Emergency Potable Water Planning for UBC

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Who is involved?

- Risk Management Services
- SEEDS Sustainability Program
- Energy and Water Services
- Building Operations
- Campus and Community Planning
- Student Housing and Hospitality Services

Outline

- Project background and planning context
- Water filtration trailer planning
  - Background and considerations
  - Storage
  - Transportation
  - Distribution
  - Recommendations
- Increasing emergency water resilience
  - Emergency water planning assumptions
  - UBC emergency water needs: challenges and considerations
  - Increasing resilience through redundant water sources
  - Recommendations
- Summary and next steps

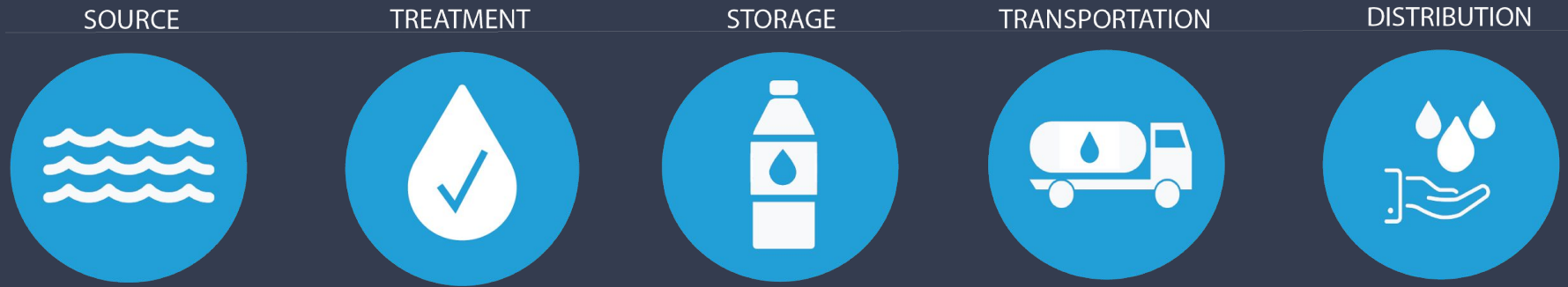
Project Background

What are the best solutions for getting clean water into the hands of the UBC community after a significant seismic event?

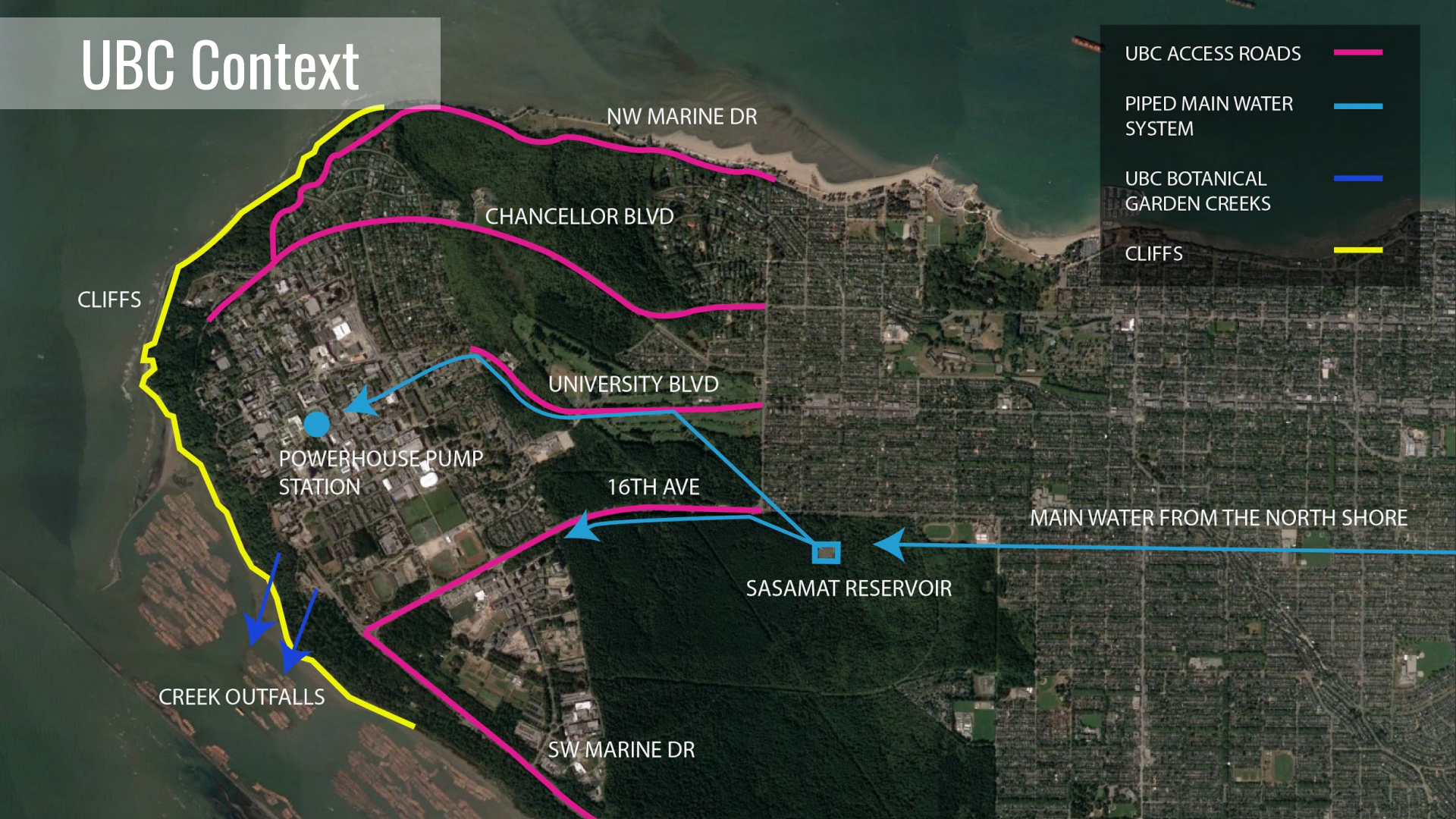
1. Completing the planning process for the water filtration trailer
2. Looking at additional ways to increase resilience

