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Some Dam – Hydro News™ And Other Stuff



Quote of Note: *“A President cannot always be popular.”* - Harry S Truman

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“Good wine is a necessity of life.” - -Thomas Jefferson
Ron’s wine pick of the week: 2014 Ferrari Carano US Red Blend “Siena”
“No nation was ever drunk when wine was cheap.” - - Thomas Jefferson



Dams:

(This is a loooonnnng letter. DWR is getting a lot of criticism. Nothing like this has happened before so there’s no experience. Sure, in hindsight some things could have been done differently. But, when you’re in the midst of a possible disaster, you have to make many decisions on the spur of the moment and it’s impossible to be perfect. Under the circumstances, DWR did pretty well. With respect to the emergency spillway, they tried something and recognized quickly it wasn’t going to work, probably saving lives and the property of 200,000 people. As Robert Moses once said: “Those who do – build, those who don’t- criticize.”.)

DWR answers letter from those impacted by Lake Oroville Spillways incident

Jun 9, 2017, gridleyherald.com

A letter sent to the Department of Water Resources dated April 19, 2017 which included questions and requests for information from a coalition of community groups, local governments and agencies, businesses, labor, and individuals who have been affected by the Lake Oroville spillways incident has been answered and follows. The cover letter by Chief Deputy Director of DWR Cindy Messer states “We respect the magnitude of difficulty that you and your community faced. We also understand the disproportionate impact that the evacuation had on residents who

are socially or economically distressed and will continue to seek solutions that address these considerations. Given the comprehensive nature of your letter, each of the items are addressed individually.”

“1. This emergency has demonstrated that the Oroville Dam lacks the operational flexibility and reliability to provide adequate flood protection to communities downstream. It is not clear how DWR is adapting both the dam itself and/or reservoir operations to accommodate these deficiencies. We believe options need to be explored to provide for large releases well in advance of high water events and well below the service spillway crest elevation. Or, overall flood protection could be improved by providing additional flood buffer when there is a large snowpack and the potential for warm storms.



ANSWER: The flood control operation of the Oroville Dam and facilities are prescribed by the United States Army Corps of Engineers (USACE) operating criteria. These criteria are designed to provide sufficient flood control to downstream communities. On February 24, 2017, Governor Edmund G. Brown, Jr. sent a letter to USACE asking them to update the federal operating manuals for key California reservoirs. It is imperative that these manuals reflect current scientific and operational knowledge and industry best practices. DWR has committed to coordinating with USACE, Federal Energy Regulatory Commission, and California’s Division of Safety of Dams regarding the 2017/2018 winter operations plan. Discussions with the USACE regarding the development of the plan have been initiated by DWR.

2. DWR’s outreach to the downstream communities directly impacted has been inadequate at best. Our best sources of information have been informal and indirect sources rather than through official DWR channels. DWR must immediately shift its thinking in how, when, and to whom it shares information. There is already a strong community distrust of DWR due to this event. A lack of communication and transparency only makes it worse. DWR could do much more to improve trust and credibility with the community by providing greater transparency and providing formal, consistent communication with the downstream communities.

ANSWER: We agree that our communication with impacted communities needs improvement. Now that we’ve moved from emergency response to emergency recovery, we are focused on improving the project’s communications program. The seven recent community meetings were the first step, and we are creating other outreach and engagement strategies as well. Feel free to send recommendations for how to effectively reach your constituents to our communications advisor at oroville@water.ca.gov Please share this information with your constituents: A new DWR webpage is dedicated to the Lake Oroville spillways incident. The most current information can be found here: www.water.ca.gov/oroville-spillway

DWR is compiling all of the questions posed at the Lake Oroville spillways public meetings. We will post answers to the questions on the Lake Oroville spillways webpage in June. The public may watch construction activities through a live feed from two cameras at the site. Hosted by the California Department of Parks and Recreation, the Lake Oroville State Recreation Area Spillway Live Stream is at www.parks.ca.gov/live/lakeorovillesra_spillway. The community meeting PowerPoint presentation is available online. DWR’s YouTube page is home to hours of video content including recordings of the community meetings. **We’re working on a viewing area for the public and a 24-hour “dam cam” is available for your viewing here.** (Note: does not play in Google Chrome browser.) DWR’s initial plans to repair both spillways are outlined here. Work is well underway to repair both spillways by November 1 for the 2017/2018 flood season. We will ensure the main spillway is reconstructed to safely accommodate any weather we might face this winter.

Also by November 1, we will construct a cut-off wall on the emergency spillway which will ensure if we ever need to use the emergency spillway again, that its use will not jeopardize the integrity of the dam. Construction will continue next season to make final updates to both spillways. DWR is also holding bi-weekly calls to provide construction updates to the media.

Inspection reports of Oroville Dam and its spillways by the state Division of Safety of Dams are available to the public on the DWR Spillways website. Lake Oroville is open for business. Check out this map to view closures and call the Visitor Center at 530-538-2219 to confirm accessibility. DWR will provide advance notice of changes in flows via emails and in coordination with the local maintaining agencies. We provide daily updates on current reservoir levels here. Here's Kiewit Infrastructure West Co.'s contract.

3. The number one priority must be to protect the lives of 200,000 people living immediately downstream. To be abundantly clear: fisheries protection, water supply issues, State Water Contractor priorities, FEMA reimbursement, politics and other issues must take a distant backseat to public safety. We urge DWR to publicly acknowledge this priority.

ANSWER: Public safety and security are DWR's highest priorities. We will continue to manage the Oroville Dam facilities throughout the year to ensure public safety, while managing reconstruction that will enable safe operation of the main spillway next winter. Frequent review by State and federal oversight and regulatory agencies are an important part of the operation and recovery process.

4. The overall infrastructure of the dam is old and, in the case of the spillways, river valves and turbines, failing. There must be a longer term plan for ensuring that Oroville Dam and all appurtenant features are repaired and brought up to 21st century standards. This plan should include not only the gated spillway and the emergency spillway, but also ensuring the plant facilities and low level release valves are adequate and fully operational. All construction plans should be reviewed by independent experts to ensure that this infrastructure is well planned, soundly built and supported. This modernization should be paid by the owners of the project, which we understand to be the State Water Contractors.

ANSWER: DWR is committed to ensuring that all infrastructure at the Oroville Dam facilities are safe and operational. The River Valve Outlet System (RVOS) was available for use prior to February 7. It was flooded during the spillway incident with resulting damage to some of the operating and control components and had to be taken offline in February 2017. It was repaired in May 2017 and is currently available at a tested safe capacity of 4,000 cfs. Plans to reconstruct the gated flood control (main) and emergency spillways are being developed to modern standards, informed by findings and recommendations from the independent Forensic Team and the independent Board of Consultants. In addition to these two groups of esteemed experts, oversight and recommendations are provided by the Federal Energy Regulatory Commission (FERC), the state Division of Safety of Dams (DSOD), the USACE, and Kiewit Corporation. Oversight of the design and construction of the restoration of the Lake Oroville spillway structures is being conducted by several entities: FERC, DSOD, and the Board of Consultants (BOC). Each entity's areas of jurisdiction are outlined on the DWR website. You may access and download the Board of Consultants memos on our website here. The BOC memos provide a significant amount of information about the Lake Oroville spillways incident response and recovery, while protecting certain information that could enable terrorist activity.

