

4.6

STREETScape & INFRASTRUCTURE

- Street Lighting200
- Street Trees204
- Stormwater Management210
- Landscape & Curb Lawns214
- Curbed Landscape Planters.....216
- Utilities.....220





STREET TYPOLOGY								
UC	E/F	MS	NB	CB	CC	NN	EN	LN
Req.	Req.	Req.	Req.	Req.	Req.	Req.	Req.	Req.

STREETScape & INFRASTRUCTURE

STREET LIGHTING

DESCRIPTION & INTENT

Lighting is an essential element of street design, safety, and security. Street lighting is used to illuminate the street, sidewalks, and bicycle facilities. Street lighting is critically important at intersections and crosswalks.

Lighting levels are important. Lighting should be sufficient for people to see comfortably and correctly distinguish persons and objects in the street, but lighting should not be so great as to create deep shadows or pronounced areas of light and dark.

Street lighting should be efficient in both energy use and direction of light. Street lights are important elements of street character during daytime hours as well. The light poles helps to distinguish the curb line of the street and establishes a particular rhythm to the street edge. The spacing of light poles often dictates the spacing of other street elements as well, notably street trees.

There are two broad categories of street lights used:

- **Roadway lighting** is mounted higher (typically 30-to 40-feet above the roadway) and poles may have an arm that extends the street light over the roadway.
- **Pedestrian-scale lighting** is typically mounted lower (12- to 16-feet above the sidewalk) and primarily used to illuminate the pedestrian area.

USE & APPLICATION

Location

Street lighting must be considered on all streets as part of providing a safe street environment. The specific approach and needs vary by street, but the following should be considered:

- On downtown street types (Urban center, event/festival, main street) and neighborhood business streets, providing consistent pedestrian and roadway lighting should be provided on all streets.
- Commercial business and civic center streets typically emphasize roadway lighting, especially at intersections and major driveway approaches. Uniform roadway lighting is important to achieve.
- On neighborhood streets types (network neighborhood, enhanced neighborhood, and local neighborhood) it is important for intersections and crosswalks areas to be properly lit. Mid-block areas are less critical to light.

Related Design Elements

- **Crosswalks:** All crosswalks, especially mid-block crossings at major streets, must be adequately lit.
- **Bus stops:** Bus stops should be well lit to provide a safe and comfortable atmosphere and ensure that pedestrians are visible to bus drivers.
- **Street Trees:** Trees should be placed and managed to minimize conflicts and impacts to street lights and lighting performance.

DESIGN & OPERATIONS

Design Requirements

A Light Levels: Street lighting shall be used to provide sufficient illumination, particularly at crosswalks and intersections. Lighting shall be placed to provide consistent lighting levels with appropriate contrast. The chart below describes target light levels based on street typology.

- » Higher levels of lighting may be desired at bus stops, bicycle share stations, or other areas of concentrated pedestrian activity. Supplemental lighting may be provided by sources other than street lights, such as from lit bollards, building-mounted lighting, or other accent lighting.

- » Mounting height for pedestrian lighting should be 12'-20' high, while the mounting height for roadway lighting should be 20'-40' high.

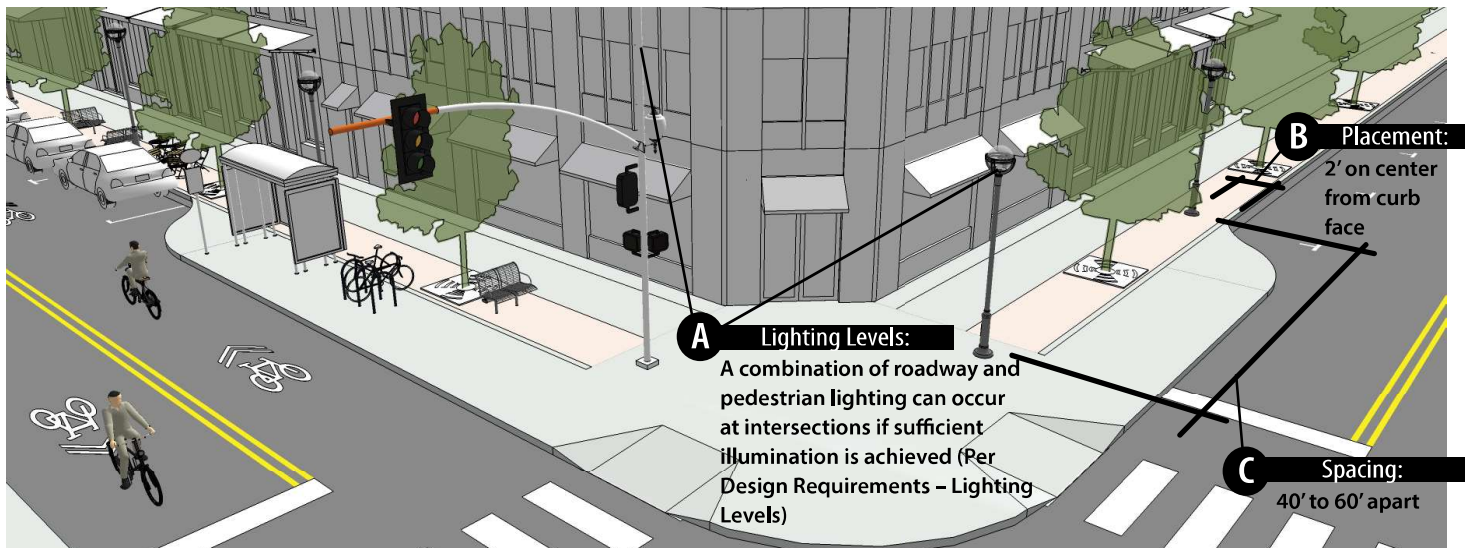
- » **Positive Contrast Lighting:** Positive contrast lighting should be utilized at mid-block crossings. This is usually achieved by placing lights in advance of the crosswalk from both directions to provide vertical illumination of pedestrians at the crosswalk.

B Placement: Light poles should ideally be placed in the amenity zone of the street. The nearest face of the light pole should be at least 24 inches back from the face of road curb.

- » Where bumpouts are present, light placement should typically be consistent with the curb line outside of the bumpouts.

TABLE Street Typology	Roadway Luminance (cd/m ²)	Target Light Level (foot candle / uniformity ratio)			
		Signalized Intersections	Unsignalized Intersections	Pedestrian Area / Sidewalk	Mid-Block Crossings
Urban Center (UC)	1.2	3.2	3.2	1.5	3.2
Event/Festival (E/F)	1.2	3.2	3.2	1.5	2.0
Downtown Main (MS)	1.2	3.2	3.2	1.5	2.5
Neighborhood Business (NB)	0.8	2.2	2.2	1.5	2.0
Commercial Business (CB)	0.6	2.0	1.5	1.0	2.0
City Connector (CC)	0.4	1.7	1.1	0.5	2.0
Neighborhood Network (NN)	0.6	1.7	1.5	0.7	1.7
Enhanced Neighborhood (EN)	0.5	1.3	0.7	0.7	1.2
Local Neighborhood (LN)	0.3	n/a	0.7	0.5	1.2

Source: Adapted from City & County of Denver Street Lighting Design Guidelines & Details (2019) (1)



-
- **Spacing:** Lighting should be spaced to achieve the target light levels in the chart below. Typically, roadway lights are placed every 150- to 250-feet, and pedestrian scale lights every 40- to 60-feet, but this will vary based on the selected fixtures.
 - **Energy Efficiency:** Lighting fixtures should use LED lighting and/or best available energy efficient technology to reduce energy consumption to the extent possible.
 - **Dark Skies Compliance and Up lighting:** Fixtures should meet Dark Skies requirements intended to prevent light pollution. This means that fixtures must limit or prevent up lighting using visors, shades, cutoffs, or ore directional lighting.
 - **Glare:** Fixtures should be selected that minimize glare (light exiting the fixture at 60- to 90-degree angles).
 - **Back light:** Back light is glare exiting the rear of the fixture and directed towards adjacent properties. In residential areas, fixtures that minimize back lighting should be used to prevent rear light spillage into residential dwellings.
 - **Materials and Finishes:** Light poles and fixtures should use durable metal material (with galvanized and powder-coated steel, aluminum or stainless steel finishes).

