PREPARED FOR:

WEST JORDAN UTAH

PREPARED BY:

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WEST JORDAN CITY LOW IMPACT DEVELOPMENT HANDBOOK

FEBRUARY 2023

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1. INTRODUCTION

1.1 Purpose and Background

The State of Utah Division of Water Quality has issued a permit to West Jordan City (City) that authorizes the discharge of municipal storm water from municipal separate storm sewer systems (MS4) into waters of the State under the Utah Pollution Discharge Elimination System (UPDES). That permit was issued in compliance with provisions of the Utah Water Quality Act (Utah Code Title 19, Chapter 5) and the Federal Water Pollution Control Act (33 U.S.C. Section 1251). One of the UPDES Permit (Permit) stipulations for minimum control measures associated with long-term storm water management in new development and redevelopment (post-construction storm water management) requires the City to implement and enforce a program to address post-construction runoff into the MS4 from new development and redevelopment construction sites, both public and private.

The Permit also requires that the City implement a process that requires the evaluation of utilizing Low Impact Development (LID) practices for all projects that disturb at least one acre of land (development or redevelopment). LID refers to engineered systems, either structural or natural, that utilize or mimic natural processes to promote infiltration, evapotranspiration, and/or reuse of storm water as close to its source as possible to protect water quality and aquatic habitat. LID practices at the regional and site-specific level preserve, restore, and create green space using soils, vegetation, and rainwater harvesting techniques. These systems and practices are referred to as BMPs.

Green infrastructure (GI) includes LID practices but is a broader practice that also includes ecological services and approaches such as “filtering air pollutants, reducing energy demands, mitigating urban heat islands, sequestering and storing carbon, enhancing aesthetics and property values, and preserving and creating natural habitat functions.” (United States Environmental Protection Agency, 2012)

Urban development has historically resulted in the increase of impervious surfaces, vehicle use, and other human activities that introduce pollutants and create adverse hydrologic conditions detrimental to water quality. In the past, the primary goal of traditional storm water management was to convey storm water runoff offsite as quickly as possible while giving little to no consideration to preserving open space or creating pervious areas where rainfall could be managed onsite. Flood control infrastructure such as storm drains have been used to collect runoff and convey it to a receiving surface water. Polluted storm water runoff degrades the quality of the receiving waters, impacting aquatic life and dependent ecosystems. Incorporating LID practices into projects reduces the impact of development on natural waterways and watersheds and provides practical and aesthetic benefits.

LID practices are not limited to long-term post-construction controls. Site design practices such as preserving natural areas and reducing the size and connectivity of impervious surfaces are examples of LID practices at the site planning stage that will result in improved water quality. City leaders, engineers, developers, and other stakeholders are encouraged to incorporate LID practices into project planning and design to maximize the effectiveness of LID strategies and minimize negative impacts on water quality.

An LID approach promotes implementation of Best Management Practices (BMPs) that allow storm water to infiltrate, evapotranspire or harvest and use storm water runoff on site to reduce runoff from the site and protect water quality. The Permit requires that the City allow for use of at least five LID practices. This handbook has been prepared to identify the five LID practices that are preferred by the City and provide some general design guidelines and target benefits for those BMPs.

The Permit requires that new development and redevelopment also meet an onsite stormwater retention standard. If meeting the retention standard or the use of BMPs on a site are infeasible, rationale shall be provided to the City for the use of alternative design criteria or BMPs. The developer or designer of a project must document and quantify that BMPs that provide infiltration, evapotranspiration, and rainwater harvesting have been used to the maximum extent feasible and that full utilization of those controls are infeasible due to site constraints. Implementing an LID BMP may be infeasible due to one or more of the following conditions: shallow groundwater, drinking water source protection zone restrictions, soil conditions, steep slopes, accessibility, etc.

2. LOW IMPACT DEVELOPMENT PRINCIPLES AND STORM WATER MANAGEMENT PRACTICES

2.1 What is Low Impact Development?

The State of Utah's "***A Guide to Low Impact Development within Utah***" defines LID as, "engineered systems, either structural or natural, that use or mimic natural processes to promote infiltration, evapotranspiration, and/or reuse of storm water as close to its source as possible to protect water quality and aquatic habitat." The goal of LID is to develop a storm water management strategy where post-development hydrologic conditions mimic pre-development conditions through utilizing storm water features that infiltrate and evapotranspirate in a cost-effective, flexible manner. It also involves protecting water quality by treating and filtering storm water near the source, before it infiltrates into the ground. This approach treats stormwater runoff as a beneficial resource instead of a nuisance. LID use and planning is a systematic approach to stormwater management that when planned, designed, constructed, and maintained appropriately, can result in improved stormwater quality, improved local water bodies, result in more attractive landscapes, improved wildlife habitats, and elevated lifestyle for all.

LID should be incorporated with other flood control measures, and should not function as a replacement for flood control.

2.2 Why use Low Impact Development?

Effective LID planning commonly minimizes flooding, erosion, and pollution by utilizing natural processes to filter, treat, and allow storm water to infiltrate into the ground. These practices preserve, restore, and create green infrastructure using soils and vegetation. By implementing LID principles and practices, water can be managed in a way that reduces negative environmental impacts often associated with developed areas and promotes the natural movement of water within the area. Adequate planning for use of LID is essential for future land use and sustainable growth of the community. In developing an LID handbook, input from planners, engineers, elected officials, developers, contractors, and other design professionals can and should be incorporated to allow for appropriate planning.

2.3 Developing a Low Impact Development Plan

Project applicants for developments and redevelopments will be required to adopt stormwater management measures into their design plans and submit the plans to the City for review and approval. The design plans will be reviewed prior to the issuance of approvals for permits.

This manual provides key information and standards that can be utilized to select suitable LID measures for a given site and to provide a standard method for sizing the selected LID measures. This manual outlines standards and common methods for sizing and designing LID facilities. These are minimum standards, and other, more rigorous methods may be needed and will be evaluated on a case-by-case basis.

2.3.1 Determining Soil Characteristics

Soil characteristics play a key role in determining LID feasibility, and in selecting and sizing LID facilities. A soil evaluation must be completed at each site. West Jordan City has selected the following standards based on the Natural Resource Conservation Service (NRCS) Hydrologic Soil Group (HSG) classifications. The NRCS system includes four hydrologic soil groups: A, B, C, and D as described below:

> ***Group A*** *is sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.*
>
> ***Group B*** *is silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.*
>
> ***Group C*** *soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.*
>
> ***Group D*** *soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.*

Details of this classification are found in *"Urban Hydrology for Small Watersheds"* published by the Engineering Division of the NRCS, United States Department of Agriculture Technical Release (55).

An on-site geotechnical evaluation should be performed to confirm soil types during the design process. It is best to conduct geotechnical investigations at the location of the future LID facility.

2.3.2 Determining Water Table

Water table considerations are also play a major role in determining LID feasibility and in selecting and sizing LID facilities. Shallow groundwater may limit the types of LID measures that can be used on site because it decreases the infiltration rate. Shallow groundwater may also increase the potential to introduce pollutants into the groundwater. The geotechnical investigation at a site should include an assessment of the groundwater level. This should include a measurement of the existing water table at the time of the investigation.

2.3.3 Determining Existing Drainage Patterns

The existing drainage system and topography will also impact the location and size of the LID facilities. A detailed site survey will need to be completed and existing contours developed based on the survey. Any existing drainage facilities should be identified, located, and elevations

established. Locating LID facilities generally works best by following natural patterns; and therefore, an understanding of flow direction and locating natural storm drainage collection points can streamline LID design.

2.3.4 Determining Infiltration Rates

The most important factor used in the design of most LID facilities is the infiltration rate. There are many different and varied options for estimating infiltration rates. To be consistent in estimating infiltration, West Jordan City has adopted the approach of using generalized hydraulic conductivity rates based on NRCS HSGs. A developer may choose to measure infiltration rates in the field, rather than basing infiltration on NRCS soil type. Table 2-1 identifies the estimated infiltration rates based on the NRCS soils type.

Table 2-1: Hydraulic Conductivity based on NRCS Soil Type

NRCS HSG	Typical Soil Texture	Saturated Infiltration Rate (in./hr)	Porosity (Volume ratio)	Field Capacity (dimensionless)
A	Sand	8.0	0.437	0.062
A	Loamy sand	2.0	0.437	0.105
B	Sandy loam	1.0	0.435	0.190
B	Loam	0.5	0.463	0.232
C	Silt loam	0.25	0.501	0.284
C	Sandy clay loam	0.15	0.398	0.244
D	Clay loam and silty clay loam	<0.09	0.465	0.325
D	Clay	<0.05	0.475	0.378

(Taken from Design of Urban Stormwater Controls, a revision of the Water Environment Federation's (WEF's) and the American Society of Civil Engineer's (ASCE's) manual of practice titled *Urban Runoff Quality management (1998).* Table 9.2, pg. 367*)*

2.3.5 Determining Water Quality Volume (WQV)

The Jordan Valley Municipalities (MS4) Permit No. UTS000001, requires projects to "manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event." The volume of water generated from this 80th percentile event is defined as the WQV. Table 2-2 identifies the 80th percentile storm depth for key locations along the Wasatch Front.

Table 2-2: 80th Percentile Precipitation Depths at Nearby Weather Stations

Location	Station	Elevation	Years of Record	80th Percentile Storm (inches)
Utah Lake Lehi	USC00428973	4504.92	115	0.39
Pleasant Grove	USC00426919	4691.93	73	0.47
Triad Center	USC00427606	4279.86	34	0.48
Salt Lake Airport	USW00024127	4225.07	71	0.44
Cottonwood Weir	USC00421759	4985.89	102	0.65

Elevations in West Jordan range from 5050 on the west side to 4330 along the Jordan River. To simplify calculations, West Jordan City has chosen to use 0.46 inches or 0.0375 feet as the 80th percentile storm depth.

The Water Quality Volume is calculated using the following equation: WQV = RVdA

Where:

WQV = 80th percentile volume, cf
RV = Volumetric runoff coefficient, unitless
d = 80th percentile precipitation depth, ft (convert from inches to feet if required)
A = Project area or BMP drainage area, sf

The NRCS has developed three regression equations to estimate the runoff coefficient Rv. Table 2-3 identifies the equations from the NRCS based on soil type:

Table 2-3: Runoff Coefficient (Rv) Equations Based on NRCS Soil Type

NRCS Soil Group		
A	B	C/D
$R_{V\text{-}A} = 0.84i^{1.302}$	$R_{V\text{-}B} = 0.84i^{1.169}$	$R_{V\text{-}C/D} = 0.83i^{1.122}$

Note: "*i*" represents the percent of imperviousness of the drainage area in decimal format (0.0 - 1.0)

Using these equations, a WQV is calculated in cubic feet. The WQV needs to be retained on-site until it infiltrates or evapo-transpires.

2.4 Universal LID Best Management Practices

Not all LID BMPs lead to construction of a structure. Some LID BMPs involve the implementation of basic principles that should be general practice on all sites. If feasible for the given site conditions, the following measures are required and should be incorporated on all projects:

2.4.1 Eliminating Directly Connected Impervious Areas

The main contributor to urban runoff is directly connected impervious areas or DCIAs. A DCIA is defined as a surface where stormwater runoff is collected and conveyed directly to a storm drain facility without crossing a pervious surface. Examples of DCIAs include roofs with downspouts that are piped directly to the gutter or storm drain pipe, roads with curb, gutter, inlets and storm drain pipes, and parking lots with inlets in the gutter that go directly to the storm drain pipe.

Whenever feasible, new development should minimize DCIAs through landscape areas and other LID facilities.

Figure 1: Downspout into Landscaped Area

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. 14).

2.4.2 Utilizing Landscaped (Natural) Buffers

Maintaining landscaped buffers for infiltration through which stormwater flows provides opportunities for natural filtering and infiltration that is not achieved in a pipe or gutter. The best buffers are those in which pre-development ground and vegetation are left undisturbed; however, a more groomed approach is desirable in many cases. Development is strongly urged to utilized landscape areas as buffer areas and direct the flow of stormwater to these landscaped areas. Stormwater can be collected in the landscaped zones after it has had a chance to filter/infiltrate.

3. BMP PRIORITIZATION AND SELECTION

3.1 Best Management Practice Categories

Structural BMPs need to be designed to manage and capture stormwater runoff. Most long-term stormwater BMPs can fit into three general functional categories: BMPs that infiltrate, BMPs that harvest, and BMPs that filter. Some BMPs are hybrids that can accomplish more than one function at a time. The order of priority specified below shall apply to all projects. Each type of BMP will need to be implemented to the maximum extent applicable when determining the appropriate BMPs for a project before moving to the next priority.

1. Infiltration
2. Harvesting
3. Natural Filters
4. Man-made Treatment
5. Combination of any of the above

Because of retention requirements, BMPs that infiltrate are given the highest priority and should be utilized until the WQV has been captured and stored. If it is not feasible to maintain the entire WQV (feasibility is defined in the section below), harvesting should be considered. Utah water rights laws limit the amount of stormwater that can be harvested and reused. If the WQV cannot be handled by the first two infiltration or harvesting, treating and releasing can be considered. If partial or complete compliance of any level is technically infeasible, the project site and LID Plan will be required to explain the reasons preventing this approach and the rationale for the chosen alternative controls on a case-by-case basis for the project.

3.1.1 Infiltration Feasibility

Infiltration will be considered feasible only when all of the following criteria can be met:

- The lowest elevation of all retention facilities shall be a minimum of five (5) feet above the measured water table
- Retention volumes must infiltrate or evaporate within three (3) days or 72 hours after a storm has subsided
- Retention facilities can be no closer than fifteen (15) feet from the nearest structural foundation
- Retention facilities can be no closer than fifty (50) feet horizontally from live streams or water bodies
- If a slope is steeper than 20%, there must be a geotechnical investigation to determine a safe setback from the top of slope to allow for any infiltration to occur.
- Retention facilities cannot be placed on slopes exceeding 5%
- Retention shall not be allowed in areas where a licensed geotechnical engineer determines that infiltration would adversely impact the potential for geological hazards on the project site or on neighboring parcels of land
- Side slopes on all open retention facilities must be 4:1 or flatter

- BMPs that focus on infiltration will not be allowed if land drains are required for a development.
- Infiltration will not be allowed in Zones 1 or 2 of any Drinking Water Source Protection Plan for a Public Water System

3.1.2 Infiltration BMPs

The following paragraphs provide general descriptions of several types of infiltration BMPs.

Infiltration Basin

Description: Infiltration basin consists of an earthen basin constructed in naturally pervious soils with a flat bottom and are typically vegetated with dry-land grasses or irrigated turf grass. An infiltration basin functions by retaining the design runoff volume in the basin and allowing the retained runoff to percolate into the underlying native soils over a specified period.

Figure 2: Infiltration Basin

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-41).

Application: Infiltration Basins are typically utilized for larger drainage areas

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all open infiltration basins:

Parameter	Requirement
Minimum depth to measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum side slope	4 H: 1 V
Minimum freeboard	1 foot
Other	Must have a safe flood path to convey up to the 100 year storm safely to an established Right-of-way
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Infiltration Trenches

Description: Infiltration trenches, which are like basins, are long, narrow, gravel-filled trenches, often vegetated, that infiltrate stormwater runoff from small drainage areas. Infiltration trenches may include a shallow depression at the surface, but the majority of runoff is stored in the void space within the gravel and infiltrates through the sides and bottom of the trench.

Application: Infiltration trenches are commonly used for moderately sized drainage areas where the available footprint is narrow.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Figure 3: Infiltration Trench

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-47).

Design Criteria: The following criteria shall be met for all open infiltration trenches:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Minimum depth of trench	2 feet
Maximum longitudinal trench slope	1%
Minimum width	2 feet
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Infiltration Galleries

Description: Infiltration galleries are like infiltration basins except they are underground. Several vendors offer prefabricated, modular infiltration galleries that provide subsurface storage and allow for infiltration. Infiltration galleries come in a variety of materials, shapes, and sizes, and are best served when there is an isolator row or pretreatment device. Maintaining underground retention without the isolator row or pretreatment can be problematic and costly.

Figure 4: Underground Infiltration Gallery

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-58).

Application: Infiltration galleries are typically utilized for drainage areas between 5 and 50 acres.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all open infiltration galleries:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way Must meet all the requirements of the manufacturer.
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Permeable Pavements

Description: Pervious surfaces such as permeable asphalt, concrete pavers, pervious concrete, modular open pavers, and other pervious surfaces allow parking or light travel surfaces to also allow infiltrate. Permeable surfaces may not be used for public roads or in

Figure 5: Permeable Asphalt

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-36).

the public right-of-way. Permeable pavements contain small voids that allow water to pass through to a stone base. They come in a variety of forms; they may be a modular paving system (concrete pavers, modular grass or gravel grids) or poured-in-place pavement (porous concrete, permeable asphalt). All permeable pavements with a stone reservoir base treat stormwater and remove sediments and metals to some degree by allowing stormwater to percolate through the pavement and enter the soil below.

