

## Appendix 3: Site Specific Stormwater Requirements & Opportunities

The stormwater management methods in the Sustainable Design Guidelines and further described here will assist you in more efficiently meeting the stormwater regulations of the Wisconsin Department of Natural Resources, Milwaukee Metropolitan Sewerage District and the City of Milwaukee. Ultimately, the performance level of your stormwater management strategy will depend on a number of site- and development-specific considerations, including:

1. **Site Location & Characteristics, Regional Treatment Opportunities**
2. **On-Site Stormwater Management Options**
3. **Stormwater Management on Environmentally Contaminated Land**



**Figure 1.**

This illustration shows a typical site in the Menomonee Valley, adjacent to the Menomonee River, the South Menomonee Canal or the Burnham Canal. Stormwater can be captured on a green roof and treated in surface bioswales, which serve to infiltrate and treat stormwater in small storm events (e.g. 2-year storm). These same swales function to convey the water from large storms to the river or canal.

### 1. Site Location, Characteristics & Regional Treatment Opportunities

There is no one solution to stormwater treatment throughout the Menomonee Valley. This section describes the different options and opportunities to treat stormwater depending upon where your property is located.

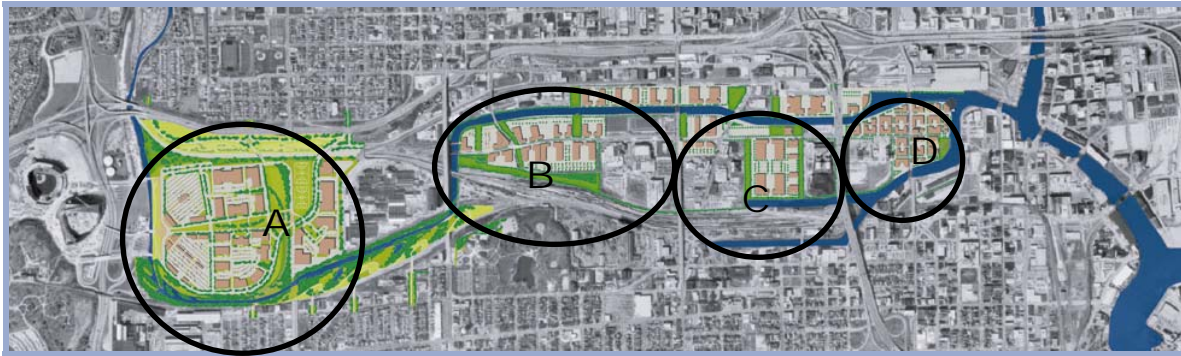
Any property adjacent to a body of water – the Menomonee River, the South Menomonee Canal and Burnham Canal has slightly different regulatory requirements than non-riparian properties. Riparian parcels are exempt from meeting Milwaukee Metropolitan Sewerage District's Chapter 13 stormwater release requirements (water quantity). These sites are still required to meet the standards of and receive permits under the City of Milwaukee Stormwater Rule (Chapter 120) and the Department of Natural Resources Stormwater Discharge Rule (NR 216), which regulate stormwater quality.

As these riparian properties are developed, stormwater quality can typically be managed entirely on site by employing a series of Best Management Practices (BMPs) to treat stormwater prior to discharge into the Menomonee River. A number of BMPs can be found in the Stormwater Management section of the Sustainable Design Guidelines (<http://design.renewthevalley.org/sitesdesign/stormwater.html>). Figure 1 illustrates a typical site under these circumstances.

Parcels not immediately adjacent to the river or a canal must meet the three stormwater regulations identified above to treat both the quantity and quality of their stormwater.

The Menomonee Valley has been separated into four distinct stormwater management sub-areas, each with their own stormwater management solutions. The four sub-areas are:

- A. The West End Shops Property
- B. Properties adjacent to Canal Street and bounded by 25<sup>th</sup> and 16<sup>th</sup> streets
- C. Properties adjacent to Canal Street and bounded by 16<sup>th</sup> Street and I-94
- D. Properties adjacent to Canal Street and bounded by I-94 and 6<sup>th</sup> Street



To a large extent, these sub-areas have been defined by the Canal Street reconstruction and extension project and its stormwater management plan. The Canal Street project has created opportunities for private developers to benefit from a regional approach to stormwater management allowing multiple properties to share costs and increase the developable land on each parcel.

#### A. The West End Shops Property

Individual properties within the planned 70-acre business park will send their stormwater to a regional treatment facility. The Stormwater Park will accommodate stormwater from each property's entire drainage area, including roof, parking lots and sidewalks. Although some parcels within the West End are along the river, all are required to use the Stormwater Park. Figure 2 shows the regional treatment plan at the Valley's West End.

The Stormwater Park will have an NR 216 permit (held by the City of Milwaukee or a business park association), but each parcel will need to obtain an individual NR 216 permit for their parcel to cover on-site BMP's and their physical connection to the Stormwater Park. This individual NR 216 permit will cover construction and post-construction stormwater management, and will be significantly easier to obtain given the existence of the Stormwater Park's master NR 216 permit. Each property owner will also need to obtain a permit governing similar stormwater management considerations under the City's Chapter 120. Properties within the business park will not be required to obtain permits under MMSD Chapter 13, except for construction site de-watering activities that discharge to municipal sewers.

