WATER ACTION PLAN

UBC Vancouver Campus

JUNE 2019

THE UNIVERSITY OF BRITISH COLUMBIA

ACKNOWLEDGMENT

We acknowledge that the Vancouver campus is situated on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people.

sʔiːɬqəy̓ qeqən (Double-Headed Serpent Post)"
Brent Sparrow Jr., Musqueam
PHOTOGRAPHER: UBC BRAND & MARKETING /HOVER COLLECTIVE

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Executive Summary

This Plan addresses water management at UBC's Vancouver campus, and includes collaboration with the University Neighbourhood Association (UNA) and other on-campus partners.

In the 2016-17 fiscal year, approximately 3.8 billion litres of potable water (enough to fill 1,500 Olympic swimming pools) were consumed on campus, including neighbourhood housing and tenants. Based on a water balance audit from 2011, the largest end uses of water were process cooling and research including animal care, and washroom facilities.

UBC has reduced academic campus water use by over 50% since 1997, despite very significant growth of the campus, as indicated by increased student enrollment - a remarkable achievement. This reduction has been accomplished primarily in core buildings through water efficiency retrofits, much of this under the Ecotrek initiative in the early 2000's, and infrastructure improvements. However without any new conservation actions, UBC's water consumption is expected to begin increasing again, increasing by approximately 10% within 5 years.

Though water in the region is cheaper than in many other jurisdictions, water costs continue to increase. Historically, the cost of water has grown at a rate of approximately 8-9% per year, doubling between 2006 and 2012; it is currently increasing at about 5% per year, well above inflation. These increasing costs support the case for further action.

WATER ACTION PLAN GOALS

1. Support UBC in meeting regional water management expectations.
2. Reduce UBC's water consumption and water costs.
3. Contribute to community water supply resiliency, considering future climate conditions.
4. Mitigate climate impacts through reducing energy consumption & GHG emissions associated with water use.
5. Strengthen UBC's sustainability profile and help build a culture of sustainability on campus through engagement.
6. Create teaching, learning and research opportunities wherever possible.

In support of these goals, the WAP establishes the following water reduction target for the academic campus:

WATER ACTION PLAN TARGET

Maintain UBC total water consumption at or below 2017 levels, despite anticipated growth.

[1] *Since water use is linked more strongly to people than floor space, water use intensity is defined here as the amount of water used per unit of population, currently indicated by Full Time Equivalent (FTE) student enrollment.*

Assuming a campus growth rate of approximately 2% per year, this target translates to a decreasing campus water use intensity[1] relative to 2017:

» 16% decrease in water use intensity by 2025
» 24% decrease in water use intensity by 2030

With current water expenditures for the academic campus of approximately $2.3 million annually, the targeted 2% annual reduction below business as usual (BAU) would result in approximately $4 million in accumulated water savings within 15 years (2035).

STRATEGY

Organized by action area, the overall strategy of the WAP is summarized below:

1. **Existing and New Buildings**: In alignment with the Green Building Action Plan (GBAP), continue to improve water efficiency of existing buildings by focusing on areas of higher impact. These include once-through water use of lab and process equipment, and cost-effective retrofits of systems and fixtures where opportunities arise. Additionally, ensure that new buildings, and major renovations, incorporate water efficiency best practices, such as efficient fixtures.
2. **Infrastructure, Metering and Reporting:** Improve UBC's metering systems and processes to measure, monitor and report water use, to support better prioritization of conservation opportunities, and engage campus stakeholders in water conservation.
3. **Landscape and Irrigation:** Increase the water efficiency of landscape irrigation through more efficient and integrated systems, more effective system maintenance, and the development of more water-efficient and resilient landscaping practices that do not rely on potable water. This will ensure that UBC can adapt and respond to changing drought and storm patterns, and water restrictions.
4. **Alternative Sources and Resilience:** Continue to advance alternative water supply options such as rainwater capture, while updating guidelines to improve effectiveness of new systems. Also work towards a more comprehensive emergency water supply strategy for the campus.
5. **Drinking Water:** Encourage tap water consumption over bottled water consumption by promoting and increasing access to clean tap water.
6. **Campus Engagement and Collaboration**: Develop and deploy communications and engagement programs to help users conserve water in high-impact areas. This involves collaborating with the University Neighbourhoods Association (UNA) and other key stakeholders, including UBC Farm and Botanical Garden, to identify water conservation opportunities and support their initiatives. Also identify opportunities for research, teaching and learning, and collaboration with the academic faculties and students.

Given the limited human and financial resources available within the university, planned actions must be carefully considered against other priorities. For ongoing implementation, resource needs and funding mechanisms will be confirmed through consultation with the lead implementation units for those actions, and the WAP Steering Committee and the Executive Committee as needed. Future projects such as building retrofits that flow from actions within the WAP will be evaluated on a case by case basis to ensure an acceptable business case. A summary of the resourcing needs and outline of the business case for these resources will be provided as an addendum to this Plan.

Part 1: Context

VISION

UBC's Vancouver campus will manage its water use responsibly by advancing water conservation and efficiency practices, fostering innovative, alternative water system solutions, and building water supply resiliency.

SCOPE

This Plan addresses water management at UBC's Vancouver campus, and includes collaboration with the University Neighbourhood Association (UNA) and other on-campus partners. While not the focus of this plan, the recommendations may inform water management planning and activities elsewhere, such as UBC Okanagan and UBC Robson Square. Within this plan, "UBC" refers to the Vancouver campus.

This plan focuses on key institutional stakeholders (see Appendix A), while also considering the major tenants and residents (e.g. housing residents represented by the UNA). Areas addressed in this plan are organized under the following themes:

- **Existing and new buildings**
- **Infrastructure, metering and reporting**
- **Landscape and irrigation**
- **Alternative sources and resilience**
- **Drinking water**
- **Campus engagement and collaboration**

The Water Action Plan complements and is supported by other UBC plans. Water use in existing and new buildings is primarily addressed within the Green Building Action Plan. Rainwater and stormwater management are primarily addressed in the Integrated Stormwater Management Plan, though there are some aspects of rainwater management that are included in the Water Action Plan in landscape and irrigation, and alternative sources and resilience.

UBC CIRS Building rainwater infiltration system
PHOTOGRAPHER: DON ERHARDT

UBC'S WATER SUPPLY AND MANAGEMENT

Metro Vancouver's potable (drinking) water comes from reservoirs in three watersheds: Capilano, Seymour and Coquitlam. The majority of water consumed at UBC comes from the Seymour and Capilano reservoirs. Water from both these reservoirs is treated in the Seymour-Capilano Filtration Plant.

UBC Energy and Water Services (EWS) purchases potable water from Metro Vancouver, via the University Endowment Lands. Water is piped over 20 km from the Capilano or Seymour watersheds before being stored in the Sasamat reservoir, an underground concrete storage tank off-campus. Water is conveyed to UBC campus through two separate water mains: one along University Boulevard and the other along West 16th Avenue. EWS manages, administers and operates the campus water infrastructure, for distribution to its institutional and commercial buildings and customers on campus.

In general, buildings and facilities at UBC can be divided into three categories with respect to water services as outlined in the table below.

Core (Institutional)	Ancillary (Institutional)	Neighbourhood & Tenant (Non-Institutional)
• UBC owned and operated buildings including laboratories, classrooms and offices, not billed for water consumption • Includes irrigation of academic lands	• UBC owned and operated buildings that are billed for water consumption by UBC Energy & Water Services (e.g. Student Housing & Hospitality Services, Athletics & Recreation)	• Buildings that are not owned or operated by UBC but occupy UBC land (e.g. market & rental housing, hospital) • Billed for water consumption by UBC Energy & Water Services

Table 1. Categories of UBC buildings and failities as they relate to water services

After water is used in buildings, it is discharged in sewer pipes as wastewater (also known as sewage) and conveyed to the Iona Wastewater Treatment Plant (WWTP), where it is treated prior to discharge to the ocean. The sewer pipes off-campus and the WWTP are owned and operated by Metro Vancouver. Rainwater runoff (also known as stormwater) is collected in a separate network of stormwater pipes that lead to one of four outfalls located along the cliffs around UBC, which discharge the runoff to the surrounding environment.

UBC'S WATER CONSUMPTION

CURRENT USES OF WATER AT UBC

- Process cooling and research in laboratories
- Toilets, urinals and sinks in washrooms
- Showers
- Irrigation and water features
- Hospital
- Construction and outdoor washing of equipment and surfaces
- Remaining steam heating systems
- Drinking and food preparation
- Leaks and unaccounted uses

Based on a water balance audit from 2011, the largest end uses of water were process cooling, research including animal care, and washroom facilities. The 2011 audit indicated that base flows, i.e. minimum flows that continue through the night, represent close to half of campus water use; recent data indicate that this is still the case. It is therefore essential to identify and investigate the sources of this base flow. Irrigation represents a relatively small portion of institutional water use at approx. 5-10%, however during summer months, water use for irrigation is often restricted by Metro Vancouver due to low regional reservoir levels. Metro Vancouver has updated the Water Shortage Response Plan with the new Drinking Water Conservation Plan active May 1, 2018, which details water restriction requirements.

