

CITY OF SANTA CRUZ
City Hall
809 Center Street
Santa Cruz, California 95060



WATER COMMISSION

Regular Meeting

November 27, 2023

7:00 P.M. **GENERAL BUSINESS AND MATTERS OF PUBLIC INTEREST, COUNCIL
CHAMBERS**

Please note: As of March 1, 2023, participation in meetings for City Advisory Bodies is in-person only. Members of the public can continue to stream the audio for the meetings from the City's website, however public comment will no longer be taken virtually and those wishing to address the board must be in attendance at the location provided on the agenda.

The City of Santa Cruz does not discriminate against persons with disabilities. Out of consideration for people with chemical sensitivities, please attend the meeting fragrance free. Upon request, the agenda can be provided in a format to accommodate special needs. Additionally, if you wish to attend this public meeting and will require assistance such as an interpreter for American Sign Language, Spanish, or other special equipment, please call Water Administration at 831-420-5200 at least five days in advance so that arrangements can be made. The Cal-Relay system number: 1-800-735-2922.

APPEALS: Any person who believes that a final action of this advisory body has been taken in error may appeal that decision to the City Council. Appeals must be in writing, setting forth the nature of the action and the basis upon which the action is considered to be in error, and addressed to the City Council in care of the City Clerk. Appeals must be received by the City Clerk within ten (10) calendar days following the date of the action from which such appeal is being taken. An appeal must be accompanied by a fifty dollar (\$50) filing fee.

Agenda and Agenda Packet Materials: The Water Commission agenda and the complete agenda packet containing public records, which are not exempt from disclosure pursuant to the California Public Records Act, are available for review on the City's website: <https://www.cityofsantacruz.com/government/city-departments/water/city-water-commission> and at the Water Department located at 212 Locust Street, STE A, Santa Cruz, California, during normal business hours.

Agenda Materials Submitted after Publication of the Agenda Packet: Pursuant to Government Code §54957.5, public records related to an open session agenda item submitted after distribution of the agenda packet are available at the same time they are distributed or made available to the legislative body on the City's website at: <https://www.cityofsantacruz.com/government/city-departments/water/city-water-commission> and are also available for public inspection at the Water Department, 212 Locust Street, STE A, Santa Cruz, California, during normal business hours, and at the Council meeting.

Need more information? Contact the Water Department at 831-420-5200.

Call to Order

Roll Call

Statements of Disqualification - Section 607 of the City Charter states that...All members present at any meeting must vote unless disqualified, in which case the disqualification shall be publicly declared, and a record thereof made. The City of Santa Cruz has adopted a Conflict of Interest Code, and Section 8 of that Code states that no person shall make or participate in a governmental decision which he or she knows or has reason to know will have a reasonably foreseeable material financial effect distinguishable from its effect on the public generally.

Oral Communications

Announcements

Consent Agenda (Pages 1.1 - 4.2) Items on the consent agenda are considered to be routine in nature and will be acted upon in one motion. Specific items may be removed by members of the advisory body or public for separate consideration and discussion. Routine items that will be found on the consent agenda are City Council Items Affecting Water, Water Commission Minutes, Information Items, Documents for Future Meetings, and Items initiated by members for Future Agendas. If one of these categories is not listed on the Consent Agenda then those items are not available for action.

1. City Council Actions Affecting the Water Department (Pages 1.1 - 1.2)

That the Water Commission accept the City Council actions affecting the Water Department.

2. Water Commission Minutes from October 2, 2023 (Pages 2.1 - 2.6)

That the Water Commission approve the October 2, 2023 Water Commission Minutes.

3. Water Supply Augmentation Implementation Plan Quarterly Report (Pages 3.1 - 3.10)

That the Water Commission receive the Water Supply Augmentation Implementation Plan Quarterly Report and provide feedback.

4. Working Draft - Calendar Year 2024 Water Commission Work Plan (Pages 4.1 - 4.2)

That the Water Commission review and approve the Working Draft of the Calendar Year 2024 Work Plan.

Items Removed from the Consent Agenda

General Business (Pages 5.1 - 5.4) Any document related to an agenda item for the General Business of this meeting distributed to the Water Commission less than 72 hours before this meeting is available for inspection at the Water Administration Office, 212 Locust Street, Suite A, Santa Cruz, California. These documents will also be available for review at the Water Commission meeting with the display copy at the rear of the Council Chambers.

5. Water Supply Augmentation Implementation Plan (WSAIP): Updates on Groundwater Modeling in Mid-County and Santa Margarita Groundwater Basins, and Santa Cruz Water Supply Planning (Pages 5.1 - 5.4)

That the Water Commission receive updates and provide feedback on various aspects of the Water Supply Augmentation efforts.

Subcommittee/Advisory Body Oral Reports

6. Santa Cruz Mid-County Groundwater Agency
7. Santa Margarita Groundwater Agency

Director's Oral Report

Information Items

8. Information Items (Pages 8.1 - 8.49)

Adjournment

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WATER COMMISSION INFORMATION REPORT

DATE: 11/17/2023

AGENDA OF: 11/27/2023
TO: Water Commission
FROM: Rosemary Menard, Water Director
SUBJECT: City Council Actions Affecting the Water Department

RECOMMENDATION: That the Water Commission accept the City Council actions affecting the Water Department.

BACKGROUND/DISCUSSION:

October 10, 2023

Water Supply Augmentation Planning (WT)

Motion **carried** authorizing the City Manager to execute the Fifth Amendment to the Professional Services Agreement for Phase 2 Recycled Water Facility Study/Water Supply Augmentation Implementation Plan in the amount of \$388,146 with Kennedy Jenks (San Francisco, CA) in a form to be approved by the City Attorney.

Loch Lomond Recreation Area Fees (WT)

Resolution No. NS-30,214 was adopted revising the Loch Lomond Recreation Area fee schedule and rescinding Resolution No. NS-29,482.

October 24, 2023

Award Agreement for Fisheries Biology Support from Hagar Environmental Science (WT)

Motion **carried** authorizing the City Manager to execute an agreement in a form to be approved by the City Attorney with Hagar Environmental Science for ongoing fisheries biology support of the City of Santa Cruz's Habitat Conservation Plan development and Incidental Take Permitting, and to authorize the Water Director to execute up to four annual agreement renewals.

PROPOSED MOTION: Accept the City Council actions affecting the Water Department.

ATTACHMENTS: None.



Water Department

Water Commission
7:00 p.m. – October 2, 2023
Council Chambers
809 Center Street, Santa Cruz

Summary of a Water Commission Meeting

Call to Order: Chair Burks called the meeting to order at 7:00 PM in the Council Chambers.

Roll Call

Present: J. Burks (Chair); T. Burns; D. Engfer (Vice Chair); M. Goddard, J. Lear, and S. Ryan.

Absent: None

Staff: R. Menard, Water Director; D. Baum, Deputy Director/Chief Financial Officer; C. Berry, Watershed Compliance Manager; H. Cagliero, Administrative Assistant III; C. Coburn, Deputy Director/Operations Manager; H. Luckenbach, Deputy Director/Engineering Manager; S. Perez, Principal Planner; I. Rivera, Associate Professional Engineer; and M. Zeman, Engineering Associate.

Others: Two members of the public.

Statements of Disqualification: None.

Oral Communications:

At 7:01 p.m. Chair Burks opened Oral Communications and the following person spoke:

Becky Steinbruner

Chair Burks closed Oral Communications at 7:04 p.m.

Announcements: Water Director Menard welcomed newly appointed Commissioners Goddard and Lear to the Commission and announced the resignation of Commissioner Duncan Merrell.

Consent Agenda:

1. City Council Items Affecting the Water Department
2. Water Commission Minutes from August 21, 2023

Commissioner Burns suggested that “IPR” be changed to “DPR” in the first bullet on page 2.4 of the Minutes from August 21, 2023.

Chair Burks opened public comment and the following person spoke:

Becky Steinbruner

Chair Burks closed public comment.

Vice Chair Engfer moved approval of the Consent Agenda as amended. Commissioner Burns seconded.

VOICE VOTE: MOTION CARRIED

AYES: All

NOES: None

DISQUALIFIED: None

Items removed from the Consent Agenda: None.

Presentation:

3. Key Project Updates on the Anadromous Salmonid Habitat Conservation Plan and Project Overviews of the Newell Creek Inlet/Outlet Pipeline Replacement Project, Concrete Tanks Replacement Project, and the Graham Hill Water Treatment Plant Facility Improvements Project

Chris Coburn, Deputy Director/Operations Manager, introduced Chris Berry, Watershed Compliance Manager, Isidro Rivera, Associate Professional Engineer, and Matt Zeman, Engineering Associate, who gave presentations on this item.

Anadromous Salmonid Habitat Conservation Plan (ASHCP or HCP):

What are ways that the current dynamic with regulatory agencies can be maintained and built upon, especially in the context of succession planning?

- Internally, one way we are addressing this is to assign some of the HCP work to staff under the supervision of the Watershed Compliance Manager. Zeke Bean has been handling the environmental review and building relationships with the regulators in the process. Relationships with agencies can be challenging because we are often on opposite sides of many issues, but the culture that has been encouraged in the Department is to focus on working together with regulating agencies to protect our water resources and responsibly plan for and manage water system facilities and infrastructure.

Turnover in the agencies' staff and the resulting lack of institutional memory is far more challenging than any internal issues. We've tackled this issue by working to create relationships between executive management from the City and executive management from the resource agencies which can help establish and maintain continuity and allow problems to be worked through when they arise.

How did you develop reasonable, realistic goals for Coho in the San Lorenzo River since it is a suitable habitat but not occupied currently?

- We largely accepted the goals of the resource agencies, and specifically in the San Lorenzo River these goals support Steelhead as well.

Can you confirm that Branciforte Creek is a priority stream in the ASHCP?

- Yes, it is. We are looking at a project similar to Mission Creek in Santa Barbara where cells to support fish passage were engineered into the bottom of the flood control channel.

Is there going to be any opportunity for adaptive management during the 30-year implementation horizon for the ASHCP?

- There is a section on adaptive management in the ASHCP and that is partially the purpose of the monitoring component. There will be a stakeholder group comprised of resource agency and City staff who will review the data and then there is a process for adaptive management.

Is improved or increased enforcement for illegal diversions in the watershed addressed as part of ASHCP implementation?

- No, the ASHCP is not an effective tool for addressing illegal diversions. The enforcement mechanisms for illegal diverters are not robust and seem to be crisis or litigation driven. It is likely that we will want to work with State agencies (California Department of Fish and Wildlife, California State Water Resources Control Board) to be a more aggressive in responding to illegal diversions to protect flows being provided for fish.

Are the funds available for the non-flow conservation available for use on private land and private outreach, or is it only available for restoration on publicly owned land?

- The funds are available for work on private land, but outreach will likely only be a small component of use of these funds as the resource agencies have been adamant that they would like to see habitat improvements.

From a practical standpoint, is there anything that the Commission can do to aid in the process with the State Water Board regarding finalizing the City's water rights change petitions that are a key element of being able to make the flow commitments in the ASHCP?

- No, not really.

How do the bypass flows compare to interim tolling agreement?

- The bypass flows are a little bit more restrictive than the interim tolling agreement.

Will the other water districts that use the San Lorenzo River as a water source also have to implement a plan similar to the ASHCP at some point?

- Yes, the National Marine Fisheries Service are already looking at the water rights for Big Basin Water Company.

In years where the flows in the San Lorenzo River are below what is required by the bypass flows, are we responsible for feeding flows by releasing water from Loch Lomond?

- No, we are not required to supplement the flow with water from Loch Lomond.

Are there publishing opportunities for staff who are involved in the research component of monitoring for the ASHCP?

- There likely could be. However, it often seems that staff don't have time to publish unless they are personally very passionate about the research.

Newell Creek Inlet/Outlet Pipeline Replacement Project (NCD I/O):

Did any work need to be done on the spillway as part of this project?

- No, work on the spillway was not required for this project.

Is there potential for public education from this project, and if so, what is the current status?

- There is an item scheduled to be on a future Water Commission agenda that will discuss outreach education and the possible future of the Nelson House, which is the piece of property we acquired at the bottom of the Newell Creek Dam due to the anticipated multi-year construction impacts. Nelson House is currently being used as construction headquarters for the NCD I/O and now that the project is nearing completion there needs to be a discussion regarding the future of the property.

Have we tested dewatering in the new system, and how is that accomplished?

- The California Division of Safety of Dams (DSOD) requires us to test the new emergency release valve as part of the project. (Note: That test has now been successfully completed.)

Do we have a new dead-pool level (the level below which we can't access any water) now, or is it the same as before?

- The lowest operating point used to realistically be at an intake at 490 feet above sea level because the original intake at 470 was covered by sediment long ago. The lowest operating point for the new structure is at an intake at 480 feet above sea level, so we now have access to 10 additional feet of water.

Has the budget vs. actual been tracked for both time and funds?

- We are still within budget for this project and also well within the 10% contingency even with the decommissioning work that wasn't within the original scope of work for the project.

Were there any concerns about stirring up contaminants due to moving soil at the bottom of the lake during this project, and was there a specific water quality plan generated to address this situation?

- No, the material that was stirred up didn't contain concentrations of any contaminants that were high enough to merit concern. Our biggest concern regarding water quality for this project was the potential for impacts to divers working in the water closely after a chemical treatment to the lake.

Concrete Tanks Replacement Project:

Can you describe the network security of the remote operations system for the Concrete Tanks?

- There is no connection between SCADA and the outside world (i.e., the internet), except for the lone situations of when our SCADA consultant needs to connect via a secure port and troubleshoot remotely. We do have an IT staff person assigned specifically to the Treatment Plant to help us internally with troubleshooting and IT assistance.

What is the life expectancy of the new tanks?

- The new tanks have a projected life expectancy of 100 years.

Graham Hill Water Treatment Plant Facility Improvements Project (FIP):

Under the new bypass flow levels required by the ASHCP, we will be taking less surface water during part of the year, while this project allows us to take more surface water during other times of the year. Do these come out as a wash in terms of our utility of sources like Loch Lomond and Beltz Wells?

- It doesn't come out exactly as a wash. If we are having less surface water due to fish flows, the way that we are making that up is mostly two-fold; one part is getting additional flexibility on using water that we haven't used very much, such as the Felton Permits (by having the option to divert this water at the Tait Street Diversion), and the other is development of additional water supply.

What is the capacity for the new plant once it's finished?

- The Concrete Tanks Replacement Project and the FIP are designed for a capacity of 20 MGD and output of 18 MGD; the remaining 2 MGD is internal process water or recycled water.

Will the charcoal filter alter the taste of the water produced after the FIP is completed?

- The use of granular activated carbon (GAC) is currently being evaluated to determine if it will be a project element or not. Functionally, we already use activated carbon at the existing Graham Hill Treatment Plant in a powdered form so it is unlikely that the addition of GAC would cause changes in taste. The element of the FIP that could potentially change the taste in a very positive way is the addition of ozone in the treatment process.

Chair Burks opened public comment and the following person spoke:

Becky Steinbruner

Chair Burks closed public comment.

No motion was required for this item as it was informational only.

General Business

4. Onboarding New Water Commissioners

Water Director R. Menard introduced this item on the agenda and the Commissioners and Water Department staff participated in an informal onboarding process for the new Commissioners which included a discussion of personal backgrounds and areas of interest for Water Commission topics.

No motion was required for this item as it was informational only.

Subcommittee/Advisory Body Oral Reports

5. Santa Cruz Mid-County Groundwater Agency (MGA)

The MGA met last at the end of September and the agenda focused mostly on the re-appointment of private well owner representatives and discussion regarding setting up a registration policy for the non-*de minimis* users in the basin for the metering program. The MGA is scheduled to meet next on December 14th and the agenda will focus on the non-*de minimis* use metering policy registration program and possibly include information on Mid-County Optimization Study.

6. Santa Margarita Groundwater Agency (SMGWA)

The SMGWA is scheduled to meet on October 26th and the agenda will include status updates on activities of the various member agencies. The agenda will also include information presented by the ad hoc committee formed to evaluate and recommend potential improvements for the annual reporting process for the Groundwater Sustainability Plan (GSP), which met on September 25th and is scheduled to meet again on October 11th.

Director's Oral Report:

R. Menard announced that the Water Department and Santa Margarita Groundwater Agency will have tables at the Environmental Town Hall with Assemblymember Gail Pellerin on October 28th from 1:00 pm to 3:00 pm at the Community Hall in Felton.

The Water Department and Santa Cruz Mid-County Groundwater Agency will also have tables at the Water Harvest Festival on October 14th at Chanticleer Park from 11:00 am to 3:30 pm.

Information Items: Information items included in the agenda packet were not discussed.

Adjournment: The meeting was adjourned at 9:56 PM.



WATER COMMISSION INFORMATION REPORT

DATE: 11/20/2023

AGENDA OF: 11/27/2023
TO: Water Commission
FROM: Heidi Luckenbach, Deputy Director/Engineering Manager
SUBJECT: Water Supply Augmentation Implementation Plan Quarterly Report

RECOMMENDATION: That the Water Commission receive the Water Supply Augmentation Implementation Plan Quarterly Report and provide feedback.

BACKGROUND and DISCUSSION: Attached is an update to the work performed on the Water Supply Augmentation Implementation Plan; the last update was provided at the Water Commission's August meeting. The progress report includes updates to the schedule, risk assessment, and budget summary.

FISCAL IMPACT: None.

PROPOSED MOTION: Receive information and provide feedback to staff on the material presented.

ATTACHMENT(S):

1. Progress Report

**City of Santa Cruz
Water Supply Augmentation Implementation Program
Work Performed through October 31, 2023**

Progress Report

The purpose of the report is to summarize key efforts on each element related to water supply planning for the City of Santa Cruz Water Department, with links provided for additional information. This progress report is updated monthly for internal reporting and quarterly for external reporting.

PROJECTS AND EFFORTS REPORTED ON BELOW

Additional information on the City's Website: [Water Supply Planning](#)

Water Supply Augmentation (WSA): Refers to work associated with non-specific supply alternatives, i.e., planning level tasks such as climate and water supply modeling that support the evaluation of all supply alternatives.

Aquifer Storage and Recovery (ASR): Includes the evaluation, piloting, demonstration, design, and construction or modification of existing and new ASR wells. Also includes water quality analyses, well capacity studies, and basis of design reports.

Recycled Water (RW): In addition to the study of water supply alternatives using recycled water, this project includes the design and construction of the 6" diameter tertiary pipeline located at the City's WWTF for the future use of tertiary water off-site for irrigation and other end-uses.

Regional Coordination: Focuses on the various efforts between the City and neighboring water agencies, specifically, Soquel Creek, Scotts Valley and San Lorenzo Valley Water Districts. Includes activities related to groundwater sustainability agencies such as the Optimization Study being performed through the Santa Cruz Mid-County Groundwater Agency and other related modeling.

Riverbank Filtration (RBF): A method of extracting water from a river through wells installed in the vicinity of the flowing source. Wells may be vertical or horizontal and located within or outside the flowing source. RBF is reported on here due to its potential contribution towards water supply reliability.

WORK ONGOING OR COMPLETED IN THE REPORTING PERIOD

Water Supply Augmentation (WSA)

City Council approved Contract Amendment No. 5 with Kennedy Jenks. The added scope of work supports two main efforts: transitioning the Santa Cruz Water System Model to the City including ongoing training on this complex and powerful tool, completion of the user manual, and an additional year of technical support from the UMass team (as a subconsultant to Kennedy Jenks); and ongoing collaboration on efforts in both the SMGWB and MCB evaluating supply alternatives.

Aquifer Storage and Recovery (ASR)

Beltz 9 ASR Pilot Test

- At the end of October, Eaton Drilling Co. completed the installation of the monitoring well and site setup for the pilot testing which may begin as early as November.
 - Received an approved Notice of Applicability (NOA) from the Regional Water Quality Control Board confirming sampling requirements and authorizing the City to conduct the ASR pilot test.
-

**City of Santa Cruz
Water Supply Augmentation Implementation Program
Work Performed through October 31, 2023**

Beltz 8 and 12 ASR

- Held design kickoff meeting and site visit with Carollo in August to initiate the design of permanent ASR facilities.
-

Recycled Water

The Pure Water Soquel construction team is conducting performance testing of the tertiary treatment system at the City's Wastewater Treatment Facility (WWTF). Once approved, the immediate purpose of this system is replacement of the previous tertiary treatment process used for in-plant wash down and process water. The system has been marginally oversized to accommodate an increment of water for potential offsite use such as a truck fill station and/or irrigation of La Barranca Park located adjacent to the WWTF.

