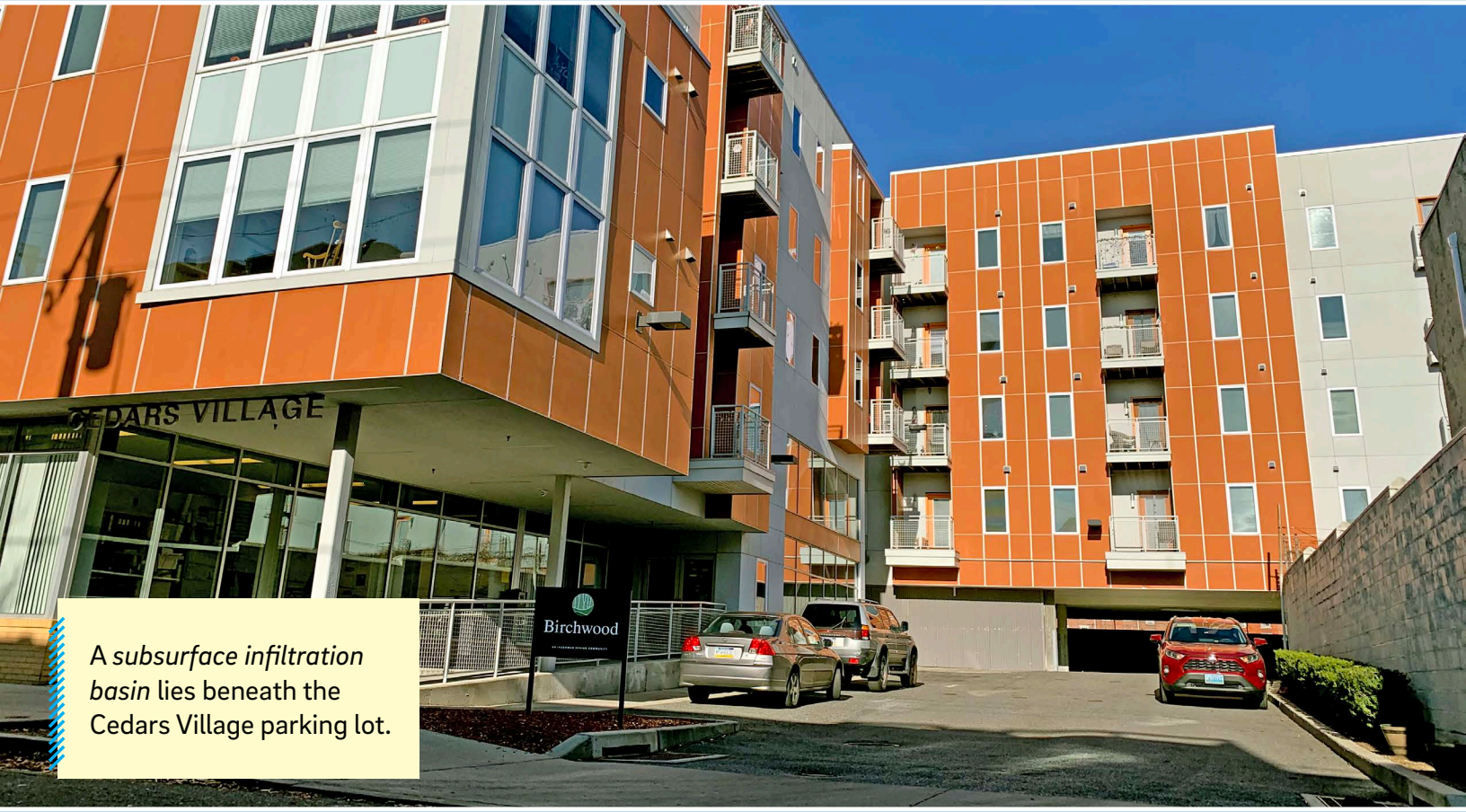
CASE STUDY

Birchwood at Cedars Village Senior Living Facility

STORMWATER PIONEERS
PHILADELPHIA WATER DEPARTMENT



A *subsurface infiltration basin* lies beneath the Cedars Village parking lot.

Stormwater Pioneers:

Recognizing private property owners for outstanding stormwater management projects. This award showcases innovation, excellence and the ability to overcome technical challenges.