Application: Permeable pavements are typically used on sites where footprint is at a premium, allowing dual usage of parking and light travel areas. Permeable pavements are typically not recommended on heavy travel surfaces or truck lanes and are not allowed on public streets.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all permeable pavements:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way Must meet all the requirements of the manufacturer.
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Injection Wells

Description: An injection well is an excavated, bored, drilled, or driven shaft or hole whose depth is greater than its width. Injection wells are like infiltration trenches in their design and function as they are designed to temporarily store and infiltrate runoff, primarily from rooftops

or other impervious areas with low pollutant loading. An injection well may be either a drilled borehole filled with aggregate or a manufactured storage chamber or pipe segment.

Figure 6: Dry Well

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-53).

Application: Injection wells are best suited for soils with high conductivity rates. They can contribute to aquifer recharge, and as such, should be registered as Class V Injection Wells with the State Division of Water Quality https://deq.utah.gov/legacy/programs/water-quality/utah-underground- injectioncontrol/drainage-wells/index.htm.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all injection wells:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way Must meet all the requirements of the manufacturer.
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Constructed Wetlands

Description: A constructed wetland is an artificial wetland created for the purpose of treating discharges such as common municipal stormwater runoff. Constructed wetlands are engineered systems that use natural functions of vegetation, soil, and organisms to treat water running through them. The wetlands should be designed to spread the flow, slow the velocity and maximize infiltration, and should also be designed to meet the specific needs of the water running through them including sediment removal, nutrient uptake, and heavy metals containment. Constructed wetlands may provide a habitat for native or migratory wildlife.

Application: Constructed wetlands can handle large amounts of water provided there is a large enough footprint to process the flows. A good metric in sizing wetlands is to use 0.5% to 2.0% of the contributing drainage area for the wetland footprint (Tyndall & Bowman, 2016 – A NRS Cost Tool Overview). Constructed wetlands are typically not as effective when they are less than 0.25 acre in size.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for constructed wetlands:

Parameter	Requirement
Maximum depth to the measured water table from the lowest elevation in the wetland	1.5 feet with no supplemental water
Supplemental water	To keep a wetland viable it requires a fairly consistent water source. Stormwater, by itself in Utah, does not usually provide adequate water source. It is very likely that supplemental water will be needed.
Hydraulic residence time	> 48 hours to achieve 80% reduction in Nitrogen
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Combined Measures

Any of the previously mentioned infiltration type BMPs may be combined with any other BMPs to fit the site and to meet the allowable discharge requirements.

3.1.3 Stormwater Harvesting

Stormwater harvesting refers to a specific type of BMP that operates by capturing stormwater runoff and holding it for use later. In the State of Utah, a person must register with the Utah Division of Water Rights to collect, store, and place the captured stormwater to beneficial use. BMPs sized to capture the runoff produced from the 80th percentile storm event, or BMPs designed to capture less than this volume (if being used in conjunction with other BMPs) must drawdown their entire captured volume within 3 days of a likely storm event.

Stormwater harvesting BMPs designed for storm events larger than the 80th percentile storm event are required to disperse enough water from the BMP within 3 days of a likely storm event to ensure that adequate capacity is available to capture the next event up to 80th percentile storm event. In instances where the amount of runoff from the 80th percentile storm event exceeds the volume of the collection tank, partial capture and use can also be achieved as part of a treatment train by directing the overflow to stable vegetated areas where erosion or suspension of sediment is not a factor or through a high flow natural filter type BMP to provide additional volume reduction and water quality treatment. Overflow from the tank into the storm drain system is not allowed.

Capture and use BMPs designed for these extended holding times need additional treatment to safeguard against fouling, to prevent the breeding of mosquitoes, and/or to improve the quality of water for reuse applications. These scenarios should be reviewed on a case-by-case basis.

Rain Barrels

Description: Rain barrels are designed to intercept and store runoff from rooftops to allow for reuse and volume reduction. Stored stormwater is typically reused for irrigation or other water needs. Rain barrels are typically above-ground structures that are directly connected to rooftop downspouts. In the State of Utah, a person may collect and store rainwater without registering in no more than two covered storage containers if the maximum storage capacity of any one container is not greater than 100 gallons.

Figure 7: Rain Barrels

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-62).

Application: Rain barrels are typically used by individual residential home owners and are limited to no more than 200 gallons (no more than two containers with no more than 100 gallons per container) stored at a time.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good*
Nutrients	Good*
Metals	Good*
Bacteria	Fair*
Oil/Grease	Excellent*

*Water Quality Effectiveness varies a lot for rain barrels depending on the reuse options implemented

Design Criteria: The following criteria shall be met for rain barrels:

Parameter	Requirement
Maximum Capture Volume without registration	200 gallons (no more than two containers with no more than 100 gallons per container)
Maximum Capture Volume with registration	2,500 gallons
WQV	As defined in Section 2.3.5

Cisterns

Description: Cisterns are like rain barrels and are similarly designed to intercept and store runoff from rooftops to allow for reuse and volume reduction. As stormwater is stored it is typically reused for irrigation or other water needs. Cisterns are usually larger than rain barrels and have more storage capacity. In the State of Utah, the total allowed storage capacity with registration is no more than 2,500 gallons, and collection and use are limited to the same parcel of land on which the water is captured and stored. Cisterns can be designed as either above or below ground structures, but above ground cisterns are to be secured in place and meet all applicable building standards.

Application: Cisterns are typically utilized on a small commercial sites, and are limited to no more than 2,500 gallons stored at a time.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good*
Nutrients	Good*
Metals	Good*
Bacteria	Fair*
Oil/Grease	Excellent*

*Water Quality Effectiveness varies a lot for cisterns depending on the reuse options implemented

Design Criteria: The following criteria shall be met for cisterns:

Parameter	Requirement
Maximum Capture Volume without registration	200 gallons
Maximum Capture Volume with registration	2,500 gallons
WQV	As defined in Section 2.3.5

3.1.4 Natural Filters

Natural filter facilities are landscaped, shallow depressions that capture and filter stormwater runoff. As the water passes down through the planting soil, pollutants are filtered, adsorbed, and biodegraded by the soil and plants. Because they are not contained within an impermeable structure, they may allow for infiltration.

Projects that have demonstrated they cannot manage 100% of the water quality design volume onsite through infiltration and/or stormwater harvesting BMPs may manage the remaining volume by using a high removal efficiency natural filter BMP. A high removal efficiency natural filter BMP can be sized to adequately capture 1.5 times the volume not managed through infiltration and/or capture and use.

Biofilters

Description: Most natural filter systems can be classified as biofilters, and normally consist of a ponding area, mulch layer, planting soils, plants, and sometimes an underdrain. Runoff that passes through a biofiltration system is treated by the natural absorption and filtration characteristics of the plants, soils, and microbes the water contacts. Various plants are used to increase infiltration and nutrient uptake.

Figure 8: Bioswale

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. C-16).

Application: Biofilters are usually incorporated into site landscaping elements and are frequently used in park strips and parking lot islands.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for biofilters:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum ponding depth	1 foot
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100 year storm safely to an established right-of-way.

Rain Gardens

Description: Rain gardens are gardens designed to capture and treat runoff. They usually consist of a small depression with engineered or native soils and a variety of plants which are used to increase infiltration and nutrient uptake. They are frequently topped with wood or rock mulch. For projects with impervious areas exceeding 4,000 square feet, biofilters, planter boxes with infiltration, vegetated swales, or natural buffer strips should be considered.

Figure 9: Rain Garden

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. 55).

Application: Small sites – impervious areas < 4,000 square feet.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for rain gardens:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum ponding depth	18 inches
Maximum side slopes	4H:1V
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100 year storm safely to an established right-of-way.
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Planter Boxes with Infiltration

Description: Planter boxes with infiltration are natural filtration treatment control measures located in and around structures and facilities to handle larger volumes of water than a common rain garden. They are usually constructed with vertical or near vertical sides and above ground and can be equipped with underdrains if necessary. Planter boxes with infiltration should be set back from adjacent buildings, other structures, sidewalks or roadways.

Application: Planter boxes with infiltration are usually incorporated into site landscaping elements and are often used in park strips and parking lot islands. Raised planters are most successful for treating stormwater from roof tops.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for planter boxes with infiltration:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum ponding depth	1 foot
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100 year storm safely to an established right-of-way.

Bio-Infiltration

Description: Bio-infiltration facilities are designed for both partial infiltration of runoff and partial biotreatment. These facilities are similar to bioretention devices with underdrains, but also include a raised underdrain above a gravel sump designed to facilitate infiltration and nitrification/denitrification. These facilities can be used in areas where there are few hazards associated with infiltration, but infiltration screening does not allow for infiltration BMPs due to low infiltration rates or high depths of fill.

Figure 10: Bioretention

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg. 52).

Application: Bio-infiltration systems are normally incorporated into site landscaping elements and are commonly used in park strips and parking lot islands. Bio-infiltration includes a higher likelihood for infiltration over the basic biofilter.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for bio-infiltration:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum ponding depth	1 foot
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100 year storm safely to an established right-of-way.

Vegetated Swales

Description: Vegetated swales are open, shallow channels with dense, low-growing vegetation covering the side slopes and bottom that collect and convey runoff to downstream discharge points. An effective vegetated swale achieves uniform sheet flow through the densely vegetated area for several minutes. The vegetation in the swale can vary depending on its location, and is the choice of the designer. Most swales are lined with grass.

Figure 11: Vegetated Swales

UDWQ. *A Guide to Low Impact Development within Utah.* Aug. 2020. (Pg.C-232).

Application: Vegetated swales serve a dual function. They are used both as a minor treatment alternative and as a conveyance system.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Good
Bacteria	Fair
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for vegetated swales:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum longitudinal slope	5%
Maximum side slope	3H:1V
Maximum velocity	1.0 ft/s
Maximum flow depth	2/3 vegetation height
WQV	As defined in Section 2.3.5
Minimum freeboard	6 inches
Maximum Infiltration Rate	As determined in Section 2.3.4
Minimum residence time	5. min
Vegetative Cover	>65%

Filter or Buffer Strips

Description: Filter strips are vegetated areas designed to treat sheet flow runoff from adjacent impervious surfaces like parking lots and roadways, or intensive landscaped areas like golf courses. While some assimilation of dissolved constituents may occur, filter strips are normally more effective in trapping sediment and particulate-bound metals, nutrients, and pesticides. Filter strips are more effective when the runoff passes through the vegetation and thatch layer in a shallow, uniform flow. Filter strips are predominantly used to pretreat runoff before it flows to an infiltration BMP or another natural filtration BMP.

Application: Most effective when inflow is not concentrated but comes in by sheet flow. Works well on road shoulders or parking lots with no curb and gutter.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Good
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for filter or buffer strips:

Parameter	Requirement
Minimum flow length	15 feet
Maximum longitudinal slope	5H:1V
Maximum flow velocity	1.0 ft/s
Maximum flow depth	2/3 vegetation height
Minimum freeboard	6 inches
Minimum vegetation cover	>65%
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

Velocity Dissipaters

Description: Velocity dissipaters are BMPs intended to slow the velocity and minimize erosive action of flowing water. Commonly used velocity dissipaters are check dams and level spreaders. Check dams are designed to create a series of step-downs with pools in between while level spreaders are created like weirs to spread the flow out and to control water levels. Level spreaders are generally used in wetland areas to maintain a uniform distribution of water and to prevent the flows from channelizing.

Application: Typically used in flow channels (concentrated flows) or to disperse water entering a wetland area

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Fair
Bacteria	Good
Oil/Grease	Fair

Design Criteria: The following criteria shall be met for velocity dissipaters:

Parameter	Requirement
Maximum flow velocity	1.0 ft/s
Minimum freeboard	6 inches
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.5 Man-made Treatment

Filtration Cartridges

Description: Passing stormwater through a filtration fabric, plate, membrane, or device is a viable option for treating stormwater. These materials are expensive to purchase and maintain and are therefore not frequently used. Additionally, forcing the water through the medium can often result in head loss. Various fabrics or media should be considered on a case-by-case basis to meet the needs of a project.

Application: Filtration cartridges are typically used when other options are unfeasible. As stated, they are expensive to buy and maintain, but they do have a relatively small footprint.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for filtration cartridges:

Parameter	Requirement
Design per manufacturer's requirements	
WQV	As defined in Section 2.3.5

Hydrodynamic Separators

Description: Hydrodynamic separators are devices that function on vortex and gravity principles to separate stormwater from pollutants. They are generally designed as flow-through systems with either online or offline storage of pollutants. They include chambers for settling and storage of pollutants and are often used in conjunction with other BMPs as pretreatment. They are not particularly effective for the removal of fine materials or dissolved pollutants. Online separators are more susceptible to scour or resuspension of pollutants over systems that incorporate offline storage. They are generally not designed to treat stormwater flows exceeding 25 cfs.

Application: Normally limited by flow rates. Small footprint, but normally require depth for pollutant storage.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Good
Metals	Excellent
Bacteria	Fair
Oil/Grease	Good

Design Criteria: The following criteria shall be met for hydrodynamic separators:

Parameter	Requirement
Maximum flow rate for prefabricated units	25 cfs
Design per manufacturer's requirements	
Typically need a high flow bypass	
WQV	As defined in Section 2.3.5

Safl Baffles

Description: Safl Baffles are a brand-name product designed mainly as a post-construction retrofit pretreatment system. They require a sump structure. A uniquely designed perforated

metal plate is installed inside a sump manhole or vault, and water flows through the plate. This action facilitates improved settling and re-suspension characteristics. Sediment removal rates are generally less than with hydrodynamic separators. These baffles are a fair low-cost alternative that require a minimal footprint. Sediment is stored in the lower reaches of the manhole or vault. Safl Baffles are not effective for floatables.

Application: Can typically be used anywhere a hydrodynamic separator can be used but can handle higher flow rates. Pollutant removal rates are slightly worse than a hydrodynamic separator.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Good
Bacteria	Fair
Oil/Grease	Poor*

*When used in conjunction with a skimmer their performance with oil/grease is "Good"

Design Criteria: The following criteria shall be met for Safl baffles:

Parameter	Requirement
Maximum flow rate for prefabricated units	50 cfs
Design per manufacturer's requirements	
Removal efficiency goes down with higher flows	
WQV	As defined in Section 2.3.5

Skimmer

Description: Skimmers are created to trap floatables in a facility until they can be removed by absorbent materials or a vactor truck. They can take many shapes and sizes and can be prefabricated or custom built to fit the needs of almost any project. They usually require a certain amount of standing water to maintain a seal so the floatables cannot escape. They also require relatively frequent inspection and maintenance because of their small storage capacity. They work on the principle of baffles.

Application: Skimmers are typically not used as standalone treatment options, and are best utilized when floatables are the primary pollutant of concern.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Poor
Nutrients	Poor
Metals	Poor
Bacteria	Poor
Oil/Grease	Good

*When used in conjunction with a skimmer their performance with oil/grease is "Good"

Design Criteria: Per manufacturer's recommendations

3.2 Sample Calculations

All categories of BMPs require determination of the Water Quality Volume (WQV). Section 2.3.5 describes that calculation process.

3.2.1 Calculating Size Requirements for Infiltration BMPs

The primary challenge associated with infiltration BMPs is preventing system clogging and subsequent infiltration inhibition. Moreover, infiltration BMPs must be designed to drain in a reasonable timeframe so that storage capacity is available for subsequent storms and so standing water does not result in unwanted conditions. Infiltration BMPs should be designed according to the requirements listed in Table 3-1 and outlined in the following text:

Infiltration facilities must be sized to completely infiltrate the design capture volume within **72 hours.**

Step 1: Calculate the Design Volume

Infiltration facilities shall be sized to capture and infiltrate the water quality volume as described in section 2.3.5

Step 2: Calculate the BMP Surface Area

Establish the size of the required infiltrating surface by assuming the water quality volume will fill the available ponding depth.

Determine the minimum infiltrating surface area necessary to infiltrate the design volume

$$\mathbf{Amin = (Vdesign \times 12\ in/ft) / (T \times Ksat, design)}$$

Table 3-1: Infiltration BMP Design Criteria

Design Parameter	Unit	Basins and Trenches	Galleries	Permeable Pavement	Dry Well	Hybrid Bioretention/ Dry Well
Design Water Quality Volume	cubic feet	See Section 2.3.5				
Design Surface Drawdown Time	hr	72				
Setbacks and Elevations	feet	In accordance with the Infiltration Feasibility Criteria, Section 3.1.1				
Pretreatment	-	Appropriate Treatment Control Measure shall be provided as pretreatment for all tributary surfaces other than roofs				
Hydraulic Conductivity, $K_{sat,measured}$	in/hr	In accordance with Section 2.3.4 or as measured in the field by a certified hydrogeologist				
Factor of Safety, FS		3				
Facility geometry		Bottom slope ≤ 3% (basins); side slope shall not exceed 4:1 (H:V)	Flat bottom slope	Pavement slope ≤ 5%; If ≥ 2%, area shall be terraced	Typical 18 – 36 inch diameter; flat bottom slope	Bioretention: Bottom slope ≤ 3%; side slope shall not exceed 4:1 Drywell: flat bottom
Ponding Depth	inch	18 (maximum)[a]				
Media Depth	feet	2 (min) 8 (max)	-	2 (min) 8 (max)	-	2 (min) 8 (max)
Gravel media diameter	inch	1 – 3	-	1 - 2	3/8 – 1	3/8 - 1
Inlet erosion control	-	Energy dissipater to reduce velocity				
Overflow device	-	Required if system is on-line and does not have an upstream bypass structure. Shall be designed to handle the peak storm flow in accordance with the Building and Safety code and requirements				

a: Ponding depth may vary for galleries (which have a storage depth) and may be different from one vendor to another. Ponding depth is not necessarily applicable to permeable pavement.

