DIRECTOR'S REPORT AND RECOMMENDATION
Living Building Pilot Program and Green Building Amendments

Introduction

From August, 2013, through January, 2015, the Department of Planning and Development (DPD) led a process to evaluate and propose revisions to the Living Building Pilot Program ("the Program"). This work responds to the City Council Resolution 31400, adopted on June 6, 2013, directing DPD to:

1) Establish a technical advisory group (TAG) to advise the City on sustainable building practices by August 30, 2013 (convened, with work concluding in 2015);
2) Develop recommendations to revise the Living Building Program by December 31, 2013 (amendments were adopted in July 2014, ORD 124535); and
3) Develop recommendations to revise the Seattle Deep Green Program by December 31, 2014 (addressed in this report and accompanying legislation).

Resolution 31400 was adopted due to concerns about allowable departures, including those concerning floor area ratios and structure height, and the level of staff and consultant review and consultation for permitting these buildings. DPD (predecessor to the Seattle Department of Construction and Inspections – SDCI) convened a Living Building and Deep Green TAG to advise the City on an improved or replacement pilot program. This report and legislation provides a summary of the work completed with the TAG, the proposed amendments to the Living Building Pilot Program, and proposed consolidation of existing green building standards into a single chapter of the Land Use Code.

Proposal Summary

Informed by the work with the TAG, SDCI recommends the following changes to the Land Use Code:

Living Building Pilot

- *Project eligibility:* Link the Program directly to the International Living Future Institute's (ILFI) Living Building Challenge (LBC), including LBC Petal Recognition. The program would be available for new buildings as well as existing buildings undergoing substantial alteration.
- *Relationship to other programs for gaining additional height or floor area.* Clarify that floor area and/or height gained by participation in the Program is not subject to the affordable housing and other provisions of Chapter 23.49 (incentive zoning) or Chapters 23.58A, 23.58B and 23.58C (Mandatory Housing Affordability (MHA)) above the maximum height allowed. However, the underlying floor area will be subject to MHA, and incentive zoning if applicable. In the case of a project not exceeding the maximum height or floor area limits allowed (in an incentive zone), compliance with both MHA and incentive zoning would be required.
- *Land Use Code modifications and departures:* Allow Land Use Code modifications related to height and floor area ratio to be approved as a Director's decision.

- *Application to vested Living Building Pilot projects:* Allow applicants for permit applications that are vested prior to the adoption to elect to perform under the provisions of the proposed Program, subject to the provisions of MHA; requiring MHA payment or performance.
- *Compliance and penalties:* Reduce the maximum penalty to 5 percent of a project's construction value.
- *Program Extension.* Enrollment will be expanded to allow an additional 20 qualifying projects through December 2025.

Other Green Building Standards

- *Reorganize and consolidate green building requirements in a new Land Use Code chapter and update the green building standards required to participate in the Incentive Zoning program to be consistent in all zones (i.e. currently it varies between LEED Silver and LEED Gold depending on the neighborhood; LEED Gold will become the new requirement for all projects participating in the program).*
- *Define a green building standard to accommodate preferences for the different certification options that currently exist for purposes of meeting Incentive Zoning requirements. This definition outlines both performance-based criteria based on post-occupancy operation of the building (LBC), and point-based programs, such as LEED and BuiltGreen, that certify projects prior to issuance of final permit by quantifying the value of sustainability and energy efficiency components (building systems, materials, etc.) by assigning points prior to occupancy.*

In addition, the TAG identified a number of opportunities beyond the Land Use Code for the City to promote the development of more living buildings. Those recommendations are described in more detail in the Additional Recommendations section of this report.

Background

The Program was adopted by the City Council in December 2009, amended in 2012 and again in July 2014, to facilitate the development of buildings that would either meet the LBC or alternative standards (the former Deep Green criteria). The Program was developed to provide flexibility for projects seeking LBC certification to encourage the use of this very high and difficult to achieve standard.

The LBC is a sustainable building certification program that focuses on a performance-based approach to certification with the aim of producing buildings that are less harmful to the environment than conventional buildings and contribute positively to their surroundings. It was created by ILFI as a green building rating system in order to recognize buildings that achieve the highest level of sustainability. Version 3.0 of the LBC requires buildings to meet 20 imperatives (i.e., requirements or prerequisites) within seven performance areas or petals: Place, Water, Energy, Health and Happiness, Materials, Equity and Beauty. In general, the imperatives require buildings to be built on non-environmentally sensitive sites, use recycled materials, generate as much or more electricity as they use through sustainable sources, capture as much rainwater as they use, treat wastewater on site, and meet standards for other elements.

In addition to the certification program, ILFI also offers Petal Recognition. The performance criteria for at least three of the seven areas, or "petals," must be met in order to receive "Petal Recognition." Recognition is further contingent upon the development demonstrating compliance with at least one of the following petal categories: Water, Energy or Materials. Additionally, certification is based on achievement of a number of "imperative" categories to demonstrate that a building can have a positive effect on the non-built environment. Two imperatives; *01: Limits to Growth* and *20: Inspiration and Education*, must also be met.

The Living Building Program facilitates the development of innovative green buildings to:

- Reduce environmental impacts;
- Test new technologies; and
- Serve as a model for development throughout the region and country.

The existing City Program allows departures from the Land Use Code through Design Review in recognition that the LBC requires the highest levels of sustainability. The Program was adopted through ordinances that amended the Code as follows:

2010: The original legislation implementing the Living Building Pilot program (Ordinance 123206).

2012: "Seattle Deep Green" tailored the Living Building Challenge to Seattle by providing developers with the option—or a pathway—to meet 60% of the Living Building Challenge requirements while meeting Seattle's energy use, water use, and storm water management requirements (Ordinance 123942).

2014: The program was amended (Ordinance 124535) to:
- Eliminate the Seattle Deep Green option;
- Revise the minimum energy use requirements to align with the new Seattle Energy Code;
- Clarify that independent third-party report is required to verify compliance with LBC;
- Modify and/or remove available design review departures; and
- Increase the maximum penalty for projects failing to demonstrate full compliance.

2016: City Council extended the program's expiration date to June 30, 2017 (Ordinance 118672) in order to prevent the program from lapsing prior to this update.

Role of the TAG:

The Living Building and Seattle Deep Green TAG was convened in 2013 by DPD to evaluate and propose revisions to the Program. In addition to industry professionals who have technical knowledge, experience, and interest in sustainable development, membership included a community organization representative as well. This expertise and feedback was used to inform DPD's decision-making process and recommendations to the Mayor and City Council for the 2014 amendment.

Their work focused on evaluating and developing recommendations regarding the following:

- *Project eligibility*: What are the minimum requirements that projects must meet to participate in the Program? Should these be based on already established third-party certification standards or should the City develop their own standards (i.e. continue to use the Deep Green approach)?

- *Land Use Code flexibility and incentives*: What flexibility is needed to meet minimum Program requirements and what incentives might attract more participation in the Program?

- *Process and procedures*: What is the appropriate review process for pilot projects and what is the role of the TAG in that process, if any?

- *Compliance and penalties*: How should compliance be evaluated? What is the appropriate approach to enforcement? Specifically, what level of penalty will ensure that applicants will strive to fully comply with program requirements (rather than paying the penalty in lieu of complying) while not setting a penalty so high that it provides a disincentive to participation in the program?

Purpose:

Based on input from the TAG, the main goal of this process was to improve the accessibility and use of the Program in order to continue to encourage development of very high performing green buildings.

The group also helped to identify the following principles, which were used to inform this work program:

- Pilot projects must be innovative – high performing green buildings should perform better over time due to their adaptability to new technologies, as opposed to incremental green improvements.
- Pilot program requirements should eventually become standard, leading to permanent changes to existing policies and code requirements.
- Incentives and flexibility beyond what the Land Use Code currently provides for are needed to increase participation in the pilot program.
- *Creating (or making permanent) a new or Seattle-specific green building standard rating system is not desirable.*

A key question that dominated discussions with the TAG is whether the Program's requirements should be tied directly to a third-party certification program, such as ILFI's LBC, or if Seattle should develop alternative criteria to more fully develop the former "Seattle Deep Green" program. The TAG recommended that existing third-party programs offer appropriate and sufficient criteria to achieve high performing development. Creating standards that are distinct from existing third-party programs would require significant staff and financial resources to implement and support.

The TAG also recommended that City link the Program to the LBC. As described by ILFI, "The Living Building Challenge sets substantially higher performance requirements across a more comprehensive set of criteria than required by regulation, or any rating system currently in use."[1] While the TAG

[1] Cascadia Region Green Building Council, *Code, Regulatory and Systemic Barriers Affecting Living Building Projects.* 2009. http://living-future.org/ilfi/ideas-action/research/building-codes/code-regulatory-and-systemic-barriers-affecting-living

acknowledged that the Land Use Code does not present significant barriers to developing Living Buildings it found that development incentives currently embedded within the Code are not strong enough to attract new projects into the Program given the associated financial cost that results from uncertainty and the additional complexity. Their recommendations for further action beyond the changes included in this proposal are listed on pages 10-11.

Living Building Pilot: Proposed Land Use Code Changes

Broad Goals of the Pilot Program

The City of Seattle has a long history of environmental stewardship. Environmental goals are inherent throughout the City's work. One of the primary objectives is to protect, conserve and enhance the region's environmental resources by setting a community standard of sustainable building practices. The Program is one of the tools being employed to further this commitment to environmental, economic and social stewardship.

Building energy use accounts for more than 20 percent of Seattle's greenhouse gas emissions (GHG). Making sure energy comes from clean, low-carbon sources and improving the overall energy efficiency of buildings are essential to reducing our GHG emissions and achieving the goals outlined in the Climate Action Plan (CAP). Reusing rainwater and greywater reduces combined sewer overflows and demand on the City's potable water supplies. The current Living Building Pilot Program requires that 100 percent of both stormwater and used- water discharge must be managed on-site.

Project Eligibility

To date, three projects have or are formally participating in the Program: the Bullitt Center, the Stone34 project, and 901 7th Avenue. The Bullitt Center pursued full LBC (achieved in April 2015), whereas the Stone34 project is pursuing the requirements under the former Seattle Deep Green program, which was subsequently removed from the Land Use Code in the preceding update of the ordinance (#124535). SDCI has reviewed the staff resources required for the Bullitt Center and Stone 34 projects (901 7th Avenue is still in permitting) against comparable projects not enrolled in the Program. Stone34, which used the Deep Green pathway, required significant staff time and resources to determine baselines and measurement procedures. Staff experience with review of these two projects contributed to the recommendation to link the Program to the LBC and simplify the compliance requirements (see below) in order to minimize the impact on staff resources.

The LBC requires that 100 percent of a project's water use must come from captured precipitation, a closed-loop water system that accounts for downstream ecosystem impacts, or by recycling water from on-site use. Purification of water for drinking and sanitation is required to be conducted without the use of chemicals. Setting a requirement that no potable[2] water may be used for non-potable uses (toilet flushing and irrigation) will require project teams to incorporate strategies to capture stormwater through rainwater harvesting[3] and reuse water through greywater harvesting[4] in order to have water

[2] Potable water is clean water — satisfactory for drinking, culinary and domestic purposes, and meets the drinking water standards established by the Washington State Department of Health.

[3] Rainwater harvesting is the capture and storage of rainwater and is considered the cleanest form of harvested water.

available for uses beyond drinking, sanitation, and cooking. This simplified Program requirement will be clearer for applicants and will significantly reduce the staff time needed to review and verify project performance.

