. The key problem involved the wells.

“Four of the eight wells are very shallow,” says Alfson. “Fairfield is surrounded by the Greenfield Irrigation District, and when it’s irrigating season and water is flowing through the canals, the wells produce just fine. But when ir-



Anheuser-Busch grain elevators and transfer facility.

rigation season ends and there’s no recharge to the aquifer, the shallower wells don’t provide enough water.”

A related problem involved lack of monitoring: the town had no way of measuring water volume in any of its wells.

“It was very difficult to coordinate the supply from the wells with demand from the town,” says Alfson. “Part of that was not knowing what the supply or demand was, because we didn’t have any meters.”

As for the sewer system, the problem was simpler. “In a word, old,” says Alfson. “A lot of sections of line were plugged with tree roots, and water infiltration was a major issue.”

The sewer system upgrade commenced in 2008. NCI Engineering of Great Falls developed the preliminary engineering report and designed the new collection system. Two SRF loans were part of the financing package, one for \$333,900, another for \$307,100. The town applied for and received forgiveness on the former loan. Construction began in 2009 and included new sewer

mains, service lines, and manholes.

The drinking water system improvements, set to begin in 2014, will include up-to-date monitoring technology.

“We’re putting in a control system that can measure water levels in each well, along with water levels in the storage tanks,” says Alfson. “The system will also determine which well to draw from at any given time. Our utilities manager will be able to control the entire city system from a laptop computer.”

Another key upgrade includes water meters, which will give the town something it hasn’t ever had: an accurate breakdown of water consumption.

“We’ve always operated on a flat rate,” says Alfson. “Now we can collect data for a year and use it to determine a new rate structure.”

NCI Engineering continues

“I don’t think you’ll find anybody more appreciative of the SRF program than the town of Fairfield”

—Mayor Lillian Alfson

to work with the town on the water system improvements. The town was able to hire Montana construction firms for all phases of both projects.

Financing for the water system improvements includes two SRF loans, one for \$248,637 and another for \$322,000. When the project is complete, the town will receive forgiveness on the former loan.

“The cost of doing any substantial infrastructure work is way beyond what a small town can afford,” says Alfson. “Without the loan forgiveness, without the grant funds, we would have been looking at a monthly rate increase of 21 dollars. Instead it’s going to be seven dollars. I don’t think you’ll find anybody more appreciative of the SRF program than the town of Fairfield.”



SRF PROJECT SIGN AT FAIRFIELD.

JUST ADD WATER

Irrigation powers a \$22 million economy on the Tongue River

Photos by Larry Mayer

What does irrigation do for Montana's agricultural economy? Take a trip down the Tongue River Valley, where you'll find about 25,000 irrigated acres along its 190-mile length.

With 130 frost-free days per year, high quality soils, and a climate that features hot days and warm nights, growing conditions are nearly identical to California's San Joaquin Valley. Apples, pears, melons, squash—just about any crop grown in the Golden State can be grown here. There's a vineyard in Miles City.

"We have an image problem," says John Hamilton, whose thriving new orchard includes 25 varieties of apples. "People think of eastern Montana as a wasteland. They don't realize what we have down here."

It all starts with the DNRC-owned Tongue River Reservoir, which stores 79,071 acre-feet of

water. A major upgrade of the dam was completed in 1999. The work included adding four feet to the height of the structure, which added approximately 13,000 acre-feet of water storage.

The Tongue River Water Users Association has a contract with DNRC for 40,000 acre-feet of stored water for irrigation. Art Hayes Jr., president of the Water Users Association, says reservoir operations are managed by a committee that includes himself, DNRC, a representative from the Bureau of Indian Affairs, a member of the Northern Cheyenne Indian tribe, and one at-large member.

Art's great-grandfather came to the Tongue



River Valley in 1884, and two years later was among the first settlers to bring cattle into the region. He also made one of the earliest water right claims.

“He realized nobody was going to survive here without irrigation,” says Art. “Our family has quite a few of the early water rights.”

Today Hayes’ Brown Cattle Company operates on 10,000 acres, 500 of which produce irrigated alfalfa hay. A portion of the crop feeds

his cows and the remainder is sold. A typical dry-land alfalfa yield is 1-2 tons per acre; irrigated, the yield rises to 7-10 tons.

In 2013, agriculture in the Tongue River Valley was analyzed by Montana State University’s Agricultural Marketing Policy Center.

“Agriculture in the valley produces \$22 million in revenue each year,” says Hayes, “and 40 percent of that production comes from irrigated land, even though it’s one-sixth of the total

acreage.”

Alfalfa hay is the most prevalent crop, accounting for \$5.5 to 7 million of the valley’s annual gross revenues. Les Hirsch takes this abundant local resource and turns it into a value-added product—feed pellets for livestock.

He got interested in making pelletized alfalfa 14 years ago. “I knew that if we could find a way to put it into pellets, we could add value and not be so dependent on the sale of a round bale.”

Hirsch grows about 1,200-1,500 tons of alfalfa each year on 320 irrigated acres. He purchases additional alfalfa from local farms and ranches, along with dried shelled peas; the peas, rich in protein, are combined with alfalfa to make the pellets. Each year, he purchases about 50,000 bushels of peas within a 60-mile radius of his farm. “It’s great for the local economy,” he says.

Tri State Alfalfa Cubes sells pelletized feed across northern Wyoming and the northern tier of Montana. “It’s turned into a product that fits the marketplace,” says Hirsch. “Our family business has grown into sales of 7,000 tons per year.”

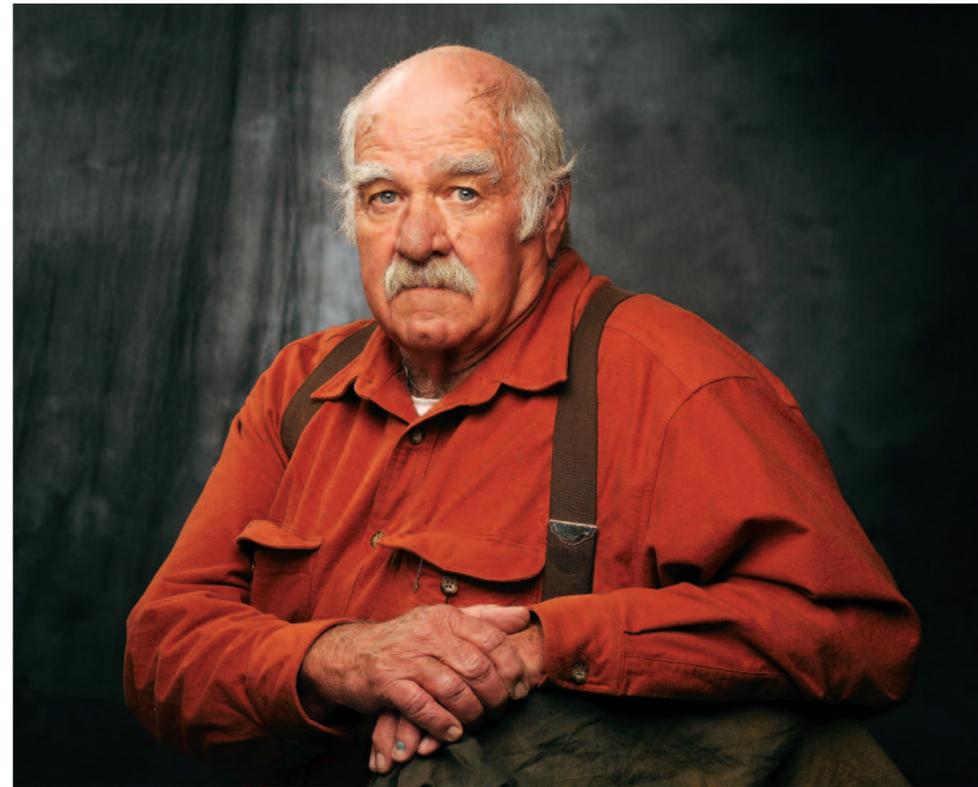
Les has lived and worked along the Tongue River his entire life. For the past 25 years he has also served as vice-chairman of the Tongue River Water Users Association.

“My mother remembers before the dam came in, without any storage there were several years that producers ran out of irrigation water,” he says. “Around here we’d probably get one cutting of alfalfa without irrigation. With it, we get three.”

Hirsch’s business has led to further economic development in the area.

“We buy 12 semi-loads of binder to make our pellets,” he says. “We buy a lot of diesel fuel to run our production facility. In any given year we’ve got 425 semi loads of ingredients coming in or going out.”

A local trucking business has sprung up.



“Agriculture in the valley produces \$22 million in revenue each year, and 40 percent of that production comes from irrigated land, even though it’s one-sixth of the total acreage.” —Art Hayes Jr.



Hirsch also needed to purchase customized trailers and trucks, and there are 2 or 3 families in the area providing these services.

“A dollar turns over about seven times here,” he says.

