CLEARING THE WATERS

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Editor:
Susan j. Styer
susan.styer@state.nm.us

If you would like to receive this newsletter by email or be removed from the mailing list, please contact Susan j. Styer at Susan.Styer@state.nm.us.

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Cold Springs Creek and the Royal John Mine

A legacy of abandoned mines and heavy metal contamination

By John Moeny
SWQB Environmental Scientist - NM Field Team, Silver City

Downstream from the old Royal John Mine mill; an area of erosion cutting through contaminated tailings and creek alluvium (pre-project).

Cold Springs Creek is a little-known perennial stream that drains the west side of the southern Black Range of the Mimbres Mountains in Grant County. It merges with Hot Springs Creek to eventually flow into the Mimbres River just north of the tiny town of Faywood. The headwaters of Cold Springs Creek originate at 8600 feet elevation and supports perennial flow for nearly three miles before entering dry sandy foothills and infiltrating into the subsurface.

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COLD SPRINGS CREEK *continued from page 1*

The Surface Water Quality Bureau (SWQB) has been monitoring Cold Springs Creek over 25 years and due to excessive amounts of heavy metals, it has been included on the SWQB list of impaired waters; (*State of New Mexico CWA §303(d)/§305(b) Integrated Report*, www.env.nm.gov/wp-content/uploads/2018/03/Appendix-A-Integrated-List.pdf). The presumed source of heavy metal contamination is the old mine workings of the Royal John Mine which saw significant mining activities between 1916 and 1969. For years, ground water percolated through abandoned waste rock and mine tailings to eventually discharge into the drainage of Cold Springs Creek which itself cuts through old tailings as it meanders downstream. The Royal John Mine and some tailings and waste rock are on land managed by the Gila National Forest.

The ore outcrops at the Royal John Mine were discovered about 1880, when prospectors searched the mountains for rich silver deposits comparable to those being worked at nearby Lake Valley and Kingston. However, the remote location and distance to ore processing precluded any development of the ore bodies until nearly 26 years later when an eighteen-mile road was constructed to Lake Valley in 1907. That initial attempt to develop the mine was a failure, and it was not until 1916 when the first ore was transported off the mountain and shipped for processing via a much shorter access road to the Deming-Mimbres highway (now NM Highway 61). The initial shipment of 161 tons of ore resulted in 116,087 pounds of lead, 56,160 pounds of zinc and 881 ounces of silver. Production peaked in 1928 with 8,842 tons of ore being mined and milled at a newly constructed facility built at the mine site. Production dropped off significantly in 1929 with the Great Depression and subsequent crash in metals prices. The mine has seen sporadic periods of productivity (*Table 1*) but was largely abandoned by the late 1960s. Since then, little active mining has taken place and very few attempts have been made to remove or stabilize the mine tailings and waste rock that cover approximately 1,440 acres within the Royal John Mine area and the adjacent Carpenter Mining District.

Years	Tons of Ore	Lead (lbs.)	Zinc (lbs.)	Copper (lbs.)	Silver (oz.)	Gold (oz.)
1916	161	116,087	56,160	-	881	-
1917	2,355	180,112	244,300	-	1,386	0.05
1922	5	7,153	-	-	68	-
1927	200	53,193	43,000	-	-	-
1928	8,842	393,997	596,695	2,897	12,799	2.20
1929	8,346	424,694	638,780	2,998	10,593	1.98
1930	3,346	177,616	187,613	279	2,870	2.90
1942	494	41,640	68,140	1,163	936	-
1943	603	21,105	92,862	-	-	-
1944	2,324	81,434	458,052	-	7,274	-
1945	65	2,288	15,062	235	227	0.65
1946	877	68,225	170,124	2,631	842	1.75
1947	1,694	125,693	283,572	4,066	1,220	
1948	1,308	99,907	213,414	2,877	1,425	
1949	702	120,113	183,752	1,124	857	
1956-1969	1,780	206,500	363,200	-	3,899	-
Total	33,102	2,119,757	3,523,726	18,270	45,288	9.53

Table 1. Production of minerals at the Royal John Mine.