Where:

A_{min} = Minimum infiltrating surface area (sq ft)
V_{design} = Design volume (cf)
T = Drawdown time (hours), 72 hours
$K_{sat,design}$ = Design infiltration rate of filter media (in/hr)

For infiltration basins, the surface area should be calculated as the surface area at mid-ponding depth. For infiltration trenches, the surface area should be calculated at the bottom of the trench.

3.2.2 Stormwater Harvesting Calculations

Step 1: Perform a site assessment to determine if harvesting is feasible such that the draw down can take place within 3 days. A site investigation may be necessary to understand if there is sufficient landscape to accommodate use.

Step 2: Determine Water Quality Volume – See Section 2.3.5

3.2.3 Natural Filter Calculations

Natural filter facilities can be sized using one of two methods: a simple sizing method or a hydrologic routing modeling method. With either process the design capture volume must be completely infiltrated within the drawdown time shown below in Table 3-2. Steps for the simple sizing method are provided below. BMPs should be designed according to the requirements listed in Table 3-2 and outlined in the following text. Swales and filter strips must be managed as indicated in the following sections.

Table 3-2: Natural Filter BMP Design Criteria

Design Parameter	Unit	Rain Garden	Planter Box	Bio-infiltration		Vegetated Swale	Filter Strip
Water Quality Volume, WQV	cubic feet	See Section 2.3.5					-
Design Drawdown Time	hr	72				-	-
Factor of Safety[c]	-	2				-	
Soil Media Infiltration Rate	in/hr	5 (max)				-	
Design Contact Time	min	-				≥ 7	
Slope in Flow Direction	%	-				1% (min) 6% (max)	2% (min) 33% (max)
Design Flow Velocity	ft/sec	-				≤ 1	
Maximum Ponding/Flow Depth	inch	18	12	18	-	5	1
Minimum Width	ft	2			-	2	15
Soil Depth	ft	2 (3 preferred) Topped with 3" of mulch			-	2	-
Underdrain	-	Slotted PVC pipe embeded in 12" gravel section and located 1" from bottom of facility		Slotted PVC pipe at least 2' above bottom of facility		N/A	Not required

Step 1: Calculate Water Quality Volume

See Section 2.3.5

Step 2: Determine Infiltration Rate

See Section 2.3.4

Step 3: Calculate Ponding Depth

Select a ponding depth (dp) that satisfies geometric criteria and is congruent with the constraints of the site. The ponding depth must satisfy the maximum ponding depth constraint shown in Table 3-2 as well as the following:

$$d_p\,(\text{ft}) = (K_{sat,design} \times T) / 12$$

Where: d_p = Ponding depth (ft)

$K_{sat,design}$ = Design infiltration rate of filter media (in/hr)
T = Required surface drain time (hrs), from Table 3-2

Step 4: Calculate Surface Area

$$A_{min} = (V_{design}) / [(T_{fill} \times K_{sat}/12) + d]$$

Where:

A_{min} = Design infiltrating area (sq ft)
T_{fill} = Time to fill to max ponding depth with water (hrs) [unless a hydrologic routing model is used, assume a maximum of 3 hours]
K_{sat},= Design infiltration rate of filter media (in/hr)
d = depth of ponded water (ft)

The calculated BMP surface area only considers the surface area of the BMP where infiltration through amended media can take place. The total footprint of the BMP should include a buffer for side slopes and freeboard.

3.2.4 Swale Sizing

Swales need to be designed with a trapezoidal channel shape with side slopes of 4:1 (H:V). They shall incorporate at least two feet of soil beneath the vegetated surface. Swale sizing will be determined on a case-by-case basis. As is the case with other biofiltration BMPs, the sizing criteria given in Table 3-2 must be met.

3.2.5 Filter Strip Sizing

Because filter strips are most often used for pretreatment purposes, their design will depend on the desired flow-rate to be treated and the type of BMP downstream. Consequently, filter strip sizing is not covered in this handbook, but should be determined on a case-by-case basis.

4. OFFSITE MITIGATION MEASURES

4.1 Offsite Mitigation Measures

Offsite mitigation should only be utilized after onsite mitigation opportunities are exhausted. If onsite mitigation meets the minimum requirements no offsite mitigation will be required. The following criteria should be implemented in considering offsite mitigation:

1. Locate offsite projects as close as possible to the project site.
2. Locate offsite projects within the same sub-watershed as the proposed project.
3. Offsite projects may be completed on either private or public land.
4. Secure needed easements and rights to the property on which offsite projects are completed.
5. Demonstrate that same level of water quality protection is achieved as if all the runoff were retained onsite.
6. Establish that the off-site project (when combined with onsite mitigation) addresses the same volume of water that would have been addressed if BMPs were all constructed onsite.
7. The developer shall execute an Agreement in Perpetuity with the city and recorded with the property, for on-going maintenance and upkeep of both onsite and offsite BMP(s).

4.2 Regional Facilities

In place of an independent offsite mitigation project designed to meet the needs of a given project, the developer may be able to work together with the City and/or other groups to construct a larger regional water quality mitigation project. If a regional project is pursued, the following criteria should be considered:

1. An agreement shall be obtained with the City and/or other partners for the design, sizing, construction, and maintenance of the regional facility.
2. The regional facility shall be sized to accommodate the water quality needs of all interested parties.
3. The same net level of water quality protection shall be achieved for the combined facility as would be required for each separate entity as if they were separate and distinct facilities.
4. The same total volume of water required to be addressed at each individual and independent site shall be addressed as the accumulated total volume at the regional facility.
5. All Maintenance Agreements in Perpetuity that would have been required for each separate facility shall be addressed in agreement(s) for the regional facility and shall be recorded with each parcel encompassed as part of the regional facility.

APPENDIX A

MUNICIPAL ORDINANCES

CHAPTER 11

STORMWATER DISCHARGES AND QUALITY MANAGEMENT

SECTION:

8-11-1: PURPOSE AND APPLICABILITY:

A. Purpose: The purpose of this chapter is to protect the health, safety and welfare of the city and its inhabitants, improve the city's storm drain system, and protect property by:

1. Minimizing entrance of pollutants to the city's storm drain system.

2. Prohibiting illicit discharges and connections to the city's storm drain system.

3. Minimizing nonpoint source pollution caused by stormwater runoff.

4. Reducing the amount and increasing the quality of stormwater runoff and requiring implementation of Best Management Practices for those purposes.

5. Ensuring that stormwater management controls are properly maintained.

6. Establishing authority to carry out all inspection, surveillance, monitoring and enforcement procedures necessary to ensure compliance with this chapter.

7. Establishing penalties for violation(s) of this chapter.

B. Applicability: The provisions of this chapter shall apply to all real property within the incorporated area of the city and all water entering the city's storm drain system generated on any developed and undeveloped lands, unless exempted by the provisions of this chapter. (Ord. 10-21, 7-28-2010; amd. Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-2: DEFINITIONS:

BEST MANAGEMENT PRACTICES (BMP OR BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

CONNECTION PERMIT, PERMIT OR STORM DRAIN CONNECTION PERMIT: A permit issued by the city pursuant to this chapter authorizing connection to the city's storm drain system.

DISCHARGE: Any addition or potential addition of stormwater or nonstormwater to the city's storm drain system, regardless of method of conveyance (i.e., by surface runoff, channel, pipe or otherwise).

HAZARDOUS MATERIALS: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

ILLICIT CONNECTION: Either of the following: a) any drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the storm drain system including, but not limited to, any conveyances which allow any nonstormwater to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by the city; or b) any drain or conveyance connected to the storm drain system which has not been approved by the city.

ILLICIT DISCHARGE: Any direct or indirect nonstormwater discharge to the storm drain system, except as exempted in section8-11-3 of this chapter.

INDUSTRIAL ACTIVITY: Any activity subject to UPDES industrial permits as defined by the State of Utah.

LAND DISTURBANCE PERMIT: A permit issued by the city pursuant to title 11 of this code.

LOW IMPACT DEVELOPMENT (LID): A versatile stormwater management approach that utilizes principles and practices that integrate Best Management Practices into the design and construction of stormwater management facilities that will: a) mimic a site's predevelopment hydrology; b) utilize natural processes (such as: infiltration, evapotranspiration, filtration, bioretention, rainwater harvesting, retention and detention); and c) reduce the potential for degrading the water quality of stormwater runoff.

NONSTORMWATER DISCHARGE, NONSTORMWATER RUNOFF: Any discharge to the storm drain system that is not composed entirely of stormwater.

OWNER OR OPERATOR: The owner or operator of any facility or activity subject to regulation under the stormwater management regulations.

POLLUTANT: Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; nonhazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, articles, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

RESPONSIBLE PERSON: Any person engaged in any land use, activity, business or operations utilizing a storm drain connection, or owning or responsible for the property served by the connection, whether temporary or permanent, including, but not limited to, property owners, developers, builders, tenants, and facility operators. If there is more than one (1) responsible person, they shall be jointly and severally responsible and liable for compliance with or violation of this chapter and the connection permit.

SITE: Real property where stormwater is generated; the land or water area where any regulated facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

STORM DRAIN SYSTEM, CITY'S STORM DRAIN SYSTEM, CITY STORM DRAIN SYSTEM OR CITY SYSTEM: Publicly-owned facilities by which stormwater is collected or conveyed, including, but not limited to, any roads with drainage systems, Municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and humanmade or altered drainage channels, reservoirs, and other drainage structures identified on the city's storm drain master plan.

STORMWATER: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

STORMWATER MANAGEMENT REGULATIONS: Any and all federal, state and local laws, ordinances and regulations, city standards, city specifications and master plans, and federal, state and local permits, including, but not limited to, UPDES permit number UTS000001, which are related to stormwater and storm drain management.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP): A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to stormwater, storm drain systems and receiving waters to the maximum extent practicable.

UPDES: Utah pollutant discharge elimination system per Utah Administrative Code R317-8.

WATERCOURSE: A natural or artificial channel through which water can flow.

WATERS OF THE STATE: All streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private, which are contained within, flow through, or border upon the State of Utah or any portion thereof, except that bodies of water confined to and retained within the limits of private property, and which do not develop into or constitutes a nuisance, or a public health hazard, or a menace to fish or wildlife, shall not be considered to be waters of the state. The exception for confined bodies of water does not apply to waters of the United States. Waters are considered to be confined to and retained within the limits of private property only if there is no discharge or seepage to either surface water or groundwater. Waters of the state includes wetlands as defined in the Federal Clean Water Act.

WATERS OF THE UNITED STATES (WATERS OF THE U.S.): Waters of the United States as defined in 40 CFR 230.3(s). (Ord. 10-21, 7-28-2010; amd. Ord. 16-39, 9-21-2016; Ord. 17-22, 4-26-2017; Ord. 19-48, 12-11- 2019, Effective at 12 noon on January 6, 2020)

8-11-3: PROHIBITED DISCHARGES:

A. Illicit Discharges Prohibited: No person shall deliberately or mistakenly discharge, or cause or allow to be discharged into the city storm drain system or watercourses any materials other than stormwater, including, but not limited to, pollutants or waters containing pollutants, whether by direct or indirect connection.

B. Exceptions: The following discharges to the storm drain system shall be exempt from the prohibitions of this section:

1. Discharges regulated under a valid state pollutant discharge elimination system (UPDES) permit, provided that the discharge complies with the terms of the permit.

2. Discharges from water line flushing or other potable water sources.

3. Discharges from sprinkled landscape irrigation or sprinkled lawn watering.

4. Discharges from individual residential vehicle or watercraft washing.

5. Discharges from natural riparian habitat or wetland flows.

6. Discharges from natural groundwater flows directly to a piped storm drain system.

7. Discharges from emergency firefighting activities or emergency management activities.

8. Discharges of dechlorinated water from swimming pools.

9. Discharges from foundation drains, footing drains, or crawl space or basement pumps if the discharges have been approved in writing by the city.

10. Other discharges approved pursuant to a permit issued by the city.

C. Discontinue Discharge: After written notification is mailed, personally delivered or posted, the city may require a responsible person to immediately, or by a specified date, eliminate or discontinue the illicit discharge, and the city, if necessary as the result of an imminent or pending storm event, may take immediate measures to eliminate the source of the illicit discharge. If the discharge is not discontinued in the time specified, the city may take any enforcement measure described in this chapter and steps reasonably necessary to eliminate the source of the illicit discharge or to prevent the reoccurrence of future illicit discharges. (Ord. 10-21, 7-28-2010; amd. Ord. 16-39, 9-21-2016; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-4: USE OF BEST MANAGEMENT PRACTICES:

A. Required: Any person engaged in any land use, activity, business or operations utilizing a storm drain connection, or owning or responsible for the property served by the connection, whether temporary or permanent, including, but not limited to, property owners, developers, builders, tenants, and facility operators, shall employ LID principles and other Best Management Practices and comply with an individualized BMP plan or preapproved BMPs promulgated by the city, to: 1) mimic a site's predevelopment hydrology; and 2) reduce to the maximum extent practicable the discharge of pollutants.

B. Commercial and Industrial Establishments: The owner or operator of a commercial or industrial establishment shall provide, at its own expense, reasonable protection from accidental discharge of pollutants, prohibited materials or other wastes into the storm drain system or watercourses through the use of structural and nonstructural BMPs.

C. Permitted Discharge: Compliance with all terms and conditions of a valid UPDES permit authorizing the discharge of nonstormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section, provided that BMPs shall be part of a stormwater pollution prevention plan as necessary for compliance with requirements of the UPDES permit.

D. City Requirements: The city may adopt requirements identifying appropriate BMPs, and the terms and content of a BMP plan for any land use, activity, business, operation, or facility which may cause or contribute to the discharge of a pollutant to, or contamination of, the storm drain system. If BMPs have been prepared and promulgated by the city, or any federal, state or regional agency, for certain activities, operations, or facilities, every person undertaking such a designated activity or operation, or owning or operating such facility shall comply with relevant BMPs. (Ord. 10-21, 7-28-2010; amd. Ord. 16-39, 9-21-2016; Ord. 17-22, 4-26-2017; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-5: STORM DRAIN MASTER PLAN:

A. Compliance with Master Plan: Stormwater shall be controlled and directed in accordance with the city storm drain master plan to eliminate potential damage and hazards to people and property within the city. (2001 Code § 90-3-101; amd. 2009 Code § 8-11-1; Ord. 10-21, 7-28-2010)

B. Extensions and Connections Generally:

1. Payment of storm drain impact and other fees does not guarantee existence of storm drain lines to the property boundaries where the storm drain connection is to be made and does not relieve the developer, builder or property owner of the responsibility to provide and maintain the necessary storm drain improvements between the property requiring drainage and the nearest defined natural drainage channel or other existing storm drain system improvements. Prior to connecting to the city storm drain system, the developer, builder or property owner shall be required to extend the then existing city system to an appropriate connection location as determined by the city engineer.

2. All storm drain improvements, extensions and connections shall be constructed in accordance with the county flood control master plan, city master plan, standards and specifications.

3. All permits necessary for discharging water into, crossing, or in any other way impacting natural drainage channels, waterways, canals or rivers, shall be issued and submitted to the city engineer prior to final development or connection approval. Documentation may include, but is not limited to, the preparation of a stormwater pollution prevention plan and notice of intent required by the state. (2009 Code § 8-11-3; amd. Ord. 10-21, 7-28-2010)

C. On Site Installations:

1. Prior to connecting to a city-owned storm drain line, the developer, builder or owner of real property shall obtain a connection permit pursuant to this chapter and provide, at its own expense, on site installations capable of handling the stormwater runoff generated by, within and upstream of any real property that is developed, graded or altered in any manner that affects stormwater runoff upon, over, across or from such real property, including, without limitation, the construction of structures or other increase of impervious surface area. At a minimum, LID BMPs (where feasible) and detention shall be provided to meet the stormwater management regulations as outlined in the city's storm drain design standards.

2. Detention requirements may be met by connection to a city storm drain facility for flag lots or subdivisions less than five (5) acres in size, provided that a city storm drain facility exists, additional capacity is available, the city engineer determines that

connection is appropriate, and the city receives payment in an amount determined by the city engineer. (2001 Code § 90-3-102; amd. 2009 Code § 8-11-4; Ord. 10-21, 7-28-2010; Ord. 17-22, 4-26-2017)

D. Temporary Storm Drain Structures:

1. Permitted: The city may allow temporary drainage solutions providing for on site detention or retention that will allow development grading or alteration of property requiring drainage, pending completion of the permanent storm drainage improvements. The temporary solutions shall provide the same level of flood protection at all times that will be provided by the completed systems. All costs of temporary solutions shall be paid by the developer, builder or property owner, in addition to the other costs and fees.

2. Required Facilities Determined by City: The city shall make the determination of the required scope of temporary facilities or improvements prior to the issuance of a building permit or development approval, whichever first occurs.