Regional Collaboration

General

- At their August 8, 2023 meeting, City Council approved an addendum to the Water Rights Environmental Impact Report, making minor adjustments to the City of Santa Cruz/Scotts Valley Water District (SVWD) Intertie Project. Currently in 95% design review, there are several outstanding issues related to operations and scheduling of the intertie project.
 - While the project is being designed for up to 1 million gallons per day (mgd) to SVWD with potential to upsize to 1.5 mgd, SVWD has a current reliable infrastructure capacity of 0.3 - 0.4 mgd for transferring water back to the City. Staff from both agencies are working together to develop plans for an additional well(s) in the SVWD service area to increase this volume of water.
 - Several easements are required for the construction of the project with two still in negotiations. Currently scheduled for resolution by the end of the calendar year.
- City staff (Rosemary Menard) presented to the SVWD (8/10/2023) on City's water supply challenges and approach to achieving supply reliability.

Mid-County Groundwater Basin

The following summarizes the activity related to the Optimization Study:

- Technical Meeting No. 2 was held (October) to review baseline modeling scenarios. Scenarios being analyzed include Group 1 and Group 2 projects defined in the GSP that work towards basin sustainability.
 - Alternative 1, Baseline: As a reference point for evaluating other alternatives, the baseline includes the Pure Water Soquel project and ASR at the four existing Beltz wells.
 - Alternative 2: This alternative builds on the Baseline and includes several scenarios that incorporate water transfers and optimizes pumping of the Baseline.
 - Alternative 3: This alternative builds on Alternative 2 and includes several scenarios that increase the sizes of the PWS and/or ASR projects.
-

City of Santa Cruz
Water Supply Augmentation Implementation Program
Work Performed through October 31, 2023

Santa Margarita Groundwater Basin

Held a meeting with SVWD and San Lorenzo Valley Water District (SLVWD) in August to discuss groundwater modeling needs for the various projects related to the Santa Margarita Groundwater Basin. This discussion resulted in defining a small scope of work related to the intertie currently in design between the City and SVWD with an acknowledgment that additional modeling will likely be needed at a future date. As a result of this discussion, the City contracted with Montgomery & Associates to model a reasonable baseline scenario in the SMGWB with assumptions about the rate and timing of water transferred to SVWD and transferred back to the City. Results will be shared with the Water Commission at their November 2023 meeting.

While SLVWD extended the due date for their Request for Proposals (RFP) for the Feasibility Analysis for Utilization of San Lorenzo Valley Water District's Loch Lomond Reservoir Source to October 31, no proposals were received. SLVWD staff will re-release the RFP following some queries of several firms. No date has been confirmed.

Staff held a follow up meeting with SVWD and City of Scotts Valley (September) as part of ongoing collaboration efforts. The City of Scotts Valley continues to assess upgrade opportunities to their WWTF and confirmed their priority to retain recycled water to their irrigation customers.

Riverbank Filtration (RBF)

Staff are working with HDR to complete the cost-benefit evaluation for RBF. Previous field studies narrowed the scope of potential new sites to the area around the existing Tait Wells, Santa Cruz Memorial, Coast Pump Station, and City Metro. Alternatives include replacing one of the existing vertical wells to restore capacity to 1.5 mgd and adding one or more wells to increase capacity. Criteria used in the business case evaluation include location(s) and infrastructure needs, chemical use, energy use, volume of additional supply, and cost.

NEAR TERM ACTIVITIES (TWO – FOUR MONTHS)

Water Supply Augmentation (WSA)

- Finalize the framework for evaluation of water quality compatibility with ASR, and interties with SqCWD and SVWD. This work will be performed in 2024 prior to bringing these projects online.
- The United States Bureau of Reclamation Feasibility Study has been deferred to summer/fall 2024 to align with the completions of the Optimization Study and WSAIP.
- Complete the Santa Cruz Water Supply Model training manual, document assumptions, and finalize workflow.

Aquifer Storage and Recovery (ASR)

Beltz 9 ASR Pilot Test

- Complete Cycle 1 of the ASR pilot test in early November followed by Cycle 2 that will continue through mid-December. Cycle 3 is planned to begin in January 2024.

Beltz 8 & 12 ASR

- Receive the 30% design deliverable and Basis of Design Report at the end of the calendar year.

City of Santa Cruz
Water Supply Augmentation Implementation Program
Work Performed through October 31, 2023

Other

- Business Case Evaluation (BCE) for selection of the 4th well to be pursued for ASR pilot testing.
 - Improvements at Beltz 12 well to install treatment for occasional occurrence of ammonia from this portion of the basin. The final phase is in design, scheduled for bidding in April, with construction complete in December 2024. The presence of ammonia has an impact on the effectiveness of the chlorination strategy and the ability to maintain the required chlorine residual in the finished water distribution system.
 - With the alternatives analysis for the reconstruction of Beltz Proper (Live Oak) Treatment Plant nearly complete, the design process will begin early 2024 and continue through early 2025 followed by construction of the facility. This project will improve reliability of groundwater treatment and expand the treatment capacity from ~1 mgd to ~3 mgd.
-

Recycled Water

Meet with the City Public Works Department staff in December/January as part of ongoing collaboration around the use of recycled water. Topics include feasibility of incorporating the City of Scotts Valley residual waste stream, long term WWTF effluent flows, and capital projects being taken on by both departments to align efforts.

Regional Collaboration

General

SVWD Intertie Project: Continue developing the operating agreement, complete the design documents, and seek an additional well site. Key milestone dates include:

- Complete easement acquisitions: First quarter CY2024
- Complete design: April 2024
- Bid Period: April – June 2024
- Construction: December 2024 – December 2025

Mid-County Groundwater Basin

- Optimization Study: Finalize Technical Memorandum 1 - Data Gap Analyses and Optimization Approach.
- Review results of baseline groundwater modeling.
- Hold scoping session with Akel Consulting for hydraulic modeling water supply alternatives developed in the Optimization Study.
- Coordinate with Beltz WTP Upgrades team regarding treatment plant upgrades.

Santa Margarita Groundwater Basin

- Hold meeting with SVWD and San Lorenzo Valley Water District to discuss additional groundwater modeling needs.
-

**City of Santa Cruz
Water Supply Augmentation Implementation Program
Work Performed through October 31, 2023**

Riverbank Filtration

Next steps include:

- Analyze existing water quality data from the Tait wells to develop operating cost savings by installing additional wells (noting the pretreatment benefits of subsurface intakes).
- Develop capital costs for the alternatives.
- Develop Initial summary evaluation (December).
- Develop the summary report (January 2024).

SCHEDULE HIGHLIGHTS {Additional information attached and on the City's website: [Water Supply Schedule](#)}

See Attachment 1.

Changes from previous (July 2023) WSAIP update:

- The Optimization Study has been delayed by approximately 3 months.
- The United States Bureau of Reclamation grant is on hold until summer/fall 2024.
- Corrosion study has been incorporated into the Water Quality Compatibility item.
- Desalination has been added for completeness.

PROJECT RISKS {See attachment for list of current risks}

See Attachment 2.

Ongoing risk(s):

- Source water availability for both ASR and recycled water alternatives.
- Water quality compatibility when incorporating transfers through two interties and ASR water.

New risk(s):

- None.

Resolved risk(s):

- The size of the Beltz Water Treatment Plant (Live Oak facility) parcel may limit the treatment capacity at this site. The alternatives analysis identified treatment for up to 5 mgd, although a smaller production will likely be selected.

BUDGET UPDATE {See attachment for summary budget}

See Attachment 3. Highlighted in bold are contracts finalized in this reporting period and include:

- Water Supply Augmentation: **Contract Amendment No. 5** as described above (Kennedy Jenks) and technical advisor to the Optimization Study (Pueblo Water Resources).
 - Aquifer Storage and Recovery: Water quality testing (Weck), labor compliance (Workforce Integrity), and design of permanent ASR wells at Beltz 8 and 12 (Carollo Engineers).
 - Santa Margarita Groundwater Basin: Initial groundwater modeling for intertie (Montgomery & Associates).
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**City of Santa Cruz
Water Supply Augmentation Implementation Program
Work Performed through October 31, 2023**

Commonly Used Acronyms: {For complete list of Acronyms and Terms [Acronyms and Glossary of Terms](#)}

ASR	Aquifer Storage and Recovery	SGMA	Sustainable Groundwater Management Act
BCE	Business Case Evaluation	SMGWA	Santa Margarita Groundwater Agency
BOD	Basis-of-Design	SMGWB	Santa Margarita Groundwater Basin
GSA	Groundwater Sustainability Agency	SOP	Standard Operating Procedure
GSP	Groundwater Sustainability Plan	SOQ	Statement of Qualifications
IRWM	Integrated Regional Water Management	SVWD	Scotts Valley Water District
MGA	Mid-County Groundwater Agency	SqCWD	Soquel Creek Water District
NCP	Newell Creek Pipeline	WIFIA	Water Infrastructure Finance and Innovation Act
RBF	Riverbank Filtration	WSA	Water Supply Augmentation
RFQ	Request for Qualifications	WSAIP	Water Supply Aug. Implementation Plan
RWQCB	Regional Water Quality Control Board	WTP	Water Treatment Plant
SLVWD	San Lorenzo Valley Water District	WWTF	Wastewater Treatment Facility

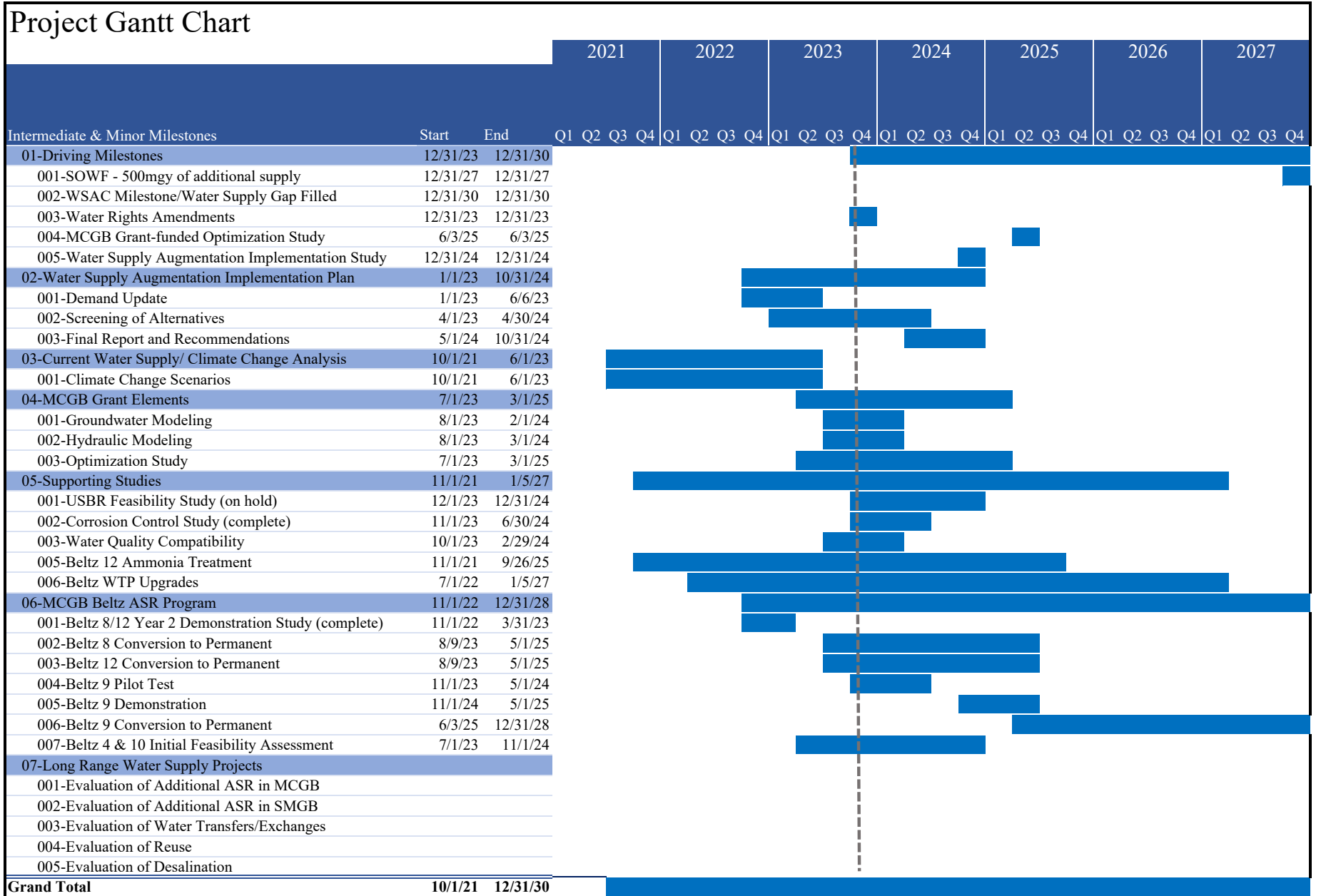
Other Links:

- Reports and Other Resources: [Online Reports](#) (This link will be modified as website continues to be updated. Also included will be any relevant Council and other Board meetings and actions.)
- WSAIP components and schedule: [WSAIP Components and Schedule](#)

Progress Report Attachments:

- Attachment 1: Water Supply Augmentation High-Level Gantt Chart
- Attachment 2: Risk Tracker
- Attachment 3: Budget Summary

Attachment 1



Attachment 2

Water Supply Planning Risks						
Risk	Comments	Status	Issue Age	Consequence#	Likelihood#	Priority Score
Beltz WTP Upgrades	Small site may be limiting factor in maximizing ASR in the MCGB.	Open	253	4	1	4
Water Quality & Compatibility	Water transferred from other agencies, groundwater, or treated surface water may impact ability to advance project(s).	Open	276	5	4	20
Funding	Regional partnerships, and grant and loan opportunities will reduce impact customer rates, but may be unavailable.	Accept	0	4	4	0
Permitting	Lack of feasible DPR and SWRO permitting pathway.	Open	225	4	4	16
Source Water Reliability	Climate change may reduce surface water available for ASR and transfers, and wastewater available for IPR.	Open	231	5	5	25
Water Rights	Delay or lack of resolution will impact ASR, water transfers and exchanges, and operational flexibility.	Open	269	5	1	5

Attachment 3

Water Supply Budget Summary		Updated thru 10/31/2023					
Program number	Eden Number - Project Name	FY23 Balance*	FY24 Budget	FY24 Encumbered	FY24 Actual Spent	Available for New POs	Vendors
3.1	c701705 -- Water Supply Augmentation <i>Includes: analysis of non-specific supply alternatives, planning level work, including modeling, WSAIP and SOWF related tasks.</i>	\$ 1,688,988.42	\$ 1,085,068.00	\$ (1,392,649.21)	\$ (173,867.99)	\$ 1,207,539	HDR Gary Fiske (modeling - supply) Kennedy Jenks/ Umass (WSAIP/modeling - supply) Simon Fraser University (modeling-hydrologic) David Mitchell (modeling - demand forecasts) Montgomery & Associates (technical advisor) Black & Veatch (corrosion study) Pueblo Water Resoures (technical advisor)
3.2	c701611 -- Recycled Water Feasibility Study <i>Includes: recycled water study, and design and construction of 6" tertiary line at WWTF.</i>	\$ 675,533.87	\$ -	\$ (473,536.00)	\$ -	\$ 201,998	Kennedy Jenks Soquel Creek Water District
3.2	c701612 -- Recycled Water - SDC	\$ 205,923.41	\$ -	\$ (202,944.00)	\$ -	\$ 2,979	Soquel Creek Water District
3.3	c701609 -- ASR Planning <i>Includes: evaluation of ASR alternatives through piloting, water quality analyses, new well siting, MW install, rehab, site prep, well capacity analysis, basis of design.</i>	\$ 1,239,742.36	\$ 676,914.00	\$ (972,312.05)	\$ (250,866.09)	\$ 693,478	Pueblo Water Resources Weck (water quality testing) Consor (technical advisor - Nathan Nutter) Montgomery & Assoc (modeling - groundwater) Pacific Surveys Workforce Integrity (labor compliance)
3.3	c701610 -- ASR Planning- SDC	\$ 398,375	\$ -	\$ -	\$ -	\$ 398,375	Pueblo Water Resources
3.3.1	c702101 ASR Mid County Existing Infrastructure <i>Includes: efforts leading to full scale operation of ASR facilities including CEQA, permits, property, design and construction.</i>	\$ 1,978,755.61	\$ 3,760,000.00	\$ (1,001,303.22)	\$ (46,495.40)	\$ 4,690,957	Pueblo Water Resources Precision Hydro Bowman & Williams Carollo
3.3.2	c702102 ASR Mid County New Wells	\$ 264,541.00	\$ 735,939.00	\$ -	\$ -	\$ 1,000,480	TBD
3.4	c702103 SMGWB Planning <i>Includes: efforts in the SMGWB, ASR, IPR, other</i>	\$ 177,924.00	\$ 6,854.00	\$ (19,042.00)	\$ -	\$ 165,736	SMGWB Collaboration Montgomery & Associates (modeling - groundwater)
4.5	c701806 Riverbank Filtration	\$ 616,341.61	\$ 279,650.00	\$ (243,454.20)	\$ -	\$ 652,537	Pueblo Water Resources PES Environmental Inc.
<p>*Notes</p> <p>FY23 Balance: Remaining (unspent/uncommitted) funds at the end of FY23. FY24 Budget: Additional project funds (or budget) requested for FY24. FY24 encumbered: Funds that are committed in Purchase Orders. FY24 actual spent: All expenses (labor, materials, other) that have been charged to the project. As invoices are paid against POs, FY24 encumbered funds will decrease. Available for new POs: Total (uncommitted) funds available for new FY24 purchase orders or expenditures.</p> <p><i>FY 23 Balance + FY 24 Budget - FY24 encumbered - FY24 actual spent = Available for new POs.</i></p>							



WATER COMMISSION INFORMATION REPORT

DATE: 11/20/2023

AGENDA OF: 11/27/2023
TO: Water Commission
FROM: Heidi Luckenbach, Deputy Director/Engineering Manager
SUBJECT: Working Draft – Calendar Year 2024 Water Commission Work Plan

RECOMMENDATION: That the Water Commission review and approve the Working Draft of the Calendar Year 2024 Work Plan.

BACKGROUND and DISCUSSION: Attached is an updated working draft of the calendar year 2024 work plan for Water Commission items. Note:

- While the content will remain relatively static with respect to all items, the dates may change depending on the ability of the various project teams to meet schedules, in particular for Water Supply items.
- There are several unscheduled informational items that will be added to the work plan and meeting agendas as time allows. Examples include updates on customer assistance programs, education and interpretive programs, the State of California’s water efficiency framework, and the Meter Replacement Project.

FISCAL IMPACT: None.

PROPOSED MOTION: Receive information and provide feedback to staff on the material presented.