In comparing the water use intensity of different institutional building types, laboratory buildings typically have much higher water use intensity on a per floor space area basis – up to ten times higher than office buildings, which have the lowest water use intensity. However, establishing a full understanding of how water is used in buildings is challenging, as most buildings have a single water meter.

In the 2016-17 fiscal year, approximately 3.8 billion litres of potable water (enough to fill 1,500 Olympic swimming pools) were consumed on campus, including neighbourhood housing and tenants. Of this, approximately 2.5 billion litres was consumed by the academic campus, and of this, approximately 1.8 billion litres was consumed by core institutional buildings. Figure 1 (opposite) shows the consumption breakdown by the three main sectors.

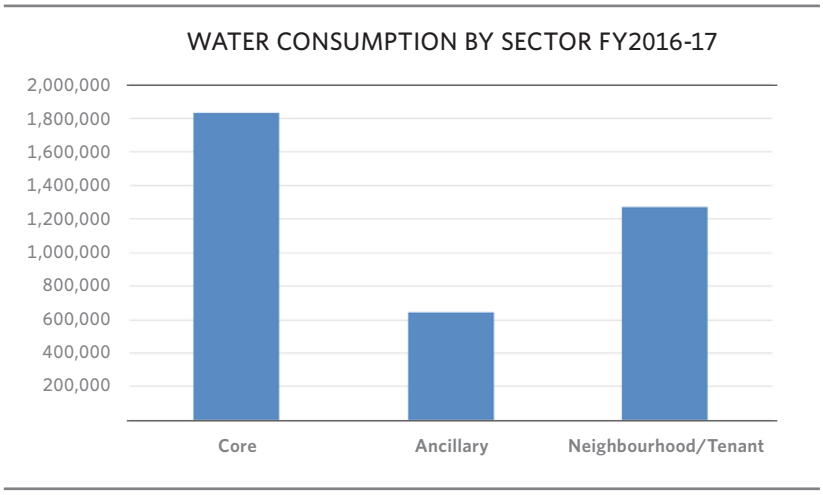

Figure 1. UBC water consumption by sector for fiscal year 2016-17.

As shown in Figure 2 below, UBC has reduced academic campus water use by over 50% since 1997, despite very significant growth of the campus, as indicated by increased student enrollment - a remarkable achievement. This reduction has been accomplished primarily in core buildings through water efficiency retrofits, much of this under the Ecotrek initiative in the early 2000's, and infrastructure improvements. The steam to hot water district energy system conversion has already reduced consumption and is expected to result in 136 million litres of water savings per year by the 2017-18 fiscal year. Ancillary buildings including student housing show a slight decrease in water consumption over time, also despite growth – this can also be attributed largely to student housing water efficiency retrofits such as efficient toilets and shower heads. And finally, neighbourhood residential and tenant buildings show a steady increase due to growth – noting that most buildings in this sector are relatively new and not being retrofitted yet.

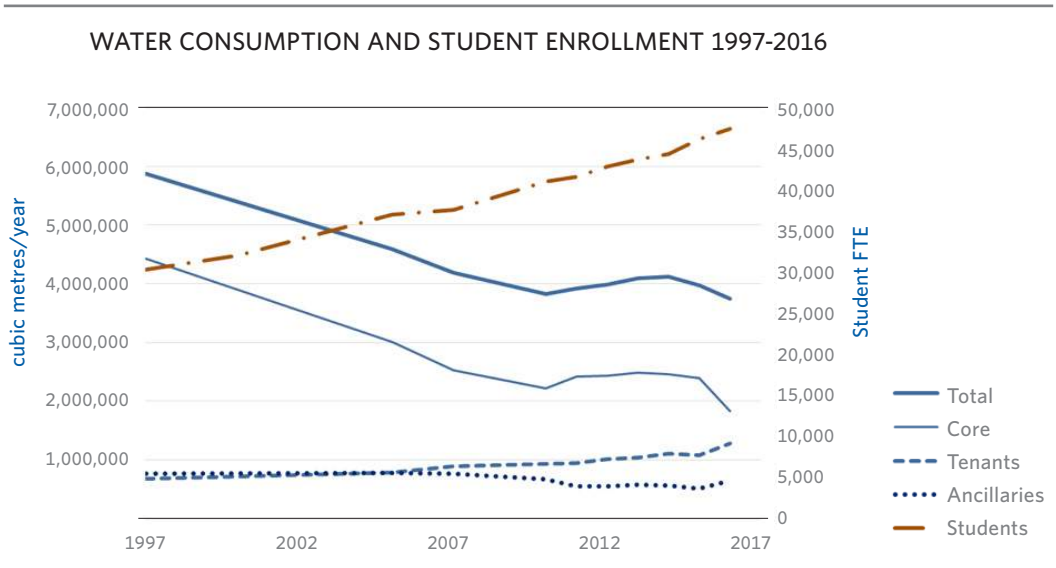

Figure 2. UBC Vancouver academic campus water consumption and student enrollment 1997-2016.

Though water in the region is cheaper than in many other jurisdictions, water costs continue to increase. Historically, the cost of water has grown at a rate of approximately 8-9% per year, doubling between 2006 and 2012. It is currently increasing at about 5% per year, well above inflation. Despite the major decrease in consumption, the annual cost for water purchases has doubled since 2006. In 2017, UBC's water purchases for core buildings alone were over $1.6 million, and were $2.3 million for the academic campus (core plus ancillaries).

For collection and treatment of wastewater from the campus, UBC pays a fixed fee that is set by Metro Vancouver, which is not directly linked to the volume of wastewater or water consumed.

There remain many opportunities for resource and cost savings, in both existing buildings and systems, and in new buildings as the campus grows.

BENCHMARKING[2] UBC'S WATER CONSUMPTION

To compare UBC's water consumption with regional figures, the average overall municipal water consumption (including residential, commercial and other uses) in Metro Vancouver was 455 litres per person per day or 167 m3/person/year. Looking at the academic campus, 2016-17 water consumption was approx. 2.5 million m3/year, which would correspond to a population of 15,000 people using the Metro Vancouver municipal average. In the same year the UBC student residence population alone was approximately 11,000, however daytime population on campus during the main academic terms was over 50,000, suggesting that UBC's water consumption compares favourably with the regional average. Nevertheless there are significant opportunities for better and more efficient management of water on campus.

It is challenging to directly compare UBC's water consumption with other institutions and municipal jurisdictions due to the major differences between these cases, and lack of a standardized protocol for benchmarking water consumption. UBC is often considered a quasi-municipality, however it has a unique blend of residential, administrative and research building types, as well as a highly variable daily population.

Low flow automatic faucet
PHOTOGRAPHER: PHILIP BERTOGG

[2] *Benchmarking is defined here as evaluating water consumption in relation to other similar organizations or jurisdictions.*

Bioswale at the Beaty Biodiversity Centre improves the quality of rainwater runoff
PHOTOGRAPHER: PHILIP BERTOGG

WATER CONSUMPTION FORECAST

As shown in Figure 3, without any new conservation actions, UBC's water consumption is expected to begin increasing again, increasing by approximately 10% within 5 years. With a historical campus growth rate of approximately 2% per year, it is anticipated that this growth will continue.

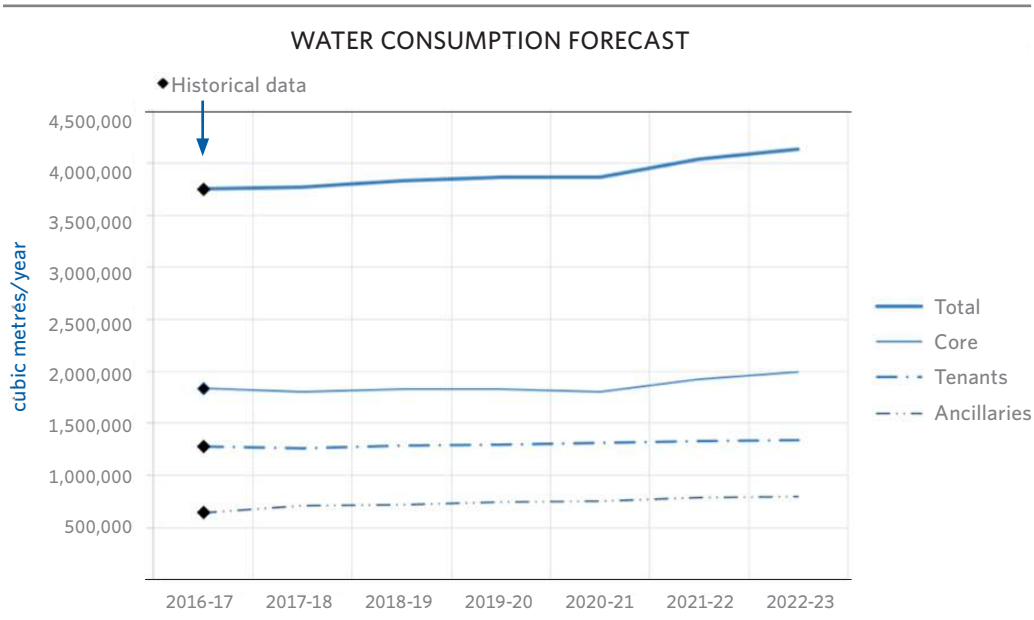

Figure 3. UBC five year water consumption forecast without additional conservation actions in WAP.