John Hamilton is a local innovator. “This area grows just about anything you can grow in California,” he says. To prove it, Hamilton in 2007 designed an orchard with 105 fruit trees. He’s growing plums, pears, apples, cherries, peaches.

“I’m growing about 25 different varieties of apples—early, mid and late season varieties,” says Hamilton. “This year it was phenomenal. Some of the Honeycrisp apples weighed half a pound each. This was my first year of full production.”

Above: Les Hirsch, his daughter Sara and hired hand Mark Mindermann work at producing alfalfa feed cubes at Hirsch’s Tongue River area farm.

Right: A closeup of Hirsch’s alfalfa feed cubes.





“People think of eastern Montana as a wasteland. They don’t realize what we have down here.” —John Hamilton

Hamilton is known in Miles City as The Watermelon Man. “A lot of people out here have never tasted vine-ripened fruit,” he says. “There’s no comparison to a watermelon you buy at the supermarket. Those are picked green and they ripen during transport. Mine are picked ripe and sold fresh off the truck.”

He also raises squash, cantaloupe, and pumpkins. He’s a fixture at the Miles City Farmers Market.

All of Hamilton’s crops are grown with irrigation water.

“You can get by without irrigation for one in twenty years,” he says. “The other 19 years you’ll get nothing. We can regulate the flow to where we get irrigation water all summer. It’s a tremendous system we have.”

On his Cedar Hills Ranch, Hamilton also raises cattle and grows spring wheat, barley and alfalfa.

“Wonderful soils, wonderful grass, wonderful water,” Hamilton says. “We have some incredibly valuable natural resources in this valley.”

All three water users are determined to keep things that way. They say energy development in the Tongue River watershed impacts water qual-

ity and threatens the valley’s vibrant economy. Water discharged from coalbed methane drilling contains elevated sodium levels. Hamilton says it doesn’t take much to disrupt soil productivity.

“A lot of these crops are sensitive to salt. We’ve always had high quality water in the Tongue River until energy development. With naturally occurring salts in the ecosystem, you start adding a little more and you can tip the balance.”

Hayes says the balance has already been tipped toward higher levels of salinity. “We’re at the point now where we need a strong flushing flow each spring to mitigate it.”

Each of DNRC’s 21 water projects supports an agricultural economy. Irrigation water generates direct economic benefits by directly increasing the supply and / or value of some crops, and in the process generating jobs and income. And like the Tongue River Valley, most all irrigation-driven economies produce a ripple or multiplier effect, making the overall impact larger: farmers and ranchers spend a portion of their income on goods and services in the local area, supporting local businesses and their workers. 

FISHING ECON 101

The total economic value of recreation in state water parks and reservoirs is immense. Most DNRC reservoirs support fisheries that attract hundreds of thousands of anglers every year.

Revealed Value/Day Fishing in Montana

Average among residents and non-residents

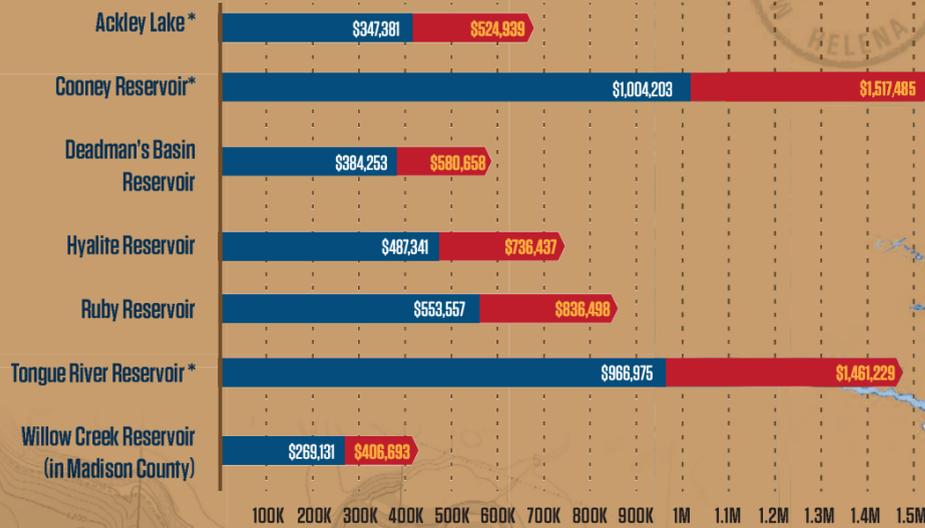
TRIP COSTS TRIP & GEAR COSTS

\$59.28* \$89.58*

* updated to 2013 dollars from the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, USFWS 2006



Estimated Annual Angler Spending



\$6M MT Recreational Fishing Economy

Estimated Annual Angler Travel Economy
Estimated Total Annual Angler Economy

STATE WATER PROJECTS

- 20 WATER STORAGE PROJECTS STATEWIDE
- 311,000 ACRE-FEET OF WATER UNDER CONTRACT



HOW MUCH WATER?

An Acre-Foot is the volume of water needed to inundate one acre of land beneath a foot of water.

WHAT CAN 311,000 ACRE-FEET OF WATER DO? IT CAN:



Provide water for **354,000 homes** per year (2.5 people per household)



Irrigate **124,000 acres** of cropland per year (that's 194 square miles)



Submerge **235,606** football fields beneath a foot of water

WHAT'S IT USED FOR?

- Contracted Uses: Irrigation, Municipal, Industrial, In-Stream Flows, Stock Water
- Other Beneficial Uses: Fish & Wildlife, Recreation

DNRC WATER PROJECTS MAKE A NOTABLE CONTRIBUTION TO MONTANA'S RECREATION ECONOMY

State Parks: Ackley Lake and Cooney, Painted Rocks, and Tongue River reservoirs host State Parks. In 2012, these four parks logged more than 215,000 visitors.

CONTRACTED SERVICES

Many of DNRC's 23 dams were constructed before 1940 and require ongoing maintenance and repair—as well as occasional large-scale rehabilitation—to maintain their safe and efficient operation. Since 1995, contracted services for work on DNRC water projects have totaled more than \$70 million, creating employment opportunities for Montana construction and engineering firms.

PAYING FOR MAINTENANCE AND REPAIRS

In addition to providing irrigation for approximately 23,000 acres of farm and ranch land, DNRC's Toston Dam produces hydropower. Revenue from hydro sales pays for maintenance and repair work on all DNRC water projects. In FY 2013, hydro sales produced \$2.68 million; maintenance costs totaled \$466,534.

WHEN MINUTES COUNT



Initial attack and
the economics
of fire suppression

Photos by Mark Nanke and Larry Mayer

When a wildland fire breaks out on land assigned to DNRC for direct protection, the odds are good that fire will be controlled before it reaches 10 acres in size.

How good are the odds? In 2012, DNRC suppressed 304 of 322 wildfire starts before they reached 10 acres—a success rate of 94 percent. In 2013, it was 293 of 299 for a success rate of 98 percent.

DNRC believes that safe, aggressive initial attack is the best wildfire containment strategy, one that minimizes costs and damages to state

and private property. As soon as a fire is reported, DNRC fire and aviation crews are mobilizing to fight it. Their goal is to suppress the fire as quickly as possible—typically within the first 24 hours.

A fire suppressed at less than 10 acres carries the lowest possible cost to taxpayers, and the lowest risk to firefighters and the public. As fires grow in size and complexity, the cost of containing them grows exponentially. A recent state legislative audit found the 10-year average cost of suppressing a fire of 10 acres or less to be \$4,500; for fires that grew to 5,000 acres or larger, the average was \$2.3 million.





\$4,500 : **\$2,300,000**

Cost to suppress a 10-acre wildfire



Cost to suppress a 5,000-acre wildfire



In economic terms, DNRC’s initial attack strategy does more than hold down firefighting costs. Each year, wildfires threaten homes, businesses, property and infrastructure. In rural areas, wildfires that escape containment burn up rangeland pasture and the year’s hay crops, leaving ranches without critical feed for livestock. A fire suppressed at less than 10 acres represents a wide range of potential costs averted.

DNRC is responsible for ensuring wildfire protection on about 50 million acres of state and private land in Montana. Of that total, protection on 45 million acres is provided by a network of more than 400 volunteer and county fire departments in partnership with DNRC. The partnership is called the County Cooperative Fire Protection Program. All 56 counties are members.

The partnership works as follows: DNRC provides equipment, training, and support with

managing and paying for fires that exceed the counties’ capabilities. In return, each county develops and maintains a network of firefighting forces to provide initial attack on state and private lands in the county.

Every minute counts during initial attack. Firefighters, equipment and machinery must perform to a high standard. In Rosebud County during the early 2000s, machinery was an issue; specifically, the fire engines.

At the time, Rosebud County firefighters were using a fleet of Dodge crew cab engines that dated back to the 1960s and 70s. Before they were rebuilt to serve as wildland fire engines, the vehicles were federally-owned and used on Air Force bases.