ATTACHMENT(S):

1. Working Draft Calendar Year 2024 Work Plan

WORKING DRAFT
Water Commission Work Plan – January 2024 through December 2024
(Updated November 2023)

Major Water Commission Work Plan Item	Anticipated City Council Action on Water Commission Recommendations
January 11, 2024	
➤ Presentation by Dr. Tiffany Wise-West on preparation of the updated Local Hazard Mitigation Plan and Climate Adaptation Plan	➤
➤ Anadromous Salmonid Habitat Conservation Plan Update and state and federal environmental document reviews	➤ January 23, 2024 – Council action on IS/MND and MMRP, and project approval
➤ Water Supply: FYI summarizing November’s Deep Material, response to comments/questions, additional findings.	➤
➤ 4th Quarter 2023 & 1st Quarter 2024 Financial Reports	➤
February 5, 2024	
➤ First Water Supply Forecast	➤
➤ Review of Select Department work on the CIP (Parade of Projects)	➤
➤ Water Supply: Regulatory Update: ASR, water rights, recycled water, desalination	➤
March 4, 2024	
➤ Water Supply: WSAIP Quarterly Report	➤
➤ Water Supply: Update on Optimization Study (MCGB) & Modeling in the SMGWB	➤
➤ Water Supply: Source Water Reliability (surface water and treated wastewater)	➤
➤ 2nd Quarter 2024 Financial Report	➤
April 1, 2024	
➤ Second Water Supply Forecast – Recommendations to Council for curtailment if/as needed	➤ First City Council Meeting in April if action is needed for curtailment.
➤	➤
May 6, 2024	
➤ Annual Review and Recommendation on Budget and CIP	➤ Council Budget hearings
➤	➤
June 3, 2024	
➤ Annual Review and Recommendation on Budget and CIP	➤ Council Budget action
➤ Water Supply: WSAIP Quarterly Report	
➤ Water Supply: Findings of Source Water Compatibility Study(ies)	
➤ 3rd Quarter 2024 Financial Report	
July 1, 2024 (cancel?)	
➤	➤
August 5, 2024	
➤ GHWTP Facility Improvement Project FEIR	➤ City Council Consideration for Certification (September)
➤ Water Supply: Update on Optimization Study (MCGB)	➤
➤ Water Supply: Preliminary Look at proposed Water Supply Portfolios	➤
September 2, 2024 (to be rescheduled)	
➤ Water Supply: WSAIP Quarterly Report	➤
➤	➤
October 7, 2024	
➤ Water Supply: Draft WSAIP Report	➤
➤ Water Supply: Draft Optimization Study Report	➤
November 4, 2024	
➤ Water Supply: Final WSAIP Report	➤ City Council action on WSAIP
December 2, 2024	
➤ Water Supply: WSAIP Quarterly Report	➤
➤	➤



WATER COMMISSION INFORMATION REPORT

DATE: 11/20/2023

AGENDA OF: 11/27/2023

TO: Water Commission

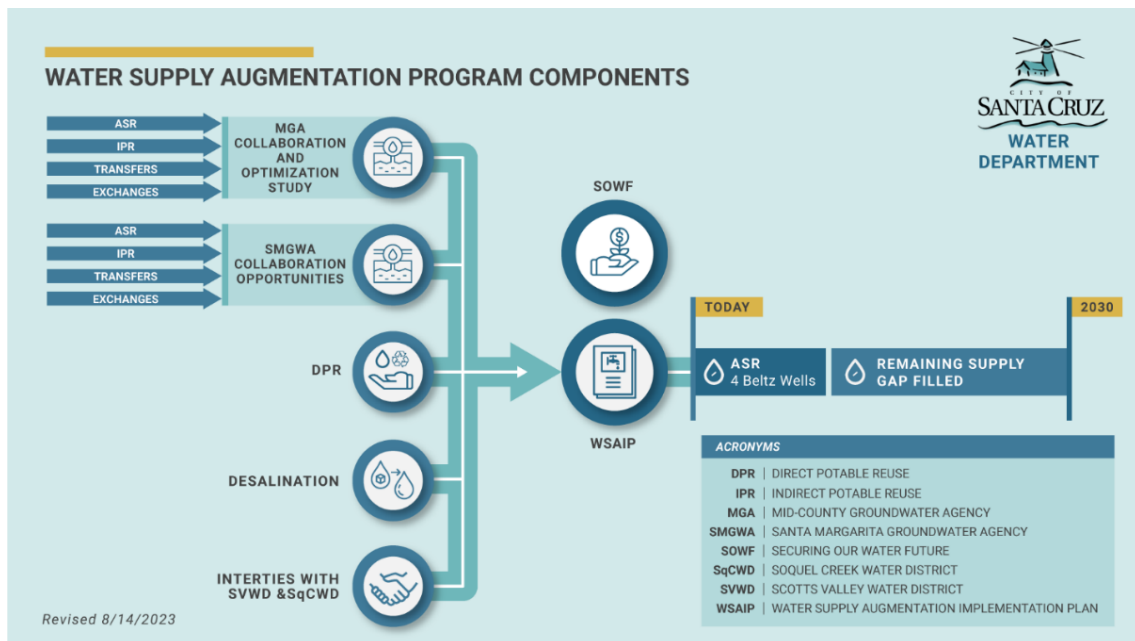
FROM: Heidi Luckenbach, Deputy Director/Engineering Manager

SUBJECT: Water Supply Augmentation Implementation Plan (WSAIP): Updates on Groundwater Modeling in Mid-County and Santa Margarita Groundwater Basins, and Santa Cruz Water Supply Planning

RECOMMENDATION: That the Water Commission receive updates and provide feedback on various aspects of the Water Supply Augmentation efforts.

BACKGROUND and DISCUSSION: Building on the recommendations of the Water Supply Advisory Committee (2015), the Saving Our Water Future Policy adopted by City Council in November of 2022 provides the guidance and direction for the development and implementation of water supply augmentation projects and strategies needed to resolve Santa Cruz’s long-standing water supply reliability issue. Links to these documents are provided in the attachments below.

Passive and active recharge of both the Mid-County and Santa Margarita groundwater basins, as well as collaboration with neighboring water agencies, are key to meeting supply reliability goals for the City of Santa Cruz (City) and the region. Efforts underway to achieve supply reliability are summarized in the following chart.



Projects being modeled at this time and discussed at the Water Commission’s meeting include:

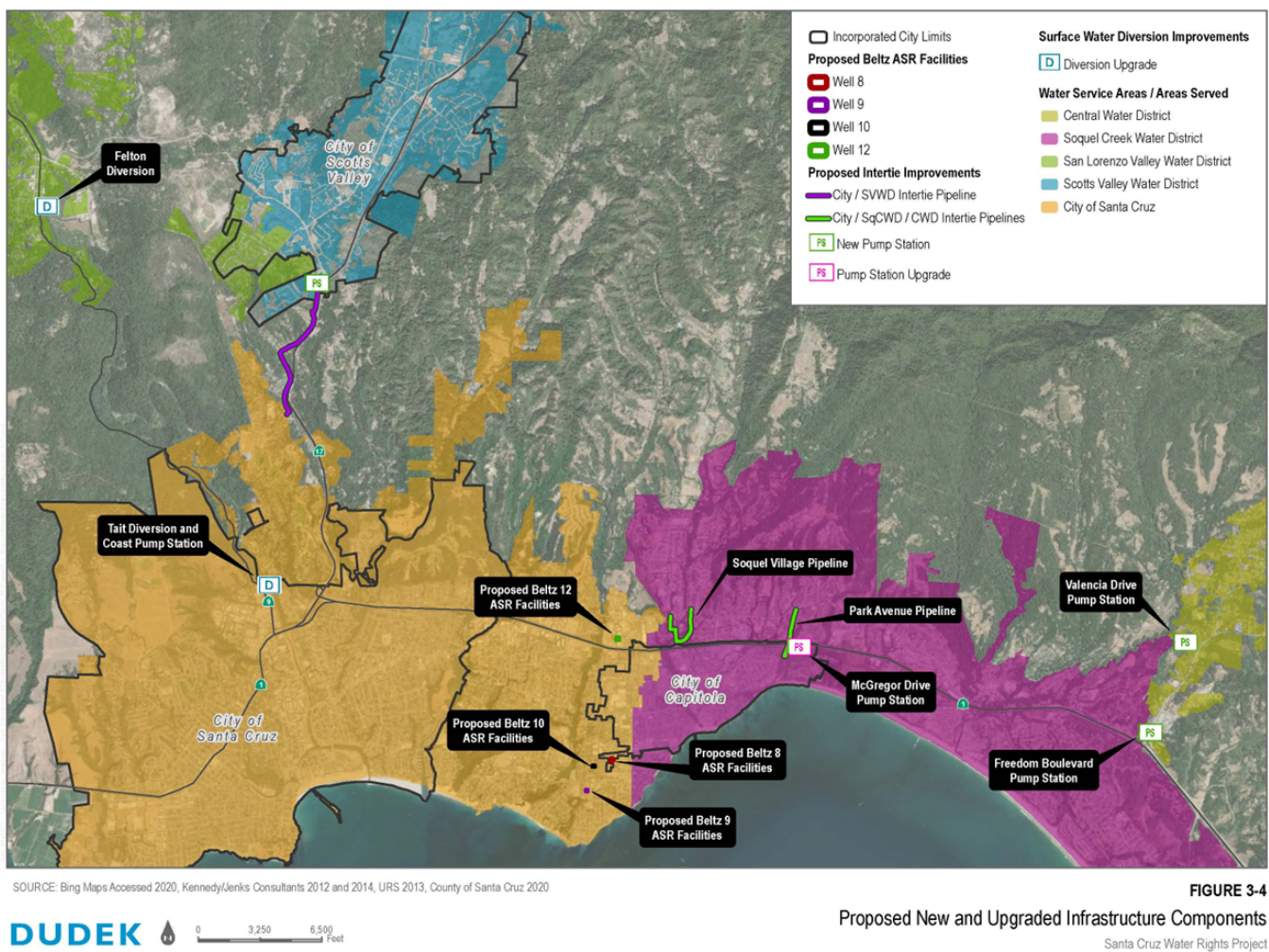
Mid-County Groundwater Basin

- Alternative 1 - Baseline: As a reference point for evaluating other alternatives, the baseline includes the Pure Water Soquel Project and ASR at the four existing Beltz wells.
- Alternative 2: This alternative builds on the Baseline and includes several scenarios that incorporate water transfers and optimizes pumping of the Baseline.
- Alternative 3: This alternative builds on Alternative 2 and includes several scenarios that increase the sizes of the PWS and/or ASR projects.

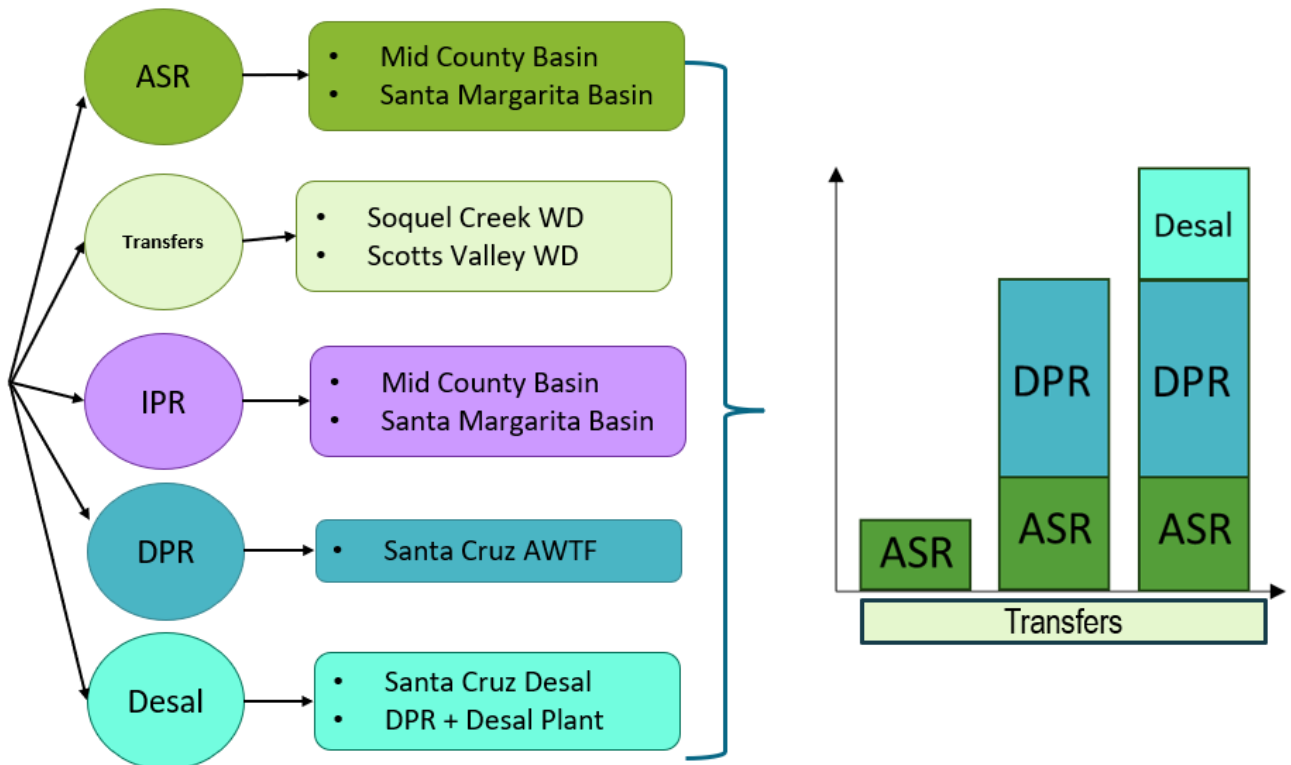
Santa Margarita Groundwater Basin

- Scotts Valley Water District/City of Santa Cruz Intertie Project including pipeline and pump station.

The following provides regional context and location of key facilities.



From left to right in the chart below are the projects under evaluation; the location, agency and/or source water; and potential portfolios of projects to achieve supply reliability.



The presentation and discussion at the Water Commission meeting will focus on:

- Recent groundwater modeling in the Mid-County and Santa Margarita groundwater basins; and
- Potential benefits of water supply projects: water transfers, ASR, reuse, or desalination.

The draft agenda includes:

Part I – General Update

- Climate scenarios and models
- WSAIP Objectives and Timeline

Part II – Santa Margarita Groundwater Basin

- Scotts Valley Water District/City of Santa Cruz Intertie Project
- Findings of preliminary groundwater modeling

Part III – Mid-County Groundwater Basin

- Optimization Study Baseline and alternatives

Part IV – WSAIP Updates

- Wastewater Availability
- Water Supply Gap: Portfolio Concepts and Operational Scenarios

A summary report will be provided at the next Water Commission meeting to summarize this work and respond to any questions.

FISCAL IMPACT: None.

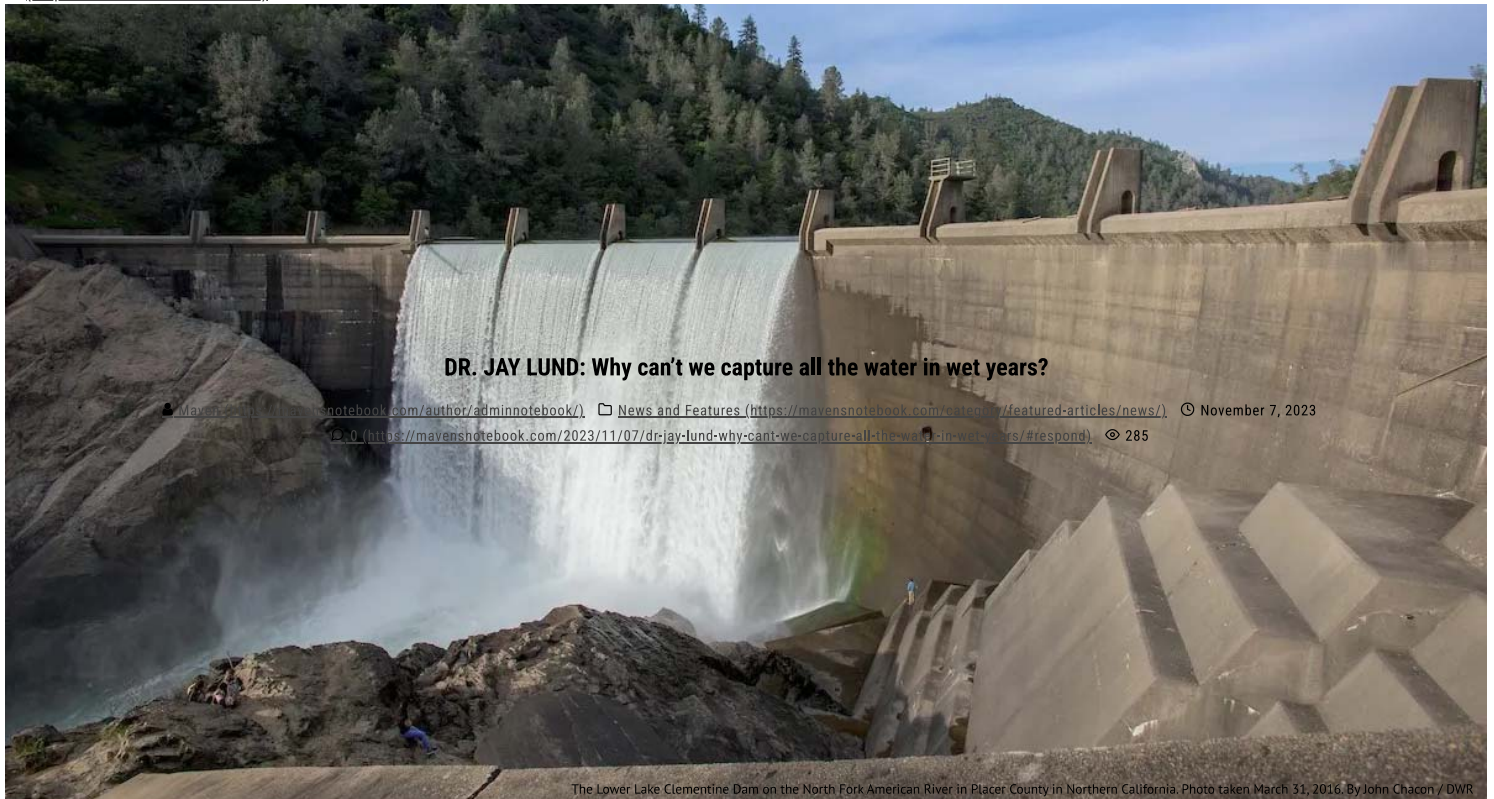
PROPOSED MOTION: Receive information and provide feedback to staff on the material presented.

ATTACHMENT(S):

1. [Securing Our Water Future Policy \(2022\)](#)
2. [WSAC Recommendations \(2015\)](#)



(https://mavensnotebook.com)



DR. JAY LUND: Why can't we capture all the water in wet years?

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© 0 (https://mavensnotebook.com/2023/11/07/dr-jay-lund-why-cant-we-capture-all-the-water-in-wet-years/#respond) © 285

The Lower Lake Clementine Dam on the North Fork American River in Placer County in Northern California. Photo taken March 31, 2016. By John Chacon / DWR

Capturing and Managing Large Storms and Wet Winters in California—Prospects and Limitations

Capturing water from wet periods for use in drier seasons or years has been central to California's water management since the early 1900s. Reservoirs and aquifers (https://mavensnotebook.com/glossary/aquifer/) are routinely used for this purpose by many agencies and regions. How much more water can be saved in wetter times for later use? How much would this cost? What are the potential environmental costs (and benefits) of storing additional water? Dr. Jay Lund, Vice Director of the Center for Watershed Sciences (https://mavensnotebook.com/glossary/watershed/) and an engineering professor at UC Davis, dove into those questions in the presentation for Sacramento State's Office of Water Programs webinar series.

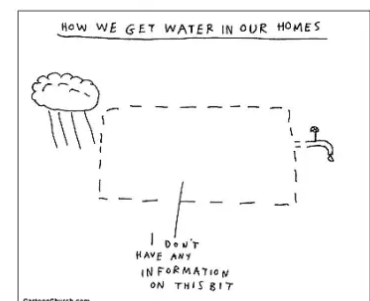
(https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_02.jpg?ssl=1) So why California can't catch all the water in wet winters? In most years, we have at least one storm where we can't catch it all. In the aftermath of those storms, it's a question many folks ask.

