

On the Water Front

Rocky Mountain Water Quality Analysts Association

Second Quarter 2015

US Wastewater Treatment History

1800s

- US population grew from 5 million to 75 million
- Collection systems were installed to help prevent disease
- Buried sewers systems replaced pit privies and open ditches increasing the “sewered population” from 1 million in 1860 to 25 million by 1900.
- “Treatment” was mostly dilution into receiving waters

TREND: Awareness and control of sewage discharge to minimize impacts on receiving waters through standards, regulation, and simple or primary treatment

Key Dates:

1887 First biological treatment, an intermittent sand filter, installed in Medford, MA

1886 Standards for discharge loading and treatment developed at Lawrence, MA and Chicago, IL

1899 First federal regulation of sewage, Rivers and Harbors Appropriations (“Refuse Act”) prohibited discharge of solids to navigational waters without permit from US Army Corps of Engineers

Early 1900s

- 1 million people served by 60 sewage treatment plants for removal of settling and floating solids.
- “Sewered population” increased at ~same rate as total population

TREND: Development of biological or secondary treatment (i.e. “secondary”)

Key Dates:

1901 First trickling filter operated in Madison, WI

1909 First Imhoff tank used for solids settling

1914 First liquid chlorination process used for effluent disinfection

1916 First activated sludge plant in San Marcos, TX

TREND: Protection of receiving water quality

Mid 1900s

- Wastewater treatment linked to the surface water
 - Importance of dissolved oxygen to aquatic life
 - Aesthetic properties (odor, color, solids)
 - Measurement of organic matter in sewage as biological oxygen demand (BOD)

TREND: New regulation and government funding

Key Dates:

1921 Mechanical dewatering of sludge using vacuum filters and centrifuges in Milwaukee, WI

Early 1930s Sludge drying & incineration in Chicago

1944 Steeter Phelps DO sag curve model for streams to predict BOD assimilation capacity

Secondary treatment processes to remove BOD
Increased wastewater treatment meant increased residuals (sludge)

Heated sludge digesters and use of gas

1948 Federal Water Pollution Control Act provided federal funds for water quality surveys and construction of collection and treatment plants

1952 Extension of FWPCA funding.

1966 Clean Water Restoration Act extended federal grants for plant construction.

Late 1900s

- By 1960, 50% of US population had access to some form of wastewater treatment.

TREND: Advances in treatment process to improve receiving water quality

- Nitrogen and phosphorus removal technologies were added to the wastewater treatment train in order to control eutrophication in receiving waters especially in downstream reservoirs
- Use of chemical conditioners (polymers, polyelectrolytes) and dissolved air flotation for enhanced solids separation and thickening
- Improved sludge digesters using high temperature processes
- Effluent disinfection

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CHANGING PHASES

Jon Downey

Jon Downey has arrived in Colorado and is happy to continue his work in the water quality field!

Jon comes to us originally from Massachusetts, via Vermont, Oregon, Washington, and, finally, California.

Jon's most recent position in fishery sciences had him travelling often - he even enjoyed some time at sea as a fisheries biologist aboard various commercial fishing vessels. He also has experience as a lab technician and researcher in organic chemistry and coastal science.

Now Jon plans to settle into his new life in Colorado, where he landed with a group of friends tackling everything Colorado has to offer together. He should have plenty of fun here, as his hobbies include snowboarding, mountain biking, hiking, fishing, backpacking, and home brewing.

Jon hopes to get a canine friend soon to share in his Colorado adventures. He also wants some foreign adventures and hopes to travel internationally soon.



Jon helping out with field work at Metro Wastewater

Lucky Krause

Lucretia 'Lucky' Krause came to the Denver area and Metro Wastewater Reclamation District from her previous home in Austin, TX. She came to CO with her life partner, James and her two dogs, a German Shepherd and a Boxer.



Lucky, modeling proper PPE for the lab.

Before attaining her position at Metro as an Analyst 1, Lucky spent 14 years in research, public health, and academic labs. Six of those years were spent managing academic cellular/molecular, genetics, and biotechnology laboratories. Lucky also has a B.S. in microbiology, an undergraduate thesis in molecular genetics, and an advanced technical certificate in environmental technology.

Lucky has already started to pursue her interests and further her education here in Colorado. She volunteers doing community awareness and non-point source pollution identification in the Bear Creek watershed, and she is studying for her wastewater operator's license and exploring graduate programs in water quality. Lucky also enjoys the outdoors, and is looking forward to hiking and exploring the varied ecology of Colorado.