3. Maintenance: The developer, builder and property owner shall be responsible for maintenance and cleaning of the temporary storm drain facility. This maintenance responsibility shall continue until such time as permanent or alternate facilities are installed and approved by the city. The developer, builder or property owner shall also, if required by the city, file with the city a ten (10) year financial guarantee for maintenance, in a form acceptable to the city, to guarantee proper maintenance of the facility. (2001 Code § 90-3-105; amd. 2009 Code § 8-11-6; Ord. 10-21, 7-28-2010)

E. Off Site Installations:

1. The developer, builder or property owner shall obtain, at its expense, easements as are necessary for the installation of off site storm drain improvements to ensure future access for operation, maintenance, repair and removal. If the storm drain improvements are required by the city to be public improvements and part of the city's storm drain system, a perpetual easement shall also be dedicated to the city authorizing the city to operate, maintain and repair the storm drain facilities so dedicated.

2. Storm drain facilities that are required by the city to be public improvements, and that are dedicated to the city shall become the property of the city upon written acceptance of the city. Only after such acceptance the city shall operate and maintain the facilities or appurtenances. (2001 Code § 90-3-106; amd. 2009 Code § 8-11-7; Ord. 10-21, 7-28-2010)

F. Storm Drain System in New Developments: For all new developments, the developer shall install a storm drain system which is constructed in compliance with the stormwater management regulations and the connection permit as required by this chapter. If the city storm drain master plan shows a pipeline larger than that required to serve the proposed development, the developer shall comply with the master plan. (2001 Code § 87-5-111; amd. 2009 Code § 8-11-8; Ord. 10-21, 7-28-2010; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-6: ILLICIT CONNECTIONS PROHIBITED:

A. Violation: It is a violation of this chapter for any person to make or allow to be made, or use or allow to be used any connection to the city's storm drain system without city approval.

B. Prohibited Connections: The construction, use, maintenance or continued existence of illicit connections to the city's storm drain system is prohibited. This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection. No person shall act, cause, or permit any agent, employee, or contractor to construct, maintain, operate or utilize an illicit connection, or cause, allow or facilitate an illicit discharge. A person is considered to be in violation of this chapter if the person connects a line conveying sewage to the city storm drain system, or allows such a connection to continue.

C. Discontinue Connection: A connection that violates this chapter shall be addressed through a notice of violation and an emergency order issued and processed under title 16 of this code. If, subsequent to eliminating a connection found to be in violation of this chapter, the person can demonstrate that an illicit discharge will no longer occur, said person may request approval to reconnect. The reconnection or reinstallation of the connection shall be at the city's discretion and shall be subject to such conditions as the city may determine; such reconnection or reinstallation shall be at the requesting person's sole expense. (2009 Code § 8-11-2; amd. Ord. 10-21, 7-28-2010; Ord. 12-10, 4-25-2012, eff. 7-1-2012; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-7: CONNECTION PERMIT:

A. Required for New and Modified Connections:

1. It is a violation of this chapter for any person to make or allow to be made a new connection, or to modify or allow to be modified any existing connection to the city's storm drain system without first obtaining a storm drain connection permit from the city.

2. The requirement to obtain a connection permit applies to direct connections to the storm drain system (e.g., a piped connection to a piped portion of the storm drain system) and indirect connections to the storm drain system (e.g., overland discharges to any part of the storm drain system). The approval of the long term connection is different than a land disturbance permit issued pursuant to title 11 of this code.

3. Connections from a detached single-family residence are exempt, provided that the runoff from the residence is handled according to a plat or site plan approved by the city. However, any person desiring to install a basement pump, foundation drain, or other related fixture directly or indirectly connecting to the storm drain system must obtain a connection permit.

4. The connection permit shall run with the land and shall be binding on the original property owners, applicants, and their respective heirs, successors, and assigns. The city may, in the city's sole discretion, record the connection permit or notice thereof at the office of the county recorder.

5. Connections made by the city are exempt from the connection permit requirement.

B. Timing: Any person beginning any type of construction requiring a building permit shall obtain a storm drain connection permit before or concurrent with the building permit. If site plan or subdivision approval is sought, the application for a storm drain

connection permit shall be submitted with the earlier of the submittal for final site plan or final subdivision approval and shall be issued prior to or concurrent with the final approval.

C. Requirements of Connection Permit Application:

1. Required: Each person desiring to connect to the city's storm drain system or to modify an existing connection shall submit an application to the city for a storm drain connection permit.

2. BMP Plan: A Best Management Practices plan shall be submitted with the application and shall designate specific BMPs that the applicant will use to regulate, control, and facilitate discharges as specified in the city's storm drain design standards. The BMP plan shall be incorporated in the connection permit. All BMP plans shall provide for pretreatment of discharge unless the applicant demonstrates to the satisfaction of the city that pretreatment is not necessary because of: a) lack of potential pollutants in the discharge from the site, and b) insufficient quantity of discharge from the site.

a. The BMPs shall be designed to ensure that the quality and quantity discharge to the city's storm drain system meet the stormwater management regulations. The BMPs shall ensure that the quality of receiving water is not degraded by stormwater runoff and that the quantity of discharge does not exceed the designed capacity, or jeopardize the integrity of the storm drain system.

b. The BMPs may be structural or nonstructural, depending on the needs of the site. The proposed BMPs shall be designed specifically for a given site; provided that, if the city has established preapproved BMPs, the preapproved BMPs shall be used.

c. City shall not issue a storm drain connection permit until the BMP plan has been submitted to and accepted by the city.

3. Maintenance Plan: For storm drain improvements and postconstruction BMPs located on private property and not dedicated to the city, a maintenance plan shall be submitted to the city outlining how the storm drain improvements and postconstruction BMPs will be maintained to ensure the upkeep of the connection and on site storm drain improvements. The maintenance plan shall be incorporated in the connection permit. Provisions for the periodic review and evaluation of the effectiveness of the maintenance program and the need for revisions or additional maintenance procedures shall be included in the plan and shall be part of the connection permit. At a minimum, the maintenance plan shall contain the following provisions:

a. The name(s) of the owner(s) for all components of the storm drain facilities;

b. The name(s) and address(es) of the person or persons responsible for maintenance;

c. The person(s) responsible for financing maintenance and emergency repairs;

d. A maintenance schedule and record keeping requirements for all storm drain improvements and postconstruction BMPs, including, but not limited to, swales, separators, pipes and ponds;

e. A list of easements with the purpose and location of each; and

f. The signature(s) of the property owner(s).

4. Engineering Plans: Engineering plans, stamped by an engineer registered in the State of Utah, shall be submitted to the city showing permanent storm drain improvements and the connection to the city system. City shall not issue a connection permit until the plans are submitted to the city, city comments have been addressed, and the city has accepted the engineering plans.

5. Fees: The applicant for a connection permit shall pay a fee as adopted by resolution of the city council.

D. Approval of Connection Permit: When deciding whether to approve, conditionally approve, or not approve a connection permit, the following factors may be considered:

1. Connection will only be allowed for stormwater, surface drainage, subsurface drainage, groundwater, irrigation tail water, roof runoff and cooling water. Such water may be discharged only into the storm drain system that has adequate capacity for the accommodation of such water. Such discharged water shall comply with the stormwater management regulations.

2. Whether the requested connection complies with the stormwater management regulations.

3. Whether the requested connection complies with the storm drain master plan.

4. Whether the BMP plan, maintenance plan, and engineering plans have been submitted, city comments have been addressed, and city has accepted the plans.

5. Whether the proposed connection introduces or will potentially introduce pollutants into the storm drain system.

6. Whether the proposed connection creates a safety hazard.

7. Whether the proposed connection affects the integrity of the storm drain system infrastructure.

8. Whether the proposed connection endangers the city's drinking water.

E. Compliance with Plans: Failure to construct or maintain the stormwater improvements in accordance with the accepted plans (including the BMP plan, the maintenance plan, and engineering plans) shall be a violation of the connection permit and this chapter.

F. As Builts: Any person connecting to the storm drain system shall provide "as built" plans showing the details and the location of the connection. The plans shall be in a format that is acceptable to the city engineer. (Ord. 10-21, 7-28-2010; amd. Ord. 17-22, 4-26-2017; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-8: POSTCONSTRUCTION BMPs:

A. Condition of Connection Permit: It shall be a condition of each connection permit and continued use of any connection to the city's system, whether by permit or other approval, that long term maintenance of all privately-owned structural and nonstructural

postconstruction BMPs be continued after construction.

B. Annual Postconstruction BMP Certification: It shall be a condition of continued operation and use of any new or existing connection to the city's storm drain system that annual certification be provided to the city of privately-owned postconstruction BMPs, including, but not limited to, inspection, maintenance, repair and cleaning sufficient to maintain the integrity of the storm drain system. Each structural BMP shall be cleaned a minimum of once per year or more frequently as required. If cleaning does not occur, the city may perform the cleaning on behalf of the responsible person, and the responsible person shall reimburse the city actual costs of such performance.

C. Records: Records of maintenance activities performed on all BMPs shall be kept by the responsible person for not less than three (3) years. These records shall be made available to the city upon written or verbal request. If cleaning is not performed in accordance with this section, the city may perform the cleaning on behalf of the responsible person, and the responsible person shall reimburse the city actual costs of such performance.

D. Design and Planning: The design and planning of all stormwater management facilities and BMPs shall include detailed maintenance and repair procedures to ensure their continued functioning. These procedures shall identify the parts and components of the stormwater management facilities and BMPs that need to be maintained, and the equipment, skills and training necessary. The current and future responsible persons, including, but not limited to, all subsequent owners of property on which such measures have been taken, shall maintain all temporary and permanent measures.

E. Abatement: In the event of failure to adequately maintain temporary or permanent BMPs, the city may authorize completion of all temporary and permanent BMPs. The responsible person shall be liable to the city for all costs and expenses that may be incurred or expended by the city in bringing the property into compliance with the stormwater management regulations. The responsible person shall further be liable to the city for any collection costs, including legal fees, incurred by the city. The city may recover these costs through appropriate legal action.

F. Requirements: Maintenance and repair requirements may include, but not be limited to, the following:

1. Removal of silt, litter and other debris from all catch basins, inlets and drainage pipes;

2. Grass cutting and vegetation removal; and

3. Replacement of landscape vegetation. (Ord. 10-21, 7-28-2010; amd. Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-9: INDUSTRIAL AND CONSTRUCTION ACTIVITY DISCHARGES:

A. Compliance with Permit: Any person subject to a permit issued under UPDES or the city's land disturbance ordinance shall comply with all provisions of such permit. Proof of compliance may be required in a form acceptable to the city prior to allowing any new or continued discharge to the city's storm drain system.

B. Accidental Discharge:

1. Training: The responsible person shall train personnel, maintain records of training and maintain notification procedures to assure that immediate notification is provided to the city upon becoming aware of any suspected, confirmed or unconfirmed release of material, pollutants or waste that may enter the storm drain system.

2. Containment: As soon as any responsible person, or other person responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illicit discharges or pollutants entering the storm drain system, or waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release.

3. Notification Required: The responsible person or person responsible for emergency response shall immediately notify emergency response agencies of any release of hazardous materials via emergency dispatch services. In the event of a release of nonhazardous materials, the responsible person or person responsible for emergency response shall notify the city in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the city within three (3) business days of the phone notice. If the illicit discharge emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three (3) years.

4. Effect on Other Requirements: The notification shall be in addition to any other notification requirements set forth in federal, state and local regulations and laws.

5. Additional BMPs: The city may require implementation, at the expense of the responsible person, of additional structural and nonstructural BMPs to prevent the further discharge of pollutants to the storm drain system. (Ord. 10-21, 7-28-2010; amd. Ord. 16-39, 9-21-2016; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-10: WATERCOURSE PROTECTION:

A. Property Near Watercourses: Every person owning property through which a watercourse passes shall comply with applicable stormwater management regulations including, but not limited to, keeping and maintaining that part of the watercourse within the property free of trash, debris, excessive vegetation, silt and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner shall maintain existing privately-owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

B. Alteration Prohibited: Except as performed in strict accordance with written city approval, no person shall block or modify the natural flow of water in the city's storm drain system or alter, enlarge, change or remove any part of the city's storm drain system. (Ord. 10-21, 7-28-2010; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-11: PROHIBITED OBSTRUCTIONS:

A. Unlawful Obstructions: It is unlawful for any person to:

1. Obstruct the flow of water in the storm drain system.

2. Contribute to the obstruction of the flow of water in the storm drain system.

3. Cover or obstruct any drain inlet, except that drain inlets may be temporarily obstructed in emergency situations in order to prevent contaminants from entering the storm drain system.

B. Exceptions: The following obstructions are exempt from the prohibitions of this section:

1. Street and storm drain improvement projects authorized by the city.

2. Flood control and prevention activities performed by the city.

3. Obstructions approved by the city as part of a site's stormwater drainage plan. (Ord. 10-21, 7-28-2010)

8-11-12: INSPECTIONS, TESTING AND MONITORING:

A. Inspections: All new and existing stormwater management facilities shall be subject to periodic inspection by the city to document maintenance and repair needs and to ensure compliance with the stormwater management regulations.

B. Compliance Assessments: The city may inspect property for the purpose of verifying compliance with this chapter, including, but not limited to, the following:

1. Identifying products produced, processes conducted, chemicals used and materials stored on or contained within the property;

2. Identifying point(s) of discharge of all wastewater, process water systems and pollutants;

3. Investigating the natural slope at the location, including drainage patterns and manmade conveyance systems (including roads with drainage systems, catch basins, curbs, gutters, channels and storm drains);

4. Establishing the location of all points of discharge from the property, whether by surface runoff or through a storm drain system;

5. Locating any illicit connection or the source of any illicit discharge;

6. Evaluating compliance with any stormwater pollution control plan;

7. Evaluating compliance with any permit issued pursuant to this chapter.

C. Records Review: The city may demand the production of such records as necessary to determine compliance with the provisions of this chapter and for the purpose of examination and copying.

D. Sample and Test:

1. For the purpose of determining the potential for contribution of pollutants to the storm drain system, the city may inspect, sample and test any of the following: area runoff; soils within the source property; liquids, discharge, or materials within any storage area (including any container contents); and treatment system discharge.

2. The city may investigate the structural integrity and condition of all new and existing storm drains, sanitary sewer facilities/systems or other tanks, reservoirs or pipelines on the property using appropriate tests, including, but not limited to, smoke and dye tests and video surveys. The city's authorized representative may take photographs or videotape, make measurements or drawings, and create any other record reasonably necessary to document conditions on the property.

3. The responsible person shall provide copies of test results to the city and, on submission of a written request to the city, be entitled to a copy of the test results conducted by the city.

E. Monitoring:

1. For the purpose of measuring any discharge or potential source of discharge to the storm drain system, the city may undertake a monitoring program and other analysis, which may include both the installation and maintenance of monitoring devices.

2. Whenever the city determines that there is any illicit discharge to the storm drain system, the city may, by written notice, order that the responsible person undertake such monitoring activities or analyses and furnish such reports as the city may recommend. The written notice shall be served either in person or by certified or registered mail, return receipt requested, and shall set forth the basis for such order and shall particularly describe the monitoring activities and analyses and reports required. The responsible person shall be responsible for the costs of these activities, analysis and reports. The recipient of such order shall undertake and provide the monitoring, analyses and reports within the time frames set forth in the order.

3. In the event that a responsible person fails to conduct the monitoring and analyses and furnish the reports required by the order in the time frames set forth therein, the city may cause such monitoring and analyses to occur and assess all costs incurred, including reasonable administrative costs and attorney fees, to the responsible person. The city may pursue judicial action to enforce the order and recover all costs incurred.

F. Right to Enter to Inspect, Monitor and Test:

1. New Facility or Connection: When any new stormwater management facility is installed on private property, or when any new connection is made between private property and the city's storm drain system, the property owner shall grant to the city the right to enter the private property at reasonable times and in a reasonable manner for the purpose of inspection. This includes the right to enter the property for compliance assessments and when the city has a reasonable basis to believe that a violation of this chapter is

occurring or has occurred and to enter when necessary for abatement of a public nuisance or correction of a violation of this chapter.

2. Notice of Entry: Upon presenting identification and an oral request to enter made to any person who appears to be in possession or control of any operation, business or real property, or where no such person is present, after a written request to enter is mailed, personally delivered, or faxed to a responsible person, the city has the right to, and is hereby granted the power and right to, enter onto the exterior/out of doors (or areas not being within a fully enclosed structure) of private property within the city solely for the purpose to inspect, monitor or investigate the possible or potential source of an illicit discharge to the storm drain system or watercourses. Except for occupied residential property, such right to enter shall be exercisable at any time. For an occupied residential property, such entry shall be made only during daylight hours.

3. Industrial Activity: The city shall be permitted to enter and inspect facilities as often as may be necessary to determine compliance with this chapter. If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the city. Facility operators shall allow the city ready access to all parts of the premises for the purpose of inspection, sampling, examination and copying of records that must be kept under the conditions of a UPDES permit, and the performance of any additional duties as defined by state and federal law.

4. Unreasonable Delays: Unreasonable delays in allowing the city access to a permitted facility is a violation of any storm drain connection permit and this chapter. A person who is the operator of a facility with a UPDES permit associated with industrial activity is in violation of this chapter if the person denies the city reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this chapter.

