Preparing for the Future of Seattle's Drinking Water

Contaminants in our drinking water system

By: Gaurav Mukherjee, Kaitlyn Casimo and Robert Franceschini

I. Abstract

On Friday, October 28, 2016, we, the University of Washington (UW) ELISS Fellows, brought together eight stakeholders with an interest in drinking water systems to the UW campus for a three-hour workshop. The goal of the event was to better understand the drinking water system of the Seattle region, the key actors involved, and how decisions should be made. We held this event with the hopes that takeaways from the workshop would inform conversations with and presentations to national stakeholder groups in Washington, D.C. about the Puget Sound's priorities for drinking water policy. Having held the event, we now have a keener insight into the system and several recommendations for how the region's strengths and weaknesses may inform national drinking water policy.

II. Background: What is ELISS?

Emerging Leaders in Science & Society (ELISS) is a service leadership program for graduate students that is hosted by the American Association for the Advancement of Science. ELISS Fellows, representing multiple disciplines and campuses, build their capacity to translate knowledge to action by leading an Idea Lab project to help their local communities better understand a complex challenge. University of Washington (UW) is one of five participating campuses, along with UC Irvine, Purdue University, UNC Chapel Hill, and Duke University. National ELISS advisors asked the Fellows to examine how their regions can ensure safe, sustainable, and affordable drinking water. As non-experts in the topic of drinking water policy, we Fellows sought to bring together experts in the field to discuss their opinions and then synthesize their expertise.

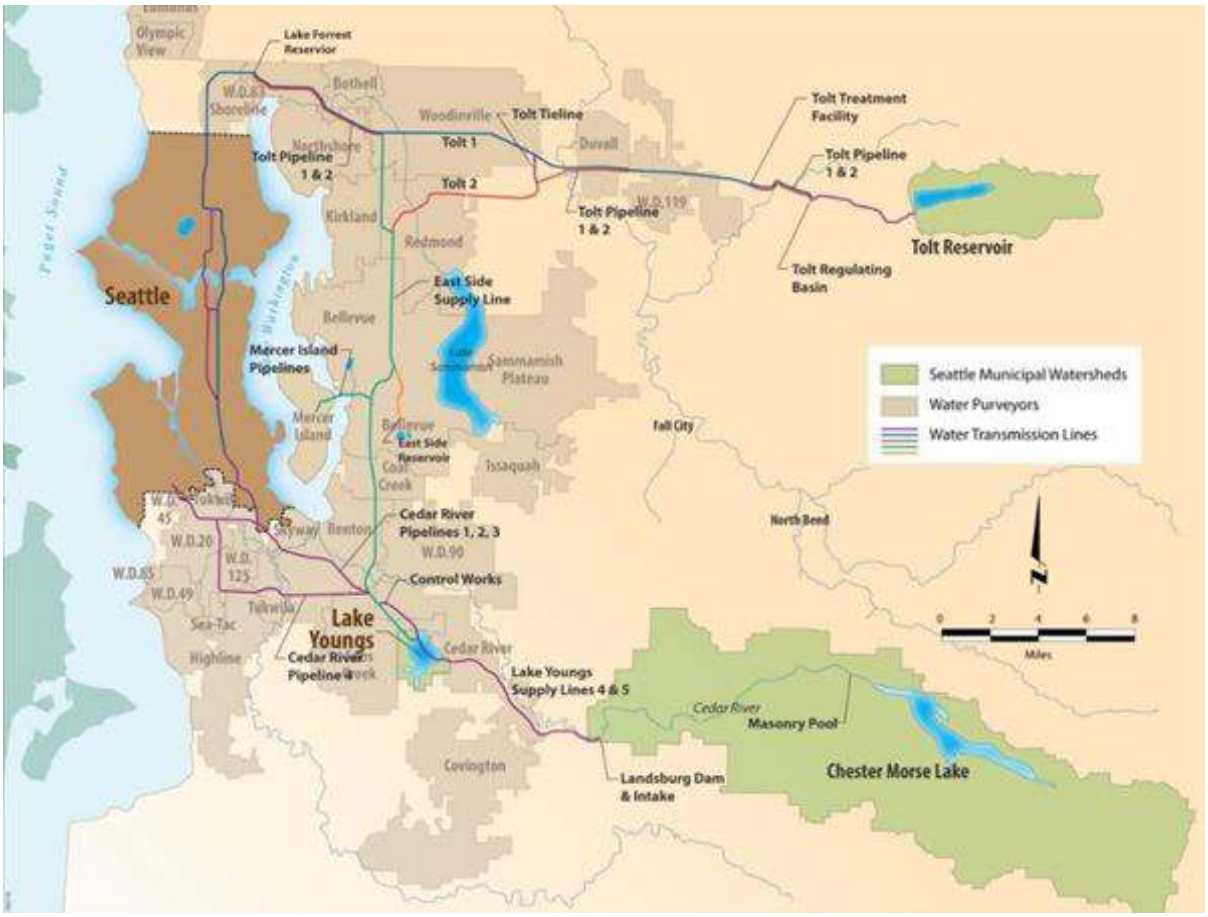
III. Background: What the Fellows Learned before the Workshop