Additional Design Considerations

- **Light Fixture Style:** A variety of light fixtures are found throughout the city:
 - » Consistent light fixtures within a character district will reinforce the image of the place and facilitate maintenance.
- **Arrangement:** The type and arrangement of light fixtures can reflect the character and hierarchy of the street. Light poles may be arranged in an “alternate” or “opposite” configuration. Opposite configurations are typically associated with a more formal, higher order

streetscape, although such a configuration may result in uneven lighting levels and more lights and light poles than are necessary to meet target lighting standards.

- **Banner Poles:** Brackets for banners, hanging baskets, or other ornamentation may be affixed or integrated into the light pole.
- **Electrical Outlets:** Light poles may provide electrical outlets to support activities or seasonal displays. Access to electrical outlets should be secure behind a panel or located at a higher elevation to access control.
 - » Electrified street lighting may also be an opportunity to incorporate public Wi-Fi, speaker systems, and traffic cameras/detection.
- **Signage:** Street signage, bicycle parking and/or single space parking meters should be attached onto light poles (wherever feasible) to reduce sidewalk clutter.

Sustainability Considerations

- Solar-powered or other emerging technology lights offer additional alternatives to consider.
- Lighter street surfaces and/or higher levels of reflectivity may lower lighting requirements and associated costs.

Design References

- City & County of Denver Street Lighting Design Guidelines & Details (2019) provides extensive guidance on street lighting practices.
- The Illuminating Engineering Society of North America (IES) authors the nationally recognized “Recommended Practice for Roadway Lighting” – the standard for roadway, pedestrian and bicycle facilities approved by the American National Standards Institute (ANSI).²
- FHWA Lighting Design for Mid-block Crosswalks (2008) provides guidance on lighting and visibility considerations at crosswalks to improve pedestrian safety.
- ANSI/IES LP-2-20 Lighting Practice: Designing Quality Lighting for People in Outdoor Environments
- IES G-1-16 Guide for Security Lighting for People, Property, and Critical Infrastructure

MAINTENANCE & MANAGEMENT

General Maintenance

- Maintenance responsibilities for street lighting depends on the installer of the lighting.
 - » Standard street lighting is installed and maintained by Consumers Energy.
 - » Special street lighting installed as part of a development project or private entity is the responsibility of that entity to maintain.
 - » Special street lighting may be provided by other city departments or public entities, such as in the downtown or designated commercial districts. Maintenance of such lighting becomes the responsibility of that entity.



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STREETScape & INFRASTRUCTURE

STREET TREES

DESCRIPTION & INTENT

Street trees are critical component of the City’s overall green infrastructure system. Street trees provide a broad range of benefits, such as managing stormwater volumes, providing shade for pedestrians, making streets safer and more appealing, enhancing the aesthetic character of the street, and reducing the urban heat island effect. Street trees also have a positive impact on adjacent property values.

Maintaining healthy street trees is a challenge in dense urbanized environments, where trees may only last 40-60 years. Proper consideration of the growing environment that yields large and healthy street trees that provide maximum benefit is crucial. Equally important is planning for the eventual replacement of street trees and proactive re-planting to maintain canopy cover



USE & APPLICATION

Location

- Trees are especially important to locate near seating, bus stops, and other locations where pedestrians may be sitting, resting, or waiting and can take advantage of the shade trees provide.
- Limited space at the curbside on urban streets may not allow for street trees in all desired locations. Streets need to balance space for trees with a bus stop, on-street parking, seating, and other uses.

Street trees can be planted in one of three different conditions:

- **Trees in Open Landscape Planters:** Landscape planters are curbed or raised planting beds with exposed soil/ mulch within the amenity zone.
 - » Open landscape planters are the preferred method for accommodating trees in commercial areas as they provide more soil surface for water and air to access the tree roots.
- **Trees in a Tree Trench:** Tree trenches use a combination of grates and covered soil areas within the amenity zone to provide an area for root growth beneath a hardscape surface.
 - » Covered Tree Trenches are best-used in locations where significant foot traffic—such as high on-street parking turnover, loading/unloading zones, bus stops, taxi stands, and other intense uses compete for limited space.
- **Trees in a Curb Lawn:** Trees are located within a lawn area in the amenity zone, typically in non-commercial areas.

Tree Species Selection and Planting Criteria

- **Street Character:** Selecting the right tree for a given street type is important and must consider the specific conditions, space, and growing environment for the planting itself. Trees play a critical role in defining the street character, as such congruency with the street use is critical.
- **Tree Placement:** Proper selection of tree species for a given site shall consider:
 - » Size of available growing areas and growing medium.
 - » Width and height of the tree relative to the distance between trees (tree spacing) and adjacent building faces.
 - » Presence of other street elements that would adversely impact trees or be adversely impacted by trees, such as signs, light posts, and overhead or underground utilities.
 - » Sight line visibility at intersections and proximity to crosswalks.
- **Soil Volumes:** Trees typically need 2-cubic feet of growing soil for every square foot of canopy area for healthy growth based on the anticipated canopy area of the tree at maturity.
 - » Ideally, the soil volumes listed below are accommodated within open landscape areas (planters, lawn, or under tree grates). Practically, this can be challenging to achieve. The following approximate soil volumes by tree size are desired targets.
 - » Small Trees = ~10-foot diameter canopy (approximately 150-cubic feet of soil)
 - » Medium Trees = ~15- to 20-foot diameter canopy (approximately 350-cubic feet of soil)
 - » Large Trees = 20+ foot diameter canopy (approximately 600-cubic feet of soil)
- **Planting Layout and Spacing:** Trees should be planted in a sequence of two to three of the same species in a row to provide a consistent character for a given segment of the street. Typical tree spacing uses the following distances:
 - » Small Trees = 25-foot spacing typical
 - » Medium Trees = 35-foot spacing typical
 - » Large Trees = 45-foot spacing typical
- **Tree Height:** Height requirements based on tree size for the City of Kalamazoo include the following:
 - » Small Tree: Less than 30-feet at maturity
 - » Medium Tree: 30- to 40-feet at maturity
 - » Large Trees: 40-feet or more at maturity
- **Clearance:** The minimum clearance of any overhanging portion should be 8-feet over sidewalks and 16-feet over all streets.
- **Drainage:** Provide subsurface drain lines connected to the stormwater system in areas with poorly drained surrounding soils.



DESIGN & OPERATIONS

Permitted Tree Types

- The City's zoning code (Chapter 42- Tree Ordinance) provides a list approved and/or prohibited street tree species that may be used.
- The list in the box below indicates some additional street trees species to consider. The exact installation location should be considered closely to understand the needed salt-tolerance, drought-tolerance, and wet-root tolerance that is needed.

Design Requirements - Tree Installation

- **Soil Mix:** Street trees must be installed with an approved planting soil mix.
- Planted street trees must include a 3-year maintenance agreement from the installer to ensure that planted trees are property watered and survive long enough to become established.
- Trees should be planted so that the top of the root ball is level with the finished soil surface.

- Avoid placing mulch directly against the bark of trees. Keep mulch 6 inches back.
- The sides of landscape planters and covered tree trenches should be open to existing sub-grade wherever possible to provide for additional root space.

Utility Considerations

- Do not plant trees directly on top of major utilities, utility leads, vaults, access panels, or other utility infrastructure that are within the soil growth zone.
- No large trees may be planted under or within 10-lateral feet of any overhead primary electric wire. Selection of small or medium size trees should carefully consider wire height. The height of lower hanging non-electric wires (cable, telephone, etc.) should also be considered when selecting tree species.
- Trees should be placed within 5-feet of fire hydrants in order to provide clear space for accessing hydrants.

Street Tree Species for Consideration

Trees marked with an asterisk (*) typically have Michigan native cultivars available.

- **Small Trees (includes but is not limited to):**

- » Striped Maple*, Serviceberry* (single stem), Eastern Redbud*, Chinese or White* Fringetree (single stem), Kousa Dogwood (single stem), Cornelian Cherry, Crabapple, Flowering Cherry, Sargent Cherry, Kwanzan Cheery, Japanese Tree Lilac

- **Medium Trees (includes but is not limited to):**

- » River Birch (single stem), European or American* Hornbeam, American Yellowwood, Carolina Silverbell, American Hophornbeam*, English Oak

- **Large Trees (includes but is not limited to):**

- » Red & Sugar Maples*, Hackberry*, Ginko (male variety only), Honeylocust*, Kentucky Coffeetree*, Sweetgum, Tuliptree*, Blackgum*, American Sycamore*, London Planetree, Oaks (Swamp White*, Shingle*, Burr*, Chestnut*, Chinkapin*, Northern Red*), American* or Big Leaf Linden, American Elm* (Dutch Elm disease resistant varieties), Zelkova

List adapted from the City of Ann Arbor

Trees in Curbed Landscape Planters

Open landscape planters are curbed areas containing open soil and mulch for accommodating trees and landscape. See [Curbed Landscape Planters](#) for additional planter details.

