Simsbury Stormwater Design Guidelines

A Companion Document to the Simsbury Stormwater Article and Simsbury Center Code

September 30, 2011

MORRIS BEACON design
CIVIL ENGINEERING.
PLANNING.
URBAN DESIGN.
implementing community vision

Project completed by Morris Beacon Design with Russell Preston for the Town of Simsbury, funded by the Connecticut Department of Environmental Protection.

Simsbury Stormwater Design Guidelines

1.1 INTRODUCTION

The reasons for, objectives of, and strategies to achieve Low Impact Development (LID) have been covered at length by numerous federal, state, and local stormwater ordinances and design guidance documents, therefore extensive LID background material is not included in this document. Those searching for LID resource material are directed to the Low Impact Development Appendix to the Connecticut Stormwater Quality Manual[1] and the additional references listed in the Appendix of this document.

The Simsbury Stormwater Design Guidelines document serves as a companion to the Simsbury Stormwater Article and Simsbury Center Code, addressing the following objectives:

- Establish the connection between LID stormwater Best Management Practices (BMPs) and compact, walkable development patterns as a framework for watershed health in Simsbury.

1.2 LID IN SIMSBURY CENTER & OTHER COMPACT, WALKABLE AREAS

Compact Development for Watershed Health

A number of valuable LID design guidelines already exist; many of them are listed in the Appendix for further study. Most case studies and example LID applications are set within suburban low-density land development patterns and are therefore perfectly applicable in many areas of Simsbury. However, in order to fully reap the watershed-scale benefits of compact development and implement the vision expressed in the Simsbury Center Code, one must understand how realization of ecologically and hydrologically sensitive development differs within the more challenging conditions presented by compact, walkable places.

A Vision for Simsbury Center: Compact, Walkable Development (Code Studio: Simsbury Center Charrette Report)

- Demonstrate how LID tools and techniques can be implemented within Simsbury Center's unique land use context and in accordance with the Simsbury Center Code.
- Explain town-wide LID design criteria and performance standards in more detail to minimize uncertainty for applicants.
- Add clarity to specific items in the Stormwater Article that benefit from additional explanation.

Specific stormwater management requirements and design criteria are found in the Stormwater Article itself – these Design Guidelines are intended to be the "how and the why".

Compact development and accompanying preservation of natural resources can dramatically reduce runoff volumes and pollutant loadings within the watershed when compared to conventional lower-density development patterns[2]. In other words, for a given increment of community growth, compact development such as that prescribed by the Simsbury Center Code typically requires far less total impervious area per capita – street pavement, parking surfaces, building roof area – than the same buildout using typical Conventional Suburban Development (CSD) patterns. This leads to a decrease in stormwater runoff volume and pollutant loadings, not to mention infrastructure cost savings.

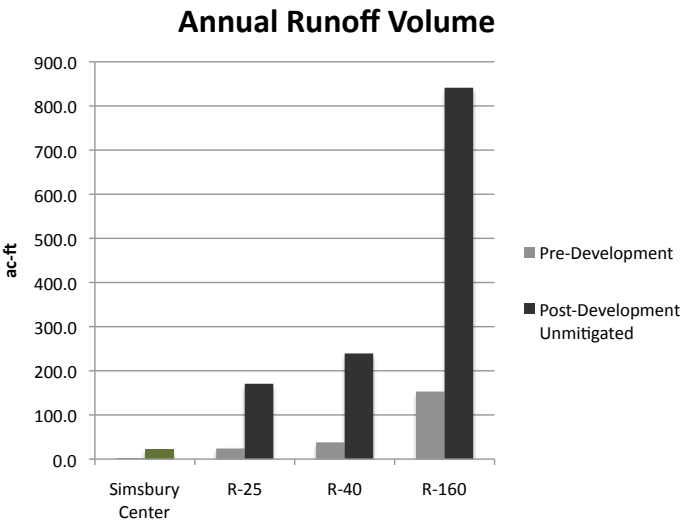
1 http://www.ct.gov/dep/lib/dep/water/nps/swgp/lid_stormwaterfinal.pdf

2 Protecting Water Resources with Higher Density Development, US EPA, January 2007.

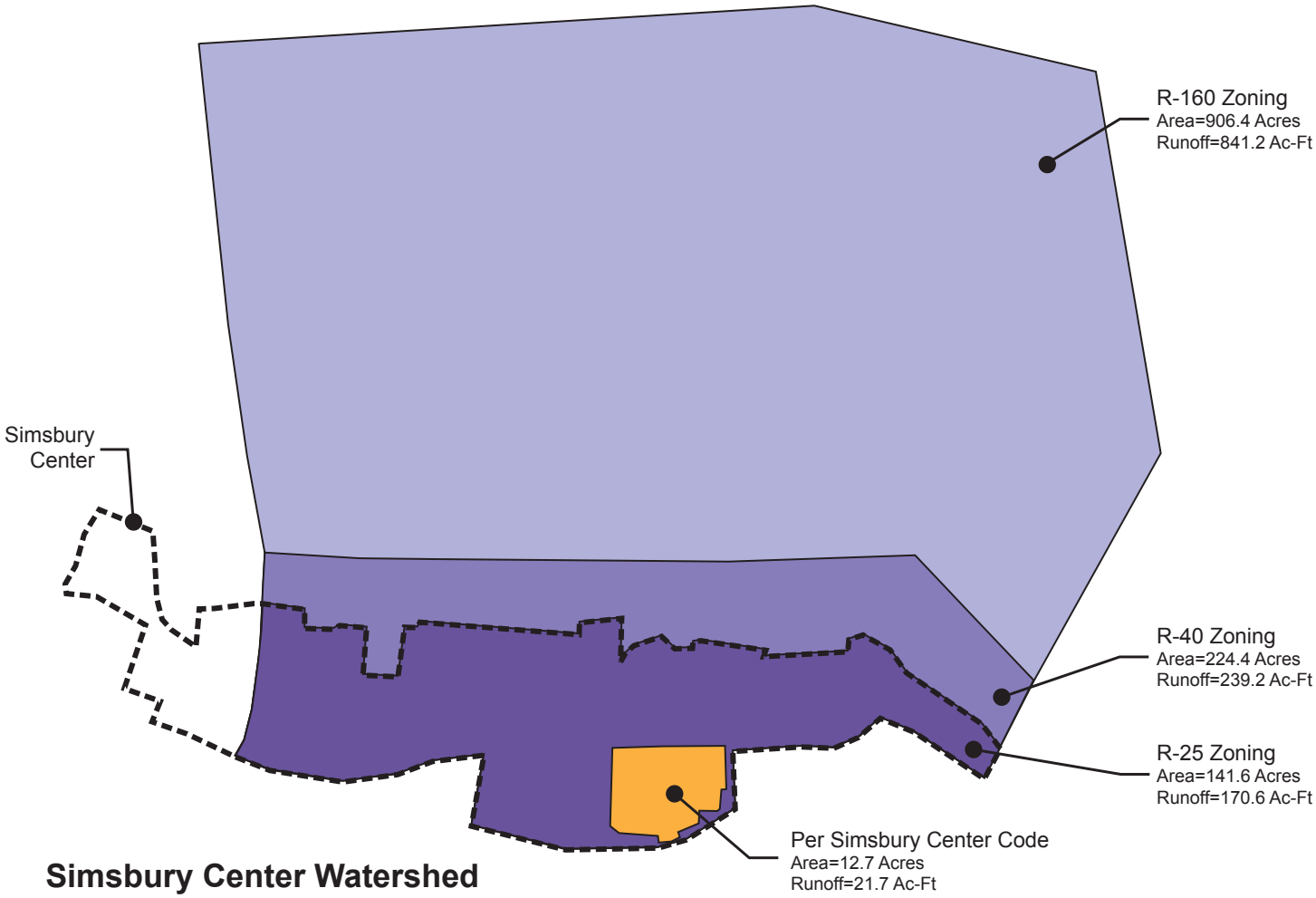
For example, these principles are demonstrated on the following pages using Simscroft Farms, a property within Simsbury Center designed for compact residential development in the Simsbury Center Code. Morris Beacon Design calculated the area required to accommodate the same buildout prescribed in the Simsbury Center Code using conventional Simsbury residential zoning (zones R-25, R-40, and R-160). Even though the Simsbury Center Code generally allows for a higher site impervious area percentage, the *total* disturbed area, impervious area, and annual runoff volume for the buildout is much lower than that of the conventional lower density zoning alternatives.

The graph at right demonstrates the reduction in annual runoff volume associated with the compact, walkable version of the Simscroft Farms buildout – the benefit provided by neighborhood-scale land use patterns alone.

Taking a step further with this data, stormwater mitigation requirements can, and should, be adjusted within Simsbury Center and potentially other compact, walkable places within town. Reducing stormwater quantity performance standards in Simsbury Center by the location-based adjustments in Section 1.1.2B of the Stormwater Article (a 50% reduction for the Simscroft Farms site) is a reasonable strategy from a watershed health perspective to help incentivize and enable the types of compact, higher-intensity development patterns envisioned by the Plan of Conservation and Development and the Simsbury Center Code. As demonstrated on the following page, even with reductions in the stormwater volume mitigation requirement the Simscroft Farms Simsbury Center design alternative's annual runoff volume is well below what would be expected if the buildout were a combination of conventional R-25, R-40, and R-160 alternatives.