“They must have sat around a lot,” says Doug Martens, Rosebud County Commissioner, “they had rust in the fuel tanks.”



“We would take a strike team out on a fire, and it seemed a given that one of the vehicles was going to be towed back.”

—Commissioner Doug Martens

2005 
42 Average age of a Montana county fire engine in 2005



Sometimes the vehicles refused to start. The driver of one engine kept a case of fuel filters on the front seat. “He knew if it wouldn’t start the fuel filter was clogged with rust, so he’d throw in a fresh one,” Martens says.

Rosebud County wasn’t alone in making do with old machinery. In 2005, the average age of a county fire engine in Montana was 42 years. A few counties were using military surplus vehi-

cles from World War II.

“We would take a strike team out on a fire, and it seemed a given that one of the vehicles was going to be towed back,” Martens says.

Beginning in 2005, DNRC launched a major effort to aid counties in modernizing their fire engines. The Montana Legislature approved \$500,000 in annual funding to build new fire engines for counties. DNRC also received a one-time

2013 
 22 Average age of a
 Montana county
 fire engine in 2013

allocation of \$1.25 million in Fiscal Year 2009.

In all, the state has invested \$5.25 million to date on development of new county fire engines. The average age of a county fire truck has decreased from 42 years to 22 years. Today there are 364 engines and water tenders in the County Coop Program, positioned for initial attack in every Montana county.

Rosebud County’s firefighting equipment now includes six DNRC-purchased Type 6 engines. Not only do they start when needed, their capabilities are superior.

“The water capacity is more than double the old units,” Martens says. “The old engines held 200 gallons. The new ones carry 500 gallons. It’s almost like having two engines in one.”

With reliable machinery and greater capacity, county fire crews shorten their response time. They’re more efficient and effective at putting a fire out. Reliable equipment with the newest technology and added water capacity has another critical benefit: it provides safer working conditions for firefighters.

Since 1980, fire seasons in Montana have grown approximately 77 days longer. If the new engines enable county firefighters to suppress three more wildfires before they reach 5,000 acres, the savings will more than cover the state’s investment. The other savings—in averted damage to homes and businesses, infrastructure, agricultural crops, and other natural resources—are even larger. 

2013  293 OF 298 WILDFIRES SUPPRESSED
 BEFORE THEY REACHED 10 ACRES IN SIZE
 98% SUCCESS RATE



Rosebud County fire managers with one of their DNRC-purchased engines. From left, Mark Wanner, Josh Quinlan, county commissioner Doug Martens, and fire chief Rodney Dresbach. Photo by Larry Mayer

MONTANA'S LAND ENTERPRISE

The legacy of the state trust endowment

Without advertising, the DNRC Trust Land Division continues to run one of the oldest businesses in Montana. Dating back to statehood, Section 10 of the 1889 Enabling Act set aside Montana sections numbered sixteen and thirty six, granting them for support of common schools. This school trust endowment has remained solvent and today, nearing its 125th year in business, carries forward generating \$100 million in base revenue for Montana's public education system.

The school trust endowment is not only Montana's largest purveyor of land and natural resources; it is perhaps the largest of any enterprise started in the state: Trust lands make more than 10 times what they cost to manage.

Operating free of debt, these endowment lands continue to support education and put a large number of Montanans to work, supplying manufacturers and fueling the urban and rural Montana economy. These lands are so productive that they are just as important in stabilizing

employment and commodity supplies as in supporting education.

Every year tens of thousands of contracts with the private sector connect a vast number of Montana companies into the trust land econ-

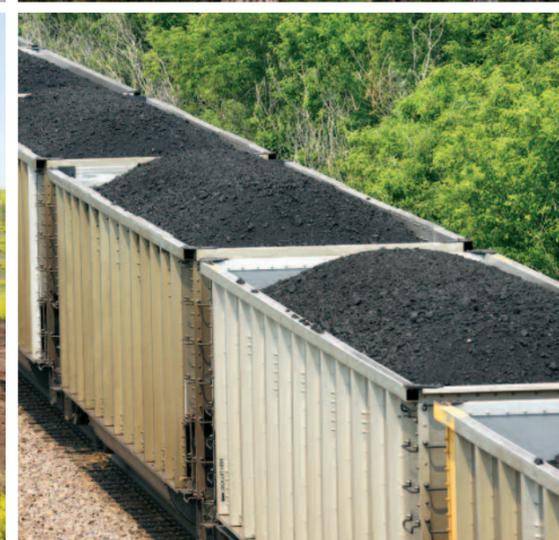
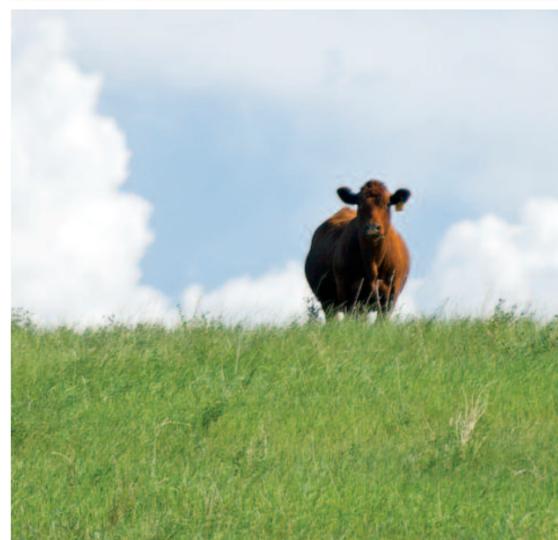


10X Trust lands make more than 10 times what they cost to manage

omy. And where labor is concerned, a very high percentage of the work load to manage these endowment lands is made available through private firms. Thousands of jobs are working in this economy. In Montana, it is estimated that every million board feet of harvested timber supports an economy of ten full-time positions across the state. With nearly 60 million board feet harvested annually in school trust forests, this University of Montana research would indicate a subsequent economy of 600 forest product jobs alone. And with each additional resource, be it coal, oil and gas, or land for agricultural production, there are many more private jobs in this endowment based economy.

Not only is the endowment valuable for private sector employment, but the location of where this work is needed stretches across the state. Examples of this range from the profitable timber sales of the Swan Valley, to strategic commercial development for the Bozeman and Kalispell growth corridors, pipeline and well development in the Elm Coulee oil field and Richfield County, or agricultural jobs supported in rural communities across the Hi-Line and prairie East. The dispersed network of trust land helps spread these employment benefits across Montana.

In 2013, trust lands continued to make significant impact to the Montana economy generating \$11, \$30, and \$40 million in forest, agriculture, and mineral leases and sales, respectively. In the same year, approximately \$60 million in profits from these endowment activities provided \$400 in funding for each of the 143,000 students enrolled in Montana's K-12 schools. Millions more were also distributed to Montana Universities and specialized schools, lowering statewide education tax liability. As the endowment business grows into the future, these economic, education and tax benefits will continue to grow for Montana residents. dnrc.mt.gov





THE DNRC

ECONOMY



By the numbers:

\$250,000,000

authorized annually in department and project funding

\$40 to \$50,000,000

40,000,000-50,000,000 paid in salaries

\$20.50

20.40 average wage rate paid

400 to 800

400 - 800 temp workers employed each year

Over 700

employed full time during the course of a year

Over \$25,000,000

in grants awarded by DNRC in FY 2013

2,500 -12,500

Range of total employment jobs impacts

\$250 - \$750,000,000

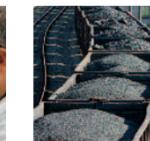
Range of total spending impacts

Montanans have a long and enduring history of making our living from the land. The fabric of our economy is drawn together by all who contribute to its growth and sustainability—from forest products, mining, ranching, farming, recreation, tourism and various others—we all value the abundant natural resources available throughout this great state.

Today, DNRC continues to work at the center of Montanans' vision for life, land and conservation in Montana. The Department not only supports and invests in many industries in the state, but also provides and generates considerable employment. Every four years the Department manages \$1 billion for project and program investment. And in a normal wildfire year, DNRC delivers paychecks to sixteen hundred employees, working across 21 or more counties. These authorized funds are depend-

able capital, energizing private enterprise and helping to spur thousands of jobs in Montana's economy. In Fiscal Year 2013, DNRC water projects delivered approximately 290,000 acre-feet of contracted water for irrigated agriculture.

Studies suggest the value of public investments into natural resource industries can sustain between 10 and 50 jobs per million dollars invested, and double or even triple as private income. Summarizing this broad industry evidence, it would not be unreasonable to expect that the DNRC economy influences between 2,500 and 12,500 private jobs across the state in any given year. Along with driving employment, DNRC investments in resource development and restoration would also potentially generate somewhere between \$250 and \$750 million in private income statewide. This vast potential is the contribution of DNRC to Montana's economy.