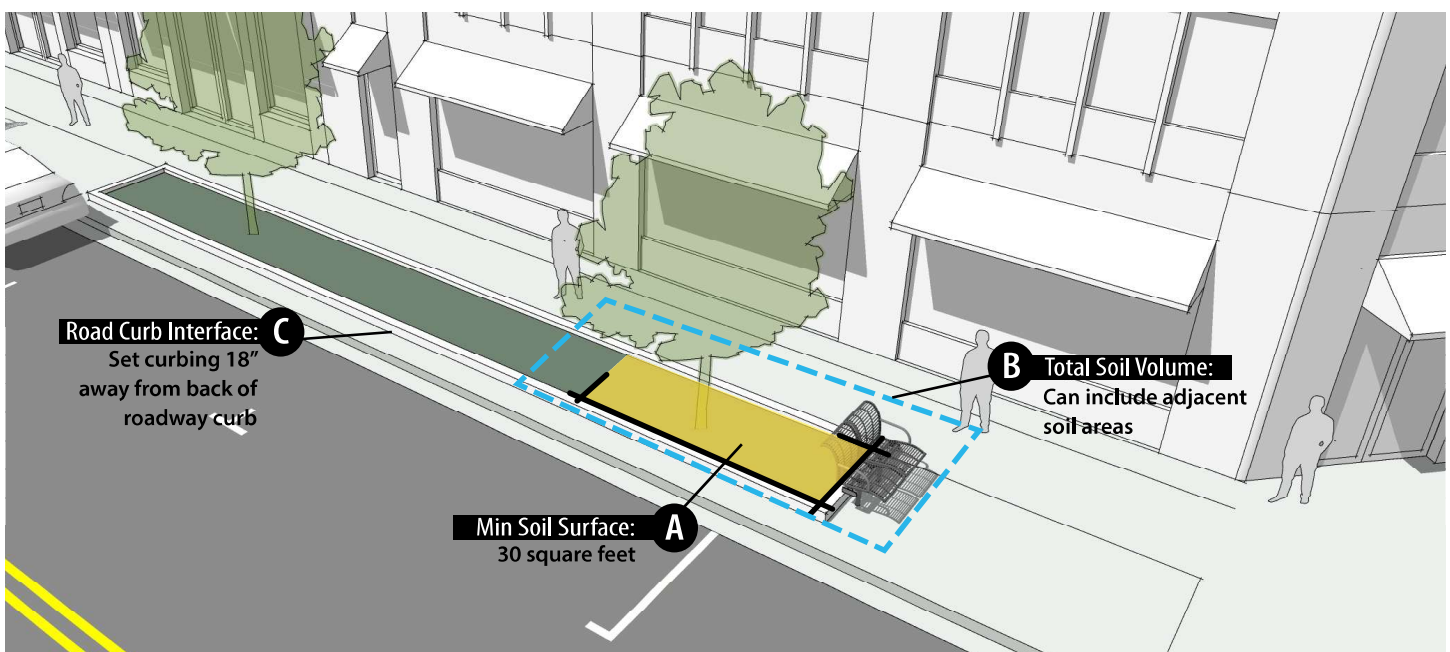
- A Minimum Soil Surface Area:** Minimum of 30 square feet for trees in landscape planters (eg. 6-feet x 5-feet).
 - **Width of Planting Area:** Planting areas should provide at least 1-foot of clearance around the tree root ball in all dimensions at a minimum for trees 3 inches in caliper or less, and 18 inches of surrounding soil for trees over 3-inch in caliper.
- B Soil Volume:** Strive to have as much soil area as can be accommodated in the planter. Achieving at least 50% of the target volume within the planter curbing is desired, provided the planter is open to surrounding soil areas to absorb future growth.
 - **Planter Curbing:** Curbing for planters should be 4 to 6 inches in height and 6- to 10-feet wide. Precast curbing may be used or curbs may be poured in place and/or integral to the surrounding sidewalk. For cast-in-place curbing, ensure that the back (interior) or the curbing is finished.
 - **Landscape Surface Elevation:** The soil surface should be 3 to 4 inches below the top of the curb, allowing for 2 to 3 inches of mulch cover and a remaining 1-inch of free board to contain materials during rain events.

Additional Design Considerations

- **Curbless Planters:** Curbless planters should be avoided on downtown street types, neighborhood commercial streets, and other areas with heavier pedestrian traffic. Curbless planters do not effectively discourage foot track through the landscape beds, are prone to having mulch or soil materials washout, and allow for deicing agents (salt, etc.) to flow into the planters more readily.
- C Interface with Road Curbs:** Landscape planters should be set back at least 18 inches (24 inches is preferred where space allows) from the back of roadway curbs to accommodate curbside access or vehicle clearances near the curb.

Sustainability Considerations

- Explore opportunities for using structural soils below existing paved sidewalk and amenity zone areas when they can be connected to the growing zone of tree roots. Structural soils utilize larger coarse aggregates to provide load bearing for sidewalks, with the voids between them filled with looser, less compacted soil mixes.
- Use permeable pavements in the amenity zone to encourage infiltration of stormwater into the root zone around trees.
- Landscape planters can be designed as bio retention facilities (see [Stormwater Management](#) section).



Trees in a Tree Trench

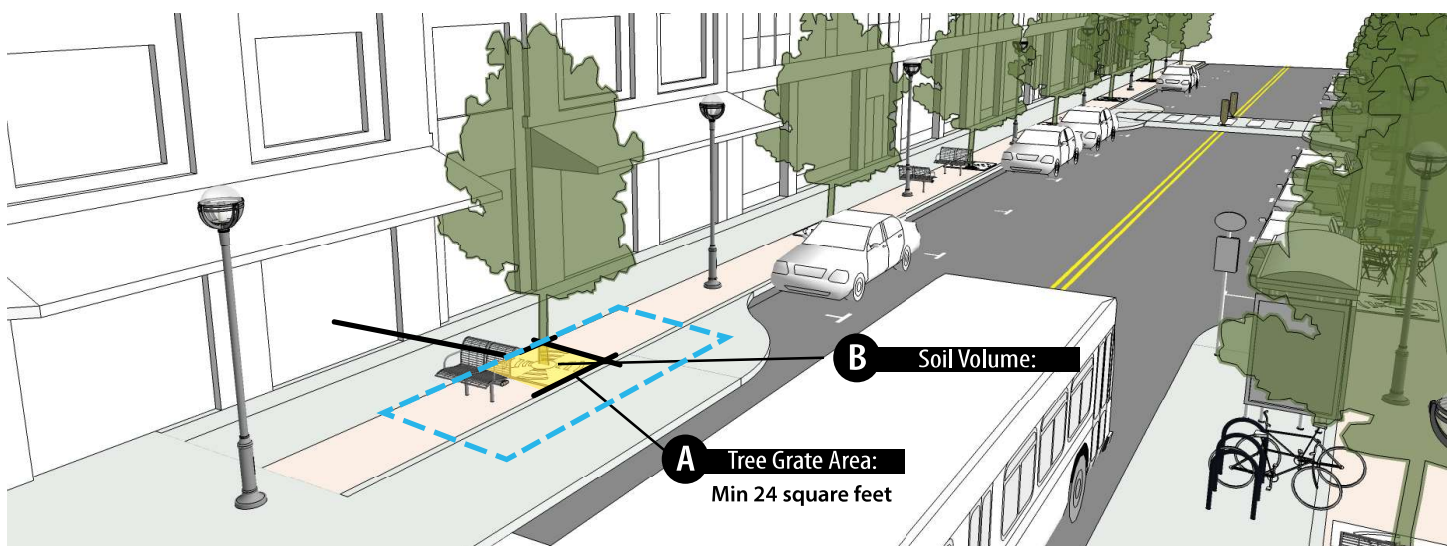
Tree trenches are used in more constrained planting areas (e.g. downtown commercial areas) and utilize tree grates and other structural treatments to provide space for trees to grow while maximizing the area around the tree for flexible, pedestrian uses.