Tying the Program's energy requirement to the energy use targets set in the Seattle Energy Code will simplify the process for applicants and staff in determining and measuring project performance. There will also be the option to rely on alternative energy use targets in cases where the unique aspects of the building design or program warrants an approach not contemplated by the Energy Code. This will need to be approved by the Director during the application submittal.

The building must operate within the energy use target and water requirement for a full year after occupancy in order to meet the City's compliance requirements and receive documentation of such.

SDCI 2016 Proposal:

In order to participate in the Pilot Program, a project would be required to:

- Participate in Seattle's Design Review Program and be located outside the shoreline jurisdiction. Owners of existing buildings that would like to participate in the Program will be able to voluntarily go through design review in order to receive the related incentives.
- Meet all of the imperatives in the International Living Future's (ILFI) full Living Building Challenge™ (LBC) certification, version 3.0; or
- Attain at least three of the seven performance areas or "petals" (Place, Water, Energy, Health and Happiness, Materials, Equity and Beauty) of the ILFI's Petal certification program. At a minimum at least one of the following petals must also be met: Energy, Water or Materials; and
  - Ensure that the energy use is 25 percent below the targets set in the Seattle Energy Code's Target Performance Path[5] or an energy use intensity (EUI)[6] established by the Director.
  - Ensure that no potable water is used for non-potable purposes.
- Maintain these requirements for the life of the building.

Land Use Code Incentives and Departures

In addition to the general Design Review departure criteria, departures are available to projects participating in the Program when an applicant demonstrates that approval of a departure would better meet the goals of the LBC or would not conflict with adopted design guidelines. Both the TAG and separate discussions with developers emphasized that economic feasibility and incentives are necessary

[4] Greywater harvesting is the capture and storage of water that has already been used for non-sewage purposes — from baths and showers to washing machines, sinks and vehicle washing run-off. Reuse of greywater triggers more code requirements and design regulations than the use of rainwater. Some applications are restricted by local building codes.

[5] This optional energy code compliance path allows the design team, contractor, and owner to determine the most effective methods to achieve energy efficiency. Rather than complying with all the details of the Seattle Energy Code, designers of several common building types will be permitted to submit energy models demonstrating that their proposed buildings will meet specific energy use targets.

[6] EUI is a common measure used to normalize a building's annual energy performance as a function of its size. The EUI is expressed as units of energy, per square foot, per year (kBtu/SF/year). Generally, a low EUI signifies good energy performance. However, it is important to note that some building types and uses are more energy intensive than others and will consistently have higher EUIs.

to stimulate innovation and encourage higher levels of innovation due to the increased financial risk that results from the initial capital investment in equipment and materials. Developers expressed concern about additional costs associated with living buildings and perceive the existing permit approval process to be a barrier to adopting green building techniques due to the lack of certainty regarding the ability to secure the departures for additional development capacity. This proposal recommends modifying the Program to allow some of the existing departures, such as additional height and floor area, to be approved by the Director as a Type I decision (no appeal), as opposed to discretionary Type II decision (appealable to the City's Hearing Examiner), in order to provide certainty in the approval process. The change is also intended to offset the increased cost associated with living building systems as the additional floor area and/or height should increase a development's leasable area.

The following Design Review departures unrelated to height or floor area could continue to be pursued through the existing Design Review process for any project enrolled in the Program if the applicant demonstrates that the project would result in a development that better meets the intent of adopted design guidelines, or that better meets the goals of the Program and would not conflict with adopted design guidelines:

- Residential density limits;
- Reduction in quantity of parking;
- Permitted, prohibited or conditional use provisions for accessory uses that would directly address an imperative of the LBC;
- Maximum size of use;
- Standards for storage of solid-waste containers;
- Quantity of open space required for major office projects in Downtown zones;
- Standards for the location of access to parking in Downtown zones; and
- Structural building overhangs and minor architectural encroachments.

SDCI 2016 proposal:

Land Use Code modifications

The following incentives will be available to any project enrolled in the Program:

- Increased height (up to 10 feet in zones with height limits up to 85 feet and 20 feet in zones with height limits 85 feet and above); and
- Up to an additional 15 percent of floor area.

These increases would be additive to any additional floor area or height gained by other programs such as incentive zoning or MHA. If additional height and/or floor area is gained through the Program, that additional height and/or floor area would not be subject to incentive zoning or MHA requirements.

Compliance and Penalties

While the goal of the Program has always been to encourage buildings to meet the LBC, SDCI recognizes that the LBC is an innovative and very ambitious program. Penalizing a project that strives to meet these goals but falls slightly short may deter future interest and participation in the Program.

The amendments to the Program, adopted in July 2014, increased the maximum penalty for noncompliance from 5 percent of a project's construction value to 10 percent. Noted at the public hearing, and reiterated in discussions with both the TAG and developers, the penalty may act as a

disincentive to participation in the program. In recent discussions with project teams considering participating, the 10 percent penalty has been the main concern raised and in some cases may be the deciding factor.

SDCI 2016 proposal:

- Compliance: Applicants must submit a third-party report demonstrating compliance within two years after issuance of a final Certificate of Occupancy. This allows one year of post-occupancy operations to ensure proper performance and may include retro-commissioning to resolve any problems that may have been encountered during design and construction. The applicant may request an extension if they demonstrate additional time is warranted and likely to result in the intended outcome.

- Maximum Penalty for Non-compliance: SDCI proposes reducing the maximum penalty from 10 percent to 5 percent of a project's construction value, but will continue to evaluate whether the penalty is sufficient as more projects enroll and achieve compliance. If it is demonstrated that the penalty is not high enough to ensure that projects fully comply with the requirements, SDCI will evaluate an increase to the maximum penalty.

Other Green Building Certifications

Separate from the Living Building Pilot Program, the Builtgreen, LEED, Passive House and Evergreen programs are point-based systems that provide certifications prior to occupancy and operation, whereas LBC is based on actual operations one year from occupancy. Currently, to qualify for the higher floor area ratio (FAR) limit in multifamily zones, projects must meet green building performance standards by earning a LEED Silver, a Built Green 4-star rating, or other similar standard. Council recently added Passive House as an option in Lowrise multifamily zones.

SDCI 2016 proposal:

SDCI proposes a new Land Use Code Chapter to consolidate requirements related to green building standards as a condition of a permit. The intent of this consolidation is to provide consistency and make it easier to understand the standards and the process for demonstrating that a project meets those requirements. A new Green Building Requirements chapter will be created to affect this change.

Additionally, the proposal defines the Green Building Standard for Incentive Zoning purposes and allows the Director to establish by rule, procedures for determining whether a proposed or final project meets those standards. For instance, the rule may outline the requirements for enrolling in the Program, identify the type of or format for data required to verify a project's ability to meet the Program's requirements, and outline the process by which the Director establishes an EUI alternative to the Target Performance Path. Inclusion of this type of information in a rule (as opposed to the Land Use Code) will allow changes to requirements to be made in step with technological advancements, alleviating the need to make legislative changes to address minor modifications to criteria and metrics.

The Green Building Standard applies to a development that meets the standards for one of the following:

- A Net Zero Energy certification according to the criteria in the ILFI's LBC, version 3.0;

- A Gold certificate (changed from currently required Silver) for either LEED for New Construction v4 or for LEED for Homes v4, according to the criteria in the U.S. Green Building Council's LEED Green Building Rating System;
- A 4-Star rating either for BuiltGreen Multi-Family New Construction Version 2009 or BuiltGreen Single-Family/Townhome New Construction Version 2014, at the election of the applicant, according to the criteria in the Master Builders Association of King and Snohomish Counties Rating System;
- A Passive House certificate, according to the criteria in the Passive House Institute US's (PHIUS) 2014 rater checklist;
- Compliance with the standards for the Evergreen Sustainable Development Standard (ESDS) version 2.2 according to the State of Washington Department of Commerce Rating System; or
- A substantially equivalent standard, as approved by the Director, for any of the above. The owner must submit a written request and documentation demonstrating to the Director how the proposed standard is equivalent to the standards for one or more of the certification programs listed above.

2030 District

Proponents of the Seattle 2030 District, a high-performance building district in downtown Seattle that aims to reduce environmental impacts of building construction and operations, have been interested in identifying incentives for existing buildings to achieve high levels of sustainability. A number of existing buildings that were constructed between the 1950s and 1970s will require recladding and other major overhauls over the course of this decade, which may be economically infeasible leading to demolition rather than rehabilitation.

The 2030 District has suggested that given the proper incentive, this may be an opportunity to dramatically improve the environmental performance and energy efficiency of existing buildings. They have been in conversations with ILFI regarding how LBC certification might facilitate such rehabilitations being eligible for the Program. In order to further this concept, the proposal provides existing buildings the ability to voluntarily participate in design review, which would allow participation in the LBC.

Recommendations for Further Consideration

The TAG identified a number of opportunities beyond the Land Use Code that the city may explore to promote the development of more living buildings. Those recommendations are outlined below.

Throughout DPD's work with the TAG, a number of barriers and opportunities were identified that are not linked to the Land Use Code but are areas where the City, or the City in partnership with other agencies, could take steps to promote the development of more living buildings. The recommendations outlined below highlight areas identified by the TAG that would require additional work and leadership from other City departments or other jurisdictions:

RECOMMENDATION	DESCRIPTION	TIMEFRAME
City pursues Living Building Challenge Certification for a city	Both the Seattle Climate Action Plan and the City's Sustainable Buildings and Sites Policy recommends the	Short-term goal

RECOMMENDATION	DESCRIPTION	TIMEFRAME
building.	City take a leadership role in promoting high performance buildings. The Sustainable Buildings and Sites Policy calls for one City of Seattle project to be Living Building Challenge certified project by 2015. The TAG emphasized that the City should fulfill this goal and continue to be a leader for green building and demonstrate higher levels of environmental performance while also evaluating the effectiveness of alternative rating systems. The TAG noted that the City has been a leader in developing LEED certified buildings that helped to establish a market for the increase in LEED certified projects in the private sector, and this is an opportunity to lead the market for living buildings.	
Work with local, state and federal policy makers to allow more flexibility and innovation in water reuse and stormwater management.	In February 2011 the Cascadia Green Building Council (CGBC) and the City of Seattle released a report (prepared by Cascadia GBC) titled "Regulatory Pathways to Net Zero Water: Guidance for Innovative Water Projects in Seattle" (see attachment 2). The report summarizes regulatory challenges in current codes that a net zero water project may encounter, identifies alternative pathways and recommendations on possible changes to consider and provides guidance for future net zero water projects. Many of the issues identified in the report are still a challenge for Living Building projects and more work to change existing local, county, state and federal codes need to be considered. In addition to the challenges outlined in that report, the following issues and opportunities emerged from discussions with the TAG: • Allow hybrid vault/cisterns with a seasonal valve – with clear approval process. • Consider options to license smaller operations & maintenance providers or have the City operate a smaller distributed system and establish a framework for city management of 'private' systems. Allowing decentralized site- or district-level solutions is one approach to achieve net positive water systems. A cost/benefit analysis of the current water delivery and treatment system and associated infrastructure maintenance costs compared to smaller scale systems (at the building or district level) would be an important step to inform the discussion.	Medium-term goal

RECOMMENDATION	DESCRIPTION	TIMEFRAME
Provide Financial incentives to offset the increased upfront costs associated with deep green development. **Often described as an ~10-20% premium that is not typically covered by lending institutions, increasing the equity investment needed from the developer to promote living buildings**	Financial incentives that offset some of the higher upfront costs (additional design, modeling and systems and materials costs) for projects seeking LBC certification may be the most effective strategy to increase participation in the Program. We have heard from the TAG and developers that there is a financial cost associated with use of new technologies as conventional lenders will not provide financing (requiring a larger equity investment), in addition to the risk associated with the penalties for noncompliance. SDCI is currently in discussions with Seattle City Light to develop an energy performance financial incentive. Other areas to consider are a Seattle Public Utilities (SPU) conservation incentive program, tax incentives (would likely require changes to state law), reduced permit fees (similarly may require changes to state law) or seek grant funds.	Long-term goal

Attachment:
Att 1: Draft Director's Rule
Att 2: Regulatory Pathways to Net Zero Water: Guidance for Innovative Water Projects in Seattle

DPD

DRAFT Director's Rule __ 2016

Applicant: City of Seattle Department of Construction & Inspections	**Page:** 1 of 3	**Supersedes:**
	Publication: ___	**Effective:** ___
Subject: Green Building Standards: requirements, compliance and documentation.	**Code and Section Reference:** SMC 23.58D.002, 23.58D.004 and 23.84A.014 "G"	
	Type of Rule: Code Interpretation and Procedural Rule	
	Ordinance Authority:	
Index: Land Use Code/Technical Standards and Procedural Requirements	**Approved** **Date** _____ **Nathan G. Torgelson, Director**	

Purpose

The purpose of this rule is to:

A. Establish the requirements for development to meet either Green Building Standard A or Green Building Standard B, or a substantially equivalent standard.
B. Establish procedures for documenting an owner's commitment that a proposed development will meet a green building performance standard.