Why are we here today?

- To have a conversation about comprehensive emergency water planning, and about storage, transportation, distribution of water from the trailer.
- To understand and clarify assumptions, roles & responsibilities in the process.
- To understand and clarify what additional decisions need to be made, and potential actions for the future.
- To identify opportunities for increasing resilience.



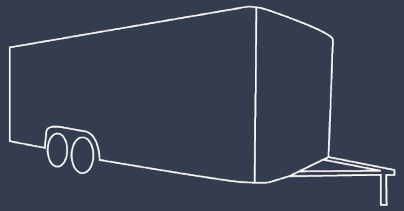
UBC Context


UBC ACCESS ROADS
PIPED MAIN WATER SYSTEM
UBC BOTANICAL GARDEN CREEKS
CLIFFS
NW MARINE DR
CHANCELLOR BLVD
CLIFFS
UNIVERSITY BLVD
POWERHOUSE PUMP STATION
16TH AVE
MAIN WATER FROM THE NORTH SHORE
SASAMAT RESERVOIR
CREEK OUTFALLS
SW MARINE DR

Water Filtration Trailer Background

- Purchased in 2016 to increase UBC's resiliency
- Can filter up to: **120,000 L** of water per day, enough for **2 L** of water per day for 60,000 people
- Water drawn from creeks near the UBC Botanical Gardens

Source & Treatment



Storage

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Transportation

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Distribution

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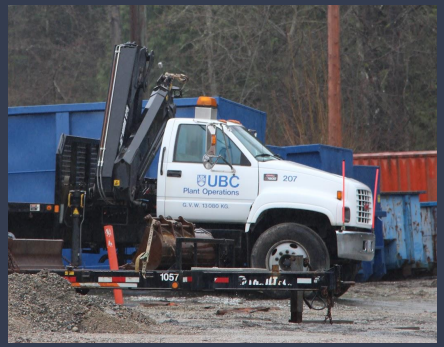
Energy and Water Services

Building Operations

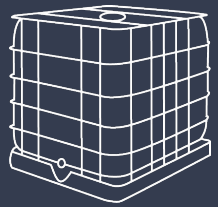
Student Housing and Hospitality Services

Existing Equipment



Source: BIPW, 2016

Flatbed Truck & Crane, Auto Levelling Attachment



Cage Tote

Water Bladders

Considerations

- Minimal Storage Space
- Minimal Maintenance
- Ability to integrate into day-to-day / Uses existing equipment
- Simplicity / Ease of Use
- Flexibility
- Minimal Cost

