

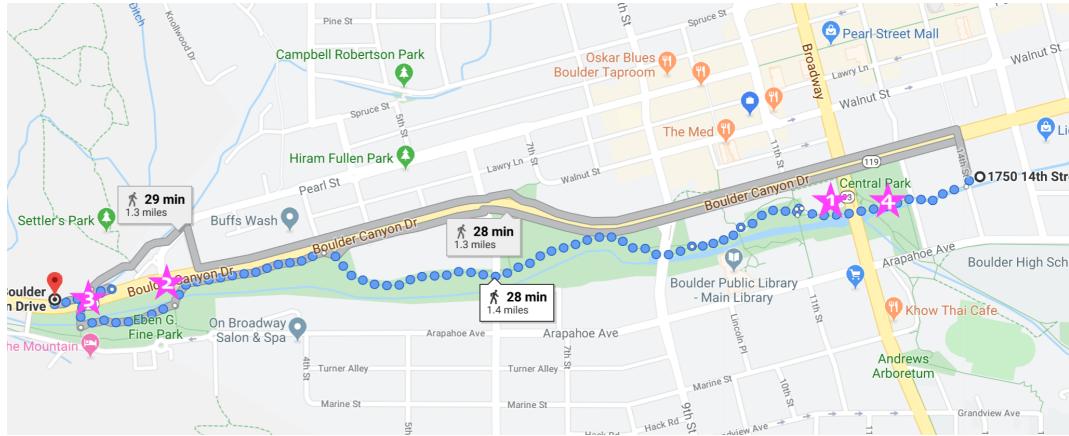
User Study Results

Lucy Van Kleunen & Mel Rush

Research Method 1: Contextual Inquiry

Date: October 13th, 2019 Sunday 11:30AM

Location: Boulder Creek Path - Between Boulder Tea House and Eben G Fine Park (~2.8 miles)



Summary: Mel and Lucy walked along the Boulder Creek taking turns approaching people enjoying the water. One person would ask questions, as the other took notes on an iPad.

Contextual Inquiries: 2 Full, 1 Partial, 1 Attempted

Overall Findings:

- Fishers are some of the people who are most engaged with the Boulder Creek. They often move between locations on the Creek. Adults go through a process to receive a license to fish and are often connected to the local fishing community. We did not know before we arrived that this would be the primary group that we talked to, however this ended up being the group that we observed to have the most interaction with the Creek at this time of year.
- Fishers care about some specific types of data related to the creek, which include CFS and data related to water quality. They sometimes look up this information, but it is also sometimes challenging to find.
- Fishers would be interested in collecting data about the Creek if it was easy to do.

Contextual Inquiry 1 (Full): Man Fishing

Location: Boulder Creek West of Broadway

Setting: Older man (60+) wearing fishing vest using a fishing pole standing on a grass peninsula facing the creek. No electronics. Walked along the creek exploring different spots.

Summary:

- He fishes all year long at the Boulder Creek, and has been doing so for about 20 years. He lives just "down the road" and has lived in Boulder all his life. He catches and releases his fish in the Creek.
- His favorite spot to fish is up Boulder Canyon road. He hasn't been able to fish there this summer because of the construction. He claimed the city promised to make fish holes to preserve the fish during construction, but ended up killing them instead.

- He tried to contact the Parks & Wildlife department about the fishing problem up Canyon road and didn't find them helpful. He noted the farmers have more power over the water than the city.
- He used to look up water levels before fishing, but no longer does. Since he is an experienced fisherman, he knows the best places to fish in the creek from his past experience - based on the season and weather.
- He would collect water data if he knew how. He seemed most interested in CFS levels.
- Fishing is catch and release

Data Collected:

- The Boulder Creek is 80% Brown Trout, and 20% Rainbow Trout
- CFS (cubic feet/second) helps fishers understand water depth. If the water is too low, then there isn't water to fish. Fishers like to find the balance of not too high but not too low for the best fishing. Water pockets are key - it is where fish gather.