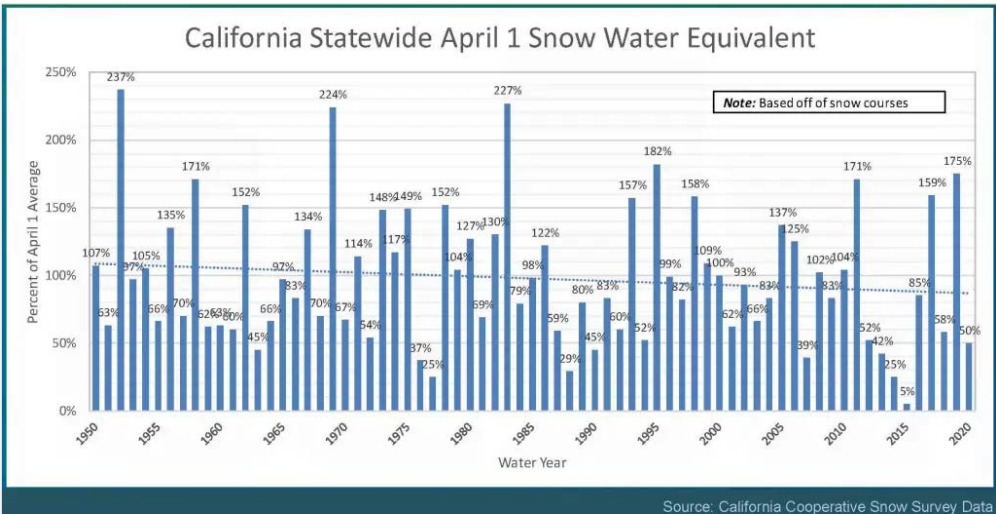
California's water system is very complex, and there's a lot of partial understanding of the system, even by experts. Many things go on in the state's water systems, between the precipitation falling and the water coming out of the tap, including collection, storage, treatment, water quality control, regulations, and governance.

"Even the most expert person on California water doesn't know everything inside that box, so it's a big social activity as well as highly technical activity," said Dr. Lund.

California is a wild place hydrologically. Last year was one of the wettest years on record, preceded by one of the driest years on record. Precipitation in California comes in big gulps and depends upon the number and frequency of the storms that arrive.

We all know and don't know

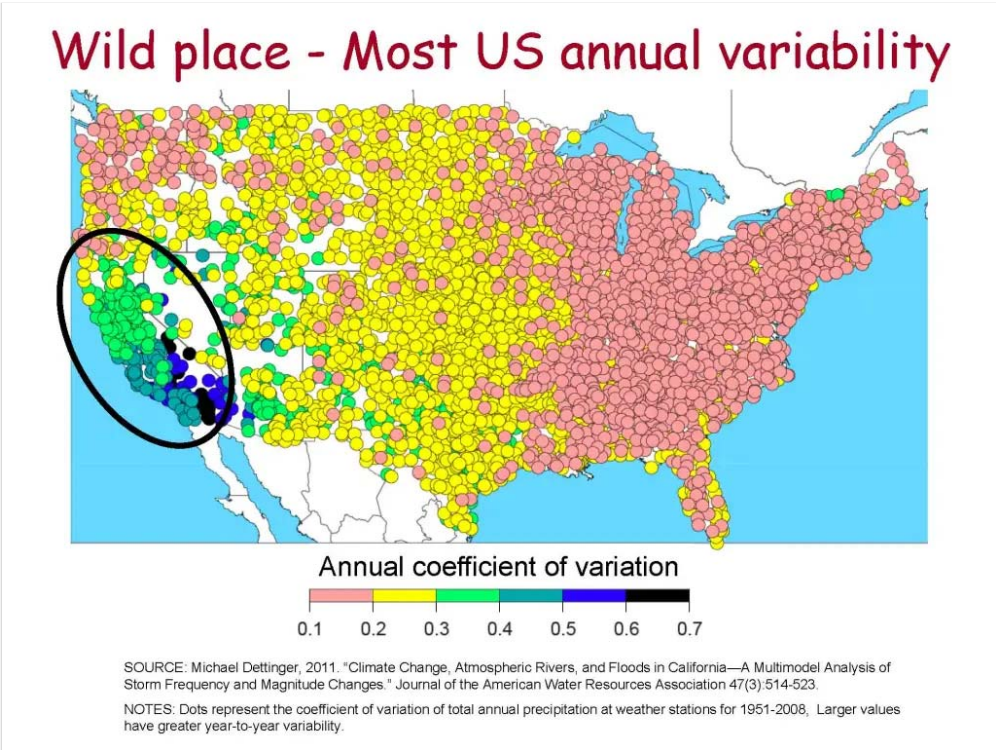




Source: California Cooperative Snow Survey Data

<https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2021/01/Statewide-April-1-Snow-Water-Content.jpg?ssl=1>

Precipitation is also highly variable between years. The chart below shows the annual coefficient of variation for precipitation for thousands of stations across the United States. The Eastern US has very little variability, but there is more interannual variability as you move west. California, particularly Southern California, has an incredibly high precipitation variation from year to year.

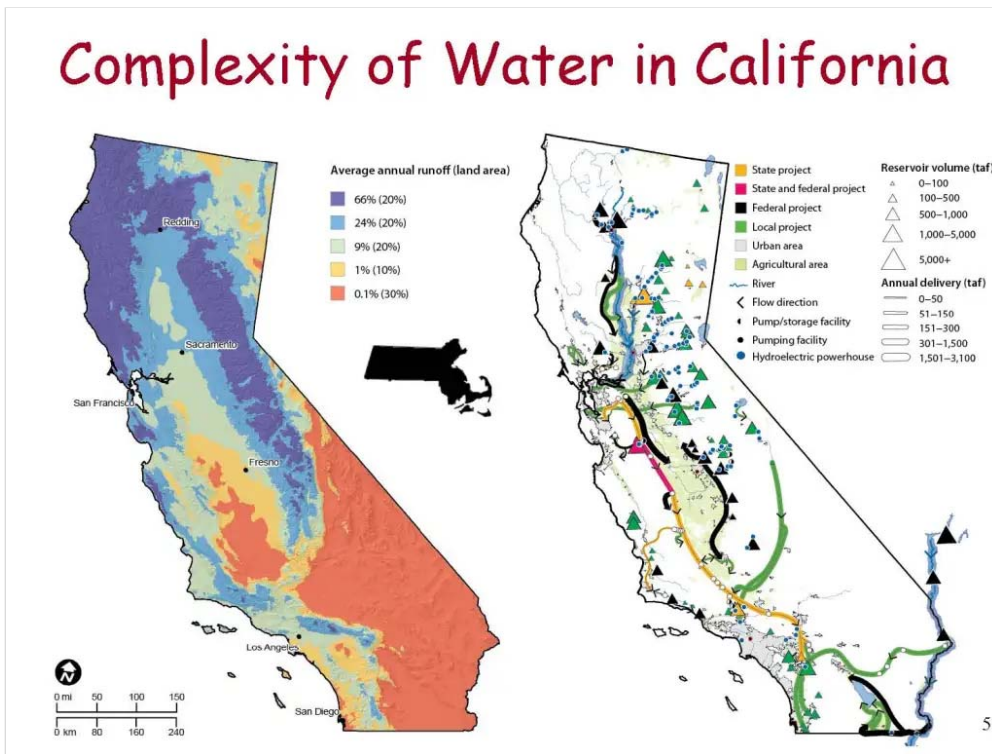


https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_04.jpg?ssl=1

"In California, we have more flood years and drought years per average year than any other state in the union," said Dr. Lund.

California water is also challenged with the spatial and temporal distribution of water. The map on the left shows that about two-thirds of all the runoff in the state comes off about 20% of the surface area, and about 90% of the runoff in the state comes off about 40% of the state's surface area. The areas shown in red represent 30% of the surface area of California and produce point .1% of the runoff.

Complexity of Water in California

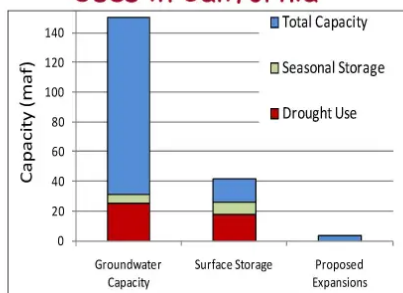


https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_05.jpg?ssl=1

The map on the right shows the infrastructure built for storing and delivering water. Dr. Lund noted that the map is color-coded for ownership, illustrating the mix of federal, state, local, and private ownership.

“We have deserts and some pretty wet areas,” said Dr. Lund. “This water is available, but not where we want it because it tends to be far from the large agricultural and urban areas. It’s not at the times that we want it as it tends to be available in the wintertime when we would like it in the summer and the spring for irrigation of our lawns and of our crops. So we have a big mismatch in space and time for our water. California has become a heaven for infrastructure and water engineers because we’re always trying to move water in space and time to make that natural water distribution better match what humans want.”

Water Storage Capacity and Uses in California



https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_06.jpg?ssl=1

The graph shows the total amount of groundwater and surface water storage available in California and how much we use. About 150 million acre-feet of groundwater storage capacity is accessible in principle, although wells might have to be deepened to get to it. There is about 42 million acre-feet of surface storage capacity. The green shows the seasonal storage in an average year.

“For normal average seasonal storage, we depend more on the surface water storage than the groundwater storage, although certainly, we use a lot of groundwater seasonally,” said Dr. Lund. “But in droughts, we rely more on groundwater than surface water. And the longer the drought, the less surface water we have for the later years of a drought, and we’ve become more reliant on groundwater over time.”

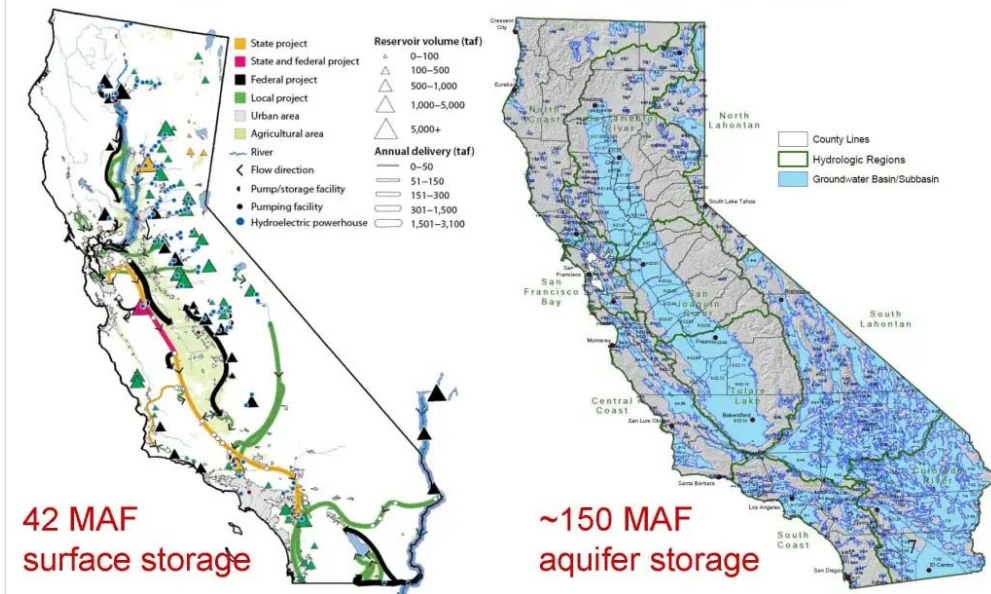
Dr. Lund pointed out that the third bar shows the total amount of storage for all of the Prop 1 water storage projects is about 4 million acre-feet of storage. “So even if we built everything that people propose for surface water storage, it doesn’t really add all that much storage to California’s water system.”

The map on the left shows the infrastructure and where the 42 million acre-feet of surface storage is located. The map on the right shows the groundwater basins. “So both surface water and groundwater storage are important, but, by far, the greatest capacity for storing water and water available in storage is in groundwater basins,” said Dr. Lund.

California Water and Infrastructure

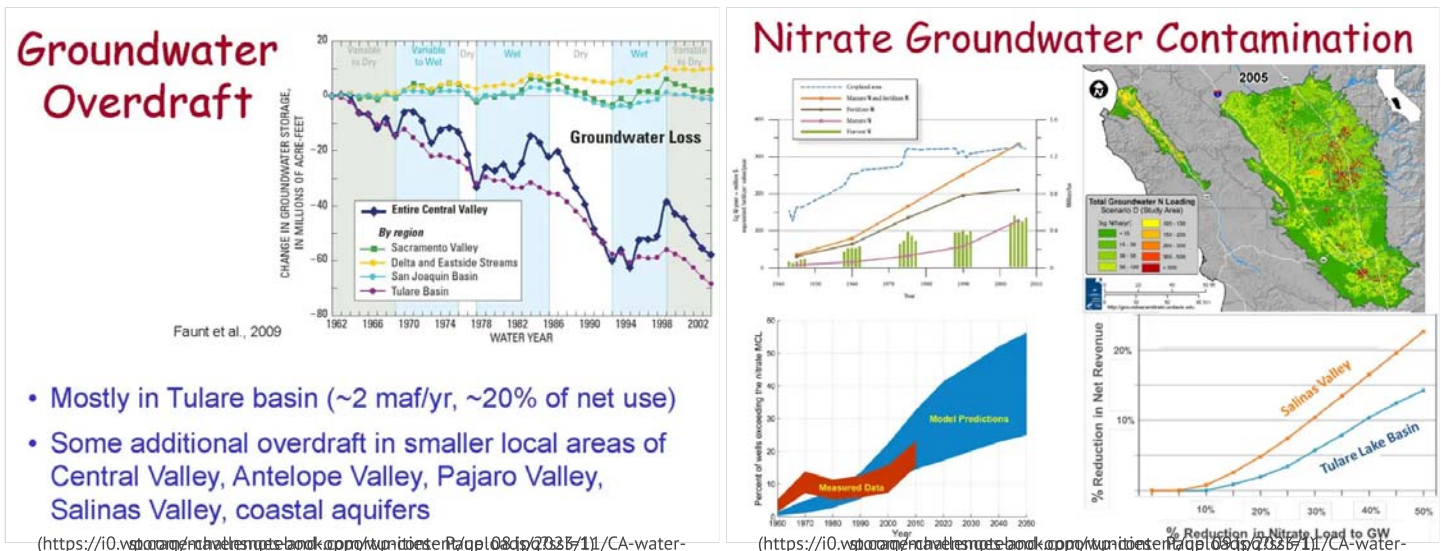
Top down view

Aquifer up view



(https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_07.jpg?ssl=1)

There certainly are groundwater overdraft (<https://mavensnotebook.com/glossary/overdraft/>) problems. The plot on the lower left from the USGS shows that most of the groundwater overdraft tends to be in the Tulare Basin. "The other basins have some overdraft problems in places and at times," said Dr. Lund. "But probably 90% or more of the groundwater overdraft in California is in the Tulare basin. And about 20% of the water use is in that basin."



(<https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water->

<https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water->

Some of the groundwater basins have water quality issues. The slide on the above right shows the nitrate (<https://mavensnotebook.com/glossary/nitrate/>) contamination problems, particularly in the Tulare Basin. "Nitrate contamination doesn't really affect agriculture, but it does affect human consumption, and it's projected to increase considerably over the coming decades."

REQUIREMENTS FOR WATER STORAGE

To store water, five things are needed:

- First**, there has to be water available to store.
- Second**, there has to be a place to store the water, such as a reservoir or aquifer.

Third is conveyance (<https://mavensnotebook.com/glossary/conveyance/>) to the storage location. Water is not always available when we want it and where we want to store or use it, so water is moved from where it is to where we want it to be. This is a challenge for California as most of the water is in the north, and most of the empty storage capacity is in the San Joaquin Valley.

Fourth is the ability to withdraw water. You have to have the ability to get the water out of storage to use it. This can be a problem with groundwater banks as the well capacity to withdraw water during drought can be limited.

Fifth is having the coordination and knowledge to combine all these pieces. Typically, the water available for one location is controlled by one water right or another. To move the water, we may need to move it through conveyance controlled by the [State Water Project](https://mavensnotebook.com/the-notebook-file-cabinet/californias-water-systems/state-water-project/) or [Central Valley Project](https://mavensnotebook.com/the-notebook-file-cabinet/californias-water-systems/the-central-valley-project/). So, there needs to be coordination between the owners of the different components of the transaction, as well as the regulators of water, water rights, groundwater basins, and recharge ponds.

Lack of or high costs with any one of these items can prevent storage from occurring or limit the amount of storage available.

"It's important to think of water storage as involving all five of these components," said Dr. Lund. "We often hear in our public discourse, just to focus on places of storage and storage capacity. But I think engineers and most folks understand that if you don't have water to put in it, and if that storage is in the wrong place, you won't get much use out of it."

SO WHY CAN'T WE CATCH ALL THE WATER IN THE WINTERTIME?

First, water is generally available infrequently and often in the wrong places. We have plenty of water this year, but that's not every year.

Second, new surface reservoirs, in particular, are costly, both in terms of finance and in terms of environmental impacts. "If you're going to build a large enough surface water storage project to capture all the flows available in winter, it has to be very large," said Dr. Lund. "But that means that the reservoir will not be able to deliver water in very many years. It will be partly empty most years; it will mostly be for drought storage. And so you will actually be able to make deliveries from that expensive capital facility fairly infrequently."

Third, most of the empty aquifer storage is in the San Joaquin Valley, particularly the Tulare basin, which is far from where the water is. Dr. Lund noted that the Tulare Basin is in overdraft partly because there's not as much surface water there. "So sometimes having available storage indicates that you don't have enough water coming into storage, or as much as you'd like anyway."

Fourth, moving water often requires diversions and conveyance, and when it involves the Delta, it can involve a lot of costs and be controversial on many levels.

Fifth, having infrequently used infrastructure raises water delivery costs.

"So the short answer to why we can't catch all the water available in wet winters is physics: not much water available very frequently; economics: it costs a lot to build dedicated storage and dedicated diversions in advance for those unusual peaks when water is available; and politics because of the controversies and environmental impacts of this infrastructure and its operation."

ECONOMIC LIMITS OF WATER STORAGE

[Slide 12] The [capital costs](https://mavensnotebook.com/glossary/capital-costs/) of a water storage project are paid for every year, even when the project is not delivering water. And the economic value of having water delivered is finite.

"People like to talk about how water is our most valuable resource, but it isn't really," said Dr. Lund. "Most of the time, it's worth a few \$100 an acre-foot, and this leads to one of my favorite quotes: there is rarely a shortage of water, but often a shortage of cheap water."

The graph on the slide shows the annual cost of \$1,000 capital cost increases when the recurrence of the benefits is frequent on the left and infrequent on the right. "If you have \$1,000 in capital costs and a 5% interest rate, it's pretty reasonable if, every few years, you get benefits from it. But if you're storing water for ten years, and then you get the benefits, you have to pay the capital cost for all of those ten years when no water is being delivered to get that delivery in an unusual year."

Wind turbines illustrate a similar point. Why are we allowing all that wind energy to go to waste? Can we build wind turbines so that we don't have to waste all that energy flowing across the state? Why don't we build so many turbines that we never feel the wind because the turbines are capturing almost all that wind energy?

"It's just not economical to do it," said Dr. Lund. "The frequency and the magnitudes of winds have to be high enough and frequent enough to justify the expense of building a turbine. It's the same thing with capturing water as with capturing energy out of the sky. There are ecosystem limits to our ability to capture it all. ... Capturing all the water in the winter would cause quite a bit of harm to most of the ecosystems; high flows flowing out to sea are needed occasionally to clear out habitats, reset them, and disrupt invasive species and predators."

Particularly with a warming climate, Dr. Lund said storing water for ecosystems, both for providing cold water for species and flows in dry years, will become increasingly important. "We normally think of the environmental impacts of water storage as being negative, but there will certainly be increasing cases that we're going to have to consider where the stored water has environmental values. And we have several projects that are working on that."

INCREASING WATER CAPTURE

So, while we can't capture all the flows, we can capture more water. Dr. Lund suggested focusing mostly on opportunities where water is available frequently, storage capacity already exists, such as empty groundwater basins or already constructed reservoirs, and infrastructure that makes moving water in and out easy. Look for opportunities with existing infrastructure, such as unlined irrigation canals, which can serve essentially as linear recharge basins.