The DNRC Economy

3,200

new business contracts in FY13

Expanding employment by

2,500-12,500

private sector jobs

Generating an additional

\$250 - \$750M

in business income

\$250M

authorized in program and project spending

Attracting

\$27M

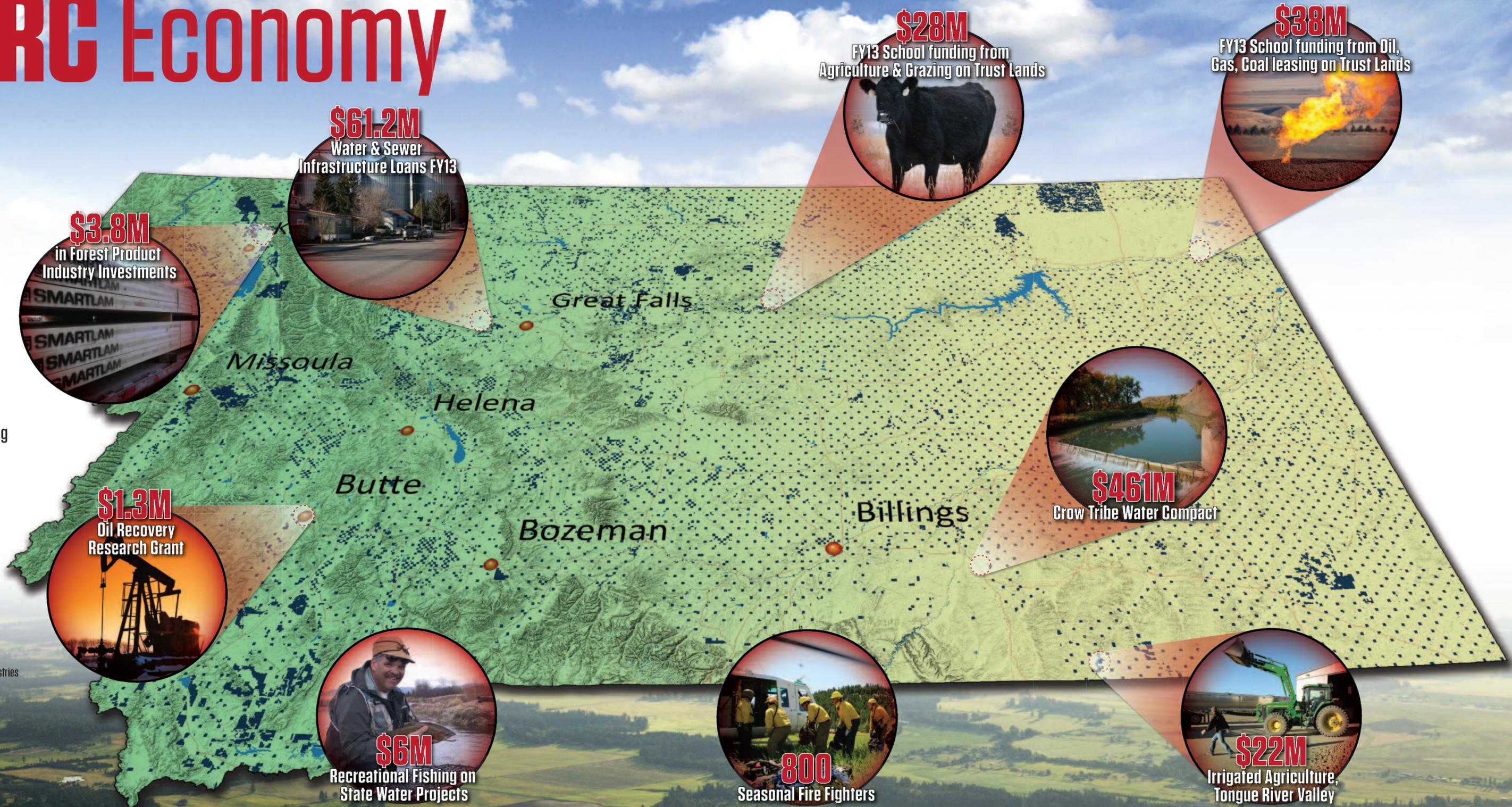
in grant funding for MT investments

Employing over

700

full time positions

*estimated annual contributions based on empirical results from economic impact studies for conservation and resource related industries





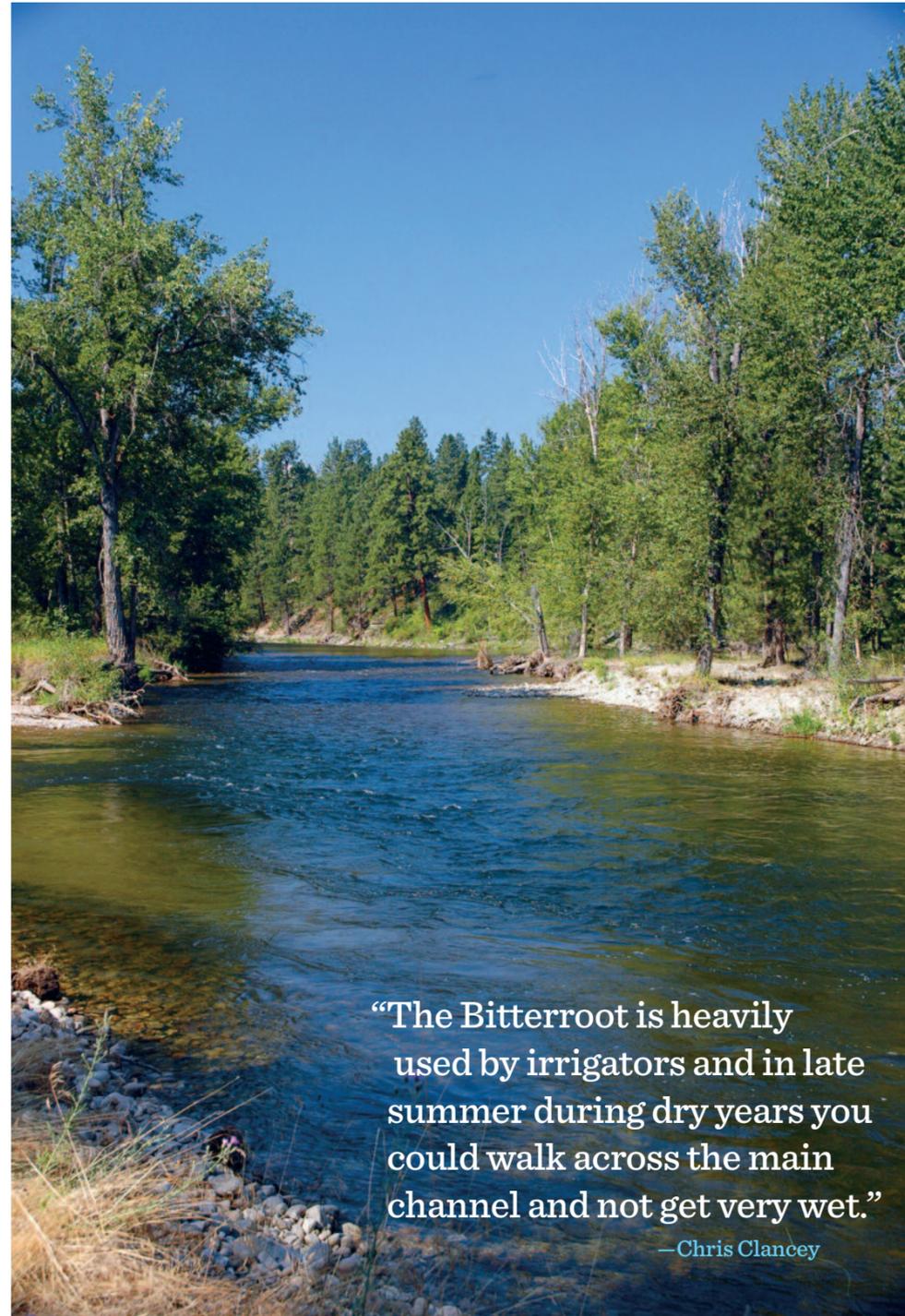
COLD STORAGE

When summer heats up, Painted Rocks Reservoir keeps the Bitterroot fishery cool

All of DNRC's water projects support irrigated agriculture. Painted Rocks Dam, located on the West Fork of the Bitterroot River south of Darby, plays a vital role in sustaining the multi-million-dollar fishery of the Bitterroot River.

By the mid 1970s, irrigation demands on the Bitterroot River left it seriously dewatered during some summers. The stretch of river between Hamilton and Florence was most severely affected, says Chris Clancy, Regional Fisheries Biologist for the Montana Department of Fish, Wildlife & Parks (FWP).

"In low water years, there wasn't much water left in the river between Tucker and Stevensville," Clancy says. "The Bitterroot is heavily used by irrigators and in late summer during dry years



“The Bitterroot is heavily used by irrigators and in late summer during dry years you could walk across the main channel and not get very wet.”

—Chris Clancey

you could walk across the main channel and not get very wet.”