C. Establish procedures for determining whether the development, once constructed complies with an owner's commitment that the development will meet a green building performance standard.

A. Requirements for Green Building Standard A and B, or a substantially equivalent standard

Green Building Standard A applies to a development that meets all of the imperatives in the International Living Future Institute's (ILFI) full Living Building Challenge™ (LBC) certification, version 3.0; or all of the following:

1. Attain at least three of the seven performance areas, or "petals," (Place, Water, Energy, Health and Happiness, Materials, Equity, and Beauty) of the ILFI's Petal certification program. At a minimum the criteria for at least one of the following petals must be met: Energy, Water, or Materials;
2. Total building energy use shall be 75 percent or less of the energy use targets established in the Seattle Energy Code's Target Performance Path, Section C402.1.5; and
3. No potable water shall be used for nonpotable uses.

Green Building Standard B applies to a development that meets the standards for one of the following:

1. A gold certificate either for LEED for New Construction v4 or for LEED for Homes v4, according to the criteria in the U.S. Green Building Council's LEED Green Building Rating System;
2. A 4-Star rating either for BuiltGreen Multi-Family New Construction Version 2009 or BuiltGreen Single-Family/Townhome New Construction Version 2014, at the election of the applicant, according to the criteria in the Master Builders Association of King and Snohomish Counties Rating System;
3. A Passive House certificate, according to the criteria in the Passive House Institute US's (PHIUS) 2014 rater checklist;
4. A Net Zero Energy certification according to the criteria in the ILFI's LBC, version 3.0;
5. Meets the standards for the Evergreen Sustainable Development Standard (ESDS) version 2.2 according to the State of Washington Department of Commerce Rating System; or
6. A substantially equivalent standard, as approved by the Director. The owner must submit a written request and documentation demonstrating to the Director how the proposed standard is equivalent to the standards for one or more of the certification programs listed above.

B. Procedures for documenting an owner's commitment that a proposed development will meet a green building performance standard

At the time an owner submits an application for a Master Use Permit (MUP), the owner and/or applicant must submit:

1. A written and signed statement identifying which of the standards identified in section A above will be used to meet either Green Building Standard A or B. The statement must also acknowledge the requirement to submit documentation demonstrating compliance as required by SMC 23.58D.004.
2. Documentation that the owner has registered the development project with an independent third party that will verify that the required standards have been met. This may be achieved through a letter, email or registration confirmation from one of the independent third party organizations identified in section C below.

C. Process to demonstrate compliance

To demonstrate compliance, the owner must submit a report to the Director from one of the independent third party organizations identified below:

1. For projects using the Living Building Challenge program, the report will be produced by the ILFI.
2. For projects using the LEED program, the report will be produced by the Green Building Certification Institute.
3. For projects using the BuiltGreen Program the report will be produced by the Master Builders Association of King and Snohomish Counties.
4. For projects using the Passive House program, the report will be produced by the PHIUS.
5. For projects using the ESDS program, the report will be produced according to the process managed by the Housing Trust Fund Contract Manager for the State of Washington.
6. If the Director approves a commitment to achieve a substantially equivalent standard, the report must be produced according to terms approved by the Director. The owner must submit a written request for this compliance method at the time of MUP submittal. This request must include documentation demonstrating to the Director how the proposed standard or method is equivalent to the standards required for compliance with Green Building Standard B under one of the programs as listed in Section A. The request must also identify who will serve as the independent third party verifier for this standard or method and include documentation that the verifier has provided similar certification previously.

Following submittal of the report produced by the independent third party the Department of Planning and Development or another City agency with regulatory authority and expertise in

green building practices shall make a final determination as to whether an applicant has demonstrated that a new structure has met the required green building performance standard, as required by SMC 23.58D.004.

Regulatory Pathways to Net Zero Water:
Guidance for Innovative Water Projects in Seattle

Phase II Summary Report
February 2011

City of Seattle

Prepared by: CASCADIA GREEN BUILDING COUNCIL

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INTRODUCTION

the City of Seattle to identify regulatory pathways for Seattle-area projects pursing net zero water strategies. Net zero water projects are described as those that operate solely within the water budget of their site on an annual basis, meeting all water needs from on-site sources and managing all wastewater and stormwater on-site. Building on the Seattle City Council's 2009 Living Building Pilot Program Ordinance (#123206), this effort brought together public agencies and water utilities at the local and state levels to discuss current codes and gain a shared understanding of regulatory authority, technical viability, and financial costs for building scale water systems. One of the outcomes of that process is this report, which describes obstacles present within current codes, identifies possible alternative pathways for projects seeking approvals, and provides guidance to design teams pursing the goals of the Living Building Challenge℠.

This report is not intended to endorse one approach over another as the appropriate scale for managing water resources in Seattle— from larger scale centralized systems to building scale decentralized systems. Instead, it is expected that the initial findings from this process will be used to refine and improve upon a collective understanding of the regulatory implications of Living Buildings and their financial, operational and managerial considerations. In addition, it is expected that the process of designing, permitting, constructing, operating and maintaining Living Buildings developed through the Pilot Program will be an essential part of future discussions.

While the efforts of this project are specific to the City of Seattle, it is intended to serve as a model for other jurisdictions around Washington State and to support the evolution of policies and programs at the national level.

AUDIENCE

Pathways to Net Zero Water is a resource for design teams as well as local and state agencies responsible for approval of water systems. Primary audiences include:

- Water, stormwater and wastewater utilities
- Local and state public health agencies
- Local planning and building permit departments
- Long range planners
- Policy makers
- Environmental agencies
- Building owners and developers
- Architects, engineers and contractors

BACKGROUND

Throughout the United States and globally, communities are facing significant water-related challenges. Water supply and wastewater treatment infrastructure—most of which was designed and built in the early 20th century—is continuing to age and is in need of major overhauls and repair. Each year, surface water and groundwater resources are degraded by combined sewage and stormwater overflows, creating financial burdens for water utilities and their customers. According to the 2009 American Society of Civil Engineers Report Card on our nation's water and wastewater infrastructure, over $255 billion is needed to upgrade these systems over the next 5 years.

With growing awareness around these and other challenges, sustainable water use programs, policies and regulations are beginning to emerge. Conventional practices for supplying water have been modified to include extensive demand management programs focused on conserving potable water in residential, commercial and industrial sectors. Likewise, conventional practices for managing stormwater have been augmented by "green infrastructure" approaches that attempt to mimic natural processes such as infiltration, storage and evaporation. More recently, there has been a growing interest in green building standards, such as the Living Building Challenge, that promote on-site water capture and treatment approaches to reduce the need for conveyance to and from centralized facilities. Emerging building and neighborhood scale technologies need to be piloted in order to learn about how they work and their effectiveness in managing water resources. Additional research and analysis is also needed to evaluate how these approaches can complement and be integrated with existing water infrastructure systems to enhance overall resiliency.

SEATTLE LIVING BUILDING PILOT PROGRAM

In December 2009 the Department of Planning and Development launched a pilot program to assist building owners in meeting the requirements of the Living Building Challenge. The Pilot Program allows flexibility in the application of development standards to accommodate innovative technologies or design approaches that might otherwise be discouraged or prohibited.

www.seattle.gov/dpd/GreenBuilding/

Local Context

The Pacific Northwest, with its historic abundance of fresh water, will also face challenges with respect to climate change. Current climate change projections indicate wetter winters and drier summers for the Puget Sound region. These projections reinforce the importance of sustaining aggressive water conservation programs as well as supporting robust stormwater management strategies to reduce sewer overflows and to manage peak winter storm events.

Seattle residents are served by Seattle Public Utilities (SPU) for water supply and King County's regional utility for wastewater treatment services. Drinking water is sourced from two rivers that originate in the central Cascade mountains. Because of SPU's aggressive water conservation efforts over the last 30 years, demand for potable water has declined despite a growing population.

Looking forward, participants in the Seattle water supply system have agreed to pursue an additional 15 million gallons per day in water savings through 2030, which is an important aspect of Seattle's climate adaptation strategy.

The City of Seattle actively promotes green building practices and has developed policies and incentives that support water resource protection. For example, the City recently adopted new stormwater codes that require low impact development techniques. Seattle also secured a water right for rainwater harvesting, provides permitting guidance for rainwater harvesting systems and offers rebates and technical assistance for water conservation efforts.

In December 2009, Seattle established a Living Building Pilot Program Ordinance to assist developers seeking to meet the advanced sustainability standards set by the International Living Building Institute's Living Building Challenge . The ordinance identified three purposes for the Pilot Program: 1) stimulate development that meets the goals of the Living Building Challenge and City of Seattle design guidelines; 2) encourage development that will serve as a model for other projects throughout the City and region; and 3) identify barriers to Living Buildings in current codes and processes. The Pilot Program is limited to a period of three years, 2010 through 2012, and a maximum of twelve projects.

In light of these and other efforts, there remain a number of obstacles for Seattle projects that seek net zero water goals — that is, projects seeking to operate within the water budget of their sites by utilizing closed-loop systems that meet human needs while protecting the surrounding ecosystem. As more Seattle-area projects pursue the Living Building Challenge, there is a growing need to clarify the codes and regulations around on-site water management systems, identify regulatory authority and possible obstacles or gaps in the approval process, and learn about the financial and operational performance of buildings constructed through the Pilot Program.

PROCESS

Between December 2009 and October 2010, Cascadia convened a series of three workshops that brought together key staff from the City of Seattle Department of Planning and Development (DPD), Seattle Public Utilities (SPU), King County Wastewater Treatment Division (KC WTD), Seattle/King County Department of Public Health, Washington Department of Ecology (WA DOE) and Washington Department of Health (WA DOH). The Cascadia Center for Sustainable Design and Construction, a Living Building pilot project currently in the design and early permitting phase, served as the case study for exploring pathways for approval of net zero water buildings in Seattle (see case study on page 24).

Attendance at the workshops was limited to regulators, water and wastewater utility representatives, and key members of the Cascadia Center's project team. The primary objective of the workshops was to identify the city, county and state water use, reuse and treatment regulations relevant to a commercial or mixed-use project within the City of Seattle. The Cascadia Center for Sustainable Design and Construction was used as the platform for the discussion, allowing participants to discuss the regulatory pathways the project may seek for approval of its innovative water systems. It was acknowledged that obstacles within the current regulations may be outside the control of the local or state authorities responsible for implementing them and that some solutions will require broader policy changes through legislative efforts.