5. Obstructions: Any temporary or permanent obstruction to safe and easy access to the facility to be inspected or sampled shall be promptly removed by the operator at the written or oral request of the city and shall not be replaced. The costs of clearing such access shall be borne by the operator.

6. Search Warrants: If the city has been refused access to a building, structure, property or any part thereof, and is able to demonstrate probable cause to believe that there may be a violation of this chapter, or that there is a need to inspect, monitor or sample as part of a routine inspection and sampling program of the city designed to verify compliance with this chapter or any permit or order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the city may seek issuance of an administrative inspection or criminal search warrant from any court of competent jurisdiction.

G. Correction of Deficiencies: Any maintenance and repair deficiencies shall be corrected within such time period as is determined to be reasonable by the city, and the inspection and maintenance requirements may be increased as deemed necessary to ensure proper functioning of the stormwater management facility. Additional inspections may be required as determined to be appropriate by the city. (Ord. 10-21, 7-28-2010; amd. Ord. 16-39, 9-21-2016; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

8-11-13: ENFORCEMENT:

A. Remedies: This chapter may be enforced by administrative enforcement under title 16 of this Code or criminal actions as provided by law. The city has sole discretion to decide whether to proceed administratively or through criminal process, or both, for a violation. If the city chooses to pursue both administrative and criminal enforcement for the same violation, no court imposed civil penalties may be assessed, but all other remedies are available.

B. Violations Deemed a Public Nuisance: In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this chapter is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the responsible person's expense through an administrative enforcement process, or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

C. Notice of Violation: Whenever an enforcement official finds that there has been a violation or failure to meet a requirement of this chapter, the enforcement official may order compliance by written notice of violation to the responsible person.

1. Such notice may require without limitation: a) the performance of monitoring, analyses, and reporting; b) the elimination of illicit connections or discharges; c) that violating discharges, practices, or operations shall cease and desist; d) the abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property; and e) the implementation of source control or treatment BMPs.

2. If abatement of a violation or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the responsible person fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the responsible person.

3. Failure to comply with an emergency order and/or a notice of violation shall constitute a separate violation.

D. Cease and Desist Order: Whenever an administrative hearing officer finds that there has been a violation or failure to meet a requirement of this chapter, or the administrative hearing officer determines that a responsible person's past violations are likely to recur, the administrative hearing officer may order the responsible person to cease and desist all such violations and direct the responsible party to:

1. Immediately comply with all requirements; and

2. Take such appropriate remedial or preventive action as may be needed to properly address a continuing or threatened violation, including halting operations, implementing additional BMPs, and terminating the discharge.

Issuance of a cease and desist order shall not be a prerequisite to taking any other action against the responsible party.

E. Criminal Prosecution: The violation of any of the provisions of this chapter shall be a Class C misdemeanor. Each day that a

violation occurs shall constitute a separate offense.

F. Additional Sanctions Against Corporation or Association:

1. When a corporation or association is found to have violated any of the provisions of this chapter, the administrative hearing officer or court may, in addition to or in lieu of imposing other authorized penalties, require the corporation or association to give appropriate publicity of the conviction by notice to the class or classes of persons or sections of the public interested in or affected by the conviction, by advertising in designated areas, or by designated media or otherwise.

2. When an executive or high managerial officer of a corporation or association is found to have violated any of the provisions of this chapter, committed in furtherance of the affairs of the corporation or association, the administrative hearing officer or court may disqualify him or her from exercising similar functions in the same or other corporations or associations for a period not exceeding five (5) years if it finds the scope or willfulness of his illegal actions make it dangerous or inadvisable for such functions to be entrusted to him.

G. Cost of Abatement: After abatement of a violation, the property owner will be notified of the cost of abatement, including administrative costs. The property owner may file a written protest objecting to the amount of the assessment as provided in title 16 of this code. If the amount due is not paid within a timely manner as determined by the city or by the expiration of the time provided in which to challenge the cost assessment, the cost assessment shall be processed as a lien against the property for the amount of the assessment.

H. Cost of Enforcement: The city may recover all attorney fees, court costs and other expenses associated with enforcement of this chapter, including sampling and monitoring costs.

I. Injunctive Relief: It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this chapter. If a person has violated or continues to violate the provisions of this chapter, the city may petition for a preliminary or permanent injunction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

J. Emergency Suspensions: The city administrator or designee may order the immediate suspension or shutoff of a responsible person's discharge or storm drain system access according to the provisions of title 16, chapter 2, article B of this code whenever such suspension or shutoff is necessary in order to stop an actual or threatened discharge which reasonably appears or presents or causes a risk of an imminent or substantial:

1. Damage to the storm drain system or harm to the receiving waters;

2. Endangerment to the health, safety or welfare of any residents served by the storm drain system;

3. Interference with the operation of the storm drain system;

4. Violation of the UPDES permit number UTS000001;

5. Endangerment to the environment.

Any responsible person notified of a suspension of its discharge privilege shall immediately stop or eliminate its contribution or discharge. In the event of a responsible person's failure to immediately comply voluntarily with the suspension order, the authorized enforcement official may take such steps as deemed necessary, including immediate severance of the storm drain system connection, to enforce such order. The authorized enforcement official shall allow the responsible person to recommence its discharge when the responsible person has demonstrated to the satisfaction of the authorized enforcement official that the period of endangerment has passed, unless the termination proceedings set forth in subsection K of this section are initiated against the responsible person. A responsible person that is responsible in whole or in part, for any discharge presenting imminent endangerment, shall submit to the city administrator a detailed written statement describing the cause of the harmful contribution and the measures taken to prevent any future occurrence, prior to the date of any termination of discharge hearing under subsection K of this section. Nothing in this section shall be interpreted as requiring a hearing prior to any emergency suspension under this section.

K. Revocation of Storm Drain Connection Permit: Violation by the holder of a storm drain connection permit of any of the provisions thereof, or any of the provisions of this chapter, shall be grounds for termination and revocation of such permit by the city. Such termination or revocation shall be processed through the procedures of title 16 of this code.

L. Removal of Obstructions: In addition to any penalties which may be imposed pursuant to this chapter, the city may do the following:

1. Remove any prohibited obstructions and also, any pipelines or other devices installed in violation of the provisions of this chapter.

2. Bring an action for the abatement of the nuisance caused by the offending installation and for the recovery of the city's costs and expenses incurred in removing the offending installation pursuant to this section.

M. Remedies Not Exclusive: The remedies listed in this chapter are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the city to seek cumulative remedies. (Ord. 10-21, 7-28-2010; Ord. 12-10, 4-25-2012, eff. 7-1-2012; Ord. 19-48, 12-11-2019, Effective at 12 noon on January 6, 2020)

APPENDIX B

WATER QUALITY REPORT FORM

STORM WATER QUALITY REPORT

Date: _____
Project Name: _____
Project ID: _____
Design Engineer: _____

Is the project within a watershed that is 303(d) listed?

If yes:

Name of Receiving Water(s): _____

Listed Impairment(s): _____

Does the watershed have an approved TMDL?

If yes:

Approved TMDL(s): _____

I have reviewed the storm water quality design and find this report to be complete, accurate, and current.

_____
(Name), Project Manager

_____
(Name), Permittee's Designated Storm Water Coordinator

(PE stamp required)

_____
(Name), Permittee's Head of Maintenance

Project Information

Type of Project (New Development, Redevelopment): _____

Area of Land Disturbance (acre): _____

Project Impervious Area (acre): _____

Project Imperviousness (%): _____

Project Runoff Coefficient, R_v: _____

90th Percentile Storm Depth (in): _____

Project 90th Percentile Volume, V_{goal}(cf): _____

Groundwater Information

Depth to Groundwater (ft): _____

Historical High Depth to Groundwater, if known (ft): _____

Source: _____

Soil Information

Infiltration Rate (in/hr): _____

Source: _____

LID Drainage Areas

(add additional rows as needed)

Contributing Drainage Area	Area (acre)	Impervious Area (acre)	Imperviousness (%)	Runoff Coefficient, R_v	Water Quality Volume WQV (cf)
				Total WQV (cf)	

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LID BMP Design

(add additional rows as needed)

Contributing Drainage Area	LID BMP Type	Water Quality Volume WQV (cf)	Runoff Retained (cf)	Percent of Runoff Captured (%)
Total Volume Retained (cf)				

Percent of V_{goal} captured by LID BMPs: _____%

If 100% of V_{gpal} is not captured, document and provide narrative of technical infeasibilities and/or alternate compliance measures below:

_____

_____

_____

_____

Describe additional storm water quality measures incorporated into the site:

_____

_____

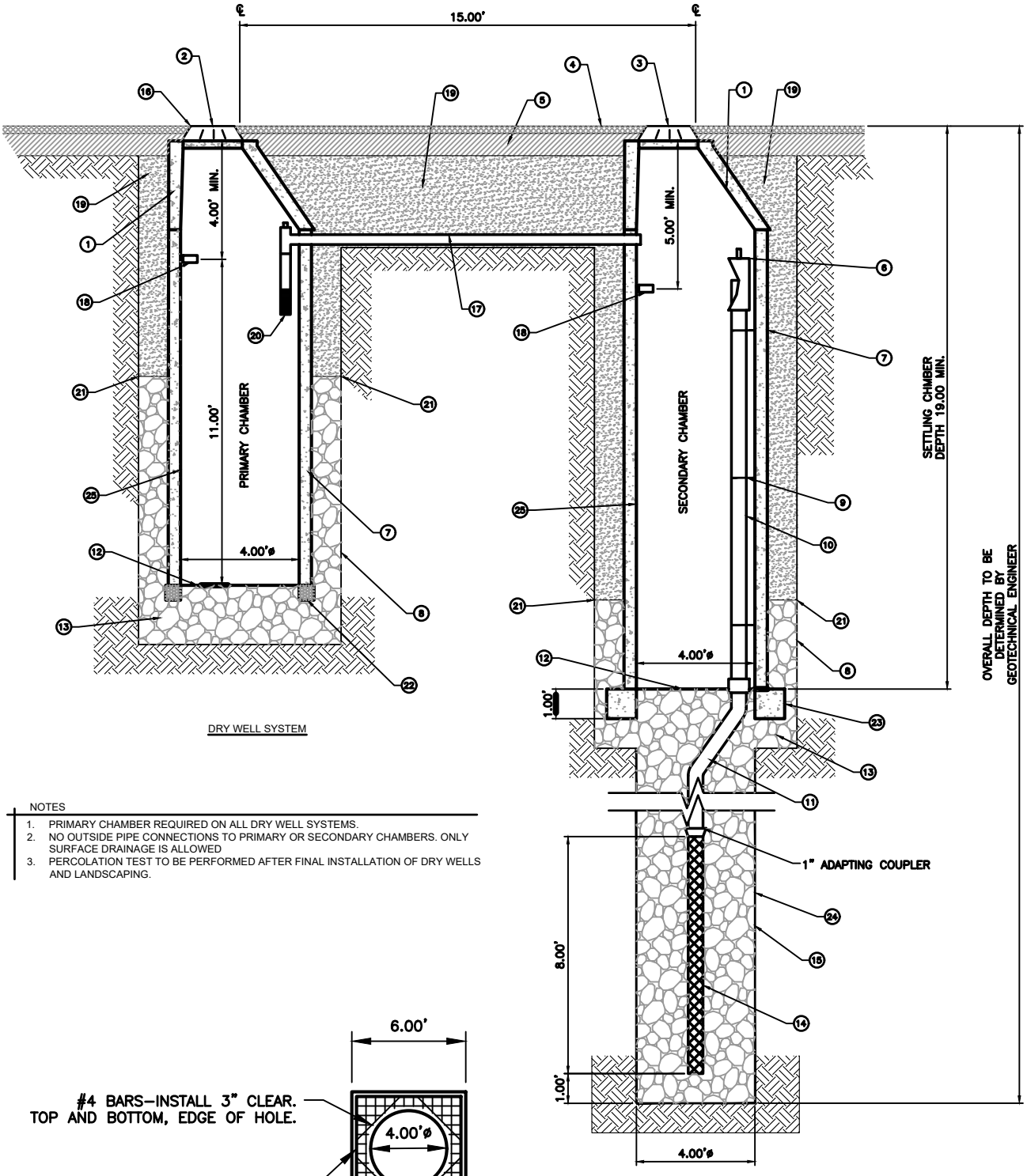
_____

_____

APPENDIX C

LID BMP DETAILS

Appendix C: LID BMP Standard Details



DRY WELL SYSTEM

NOTES

1. PRIMARY CHAMBER REQUIRED ON ALL DRY WELL SYSTEMS.
2. NO OUTSIDE PIPE CONNECTIONS TO PRIMARY OR SECONDARY CHAMBERS. ONLY SURFACE DRAINAGE IS ALLOWED
3. PERCOLATION TEST TO BE PERFORMED AFTER FINAL INSTALLATION OF DRY WELLS AND LANDSCAPING.

CONCRETE FOOTING

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11/6/19		DTJ	DTJ
			DATE
			11/19

DRYWELL

STANDARD DRAWING
LID 1.1

KEYED NOTES

1. MODIFIED FLAT-BOTTOM MANHOLE CONE
2. MIN. 30" DIA BOLTED CAST IRON RING AND GRATE
3. MIN. 30" DIA BOLTED CAST IRON RING AND SOLID STORM DRAIN COVER
4. GRADED BASIN, CITY VAC TRUCK ACCESS TO BE PROVIDED AT A MIN HORIZONTAL DISTANCE OF 15' AND NO MORE THAN 8% INCLINE FROM EACH MANHOLE LID
5. COMPACTED BASE MATERIAL
6. DEBRIS SHIELD: ROLLED 16 GA X 24" LENGTH W/ VENTED ANTI-SIPHON AND INTERNAL 0.265" MAX SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH, FUSION BONDED EPOXY COATED.
7. PRECAST CONCRETE LINER, 4000 PSI 48" I.D. AND 54" O.D., CENTER IN HOLE
8. MIN. 6' DIA DRILLED SHAFT.
9. SUPPORT BRACKET (TYP), FORMED 12 GA STEEL, FUSION BONDED EPOXY COATED
10. 6" DIA SCH 40PVC OVERFLOW PIPE
11. 6" DIA CORRUGATED HDPE, NO PERFORATIONS BELOW SETTLING CHAMBER
12. NON-WOVEN GEOTEXTILE FABRIC MIRFI 140 NL OR APPROVED EQUAL, PLACED AFTER OVERFLOW PIPE HAS BEEN INSTALLED
13. 3/8" TO 1-1/2" WASHED ROCK
14. DRAINAGE SCREEN: SCH 40 PVC 0.12" SLOTTED WELL SCREEN 32 SLOTS PER ROW/FT
15. MIN. 4' DRILLED SHAFT
16. FABRIC SEAL, UV RESISTANT GEOTEXTILE. COVER GRATE UNTIL PAVING AND OR LANDSCAPING IS COMPLETE.
17. 4" DIA SCH 40 PVC CONNECTOR PIPE W/ VENTED ANTI-SIPHON INTAKE & FLOW REGULATOR, PIPE TO BE FULLY CAPPED UNTIL BASIN FULLY VEGETATED OR AS APPROVED BY CITY ENGINEER.
18. ABSORBANT - HYDROPHOBIC IMBIBER PILLOW, MIN. 4 QUART CAPACITY.
19. 1 SACK SLURRY IN ANNLAR SPACE AROUND CHAMBERS.
20. INTAKE SCREEN, SCH 40 PVC 0.12" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. 48" OVERALL LENGTH WITH TRI-C END CAP.
21. 6 MIL PLASTIC LINER WATER STOP.
22. 6" X 6" CONCRETE FOOTING.
23. 6' X 6' X 1' CONCRETE FOOTING (SEE DETAIL, THIS SHEET) OR AS APPROVED BY CITY ENGINEER.
24. NON-WOVEN GEOTEXTILE SLEEVE, MIRAFI TM/ 140 NL. MIN 6' DIA, HELD APPROX 15' OFF THE BOTTOM OF EXCAVATION.
25. 8 FT MIN "FOOT RULER" INSTALLED FROM FINISHED FLOOR OF CHAMBER

