Fulton Neighborhood Rainwater Management Fact Sheets

24July02

Introduction

Rainwater and stormwater management has become a growing concern in many urbanized and developing areas. Changes in the amount of hard (impervious) surfaces in urban areas have significantly altered the way rainwater moves over, and infiltrates into, the land. The amount of pollutants and nutrients in stormwater increases as a result of automobiles, certain landscaping and yard maintenance practices, and other land uses. Numerous techniques have been developed to address these issues and help restore a more natural water cycle in urban areas. Improved rainwater management in the Fulton Neighborhood of Minneapolis has the potential to:

- Alleviate flooding by reducing pressure on the City's stormwater management system
- Help protect and restore natural hydrology of the local watershed by replenishing groundwater aquifers, which helps protect lakes and wetlands and helps sustain baseflow of streams
- Trap pollutants by storing and filtering runoff laden with sediment and other contaminants (e.g., rain gardens can remove 94% of sediment, 43% of phosphorus, and 70% of nitrogen pollution from rainwater – USEPA publication)
- Reduce erosion of our stream banks and lakeshores

There are a variety of options for managing rainwater effectively on your property. The four techniques that have been targeted for the Fulton Neighborhood Rainwater Management Assistance Program are:

1. Rain Gardens
2. Rain Barrels
3. Infiltration Systems
4. Rainwater Interception/Redirection

Up to one hour of free consulting support from the consultant or a trained committee member will be available for approved residents to identify the approaches best suited to their property and interests.

Basically, the above techniques collect or intercept rainwater, which is routed to your on-site system and filtered naturally by plants, rocks, and soils (depending on the technique employed). This allows for permanent storage (retention) and temporary storage (detention) of rainwater, reducing the rate and volume of stormwater runoff. The filtration processes improve stormwater quality by removing nutrients and pollutants that would otherwise flow more directly to storm drains and then to Lake Harriet and Minnehaha Creek.

The following fact sheets describe briefly the four targeted techniques. Different properties warrant different approaches, but almost any property can implement one or more techniques. Give some thought to what might work on your property, and then consider participating in the Fulton Neighborhood Rainwater Management Assistance Program. The more participation, the greater impact we can have on reducing flooding and improving the quality of our lakes and streams.

Rain Gardens

Rain gardens use rainwater to create a beautiful amenity, while helping store and filter stormwater. A rain garden is basically a shallow depression on your property that is designed to receive runoff from roofs, alleys, driveways, sidewalks, or other hard (impervious) surfaces via gutters, pipes, swales, or surface runoff. Filter strips of dense grass can provide some filtering of sediment-laden runoff before it reaches the rain garden. Rain garden soils are generally moist, and after rainfall or snowmelt the center typically ponds with <= 6 inches of water (depending on the soil, design, and desired appearance). Ponded water usually disappears over the next few days by draining into the soil, evaporating, or by plant uptake. Mosquitoes are only an issue if water ponds for greater than 4 days. The rain garden is planted with a variety of appropriate, hardy, native plants that thrive in wet and droughty conditions, have deep root systems (8 to 15 feet deep), and require no fertilizer and limited maintenance. Consideration should be given to the rain garden's overflow. Rarely, residential rain gardens may require a sand/gravel layer, an underdrain (e.g., perforated PVC pipe), or soil amendment, depending on site conditions.

Basic Steps:

1. Identify source(s) of water and calculate quantity
    - Multiply hard surface collection area (sq ft) by 0.02 ft (0.25") rainfall = target volume (cu ft)
2. Identify desired location of rain garden
    - Consider source of water and how water will reach rain garden
    - Construct rain garden at least 10 feet downgradient from foundations
    - Avoid locating over utility lines (always call Gopher State One Call (651-454-0002) for utility locating before digging), but generally not a problem if no other suitable location
    - Sunny locations preferred, but can be designed for shady sites
    - Lay out garden hose to help envision perimeter
    - Tie in visually with existing or future landscaping
3. Assess existing slopes to assure positive drainage away from structures
4. Dig a test hole and measure infiltration rate of water (how fast it soaks into soil)
    - Well drained soils = 0.5" - 2"/hr; Clay soils = 0.1"- 0.25"/hr
5. Conduct a ribbon test to determine soil texture (squeeze soil between thumb and finger into ribbon)
    - Well drained soils = ribbon to ½" or less; Clay soils = ribbon to ½" or more
6. Calculate area/depth required (usually ~¼ the size of the impervious collection area)
7. Estimate cost, considering available labor and plant costs
8. Remove sod/topsoil and hand dig or have lightweight excavator dig desired depression
    - Separate topsoil for spreading over final grade
    - Create shallow, flat, depression with gradually sloping sides
    - Can rototill or add soil amendments (e.g., peat) to provide higher infiltration
    - Average depth of 4" to 6" (unless you want standing water)
    - Install sand or gravel base layer and/or underdrain if soils warrant
    - Use spoils to create berms, guide overflow drainage, or enhance slopes
    - Test infiltration and overflow by overfilling the depression with water from your garden hose
9. After dries, plant live native plugs on 1-foot centers (appropriate native shrubs can be added as well)
    - Plant wetter species into lower, wet zone and drier species into upland zone
    - Mark with flags or labels for quick ID during weeding
10. Mulch garden (~3" coarse, fibrous shredded hardwood mulch), stabilize spoils areas (seed and straw)
11. Water 3x/week for first two weeks to ensure healthy establishment – no fertilizer necessary!
12. Weed as necessary (especially first year)
13. In spring, hand clip to ~6" and remove dead herbaceous stems
14. Add or shift plants as desired…and ENJOY!

Rain Gardens (continued)

Rain Gardens:

Pros

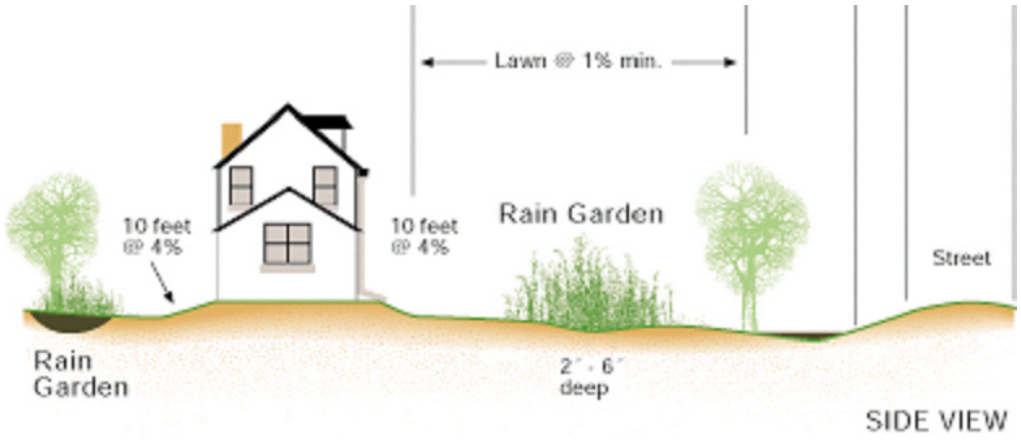
- Effective at restoring many components of a more natural water cycle (on a local scale) by storing water, filtering pollutants, promoting infiltration which recharges groundwater aquifers, and potentially reducing flooding
- Benefits desirable wildlife (e.g., dragonflies - which eat mosquitoes!, birds, and butterflies) by providing native habitat
- Aesthetics can be tailored to meet your preferences
- Relatively low maintenance (weeding may be necessary, primarily during plant establishment)

Cons

- Require some money to design, plan, and install, but can be done quite cost effectively – especially if providing your own labor (couple hundred to couple thousand dollars, depending on size, design, engineering, etc.)
- Require some space, but even small rain gardens (e.g., 25 sq. ft.) can be installed and benefit rainwater management

Additional Information:

www.ci.maplewood.mn.us



Graphic from Applied Ecological Services, Inc.