STORAGE

Water Bladders

- Also known as ‘pillow bladders’
- Come in a variety of sizes
    - likely 10,000 L or 20,000 L sizes appropriate for UBC
- Difficult to move when full
- UBC already owns 2 water bladders

Source: BIPW, 2016

Onion Tanks

- Come in a variety of sizes
  - likely 10,000 L or 20,000 L sizes appropriate for UBC
- Takes up less ground area
- Difficult to move when full

Source: Ready Containment

Water Buffalos

- Water wagons, water trailers, water bowsers
- Could be used as an intermediary storage and transportation method
- Come in a variety of sizes, up to ~20,000 L
- Would need to pump the water out at the distribution sites, as you may not want to leave the trailers at the distribution sites

Source: Snodgress Equipment

Cage Totes

- Also known as Intermediate Bulk Containers
- Approximately 1,000 L
- Light when empty
- Cannot be lifted from above when full, must be lifted by forklift or auto-levelling crane attachment
- Small enough to be placed at elevated locations like loading docks, which could provide enough water pressure to distribute

Evaluation of Storage Alternatives

	Minimal Storage Space	Minimal Maintenance	Ability to Integrate/ Uses existing equipment	Simplicity/ Ease of Use	Flexibility	Minimal Cost
Water Bladder						
Onion Tanks						
Water Buffalo						
Cage Totes						

 = Meets consideration  = Partially meets consideration  = Does not meet consideration

TRANSPORTATION

Trailer Location & Possible Distribution Sites

Flatbed with Auto-Levelling Attachment

- Can carry up to 6 full cage totes (6,000 kgs)
- Would be utilized with the cage totes
- Would need to attach an auto-levelling attachment to the crane so that the cage totes could be lifted from below
- Could easily place cage totes on an elevated area
- May be needed for many other tasks after an emergency
- If there is a problem with the truck, we only have one other one which cannot carry as much

Source: Francois Desmarais

Pickup Trucks Towing Trailers

- UBC has 12 trucks which can tow more than 10,000 kgs (which is more than enough)
- Would likely be used with the water buffalos, however they could be used to carry the cage totes if forklifts were placed by the filtration trailer and at distribution sites
- Trucks will likely be needed for many other tasks after an emergency

Source: Carleton

Piping

- Fire hoses or some sort of piping to set up temporary connections to distribution points
- Would need a lot of piping, pumps, road crossings, etc.
- Not very easy to set up, would take a long time
- Would need fewer intermediate steps than other options

Source: TanMar Companies

Evaluation of Transportation Alternatives

	Minimal Storage Space	Minimal Maintenance	Uses Existing Equipment	Simplicity/ Ease of Use	Flexibility	Minimal Cost
Flatbed with Auto-Levelling Attachment						
Pickup Trucks Towing Trailers						
Piping						

● = Meets consideration ◐ = Partially meets consideration ○ = Does not meet consideration

DISTRIBUTION

Simple Tapstands

- Galvanized steel piping
- Typically has 6 to 8 taps
- Can be set up and dismantled very easily
- Does not need electricity, and may not need pumps to function if source is elevated and there is enough pressure
- Can fill a variety of container sizes

Source: Butyl Products Ltd Group

DIVVY Point of Distribution Pump Station

- Has 4 hoses to distribute water
- Fairly easy to set up
- Does have a filtration component, which is redundant considering the water filtration trailer
- Water does need to be pumped through the system because of this filtration component, but is done by hand
- Can fill a variety of container sizes

Source: DIVVY

WaterFillz

- Water stations with 4 taps
- UBC AMS already has a contract with WaterFillz and has two setups like this, would need to purchase more
- Would cost significantly more than simple tapstands
- Redundant filtration
- Would not require a lot of setup, but does require electricity
- Does not allow for a variety of container sizes to be filled

Source: WaterFillz

QuenchBuggy

- Similar to WaterFillz
- 8 taps, 4 on either side
- Redundant filtration
- Taps allow for more variety in size of containers
- Would not require a lot of setup, but does require electricity