...Wastewater Treatment History continued from page 1

- New process configurations implemented at wastewater facilities including high rate activated sludge processes, high purity oxygen, sequencing batch reactors, high rate trickling filters, hybrid trickling filter-activated sludge processes, and membrane bioreactors

TREND: Stricter regulation at the federal level

Key Dates:

1972 Amendments to the Federal Water Pollution Control Act (PL 92-500)

1977 Clean Water Act which included:

- Water Quality Standards (WQS) for receiving

waters based on designated uses and related human health and aquatic life criteria

- Antidegradation policy with ambient monitoring
- If WQS not met, strategies and controls put in place to improve impaired waters using Total Maximum Daily Load (TMDL) approach.
- Implemented through the National Pollutant Discharge Elimination System (NPDES) permit program
- Control of toxics with help from Industrial pretreatment
- Sludge (i.e. Biosolids) disposal



Colorado Water Law Quiz

OK, so we are all involved with water in Colorado in some way: sampling it, analyzing it, protecting it, cleaning it, regulating it, or just plain loving it.

But how much do we know about water law in Colorado?

Laws cover all aspects of water use, and Colorado has a unique history during which a unique set of laws regarding water use developed. Answer the questions below to find out how much you know about water law in Colorado.

Disclaimer: The author is not a lawyer. Nor does he play one on TV. No legal weight should be given to anything written here. If you have legal issues surrounding water, talk to a professional.

1. The law in Colorado governing water use is commonly referred to as:
 - A. The High and Dry Law
 - B. Riparian Doctrine
 - C. The Tragedy of the Commons
 - D. The Doctrine of Prior Appropriation
2. True or False? Because of its benefit to society while using only small amounts of water, a solar panel manufacturing plant preferentially gets water over an amusement park.
3. Water law in CO today evolved primarily from:
 - A. The Anasazi irrigation projects in the four corners area, 1100s-1200s
 - B. Established water law in the Eastern US from European settlers, 1600s
 - C. Miners during the CO Gold Rush of the 1800s
 - D. The Colorado River Treaty between the U.S. and Mexico, 1944
4. True or False? Water uses that are **not** considered water-wise (such as growing watermelons on irrigated land) are being legally phased out due to the increased demand for water for more beneficial uses.
5. True or False? Generally in Colorado, water rights are recognized based on who used the water first. If you use the water first, you have first right to that water.
6. True or False? Due to the lack of water supplies, water reuse (diverting discharged wastewater, treating it further, and using it to irrigate parks, golf courses, etc.) is encouraged and is only legally limited in that it must meet certain water quality standards.
7. True or False? In CO, water in streams is considered a public good. Therefore, in accordance with the rules of the Colorado Water Conservation Board, water can only be withdrawn for consumptive use after minimum in-stream flows to protect aquatic life have been met.
8. CO law allows for “beneficial use” of water. This can include which of the following (choose all that apply):
 - A. Dryland irrigation of melons
 - B. Fire protection
 - C. Environmental preservation
 - D. Snowmaking
 - E. Flood Control
 - F. Washing your hair
9. True or False? Water transported across the Continental Divide to the Front Range is legally treated the same as water from Front Range watersheds.
10. True or False? Colorado’s consumptive use of Colorado River water is limited by the Colorado River Compact of 1922, which guarantees a specified amount of water to downstream states like Arizona and California, regardless of the actual amount of water available in a given year.

How did you do?
Check out the last page for detailed answers.



UPCOMING 2015 EVENTS

April- RMWQAA Annual Symposium- RMWQAA host

June- Aquarium Tour- RMWQAA host

July- RMWEA LPC (Lab Practices Committee) Joint Summer Social- RMWEA host

Sept- RMWEA/RMSAWWA Joint Conference- RMWEA Host...Check out the water lab track and wastewater lab track which are new this year!

Oct- Centennial W&S Plant tours (includes both Drinking and WW plants) - RMWQAA Host

Dec- RMWQAA/RMWEA Joint Holiday Social- Both Orgs Host

Graywater Update

Graywater is the portion of the water used in a residential, commercial or industrial building that may be collected, after the first use, and put to a second beneficial use. House Bill 13-1044, signed in 2013, directed the state health department (CDPHE) to create a graywater control regulation to allow local jurisdiction to develop a graywater control program. The Water Quality Control Commission passed Regulation 86 in April with an effective day of July 1, 2015.

On or after July 1, 2015, a local ordinance may be created to allow for indoor reuse of graywater for toilet flushing or outdoor reuse for irrigation. Some of the larger systems, if allowed by the local ordinance, would need a certified operator. At this time the state regulation does not require water quality monitoring and reporting, although water testing is encouraged and local ordinance may require water quality monitoring and reporting. Check in with your local governing bodies for more information. Some likely water tests include coliform, dissolved oxygen, pH, biochemical oxygen demand, and carbonaceous biochemical oxygen demand.

