## PART 1 - INTRODUCTION

1.1 Principles of Stormwater Management prioritize restoration of watershed function through low-impact stormwater management strategies. Green infrastructure (including raingardens, porous pavement, or vegetated bioswales) support University objectives including pollution prevention, increased biodiversity, enhanced greenspace, lower flood risk, replenishment of groundwater reserves, reduction of urban heat island effect, lowered building energy demands, protection of water resources, limitation of erosion, and reduced stress on municipal sewer and storm systems. In alignment with the principles described in the *Yale Sustainable Stormwater Management Plan* (see this link) provide stormwater mitigation strategies that:

A. Recognize stormwater as a resource and manage it to enhance its positive effects on the environment and to reduce associated risks to Yale assets and infrastructure.

B. Prioritize restoration of watershed function. Watershed function is restored with low-impact stormwater management strategies, including natural features, landscapes, and green infrastructure systems. Design teams shall implement stormwater management strategies following a fundamental order of priority:
   1. infiltration of stormwater where it falls,
   2. storage for infiltration or reuse,
   3. temporary detention and gradual release of stormwater to the storm sewer, and
   4. temporary detention and gradual release of stormwater to the combined storm and sewer system.

C. Prevent Pollution by
   1. reducing volume of CSOs (Combined Sewer Overflows) in areas of combined storm and sanitary sewer systems
   2. reducing total storm water volume and rate at separate storm sewer systems

D. Meet the requirements of DEEP's Municipal Separate Storm Sewer System (MS4) General Permit required though the federal Clean Water Act. (see this link).

E. Prevent flooding on and off campus in alignment with the City of New Haven's Natural Hazard Mitigation Plan developed to protect people and properties at risk from natural disasters such as inland flooding.

## PART 2 - GENERAL DESIGN REQUIREMENTS

2.1 Proposed design shall be in alignment with Section: 32 01 01 Exterior Improvements Landscape Design – including Site Evaluation and Sustainability Assessment, Site Design Intent and Campus Integration, and Site Protection from Construction Activity. For projects including new or renovations to a parking lot refer to Section 32 10 01 Parking Lots.

2.2 Preference in all cases is for a landscape-based approach to mitigate stormwater (i.e. use of green infrastructure). Overarching goal is for all impervious surfaces to connect to green infrastructure.

2.3 Green infrastructure design shall specify plant materials and construction details to achieve infiltration rates to capture anticipated stormwater flow.

2.4 Design teams shall inspect and assess all downspouts for disconnection from storm sewer or combined storm and sewer system to redirect stormwater flow to landscape-based stormwater capture.

2.5 Proposed design shall be in alignment with Section: 01352 Sustainable Design Requirements - Follow LEED BD+ C requirements, specifically following the recommendations of Sustainable Sites Rainwater Management Credit:

To achieve Option 1, Path 1, of SSc4 (2 points), runoff from the developed site for the 95th percentile (~1.4 inches) of regional or local rainfall events has to be managed using LID and green infrastructure.

To achieve Option 1, Path 2, of SSc4 (3 points), runoff from the 98$^{th}$ percentile (~2.16 inches) of regional or local rainfall events needs to be managed using LID or green infrastructure.

To achieve Option 1, Path 3, of SSc4 for zero lot line projects only (3 points), runoff from the 85th percentile (~0.76”) would need to be managed using LID or green infrastructure.

Option 2 of SSc4 (3 points) can be achieved by managing on site the annual increase in runoff volume from the natural land cover condition to the post developed condition.

## PART 3 - SPECIFIC DESIGN REQUIREMENTS

3.1 Low Impact Development

A. Low impact development (LID) and green infrastructure is preferred in all cases. Design teams shall take a holistic approach in meeting the specified regulations by developing strategies that encourage a district approach through multiple projects while considering the best possible options to reduce stormwater runoff for the intended project.

B. Design teams shall implement stormwater management strategies following a fundamental order of priority:
   1. infiltration of stormwater where it falls,
   2. storage for infiltration or reuse,
   3. temporary detention and gradual release of stormwater to the storm sewer,
   4. temporary detention and gradual release of stormwater to the combined storm and sewer system.

3.2 Retention, Volume, and Flow Requirements

A. Verify mandated retention requirements as they vary by municipality. Retention requirements can be found in each municipality's Stormwater Management Plan in fulfillment of DEEP's Municipal Separate Storm Sewer System (MS4) General Permit. Required through the federal Clean Water Act, CT DEEP established the MS4 General Permit to protect water quality and reduce the discharge of pollutants from a municipality's storm sewer system. These plans were updated in July 2017. The MS4 General Permit requires that all new development or redevelopment projects with greater than one acre of soil disturbance retain the volume of runoff generated by one inch of rainfall on the site.

B. Section 60 of New Haven's Zoning Ordinance goes beyond the one-acre requirement by including sites that disturb one half or more acres of total land area on site and requires the preparation of a stormwater management plan - including criteria that stormwater management systems be designed to collect, retain, and treat the first inch of rain on-site, so as to trap floating material, oil, and litter . (See City of New Haven Zoning Ordinance and City of New Haven Stormwater Management Plan, July 2017).

C. Greater New Haven Water Pollution Control Authority (GNHWPCA) manages New Haven's combined sewer system and separate sanitary sewers. One of the goals of GNHWPCA is to reduce the volume of CSOs. Toward this goal, for new construction projects to be permitted within areas serviced by a combined system, GNHWPCA requires that "the post-development stormwater runoff for a 2-year, 6-hour storm frequency (rainfall = 2.05 inches) shall be detained by underground infiltration / detention systems designed by a professional engineer licensed in the state of Connecticut." (See GNHWPCA sewer service area maps and City of New Haven flood maps).

3.3 Required Submittal

A. Design teams will provide various concept options incorporating system descriptions and required maintenance. The options are to vary by ratio of water designed to infiltrate where it falls utilizing green infrastructure options versus grey storm water systems for evaluation of best approach to meet Yale's sustainability initiatives. Include estimate of volume of water diverted per BMP (Best Management Practices). See 2004 CT Stormwater Quality Manual (see this link)

B. Post construction operations and maintenance plans, including commissioning of any rainwater harvesting systems are required.

C. Soil percolation test verification to ensure infiltration capacity.

D. Design teams will provide to Yale representative all data required to complete indexing of stormwater management practices on the Yale campus. The tracking of stormwater projects is intended to afford a comprehensive view of stormwater practices implemented at Yale on a project-by-project basis, providing data to consider holistic impacts of individual projects over time.

E. Data to be provided in a format to align with the 2017 MS4 General Permit. Under said permit municipalities are required to annually track the total acreage of Directly Connected Impervious Areas (DCIA) that is disconnected from the MS4 as a result of redevelopment or retrofit projects within their municipality. Impervious surfaces are considered disconnected when the required portion of stormwater is retained through infiltration or reused for other purposes without a surface or storm sewer discharge. Starting on July 1, 2021, municipalities shall reduce 1% of their total DCIA acreage per year to the maximum extent possible, incorporating all DCIA disconnections implemented in the city since July 1, 2012. (see BOD to record stormwater data).

| Date | Description of Change | Pages / Sections Modified | ID |
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