Table courtesy of Steve McDonald, US Forest Service (USFS) *Region 3 from data compiled by Soule and Hedland.*

Since the original impaired waters listing in 1996, the SWQB recognized that the abandoned waste rock and tailings are the primary source for heavy metal contamination in Cold Springs Creek. In 1996, the Bureau funded construction of several critical, best-management-practices in an effort to at least limit the volume of tailings and contaminated waste rock that was being mobilized into Cold Springs Creek. A Clean Water Act, Section 319-funded project constructed a sediment retention area

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below the largest of the unreclaimed tailings piles and reconstructed the creek channel that winds through the mine area. The reconstructed channel was lined with a geotextile fabric to stabilize fine tailing material beneath the channel which was armored by hand with limestone riprap. The drainage channel was designed to include as much natural meander as possible to reduce the slope and restrain the velocity and power of the creek during high flow events. Finally, the deeply incised and eroding waste piles were graded back toward the adjacent undisturbed slopes. While the project certainly helped prevent some metal laden sediment from being transported by Cold Springs Creek, water quality still did not meet state standards. A survey completed in 2009 found that chronic aquatic life criteria for lead and cadmium were exceeded 4 of 4 and 3 of 4 times, respectively, and consequently the creek remained on the impaired water list for the 2012 listing year. A wildfire in 2013 added yet more cause for concern.

On June 7, 2013 a lightning strike sparked the Silver Fire approximately 3 miles north of the Cold Springs Creek watershed. By the time it was officially contained, the fire had charred nearly 140,000 acres, with over 42 percent of those acres burned at moderate to high severity. The Cold Springs Creek watershed was typical of many upper elevation watersheds that burned during the Silver Fire. Pockets of high severity fire were surrounded by moderate severity fire while remnant stands of unburned forest remained intact. While the actual mine site escaped the fire, the stage was set for large scale flooding that would impact the mine site, Cold Spring Creek, and downstream landowners and water users.

In July 2014, the USFS notified the SWQB of large-scale flooding of Cold Springs Creek and the Royal John Mine site. The USFS had been alerted by the property owners downstream who were concerned about contaminated water and sediment washing onto private land and potentially contaminating their drinking water wells. A team consisting of staff from NMED (Ground Water and Surface Water Quality Bureaus), local Forest Service employees and an engineer from the Forest Service Regional office in Albuquerque toured the watershed and mine site in August 2014. Damage to the mine site was extensive, with all the BMPs constructed in 1996 destroyed. Consequently, all the retained sediment was being mobilized downstream and headcuts and lateral erosion were rapidly cutting into contaminated waste rock and tailings (*Figure 1*). Water quality sampling conducted by SWQB staff from the Silver City field office in August 2014 showed elevated levels of lead, zinc and cadmium which exceeded New Mexico's surface water quality standards. Because the watershed has been in a state of prolonged instability and perpetual release of contaminated tailings and waste rock, the USFS began developing a remediation plan to permanently remove contaminated material from the upper watershed and build a stable repository which would be unaffected by large scale fire and flooding; lower in the watershed and away from the stream channel.

Figure 1. Private landowners, USFS personnel and NMED staff evaluate eroded areas through waste rock and tailings (pre-project).