Contextual Inquiry 2 (Full): Father watching Son fishing

Location: Eben G. Fine Park

Setting: Father sitting up on high up rock on side of creek watching son. Son standing on rock in the creek using a fishing pole. Father had cell phone visible, and was watching son fish as a little girl climbed on him.

Summary:

- The family lives right on the Boulder Creek. They come to the Creek regularly, and the son fishes about 10x a month. The family also likes to dip their feet in the water.
- The family doesn't look up any information before coming to the creek to fish. They do look up information before they fish at other locations (such as large lakes).
- The dad has tried to look up water quality data for the Boulder creek in the past, but found it hard to find. He heard rumors of chemicals coming downstream due to mining. He was concerned because his children love to splash in the creek. He gave up and allows his kids swim anyway.
- The father thinks it would be fun to collect data with his son. They are also the most interested in CF/S levels.
- He suggested handing out kits for people to sample. He thinks fisherman would be very interested. He noted the fisherman are the most consistent people on the creek, and since they are there anyway they would probably love to take samples.

Contextual Inquiry 3 (Attempted): Man, Woman, and Dog

Location: Under Bridge in Eben G. Fine Park

Setting: Man, Woman, and dog sitting on separate rocks in the creek

Summary: Asked woman if we could speak to them, got rejected. The dog began to bark at us and the lady said he was aggressive. We left. We had to yell loudly because the creek's roar was noisy. It was hard for the lady to hear us, and she seemed confused why we were approaching her.

Contextual Inquiry 4 (Partial): Two Men Fishing

Location: Boulder Creek East of Broadway

Setting: Older man with young man each with their own fishing pole walking on the paved path next to the creek. No electronics were visible.

Summary:

- The older man rarely fishes, and the younger man fishes regularly at the Boulder Creek. The older man did not have a fishing license, and the younger man did.
- The older man thought the fishing was great and they were doing well. He thought they caught a couple fish already, but the younger man disagreed and said they didn't catch anything. He seemed frustrated at the number of fish caught.
- The younger man seemed much more knowledgeable on fishing at the creek.

Data Collected:

- You need a license to fish at the Boulder creek if you are between the ages of ~16-60

Research Method 2: Observations

Date: October 13th, 2019 Sunday 11:30AM

Location: Boulder Creek Path - Between Boulder Tea House and Eben G Fine Park (~2.8 miles)

Summary: Mel and Lucy walked along the Boulder Creek and made observations about who was there, what they were doing, technology use, and the built environment. These were done during the same period of time as the contextual inquiries.

Overall Findings:

- On the weekend people often spend time by the Creek in groups, often familial, and they are primarily undertaking social and athletic activities
- At the Creek people are often not using technology except for taking pictures with mobile phones
- Public displays should complement existing educational displays and public art. Some common themes revolved around nature/wildlife, water/flooding, (indigenous) heritage

Data Collected - Notes on people observations (excluding contextual inquiries):

- Groups of people participating in a Creek clean up event
- 2 people fishing, likely family
- A number of bikers, joggers, dog walkers along the path by the Creek, typically solo
- At least 2 families walking along the creek path (about 5 people each)
- Older woman sitting by water
- 2 joggers on a break from run sitting down by water talking
- Couple taking engagement photos by creek with photographer
- Large Indigenous People Powwow event near downtown - tents, large groups
- At Eben G Fine Park:
 - Many families and groups, some set up at picnic tables with food - group size 5-10
 - A handful of people fishing at park
 - People walking dogs, some sitting with dogs by water
 - Group playing frisbee
 - Group of young women taking selfies near creek
 - Lots of children climbing on rocks in water or splashing in water
 - Painter painting the scene by the creek

Data Collected - Notes on technology use:

- The vast majority of people being social or active and not using mobile phones
- People have mobile phones with them, just not actively using them
- The people we saw using phones were mostly taking photographs