ISSUES AND DRIVERS: WHY IS THE WATER ACTION PLAN IMPORTANT?

In many parts of the world, water scarcity, drought or high costs drive people to use water with great care. In the Lower Mainland of BC, there exists a relative abundance of water due to the large amount of rainfall; however, due to seasonal rainfall patterns and the limited storage in reservoirs, there are still periods when water reservoir levels run low and water use must be restricted. As with other resources, UBC chooses to be a leader in conserving water, treating water as a valuable resource that is managed wisely.

Provincial Priorities

Living Water Smart sets targets for all British Columbians to work towards protecting water resources, using water efficiently and ensuring that water is available for public health, economic development, and environmental sustainability. The Living Water Smart strategy set a target that by 2020, water use in B.C. will be 33 percent more efficient compared to a 2008 baseline.

Water resiliency is also an emerging issue in BC. Climate projections indicate that wetter winters and drier summers are likely in the future[3] , and the frequency and length of droughts in the summer will increase[4] ; jurisdictions including the City of Vancouver are building new climate resiliency plans. In addition to updating stormwater management methods, increasing water efficiency and using alternative water systems and water storage can potentially help strengthen UBC's water resiliency.

Regional Water Supply

UBC falls within the Metro Vancouver Water District, under Electoral Area A, and water is sourced from the Metro Vancouver system. Though UBC does not have local government status like other municipalities in the region, UBC supports the goals, strategies and actions outlined in the Metro Vancouver Drinking Water Management Plan, which include:

- Responding to watering restrictions during drought periods, as identified in the 2017 Drinking Water Conservation Plan;
- Managing infrastructure proactively, for example through infrastructure renewal and leak identification and management;
- Increasing water efficiency; and
- Promoting non-potable water use where appropriate.

Cascade fountain water feature.
PHOTOGRAPHER: DON ERHARDT **SOURCE:** UBC BRAND & MARKETING

[3] *Climate Projections for Metro Vancouver, http://www.metrovancouver.org/services/air-quality/AirQualityPublications/ClimateProjectionsForMetro-Vancouver.pdf*
[4] *A Water Sustainability Act for UBC, Legislative Proposal Overview, 2013.*

Business Case

Sustainability planning integrates environmental, economic and social dimensions. Given the limited human and financial resources available within the university, planned actions must be carefully considered against other priorities. For actions that require significant resourcing, the business case is an important decision factor. Business case considerations are discussed at a high level in the Actions section, and more detailed resourcing and business case information will be provided in an addendum document.

UBC Sustainability Context

UBC's 20 Year Sustainability Strategy outlines strategic goals that relate to water use, including an integrated approach to sustainability, linkages with the wellbeing of the campus community, continuous improvement in sustainable performance, and demonstration of regenerative design that improves both environmental and human wellbeing.

UBC's Sustainability Strategy 2006-2010, Inspirations & Aspirations, set a target of reducing water consumption in institutional and ancillary buildings by 40% (adjusted for growth) from 2000 levels by 2010. This target was met in 2009 and maintained every year since. Other applicable policies and frameworks that include water sustainability performance components include:

- LEED and REAP green building rating systems, which guide building design and construction;
- STARS sustainability reporting framework for colleges and universities.

As part of its implementation of green buildings, UBC has also applied innovative, alternative water systems in buildings including the Centre for Interactive Research on Sustainability (CIRS), Bioenergy Research and Demonstration Facility (BRDF) and the new Aquatic Centre.

GOALS

Given the regional and UBC context described above, the overall goals of the Water Action Plan are:

1. Support UBC in meeting regional water management expectations.
2. Reduce UBC's water consumption and water costs.
3. Contribute to community water supply resiliency, considering future climate conditions.
4. Mitigate climate impacts through reducing energy consumption & greenhouse gas (GHG) emissions associated with water use.
5. Strengthen UBC's sustainability profile and help build a culture of sustainability on campus through engagement.
6. Create teaching, learning and research opportunities wherever possible.

TARGET

In support of these goals, the WAP establishes the following target:

Maintain UBC total water consumption at or below 2017 levels despite anticipated growth.

Assuming a campus growth rate of approximately 2% per year, this target translates to a decreasing campus water use intensity[5] relative to 2017:

» 16% decrease in water use intensity by 2025
» 24% decrease in water use intensity by 2030

Figure 4 below illustrates the projected academic Business As Usual (BAU) campus water consumption to 2025, compared with the target level set by the 2017 baseline, by assuming a 2% per year campus growth rate following the five-year forecast shown in Figure 3. Note that long term water consumption will be influenced strongly by the actual campus growth rate which may vary significantly.

The targeted 2% annual reduction below BAU would result in approximately $2.5 million accumulated savings in water costs by 2030.

Developing meaningful targets is informed by understanding current water usage patterns and identification of achievable opportunities to reduce consumption. Enhancements planned for water metering across campus (see Actions section) along with additional performance benchmarking will support more refined analysis and opportunity identification over time. Within five years of initiation of WAP implementation, a review and update of the plan will be undertaken that may include revision of targets and actions based on this work.

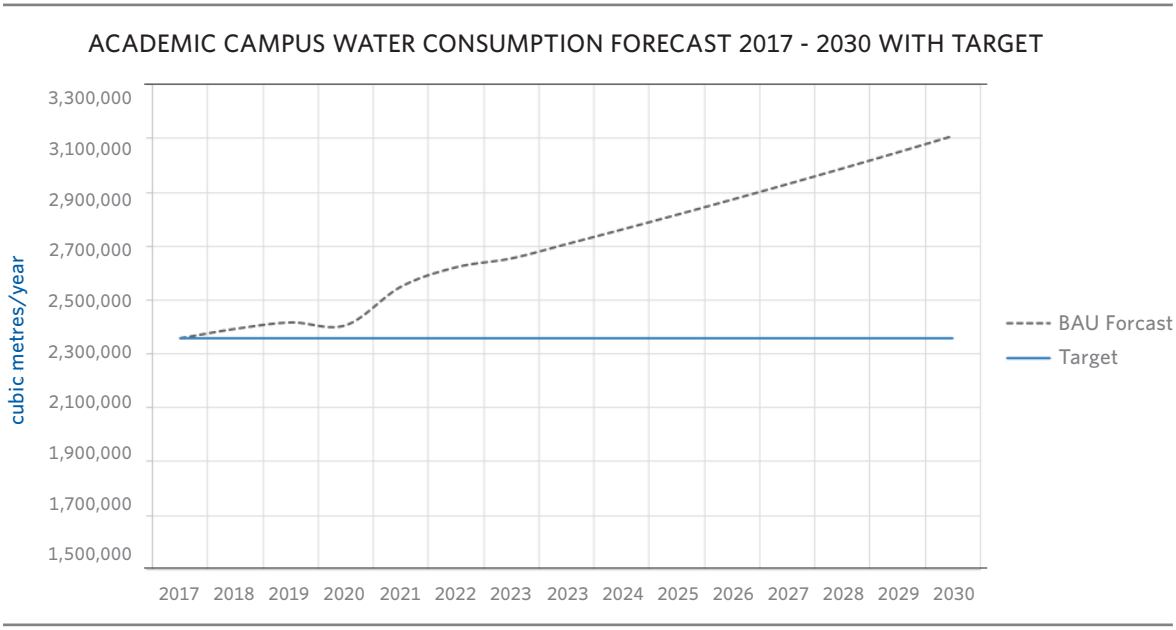

Figure 4. Academic campus water consumption forecast 2017 to 2030, BAU and WAP target.