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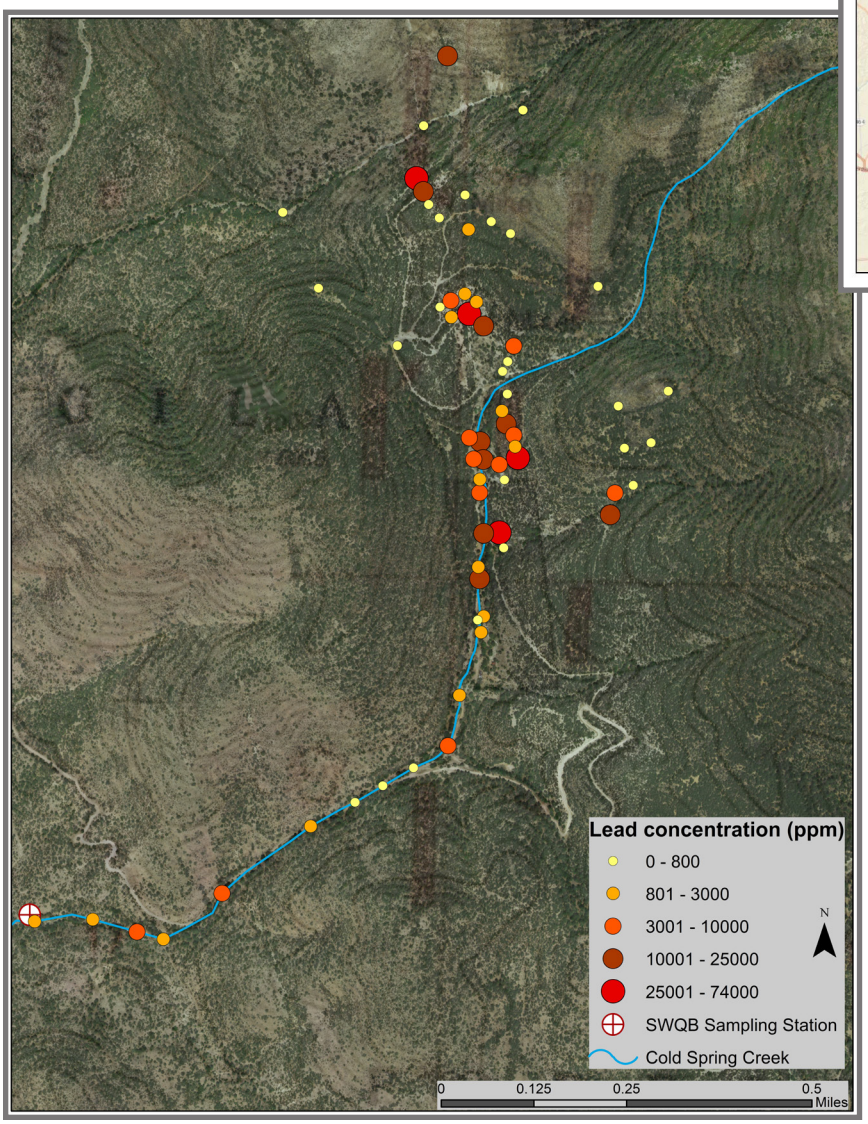
COLD SPRINGS CREEK *continued from page 3*

The map below (*Figure 2*) shows the results of the initial site characterization of the historic mining district. Samples were taken from tailings, waste rock and stream bottom sediments and analyzed for heavy metals. High concentrations of lead were found throughout the watershed but were concentrated within the old mill site and mine openings where an estimated 89,600 cubic yards of waste rock and tailing litter the site. For some perspective, the NMED soil screening level for residential areas is 400 parts per million (ppm) while the industrial level is 800 ppm. Stream bottom sediment samples taken along Cold Springs Creek ranged from 21.9 ppm to 3,620 ppm while some areas of tailings tested at over 74,000 ppm. Following the initial engineering report the remediation was put on a priority list by Region 3 of the USFS. In late 2018, the Forest Service hired Engineering Remediation Resources Group under a $970,331 contract to complete phase 1 of the mine reclamation. Phase 1 included removal of contaminated waste rock and tailings to a stable repository location located approximately 2 miles downgradient from the mine and mill site. The repository will be covered with 3 feet of cover material (subsoil) and 6 inches of top soil and seeded with native species. The entire repository location will be fenced to prevent vehicular access and ensure the long-term stability of the site and is expected to be completed by the fall of 2019. Phase 2 will include additional work to close mine adits and shafts using bat-friendly culverts and grates.