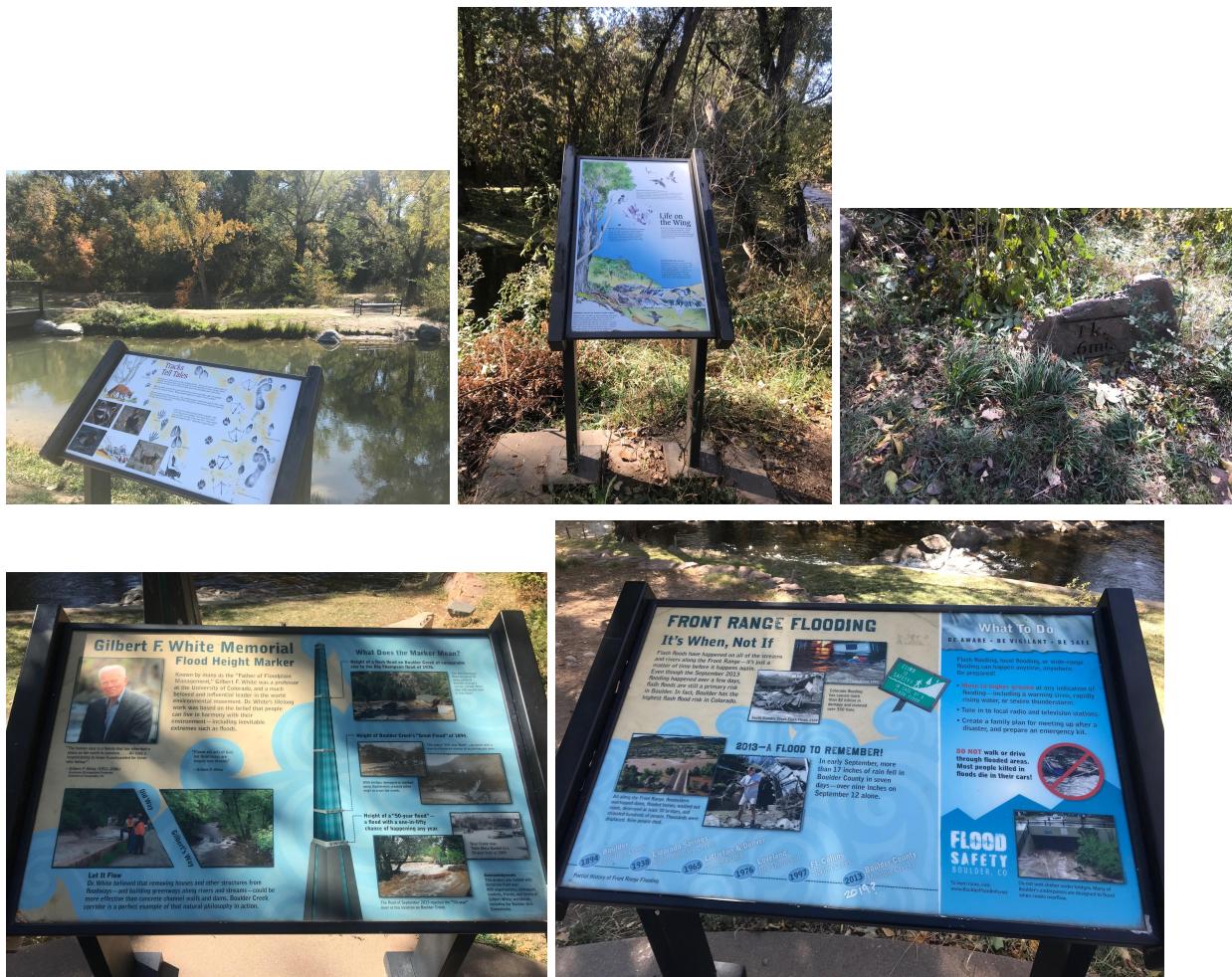
Data Collected - Notes on the built environment:

- Kids fishing pond between downtown and Eben G Fine Park

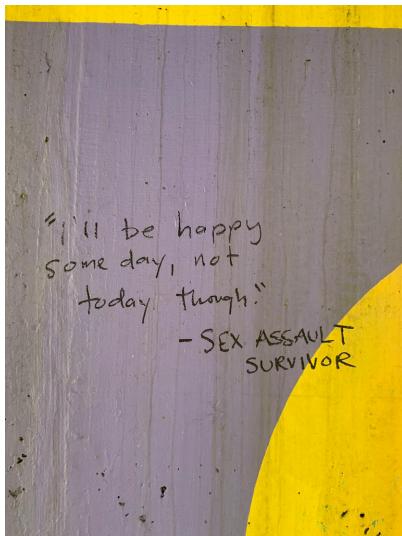
- Improvised shelter and bikes under library near Creek, where people who are homeless sleep
- Educational plaques along the Creek
- Water height gauge at the kid's fishing pond (likely USGS run)
- Boulder High School is right next to the Creek
- Lots of picnic tables, benches, public art and sculptures along the creek

Data Collected - Photos:

Educational Signs, mile markers - Topics = wildlife, flooding



Public Art + Graffiti - Topics = Nature, Indigenous Heritage, Flooding/water, Disclosure:



Research Method 3: Interviews

Summary: We interviewed people with expertise related to water quality and the Boulder Creek

Interviews: 2 In-Person, 1 Email exchange, 1 Attempted

Overall Findings:

- A number of data points are collected by scientists to study water quality. Many of these require water samples to manually be collected and then analyzed in a lab. This is, in theory, an activity that could be supported as a citizen science project.
- Information and modelling about water quality levels at Boulder Creek exists, however it is currently not easy to find or available in real-time on location at Boulder Creek
- Earth scientists and public health officials care a lot about public engagement and we should build upon existing efforts and expertise in this space by working with scientists and public health officials as stakeholders to think about how to relate water quality data to broader issues around water and climate
- Fishers are an extremely active group in regards to the Boulder Creek, already holding a number of educational and clean-up events
- Fishers are primarily concerned about data related to fishing quality (temperature, gauge height, CFS) as well as more generally concerned about whether there are contaminants or trash in the water

Interviewee 1 (In person): Participant 1

Setting: Participant 1 is a Hydrology, Water Resources, and Environmental Fluid Mechanics graduate student at CU Boulder. She received her undergraduate degree in Mechanical engineering in Iowa, and is now a second year graduate student in Colorado researching the effects wildfires have on soil and streams, and how it affects the environment around it. She recently sent in a GRFP proposal which has an educational component for water supply and quality. If accepted, she will have a museum exhibit targeted at rural and tribal communities with low income to teach them about the severe implications water changes can have on a community.

Location: Mel and Lucy interviewed Participant 1 over lunch at Noodles and Company

Date: Sunday 10/28/2019, 12:00

Notes:

- Stream water is dangerous to drink because it is high in natural and artificial contaminants, though it is often not lethal and different people's bodies are affected differently
- Informing and educating the public is a major challenge in the Earth Sciences that the research community is actively working on
- Communities would need to know if there was - happening, which results in large algal blooms and could have an effect on recreational uses of public water bodies
- Common cause of contaminants in public water bodies are from industrial discharges, wildfires, or airborne contaminants (acid rain)

- It would be interesting to put up some sort of sign near a public water body indicating the “danger” level (like wildfire signs)
- There likely is a way to look up modelling results for water quality level at the Boulder Creek
- The public could be involved by taking water samples and then sending them back to the lab for scientists to analyze
- It would be great if public education efforts about environmental health could be linked to broader narratives around water and climate issues and ideally could inspire more knowledge and activism around the climate / global climate change, which ultimately needs to be dealt with by governments, not via individual behavior change
- In this area, the cleanest water will be after snowmelt (March-ish), the least clean water is around August, generally
- You cannot tell water quality by looking at water - sometimes murky water is safe and clear water is toxic

Data Collected:

- Some measurements related to water quality that we could measure at the Boulder Creek are bacteria levels, DOM (dissolved organic materials), turbidity (how murky it is), nitrate oxide / heavy metal levels, levels of artificial chemicals from agriculture (pesticides, herbicides)

Interviewee 2 (In person): Participant 2 at Rocky Mountain Anglers

Setting: Participant 2 is a fisherman who works at the Rocky Mountain Anglers store on Arapahoe in Boulder, Colorado. Rocky Mountain Anglers is a fishing and hunting store, which sells fly fishing equipment, tying materials, and other accessories. They also educate the community through fly fishing classes, lessons and youth camps. The store sponsors an annual Boulder Creek clean up day, as well as many other clean up days throughout the year. They aim to keep Boulder clean, give back to the community, and help inspire fisherman.