Look for “multi-benefit” project opportunities that provide additional ecosystem, recreation, water supply, or flood benefits. Water trading, improved water operations, and forecast-informed reservoir operations can get more water from the same infrastructure or with less expensive infrastructure expansions or modifications. Cooperation among the regulators and the owners of the different pieces of infrastructure and the different water rights will be important.

SOLUTIONS FOR CALIFORNIA'S WATER PROBLEMS

Dr. Lund said that there's no silver bullet for California's water problems, although there are plenty of silver bullet vendors pushing their solutions, such as desalination, surface water storage, recycled water, or conservation.

“We're moving away from that, hopefully in a big way, to looking at taking advantage of the existing system and using a portfolio approach of different supply and demand management actions to make better use of infrastructure and capital costs and provide opportunities for multi-agency and multi-sector benefits.”

The hydrology varies greatly across the state's various regions, and every drought impacts the regions differently; some regions may be wetter in some droughts and drier in others. So, having the flexibility to trade water and move it around can help reduce the need to construct large, expensive infrastructure and mitigate environmental impacts.

“We have to do these portfolio approaches where you're managing supplies and demands all together in different ways,” he said. “Even across multiple agencies, you need more data, more knowledge, better modeling, and it will require some shifting of institutional capabilities.”

In California, water problems are changing over time; the water problems the state faced 100 years ago and the water problems today have quite a bit in common, but they're also fundamentally different. The structure of the economy has altered water demands; [agricultural water use \(https://mavensnotebook.com/glossary/agricultural-water-use/\)](https://mavensnotebook.com/glossary/agricultural-water-use/) has changed along with the economic value of supplying those demands. Sometimes, the institutions were structured to solve water problems as they existed 50 years ago, and we need to modify the institutions and the governance of the problem so that problems can be solved or better understood.

California has an extensive network of water infrastructure that really functions as one large network that is mostly governed locally. “It's more than just storage and conveyance,” said Dr. Lund. “It has water demand management, local sources, water quality issues, water treatment, pumping costs – all kinds of things that are going on. And it really gives us a lot more opportunities to have very extensive diverse variable portfolios of activities to manage these problems as they vary over wet and dry conditions. And it's going to vary even more with changes in climate.”

Portfolio approaches have been quite successful, and most of the major water agencies have tried to adopt them. But it takes extra time to organize them and for them to be successful.

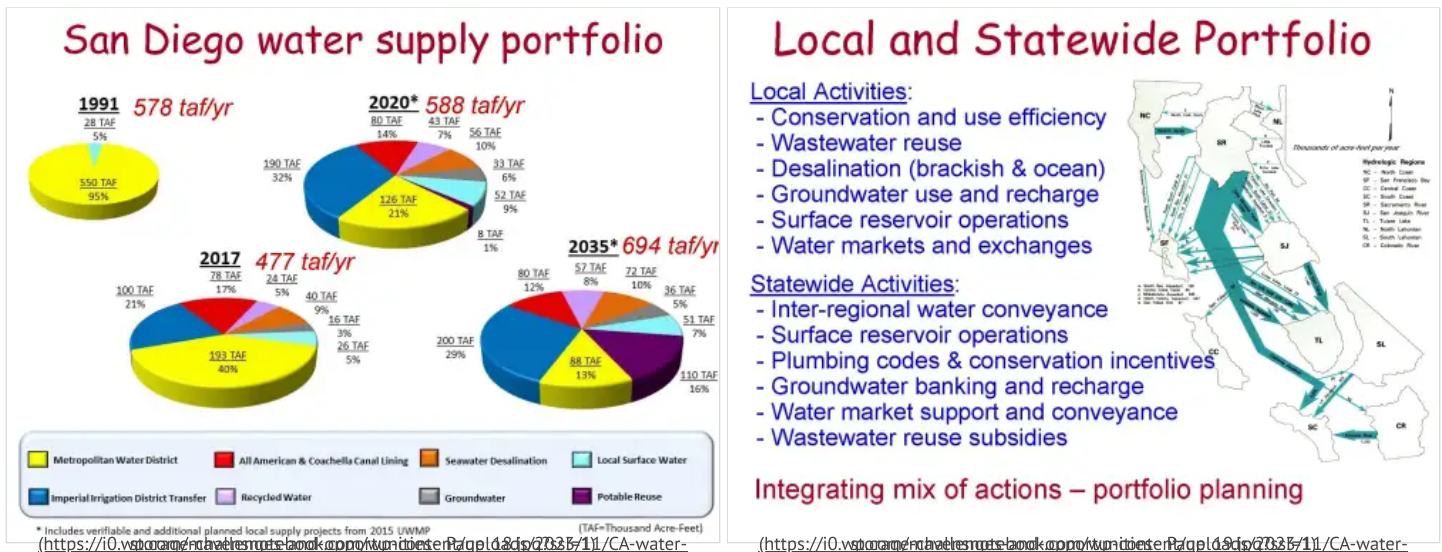
The slide below lists the various activities that can be used in a portfolio approach.

Water supply system portfolio actions	
Water supply	
Water Source availability	Treatment
Capture of fog, precipitation, streams, groundwater, wastewater	Existing water and wastewater treatment
Protection of source water quality	New water and wastewater treatment
Conveyance capacities	Wastewater reuse
Canals, pipelines, aquifers, tankers (sea or land), bottles, etc.	Ocean Desalination Contaminated aquifers
Storage capacities	Operations
Surface reservoirs, aquifers and recharge, tanks, snowpack, etc.	Reoperation of storage and conveyance Conjunctive use
Water demands and allocation	
Agricultural use efficiencies and reductions	Ecosystem demand management
Urban water use efficiencies and reductions	Recreation water use efficiencies
Incentives to work well together	
Pricing	Subsidies, taxes
Markets	Education
“Norming”, shaming	17

(https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_17.jpg?ssl=1)

There are many activities for water supply, such as different sources, storage capacities, operational strategies, conjunctive use of surface water and groundwater, and strategies for water allocation and demand management. And because water systems often involve millions of people and hundreds of agencies, there needs to be incentives to encourage people to work well together. These can include pricing and markets, subsidies, norming, and shaming.

The slide at the lower left shows how San Diego has diversified their water portfolio over time, reducing their dependence on the Metropolitan Water District and improving their water supply reliability. Portfolio activities can be at the local, regional, and statewide levels. The goal is to have an integrated mix of various activities over time so they work well across agencies, users, and individual actions.



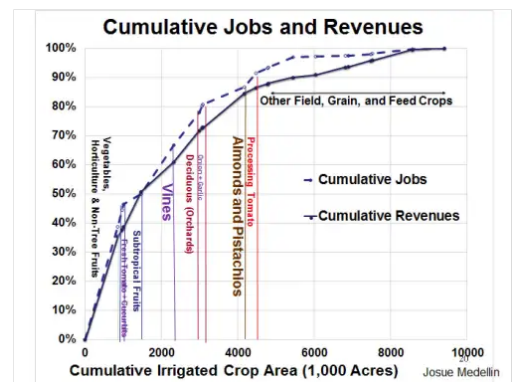
WATER DEMAND

(https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_20.jpg?ssl=1)The slide from Josue Medellin at UC Merced shows the total number of acres of crops in California, ordered by the share of statewide employment and revenues from those crops.

“About half the acreage provides about 85 or 90% of the revenues and jobs in agriculture in the state,” said Dr. Lund. “I’d love to see a similar plot for water use in urban areas where half the water use in most urban areas is for landscape irrigation, which has relatively few jobs and relatively little economic importance compared to flushing toilets and industrial and commercial uses. But it gives you some confidence that if you manage the demand side properly, you can suffer some fairly sizable water shortages without causing grave damages to your economy in the agricultural and urban sectors.”

RESISTANCE IS FUTILE ...

“We’re going to see some changes in California in the future,” he said. “It’s really based on the physics and economics of the situation. No matter how much we want not to have this happen, it’s going to happen, so we should prepare for that. Some things are not within our management control.”



Resistance is Futile



- 1) Flooding in parts of the Delta
- 2) Reduced Delta diversions
- 3) Less irrigated land in the southern Central Valley
- 4) Less urban water use, more reuse & storm capture
- 5) Some native species unsustainable in the wild
- 6) Funding solutions mostly local and regional
- 7) State's leverage is mostly regulatory, not funding
- 8) Nitrate groundwater contamination is inevitable
- 9) Groundwater will be managed more tightly
- 10) The Salton Sink will be largely restored

We cannot drought-proof, but we can manage better.

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(https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_21.jpg?ssl=1)

CONCLUSIONS

(https://i0.wp.com/mavensnotebook.com/wp-content/uploads/2023/11/CA-water-storage-challenges-and-opportunities- Page_22.jpg?ssl=1) California's water system was designed to capture water in wetter seasons for drier years and seasons; we can do more of this, especially aquifer recharge.

"We're still going to have major water shortages even if we capture all the economically feasible water with additional aquifer recharge and surface water storage," he said. "We're still going to have water shortages given our climate.

Climate warming will make capturing water harder and a bit more valuable. Because more of the flows will occur in the winter when we also have flood control concerns and less flows in the spring, it will give us more incentives to try to move much more of our drought storage from surface reservoirs into groundwater."

"There are economic and environmental limits to capture all the water, even a bit more. It's important, and I think feasible, to capture a bit more water. But don't be greedy about it. Don't have expectations that are unrealistically high."

Q&A

QUESTION: More funding is needed to address California's water problems. What are some current and potential funding solutions?

DR. LUND: "Everyone would always like to have someone else pay for the solution to the problems that they're experiencing. But of the roughly \$40 billion a year that we spend in California on water systems, 80% of that is from local revenues, and maybe about 10%, each from the state and federal sources. So, really, we have to look mostly at beneficiaries paying for water infrastructure and water storage. That's a good model for accountability and ensuring that money is well spent because the beneficiaries will be paying for most of it. I think you have to look at water rates to pay for most of this. People are always proposing water bonds, but that's a fairly inefficient way to get things done. I would much prefer other methods of regularly coming up with money to fund state activities."

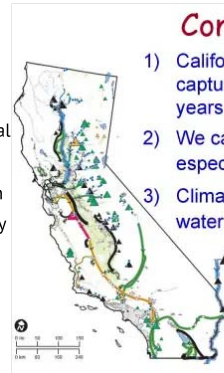
QUESTION: Last year, farmers complained that the California and local governments moved too slowly to take advantage of the storms. What has been done to improve the speed of approval?

DR. LUND: "This is a very diverse state with thousands of local governments that manage water. What impresses me when I get out in the field is that this is not a new problem for most of the local governments that manage water systems. They're always very keen on trying to store as much water as they can. So there will be occasions where they have regulatory problems or mis-organization locally. But for the most part, the problems they're facing are economic; it's not worth building infrastructure to capture all that water where there are infrequent opportunities when it's available."

"There will be some hundreds of thousands of acre-feet that you can capture with a little better regulatory attention and coordination of state and local activities. But that's always going to be a struggle because every wet year is a little bit different. It's a little different time of the year and a little different place. We're always going to be moving water around, so that coordination part of storage for water is always going to be a challenge."

Conclusions

- 1) California's system is designed to capture water in wetter seasons and years for drier times.
- 2) We can do a bit more of this, especially for aquifer recharge.
- 3) Climate warming makes capturing water harder but more valuable
- 4) There are economic and environmental limits to trying to capture it all
- 5) Capture a bit more, but don't be greedy.



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"I know that the local folks are always scrambling and looking for opportunities to bank more water, to get the water from where it's in excess to where we can put it underground or in a reservoir someplace. They work very hard at that and pretty creatively. But sometimes, it's just a lot to do in a short period of time. Sometimes, the state can get out ahead of it, or the regions can have some agreements on water rights, water exchanges, conveyance capacity, and operations to be better able to react more quickly. So a lot depends very locally on just how prepared they are. But it's not that these people are lazy or unaware of a concept here."

QUESTION: How does the shift of precipitation from snow to rain due to climate change affect the desirability of storage?

DR. LUND: "I think it increases the value of storage because you now have more water available in the wet season and less water available in a longer dry season; the spring becomes more of a dry season when you don't have snowpack. So that would give you some greater value for storing water from the wet season to the dry season. The cheapest way to do that, in many cases, will be to move some of your drought storage from surface reservoirs into groundwater. Because that way, you're better utilizing existing storage capacity."

The problem is we've already built many reservoirs fairly large, and to go back in and expand them gets really expensive. Not only have things gotten more expensive in the construction field and the regulations but also the locations of many of our reservoirs already have been economically sized, so if you were to expand those reservoirs, you'd have to do special construction – expensive construction, such as saddle dams, that raise the construction costs. The larger you build the reservoir, the harder it is to fill it up in general."

QUESTION: Do we have the physical capacity and ability to store runoff in aquifers?

DR. LUND: "If all of our surplus water were available in the Tulare basin, we would not have a groundwater overdraft problem down there. We would be able to use that 100 million acre-feet of empty groundwater storage to mitigate droughts. But most of that surplus water in the wet years is available up in the Sacramento Valley. And to get it across the Delta and down into the Tulare Basin is the real is a real challenge, both economically physically and legally regulatory perspective."

QUESTION: Is storage in aquifers and the subsequent pumping more expensive than surface storage?

DR. LUND: "Surface storage is more expensive to construct. If you have pumped storage, you have to you have to pay to pump the water in, but then you get a little bit of hydropower back out. But for the most part, the operating capital cost of aquifers is very small, and you might have some capital costs to increase the recharge capacity, such as recharge basins. Then you have to pay to take the water out when you pump it out with the wells."

QUESTION: What are the biggest challenges, maybe the top three, you think we need to be addressing in the next 20 years?

DR. LUND: with how that's going, but it's a long road to go. Second, ecosystem management, and we're really doing a terrible job. We're investing a moderate amount of money, but we're not really quite highly organized or understand how effective that has been. And it's going to become a harder challenge with climate change. I think the hardest one is the ecosystem.

Third is the Sacramento San Joaquin Delta; there's a lot going on with sea level rise and changes in ecosystems and flooding of islands and all kinds of things. It's a mess in many dimensions. And the fourth one is the rural water systems that have problems with safe drinking water. There is a nitrate contamination problem in the Tulare basin and in many rural areas. This is the problem of high groundwater drawdown during drought years, leaving households and small community well supplies stranded. There are problems with the lack of economies of scale in those small systems in rural areas and financially keeping them viable."

"Those are the four big problems that I see. Everybody has problems, but for urban and most agriculture, they're pretty well organized and pretty well funded. They would always like to have more money, but I think ecosystems, the Delta, groundwater management, and small rural water systems are the biggest problems that the state really is struggling with."

QUESTION: Wetter areas have more opportunities because solutions are more economical and physically possible. What about areas with drier areas? How can they better solve water problems if they are worse off geographically and would have to pay higher costs?

DR. LUND: "Traditionally, what the drier regions did was they tried to bring in water. I think we're not going to see too much expansion of that strategy for the drier regions. Certainly, on the urban side, we're seeing declining per capita water use, which is really helping in a lot of cases. So, we have a larger fraction of our economy using a smaller fraction of the water. That really, really helps a lot. With agriculture, the drier parts of the state are going to see some losses of irrigated agricultural land. There will be a little bit of dryland farming, which is really hard to make a go of in much of the state, and some dryland grazing, which is not nearly as valuable as irrigated crops. So the drier areas are going to have to reconcile with being dry more than they have in the past."

QUESTION: What are the technical issues with storm prediction and modeling?

DR. LUND: Well, the fundamental one is we're really never going to have weather predictions up more than, say, 10 or 11 days that are any good. Just the nature of the equations of fluid motion in the atmosphere is highly subjected to chaos after about 7 to 10 days. So today, we have pretty good forecasts, maybe three to five days out, sometimes seven days out, to sort of see really big events coming. Maybe even a little bit longer than that, but there are just limits to how far ahead we're going to be able to forecast. And it'd be nice if we could forecast once a month out, but months and months out, or forecasts might get a little better than they are today. But then they're not going to be substantially better, I think, for operational purposes, most operational purposes than what we've got.

QUESTION: For a fuller picture, shouldn't the chart from Josue Medellin add in economic value of much higher value dairy and livestock aspects for which feed crops are just inputs?

"That's a reasonable a reasonable concern. Even with that, those very feed crop things are like \$9 billion of the \$50 billion agricultural economy, so it's pretty sizable. 50% of what I had there was field crops. But I don't think that 50% is what feeds the dairies and the beef industry so much. So, if you want to make that correction, go right ahead. But you still have a sizable amount of lower value field crops out there."

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NEW VIDEO

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Ashlyn Perri

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IMPACT INVESTING
OPPORTUNITIES TO ADVANCE

WATER, HEALTH & EQUITY



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July 2022



ENVIRONMENTAL POLICY
INNOVATION
CENTER

EXECUTIVE SUMMARY

The Environmental Policy Innovation Center's report [H2Equity: Rebuilding a Fair System of Water Services for America](#) highlights how America's water systems – which are used to deliver drinking water, remove waste and manage stormwater – are degraded or broken in more regions of the country than we think. This has resulted in a lack of access to safe drinking water or sewage treatment in some places, and in others unaffordable water supply, sewage overflows and flooded streets. The failures of our water systems prevent all Americans, especially lower income and historically marginalized Americans, from having the healthy and prosperous lives they deserve.

There is an opportunity for philanthropic impact investors to align their investment strategies with their or others' grantmaking – and with government funding initiatives – to advance solutions to these challenges and help move towards an equitable water future.

Two circumstances are combining to create this opportunity:

- **First, the water sector is becoming more innovative.** Generally hesitant to try new approaches, leading water utilities have recognized the need for innovation to address aging infrastructure, climate change and historic racial inequities. A wave of leadership retirements across the sector are also creating an opportunity for new diverse and innovative leadership. Non-profits, including the [US Water Alliance](#), [Rural Community Assistance Partnership](#), [Moonshot Missions](#), [EPIC](#) and others are sparking and responding to this interest to build a movement of change.
- **Second, federal infrastructure financing is increasing,** both with stimulus funding and with the [Infrastructure Investment and Jobs Act of 2021](#). The federal [Justice40](#) initiative creates incentives for this new financing to be allocated to historically marginalized communities. Because the bulk of water infrastructure is funded through low interest federal financing and municipal bonds, the catalytic role for impact investors is to help unlock these larger sources of capital for equitable and climate resilient projects. Investors can create significant leverage if they use their investment and grant resources to help direct federal funding to equitable and climate resilient projects.

The report's top recommendations to philanthropies making impact investments are focused on the following:

1. Make an allocation to early-stage tech companies in the water arena.

There are promising opportunities to invest in technology companies that are creating data tools to address transparency or operational needs of utilities and otherwise advance water, health and equity.

- (a) Investing directly in early-stage companies is where impact investors can be most catalytic and help new ideas take root. Some early-stage companies that previously benefited from impact investments over the past few years include [SimpleLab](#), [Varuna](#), [120Water](#), and [BioBot Analytics](#).
- (b) Impact investors could also deploy capital through a fund. This requires less hands-on staff time, and the companies benefit from fund managers' expertise and connections. Some investment funds dedicated to water sustainability include [Burnt Island Ventures](#), [Echo River Capital](#) and [Sciens Asset Management's](#) Sustainable Water Opportunities Fund.
- (c) An investor could also partner with an accelerator to encourage companies to apply that are aligned with equity, health and water criteria. For example, [ImagineH2O](#) is a non-profit accelerator expressly focused on water tech, and the accelerator [TechStars](#) has partnered with The Nature Conservancy to support environmental sustainability focused startups, including water tech companies.

2. Invest in intermediaries to unlock larger public funding sources for sustainable projects in historically marginalized communities.