- A Minimum Tree Grate Area:** The minimum width of tree grates is 4-feet. Tree grates should be as long as possible in order to achieve at least 24-square feet of area. Additional tree grate panels are encouraged to provide a larger open soil area.
- **Width of Planting Area:** Trees should be sized and selected based on the size of the tree grate available, such that the root ball is as least 6 inches (preferably 12 inches) away from the edges of the tree grate/sides of the trench.
 - » Additional soil volume can be achieved by using structural soils or geengineered solutions underground to provide an expanded and uncompacted soil area.
- **Tree Grate Materials:**
 - » Tree grates shall be constructed out of solid steel or cast iron and able to meet the load bearing capacity and requirements of the surrounding sidewalk area.

- » Tree grates shall be able to be locked in place or bolted down to prevent vandalism, but still removable in order to provide maintenance access below the tree grate.
- » Tree grates shall provide a 18-inch diameter opening around the tree trunk to allow for tree growth. The grate system shall be able to be removed and replaced with a larger opening grate in the event the tree trunk grows too large for the opening.
- » Tree grates shall provide openings within the tree grate to allow air and water to enter the planting soil. These other openings should not allow an object greater than 0.5-inch in diameter to pass through (e.g. a chair leg).
- **Landscape Surface Elevation:** The distance between the finished soil grade and the top of the tree grate may not be more than 6 inches in height.

Additional Design Considerations

- **Interface with Road Curbs:** Tree grates should be at 12 inches or more away from the back of the roadway curbs, allowing for a stable paving area to install tree grates.
- **Permeable/Flexible Surfacing Alternative:** Where tree grates or other planting approaches are infeasible, use of permeable and flexible surface materials may be used. This material is preferred over mulch in areas where the mulch cannot be contained and/or periodic foot traffic is expected.



Sustainability Considerations

- Use permeable pavements in the amenity zone to encourage infiltration of stormwater into the root zone around trees (see [Stormwater Management](#)).

Trees in a Curb Lawn

Trees planting in a lawn extension (typically between the road curb and sidewalk edge) can provide ample space for tree plantings.

- **Width of Planting Area:** Trees should only be planted in a lawn extension areas where at least 1-foot of planting space beyond the root ball can be achieved (e.g., a 3-foot diameter root ball requires minimally a 5-foot wide planting area).
- **Tree Planting Area:** A 2- to 3-inch thick mulch ring should surrounded the disturbed area for newly planted trees. Keep mulch 6 inch" away from the edge of the trunk.
- **Lawn and Landscape Planting:** See [Curb Lawn](#) design element.

Additional Design Considerations

- **Interface with Road Curbs:** Tree trunks should not be closer than 30 inches to the back of curb at maturity.

MAINTENANCE & MANAGEMENT

- All maintenance performed on trees located in public places, amenity zones, and street rights-of-way will be performed by the City or its agent, unless an exemption is made.
 - » Weeding, trash removal, and mulching must be maintained to keep the tree area free from weeds, trash, and other debris.
 - » Street tree pruning in downtown and neighborhood commercial areas for storefront and signage visibility is important.

Seasonal Use and Maintenance

- **Snow Removal:** Snow should be cleared from landscape planters and grated tree areas as soon as possible to minimize salt and other pollutant loading from entering exposed soil areas. Snow should not be stored on top of landscape planters and grated tree areas.



STREET TYPOLOGY

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STREETScape & INFRASTRUCTURE

STORMWATER MANAGEMENT

DESCRIPTION & INTENT

Managing stormwater in the urban environment is critical for protecting water quality and reducing the volume of stormwater entering rivers and other water bodies.

Stormwater management techniques, often referred to as Green Stormwater Infrastructure (GSI) at the City of Kalamazoo, include facilities designed to divert, infiltrate, store, and/or filter stormwater runoff prior to entering the city’s wastewater system. A variety of stormwater management techniques may be applied in order to achieve management targets. Typically, these techniques will include infiltration planters and underground infiltration and/or storage systems.

USE & APPLICATION

Location

- All public street construction and re-construction projects require stormwater management and should explore opportunities to include GSI.
- Stormwater management facilities can be located in various places of the public right-of-way from within the roadway (pervious pavement and subsurface infiltration) to within the amenity zone (infiltration planters and plantings).



DESIGN & OPERATIONS

Design Requirements - Bioretention Systems (Infiltration Planters and Rain Gardens)

Infiltration planters are open landscaped areas typically in the amenity zone of the street. They may also be located in other zones depending on the overall design of the street. Infiltration planters are designed to capture runoff from the roadway and other impervious areas of the street. Captured water is filtered through plants and soil and infiltrated completely through the planter or into an overflow underdrain and can be treated in a secondary stormwater system.

- **Management Volume:** Infiltration planters shall be designed, in conjunction with other stormwater systems, to infiltrate the required stormwater quantities per the city's guidelines (50 year, 24 hour design storm for depressed storage).

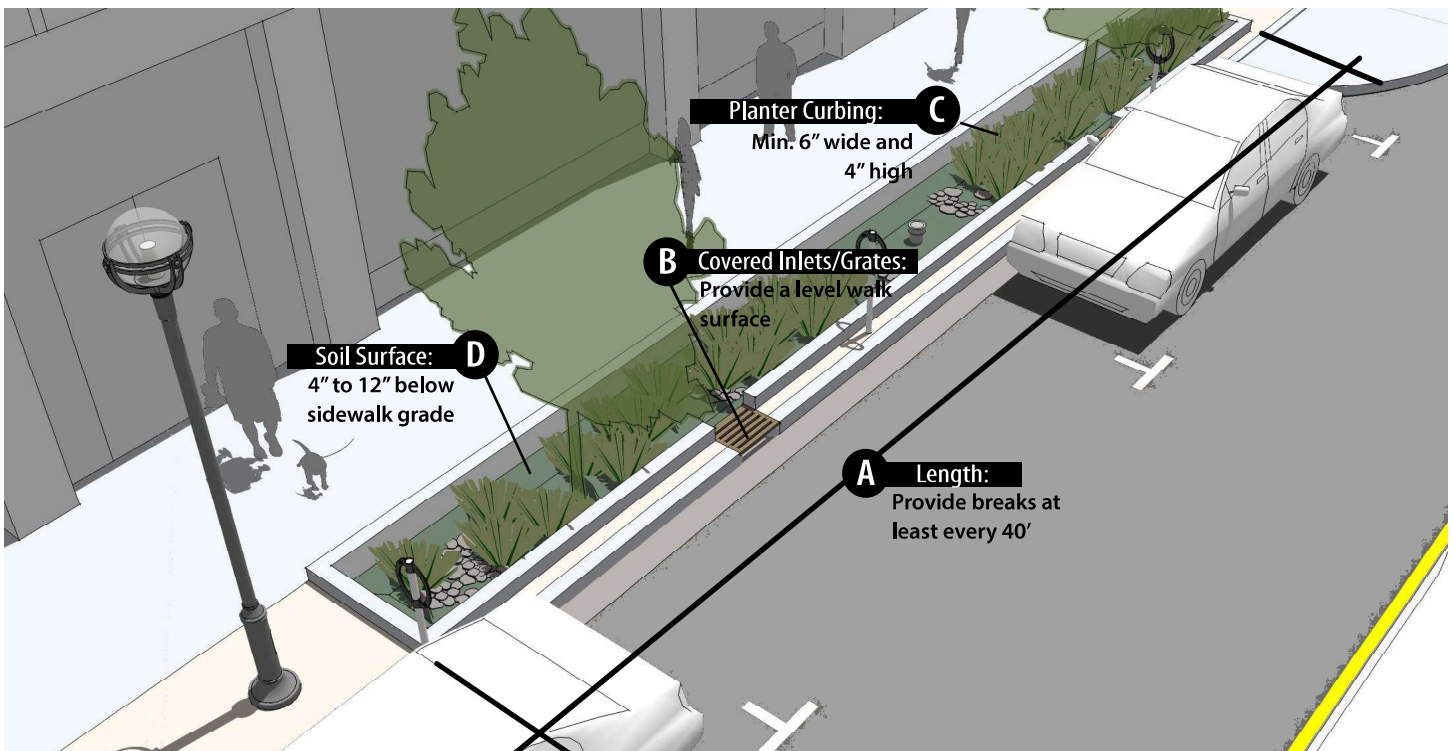
A Length: Stormwater planters may line the entire street length, however where on-street parking is provided, breaks shall be provided at least every 40-feet (approximately two car lengths) to allow access from parked cars to the sidewalk.