[5] *Since water use is linked more strongly to people than floor space, water use intensity is defined here as the amount of water used per unit of population, currently indicated by Full Time Equivalent (FTE) student enrollment.*

Achieving Multiple Objectives

Water conservation can both support, and be in tension with, other UBC objectives and priorities. In planning and implementing water strategies, a balanced approach is needed that maximizes opportunities to align with multiple objectives, and considers impacts on other areas. Areas of alignment include:

- Water conservation that reduces energy consumption and GHG emissions – for example, reducing hot water consumption.
- Strategies that decrease reliance on potable water supply, and increase the resilience of UBC's water supply – such as alternative water sources that can be used in emergencies.

Areas of tension include replacement of once-through cooling with equipment such as chillers, which can increase UBC's energy consumption and potentially contribute to peak electricity demand; limiting peak electricity demand is currently a high priority for UBC due to electricity infrastructure constraints. This will require further exploration to find optimal ways to reduce both peak electrical demand and water consumption.

PLAN DEVELOPMENT PROCESS

In February 2011, a consultation process for this plan was started with a public workshop and open house to help establish a long-range vision and to solicit ideas on how to achieve this vision. Working groups were subsequently established to fully develop these ideas and prioritize actions.

In 2017, after completion of the Zero Waste Action Plan and Climate Action Plan 2020 Update, work on the WAP was resumed. A new Steering Committee was formed to provide overall guidance and direction for the plan. With content resulting from the original consultations as a starting point, stakeholder groups were convened under the themes described earlier in order to review existing actions and propose new actions.

A significant proportion of the consultation for the Water Action Plan was integrated within the Green Building Action Plan consultation process for institutional and residential buildings. The planning process and schedule is outlined in Figure 5.

More detail on the consultation process is provided in Appendix A.

For Implementation including ongoing plan management, refer to the Actions section of the plan.

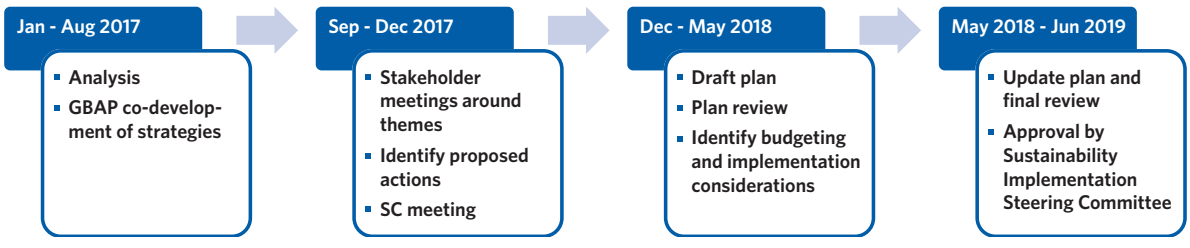

Figure 5. UBC's Water Action Plan development process

Part 2: Actions

This section identifies the overall strategy and specific actions that will need to be taken in order to meet the objectives and targets described in the Context section, including who will lead and support the actions, and timeframes.

ACTION AREAS

Actions are organized into the following areas:

- **Existing and new buildings**
- **Infrastructure, metering and reporting**
- **Landscape and irrigation**
- **Alternative sources and resilience**
- **Drinking water**
- **Campus engagement and collaboration**

For each area, the context and rationale for action is provided, as well as considerations on implementation and the business case that are specific to that action area. The overall implementation strategy for the plan is summarized at the end of the document.

OVERALL STRATEGY

Organized by action area, the overall strategy of the WAP is summarized below. Specific actions are described in the sections following.

1. **Existing and New Buildings**: In alignment with the Green Building Action Plan, continue to improve water efficiency of existing buildings by focusing on areas of higher impact. These include once-through water use of lab and process equipment, and cost-effective retrofits of systems and fixtures where opportunities arise. Additionally, ensure that new buildings, and major renovations, incorporate water efficiency best practices, such as efficient fixtures.

Wesbrook Neighbourhood water feature
PHOTOGRAPHER: PHILIP BERTOGG

2. **Infrastructure, Metering and Reporting:** Improve UBC's metering systems and processes to measure, monitor and report water use, to support better prioritization of conservation opportunities, and engage campus stakeholders in water conservation.
3. **Landscape and Irrigation:** Increase the water efficiency of landscape irrigation through more efficient and integrated systems, more effective system maintenance, and the development of more water-efficient and resilient landscaping practices that do not rely on potable water. This will ensure that UBC can adapt and respond to changing drought and storm patterns, and water restrictions.
4. **Alternative Sources and Resilience:** Continue to advance alternative water supply options such as rainwater capture, while updating guidelines to improve effectiveness of new systems. Also work towards a more comprehensive emergency water supply strategy for the campus.
5. **Drinking Water:** Encourage tap water consumption over bottled water consumption by promoting and increasing access to clean tap water.
6. **Campus Engagement and Collaboration:** Develop and deploy communications and engagement programs to help users conserve water in high-impact areas; collaborate with UNA and other key stakeholders including UBC Farm and Botanical Garden, to identify water conservation opportunities and support their initiatives; identify opportunities for research, teaching and learning, and collaboration with the academic faculties and students.

Aquatic research fish tanks
PHOTOGRAPHER: AINA CROZIER

ACTION CLASSIFICATION

These timeframes represent when actions are planned to start:

SHORT TERM 2018-2020	MEDIUM TERM 2021-2025

Participating Units

AMS	Alma Mater Society
AR	Athletics & Recreation
BG	Botanical Garden
BO	Building Operations
CCP	Campus & Community Planning (units other than SE and PD)
EWS	Energy & Water Services
ID	Infrastructure Development
PD	Planning and Design (within Campus & Community Planning)
PT	UBC Properties Trust
RMS	Risk Management Services
SE	Sustainability & Engineering (within Campus & Community Planning)
SHHS	Student Housing & Hospitality Services
UF	UBC Farm
UNA	University Neighbourhoods Association
USI	University Sustainability Initiative
UW	UBC Wellbeing (Office of the Vice-President Students (Wellbeing))

1. EXISTING AND NEW BUILDINGS

Context & Rationale

In terms of existing policy, water consumption in buildings is currently most significantly influenced through the UBC Technical Guidelines, Leadership in Energy and Environmental Design (LEED) Implementation Guide and the Residential Environmental Assessment Program (REAP). These policies include requirements for high efficiency water fixtures including toilets and faucets, and some types of appliances and other equipment. The Technical Guidelines prohibit installation of once-through cooling of equipment.

Laboratory helium compressor cooled by water
PHOTOGRAPHER: PHILIP BERTOGG

PRIORITY ACTIONS (SHORT TERM)				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
1.0	Pursue retrofits of once-through cooling (and other similar water uses) of lab equipment where feasible and appropriate, focusing on existing high water use installations.	SE	EWS, BO	2018+
1.1	Identify opportunities to reduce cooling tower water use in existing and new buildings and determine if these can be implemented as part of maintenance programs.	BO	SE	2018+
1.2	Identify opportunities for integration of water efficiency retrofits into fixture maintenance schedules.	BO	SE	2018+

MEDIUM TERM ACTIONS				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
1.3	Identify opportunities to utilize alternate, non-potable water sources for once-through cooling, where the cooling cannot be avoided, or use of cooling discharge water for other non-potable uses.	SE	EWS, BO	2018+

Actions that are specific to design and construction of buildings are documented within the Green Building Action Plan, and are not reproduced in detail here to avoid duplication. However, the key actions are summarized as follows.

- Review & update plumbing fixture guidelines for new buildings to reflect current leading practice guided by recognized standards, including LEED and REAP rating systems.
- Pursue cost effective water efficiency retrofits informed by benchmarking of buildings and prioritized by business case and impacts on water and energy consumption.
- Investigate opportunities to integrate efficiency retrofits into regular fixture maintenance.
- Develop guidelines for inclusion of alternative water sources and systems within development projects.
- Explore opportunities to incorporate leading water management practices into the Stadium Neighbourhood planning process through a Whole Systems Infrastructure approach.

Implementation and Business Case Considerations

- Overall, UBC will follow a structured approach and implement the most cost-effective options first, and will work within the context of ongoing activities wherever possible.
- Retrofitting water fixtures with more efficient models in existing buildings will increase efficiency and reduce water consumption and operating costs. Efficient fixture retrofits can often be integrated within renovation, maintenance and replacement activities at minimal cost.
- Once-through cooling retrofits are generally more complex and expensive, however can save many thousands of dollars of water annually in the longer-term. Projects with potentially significant costs, such as laboratory cooling retrofits, will be evaluated on a case by case basis to ensure there is an acceptable business case.

2. INFRASTRUCTURE, METERING & REPORTING

Context & Rationale

Improving metering and reporting offers an opportunity to further engage the UBC community in water conservation by providing enhanced, more accessible water consumption data and reporting. This can support water conservation action and behaviour change for stakeholders such as facility managers, department heads, administrators, student residence managers and sustainability program managers. Accessible data can also support campus research projects. Also, further detailed analysis of campus and building water consumption data is essential to identify the best opportunities to reduce consumption, in particular the base flows (see an example in Figure 6 below); enhanced metering and reporting systems will support this.