Rain Barrels

A rain barrel is simply a barrel, usually plastic or wooden, which can range from 40 to 80 gallons in size. It receives water from gutter downspouts, a sump pump, or overland flow. The rain barrel collects and stores rainwater for later use in your yard and garden. Typically a hose can be attached to the bottom and collected rainwater is used for watering plants. A trickle hose can also be attached to the barrel so the rainwater is slowly released into garden or lawn areas (or rain gardens). Rain barrels should be equipped with an overflow outlet, child resistant cover, and debris/filter screen to prevent clogging and breeding of mosquitoes. Rain barrels are an excellent option for urban stormwater management because they can be used on any property. While one rain barrel doesn't make a huge difference to the regional storm sewer system and water quality, many rain barrels in a neighborhood can make a positive impact.

Rain Barrels:

Pros

- Can be used on any property
- Cheap (can be under $100) and easy to install
- Reduces amount of drinking water used for plants
- Several different sizes, colors, and configurations

Cons

- Don't have a significant impact unless many are used within a watershed

Additional Information (no endorsement implied):

www.composters.com

Rain barrel photo from www.composters.com

Infiltration Systems

Infiltration systems consist of underground cells or trenches that are constructed to receive rainwater, provide storage, and encourage infiltration. Infiltration systems basically consist of a pit or trench that has been dug out, lined with filter fabric, and backfilled with coarse gravel. Rainwater is directed to the system either via overland flow or pipes (above ground or underground) and should be pre-filtered. The filter fabric helps prevent clogging of the gravel with fine soil particles, the gravel backfill provides pore spaces for water storage, and the walls of the cell or trench provide additional surface area for water to soak (infiltrate) into the soil. An observation well (perforated PVC pipe) is typically installed in the system to monitor water levels in the cell or trench. Infiltration systems are often used when an "out-of-sight" or low profile technique is desired, or when there is insufficient space for a rain garden. Infiltration cells/trenches should be constructed >=4' above the high water table and should not be used to capture highly polluted stormwater due to the potential for groundwater contamination.

Basic Steps:

1. Identify source(s) of water and calculate quantity
    - Multiply hard surface collection area (sq ft) by 0.02 ft (0.25") rainfall = target volume (cu ft)
2. Identify desired location of infiltration system
    - Consider source of water and how water will reach infiltration system
    - If stormwater will be laden with sediment or low-level pollutants, design for pre-filtering prior to water entering the infiltration system
    - Construct at least 10-25 feet downgradient from foundations (depending on depth and size)
    - Do not construct where there are utility lines (always call Gopher State One Call (651-454-0002) for utility locating before digging)
3. Assess existing slopes to assure positive drainage away from structures
4. Dig a test hole and measure infiltration rate of water (how fast it soaks into soil)
    - Well drained soils = 0.5"- 2"/hr; Clay soils = 0.1"- 0.25"/hr
5. Conduct a ribbon test to determine soil texture
    - Well drained soils = ½" or less; Clay soils = ½" or more
6. Calculate area/depth (typically >=3' deep) required, considering infiltration rate and 40% pore space
7. Estimate cost, considering available labor and cost of materials
8. Remove sod/topsoil and hand dig or have lightweight excavator dig desired cell or trench
    - Separate topsoil for spreading over final grades
    - If capturing surface runoff, grade to provide evenly distributed sheet runoff into the system
    - Install any drainage pipe(s) necessary to convey water to infiltration system
    - Avoid "smearing" sides and bottoms of cell/trench, and rake/abrade to provide higher infiltration
    - Line with filter fabric (bottom of cell/trench can be lined with 6-12" clean sand instead of filter fabric)
    - Install 4-6"-diameter perforated PVC observation well
    - Backfill with coarse gravel (1.5-3" diameter) to within ~1' of top of cell/trench
    - Install a horizontal layer of filter fabric that wraps up sides of cell/trench
    - Continue filling cell/trench with coarse gravel, or preferably, pea gravel to top
    - If water will enter system via an underground pipe, cover top of gravel with impermeable geotextile liner
9. Monitor system after rain events using observation well (should drain within ~24 hours)
10. Maintain area around infiltration system to prevent clogging by sediment, grass, leaves, debris, etc.
11. Continue to inspect and maintain system to reduce chance of failure