B Inlets: When water runoff is captured from the street, it must be brought into the infiltration planter through a covered flow inlet structure or a curb cut with adequate scour protection.

C Curbing: Infiltration planters must be curbed with a minimum of 6 inches wide and 4 inches high curb when adjacent to sidewalk and amenity zone areas. When adjacent to the road curb, this additional curbing is not required along that side of the infiltration planter.

D Soil Surface: The finished soil height must be recessed at least 4 inches but not more than 12 inches below the grade of the surrounding sidewalk and amenity zone areas.

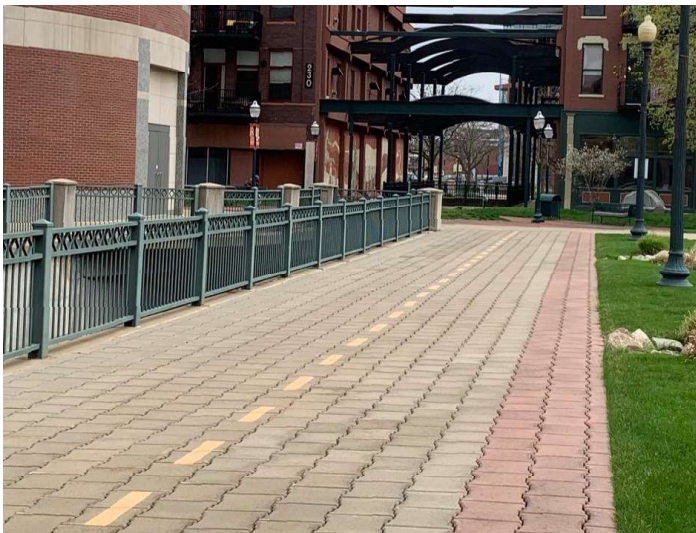
- **Soil Mix:** Soil mix must be specified to infiltrate stormwater and have sufficient depth to store and infiltrate the targeted water volume.
- **Drainage:** Infiltration planters must include a positive overflow drain to divert water accumulation in excess of the infiltration rate of the planter to another treatment system such that areas adjacent to the landscape planter do not get flooded or eroded.
 - » For infiltration planters unable to drain collected water within 12 hours of the end of the rain event, under-drains must be provided to drain excess water into the storm sewers.
- **Plant Materials:** Plant materials must be tolerant of salt and other common runoff pollutants.



Design Requirements - Subsurface Infiltration

Subsurface infiltration can take a number of forms, including underground infiltration systems, infiltration trenches, and dry wells. These systems can be used to provide stormwater infiltration and constrained urban areas with limited surface area available for landscape planters and/or in conjunction with surface treatments to add additional storage and infiltration capacity.

- **Management Volume:** Subsurface infiltration systems must be designed, in conjunction with other stormwater systems to infiltrate the required stormwater quantities per the city's guidelines.
 - » At a minimum, stormwater infrastructure with enclosed drainage must be designed to drain the 10-year storm event without surface accumulation. Open ditches or depressed drainage must accommodate the 50-year storm event.
- **Load Bearing:** Subsurface infiltration systems must be designed to accommodate the load bearing requirements of the roadway, constructions or other accessible surfaces above the infiltration system.
- **Conveyance:** Water shall be conveyed to the subsurface infiltration systems through piping and conventional curb and gutters and/or through an inlet.
- **Pre-treatment:** Water being conveyed into a subsurface infiltration system shall be pre-treated through a sump, stormwater flow-through planter, or comparable facility to remove large debris and materials.
- **Subsoils:** Geotechnical evaluations including infiltration tests are critical to understanding the underlying soils and an infiltration system.

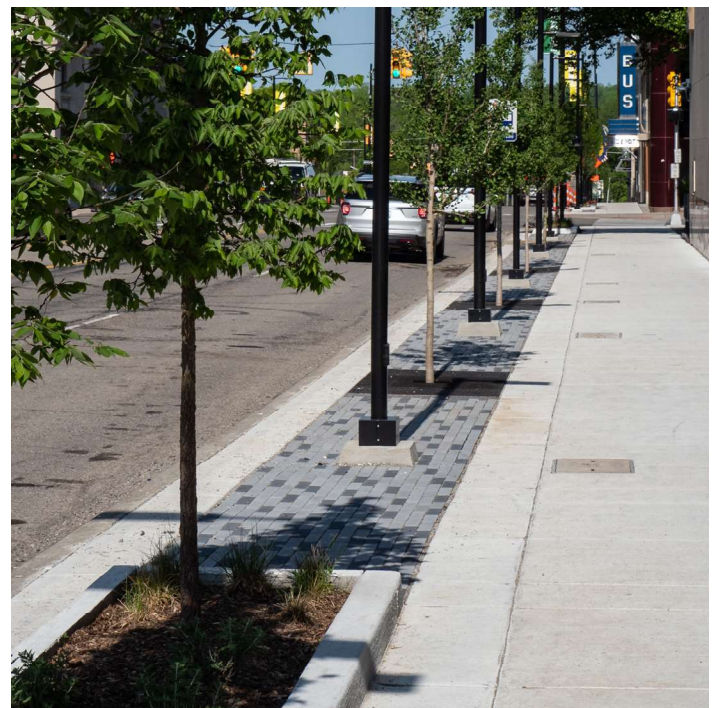


Green infrastructure in Syracuse, New York

Design Requirements - Pervious Pavement (Pavers, Concrete, Asphalt)

Pervious pavements can be located within the roadway or in the sidewalk zone in areas where traditional impervious pavements have been used. In pervious pavements, stormwater runoff infiltrates through the pavement section, then is stored in the aggregate base, and infiltrates into native soils.

- **Load Bearing:** The pavement section must be designed to accommodate the load bearing requirements of the roadway, constructions or other accessible surfaces above the infiltration system. Pervious pavement is typically located in areas of lower traffic volumes including parking lots, sidewalks, and plazas.
- **Conveyance:** Water shall be conveyed to the subsurface infiltration systems by permeating through the open graded pavement section into an aggregate base and infiltrating into native soils, or discharging to the city's wastewater system via an underdrain
- **Pre-treatment:** Pervious pavements are susceptible to clogging. Runoff from erodible areas like lawn and landscape should be avoided. Concentrate flows from gutters and downspouts should be allowed to disperse with level spreaders.
- **Subsoils:** Geotechnical evaluations including infiltration tests are critical to understanding the underlying soils and an infiltration system.



Additional Design Considerations

- Locate pre-treatment material, such as cobble and stone, to capture debris just inside the inlet point and provide easily access to clean out.
- Incorporate appropriate trees into the infiltration planter to enhance the stormwater benefits.
- Incorporate stormwater planters with traditional landscape planters, and integrate seat-walls and other vegetation into the design.
- Consider locating special signage along the street at key locations to tell people there is an underground stormwater management facility present and educate them about their operation and benefits.

Utility Considerations

- Consider the location and condition of existing utility infrastructure and access points.
- Ensure overflows into existing stormwater pipe infrastructure do not result in additional flooding or bottlenecking.
- Install waterproof vault covers or other utility access points if located within an infiltration planter.

Design References

- SEMCOG Low Impact Development Manual for Michigan (2008).

MAINTENANCE & MANAGEMENT

- Regularly (quarterly, at a minimum) remove excess sediment, litter, and debris, particularly within any pre-treatment facilities, to maintain a clean appearance and preserve effective functioning.
- Quarterly Inspection of inlets, sumps and outlet points to ensure there are no blockages or impediments to designed water flows (including sediment buildup and excess debris).
- Sumps or pre-treatment areas should be cleaned out at least once per year unless excess debris and sediment build up occurs requiring more frequent service.
- Regular landscape maintenance, such as deadheading, weeding, and leaf removal is important to maintaining the health and attractiveness of infiltration planters.
- Bioretention systems are susceptible to compaction of the soils. Snow storage should be restricted from the footprint of these systems.
- Pervious pavement systems require periodic maintenance to prevent surface clogging. Maintenance can include periodic vacuuming to remove debris from the surface and minimal use of de-icing salts and sand.