Local sportsmen and FWP began to explore the possibility of using stored water out of Painted Rocks Reservoir to supplement flows on the Bitterroot. “Fish, Wildlife and Parks in 1958 had a contract with DNRC for 5,000 acre-feet of water,” says Larry Schock, Regional Engineer at DNRC’s Water Resources Office in Missoula. “In 1992, they contracted for an additional 10,000 acre-feet.”

FWP’s 15,000 acre-feet of water accounts for nearly half of Painted Rocks’ 32,000 acre-feet storage capacity. The management plan calls for holding onto that water until stream flows on the Bitterroot diminish to a target level. Water is then released at a rate biologists deem necessary to safeguard the fish population through the hottest, driest weeks of late summer and early fall.

As part of the operating agreement, Fish, Wildlife & Parks also agreed to pay the salary of a water commissioner.

“His job was to shepherd the water down the river and make sure everyone was taking their allocated amount, and to make sure FWP water stayed in the river,” says Clancy. “He had a lot of credibility and gained people’s trust. Over time, the irrigators, water commissioner, DNRC and FWP evolved a unique system. People started to recognize and understand each other’s water uses and needs.

“Today, people on the Bitterroot cooperate more for water management than on most rivers in the state. It’s not perfect, but we actually have a situation where irrigators voluntarily don’t take all the water they’re entitled to—they’ll leave it in stream to benefit fisheries and recreation.”

2013, a very low water year, offers a prime example. After reviewing the numbers, Clancy says irrigators used approximately two-thirds of the water they were legally entitled to, leaving the rest in the river.



Photo courtesy Jack Mauer/Wapiti Waters Outfitting

“Painted Rocks is the lifeblood of the Bitterroot River, and that’s never been more apparent than during a really dry year like we had in 2013.”

—Larry Schock

Each year, Fish, Wildlife & Parks calls on DNRC to begin releasing its water in mid-July. The goal of the releases is to maintain a minimum flow of 400 cubic feet per second (CFS) at Bell’s Crossing on the Bitterroot. “That’s the area we monitor to see how we’re doing,” Clancy says. “We don’t always hit 400 CFS. In a really dry year we hope for 200 CFS. We coordinate with the water commissioner and decide exactly when we’ll start releasing. The commissioner keeps track of how much water we’ve used and how much we have left.” Flows typically continue through mid-September.

Larry Schock has been part of DNRC’s management team for Painted Rocks since 1995. “Painted Rocks is the lifeblood of the Bitterroot River, and that’s never more apparent than during a really dry year like we had in 2013,” he says. “The

coordination between DNRC and Fish, Wildlife and Parks makes it possible to have sustained flows on the river when they’re most needed.”

The Bitterroot River is one of the most heavily-fished rivers in the state and the most-fished river west of the Continental Divide. It typically attracts more than 100,000 angler-days of use each year, according to FWP surveys. In 2009, the total was 110,000 angler-days. In its upper reaches, the Bitterroot supports about 1,000 trout per mile, including a healthy population of cutthroat trout; in the lower reaches, the fishery is dominated by rainbow and brown trout, with populations of 500 to 600 trout per mile.

The Bitterroot River and its fishery are a source of income for guides, outfitters, fly shops, restaurants and lodging establishments up and down the valley. Victor resident Jack Mauer has



Painted Rocks Dam

110,000
Total Angler-Days on
Bitterroot River, 2009



Economic Impacts of
Annual Angler Travel **\$6.5M**

Total Angler
Economic Impacts **\$9.8M**



operated Wapiti Waters, a guiding and outfitting business, for nearly 40 years. He spends at least 100 days a year on the Bitterroot guiding clients, and understands the value of in-stream flows as well as anyone.

“Without Painted Rocks, FWP and the other people who care about this river, we’d be in a world of hurt,” he says. “We’ve got conscientious irrigators. We’ve got the in-stream flows to work with. There’s cooperation and it’s a great thing.”

EXPERTISE

GAUGING SUCCESS

Expertise and dedication
drive water permitting

Photos by Craig Roberts



At the mouth of the Judith River, just above its confluence with the Missouri River, there is a U.S. Geological Survey stream gauge. Installed in 2000, the gauge has done its job flawlessly for 13 years, providing a constant record of river flows on the Lower Judith. But when it comes to processing a water right application for a new business—when it comes to really knowing water availability—the expertise and dedication of people will trump the stream gauge every time.

Robert Peterson was developing a new business in Judith Basin County. His proposed cattle feeding operation, called Bos Terra, would create 20-25 new jobs in a county with 2,072 residents. In addition to growing much of the cereal grain needed for silage on site, Bos Terra would also purchase grain through the local market. As rural economic development goes, Peterson's business would have impact.

To be a viable operation, Bos Terra needed water—for irrigating crops, for livestock, for all the other needs of any business. And for that, Robert Peterson needed a water right permit. In 2012, he submitted an application for a 150-gallon-per-minute well to the DNRC regional water office in Lewistown. He had never been through the permit application process before. He had plenty of concerns.

"It's an agonizing process," Peterson says. "You have a large amount of capital tied up in a process that's open-ended. You go all the way through it, you provide all the information knowing you may not get approved in the end. And it's a fairly high hurdle to get over."

His application landed on the desk of Scott Irvin, who has served as manager of the DNRC

regional office in Lewistown for 16 years. "The Judith River Basin isn't a closed basin, but water availability is tight from a legal perspective," Irvin says. "I couldn't honestly say at the start whether the application would be approved or not."

The Lewistown staff began their analysis. In geologic terms, the proposed well would draw from a confined sandstone aquifer within the Third Cat Creek Member of the Kootenai Formation at a depth of 1,548 feet. Results of a pump test and computer modeling indicated the new well would have a "zone of influence" extending 105,000 feet. Within this zone were 26 established rights to groundwater. "But in terms of groundwater availability, things looked good," Irvin says, "the established water rights accounted for only 378 acre-feet out of a total estimated volume of 4,000 acre-feet in the groundwater zone."

The surface water analysis was a different story. By law, no new water appropriation in Montana can adversely affect established rights to ground or surface water. And the connection between groundwater and surface water is scientifically established, and legally recognized, and often a key factor in the technical review for

a new permit.

The initial analysis for Bos Terra concluded the proposed well would deplete stream flows in the lower reaches of the Judith River, above its confluence with the Missouri. Based on 13 years of data recorded by the USGS stream gauge, there would be a deficit in July, August and September between the amount of water physically available in the river and the volume of water legally claimed by existing water right holders.

This could have meant a denial for the Bos Terra application. Instead, DNRC staff put their expertise to work. They wanted to take a look at the issue of return flows.

"If you simply add up the volume of water claimed by each water right, you arrive at the assumed amount of water diverted or taken out of the river," Irvin says. "But that isn't necessarily the amount of water that's consumed. When people flood irrigate, a substantial percentage of diverted water returns to the stream.

"We decided to consider return flows in our analysis. We thought it would give us a more detailed picture of actual surface flows, rather than just relying on what we have on the books or what the stream gauge was telling us."

Irvin and his staff went back and re-evaluated the Lower Judith. Instead of analyzing that 50-mile reach as a single unit, they broke it down into two smaller segments, in order to more accurately identify where individual water rights were located, and the type of irrigation methods used. In the first segment of the river, between the mouth of Warm Springs Creek and the stream gauge, staff noted the majority of water rights were used for flood irrigation.

James Heffner, a DNRC Groundwater Hydrologist, developed a methodology of accounting for return flows from appropriated water. His results indicated that the physical water supply in the Judith River, in both flow rate and volume, above and below the USGS gauge,



exceeded all legal demands in every month of the year. In his findings of fact for the permit application, Irvin wrote, "The Department finds the method developed by its groundwater hydrologist of accounting for return flow accretions credible and reasonable. The analysis can be applied in this instance because DNRC staff are generally familiar with the irrigation practices along the reaches of river at issue."

Managing Montana's water—protecting the rights of existing water users while meeting the never-ending demand for new permits—is an enormous responsibility, and one of the most difficult activities DNRC is charged with overseeing. It requires dedicated and highly knowl-

"We always work hard to base our decisions on what's really happening in the river, and in this case it worked out for the applicant"

—Scott Irvin, DNRC regional water manager

edgeable people. It requires a commitment to fairness and accuracy. It requires a sense of stewardship.

"We always work hard to base our decisions on what's really happening in the river, and in this case it worked out for the applicant," says

Irvin. "Sometimes our decisions go the other way and we have to deny an application.

"Either way, we give all parties plenty of personal attention. Our door is always open. If we need to go to the field to gain an on-the-ground perspective, we go. We do whatever it takes to make the best decision."

What's at stake is nothing less than the state's ability to grow jobs and its economy, says Peterson.

"The ability to develop water is the key to rural economic development," he says. "It's the key to Bos Terra's ability to do business. We can't do what we do without it." 📍



WHEN THE LEVEE BROKE

After record floods in 2011,
DNRC helped communities rebuild

Photo courtesy The Billings Gazette

In the spring of 2011, late heavy snowpack gave way to torrential rain, with devastating results across much of Montana. Between late May and mid-June, major floods swept through the Yellowstone, Musselshell and Milk river basins, destroying homes, businesses and infrastructure. The state's agricultural economy was hit hard.