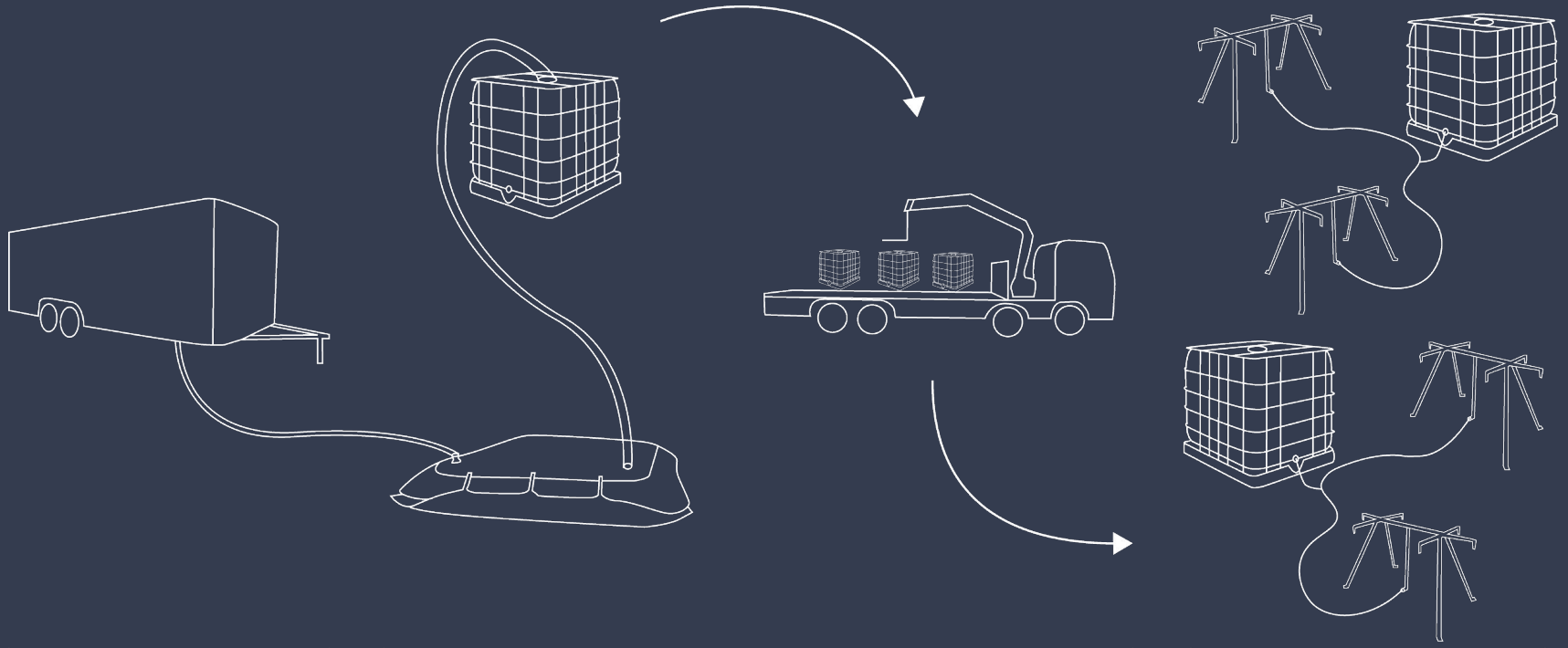
Source: QuenchBuggy

Evaluation of Distribution Alternatives

	Minimal Storage Space	Minimal Maintenance	Ability to Integrate/ Uses Existing Equipment	Simplicity/ Ease of Use	Flexibility	Minimal Cost
Simple Tapstands	●	●	◐	●	●	●
DIVVY POD	●	◐	◐	◐	●	◐
WaterFillz	○	◐	●	◐	○	○
QuenchBuggy	◐	◐	◐	◐	◐	○

● = Meets consideration ◐ = Partially meets consideration ○ = Does not meet consideration

Recommendation



Energy and Water Services

Building Operations

Student Housing and Hospitality Services

Recommendations for Next Steps

- **Consider water storage, transportation and distribution options** & **coordinate decisions** around implementation between departments
- **Test the system** and have regularly scheduled drills
- **Cross-train staff** on equipment, consider prioritizing campus housing for people with critical specialty training
- **Evaluate how people should collect water** at distribution sites
- Create a **plan for communicating water distribution** information