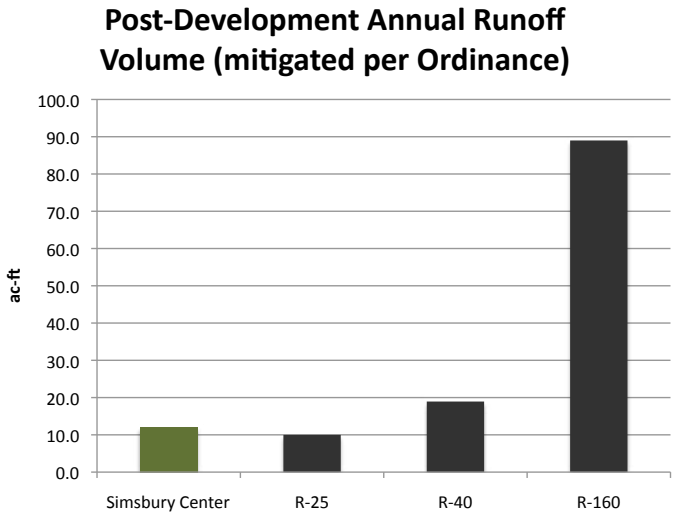


Simscroft Farm Watershed Impact Comparison: Compact Development vs. Traditional Zoning



Simsbury Center Watershed
Simscroft Farms Test Site Buildout Comparison

On the other hand, projects located towards a neighborhood edge or projects not located within compact, walkable places



Simscroft Farm Application of Location-Based Performance Standard Adjustments

will appropriately benefit from conventional LID planning and design principles along with strategic open space preservation to reduce their watershed impact. In fact, sometimes lower-intensity development should be asked to work harder, accommodating neighborhood or district scale flood control BMPs and increased performance standard requirements that aren't appropriate or technically feasible within compact development.

Simsbury Center Watershed Planning & Design Framework

Within Simsbury Center itself, site planning and stormwater management design principles must be calibrated to the neighborhood planning and place-based requirements established by the Simsbury Center Code. The Simsbury Center Watershed Planning and Design Framework located in the Appendix establishes specific approaches given a project's location within Simsbury Center and site soil conditions (infiltration capability). Soil conditions, form-based zoning metrics, and natural conditions including topography are synthesized to provide a guide for stormwater approach and locate potential areas for neighborhood-scale flood control, if required.

Locations for neighborhood-scale flood control and/or stormwater quality treatment, labeled stormwater receiving zones, fit nicely within the Simsbury Center Code neighborhood pattern, as topography and soil conditions naturally suggest areas for stormwater control south of Iron Horse Boulevard and downgradient from Simsbury Center compact development zones. Since land use context, or quality of place, should be a top priority for site planning within Simsbury Center, the offsite mitigation or payments in lieu of mitigation could target improvements in these areas to receive overflow runoff during larger storms from sites that cannot handle full mitigation on site.

Design Process

The design process below is the roadmap for injection of LID principles into a project, beginning with the earliest project planning stages. To achieve maximum watershed benefit, and often provide significant construction cost reduction, LID cannot be applied after the fact as a last engineering overlay on a finalized site plan.

It is highly recommended the design process for every land disturbance project utilize the following steps[3], with the Planning and Site Design Criteria Checklist (explained in more detail in the following section) as a key reference:

1. Define basic project goals, objectives, constraints, and context.
2. Evaluate site:
   Document sensitive natural resources as a guideline for site planning.
   Simsbury Planning & Site Design Checklist Section 2.1
3. Preliminary Planning and Site Design Criteria Checklist review:
   Review the checklist with the entire design team to ensure familiarity with planning and design requirements before site analysis and conceptual design.
4. Optimize Conservation of Natural Features at the Larger Watershed and/or Neighborhood Scale:
   Simsbury Planning & Site Design Checklist Sections 1/2
5. Design the Project at the Neighborhood/Block Level:
   Utilize compact, walkable land use patterns and design principles to minimize new impervious area at the neighborhood scale. Depending on the size and location of the project, higher impervious concentrations may be appropriate to help minimize impervious area at the neighborhood/watershed scale. For example, new development within Simsbury Center may have more intense development with a higher impervious percentage than areas elsewhere in Town. New development within other designated compact, walkable areas may be appropriate places for "clustering", with higher intensity development on a small portion of the site allowing the majority of the site to remain in its natural, undisturbed state.
6. Design the Site at the Lot Level:
   Utilize LID tools implemented according to neighborhood and site context to approximate the natural water balance as closely as possible.

These steps will help establish LID planning and design techniques as project priorities, enabling environmental, financial, and community benefits to be fully realized.

Planning and Site Design Criteria Checklist

Submittal of the planning and site design criteria checklist is required as part of the Stormwater Article performance standard requirements. It is to be submitted to ensure the following planning and design principles are integrated into every project, regardless of size or location, to the maximum extent practicable:

3 Adapted from the Low Impact Development Appendix to the Connecticut Storm Water Quality Manual.

- Support compact development within Simsbury Center and other areas designated to be compact and walkable, including developments utilizing the Simsbury Center Code, Planned Area Development Designation, or other cluster development designs, or other compact and walkable areas as determined by Conservation Officer/ Zoning Compliance Officer, as a strategy to reduce overall impervious area, and thus generation of stormwater runoff volume, in the watershed.
- Preserve natural resources, native vegetation, and existing hydrologic patterns as a framework for neighborhood and site design.
- Reduce consumption of land for the sole purpose of stormwater management.
- Minimize impervious area at the block, street, and building scales of development.
- Manage rainfall as close to where it falls as possible.
- Utilize simple, natural, cost-effective LID processes for stormwater quality treatment.
- Increase property values.
- Celebrate stormwater as an integral part of the built environment.

It is not the intent of the Planning and Site Design Criteria Checklist that each and every item be fully incorporated into every project design without exception.

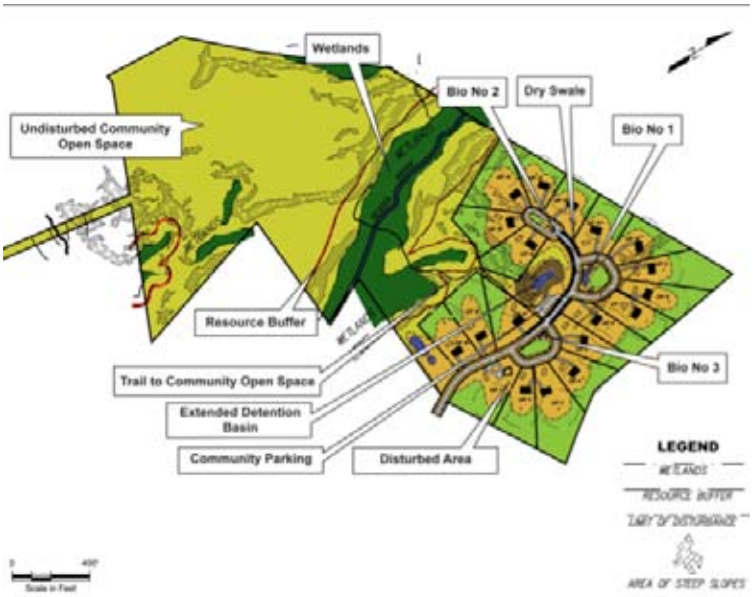
Rather, the checklist is intended as a guide to LID planning and design in Simsbury, clarifying the Town's expectations and ensuring that watershed health is incorporated as a priority from the earliest possible point in the design process. Each checklist item must be evaluated given the project's unique existing conditions, location within the town, neighborhood context, and proposed use. For a given project, it is expected that a number of checklist items will not be applicable and a number of checklist items will not be implemented or will only be partially implemented due to technical infeasibility – whether it be poor site soils, ledge, or lack of available area common to more urbanistically intense sites in designated compact, walkable areas.

More detailed explanation of each checklist item can be found in the "Simscroft Farms" test site analysis later in this document.

Design to Context

Compact development patterns should not bear the stormwater mitigation workload alone. Structural BMPs are still an integral part of any site design; however, BMP selection must be appropriate to natural context and urban context, or character of place, to support compact development.

Stormwater requirements, just like lot size, setbacks, street width, and other metrics describing the built environment, cannot be one-size-fits-all if Simsbury is going to fully achieve the vision for the future expressed in the Plan of Conservation and Development and the Simsbury Center Code. One size fits all stormwater solutions, even those whose engineering performance is in conformance with the latest and greatest green LID principles, may comply with regulations while at the same time detract from the connectedness, vibrancy, and possibly density of compact neighborhoods. Therefore, selection of stormwater management tools according to urban form is required per the Simsbury Center Watershed Planning and Design Framework (see Appendix) and the Site/ Block BMP Selection Matrix (Stormwater Article Table 1.3) to support healthy neighborhoods and optimize watershed impact.

