Increasing Access to Drinking Water at UBC

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Executive Summary

The University of British Colombia's (UBC) Vancouver campus has exhibited promising signs in its ability to expand public access to drinking water and reduce the use of bottled water. Students have collaborated with faculty and staff on several research projects to attain these two goals. Research completed in April 2013 through the SEEDS (Social Ecological Economic Development Studies) program has determined the current availability of free drinking water on campus and outlined how the institution could further improve accessibility. In response, the university has created a committee to determine the economic transition and phase-out plan for bottled water, and improve access to drinking water on campus. The UBC Tap Water Declaration Committee includes students from Common Energy as well as staff members from AMS Sustainability, Student Housing and Hospitality Services (SHHS), Campus Sustainability, UBC Building Operations, and the UBC Department of Athletics and Recreation. The committee has defined campus tap water access as:

> *Access to free fresh drinking water on campus in close proximity to every washroom, food service locations and UBC's high-density outdoor areas. Each access point is universally accessible, includes signage and bottle filling capabilities*

In continuation to the work conducted through previous SEEDS projects completed in the spring of 2013, this project will determine how the campus can make its water outlets more universally accessible and which drinking fountains are better suited to meet the campus's needs outlined in the tap water access definition.

The project objectives are:

- To conduct a review of existing standards that apply to fountains at the University of British Columbia campuses based on technical guidelines, previous inventory work conducted, other documents, and interviews with key campus stakeholders.
- Identify any corresponding modifications needed for the Technical Guidelines
- To conduct a literature review of existing standards of fountains and universal accessibility within municipalities, parks and other campuses.
- To conduct a review of each type of water fountain or outlet on campus according to the Drinking Water Outlet Assessment (Cheng, 2013), product specs, ergonomics/ease of use, universal accessibility, and the Tap Water Declaration Committee's definition of tap water access.
- Identify which food service locations are in need of water outlets.
- To determine the most appropriate fountain infrastructure that best suits the needs of the campus population and develop an upgrade strategy for water fountains at UBC.

- To suggest potential outdoor drinking fountains that the campus could consider for outdoor recreational areas and public spaces on the main campus. Potential locations will also be provided.

Review of UBC's guidelines

The review of UBC's Guidelines discusses how UBC's current Technical Guidelines and Custodial Guidelines direct the installation and maintenance of water fountains. These guidelines encompass how water fountains are installed in buildings and cleaned, but they do not include any guidelines that cover outdoor water fountains, accessibility for handicapped people, space requirements, lighting requirements, water pressure, and drainage. The main recommendation is that UBC Building Operations add a section in their Technical Guidelines on universal accessibility following the examples provided in the 'Review of municipal and campus standards' section.

Review of UBC's water outlets

The review of UBC's water outlets analyzes each type of water outlet found on campus. This review represents 174 water fountains and 9 bottle fillers found in 54 of the campus's main buildings. Each type of outlet is evaluated according to the City of Winnipeg's Accessibility Design Standards, outlet ergonomics for drinking and bottle filling, wheelchair accessibility, and bottle filling capabilities. The two water fountain types that satisfy most of the criteria are the newer Haws models accompanied by bottle fillers and the Elkay EZH_2O. The Haws model is the most common fountain type on campus and often has a gooseneck bottle filler. The Elkay EZH_2O model has recently been added to the UBC Technical Guidelines as the suggested water fountain model. This is an excellent choice because it offers maximum accessibility, an automated bottle filling mechanism, and a Green Ticker that counts how many plastic bottles are saved from waste. It is recommended that UBC Building Operations develop a fountain upgrade plan to increase accessibility where there are currently older water fountain models. The following list outlines the buildings that require higher-priority upgrades and the rationale behind each choice:

- Chemistry Building – High student traffic
- Macleod Building – High student traffic
- Irving K. Barber Learning Centre (add EZH2O dispenser or gooseneck) – High student traffic
- Civil and Mechanical Engineering Building – High student traffic
- Biological Sciences – High student traffic
- War Memorial Gym – Recreational facility
- Student Recreation Centre – Recreational facility
- Doug Mitchell Thunderbird Sports Centre – Recreational facility
- Osborne Centre (Units 1 and 2) – Recreational facility
- UBC Tennis Centre – Recreational facility

Out of the sixteen food service locations visited, three (the Loop, Magma and Stir it Up) had push-back water dispensers and one had a mini kitchenette sink (Caffe Perugia). It is recommended that UBC Food Services install water outlets at food service locations that do not

already have them along with appropriate signage. It would also be ideal to consider putting in other designs, because the current design is not the most accessible to individuals who use wheelchairs.

Literature review of municipal and campus standards

This section outlines the various actions Simon Fraser University and the University of Victoria have taken to improve water provision on their campuses along with specific pieces of infrastructure these campuses use. It also identifies the outdoor water fountains the City of Vancouver installs in its parks and along its Greenways, as well as the logistics that are involved in installing new outdoor fountains around the city. The accessibility design standards from the City of Winnipeg and York University have been highlighted to provide a reference point for universal accessibility at UBC's water outlets. Important aspects to consider include the height of the water fountain, the operating mechanism, the location of the operating mechanism on the fountain, space availability around the fountain, the trajectory angle of the water, and the water flow height or pressure.

Water provision in UBC's high-density outdoor areas

Outdoor water provision at Thunderbird Park and Thunderbird Stadium can be achieved by installing hydrant outlets and outdoor water fountains to cater to the needs of athletes and spectators respectively. Further research and discussion needs to be done to determine the optimal and most economic water outlets to install. Once specific numbers of each outlet type are determined, quotes provided by suppliers will help determine which outlets are most feasible for the campus's recreational fields. There are several locations around UBC's main campus that would benefit from outdoor water fountains because they are either recreational areas or public spaces that are not directly adjacent to buildings with water fountains. It is recommended that the Campus and Community Planning department consider installing outdoor water fountains at the following locations or collaborate with other staff at UBC on the alternatives provided.

- Public space outside Buchanan C/D/E
- Public space on North side of Irving K. Barber Learning Centre
- The UBC Bus Loop and MacInnes Recreational Field
- The UBC Skatepark and adjacent basketball court
- Grass oval south of the Forest Sciences Centre
- Memorial Road by the Music Building and Frederic Lasserre Building

These findings and recommendations will help the institution attain the standards listed in the new tap water access definition. It is highly recommended that the committee openly communicate their intentions with the various departments on campus, because the success of this initiative will require both the cooperation and collaboration from the university's students and staff. Although this project has provided and cited specific accessibility guidelines, it would be ideal to engage with the public on this aspect of water provision. People who use wheelchairs should test out highlighted outlets to confirm or refute the access claims from this project. Further research should also focus on the best way to discard old water fountain models and determine if their materials can be down-cycled into other industry products.

Introduction

The University of British Colombia's (UBC) Vancouver campus has exhibited promising signs in its ability to expand public access to drinking water and reduce the use of bottled water. Students have collaborated with faculty and staff on several research projects to attain these two goals. Research completed in April 2013 through the SEEDS (Social Ecological Economic Development Studies) program has determined the current availability of free drinking water on campus and outlined how the institution could further improve accessibility. A social marketing strategy has also been developed through another SEEDS project to engage the campus in the reduction of bottled water use and effectively communicate where alternatives are available at UBC. In continuation to the work conducted through the previous two SEEDS projects in the spring of 2013, this project will determine how the campus can make its water outlets more universally accessible and which drinking fountains are better suited to meet the campus's needs.

Background Information

About the Author

Andrea Cheng has completed her Bachelor of Science degree in the Applied Biology program within Land and Food Systems at UBC. Her specialization is in Food and the Environment, which has allowed her to complete a wide variety of courses including Climatology, Agroecology, Oceanography, Geographical Information Systems, Sustainability by Design, Environmental Geography, Research Methods in Applied Animal Biology, and Environmental Impact Assessment. She is completing this project as a member of the UBC Tap Water Declaration Committee through the UBC SEEDS Program.

Project Stakeholders and Staff

SEEDS Program

The SEEDS (Social Ecological Economic Development Studies) Program is the first academic program in Western Canada to integrate students' energy and enthusiasm for sustainability with faculty members' research experience and staff members' expertise to increase campus capacity to function as a sustainable institution. UBC's SEEDS Program allows students to earn course-based credit working on sustainability projects, while receiving mentorship from faculty and staff. Students collaborate with faculty and staff to develop solutions for sustainability challenges on campus. To date, over 800 projects covering issues that involve materials, water, energy, transportation, land, food, climate, community and finance have been completed. The SEEDS Program Library allows the public to access all completed project reports and provides a historical record of sustainability at UBC (UBC Sustainability, 2013a).

Acting staff member:
Liska Richer – UBC SEEDS Program Manager

AMS Sustainability

AMS Sustainability is the sustainability office of UBC's Alma Mater Society. It has five employees and runs the $100,000 per year AMS Sustainability Fund as well as multiple ecological footprint reduction programs. These are achieved through their Lighter Footprint Strategy, which is informed through the UBC SEEDS Program.

Acting staff members:
Justin Ritchie and Jenna Singh – AMS Sustainability Coordinators

UBC Student Housing and Hospitality Services (SHHS)

UBC Student Housing and Hospitality Services (SHHS) provides accommodation for students, faculty and staff in eight residential complexes throughout campus. SHHS also encompasses the UBC Food Services Department, which is the primary food provider for the campus (UBC Student Housing and Hospitality Services, 2013). The AMS and SHHS have formed a memorandum of understanding (MOU), through which both parties have agreed to collaborate on the installation of WaterFillz stations across campus (Cheng, 2013)

Acting staff members:
Leith Blachford – Communications and Marketing Manager
Loriann Mcgowan – Associate Director of Food Services Operations
Victoria Wakefield – Purchasing Manager

UBC's Waste Action Plan

UBC is developing a Waste Action Plan outlining waste reduction targets and the actions required to achieve those goals. UBC currently diverts about 44% of its operational waste from local landfills, a target that has been met partially through a range of successful waste reduction programs executed throughout the past decade. The campus is committed to further waste reductions in the future (UBC Sustainability, 2013b).

Acting staff member:
Bud Fraser – UBC's Water and Zero Waste Engineer

UBC Building Operations

UBC Building Operations is responsible for managing the university's built environment in a safe and sustainable way. It is dedicated to providing facilities maintenance, operations and renovation services to UBC's lands and various buildings as required (UBC Building Operations, 2013). UBC Building Operations provided information on water fountain infrastructure for this project.

Acting staff member:
Greig Samodien – Facilities Manager

UBC Department of Athletics and Recreation

The UBC Department of Athletics and Recreation manages all the institution's sports facilities. Its mandate is to provide the programs and maintain the facilities needed to keep the university's community active and healthy. Since proper hydration is important in all sports and recreational programs, the department is looking to improve water provision and reduce

waste in its facilities. The UBC Department of Athletics and Recreation provided information on Thunderbird Park and Thunderbird Stadium.

Acting staff member:
Bradley Thomas – Facility Coordinator at Gerald McGavin Rugby Centre and Thunderbird Park & Thunderbird Stadium

Common Energy

Common Energy is a student-run organization that aims to incorporate sustainability into all aspects of the UBC community. Its Tangible Solutions action team launched the Tap That: Bottled Water Free UBC campaign on January 28th, 2013. This campaign increased awareness of the impacts of bottled water consumption and the benefits of drinking tap water from reusable bottles through a website, several promotional videos, movie screenings, as well as through its Facebook and Twitter webpages. The campaign successfully gained public support for a petition that encouraged UBC President Stephen J. Toope to set a date by which the campus would become virtually bottled water free.