To provide for an independent review of the spillways incident, DWR contacted the Association of State Dams Safety Officials and the United States Society of Dams to propose a team that could conduct a forensic evaluation. The assigned Forensic Team, comprised of six engineering experts with diverse specialties, is charged with determining the root cause of the spillways incident, as well as any other contributing causes. Construction, operation and maintenance costs for Oroville Dam are covered by the 29 State Water Project Contractors. DWR is also seeking reimbursement from FEMA for all eligible emergency costs.

5. There must be a full and thorough review of how the Department of Water Resources designed, constructed, operated and maintained the dam. This review should include not only the existing, independent consulting board review and regulatory review, but also legislative oversight hearings and reviews by the State Auditor. Full disclosure and transparency of these proceedings and documents is essential.

ANSWER: The independent Forensic Team has responsibility for determining the cause(s) of the failures at the main and emergency spillway. In that capacity, they have access to all information related to operations and maintenance of the facilities, access to the construction site, and Department management information. Preliminary findings from the Forensic team are being shared with DWR during design and construction to ensure that potential problems are addressed. The Forensic Team released a memo outlining their preliminary findings and was posted on May 5 and on May 26, the Forensic team and the two national dam engineering groups released a press statement.

Thus far, the Forensic team has released [a report] outlining potential causes contributing to the spillways failure. It is important to understand that not all of the factors listed in this memorandum may have significantly contributed to the actual damages to the spillways. The Forensic team findings have been shared with the BOC as it advises DWR on work to recover spillways functions, so that any lessons learned can be incorporated into the recovery plans. The team's final report is expected to be released later in 2017. The independent BOC is responsible for advising DWR on state-of-practice planning, construction, operations, and maintenance. They also have access to all information related to operations and maintenance of the Oroville Dam facilities, and they visit the construction site as needed throughout the course of consultation. The BOC will continue to convene for one year after the end of construction and their memos are posted here. In addition to these two groups of outside experts, there are many subject matter experts from different disciplines on site daily to help DWR determine the most appropriate recovery efforts. We continue to work closely with FERC, DSOD, and the USACE throughout the recovery process; and we will regularly provide information to local, State and federal elected officials.

6. There must be a public discussion as to how Oroville Dam should be operated in the future and who should operate it. Without prejudging the conversation, some of the questions are as follows:

a. Should DWR continue to be the operator of Oroville Dam? There are other alternatives and they should be analyzed and discussed.

b. Should the Division of Dam Safety remain under the Department of Water Resources or should it become an independent body or moved to another agency to avoid perceived conflicts? Many of the most important technical regulators in the State serve under a publicly accountable board-DSOD should be no different.

DWR is focused on our responsibilities as the owner and operator of Oroville Dam and related facilities. It is not appropriate for us to address your questions about this status.

c. Are the current inspections, maintenance, repair, and replacement activities associated with the infrastructure at the dam sufficient to provide for public safety? DWR is continually assessing Oroville Dam. Oroville Dam is formally inspected by three different entities. The dam is inspected twice a year by the DSOD. The last inspection by DSOD was conducted in August 2016. Annually, the FERC Dam Safety Program also inspects the dam. The last FERC inspection occurred in May 2016. Every five years, most recently in August 2014, an independent board of expert consultants inspects the dam. All of these inspections of Oroville Dam and its spillways concluded they were safe to operate. Inspection reports dating to 1998 of Oroville Dam and its spillways by the DSOD are available online. After the spillway failure at Oroville Dam, Governor Brown on February 24 announced several actions to bolster dam safety and improve flood protection. This package is pending in the Legislature.

<https://www.gov.ca.gov/news.php?id=19696>

https://www.gov.ca.gov/docs/Fact_Sheet_Governor_Brown_Four_Point_Plan_to_Bolster_Dam_Safety_and_Flood_Protection.pdf

d. How can we ensure more local input on dam operations? We will meet this summer with one or more representatives of your coalition to learn how you would like to provide input on dam operations. In addition, public meetings will be part of the process of the USACE update of the Oroville Dam facilities operations manual.

e. Should there be a more robust public safety obligation on the part of DWR to provide for law enforcement and emergency response at the Oroville Dam and Reservoir? As of now this is obligation is largely shouldered by Butte County which has limited resources. FERC and DWR need to treat Butte County fairly for all the services provided to Lake Oroville facilities. This event has underscored the importance of public safety and effective communication. DWR has been working closely with Butte County and local area emergency responders to ensure that lessons learned help shape future planning.

f. Should the operations at Oroville Dam be modified to provide for increased flood space during seasons in which there is a large snowpack?

A revised dam operations manual from the USACE may address this question. In the meantime, DWR collaborates with Forecast-Coordinated Operations partners such as the National Oceanic and Atmospheric Administration, the National Weather Service California-Nevada River Forecast Center, and the USACE to model and plan for future weather events. Lake elevations, releases, inflows, and other hydrological considerations will be closely examined to ensure safe operations.

g. How has DWR's coordinated reservoir operations and predictive forecasted reservoir operations benefitted our communities? How could these tools be better utilized? Forecasting during this crisis has been significantly inaccurate. By all accounts, 2017 was one of the wettest on record. Oroville Dam and related facilities prevented significant downstream flooding. The storm event that preceded the spillways incident changed the reservoir's status in a matter of hours. DWR and our partners learned a great deal this year that will be considered in future planning.

More than 14 different agencies participate in the California Data Exchange Center (CDEC), which provides a centralized database to store, process, and exchange real-time hydrologic information gathered by various cooperators throughout the State. The data collected by CDEC enable forecasters to prepare flood forecasts and water supply forecasts; reservoir and hydroelectric operators to schedule reservoir releases; and water suppliers to anticipate water availability. The two main entities that collect and manage data related to flood forecasting and response for California are CDEC and the National Weather Service California-Nevada River Forecast Center.

The Department has partnered with Yuba County Water Agency, the CNRFC, and the US Army Corps of Engineers on the Forecast-Coordinated Operations Program (F-CO) over the past 12 years. The F-CO program coordinates operations of Lake Oroville and New Bullards Bar Reservoir, and using improved decision support forecasting tools, guides reservoir releases in advance of and during major flood events to reduce peak flood flows, resulting in additional levels of protection.

7. Improving Flood Protection Downstream:

a. There are several constrictions of the Feather River downstream that could be improved to better contain flood flows from the spillway. A cost-benefit study should be conducted to analyze projects that might alleviate these constrictions.

b. There are also several critical repair sites along the Feather River levee system that should be improved in order to better contain future flood flows from the spillway, including but not limited to sites in District 10, south of Yuba City, and south of Nicolaus. These were the sites of significant seepage during the recent crisis.

c. We have also seen large-scale erosion of the river banks as a result of quick draw downs of the spillway in the aftermath of the crisis. This erosion could ultimately threaten levees and, combined with the debris from the spillway collapse, has contributed to significant debris in the river channel. The debris impact to the carrying capacity of downstream levees must be analyzed/measured and removal/mitigation measures must be taken to protect property, lives, and the ecology and fish habitat of the Feather River.