INCREASING WATER RESILIENCE AND REDUNDANCY

Challenges: Source and demand

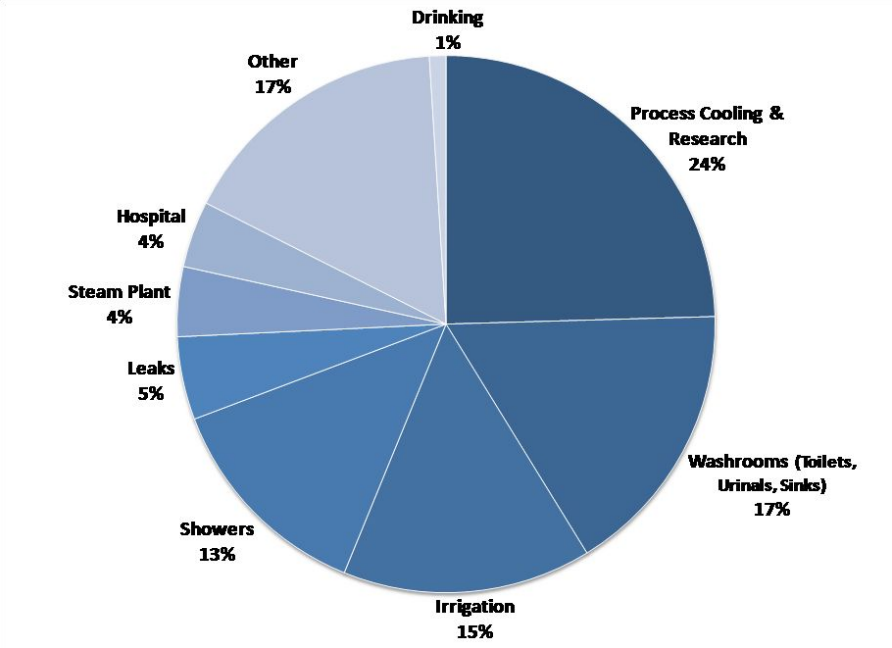
- Under optimal conditions, the trailer can produce **120,000 L** per day.
- This, along with supplies on hand could meet drinking water needs, unless:
  - people are stranded or displaced for more than couple of days;
  - an earthquake occurs at a time when the campus is very busy;
  - an earthquake takes place when the streams could be dry or have very low flows; or
  - an earthquake damages the stream source, the trailer, or buildings that contain emergency water supplies.