For more information, visit <https://www.colorado.gov/pacific/cdphe/wq-graywater>

Congratulations to the analysts who took certification exams in October 2014.
6 people passed level I
2 people passed level III

Chlorophyll Round Robin

Are you interested in competing against other labs? How about just comparing the results from your method to those of a neighboring lab? If so, join the City of Northglenn's water quality laboratory as they host a local Round Robin for chlorophyll-a this Spring or Summer. The current lab method for analyzing chlorophyll-a has limited recognized quality control as there are no standards or proficiency tests developed. The Round Robin will be designed as a local quality control exercise and to acquire comparative data to make decisions regarding training, quality control, and identify any other needs.

Samples will be collected in May or June depending on the weather and algae levels. The samples will then be available for same day pick-up by participating laboratories. The pick-up locations will be around the Denver Metro area meaning you can hopefully find a convenient location for pick-up. Once samples arrive, each lab will have 28 days to complete analyses and submit results to the host, City of Northglenn's water quality laboratory. Northglenn's staff will do some basic statistical analysis and send the data and analytics to all participating laboratories.

If interested, please email Evelyn at erhodes@northglenn.org with the subject line *chlorophyll round robin*. Join RMWQAA at the next symposium to hear about the experience of running a round robin and the lessons learned.

Looking for a Job?

We often have job postings on the website.
Check it out! RMWQAA.ORG

Answers to Colorado Water Law Quiz:

1. D. The Doctrine of Prior Appropriation. AKA First in Time, First in Right. In Colorado, whoever first diverts and makes beneficial use of a quantity of water (as long as it is properly recorded), has a legal right to use that water. The second person to divert and beneficially use water gets to use their water only after the first person's water right has been satisfied. And so on down the line. Older is truly better when it comes to CO water rights.
2. False. Water law takes no account of the societal benefit of the use of water when determining water rights. Who gets water is determined by who has the most senior right, as long as that water is beneficially used.
3. C. Miners established the idea of Prior Appropriation. During the Gold Rush, water was a rare commodity and was needed for extracting gold. Miners who first diverted water from rivers to their mines (often miles away, requiring a huge investment and labor and resources) were unhappy to say the least when others diverted the water they used at some point upstream from them. Water disputes in that age were sometimes resolved at gunpoint, with the resulting law being that the first miner had a right to the water that he was using.
4. False. The law has not changed in the face of new demands on water. Pressures on farmers and agricultural communities have grown as other users like cities try to get more water (and have more money to spend), but the law remains the same.
5. True. This is the basis of Prior Appropriation and is generally followed.
6. False. Water reuse is subject to the limits of Prior Appropriation law and is not always legal. For example, cities may be legally obligated to discharge a percentage of their water rights to downstream users (depending on the water rights that they have). Reusing this water would lessen the amount of water discharged, illegally infringing on the water rights of others. It should be mentioned that reuse water quality is also monitored.
7. False. There is no requirement for in-stream flows to be maintained. In fact, many streams are over-appropriated (meaning that there are more rights to use water out of a stream than there is flow in the stream-in which case junior (younger) water rights do not get satisfied). The Colorado Water Conservation Board is exclusively authorized to apply for and purchase water rights that can be used for in-stream flows.
8. All of these can be considered "beneficial use". When there are competing uses, the use that has the oldest claim gets priority. In the Front Range, irrigation for melons has higher priority than any use for environmental preservation.
9. False. Legally, water imported into a watershed is treated separately from water that is native to the watershed. One of the most important differences is that water that is imported into a watershed can be used to extinction (can be completely used up), while water from inside the watershed can only be used to the extent, and during the times, that it has historically been used. This gets complicated, but if a city buys water rights from a farmer to use water that originates in the watershed the city needs to use the water in approximately the same manner as the farmer had historically. That means that if it was determined that the farmers use of the water for irrigation had a 30% return flow (water returned to the watershed through overland flow or infiltration into groundwater, as will happen with irrigation), then the city cannot use up that 30% either. However, if a city uses water pumped across the Continental Divide, it can use that water to extinction. As an example, say the city uses the water and it is determined that it has a 50% consumptive use (meaning after one use 50% of the water is released into the watershed), the city can reuse that water again and again until none of it is released into the watershed. This has obvious implications for reuse plants.
10. True. Colorado can use what is left over after its obligations to downstream users are fulfilled. This puts Colorado in a difficult position during drought. Also, it is thought that the average flow of the Colorado River was overestimated at the time.

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