Figure 2: Stormwater Park Flow illustration



**B. Properties adjacent to Canal Street and bounded by 25th and 16th streets**

A regional treatment facility similar to the West End Stormwater Park is being constructed at 26th Street as part of the Canal Street reconstruction and extension project. This facility will treat stormwater from adjoining private properties in the Central Valley between 25th and 16th Streets. There may be significant advantages for a developer to utilize the regional facility at 26th Street to treat stormwater, including cost reductions, ease of permitting and increasing developable acreage of the site. Figure 3 is a preliminary site design rendering for this treatment area.

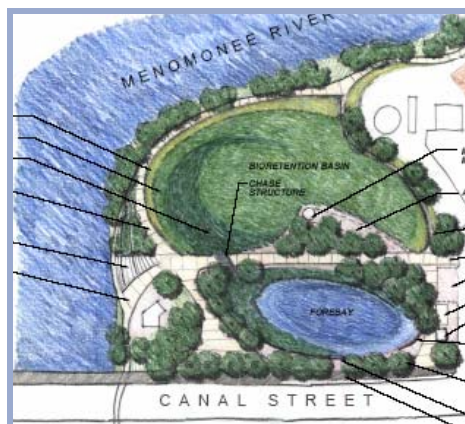


Figure 3: Preliminary sketch of Stormwater Treatment at 26<sup>th</sup> Street

### **C. Properties adjacent to Canal Street and bounded by 16<sup>th</sup> Street and the I-94 bridge**

Properties bounded by 16th Street and I-94 may be able to take advantage of a regional treatment facility planned for land adjacent to the South Menomonee Canal. This facility will be capable of treating stormwater from Canal Street and adjoining private properties. It will be capable of generating the same benefits to a private developer as mentioned above.

### **D. Properties adjacent to Canal Street and bounded by I-94 and 6th Street**

The properties east of the I-94 can meet their stormwater treatment requirements through either on-site BMPs or a regional treatment approach. The four properties surrounding the intersection at 6th and Canal Streets will likely utilize a shared facility to treat the entire acreage of these properties as well as stormwater from the Canal Street ROW east of I-94. The remaining properties in this sub-area will be capable of managing stormwater entirely on site by employing a series of BMPs to treat stormwater prior to discharge into the Menomonee River. A stormwater management approach similar to the one demonstrated in Figure 1 could also be utilized on these sites.

For more information on the regional stormwater treatment areas and how to connect to them contact Menomonee Valley Partners at 414-274-4655 or [info@renewthevalley.org](mailto:info@renewthevalley.org).

## **2. On-Site Stormwater Treatment to Efficiently Meet Regulatory Requirements and Increase Developable Acreage**

How a developer approaches stormwater management on a property will impact the developable acreage of each site, and affect long term costs associated with stormwater and landscape management (i.e. ongoing maintenance). The items listed in the Sustainable Design Guidelines and further detailed in this section will help optimize your developable land while meeting the regulatory requirements.

### **A. Surface Treatment and Conveyance through Native Landscaping and Vegetation**

Conventional approaches to stormwater management have historically focused on collection and conveyance of stormwater by using “end of pipe” treatments that remove suspended solids and other pollution typically found in urban stormwater runoff. These systems use a network of gutters and underground pipes to carry stormwater into ponds or detention basins. A stormwater management system that utilizes a system of native landscaping and vegetation to treat and convey stormwater in place of these conventional approaches allows natural infiltration to occur as close as possible to the original area of rainfall, and by engineering terrain, vegetation, and soil features to perform this function, costly conventional conveyance systems can be avoided and the site’s hydrologic characteristics can function in a more natural way.

### **B. Green Roofs**

The savings and benefits of green roofs vary widely from site to site. The direct cost savings and benefits of utilizing green roof technologies include the potential to reduce the size and cost of HVAC equipment on new and retrofitted buildings and a potential reduction in energy costs due to the insulating properties of most green roof systems. The contribution of a green roof system to a site’s stormwater management strategy allows for a reduction in the site’s acreage dedicated to stormwater treatment, allowing for more developable acreage and a more dense development.

### **C. Porous Paving**

There are many practical, fiscally responsible, and environmentally compelling reasons why porous paving systems should be considered in the Menomonee Valley. Porous paving solutions can be financially comparable to the costs of asphalt or concrete when long-term life-cycle costs are taken into consideration. Potential Valley applications of porous paving systems, even on sites that require clay or geotextile capping, include parking areas, driving lanes and roads, loading areas, outdoor storage, and, to a slightly lesser degree, pedestrian pathways. How porous paving systems are applied on a site-by-site basis, and how beneficial they can be, depends upon the needs of the development. Any incremental use of porous

pavement systems will lessen the peak stormwater runoff rate from a site, and will assist in meeting applicable regulations governing stormwater quality as well.