(Cheng, 2013)

UBC's Tap Water Declaration Committee

In response to the research completed in 2013 along with Common Energy's successful Tap That Campaign, the campus has created a committee (modeled after the Waste Free UBC Committee) to determine the economic transition and phase-out plan for bottled water, and improve access to drinking water on campus. This committee includes students from Common Energy as well as staff members from AMS Sustainability, UBC SHHS, Campus Sustainability, UBC Building Operations, and UBC Department of Athletics and Recreation. Over the summer of 2013 the committee selected a water fountain icon for campus signage, developed a campus communications plan and defined campus tap water access as:

> *Access to free fresh drinking water on campus in close proximity to every washroom, food service locations and UBC's high-density outdoor areas. Each access point is universally accessible, includes signage and bottle filling capabilities*

Drinking Water Outlet Assessment

The Drinking Water Outlet Assessment was the principal component of one of the two projects completed in April 2013. It encompassed an inventory and evaluation process of 197 drinking outlets from 59 buildings on UBC's main campus. The study provided a baseline representation of the availability, accessibility, functionality and appeal of UBC's drinking water sources. The inventory and evaluation yielded the following results:

- Two thirds of the drinking water outlets evaluated are not visible from the main entrances of their respective buildings
- The majority of drinking water outlets evaluated are visible to passing traffic within their respective buildings
- 38% of drinking water outlets evaluated are situated within 5 meters of a washroom.
- 56% of water outlets are very clean and appear well-maintained
- 7% of drinking outlets are either dirty or have a substantial amount of residues on them.
- 2% of water outlets do not work
- 14% of water outlets have insufficient water pressure to avoid mouth contact with spigots
- 62% of water outlets have sufficient pressure to create an arch where drinking occurs mid-stream and easily allows for bottle filling
- Reusable bottles can be filled at 82% of the evaluated water outlets
- 42% of the 171 water fountains evaluated have goosenecks for bottles
- Water from 81% of the water outlets was colourless and free of air bubbles (initial flush)
- Water from 14% of the water outlets had colour or air bubbles in the initial flush that was absent in the second flush 15 seconds after. Air bubbles dissipate after 30-40 seconds.
- Water from 81% of evaluated water outlets had no unpleasant tastes upon initial flush
- Mean 1-Litre fill times decrease as water pressure increases
- Mean 1-Litre fill times of goosenecks are shorter than the fill times of spigots

In response to these results, the following goals were recommended to increase accessibility to free drinking water on UBC's Vancouver campus:

Goal 1: Improve the infrastructure and maintenance as well as increase convenience of tap water usage available on campus

Goal 2: Increase awareness and promotion of tap water available on campus

Goal 3: Continue research on and monitoring of drinking water access on campus

(Cheng, 2013)

Rationale for This Project and its Scope

Following discussion within the Tap Water Declaration Committee and the newly formed campus tap water access definition, another research project was initiated. The purpose of this project is to use the information from the Tap Water Outlet Assessment and further evaluations to determine how well the campus's fountain infrastructure meets the needs outlined in the tap water access definition. This project will determine if the campus's water outlets are universally accessible, if they have bottle-filling capabilities, and will discuss the logistics of having access points in close proximity to all of UBC's food service locations and high-density outdoor areas.

The project objectives are:

- To conduct a review of existing standards that apply to fountains at the University of British Columbia campuses based on technical guidelines, previous inventory work conducted (Cheng, 2013), other documents, and interviews with key campus stakeholders (SHHS, Building Operations, Department of Athletics and Recreations, and Campus and Community Planning).

- Identify any corresponding modifications needed for the Technical Guidelines

- To conduct a literature review of existing standards of fountains and universal accessibility within municipalities, parks and other campuses.

- To conduct a review of each type of water fountain or outlet on campus according to the Drinking Water Outlet Assessment (Cheng, 2013), product specs, ergonomics/ease of use, universal accessibility, and the Tap Water Declaration Committee's definition of tap water access.

- Identify which food service locations are in need of water outlets.

- To determine the most appropriate fountain infrastructure that best suits the needs of the campus population and develop an upgrade strategy for water fountains at UBC. This may include potentially grandfathering or replacing existing fountains on campus.

- To suggest potential outdoor drinking fountains that the campus could consider for outdoor recreational areas and public spaces on the main campus. Potential locations will also be provided.

1. Review of UBC's Guidelines

All buildings on campus must adhere to the British Columbia Building Code, but it doesn't have any specifications regarding water fountains and their locations within buildings. The Technical Services Department within UBC's Building Operations is responsible for the following Technical Guidelines and applying them to new construction, building renewals and renovations. The UBC Technical Guidelines were first written in 2002. They have been revised since then and will continue to be altered as needed. These Technical Guidelines are strongly encouraged by the Technical Services Department, but it is not mandatory that they be followed (Cheng, 2013). The most current version stipulates that:

8. Drinking water Fountains and Stations.

1. All buildings over 600 gross square metres shall have at least one accessible drinking water fountain, located in a public area. The drinking fountain should include an appropriate fixture for filling water bottles. An example of this might be the Elkay Drinking Fountain and Bottle Filling Station: http://www.elkayusa.com/cps/rde/xchg/elkay/hs.xsl/elkay-com-101698.aspx
2. All new buildings shall have drinking water fountains installed on the shortest dead leg possible off of a line that is flowing regularly. This line would preferably be serving a washroom.
3. The drinking water fountain shall NOT be cooled.
4. Drinking water fountains shall NOT have filters and hence no backflow preventers will be required.
5. Drinking water fountains shall only be located inside buildings at level-1 entrance lobbies and should be visible from the exterior.
6. Filtered water drinking stations for office-type areas are acceptable provided that a UBC Plumbing Permit is obtained. An approved backflow prevention device must be installed as per Section 15401 Backflow / Cross Connection Control to prevent water from being drawn out of the filter system back into the water supply line. A regular filter maintenance program must also be in place as part of the service agreement with the filtration system vendor.
7. When retrofitting existing buildings, installation costs plus recurring filter changes are to be funded by the relevant Academic Department.

(UBC Technical Services Department, 2013)

Section 8.1 suggests that the larger buildings on campus should have at least one public drinking fountain. It emphasizes that the fountain should be capable of filling water bottles, which corresponds to the bottle filling capability section of the tap water access definition. As an example, UBC Building Operations has suggested installing the Elkay EZH_2O. A review of how well it meets the demands of the access definition can be found later on in the 'Review of UBC's water outlets' section.

Section 8.2 advises that drinking fountains in newer buildings are installed on the shortest dead leg possible off a pipe that is flowing regularly. This ensures that the water in the pipe gets

flushed regularly and allows fresh water to be supplied to the water fountain. Washrooms and kitchens are examples of where these locations would be found. This suggestion aligns with the section of the tap water definition that assures drinking water will be available in close proximity to every washroom on campus. The water outlet inventory and evaluation from April 2013 found that water fountains in older buildings typically had stale tasting water because they were located further away from pipes that flowed regularly.

Sections 8.3 and 8.4 minimize the amount of energy and resources that the water fountains consume as well as decrease the maintenance UBC Building Operations needs to perform on the fountains (personal communication with Greig Samodien, July 22nd, 2013).

Section 8.5 suggests that drinking fountains only be located inside buildings at level-1 entrance lobbies and should be visible from the exterior. The rationale behind this section may be to ensure that water fountains are located in public areas that are easy to find from main entrances of buildings. It is unclear on whether water fountains should only be located on main levels. The section could also suggest that water fountains only be located indoors, but this may be a question of sentence structure. The following modification could help clarify the section's intention.

> Indoor drinking water fountains shall only be located in public areas of building floors such as hallways and lobbies. Water fountains or appropriate signage should be visible from main entrances, stairways and elevators.

Sections 8.6 and 8.7 are geared towards campus departments that want cooled filtered water available in their buildings. This ensures that the departments are responsible for these extra features and helps manage the amount of maintenance costs UBC Building Operations must pay (personal communication with Greig Samodien, July 22nd, 2013).

In addition, under general guidelines for plumbing fixtures, the Technical Guidelines assert that:

2.1 General

.1 Architects and Mechanical Engineers must propose the fixture types very early in the design to enable them to be tested on campus.
.2 Hard-wired, 'No-touch' motion detector-activated plumbing fixtures and accessories are preferred for faucets, urinals, water closets and are to be considered for paper towel and soap dispensers.
.3 All fixtures and trim shall be CSA approved.
.4 Emergency showers and eye wash stations shall meet ANSI Z358.1 Standards Latest Edition.
.5 All plumbing fixtures and trim used in handicapped accessible locations shall comply with the British Columbia Building Code.

(UBC Technical Services Department, 2013)

While section 2.1.2 is geared toward washroom fixtures, having a 'No-touch' standard for water fountains or bottle filling units would be a good enhancement to maintain better access and hygiene, especially if water fountains are near washrooms.

UBC Building Operations also has custodial guidelines, which indicate how water fountains should be cleaned by custodial staff. The current guidelines are as follows:

PROCEDURE FOR CLEANING DRINKING FOUNTAINS

Wiping down the drinking fountain using a microfiber cloth and multi-purpose cleaner will not only clean the surface but will also prevent sickness.

DAILY BASIC PROCEDURE:
Spray down the drinking fountain with multi-purpose cleaner. Using a clean grey micro fibre* cloth, wipe down the drinking fountain including underneath. Do not spray on the drinking* faucet as this can go inside.

*Typo from original document
(Personal communication with Greig Samodien, Sept. 5th, 2013)

These cleaning guidelines are adequate for ensuring that water fountains are kept clean. However, these guidelines do not indicate how frequent custodial staff should clean the water fountains. It would be ideal to have all water fountains cleaned every day or every other day to assure users that they are clean. In addition, the Custodial Guidelines could highlight parts of the fountains that are extremely important to clean such as activation buttons, spigots and any other areas that may come into contact with water bottle rims.

Though the Technical Guidelines and Custodial Guidelines encompass how water fountains are installed in buildings and cleaned, they do not include any guidelines that cover outdoor water fountains, accessibility for handicapped people, space requirements, lighting requirements, water pressure, and drainage. If each water outlet on campus is to be universally accessible and water outlets are to be available in high-density outdoor areas, there ought to be standards to ensure they are installed appropriately. How the water outlets are maintained to meet the needs of the campus population is equally important. Cleanliness, lighting, space availability and proper drainage were issues that were identified in Cheng's (2013) project. The following guidelines could be added to clarify these components.

- Space surrounding the water outlet must be kept clear of objects to maintain maximum accessibility.
- Proper lighting shall be available near the water outlet to keep drinking area visible.
- Drinking water fountains shall drain to keep the drinking areas clear of stagnant water
- Water fountain spigots or spouts shall provide a water flow of at least 10 cm high

Possible guidelines that UBC could follow regarding universal accessibility and outdoor water fountains will be further discussed in the next section of this report: Review of municipal and campus standards.

2. Review of municipal and campus standards

One component of the Cheng's (2013) project was a literature review of best practices in bottled water bans from the University of Winnipeg, Queens University, the University of Toronto and Ryerson University. The University of Toronto, Queens University and York University also demonstrate effective communication and promotion tools to encourage their students to drink from water fountains. Likewise, UBC can learn from how other institutions and municipalities provide drinking water, and incorporate their best practices into campus plans. Simon Fraser University and the University of Victoria were contacted by email to learn what drinking water standards they follow on their campuses.

Simon Fraser University

Simon Fraser University (SFU) started updating their water outlets a few years ago when a Waterfillz vendor approached the campus staff asking them to try out their product. They installed a pilot machine in a high traffic concourse adjacent to other vending machines. The free water was promoted through a short public campaign and became popular with the students. Though the Waterfillz machine was a highly successful alternative to bottled water, facilities staff did not believe these machines were the optimal method to provide the campus with drinking water. They found the machines very bulky and they took up too much floor space. The machines also required a service contract with the vendor to keep replacing filters. They required new plumbing and new drainage lines as well as a power supply. The facilities staff kept looking for a more favorable solution and decided to try the Elkay EZH_2O water fountain to assess its performance. SFU has been installing the Elkay EZH_2O water fountains in their newer buildings since 2008. Due to a strong preference by users, all these fountains provide refrigerated water. They do not use filters because British Columbia's water quality is excellent. Using filters would have created unnecessary maintenance and waste. Although bottled water is still sold on campus, students are aware of these refilling stations and can choose to use them (personal communication with Wendy Lee from SFU Facilities Services, Aug. 9th, 2013).