Prior to the fall workshop, we spent much of 2016 meeting with stakeholders in the Greater Seattle area to better understand the drinking water system. In particular, we consulted experts

on topics including water source and quality; the means of water distribution; the government's role in the system; the economics of drinking water; community perceptions of drinking water; and the right to drinking water.

A. The water's path

Keywords: *River watershed, snowmelt, protected sources, old distribution system, cascade water alliance, state of the art water treatment*



The path of the water from source to tap. Source: www.seattle.gov

Through conversations with expert stakeholders from water utilities, city government, universities and local communities, we learned much about the state of the drinking water system in the area served by the Seattle Public Utilities (SPU) and the Redmond Public Utilities (RPU). Seattle Public Utilities sources its permanent supply from the Cedar and Tolt River basins. These watersheds begin in the Cascade Mountains, as rainfall and snowmelt and are owned by Seattle Public Utilities. While the Tolt watershed is owned partially by private owners, Seattle owns 99% of the Cedar watershed. Through various transmission lines, the water is then transported to the new treatment facilities, built in 2001 and 2004, where mandated

treatment occurs. Water is then pumped to storage reservoirs and to the Cascade Water Alliance, whose municipal members include the cities of Bellevue, Kirkland, Redmond and Issaquah, among others.

From reservoirs, the water then travels through a distribution network, with construction spanning the last century. The aging distribution network infrastructure presents interesting challenges in Seattle, such as risk of failure due to shifts in the Earth, particulates in water due to corrosion and sedimentation, fittings that may contain regulated chemicals. From this distribution system, the water flows to private pipes, and exits the pathway at the faucet.

While Seattle relies primarily on snow melt for drinking water, surrounding areas such as Redmond, Issaquah, Renton, among others, rely on aquifers and well drinking water. The city of Redmond, for instance, relies on its ground water sources for about 30 - 40 percent of its drinking water supply. With wells used to monitor water quality, called sentinel wells, RPU monitors the ground water very closely. The aquifers that feed these municipal wells are close to the surface, and are primarily under the urban areas.

B. Challenges

Keywords: *Distribution system, cost, environment, change in source composition, private wells, municipal wells*

Seattle's drinking water is unique. While the city has a protected source water that greatly reduces sources and pathways for contaminants, the sources present some unusual challenges that concentrate around adaptability to changing source composition, contamination due to pharmaceuticals, and alternate sources of drinking water.

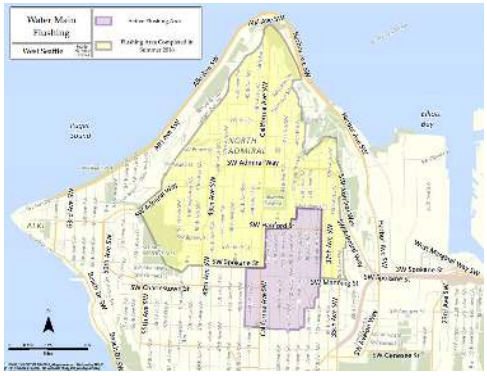
A gooseneck fitting.

Lead

In April 2016, traces of lead were discovered in the drinking water of 4 houses in Tacoma. According to sources at the SPU, the high lead results Tacoma measured were directly from the service line, due to disruptive sample collection. In follow up testing, SPU conducted sequential sampling that indicated low lead concentrations within regulatory limits. Although the corrosion control program is considered to be very effective, fittings in old houses were found to contain lead. These fittings are present in about 2000 houses in Seattle serviced by galvanized steel pipes, and this was communicated and resolved in a timely and

Gooseneck fitting. Source: Seattle Times. March 2015

detailed manner by SPU. Newer constructions have copper pipes without these gooseneck fittings, which prevents lead from leaching into the water.