Water utilities have ample sources of low-cost financing available to them, including federal infrastructure funding and

bond financing. But availability and access are not the same thing. Impact investments can provide predevelopment and bridge financing to help direct these funds to smaller and/or historically marginalized communities and to sustainable infrastructure projects. There are several intermediaries that are currently seeking funding to develop different (but complementary) predevelopment approaches:

- (a) [Communities Unlimited](#), a CDFI that is the regional affiliate of the [Rural Community Assistance Partnership \(RCAP\)](#), is providing predevelopment loans to historically marginalized communities in several Deep South states to help them prepare projects for federal water infrastructure funding. Another RCAP affiliate, the [Rural Community Assistance Corporation](#), also provides predevelopment financing for small system water projects across the West.
- (b) [Water Finance Exchange](#) is helping small, disadvantaged and rural communities navigate the decision-making process and steps necessary for public funding of sustainable and safe drinking water and wastewater systems. This includes a revolving predevelopment fund to support community predevelopment expenses.
- (c) [NDN Fund](#) is a Native Community Development Financial Institution that is providing predevelopment, bridge, and large-scale financing for Indigenous regenerative development projects. Water and wastewater projects can qualify for this financing.
- (d) [CK Blueshift](#) is developing several “Blue Bank” revolving funds to provide predevelopment financing and technical support to several replicable water use cases, including potential financing of water infrastructure and restoration on Tribal Lands.

3. Establish a municipal bond strategy.

The municipal bond market is another ripe opportunity for investment. An impact investor could partner with an existing fixed income manager that has a track record of sustainable bond portfolios, such as [Breckinridge Capital Advisors](#), [Alliance Bernstein](#), or [Community Capital Management](#).

These three recommendations offer strategies for impact investors to support and finance improvements in water infrastructure today. Other recommendations detailed in the report also include strategies to use grantmaking or below market loans (called program-related investments or PRIs for foundations) to support the development of projects in a pre-investment stage that could be investable in a few years.

There is an opportunity for philanthropic impact investors to align their investment strategies with their or others’ grantmaking – and with government funding initiatives – to advance solutions to these challenges and help move towards an equitable water future.

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ABOUT THE ENVIRONMENTAL POLICY INNOVATION CENTER

The Environmental Policy Innovation Center builds policies that deliver spectacular improvement in the speed and scale of environmental progress. A nonprofit start-up, EPIC is committed to advancing the best approaches to achieving results quickly. EPIC focuses on clean water, environmental markets, and utilizing data and technology to reach conservation outcomes. Our work in water focuses on eliminating disparities in water infrastructure funding, replacing lead service lines, investing in nature-based solutions, outcomes-based stream and wetland restoration, water quality partnerships, and affordability. EPIC is a fiscally sponsored project of Sand County Foundation.

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FOREWORD

This report is the result of an analysis conducted by the Environmental Policy Innovation Center (EPIC) to develop a framework with which to evaluate drinking water, wastewater, or stormwater return-generating investment opportunities and strategies, particularly those related to the health and racial equity aspects of water management. EPIC convened a team of experts in these fields and conducted semi-structured interviews with water-focused businesses, investors, policymakers and other experts to inform a capital scan and strategy for water investment opportunities.

The water investing landscape is smaller than other infrastructure sectors and lacking as strong of a set of deal pipelines. However, the team concluded that there is a significant opportunity for impact investors and grant makers to help build the water finance field and to engage in transactions that can catalyze markets and leverage capital to address health and equity disparities in the management of water.

This public summary of EPIC's analysis will enable foundations and impact investors to learn about potential investment strategies that can advance solutions at the intersection of sustainable water, equity and health.

Nothing in this report implies a recommendation or endorsement by EPIC of specific investments. Specific companies and investments are provided as illustrative examples only.

Photo by Maraget Bowman





INTRODUCTION:

CONTEXT AND FRAMING

DEFINITIONS:

For the purpose of this report, we use the Robert Wood Johnson Foundation's definition of health equity: "Health equity means that everyone has a fair and just opportunity to be as healthy as possible. This requires removing obstacles to health such as poverty, discrimination, and their consequences, including powerlessness and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care."

We use Race Forward's definition of racial equity: "We achieve racial equity when race no longer determines one's socioeconomic outcomes; when everyone has what they need to thrive, no matter where they live."

When we refer simply to equity, we mean both health and racial equity.

When we refer to "historically marginalized" or "underserved" communities, we mean communities and neighborhoods that are low-income, historically disinvested in, or otherwise struggling to access health or financial resources.

This report builds upon Environmental Policy Innovation Center's report [H2Equity: Rebuilding a Fair System of Water Services for America](#). That report highlights how America's water systems – which are used to deliver drinking water, remove waste, and manage stormwater – are degraded or broken in more regions of the country than we think. This has resulted in a lack of access to safe drinking water or sewage treatment in some places, and in others unaffordable water supply, sewage overflows and flooded streets. The failures of our water systems prevent all Americans, especially lower income and historically marginalized Americans, from having the healthy and prosperous lives they deserve.

There are many systemic and institutional changes needed to transform how water is managed to address aging infrastructure and meet new challenges brought on by climate change and demographic shifts. In addition, a large investment of capital is needed. An estimated \$1 trillion additional investment over the next 25 years is needed to maintain and improve the nation's drinking water infrastructure, coupled with billions of dollars in additional costs for wastewater treatment upgrades and other capital improvements that will help water providers meet regulatory standards. This scale of investment has been a challenge for some water utilities, particularly those in smaller cities, rural communities and post-industrial cities with severely aged water infrastructure and a shrinking user base.

Ratepayers and taxpayers have financed more than \$4 trillion in water infrastructure since the 1950s. While the passage of major federal clean water legislation in the 1970s provided a large increase in federal grants to upgrade water services, federal water infrastructure grant funding has consistently fallen since then (until 2022). Congress has continued to fund critical programs such as EPA's water State Revolving Funds (SRFs) and the Water Infrastructure Financing and Innovation Act (WIFIA). However, these have been primarily loan- rather than grant-based programs, making it difficult for certain historically marginalized communities to apply for funding. State spending is typically only

a small fraction of federal funding. Local government and utility ratepayers, typically through municipal bonds, cover most of \$105 billion in water capital and operations expenses today, compared to \$4.4 billion in federal spending.¹

Water infrastructure requirements and costs are higher today. This is not just because of decades of underinvestment in maintaining infrastructure, but also because there are increasing requirements for treatment of drinking water and wastewater. For example, utilities must address legacy contaminants such as lead water pipes, naturally occurring contaminants such as arsenic, and emerging and persistent synthetic chemicals like per- and polyfluoroalkyl substances (PFAS). In addition, changing demographics and socioeconomic patterns mean that some utilities are overbuilt for their population, while others are straining to meet expanding user needs. And a changing climate has put new strains on the system as well, with too much stormwater being delivered in intense storms in some communities, and droughts causing a lack of drinking water in other communities. Further, estimates of infrastructure needs don't include costs for the millions of Americans relying on domestic wells and septic systems for their water needs.

At a high level, current financing mechanisms for municipal water solutions can be broken down into five categories:

1. **State Revolving Funds** (SRFs) for drinking water and wastewater administered at the state level, with most funding coming both from Congress and from repayment of existing loans.
2. **Tax-free municipal bond financing**, which can include certain green bonds.
3. **Impact bonds**, which are a form of outcomes-based financing specifically for environmental or social solutions.
4. **Venture capital investments** in early-stage companies and funds.
5. **Public equity investments** in established water-related companies and funds.

Generally speaking, the first three categories above address infrastructure and capital improvement needs. This can include green infrastructure projects, lead pipe replacement, and rural utility consolidation solutions, but often also includes general "gray" infrastructure upgrades and expansion. The fourth category includes data- and tech-driven solutions that can be used by water utilities, municipalities or consumers to better inform or design targeted interventions. This includes companies seeking to use data to promote better transparency, deploy technology that will make existing infrastructure and operations more efficient, and launch new distributed water treatment designs. The final category primarily supports more traditional water companies and solutions, though there are a few fairly innovative public water companies.

There is currently an opportunity for impact investors to align their investment strategy to advance solutions to these challenges and help move towards an equitable water future. Two circumstances are combining to create this opportunity.



There is currently an opportunity for impact investors to align their investment strategy to advance solutions to these challenges and help move towards an equitable water future.

¹ While municipal bonds represent private investment financed by utility revenues or other municipal assets, the tax-free nature of municipal bonds means that federal taxpayers are also effectively paying for a portion of the bonds by giving up revenue for other programs that must be made up through other taxes and revenue.

First, the water sector is becoming more innovative. Long hesitant to try new approaches, leading water utilities have recognized the need for innovation to address aging infrastructure, climate change and historic racial inequities. A wave of leadership retirements across the sector are also creating an opportunity for new diverse and innovative leadership. Non-profits, including the [US Water Alliance](#), [Rural Community Assistance Partnership](#), [Moonshot Missions](#), [EPIC](#) and others are sparking and responding to this interest to build a movement of change.

Second, federal infrastructure financing is increasing, both with stimulus funding and with the [Infrastructure Investment and Jobs Act of 2021](#). The federal [Justice40](#) initiative creates incentives for this new financing to be allocated to historically marginalized communities. Because the bulk of water infrastructure is funded through low interest federal financing and municipal bonds, there is a catalytic role for impact investors to help unlock these larger sources of capital for equitable and climate resilient projects. Investors can create significant leverage if they use their investment and grant resources to help direct federal funding to equitable and climate resilient projects.

Photo by Albert Flamingo on Unsplash





B



IMPACT FOCUS AREAS

Using EPIC's [H2Equity](#) report as a foundation, this investigation focused on five primary areas of interest to advance equity, water and health.



Consolidate small water utilities. There are 50,000 water systems, 15,000 wastewater systems, and a growing number of stormwater systems operating in the U.S. More than half the water systems each serve 500 persons or less. Small utilities struggle to meet today's health standards while staying solvent, resulting in inequity for those served by small systems.² A massive reorganizational effort is needed to consolidate small utilities or regionalize various utility functions to improve health outcomes for millions of households.



Eliminate lead water pipes. Lead is a neurotoxin.³ Removal of all of America's 9-10 million lead pipes in a generation or less is an achievable goal. Most utilities are reluctant to expend the substantial financial resources to remove them – certainly not on a fast time scale. While a few cities have succeeded in eliminating their lead pipes and a handful of others are on their way to doing so, most cities are a long way from removal. Given \$15 billion in new financing, and with the proper political will and policies, lead pipes could be eliminated in America in one to two decades.



Improve water rate affordability. Water rates have nearly doubled since 2000, making water increasingly unaffordable for the poorest households and putting a significant strain on middle-income households.⁴ Deferred maintenance has resulted in an urgent need for infrastructure upgrades, whose costs are now borne by consumers – thus accelerating the trend toward higher rates.



Use data technology to increase public trust in tap water and utilities. Roughly 25% of Americans say they never drink their tap water, with fears about water safety being one reason why (along with taste and smell concerns).⁵ Such mistrust is particularly high among Black and Latino households, even when their water quality is essentially similar to their white neighbors.⁶ Mistrust of tap water is linked to decreased water consumption and use of expensive or unhealthy substitutes such as bottled water and sugary beverages.⁷ Improving trust in tap water is an immediate goal for water utilities and EPA, but they are seen as part of the problem. Increased transparency of water quality could be a huge step forward in addressing this trust gap. Where water is objectively safe to drink, all customers should have access to information they trust that confirms that. In this global era of information technology, this increased transparency should be achievable.



Reduce the inequity of stormwater impacts. Communities are experiencing 500-year flood events, coastal storm surges, sewer overflows, and basement backups with increasing frequency. These disasters, fueled by a rapidly changing climate, have a disproportionate impact on low-income residents and historically marginalized communities.⁸ Increased investment, especially in distributed systems like green infrastructure, is needed to improve community resilience.

2 NRDC. 2019. [Watered Down Justice](#) at 22; Teodoro, M. P., & Switzer, D. 2016. [Drinking from the talent pool: A resource endowment theory of human capital and agency performance](#). *Public Administration Review*, 76(4), 564-575.

3 Lanphear, B. P., Rauch, S., Auinger, P., Allen, R. W., & Hornung, R. W. 2018. [Low-level lead exposure and mortality in US adults: a population-based cohort study](#). *Lancet Public Health*, 3(4), e177-e184. doi:10.1016/s2468-2667(18)30025-2.

4 Teodoro, M. P. 2019. [Water and sewer affordability in the United States](#). *AWWA Water Science*, 1(2), e1129.

5 Results from the [2020 J.D. Power customer satisfaction survey](#) of residential customers of 90 water utilities that deliver water to at least 400,000 customers.

6 Javidi, A. and Pierce, G. 2018. [U.S. households' perception of drinking water as unsafe and its consequences: Examining alternative choices to the tap](#). *Water Resources Research*, 54, 6100–6113.

7 Id.

8 Frank, Thomas. [Flooding Disproportionately Harms Black Neighborhoods](#), *Scientific American* (June 2, 2020).



SPOTLIGHT—WHAT IS THE EXPERIENCE FROM OTHER FOUNDATION INVESTORS?

Water sustainability and equity issues are increasingly in the public eye. And both grantmaking and investing interest have followed that attention. A small handful of foundations are starting to chart a path forward for municipal water-related impact investing. Most notably:

- [The Kresge Foundation](#) provides grants and investments to advance equity-focused stormwater resilience solutions in large cities.
- [The Emerson Collective](#) is providing grants and technology investments at the intersection of climate innovation and social equity (including water).
- [Spring Point Partners](#) has provided grants and investments to advance municipal water sustainability solutions.
- [The Walton Family Foundation](#) has provided grant funding to advance municipal water supply investments in the American West.

There are also a few other foundations who have made occasional investments in the water arena, listed in [Appendix I](#).

Several foundations have shared useful lessons learned from their impact investing efforts. These have informed the EPIC team's observations and recommendations. For example:

- **Utility investment decisions are generally compliance driven.** Investments are most successful when they increase utility compliance as well as make a utility's operations more equitable and climate resilient.
- **The culture of utilities does not incentivize innovation.** Finance staff in particular tend to be traditional and risk averse. Innovative financing approaches are most successful in utilities with finance staff that are open to new approaches.
- **Fear of negative public feedback has made government transparency efforts difficult,** including public water quality reporting, public lead service line inventories, and even public disclosure of disbursement of SRF funds. But where present, transparency has driven action. Transparency progress may need to be made outside of the regulatory sector.
- **Because the non-water benefits of green stormwater and other natural infrastructure solutions (local jobs, wildlife habitat, urban greening, etc.) accrue to non-water entities, they can be viewed by utilities as "externalities" and not valued.** Incorporating funding for those non-water benefits involves collaboration among municipal agencies. It is important to plan for a longer process to accommodate inter-agency collaboration.
- **Traditional approaches to public contracting and procurement for large, engineered projects make it hard for utilities to design and build small, distributed and more resilient infrastructure.** A creative approach to contracting and procurement is vital in advancing these smaller solutions.

A small handful of foundations are starting to chart a path forward for municipal water-related impact investing.



C

CENTERING A WATER INVESTMENT STRATEGY IN EQUITY

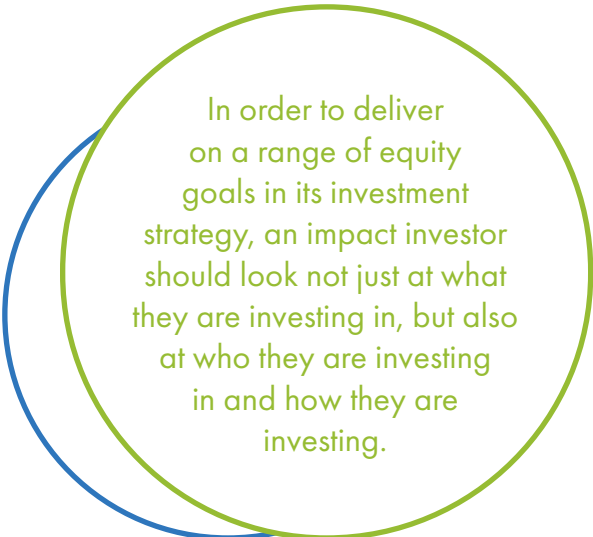
Race Forward, defines [racial equity](#) as both an outcome and a process. “As an outcome, we achieve racial equity when race no longer determines one’s socioeconomic outcomes; when everyone has what they need to thrive, no matter where they live. As a process, we apply racial equity when those most impacted by structural racial inequity are meaningfully involved in the creation and implementation of the institutional policies and practices that impact their lives.” This includes elimination of policies, practices, attitudes, and cultural messages that reinforce differential outcomes by race or that fail to eliminate them.

Morgan Stanley defines [racial equity investing](#) as “the effort to direct investment capital toward the advancement of historically disadvantaged groups, including Black, Hispanic, Asian-Indian, Asian-Pacific and Native American populations” with a goal “to use race and ethnicity as a consideration when redressing areas of inequity and promote efforts to advance equitable opportunities using investor capital as a lever.”

There is a broader Diversity, Equity and Inclusion framework that is needed to address racial inequities across investments from all sectors (corporate, government, philanthropy, etc.). Achieving balance in representation, empowerment and economic opportunity is critical to financial outcomes.

In order to deliver on a range of equity goals in its investment strategy, an impact investor should look not just at *what* they are investing in, but also at *who* they are investing in and *how* they are investing. While this report focuses primarily on *what* an impact investor should be investing in, as an investor proceeds towards specific investments, they should also incorporate equity criteria and processes to address the *who* and *how* factors as well.

An investor interested in centering equity should build a set of expectations into how it sources and designs any investment, from designing a loan vehicle, to selecting a potential fund manager, to developing a bond portfolio. This includes prioritizing investment partners that are: (1) led by People of Color; (2) committed to addressing diversity, equity and inclusion within their company; and/or (3) committed to working/investing at the intersection of social justice and environmental sustainability. In addition, an investor should intentionally assess the potential impacts on health and racial equity of any investments under consideration – both the benefits and negative consequences. Investors should also take care to ensure that impacted communities are or have been consulted about the project or investment to ensure potential impacts are fully understood and communities have a chance to influence the project.





SPOTLIGHT: HOW TO STRUCTURE BOND SPENDING TO EQUITABLY BENEFIT COMMUNITIES

In 2006, California voters approved Proposition 84, a bond measure authorizing \$5.4 billion in spending on projects to improve parks, natural resource protection, and water quality, safety, and supply. Spending was explicitly prioritized for disadvantaged communities. UCLA released an [analysis](#) of the bond spending with lessons learned about how prioritizing investments in disadvantaged communities can be most effective. While this analysis focuses on a statewide bond initiative, the lessons learned can provide insights for other investment efforts that seek to advance equity:

- Define priorities for bond spending more clearly and set specific criteria to operationalize those values and specific goals to measure success.
- If you want results to benefit more people, put people into the equation, through establishing clear targets of people served.
- Improve and standardize data reporting requirements so that data is more readily available, easily accessible, reliable, and usable for accountability.

Equity, Health and Water Sustainability Impact Criteria

If an investor or foundation is interested in advancing equity, health and water sustainability goals, a set of screening criteria can be useful when reviewing investments. These could be utilized to evaluate specific opportunities across the life cycle of the investment, particularly during the due diligence phase. The criteria listed below are modeled off water investment criteria developed by one of our authors (Jalonne White-Newsome) to guide investments at another foundation. While these questions provide a starting point, they should be fine-tuned by the investor or foundation to ensure the questions closely align with individual goals. These criteria may need to be adjusted or supplemented depending on the type of resource being deployed (e.g., bond, equity, loan, PRI, grant). For example, a set of bond criteria may want to assess whether the bond complies with one or more of the emerging bond standards such as the Climate Bond Initiative's [Climate Bond Standards](#) or the Center for American Progress' proposed [green bond labeling system](#).