Pat Riley, who retired after 30 years with DNRC and managed its Irrigation Development Grant program for 10 years, wrote in a letter assessing the 2011 floods, "In some basins, the amount of water we have been dealing with is almost incomprehensible to those of us who have measured and managed water for years."

More than two years later, it's still difficult to make an accurate tally of the cost. In all, 31 counties and four Indian reservations were eligible for federal disaster relief.

Before all the water receded, staff in DNRC's Conservation and Resource Development Division (CARDD) was fielding a second flood of phone calls from producers, conservation districts, municipalities and irrigation districts looking for guidance on damage assessment and funding sources for recovery. Staff made site visits to evaluate damaged wastewater and

drinking water systems, irrigation works, and other infrastructure.

Between June and October of 2011, DNRC used funding from several grant programs to finance about \$250,000 worth of emergency planning and repair throughout Montana. In addition, DNRC was able to shift another \$397,800 in funding for projects approved by the Montana Legislature from their original purpose to address flood recovery projects.

DNRC continues to fund 2011 flood damage assessment and repair projects even today. In October of 2013, the agency approved a \$10,000 Reclamation and Development Grant for treatment of salt cedar infestation in cropland following the flood.

DNRC's leadership, expertise and strong working partnerships are a fixture of Montana's agricultural economy, helping it grow and adapt



to future challenges, and ready to help when the unexpected strikes.

No one in the valley had ever witnessed anything like it. Fueled by a combination of rapid snowmelt and torrential rain in late May and early June of 2011, the Musselshell River flood spread misery along its 340-mile-long path.

In the hamlet of Musselshell, located 23 miles downriver from Roundup, Lynn Rettig monitored the weather updates and kept an eye on the river. In addition to his duties as pastor of the Community Bible Church of Musselshell, Rettig manages the Delphia-Melstone irrigation works. Constructed in 1950, the project provides water for 50 ranches along roughly 30 miles of the lower river. Along much of its length, the main canals parallel the river, separated by a high berm wide enough to accommodate a vehicle.

On May 26, Rettig says, “The river had reached a level where we knew from past experience it would overtop the berm and start running into the canal.” To reduce the overall force of floodwater on the system, Rettig called in a backhoe operator to breach the canal by removing sections of the berm.

Downstream he saw another potential problem: an elevated pipeline (called a siphon) that crossed the river, bringing water from the north-side canal to the south side. Four metal piers supported the pipeline as it crossed the river. The water level was still rising and the piers were under tremendous stress from the current.

On May 26, 2011, the Musselshell River reached a height of 14.78 feet at Roundup. Disaster and emergency specialists refer to floods as “slow-motion disasters.” Unlike a tornado or earthquake which begin and end in minutes, floods unfold over days or weeks. Rettig says the community endured extreme levels of anxiety. Following the initial crest in late May, a second

rain event triggered another flood surge on June 8. In all, flooding went on for three weeks. When Rettig was finally able to get out for an assessment, it didn’t take long to determine the Delphia-Melstone canal system had sustained major damage.

“It wasn’t a complete and continuous destruction of the canal—it was a series of half-mile-long breaches here and there,” Rettig says. “Overall I had about 20 places of specific damage. Amazingly, no headworks or dam structures were lost. But all that water had to go somewhere.”

In some places, especially where the canal made a turn, the water pushed straight ahead, sweeping away massive sections of berm and making the canal part of the river channel. The elevated pipeline was destroyed. The south end of the pipeline had fallen into the river as floodwaters scoured away the bank; three of the four metal piers were twisted or destroyed and all would need major repairs or replacement.

With damage assessments adding up, members of the Delphia-Melstone ditch board faced a monumental decision: was the system worth fixing? Projected repair costs were approaching one million dollars. Most water users were small family ranches running 100 to 500 cow-calf pairs, with the average ranch irrigating about



BEFORE

A DNRC grant helped fund major repairs of the canal system after it was destroyed by floodwaters.

150 acres of alfalfa hay to feed its herd through winter. Could each ranch maintain its own irrigation works? Could ranchers purchase hay instead of growing it themselves?

Richard Haxton, a Melstone-area rancher who had served five years as president of the board, wrote an assessment of Delphia-Melstone’s role in the valley’s economic and cultural life:

“Ranching is the only agricultural activity on the lower Musselshell. The only other basic job-providing resource is the small oil patch. Whatever the board’s decision, it will certainly impact the entire community, the school, the hardware and convenience store, the garage and gas station, as well as several construction-related businesses that call Melstone home ... Without a doubt abandonment would require purchasing most of the hay to winter the present cow herds. Buying hay from out of the community is costly. In some cases the smaller places would likely be absorbed into the larger ones.”

Haxton also concluded that most ranches could not afford to operate their own irrigation systems. Rettig says one area ranch set up its own pumping system and gave it a try, and found it too expensive. The canal system was far more cost-effective.



AFTER



A DNRC grant financed the engineering study for reconstruction of the irrigation pipeline. The new pipeline was encased in concrete and routed beneath the riverbed at the same location.



Before the flood, Lynn Rettig had been working with DNRC to obtain a Renewable Resource Grant (RRG). The grant for \$100,000 had been approved to fund new lining in a portion of the canal system and to rehabilitate a check structure. Alice Stanley, who manages a dozen grant and loan programs for DNRC, says part of the agency’s response to the Musselshell River flood included reviewing grants and loans already approved to see if they might be revised to help with recovery projects.

“We were able to shift the purpose of the grant to repairing or replacing the transfer pipeline, and given the situation around the state we were able to do it quickly,” Stanley says.

The canal board decided the first step was a comprehensive damage assessment of the entire system. Rettig applied for a \$5,000 Irrigation Development Grant, another DNRC program that allows private entities to defray a portion of the costs for project development or recovery. That grant paid for an engineering assessment of damage in areas where the canal was breached.

The elevated pipeline was the most challeng-

ing project from a technical perspective. Should it be repaired or replaced? Rettig and the canal board needed to know the best course of action. They worked with DNRC staff to write a Renewable Resource Planning Grant for \$10,000. The grant paid for a Billings-based engineering firm to do a technical assessment.

“The grant was approved that fall, and the

“The canals were in better shape and weeds weren’t an issue. We never got behind in terms of irrigation demand. And we had good crop production.”

—Lynn Rettig

engineers were out here soon after,” says Rettig. “They recommended we replace the overhead pipeline with an inverted siphon. It’s a submerged pipeline under the riverbed. The pipe is encased in concrete and it offers much better durability long term.”

In one of the hardest-hit areas along the canal, floodwaters completely removed a section of the berm, then excavated a massive crater in a culti-

vated field. Engineers recommended that stretch of canal be re-routed and the old section filled in. Because a portion of the damage involved private land, the repairs were eligible for a \$15,000 Conservation District Grant.

By October of 2011, repairs on the Delphia-Melstone canals were in full swing. The irrigation company’s share of the costs totaled \$450,000. DNRC grants added \$132,668. Rettig says the total reconstruction cost will approach one million dollars.

In May of 2012, the Delphia-Melstone Canals were operating in time for irrigation season. Repair work made it difficult to rotate among water users. Weeds, seepage and evaporation due to extreme heat limited the overall efficiency of the system. Some ranches were still forced to purchase hay on the open market.

Rettig says 2013 was a much better year.

“The canals were in better shape and weeds weren’t an issue. We never got behind in terms of irrigation demand. And we had good crop production.”

Late in 2013, Rettig still has a small to-do list of repair and recovery projects associated with the 2011 flood. He’s got areas along the river that need rip-rap material. Weeds are still a problem in places where the canal was rebuilt or soils were disturbed. But compared to what he went through, it’s not much.

“It took a lot of people working together to put this canal system back in operating condition,” Rettig says. “State and federal agencies bent over backwards to help. Our canal clerk, Gena Allen, spent countless hours on paperwork to get us through the funding process. We used four different contractors to do the work; sometimes there were several projects going at once. For a year and a half I was married to this. But we got it done.”



BOARDS AND BIOMASS

Grants help
Montana's forest
economy grow ▶



SmartLam Technologies Group: From the Ground Up

Every new business needs a foundation, a market or product to build upon. In the case of SmartLam Technologies Group, LLC, that foundation measures eight feet wide by forty feet long, is built entirely from Montana timber, and comfortably supports several hundred tons of equipment and machinery in some of the world's most brutal environments.

Located in Columbia Falls, SmartLam has developed the first Cross-Laminated Timber (CLT) processing line in the United States. The company found immediate market interest in CLT "mats" for use in the energy and utility industries—most notably in the exploration and transmission sectors, where SmartLam mats support massive drilling rigs, pipelines and other supporting machinery.