The workshops were not intended as a forum for any one group to advocate their specific positions on or changes to existing codes and regulations. Rather, the intended outcome was a shared understanding by each agency of the regulations that exist at the various jurisdictional levels and where conflicts or gaps present potential barriers for net zero water projects.

As part of laying the groundwork for discussion, the group agreed on the following shared goals and assumptions:

- All parties are committed to protecting public health and safety. Any solution to addressing current obstacles to net zero water projects must meet or exceed the intent of current regulations in place to protect public health.
- All parties are committed to a sustainable future with respect to our water resources. Solutions must support long-term resiliency of our water systems and address risks from an economic, environmental and social perspective.
- Pilot projects, such as the Cascadia Center for Sustainable Design and Construction, serve as important models for future sustainable development practices in Seattle.

The following sections summarize the findings, potential barriers encountered by project teams, and recommendations and/or opportunities for creating regulatory pathways for net zero water projects in the future.

LIVING BUILDING CHALLENGE: NET ZERO WATER AND ECOLOGICAL WATER FLOW

To frame the exploration of regulatory pathways to achieving net zero water, the standards defined by the Living Building Challenge were chosen because they set high performance goals for water use and discharge. The Living Building Challenge, launched in 2006 and operated by the International Living Building Institute, is a benchmarking standard and certification program that defines the most advanced measures of sustainability in the built environment available today. The Living Building Challenge applies to building and renovation projects at all scales, including infrastructure projects, and is intended as a tool for transforming the way the built environment is conceived, designed and constructed. Additionally, it serves as an advocacy tool, providing a platform for design teams and regulatory agencies to define codes and policies to support more sustainable development practices.

The Living Building Challenge is comprised of seven performance areas, or 'Petals': site, water, energy, health, materials, equity and beauty. Petals are subdivided into a total of twenty Imperatives, or mandatory requirements. The intent of the Water Petal is to realign how people use water, to redefine 'waste" in the built environment, and to ensure that water is respected as a precious resource.

There are two requirements of the Living Building Challenge Water Petal:

Imperative 5: Net Zero Water

One hundred percent of occupants' water use must come from captured precipitation or closed loop water systems that account for downstream ecosystem impact and that are appropriately purified without the use of chemicals.

Imperative 6: Ecological Water Flow

One hundred percent of stormwater and building water discharge must be managed on-site to feed the project's internal water demands or released onto adjacent sites for management through acceptable natural time-scale surface flow, groundwater recharge, agricultural use or adjacent building needs.

Building and development projects seeking to meet these imperatives are fundamentally different from conventional projects in their approach to sourcing water, using and re-using water in both interior and exterior applications, and treating water prior to outflow off the building site or into the environment.

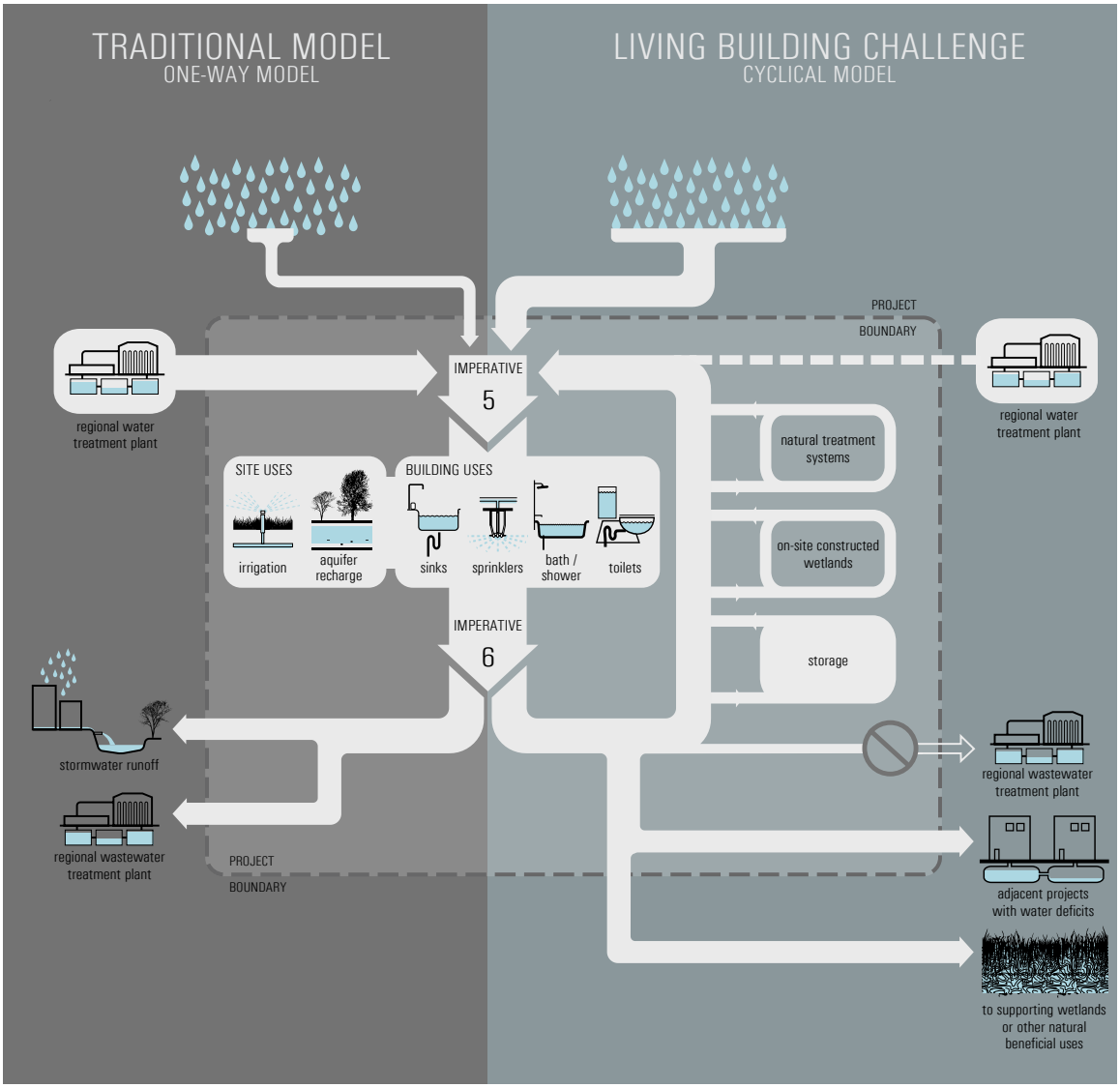
The first two certified Living Buildings in the United States, The Omega Center for Sustainable Living in Rhinebeck, NY (above left) and Tyson Research Center's Living Learning Center in Eureka, MO (above right) utilize different strategies to manage water and waste on-site. The Omega Center collects wastewater from the surrounding campus and treats it on-site through an eco-machine and constructed wetlands. Tyson's potable water is provided by a chemical-free rainwater harvesting system. The project includes composting toilets and a sub-surface constructed wetland to treat greywater.
Images courtesy of BNIM Architects and Clivus Multrum.

Figure 1 on the following page demonstrates these differences. Traditional models rely solely on regional potable water supply for all water uses and regional facilities for treatment of all stormwater and wastewater leaving a project site. In contrast, Living Building projects seeking net zero water and ecological water flow goals source their water through rooftop harvested precipitation, groundwater, surface water, stormwater, and/or on-site reclaimed water sources.

Regionally supplied water is allowed only for potable supply to sinks, faucets and showers where local health regulations require it, and only if an appeal has first been filed to the appropriate agency. However, it is not permitted for any other use including irrigation, toilet flushing and equipment.

Figure 2 shows possible design paths to meet the requirements of the Living Building Challenge. Design teams often utilize two different methodologies in their approach to net zero water strategies, either a treatment and reuse route or a waterless/composting fixture route. The