The Oroville Field Division works closely with the Division of Flood Management, the Local Maintaining Agencies and other Feather River partners downstream. In the upcoming months, task forces will be formed to investigate restoration plans to protect the river channel and other downstream resources. The State has invested more than \$200 million in recent years to improving flood protection at particularly vulnerable locations on the Feather River downstream.

8. As a result of the crisis and evacuation, there were business and property losses, lost wages, and damages to public and private property. These damages are harder to take for communities that are already struggling and families that are already living paycheck to paycheck. Emergency relief dollars may provide some compensation for these losses but it will not be complete. We would like to see some discussion as to how these gaps can be covered to help make our communities whole. Discussions are necessary to address the financial impact of the emergency response on individuals, businesses, and local governments. DWR will share information as we receive it from FEMA, CalOES and other relevant entities, and we will plan to meet with you and other elected officials this summer to discuss this issue in more detail.

(Good question! What next!)

Why is the state withholding asbestos records at Oroville Dam?

By Ryan Sabalow and Dale Kasler, sacbee.com, June 7, 2017

In the latest skirmish over transparency at the troubled Oroville Dam, a Northern California activist group has sued state officials alleging they're illegally withholding information about potentially toxic asbestos. AquAlliance, a Chico-based advocacy group focused on Sacramento Valley water issues, filed a lawsuit in Sacramento Superior Court on Tuesday alleging the Department of Water Resources broke state records laws when it denied the group's request for emails containing information about the asbestos at the dam. The state did release nine documents, the group said, but not the relevant emails.



Construction workers begin the tear down and reconstruction of the Oroville Dam spillway on May 23 in Oroville. Randy Pench
rpench@sacbee.com

The suit claims the DWR told the group the records didn't exist or were protected from disclosure by attorney-client privilege. The group's executive director, Barbara Vlamis, said she has no idea whether there is anything in the records that could show the state is putting the public at risk, but she doesn't like the idea of the state hiding information. "There may be nothing damning at all in the material," she said. "Well, then, let's see it." Erin Mellon, a spokeswoman for the California Resources Agency, declined to comment on AquAlliance's suit. Asbestos occurs naturally in certain types of rock around Northern California, but DWR officials have insisted since crews began working on the troubled dam's badly damaged spillways this winter that there's no risk to the public. The agency says it's also taking steps to keep asbestos dust out of the lungs of those working on the dam. The suit is the latest in a tug of war between the state and members of the public over Oroville Dam records. The state has denied The Sacramento Bee's requests for certain technical documents and dam safety records. The agency also hasn't yet fulfilled a request the paper made in February seeking emails from top DWR officials during the spillway crisis. Mellon said the state is reassessing The Bee's requests.

Oroville Dam's main flood control spillway cracked in two Feb. 7, leaving an enormous chasm that hindered water releases and eventually triggered the evacuation of 188,000 downstream residents. On Wednesday, state officials said they're making good progress on phase 1 of the spillway's reconstruction, which will last through 2018. Officials said they aren't worried about rain expected to hit the region Thursday, even though the spillway gates have been closed for the remainder of the season. "It's not the kind of rain (like) we normally see in the winter months," said David Gutierrez, a consultant working for DWR. Reservoir levels have been reduced to 816

feet, leaving plenty of empty space for more water, and officials said the dam's hydro power plant will be able to make releases to keep water levels low.

(Knowing Oroville dam.)

5 things to know about the Oroville Dam

By Don Sweeney, sacbee.com, June 8, 2017

The Oroville Dam has been making headlines for decades, but especially since a damaged spillway in February forced the evacuation of nearly 200,000 people. Here are some things you may not know about the dam:

1. It's the tallest dam in the U.S. At 770 feet high, the Oroville Dam tops Hoover Dam and downtown Sacramento office towers. It fares less well against the world's tallest dams – the Jinping-I Dam in China towers over it at 1,001 feet.

The dam boasts some other big numbers. The earthfill dam, completed in 1967, spans 6,920 feet in length and 50 feet in width at the crest. It contains 80 million cubic yards of dirt and rock. Behind the dam, Lake Oroville has a maximum operating storage capacity of 3.5 million acre-feet of water. (Each acre-foot covers an acre of land one foot deep, about as much water as a typical suburban family uses in one year.) At its fullest, the lake covers 15,810 acres and has a 167-mile shoreline – the driving distance from Sacramento to Yosemite National Park.

2. It was completed in 1968. Construction began in 1961. Former governor Pat Brown, father of current Gov. Jerry Brown, pushed hard for the Oroville Dam as part of the State Water Project. Determined to leave a personal legacy, Brown misled voters about the State Water Project's costs, ignored recommendations to delay Oroville's construction and brushed aside allegations that substandard building materials were being used at the dam, archives, oral histories and other documents show. His administration steamrolled past a land-speculation scandal, relentless labor strife and the deaths of 34 workers to get Oroville built on time.

3. Spillway repairs will cost \$275 million. The dam's main flood control spillway ruptured Feb. 7, leaving an enormous chasm that hindered water releases and eventually triggered the evacuation of 188,000 downstream residents. Reconstruction of the spillway will last through 2018.

Kiewit Corp. of Omaha, Neb., which was awarded a \$275.4 million contract to fix the dam's two spillways, says it will have up to 500 workers on-site by August and plans to work 20 hours a day, six days a week, to get as much work as possible done this summer.

4. The dam produces 2.2 billion kilowatt hours of energy per year. The Edward Hyatt Powerplant, located underground on the Feather River downstream from the Oroville Dam, takes its name from Edward Hyatt, state engineer of the former division of water resources, now the Department of Water Resources. When it was constructed, it was the largest underground power station in the United States. The 2.2 billion kilowatts of energy produced per year by the Hyatt Powerplant in conjunction with the nearby Thermalito Powerplant provides about half the total power produced by the State Water Project's eight hydroelectric facilities.

5. It's one of California's seven wonders of engineering. The California Society of Professional Engineers bestowed the honor on the dam in 1967.



Oroville Dam progress: Watch crews pour concrete into spillway section

(Is this really a problem?)

Isabella Lake brimming with water, highlighting dam risks

BY JAMES BURGER, bakersfield.com, Jun 9, 2017

This weekend the water level in Isabella Lake is expected to reach — and maybe even exceed — the restricted pool allowed by the U.S. Army Corps of Engineers. And that means it might be time for residents who reside below the lake's troubled dam to review their risks. County emergency officials even recommend developing a plan for how to get out of town in the unlikely event that the dam fails due to something like a massive earthquake. A dam failure could send a wall of water down the Kern River Canyon that would flood downtown Bakersfield under as much as 20 feet of water. The whole city would be flooded.



THE RIVER

Kern River Watermaster Dana Munn said so much water is being allowed out of the Isabella Lake dam that it's causing damage to river banks and levees downstream. At 5,400 cubic feet per second, it's the highest flow in the lower Kern since 1983, he said. Chevron has recently had to reinforce river banks and levees in the Kern River Oil Field, he said.