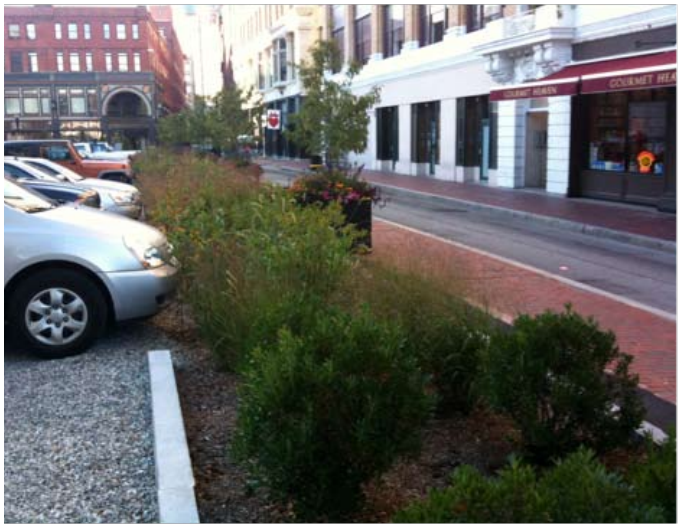


Suburban Low-Density LID: Not Appropriate for Simsbury Center
(RI DEM Stormwater Design and Installation Standards Manual, 12/10)

Projects located within areas designated for compact, walkable development should not be subject to extreme stormwater BMP requirements that may water down what should be small doses of higher-intensity development. Neither should they be expected to accommodate area-hogging structural BMPs such as detention basins. Town centers must be allowed to be town centers, because this is where the real per capita watershed improvement is seen.

Consideration of retail is another key design parameter. Street and site design must take into account retail visibility and access, or the long-term viability of an entire project may suffer. For example, the conventional LID approach on a Simsbury Center SC-2 street frontage might suggest hard-edged vegetated roadside swales as a conveyance BMP. But swales, especially if planted with taller wetland-type grasses, may interfere with visibility of more urban retail storefronts where on-street parking is present, causing confusion for those who would park directly in front of shops and restaurants. Some retail may play well with specific stormwater approaches, and some may not. BMP layout must be thoughtfully coordinated with proposed building uses and expected access requirements in detail for a win-win. Sometimes flexibility is needed.

For example, Grant's Block, a green parking lot retrofit project within Providence's urban Downcity neighborhood, was



Grants Block, Providence Case Study: Context-Appropriate Green Parking Retrofit (Image: MBD)

designed using permeable parking surfaces, bioretention systems, and drywells to filter and infiltrate over 90% of the annual stormwater volume on the site. The retrofit was relatively simple, and serves as a significant aesthetic improvement in front of key downtown retail. Since the parking lot is across the street from prime retail frontage, visibility or access to the adjacent coffeeshop and small grocery store is not a factor. Much of the traffic within the neighborhood is by foot or bicycle, and the lot serves mostly monthly and "destination" parking. Bioretention may not have been appropriate on the next block – a narrow, intricate, pedestrian scale retail street with on-street parking.

In contrast, compact development with a lower intensity of development or located in a more isolated part of town, perhaps in the form of cluster residential development and retail with parking lots between the building and the street, generally accommodates full prioritization of LID site design techniques and BMPs and more extensive inclusion of bioretention, swales, vegetated filters, and self-treating/ self-retaining areas without harming community character. In fact, since a broad site planning goal is design in harmony with urban context, vegetated LID BMPs are aesthetically appropriate to the lower intensity of development, and thus value added to the project.

For example, the below sample project design clusters residences onto a small portion of the site, thus minimizing total impervious area and preserving natural resources located outside the limit of site disturbance. The design utilizes a number of LID site layout techniques to reduce impervious area and therefore minimize runoff in the first place, including a shared access lane, narrow pavement width with pervious emergency access shoulders, tandem "two-track" driveways.

Beyond the technical LID site design and BMP solutions offered in this example design, the concept takes a new

Cluster Development Prototype: Beyond LID (Russell Preston)

East Greenwich, RI Cottage Court: Shared Common Green Provides Setting for Neighborhood Gatherings While Integrating LID BMPs (Image: Donald Powers Architects)

approach to cluster development. Residences are strategically clustered in a "cottage court" type layout, framing a common shared space which provides for neighborhood enjoyment and a "community" feeling much desired by the transforming housing market as an alternative to sprawl-oriented cul-de-sac style cluster design[4]. This layout offers an opportunity to weave stormwater management through the site as a landscape amenity. Stormwater can be visible and celebrated, while LID BMP vegetation acts as a strategic buffer between public space (sidewalks and the common green) and semi-public space (front porches).

Long-Term Maintenance

The most dazzling technological stormwater management solutions lose value quickly if they are abandoned after a year because they were too complicated or costly to maintain. Projects must factor in the future residents of the sites they design and the property managers who will maintain them when considering the true functional performance of proposed solutions.

There are useful parallels here to the concept of Original Green[5] when thinking about the lifecycle of a site during the design process, where in this case the benefits of site design solutions on paper sometimes do not translate to the functional reality over time. Original Green poses that sustainable buildings are "lovable, durable, flexible, and frugal". In the words of Steve Mouzon, the author: "…it does not matter how efficiently the building performs if it is demolished and carted off to the landfill in a generation or two because it cannot be loved."

Similarly, site sustainability is purely academic if only evaluated as a series of required metrics on paper during the design process. Stormwater management maintenance is required by the Simsbury Stormwater Article and in accordance with the 2004 Connecticut Stormwater Quality Manual, but chances for long-term success are highest when stormwater management BMPs are:

- Obvious: surface filters, bioretention, tree filters, green roofs, pervious paving surfaces
- Simple: bioretention, vegetated swales, natural filtration systems and erosion control measures, roof downspout daylighting, self-treating and self-retaining areas
- Lovable: landscaping that provides additional function for stormwater management, green roofs
- Not needed in the first place: strategies to minimize impervious area with compact development, redevelopment/infill, shared parking & reduced parking requirements, appropriate-width streets

Obvious, Simple, & Lovable Stormwater Management (Image: MBD)

Clearly a long-term approach takes some extra thought, but through this lens intertwined benefits become apparent. For example, reducing site impervious area using more appropriate minimum parking requirements reduces the stormwater volume/quality load to be mitigated. Less pavement to build and maintain *and* cheaper stormwater mitigation – the mitigation is not needed in the first place due to strategic planning and design. A combination of bioretention other natural filtration systems when properly designed can meet municipal stormwater mitigation requirements just like a highly engineered proprietary manhole filter unit, but in contrast the natural systems are obvious, simple, lovable, higher-performing, and cheaper to construct and maintain.

Maintenance: Permeable Pavement

Permeable pavement maintenance has been a topic of some debate in Simsbury and across the country, due to concerns relating to the introduction of automobile and de-icing pollutants to the underlying aquifer and impacting water supply. A recent study by the University of Rhode Island in partnership with the Rhode Island Department of Public

4 US Department of Housing & Urban Development "Breakthroughs" Newsletter, September, 2011; Lin, Sara "The Newest Cottage Industry", Wall Street Journal, July 18, 2008; Rice, Alison "Consumers Rethink Home-Buying Priorities", Builder Magazine, January 22, 2009.

5 See www.originalgreen.org.

Health[6] compiled available data, and found the following relating to *properly designed, constructed, and maintained* pervious bituminous and porous concrete systems:

- Systems trap and biodegrade oil accidentally released onto parking surfaces.
- Systems are able to retain suspended solids, copper, lead, and zinc, and to a lesser extent cadmium.
- Evidence that porous concrete pavement systems can effectively degrade hydrocarbons.
- Longer flow paths lead to higher attenuation of pollutant loads, decreasing the potential for long-term groundwater impacts.
- The EPA recommends a minimum four-foot separation between the bottom of a porous pavement system and underlying bedrock or water table, consistent with the Simsbury Stormwater Article 1.2B.7 requirements.
- Stormwater hotspots such as commercial nurseries, auto recycle facilities, vehicle service and maintenance areas, vehicle/equipment washing facilities, fueling stations, industrial parking lots, marinas and marina service, hazardous material generators, outdoor loading facilities, or public works storage areas are not appropriate areas for porous pavement, consistent with Simsbury Stormwater Article 1.2B.7.

Available data is consistent with inclusion of properly designed, constructed, and maintained permeable pavement systems as a recommended LID BMP, especially within Simsbury Center and other areas within Simsbury with limited aquifer impact potential due to soil types, distance to groundwater, and proximity to the Farmington River for dilution.

