CASE STUDY: Pringle Creek Green Streets

LOCATION: 2110 Strong Rd SE, Salem, Oregon
PROJECT TYPE: Bioswales, pervious pavement, tree preservation
PROPERTY TYPE: Mixed use residential, new construction
CONSTRUCTION DATE: 2006
OWNER: Sustainable Development, Inc.
INSTALLER: W+H Pacific; North Santiam Paving; Evolution Paving; DeSantis Landscapes
DESIGN: Patrick Condon, University of British Columbia; James Meyer, Opsis Architecture

Figure 1: Green streets at Pringle Creek feature pervious asphalt and grassy swales, plus rain gardens at every intersection.

Summary

The Pringle Creek Community is an example of an entire community designed and constructed with an emphasis on environmental and social sustainability. This case study describes the community's "Green Streets" which are designed to allow rain water to percolate into the ground and return to the aquifer. These streets feature what is believed to be the biggest residential application of porous asphalt in the country.

Project Background

The Pringle Creek Community is located in South Salem, off of Madrona and Fairview Industrial Drive. As the name would suggest, Pringle Creek, a tributary of the Willamette, runs through the community. There are 150 homes of various types slated for development on 32 acres, 12 of which are dedicated open space. The homes are designed to maximize environmental sustainability, requiring a LEED-H Silver standard or higher . The layout of the community is also designed to minimize environmental impacts. The focus of this case study is the "green streets" installed in the Pringle Creek Community.

Traditional road-building practices focus on ways to most efficiently move water away from the road. Typical pavement is impermeable, causing water to flow over it. Traditional curbs channel water down the street to a receiving storm sewer, where it is rapidly moved to a stream or river.

By contrast, the green design and street system at Pringle Creek do just the opposite: slow stormwater so as to allow percolation into the ground. According to developer Don Myers of Sustainable Development Inc., "Ninety percent of the rainwater that falls on Pringle Creek Community will return to the aquifer." This is achieved through an all-porous street system, a network of vegetated bioswales, the conservation of 30% open space, and the preservation of 80% of existing trees.

Soil Type and Infiltration

Prior to street development, a geotechnical analysis was performed by GRI Geotechnical and