Seasonal Use and Maintenance

- **Winter Conditions:** Inspect inlet and outlet points more frequently in winter to ensure they are clear of excess snow and ice and remain open, particularly positive overflow drains.



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STREETSCAPE & INFRASTRUCTURE

LANDSCAPE & CURB LAWNS

DESCRIPTION & INTENT

Curb lawns are areas in the amenity zone between the sidewalk and street curb where plantings are used to provide buffers between the sidewalk and the roadway.

Curb lawns are typically found in more neighborhood contexts where more intense commercial uses and foot traffic over the lawn area is less frequent. While lawn areas require maintenance (watering, mowing, and weed control) to stay healthy, they add flexible greenery to neighborhood environments.



USE & APPLICATION

Location

- Curb lawns should not be used in downtown street types (urban center, event/festival, and main streets).
- Curb lawns may be used in neighborhood business or commercial business streets in locations where frequent foot traffic is not anticipated. Where frequent foot traffic is present (e.g. due to presence of on-street parking or loading areas), hard surfacing treatments should be used instead (concrete or pavers).
- Curb lawns should occur along the majority of the block side where they are being used to provide a cleaner and more consistent look for that portion of the street.

Related Design Elements

- **Bus stops:** Gaps in lawn/landscape panels should be provided at bus stops, with areas of the amenity zone paved in order to provide an ADA accessible pathway for transit access.

DESIGN & OPERATIONS

Design Requirements

- **Width:** Curb lawns shall be a minimum width of 3-feet between the back of the street curb and edge of the sidewalk.
 - » If this width cannot be achieved, the area between the curb and sidewalk should be paved with a hard surface (concrete or pavers).
- **Lawn Seeding:** Lawn areas shall be seeded or sodded with a species mix suitable for Kalamazoo’s climate region and consistent with the sun/shade availability of the specific planting site.
 - » When installing lawn extensions with seeding, a straw cover shall be used to minimize soil runoff and discourage pedestrian traffic while the lawn is established
- **Soil:** Lawn areas shall contain at least 4 inches of topsoil and the topsoil or soil surface for sod applications must be flush to the edge of the sidewalk and the back of curb.
 - » Curb lawns shall be smooth and not result in water pooling or ponding on their surface or on the surface of adjacent sidewalk areas.

Additional Design Considerations

- **Landscape Plantings:** Curb lawns may be planted with perennials beds or ground covers as an alternative to or complimenting lawn areas. These plantings should grow to a height in excess of 36 inches above the adjacent sidewalk road surface. Shrubs or other low woody plants may not be used. Vegetation should not grow into or otherwise obstruct the sidewalk area.
 - » Where perennials and ground covers are used, periodic clear zones or pathways connecting from the street edge to the sidewalk are important where on-street parking occurs to provide ADA accessible pathways and minimize foot traffic impacts on ornamental plantings. Gaps should typically be provided at least every 40-feet (i.e. car lengths)
 - » Where perennials and ground covers are used, at least 1-inch of mulch should be applied to cover and protect exposed soil areas. Stone, cobble, pea gravels, and other hard mulches should not be used as mulching materials.

- **Street Trees:** Larger lawn extensions are ideal locations for planting street trees. Street trees are required on all streets (see *Street Trees*).

Utility Considerations

- Lawn extensions may be located on top of most utilities. Identify and avoid covering access to water valves or other utility access panels that may be found in the amenity zone.

Sustainability Considerations

- Consider using lawn substitutes, such as “no mow” plant species or creeping ground covers as an alternative to traditional lawn turf species. Such alternatives should be selected based on their ability to withstand foot traffic when used as a lawn substitute.
- Consider using xeriscaping practices or other low water need plants to conserve water compared to typical lawn plantings.
- Avoid the use of synthetic fertilizers and herbicides to avoid impact on water quality and pollutant exposure to people touching lawn areas.
- Phosphorous fertilizer should not be used, due to its impacts on water (can cause unhealthy nutrient loading into local waterways).

MAINTENANCE & MANAGEMENT

- **Plant Care:** Lawn extensions and any plantings within that zone must be maintained by the fronting property owners. Regular maintenance includes mowing to maintain lawn areas, watering, weeding, trash removal, trimming, and maintaining mulch.
 - » Lawn extensions covered in turf grass must be maintained with an average height not in excess of 9 inches.



STREET TYPOLOGY								
UC	E/F	MS	NB	CB	CC	NN	EN	LN
Rec.	Rec.	Rec.	Rec.	Opt.	Opt.	Opt.	Lim.	Lim.

STREETScape & INFRASTRUCTURE

CURBED LANDSCAPE PLANTERS

DESCRIPTION & INTENT

Curbed landscape planters (referred to in this document simple as landscape planters) are fixed, curbed or raised soil areas designed to accommodate decorative plantings in a clean and clearly maintained fashion within the streetscape. Landscape planters soften the urban environment and provide foliage and flowers to make the street environment more appealing and engaging for all types of users.

Landscape planters typically contain a variety of suitable and tolerant perennial plant species and may be used to accommodate street tree plantings. Annual plants can be suitable for landscape planters provided that arrangements for their maintenance and replacement have been made.

Landscape planters are either curbed or raised in order to deter pedestrian traffic from moving through the landscaped area and harming or impacting plant materials. Curbing landscape planters provides a strong edge for the planter, improves soil and mulch containment, and discourages pedestrians from cutting through the planting beds. Raised planter designs provide an opportunity to incorporate informal seating areas into the streetscape design.

The use and abundance of landscape planters within the amenity zone must be carefully considered alongside other competing uses.

USE & APPLICATION

Location

- Landscape planters are well suited to the downtown street types and neighborhood business areas. They can be used in other street types where lawn/landscape panels are less appropriate (e.g. limited space, foot traffic, etc.).
- Landscape planters occur primarily within the amenity zone between the sidewalk and the curb. Where buildings are setback from the sidewalk, landscape planters are also appropriate in the frontage zone, and can be incorporated into building facades.