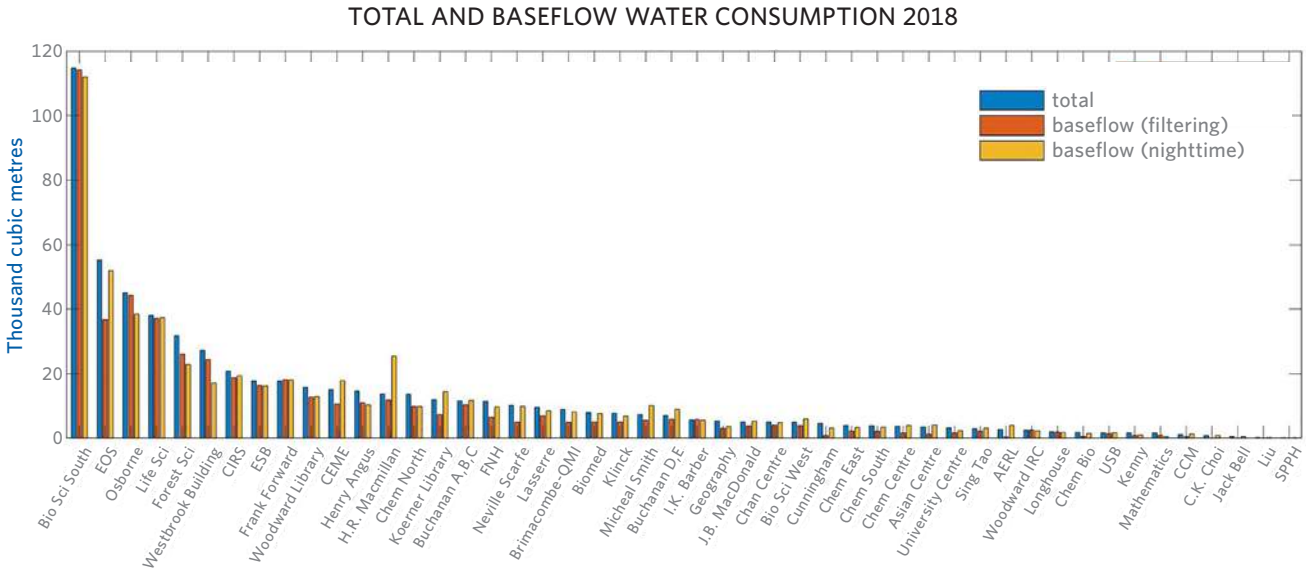

Figure 6. Water consumption analysis for metered buildings

PRIORITY ACTIONS (SHORT TERM)				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
2.1	Conduct a comprehensive metering audit for core buildings to determine the status of existing meters and a scope of work to repair/replace.	EWS	SE	2018-2019
2.2	Analyze the gaps in core building metering and develop recommendations and business case for addressing gaps.	SE	EWS	2018-2019
2.3	Develop a water metering and reporting update plan that is guided by the overall directions in the draft strategy in Appendix B and considers the results of the audit and study represented in Figure 6.	EWS/ SE	SE/ EWS	2019+

PRIORITY ACTIONS (SHORT TERM) *continued*				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
2.4	Implement the metering and reporting plan developed as per the previous action[6].	EWS	SE	2019+
2.5	Assess the cost/benefit and feasibility of additional monitoring systems and activities to analyze water losses and/or detect leaks.	SE/ EWS	SE/ EWS	2019
2.6	Using updated metering/billing systems, explore and pilot the provision of water consumption reports to core buildings/departments to build awareness of water use through department activities.	SE	EWS	2019
2.7	Utilize building-level water use benchmarking[7] (including core, ancillary and neighbourhood/tenant buildings) to identify water conservation opportunities. • SHHS and AR to be involved in tracking building performance and benchmarking for their portfolios.	SE	EWS, BO, SHHS, AR	2018
2.8	Explore the potential for financial incentives for core departments to incentivize water conservation, supported by core building water consumption reporting.	SE	EWS	2019-2021
2.9	Monitor and report overall water consumption on an annual basis and track progress as part of the Annual Sustainability Report.	SE	EWS	Annually
2.10	Add manual read meters to water features, where feasible, to enable quantification of water use.	SE/ EWS	BO,	2019-2020

MEDIUM TERM ACTIONS				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
2.11	Complete remaining metering, monitoring and reporting system updates and implement core department financial incentives program as appropriate based on earlier investigations.	SE/ EWS	SE/ EWS	2021-2024

Implementation and Business Case Considerations

- Improved water metering and reporting systems are expected to uncover additional opportunities for conservation and cost-effective retrofits, and to support conservation behaviours that further reduce consumption and costs.
- Investments in metering improvements (either existing meter replacement or new meter addition) will be informed by the audit assessment and will incorporate the business case.

[6] *Pending development and approval of the plan co-developed by EWS and informed by the audit.*
[7] *Benchmarking is defined here as generating performance metrics for water consumption to allow for comparison across buildings and considering uses; metrics could include Water Use Intensity based on floor space and occupancy.*

3. LANDSCAPE AND IRRIGATION

Context & Rationale

Irrigation across the entire Vancouver campus is estimated to account for 5-10% of annual water consumption. However, irrigation often creates large peaks in water demand as many irrigation systems are operated concurrently during early morning periods on specific days. UBC also needs to respond to watering restrictions as per the updated Metro Vancouver 2017 Drinking Water Conservation Plan.

The campus has experienced significant drought periods in the last several years. With anticipated impacts of climate change, these drought periods will continue or increase, resulting in more stress on plants and potential loss of soft landscape assets. Going forward, the actions identified here can provide guidance for the transition to a landscape that is better adapted to these changing conditions and less dependent on potable water for irrigation. This trajectory will increase landscape resiliency, reduce loss of plants due to drought stress, and reduce overall irrigation water demands. Landscapes can be classified to identify "priority" areas that will meet a higher standard of irrigation, maintenance and aesthetics, and underutilized irrigated grass areas could be retrofitted with drought resistant landscaping.

Water-wise landscaping
PHOTOGRAPHER: PHILIP BERTOGG

In June 2018 a UBC Farm Project, Living Laboratory for Water Sustainability at UBC Farm, was initiated. This project is aimed at minimizing the water footprint of agriculture at UBC Farm and supporting UBC's Water Action Plan objectives including metering, water efficiency, alternative water sources and research.

PRIORITY ACTIONS (SHORT TERM)				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
3.1	Review and update operating procedures and identify irrigation system updates needed to ensure maximum alignment between regional watering restrictions and irrigation practice.	BO, AR, SHHS	EWS, SE	2018-2019
3.2	Undertake research project(s) to evaluate feasibility and business case of alternative water sources, storage and distribution to supply irrigation during severe water restrictions.	SE	BO, EWS	2019
3.3	Going forward, investigate the tracking of landscape asset losses due to drought, to help estimate potential benefits and savings of drought-tolerant landscapes and help inform future climate adaptive planting standards.	BO	SE, PD	2018+

PRIORITY ACTIONS (SHORT TERM) *continued*				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
3.4	Develop a comprehensive irrigation system inventory and explore enhanced maintenance processes. • Develop an inventory (including a process for future inventory updates) for irrigation systems that include GIS, area coverage, meters, and basic technical information. Support with academic departments/SEEDS where appropriate. • Review irrigation maintenance procedures for opportunities to improve system performance, such as after-hours visual inspections and/or systems such as phone apps for reporting malfunctioning equipment. Continue to liaise with EWS and others on scheduling of irrigation in order to manage peak flows. • Assess opportunities for metering and monitoring enhancements and the business case for leak detection and loss analysis (integrate with the Metering & Reporting Strategy in Appendix B).	BO	EWS, SE, PD, PT, SHHS, AR	2018-2019
3.5	Develop a strategy for standardizing and upgrading irrigation systems and technology across campus for improved integration, higher efficiency and better monitoring, e.g. smart controllers, sensors, centralized control, leak detection. • Develop an approach to manage and coordinate building irrigation systems with public realm irrigation systems. • Prioritize centralized control to reduce labour required for programming and devote the labour savings to address maintenance needs and reduction of losses. • Inform with UBC Farm Living Lab water project.	SE	BO, PD, EWS, PT, SHHS, AR	2019-2020
3.6	For athletic fields, monitor and review water consumption and explore opportunities to increase irrigation efficiency and conservation.	AR	SE, EWS	2018+

MEDIUM TERM ACTIONS				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
3.7	Develop requirements for meeting a percentage of irrigation water supply from alternate sources.	SE/PD	BO, PT, SHHS, AR	2021-2025

Implementation and Business Case Considerations

- Increasing the efficiency of irrigation systems will reduce water consumption and costs. For example: low cost options implemented previously include rain sensors. Retrofits and upgrades will be evaluated for acceptable business cases.
- Transitioning landscapes to less water intensive designs will reduce consumption and water costs and could reduce the costs of replacing drought-damaged plants.