John Ryan, water resources superintendent for the City of Bakersfield, said the city had to bolster the riverbanks under the Westside Parkway bridge with slabs of broken concrete called rip-rap. Homes along Goodmanville Road have had parts of their lawns flooded, though no structures have been damaged. All up and down the river, there is erosion and damage, he said. "We are managing it right now," Ryan said. "If it went any higher, we would be having problems." There are no plans to increase the flow into the lower Kern River. But even that high flow can't keep up with the torrents that Mother Nature is pouring into Isabella Lake from the mountains around Mount Whitney. Ryan said 6,452 cubic feet was roaring into the lake from the upper Kern River on Friday, down a bit from recent days but still a massive flow.

THE LAKE

The bottom line, Ryan said, is that Isabella Lake is nearly as full as the engineers who maintain it are willing to let it get. The magic number, set by the Army Corps of Engineers, is 361,250 acre-feet of water. On Friday morning, Ryan said, the lake level was about 354,000 acre-feet and creeping upward. It's expected to peak on Sunday, he said. Munn said the Corps has "kind of consented to let it go above" the restricted pool level. Kern County Emergency Services Manager Georgianna Armstrong said the Corps has been asked if the restriction can be exceeded but has not yet replied. Ryan said modeling shows the lake won't get that full, at least not for too long. But, he said, if you can predict where the lake level is going to end up, it might be time to take a shot at the Powerball jackpot. The worry in having the lake so full comes from the fact it was identified in 2006 as one of the most dangerous dams in the nation.

An active earthquake fault runs along the spine of rock between the main and auxiliary dams. And the Corps has recorded evidence of water damage that, if it remained under full pressure, could increase the risk of dam failure. That's why the restricted pool was put in place. "What they have told us is that, at 66 percent of capacity, the dam meets current dam safety standards," Armstrong said. However, that limit has been exceeded once before with minimal impact, Ryan said. In 2011, the last high water year, the water level increased to 368,000 for 10 days in July. It wasn't a problem, he said. "I'm not a dam safety guy. But we didn't really have a problem," Ryan said.

THE DAM

The Isabella Lake dam is watched like a hawk, Armstrong said. "The Isabella Dam is monitored in real time in Sacramento," she said. And the Corps of Engineers has people who walk the dam every day looking for signs that it has been compromised. Any suspicious activity, leak, earth movement or other clue triggers a five-step system that could lead, if it escalates, to the evacuation of everyone in Bakersfield. A dam failure, the Corps has said repeatedly, is very, very unlikely. But the sheer number of human lives that would be in danger if the dam collapsed with a

full pool of water behind it makes it a critical priority for repair. And Armstrong said the scope of the destruction that would fall on Bakersfield if even the 361,250 acre-feet of water were released by a failing dam would be massive. **At a restricted pool, you have 20 feet of water in downtown Bakersfield. With a full pool, it's 30 feet.**

Repair is coming.

The window for companies to bid on construction of the main improvements to the dam — increasing its height 16 feet and constructing a new spillway, as well as an option to improve the auxiliary dam — closed in May. **That work could begin as soon as this year.** In the meantime, there is a plan for evacuating people from Bakersfield in the event the dam begins to fail or, in the worst case, collapses in a seismic event. At **alert level 1**, the county would be notified that there might be a concern. At **level 2**, with additional signs of trouble, first responders, hospitals, schools and other critical agencies would be directed to begin activating their emergency plans.

At **level 3**, the general public would be alerted and, Armstrong said, some evacuations would likely begin. At **level 4**, the likelihood of a dam failure would top 50 percent and a full evacuation of Bakersfield, Lake Isabella and the Kern River Canyon would be ordered. The dam breaks at **level 5** and the water begins its eight-hour run into northeast Bakersfield. The county's emergency plan for Isabella Lake — including maps of where the city would flood and how long it would take water to get to each part of town — is available at the Kern County Fire Department website at KernCountyFire.org; go to the "Operations" tab and click on on "Emergency Plans." **Residents, Armstrong said, should be ready for the worst.** Different parts of the city would be evacuated in different directions. Families should talk and develop a plan for when to evacuate. They should, she said, arrange for a place to meet up if different family members have to flee in different directions. **"It's not something to blow off. Water carries tremendous power. Just look at the river," Armstrong said.**

(Dam removal ain't always an easy thing.)

Two species – one to preserve, one to control – challenge dam removal

By IAN WENDROW, June 8, 2017, by Capital News Service, news.jrn.msu.edu

LANSING, MI — A proposed dam removal along the Grand River faces significant delays due to its potential to disrupt river ecosystems. The environmental risks involve the fate of two species: sea lamprey and snuffbox mussels. One needs to be kept out while the other needs to be protected. **The Sixth Street Dam in downtown Grand Rapids was installed in the mid-1800s to help ship milled logs downstream by controlling the water's height and flow.** It drowned the river's naturally occurring rapids, allowing logs to float over them. Eventually log transportation no longer relied on the river, but the dam remained.



Years of inadequate maintenance began to pose a hazard to kayakers and swimmers. In 2013, firefighters rescued two kayakers after the bumped against the dam and capsized. This and other accidents motivated city and state agencies to get the removal process going in earnest. **"This project has been going on for about eight years and has probably got a good eight years to go,"** said Wendy Ogilvie, the director of environmental programs for the Grand Valley Metropolitan Council. The council is a regional governing body representing Allegan, Montcalm, Ionia, Ottawa, Barry and Kent counties. One of the project coordinators working with Ogilvie, Matt Chapman, is the founder and head of Grand Rapids Whitewater. The nonprofit organization's original mission was to restore the rapids for recreation, but it's evolved into a "holistic river revitalization." "Recreation is certainly still a component of it , but much more of it is focused on making the river a better place for the animals and creatures that live in it as well as those of us that want to play

on it," Chapman said. Lamprey are an invasive parasites that attach themselves to fish like leech and feed off the host's blood and bodily fluids, killing them in the process. They could spread along rivers and tributaries without the dam to stop them.

"Removing the existing Sixth Street Dam would require a new structure to be built that would also stop sea lamprey," said Jay Wesley, the Lake Michigan basin coordinator for the Department of Natural Resources (DNR). "A sea lamprey infestation could be quite severe if they're allowed to get past Grand Rapids," he said. Chapman said Engineers hired by Grand Rapids Whitewater, working with the U.S. Fish and Wildlife Service and the Great Lakes Fishery Commission, intend to install an adjustable structure a mile upstream from the dam. It would be raised when lamprey migrate and lowered when lamprey aren't much of a threat, he said. That would allow native fish to pass. Obermeyer Hydro Inc. is the manufacturer of this structure, said Chapman. They have installed similar adjustable structures across the country and around the world. "The application of using Obermeyer adjustable gates for sea lamprey control is emerging and one we think will provide a range of benefits that include public safety and flood control improvements, sea lamprey control, natural river connectivity and enhanced recreational benefits," Chapman said. While the sea lamprey challenge was known from the outset, the discovery of endangered snuffbox mussels added another layer of complexity to an already intricate undertaking. Ogilvie said, "The Grand River has always been known as a very good source of clams and mussels. But no one had really researched it that much, there just hadn't been any interest just because there hadn't been any construction plans on it."