Focus on Superior Maintenance

After a project is built, long-term maintenance is critical to the functionality of stormwater management systems. Property owners are responsible for conducting regular inspection and maintenance of on-site practices. In 2019, PWD is recognizing Birchwood at Cedars Village for excellence in addressing maintenance concerns and creation of a long-term maintenance plan.

About the Project

This South Philadelphia-based senior living community is for restricted income residents over the age of 55. This 64-unit, five story development at 921 – 931 Ellsworth Street was completed in 2014, through the combined efforts of the nearby St. Maron Community Development Corporation, BCM Affordable Housing, and the Cedars Village property manager, Ingerman Affordable Housing.

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Stormwater Management Practice (SMP) Layout

Cedars Village maximized stormwater management through multiple SMP types, and their surface features provide an amenity to residents.

Technical Summary

PWD promotes an integrated design approach to build stormwater management solutions that protect receiving waters in a cost-effective manner. To meet PWD's Stormwater Regulations, Cedars Village developed a series of stormwater management practices on the property including a green roof, permeable concrete pavers in their central courtyard, and subsurface infiltration and detention basins. While a practical maintenance strategy is important from the onset of installation, Cedars Village is a great example of how SMPs can be restored to a fully functioning status should construction issues persist or maintenance lapse.

Post Inspection – Corrective Actions Taken

Every four years, PWD periodically inspects completed private development projects to ensure SMPs are still functioning and being properly maintained. In 2018, a routine inspection of Cedars Village yielded several items for Cedars Village to address, including:

- Cross connection with the building's stormwater and sewer lines
- Large areas of the green roof were lacking vegetation
- Debris, sediment, and trash were found in inlets and outlet controls (structures that control the rate at which stormwater exits the basin)
- Loose stones around the permeable concrete pavers in the courtyard

Actions for Compliance

Within a matter of months, Cedars Village had addressed all of these concerns by doing the following:

- Reconfiguring sanitary laterals so they connected directly to the PWD sewer in the street instead of the infiltration basin.

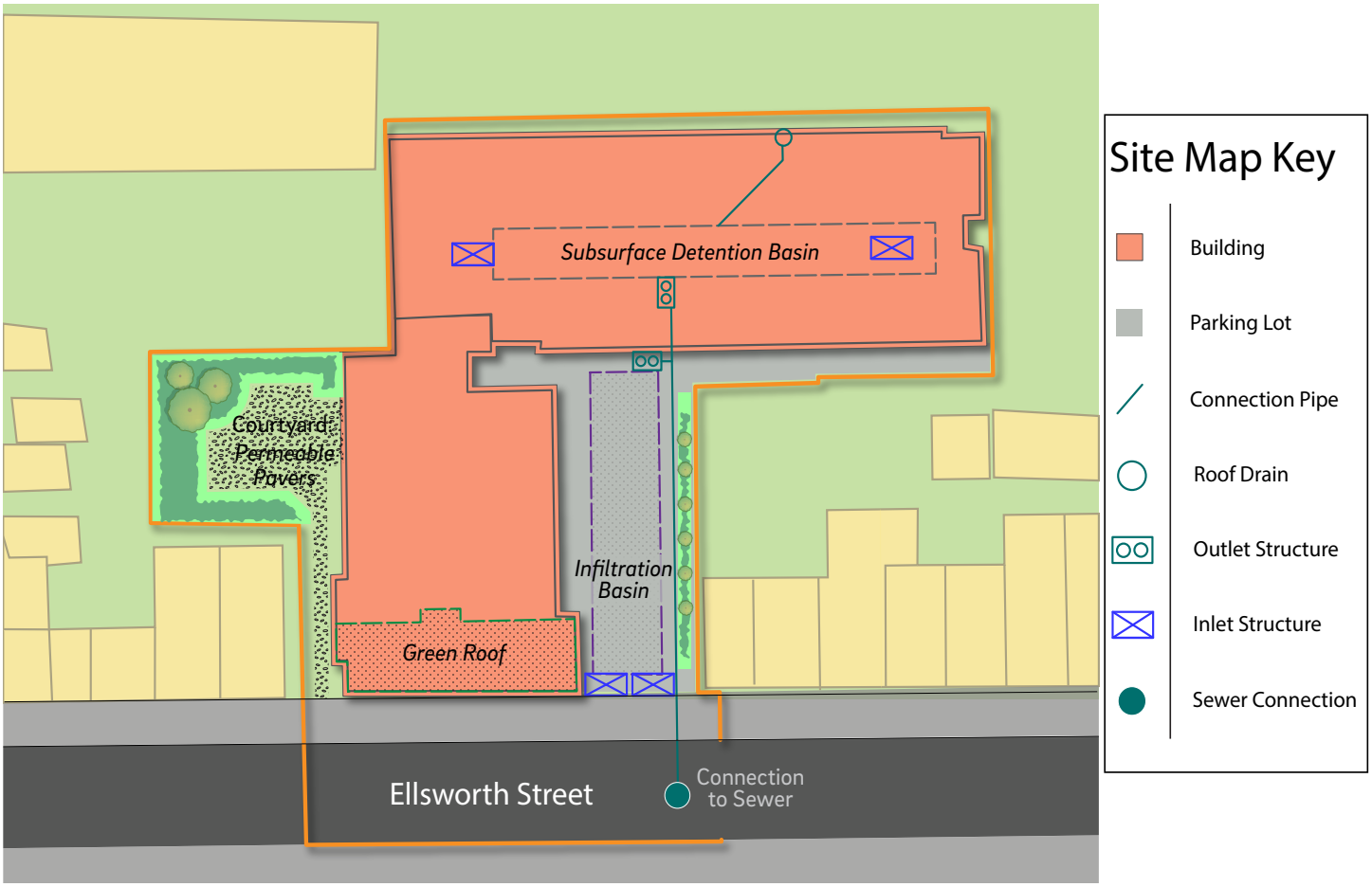
Actions for Compliance (continued)