As noted in the Stormwater Article Design Criteria, permeable pavement requires alternative maintenance; including a recommended minimum twice annual vacuuming. Systems should be clearly designated using signage to ensure awareness and a commitment to alternative maintenance over time. The University of New Hampshire Stormwater Center recommends the following winter maintenance guidelines, which also attempt to minimize potential introduction of pollutants to groundwater through permeable pavement systems[7]:

- If possible plow with a slightly raised blade to prevent scarring of pavement surfaces.
- Up to 75% salt reduction for porous asphalt can be achieved. Salt reduction amounts are site specific and are affected by degree of shading. Use reduction with caution.
- Pervious concrete salt reduction will vary and is heavily dependent upon shading. For shaded areas, pervious concrete may not achieve salt reduction.
- Apply anti-icing treatments prior to storms. Anti-icing has the potential to provide the benefit of increased traffic safety at the lowest cost and with less environmental impact.
- Challenge: de-icing chemicals work by lowering the freezing point of water. Generally, the longer a de-icing chemical has to react, the greater the amount of melting. Meltwater readily drains through porous surfaces thereby reducing chemical contact time. This is corrected by excess salt application.
- Deicing is NOT required for black ice development. Meltwater readily drains through porous surfaces thereby preventing black ice.
- Apply deicing treatments during and after storms as necessary to control compact snow and ice not removed by plowing.
- Sand application should be limited since its use will increase the need for vacuuming.
- Vacuum porous areas a minimum of 2-4 times per year, especially after winter and fall seasons when debris accumulation and deposition is greatest.
- If ponding water is observed during precipitation cleaning is recommended.

1.3 TEST SITES

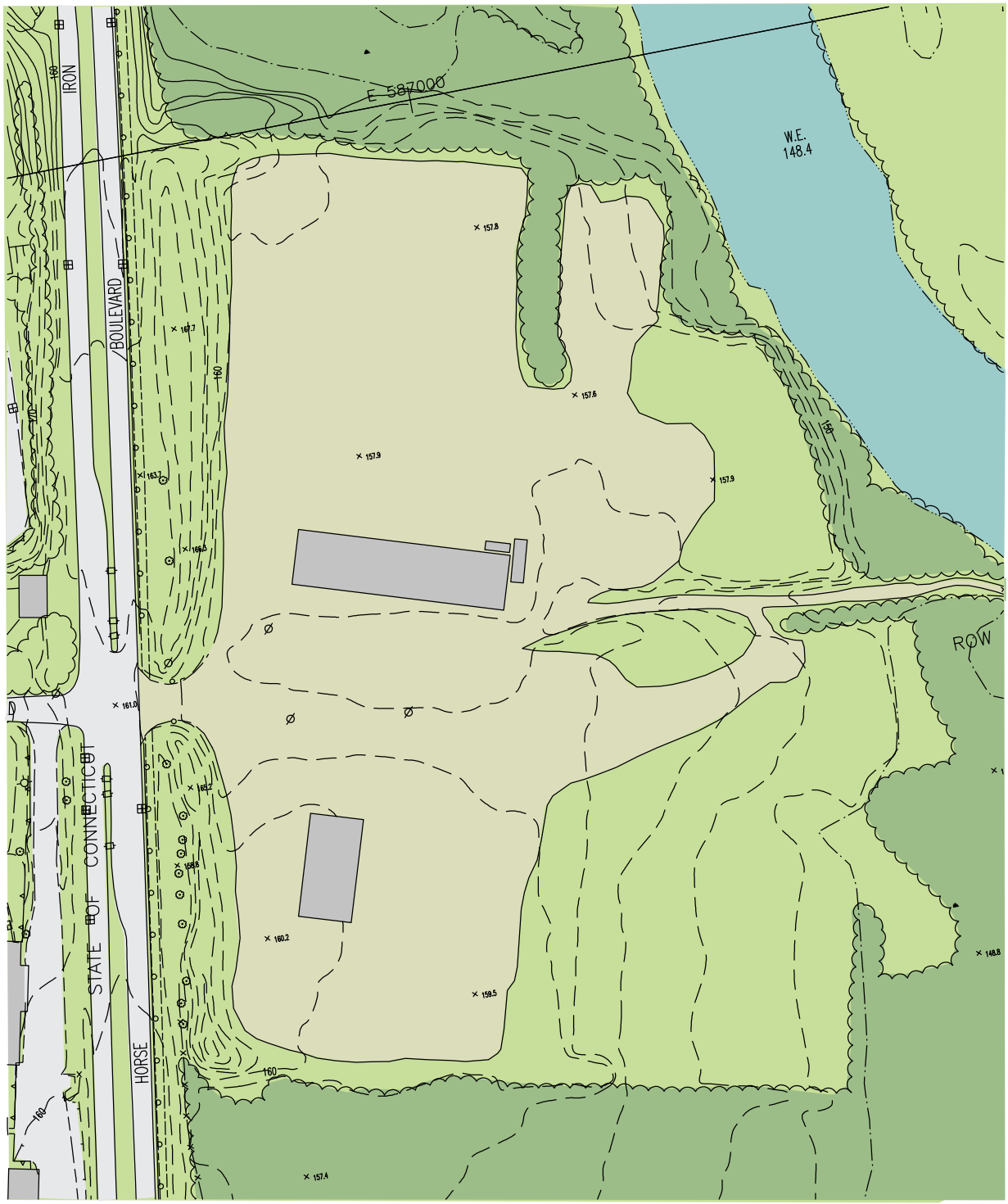
Three test sites were analyzed to demonstrate detailed application of the Planning and Site Design Criteria Checklist, Performance Standards, and design principles unique to Simsbury Center or other designated compact, walkable places. The test site solutions presented here are conceptual in nature – available existing conditions data and proposed development, stormwater solutions, and calculations should be taken as a general guide for design efforts and the permitting process, not as one-size-fits all methodology.

The Simscroft Farms test site is explained in detail on the following pages. See the Appendix for all three test sites.

Simscroft Farms Existing Conditions (Google Earth)

6 Porous Pavement and Groundwater Quality Technical Bulletin, URI in partnership with the RI Department of Public Health Source Water Protection Program.

7 See http://www.unh.edu/unhsc.



Test Site #1: Simscroft Farms

Post-Development Conditions

Post-Development			
Total Area	555,440		
Impervious Area (sf)	333,234	60.0%	
Redevelopment credit	no		Existing land cover to be verified
Location-based credit	50%		Simsbury Center Zone SC-5

Layout by Russell Preston

Test Site #1: Simscroft Farms

Post-Development Conditions

	Value	%	Notes
Post-Development			
Total Area	555,440		
Impervious Area (sf)	333,234	60.0%	
Redevelopment credit	no		Existing land cover to be verified
Location-based credit	50%		Simsbury Center Zone SC-5
Office Space (sf)	0		
Residential Units	224		

Test Site #1: Background

Simscroft Farms is currently the Simscroft-Echo Farms site excavation, road & utility contractors equipment yard. Site land cover is mostly compacted earth equipment and materials storage areas, with several buildings and associated outbuildings.

The property slopes from Iron Horse Boulevard to the east property line and the Farmington River approximately 1,200 feet beyond at its closest point.

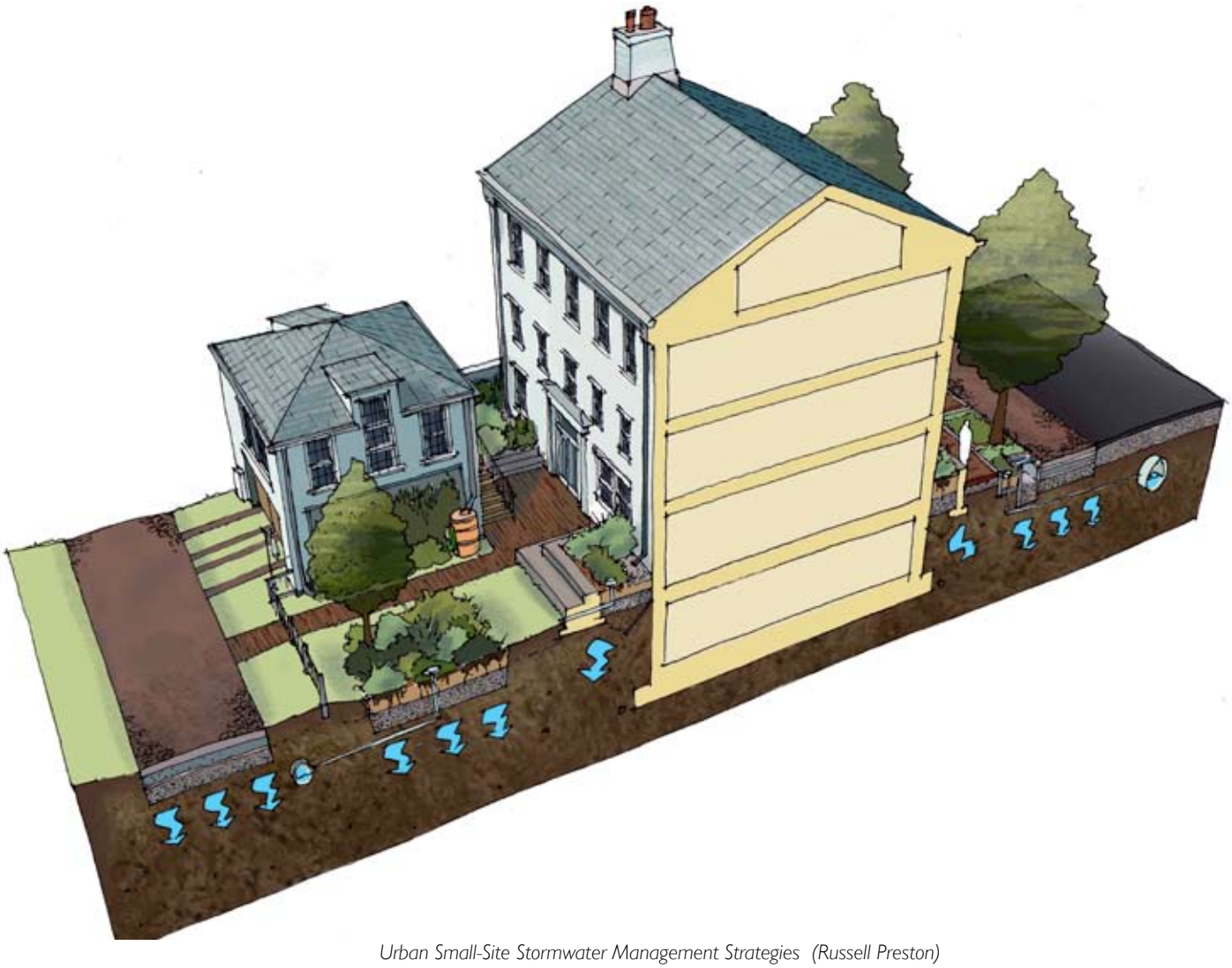
The property is identified in the Simsbury Center Code as SC-5: "Intended to accommodate only residential development, including townhouse and multifamily buildings".