At the same time, the campus had also developed an inventory of all the water fountain locations and assessed their proximity to high traffic areas, student study locations and power connections. The inventory gave the facilities staff the knowledge base needed to understand the scope and feasibility of developing a systematic program for replacing the water fountains. Since SFU Burnaby facilities operations staff are the certified water purveyors for the campus, regular water testing was also conducted throughout the inventory. The staff knew the campus water quality was optimal and did not see a need to dispense the same water through Waterfillz machines (personal communication with Wendy Lee, Aug. 9th 2013).

Facilities staff have developed an operations initiative to replace older water fountain models in existing buildings with the Elkay EZH_2O model. The goal of this program was to reduce the use of single-use bottled water by providing an attractive alternative that was free

and clean. Minor renovations adjacent to plumbing for water fountains include the replacement of older fountains with new fountains as part of the work. There are almost 200 indoor water fountains located in public corridors on SFU's Burnaby campus and only about 10-15% have been replaced. Replacing a few fountains per year has been a slow process, because fountain replacements are rarely high priority for SFU's facilities staff. However, the availability of funding helps keep the process moving forward. To ensure the replacement program continues its progress, the campus has budgeted for the program annually. It has been incorporated into the SFU operations actions to support the SFU sustainability plan (personal communication with Wendy Lee, Aug. 9th 2013).

Existing water fountains already provided infrastructure for water dispensing. The only new functional requirement was to add the refillable water bottle feature. A key drawback of replacing older water fountain types was often that they were not selected based on the highest traffic. Their locations would require going to them as destinations rather than being convenient stops. In contrast, an advantage of replacing in older locations was that they were already established in ongoing maintenance schedules and permanent.
These considerations were critical to the durability and sustainability of the initiative. Determining that this was the right solution for the campus however required the staff to make conscious trade offs. Initially, graphic posters with environmental messaging were used to promote the new EZH_2O fountains. Standard ID "flag" signs for water fountains have also been added into the way finding signage system and installed as the new water fountains get installed (personal communication with Wendy Lee, Aug. 9th 2013).

University of Victoria

To date, the University of Victoria (UVIC) has retrofitted 75 of its water fountains with pushback bottle fillers (Figure 2.1). UVIC's plumbers retrofitted the water fountains as time in their schedules allowed and each retrofit job took about 15 minutes. The campus has also added new fountains with bottle fillers in several food outlet locations to encourage the use of personal water bottles. Each fountain has a nearby sign that says "Water bottle refilling station" in bright blue letters, so that it is easily recognizable. The campus has stopped selling bottled water in some locations where there is easy and convenient access to water fountains. The Student Union building is 100% bottled water free, but it is yet to be investigated whether or not the campus has experienced an increase or decrease in the purchase of alternative bottled drinks (juices, pop, sports drinks, vitamin water, etc.) in response to the changes in bottled water availability (personal communication with Rita Fromholt from UVIC's Office of Campus Planning and Sustainability, Aug. 29th, 2013).

Figure 2.1 The most common water fountain model at UVIC

For outdoor events and stadium events, the campus uses a portable Waterfillz machine that has four bottle filling stations (Figure 2.2 and 2.3). This machine encourages the refilling of personal water bottles or travel mugs and has become very popular. The single machine was $12,000 and was subsidized by a corporate sponsor (Waste Management). Outdoor event planners are encouraged to book the machine to reduce the number of plastic water bottles that are used. The machine has wheels and is moved around campus as needed. It can only be moved on concrete or cement, and not on grass. Once it is delivered to an event venue, the connecting hose can be connected to any conventional water outlet like a garden hose. In the case that the machine is damaged at an event, the UVIC insurance would cover the repair costs (personal communication with Rita Fromholt, Aug. 29th, 2013).

Figure 2.2 and 2.3 The portable Waterfillz machine that UVIC uses at its outdoor events

The City of Vancouver

The City of Vancouver's engineering department is responsible for Greenway and street-side fountains. Greenways are scenic pedestrian and cyclist routes that connect important destinations throughout the city. They comprise of expanded parks, increased landscaping, public art and drinking fountains (City of Vancouver, 2013). Currently, two main types of water fountains are installed along the city's Greenways and in areas of high traffic. The first is a freeze resistant fountain that comes in two models: HAWS 3500FR and 3380FR. Freeze resistant fountains are preferred because they allow for year-round use and require less maintenance than traditional fountains, which need to be shut off during the colder winter months. The second type could either be the HAWS model 3500 or 3380 (Figures 2.4 and 2.5), and has a more traditional internal design. Both models allow for wheelchair access. The difference between the 3500 and the 3380 models is their appearance. Typically, the square pedestal 3500 model is installed on sidewalks and in plazas. The 3380 model is installed along greenways. Also, in locations near a dog park or walking path, Vancouver's engineering department may also consider installing a model 3500D, which has a dog bowl feature (personal communication with Megan Pate, EIT from Vancouver's Waterworks group, Aug. 19th, 2013).

Figure 2.4 (Left) HAWS drinking fountain model 3500
Figure 2.5 (Right) HAWS drinking fountain model 3380 (HAWS Corporation, 2012)

The traditional type of fountain is installed when an existing fountain location is being upgraded. Since existing servicing is compatible with these fountain models, upgrading is easier and more cost effective than altering the system for the freeze resistant models. A freeze resistant installation is generally more expensive than a traditional fountain installation, but the additional costs can be offset through lower maintenance fees over time. The main costs of

installing drinking fountains are the fountain, the water and drainage services, sidewalk repair, labour, and equipment. Please refer to Table 1 for the costs of each of the fountain models. The service costs vary significantly depending on the length of service needed. Connections to catch basins are preferred over storm lines to save on expenses. Another variable cost is sidewalk and street repair. If the services cross a boulevard, the cost will be significantly cheaper than having to repair a section of a street or sidewalk. Labour is divided between plumbers, street repair workers and workers who lay the services for the fountains. Other costs such as traffic control, overtime work, and equipment rentals could also be added, but most of the Vancouver engineering fountain installations cost about $20, 000 in total (personal communication with Megan Pate, Aug.19th, 2013).

Water fountain model	Cost
Haws 3500	$5000
Haws 3500FR	$5000+ $2000 (frost free valve)= $7000
Haws 3800	$3500
Haws 3800FR	$3500+$2000 (frost free valve)= $5500

Table 2.1 The costs of four water fountain models from HAWS

Vancouver's engineering department primarily determines water fountain locations based on high pedestrian or cyclist traffic and where access to water is limited or in high demand. Next, servicing with drainage and water connections are considered. Ideally, the fountain should be located close to a storm sewer and water main to minimize servicing costs. Water fountains are also located in visible areas as well as away from trees that will drop leaves and clog the fountain. Many of Vancouver's water fountains get vandalized and bird droppings do occur. Vancouver maintenance crews address these occurrences on a reaction basis (personal communication with Megan Pate, Aug.19th, 2013).

Universal Access in Winnipeg

In 2010, the City of Winnipeg revised its Accessibility Design Standards and the document was intended to apply to all newly constructed and renovated facilities. The design standards address a diverse range of user needs, including people with disabilities, and strive for the most accommodating and inclusive environments possible (City of Winnipeg, 2010). The full section on drinking fountains can be seen below (Figures 2.6 and 2.7). Important aspects to consider include the height of the water fountain, the operating mechanism, the location of the operating mechanism on the fountain, space availability around the fountain, the trajectory angle of the water, and the water flow height or pressure.

1.3.1 Drinking Fountains

RATIONALE

Planning for the design of drinking fountains should consider the limited height of children or persons using a wheelchair. In the same respect, there may be individuals who have difficulty bending who would require a higher fountain. The operating system should account for limited hand strength or dexterity. The placement of the fountain is also important. Fountains should be recessed to avoid protruding into the path of travel, especially if they are wall mounted above the height of *cane-detection*.

APPLICATION

Where only one drinking fountain is provided on a floor, it shall incorporate components that are *accessible* to individuals who use wheelchairs in accordance with this section, as well as components that are *accessible* to persons who have difficulty stooping or bending.

Where more than one drinking fountain or water cooler is provided on a floor, at least 50% shall comply with this section.

DESIGN REQUIREMENTS

Accessible drinking fountains shall

- be located on an *accessible route* complying with 1.1.3;
- have a spout located near the front of the unit between 760 mm (30 in.) and 900 mm (35 in.) above the floor or ground surface;
- have a spout that directs the water flow in a trajectory that is parallel or nearly parallel to the front of the unit;
- have a spout that provides a water flow at least 100 mm (4 in.) high; and
- be equipped with controls that are located on the front of the unit, or on both sides of the unit, easily operated from a wheelchair, using one hand, with a force of not more than 22 N (4.9 lb.), or be automatically operable.

Cantilevered drinking fountains shall

- have a *clear space* of at least 900 mm (35-1/2 in.) by 1500 mm (59 in.);
- have a knee *space* between the bottom of the apron and the floor or ground of at least 900 mm (35-1/2 in.) wide, 200 mm (7-7/8 in.) deep and 685 mm (27 in.) high;
- have a toe *space* not less than 900 mm (35-1/2 in.) wide, 230 mm (9 in.) deep, and 230 mm (9 in.) high; and
- be recessed or otherwise located out of the circulation route.

Cantilevered drinking fountains that project into an *accessible route* shall be identified by a *detectable warning* surface of at least 300 mm (11-3/4 in.) around the object, installed flush with the walkway surface.

Freestanding or built-in fountains not having a knee *space* shall have a *clear space* at least 1500 mm (59 in.) wide by 900 mm (35-1/2 in.) deep in front of the unit.

RELATED SECTIONS

1.1.1 Space and Reach Requirements
1.1.2 Protruding and Overhead Objects
1.1.3 Accessible Routes, Paths and Corridors
1.2.1 Texture, Finishes and Colour
2.1.1 Exterior Ground Surfaces
2.1.3 Streetscape
3.1.1 Interior Floor Surfaces

Figure 2.6 Water fountain design standards from the City of Winnipeg's Accessibility Design Standards (2010).