"Right now our biggest markets are Alaska, Texas and North Dakota," says Casey Malmquist, SmartLam's general manager. "Energy and utility companies face stringent environmental regulations to protect soil and water and our mats help them meet those objectives in a cost-effective and sustainable manner."

In the cross-lamination process, milled boards are finger-jointed and glued to create a single board of the desired length. A group or "deck" of these boards are laid out flat, adhesive

is applied to the top of the deck, and then a second deck of boards is set at 90 degrees to the layer below. The process continues, like building a sandwich, until the product reaches the desired thickness. After that, the multi-layer unit is pressed and routed.

"The cross lamination acts like rebar in reinforced concrete, delivering strength in two directions just like a slab of concrete," says Malmquist. "The strength of the non-toxic formaldehyde-free adhesives exceeds that of

“SmartLam is just one example of a small company that can add value to our forest resources while ushering in a new era of sustainable forest management policies.”

the wood fiber, allowing us to earn 100% of the engineering values of the wood, a renewable and sustainable natural resource.”

SmartLam directly employs 17 people, including many highly-skilled mill workers who had lost their jobs to cutbacks in the forest products industry. "We're fortunate to have three major sawmills in the region, Plum Creek,

Stoltze and Pyramid, all of whom have been incredibly supportive and helpful," says Malmquist. "We expect our workforce to approach 30 within the next year, and it won't be long before we are capable of processing 20 million board-feet of wood fiber annually."

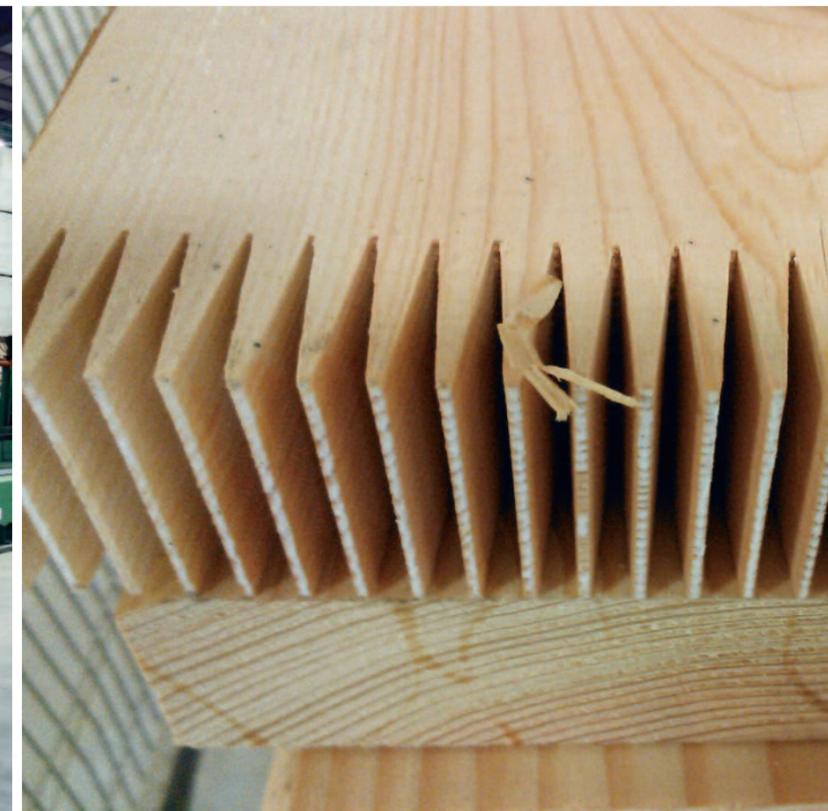
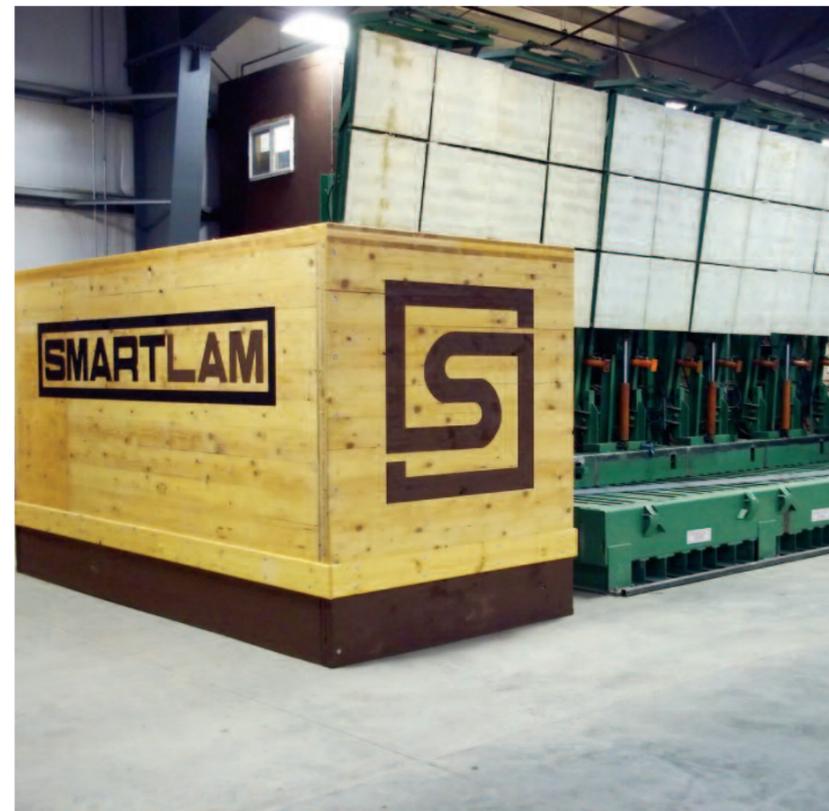
SmartLam was awarded a \$30,000 Wood Product and Biomass Utilization Grant from DNRC in January of 2013, just as the company was getting on its feet. Funding for the DNRC grant was made available through the USDA Forest Service.

"The funds really helped jumpstart those first few critical hires and helped us get a first payroll put together before we were into revenue," Malmquist says. "Partnering with the DNRC and several universities has been very successful. The success of efforts to commercialize CLT in other countries was driven by public / private and academic collaboration. We believe in that same model."

Malmquist also believes that CLT technology has a bright future in Montana and the U.S. "The products we're making today are a starting point," he says. "Down the road we expect to begin building prefabricated CLT panels to replace concrete and steel in low and mid-rise commercial and residential structures. The Europeans are raising 10-12 story buildings with no concrete or steel above the ground floor. That's a game-changer."

And Montana, he says, is an ideal place for the CLT industry to take root.

"Montana has a world-class supply of renewable and fast-growing fir and larch, as well as western white woods like ponderosa pine, Englemann spruce and lodgepole pine. SmartLam is just one example of a small company that can add value to our forest resources while ushering in a new era of sustainable forest management policies." 



Blue Marble Biomaterials: Beyond Petroleum

Photos by Lisa Hensley/Details Photography

James Stephens has a vision in which the endless array of stuff the world needs—from kitchen utensils to automobile dashboards, flavors, and advanced carbon composites—is made from pine trees, or corn stalks, or the needles from a Western red cedar, rather than from petroleum.

“Ninety-six percent of the world’s consumer goods right now are made from petroleum products,” says Stephens, President and Chief Scientific Officer of Missoula-based Blue Marble Biomaterials. “Our mission is to replace petroleum-based chemicals with fully sustainable, zero-carbon specialty chemicals. We believe a renewable economy has arrived. Today people are manufacturing bioplastics from corn sugars. We can turn a tree into blueberry flavoring.”

Along the way, Stephens also believes companies like Blue Marble, which depend upon forest and agricultural biomass for raw materials, can play an integral role in Montana’s forest management practices.

In the beginning, Blue Marble was a concept in search of a market. “In 2005 we were focused on renewable jet fuels and renewable natural gas,” Stephens says. “Three years later, we turned away from renewable energy. We started to explore what it would take to manufacture

the highest-value biomass products.”

Blue Marble learned of the DNRC grant program supporting the development and expansion of markets for woody biomass. The company submitted a proposal and was awarded a \$30,000 grant to move forward. Funding for the DNRC grant was made available through the American Recovery and Reinvestment Act of 2009 and the USDO Bureau of Land Management.

The DNRC grant “helped us establish and plan the engineering and turn the raw materials

“They’re innovative. They’re thinking locally and globally. They employ talented, well-paid professionals.”



into real products,” Stephens says. “That grant is a big key to Blue Marble actually focusing on forest products. Without that encouragement we would not necessarily have pursued forest materials. It was pivotal in moving us in the direction we’re going now.”

Julie Kies, biomass utilization program manager in DNRC’s Forestry Division, says, “We

were impressed and intrigued by Blue Marble’s project proposal. They were really going after the small-diameter wood, branches and needles—the lowest value biomass material that is commonly burned in the forest after harvest. They’re innovative. They’re thinking locally and globally. They employ talented, well-paid professionals. And they use a locally-abundant, low-value resource to produce a high-value product.”