Equity, Health & Water Sustainability Impact Criteria

Key Questions	Weight of Impact (Strong, Moderate, Weak)
Equity Questions	
<i>Equity:</i> Does the project or investment provide tangible – direct and/or indirect – benefits to underserved communities? Does it allow financial and other resources to reach new places? What does success look like, now and into the future?	
<i>Unintended Consequences:</i> Is there a risk that underserved communities will be disproportionately impacted by the investment? If so, are there opportunities to mitigate the risk?	
<i>Systems Approach:</i> Does the project or investment help address systemic and institutional barriers that exacerbate poor health outcomes and other conditions for underserved communities?	
<i>Equity-Focused Leadership:</i> Does the grant or investment partner adequately demonstrate a commitment to diversity? Is the leadership team and board diverse, and do they have internal policies that address diversity, equity and inclusion?	
<i>Key Stakeholder Engagement:</i> Has the grant or investment partner meaningfully engaged impacted partners? Have outcomes/goals been co-created with the community?	
Water & Health Questions	
<i>Utility Consolidation:</i> Will the project or investment help small utilities share services or consolidate with neighbors?	
<i>Lead Water Pipes:</i> Will the project or investment help to advance full removal of lead pipes?	
<i>Affordability:</i> Will the project or investment help to improve affordability of water rates?	
<i>Data & Transparency:</i> Will the project or investment generate better data or publicize data related to water affordability, quality, or health outcomes?	
<i>Stormwater:</i> Will the project or investment help reduce the inequities of stormwater impacts?	
<i>Measurable Co-Benefits:</i> Does the project or investment provide ancillary benefits to communities or in areas of work that are a priority for the investor?	
<i>Alignment with Local Plans:</i> Will the project or investment support the goals/objectives of local plans that address water, health and/or equity (such as climate action plans, health impact assessments, lead line replacement plans, etc.)? Does the plan cover unique issues of any disadvantaged populations in the community?	
Market Development Questions	
<i>Additionality:</i> Will the investor’s support of this effort be catalytic? Would this project or organization be able to attract resources without the investor’s involvement?	
<i>Scalable & Replicable:</i> Can the proven intervention be replicated or scaled to other cities, organizations, Native lands, utilities, etc.?	
<i>Co-Funders & Co-Investors:</i> Are there other like-minded private or public investors interested in this opportunity? Is there a way to stack capital?	



RECOMMENDATIONS

Below is a list of recommended options for advancing a water, health and equity investment strategy. The first three recommendations are specifically investment-oriented, whereas the latter three focus on where a grant maker could target a range of resources both to strengthen the sector and to deliver a pipeline of investments for more meaningful impact. A summary chart of the recommendations is provided at the end of this chapter.

Recommendation 1: Make an allocation to early-stage tech companies in the water arena.


The most immediate investment opportunities in water center around equity investments in early-stage companies. The municipal water space is outdated in terms of information technology. Improved data and information technology can not only improve operational efficiency and thus reduce costs, but also can increase transparency of water quality and other risks. There is growing activity in venture capital and the startup ecosystem to explore how data-driven solutions can promote transparency and encourage more targeted and equitable water infrastructure investments.

There are three potential ways an investor could pursue investments in this arena.

a. Invest directly in technology companies that are working to expand data transparency and otherwise advance water, health and equity. Investing in early-stage companies is where an investment can be most catalytic and help new ideas take root. Some early-stage companies that benefited from impact investments over the past few years include [SimpleLab](#), [Varuna](#), [120Water](#), and [BioBot Analytics](#). [Appendix II](#) provides some examples of early-stage water companies.

b. Invest through a fund. In an investment fund, the fund manager leads the oversight and support of portfolio companies. Fund investments require a lot less hands-on staff time for the impact investor, and companies benefit from fund managers' expertise and connections. There are very few fund managers focused exclusively on water. A few that do focus only on water are [Burnt Island Ventures](#), [Echo River Capital](#), and [Sciens Asset Management's](#) Sustainable Water Opportunities Fund. Alternatively, an investor could invest in more general sustainability funds that touch on water. This would provide some exposure to new water companies but would be more limited in its impact. [Appendix II](#) provides some examples of funds.

c. Partner with an accelerator. An investor could also partner with an accelerator to encourage companies to apply that are aligned with equity, health and water criteria. A startup accelerator is a business program that supports early-stage companies through education, mentorship, public recognition, and sometimes financing. For example, [ImagineH2O](#) is a non-profit accelerator expressly focused on water tech, and the accelerator [TechStars](#) has partnered with The Nature Conservancy to support environmental sustainability focused startups, including water tech companies. [Appendix II](#) provides some examples of accelerators.



The most immediate investment opportunities in water center around equity investments in early-stage companies.

Recommendation 2: Invest in intermediaries to unlock larger public funding sources for sustainable projects in historically marginalized communities.

The municipal water sector has access to substantial low-cost financing through SRF and municipal bond programs. A catalytic role for impact investors is to use their investment flexibility to unlock public financing for targeted investments, such as those that provide health benefits to historically marginalized communities or those that advance climate resiliency.

Investment is easiest when there is a deep deal pipeline from which to select investments. A suite of intermediaries is needed to build this deal pipeline. This includes fund managers, developers who construct and finance sustainable infrastructure such as green solutions, and technical assistance providers who work with utilities and cities to develop fundable projects. The water investing space is young and strong intermediaries with established pipelines of deals do not currently exist. However, there is some encouraging movement towards this. Several organizations have identified common pain points, particularly for infrastructure needs, and are working to design blended capital solutions that address these issues. These efforts could potentially benefit from a

combination of grant support, concessionary debt and/or credit enhancements.

Multiple solutions are being explored by these intermediaries, but the most notable theme is the opportunity to provide predevelopment financing and technical assistance to small and/or historically marginalized communities that have high infrastructure needs but can't afford the costs to develop proposals (especially innovative equitable and climate resilient designs) and can't afford the staff time to navigate complex loan fund application processes. This was identified as a major pain point in many of our interviews. Addressing this challenge would help to meet needs related to utility consolidation, lead pipe removal, water rate affordability and stormwater.

The passage of the [Infrastructure Investment and Jobs Act](#) highlighted the need for intermediaries to provide predevelopment loans to help historically marginalized communities apply for infrastructure funding. There is exciting work in development, but capacity is still low and solutions are not fully developed. Many intermediaries may require grant support in combination with investment funding.

There are several intermediaries that are currently seeking funding to develop different (but complementary) predevelopment approaches. For example:

- a. [Communities Unlimited](#), a CDFI that is the regional affiliate of the [Rural Community Assistance Partnership](#) (RCAP) is providing predevelopment loans to historically marginalized communities in Arkansas, Oklahoma, Tennessee, Mississippi, Alabama, Louisiana and Texas to help them prepare projects for federal municipal water infrastructure funding. Another RCAP affiliate, the [Rural Community Assistance Corporation](#), also provides predevelopment financing for small system water projects across the West.
- b. [Water Finance Exchange](#) is helping small, disadvantaged and rural communities navigate the decision-making process and steps necessary for public funding of sustainable and safe drinking water and wastewater systems. This includes a revolving predevelopment fund to support predevelopment expenses.
- c. [NDN Fund](#) is a Native Community Development Financial Institution that is providing predevelopment, bridge, and large-scale financing for Indigenous regenerative development projects. Water and wastewater projects could qualify for this financing.
- d. [CK Blueshift](#) is developing several "Blue Bank" revolving funds to provide predevelopment financing and technical support for several replicable water use cases, including potential financing of water infrastructure and restoration on Tribal Lands.

In addition to these projects, there are also ideas that are much earlier in their development and are not currently being championed by an existing intermediary. These ideas would likely require some feasibility analysis as well as the right partner to design, structure and raise capital for this effort. An example is developing a financing program for post-industrial and other smaller underserved cities that need infrastructure investment, but lack the population base to service future debt, and thus would struggle to repay without significant grant support or credit enhancements.



Across these and other examples, grant capital would most likely be needed in the near term in addition to investment funding, both to build the capacity of the intermediaries that could execute these options and to develop a pipeline of investments. Once capacity and pipeline are built, low interest loans, forgivable grants and/or guarantees could be used to capitalize each opportunity.

An investor could also seek to help some of these water intermediaries partner with non-water intermediaries to develop the financial infrastructure for the tools more quickly. We have heard some skepticism about whether existing intermediaries would be willing to partner, given the likely small size of the resulting loans and the time it will take to develop replicable deal flow.

Although guarantees seem like a natural tool for many of these efforts, some experts we interviewed shared a skepticism of the potential benefits of a partial guarantee, as they are unlikely to result in more favorable financing terms for the project. Many of the risks inherent to the ideas above – including predevelopment financing or supporting infrastructure needs in post-industrial cities – are real (versus perceived) risks. If guarantee losses are more likely, grants to cover the anticipated losses may be more appropriate.

Recommendation 3: Pursue a municipal bond strategy.

The municipal bond market is another ripe opportunity for investment. Local municipal water utilities account for roughly 85% of water infrastructure spending, and the vast majority of that is financed through municipal bonds. While most water bonds fund traditional “gray” infrastructure, there is increasing interest in bond financing sustainable infrastructure solutions that would better advance health and equity, including bonds that finance lead pipe removal, more natural stormwater management, and utility consolidation. Alternatively, an investor could also pursue investments in state-issued bonds. For example, the State of Massachusetts’ [Clean Water Trust State Revolving Loan Program](#) has begun to issue Sustainability Bonds that will leverage their SRF funding to finance water infrastructure improvements for communities identified as the most disadvantaged, based upon an affordability criteria developed by the Trust.

To invest in municipal bonds, an investor may want to partner with an existing fixed income manager that has a track record of sustainable bond portfolios, such as [Breckinridge Capital Advisors](#), [Alliance Bernstein](#), or [Community Capital Management](#). Because bond issuances are generally rated, sizable and more liquid, a municipal bond strategy could be pursued as part of an investor’s standard investment portfolio. No outsized risk or below market return would be involved. For foundation investors, this means that a water-focused municipal bond strategy could be established as part of the foundation endowment’s portfolio rather than the Program Related Investment (PRI) portfolio that is usually managed out of the foundation’s grants allocation.

One caveat associated with creating a bond portfolio is that many of the investment managers noted above require commitments of at least \$100M to develop unique bond investment criteria. This strategy is thus likely most suited for a large foundation endowment. An investor could explore partnering with a few other interested investors to allocate sufficient capital to justify a unique bond portfolio, but it is unclear if an investment manager would be receptive to this approach. Alternatively, [Adasina Social Capital](#) enables separately managed accounts for bond investments with a \$1M minimum investment (though they currently have a waiting list for access to this strategy). Adasina invests with a screen of racial, climate, gender and economic justice.

An investor could also pursue more innovative forms of bond issuances. For example, [Quantified Ventures](#) has developed several environmental impact bonds with municipalities that link investors’ rate of return to a pre-established environmental outcome, transferring the risk of trying new environmental approaches from the municipality to the investor.



While most water bonds fund traditional “gray” infrastructure, there is increasing interest in bond financing sustainable infrastructure solutions that would better advance health and equity.

WHAT DOES RISING BOND RATES MEAN FOR WATER INFRASTRUCTURE?

For the past decade or so, municipal bond rates have been very low, making it relatively inexpensive for cities to borrow money through the bond market. With low rates, many well-resourced cities have preferred issuing bonds over borrowing funds from State Revolving Loan funds because of the increased paperwork of SRF loans and associated loan conditions such as the requirement to use American iron and steel that drive up the cost of a project.

The current inflationary period has driven the Federal Reserve to raise interest rates. This means that the cost of issuing new bonds has increased for municipalities. While it is too early to know for sure the impact of this change, it may increase the attractiveness of SRF loans for sophisticated cities, especially in states where the 49% loan forgiveness is spread across all loans (rather than concentrated on more financially disadvantaged communities). This may increase competition for SRF funds, potentially making it harder for historically marginalized communities to access SRF funds. This development makes even more important the interventions from impact investors and grantors to help marginalized communities submit viable SRF applications.

Recommendation 4: Build investment capacity in the water arena.

A strong theme in our research was the relatively low investment capacity in the water arena that is focused on creative equity, health and sustainability solutions. This capacity will be critical to develop the pipeline of deal flow needed to expand investment in the area. A foundation or other investor that also provides grant funding could pursue a complementary grant or set of grants to build the water investing ecosystem while investing in early opportunities.

There are two actions that could help build this capacity:

1. Technical assistance support for small and/or historically marginalized communities. As discussed previously, many utilities in small and/or historically marginalized communities lack the capacity to design and apply for federal and state grant and loan funding for their water infrastructure needs. A grantor could support “circuit rider” technical assistance staff at regional organizations that could help these small and underserved communities design sustainable projects and navigate the complex processes to access state or federal infrastructure funding.

2. Convenings. To build the field’s investment capacity, a grantor could support a series of convenings focused on water, equity and health investing. A core group of individuals interested in water investing could attend all the convenings. Early convenings could bring in experts from other fields who have had similar experiences. Later convenings could support strategy development and peer input for differing investment strategies.



Investment intermediary capacity will be critical to develop the pipeline of deal flow needed to expand investment in the area.

Recommendation 5: Focus on place-based investments in communities with a strong equity pull.

Water is inherently a local issue. An investor could select several communities (e.g., two to 200, depending on funds available) where it would dig deep in supporting the development of innovative financing solutions through grants and low interest investments. This would require selecting a community that has some key attributes indicating that engagement would be timely and have a reasonable chance of success, including:

- Water issues impacting the health of underserved populations that have a feasible solution;
- Core leadership capacities in place to consider innovative solutions and financing (such as innovative leadership at the utility and/or municipality and engaged community groups);
- Sufficient potential resources (state and federal grants and loans, bonding capacity, etc.) to address the infrastructure needs; and
- An urgency for investment funding, without the solution being so sufficiently developed that introducing innovative approaches would be too late in the process.

Engaging in a place-based approach would provide direct impacts to priority populations. If the solutions and the process of achieving them are well-documented and publicized, they could be replicated in other communities. It is also an opportunity to build partnerships with other entities that are working in place, to stack different forms of capital (such as EPA environmental justice grant dollars), and potentially address other equity concerns in these places.

Recommendation 6: Provide specific grant or investment support for priority issue area solutions.

While the other recommendations in this report are each designed to address several or all of the priority issue areas outlined above in [Section B](#), several of the issue areas have some unique needs where investment or investment-related grant support could advance solutions. Grant funding could help directly advance solutions, and some grants could build eventual deal flow. While the investment opportunities identified below may not result in extensive deal pipelines, they provide unique but important value for the priority issues.

1. Consolidate small water utilities:

- a. A grantor could provide grant funding in one/more states to create policy urgency for consolidation.
- b. A grantor could provide grant funding in one/more states to support facilitation for consolidation exploration.
- c. An investor could invest in a regional co-op or other progressive consolidating entity.

2. Eliminate lead water pipes: In many states, the replacement of the portion of a lead service line on private property cannot be financed through public funds. This [has been demonstrated](#) as leading to inequitable outcomes.

- a. A grantor could establish a fund in one/more communities to support replacement of the private portion of lead service lines. Because this funding is non-reimbursable by the municipality, this would not be a revolving fund.
- b. A grantor could support advocacy to clarify that public funding can be used for the private line portion of replacement, indirectly expanding investment opportunities.

3. Restructure water rates and assistance programs to improve affordability:

- a. An investor could support development of unique financing structures to enable underserved utilities to pay for cost-saving infrastructure or technology improvements through the cost savings. This could reduce the pressure to increase rates.
- b. A grantor could support research and technical assistance to develop industry-wide recommendations for rate restructuring to address affordability.
- c. A grantor could support advocacy for federal and state customer assistance programs, and/or provide direct assistance to customers through intermediaries such as [The Human Utility](#) or [We the People of Detroit](#).

4. Use data technology to increase public trust in tap water and utilities:

- a. A grantor could pilot a grant fund that would reimburse small or underserved utilities for costs of trying a new technology if that technology did not meet articulated goals.

5. Reduce the inequity of stormwater impacts.

- b. An investor could provide equity, debt or grant support to progressive consulting companies such as [Greenprint Partners](#) that are expressly seeking to develop green stormwater infrastructure in underserved neighborhoods.
- c. An investor could provide grants to support development of more environmental impact bonds to finance green stormwater in underserved communities, and then invest in those bonds (as described in [Recommendation 3](#) above).
- d. A grantor could support efforts to enable cities to blend stormwater financing with other city financing that would pay for the green stormwater co-benefits. The [World Resources Institute](#) is currently piloting this in San Francisco.

Several water issue areas have unique needs where investment or investment-related grant support could advance solutions.



Summary of Recommendations

Recommendation	Impact Topics Addressed	Pros	Cons
1. Make an allocation to early-stage tech companies in the water arena.	<ul style="list-style-type: none"> ● Increase transparency & trust ● Water rate affordability ● Stormwater 	<ul style="list-style-type: none"> ● Immediate deal flow available & this sector is growing ● Water sector has outdated IT -- lots of room for improvement ● Could increase efficiency & costs as well as transparency 	<ul style="list-style-type: none"> ● Direct investing could be hands on & time consuming for investor's staff ● There are only a few impact funds focused on water ● Utilities have been slow to adopt new technology ● Municipal market means unlikely to have typical VC "hockey stick" returns
2. Invest in intermediaries to unlock larger public funding sources.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Water rate affordability ● Stormwater 	<ul style="list-style-type: none"> ● Huge opportunity to leverage federal funds ● Builds critical capacity for investment field ● Opportunity for investor to be catalytic ● Direct links to impact focus topics 	<ul style="list-style-type: none"> ● Grant support may be initially needed to build capacity & pipeline ● Risk that deals will not develop
3. Establish a muni bond strategy.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Stormwater 	<ul style="list-style-type: none"> ● Deal flow exists & could be targeted (if investment is of sufficient size) ● Bonds are stable low risk investments ● Bonds are the primary way municipalities fund water infrastructure 	<ul style="list-style-type: none"> ● Additionality value is weak (the bonds will be bought by someone) ● It is hard to filter out sustainable bonds from traditional infrastructure bonds ● Muni bond managers require substantial commitments to design a focused portfolio
4. Build investment capacity in the water arena.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Water rate affordability ● Increase transparency & trust ● Stormwater 	<ul style="list-style-type: none"> ● Capacity development is a key prerequisite for developing deal pipeline ● An investor could be catalytic in advancing the field ● TA support for underserved communities could unlock large public investments – good leverage 	<ul style="list-style-type: none"> ● Grant funds, not investments, are needed here
5. Focus on place-based investment in communities with a strong equity pull.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Water rate affordability ● Increase transparency & trust ● Stormwater 	<ul style="list-style-type: none"> ● Opportunity to provide direct benefits to a few communities ● Strong partnership opportunities with NGOs, other public & private funders, & investors ● On-the-ground work provides large learning opportunities 	<ul style="list-style-type: none"> ● Risk that the intended result is not attained or takes a long time ● Opportunity costs of not investing in other more broadly applicable (but less directly impactful) solutions
6. Provide specific grant or investment support for priority issue area solutions.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Water rate affordability ● Increase transparency & trust ● Stormwater 	<ul style="list-style-type: none"> ● Targeted solutions for targeted impact interests 	<ul style="list-style-type: none"> ● Most opportunities require grant funding ● The few investment opportunities are potentially impactful on their own, but may not scale



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CAUTIONS ABOUT THE WATER INVESTING LANDSCAPE

Based on interviews, research and experience, the EPIC team has observed that, relative to other sectors (community development, affordable housing, energy, etc.), the water arena has some unique opportunities and challenges which should be considered when crafting an investment strategy. All of these factors were taken into account when developing the recommendations described above.

1. The realities of raising taxes or rates, and elected leader roles, constrain the level of new investment in water infrastructure.

The Safe Drinking Water Act and Clean Water Act provide a baseline of regulatory compliance, but these do not adequately address many of the current water challenges (such as emerging contaminants and lead service lines). When they do provide a mandate, resulting consent decrees more often than not are in place for years if not decades before the environmental problem is resolved. These laws are also not designed to ensure a utility is resilient to climate-related risks. The benefits of many sustainable water infrastructure investments often flow beyond the water utility and its customers to the broader community, creating disincentives for utilities to invest in multi-benefit solutions. This can be mitigated by political pressures placed on water utilities by the community, but this requires the community to have a level of awareness and advocacy to wield their influence. At a political level, investments in improved water management result in real and immediate costs, but their benefits are often avoided problems and thus not something that a utility or city council leader can point directly to in justifying expenses. To address these challenges, donors and investors should ensure that the community is engaged in infrastructure decisions, which will build political will for sustainability-focused solutions.



2. The existence and structure of SRF programs make it difficult to design a loan product that is competitive on interest rate, repayment structure and term.