1.3.1 Drinking Fountains (continued)

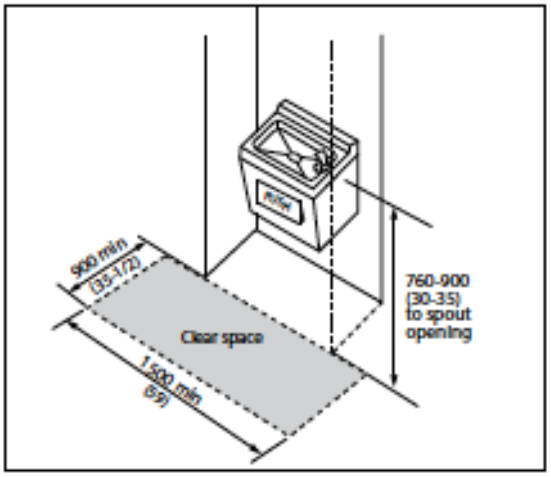


Figure 1.3.1.1 Parallel Approach to Drinking Fountain

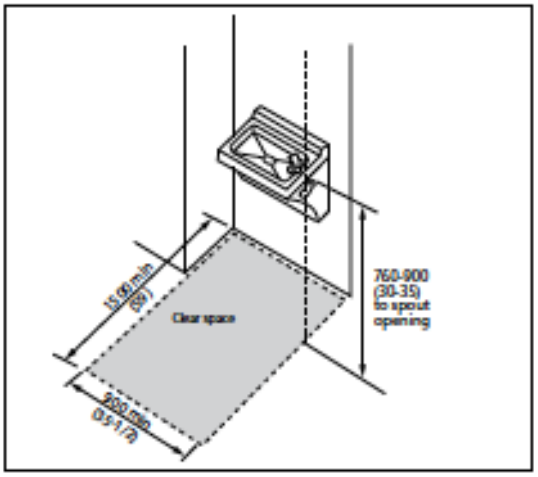


Figure 1.3.1.2 Frontal Approach to Drinking Fountain

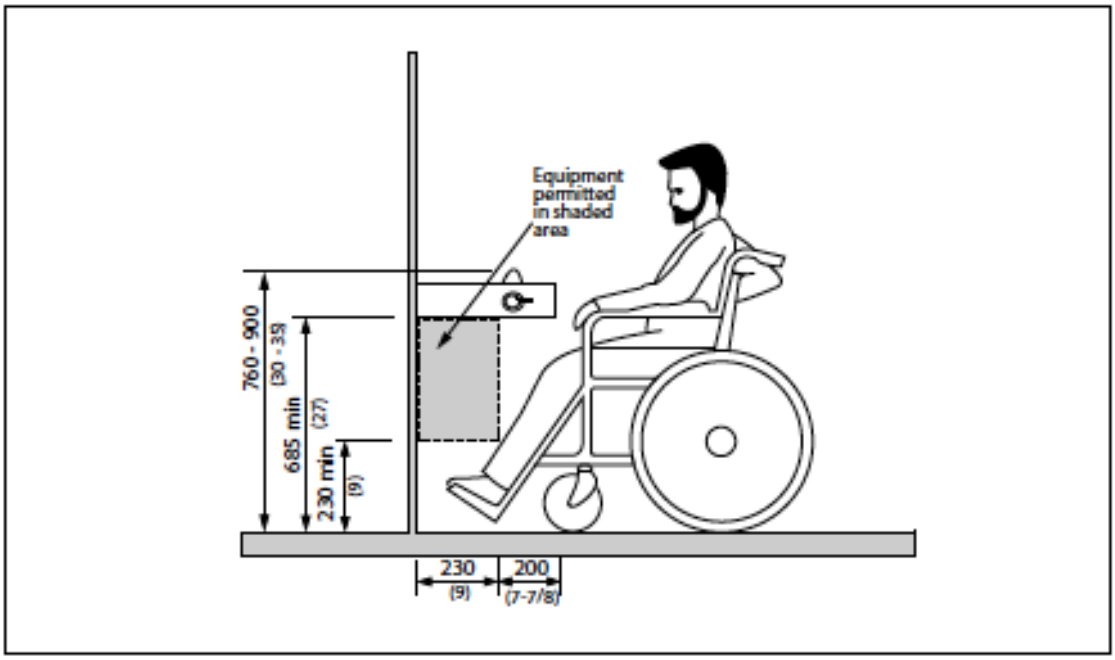


Figure 1.3.1.3 Clearances at Drinking Fountain

Figure 2.7 Water fountain design standards from the City of Winnipeg's Accessibility Design Standards (2010).

York University's Building Standards

York University's Building Standards contains a section dedicated to indoor public water fountains and indoor water bottle refill stations. Both types of outlets have their own product standards, which can be viewed in the document itself. The products approved by the building standards are the Elkay EZS8 stainless steel water fountain (Figure 2.8), HAWS HWUACP8 (Figure 2.9), HAWS Brita Hydration Station (Figure 2.10), Elkay Filtered EZH2O Surface Mounted LZWSSM hands free operation (Figure 2.11), Elkay Cooler Kit LZS8WSLK wall mounted filtered water fountains with incorporated wall mounted water bottle refill station (Figure 2.12) and the Halsey Taylor Universal Glass Filler Assembly Kit (Figure 2.13) (York University Building Standards, 2011).

Figure 2.8 (Left) Elkay EZS8 stainless steel water fountain (Elkay Manufacturing Company, 2013)
Figure 2.9 (Right) HAWS HWUACP8 (Haws Corporation, 2006)

Figure 2.10 (Left) HAWS Brita Hydration Station
Figure 2.11 (Right) Elkay Filtered EZH2O Surface Mounted LZWSSM hands free operation

Figure 2.12 (Left) Elkay Cooler Kit LZS8WSLK wall mounted filtered water fountains with incorporated wall mounted water bottle refill station
Figure 2.13 (Right) Halsey Taylor Universal Glass Filler Assembly Kit

York University Building Standards also have a section outlining how water fountains should be installed to maintain universal accessibility. They are as follows:

3.1 Installation requirements for water bottle refill stations and for public drinking water fountains:

.1 shall be installed in such a manner so as to provide a barrier-free access and shall be wall hung flush mounted, or can be

.2 barrier-free and freestanding

.3 Placement of drinking water fountains as well as water bottle refill stations must taken into consideration access for persons using mobility devices such as wheelchairs, walkers, scooter and canes

.4 The installation of drinking water fountains shall be such that the front and side controls for the operation of the fountain are located at a height that is not greater than 900- to - 1000 mm above the finished floor

.5 Controls shall be pressure plate operated requiring a maximum force of no more than 22.2N

.6 The installation of water bottle refill stations shall be such that the tray upon which a cup or a bottle rests for filling is located 900 - to -1000 mm above the finished floor

.7 Water bottle refill stations shall be equipped with York University standard signs denoting the type and use of installation to be placed flush mounted adjacent to the fixture and flag mounted above the fixture. Please refer to Interior Signage Standard Manual, Campus Services and Business Operations (CSBO)

.8 Public drinking public water fountains shall be equipped with York University standard signs denoting the type and use of installation to be placed flush mounted adjacent to the fixture and flag mounted above the fixture. Please refer to Interior Signage Standard Manual, CSBO

(York University Building Standards, 2011)

3. Review of UBC's water outlets

The following series of pages are structured to present an analysis of each type of water outlet found on campus. This review represents 174 water fountains and 9 bottle fillers found in 54 of the campus's main buildings. It excludes water outlets that were found in washrooms and commercial water coolers along with kitchenette sinks. Each type of outlet is evaluated according to the City of Winnipeg's Accessibility Design Standards, outlet ergonomics for drinking and bottle filling, wheelchair accessibility, and bottle filling capabilities. These criteria will determine how accessible the water outlets are and how well they are able to fill water bottles. A summary table is found on page 60.

Legend:
Embedded (EM)
Wall-hung (WH)
Freestanding (FS)
Porcelain (P)
Stainless steel (SS)
Bottle filler (BF)

Sixteen locations maintained by UBC Food Services were visited to determine which locations need water outlets installed. A summary table is found on page 62.

EM_P 1

Locations: D.H. Copp Building (6)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. It would be difficult to fill a water bottle because the hand required to hold the bottle would also need to be pushing the button. Filling a bottle requires individuals to cross arms or fill from the right side.

Accessibility: Similarly, to the bottle-filling complication, this water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access the fountain with the parallel approach or frontal approach. The spigot is near the front of the fountain and the water trajectory is parallel to the front of the unit.

Sample height of spigot: 102.5 cm
Angle of water trajectory: 0°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

Other details:
Proper flushing instructions would be helpful.

EM_P 2

Locations: Osborne Unit 1 (2)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the left side and requires both arms.

Accessibility: Similarly, to the bottle-filling complication, this water fountain would be difficult to activate with an injured, broken or amputated left arm. Wheelchairs can access with the parallel approach. Usage from a wheelchair will require twisting of the torso.

Sample height of spigot: 97 cm
Angle of water trajectory: 30°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. Filling longer bottles may be difficult.

EM_SS 1

Locations: Buchanan Tower (11)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Filling a bottle will be difficult because the hand required to hold the bottle would also need to be pushing the button. Filling a bottle requires individuals to cross arms.

Accessibility: Similarly, to the bottle-filling complication, this water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can only access with the parallel approach. Usage from a wheelchair will require twisting of the torso.

Sample height: 105.5 cm
Angle of water trajectory: 45°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

Other details:
Signage is needed from the first floor and elevator. Proper flushing instructions would be helpful.

EM_SS 2

Locations: Food, Nutrition and Health (2)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: Similarly, to the bottle-filling complication, this water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access with the parallel approach. Usage from a wheelchair will require twisting of the torso.

Sample height: 90 cm
Angle of water trajectory: 30°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. As this fountain is a smaller embedded fountain, the walls make it difficult to fill up larger bottles.

EM_SS 3

Locations: CK Choi Building (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: Similarly, to the bottle-filling complication, this water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access with the parallel approach. The corner location will make it difficult to use from a wheelchair and wheelchair users need to maneuver around a nearby wooden post. Usage from a wheelchair will require twisting of the torso.

Sample height: 100 cm
Angle of water trajectory: 40°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. The pressure was very poor during the Spring evaluation.

Other details:
Visible from entrance.

EM_SS 4

Locations: Longhouse (1), Walter C. Koerner Library (2), Brimacombe (4)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: Similarly, to the bottle filling complication, this water fountain would be difficult to activate with an injured, broken or amputated right arm. The button is more accessible to the left arm because it is at the front of the fountain. Wheelchairs can access with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access.

Sample heights: 88.5 cm (WCKL), 101 cm (BRIM)
Angle of water trajectory: 22°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

They are easy to find because of their proximity to the washrooms.

WH_P 1a-1d

WH_P 1a-1d (continued)

Locations: a. (Top left) BIOL North (3), GEOG (1), CEME 1005, 1052, 2065, 2208 (4)
b. (Top right) CEME 2027 (1)
c. (Lower left) COPP 3101/3108 (1)
d. (Lower right) Fairview Common block (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms. The activation mechanism is usually a knob that must be twisted, which may be difficult for people who have limited hand strength. Type b has a push button on the right side.

Accessibility: This water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access these fountains with the frontal approach or parallel approach depending on location.

Sample heights: 95 cm (BIOL), 101 cm (CEME), 88 cm (Fairview)
Angle of water trajectory: 45°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

WH_P 2

Locations: Chemistry B (3)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms. The activation mechanism is a knob that must be twisted, which may be difficult for people who have limited hand strength and mobility.

Accessibility: This water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access these fountains with the frontal approach.

Sample height: 83.5 cm
Angle of water trajectory: 45°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

Other details:
Proper flushing instructions would be helpful.

WH_P 3

Locations: MCLD 306 and 410 (2), and HEBB_9L (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. The activation mechanism is a knob that must be twisted, which may be difficult for people who have limited hand strength and mobility. Users may not like sticking their faces into this fountain. Bottle filling is only ergonomically viable when the bottle is held with the left hand and requires both arms.

Accessibility: Wheelchairs can access these fountains with the parallel approach and frontal approach. The knob is located at the front of the fountain and can be turned with either hand.

Sample height: 90 cm (HEBB)
Angle of water trajectory: 0°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. The highly enclosed structure of the fountain makes it difficult to fill larger bottles.

WH_P 4

Locations: Macleod_214 (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: This water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access this fountain with the parallel approach or frontal approach.

Sample height: 90.5 cm
Angle of water trajectory: 45°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

WH_P 5a and 5b

Locations: SUB_244 (1) and Thunderbird Residence Gym (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: This water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access this fountain with the parallel approach or frontal approach. The fountain in the SUB is located in a narrow side hallway. Wheelchair manoeuvring may be difficult.

Sample height: 103.5 cm (SUB)
Angle of water trajectory: 42°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. Filling larger bottles may be difficult.

WH_SS 1a-1c

WH_SS 1a-1c (continued)

Locations:
With goosenecks – Buchanan Classrooms (A, B) (3), Allard Hall (9), IRC_Main Lvl and Basement (2), SUB (5), War Memorial Gym_303 (1), Wesbrook (1), Woodward (4), Geography (1), Hebb (5), Hennings (2), LSK (1), Math (2), Math Annex (2), Scarfe Buildings (20), CEME 1214 (1), CHBE (4), MCLD 148, 254, 348, 448 (4), Doug Mitchell Thunderbird Sports Centre (1)

No gooseneck – WCKL (3), BIOL (1), HORT (1), WWW EDC_102 (1),
Thunderbird Stadium (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot and bottle filling at the gooseneck. Bottle filling can be done with the spigot and is ergonomically viable with activation from the front. Bottles can also be filled from either side with the gooseneck (depending on which side it has been installed). When the gooseneck is installed on the same side as the spigot, it provides more head space for spigot drinking.