Source: Rick Chung

Water planning assumptions

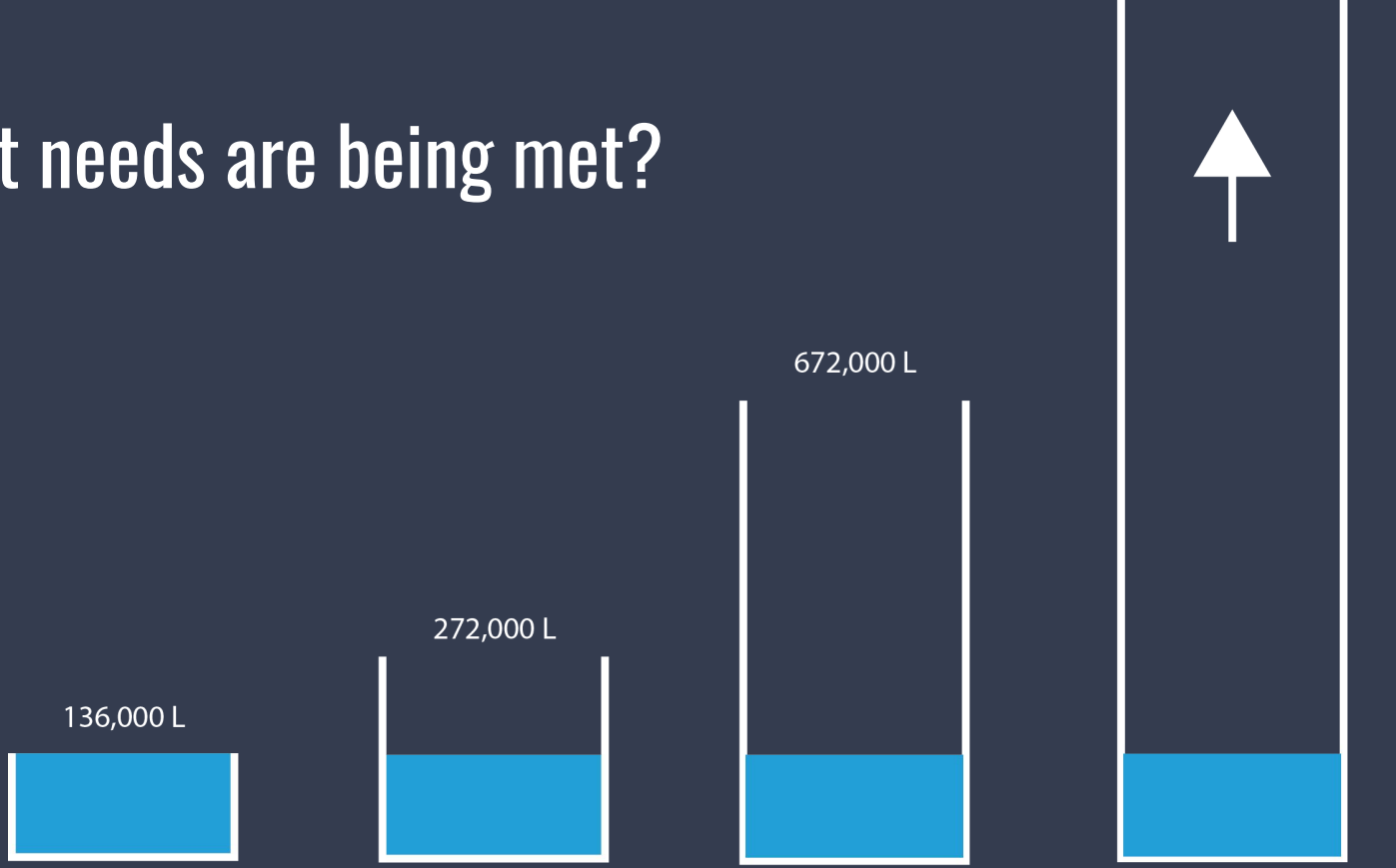
- Disaster and outage scenario: Campus-wide piped potable water supply outage due to a significant seismic event.
- Time scale of outage: **3-7 days.**
- Population considered: **68,000 people.**
  - Staff: 9,250
  - Faculty: 3,396
  - Students: 54,232
  - Visitors: 1,726
- Water use per capita: **2-4 L per person per day.**
- Water quality: Should comply with Canadian Drinking Water Guidelines.

Water consumption



- 2011 audit, 80% of buildings
- 4 billion litres of water per year, about 10 million litres per day
- 1% or 100,000 L per day for drinking, but possibly more
- 400,000 L per day is used by the hospital, and 2,400,000 L for process cooling and research

What needs are being met?



Drinking
2 L / Person / Day

Drinking + sanitation
4 L / Person / Day

Drinking, sanitation + UBC Hospital

Drinking, sanitation, UBC Hospital + research and process cooling

Increasing water source redundancy

Type	Initial Cost	Maintenance Cost	Storage Required	Control (no outside agreement required)	Knowledge of systems and process required	Possibility of day-to-day use	Efficiency of delivery
Local Untreated Source	$ - $$	Maybe	Maybe	Yes	Yes	Yes	Medium
Bulk and pre-packaged water from off-campus	$$ - $$$	No	No	No	No	No	Medium-Low
Treated water on site	$ - $$$	Maybe	Yes	Yes	Yes	Yes	High

LOCAL UNTREATED SOURCES

Creeks

- Continue to monitor creeks to ensure they continue to be viable.
- Second creek has more water (2 L / minute), but needs to be tapped, requires permit for dropping a barrel in for the intake system to pump water from the second creek to the first.
- Cross-train staff to deal with operational issues such as high turbidity (ideally 1 NTU, up to 5 NTU is acceptable).
- Consider recommendations from the complementary report to complete the planning process.