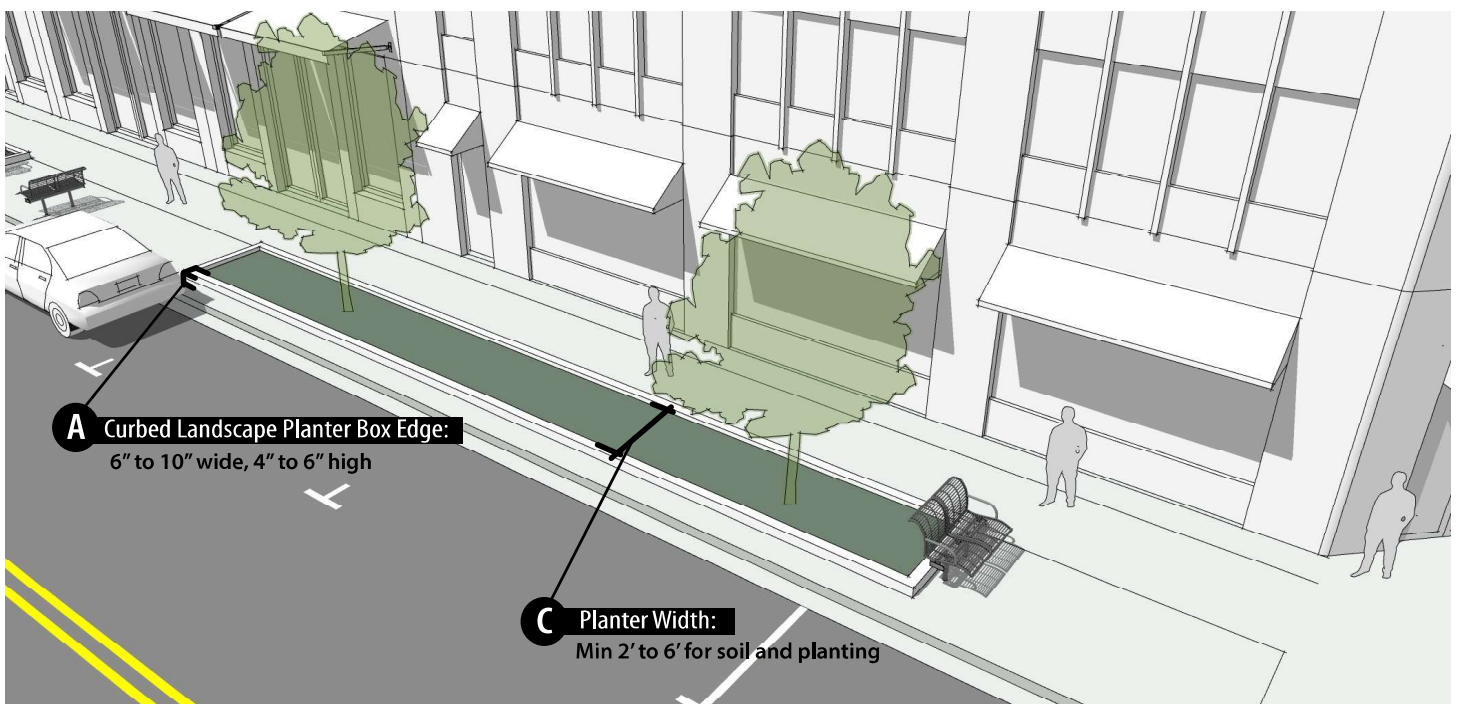
Related Design Elements

- **Amenity Zone Uses:** Locate landscape planters in coordination with street lighting, signs, parking meters, and other elements within the amenity zone.
- **Public Seating:** In areas with higher pedestrian volumes, planters can incorporate seatwalls to provide flexible seating for people.
 - » Seatwalls are especially beneficial at intersections and when used in conjunction with bulb outs at the corner or in a mid-block location to provide a seating zone close to intersections where people may have to wait for a signal.

DESIGN & OPERATIONS

Design Requirements

- **Planter Type:** Design landscape planters as either a curbed planting bed, a raised planter, or a hybrid design.
 - A Curbed Landscape Planters:** For a curbed planting bed, edge the planter box with a 6- to 10 inch wide and 4- to 6 inch high concrete curb with chamfered edges following the grade of the sidewalk and amenity zones.
 - B Raised Landscape Planters:** For a raised planter, surround the planter box by a 12- to 16-inch wide and 15- to 22-inch (18 inches preferred) tall concrete seatwall with chamfered edges. Design seatwalls to provide a level surface for seating.
 - » **Hybrid Landscape Planters:** Design hybrid planters as a curbed planter except with one, two, or three sides of the landscape planter designed with seatwalls.
- C Width:** The width of landscape planters must provide at least a 2.5-foot wide zone for soil and plantings, not accounting for the width of curbing or seatwalls.
- D Curb Strip:** Provide at least 18 inches (24 inches preferred) of paved surface between the back of the street curb and the nearest face of the landscape planters. This paved zone provides a place for people to walk around the planter and/or for parking meters and other signage to be installed outside of the planting bed itself.
 - **Planting Mulch:** Provide a 2- to 3-inch thick mulch surface for all exposed planting soils.
 - » Keep mulch surfaces for planting between 2 to 3 inches below the edge of curbs or seatwalls to prevent mulches from spilling outside of the landscape planter.
 - **Plantings:** Planters use a combination of herbaceous plants and street trees.
 - » Select perennial species suited to specific site conditions, including sun/shade, water availability, and salt tolerance for plantings within landscape planters.
 - » Suitable herbaceous annuals may be planted by private entities but only with a maintenance agreement and approval.



Additional Design Considerations

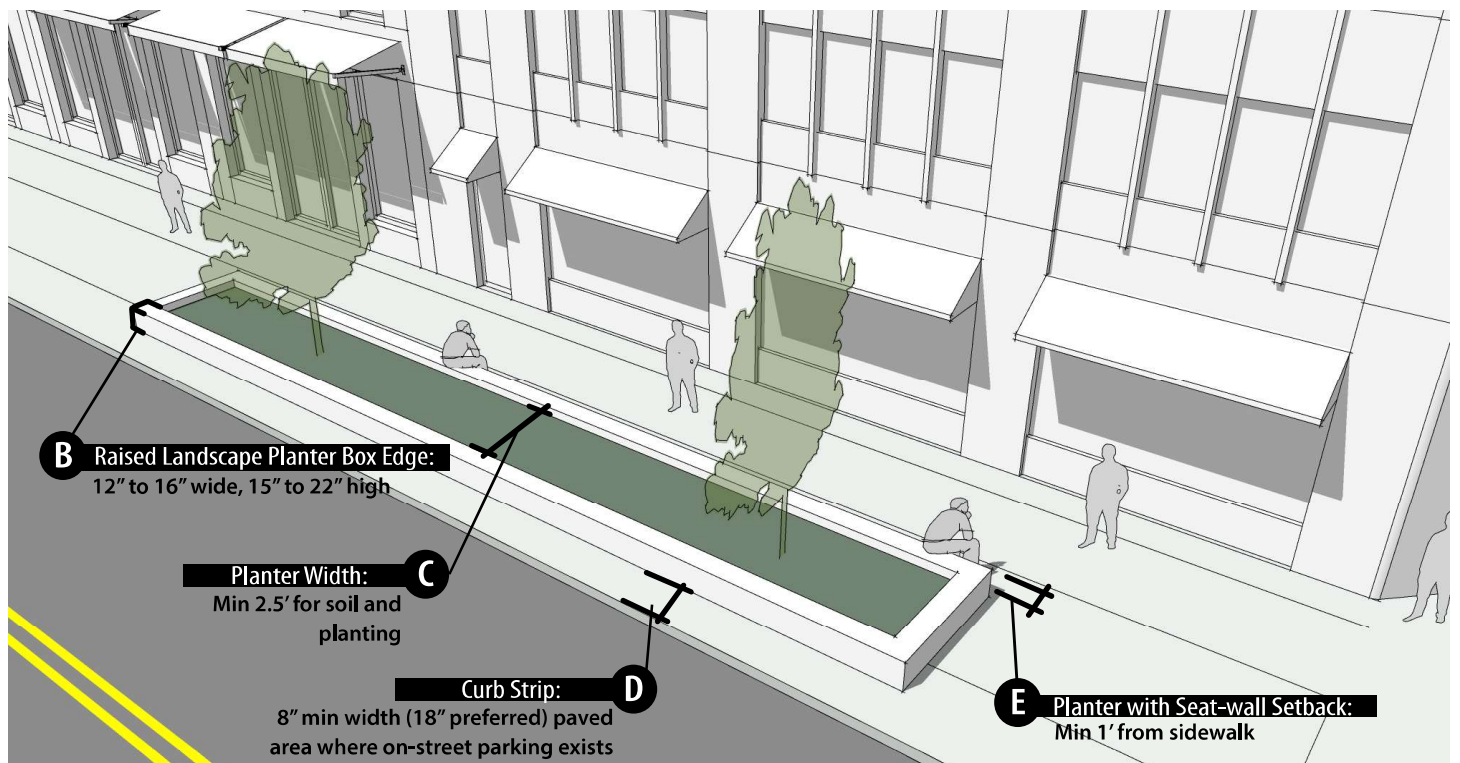
- E Seatwalls:** Raised landscape planters with seatwalls, if space is available, should be setback at least 1-foot from the through sidewalk areas so that people sitting on the seat-wall minimize impacts to the flow of pedestrian traffic.
- Street Trees:** Consider locating street trees in landscape planters.

Utility Considerations

- Landscape planters should not be located in areas where utility access panels, vaults, or other regular utility maintenance and access occurs.
- Street lights may be set within curbed landscape planters when the width of the landscape planter is at least three times the needed width of the street light base and footing to still provide sufficient soil volume and planter width.

Sustainability Considerations

- Consider drought tolerant plant materials that do not require extensive watering outside of their establishment period (typically two years).
- Design landscape planters into stormwater infiltration planters. Lower the soil surface elevation to below the sidewalk and/or street grade and provide a break in the curb or seat-wall with an inlet structure to divert stormwater into the planter. Design the planter to handle anticipated rainfall and water quantity volumes.



MAINTENANCE & MANAGEMENT

- **Plant Care:** Plant materials shall be maintained in accordance with a maintenance agreement established as part of the planter design and construction process. As with curb lawns, plantings in adjacent landscape planters (except for street trees) should be maintained and cared for by the adjacent property owner or other designated entity.
 - » Maintain at least a 2-inch mulch cover over the landscape planter.
 - » Weed, remove litter, and maintain plants (deadheading, cutting, etc.).
 - » Clear, sweep, and remove mulch and other materials that spill outside of the landscape planter.
 - » Regularly water, especially during dry periods.
 - » Replace dead or missing plant material.
- **Establishment Period:** Following new landscape planter construction, water new plant materials regularly during the growing season for the first 3-years during plant establishment.