Test Site #1: Neighborhood Plan

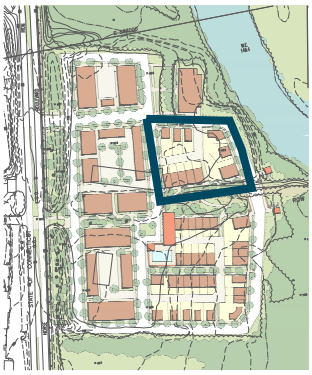
The conceptual plan for Simscroft Farms used as a base for stormwater analysis (see page 13) was prepared using the Simsbury Center Code and the Simsbury Center Charrette's illustrative plan as a starting point. The conceptual plan was then modified to be consistent with the Stormwater Article Planning and Site Design Criteria, as described on the following pages.

A block selected from the Simscroft Farm conceptual plan is shown in more detail on the following page to illustrate incorporation of Planning and Site Design Criteria within a higher-intensity residential block. Context appropriate decentralized LID BMPs including bioretention; permeable alleys, sidewalks and on-street parking; and flow-through planters are distributed throughout the block to naturally filter and infiltrate runoff as close as possible to where it hits the ground, and neighborhood-scale filtration and flood control BMPs are selectively incorporated into adjacent natural space. Due to the more urban nature of the site (per the Simsbury Center Code), sizing and placement of BMPs must be strategic and driven by the context of place.

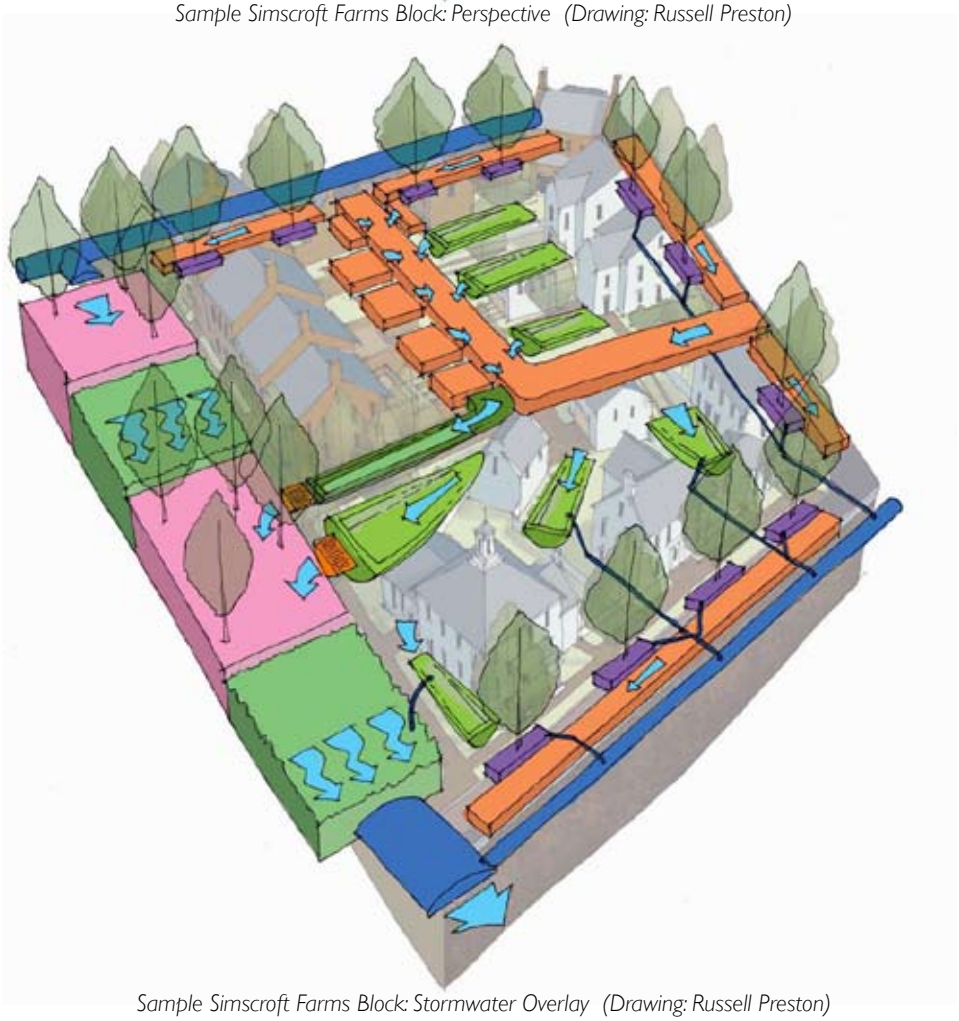
For example, it is important to note the importance of topography to the incorporation of LID into more dense compact development. Often reduced frontyard setbacks at the downgradient end of sites lead to little or no available room for stormwater migitation unless the building roof can be configured to direct all runoff to rear downspouts. Reduction of stormwater volume mitigation requirements in these zones per the Stormwater Article Location-Based Adjustments Table 1.1 is part of the solution, as the required mitigation might be focused in a site's rearyard as shown in some of the properties above with unmitigated front yard runoff.



Urban Small-Site Stormwater Management Strategies (Russell Preston)



Sample Simscroft Farms Block: Perspective (Drawing: Russell Preston)

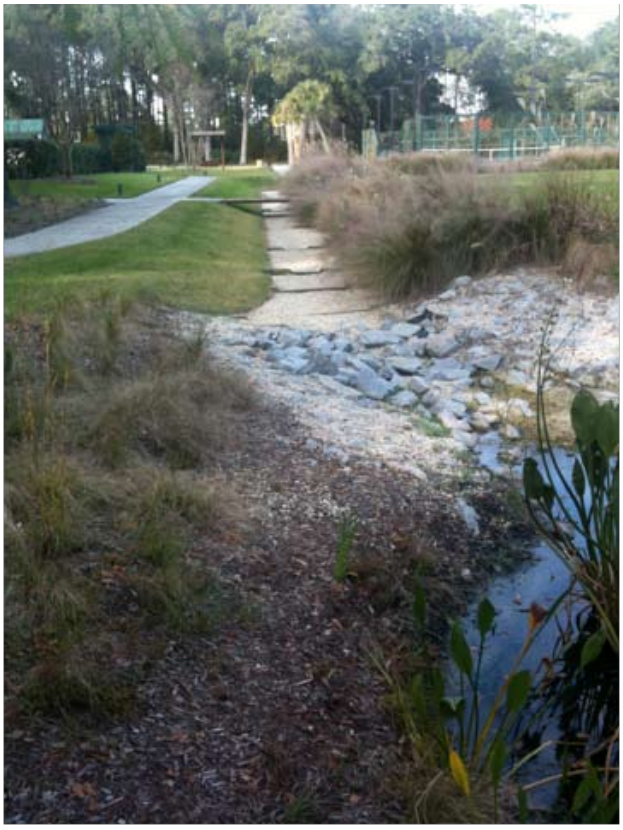


Sample Simscroft Farms Block: Stormwater Overlay (Drawing: Russell Preston)

However, water quality filtration is still a requirement. Flow through planters can be a simple and effective water quality filtration technique in these conditions. As shown in the detailed design of a single Simscroft Farm property on page 14, flow-through planters designed to treat the water quality volume from roof runoff tributary to a single downspout can be integrated into the site as an aesthetic design element. The planter system against the building in the foreground is designed to treat the water quality volume with a piped overflow that daylights in the integral seat wall, where runoff flows through a grass filter before the bioretention area near the rear property line. Since the planter is flow-through, infiltration against the building foundation is not a concern.

A rain barrel is incorporated for reuse of garage roof runoff for watering of bioretention and planter vegetation, and sidewalks, alleys, and on-street parking spaces are permeable.

Lower cost alternate methods are available for filtration and infiltration of runoff from building roofs and other impervious area on a small site, including BMPs such as underground infiltration trenches and drywells, however natural filtration using vegetated systems and a treatment train approach routing runoff through multiple LID BMPs is recommended.