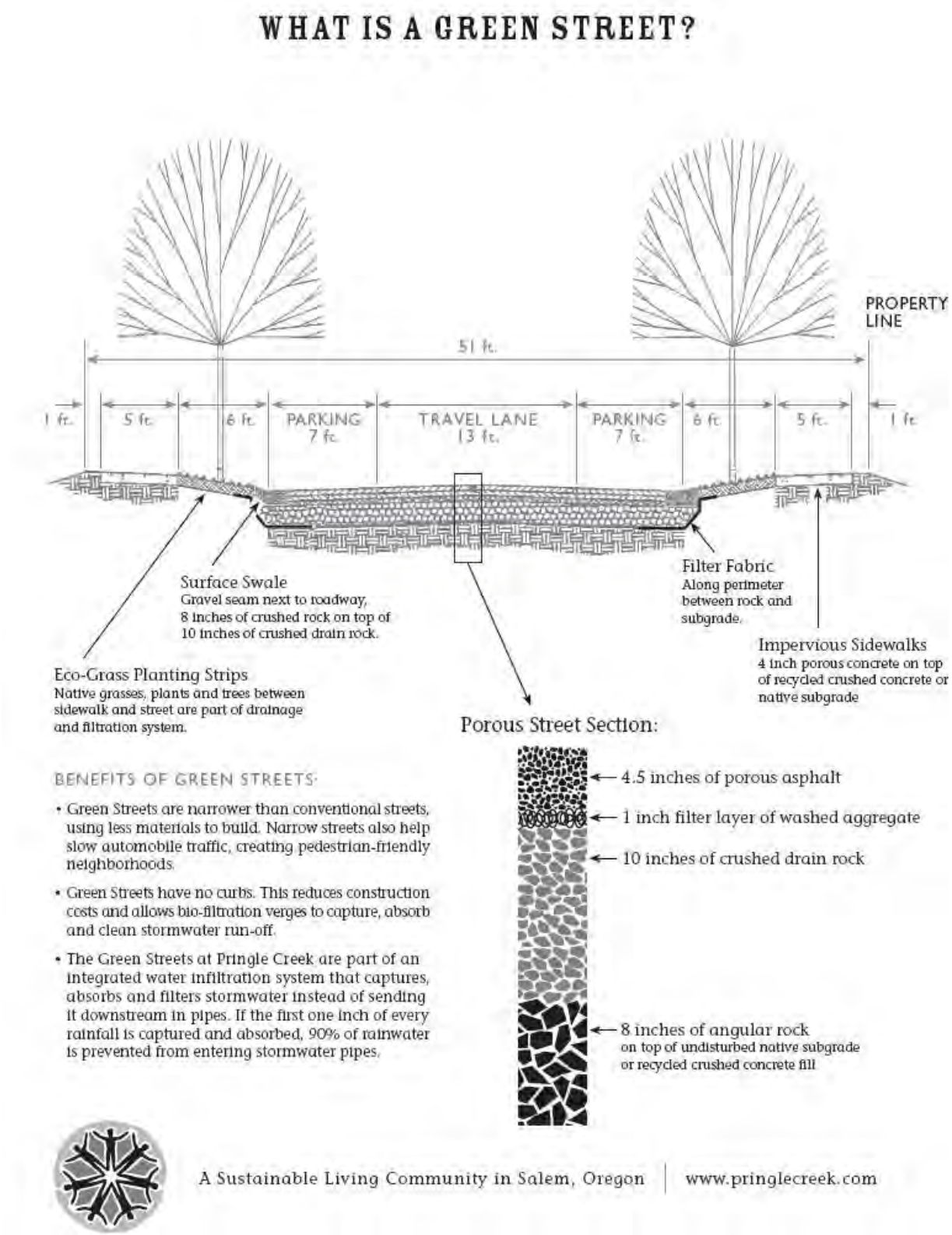

Figure 2: Green Street Specifications

Figure 3: Curbless swale zone with gravel verge

Right— Figure 4: Rain Garden

Environmental Consultants. Pringle Creek Community's predevelopment subsoil infiltration rates were between 2 inches and 11 inches in a 24 hour period. The streets are designed to accommodate a rainfall of 1 inch per 24 hour period. The Salem area receives an estimated 40 inches of precipitation annually.

Specifications

Figure 2, "What Is A Green Street?" on the previous page, provides an illustration that summarizes the primary components of green street design utilized by the Pringle Creek Community.

The streets at Pringle Creek were laid with porous asphalt. Bounding the asphalt on either side is a curbless swale zone with a gravel verge and a vegetated strip (figure 3). The short gravel verge acts as a transition to the grassy strip and allows infiltration of rainwater should the street's porosity become compromised. Between this surface and the sidewalk is a vegetated strip comprised of native grasses, and plantings of ornamental street trees. Pringle Creek Community has also installed rain gardens at each intersection, which collect excess rainwater during periods of heavy precipitation (see figure 1 on front page and figure 4).

The streets are curbless, which prevents stormwater channeling and eliminates the expense of pouring concrete curbs.

Benefits

The design of the porous pavement serves multiple purposes. The porous pavement allows rainwater to soak through the pavement into the subsoil. Any pollutants on the street will be broken down by microbes in the soil, eventually yielding clean water that will either be stored as groundwater or percolate into the stream through the soil. According to the Pringle Creek website, "with 9,000 linear feet of streets and alleyways, it is believed to be the largest residential application of porous asphalt in the North America."

A second benefit of porous pavement is the ability of the water to soak through the pavement during a heavy rain, as opposed to high volumes of runoff causing the storm sewers to back up and flood the streets. In figure 5, one can observe the difference between permeable (background) and traditional

Figure 5: At the entrance to Pringle Creek Community: Permeable vs. Impermeable Asphalt

pavement (foreground) during a rainstorm.

Cost

The cost of designing and installing porous pavement was slightly higher than the cost of installing traditional pavement, mainly due to the expense of innovative engineering. The cost to lay the material is similar in comparison, as the same equipment and virtually the same mixes are used in the application. However, as the street system functions as the driving surface as well as the actual stormwater conveyance system, the need for buried pipe, gutters, drains and curbs is eliminated, a cost of nearly $250,000 that Pringle Creek Community did not incur.

Though the City of Salem does not currently offer a stormwater fee abatement for homeowners who are not connected to the City storm sewers, Public Works is strongly recommending such a program.

Maintenance

Although the streets of Pringle Creek Community are private, the City of Salem continues to explore the feasibility and performance of permeable street systems. At the time of installation, the all-porous streets at Pringle Creek Community were necessarily made private, with the deliberate decision to allow public access. This allows for the potential future adoption of the green streets into the public street grid.

The Homeowners Association is responsible for street maintenance. Because the pavement is still relatively new, major repairs have not been necessary to date. It is estimated that porous pavement will withstand comparable usage to traditional pavement. A four-block test section of North Gay Avenue in Portland, OR (a high-traffic throughway) was installed in August 2005, and has provided support for this assertion, as have other installations around the country that have existed for decades.

Several preventive measures are taken to maintain street permeability. For example, a vacuum truck can clean the streets annually or as needed for a minimal cost (less than $400 for entire project site). When any construction is to be performed, contractors and subcontractors must be educated about protecting the streets, and *Geotec* fabric is used to protect the streets in front of a construction site (figure 6). If dirt, sand or other materials are spilled on the street, they can be pressure-washed through the top lift of asphalt into the reservoir course of the road bed, thus restoring the porosity of the street again.

Figure 6: Geotec Fabric on the permeable pavement for protection during home construction.

Effectiveness & Monitoring

Currently, Pringle Creek Community is not conducting any formalized analysis of the effectiveness of the green street design, but is interested

in doing so. It would be very interesting to monitor water quality and flow at two overflow points and compare that to what a conventional neighborhood of this size would discharge.

Successes & Lessons Learned

The developers cited several lessons learned through this process:

To trench the sides of the streets deeper than the street bed itself would have required a DEQ permit for underground injection; however, by excavating the entire road base at a shallower level (maintaining the same amount of reservoir capacity), an underground injection permit was not required. The extra excavation increased the cost due to the need for extra fill material, but it reduced permitting costs. *Geotec* fabric was not applied to the bottom of the road bed as prescribed in order to maximize full infiltration capability. Fabric was applied to the walls of the road bed between gravel and topsoil to keep the reservoir course clean.

In an effort to minimize compaction of the subsoil caused by excavation equipment, the roads were excavated from the back of the property forward, rock was added from the front of the property to the back, and the utilities were installed only after the first lift of asphalt was applied. *Geotec* fabric was used to protect this first lift of asphalt while the utilities were trenched and installed. Once the landscaping and utilities were installed, the final lift of asphalt was applied.

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Pictures supplied by James Santana.