The snuffbox mussels were first noticed in the summer of 2011, when water was low enough that biologists from Central Michigan University and Grand Valley State University and DNR specialists could wade in it. A nearby highway renovation also helped reveal the presence of this endangered species. Their mussel inventory revealed five living snuffbox mussels, kicking off conservation efforts to ensure the species wouldn't be severely harmed by the dam removal. Grand Rapids Whitewater consulted with Heidi Dunn, an ecological consultant at Ecological Specialists Inc., on what to do. "We're going to go in and remove as many mussels as we can before they start their project, but you can't get them all," Dunn said. Mussels are important for the Great Lakes and its tributaries due to their feeding habits. Attaching themselves to hard surfaces like rocks, they filter micro-organisms like plankton and are a natural water purification system. They also help support aquatic insects and fish species. "These animals are aquatic animals — people tend to think of them as rocks because they're kind of in the bottom and just kinda hard shelled animals," Dunn said. "You have to keep them in water, you have to handle them properly, you have to mark them all, you have to move them to a suitable habitat." Dunn and other experts have found new habitat areas upstream, between Ionia and Grand Rapids, where the mussels can be relocated. Doing so requires divers to go in at the dam site and dig up as much as 6 inches of the river bottom as mussels tend to burrow. Chapman and others declined to give a timeline for when actual removal work would begin. Project coordinators are still planning for many aspects of the project, and Dunn hinted that the mussel relocation might take around a year to complete. Wesley said Grand Rapids isn't the first Michigan city to deal with these environmental concerns. The recent removal of the Lyons Dam on Grand River ran up against mussel conservation problems, and Traverse City faced similar concerns of sea lamprey expansion with the removal of a dam from the Boardman River. Such experience means the Sixth Street Dam project has a greater chance of success, removal experts said.

(Dam removal in Alaska.)

Deconstruction begins on Eklutna River dam

By Associated Press, Jun 8, 2017, newsminer.com

ANCHORAGE, Alaska (AP) - A \$7.5 million project to remove a dam in Alaska is set to begin. The project to deconstruct a dam at an Eklutna River ravine to restore salmon populations on the river begins this month. The project largely will be



funded by the Conservation Fund in a partnership with Eklutna Inc., an Anchorage real estate development company. Eklutna CEO Curtis McQueen said Monday at the Anchorage Chamber of Commerce forum it will take a 400-foot crane, the largest in the state, to handle the task of taking down the dam, which was built between 1927-29 by the Anchorage Light and Power Co. McQueen said he believes Eklutna is the first tribe in the nation to get involved in such a massive project. "We haven't heard of another story where the actual Native people are playing a part in the removal of a dam," he said.

Alaska State Director of the Conservation Fund Brad Meiklejohn said the dam was built without consulting the local village and it diminished the fish population. He says the project will "make amends" for that wrongdoing, the Alaska Journal of Commerce reported (<http://bit.ly/2sGBWpz>). Meiklejohn said \$6.5 million has been raised by the fund, with another \$1 million needed. The land came under Eklutna title following passage of the 1971 Alaska Native Land Claims Settlement Act. McQueen told the Anchorage Chamber that of the many Eklutna projects his corporation is in charge of around the state, he's proud of this one as a bipartisan effort and grateful for the help of the Conservation Fund.

(What might have been.)

Sullivan Dam Project: What Might Have Been - Voters Killed Project 39 Years Ago

By Monte Miller, Missourian Staff Writer, emissourian.com, 6/10/17

In 1977, the visitors center at the newly created Meramec State Park, MO had more than 177,000 visitors. It was closed and boarded up in February 1978, five months prior to a referendum vote that killed the \$68 million project. In August 1978, work was about 18 percent complete on the Meramec River dam project near Sullivan that would have created a reservoir and state park expected to rival Lake of the Ozarks. That was before a regional referendum vote by the residents of a 12-county area voted to terminate the project.



According to The Missourian reports from August 1978, the vote to stop the dam was 249,879 to 141,450. In Franklin County, the vote totals were much closer with the referendum failing by just 78 votes. The final tally was 7,721 in favor of and 7,799 against or 50.25 percent to 49.75 percent. When all was said and done, approval for the dam project to continue was won in only Crawford, Jefferson and Washington counties.

The advisory vote was authorized by state lawmakers after funding for the dam project was stopped by President Jimmy Carter in late 1977. Congress then overrode the president and had approved an additional \$12 million for the project subject to the referendum passing. Money Wasted If plans made in 1974 would have come to fruition, there would be a total of 31 dams on waterways in the Meramec Basin today with five in or very near Franklin County. Calculating for inflation, the \$68 million project in 1974, would cost more than \$250 million in today's dollars. More than \$18 million had already been spent and years of work had already been done on the park complex, including a visitors center, parking lots and camping sites, when the voters killed it. In 2017 dollars, that number rises to \$66.6 million. The visitor's center alone had a price tag of \$1.7 million, or \$6.2 million today. Once completed, it would have impounded 42 miles of the Meramec River, nine miles of the Courtois Creek and 12 miles of the Huzzah Creek to form Meramec Park Lake. The 180-foot-tall structure was to consist of earth fill and impound a 23,000-acre lake, about 40 percent the size of Lake of the Ozarks.

Progress

Just before the referendum vote, the Corps of Engineers released data regarding how far along the Meramec Park Lake project was. That included land acquisitions, dam construction, buildings and roads, engineering, supervision, administration and other miscellaneous items. Land acquisition had cost more than \$15.6 million, which was 61 percent of the total \$25 million budgeted. The project called for acquisition of 34,600 acres outright and an additional 4,100 acres of easements. As of Dec. 31, 1977, the Corps had purchased about 27,000 total acres, which was 75 percent of the total needed. By August 1978, 6 percent of the total construction was complete with expenditures of \$2.5 million of the total \$43.4 million. Also included in that price was the lookout point, outbuildings, a lab building, wells, sewage, roads and a parking lot to accommodate 115 cars.

(This is not good news.)

Lopez and Whale Rock dams may have design flaws, state says as it orders assessments

By Monica Vaughan, sanluisobispo.com, 6/12/17

Lopez and Whale Rock dams are among more than 50 dams statewide considered highly hazardous that may have a design flaw and are being required to undergo an assessment of their concrete spillways “as soon as possible.” The state Division of Safety of Dams is ordering comprehensive assessments of spillways and structures that are similar to Oroville Dam — whose spillway crumbled four months ago, forcing downstream evacuations of thousands of people. A letter received by the San Luis Obispo County Flood control District on Monday says that the state agency completed an assessment of the Lopez Dam and noted that the spillway “may have potential geologic, structural, or performance issues that could jeopardize its ability to safely pass a flood event.”