Location: Rocky Mountain Anglers Fishing Shop

Date: Sunday 10/28/2019, 1:30 PM

Notes:

- Participant 2 mentioned that the manager at the store helps organize different events through Rocky Mountain Anglers. He works with the Boulder Parks Department to engage with the community through their annual Boulder clean the Creek Day. This year in the creek, they found bike tires, street signage, shoes, and lots of alcohol cans.
- They have also seen heroin needles at the Creek in the past. They do not pick up the needles and call the city of Boulder to safely dispose of them.
- Recently, there have been many dead fish on the surface of the water at the Creek. This could be due to multiple reasons. Participant 2 noted that there is a lot of runoff from the condos who live alongside the creek. Participant 2 also noted the Creek is home to lots of trash. Rainstorms help carry trash from around town into the Creek.
- Participant 2 likes to look up information before he goes fishing. He uses websites such as USGS (The United States Geological Survey), tailwaters, and the DWR (Department of Water Resources)

- Participant 2 gave Mel his manager's business card and said they would be interested in helping organize a community data collection day on the Boulder Creek. The manager could put up a brochure at the front of the store which would attract people to participate. He seemed very interested to know what the water quality is like at the water by the shop at the bottom of the creek, VS the top at the canyon and if that would be cleaner.
- Different groups come to the Rocky Mountain Anglers, such as the Boulder Fly Casters, and they host events together. If there is a group that would host the data collection event, the Rocky Mountain Anglers would happily sponsor it. This seems like the model most events are ran at the store. Once they sponsor an event, they store provides fishing guides which fish along the creek with the participants.

Data Collected:

- The most important data to a fisherman includes temperature, gauge height, and CF/S
- August is the peak time for fishing. The warmer air temperature and large quantity of bugs creates an excellent fishing environment. The fish are the most active at this time of year.
- "Thanks to everyone who came by today for the 6th annual Boulder Creek Cleanup. Unfortunately a 10 yard dumpster was almost filled. #stillpartying #volunteering @candid #peoplepowereddogoodery #friends #community #flyfishing #getreadytolive #saveawormfishafly" - Rock Mountain Anglers, Facebook Photo.



Interviewee 3 (Email exchange): Boulder Stormwater Quality Supervisor

Setting: Participant 3 is a Stormwater Quality Supervisor with the City of Boulder who focuses on the Boulder Creek. We reached out to her over the phone multiple times from a number listed on the City of Boulder website but were unable to find a mutual time to talk, so we ended up asking her questions over email.

Location: Over email

Date: Wednesday 10/23/2019 - Monday 10/28/2019

Data Collected:

- Within the urban corridor, Boulder collects data on discharge / flow, bacteria, nutrients, metals, habitat, macroinvertebrates, and periphyton
- Data is collected with flow measurement devices, manual sample collection (taken back to lab for analysis), and special sampling events with experts
- The data is stored by the city and available upon request
- Sampling events occur throughout the year
- They receive information requests a few times a year
- They do not have numbers on how many people use the Boulder Creek for recreation
- Information the public should know:
 - “Recreators should take care and not swim within 72 hours of a rainfall event, not ingest the water, and shower and wash hands immediately after recreating”
 - “The public can help combat this issue by picking up dog waste, not over-irrigating; and reporting spills and suspicious discharges to the city.”
- They don't have a program in place for the public to be involved in data collection, but would be open to citizen science if there was interest
- They would be interested in seeing finalized designs and would consider supporting the application longer term if it gets built

Follow Up:

- We have requested access to the data mentioned, this request is pending

Interviewee 4 (Attempted): Boulder City employee in charge of Boulder Reservoir

Setting: We attempted to reach out over email to set up an interview (week of 10/21/2019) but have not received a response

Research Summary

Public Displays of Water Quality Data

Meeting Logistics:

Date: Sunday, October 27, 2019

Location: Over the phone (it was snowy!)