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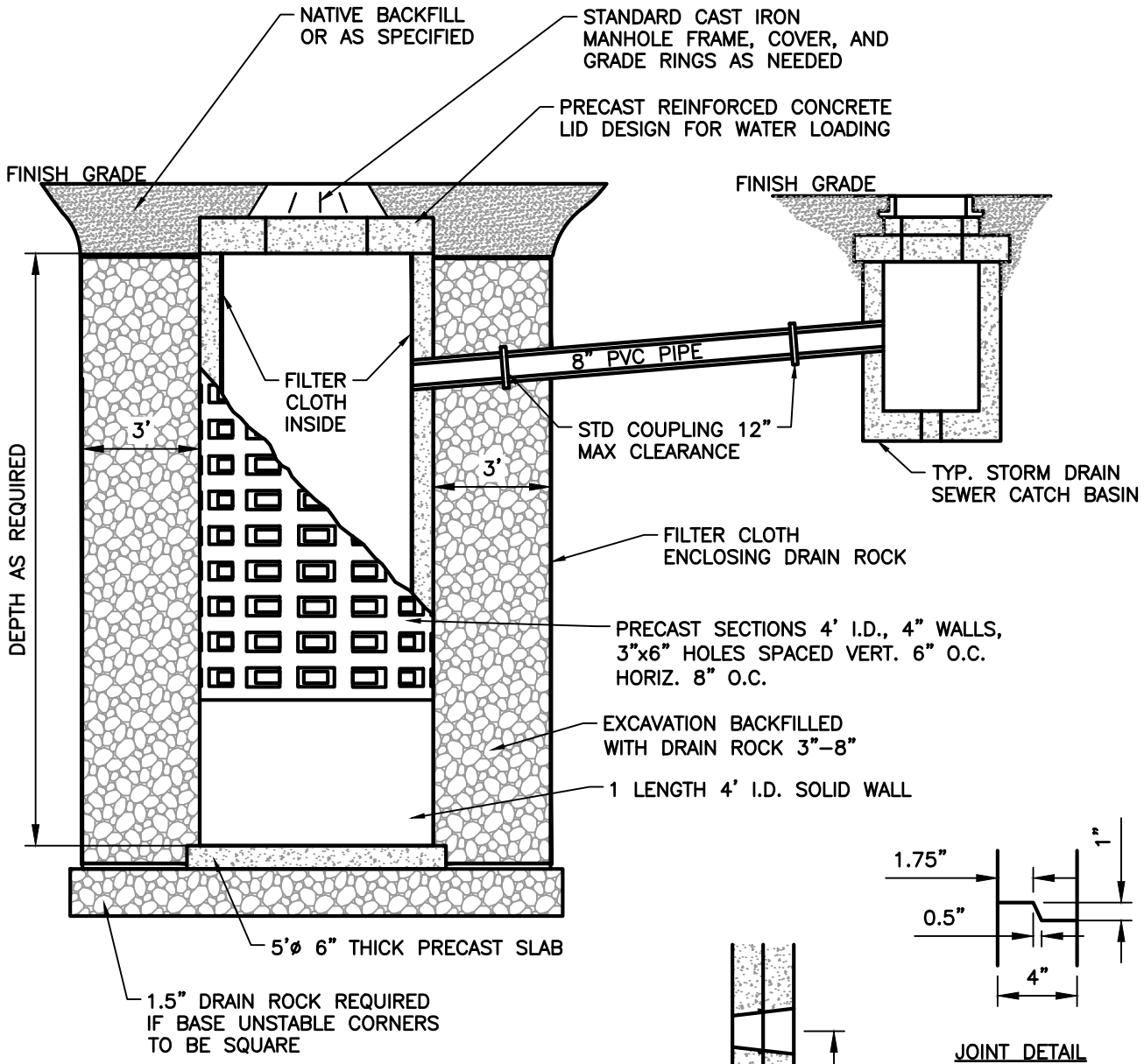
DRAWN: DTJ

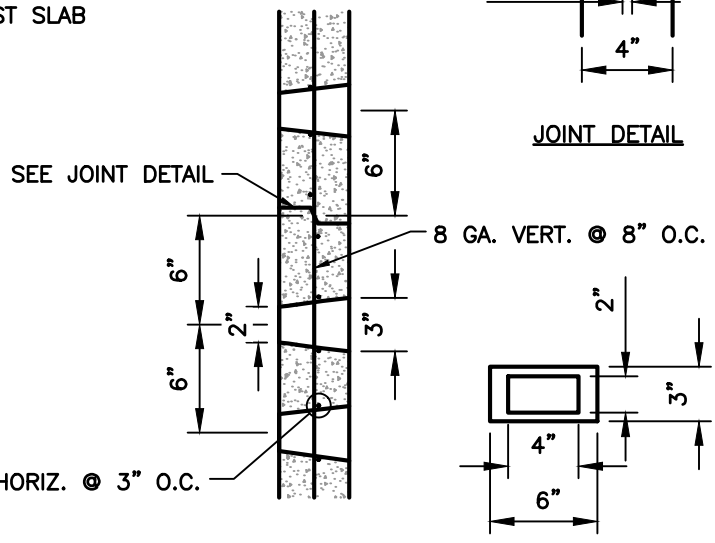
DATE 11/19

DRYWELL

STANDARD DRAWING
LID 1.2



JOINT DETAIL



SECTION – BARREL

NOTES:

1. FILTER CLOTH TO BE TEXEL MODEL 7609 OR EQUAL
2. SIZE OF EXCAVATION AND VOLUME OF DRAIN ROCK TO BE DETERMINED

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PREPARED BY: _____

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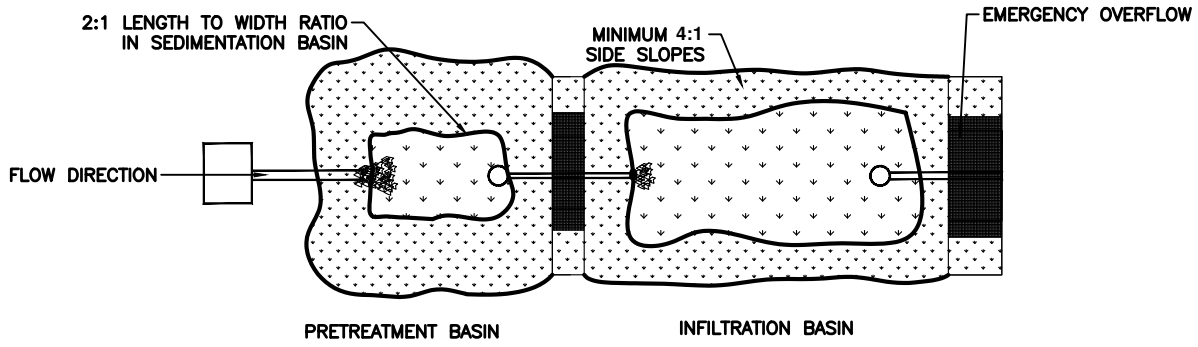
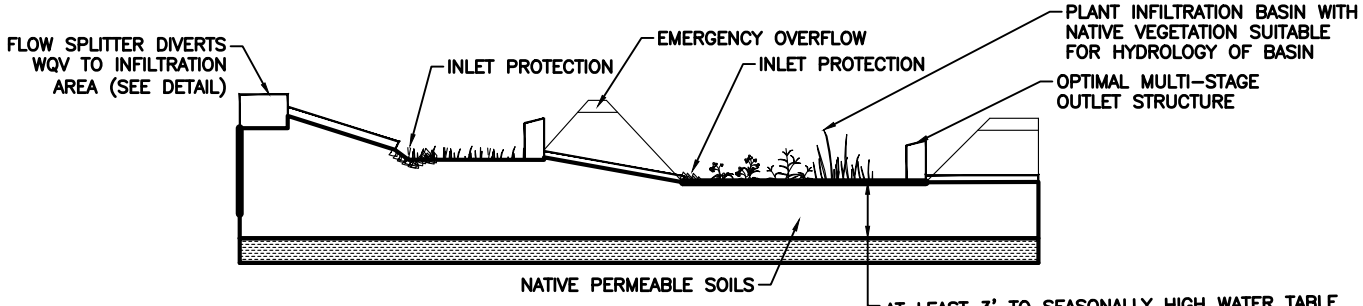
			11/19

DRAINAGE DRYWELL

STANDARD DRAWING
LID 2



PLAN



ELEVATION

CONSTRUCTION SEQUENCING:

1. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
3. ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPS MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
6. SEED AND MULCH DISTURBED AREAS ON SITE.
7. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
8. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPS INTO CONSIDERATION.
9. FINAL GRADE THE SITE.
10. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
11. INSTALL THE EROSION CONTROL BLANKET.
12. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

GENERAL NOTES:

1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
3. IF THE STORMWATER BMP IS BEING DESIGNED TO SERVE AS A TEMPORARY SEDIMENT BASIN, GRADE THE BMP TO WITHIN THREE (3) FEET OF FINAL GRADE TO PROTECT THE UNDERLYING MATERIAL FROM CLOGGING. ONCE CONSTRUCTION IN THE CONTRIBUTING DRAINAGE AREA HAS BEEN COMPLETED AND THE SITE IS STABILIZED, EXCAVATE THE INFILTRATION BASIN TO FINAL GRADE AND COMPLETE CONSTRUCTION OF THE BMP.
4. GRADING OF THE INFILTRATION BASIN SHALL BE ACCOMPLISHED USING LOW-IMPACT EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF THE UNDERLYING SOILS. SMALL TRACKED DOZERS AND BOBCATS WITH RUNNER TRACKS ARE RECOMMENDED.
5. EXCAVATE THE INFILTRATION BASIN TO THE SPECIFIED DEPTH (ELEVATION). IT IS RECOMMENDED THAT ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
6. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
7. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE BASIN PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. SEDIMENT THAT HAS BEEN WASHED INTO THE BASIN DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
8. SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.
9. INFILTRATION AREA SHALL BE STAKED OFF DURING CONSTRUCTION TO RESTRICT HEAVY EQUIPMENT TRAFFIC FROM COMPACTING NATIVE SOILS.

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PREPARED BY:_____

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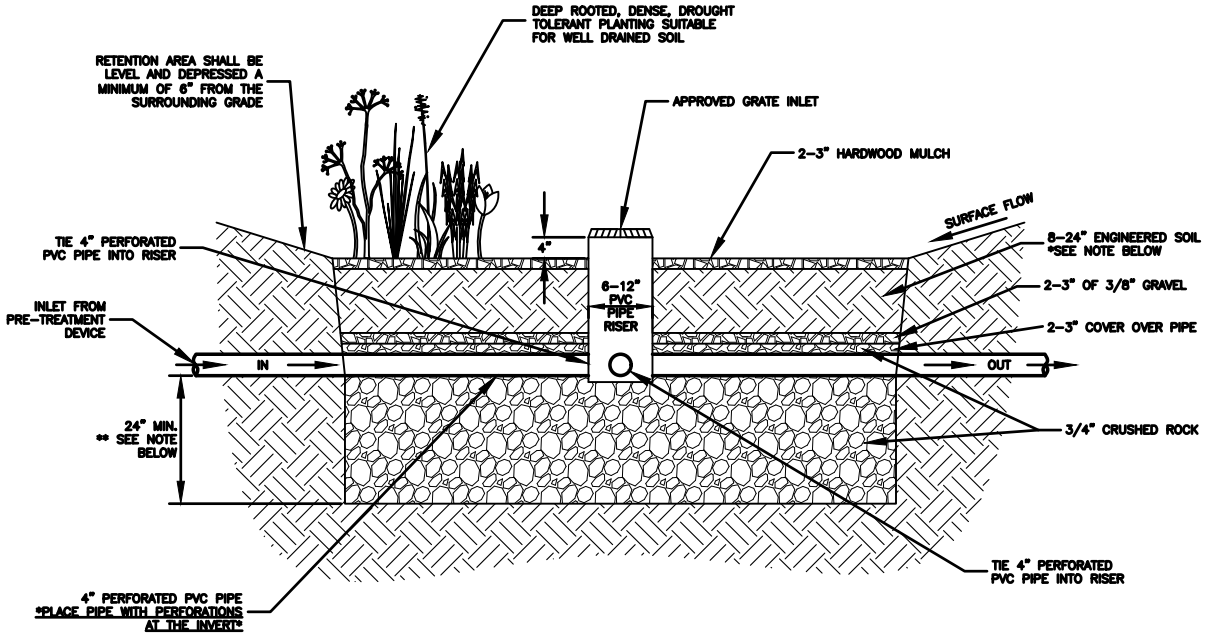
DATE	REVISIONS	BY	DRAWN: DTJ	INFILTRATION BASIN PLAN & PROFILE	STANDARD DRAWING LID 3
11/6/19		DTJ	DATE 11/19		



NOTES:

1. *BIORETENTION "ENGINEERED SOIL" LAYER SHALL BE MINIMUM 8" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOOD MULCH, AND 20-30% TOPSOIL.

2. **3/4" CRUSHED ROCK LAYER SHALL BE A MINIMUM OF 24" BUT MAY BE DEEPENED TO INCREASE THE INFILTRATION AND STORAGE ABILITY OF THE BASIN.

WEST JORDAN UTAH

PREPARED BY:_____

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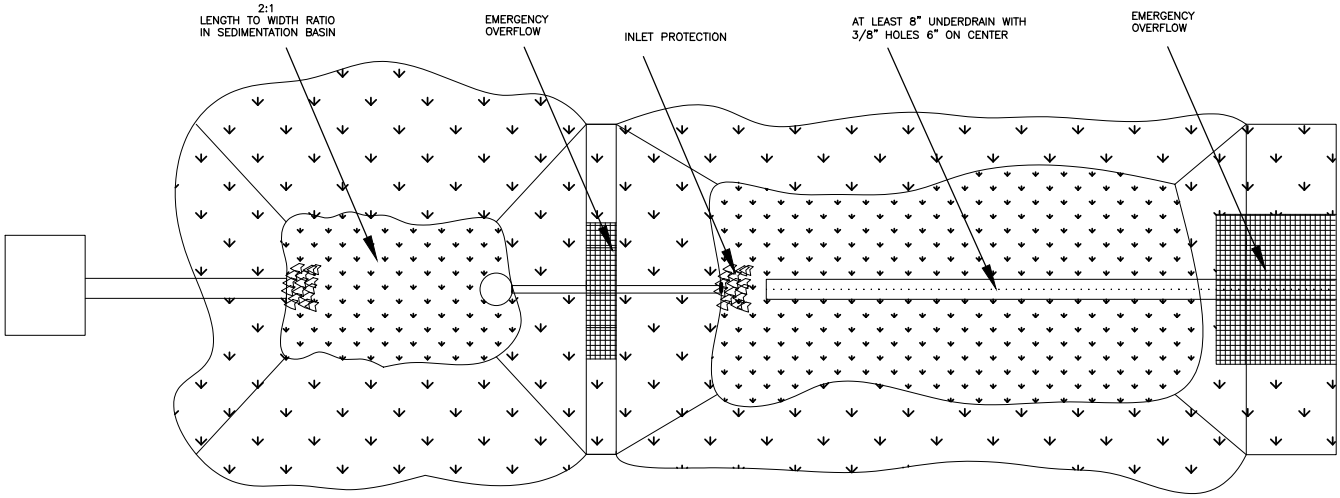
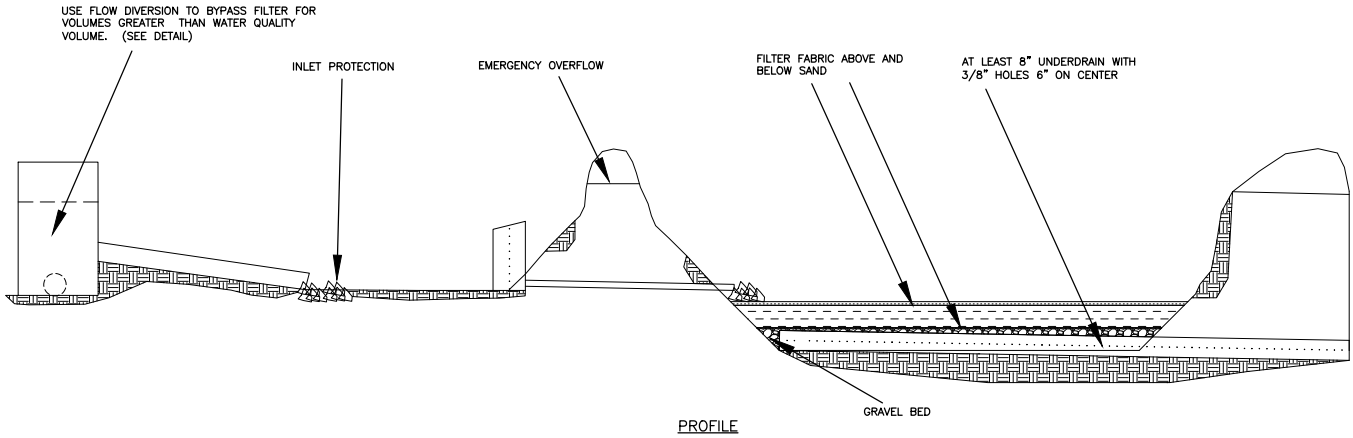
DATE	REVISIONS	BY	DRAWN: DTJ	INFILTRATION BASIN WITH BIOFILTER	STANDARD DRAWING LID 4
11/6/19		DTJ	DATE 11/19		



PLAN



PROFILE

GENERAL NOTES:

1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
3. EXCAVATE THE INFILTRATION BASIN TO THE SPECIFIED DEPTH (ELEVATION). IT IS RECOMMENDED THAT ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
4. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE BASIN PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. SEDIMENT THAT HAS BEEN WASHED INTO THE BASIN DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
6. NON-STANDARD COMPONENT: CLEAN, WASHED 1.5 TO 3.5-INCH GRAVEL SHALL BE PLACED IN THE BOTTOM OF THE BASIN TO THE DEPTH OF AT LEAST 12 INCHES OR AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS. GRAVEL SHOULD BE PLACED IN LIFTS AND LIGHTLY COMPACTED WITH PLATE COMPACTORS.
7. NON-STANDARD COMPONENT: THE PERFORATED PIPE (UNDERDRAIN) SHALL BE LAID DIRECTLY ON THE GRAVEL BED. GRADE AND ALIGNMENT SHALL NOT VARY FROM THE PRESCRIBED GRADE BY MORE THAN 0.03 FEET (9 MM) AT ANY POINT. THE JOINTS BETWEEN SECTIONS OF PIPE SHALL BE CONNECTED IN A FASHION ACCEPTABLE TO ENGINEER. ONCE THE PIPE IS IN PLACE, IT SHALL BE COVERED IMMEDIATELY WITH GRANULAR MATERIAL AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS. THE GRANULAR MATERIAL SHALL BE OF UNIFORM DEPTH ON BOTH SIDES OF THE PIPE. SPECIAL INLETS AND SPECIAL DEVICES AT THE OUTLET END OF THE PIPE SHALL BE CONSTRUCTED AS SHOWN IN THE PLANS.
8. SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.