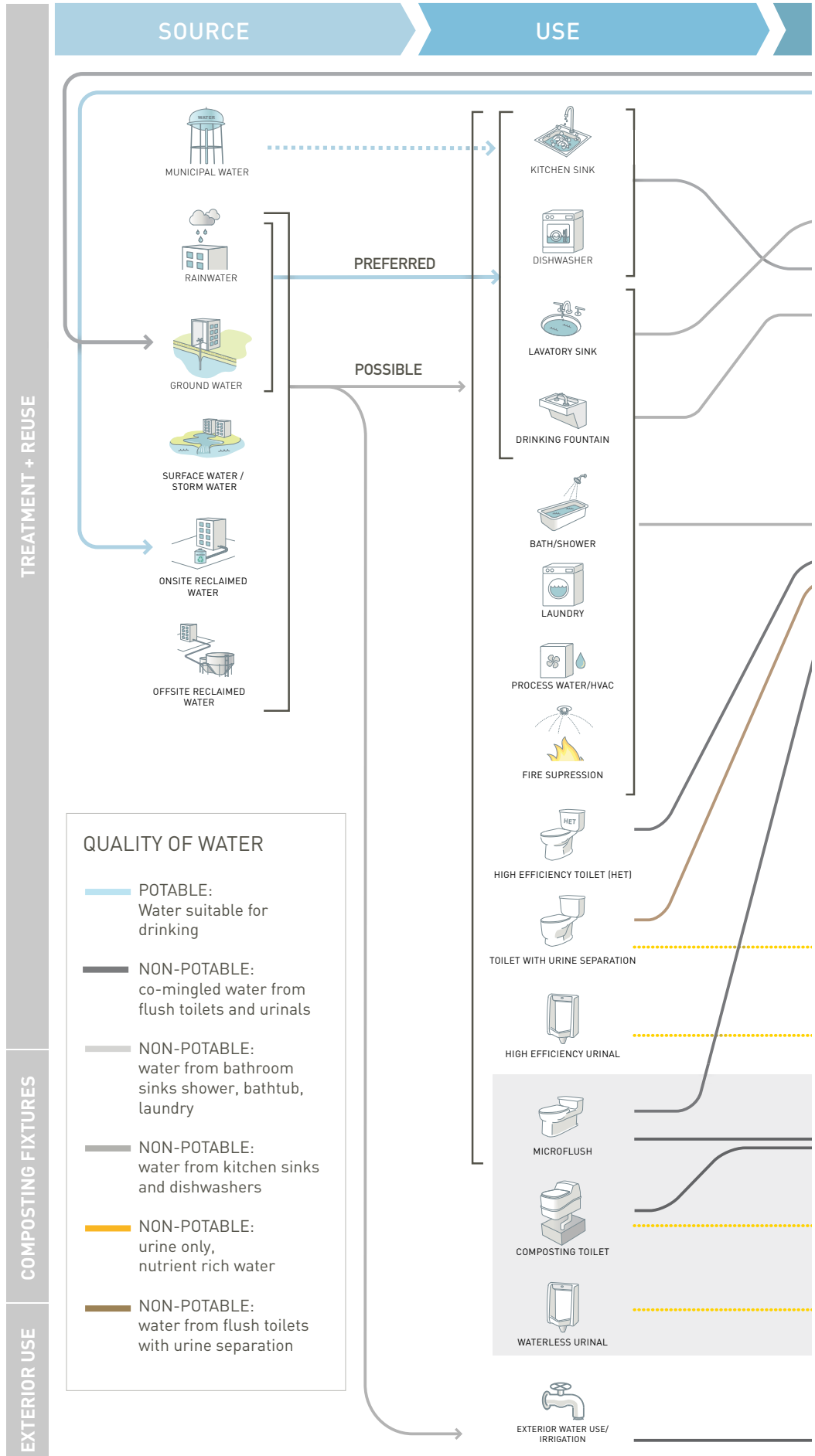
FIGURE 1. TRADITIONAL VERSUS CLOSED LOOP WATER SYSTEMS

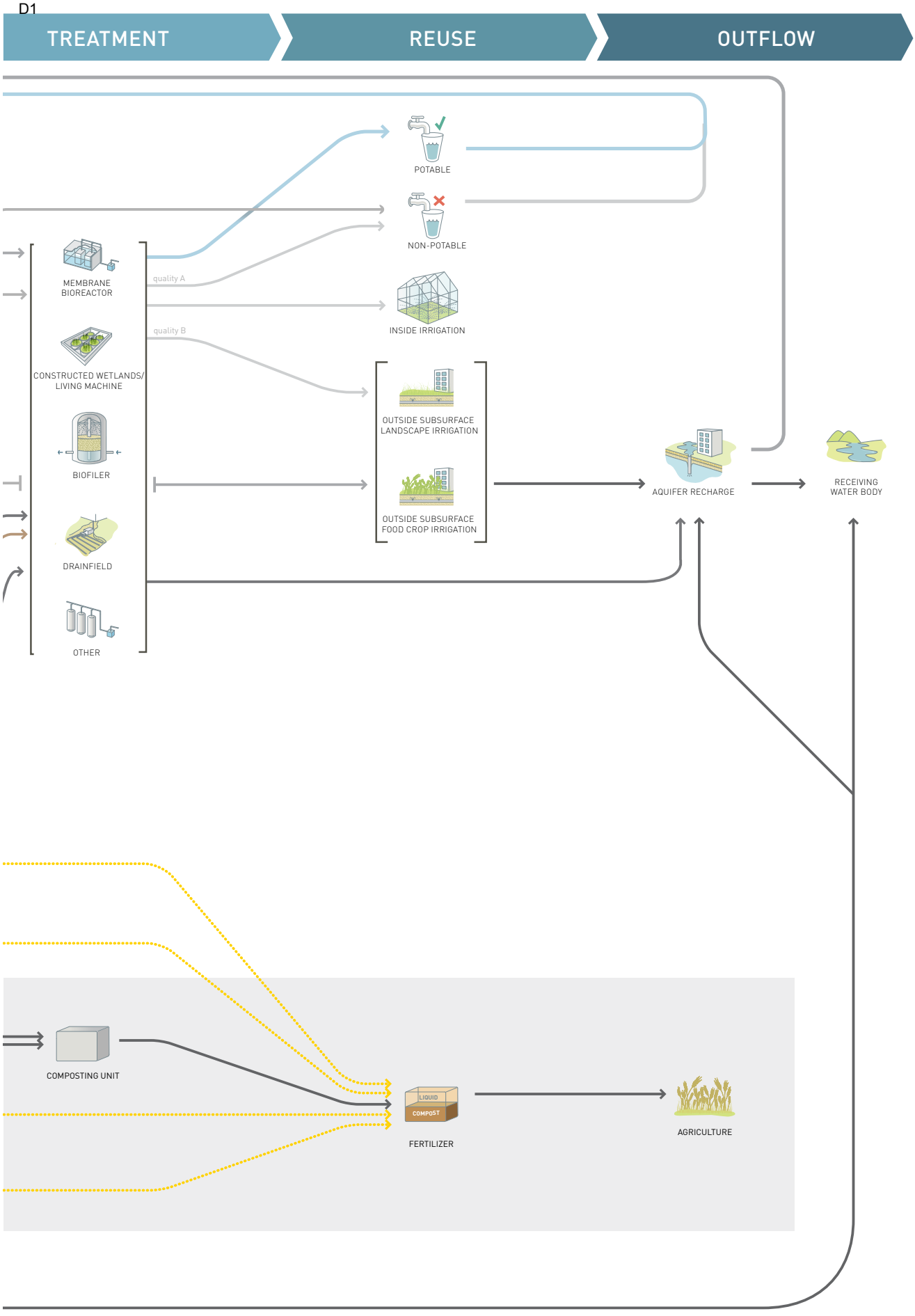


Living Building Challenge projects utilize closed-loop water systems, sourcing water through captured precipitation and other onsite methods. Water is treated for reuse, onsite discharge or routed to adjacent sites for beneficial use. Image courtesy of The Miller Hull Partnership, LLC.

former utilizes storage and treatment systems to collect water from its point of use and to process it to a level of treatment appropriate for its reuse application or prior to discharge. The latter route seeks to minimize water demand and the need for on-site treatment by utilizing waterless and composting fixtures for toilets and urinals. This route provides opportunities to reclaim nutrients otherwise diluted by water and offers a variety of ways in which the remaining greywater can be reused on-site, with or without treatment. The most appropriate pathway for any Living Building project is contingent upon careful analysis and investigation of climate, site conditions, building occupancy and use.

FIGURE 2. DESIGN PATHWAYS TO NET ZERO WATER




TREATMENT
REUSE
OUTFLOW
POTABLE
NON-POTABLE
MEMBRANE BIOREACTOR
quality A
INSIDE IRRIGATION
quality B
CONSTRUCTED WETLANDS/ LIVING MACHINE
OUTSIDE SUBSURFACE LANDSCAPE IRRIGATION
BIOFILER
AQUIFER RECHARGE
RECEIVING WATER BODY
OUTSIDE SUBSURFACE FOOD CROP IRRIGATION
DRAINFIELD
OTHER
COMPOSTING UNIT
LIQUID
COMPOST
FERTILIZER
AGRICULTURE

CODES AND REGULATIONS RELATED TO NET ZERO WATER

WATER SUPPLY: RAINWATER HARVESTING FOR POTABLE USE

CURRENT CODES

Regulations		Comments
Seattle / King County Board of Health Code (BOH)		
12.32.010	Requires connection to an existing public water supply	BOH 12.36.010 Conditions for a waiver: not to conflict with WAC and Federal Safe Drinking Water Act.
Washington Administrative Code (WAC)		
246-290	Group A Public Water System Regulations	Includes initial design, ongoing operational, monitoring and response requirements for larger systems. Also reflects Federal Safe Drinking Water Act requirements.
246-291	Group B Public Water System Regulations	Requirements for smaller public systems. King County does not have a Group B water program.
246-292	Water Works Operator Certification	Water Works Operator Certification Certified operator must be in charge of day-to-day operations.
246-293	Water System Coordination Act	Applies to most of King County, outside of the City of Seattle.
246-295	Satellite System Management Agency	
Code of Federal Regulations (CFR)		
Title 40 Parts 141 and 143	Federal Safe Drinking Water Act Requirements	Group A water systems must comply with Federal drinking water laws and are subject to regulation by EPA.

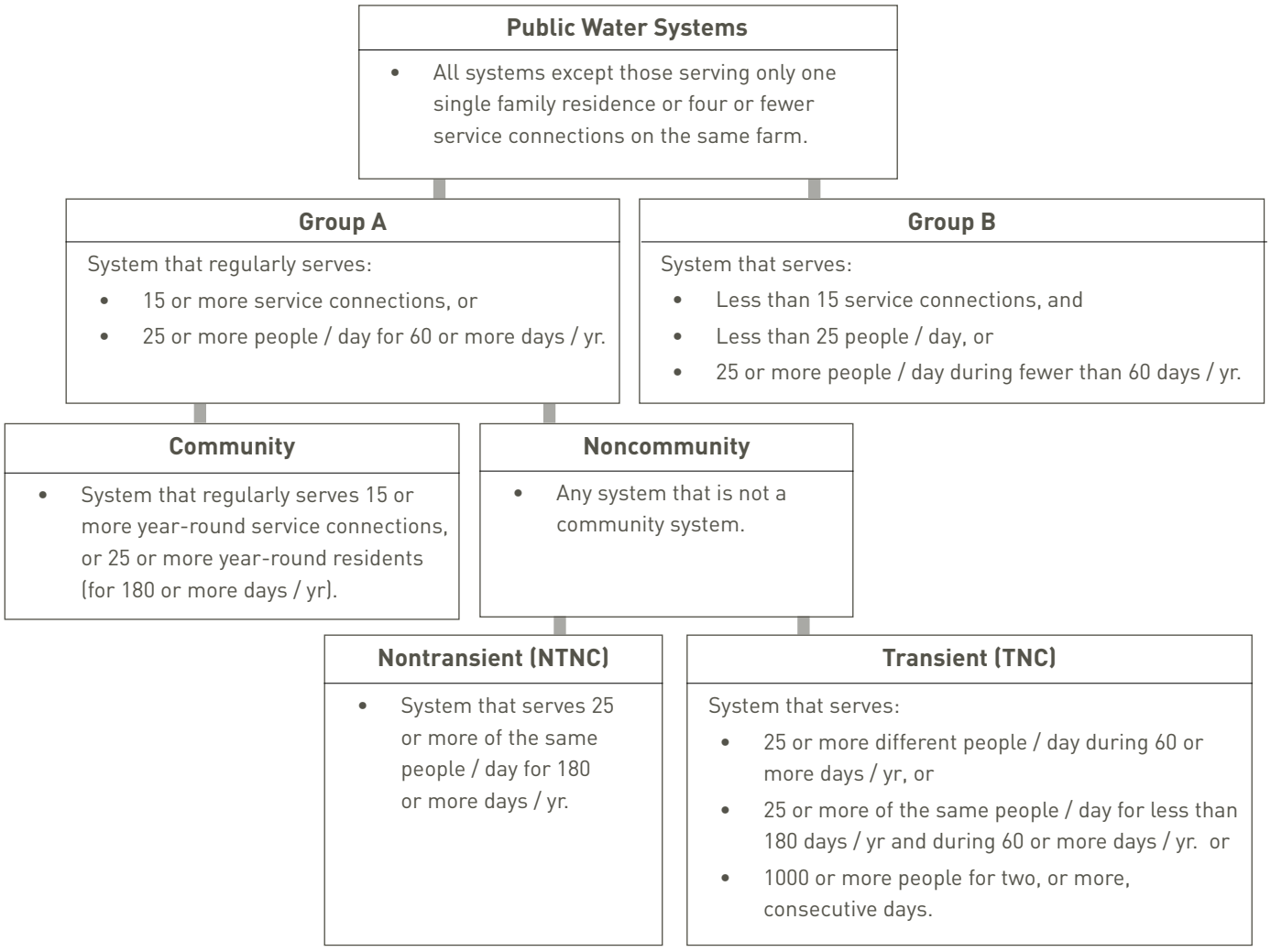
FINDINGS

For commercial and multifamily buildings seeking to meet potable water needs through captured precipitation, regulatory authority lies with the Washington State Department of Health (WA DOH). Currently, these types of systems are permitted as a new public water supply and fall under

the state's regulations for Group A or Group B water systems depending on their size. Group A systems are those that have 15 or more service connections or serve 25 or more people per day. Group B water systems serve fewer than 15 connections and fewer than 25 people per day.

Group A water systems are subject to federal, state and local regulations related to safe drinking water. For a new Group A public water supply system proposed within the service area of an existing Group A system, WA DOH requires the concurrence of the local water utility as a condition of approval. Under Group A regulations, a certified operator is required for daily operations including monitoring and reporting, and for maintaining a continual safe drinking water supply. In addition, any local ordinances pertaining to drinking water standards must also be met, such as Seattle's requirement for fluoridation of water supply.

FIGURE 3. PUBLIC WATER SUPPLY SYSTEMS IN WASHINGTON STATE



RAINWATER FOR POTABLE USE APPROVED FOR RESIDENTIAL BUILDINGS

While outside the scope of this effort, Seattle/King County Public Health recently defined standards for residents of detached single family dwellings and townhomes choosing to harvest rainwater for potable uses on their properties. The provisions are spelled out in Health Document Code Method #10-004. Rainwater treated for potable purposes is only permitted for use within the dwelling unit from which it is captured and it cannot be the sole source of water supply to the home.

