

LOCATION

BEND, OR

TYPE

SINGLE-FAMILY HOME

SIZE

4,810 SQUARE FEET

DAILY OCCUPANTS

4 - 6 FULL-TIME

RAINWATER HARVESTED/YEAR

59,052 GALLONS

RECLAIMED GREYWATER/YEAR

12,216 GALLONS

WATER USE INTENSITY

5.0 GALLONS/SF/YEAR

CLIMATE

HIGH DESERT

11 inches of rain/year

46 days of precipitation/year

WATER PETAL CASE STUDY DESERT RAIN

Achieving the Water Petal can be hard. Achieving the Water Petal in the high desert with 11 inches of rain per year is even harder. Yet that's just what the owners of Desert Rain accomplished for their Bend, OR home. In partnership with Morgan Brown of Whole Water Systems LLC, the team designed and constructed the first Living Certified single-family home. The residents harvest rainwater for all their potable uses and treats and reuses all of their domestic sewage on site. They are also believed to be the first vacuum plumbing system building approved in the United States, establishing policy precedent for other buildings striving to achieve the Water Petal.

SYSTEMS

The five-building property relies on a series of off-the-shelf systems to meet their water goals, though some of the technology is relatively new to the United States.

RAINWATER HARVESTING

Precipitation falling on the standing seam metal roofs is collected and directed to gutters at the bottom edges of each roof, where it passes through a 20-inch deep gravel box filter. The water is stored in a 30,000 gallon cistern before being filtered through an Orenco Biotube, a microfilter, and finally a UV disinfection unit.

GREYWATER REUSE

Desert Rain has three residential structures that generate greywater. This water (from sinks, showers and laundry machines) passes through a treatment system consisting of a primary tank for trapping solids and oils, subsurface constructed wetland for secondary treatment of suspended solids and organic material, storage and irrigation system for reuse.

BLACKWATER TREATMENT

Blackwater is generated in the three residential buildings from toilet fixtures and dishwashers. Vacuum toilet fixtures in the main residence and guest apartment are routed via vacuum plumbing to a Phoenix compost toilet system. The Phoenix system includes an evaporator to ensure that compost leachate will not overflow to the public sewer. This evaporator was enlarged to allow it to also evaporate the dishwasher discharge, provided that the occupants stay within a reasonable water budget.

GRAVEL FILTER FOR CAPTURED RAINWATER



DIAGRAM COURTESY DESERT RAIN

WATER PETAL CASE STUDY POLICY SOLUTIONS

RAINWATER HARVESTING

Tom Elliot and Barbara Scott, the owners of the Desert Rain home, did not know of any single-family homes like theirs that had successfully permitted rainwater capture and treatment for potable use. So as they dug into Oregon's plumbing code, they were surprised to stumble upon something called "Appendix M: Rainwater Harvest Guidelines."

Appendix M was relatively new at the time and still in the form of guidelines, rather than finished code. The project team ended up working closely with Oregon's Chief Plumbing Inspector in order to interpret the guidelines and apply them to a real project.

Appendix M guidelines specified that each downspout be equipped with a First Flush Diverter (FFD) to dispose of the initial "dirty" water during a rain event. Since achieving Net Zero Water is difficult enough in an arid climate without adding losses from FFDs (known to be relatively water inefficient in practice), the project requested and achieved approval for a design that replaced FFDs with gravel filters at the bottom of each downspout. The project team had to point to international examples, including projects in Australia, in order to prove the legitimacy of their argument and design.

BLACKWATER AND GREYWATER

The project team originally planned to treat its blackwater and greywater with a constructed wetland, though no project in the state had ever been permitted for this. Though they received initial encouragement and permission from the City Engineer to pursue this path, the Public Works Department ultimately would only permit a design for on-site greywater treatment - the water from the dishwasher would have to be directed to the sewer.

In June 2013, the project team became the first in Oregon to receive approval from Bend and the State of Oregon to treat and reuse greywater by having it filtered through a constructed wetland. The constructed wetland is intentionally oversized by design, in order to eventually treat blackwater if that regulatory path becomes available.

PROCESS

The project team worked with numerous stakeholders and experts, approaching every permitting meeting with the intention of getting to "yes". They formed partnerships with local policymakers and plumbing inspectors in order to point to local knowledge and strategically apply political pressure.

When they wanted to permit their vacuum plumbing system and found that no code in the world spoke to it, they acquired the stamp of approval from a local engineer that served on the code review board. His expertise and local recognition lent their proposal enough validity to make regulators comfortable with a precedent-setting permit.

Ultimately, the Desert Rain home serves as a powerful example of Net Positive Water in one of the most arid regions of America, and a testament to the possibilities that open up when everyone is working together at the same table.



MASTER BATH, FEATURING POTABLE RAINWATER

PHOTO COURTESY DESERT RAIN