CONSTRUCTION SEQUENCING:

1. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
3. ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPS MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
6. SEED AND MULCH DISTURBED AREAS ON SITE.
7. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
8. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPS INTO CONSIDERATION.
9. FINAL GRADE THE SITE.
10. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
11. INSTALL THE EROSION CONTROL BLANKET
12. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

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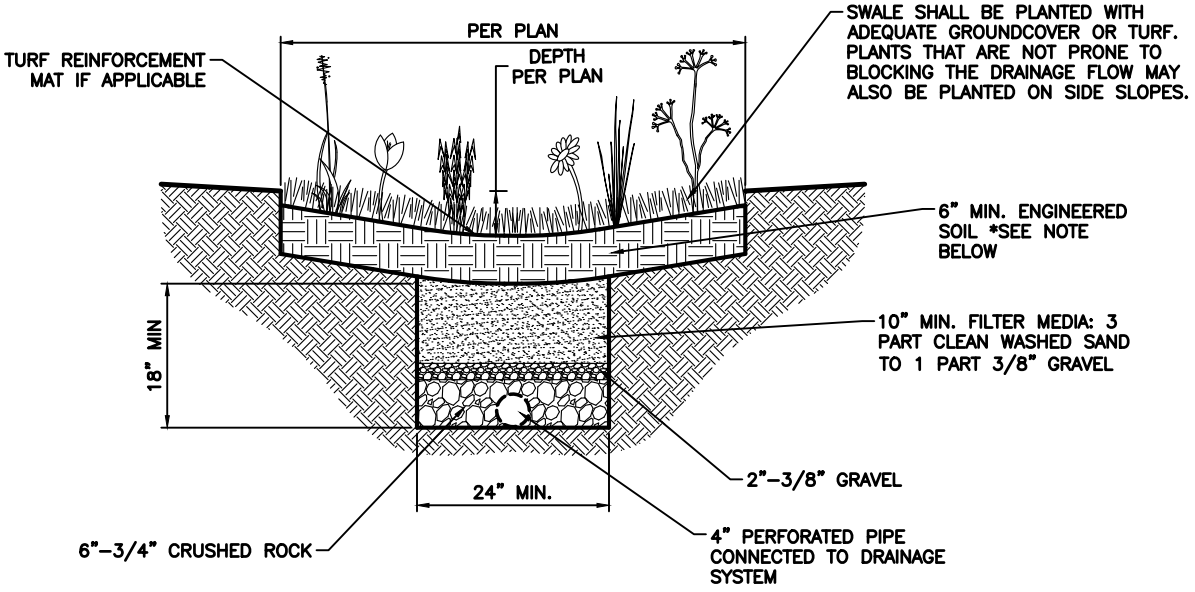
DATE 11/19

SURFACE SAND FILTER

STANDARD DRAWING
LID 5



NOTES:

1. *"ENGINEERED SOIL" LAYER SHALL BE MINIMUM 6" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50–60% SAND, 20–30% COMPOST OR HARDWOOD MULCH, AND 20–30% TOPSOIL.

2. VEGETATED SWALES ON GRADES OF MORE THAN 2.5% MUST INSTALL CHECK DAMS TO LIMIT THE SLOPE OF THE SWALE TO 2.5% UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING SERVICES.

3. NO FILTER FABRIC IS TO BE USED IN THIS SECTION.

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PREPARED BY:_____

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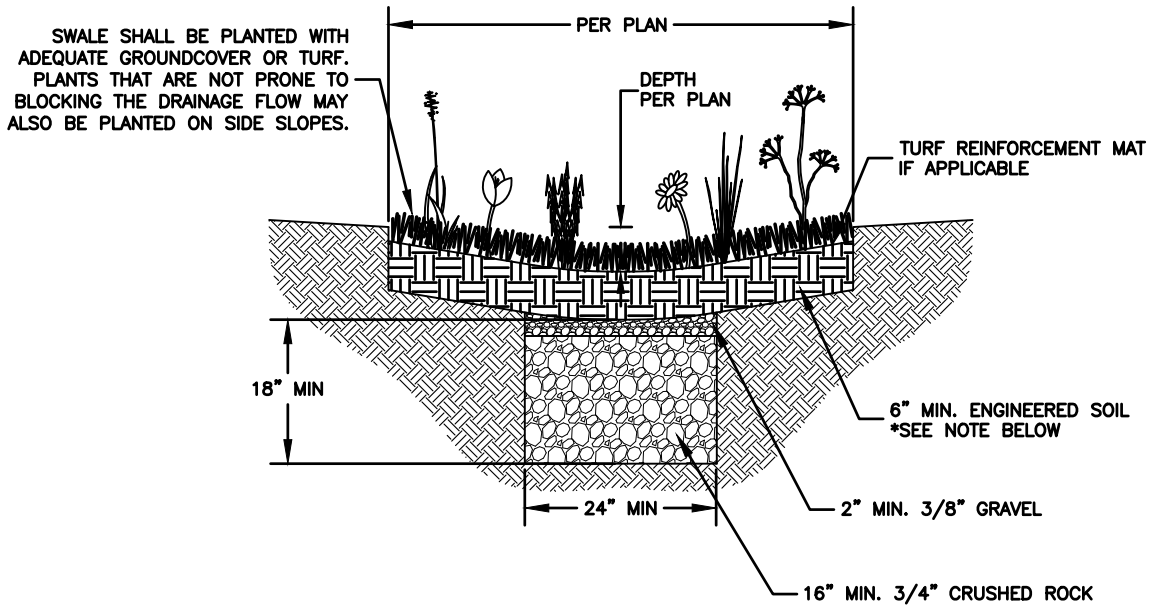
DATE	REVISIONS	BY	DRAWN: DTJ	VEGETATED SWALE UNDERDRAIN CLAYEY SOIL	STANDARD DRAWING LID 6
11/6/19		DTJ	DATE 11/19		



NOTES:

1. *"ENGINEERED SOIL" LAYER SHALL BE MINIMUM 6" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50–60% SAND, 20–30% COMPOST OR HARDWOOD MULCH, AND 20–30% TOPSOIL.

2. VEGETATED SWALES ON GRADES OF MORE THAN 2.5% MUST INSTALL CHECK DAMS TO LIMIT THE SLOPE OF THE SWALE TO 2.5% UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING SERVICES.

3. NO FILTER FABRIC IS TO BE USED IN THIS SECTION.

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PREPARED BY: _____

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DATE	REVISIONS	BY	DRAWN: DTJ	VEGETATED SWALE UNDERDRAIN SANDY SOIL	STANDARD DRAWING LID 7
11/6/19		DTJ	DATE 11/19		

APPENDIX D

SMALL SCALE RESIDENTIAL AND COMMERCIAL PRESCRIPTIVE MEASURES AND RESOURCES

Small Scale Residential Prescriptive Measures

Small Scale Residential BMP Fact Sheets

The following pages provide fact sheets with recommended criteria for the design and implementation of various residential BMPs. These fact sheets have been designed in a simplified, user-friendly way with the intent of achieving optimal performance of the measures. The siting, design, and maintenance requirements in the fact sheets are not exhaustive. Alternative designs may be approved by the City based on site specific conditions if equivalent pollutant removal performance is provided. New BMPs that are equivalent to those included are acceptable if approved by the City. All BMPs must be designed and implemented to be in full compliance with all applicable sections of the most recent municipal code, including site drainage requirements per the City Building code.

The following BMPs for small scale residential projects are included in this Appendix:

- Rain Barrels and Small Cisterns
- Permeable Pavements (or Porous Pavement Systems)
- Planter Boxes
- Rain Gardens
- Dry Wells

Following the BMP Fact Sheets, a reference section with resources for additional information is provided. Applicable vendor information has also been provided.

RAIN BARREL FACT SHEET

Rain barrels capture runoff from roof downspouts during storms and temporarily store that runoff for later use. They are low-cost, effective, and easily maintained devices that can be sized for a specific volume of water. Retained water may be used for garden watering, and other outdoor non-potable uses. Rain barrel storage can reduce the amount of stormwater pollutants that are picked up and conveyed to local streams and the ocean. In addition, harvested water conserves precious City-supplied potable water and, if directed to unpaved surfaces, can recharge groundwater. Rain barrels are typically made of heavy duty plastic and can range in size from the standard 55 gallons to more than 80 gallons.

How many rain barrels do I need?

The number of rain barrels required to capture runoff from a given roof or impervious area is shown in the following table.

Are Rain Barrels Feasible at My Residence?

Rain barrels are appropriate where the following site characteristics are present:

- Roof areas with downspouts are required.
- A level, firm surface for support of the rain barrel(s) is required. Rain barrels should only be elevated with solid construction materials and kept away from retaining walls as a full 55-gallon rain barrel will weigh over 400 lbs.
- An area where the captured water can be used is required to be present within a reasonable distance from the rain barrel(s).
- Design of an appropriate area for overflow from the barrel is necessary.

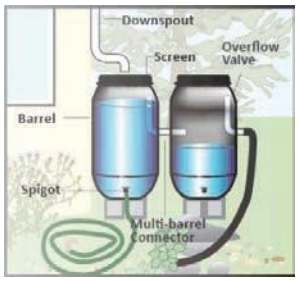
Roof or Impervious Area (sq.ft.)	Number of 55 Gallon Rain Barrels*
500 – 1,000	4**
1,001 – 1,500	8**

* Or equivalent capture using larger rain barrels.

** Minimum landscape area for 4 rain barrels shall be 200 square feet and the minimum landscape area for 8 rain barrels shall be 400 square feet.

Design Criteria and Considerations
(check all that apply)

- ❑ Screens are present on all rain barrel inlets to remove debris and larger particles as the water enters the barrel. Removable child-resistant covers and mosquito screening are in place.
- ❑ Barrel is child safe: access is child-proof and the barrel is properly sited and anchored on a stable surface to prevent barrel from tipping over. Remember – each rain barrel weighs approximately 400 lbs when full!
- ❑ Above-ground barrels are not located on uneven or sloped surfaces; if installed on a sloped surface, the base where the barrel is installed has been leveled using appropriate construction materials prior to installation.
- ❑ Installed rain barrels have not been placed on elevated platforms, decks or porches without consulting local building code officials.
- ❑ Overflow outlet is provided and designed to disperse overflow onsite and through stable vegetated areas where erosion or suspension of sediment is minimized.
- ❑ Dispersion is directed so as not to knowingly cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement. Overflow dispersion will take place at least 3 feet away from public sidewalks, at least 5 feet away from property lines and foundations, and at least 10 feet from building foundations.
- ❑ Rain barrels are opaque and dark in color to prevent UV light penetration and discourage algae growth.
- ❑ Barrel placement allows easy access for regular maintenance.



Rain Barrel Setup

Operations and Maintenance (check all that apply)

- ❑ Rain barrel components will be inspected 4 times annually and following major storm events. Screens, spigots, downspouts, and leaders will be repaired or replaced as needed.
- ❑ Rain barrels will be cleaned as necessary to prevent algae growth and the breeding of vectors. Cleaning should always take place on a permeable surface. If vectors are breeding in a rain barrel, the barrel will be drained immediately.
- ❑ During dry periods, spigot drains will be left open when barrel is not in use.
- ❑ Dispersion areas will be maintained to remove trash and debris, loose vegetation. Areas of bare soil should be rehabilitated to minimize erosion.
- ❑ Where possible, effective energy dissipation and uniform flow spreading methods will be used to prevent erosion and aid dispersion.
- ❑ If adequate mosquito control is not in place and well-maintained, rain barrels will be emptied as necessary to prevent standing water from remaining in a barrel for more than 3 days, thereby preventing vectors from breeding. If vector breeding occurs as a result of contained storm water or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.
- ❑ Rain gutters will be inspected and cleaned at least twice annually.

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature _____ Date _____

PERMEABLE PAVEMENT FACT SHEET

Permeable Paver Driveway
Photo Credit: City of Los Angeles

Permeable pavement contains pores or separation joints that permits non-concentrated water to flow through and seep directly into a base material. Permeable pavement systems include porous asphalt and concrete, permeable pavers (i.e. permeable interlocking concrete pavers), and restrained systems (plastic or concrete grid systems with gravel-filled voids). These systems reduce runoff and encourage infiltration of stormwater into surrounding soils.

Installing permeable pavement reduces stormwater quantity and filters out contaminants that would otherwise run off into storm drains, creeks, and waterways. This improves water quality, reduces runoff velocity and volume, and can encourage groundwater recharge. Permeable pavement is available in many different types that offer environmentally friendly and aesthetically pleasing options for driveways, wallkways, parking areas, and patios.

Is Permeable Pavement Feasible at My Residence?

Permeable pavement is appropriate where the following site characteristics are present

- Permeable pavements should work well on most resi dential sites where paved surfaces such as patios and driveways exist. Areas with slopes greater than 3 percent may not be appropriate.
- If the permeable pavement is designed to receive runoff other than incidental rainfall (e.g. roof) it should be installed at least 3 feet from public sidewalks and 10 feet from building foundations.
- Promoting infiltration should be avoided under permeable pavements at sites with expansive, clay-rich soils, or soils susceptible to tunnel erosion.
- At sites with certain characteristics that do not permit infiltration, an underdrain system can be installed to route the water to a storm drain or other BMP (i.e. rain garden). This type of system provides temporary storage, slows runoff, and filters some pollutants.
- There are many types of permeable pavements, including pour-in-place concrete or asphalt, unit paver blocks, and granular materials. Modular types, such as stone or brick pavers and open cell pavers, tend to be good options for residential projects. The use of the surface (i.e. vehicles, foot traffic, recreation), site conditions, aesthetic qualities, price, and maintenance requirements should be considered during the design process.

How Much Permeable Pavement Do I Need?

Permeable pavement should be sized to capture the runoff produced from the design storm within the gravel subbase of the pavement. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for permeable pavement.

Contributing Area (ft^2)	Permeable Pavement Area 1ft Gravel Subbase (ft^2)	Permeable Pavement Area 2ft Gravel Subbase (ft^2)
500 – 1000	90	50
1001 – 1500	150	80
1501 – 2000	210	110
2001 – 2500*	280	140

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 60 sq. ft. of permeable pavement (with 1' of gravel subbase) or 30 sq. ft. of permeable pavement (with 2' of gravel subbase) per every 500 sq. ft. of addition.

Design Criteria and Considerations

When installing permeable pavement, the following criteria should be adhered to unless otherwise permitted by the City. The owner should check all boxes that will be complied with.

- ❑ Installed subsurface is an open-graded base of crushed stone, which has 35 to 45 percent pore space, to allow for adequate drainage and storage.
- ❑ Site soils have adequate drainage (at least 0.5 inches per hour) and depth to groundwater (5 feet) if water will infiltrate from the open-graded base into site soils.
- ❑ Infiltration will not cause geotechnical hazards related to expansive soil movement, tunnel erosion, or slope stability.
- ❑ If infiltration hazards are a concern, an underdrain has been installed to drain water into a storm drain inlet or onsite BMP.
- ❑ Slope is not greater than 3 percent.
- ❑ Flow directed to permeable pavement is dispersed so as not to be concentrated at a small area of pavement.
- ❑ Pavers have a minimum thickness of 80 mm (3.14 inches).
- ❑ Pre-fabricated products have been installed per all appropriate manufacturer's specifications. If required, sub-grade soil has been compacted in accordance with product installation specifications.
- ❑ Project is in full compliance with all applicable sections of the current municipal code, including disabled access requirements and site drainage requirements.

Operations and Maintenance

Once permeable pavement is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- ❑ Pavement will be inspected after rains for pooling or other visible problems. Surface clogging or movement of modular pavers can cause problems with both drainage and pavement function. Missing sand or gravel between pavers will be replaced as necessary.
- ❑ Pavement will be inspected for vegetation. Depending on the type of pavement and growth, vegetation may need to be removed.
- ❑ Home owners have talked with the contractor or manufacturer for additional maintenance requirements for their specific installation. Permeable pavement can involve significant maintenance, depending on the type of pavement installed.

Grass Paver Block Walkway
Photo Credit: City of Los Angeles

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature

Da

PLANTER BOX FACT SHEET

Planter boxes function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. The components normally consist of a ponding area, mulch layer, planting soils, plantings, drainage layer, and an outlet drain. As stormwater passes down through the planting soil, pollutants are filtered by the soil and plants.