Neighborhood-Scale Runoff Quality & Quantity Mitigation Strategically Integrated into a Public Park at the Neighborhood Edge (Image: MBD)

Test Site #1: Planning & Site Design Criteria

Additional explanation of the Planning and Site Design Criteria Checklist items for the Simscroft Farms conceptual design is included below. No additional explanation is necessary for items "verified" on the actual checklist to be submitted (noted as "YES" below). If site conditions partially or completely prevent implementation of criteria (noted as "YES*" or "NO"), additional documentation demonstrating technical infeasibility must be provided.

1.1 - YES: The development avoids sensitive natural resource areas most importantly by limiting the proposed development footprint to areas already cleared and compacted – within the existing treeline. Additional existing hydrologic patterns – two green "fingers" extending into the north and eastern portions of the site – are protected for their hydrologically valuable ecology as well as value to the community. Selective and strategic addition of both neighborhood-scale water quality and quantity BMPs as well as walks and paths for community enjoyment should be in balance with preservation and restoration of existing natural ecology and hydrologic patterns.

1.2 - YES: Since the project is located within Simsbury Center,

Small Park Designed for Neighborhood-Scale Rate/Volume Mitigation (Image: MBD)

an area of town designated as a compact, walkable place in the Simsbury Center Code, buildout of this parcel with relatively dense development is an appropriate strategy for watershed health and is in support of the Plan of Conservation and Development as a town-wide method to reduce overall impervious area.

1.3 - YES: The proposed concept plan includes a plaza near the center of the site to be designed as a Special Detention Area with bioretention systems and underground stormwater infiltration systems for mitigation of flow from upgradient development, balancing public use with stormwater function.

1.4 - YES: The concept plan follows the principles established in the Simsbury Center Watershed Planning & Design Framework, with widespread implementation of block, street, and site scale decentralized infiltration BMPs to maximize water quality treatment and volume recharge, especially incorporating neighborhood-scale strategies for shared solutions. Generally well-draining soils support widespread simple infiltration BMPs to approximate the natural water balance and infiltrate as close to the source of rainfall as possible, also reducing the need for (and cost to construct) neighborhood-scale flood control solutions.

Stormwater receiving areas adjacent to Iron Horse Boulevard should provide water quality and quantity mitigation for upland areas within Simsbury Center, especially valuable in this location outside the 100-year flood plain. An agreement could provide mutual benefit to upland property owners, the Simscroft site, and the Town. For example, upland Simsbury Center property owners unable to accommodate required stormwater management on their property due to Simsbury Center Code development criteria might pay a fee in lieu of required mitigation (See Stormwater Article Section 1.1.2B-6), with the required mitigation built on the Simscroft site stormwater receiving areas along with additional consideration, perhaps density/height bonus, to the Simscroft site.

2.1 - YES: An existing conditions plan documenting sensitive natural resources is necessary to accurately achieve the benefits described in Planning and Site Design Criteria Sections 1 and 2.

2.2 - YES: See watershed criteria 1.1. Additional design detail relating to planning for well-draining soils is not shown in this conceptual plan assuming that the entire property is well-drained. More detailed soils data will help determine areas that should be preserved for their infiltration capacity.

2.3 - YES: The majority of the site is developed, in accordance with the Simsbury Center Code and the Simsbury Center Watershed Planning and Design Framework, however neighborhood-scale volume mitigation and flood control, if required, is located at the edges of the neighborhood or selectively within green natural “fingers” extending into the site.

2.4 - YES: Community open space is located in areas of well draining soils – adjacent to Iron Horse Boulevard and within green “fingers” extending into the site. The central plaza location (and potentially the street network) may be adjusted to accommodate areas of well-draining soils for more effective stormwater function when more detailed soils data is available.

2.5 - YES: Existing stands of mature trees are incorporated into the neighborhood and site design, as described at the neighborhood scale in item 1.1 and throughout the property at the more detailed lot level site design scale.

Creative Preservation of Mature Trees (Image: MBD)

2.6 - YES: Block layout and parking design is consistent with urban form. Block design transitions from larger multi-family buildings requiring mid-block interior parking lots near the busy Iron Horse Boulevard, to alley-loaded townhouse and detached single-family residential blocks towards the eastern end of the property. Mid-block interior parking lots and alley loaded residential blocks are key design element for small, walkable blocks accommodating higher density residential development, thus providing reduction of impervious area on the neighborhood scale.

2.7 - YES*: The neighborhood parking approach incorporates shared parking provisions and all streets provide on-street parking, however densities do not support structured parking.

3.1 - YES: New thoroughfares are designed to meet Section 1.1.2B Water Quality and Recharge Volume requirements through a combination of permeable pavement, bioretention/ swale systems, tree box filters, underground recharge systems. Due to well-draining soils, offsite mitigation is not necessary to meet requirements.

3.2 - YES: Thoroughfare and driveway pavement widths are compliant with Section 5 of the Simsbury Center Code, assumed to be the minimum required to accommodate public safety and emergency access – thus minimizing impervious area. Thoroughfare and driveway pavement widths for projects outside Simsbury Center may require more detailed design to be approved by the Fire Department and Town Engineer.

3.3 - YES: Rear alleys, on-street parking spaces, sidewalks,

Permeable On-Street Parking: Less Urban (Image: MBD)

Permeable Off-Street Parking: Less Urban (Image: MBD)

Permeable On-Street Parking: More Urban (CT DEP LID Appendix)

Permeable Off-Street Parking: More Urban (Image: MBD)

pedestrian paths, and driveways are constructed of permeable materials with a section including a stone infiltration reservoir. Most areas do not require an underdrain. Permeable surfaces appropriate to zone SC-5 per the Site/Block BMP Selection Matrix include pavers, brick, and permeable bituminous or concrete pavement. Compacted earth, crushed stone, and grassed cellular plastic/concrete may be appropriate in selective areas such as residential driveways, overflow parking areas, and emergency access lanes.

3.4 - YES*: The majority of street trees within the site are designed as tree box filters or as part of bioretention systems to filter and infiltrate stormwater runoff as part of the green street design. Not all trees are designed to provide stormwater function, as design may be limited by topography and/or other constraints.

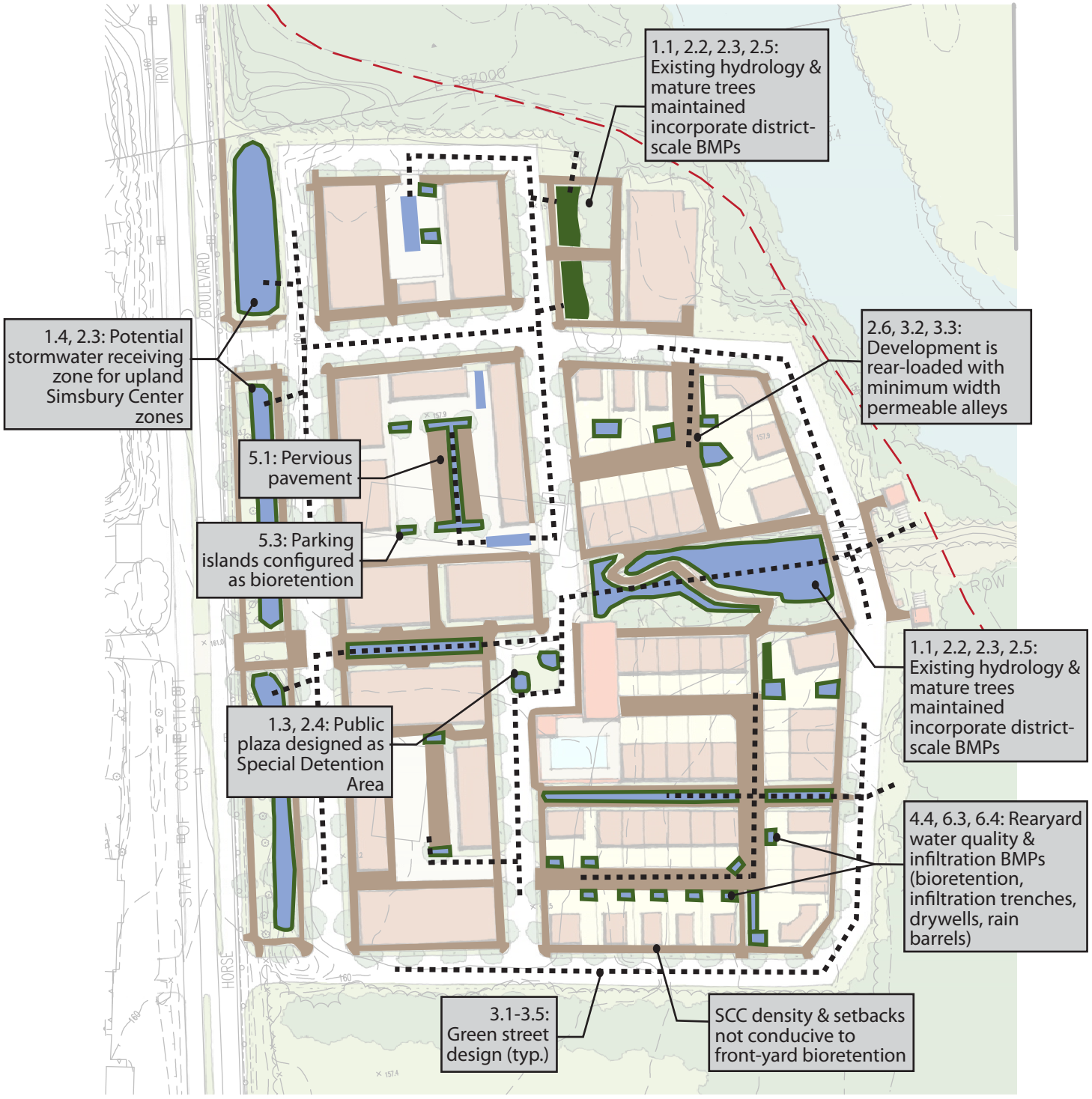
3.5 - YES: Street trees are designed by the civil engineer and landscape architect to provide adequate soil volume and structural soil design to support long-term root growth and tree canopy without excessive impact to utilities or sidewalks.