Accessibility: This water fountain can be activated with both arms using the activation button at the front. Wheelchairs can access this fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample heights: Mostly compliant with the 76-90 cm standard
Angle of water trajectory: 20°

Bottle-filling capabilities: Most fountains have a gooseneck for bottle filling. Assuming the pressure at the spigot is adequate, it is also possible to fill bottles using it. When pressure is very good, the goosenecks fill water bottles faster than spigots.

Fountains without goosenecks could be enhanced with bottle-filling fixtures.

Other details:
This fountain type meets all current Federal Regulations for the disabled including those in the Americans with Disabilities Act.

The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A pushback mechanism would be easier to use.

WH_SS 2

Locations:
ESB (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot and bottle filling at the gooseneck. Bottle filling is ergonomically viable with activation from the front and bottle tilted to the right. This requires both arms. Bottles can also be filled with the gooseneck from the right side and requires both arms.

Accessibility: This water fountain can be activated with both arms using the activation button at the front. Wheelchairs can access this fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample height: 83.5 cm
Angle of water trajectory: 20°

Bottle-filling capabilities: This fountain has a gooseneck for bottle filling. Assuming the pressure at the spigot is adequate, it is also possible to fill bottles using it. When pressure is very good, the goosenecks fill water bottles faster than spigots.

Other details:
Visible from the back entrance.

This fountain type meets all current Federal Regulations for the disabled including those in the Americans with Disabilities Act.

The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

WH_SS 3

Locations:
Hugh Dempster Pavilion (1), ICICS_X2 (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is ergonomically viable with activation from the front and the bottle tilted to the right.

Accessibility: This water fountain can be activated with both arms using the activation button at the front. Wheelchairs can access this fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample heights: 88.5 cm (DMP),
85 cm (ICICS)
Angle of water trajectory: 14°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure at the spigot is adequate, bottle filling is possible. These fountains could be enhanced with bottle-filling fixtures. When pressure is very good at fountains with goosenecks, goosenecks fill water bottles faster than spigots.

Other details:
Signage would be helpful.

This fountain type meets all current Federal Regulations for the disabled including those in the Americans with Disabilities Act.

The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

WH_SS 4

Locations:
Brock Hall (3), Jack Bell School for Social Work (4)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is ergonomically viable with activation from the front and the bottle tilted to the left. Filling larger bottles may be difficult; installing a bottle-filling fixture would be helpful.

Accessibility: This water fountain can be activated with both hands using the activation button at the front. Wheelchairs can access this fountain with the parallel approach (depending on location) and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample height: 86 cm (SOWK)
Angle of water trajectory: 0°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure at the spigot is adequate, bottle filling is possible. All water fountains in Brock Hall had very poor pressure and water fountains in Jack Bell either had good pressure or very good pressure. These fountains could be enhanced with bottle-filling fixtures.

Other details:
The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

WH_SS 5

Locations:
Chan Centre (3)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is ergonomically viable with activation from the front and the bottle tilted to the left.

Accessibility: This water fountain can be activated with both hands using the activation button at the front. Wheelchairs can this fountain access with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample height: 85 cm
Angle of water trajectory: 30°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure at the spigot is adequate, bottle filling is possible.

WH_SS 6

Locations: Osborne Unit 2 (2)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Filling a bottle will be difficult because the hand required to hold the bottle would also need to be pushing the button. Filling a bottle requires individuals to cross arms.

Accessibility: This water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access this fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample height: 92.5 cm
Angle of water trajectory: 45°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible.

WH_SS 7a-7c

WH_SS 7a-7c (continued)

Locations:
SRC (4), Ritsumeikan (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is ergonomically viable with activation from the front and the bottle tilted to the left.

Accessibility: This water fountain can be activated with both arms using the activation bar at the front. WH_SS 7c requires activation from the left side. Wheelchairs can access this fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample height: 90 cm (SRC)
Angle of water trajectory: 15°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure at the spigot is adequate, bottle filling is possible.

WH_SS 8

Locations: IRC (2)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: This water fountain would be difficult to activate with an injured, broken or amputated right arm. Wheelchairs can access this with the parallel approach and frontal approach. Spigot is near the front of the fountain and the water trajectory is parallel to the front of the fountain.

Sample height: 99 cm
Angle of water trajectory: 0°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. The pressure was very poor during the Drinking Water Outlet Assessment (2013).

Other details:
In office space, not likely to be used by students

WH_SS 9

Locations: Irving K. Barber Library (7)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot. Bottle filling is only ergonomically viable with activation on the right side and requires both arms.

Accessibility: This water fountain can be activated from both sides and from the front. Wheelchairs can access with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring. Spigot is near the front of the fountain and the water trajectory is near parallel.

Sample height: 89.5 cm
Angle of water trajectory: 12°

Bottle-filling capabilities: This fountain does not have a specific fixture for bottle filling. Assuming the pressure is adequate, it is possible. Although the pressure was good or very good during the Spring evaluation, it was difficult to completely fill taller bottles. This type of fountain could be retrofitted with bottle fillers.

Other details:
They are easy to find because of their proximity to the washrooms.

WH_SS 10 (ElkayEZH2O)

Locations: Pharmaceutical Research Building (1), Henry Angus (3)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot and for bottle filling. The motion sensor allows for one-handed filling and minimal contact.

Accessibility: This water fountain can be activated using the large activation button at the front and is accessible from both sides. Wheelchairs can access the fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Sample heights: 84 cm (ANGU),
89 cm (PHARM)
Angle of water trajectory: 7°

Bottle-filling capabilities: This fountain has a bottle filler with an electric motion sensor for touchless activation (20-second auto shut-off timer). Assuming the pressure is adequate at the spigot, it would also be possible to fill a bottle using the spigot as well (from the left side).

Other details:
Automated bottle filling
Green Ticker counts how many plastic bottles are saved from waste.
American Disabilities Act Compliant
Green Spec Listed

WH_SS 10b

Location: Old Barn Community Centre (1)

Ergonomics/Ease of use: The fountain is designed for drinking from the spigot and for bottle filling.

Accessibility: This water fountain can be activated using the large activation button at the front and is accessible from both sides. Wheelchairs can access the fountain with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring.

Height: Shorter to accommodate children
Angle of water trajectory: 7°

Bottle-filling capabilities: This fountain has a gooseneck for bottle filling. Assuming the pressure at the spigot is adequate, it is also possible to fill bottles using it. When pressure is very good, the goosenecks fill water bottles faster than spigots. Assuming the pressure is adequate at the spigot, it would also be possible to fill a bottle using the spigot as well.

Other details:
American Disabilities Act Compliant

The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

2WH_SS 1

Locations:
Continuing Studies (2)

Ergonomics/Ease of use: These fountains are designed for drinking from the spigot. Bottle filling can be done with the spigot and is ergonomically viable with activation from the front.

Accessibility: These water fountains can be activated with both hands using the activation buttons at the front. Wheelchairs can access these fountains with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountains for wheelchair manoeuvring. This water fountain pair offers two heights for wheelchair access and individuals who have difficulty bending.

Sample heights: 87 cm and 101 cm
Angle of water trajectory: 20°, 20°

Bottle-filling capabilities: Assuming the pressure at the spigots is adequate, it is also possible to fill bottles using it. When pressure is very good, the goosenecks fill water bottles faster than spigots. Neither of these fountains has a specific fixture for bottle filling and could be enhanced with one.

*There is a bottle-filling cooler right next to it.

Other details:
This fountain type meets all current Federal Regulations for the disabled including those in the Americans with Disabilities Act.

The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

2WH_SS 2

Location:
David Lam (1)

Ergonomics/Ease of use: Both fountains are designed for drinking from the spigot and one has a gooseneck for bottle filling. Bottle filling can be done with the spigot and is ergonomically viable with activation from the front. Bottles can be filled from the left side with the gooseneck and requires two hands.

Accessibility: These water fountains can be activated with both hands using the activation buttons at the front. Wheelchairs can access these fountains with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountains for wheelchair manoeuvring. This water fountain pair offers two heights for wheelchair access and individuals who have difficulty bending.

Heights: 87 cm and 100.5 cm
Angle of water trajectory: 0°, 20°

Bottle-filling capabilities: One of the fountains has a gooseneck for bottle filling. Assuming the pressure at the spigots is adequate, it is also possible to fill bottles using them. When pressure is very good, the goosenecks fill water bottles faster than spigots.

2WH_SS 2 (continued)

Other details:
This fountain type meets all current Federal Regulations for the disabled including those in the Americans with Disabilities Act.

The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

2WH_SS 3

Locations:
Life Sciences Centre (4)

Ergonomics/Ease of use:
These fountains are designed for drinking from the spigot and bottle filling. Bottle filling can be done with the spigot and is ergonomically viable with activation from the front.

Accessibility: These water fountains can be activated with both hands using the activation bars at the front. Wheelchairs can access these fountains with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountain for wheelchair manoeuvring. This water fountain pair offers two heights for wheelchair access and individuals who have difficulty bending.

Sample heights: 101 cm and 85 cm
Angle of water trajectory: 15°

Bottle-filling capabilities: Two locations have goosenecks for bottle filling. Assuming the pressure at the spigots is adequate, it is also possible to fill bottles using them. When pressure is very good, the goosenecks fill water bottles faster than spigots. There are two locations where neither of the fountains have a specific fixture for bottle filling and could be enhanced with one.

Other details:
The goosenecks can be broken off the fountains. Perhaps a more durable bottle filler would be better. The mechanism also requires both hands. A push back mechanism would be easier.

2WH_SS 4

Location:
Tennis Centre (1)

Ergonomics/Ease of use: These fountains are designed for drinking from the spigot. Bottle filling can be done with the spigot and is ergonomically viable with activation from the front.

Accessibility: These water fountains can be activated with both hands using the activation button at the front. Wheelchairs can access these fountains with the parallel approach and frontal approach. There is adequate space underneath for wheelchair access and plenty of space around the fountains for wheelchair manoeuvring. This water fountain pair offers two heights for wheelchair access and individuals who have difficulty bending.

Sample heights: 94.5 cm and 81 cm
Angle of water trajectory: 22°, 22°

Bottle-filling capabilities: Assuming the pressure at the spigots is adequate, it is also possible to fill bottles using it. Neither of these fountains have a specific fixture for bottle filling. Installing a fountain with bottle-filling capabilities would be ideal as this is found at a recreational facility.

Other details:
This fountain type meets all current Federal Regulations for the disabled including those in the Americans with Disabilities Act.

BF 1

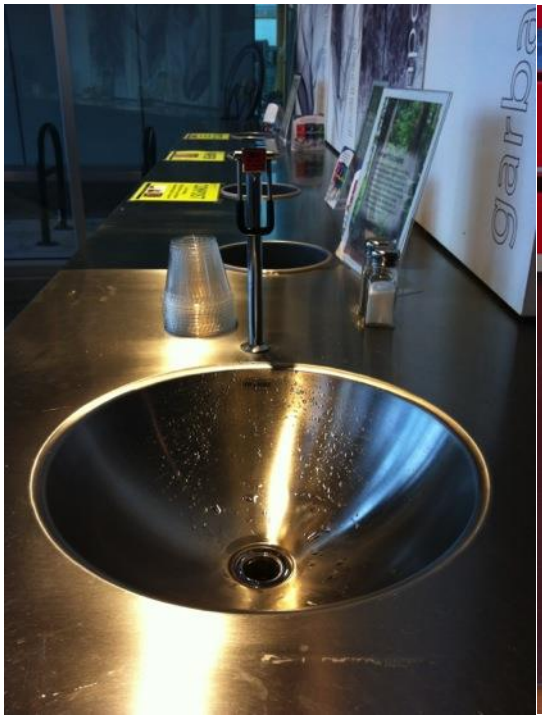
Location:
Stir it Up Café (1)

Ergonomics/Ease of use: This water outlet is designed for bottle filling and is ergonomically viable with both hands.