- Replanting barren green roof areas and educating residents about the importance of not walking on the vegetation and removing deck furniture from planted areas.
- Manual cleaning of existing debris, and prevention of future debris accumulation by parging manholes and inserting pre-treatment devices (snouts, trash racks, and traps) over vital components of the SMPs.
- Sweeping loose stones from the permeable pavers

Project Details

Watershed	*Delaware River Watershed*
Sewer Type	*Combined*
Compliance Approach	*Green Roofs, Subsurface Infiltration Basin, Subsurface Detention Basin, Permeable Pavers*
Green Roof Area	*Footprint: 1,026 sf* *Drainage Area: 1323 sf*
Subsurface Infiltration Basin	*Footprint: 1,480 sf* *Drainage area: 9,413 sf*
Subsurface Detention Basin	*Footprint: 1,632 sf* *Drainage Area: 8,094 sf*
Permeable Paver Courtyard	*Footprint: 1,198 sf*

Site Plan



Maintenance of SMPs

Cedars Village recognized the necessity of developing a maintenance plan for each of their SMPs moving forward. As an example, Cedars Village set forth a weekly maintenance routine for the green roof for the spring and summer seasons. Effective Spring 2020, the weekly maintenance and care plan includes the following:

- Weeding out unwanted plants
- Keeping the drainage areas clear of plants
- Watering at least twice a week during growing season
- Monitoring vegetation for pests and disease
- Keeping a detailed maintenance log/diary

Detailed maintenance information for each SMP can be found at the back of this case study.

Green Roof Maintenance Guidance

Stormwater Requirements

Green roof maintenance activities largely focus on maintaining drainage capacity and the health of vegetation. All facility components, including plant material, growing medium, filter fabric, drainage layer, and waterproof membrane must be inspected regularly for proper operations, integrity of the waterproofing, and structural stability throughout the life of the green roof.

General recommended maintenance activities for green roofs are summarized in the table.

During the plant establishment period, maintenance staff must conduct three to four visits per year to conduct basic weeding, fertilization, and in-fill planting. Thereafter, only two annual visits for inspection and light weeding is required (irrigated assemblies will require more intensive maintenance).

Use of herbicides must be avoided to prevent root penetration of waterproofing.

Fertilization must be applied according to soil test to maintain soluble nitrogen (nitrate and ammonium ion) levels between one and four ppm. The best source of nutrients for fertilization is mature compost.

Spill prevention measures from mechanical systems located on roofs must be exercised when handling substances that can contaminate stormwater.