Water mains flushing. Source: SPU

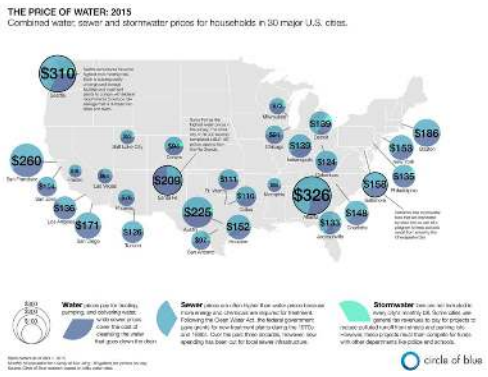
Particulates

An incident involving discolored “brown water” in West Seattle served to highlight the susceptibility of old infrastructure to rust, and the responsiveness of the public utility companies to public perceptions of non-potable water coming from their tap. SPU dealt with this challenge by flushing the distribution network. The source was said to be back flow due to reduced pressure in the line after fire hydrants were activated.

www.seattle.gov/util/MyServices/Water/Water_Quality/WaterSourcesContaminants/DiscoloredWater/index.htm

Cost of water

While water utilization per capita is decreasing, Seattle’s overall monthly expenditures on drinking water are increasing. In 2015, according to Circle of Blue, for families using 150 gallons and 50 gallons per person per day, average water prices rose 6 percent and 5.2 percent, respectively nationally. The adjoining figure shows the total cost of drinking, sewer and storm water in 2015 for different regions of the country. This price is one of the highest nationwide. However, sources at the SPU say that drinking water costs are substantially lower than projected.



Cost of water. Source: Circle of Blue

www.circleofblue.org/2015/world/price-of-water-2015-up-6-percent-in-30-major-u-s-cities-41-percent-rise-since-2010/

Natural calamities

The city of Seattle and King County sit on a tectonic fault line, placing them at risk for earthquakes, volcanic eruptions and water damage. It is estimated by SPU, that 12 critical water facilities are in areas prone to liquefaction, or ground failure after an earthquake, due to loose soil. SPU is actively replacing brittle cast iron pipes with seismically resistant pipes. Seismic retrofits are a part of a comprehensive assets management program. In an emergency, SPU has contingency plans in place to tide the demand over while the system is

restored.
www.seattle.gov/Documents/Departments/Emergency/PlansOEM/SHIVA/2014-04-23_Earthquakes(0).pdf

Equity and infrastructure

Water in the state of Washington is considered to be public property, and an individual or group cannot own it. Instead the concept of water rights exists for people to withdraw reasonable amounts of water for non-wasteful use. While the state water code of 1917 mandates the requirement of a water permit for surface water, the withdrawal of underground or ground water is mandated by the state groundwater code, enacted in 1945.
Washington is also home to seven Native American tribes, who have separate water rights and access under treaties. Tribal waters do not avail themselves of federal infrastructure mandatorily, and therefore, cases of waterborne illnesses are more prevalent.
www.ecy.wa.gov/programs/wr/rights/Images/pdf/landownerguide_2009-2ndEd.pdf

IV. The Workshop

A. Objectives of the workshop

The objectives of the workshop were to convene experts and members of the public to 1) refine our understanding of the main challenges to resilience that either already have or need adaptable responses, and 2) develop a common knowledge base and personal networks for further decision-making. We were interested in what features of the water system are undergoing or may undergo change in the future, who is responsible for those features, and how adaptability-oriented solutions can be developed (and who should be involved in that).

B. Proposed deliverables of the workshop

WHAT	**FOR WHOM?**
Challenge statement - what question are we asking them to tackle? A clear formulation of the topic.	Participants, written by Fellows
Background reading/participant brief - to provide participants with a limited universe of information (e.g. regulations, news articles, data, quotes, journal articles) so participants have common knowledge in addition to their expertise	Participants, compiled by Fellows Can also be included in post-event deliverables as representative snapshot of system
Presentation (and/or written brief) on participant	Fellows will record content for use in

group consensus - brief oral summary by each working group on the challenges identified and suggestions developed	further deliverables
Written brief/other summary document of ALL participant input and ideas for use by national events/individuals	Based on participants' blurbs, fellows will assemble for benefit of participants
Revision of above with feedback from participants - fellows include comments/feedback	Fellows send out preliminary summary to participants for comments. Final product used in national level event

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Convening Methods

To frame the event's theme and objectives, we presented participants with a case study, which was loosely based on a contamination of drinking water system in West Virginia. Several additional materials accompanied the case study in a briefing packet. These included news articles, scientific reports, and legal reading excerpts. We asked participants to review provided materials to understand the current process before the event

We also separated participants into groups to ensure an equal representation of experts and non-experts alike. Within the groups, we used a human centered design approach to facilitating the conversations surrounding both parts of the workshop.