Infiltration Systems (continued)

Infiltration Systems:

Pros

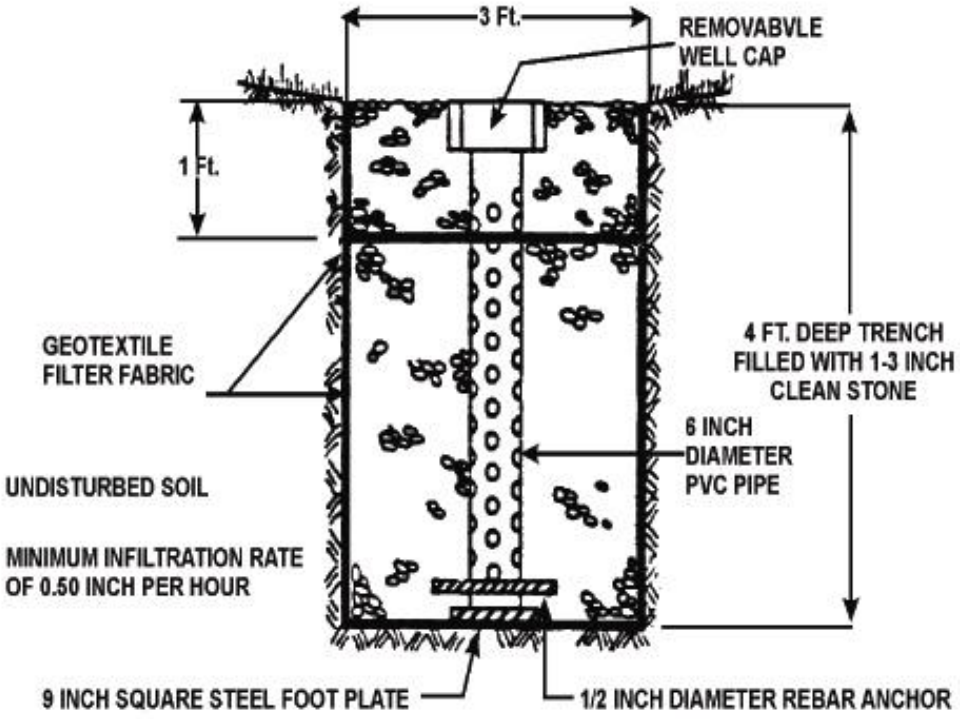
- Effective at restoring some components of a more natural water cycle (on a local scale)
- Requires little space (but must be ~25' downgradient of foundations)

Cons

- Usually much more costly than other techniques due to design requirements, digging, and materials (e.g., several thousand dollars for a small infiltration trench)
- Requires preventative and remedial maintenance over time (more so than other techniques) – may require trench rehabilitation every 5 to 15 years

Additional Information:

http://www.epa.gov/owm/mtb/infltrenc.pdf



Graphic from Southeastern Wisconsin Regional Planning Commission, 1991.