Accessibility: This bottle filler can be activated with both hands using the activation lever. Wheelchairs can access this counter unit with the parallel approach. There is adequate space around the outlet for wheelchair manoeuvring.

Height of counter: 91.5 cm
Distance from counter edge: 28.5

BF 2a and 2b




Location:
2a. The Loop Café (1)
2b. Magma Café (1)

Ergonomics/Ease of use: This water outlet is designed for bottle filling and is ergonomically viable with both hands.

Accessibility: These water outlets can be activated with both arms using the activation lever. Wheelchairs can access with the parallel approach. There is adequate space around the outlet for wheelchair manoeuvring.

Height of counter:
2a. 1 m 10.5 cm (This outlet would be difficult for individuals in wheelchairs to use)
2b. 94.5 cm

Distance from counter edge:
2a. 53 cm
2b. 49.5 cm

Other details:
Sink allows for users to wash out their bottles and cups

BF 3

Location:
Walter Gage Residence (1)

Ergonomics/Ease of use: This water outlet is designed for bottle filling and is ergonomically viable with both hands.

Accessibility: This water outlet is activated with a motion sensor. Wheelchairs can access with the parallel approach or the frontal approach. There is adequate space around the outlet for wheelchair manoeuvring.

Height of sensor: 1 m 22.5 cm

Other details:
Meets the American with Disabilities Act's standards when mounted at the correct height (121.7 cm).

FS_1 (Waterfillz)

Location:
Swing (1), Macmillan (1), Kaiser Building (1), SUB (2),

Ergonomics/Ease of use: This water outlet is designed for bottle filling and is ergonomically viable with both arms.

Accessibility: This water outlet is activated with a button. The button may be too high for individuals in wheelchairs. Wheelchairs can access this outlet with the parallel or the frontal approach and there is adequate space around the outlet for wheelchair maneuvering.

Height of shelf: 1 m 11 cm
Height of button: 1 m 43 cm

Other details:
Counts how many bottles have been saved

Summary Tables and Graphs:

		At UBC...			Wheelchair access		Mechanism					
Water Outlet Type	**Description**	**Height 76-90 cm**	**Angle of trajectory**	**2 heights available**	**Parallel approach**	**Frontal approach**	**Both sides/front**	**Auto bottle fill**	**Pushback**	**Gooseneck**	**Can add bottle filler**	**Ergonomic bottle filling**
EM_P 1	COPP	✗	0	✗	✓	✓	✗	✗	✗	✗	✗	✗
EM_P 2	Osborne Unit 1	✗	30	✗	✓	✗	✗	✗	✗	✗	✗	✓
EM_SS 1	BUTO	✗	45	✗	✓	✗	✗	✗	✗	✗	✗	✗
EM_SS 2	FNH	✓	30	✗	✓	✗	✗	✗	✗	✗	✗	✓
EM_SS 3	CK Choi	✗	40	✗	✓	✗	✗	✗	✗	✗	✗	✓
EM_SS 4	LONG, WCKL, BRIM	✓/✗	22	✗	✓	✓	✗	✗	✗	✗	✗	✓
WH_P 1a-1d	BIOL, CEME, GEOG	✗	45	✗	✓	✓	✗	✗	✗	✗	✗	✓
WH_P 2	CHEM	✓	45	✗	✗	✓	✗	✗	✗	✗	✗	✗
WH_P 3	MCLD, HEBB	✓	0	✗	✓	✓	✓	✗	✗	✗	✗	✓
WH_P 4	MCLD	✓	45	✗	✓	✓	✗	✗	✗	✗	✗	✓
WH_P 5a-5b	SUB 224, Thunderbird	✗	42	✗	✓	✓	✗	✗	✗	✗	✗	✓
WH_SS 1a-1c	Everywhere/Common	Mostly	20	✗	✓	✓	✓	O	O	✓	✓	✓
WH_SS 2	ESB	✓	20	✗	✓	✓	✓	O	O	✓	✓	✓
WH_SS 3	DMP, ICICS	✓	14	✗	✓	✓	✓	✗	✗	✗	✓	✓
WH_SS 4	BROCK, SOWK	✓	0	✗	✓	✓	✓	✗	✗	✗	✓	✓
WH_SS 5	CHAN	✓	30	✗	✓	✓	✓	✗	✗	✗	✗	✓
WH_SS 6	Osborne Unit 2	✗	45	✗	✓	✓	✗	✗	✗	✗	✗	✗
WH_SS 7a-7c	Ritsumeikan, SRC	✓	15	✗	✓	✓	✓	✗	✗	✗	✗	✓
WH_SS 8	IRC 4/5	✗	0	✗	✓	✓	✗	✗	✗	✗	✓	✓
WH_SS 9	Irving	✓	12	✗	✓	✓	✓	✗	✗	✗	✓	✓
WH_SS 10 (EZH2O)	ANGU, PHARM	✓	7	✗	✓	✓	✓	✓	O	O	O	✓
WH_SS 10b	Old Barn Community	✓	7	✗	✓	✓	✓	O	O	✓	✓	✓
2 WH_SS 1	CONT_ST	✓	20, 20	✓	✓	✓	✓	✗	✗	✗	✓	✓
2 WH_SS 2	DLAM	✓	0, 20	✓	✓	✓	✓	O	O	✓	✓	✓
2 WH_SS 3	LSC	✓	15, 15	✓	✓	✓	✓	O	O	✓	✓	✓
2 WH_SS 4	Tennis Centre	✓	22, 22	✓	✓	✓	✓	✗	✗	✗	✗	✓
BF 1	Stir it Up	N/A	N/A	✗	✓	✗	✓	O	✓	O	N/A	✓
BF 2a-2b	Loop/Magma	N/A	N/A	✗	✓	✗	✓	O	✓	O	N/A	✓
BF 3	Gage	N/A	N/A	✗	✓	✓	✓	✓	O	O	N/A	✓
FS_Waterfillz	Various locations	N/A	N/A	✗	✓	✗	✓	O	O	O	N/A	✓

Table 3.1 This table summarizes the results from the review of UBC's water fountains

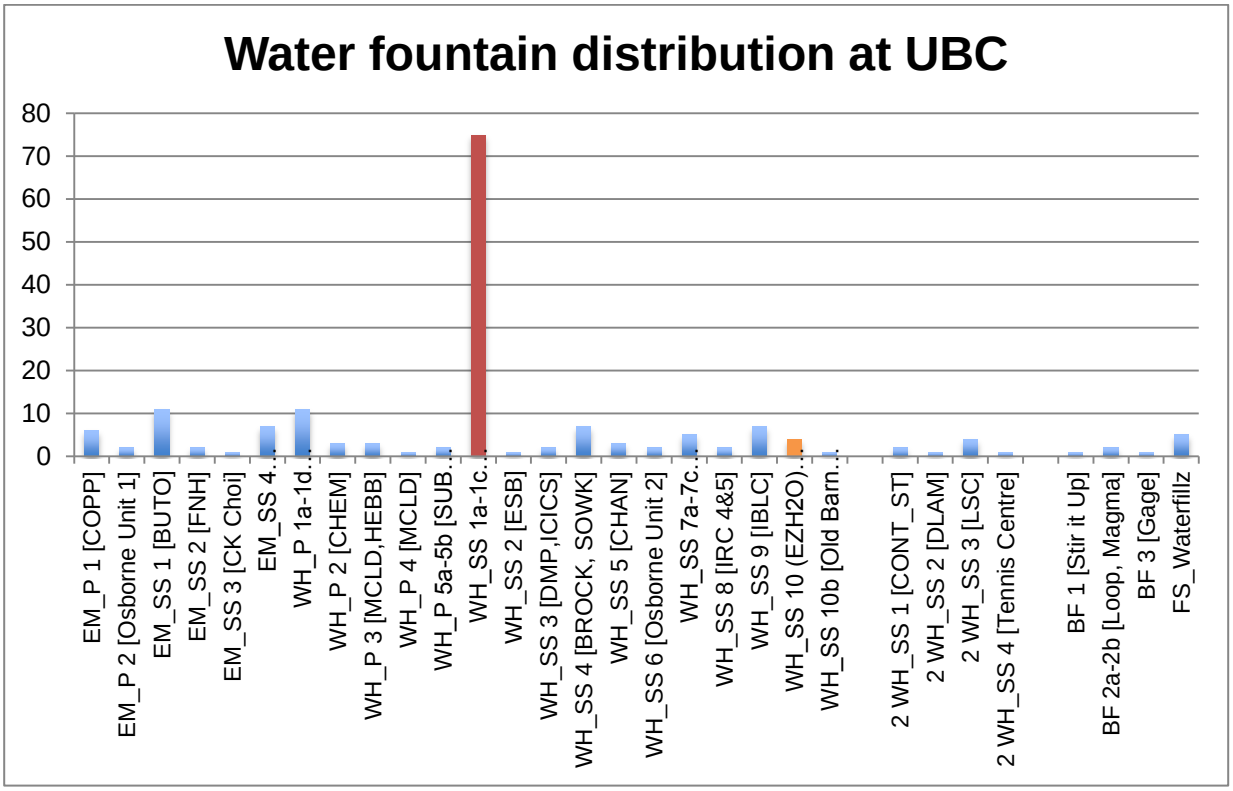


Figure 3.1 This graph shows the distribution of each type of water fountain on the UBC campus. The red bar represents the common Haws model and the orange bar represents the Elkay EZH2O model.

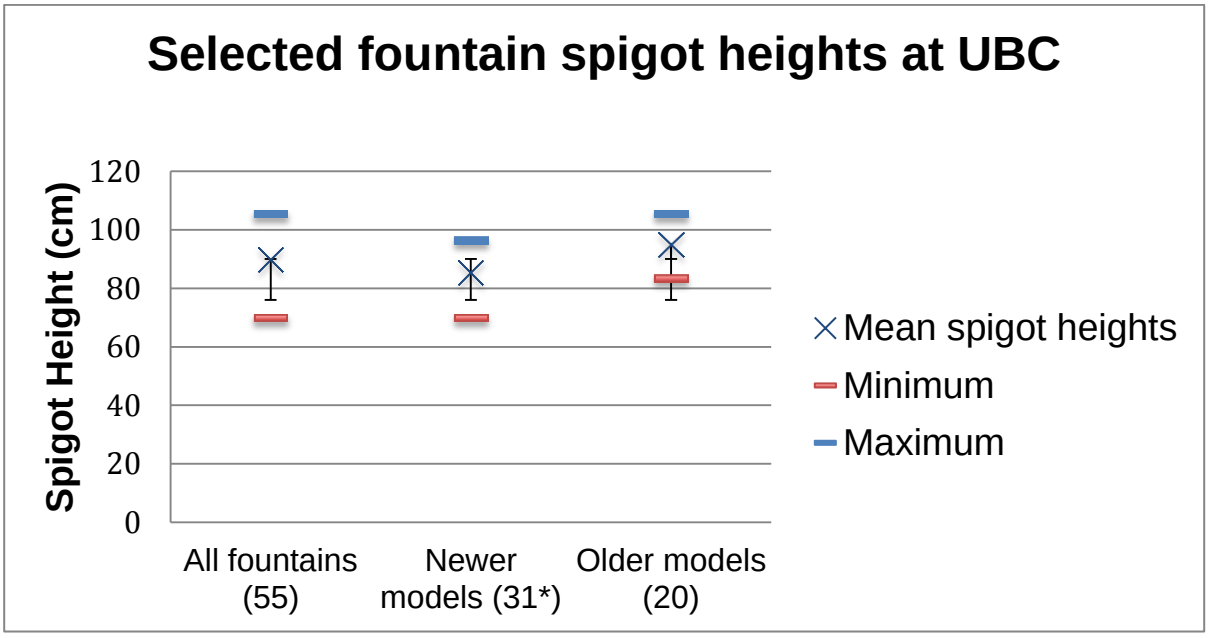


Figure 3.2 This graph shows how the sample heights from water fountains at UBC compare to the 76-90cm standard (error bars) from the City of Winnipeg's Accessibility Design Standards. The sample size is 55 water fountains from the overall 174 that were reviewed.
* Does not include higher fountains from double-fountain units (4)

Food Location	Yes/No	Height (cm)
Pacific Spirit Place	No	
BAJA (Trek Express) DLAM	No	
Caffe Perugia	Yes	107
Ike's Café	No	
The Loop	Yes	110.5
Café MOA	No	
Daily Dose Café (PHARM)	No	
IRC Snack Bar	No	
Law Café	No	
Magma Café	Yes	94.5
Neville's Café	No	
Niche Café	No	
Pond Café	No	
Reboot Café	No	
Sauder Exchange Café	No	
Stir It Up	Yes	91.5

Table 3.2 This table summarizes where UBC Food Services has installed water outlets at their food service locations. 'Yes' indicates that the food service location has a water bottle refilling station. 'No' indicates that the venue does not have a water outlet.