Mark Hutchinson, deputy director of SLO County Public Works, leads tour of the Lopez Dam spillway in May. To give a sense of scale, a car is parked in a shadow under bridge. **David Middlecamp**
dmiddlecamp@thetribunenews.com

The operator of Whale Rock received a similar letter last week. The Division of Safety of Dams, which confirmed that more than 50 letters have been sent, oversees and performs annual inspections on more than 100 high-hazard dams in California, including Oroville, Lopez and Whale Rock. We question their (the dams’) ability to work as designed or intended. Daniel Meyersohn, project engineer with the Division of Safety of Dams High-hazard dams are categorized this way because of their height, the volume of water stored behind the dams, and the risk posed to those living downstream. “Many of these dams are quite old,” said Daniel Meyersohn, a project engineer with the Division of Safety of Dams, in a phone interview. “Because they’re not designed or built to current design standards, we question their ability to work as designed or intended.” Dam operators have been anxious to learn lessons from what happened at Oroville so that they can make any needed improvements. While Lopez and Whale Rock dams hold back much less water than Oroville, the cement spillways designed to safely release water and protect downstream communities from flood were built in the same decade as Oroville: The 1960s.

“Most of us that stare at a dam every day, we could thank everyone at Oroville for finding an opportunity to make everyone a little safer.” Mark Hutchinson, deputy director of San Luis Obispo County Public Works, has been reviewing old design documents for Lopez Dam and old inspection reports. He agreed that this is a good opportunity to reassess the facilities comprehensively, but he is frustrated with a lack of information coming from the Department of Water Resources. They’re the same ones, the same agency that inspected Oroville... Should we have been trusting them that much? A full report detailing the cause of the spillway collapse at

Oroville has not been released, and the letter provided little clarity about what dam operators should be looking for. “We’re just very disappointed. You put a lot of faith in these inspectors every year. They’re the same ones, the same agency that inspected Oroville. ... Should we have been trusting them that much?” Hutchinson said. “I want more information, more details. What are we looking for, exactly?”



Hydro:

(Hydropower is their future.)

Developing clean energy solutions that last for generations

Cannelton, Smithland, Willow Island, and Meldahl, US

stantec.com, June 9, 2017

American Municipal Power (AMP), a non-profit energy provider, was seeking a way to both diversify their energy portfolio and serve the growing energy demands of their members. Their foresight led them to hydropower—a clean, reliable, renewable energy solution that would meet the needs of their current rate payers and benefit generations to come.



Their goal was to find a cost-effective way to add generating capacity at four of the Ohio River’s 20 dams to capture the natural power of the river. The solution? Our team created four concrete powerhouses—a design choice that didn’t impede the natural flow or affect river navigation. To maximize economy through design repeatability, bulk procurements, and coordinated schedules, all four powerhouses were built simultaneously. Additionally, we designed with community in mind by developing wheelchair-accessible recreation and fishing features at each site. The resulting projects have a combined capacity of more than 300 megawatts: enough energy to power 200,000 homes.

(Pumped storage, the most efficient battery. U.S. has 5 Of the top 30 largest projects, not enough.)

Global Pumped Hydroelectric Energy Storage Market 2017 – Bath County

Pumped Storage Station, Huizhou Pumped

Storage Power Station

BY: NAKUL SHIRKE, June 9, 2017, dailyhover.com

The Pumped Hydroelectric Energy Storage Market 2017 examines the performance of the Pumped Hydroelectric Energy Storage market, enclosing an in-depth judgment of the Pumped Hydroelectric Energy Storage market state and the competitive landscape globally. This report analyzes the potential of Pumped Hydroelectric Energy Storage market in the present as well as the future prospects from various angles in detail. The Global Pumped Hydroelectric Energy Storage Market 2017 report includes Pumped Hydroelectric Energy Storage industry volume, market Share,



market Trends, Pumped Hydroelectric Energy Storage Growth aspects, a wide range of applications, Utilization ratio, Supply and demand analysis, manufacturing capacity, Pumped Hydroelectric Energy Storage Price during the Forecast period from 2017 to 2022. To Get Sample Report Click Here: <https://market.biz/report/global-pumped-hydroelectric-energy-storage-phes-market-2017/97975/#inquiry>

Manufacturers Analysis and Top Sellers of Global Pumped Hydroelectric Energy Storage Market 2017:

- | | |
|---|--|
| 1 Bath County Pumped Storage Station | 16 Chaira Hydropower Cascade |
| 2 Huizhou Pumped Storage Power Station | 17 Sardar Sarovar Dam |
| 3 Guangdong Pumped Storage Power Station | 18 Ingula Pumped Storage Scheme |
| 4 Okutataragi Pumped Storage Power Station | 19 Entracque Power Plant |
| 5 Ludington Pumped Storage Power Plant | 20 Vianden Pumped Storage Plant |
| 6 Tianhuangping Pumped Storage Power Station | 21 Okawachi Pumped Storage Power Station |
| 7 Grand'Maison Dam Station | 22 Qingyuan Pumped Storage Power Station |
| 8 La Muela II Pumped Storage Power Station | 23 Shin Takasegawa Pumped Storage Station |
| 9 Dinorwig Power Station | 24 Presa de Aldead-vila |
| 10 Raccoon Mountain Pumped-Storage Plant Station | 25 Hohhot Pumped Storage Power Station |
| 11 Mingtan Pumped Storage Hydro Power Plant Station | 26 Okuyoshino Pumped Storage Power Station |
| 12 Okukiyotsu Pumped Storage Power Station | 27 Hongping Pumped Storage Power Station |
| 13 Castaic Power Plant Station | 28 Fengning Pumped Storage Power Station |
| 14 Tumut Hydroelectric Power Station | 29 Zagorsk Pumped Storage Station |
| 15 Liyang Pumped Storage Power Station | 30 Rocky Mountain Hydroelectric Plant |

At the beginning, the report covers the top Pumped Hydroelectric Energy Storage manufacturing industry players from regions like United States, EU, Japan, and China. It also characterizes the market based on topographical regions. Further, the Pumped Hydroelectric Energy Storage report gives information on the company profile, market share and contact details along with value chain analysis of Pumped Hydroelectric Energy Storage industry, Pumped Hydroelectric Energy Storage industry rules and policies, circumstances driving the growth of the market and compulsion blocking the growth. Pumped Hydroelectric Energy Storage Market development scope and various business strategies are also mentioned in this report. To Buy Complete Report Click Here: <https://market.biz/report/global-pumped-hydroelectric-energy-storage-phes-market-2017/97975/> The Pumped Hydroelectric Energy Storage research report includes the products that are currently in demand and available in the market along with their cost breakup, manufacturing volume, import/export scheme and contribution to the Pumped Hydroelectric Energy Storage market revenue worldwide. Finally, Pumped Hydroelectric Energy Storage market report gives you details about the market research findings and conclusion which helps you to develop profitable market strategies to gain competitive advantage.

(Canal project comes to life.)

New hydroelectric plant opens in Shoshone

By Amy Reid | Jun 09, 2017, kmvt.com

SHOSHONE, Idaho (KMVT/KSVT) The new hydroelectric plant in Shoshone is now ready to go. At the ribbon cutting on Friday, the company showed off the new plant. They built it on the Milner-Gooding canal. The water runs



14
Copy obtained from the National Performance

up to the plant, through the system and goes out the other side still ready for use on fields. The owner of the plant wants people to think of ingenuity when they think of the machine.