	ACTIVITY	FREQUENCY
EARLY	Water vegetation at the end of each day for two weeks after planting is completed.	*Daily for two weeks after installation*
EARLY	Water vegetation regularly to ensure successful establishment.	*Every four days during periods of four or more days without rain, June through August for the first year after installation*
EARLY	Hand-weed non-target/invasive plants.	*Four times per year for the first 24 months after planting*
EARLY	Inspect vegetation for signs of disease or distress.	*Biweekly for the first year after installation*
ONGOING	Roof drains must be cleared when soil substrate, vegetation, debris or other materials clog the drain inlet. Under normal operating conditions, all roof discharge must be filtered and medium must not be vulnerable to migration toward the drains. Sources of sediment and debris must be identified and corrected.	
ONGOING	Plant material must be maintained to provide a minimum of 90% foliage cover during warm months. If coverage rate is declining, determine the reason (e.g., soil nutrition or soil moisture conditions) and implement remedial measures.	*As needed*
ONGOING	Preferentially, weeding must be done manually, with herbicide use limited to extreme instances of weed infestations that compromise the plant cover integrity. Weeds must be removed entirely.	
ONGOING	Inspect root development. If root zone is not well developed, determine the reason (e.g., soil nutrition or soil moisture conditions) and implement remedial measures.	
ONGOING	Projects with permanent irrigation must be inspected and irrigation dosing rates adjusted to optimize plant performance and water use efficiency.	
ONGOING	Growing medium must be inspected for evidence of erosion from wind or water. If erosion channels are evident, a problem with the drainage system or with the green roof medium is indicated. Surface ponding or runoff must not occur except during very large rainfall events. After correcting the problem, refresh the affected areas with additional growth medium and provide temporary soil stabilization.	*Quarterly*
ONGOING	Manually cut detrital herbaceous vegetation from the previous growing season to four to six inches above the ground.	
ONGOING	Inspect drain inlet pipe and containment system.	*Annually*
ONGOING	Test growing medium for soluble nitrogen content. Fertilize as needed.	

Porous Pavement Maintenance Guidance

Stormwater Requirements

Maintenance of porous pavement systems focuses on the periodic removal of sediment and debris from the porous surfaces.

General recommended maintenance activities for porous pavement are summarized in the table.

Sediment Control

Superficial soil does not necessarily clog the voids in porous surfaces. However, soil that is ground in repeatedly by tires can lead to clogging. Therefore, trucks or other heavy vehicles should be prevented from tracking or spilling soil onto the pavement. Furthermore, all construction or hazardous materials carriers should be prohibited from entering a porous pavement lot. Areas with heavy vehicular traffic will require more frequent vacuuming.

Winter Maintenance

Winter maintenance for a porous pavement may be necessary, but is usually less intensive than that required for a standard asphalt lot. By its very nature, a porous pavement system with subsurface aggregate bed may have better snow and ice melting characteristics than standard pavement. Once snow and ice melt, they flow through the porous pavement rather than refreezing. Therefore, ice and light snow accumulation are generally not as problematic. However, snow will accumulate during heavier storms. Abrasives such as sand or cinders must not be applied on or adjacent to the porous pavement. Snow plowing is acceptable, provided it is done carefully (i.e., by setting the blade about 0.5 inches higher than usual and using a rubberized blade or blade tip). Salt is acceptable for use as a deicer on the porous pavement, though non-toxic, organic deicers, applied either as blended, magnesium chloride-based liquid products or as pretreated salt, are preferable. Any deicing materials should be used in moderation.

	ACTIVITY	FREQUENCY
EARLY	Inspect erosion control and flow spreading devices until soil settlement and vegetative establishment of contributing areas has occurred.	*Biweekly*
	Mow grass in permeable paver or grid systems that have been planted with grass.	*As Needed*
	Vacuum porous asphalt or concrete surfaces with regenerative air sweeper or commercial vacuum sweeper (traditional street sweepers are not appropriate). Clean out inlet structures within or draining to the structural SMP beneath the porous pavement surface. Inspect underdrain cleanouts, if any.	*Semiannually*
	Maintain records of all inspections and maintenance activity.	*Ongoing*

Repairs

Potholes are not common; though settling might occur if a soft spot in the subgrade is not removed during construction. Damaged areas that are smaller than 50 square feet and comprising less than 10% of the total porous area can be patched with a porous or standard asphalt mix, depending on the location within the porous area. In many cases the loss of porous surface will be insignificant. If an area greater than 50 square feet or 10% of the total is in need of repair, approval of patch type must be sought from either the engineer or owner. Porous pavement must never be seal coated under any circumstances. Any required repair of drainage structures should be done promptly to ensure continued proper functioning of the system.