The discussion below addresses the long and short term cost effectiveness of using porous pavers versus asphalt and concrete. The actual costs and benefits generated by porous paving materials depend greatly upon site constraints, surface area, type of development and land use, but the following generalizations can be made at Menomonee Valley sites:

Porous pavement is often more cost-effective than asphalt or concrete paving on the basis of both initial construction costs and life-cycle costs, and the cost-effectiveness tends to increase with an increase in traffic loads, traffic repetitions, reduction in soil strength and increase in design life.

Cost studies have been completed for more than 300 lane miles of roads and 50 million square feet of industrial paving, and show in very conservative figures that porous pavement costs approximately 70% less than asphalt to maintain. Maintenance cost studies in the US have shown that porous pavement requires less maintenance, and thus decreases the overall costs and impacts associated with repairs and utility cuts. By comparison, maintenance of asphalt surfaces includes resealing every 10 years, patching after 20 years and at 30 years, and new asphalt overlays every 18 years, along with periodic routing and sealing.

Upper Midwest case studies of facilities that have successfully incorporated porous paving into their site design and stormwater management strategy include:

- Unilock Inc., Chicago IL. This storage and distribution yard has been in place for 15 years and has no costs associated with cleaning or maintenance.
- The Courts of Northbrook, a residential subdivision in Northbrook Illinois, has had pavers installed for 13 years, and have had \$5,000 worth of maintenance costs and no costs associated with cleaning.
- Coffee Creek in Chesterton, Indiana has had pavers installed for 4 years with no maintenance or cleaning costs.

#### **D. On-lot Best Management Practices**

The Milwaukee Metropolitan Sewerage District has developed fact sheets for a variety of best management practices and can provide technical expertise for their implementation.

- Bioretention areas – landscaped features adopted to treat stormwater runoff site - [http://www.mmsd.com/wqi/docs/factsheet\\_bioretention.pdf](http://www.mmsd.com/wqi/docs/factsheet_bioretention.pdf)
- Cisterns – roof water collection devices that provide stormwater storage - [http://www.mmsd.com/wqi/docs/factsheet\\_cisterns.pdf](http://www.mmsd.com/wqi/docs/factsheet_cisterns.pdf)
- Green Parking Lots – a combination of techniques to reduce the impervious area in a parking lot - [http://www.mmsd.com/wqi/docs/factsheet\\_green\\_parking\\_lots.pdf](http://www.mmsd.com/wqi/docs/factsheet_green_parking_lots.pdf)
- Inlet Restrictors – flow regulation devices attached to catch basin outlets - [http://www.mmsd.com/wqi/docs/factsheet\\_inlet\\_restrictors.pdf](http://www.mmsd.com/wqi/docs/factsheet_inlet_restrictors.pdf)
- Porous Pavement – slows and absorbs stormwater flow - [http://www.mmsd.com/wqi/docs/factsheet\\_porous\\_pavement.pdf](http://www.mmsd.com/wqi/docs/factsheet_porous_pavement.pdf)
- Rain Barrel – collects and stores rainwater from the rooftop for use in landscaping - [http://www.mmsd.com/wqi/docs/factsheet\\_rain\\_barrels.pdf](http://www.mmsd.com/wqi/docs/factsheet_rain_barrels.pdf)
- Rain Gardens – capture and slow stormwater runoff from the property - [http://www.mmsd.com/wqi/docs/factsheet\\_rain\\_gardens.pdf](http://www.mmsd.com/wqi/docs/factsheet_rain_gardens.pdf)
- Stormwater Trees – hold and store rainwater - [http://www.mmsd.com/wqi/docs/factsheet\\_stormwater\\_trees.pdf](http://www.mmsd.com/wqi/docs/factsheet_stormwater_trees.pdf)
- For a full list of the MMSD factsheets and other water quality information - <http://www.mmsd.com/wqi/publications.cfm>

### 3. Stormwater Management on Environmentally Contaminated Land

There may be limitations to the depth of soils that are available for stormwater infiltration and detention. In certain cases there may be an infiltration zone of less than two feet in depth due to high groundwater tables or a need to install an impermeable cap in response to subsurface soil contamination. Under these circumstances, alternative stormwater management systems can still be used to collect and treat stormwater efficiently.

If native prairie installations or rain gardens are used as a part of your site's stormwater management plan, they may require maintenance techniques different than those used in conventional landscapes. In many native prairie installations, burning is generally a recommended maintenance technique that approximates the natural ecology. The potential presence of methane in the Menomonee Valley means that burning may not be feasible and creative solutions will be needed to maintain such systems. However, naturalized landscapes have been successfully installed and maintained in similarly shallow soils over capped landfills (e.g., Blackwell Forest Preserve in Warrenville, Illinois), with successful maintenance plans. The presence of methane should not rule burning out, and should be addressed and discussed on a site-by-site basis.

If your development requires capping and grading, consider your stormwater management in the final grading plan, so that the final grade allows the stormwater to naturally flow toward the river or treatment area.