While existing Group A drinking water regulations do allow rainwater as a source of supply, these types of systems are generally not approved for smaller Group B systems. Because of the potential for contamination by animals and wind-borne agents, WA DOH classifies rainwater capture systems as a surface water source subject to standard surface water treatment requirements. Treatment requirements include filtration, continuous disinfection and a chlorine residual at the entrance to the distribution system.

BARRIERS

Current regulations for new public water supply systems are not intended for building scale systems within areas that already have a public water supply available. As such, building owners seeking approval to create a new public water supply will likely encounter regulatory requirements and financial obstacles. Building owners also take on much greater liability and risk associated with maintaining and operating the water system. The eight major steps necessary for approval of a new proposed Group A water system are outlined in the text box on the next page.

Projects pursuing the Living Building Challenge must purify captured precipitation without the use of chemicals, posing debate around the federal and state treatment regulations that require chlorine disinfection. For a rainwater harvesting system supplying potable water to a building, an appeal to the state board of health would be necessary for approval of an alternative disinfection method. However, current regulations do not allow any variances for the surface water treatment requirement. Additionally, there is no precedent for such an appeal and state regulators are reluctant to advocate for one, stating that there is an absence of compelling factors.

Currently, the pathway identified for approving a building scale potable rainwater harvesting system in Seattle involve their installation solely as a redundant system to the existing public water supply. One Living Building project under construction in the City has elected to install but not hook up the necessary rainwater harvesting infrastructure for potable use in anticipation of future regulatory changes.

Washington State Department of Health has identified additional barriers or issues that merit further discussion. These include:

- Issues associated with creating new water supply systems inside the service area of existing water systems including the rationale for new systems, the selection of source and treatment alternatives and the State's interest in reducing the proliferation of new supply systems;
- Identification by a building owner of the cost of operating and maintaining on-site systems over an extended period of time; and
- The conflict between the Living Building Challenge prohibition of using chemicals for water treatment and federal requirements (enforced by state agencies) for the use of chlorine in Group A water systems.

APPROVAL OF NEW GROUP A WATER SYSTEMS

The following is a list of the major steps for approval of a new Group A water system:

1. Preliminary meeting with WA DOH to define submittal requirements and review roles and responsibilities.
2. Request to Seattle Public Utilities for approval of a new Group A water system within their service area.
3. Submit planning and project engineering documents for WA DOH review and approval. Include justification for creation of new system.
4. Project report review and approval by WA DOH.
5. Submit construction documents/ drawings and specifications for WA DOH approval.
6. Construct water system.
7. Once certified, begin water system operation in accordance with operations and management program.
8. Conduct daily operations including reporting to State.

OPPORTUNITIES + RECOMMENDATIONS

Alternative Pathways for Disinfection

Based on feedback and discussion at the workshops, the need for finding common ground at the local and state level on the rationale behind the Living Building Challenge requirements for treatment without the use of chlorine was clear. Opportunities exist for public agencies and the design community to work collaboratively on identifying acceptable alternatives that meet or exceed public health protection as prescribed in current codes.

During the process of convening regulatory agencies, two recommendations emerged on possible pathways for re-classification of rainwater as a potable supply source at the building scale. First, it was identified that the quality of rooftop-harvested rainwater may be quite different from other surface water sources for which the current regulations are intended to address. Re-classification of rainwater as a new supply source by WA DOH is one option for addressing regulatory obstacles to using chlorine disinfection, potentially allowing for new definitions of acceptable disinfection methods for these types of systems.

Second, the intent of the regulations is to maintain public health by disinfecting water prior to entering the distribution system and before it comes into contact with the public. When the "distribution system" is merely the plumbing within the building as opposed to large-scale conveyance of municipal water supply, there may be a possibility of re-defining disinfection requirements for building scale systems. Under current regulations, a building scale potable rainwater harvesting system must add chlorine disinfection after leaving the cistern and before entering the interior plumbing lines within the building where it can then be removed through carbon filters at the tap. Opportunities exist to work at the state and federal levels to evaluate alternative disinfection methods for water systems at this scale that may have a lower environmental impact than chlorine. Regardless of the disinfection method proposed, any alternative would need to meet or exceed current public safety standards outlined by the federal regulations.

Operating Entity

At this time, the net zero water system would need to be operated and maintained by a satellite water operations company. Seattle Public Utilities does not operate or provide monitoring services for small-scale Group A water systems within their service provider area. Future opportunities may exist for other entities to provide these services for a fee to building owners.

Pilot Projects

Due to the number of challenges a project may encounter around alternative supply sources, local and state agencies might consider establishing a formal pilot program to define alternative pathways for permitting net zero water projects that meet existing code for potable water. Seattle's existing Living Building Pilot Program provides an excellent model for establishing political and regulatory support for innovative projects.

GREYWATER REUSE

CURRENT CODES

	Regulations	Comments
Uniform Plumbing Code (UPC)		
Chapter 601 and 305.1	Requires potable water to fixtures and connection to public or private sewer	Requires administrative ruling for alternatives
Chapter 16	Graywater Systems	Adopted by WA state
Washington Administrative Code (WAC)		
173-219	Reclaimed Water Use	Draft Department of Ecology Regulations
246-274	Greywater Reuse for Seasonal Subsurface Irrigation	Allows greywater reuse up to 3,500 gallons per day for subsurface irrigation only. A local health jurisdiction must first adopt a program to regulate greywater uses.

FINDINGS

Greywater reuse systems vary widely in their design and discharge applications. There are different ways in which greywater systems are permitted currently and will be permitted in the near future as new draft regulations are adopted.

Residential and commercial scale systems that collect light greywater for reuse inside buildings AND have a traditional discharge connection to a sewer are permitted at the local level through Seattle/King County Public Health. Currently, Public Health utilizes the alternate methods and materials provisions in Chapter 3 of the Uniform Plumbing to approve the reuse of greywater for non-potable purposes. Projects permitted in Seattle are unique in that the City's plumbing and the County's on-site wastewater treatment programs are housed in the same agency and therefore can coordinate on these types of project approvals.

Chapter 16 of the 2009 Uniform Plumbing Code, which has been adopted by Washington State, defines standards for greywater to be reused as toilet and urinal flushing and for other uses. Testing requirements are also identified in the code. In addition, the International Association of Plumbing and Mechanical Officials (IAPMO) new "green supplement" provides provisions for greywater reuse, as will the forthcoming International Code Council's new International Green Construction Code (IgCC).

At the state level, two important rules are under development with respect to how greywater systems may be permitted in the future. WA DOH has developed new greywater regulations for seasonal exterior subsurface irrigation for both residential and commercial buildings.

The new rules have just recently been adopted and will take effect on July 31, 2011.

WAC 173-219, also under development, will provide new regulations for reclaimed water in Washington State. While these regulations are not specifically written for the reclamation and reuse of on-site greywater, state officials indicated that they may provide the pathways for approval of on-site systems that fall outside the regulatory authority of local public health departments. According to the Department of Ecology, concerns raised by stakeholders during the comment period has delayed the filing of the draft reclaimed water rule, which was originally scheduled for adoption at the end of 2010.

BARRIERS

Where greywater will be routed outside the building at the commercial scale, it is currently undefined whether projects will be permitted at the local level under the greywater regulations stated above or the new WA DOH reclaimed water regulations. As both of these are still under development, larger net zero water projects such as the Cascadia Center for Sustainable Design and Construction will be permitted through WA DOH as a Large On-Site Sewage Systems (see the following Wastewater section for applicable codes) in the interim.

OPPORTUNITIES + RECOMMENDATIONS

Provisions for Greywater Reuse Inside Buildings

A number of opportunities exist for greywater reuse in buildings and to develop codes and regulations that provide clear pathways for projects to pursue. Part of the challenge is the fact that there are multiple definitions of greywater since there are various qualities of greywater depending on the source. WA DOH and local health departments should clearly define greywater based on source and identify regulatory provisions for on-site greywater reuse inside commercial and residential buildings. In addition, these entities should develop clear provisions for how state and local regulations overlay UPC requirements.

As the new state regulations come online, further clarification is needed to define whether a project will be permitted under the greywater provisions at local public health departments versus the pending reclaimed water regulations through WA DOH.

ON-SITE WASTEWATER TREATMENT

CURRENT CODES

Regulations		Comments
Seattle Municipal Code (SMC)		
21w.16.040 A	Requires wastewater side sewer connection	
22.206.050 E	Requires flush-type toilets	
Seattle / King County Board of Health Code (BOH)		
13.04.050	Connection to public sewer	
13.52.020	Provisions for composting toilets	
13.52.057	Provisions for subsurface drip irrigation systems	
Washington Administrative Code (WAC)		
173-219	Reclaimed Water Use	Draft regulations
246-272 A	Sewage Technologies	Includes composting toilets
246-272 B	Large On-Site Sewage Systems	

FINDINGS

Seattle Municipal Code 21.16.040 A Subtitle 2 requires all projects within the City to have a side sewer connection. Permitting for on-site wastewater treatment is dictated by the size of the system. For on-site systems with design flows under 3,500 gallons per day, jurisdictional authority lies with Seattle King County Public Health. For larger systems, WA DOH has authority and approval over those with domestic strength design flows between 3,500 to 100,000 gallons per day. Washington State Department of Ecology permits on-site systems greater than 100,000 gallons per day.

A current list of all composting toilet models approved for use in Washington State is available at:

www.doh.wa.gov/ehp/ts/ww/ww-register.pdf

FIGURE 4. REGULATORY OVERSIGHT FOR ON-SITE WASTEWATER TREATMENT SYSTEMS

System Design Flow (gallons per day)	Jurisdiction
0 - 3,500	Local Health Officer
> 3,500 - 100,000	Washington State Department of Health
Above 100,000	Washington State Department of Ecology

Regardless of their size, on-site wastewater treatment systems in urban areas such as the Cascadia Center for Sustainable Design and Construction (which is expected to fall under 3,500 gal/day due to the use of composting toilets) would need to be permitted at the state level under WA DOH's draft water reclamation rules (WAC 173-219) as a private utility OR under the state's current regulations for Large On-Site Sewage Systems (LOSS). All projects permitted under the LOSS regulations require a management entity to provide ongoing testing and monitoring.

King County assesses capacity charges to building projects hooking up to public sewerage. King County Code 28.84.050 and 28.86.160, and RCW 35.52.570 and 36.94.140 determine annual sewer rates and capacity charges. Capacity charges are established based on the number of plumbing fixtures and are collected to finance the cost of the County's wastewater capital improvements.

BARRIERS

Existing regulations in place for on-site wastewater treatment are not applicable for projects in urban areas where a connection to a public sewer exists, presenting obstacles for net zero water projects seeking to treat all of their waste on-site. For the Cascadia Center project, the existing sewer connection is expected to remain in place and be used as a backup overflow. Similar to the issue noted in the rainwater section, the preliminary step requires an agreement between Seattle Public Utilities and the building owner/certified operator to relinquish the utility's requirement to provide primary wastewater service to the building. Likewise, DPD's requirements for flush-type toilets in SMC 22.206.050E would need to be waived.