Subsurface Detention Maintenance Guidance

Stormwater Requirements

Maintenance of subsurface detention SMPs requires the periodic removal of sediment and debris from pretreatment and storage areas and the prevention of outlet control clogging. Sediment removal from vaults, chambers, and pipes is typically conducted using vacuum or flushing systems. Guidance on the use and operation of vacuum or flushing sediment removal equipment is beyond the scope of this Manual; a maintenance professional should be contacted for additional details. As applicable, subsurface detention SMP maintenance procedures must meet OSHA confined space entry requirements.

General recommended maintenance activities for subsurface detention systems are summarized in the table.

	ACTIVITY	FREQUENCY
EARLY	Inspect erosion control and flow spreading devices until soil settlement and vegetative establishment of contributing areas has occurred.	*Biweekly*
EARLY	Inspect inlet controls, outlet structures, and storage areas for trash and sediment accumulation.	*Monthly for the first year after installation to determine ongoing maintenance frequency*
ONGOING	Regularly clean out gutters and catch basins to reduce sediment load to detention system. Clean intermediate sump boxes, replace filters, and otherwise clean pretreatment areas in directly connected systems.	
ONGOING	Remove sediment and debris from subsurface detention SMP sedimentation chamber, as applicable, when the sediment zone is 3/4 full.	*As Needed*
ONGOING	Remove sediment and debris from pipe/vault systems. Sediment depth is not to reach a maximum depth of four inches below the SMP's outlet invert elevation. Removal of sediment from grid systems must be per manufacturer's recommendations or as per the site-specific maintenance schedule.	
ONGOING	Inspect subsurface detention facility and control structures.	*Quarterly*
ONGOING	Remove floating debris and accumulated petroleum products.	
ONGOING	Maintain records of all inspections and maintenance activity.	*Ongoing*

Subsurface Infiltration Maintenance Guidance

Stormwater Requirements

Maintenance of subsurface infiltration SMPs focuses on the periodic removal of sediment and debris from pretreatment and storage areas. Sediment removal from vaults, chambers, and pipes is typically conducted using vacuum or flushing systems. Guidance on the use and operation of vacuum or flushing sediment removal equipment is beyond the scope of this Manual; a maintenance professional should be contacted for additional details. As applicable, subsurface SMP maintenance procedures must meet OSHA confined space entry requirements.

General recommended maintenance activities for subsurface infiltration SMPs are summarized in the table.

	ACTIVITY	FREQUENCY
EARLY	Inspect erosion control and flow spreading devices until soil settlement and vegetative establishment of contributing areas has occurred.	*Biweekly*
EARLY	Inspect inlet controls, outlet structures, and storage areas for trash and sediment accumulation.	*Monthly for the first year after installation to determine ongoing maintenance frequency*
ONGOING	Regularly clean out gutters and catch basins to reduce sediment load to infiltration SMP. Clean intermediate sump boxes, replace filters, and otherwise clean pretreatment areas in directly connected systems.	
ONGOING	Remove of sediment and debris from subsurface infiltration SMP sedimentation chamber, as applicable, when the sediment zone is 3/4 full.	*As Needed*
ONGOING	Remove sediment and debris from pipe/vault systems. Sediment depth is not to reach a maximum depth of four inches below the SMP's outlet invert elevation. Removal of sediment from grid systems must be per manufacturer's recommendations or as per the site-specific maintenance plan.	
ONGOING	Inspect subsurface infiltration facility and control structures.	*Quarterly*
ONGOING	Remove floating debris and accumulated petroleum products.	
ONGOING	Evaluate the drain down time of the SMP after a storm of at least one inch to ensure a SMP drain down time of less than 72 hours.	*Ongoing*
ONGOING	Maintain records of all inspections and maintenance activity.	