4. ALTERNATIVE WATER SOURCES & RESILIENCE

Context & Rationale

Alternative sources are non-municipal water sources such as rainwater, surface water, groundwater, greywater or wastewater including pool water, and off campus bulk water. Water storage systems can also be coupled with any water source including municipal potable water. Alternative water sources and systems could potentially be used for daily (e.g., toilet flushing), seasonal (e.g., irrigation) or emergency use, and could potentially also be used for cooling, process water and firefighting. Alternative water systems can be implemented from the building scale up to the neighbourhood scale.

To date, alternative water systems implemented on campus which include building scale rainwater harvesting and wastewater treatment systems, have had significant shortfalls in system performance, such as long or unsuccessful commissioning periods, or downtime due to failures. Relative to conventional water systems, alternative systems have additional complexity and considerations throughout the project process, including design, collaboration, construction, commissioning and operations. The unit cost of water produced from alternative systems also tends to be high relative to municipal supply, resulting in long paybacks when only considering potable water savings. However, alternative systems still hold potential to deliver benefits such as contributing to campus rainwater management, water supply resiliency and research. For example, alternative sources may offer a way to protect loss of valuable plantings in the event of severe water restrictions.

CIRS building rainwater treatment equipment
PHOTOGRAPHER: PHILIP BERTOGG

PRIORITY ACTIONS (SHORT TERM)

No.	Action	Lead Dept/ Units	Support Dept/ Units	Timeline
4.1	As part of campus emergency planning, develop an emergency water supply plan. Key actions involved in emergency water planning are to identify UBC's role in emergency supply within the regional context, defining critical functions and determine demand requirements including population, time and uses for emergency water supply. • Assess the need for different water supply sources, storage and distribution. • Consider vulnerability to a changing climate. • Identify linkages with building design and co-benefits of systems solutions. • Research the role and value of alternative water systems including building-scale water storage for resiliency and as an emergency supply.	RMS	SE, EWS, BO, ID, SHHS	2018-2019

PRIORITY ACTIONS (SHORT TERM) *continued*				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
4.2	Through pilot projects or via development planning projects, research the feasibility of creating neighbourhood or campus-level infrastructure to enable use of alternate water sources, thereby addressing environmental, economic and social factors. • Centralized rainwater or stormwater storage and reuse systems, for example to supply irrigation during drought in order to protect landscape assets. • Non-potable water distribution systems. • Centralized wastewater or greywater treatment and reuse facility (or facilities), including recovery of energy, water and other resources.	SE	CCP, EWS, SHHS, PT, BO, RMS, ID, USI	2020+
4.3	Identify the resources needed to properly commission, operate and maintain the CIRS wastewater reuse and rainwater harvesting systems, and other existing systems on campus as needed. • Identify faculty researchers and external partners to undertake related research and reporting.	USI	SE	2018-2019

Actions specific to building design are documented within the Green Building Action Plan. These include actions to:

- Investigate the performance of existing UBC systems.
- Develop guidelines for design and implementation of alternative water systems.

Implementation and Business Case Considerations

- Resiliency and emergency water supply may have important business case elements; these are complex and will require additional research to characterize.
- Due to the high costs of implementing alternative water sources, the overall priority will be on efficiency first.
- Alternative systems have already been implemented in a number of new construction projects. The actions identified are in part aimed at clarifying the business cases and reducing operating costs for these systems in the future.

5. DRINKING WATER

Context & Rationale

Tap water can potentially displace consumption of other less healthy beverages - an important step towards increasing the health and productivity of UBC community members. This supports the Vision of the UBC Wellbeing Food and Nutrition Action Framework and its goal for UBC community members to choose tap water most often. It is true that a transition to drinking more tap water will increase UBC's water consumption, however the potential increase in water consumption is minor at less than 1%. Transitioning away from bottled water to tap water can reduce the cost of drinking water for campus users, and can reduce solid waste and associated impacts, including plastic litter in land and marine ecosystems and GHG emissions.

Overall, a key objective is to encourage tap water consumption by increasing access to good quality tap water and promoting its use to the campus community. Drinking water fixtures are often perceived as not providing high quality water, and in some cases old fixtures do require updating. Education about tap water is also important on campus, given that negative perceptions are a significant barrier to increased tap water consumption.

Water fountain with gooseneck bottle filler
PHOTOGRAPHER: PHILIP BERTOGG

PRIORITY ACTIONS (SHORT TERM) No.	Action	Lead Dept/ Units	Support Dept/ Units	Timeline
5.1	Restart and formalize the multi-stakeholder Drinking Water Committee and ensure representation from key UBC faculty, resident, staff and student groups.	SE	SHHS, AR, FO, BO, USI, AMS, RMS, UW	2018
5.2	Strategically address drinking water infrastructure and signage gaps in order to develop a project to complete implementation with partner units. • Research gaps and opportunities in drinking water infrastructure and build on existing SEEDS work[8]. • Based on research, undertake retrofits to improve drinking water stations in buildings and public spaces, including prioritization of locations and budgeting. • Review and update Technical Guidelines if necessary to ensure new buildings have the appropriate number and type of fixtures to support drinking water objectives. • Review and update if necessary the Campus Design Guidelines for outdoor drinking water fixtures in order to meet drinking water and maintenance objectives.	SE	SHHS, AR, BO, AMS	2018-2020

[8] *Benchmarking is defined here as generating performance metrics for water consumption to allow for comparison across buildings and considering uses; metrics could include Water Use Intensity based on floor space and occupancy.*

PRIORITY ACTIONS (SHORT TERM) *continued*				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
5.3	With potential alignment and collaboration with the Zero Waste program and Food & Nutrition Working Group, develop and implement a campus-wide drinking water and healthy beverage communications campaign. • Explore research that builds on existing work to develop messaging and communications.	TBD	SE, SHHS, AMS, UW	2018-2019
5.4	Explore the feasibility of purchasing or leasing a mobile water filling station for larger events and/or field recreational areas. • Also explore the potential use of mobile water filling stations for distribution of emergency water supply.	SHHS	SE, AR, EWS	2018-2019

Implementation and Business Case Considerations

- While this action links to benefits including health and waste reduction, increasing access and promoting tap water for drinking creates a financial benefit to the campus community by reducing the cost of drinking water relative to bottled water.

6. CAMPUS ENGAGEMENT AND COLLABORATION

Context & Rationale

Communications and engagement with the campus community and stakeholders is an important component of water management. Water consumption is driven in part by individual behaviours and decisions, from how long you take a shower, to understanding the implications of connecting laboratory equipment to water supplies for cooling. Decisions to dispose hazardous and non-hazardous materials in sanitary and storm sewers can also pollute marine ecosystems adjacent to the campus.

Another important element of communications and engagement on campus is facilitating the implementation of water use restrictions during drought periods.

Engagement activities undertaken by UBC are in part guided by the Sustainability Engagement Strategy, which identifies high impact resource conservation opportunities across office workplaces, residences, and laboratories, and help to strengthen the culture of sustainability at UBC. This strategy is being updated in 2018.

Though the focus of the WAP is the academic campus, residential neighbourhoods now account for over one third of UBC's water consumption. Collaboration with the University Neighbourhoods Association (UNA and other key stakeholders, including UBC Farm and the Botanical Garden, offers the opportunity to advance sustainable water management and water related research.

Since the Green Building Action Plan addresses neighbourhood residential buildings, it is anticipated that water related actions in the UNA included below should be coordinated with overlapping GBAP actions.

Wesbrook Neighbourhood
PHOTOGRAPHER: PHILIP BERTOGG

PRIORITY ACTIONS (SHORT TERM) No.	Action	Lead Dept/ Units	Support Dept/ Units	Timeline
6.1	Develop & implement conservation campaigns based on best opportunities for impact and meeting Sustainability Engagement Strategy[9] objectives.	SE	USI, EWS, CCP, SHHS	2018+
6.2	Engage UBC staff and faculty in implementation of guidelines, including: elimination of once-through cooling, identification of water efficiency retrofits, and other related water efficiency opportunities.	SE	EWS, BO	2019+

[9] An updated Sustainability Engagement Strategy is being developed prior to end of 2018. Water conservation objectives will be integrated into the resulting sustainability programming as appropriate based on this Strategy.