King County Wastewater Treatment Division requires capacity charges for all sewer connections. While a project without a sewer connection would not encounter any fees from King County, there is no variance process or

APPROVAL OF GREYWATER AND COMPOSTING TOILET SYSTEMS

The following is a list of the major steps for seeking approval for a combined greywater and composting toilet system in Seattle under the state's Large On-Site Sewage System (LOSS) regulations:

1. Complete a LOSS feasibility study with soils/groundwater evaluation.
2. Pre-Design report submittal including project summary, narrative, and site conditions.
3. Pre-Design meeting with WA DOH.
4. Request to Seattle Public Utilities for approval of a LOSS wastewater system within their service area.
5. WA DOH LOSS site review approval.
6. Engineer's report submittal:
   a. Project documents and design calculations
   b. Plans and specifications
   c. Operating and maintenance manual
   d. Management entity approval
   e. Certified operator approval
7. WA DOH engineer's report review and comments.
8. Final engineer's report submittal including any additional requested information.
9. Apply for operating permit.
10. WA DOH construction approval.
11. Final WA DOH approval/inspection.
12. WA DOH annual operating permit.

alternative rate structure from the County's capacity charges for projects seeking to install on-site wastewater treatment systems that rely on the County connection solely as a backup emergency connection.

OPPORTUNITIES + RECOMMENDATIONS

On-Site Treatment in Sewered Areas

It is recommended that the City of Seattle Department of Planning and Development (DPD) work with King County to define a variance process establishing requirements for projects seeking to install sewer connections for emergency backup use only. Requirements should include clearly documented and engineered designs that meet the intent of current codes around health and safety, insurance, management and inspection responsibilities for on-site systems, change of ownership, and how wastewater will be handled in the event of on-site system failure. Another option is to define standards that allow projects to be "sewer ready," meaning that they would provide a jacketed internal easement so that a sewer connection could be added at a later date if necessary or desired.

Sewer Fees

It is recommended that King County develop a fee structure that reflects only the need for a backup or emergency connection. King County may look for guidance from municipalities that have instituted innovative fee structures. One example is the City of Portland, which allows for emergency-only connections but charges large use fees in the event that the utility connection is needed.

FUTURE RESEARCH

During the process of this project, a number of important topics were raised that require ongoing research and further discussion.

Benefits and risks to public health and safety.

Current codes and regulations exist to safeguard human health and welfare and to ensure access and availability of clean water supply and wastewater treatment to all people. Further exploration of the benefits and risks of alternative strategies to conventional systems is needed in order to conduct comparative analyses of centralized and decentralized approaches. Opportunities exist for regulatory agencies, utilities, research groups and trade associations to evaluate risks to public health and safety beyond what is currently mandated by codes, including risks associated with climate change, resource depletion, and pollution prevention.

Life cycle cost analysis of net zero water strategies.

Further research is needed to assess the full costs and benefits of on-site systems to determine their economic feasibility for building owners. Consideration for an on-site system's increased costs associated with ongoing operations and maintenance as well as potential increased operating energy costs and capital costs for installation of treatment technologies and/or redundant infrastructure should be evaluated against reduced utility fees in order to fully understand the economic feasibility of these systems.

Occupant behavior around water use.

Net zero water strategies such as rainwater harvesting and greywater reuse systems demand a higher level of occupant attention and ongoing maintenance. Further research is needed to determine how occupant behavior, especially through change of a building's ownership, affects the performance of on-site water systems and how this is addressed on an on-going basis in the permitting of Living Building projects.

Quality and level of wastewater treatment in municipal systems versus on-site systems.

Further research is needed to evaluate the effectiveness and efficiency of achieving higher levels of water quality through on-site treatment systems, and for addressing public health risks such as contamination and pollution at both scales.

Appropriate scale for alternative water supply systems in Seattle.

A number of questions arose around the appropriate scale for Living Building water systems given that Seattle is fortunate to have a primarily gravity-fed and, at present, a resilient source of water supply. Further analysis beyond the scope of this effort is needed to evaluate environmental impacts of alternative systems and the financial, operational and managerial implications for existing water management systems. In addition, research is needed to assess how Living Building systems can be integrated with existing water management systems to improve overall resiliency and economic sustainability.

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Steve Deem	WA State Department of Health	Office of Drinking Water
Ginny Stern	WA State Department of Health	Environmental and Public Health Liaison
Denise Lahmann	WA State Department of Health	Supervisor, LOSS & Reclaimed Water Program
Craig Riley	WA State Department of Health	Program Lead, Water Reclamation & Reuse Program

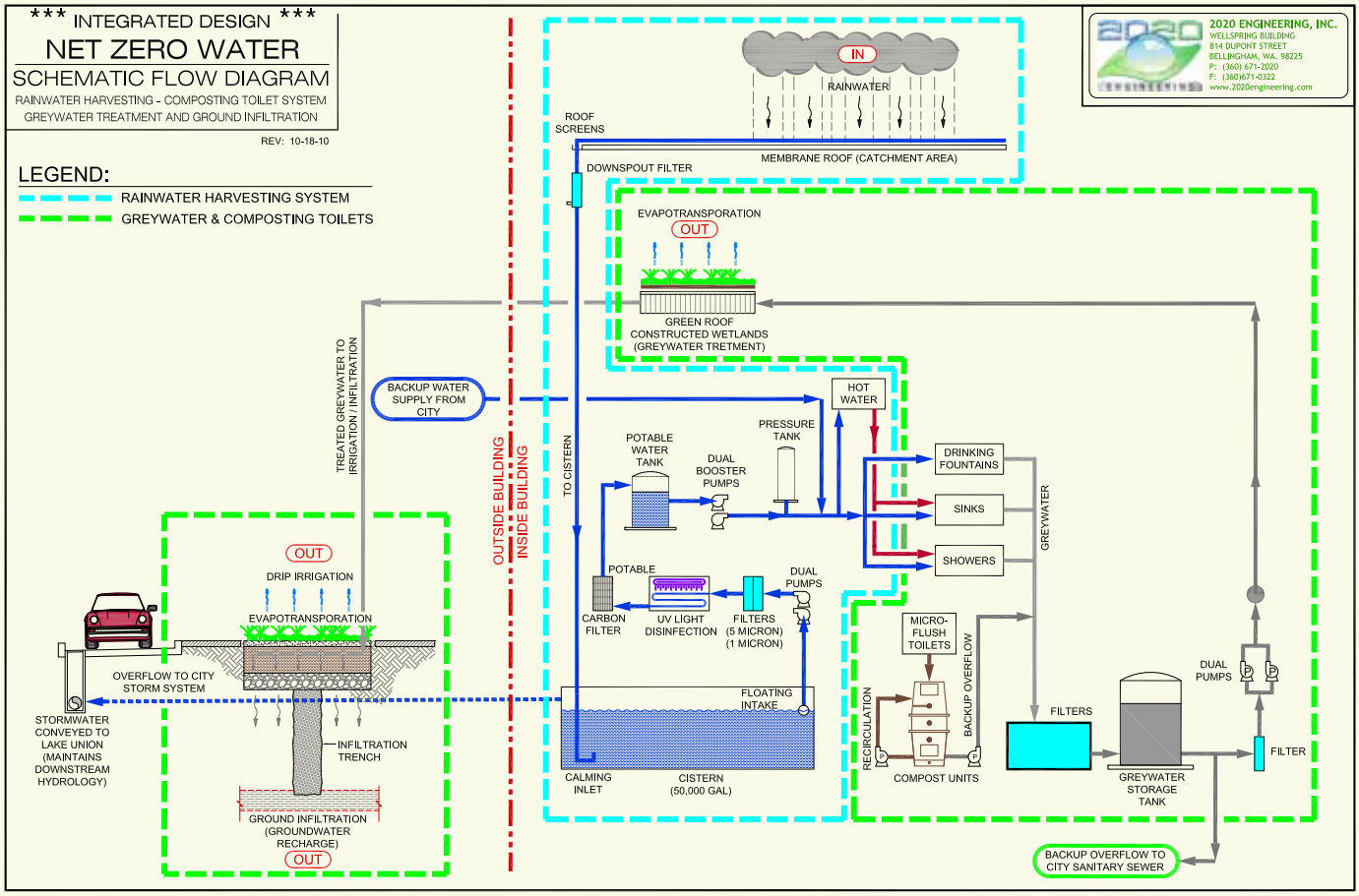
CASCADIA CENTER FOR SUSTAINABLE DESIGN AND CONSTRUCTION

Date Completed:	Expected late 2011
Location:	Seattle, WA
Building Owner:	The Bullitt Foundation
Project Type:	Commercial / Office
Project Size:	42,773-sf
Site Area:	10,000-sf
Capacity:	166 daily occupants
System Selected:	Phoenix composting unit / constructed wetland

Design Team:
Point 32, LLC / The Miller | Hull Partnership / 2020 ENGINEERING / PAE Consulting Engineers / The Berger Partnership / Schuchart Construction Co. / The University of Washington's Integrated Design Lab

The Bullitt Foundation's Cascadia Center for Sustainable Design and Construction serves as a valuable case study for mapping the regulatory pathways to net zero water within the City of Seattle. The project, currently in the design phase, provides a real-life context for discussing net zero water design goals and the regulatory framework affecting the project.

The six-story, 42,000-sf building, located at the intersection of 15th & Madison in the Central Area and Capitol Hill neighborhoods, will be one of the first to participate in the City of Seattle's Living Building Pilot Program. In addition to the Bullitt Foundation, the building will be occupied by various tenants whose mission is to provide education in the green building and sustainability fields, or are practioners of green design and construction.



Cascadia Center Net Zero Water Schematic Flow Diagram/ Courtesy of 2020 ENGINEERING

Courtesy of The Miller Hull Partnership, LLC

The design team for the Cascadia Center is evaluating a number of innovative strategies for meeting net zero water goals, such as a rainwater harvesting system to meet 100% of the building's interior water needs, including potable water use. Water will be harvested off the roof area and stored in a large cistern in the basement. Ultraviolet and carbon filter systems are proposed to treat rainwater to reach potable quality without the use of chemicals.

The building includes micro-flush composting toilets on each floor. This greatly reduces the building's overall water use and eliminates the generation of blackwater. All solid wastes from the toilets will be routed to basement composting units. Wastes are then combined with sawdust (or another composting media) in the composting chamber. The units compost the waste into valuable fertilizer which can be applied to agricultural or forest land.

Greywater from sinks and showers will be collected and stored in basement tanks before it is pumped to a vegetated roof located on the third floor of the building.

The 485-sf green roof will serve as the treatment system by utilizing the natural, chemical, physical and biological treatment processes occurring in subsurface wetlands. The roof will contain a 15" depth of gravel-type media to treat the daily estimated greywater flows. Average treated effluent BOD and TSS levels are expected to be <10 mg/L.

The treated greywater will then be discharged from the green roof area to a 1,000-sf landscape area at the ground level located along the sidewalk via a subsurface drip-emitter piping system. The landscape area will have a minimum 18" depth of engineered drainfield soil and the treated greywater will remain below the surface to avoid human contact. An infiltration trench connecting the drainfield and the existing sand layer will be dug to ensure that the treated greywater infiltrates through the engineered drainfield soil layer and into the native soils below, similar to a typical drainfield area.

The integrated system design will provide a "closed loop" water system that meets the intent of the Living Building Challenge water imperatives.