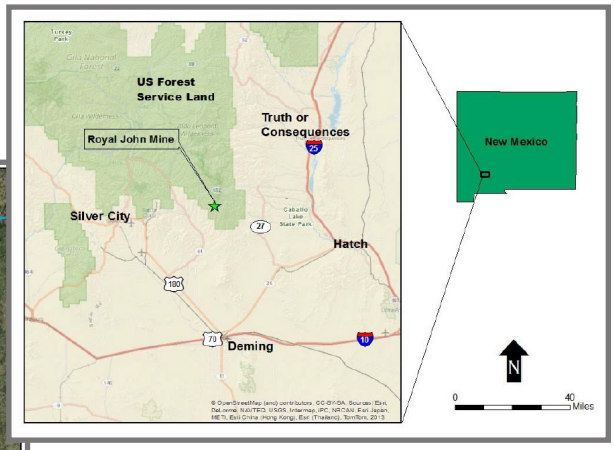


Figure 2. Above - Map of lead concentrations through site. Above right - Royal John Mine general site location, map provided by USFS.

The SWQB Silver City field office continues to monitor water quality downstream of the old mill and tailings piles to document the effects of the reclamation. Sampling will continue through 2019 and 2020 with the expectation that removal of the contaminated tailings and waste rock will result in improved water quality and an eventual de-listing of Cold Springs Creek as an impaired perennial water of the state.

Watershed Protection Section Staff Changes

Two Notable Retirements

Chris Canavan, team leader of the New Mexico Field Offices Team of the Watershed Protection Section, retired at the end of 2018, and **Chris Cudia**, team leader of the Implementation and Restoration Team in Santa Fe, retired at the end of January 2019. Both had worked for NMED for significant periods, and their institutional knowledge is sorely missed.

Chris Cudia worked in various positions for NMED and the Department of Transportation, and is considered one of the founders of the Nonpoint Source Program, having worked on the program starting in 1994 and having established the Silver City office of the Surface Water Quality Bureau in 1997.

Chris Canavan began his work with NMED in 2004, working in the Las Cruces field office and completing significant capacity-building achievements such as assisting the formation of the Paso del Norte Watershed Council and completion of the area's Paso del Norte Watershed-Based Plan.

Chris Cudia

Chris Canavan

Chris Cudia and Chris Canavan earned respect and the nickname "*C Squared*" for their participation in the emergency response team following the Little Bear Fire near Ruidoso, during which they strived to minimize impacts to the Rio Ruidoso and Rio Hondo and to ensure that emergency actions taken in stream channels were compliant with Sections 404 and 401 of the Clean Water Act.

Watershed Protection Section Staff Changes

Two Welcome Additions

Davena Crosley, joined the Watershed Protection Section as a Project Officer in January. She joined NMED from the Energy , Minerals, and Natural Resources Department, where she worked in the regulatory program as the lead on the Questa Chevron molybdenum mine, and later worked in the Abandoned Mine Lands program managing projects to reclaim and increase safety of abandoned mines. Davena quickly got up to speed with Chris Canavan's prior projects and water quality protection programs such as the Clean Water Act Section 401 program, and started working on developing new projects in the Las Cruces area. She also applied for and was selected for Chris Canavan's team leader position, and in June moved into her new position and gained supervisory and coordination responsibilities.

Wendy Melgin-Pierard, joined the Watershed Protection Section as team leader of the Restoration and Implementation Team (i.e., Chris Cudia's former position) starting in June. She joins NMED after a career with the Environmental Protection Agency in both the San Francisco and Chicago Regional Offices. Wendy is very well-versed in Clean Water Act details and counts among her achievements technical contributions to the 2015 Waters of the United States Rule. Wendy is a trained hydrologist and is looking forward to working more directly with stakeholders and affected resources than she has in recent positions. She is also glad to return to the west where she spent her college years and began her professional life working for the Forest Service and Tahoe Regional Planning Agency.

Welcome Davena and Wendy!

Updates from The SWQB Monitoring, Assessment and Standards Section

Jon Celmer, SWQB Monitoring Team, collecting data in the San Francisco River.

Monitoring Team News:

Monitoring team fieldwork continues on schedule for the first year of our two-year survey of the following watersheds: Upper Pecos, Lower Rio Grande, Mimbres, Gila, and San Francisco. The survey Field Sampling Plan is available at www.env.nm.gov/surface-water-quality/water-quality-monitoring/.