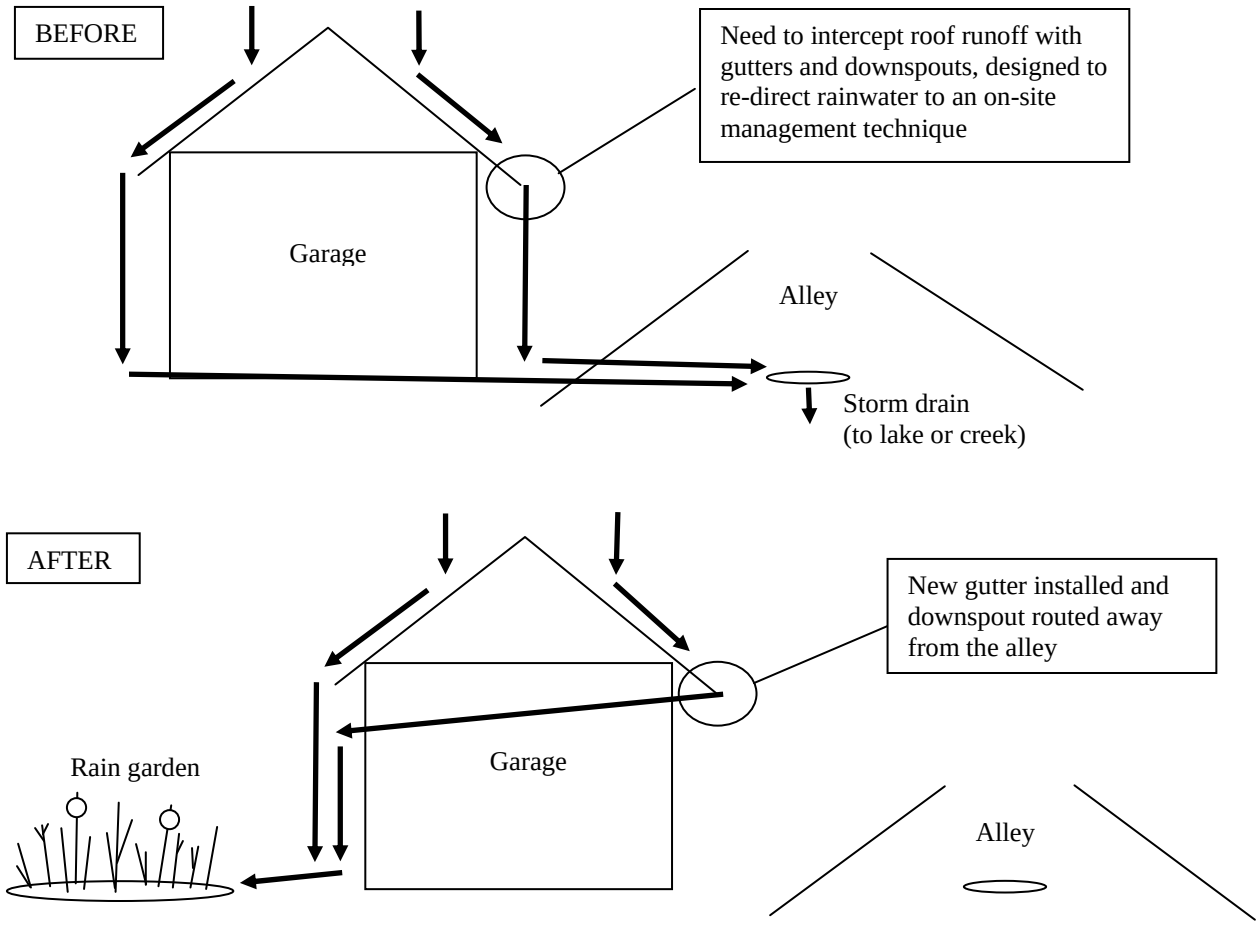
Rainwater Interception/Redirection

Rainwater interception/redirection entails intercepting runoff from roofs, alleys, driveways, sidewalks or other hard (impervious) surfaces via gutters, pipes, swales, or surface runoff. The water is then redirected to storage/infiltration areas (e.g., rain gardens, rain barrels, infiltration systems, lawns, etc.).

Basic Steps:

1. Identify impervious surfaces on (or adjacent to) your property (e.g., house and garage roofs, driveways, sidewalks)
2. Pay special attention to contiguous impervious surfaces that discharge into the street or alley (e.g., rainwater hits roof ➔ gutter ➔ downspout ➔ alley ➔ storm drain); observe during rainstorms
3. Assess methods of breaking up impervious surfaces (intercept rainwater and introduce opportunities for infiltration or at least filter strips)
4. Assess methods of collecting runoff from impervious surfaces (e.g., gutters, downspouts, pipes, swales)
5. Determine appropriate destination for collected rainwater (e.g., rain garden, rain barrel, etc.) and route it appropriately.

Example ("Alley Gutter Re-Route"):



Rainwater Interception/Redirection (continued)

Rainwater Interception/Redirection:

Pros

- Effective means of reducing stormwater flows and improving water quality
- Relatively flexible and affordable technique (can be under $100) that can be applied to almost any property

Cons

- Typically requires another technique to manage the rainwater that has been intercepted/redirected