PRIORITY ACTIONS (SHORT TERM) *continued* No.	Action	Lead Dept/ Units	Support Dept/ Units	Timeline
6.3	Form a Water Action Committee to periodically review progress and status of Water Action Plan implementation.	SE	EWS, BO, SHHS, AR, RMS, UNA	2018
6.4	Incorporate relevant WAP actions in the development of the Operational Unit Plans through the Operational Sustainability Strategy.	SE	All units partici-pating in OSS process.	2018+
6.5	Explore opportunities to engage staff, faculty, students and other campus users to prevent water pollution.	SE	RMS, SHHS, UNA	2019+
6.6	Collaborate with UBC Farm and the Botanical Garden to gain a better understanding of how water is used within their operations. Develop and implement water management and conservation initiatives based on these investigations.	SE	UF, BG, BO	2018+
6.7	Explore the use of water consumption dashboards (e.g., in-building or online) to influence water consumption behaviours, via SEEDS research projects for example.	SE	CCP/ SEEDS, EWS	2019-2020
6.8	Review and evaluate processes for dissemination and implementation of watering restrictions associated with the new Metro Vancouver Drinking Water Conservation Plan to maximize alignment. • Identify opportunities for improved alignment and work with users to better align water use if needed. • Facilitate a mechanism by which irrigation scheduling preferences of EWS are integrated wherever possible.	UNA, EWS	SHHS, AR, BO, SE	2018+
6.9	Continue to utilize regular communications to the UNA, strata councils and property managers to promote water conservation (and potentially other sustainability) issues and campaigns.	UNA	SE	2018+
6.10	Explore opportunities to improve irrigation efficiency and more effectively manage irrigation and associated operational costs, including: • Conduct audits of existing systems to identify potential retrofits or other changes and assess business cases. • Liaise with irrigation contractors on operations and scheduling of irrigation systems to maximize alignment with EWS preferred schedules. • Provide a mechanism for easy reporting and correction of irrigation system failures (e.g., broken sprinkler nozzles), particularly for the public realm.	UNA	PT, EWS, SE	2018-2019
6.11	Undertake more active monitoring of water consumption (e.g. public realm irrigation) and explore research projects or studies to develop a more granular breakdown of water uses and consumption patterns. This will help to identify opportunities for water and cost savings. It is recommended that this project align with the EWS update of its billing system and associated data collection and accessibility.	UNA	EWS, SE	2018-2019

PRIORITY ACTIONS (SHORT TERM) *continued*				
No.	**Action**	**Lead Dept/ Units**	**Support Dept/ Units**	**Timeline**
6.12	Explore benchmarking of UNA buildings using EnergySTAR Portfolio Manager in order to identify high water users and opportunities for conservation initiatives. Coordinate with the EWS billing system updates.	UNA/ SE	EWS	2018-2019
6.13	Explore opportunities for water storage and/or alternative sources in Neighbourhoods to contribute to emergency supply.	SE/ UNA	EWS, RMS	2019+
6.14	Explore opportunities to link WAP objectives and actions with teaching, learning and research (including SEEDS and other programs), and explore research collaborations with external partners such as Metro Vancouver.	SE	USI, faculties, others	2018+

Implementation and Business Case Considerations

- Communications and engagement programs will support water conservation behaviours and reduction of water costs.

IMPLEMENTATION

This section outlines the mechanisms needed for plan implementation. Achievement of plan objectives will be strongly influenced by the involvement of lead and support units, as well putting the human and financial resources in place to follow through on actions.

Approach & Business Case

The business case for many water conservation actions and projects is positive under current and near future conditions. Due to the anticipated increases in water costs (beyond the inflation rate), business cases will tend to become more positive over time.

Resource Requirements

Resources required to implement the majority of institutional actions outlined in this plan will be prioritized through existing budgets and staff. Each department/ unit involved is asked to review and approve the actions and commitments in respective work programs to lead or support. There are a few key strategies and actions that will require additional resources for implementation, namely:

- Metering updates
- Irrigation system inventorying and retrofits
- Drinking water fixture and signage retrofits
- Completion of commissioning of key demonstration alternative water systems, notably CIRS
- Development of the emergency supply plan
- Communications and engagement campaigns

These resource needs and funding mechanisms will be confirmed through consultation with the lead implementation units for those actions, and the WAP Steering Committee and the Executive Committee as needed. A summary of the resourcing needs and outline of the business case for these resources will be provided as an addendum to this Plan.

Management System

In order to drive, track and adjust implementation of the WAP, the following steps are planned for execution on an annual basis. Budget allocations will be identified in the fall of 2018 for implementation in the following fiscal year as needed.

1. SE works with plan stakeholders to prioritize actions and embed actions into work plans.
2. Lead and support units execute their committed actions.
3. Review progress against objectives and performance metrics, and develop a summary report.
   - Key performance metrics are identified in the Annual Sustainability Report and other reporting mechanisms including the Operational Unit Sustainability Plans and the STARS rating system.
4. Identify changes and adjustments needed, including budget and resourcing allocations to be included in the next year planning cycle.

The process is supported by:

- The Operational Sustainability Strategy (OSS) process is a collaboration with CCP that embeds planning actions into unit work plans on a three-year cycle with annual reviews.
  - The OSS process identifies key sustainability performance metrics for each unit necessary for reporting back on progress toward objectives.
- A Water Action Committee, which will meet one to two times per year to review progress against WAP objectives and any resourcing shortfalls.

A five-year review of the WAP will be completed to determine the success of this plan's activities. As a result of this review, UBC will produce an updated plan, including a summary of progress made and produce revised goals, targets and actions where necessary.

Appendix A:

Summary of Plan Development, Stakeholder Consultation Process and Steering Committee

The development of the Water Action Plan was led by Bud Fraser, Sustainability and Engineering, with valuable contributions from operational unit representatives, faculty, students and researchers.

Due to the relatively technical focus of the WAP and the minimal impact on the broader UBC community, consultations were focused on UBC internal stakeholders, with the exception of the consultations done as part of the Green Building Action Plan process that covered existing and new buildings, reaching a broader range of stakeholders.

Stakeholder Consultation

Stakeholders consulted in 2017 on other themes within the WAP are summarized as below. Typically, stakeholder workshops were held with subsets of stakeholders, primarily UBC staff, according to their area of influence, expertise, and/or interest.

The workshop process included the following:

- Present context for WAP including policies, drivers, UBC's water consumption.
- Discuss input on WAP vision, goals and objectives.
- Identify potential actions and discuss applicability of those actions.
- Following the workshop, circulate the notes including draft actions to invitees, for comment.
- Distill the workshop notes and actions into draft WAP content.
- In some cases, additional stakeholder meetings were convened to refine the actions further.

Outputs from workshops were documented and circulated back to stakeholders for comment. Draft plan content was later circulated to stakeholders for comment and further input, leading to final draft plan content. Final draft plan content was circulated to the Steering Committee for review.

Stakeholders

Alma Mater Society
Adriana Seibt, VP Sustainability

Athletics and Recreation
Daniel Cooper, Associate Director, Facilities

Building Operations
Frank Crudo, Superintendent Municipal Services
Jason White, Mechanical Technical Specialist
Jeff Nulty, Municipal Landscape Architect
Matt Holm, Manager, Municipal Services
Michael Thayer, Architect, Building Maintenance & Operations
Janice Weigel, Superintendent, Customer Services

Campus + Community Planning
Camila Curi, Student Project Coordinator, SEEDS
David Gill, Program and Policy Planner, SEEDS
Emma Luker, Planning Analyst
Hannah Land, Green Labs Coordinator
Charlene Ponto, Sustainability Engagement Lead
Rowan Waldron, Climate Action Planner
Liska Richer, Manager, UBC SEEDS
Bud Fraser, Senior Planning and Sustainability Engineer
Doug Doyle, Associate Director, Municipal Engineering
John Madden, Director, Sustainability and Engineering
Penny Martyn, Manager, Green Buildings
Ralph Wells, Community Energy Manager
Dean Gregory, Landscape Architect

Common Energy
Flavien Niederst, Student

Energy and Water Services
Aleks Paderewski, Mechanical Utilities Manager, Engineering & Utilities
David Woodson, Managing Director
Orion Henderson, Director, Energy Planning and Innovation
Julie Pett, Energy Conservation Manager, Energy Planning & Innovation
Dee Kaila, Associate Director, Finance
Erin Kastner, Geospatial Information Manager, Engineering & Utilities
Jenny Liu, Mechanical Utilities Engineer, Engineering & Utilities
Paul Holt, Director, Engineering and Utilities
Richard Hugli, Electrical Utilities Manager, Engineering & Utilities

Faculty of Land and Food Systems
Hannah Wittman, Associate Professor (also with UBC Farm)
Tim Carter, Research Assistant Technician

Financial Operations
Ray McNichol, Assistant Dean
Alexey Baybuz, Category Analyst Supply Management