TMDL/Assessment Team News:

The SWQB is soliciting chemical, physical, biological, and bacteriological data for all surface waters of the state that can be compared to water quality standards. All submittals must be accompanied by the standard operating procedures and quality assurance/quality control protocols under which the data were collected and validated. Additional details and data templates are available www.env.nm.gov/surface-water-quality/data-submittals/.

Public comment closed on a TMDL report for impaired waters from the 2015-2016 Canadian/ Dry Cimarron survey. The report will be presented to the NM Water Quality Control Commission during their meeting in Santa Fe on August 13.

WPS - Wetlands Program

Solicitation for Applications (SFA) – East Fork Jemez River Wetlands Restoration Project

Federal Clean Water Act Section 104(b)(3) subgrant for East Fork Jemez River Wetlands Restoration Project.

The NMED SWQB is requesting applications for convening a Wetlands Action Plan process for the East Fork of the Jemez River Watershed, to design and implement a project that demonstrates the effectiveness of innovative water-slowing, spreading and infiltrating structures and include a variety of outreach activities and the creation and distribution of a technical guide and fact sheet. Applications are due by 5:00pm mountain daylight time on **September 5, 2019**. The SFA is available online at https://www.env.nm.gov/surface-water-quality/funding-sources/.

EVENTS & ANNOUNCEMENTS

August

August 16th - 18th - near Questa. Join Albuquerque Wildlife Federation volunteer restoration service project at Midnight Meadows, near Questa, NM. For additional details or to sign up: Contact Scial at rioscial@gmail.com or abq.nmwildlife.org/projects.html.

August 30th - September 1st - San Mateo Mtns. Join Albuquerque Wildlife Federation volunteer restoration service project at Limestone Canyon, San Mateo Mtns., NM. For additional details or to sign up: Contact Scial at rioscial@gmail.com or abq.nmwildlife.org/projects.html.

September

September 19th - September 22nd - Silver City. 15th Annual Gila River Festival features expert-led field trips to the Gila River and Gila National Forest, focusing on local cultural and natural history, such as archaeology, rock art, birding, and more. Explore the future of the Gila River in relation to the changing climate, as well as our responsibility to act as responsible earth stewards, with keynote speaker climate activist Tim DeChristopher and many renowned presenters. For additional details or to sign up: www.gilariverfestival.org/.

September 20th - September 22nd - near Grants. Join Albuquerque Wildlife Federation volunteer restoration service project at Cebolla Canyon, near Grants, NM. For additional details or to sign up: Contact Scial at rioscial@gmail.com or abq.nmwildlife.org/projects.html.

October

October 19th - Santa Fe. *Hunt for the Red Rocktober Community River and Arroyo Cleanup* at Alto Park from 10:00 am-12:00 pm. Organized by the Santa Fe Watershed Assoc. for more information: (505) 820-1696, https://www.santafewatershed.org/event/hunt-for-the-red-rocktober-community-river-and-arroyo-cleanup/, or raquel@santafewatershed.org.

October 21st - 22nd - Rio Rancho. Children's Water Festival. Fourth graders from the City of Rio Rancho and nearby Town of Bernalillo will be lugging jugs of water to understand the meaning of "one gallon," learning how to clean dirty water, and becoming familiar with water resource management when they participate in the Rio Rancho Children's Water Festival. Designed to educate fourth grade school children about water and its relationship to human and other natural resources in a fun and interactive atmosphere, the event introduces fourth graders to new ideas, options and solutions to encourage them to conserve and protect water through participation in games and fun activities. If you are interested in volunteering, please visit: https://www.rrnm.gov/2459/Childrens-Water-Festival.

Save the Date

November 6th - 8th - Pueblo of Pojoaque. The New Mexico Water Resources Research Institute is hosting the 64th annual NM Water Conference: *Common Water, Sacred Water: Tribal Perspectives on Water Issues in New Mexico*. Check for updated information coming soon: https://nmwrri.nmsu.edu/.

If you have a related event that you would like distributed, please send an email to susan.styer@state.nm.us