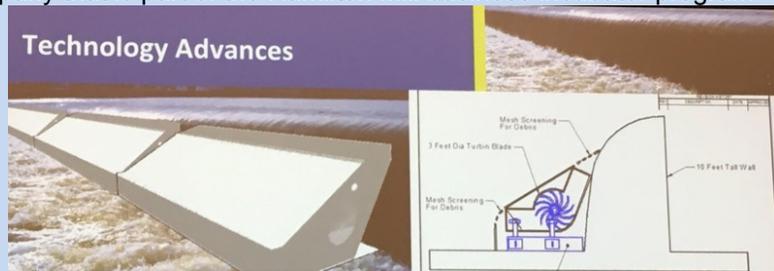
"Think of Idaho, where we harness rivers for the use of man," said Ted Sorenson, owner and design engineer at North Gooding Main Hydro, LLC, "and think of this water that's already been harnessed and worked for agriculture, and we're just going to work it a little harder on its way to being used for agriculture." Sorenson projects this plant will generate enough power to run 409 homes. He also said it will add in about \$3 million to Shoshone's tax base as well as jobs for the community.

(Getting power out of low head dams.)

Water-energy innovator has plan for Hamilton dam

By Mike Rutledge, June 13, 2017 Hamilton. journal-news.com

HAMILTON, Ohio - A local company that is part of the Hamilton Mill business incubator program and was part of the first class of the Pipeline H2O water-innovation program based in Hamilton and Over-the-Rhine wants to harness power from the Great Miami River south of downtown Hamilton, with plans to ultimately take the concept national and global.



"The electric-energy industry is changing dramatically, and it will influence how power is delivered to all of us," Paul Kling of Colerain Township, a co-founder of Hamilton-based kWRiver Hydroelectric, told an audience last month in Over-the-Rhine. The device is to be installed on the downriver side of the dam, and its angle would make Hamilton's existing "south dam" safer by reducing the churning of river caused by the steep dropping of water as it passes over the dam, which causes a boiling effect that can trap and drown wayward boaters. The dam still would not be safe, but would be less dangerous, Kling said.

"What we have found was this device and these conditions have stunning market potential," he said. "Each individual site that we build out can produce \$1.4 million of revenue per year, has a pay-back on the investment of less than eight years, and has a 25-year operating life." The Department of Energy "recently commissioned studies that revealed that there are 70,000 powerless low-head dams in the United States, and 3 percent of these alone can provide enough power for 10 million homes," he said. "At the same time, kWRiver Hydroelectric was developing a technology unlike another that requires no modification to the dam, makes the dam safer, produces significant amounts of power continuously, is considered environmentally benign, and is actually unseen beneath the water."

Dam owners — often cities, or organizations like the Miami Conservancy District in Hamilton's case — would receive money from the electric sales, while utilities are required to purchase such renewable electricity, Kling said. The devices can be sold, can be owned by the kWRiver, or licensed, he said. Kurt Rinehart, chief engineer for the conservancy district, said he's looking forward to seeing actual plans: "We're waiting until they get more details that we can actually review, and see how it would affect us, or not affect us. Until we see those more details, it's hard to say how we think it would work." That includes an evaluation of how much more safe it could be, Rinehart said. "It's promising, if the details work out. We're just waiting for the details to see how this would look, and how it would work."

"Overall, the market value of the top 2,000 sites of the 70,000 produces over \$2.8 billion in revenue per year," Kling said in his presentation. Kling said the device is to be installed during the first quarter of 2018 in Hamilton, with sales happening after that. Kling said the company has "world-class partners," including TSS Technologies in West Chester, which is building the

product. Kling said no new nuclear plants are scheduled to be built in the country, with 20 percent of those that exist are scheduled to be retired within a decade. And 135 coal-fired power plants have been closed in two years: "That's the equivalent of the entire state(s) of Colorado and Kentucky combined," he said. "There's been a lot of wind and solar built recently, but even at its best, they have limited capability to supply the energy needs of the United States," he added. And nearly every large hydroelectric location in the country has been built out, he said.

"Undoubtedly, our technology will have a large impact in the United States," Kling said. "But we also believe it will be game-changing for humanitarian efforts worldwide. We're inspired by a phone call that we received several months ago from a Nigerian official who told us this technology would absolutely save lives in his country. When could he get a device?" The man told Kling "how desperately they need it, and said they would actually build a dam just to build our device," by providing electricity to clean water for drinking there. "It's one of the things that's really motivating us."

(Cranking out the kWh.)

4 Reasons Why Bagnell Dam Just Set A New Energy Record

LakeExpo.com, Jun 13, 2017

LAKE OF THE OZARKS, Mo. — **Bagnell Dam just set a new "personal best" for energy generation in the month of May.** Ameren Missouri reports the Osage Energy Center generated more renewable electricity last month than any other May in its 86-year history. Final production numbers just came in and the energy center, located at Bagnell Dam, produced 168,218 megawatt hours in May. **Enough energy was produced at Osage Energy Center in May to power nearly 153,000 average homes for the month.**



Since Osage began generating renewable energy in 1931, the May 2017 energy production is the second highest monthly total in the energy center's history, eclipsed only by generation in January 2016 (which was also the month following major rainfall at Lake of the Ozarks and Truman Lake). "To put that in perspective, the energy produced could power every home in Cole County for more than two years; every home in Cape Girardeau County for more than two years; and is equivalent to the number of households in St. Charles County," said Warren Witt, director of hydro operations at Ameren Missouri.

Ameren attributes the high energy output to four causes—some more obvious than others.

- 1. Rain.** Bagnell Dam's generators can pass 40,000 cubic feet per second (cfs) at maximum capacity. Flowthrough typically varies within a given week, but normal flow is well below full capacity. However, in the month of May, the generators only operated below max capacity for four days: May 4 at noon until May 8 at 1 p.m. Heavy rain at the beginning of the month, followed by major flooding the second weekend of the month kept the generators running—and the floodgates open—for nearly the entire month.
- 2. Rain.** (Yes, like #1, but different.) Truman Lake, which feeds into Lake of the Ozarks, acts as flood protection for the heavily-developed downstream lake. So even after Bagnell Dam had dealt with all the Lake of the Ozarks watershed's runoff from May flooding, Truman was seriously flooded. The second half of May was spent passing water from Truman Lake to Lake of the Ozarks and through Bagnell Dam, which kept generators running at max capacity and floodgates slightly open.
- 3. Upgrades.** Ameren is currently working on a \$52 million project to upgrade Bagnell Dam. But according to Ameren, energy generation upgrades over the past 15

years have improved generation capacity by 25 percent. "Osage Energy Center and Bagnell Dam are vital to Ameren Missouri's commitment to powering the quality of life for more than 1.2 million customers in the state," Witt noted.

4. Upkeep. Such a complex system takes regular maintenance, efficient repair and upgrading of components. Ameren says that constant upkeep keeps the dam running at peak generation capacity. "All the credit goes to the hard-working men and women who keep the generating units running efficiently and reliably each and every day," Witt said.

This spring, Ameren Missouri launched a \$52 million project to maintain Bagnell Dam. Construction crews are installing a series of new anchors and concrete on the downstream side of the dam. The approximately 18-month project consists of three parts: new post-tension anchors will further secure the dam to the underlying bedrock; concrete will be added between the highway piers to add weight to the dam; and a new concrete overlay will replace weathered concrete on the east and west sections. "This is the largest, most visible project we've done at the dam in more than 30 years," Witt said. "Projects like this will keep Bagnell Dam and the Osage Energy Center in top shape and able to provide record-breaking, clean energy, for decades to come."