While there is a massive water infrastructure investment need in the U.S., many critical projects are not being financed. This is partly due to the hesitation among water utilities to take on debt. The SRF originally was a grant program, but less than one percent of SRF funds are still grants. It now mainly provides low-cost debt at 0%-1%. The potential availability of SRF and grant capital has created an aversion to higher borrowing cost debt among some water utilities, who would rather delay their infrastructure needs in anticipation of a future grant. The availability of low-cost SRF debt also makes utilities resistant to higher priced privately financed alternatives – even if they don't actually plan to access the SRF loan program. For those utilities that decide to take on debt, the application process for SRF funding is complex, and small and underserved communities without experienced staff and financial resources to cover predevelopment costs struggle to tap into these funds.⁹ On the positive side, the SRF is an incredibly valuable source of long-term financing for infrastructure projects if water utilities can address their predevelopment needs and the time and effort associated with tapping into these resources. For larger and particularly investment grade water utilities, the municipal bond market is a relatively efficient way for them to finance capital improvement projects.

3. Smaller and historically marginalized communities face an uphill battle when solving for their water financing needs.

There is an inherent tension in many communities in trying to finance their water infrastructure needs while keeping water rates affordable. The energy space benefits from a reduction in energy costs to the consumer or business which can be used to repay any outstanding debt – water rates are often too low for savings to cover capital investments over a reasonable time period. Beyond the debt/rate trade-off question, small and underserved

⁹ Data is sparse, but recent research by EPIC indicates that SRF funding tends to go to larger utilities that can afford the predevelopment costs and can navigate the complex application process. Based on data from 2011-2020, only 7% of water systems received SRF funding, representing roughly 30% of the U.S. population. And funding goes unspent every year in multiple states, reflecting both the complexity of the application process and the need for predevelopment support. This is especially true for smaller underserved systems. [Katy Hansen, Sara Hughes, Andrea Paine, and James Polidori. \(2021\). "Drinking Water Equity: Analysis and Recommendations for the Allocation of the State Revolving Funds." Environmental Policy Innovation Center.](#)

communities have fewer residents, and oftentimes shrinking populations. This limits the ability of the water utility or city to service any debt through rate increases. In addition, these smaller borrowers are also more likely to be below investment grade, which increases their cost of capital and debt service payments. As mentioned above, smaller and underserved communities also often lack staff and expertise to apply for lower cost capital (such as SRF funding or USDA rural development financing), or to design other innovative forms of investment. There is a need to solve for how these projects can “pencil” before exploring financing options. The new federal water infrastructure funding that requires at least 49% be disbursed as grant or loan forgiveness provides a strong opportunity to address the infrastructure needs of these marginalized communities with a high percentage of grant funds.

- 4. The landscape of intermediaries is small, and many have limited capacity.** For investors to deploy capital into equitable water solutions in an efficient manner, a suite of intermediaries is needed. This includes fund managers, developers who construct and finance sustainable infrastructure such as green solutions, and technical assistance providers who work with utilities and cities to develop fundable projects. The landscape of intermediaries is currently quite limited in the water space. While there is interest in doing more work in this arena, the existing intermediaries currently do not have the capacity and scale to manage an ambitious grant or investment pool. Developing increased intermediary capacity can be a strong leverage strategy for building deal flow and scalable impact.
- 5. The development of water impact metrics – especially equity metrics – is young, and an agreed set of metrics do not yet exist.** Developing environmental metrics for investments is still a relatively new practice, and metrics for water or equity investments is even more nascent. Some equity impact metrics for investments are currently being designed, but they are new and untested.¹⁰ Water metrics are slow to develop because water can be more nuanced and place-based than other environmental investments – while an energy efficiency investment can be evaluated by measuring energy saved, the impacts of a water investment often depend on where and how the improvement is achieved (for example, by traditional “gray” infrastructure vs. green infrastructure). There is a real opportunity for leadership here. In addition to the need for a general impact metrics framework, we would expect the impact criteria to vary depending on if the investment is a bond or public equities strategy versus a smaller, bespoke PRI strategy or early-stage investment in a startup. A bond or public equities strategy is designed for scale and therefore must be realistic as to what companies or projects are eligible to meet deployment targets. A more tailored program can be more rigorous and targeted if the investment commitment is smaller and therefore the size of the pipeline less of a concern.



¹⁰ Fixed income managers have developed frameworks for green bonds and select foundations have also developed their own proprietary strategies, mostly for grant/PRI resources.

APPENDICES

APPENDIX I

OTHER FOUNDATIONS ENGAGED IN WATER INVESTING

Water sustainability and equity issues are increasingly in the public eye, and both grantmaking and investing interest has followed that attention. A small handful of foundations have engaged in municipal water-related impact investing. While sparse, they are starting to chart a path forward.

Four of the most active foundations investing in water have been Kresge, the Emerson Collective, Spring Point Partners, and the Walton Family Foundation.

- The [Kresge Foundation's](#) Social Investment Practice and Investments team developed a strategy to advance climate resilience and water equity, in alignment with their Environment Program grantmaking. Water investments have focused on sustainable stormwater solutions.
- The [Emerson Collective](#) is providing grants and technology investments at the intersection of climate innovation and social equity (including water). The [Elemental Accelerator](#) is a primary investment tool for Emerson's investing. They have funded more than 70 projects across systems at the root of climate change. A few of these have focused on water topics.
- [Spring Point Partners](#) is a social impact venture blending grantmaking, impact investing and program operations to advance social change. From 2017-2020 Spring Point made a series of investments related to municipal water and food/agriculture sustainability. Spring Point pivoted its strategy in 2020, focusing their water program on developing innovative water utility leadership.
- While the [The Walton Family Foundation](#) has not yet deployed PRI or other mission related investments in their environment program, the Foundation provided grant capital to develop the 2015 report [Liquid Assets: Investing for Impact in the Colorado River Basin](#) that designed blueprints for water investment opportunities in the region. They then partnered with other foundations to provide grant support to develop municipal and agricultural investment opportunities outlined in that report.

There are a handful of other foundations that have made occasional investments in the water arena. They include:

- The [San Francisco Foundation](#)
- The [Silicon Valley Community Foundation](#)
- The [McKnight Foundation](#)
- The [Cleveland Foundation](#)
- The [Great Lakes Protection Fund](#)
- The [William Penn Foundation](#)
- The [Agua Fund](#)
- The [Zell Family Foundation](#)

APPENDIX II

CHART OF PLAYERS IN THE WATER INVESTMENT LANDSCAPE

This chart provides an overview of some of the players in the water investment landscape. This is not designed to be an exhaustive list of all players. Instead, it is provided to give a sense of the range of players in water.

Nothing in this appendix implies a recommendation or endorsement of specific investments by EPIC. Specific companies and investments are provided as illustrative examples only.

THE CHART INCLUDES THE FOLLOWING CATEGORIES:

- [Intermediaries & Consultants](#)
- [Accelerators](#)
- [Technology Companies](#)
- [Investment Funds](#)
- [Bond Asset Managers](#)
- [Public Equities](#)

Company/Fund Name	Description	Alignment with Impact Topics
INTERMEDIARIES & CONSULTANTS		
Rural Community Assistance Partnership	Exploring development of a predevelopment/technical assistance financing mechanism to help small systems with their water sustainability needs.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Affordability ● Transparency & trust ● Stormwater
CK Blueshift	Developing a “Blue Bank” revolving fund to provide predevelopment financing & technical support to replicable water use cases.	<ul style="list-style-type: none"> ● Utility consolidation ● Affordability ● Water supply
NDN Fund	A Native CDFI and the lending arm of the NDN Collective. Providing financing for predevelopment, bridge, and large-scale Indigenous regenerative development projects that dramatically scale up investment and shift all decision-making power to Indigenous peoples. Could include financing for water & sewer.	<ul style="list-style-type: none"> ● All tribal water topics
Nonprofit Water	Non-profit wholesale water service provider designed to address consolidation needs for small water systems.	<ul style="list-style-type: none"> ● Utility consolidation
Greenprint Partners	Consulting company developing green stormwater solutions with a priority on installations in underserved communities	<ul style="list-style-type: none"> ● Stormwater
Quantified Ventures	Consulting company developing Environmental Impact Bonds and other pay-for-performance tools for municipalities and others.	<ul style="list-style-type: none"> ● Utility consolidation ● Lead pipe removal ● Affordability ● Transparency & trust ● Stormwater
Great Lakes Impact Investment Platform	Showcases sustainable investments under development or financed in the Great Lakes.	<ul style="list-style-type: none"> ● Great Lakes sustainability

Company/Fund Name	Description	Alignment with Impact Topics
Upwell Water	Providing capital to enable water solutions. Customers receive cash for existing water-related assets or pay over time for new ones. Solution partners sell with no upfront cost.	<ul style="list-style-type: none"> All water topics
ACCELERATORS		
Imagine H2O	A water innovation accelerator NGO that supports early-stage start-ups & deployment of their products. They help companies connect to investors, advise on business plans, and help develop roadmaps to foster company growth.	<ul style="list-style-type: none"> All water topics
BREW 2.0	A project of the Water Council in Milwaukee, a global hub dedicated to solving critical water challenges by driving innovation in freshwater technology and advancing water stewardship.	<ul style="list-style-type: none"> All water topics
Current	Headquartered in Chicago, Current collaborates with corporations, universities, nonprofits and governments to develop solutions that would be too risky or even impossible to undertake alone.	<ul style="list-style-type: none"> All water topics, focused on Chicago & Great Lakes
WaterStart	Based in Las Vegas, a non-profit collective of globally recognized leaders who deploy and co-fund innovative technology pilots to lower risks to implementation.	<ul style="list-style-type: none"> All water topics, but focused particularly on water supply issues
TechStars + TNC Sustainability Accelerator	Based in Colorado & focused on solving conservation challenges globally through for-profit ventures.	<ul style="list-style-type: none"> Environmental conservation topics
Elemental Exceleator	Part of the Emerson Collective, an accelerator focused on driving international growth for startups focused on climate change, & empowering CEOs to infuse equity and access into their companies.	<ul style="list-style-type: none"> Climate change & equity, including related water topics
TECHNOLOGY COMPANIES		
Blue Conduit	Using AI to expedite lead service line mapping.	<ul style="list-style-type: none"> Lead pipe removal Transparency & trust
Varuna	Data visualization platform for small/medium utilities, with linkage to remote sensors. Benefits are cost savings, improved prediction/analysis, and improved customer communications.	<ul style="list-style-type: none"> Affordability Transparency & trust
SimpleLab	Software platform for enviro health testing and laboratory logistics. Water quality test kit provider with insights on nationwide data.	<ul style="list-style-type: none"> Transparency & trust

Company/Fund Name	Description	Alignment with Impact Topics
Aquagenuity	Web- and app-based data service that: (1) provides home water testing kits; (2) Seeks to map 80% of the water systems in the US; (3) educates young people about water.	<ul style="list-style-type: none"> ● Transparency & trust
BioBot Analytics	Wastewater data analysis to track public health problems such as covid, drug use, etc.	<ul style="list-style-type: none"> ● Transparency & trust
120 Water	Provides advising, water testing kits and data management for munis, labs & consumers.	<ul style="list-style-type: none"> ● Lead pipe removal ● Transparency & trust
2nd Nature	Helping communities manage their stormwater assets.	<ul style="list-style-type: none"> ● Stormwater
Stormsensor	Cloud-based, networked sensors & software that maps how water moves through cities' systems in real time.	<ul style="list-style-type: none"> ● Stormwater ● Affordability
Cloud to Street	Uses satellites and AI to track floods in near real-time.	<ul style="list-style-type: none"> ● Stormwater ● Affordability
Natural Systems Utilities	Innovative stormwater management and on-site water reuse utilizing Design-Build, Design-Build-Operate and Design-Build-Own-Operate-Maintain approaches.	<ul style="list-style-type: none"> ● Utility consolidation ● Affordability ● Stormwater
Opti RTC	Cloud-based stormwater management for individual properties, which can be combined for a Smart Watershed Network Management for a community.	<ul style="list-style-type: none"> ● Transparency & trust ● Stormwater
Source	Hydro panels powered by the sun that extract drinking water from the air.	<ul style="list-style-type: none"> ● Utility consolidation ● Affordability ● Water supply
Fracta	Rapidly identify weaknesses in water pipe networks, understand the impact of an unplanned failure & improve the overall reliability of muni infrastructure.	<ul style="list-style-type: none"> ● Affordability
Zilper	Trenchless technology to monitor & repair pipes	<ul style="list-style-type: none"> ● Affordability
DropCountr	Customer engagement and analytics for utilities.	<ul style="list-style-type: none"> ● Affordability
Mapistry	Stormwater & flood control, digital water	<ul style="list-style-type: none"> ● Stormwater ● Affordability
NJBsoft	Regulatory compliance & data management software	<ul style="list-style-type: none"> ● Stormwater ● Affordability
AquaAffirm	Low-cost digital sensors for rapid measurement of arsenic & fluoride, & software platform that facilitates planning, mapping & optimization for infrastructure projects.	<ul style="list-style-type: none"> ● Affordability ● Transparency & trust

Company/Fund Name	Description	Alignment with Impact Topics
Orb	Real-time detection for utilities of pathogens & contaminants in water.	<ul style="list-style-type: none"> ● Affordability ● Transparency & trust
Space Ages Labs	Wireless technology for utilities to monitor & maintain water assets.	<ul style="list-style-type: none"> ● Affordability
Smarter Homes	Smart water meters for high rise apartments that enable leak detection & individual billing.	<ul style="list-style-type: none"> ● Affordability
Ziptility	Infrastructure management app for water operators.	<ul style="list-style-type: none"> ● Affordability ● Transparency & trust
Lotic Labs	Weather-related risk management for water & wastewater utilities.	<ul style="list-style-type: none"> ● Affordability ● Stormwater
INVESTMENT FUNDS		
Sciens Asset Management, Sustainable Water Opportunities Fund	Focused on: (1) Replacement / refurbishment of aging infrastructure; (2) increasing water reclamation; (3) Improving company managerial capabilities to meet regulatory and environmental standards; & (4) consolidating the industry to overcome inefficiencies of fragmentation.	<ul style="list-style-type: none"> ● Utility consolidation
Mazarine	Investing pool supporting early-stage innovations that improve efficiency & manage water & wastewater risk.	<ul style="list-style-type: none"> ● All water topics
Am Fam Institute	Corporate fund that invests in water, climate & disaster investments.	<ul style="list-style-type: none"> ● All water topics
Burnt Island Ventures	New fund that invests in the best entrepreneurs in water, worldwide.	<ul style="list-style-type: none"> ● All water topics
Echo River Capital	New fund that Invests in impactful water-related technologies that improve human health, the environment and urban resilience. Focus is on next generation digital solutions, distributed wastewater treatment & reuse, drinking water, & decarbonization of water systems.	<ul style="list-style-type: none"> ● All water topics
Colorado River Fund	Invest in technologies addressing water scarcity and quality issues in the Colorado River basin.	<ul style="list-style-type: none"> ● Western water quality & scarcity
Water Equity	Global water health & equity fund.	<ul style="list-style-type: none"> ● All water topics
Cycle Capital - BleuImpact Fund	Water tech impact fund.	<ul style="list-style-type: none"> ● All water topics
Urban Innovation Fund	A venture capital firm that provides seed capital & regulatory support to entrepreneurs shaping the future of cities	<ul style="list-style-type: none"> ● All municipal water topics

Company/Fund Name	Description	Alignment with Impact Topics
Equilibrium Capital	Invests in distributed infrastructure for water, waste & energy to address core business needs including environmental compliance, cost reductions, decarbonization initiatives, infrastructure resilience & climate risk mitigation.	● All water topics
Ecosystem Integrity Fund	Early growth stage investor in companies contributing to environmental sustainability.	● All water topics
BOND ASSET MANAGERS		
Breckinridge Capital Advisors	A Boston-based, independently owned asset manager specializing in investment grade fixed income portfolio management.	● All municipal water topics
Community Capital Management	An investment manager seeking to deliver superior risk-adjusted returns through investment strategies that contribute to positive environmental & social outcomes.	● All municipal water topics
Alliance Bernstein	A global asset management firm providing investment management & research services worldwide to institutional, high-net-worth & retail investors.	● All municipal water topics
Allianz Global Investors	The firm's expertise covers the developed & emerging markets as well as public & private markets.	● All municipal water topics
Adasina Social Capital	Bond fund that invests with a screen of racial justice, climate justice, gender justice & economic justice.	● All municipal water topics
PUBLIC EQUITIES		
Fidelity Water Sustainability Fund	Invests in companies helping to deliver safe, reliable, & easily accessible water.	● All water topics
Calvert Global Water Fund	The Fund seeks to track the performance of the Calvert Global Water Research Index.	● All water topics
Xylem Water Solutions	A leading water technology company committed to "solving water" by creating innovative & smart technology solutions to meet the world's water, wastewater & energy needs.	● All water topics

APPENDIX III - INVESTMENT OPTIONS FOR IMPACT PRIORITY AREAS

Investment Options for Impact Priority Areas	Consolidation	Lead Pipe Removal	Water Rates & Affordability	Data Tech to Increase Trust	Reduce Inequities of Stormwater Impacts	Endowment? (Y/N)	Impact Alignment (Strong, Medium, Weak)
Grants	Technical Assistance (TA) & facilitation of city-city dialogues; TA for accessing public funding streams; Predevelopment funding; Advocate for policies that mandate / create urgency for consolidation	Policy reforms creating urgency for removal; TA for small/underserved communities; pipe location mapping support; funding for private line replacement	Policy reforms; technical analysis; direct customer assistance	Innovation accelerators; deployment of tech in underserved communities	TA to develop co-benefit financing or other pay for performance solutions; Policy reforms making green solutions more cost effective; studies on value of co-benefits; best practices documentation; TA for accessing public funding streams; remediation of resulting sewer backups in homes	N	Strong
Guarantees	N/A	N/A	N/A	N/A	N/A	N	Weak
Project-Level Debt	Revolving loans for predevelopment & project financing	Revolving loans for predevelopment & replacement financing	Project financing for tech that will reduce utility costs, paid through cost savings	Revolving fund to finance deployment of new tech in underserved communities	Revolving fund to support predevelopment & project financing; innovative project financing such as pay for performance	N	Strong
Venture (funds or direct company equity)	Funds focused on consolidation; companies developing distributed water treatment technologies	Consulting companies working with utilities; tech companies supporting mapping/ replacement	Tech companies that reduce costs to utilities; Consulting companies working with utilities; tech companies addressing payment complexity	Tech companies increasing data availability/transparency	Tech companies making green stormwater infrastructure easier to install, maintain or manage	N	Strong
Public Equities	N/A	N/A	N/A	Public companies such Xylem that provide exits for small new tech companies	N/A	Y	Weak
Municipal Bonds	Finance consolidation costs	Finance pipe replacement	Finance cost saving investments that could pay for themselves & reduce strain on rates	N/A	Finance installation of green stormwater infrastructure	Y	Medium
Illustrative Investments	Sciens Sustainable Water Opportunities Fund; RCAP; Nonprofit Water	Blue Conduit; 120Water	Varuna; Zipility	Simplelabs; Aquagenuity, BioBot Analytics, Xylem	Greenprint Partners; 2nd Nature; Stormsensor; Quantified Ventures	N/A	N/A
Commonly Cited Challenges	Long lead time to develop trust between neighboring communities; lack of funding for planning, facilitation, predevelopment; risk to larger community from bringing in a smaller community	Lack of predevelopment funding limits the ability of smaller systems to pursue capital improvement projects; policies make it hard for cities to fund private line replacement; lack of info where lead lines are located makes replacement more expensive	"Trilemma" of financing infrastructure in lower credit quality communities while keeping rates affordable & maintaining credit rating	Munis don't have the technology to enable more real time reporting on water quality etc.; Utilities can be hesitant to deploy tech that puts more info into public hands	Green stormwater solutions are cheaper to install but more expensive to maintain; Utility pays for stormwater management but doesn't directly benefit from community co-benefits of GSI	N/A	N/A