4.1 - YES: Soil testing by a Certified Soil Scientist has been completed and has guided site design at the lot level to maximize preservation of undisturbed well-draining soils.

4.2 - YES*: Infiltration BMPs have been located in areas of well draining soils. Where the block and lot layout does not provide for lot-level infiltration BMP location in areas of well draining soils underdrains are provided.

4.3 - YES*: Building roof downspouts discharge runoff to vegetated areas wherever feasible within the framework of the neighborhood and block design. Where constrained sites and/or reduced setbacks exist it may be appropriate to route roof runoff to underground infiltration systems or neighborhood-scale filtration and infiltration BMPs elsewhere in the project; however, given well draining soils even very small vegetated or otherwise stabilized areas can provide significant filtering and infiltration benefit. These smaller filtration/infiltration areas may require additional stabilization and level-spreader techniques to distribute infiltration and minimize erosion damage.

4.4 - YES*: The majority of runoff from impervious paved surfaces is directed towards vegetated areas for natural filtration and infiltration before conveyance offsite, however due to topography and site constraints very limited impervious paved areas drain directly to catch basins with sumps before conveyance to infiltration systems and neighborhood-scale water quality filtration systems.



Layout by Russell Preston

Test Site #1: Simscroft Farms

Post-Development Conditions

LEGEND

- Recharge
- Water Quality
- Recharge & Water Quality
- SR/ST Areas
- Tree Credit
- Underground Pipe
- Pervious Pavement
- Approximate FEMA Flood Plain

Planning & Design Criteria

1.1	y
1.2	y
1.3	y
1.4	y
2.1	y
2.2	y
2.3	y
2.4	y
2.5	y
2.6	y
2.7	y*
3.1	y
3.2	y
3.3	y
3.4	y*
3.5	y
4.1	y
4.2	y*
4.3	y*
4.4	y*
4.5	y
4.6	n/a
4.7	n/a
4.8	n/a
5.1	y
5.2	y
5.3	y*
5.4	y
5.5	y
6.1	y
6.2	y
6.3	y
6.4	y
6.5	y
6.6	y
6.7	y

Runoff From Impervious Paved Surfaces Directed to Vegetated Areas (Image: Josh Martin)

4.5 - YES: Driveways are the minimum required width to accommodate public safety and emergency access, thus minimizing impervious area.

4.6 Not applicable.

4.7 Not applicable.

4.8 Not applicable.

5.1 - YES: Assuming all residential units are 2+ bedrooms, per the Simsbury Center Code Section 6.2 the total number of parking spaces required for this conceptual plan is 448. Therefore 219 spaces are required to be permeable. These spaces are located towards the center of two of the three mid-block parking lots where they are set back from building foundations, and also include permeable on-street parking spaces and parking spaces within alley-served blocks to be constructed using permeable paver systems.

5.2 - YES: Signs marking permeable pavement and clearly listing applicable maintenance requirements will be installed adjacent to parking areas containing 5 or more permeable parking spaces (on-street parking spaces and mid-block parking lots), and permeable pavement maintenance is included in the Stormwater Operation and Maintenance Plan.

5.3 - YES*: Parking lot islands and landscape buffer locations are coordinated with topography and configured as bioretention systems, except for limited parking lot islands

Parking Lot Island Configured as Bioretention (CT DEP LID Appendix)

Permeable Two-Track Driveway (Image: MBD)

Residential Rain Barrel (CT DEP)

Native Planting & Xeriscaping Minimizes Excessively Watered & Fertilized Lawn (Image: MBD)

where topography and lot layout constraints prevent this design.

5.4 - YES: Ten percent of parking spaces provided in excess of 10 parking spaces (44 parking spaces) are compact parking spaces. These compact parking spaces are evenly distributed amongst the three mid-block parking lots.

5.5 - YES: Bicycle racks are included in the project design per the Simsbury Center Code Section 6.2.

6.1 - YES: All stormwater BMPs are designed per the requirements of the Connecticut Stormwater Quality Manual as to be demonstrated in detail by drainage calculations to be submitted.

6.2 - YES: Stormwater BMPs are selected and designed according to transect zone and soil conditions per the Simsbury Center BMP Selection Matrix.

6.3 - YES: Site landscaping design minimizes ornamental lawn, using native plantings and xeriscaping strategies.

6.4 - YES: Rain barrels are included with townhome and detached single-family residential properties for garden watering and other non-potable uses, and underground cistern systems are included for reuse of runoff for irrigation of select landscaped areas within multi-family residential blocks. Only a portion of landscaped area is to be irrigated.

6.5 - YES: Additional trees (specify percentage) beyond the number required by zoning Section 9.02 are incorporated into the parking and landscape design adjacent to impervious areas, with Tree Impervious Area Credit taken accordingly.

6.6 - YES: An erosion and sedimentation control plan conforming to the standards of the Connecticut Guidelines for Soil Erosion and Sediment Control is included with the project design.

6.7 - YES: Water quality and infiltration BMPs incorporate appropriate pretreatment per the Connecticut Stormwater Quality Manual, with some areas utilizing alternate grass and stone pretreatment filters with details provided for the Town Engineer's review. A very limited portion of clean roof runoff in the most dense portions of the project is conveyed to underground infiltration systems including drywells, crushed stone infiltration trenches, and perforated pipe infiltration systems.

7.1 - YES: The site design accommodates maintenance access for all BMPs. Compact development site design at the detailed lot level requires inclusion of realistic maintenance requirements. For example, the design should provide adequate access for maintenance crews and/or vehicles to maintain or repair bioretention or underground infiltration systems located towards the interior of dense sites.

7.2 - YES: A stormwater maintenance and operation plan is provided, and includes specific maintenance thresholds and maintenance requirements for all BMPs.

7.3 - YES: Responsible part for implementation, maintenance, and correction of stormwater treatment practices is designated in the operation and maintenance plan, and includes provision for transferring maintenance requirements as properties are sold to individual owners.

Test Site #1: Stormwater Quality & Quantity Performance Standards

It is the assumption of the Simscroft Farm sample calculations presented in these Design Guidelines that the drainage system will be masterplanned on a neighborhood scale. In other words, performance standard requirements will be calculated for the neighborhood as a single land disturbing activity, assuming that pre and post-development runoff is tributary to the same, single design point. Therefore, mitigation BMPs may be strategically sited at the neighborhood edge to support the block structures and densities established by the Simsbury Center Code, as long as applicable Planning and Site Design Criteria are met at the site and block scales.

The project should generally follow the Simsbury Center Watershed Planning and Design Framework:

> "Simsbury Center-5 areas support widespread implementation of block, street, and site scale decentralized

A Note Regarding Phasing

It is the assumption of the Simscroft Farm sample calculations presented in these Design Guidelines that the drainage system will be planned on a neighborhood scale. In other words, performance standard requirements will be calculated for the neighborhood as a single land disturbing activity, assuming that pre and post-development runoff is tributary to the same, single design point. Therefore, mitigation BMPs may be strategically sited at the neighborhood edge to support the block structures and densities established by the Simsbury Center Code, as long as applicable Planning and Site Design Criteria are met at the site and block scales.

infiltration BMPs to maximize water quality treatment and volume recharge, thus reducing land consumption required for larger, centralized structural BMPs…Simsbury Center-5 development should prioritize the neighborhood sclae strategies in the Site Planning and Design Criteria Checklist. Neighborhood-scale rate and volume BMPs located at the edges of neighborhoods or in adjacent open spaces may preserve residential urban design character."

Realistically, since construction of the neighborhood will likely be phased, it is expected that neighborhood-scale BMPs may be built during the initial stages of the project (in accordance with an approved stormwater master plan) in order to serve several future built phases. Alternately, smaller pieces of the project might be required to self-manage stormwater on a site-by-site basis.

Given this design flexibility, any sample calculations presented in these Design Guidelines are merely generally representative of one possible application of performance standard requirements and adjustment factors for Simscroft Farms and may not necessarily accurately portray realistic block and lot scale conditions, quantitative requirements, or stormwater phasing strategies.

Performance Standards: Location Based Adjustments

The Simscroft Farms site is subject to the requirements of Simsbury Center SC-5 zone, therefore the minimum performance standard mitigation requirements are to be multiplied by 50%, the location-based adjustment factor per Stormwater Article Table 1.1.