STREET TYPOLOGY								
UC	E/F	MS	NB	CB	CC	NN	EN	LN
Req.	Req.	Req.	Req.	Req.	Req.	Req.	Req.	Req.

STREETScape & INFRASTRUCTURE

UTILITIES

DESCRIPTION & INTENT

The public right-of-way is home to the utilities that serve the buildings and uses of the city, and their presence is typically unremarkable to the average visitor. The intent of this section is to provide guidance for locating private and public utility services, particularly as they relate to the pedestrian environment.

USE & APPLICATION

Location

Almost all public streets projects impact utility mains and services in some way. A few examples include:

- Sidewalk reconstruction and streetscape improvements which impact utility service lines, hand holes, valves, and storm inlets.
- Utility main replacement and subsequent service line adjustments.
- Utility repairs to mains and service lines.
- Street resurfacing, which may impact manholes and catch basin inlets.

Private Development

Private development projects that impact the street right-of-way or require reconstruction of portions of the public right-of-way will typically impact public and private utilities in the following ways:

- Installation of new water and sanitary service leads from existing mains.
- Connection to the stormwater system.
- Replacement or up-sizing utility mains to provide for the new development’s needs.
- Streetscape reconstruction, which may include new lighting.
- Electrical and communication service connections.
- **Repair Standard:** Private projects must repair the public right-of-way to the design standards consistent with this design manual. The physical design and layout of repaired areas should match the prior condition’s design intent and layout.

DESIGN & OPERATIONS

Design Requirements - Manholes/ Vaults, Valves, and Hand Holes

Access to utility service junctions through manholes, hand holes, and valves are critical to the maintenance, emergency management, and safety of the utility systems. The cover for these access points are typically flush with adjacent pavement, or slightly raised when located in unpaved areas.

- Hand holes are used for electrical and communications cable junctions and have specific design requirements based on the utility service provider.
- Locate hand holes as follows:
 - » Locate within landscape beds if used in design. Conduits should sweep into the hand holes such that they are located at least 12 inches from the planting soils of the beds and trees.
 - » In streetscapes without planting beds, locate sidewalks to limit conflicts with conduits running through the urban street tree soil treatment.
 - » Avoid placing hand holes on barrier-free ramps or at grade breaks in the sidewalks, as the long rectangular shape of most hand holes makes it difficult to pour the concrete in these situations without grade issues.
 - » Place the top of the conduits at least 12 inches below the base of the subgrade.
- Where electrical junctions occur in vehicular traffic areas use precast concrete structures and cast iron frames and lids designed to carry heavy traffic loads, in lieu of hand holes.
- Avoid locating manholes and water main valves within the road curb or within the clear zone of the sidewalk. Locating these within the roadway zone or amenity zone of the street is preferred.
- Locate utility manholes and building vaults a minimum of 10-feet from water mains and services.



Design Requirements - Fire Hydrants

Providing for fire safety is critical to protecting historic architectural resources and providing for new development and growth. Providing adequate number and spacing of fire hydrants is an important element in ensuring for adequate fire protection.

- Hydrants shall be typically spaced at 300-feet along the roadway or as required by the City of Kalamazoo Code and the fire code official.
 - » Hydrant placement should also consider necessary proximity to building Fire Department Connections (FDCs). This is typically a 100-foot maximum from FDC to hydrants, or per the Fire Marshall's requirements.
- Hydrants should be located a minimum of 4- to 6-feet and maximum of 7-feet from the face of the curb or edge of a paved area. Setting the hydrant closer to the shorter end of the range will allow more flexibility in the design and use of the intersection, and will typically place the hydrants outside of the sidewalk zone, and in the amenity zone.
- A 3-foot clear zone or distance required by the fire code official around the hydrant is required to maintain access. Curb use around a hydrant is restricted. No parking, loading, standing, or pick-up will be allowed at the curb in front of a hydrant. Provide a clear path between the curb and the hydrant. No site furnishings will be allowed between a hydrant and the curb.
- Hydrant barrels shall be painted safety yellow and hydrant caps and operating nut shall be painted John Deere green per the City of Kalamazoo Standard Specifications for Water Main and Services Installation.



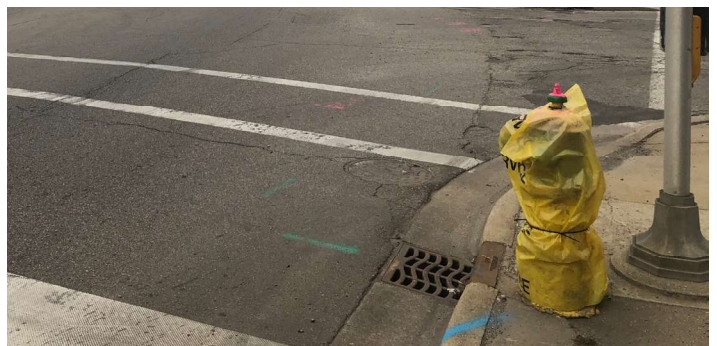
Design Requirements - Storm Inlets

The placement of stormwater inlets/catch basins at crosswalks and intersections is important for efficient storm drainage, as well as providing an accessible street environment. Of particular concern is ensuring universal access, avoiding the puddling of water at the base of curb ramps and on sidewalks during the snow season and providing for maintenance of the drains, inlets, and catch basins.

- Storm sewer systems shall be designed for the minimum 10-year, 24 hour design storm.
- Typically, place Inlets/catch basins at the point of curvature (spring point) of each intersection, thus requiring two inlets/catch basins for each corner.
- Adjust the location of inlets/catch basins so that they are:
 - » Not within the travel lane of curb ramps.
 - » Placed on the higher elevation side and directly adjacent to curb ramps so that ice and snow are less likely to block drainage to the inlets and catch water before crossing a curb ramp.
- Locate inlets/catch basins directly adjacent to mid-block crossing curb ramps on the higher elevation side of the curb line from the curb ramp.



- If inlets/catch basins must be placed in the travel lane of curb ramps, design the cast grate of the structure to accommodate universal access.
- Use bicycle safe grates in bicycle lanes.
- Valley grates that meet City of Kalamazoo minimum standards are permitted.
- **Trench Drains:** The use of trench drains is discouraged and they should not be used unless there is no adequate storm drainage alternative. While the use of trench drains and sidewalk inlets should be avoided, where they are deemed necessary they should meet the following design requirements:
 - » The accessible body of all trench drains and sidewalk drains must be a minimum of 8 inches wide for maintenance purposes.
 - » Trench drains and sidewalk drains must be rated for light duty traffic. Non-metal drain grates are not allowed.
 - » The grate of the structures must accommodate universal access.
 - » Lateral pipes draining the trench drains and sidewalk inlets must be a minimum of 8 inches in diameter, and be no longer than 40-feet before tapping into a city standard inlet/catch basin or manhole.



Design Requirements - Above Ground Utilities

New building construction and electrical and communications services often require above grade utility boxes, panels, and transformers.

While these appurtenances provide for important private utility service, they can hamper the pedestrian use of streets and sidewalks.

- Where such appurtenances are required for a specific private development, they should be located on private property.
- If appurtenances are serving public amenities and/or multiple properties and private buildings, they should still be located on private land, alleys, or parking lots. Co-locate surface mounted utilities and share boxes or pedestals wherever possible.

Additional Design Considerations

- Overhead electrical and communication lines provide maintenance issues and can be unsightly. Underground lines are strongly preferred.
- Utility poles shall be located at regular intervals within the amenity zone, typically 3-feet from the face of the curb.



MAINTENANCE & MANAGEMENT

- Complete inspection of the condition of hand hole and valve covers annually, particularly after the winter snow removal season, to assess any damage or impact to the walkability of the sidewalk surfaces.

Design References

- City of Kalamazoo Department of Public Services, Standard Specifications for Water Main and Service Installation, 2021.
- Federal Highway Administration Hydraulic Design Series 2
- AASHTO Highway Drainage Guidelines

Sustainability Considerations

- Coordination of utility main upgrade and the need for street or streetscape reconstruction is itself a technique of sustainability as it minimizes the use (and expenditure for) construction materials and the energy and resources used to install them.

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