Photo Credit: Deco Alfresco

Planter boxes at residential locations should be placed beneath rain gutter downspouts, or they may be placed directly beneath roof drip lines where rain gutters are not present so as to directly capture runoff from the roof. The overflow outlet should discharge away from the building to ensure water does not percolate into footings or foundations. Planter boxes can be designed as a single linear trough or a series of "pots" of various shapes and sizes.

Are Planter Boxes Feasible at My Residence?

Planter boxes are appropriate where the following site characteristics are present:

- Roof areas with downspouts, or roof areas without downspouts that drain runoff to impervious surfaces.
- A level, firm surface away from retaining wall structures for support of the planter(s). Planters should only be elevated with solid construction materials.

How Large Does My Planter Box Need to Be?

The total size of planter{s) necessary to capture run-off from a given roof area is shown in the table to the right. The table assumes a minimum planter depth of 2.5 feet, with 2 feet of soil and 0.5 feet of storage space., or "'free-board", above the soil surface.

Roof Area Tributary to Planter Boxes(sq.ft.)	Total Surface Area of Planter(s) (sq.ft.)
500 – 1,000	32
1,001 – 1,500	52
1,501 – 2,000	108
2,001 – 2,500*	168

• Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 20 sa. Ft. of planter box surface area per every 500 sq. ft. of additional area.

The table assumes that all runoff generated from the roof area will be directed to the planter{s). If a planter only extends acrossa fraction of a roof drip line for which it was designed to capture all runoff. one of the following methods shall be implemented:

- Additional planters shall be installed to extend across the entire roof drip line.
- Gutters or other devices shall be installed on the tributary roof to direct all runoff to the planter(s).
- Additional UD BMPs shall be implemented to capture the runoff unaccounted for by the planter(s).

Design Criteria and Considerations

When installing a planter box, the following criteria should be adhered to unless otherwise permitted by the City of Los Angeles. The owner should check all boxes that will be complied with.

- ❑ At locations without rain gutters, planters are placed directly below roof drip lines to capture runoff as efficiently as possible.
- ❑ At least 6 inches of storage is present between the planting surface and the crest of each planter.
- ❑ At locations implementing multiple planters, planters are placed directly adjacent to one another so as to minimize the impervious space between planters.
- ❑ Planters are not located on uneven or sloped surfaces.
- ❑ Planting soil is at least 2 feet deep.
- ❑ Planting soil contains no more than 30% compost.
- ❑ Planters have not been installed on elevated platforms, decks or porches without consulting local building code officials.
- ❑ The project is in full compliance with all applicable sections of the current municipal code, including drainage requirements per the Los Angeles Building and Safety Code.

Photo Credit: City of Los Angeles

Operations and Maintenance

Once a planter box is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- ❑ Planters will undergo annual plant and soil maintenance typical of landscape care procedures to ensure optimum filtration, storage, and drainage capabilities.
- ❑ Following rain events, planters will be inspected to ensure that standing water is not present in the planter for more than 72 hours (3 days). Ponded water that is not completely drained after 72 hours can cause vector breeding. If vector breeding occurs as a result of contained stormwater or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.
- ❑ Pesticide additives will not be used in the planters.

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature _____ Date _____

RAIN GARDEN FACT SHEET

Rain gardens are simply gardens designed to capture and treat runoff. Stormwater runoff from impervious surfaces is directed toward a depression in the ground, which is planted with flood and drought-resistant plants. As the water nourishes the plants, the garden stores, evaporates, and infiltrates rainwater, reducing runoff and pollutant loads.

Rain gardens are a low-cost, effective, and aesthetically pleasing way to reduce the amount of stormwater that runs off your property and washes pollutants into storm drains, local streams, and the ocean. They are most often planted with native species. While mitigating the environmental impacts of land development, rain gardens also provide attractive landscaping and habitat for birds, butterflies, and other animals.

Photo Credit: City of Los Angeles

Are Rain Gardens Feasible at My Residence?

Rain gardens are appropriate where the following site characteristics are present:

- Edge of rain gardens should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines, and in an area where potential overflow will not run onto neighboring properties. Rain gardens may be located closer than the above mentioned criteria provided
    1) A geotechnical report is submitted and approved or;
    2) A impermeable liner is installed to prevent infiltration under these facilities, and an over flow drain pipe to the street is installed
- Ground adjacent to the building should slope away at a 2% minimum. The rain garden area should receive full sunlight throughout most of the day. A downspout extension or bioswale can be used to convey rain from a roof directly into a rain garden. They are also appropriately sited downstream from a rain barrel overflow line.
- Do not site rain gardens above septic systems.
- The site should have well-drained soil and be relatively flat. Soil amendments can improve infiltration in areas with poor drainage.
- A front or back yard can work well for a rain garden, but look for areas where the slope naturally takes the stormwater. Areas where water naturally flows or ponds are ideal locations for a rain garden. Work with the site drainage and hydrology.
- Areas highlighted in Figures E-1 through E-3 are not ideal for rain gardens and must be approved by the City prior to installation. Areas highlighted in Figures E-4 require soils amendments to increase the natural soils infiltration abilities.

How Large Does My Rain Garden Need to Be?

Rain gardens should not exceed 300 square feet, and the contibuting impervious area should not be more than 4,000 square feet. A general recommendation for a garden with a 6-inch ponding depth is to size the rain garden to approximately 6% of the contributing area. The infiltration rate of water into the soil will affect how the rain garden should be sized; rain gardens will need to be larger in areas with slower infiltration. The following table can be used as general guidance.

Contributing Area (sq.ft.)	Rain Garden Area (sq.ft.)
500 – 700	36
701 – 900	48
901 – 1100	60
1101 – 1300	72
1301 – 1500	84
1501 – 2000*	105

* Projects adding roof or impervious areas in excess of 2,000 sq. ft. shall add 30 sq. ft. of rain garden surface area per every 500 sq. ft. of additional are

Design Criteria and Considerations

When installing a rain garden, the following criteria should be adhered to unless otherwise permitted by the City of Los Angeles. The owner should check all boxes that will be complied with.

❑ Location is at least 25 feet from home foundations, 3 feet from public sidewalks, 10 feet from property lines and in an area where potential overflow will not run onto neighboring properties. Rain gardens may be located closer than the above mentioned criteria provided.

1) A geotechnical report is submitted and approved by LADBS or;
2) A impermeable liner is installed to prevent infiltration under these facilities, and an over flow drain pipe to the street is installed.

❑ Rain Garden has been located to intercept and collect runoff via a downspout or adjacent impervious area. The rain garden is not located underneath the canopy of existing trees.

❑ Rain garden is appropriately sized to the soil type and drainage area.

❑ Rain garden is not located over septic systems or shallow utilities. Utilities have been located before digging by calling Blue Stakes, 411. Rain garden is not located within 50 feet of steep slopes (>25%). The rain garden has been built on a relatively flat area.

Permits are not required for typical residential landscaping projects. If you plan on making major landscaping modifications such as moving more than 50 cubic yards of soil or altering 1 acre or more, contact the City for further assistance.

❑ An overflow has been incorporated in the rain garden such that excess water will flow into another pervious area and away from the home's foundation or neighboring property.

❑ Detention and infiltration do not (knowingly) cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement.

❑ Drought and flood resistant native plant species are used whenever possible. Invasive or pest species have been avoided. A listing of resources where information on native plant species can be found is in the reference section.

Operations and Maintenance

Once a rain garden is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

❑ Rain gardens will be irrigated deeply once a week during dry months to encourage root growth and keep plants strong, especially while plants are being established. Plants will be inspected for health and weeds will be removed as often as necessary.

❑ Rain gardens will be monitored after storm events for signs of overflow. If overflow occurs significantly or often, the size and/or depth of the garden may need to be increased, or other actions to increase infiltration (e.g., soil ammendments, underdrain installation) may be necessary.

❑ Signs of erosion will be repaired immediately. Further erosion can be prevented by reinforcing the surrounding area with groundcover or using energy dispersion techniques on downspouts.

❑ Infiltration effectiveness and excess sediment deposition will be monitored annually, preferrably prior to the start of the rainy season.

❑ Standing water will not remain in a rain garden for more than 3 days. Extended periods of flooding will not only kill vegetation, but may result in the breeding of mosquitos or other vecotrs. If vector breeding occurs at a site as a result of contained stormwater or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.

❑ Rain gutters and downspouts will be inspected and cleaned at least twice annually.

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature _____ Date _____

DRY WELL FACT SHEET

Prefabricated Dry Well
Photo Credit: Canale Landscaping

A dry well is a bored, drilled, or driven shaft or hole designed specifically for the infiltration of stormwater. Simple dry wells may consist of a small excavated pit filled with gravel media, while more advanced dry wells typically consist of a prefabricated storage chamber or perforated pipe segment placed in the ground. These latter types of dry wells offer more storage capacity per unit area since they are not typically filled with media and also conserve land area since they may be buried completely in the ground.

Dry wells are situated to capture runoff from roofs or other impervious areas. They can easily be designed to be directly connected to rain gutter systems to capture runoff from rooftops. Once filled with stormwater, dry wells can accept water at the same rate at which they can dissipate water.

Is a Dry Well Feasible at My Residence?

Dry wells are appropriate where the following site characteristics are present:

- Roof areas with downspouts or other impervious areas are required.
- Sites must have soils suitable for infiltration, with a minimum saturated hydraulic conductivity of 0.3 in/hr.
- Edge of dry wells should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines and an overflow drain pipe to the street is required. Dry wells may be located closer than the above mentioned criteria provided a geotechnical report is submitted and approved by LADBS.
- Do not site rain gardens above septic systems.
- An overflow area that drains to the street is required.

How Large Does My Dry Well Need To Be?

A dry well should be sized to capture the runoff produced from the design storm over the connected impervious area, with account taken for any gravel or fill material that is used. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for dry wells.

Contributing Area (ft^2)	Dry Well Volume - Without Fill (gallons)	Dry Well Volume - Including Gravel Fill (gallons)
500 – 1000	250	600
1001 – 1500	400	1,000
1501 – 2000	550	1,400
2001 – 2500*	700	1,800

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 150 gallons of dry well volume (without fill) or 400 gallons of dry well volume (with gravel fill) per every 500 sq. ft. of additional area.

Design Criteria and Considerations

Installed Dry Well Schematic
Image Credit: ABHL Landscape Architects

When installing a dry well, the following criteria should be adhered to unless otherwise permitted by the City. The owner should check all boxes that will be complied with.

❑ Edge of dry wells should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines and an overflow drain pipe to the street is required. Dry wells may be located closer than the above mentioned criteria provided a geotechnical report is submitted and approved.

❑ Dry well has been properly located and installed to intercept and collect runoff via a downspout from a roof or adjacent impervious area.

❑ Dry well is appropriately sized in accordance with the sizing table above.

❑ For dry wells with gravel fill, gravel used is 2” or greater diameter stone.

❑ The soil under the dry well has been over-excavated to at least one foot in depth. The soild has been replaced uniformly without compaction, or amended with 15-30% of coarse sand and replaced without compaction.

❑ A fine mesh screen has been installed on the inlet to prevent sediment and debris from entering the dry well.

❑ An observation well has been incorporated into the dry well design. The observation well consists of a slotted or perforated pipe (typically PVC), 4-6 inches in diameter, capped with an above-ground, sealable lid.

❑ An overflow has been incorporated in the dry well such that excess water will flow into the storm drain system or another pervious area and away from any nearby foundations or neighboring properties.

❑ Detention and filtration do not (knowingly) cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement.

Operations and Maintenance

Once a dry well is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

❑ Water level, drawdown time, and evidence of clogging will be monitored monthly during the rainy season.

❑ Standing water will not remain in an exposed dry well for more than 3 days. Extended periods of flooding may result in the breeding of mosquitoes or other vectors. If vector breeding occurs at a site as a result of contained stormwater or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.

❑ Rain gutters and downspouts will be inspected and cleaned at least twice annually.

❑ If the dry well ever becomes plugged and overflows on a continual basis, the dry well will be excavated and removed. The dry well will be repaired or replaced as necessary, and gravel media fill will be cleaned or replaced to enhance the infiltration capacity.

Owner Certification

“As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge.”

_____ _____

Owner Signature Date

Only to be used for Single Family Residences
(Less than 1 acre and not in an ESA)

STORMWATER OBSERVATION REPORT FORM

LOW IMPACT DEVELOPMENT (LID)

STORMWATER OBSERVATION *means the visual observation of the stormwater related Best Management Practices (BMPs) for conformance with the approved LID Plan at significant construction stages and at completion of the project.*

STORMWATER OBSERVATION *must be performed by the contractor responsible for the approved LID Plan or designated staff in their employment. Homeowner can also perform the Stormwater Observation if no licensed contractor was involved.*

STORMWATER OBSERVATION REPORT *must be signed by the contractor responsible for the approved LID Plan and submitted to the City prior to the issuance to the certificate of occupancy. Homeowner can sign the Stormwater Observation Report if no licensed contractor was involved.*

Project Address:	Building Permit No.:
Name Contractor or Owner responsible for the approved LID Plan:	Phone Number:
Name of LID Plan Observer:	Phone Number:

I declare that the following statements are true to the best of my knowledge:

1. I am responsible for the approved LID Plan, and
2. I, or designated staff under my responsible charge, has performed the required site visits at each significant construction stage and at completion to verify that the best management practices as shown on the approved plan have been constructed and installed in accordance with the approved LID Plan.

Signature Date Contractor/Architect/Engineer License

APPENDIX E

ADDITIONAL RESOURCES

References

Additional Manuals

Many LID manuals exist that offer additional insight and information with regards to residential BMP implementation. The following manuals may be consulted to obtain more information on LID practices:

- County of Los Angeles, 2009. Low Impact Development Standards Manual. January 2009
- Pima County Low Impact Development and Green Infrastructure Guidance Manual, March 2015
- Low Impact Development Handbook for the State of Alabama
- Clean Water Services Low Impact Development Approaches Handbook, July 2009
- UDOT Storm Water Design Manual

Web Resources

A host of information is available on the world wide web to help homeowners design and implement LID BMPs. The following is a brief list of agencies and websites devoted to the protection and conservation of our water resources:

- Council for Watershed Health (www.watershedhealth.org)
- The Low Impact Development Center (www.lowimpactdevelopment.org)
- Metro Blooms (Rain garden installation video and information) (http://metroblooms.org)
- Rainwater Harvesting for Drylands and Beyond by Brad Lancaster (www.harvestingrainwater.com)
- The Center for Watershed Protection (www.cwp.org)
- The U.S. Environmental Protection Agency (www.epa.gov/owow/NPS/lid)
- Utah City Engineers Association (www.ucea.net/)
- Utah LID Guide (deq.utah.gov/water-quality/low-impact-development)

Appendix E: Small Scale Residential Prescriptive Measures

Vendor Information

A short list of potential product vendors is provided below. The City does not endorse any specific product or vendor.

Rain Barrels and Planter Boxes:

- Gutter Guy (www.gutterguyonline.com)
- Rain Harvest (www.rainbarrelprogram.org/urc)
- Mark's Barrel Company (marksbarrelcompany.com/basea/2010/05/05/rain-barrel-love-in-utah)
- The Home Depot (www.homedepot.com)
- Rain Barrels International (www.rainbarrelsintl.com)
- City Rain Barrel Program (http://cityrainbarrelprogram.org)
- Lowes (www.lowes.com)
- Simply Rain Barrels (www.simplyrainbarrels.com)
- WalMart (www.walmart.com)
- Water Tanks (www.watertanks.com)

Dry Wells and Underground Storage Solutions:

- Advanced Drainage Systems, Inc. (www.ads-pipe.com)
- Contech Stormwater Solutions (www.contech-cpi.com)
- Cultec, Inc. (www.cultec.com)
- HydroLogic Solutions (www.hydrologicsolutions.com)
- Invisible Structures, Inc. (www.invisiblestructures.com)
- NDS (www.ndspro.com)
- StormTech, Inc. (www.stormtech.com)
- Tensar Technologies, Inc. (www.tensarcorp.com)
- Triton Stormwater Solutions (www.tritonsws.com)

Permeable Pavement:

- Invisible Structures, Inc. (www.invisiblestructures.com)
- Geofill Cellular Concrete (www.geofill.com)
- The Home Depot (www.homedepot.com)
- Lowes (www.lowes.com)
- PermaPave (www.permapave.com)
- Terrafirm Enterprises (www.terrafirmenterprises.com)
- Uni-Group U.S.A. (www.uni-groupusa.org)
- Pave Drain (www.pavedrain.com)

DRAPER, UTAH OFFICE
154 E 14075 S
DRAPER, UTAH 84020
PHONE: 801.495.2224

BOISE, IDAHO OFFICE
776 E RIVERSIDE DRIVE
SUITE 250
EAGLE, IDAHO 83616
PHONE: 208.939.9561

ST. GEORGE, UTAH OFFICE
20 NORTH MAIN
SUITE 107
ST.GEORGE, UTAH 84770
PHONE: 435.656.3299

OGDEN, UTAH OFFICE
2036 LINCOLN AVENUE
SUITE 104
OGDEN, UTAH 84401
PHONE: 801.495.2224

BOWEN COLLINS & ASSOCIATES

WWW.BOWENCOLLINS.COM