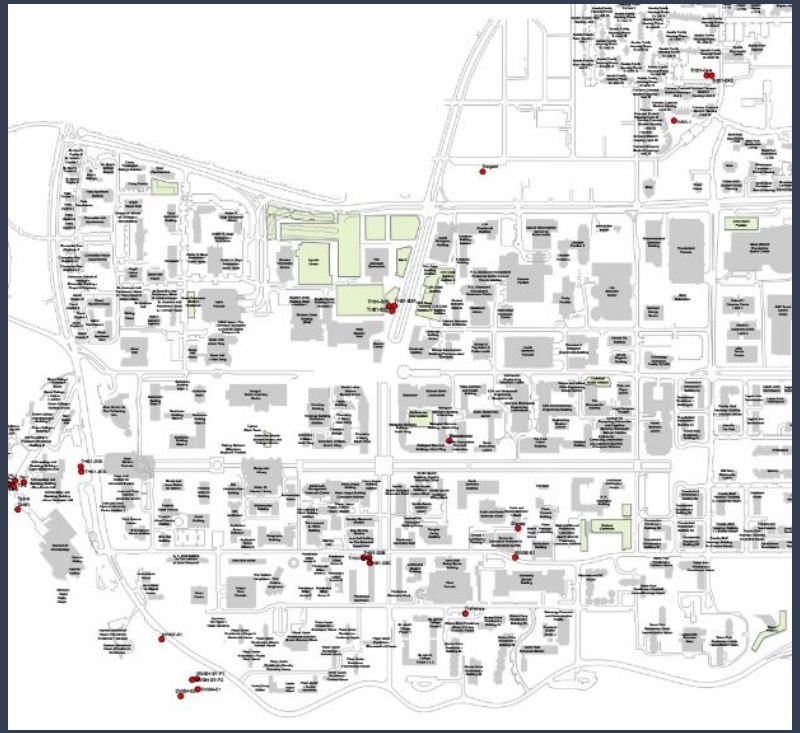
Swimming pool

- Other universities have said that they will rely on their swimming pools for emergency water.
- The new UBC Aquatic Centre hold 4.9 million L of water, uses a pressurized diatomaceous earth tank, regenerative media filters, UV and chlorine.
- Usually within 1-3 PPM of chlorine, may require dechlorination (sodium thiosulphate) if over 4, backup generators to keep the pump filtration system working,

Source: UBC Public Affairs

Groundwater

- Perched aquifer 15 m below grade, 10-30 m thick, fairly impermeable; second aquifer at 50 m.
- Majority of wells on campus are monitoring wells, cross-connection wells to relieve pressure on upper aquifer - not designed for production.
- Test drawdown, iron and manganese content (chemical flushing may be required).



Source: UBC Energy and Water Services

Blue infrastructure

- Existing rainwater cisterns - CIRS, Aquatic Centre, but there are access challenges.
- Ponds - Wesbrook Place, MOA, Nitobe
    - Access and quality issues

Source: Jennifer C.

BULK AND PRE-PACKAGED WATER FROM OFF-CAMPUS

Bulk water haulers and other trucked-in water

- Transportation of treated water, from treated reservoirs, treatment plants, or nearby utilities.
- Other universities plan to rely on this.
- Requires contracts in advance - need to prevent double counting with other areas requiring emergency supplies.
- Might not be an ideal option to rely on due to UBC's potential for isolation.
- Expensive - $50,000 for a 10 day supply to Tofino during drought

TREATED WATER ON SITE

Bottled water

- Other universities stockpile supplies: can continue to cycle through it, while keeping a certain amount on hand
- Requires storage facilities close to food and water distribution sites
- We do this at UBC, but there is a risk of supplies become inaccessible due to building damage and collapse
- Not as sustainable - trying to reduce bottled water consumption.

Source: Pennsylvania National Guard

Existing tank water

- Might be possible to access hot water and toilet tanks in undamaged buildings, would be a good solution for residential buildings.
- Hot water tanks: Let the tank cool, place a container underneath and drain.
- Toilet tanks: Safe unless treated with chemicals

Dedicated bulk storage

- Other schools have built bulk storage - plan to pump (gasoline-powered portable engine) from tank (20,000 L) via portable fire hose to drums.
- If it is built above ground, it could use gravity instead of requiring pumps.
- However, it would need to be cleaned, accessible, built to withstand a seismic event
- Requires real estate on campus- could potentially be built into a building.
- If day-to-day use is desired, needs to address existing issues of cisterns on campus - would recommend less complex systems.

Recommendations

General:

- Look at water needs for other critical functions.
- Continue to monitor the streams.

Looking at alternate sources:

- Weigh different options and determine processes for access
  - Swimming pool as a starting point
  - Water tanks for the residential community
  - Dedicated storage for critical facilities

Summary and next steps

1. **Completing the planning process for the water filtration trailer**

- Consider water storage, transportation and distribution options and coordinate decisions around implementation.
- Update the emergency water plan accordingly.
- Conduct test runs with the equipment.

2. **Looking at additional ways to increase resilience**

- Determine desired level of service.
- Consider alternate water sources.

THANK YOU!