Discussion:

In all cases, signage needs to be installed to help users find the water outlets from main entrances, main stairways and elevators. The majority of the water fountains at UBC comply with the recommended height range of 76-90 cm. The fountains that had limited accessibility had water trajectory angles closer to 45°, did not allow the frontal approach from wheelchairs, could only be activated from one side, had a twisting knob activation mechanism, and did not have a bottle filling fixture. These were typically characteristic of the older water fountain models found on campus. Newer more accessible models should eventually replace these water fountain types. Wall hung fountains are more accessible to wheelchairs than water fountains embedded into the wall.

The two water fountain types that satisfy most of the criteria are the WH_SS 1-2 (Haws) accompanied by bottle fillers and the WH_M 2 (EZH_2O). The Haws model is the most common fountain type on campus and often has a gooseneck bottle filler. UBC Building Operations has indicated that the fountains and the gooseneck bottle fillers are sold separately. They need to drill holes into the fountains to install the fillers. The goosenecks can also be broken off the fountains. A more durable bottle filler would last longer. The mechanism requires both hands and makes it difficult to fill water bottles with one hand. A sturdier push back mechanism would be a suitable solution both problems and would be more hygienic. The EZH_2O model has recently been added to the UBC Technical Guidelines as the suggested water fountain model.

This is an excellent choice because it offers maximum accessibility, an automated bottle filling mechanism, and a Green Ticker that counts how many plastic bottles are saved from waste. The automated bottle filling mechanism minimizes contact with the fountain itself and improves hygiene. The Green Ticker helps users conceptualize how they're helping to minimize plastic waste and keep the environment clean. Building Operations has also indicated that this water fountain is easier to maintain because there are no extra parts to add and its components are not easily broken.

Out of the sixteen food service locations visited (Table 3.2), three (the Loop, Magma and Stir it Up) had push-back water dispensers and one had a mini kitchenette sink (Caffe Perugia). The two newest outlets (the Loop and Magma) have their outlets situated away from the service area to allow maximum accessibility during busy hours. The counter units at the Loop, Magma and Caffe Perugia exceed the 76-90cm standard for wheelchair accessible water fountains and require individuals to reach in to fill their bottles. As wheelchairs limit the ability to reach up and forward, these water dispensers may be difficult for handicapped people to use. All three of the previously mentioned outlets would allow for the parallel approach, since the frontal approach is probably not favourable. The mini kitchenette sink located in Caffe Perugia is 107 cm from the ground in the corner of a corner counter unit, which further decreases wheelchair accessibility. More research should be done on what type of water dispenser would be most accessible for people on campus.

4. Water provision at UBC's high-density outdoor areas

Though water fountains are commonly found in UBC's main academic buildings, outdoor water fountains are very rarely seen on campus. The HAWS 3380 and the galvanized 3380G are currently recommended in UBC's design guidelines for its Vancouver campus. These fountains are low maintenance, designed for wheelchair accessibility and tolerant of heavy use (UBC Campus and Community Planning, 2010). One of these fountains has been installed near the baseball diamond situated along Wesbrook Mall on UBC's South Campus. Part 3 of UBC's design guidelines for Vancouver's campus indicates that outdoor mixed-use hubs should aim to include a public drinking fountain in its design (UBC Campus and Community Planning, 2010). Since the tap water access definition indicates that drinking water will be accessible at UBC's high-density outdoor areas and the campus is continually improving its public spaces, there is potential to install outdoor water outlets where they are needed.

The more evident outdoor areas that need access to drinking water are UBC's recreational fields. UBC Athletics and Recreation currently operates nine fields, Thunderbird Stadium, a baseball field and an oval for track and field. There are currently no designated water bottle filling stations at any of these recreational areas. To date, athletes have been filling bottles with hose bibbs and washroom sinks or bringing bottled water. It would be ideal to have at least one bottle filling station at every field or one at every team area, and water fountains wherever needed. The priority is installing fixtures that can fill personal bottles and large Gatorade jugs.

There are two main types of outdoor water outlets UBC Athletics and Recreation could consider installing in their recreational areas. The first are pedestal or hydrant outlets. Examples of pedestal outlets are model 125SM or 125SMSS from the Most Dependable Fountains INC., and the Stern-Williams model 7200-32 (Figures 4.1 and 4.2). They would be geared towards athletes who need to fill water bottles and large Gatorade jugs. There are multiple hose bibb or faucet options available. A traditional hose bibb shape may be more ideal because sprinklers can often be connected to them during children's summer sports programs.

Figure 4.1 (Left) Most Dependable Fountains, INC. Model 125SM/125SMSS (Hose bibb option) (Most Dependable Fountains, INC., 2014)

Figure 4.2 (Right) Stern-Williams Model 7200-32 (multiple barrier-free fountain hose bibb options as well) (Stern-Williams, 2000)

The second type of water outlets is drinking fountains meant for drinking from the spigot. These would be suitable for a quick drink or a slower bottle refill. Examples of outdoor water fountains are the HAWS models 3500 and 3380, the Elkay Outdoor Tubular Steel FTN Models LK4410 and LK4420 (Figures 4.3 and 4.4), and the Stern-Williams all-purpose pedestal fountains. These outlets would be useful for people who are walking around the recreational fields or watching sports events.

Figure 4.3 (Left) Elkay Outdoor Tubular Steel FTN Model LK4410
Figure 4.4 (Right) Elkay Outdoor Tubular Steel FTN Model LK4420 (Elkay Manufacturing Company, 2013)

The following schematic shows where athletes and spectators most likely gather at Thunderbird Park, along with the types of water outlets that would be suitable to meet the needs of these two groups of people. This map refers to the park's current layout and is subject to change as financing and water connections are considered. Thunderbird Park will also undergo some reconfigurations within the next two years and locations should be checked against updated plans.

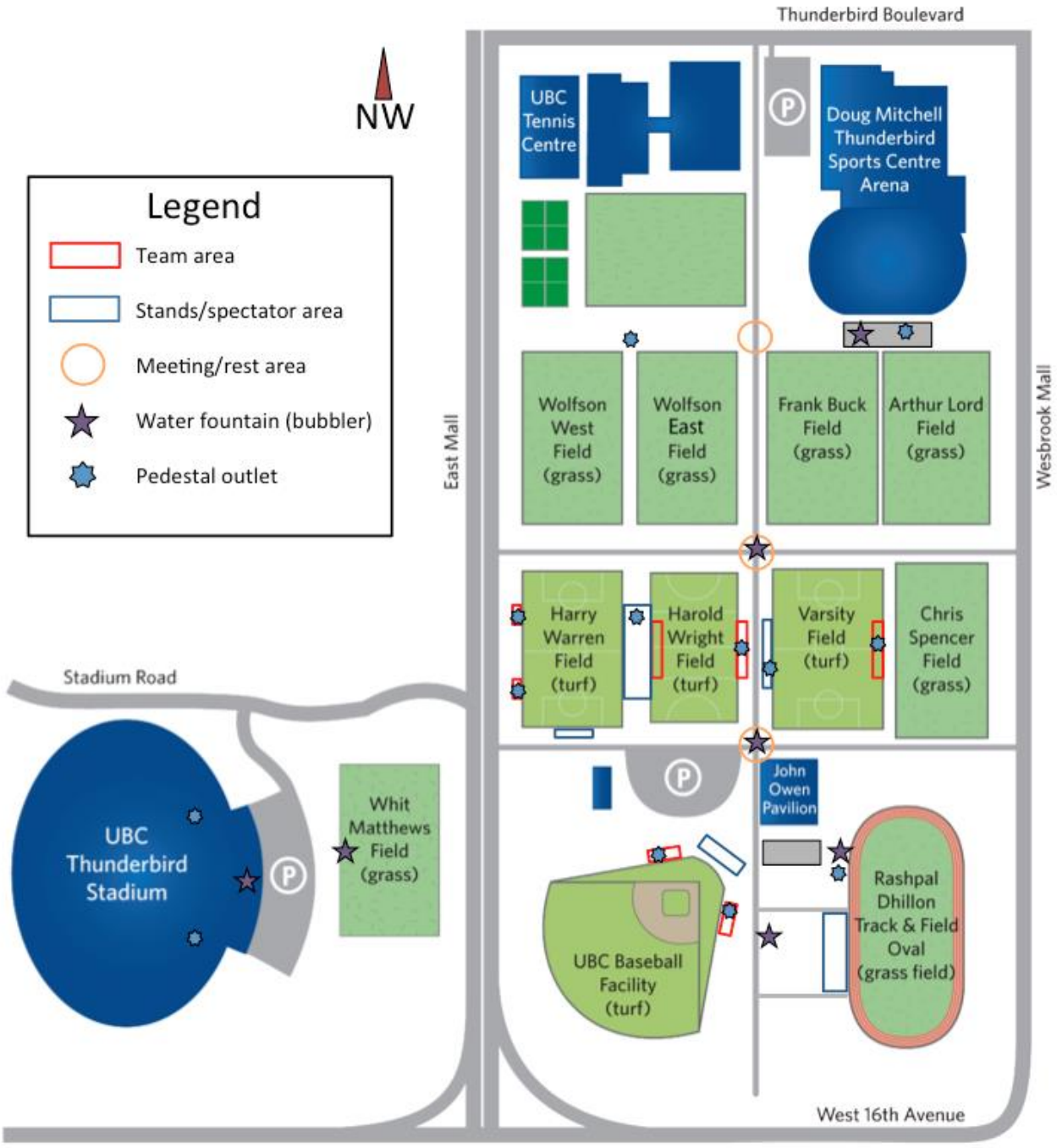


Figure 4.5 Map of proposed water outlet locations at UBC Thunderbird Stadium and Thunderbird Park

A less prominent group of outdoor areas that could use access to drinking water are outdoor public spaces on UBC's main campus. These locations range from recreational areas to public spaces that are not directly adjacent to buildings with water fountains.

The following locations at UBC may need outdoor water outlets.

- **Public space outside Buchanan C/D/E**

  Rationale: Aside from a commercial water cooler in the Meekison Arts Student Space, Buchanan D, there are no water fountains in these three sections of the Buchanan classrooms. Installing an outdoor water fountain in this outdoor space would make it convenient for people to fill water bottles on their way to class or when they spend time outside.

  Alternative solutions: Install a more permanent fixture in Meekison Arts Student Space. Fill bottle at Stir it Up in Buchanan A.

- **Public space on North side of Irving K. Barber Learning Centre**

  Rationale: Though there are water fountains in Irving, the closest one to this public space is on the other side of the building. Installing an outdoor water fountain in this outdoor space would make it convenient for people to fill water bottles on their way to class or when they spend time outside. This would be a good location to install a pilot outdoor fountain because a lot of traffic goes through this intersection.

- **The UBC Bus Loop and MacInnes Recreational Field**

  Rationale: This section of campus is quite busy because of the bus loop and recreational activities that occur on the field. Installing an outdoor water fountain somewhere in this general area would make it convenient for people to fill water bottles on their way to class, while leaving campus or when they use the field.