Today Blue Marble operates a bio-chemical refinery in Missoula that’s quickly expanding. Using low-value materials—needles from conifers, waste bark and other slash from forest management activities—the company extracts oils, terpenes and other chemicals using its proprietary technology; the chemicals are then sold to companies for use in flavoring, cosmetic scents, fragrances, lotions and other products.

Blue Marble is currently ramping up to extract the oil of Western red cedar needles, to be used in producing thujone, a personal care and cosmetic ingredient. “We brought in more than 500 tons of cedar needles from Idaho and Montana. Over the next four months we’ll be bringing in another 2,000 tons,” Stephens says. “We

have two major processes, a fermentation process and an extraction process. We have a list of clients who come to us and say, ‘I’m looking for this or that product.’ We go and find it and develop the manufacturing process for them.”

The company surveyed potential locations around the country and decided Montana had all the right elements: a strong commitment to



Blue Marble president and chief scientific officer James Stephens, left, visits with Julie Kies, DNRC’s biomass utilization program manager, at the Blue Marble facility in Missoula. In the background is a pile of western red cedar limbs, to be used in producing Thujone, a personal care and cosmetic ingredient.



environmental protection, an educated workforce in Missoula, good access to policymakers, and of course a very large reserve of biomass.

At the moment, Blue Marble boasts a workforce of 14 full-time, three part-time and a half-dozen or so temporary workers. But that's going to change soon. In the next 18 months, the company is planning to add another 100 full-time jobs in Missoula. The company also brings business to local truckers, contractors and suppliers.

"We have production people from the University of Montana College of Technology, and an extensive research-and-development staff of biologists, chemists, botanists, engineers," Stephens says. "We also hire a lot of metal work-

ers, pipefitters and other technical people when we build a new production line."

Kies invited Stephens to give a presentation about Blue Marble to the Montana Forest Products Retention Roundtable, a working group hosted by DNRC that includes state and federal forest managers, staff for elected officials, forest-dependent businesses, conservation interests, and others. Roundtable members were equally impressed with Stephens' energy and vision and invited him to become a member.

"Through his involvement with the roundtable, James became familiar with the challenges facing forest management and the forest products industry in Montana," says Kies. "As a result,

he's made direct connections with local mills to explore new partnerships, such as integrating biochemical extraction into a mill's process line, which would diversify their product line and enable the mill to get more value from each tree."

Strong working partnerships between private-sector entrepreneurs and government agencies are mutually beneficial, Stephens says. Businesses can engage with the extensive support structure an agency like DNRC provides, while entrepreneurs can provide policymakers and elected officials with a greater understanding of emerging markets and new technologies. Together, they can build Montana's economy in new and surprising directions. 



A Blueprint for Change

Water compact will bring new economic life to the Crow Indian Tribe Photos courtesy The Billings Gazette

On a brilliant day in September of 2012, leaders of the Crow Tribe stood along the banks of the Little Bighorn River to mark the beginning of a new chapter in Crow history, a chapter involving water and the social and economic opportunities that come with it.

Workers broke ground on the first phase of what eventually will be a complete renovation of the Tribe's 320-mile reservation irrigation system, a process Tribal leaders expect will take at least 15 years. The ceremonial first step involved the removal of a deteriorated headgate on the Little Bighorn that diverts water into the reservation's oldest irrigation works, the Reno Ditch, which the federal government surveyed and built in 1885.

Alden Big Man Jr., director of the Crow Tribe's

Water Resources Office, told construction workers and visitors, "You'll never forget this day," calling it "a turning point in Crow history."

A second water development effort, equally ambitious, is also in the planning and development stage. Called the Crow Municipal Rural & Industrial Water System, the project will distribute quality drinking water to all businesses, communities and rural residents on the 2.3-million-acre reservation. Like the irrigation project, tribal officials would like to see it developed in phases over about 15 years, though other variables could alter that timeline.

Both water development projects, along with funding to plan and build them, are the result of the water compact ratified by the Crow Tribe, the State of Montana, and the United States. The Claims Settlement Act of 2010, approved that



year by Congress and signed by President Barack Obama, contained \$1 billion to settle water right claims with a number of Indian tribes; the Crow portion of the settlement came to \$461 million.

Heather Whiteman Runs Him is a tribal member and a Harvard-educated attorney. She worked on the staff that helped secure ratification of the compact by the United States Congress and members of the Crow Tribe. The compact, she says, achieves two critical things. The tribe will have permanent, decreed water rights, and will have secured them without costly and protracted litigation. And equally important, the federal funding that accompanied

use, which means it can market water to industries and businesses on and off the reservation. Reliable water supplies are expected to help attract new businesses. The revamped irrigation works will serve a larger area, increasing irrigated acreage and boosting the Tribe’s agricultural economy. The settlement included funding for future operation and maintenance of both systems; Tribal officials may also opt to collect user fees to support operations. In terms of economics, it’s anticipated that both the municipal water works and the irrigation project will become self-sustaining.

On a smaller scale, the new infrastructure will

state. All have been approved by the Montana Legislature.

Compacts—both tribal and federal—offer certainty and protection for water users by settling for all time a tribe’s (or the federal government’s) legally-recognized claims to water in Montana. Tribes or federal agencies agree to accept a quantified volume of water, and further agree to give up any future legal claims to additional water. Non-tribal and state-based water users—irrigators, livestock operations, municipalities, commercial and industrial interests—gain the certainty of knowing how these quantified rights may or may not impact their lives or businesses. All parties, including Montana taxpayers and water users, avoid the expensive, drawn-out process of litigating water right claims, while benefitting from the flexibility and creative approach to problem solving that a negotiated settlement—as opposed to litigation—allows.

Most of Montana’s water compacts have also been accompanied by millions of dollars in state and federal funding. Compacts with Montana Indian tribes alone have provided \$103 million in state and more than \$1.5 billion in federal funds. The revenue has financed the kinds of large-scale infrastructure projects the Crow Tribe is developing. Funding for the Northern Cheyenne compact, for example, financed repairs and enlargement of the Tongue River Dam. The Rocky Boy’s compact provided an allocation of water from Tiber Reservoir to the Tribes; that stored water will be the centerpiece of the North Cen-



“I grew up outside of Lodge Grass, and water quality was a constant issue for families in our area. I’m so happy that I’ve been part of the effort to improve that essential fact of life.”

—Heather Whiteman Runs Him

the settlement will enable the Crow to put their water to work.

“The federal funding component is critical to developing a viable economic future for the reservation,” she says. “One of the challenges we constantly face is not having adequate utility infrastructure, basic things like access to water. Most communities have sources of revenue they can tap for development. The tribe hasn’t had that.”

With infrastructure, she says, “comes a framework for expansion of small businesses, health-care facilities and housing. We can grow and develop and provide new sources of employment.”

In the near term, both water projects will mean jobs for tribal construction crews. As the various phases become operational there will be needs for administrative personnel, system operators, ditch riders and maintenance workers. Part of the tribe’s water right involves industrial

bring a single, far-reaching change: everyone on the reservation who wants clean, quality water for their everyday needs will be able to get it.

“I grew up outside of Lodge Grass, and water quality was a constant issue for families in our area,” says Whiteman Runs Him. “The well water doesn’t smell good, you can’t drink it, it ruins your appliances. I’m so happy that I’ve been part of the effort to improve that essential fact of life.”

Since its inception in 1979, the Reserved Water Right Compact Commission (RWRCC) has negotiated compacts with seven Montana Indian tribes: the Assiniboine and Sioux of the Fort Peck Reservation; the Northern Cheyenne; the Crow Tribe; the Gros Ventre and Assiniboine of the Fort Belknap Reservation; the Chippewa Cree of Rocky Boy’s Reservation; and the Blackfeet Tribe. The Commission has also negotiated eleven compacts with five federal agencies for various federal reservations of land across the

tral Montana drinking water system, which will deliver treated water to both reservation communities as well as off-reservation farms and municipalities across northern Montana.

“Montana today is recognized as a national leader in resolving state/tribal water disputes,” says Chris Tweeten, who has been involved in all of the RWRCC negotiations and served as chairman of the RWRCC since 1993. “The foresight of the 1979 Montana Legislature has made us the envy of other western states that are only beginning to tackle the problems Montana has largely solved.”

Montana Tribal Water Compacts	Tribes	Federal Dollars (\$ Millions)	State Dollars (\$ Millions)	Total*
	Blackfeet**	\$399.0	\$49.0	\$448.0
Crow	460.0	15.0	475.0	
CSKT*	0.0	0.0	0.0	
Fort Belknap**	552.0	17.5	569.5	
Fort Peck	0.0	0.0	0.0	
Northern Cheyenne	56.5	21.8	78.3	
Rocky Boy’s	75.0	0.5	50.0	
Total	1,542.5	103.8	1,646.3	

*NO COMPACT **PROPOSED FEDERAL BILL