Infrastructure Development
Jennifer Sanguinetti, Acting Managing Director

Institute for Resources, Environment and Sustainability
Mark Johnson, Associate Professor
Office of the Vice-President, Students
Matt Dolf, Wellbeing Strategic Support Director, UBC Wellbeing

Risk Management Services
Danny Smutylo, Manager, Emergency Management
Jamiann Questa, Manager, Environmental Services

School of Regional and Community Planning
Stephanie Change, Professor
Oscar Zapata, Post-Doctoral Fellow, Water Planning Lab

School of Architecture and Landscape Architecture
Cynthia Girling, Professor
Sahar Badeiei, Graduate student

Student Housing and Hospitality Services
Victoria Wakefield, Purchasing Manager

UBC Botanical Garden
Tara Moreau, Associate Director, Sustainability and Community Programs
Patrick Lewis, Director
Brendan Fisher, Horticulturalist

UBC Farm
Chiyi Tam, Administration and Site Coordinator

UBC Properties Trust
Craig Shirra, Construction Manager
Kathy Barr, Director of Property Management
Paul Young, Director, Planning and Design

UBC Sustainability Initiative
Angelique Pilon, Director, Urban Innovation Research

University Neighbourhoods Association
Wegland Sit, Operations Manager

Steering Committee

NAME	POSITION	UNIT
Pam Ratner	Vice-Provost	Office of the Vice-President Academic
Michael White	Associate Vice President	C&CP
John Madden	Director, Sustainability and Engineering	C&CP
John Metras	Acting Associate Vice-President, Facilities	Facilities
James Tansey	Executive Director	UBC Sustainability Initiative
Greg Scott	Managing Director	Building Operations
David Woodson	Managing Director	Energy and Water Services
Andrew Parr	Managing Director	Student Housing and Hospitality Services
Ron Holton	Chief Risk Officer	Risk Management Services
Jordi Honey-Roses	Assistant Professor	SCARP
Kavie Toor	Director, Facilities & Business Development	Athletics and Recreation
Adriana Laurent	VP Sustainability	Alma Mater Society
Paul Young	Director, Planning and Design	UBC Properties Trust

Appendix B:

Metering & Reporting Strategy

SCOPE

This appendix provides an overview of the key elements of the metering and reporting changes proposed as part of the Water Action Plan. It is expected that these elements will require refinement, as a result of a metering audit, however this document lays out the overall direction and needs. The WAP Actions (Part 2 of the main document) identifies roles, responsibilities and timelines, and outreach and education components are addressed in the Campus Engagement section of the WAP.

Note that though this strategy focuses on water metering, many of the same opportunities may also apply to energy metering.

CONTEXT AND RATIONALE

UBC has a foundation of utility metering, reporting systems and activities in place, managed by Energy and Water Services (EWS). Currently, the most comprehensive water metering is in place for Ancillary and Tenant water customers, who are billed based on water usage. Core buildings are largely metered, however a smaller proportion of core buildings are not metered. Core departments are not billed for water usage; consequently there is currently no comprehensive recalibration or replacement program for core water meters. Irrigation systems on the academic campus are partially metered; similarly to the core water meters these meters are not used for billing (exceptions being the athletic fields and student housing).

EWS water consumption monitoring and reporting activities include periodic building-level water use benchmarking, currently focused on core buildings. For students or researchers who are interested there is EWS data from existing water meters is available online. Depending on the needs and expertise of the user, they may require EWS staff assistance to utilize the data for analysis or other purposes.

Improving metering and reporting offers an opportunity to more effectively manage water use and further engages the UBC community in water conservation. This is done by improving the accuracy of water

consumption data and increasing the data accessibility and ease of use of reporting systems. In the past, staff in Sustainability & Engineering, student interns, or student SEEDS researchers used water consumption data to:

- Compare water use and water use intensity of different buildings to help guide conservation activities.
- Evaluate the impacts of changes in buildings, such as before and after student housing fixture retrofits.
- Evaluate impacts of behaviour change programs in residences or academic buildings.
- Compare water consumption of different types of landscapes and irrigation.
- Increase awareness of occupants about water consumption use and patterns.

Future projects could broaden the utilization of water data to potentially include: facility owners or managers; department heads and administrators; other water account holders who are evaluating their own water consumption under different scenarios; or researchers doing more independent projects.

Providing easy and open access to data with clear documentation is an opportunity to improve systems for external stakeholder use. The documentation surrounding the data should include which systems and records are accessed for which types of data, ensure consistent naming between meters, buildings and account identifiers, and include data quality assurance. Utility billing systems used by EWS are in the process of being reviewed for potential replacement, which will facilitate improved data access and reporting capabilities. Along with the Skyspark dashboard system[10] currently being piloted, these systems have the potential to support many of the opportunities identified above.

OBJECTIVES

In support of Water Action Plan objectives, the Metering and Reporting Strategy will increase the capacity of UBC to conserve water by providing campus stakeholders, including staff, faculty, students and water customers with open access to meaningful, high quality water consumption data.

[10] The Skyspark system is a dashboard for utility metering data being piloted by UBC Energy & Water Services.

TARGETS

Meter and report on water consumption for individual UBC buildings to enhance our ability to make strategic decisions on water conservation by: 1) ensuring all new buildings include water metering, 2) maintaining or replacing existing meters as required, and 3) adding meters where economically viable, over the next five years.

Update reporting tools and provide guidance for meter data users (covering core, ancillary and tenant sectors) by 2019, enabling more utilization of metering data.

STRATEGY

1. Conduct a comprehensive core building metering audit (EWS).
    - Identify and determine the status (including calibration) of existing water meters.
    - Develop a proposed project scope for metering repairs and replacements.
2. Analyze the gaps in building metering (SE).
    - Analyze the magnitude of the unmetered water flow and the business case for metering additional existing buildings, considering:
        - Anticipated water consumption, which in turn considers building size, occupancy, and water uses in the building. While building size influences water consumption, specific water uses in buildings, such as process cooling, can dominate water consumption.
        - Building age, condition and expected lifespan. Buildings slated for demolition in the near future (e.g. five years) may not be included, however older buildings may have higher water use due to older fixtures and infrastructure.
        - Cost of meters and installation.
    - Review existing sub-metering and opportunities for future sub-metering
        - Consider potential sub-metering for specific buildings and/or key water-intensive functions, such as laboratories or cooling systems, and for distinct programs within the same building, such as the residential and academic programs in the Commons buildings[11].

[11] Metering upgrades that will only be used by units other than EWS may be funded and coordinated by the appropriate units involved.

3. As per findings in the audit, replace or add meters in existing buildings to address failing or end of life meters. Scope and prioritize meter retrofits and additions by considering several factors:
    - Update the main campus meter(s) for automatic reading.
4. Review findings of the metering gap study to determine potential scope of adding meters to existing unmetered buildings.
5. Enhance irrigation metering for new buildings and systems.
    - Require a separate meter for irrigation systems in new buildings and when installing a new public realm irrigation system at a large scale. Currently the Technical Guidelines require all construction projects to provide primary metering for reporting of total water consumption.
    - New irrigation meters may or may not require auto-reading capability.
    - Coordinate with metering requirements in LEED.
6. Consider increased metering of construction projects through conducting a cost-benefit analysis.
7. Implement a meter monitoring and maintenance program, and diagnostic tools to flag potential problems in meter data and detect major system failures (e.g. based on main campus meter).
    - Assess the business case of a more comprehensive water monitoring and leak detection initiative.
8. Ensure systems and processes are in place for long term data storage, including where and how the data is stored, and who has access.
9. Update reporting systems:
    - Core buildings: provide open access to high quality water consumption information with an easy to use system (such as Skyspark, potentially complemented with other tools in the future such as Tableau) that does not require commitment of EWS staff time in providing and cleaning up data for individual users.
    - Ancillaries and tenants: provide updated water consumption reporting and billing that is clear, timely and allows those customers and other users to access current and historical consumption information on demand, for example via an online dashboard.

- Within reporting systems, align and standardize metering and naming conventions[12] for buildings and irrigation systems for ease of use, and include the appropriate information in the GIS system.
- Provide clear guidance (e.g. via online documentation) to stakeholders on the process, procedures and tools for accessing water consumption data for all sectors.
- Create a process and tools that provide benchmarking[13] data for all metered buildings including core, ancillary and tenants, is periodically updated (e.g. annually), with data accessible to the appropriate stakeholders. For example, via Skyspark and potentially Tableau.

Cascade fountain water feature
PHOTOGRAPHER: DON ERHARDT

[12] E.g., meter number, customer name/identifier, building identifier or irrigation system identifier, GIS location of meter.
[13] Benchmarking includes water consumption indicators such as total annual water consumption, and annual water consumption per unit area and per person (residents or occupancy, where applicable). It may be possible in the future to utilize occupancy proxy data from Wi-Fi systems.

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