Group Members: Lucy Van Kleunen & Mel Rush

Project Summary: Develop a public display of real time water-related data to match public informational needs at the Boulder Creek for those who use waterways for recreational activities. This public display will integrate data from existing sources, as well as data provided by the public via a citizen science activity.

Key Motivating Questions

- What water-related information do people who use the Creek care about?
- What water-related data is already collected by public health officials and scientists? How can we access this data?
- What information do public health officials and scientists want people to know about public bodies of water?
- Are citizen science efforts feasible in this space? Are there data collection activities an amateur can do? Are there enough people actively engaged with the Creek who are interested in data collection?
- How should a public display be integrated into the built environment near Boulder Creek?

Research Methods

- In person **interviews** with a water quality expert, an active user of the Boulder Creek (fisherman), and a Boulder Parks and Recreation employee. The interviews centered around how data is collected, the types of data collected, and what this data is used for.
- **Contextual Inquiries** with four groups of people using the Boulder Creek on a beautiful Fall October day.
- **Observations** of families, fishermen, and individuals on the creek for recreational activities, and personal enjoyment.

Agreements / Disagreements between Data Collection Activities

- We did not find major disagreements amongst our data collection activities, which were largely undertaken together. The main “disagreements” came from the fact that we interviewed different stakeholders with different opinions about what data about water is interesting. Below we have tried to synthesize these opinions into design recommendations that take into account the needs of members of the general public, fishers, public health officials, and water quality scientists.

Design Recommendations

1. Design to support the information needs of fishers

Fishermen appear to be very active users of the Boulder Creek, are interested in data collection efforts, and already organize events such as Creek clean ups. Fishers are therefore good candidates for an initial group to get engaged in water-related data collection efforts. Every fisherman we talked to noted how important CF/s levels are. When they look up data before fishing (if they look up data), it is always CF/s levels or data related to fishing quality. Therefore, even if we want to display water quality data, we should also incorporate data related to fishing quality such as temperature, gauge height, and CF/s data on our public display, so that fishers can be engaged and interested in contributing to the project.

2. Design to support the information needs of families and the public

People want information about the Boulder Creek water quality conditions, but struggle to find it. This results in people giving up, and using the Creek without confidence in the water being safe and clean. Therefore, we should educate the public through real-time data displays about the current conditions so they can confidently allow their families to swim in the Boulder Creek.

3. Design to support engagement between the public and the environment

We observed groups of people spending their Saturdays cleaning up the creek, and saw multiple Facebook events supporting this effort. Many people we talked to were interested in gathering data about the creek, but didn't know how. Therefore, we will create a system for the public to gather data about the Boulder Creek's water conditions, and integrate this collected data into the public display. Ideally the data collection activity should be something that families and groups could have fun doing together, and that only requires a short amount of time on a mobile phone, analogous to taking a picture. Also, note that water quality data collection typically requires a sample to be sent to a lab, so we should support that process and make it easy for people.

4. Design to support knowledge transfer between scientists and the public

After speaking with Boulder Parks and Recreation employee and the water scientist, we learned there are already measures to gather data about the Boulder Creek. This information isn't easily accessible, and takes time and effort to obtain. Therefore, we will integrate this existing dataset into our public display. We will also integrate high level warnings and information about water that the scientists and public health officials wanted to communicate with the public, as well as try to relate the information to broader issues around water and climate.

5. Design public displays to integrate with the existing built environment

Interactive public display(s) should be integrated into the environment along the Boulder Creek and complement existing static displays and public art works. In particular, this should influence the form factor and aesthetics of the display.