  Alternative solutions: Provide signage that leads the public to the Student Recreation Centre if they need water or washrooms. Open up the Student Recreation Centre doors adjacent to the current bus loop to allow access to fountains and washrooms.

  The UBC bus loop and MacInness Field are located in the Gage South area. This section of campus will undergo significant changes in the next few years to meet the needs of the community's growing population. The highlights of these upgrades include a new aquatic centre, a permanent diesel bus loop, and a bookable recreational field for students and other outdoor events. The bus loop will be relocated and the new aquatic centre will be built on the current MacInness Field site (UBC Campus and Community Planning, 2011). Please refer to Figure 3 in the Appendix for a map of the tentative plans for Gage South. To increase access to drinking water in the upgraded area, a water fountain could be installed in the new Aquatic Centre when it is built and an outdoor water fountain could be installed at the new MacInness Field. This location should be examined in the context of the updated construction plans for this area.

http://www.examiner.com/article/how-to-be-a-transit-all-star

- **The UBC Skatepark and adjacent basketball court**

  Rationale: This is a recreational area that is not directly adjacent to a building with water fountains.

http://www.publicaffairs.ubc.ca/2013/05/01/let-the-shredding-begin-north-americas-first-campus-skatepark-opens-at-ubc/

- **Grass oval South of the Forest Sciences Centre**

  Rationale: This is a recreational area that is not directly adjacent to a building with water fountains.

  Alternative solution: Install a water outlet outside of the Forest Sciences Centre

- **Memorial Road by the Music Building and Frederic Lasserre Building**

  Rationale: This public space is located next to the Frederic Lasserre Building and the Music Building. Neither of these building have permanent water outlets that satisfy the tap water access definition. Installing an outdoor water fountain in this outdoor space would make it convenient for people to fill water bottles on their way to class or when they spend time outside.

  Alternative solution: Install water fountains inside the Music Building and the Frederic Lasserre Building.

In addition to the previously mentioned fixed water outlets, the UBC could also consider purchasing a portable Waterfillz unit similar to the one UVIC uses for outdoor events. The campus could encourage outdoor event planners to book the machine to reduce the number of plastic water bottles that are used at their events.

Recommendations

In response to the research done throughout this project, the following actions are recommended to UBC Building Operations, UBC Student Housing and Hospitality Services, the Department of Athletics and Recreation, and Campus and Community Planning to increase free drinking water accessibility on UBC's Vancouver Campus.

UBC Building Operations

As the current Technical Guidelines do not include specific standards for how water fountains should be installed to allow maximum access, it is recommended that the department add similar guidelines as those offered by the City of Winnipeg's Accessibility Design Standards and York University Building Standards. Important aspects to consider include the height of the water fountain, the operating mechanism, the location of the operating mechanism on the fountain, space availability around the fountain, the trajectory angle of the water, and the water flow height or pressure. It is also worthy to note the accessibility ratio required on a respective building floor. If there is one fountain or outlet on a floor, it needs to be accessible to individuals who use wheelchairs. Where there is more than one outlet on a floor, at least 50% of them need to be universally accessible (City of Winnipeg, 2010).

In addition to the Technical Guideline suggestions made in the Review of UBC's Guidelines section, it would also be ideal for UBC Building Operations to develop a fountain upgrade plan like SFU's operations initiative to increase accessibility where there are currently older water fountain models. Priority should be given to buildings with higher amounts of student traffic and recreation but upgrades should systematically move their way throughout all campus buildings. The following list outlines which buildings require higher-priority upgrades:

- Chemistry Building – High student traffic
- Macleod Building – High student traffic
- Irving K. Barber Learning Centre (add EZH2O dispenser or gooseneck) – High student traffic
- Civil and Mechanical Engineering Building – High student traffic
- Biological Sciences – High student traffic
- War Memorial Gym – Recreational facility
- Student Recreation Centre – Recreational facility
- Doug Mitchell Thunderbird Sports Centre – Recreational facility
- Osborne Centre (Units 1 and 2) – Recreational facility
- UBC Tennis Centre – Recreational facility

(Tran et al., 2012)

For cases where Building Operations needs to retrofit water fountains with bottle fillers, the department may want to consider installing bottle fillers with push-back mechanisms to increase convenience and durability (similar to the ones UVIC uses).

Student Housing and Hospitality Services

Since bottled water is commonly bought at UBC Food Service locations, it is suggested that UBC Food Services install water outlets at food service locations that do not already have them along with appropriate signage. It would also be ideal to consider putting in other designs, because the current design is not the most accessible to individuals in wheelchairs. As mentioned in the discussion of the Review of UBC's water outlets section, wheelchairs limit the ability to reach up and forward, and consequently the current water dispenser design may be difficult for handicapped people to use. Modifications should consider height and depth of reach guidelines similar to those found in the BC Building Code for washroom installations (Figures 1 and 2 in the Appendix). Once water outlets have been installed at food service locations, it would also be ideal to decrease the availability of bottled water and bottled water advertisements at these sites to encourage students to fill their own bottles. Disposable cups could be available for people who do not have bottles, but a more reusable solution should be considered.

In addition, SHHS could also add water fountains to the ground levels of residence common blocks at Marine Drive, Vanier and Totem. There are no fountains available in these common student areas even though they are high-traffic locations. Currently, students either need to return to their residence rooms or go to nearby food service areas for a refill. Installing water fountains in these locations would increase the convenience of using reusable water bottles.

UBC Department of Athletics and Recreation

It is recommended that the UBC Department of Athletics and Recreation increase water provision for athletes and spectators at Thunderbird Park and Thunderbird Stadium considering the suggestions made in the Water provision at UBC's high-density outdoor areas section, specifically in Figure 4.5's schematic. Although this project has proposed possible outlets the Department of Athletics and Recreation could install, further research and discussion needs to be done to determine the optimal and most economic water outlets to use. Once specific numbers of each outlet type are determined, quotes provided by suppliers will help determine which outlets are most feasible for the campus's recreational fields. The next steps for this aspect of UBC water provision are:

- To establish a budget and request quotes for potential outlets
- Work out feasible water connections with UBC Building/ Plant Operations
- Adjust the map from Figure 4.5 according to water supply, budget and heavier field usage

- Have selected water outlets and locations approved by UBC Building Operations and Campus and Community Planning

To offer a more proximate source of water to the current bus loop and MacInnes Field, the Department of Athletics and Recreation could consider opening up the Student Recreation Centre's doors adjacent to the bus loop to provide accessibility to fountains and washrooms inside. Considering the upgrades that will be occurring in the Gage South area, designs for the new Aquatic Centre could consider installing a water fountain accessible from the bus loop. This would depend on which direction the main entrance would face. An outdoor water fountain could also be installed at the new MacInness Field once it is relocated.

Campus and Community Planning

The recommendation for Campus and Community Planning is to discuss the feasibility of outdoor water outlets on campus and consider the proposed outdoor water fountain locations on main campus and along paths that connect recreational fields specified in Section 4. Water provision at UBC's high-density outdoor areas. If the decision is to keep water outlets indoors, Campus and Community Planning should collaborate with building departments, Building Operations, and SHHS to discuss given alternatives and ensure that drinking water is accessible in all areas of the campus. Campus and Community Planning may also want to consider purchasing a portable Waterfillz station (similar to UVIC's) for large outdoor events.

Conclusion

UBC has been making significant strides towards its goal of expanding public access to drinking water and reducing the consumption of single-use water bottles. The creation of the Tap Water Declaration Committee ensures that the campus is committed to improving this aspect of its overall sustainability targets. This project provides the committee with guidelines to follow in making the campus's drinking outlets universally accessible and more suitable for UBC's community. The review of UBC's water outlets has indicated that the most common water fountain found on campus and the Elkay EZH2O water fountain meet universal accessibility guidelines as well as offer excellent bottle-filling capabilities. Older water fountain models that are less accessible and convenient should be gradually phased out through a fountain upgrade program. The project has also explored the possibility of providing water outdoors on UBC's main campus and at recreational fields accompanied by suggested infrastructure and locations.

These findings and recommendations will help the institution attain the standards listed in the new tap water access definition. It is highly recommended that the committee openly communicate their intentions with the various departments on campus, because the success of this initiative will require both the cooperation and collaboration from the university's students and staff. Although this project has provided and cited specific accessibility guidelines, it would be ideal to engage with the public on this aspect of water provision. People who use wheelchairs should actually test out highlighted outlets to confirm or refute the access claims from this project. Further research should also focus on the best way to discard old water fountain models and determine if their materials can be down-cycled into other industry products.

Acknowledgements

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Appendix

BC Building Code – Washroom Accessories:

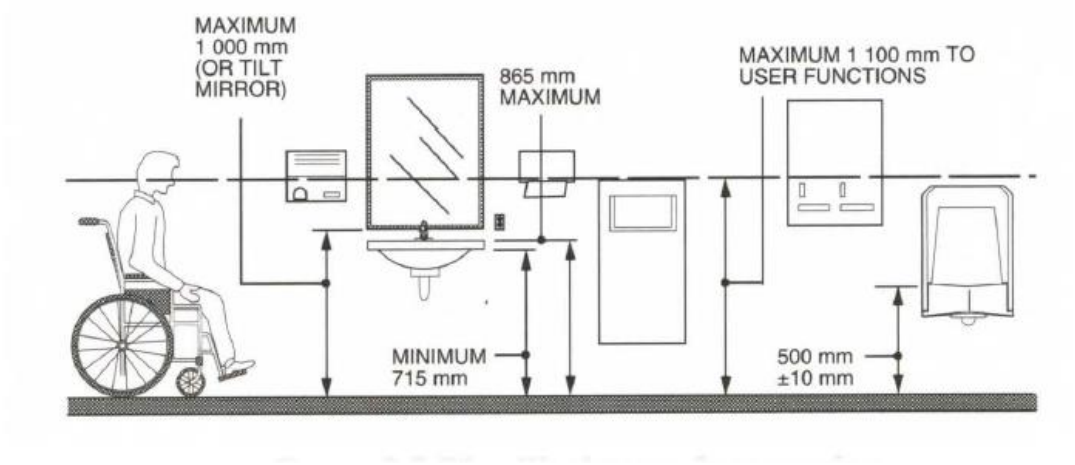
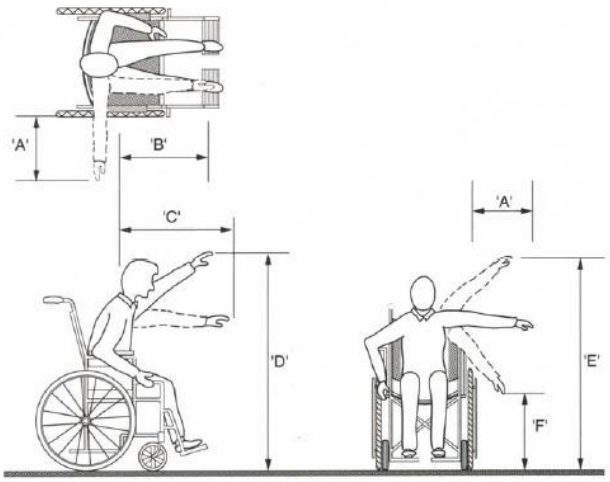


Figure 1 (Canadian barrier free design Inc., 2009)



Key	Male (1)	Female (2)	Child (3)
A - Easy side reach	505 mm	439 mm	300 mm
B - Easy forward reach	541 mm	513 mm	389 mm
C - Maximum forward reach	922 mm	869 mm	668 mm
D - High reach (forward)	1410 mm	1308 mm	965 mm
E - High reach (side)	1641 mm	1506 mm	1237 mm
F - Full reach (down)	338 mm	439 mm	508 mm
Column 1	2	3	4

Notes to Table B.3.7.1.A. (1) Male height – 1740 mm
(2) Female height – 1605 mm
(3) Child (6–9 yrs) – 1245 mm

Figure 2 – (Canadian barrier free design Inc., 2009)