We asked about who is responsible for various aspects of the system and who can be turned to for help. We hope that by bringing together people with varying expertise, we can help identify and address issues that may be falling through the cracks or where collaboration can result in a sum greater than individual ongoing efforts.

Participants:

Participants included representatives from state and local government, academia, a news outlet, and ELISS.

Agenda:

Segment Length	Goal(s)	Method
Introduction - 10 min	Introduce ELISS program and fellows. Pass out briefing books. Explain scenario and goals for each group's response. Break into 5 teams of ~6 attendees each (diverse groups by profession/background)	ELISS fellows present goals for day and outline. A format for the products of the day is introduced
Scenario discussion 1: Preventing contamination - 45 min	Groups discuss the scenario and begin to outline their responses. ELISS fellows (+ assistants?) help facilitate discussion at each table.	Briefing books include clear scenario to be considered + criteria for group's proposed response
Check-in and coffee - 10 min	ELISS fellows remind everyone of the agenda/time remaining, provide coffee.	
Scenario discussion 2: Reacting to a contamination - 45 min	Discussions continue. ELISS fellows facilitate the discussion of responses that directly address scenario criteria.	Scenario briefing includes a list of questions to be addressed in response.
Regroup and coffee - 10 min	ELISS fellows end table discussions and redirect everyone to the large group.	
Presentation - 10 min/group, 55 total	Each group has 6 minutes to present their response to the scenario + 4 minutes to answer questions from fellows or other groups.	Fellows record the presentation of responses for later combination/adaptation as final forum product
Conclude and thanks - 15 min	ELISS fellows provide each participant with a brief survey/follow-up questions form. Thank everyone for his or her time/effort.	Brief survey/contact form to assess outcomes and provide pathway to follow-up


Images: Fall forum 2016, University of Washington

Based on the hypothetical identification of a contaminant in the drinking water in Seattle and the greater area, the groups at the workshop were given two scenarios for discussion:

1. Prevention: “How could the release of a contaminant be prevented in the drinking water system?”
2. Reaction: “How would we contain the effects of the contaminant after the release has occurred? ”

C. Summary

Key themes emerged from the conversations about the challenges surrounding contaminants in drinking water.

Theme 1: Ground water/ Well water supply

Municipal and private wells form a significant percentage of the drinking water sources in the Greater Seattle region and also the in the state of Washington. However, most information that exists pertains to the surface water sources and treatment. The workshop arrived at a consensus that the aspect of drinking water in the Greater Seattle region that requires attention from the perspective of contamination is ground water. This was based partly on concerns surrounding the higher levels of PFOA/ PFOS observed in the water from Gilman well No. 4 in Issaquah. The city of Redmond expressed concerns at the lack of clarity of the relationships between established practices surrounding surface water and its relationship to water from ground sources. Since Redmond’s aquifer lies primarily under urban areas, the effects of these urban pressures on the drinking water sources, such as construction, chemical use and industrial use, among others, were brought up as major concerns.

Theme 2: Lack of a knowledge base for different non-mandated chemical contaminants, related effects and methods of control

Legal standards exist for a number of contaminants generally found in surface water. However a number of non-mandated chemicals found in varying levels in the water have no regulation around them. Also, the difference in the effect of contaminants found in surface water, when they occur in aquifers, is not well understood. Research into and action on these issues takes effort and time that may be duplicative of or inefficient compared to those actions taken elsewhere. Participants expressed a need for a shared knowledge base, and it was generally agreed upon that increasing access to and sharing of information may help reduce the risk of contaminants and in dealing with the ensuing reaction and cleanup to a release.

Quotes:

“Knowing what Indiana State Health Department is doing, would help without expending monetary or time resources” - Steve Deem, Washington State Health Department

“Washington doesn’t have limits on this specific contaminant, but California does. So we looked there” - Linda De Boldt, Director, Redmond Public Utilities, on the need for data on contaminants.

Theme 3: Effective communication

All participants at the workshop were in agreement that while the utilities, politicians and regulatory personnel converse often, more could be done to improve communication. Communicating and reinforcing the role of the public in preserving water resources by handling chemicals more responsibly, for example, or the role of firefighters in ensuring the prevention of accidental cross contamination, was expressed. Communication between the public utilities and the public is crucial as this builds trust, which is necessary to impart confidence in the public, the end consumer of drinking water.

Acknowledgements

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ELISS Fellows 2016, Orientation - Jan 15, 2016, Bainbridge Island, WA

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