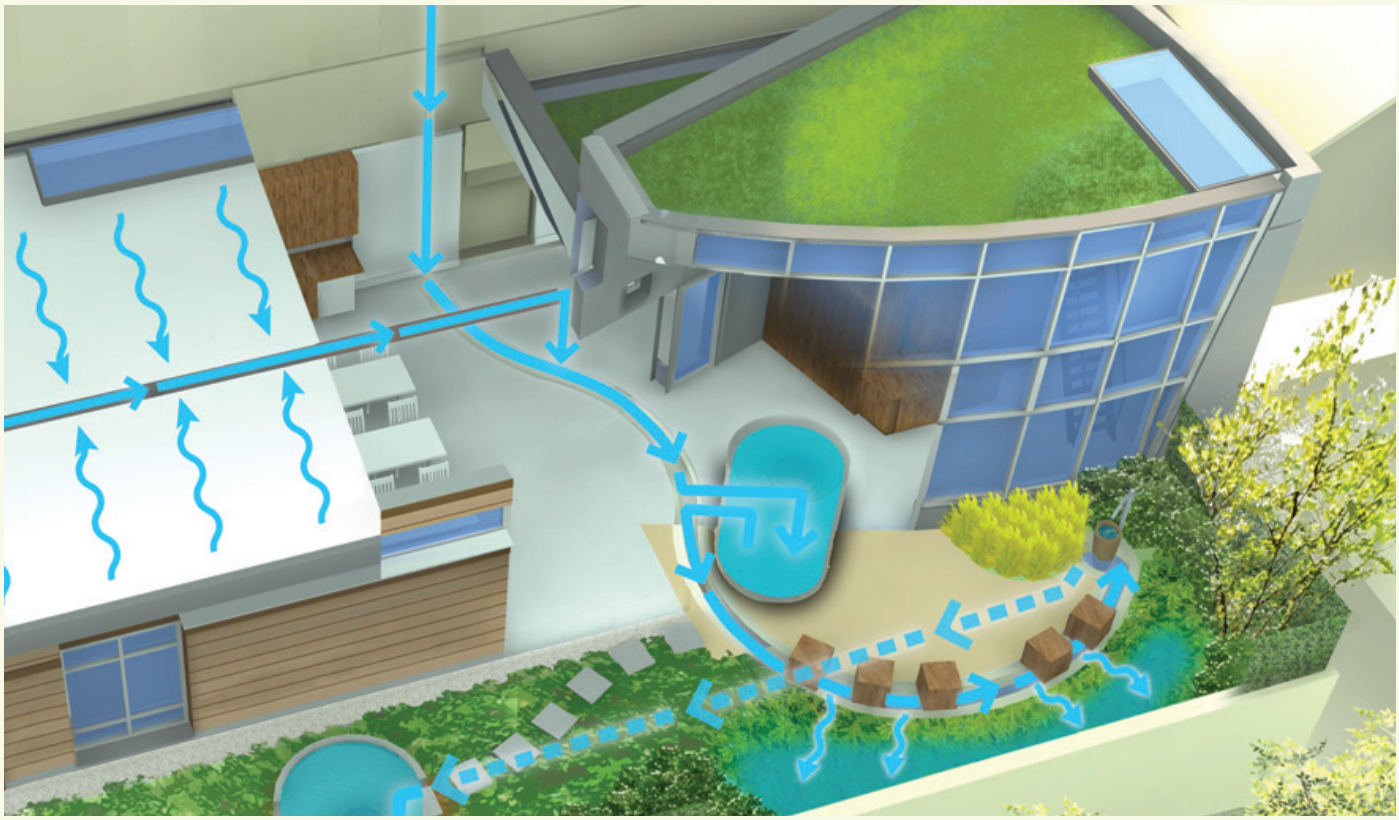
BERTSCHI SCHOOL: LIVING SCIENCE BUILDING

Date Completed:	February 2011
Location:	Seattle, WA
Owner:	The Bertschi School
Project Type:	Campus
Project Size:	1,425-sf
Site Area:	3,800-sf
Capacity:	17,500 uses/year
System Selected:	Aqua2use, Living Wall, Ekologen Envirolet FlushSmart

Design Team:
Restorative Design Collective: KMD Architects / 2020 ENGINEERING / GGLO / GeoEngineers / Quantum Consulting Engineers / Rushing / O'Brien and Company / Back To Nature Design LLC / Parsons Public Relations / Skanska

The Living Building Science Classroom at the Bertschi School, a private elementary school located in Seattle's Capitol Hill neighborhood, is slated for completion at the end of January 2011. The school is dedicated to providing students with opportunities to experience cutting-edge sustainable design to reinforce its ethic of cultivating local and global stewardship. The 1,425-sf Living Science Building has been designed to allow students to see and interact with the building's water systems and to observe water use with real-time monitoring equipment.

Striving to meet net zero water goals presented both design and regulatory challenges for the project team. While the building sits on a relatively small site, it has been designed to harvest rainwater for all of its water needs, and to treat and infiltrate all building discharge and stormwater on-site. The integrated system incorporates rainwater harvesting for both interior and exterior uses, composting toilets, and an interior vegetated green wall to evapotranspire treated greywater from the classroom's sinks.



Rainwater is collected from the roof of the building and stored in a 2,500-gal. underground precast concrete cistern painted with a food-grade Xypex waterproofing admixture on the interior walls of the vault. Some of the runoff is channeled through an interior runnel to express the activity level of the water system for students inside the science building. A second underground precast concrete tank provides additional rainwater storage for landscape irrigation. Overflow from the irrigation cistern is directed into rain gardens via an exterior runnel, where water quality is improved as it infiltrates and recharges groundwater on-site.

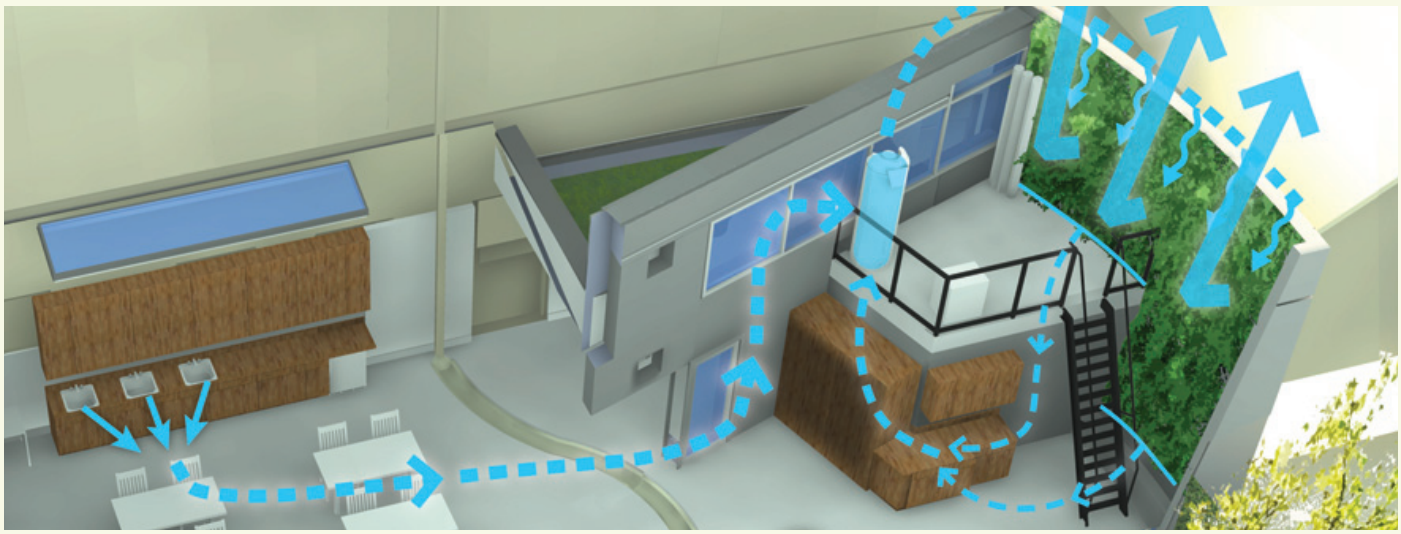
While the rainwater system is designed to treat and supply potable water to classroom and lavatory sinks, the Seattle/King County Department of Public Health denied approval of the system for potable use. As a result, municipally-supplied water is used within the building to serve these locations. However, the school has elected to install the rainwater filters and ultraviolet disinfection as designed in anticipation of future changes to local and state codes. A simple flip of a valve will allow the classroom to utilize harvested rainwater for all uses as the law allows.

Greywater from the classroom sinks and lavatory is diverted to an Aqua2use storage unit where it is filtered using a series of progressively denser filters. The lightly treated greywater is then used to irrigate an interior living wall through a subsurface drip irrigation system.

Greywater is eventually evapotranspired by the vegetation. The project team was able to gain approval for the greywater reuse system by installing a conventional overflow to the City's sewer system, allowing the local health department to permit the system through an administrative ruling on the Uniform Plumbing Code.

The Living Science Building eliminates the discharge of blackwater by utilizing a composting toilet system. The Ekologen Envirolet® FlushSmart™ VF™ 750 Double system aerates and pulverizes waste for faster composting-action while only using .05 gal. per flush. A vacuum generator pumps waste to the Y-connector which divides the waste between two tanks for up to 48 uses per day. Composted waste will be harvested about once a year and used on-site to fertilize landscape vegetation.

The greywater, composting toilet, and rainwater catchment systems for the project were all permitted with plumbing permits through Seattle-King County Public Health.



Greywater System (above): Classroom sinks drain to the greywater tank. The Living Wall evapotranspirates the greywater via a drip irrigation system. Rainwater System (opposite): The roof rainwater is collected and directed into gutters to an interior runnel before being stored in a large cistern. Overflow from the cistern is released through a runnel to the rain garden where it eventually infiltrates into the ground or temporarily stored in an underground cistern.
Images courtesy of GGLO

GLOSSARY

Blackwater is water containing solid and liquid wastes from toilets and urinals.

Closed loop water systems are ones in which all water used on a project is captured, treated, used/reused and released within the boundaries of the project site.

Effluent is the out flowing of water from a treatment process discharged into a receiving water body.

Greywater is wastewater discharged from sinks, showers, laundry, drinking fountains, etc., but not including toilets and urinals. Light Greywater is water from bathroom sinks, shower, bathtub, laundry, drinking fountains, and equipment condensate. Dark Greywater is water from kitchen sinks and dishwashers.

Groundwater is a fresh water supply that is located beneath the surface of the ground and is suitable quality for all types of uses.

Group A water systems are public water supply systems that typically have 15 or more service connections or serve 25 or more people per day.

Group B water systems are public water supply systems that serve fewer than 15 connections and fewer than 25 people per day.

Integrated Water Systems Management is an approach to manage potable water, rainwater, stormwater and wastewater holistically as part of watershed planning.

Net zero water projects are those seeking to operate within the water budget of their sites by utilizing closed loop systems that meet human needs while respecting the surrounding ecosystem.

Potable water meets the U.S. EPA's drinking water quality standards and is approved by state and local authorities having jurisdiction as fit for human consumption.

Rainwater is precipitation harvested from roof areas that is collected and stored on-site. With appropriate levels of treatment, rainwater can be reused for a variety of non-potable and potable purposes including drinking, irrigation, washing, and flushing toilets and urinals.

Reclaimed water is wastewater that has been treated to a standard at which it can be safely reused for a specific beneficial purpose such as irrigation or toilet flushing.

Stormwater is precipitation that falls on the ground surfaces of a property. Stormwater runoff flows over the surface of site and into sewer systems or into receiving water bodies.

Surface water is all water open to the atmosphere and subject to surface runoff (i.e., lakes, rivers, streams, etc.).

Wastewater is water that has been used for residential, commercial or industrial uses.

Wastewater treatment is the process of removing or reducing hazards in water and typically includes some of all of the following steps:

Primary treatment – physical treatment process, with or without chemical assistance; some heavy metals removed.

Secondary treatment – a process that removes dissolved and suspended solids by biological treatment and sedimentation; biodegradable organics, volatile organics, some nitrogen and phosphorus removed.

Tertiary treatment – such as filtration, membrane filtration, and detention in lagoons or wetlands; usually combined with coagulation, sedimentation, filtration and disinfection; more removal of nitrogen and phosphorus, dissolved solids and heavy metals.