Water:



Environment:

(Fish gotta swim. Maybe the drought had something to do with it. They didn't name it Dry Creek for no reason.)

DAMS BE DAMNED: CALIFORNIA REBUILDS THE SALMON HABITAT IT DESTROYED

By Monica Heger, June 11, 2017, truth-out.org

Wander out the back door of the tasting room at Truett Hurst Winery in Sonoma County, California, and follow the dirt path to the red Adirondack chairs next to Dry Creek. Look just

downstream to the side channel that splits off the main waterway. You will see sets of interwoven logs and overturned trees with roots that splay along the banks. These aren't the result of a particularly rough storm -- they are there by design. As Dry Creek rushes by, these logs and root beds point the way to a newly excavated side channel -- prime habitat for spawning and juvenile salmon. In freshwater waterways along the coast from Marin to Mendocino counties, agencies are restoring salmonid streams to create habitat diversity, areas that provide deep pooling, predator protection, and side channels of slower-moving water. California salmon are in dire straits. Decades of dam building and development have destroyed or altered salmon habitat, eliminating the diversity of habitat these fish need. As a result, salmon populations have plummeted. The number of coho salmon that return to the California waterways from the Pacific Ocean each year has dropped from around 350,000 in the 1940s to less than 500 in 2009. Although they've rebounded slightly, numbers are still 90 percent to 99 percent below historic levels, and many scientists are worried that California's historic five-year drought followed by an exceptionally rainy winter could wreak further havoc.

Salmon provide enormous environmental and economic benefits. They are an integral component of marine and freshwater foodwebs and play a role in transporting nutrients from the ocean into rivers. In California, salmon are the backbone of a \$1.5 billion commercial and recreational fishing industry. The Warm Springs Dam, which crosses Dry Creek, is one of two drinking water sources for around 600,000 customers in Sonoma County, but the year-round flows it produces are a problem for salmon. "Dry Creek is a tremendous misnomer," says David Manning, environmental resources manager at the Sonoma County Water Agency. "It flows so quickly that it doesn't provide habitat for steelhead and coho," and young fish are often washed downstream. To combat this, Manning and others are building "off-ramps" that will allow salmon to exit the Dry Creek freeway. The water agency has plans to build similar structures at sites along 6 miles of the creek in collaboration with the area's property owners. The Dry Creek Habitat Enhancement Project will cost an estimated \$9 million to \$10 million per mile and is being funded through a variety of sources, including the water agency itself, a property tax from the Warm Springs Dam project, and the US Army Corps of Engineers.

At Amista Winery, a couple miles downstream from Truett Hurst, Manning's team created a side pond with just one way in that fills up during heavy flows, providing an escape from the rushing creek. It also built what's called a riffle, which is basically tiers in the creek bed with elevation changes and rocks so that water bubbles up. These variations provide habitat suitable for salmon at different stages of their lives, Manning says. A more diverse, healthy habitat also helps salmon better cope with extreme weather conditions. "Salmon no longer have the habitats that allowed them to persist through droughts and floods," says Eric Ettliger, an aquatic biologist with the Marin Municipal Water District. He is spearheading similar restoration projects along Lagunitas Creek in Marin County. Lagunitas Creek winds through a flood plain on its way to its drainage into the ocean near Point Reyes. Historically, heavy rains caused the creek to spill over its banks, creating a network of tributaries and side channels for young salmon to escape the heavy flows. Woody debris encouraged these overflows, and provided deep pools and shady hiding spots. Now, due to the construction of dams, there is no woody debris and overflows only happen in the largest storms. At some sites, it would take a 25-year storm to open up historic habitat for salmon, says Michael Napolitano, an engineering geologist at the San Francisco Bay Water Quality Board. And although this winter brought heavy rains, they peaked at what would be considered a 5- to 10-year event.

A consequence of the creek being confined to its channel is that, over years, the water has dug away at the creek bed -- or substrate -- making it deeper and narrower, and increasing the speed at which water flows. This has decreased the chances that water will spill over the banks. The larger substrate materials that made the creek bed stable -- boulders, gravel, and logs -- have been washed out, but are not being replaced. Instead, the creek bed is becoming ever finer and more prone to being further incised. In this environment, salmon eggs are more likely to be washed away.

Due to damming, half of the potential habitat for salmon in the Lagunitas Creek watershed is no longer available, according to a report Napolitano authored. Coho salmon have felt the effects of this lost habitat. In the winter of 2014, Lagunitas Creek counted 292 coho. That number would need to increase to 2,600 fish for the population to be considered recovered. A portion of Ettlinger's two-year project will be completed this summer during a short window between the end of the spotted owl breeding season in August and the first winter rains of October, he says. In total, the projects will cost around \$2.4 million. Around half of the funding has come from California Department of Fish and Wildlife grants and another \$400,000 from the State Water Resources Control Board. The remainder has come from the water district and US Fish and Wildlife Service, Ettlinger says. These habitat restoration projects are one tool being employed to try to prevent California salmon from going extinct. Ettlinger says that in Marin there has been a growing movement for another type of project -- reintroducing beavers. "Beaver ponds are ideal salmon nurseries," he says. "In the salmon restoration community, it's become apparent that coho and beavers evolved together." Plus, "a lot of the wood replacement we're doing now in Lagunitas Creek the beavers would do for free."

Along the banks of the poorly named Dry Creek, David Cuneo, principal environmental specialist at the Sonoma County Water Agency, points out a PVC pipe running across the stream. It houses antennae used to determine whether the salmon are finding their new digs. Some fish have been outfitted with a passive integrated transponder tag, and are counted when they pass under these antennae. Official data will be tabulated in 2018, at which point the agency will decide whether they are working as intended. Cuneo recounts seeing a coho spawn at the Truett Hurst site earlier this year. When he examined the tag data, he saw that fish that were tagged in 2014 had made their way down Dry Creek to the Russian River and on out to the Pacific Ocean, returning to Truett Hurst this winter. Anecdotally, at least, it seems to be working.



Other Stuff:

(Cool towns.)

This Is the Coolest Small Town in America

Bruce Springsteen made Asbury Park, NJ, famous
By Arden Dier, Newser Staff, Jun 7, 2017, newser.com

(NEWSER) – Not a big fan of crowds? You might want to check out one of Budget Travel's "coolest" small towns this summer. With suggestions from readers, the site has created a list of small towns that shine through their "cultural and ethnic diversity," beaches, cuisine, "creative energy, and unparalleled natural beauty." **The seven coolest small towns:**

1. Asbury Park, NJ
2. Bisbee, Ariz.
3. Nevada City, Calif.
4. Chatham, Mass.
5. Mountain View, Ark.
6. Cannon Beach, Ore.
7. Philipsburg, Mont.

See the full list here: <https://www.budgettravel.com/article/meet-the-coolest-small-town-in-america-2017>



People take part in the Polar Bear Plunge in Asbury Park in 2015. (AP Photo/Mel Evans)



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