Performance Standards

It is important to note that evaluation of project goals, analysis of existing conditions, conceptual neighborhood planning, and site design per the Planning and Site Design Criteria Checklist all take place before detailed lot-scale stormwater design and BMP sizing calculations. Preservation of existing environmentally sensitive areas, neighborhood-scale compact/walkable neighborhood patterns, and proper site design at the block and lot level, including application of BMP Incentive Credits per Article Section 1.2B.7, all minimize impervious area, thus minimizing the quantity of stormwater runoff (and cost to mitigate that runoff) in the first place.

1. Redevelopment

Existing site land cover is largely compacted earth parking and equipment storage areas. Detailed inspection of land cover and existing infiltration, along with consult of the definition of "impervious area" in the Simsbury Zoning Regulations, latest version, is required to verify pre-development impervious percentage.

For the purposes of these sample calculations, the Simscroft Farms pre-development impervious area is assumed to be less than 50%, therefore Stormwater Article Section 1.2B.1 is not applicable and no performance standard adjustments are applied.

2. Peak Rate

Utilizing planning and design criteria and structural BMPs, the development shall be designed to control the post-development peak rate of runoff to not exceed the pre-development peak rate of runoff for the 2-, 10-, and 25-year 24-hour design storm events. Because the Simscroft Farms project is subject to the requirements of Simsbury Center Code SC-5, peak rate reduction for the 100-year 24-hour design storm event is not required, however the development must still incorporate safe overflow conveyance.

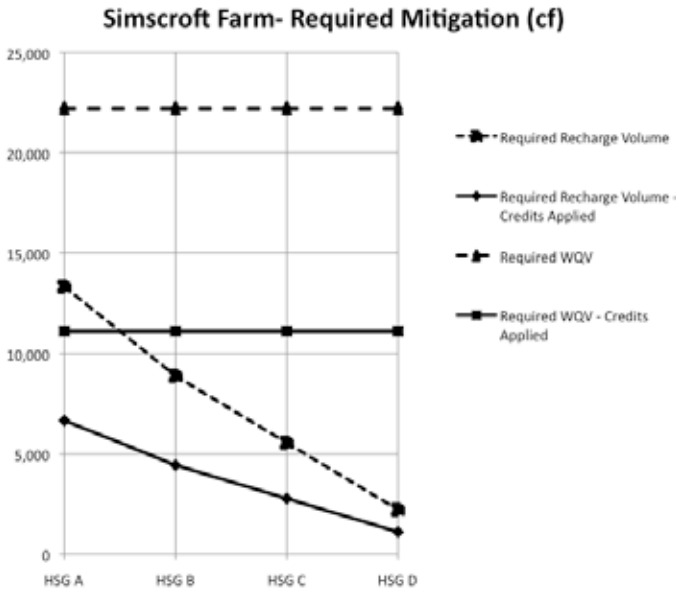
It is expected that peak runoff attenuation calculations demonstrating compliance using an SCS and TR-20 based computer modeling program, or alternate methodology approved by the Town Engineer, will be provided.

Site BMP Incentives are not applied as they are applicable only to recharge volume and water quality volume.

3. Recharge Volume

Required Recharge Volume is obtained by multiplying the Effective Impervious Area – Volume (EIA-V) by the Groundwater Recharge Depth from Stormwater Article Table 1.2. Required Recharge Volume is calculated here for the neighborhood as a whole, which as previously noted may not reflect realistic development phasing.

Higher pollutant loads due to previous land uses are not expected. However, if higher pollutant loads are present, specific source control, pollution prevention, alternative BMP design, and/or adjustment or elimination of the recharge requirement may be necessary.



Simscroft Farm Performance Standards: Water Quality and Recharge Volume Summary

Required Recharge Volume:

Required Recharge = EIA-V * Recharge Depth per Stormwater Article Table 1.2 * Redevelopment Credit * Location-Based Credit

- Post-Development Impervious Area = 333,234 sf
- Sum of Site BMP Incentives = 66,647 sf (assumed)
- EIA-V = 266,587 sf
- Redevelopment Credit = not applicable
- Location Based Credit = 50%

4. Water Quality

Required Water Quality Volume is obtained by multiplying the Effective Impervious Area – Water Quality (EIA-WQ) by one inch per Stormwater Article 1.2B.4. Required Water Quality is calculated here for the neighborhood as a whole, which as previously noted may not reflect realistic development phasing.

Required Water Quality Volume:

Water Quality Volume = EIA-WQ * 1 inch * Redevelopment Credit * Location-Based Credit

- Post-Development Impervious Area = 333,234 sf
- Sum of Site BMP Incentives = 66,647 sf (assumed)
- EIA-WQ = 266,587 sf
- Redevelopment Credit = not applicable
- Location Based Credit = 50%

According to available data, the structural BMPs listed in Stormwater Article 1.2C will meet the stated pollutant removal efficiencies when properly designed, constructed, and maintained. Pretreatment is required. The nature of the dense, walkable development proposed at Simscroft Farms may require alternative pretreatment for some infiltration BMPs, potentially including reduced-width vegetated or washed stone filters.

Higher pollutant loads due to previous land uses are not expected. However, if higher pollutant loads are present, specific source control, pollution prevention, alternative BMP design, and/or adjustment of water quality requirements may be required.

5. Conveyance

The Simscroft Farms neighborhood design is comprised of local roads, therefore the drainage conveyance systems and overflow outlets must be designed to provide adequate passage for flows for at least the 25-year, 24-hour design storm event per Stormwater Ordinance Section 1.2B.5. Systems must be designed in accordance with the Connecticut Stormwater Quality Manual recommended methodology or alternate methodology approved by the Town Engineer.

The Simscroft Farm neighborhood and site design utilizes LID principles to reduce impervious area and prioritize natural filtration systems for water quality treatment. These filtration systems often double as conveyance to additional stormwater treatment/infiltration BMPs as part of a treatment train. The Town Engineer may require the use of a larger magnitude design storm or provisons for additional erosion control for conveyance systems associated with stormwater treatment practices.

6. Offsite Mitigation and Stormwater Mitigation Bank

Simscroft Farms is an excellent location for provision of offsite stormwater mitigation due to its location within Simsbury Center and relationship with natural topography. As shown in the conceptual plan, opportunities exist to provide neighborhood-scale stormwater mitigation, especially along Iron Horse Boulevard to potentially provide benefit for upland properties.

It appears that the need for offsite mitigation or payment in lieu of mitigation for runoff from Simscroft Farm itself may be limited. Well-draining soils and strategic incorporation of water quality and quantity BMPs within pocket parks, plazas, and preserved natural areas may provide sufficient treatment and infiltration to meet requirements, especially given application of the location-based adjustment reduction.

Offsite mitigation or payment in lieu of mitigation may be a valuable tool, however, given the challenges presented by phasing of the construction over time. If pieces of the property are sold to different entities, stormwater mitigation in accordance with an approved stormwater master plan and the Simsbury Center Watershed Planning and Design Framework may require transfers of stormwater mitigation requirements to preserve the design metrics and essence of the neighborhood character set forth by the Simsbury Center Code.

7. Site BMP Incentive Credits

Tree Impervious Area

Additional trees beyond those required by Zoning Section 9.02 are incorporated throughout the site design, and for each tree complying with the requirements of Zoning Section 9.02 and the Stormwater Article, 100 square feet is subtracted from the post-development impervious area to be used in drainage calculations.

Self-Treating and Self-Retaining Areas

Opportunities for Self-Treating and Self-Retaining Areas are limited in the Simscroft Farms project due to the dense nature of the site design, leaving little space to comply with the

dimensional requirements for Self-Treating Areas or to make Self-Retaining Areas effective. Self-Treating and Self-Retaining Areas are applied to the post-development impervious area for limited single-family residential rearyards and for sidewalks in some areas of the project.

Permeable Pavement

On-street parking, sidewalks, rear alleys, and some parking spaces are designed as permeable pavement systems per the requirements of Stormwater Article Section 1.2B.7. Sidewalks, alleys, and driveways typically incorporate the minimum pavement section with a pervious surface course, setting bed, and crushed stone infiltration reservoir. Pervious pavement systems for larger parking areas are designed using sections with filter courses and a more extensive crushed stone infiltration bed to maximize infiltration.

Systems designed to the Simsbury Stormwater Article requirements are counted as pervious area in the post-development stormwater calculations. Since systems are located in areas of well-draining soils, impervious area deductions may be taken for water quality and quantity calculations. Pervious pavement systems that receive runoff from other impervious surfaces, such as the mid-block parking lot systems that receive runoff from adjacent drive aisles, are designed as structural BMPs and calculated as such in the drainage calculations.

Green Roofs

The area of properly designed, constructed, and maintained green roofs may be counted as pervious area in the post-development stormwater calculations. The project's conceptual design does not include green roofs, therefore no impervious area deduction is taken.

LID at Work: East Greenwich, RI Cottage Court (Image: Ben Morton)

MORRIS BEACON design
CIVIL ENGINEERING.
PLANNING.
URBAN DESIGN.
implementing community vision