CITY OF FORT WAYNE MASTER UPDATED: 1/5/15

SECTION

Rain Garden Construction

NTS: This section contains procedures and requirements for rain garden, underdrain system, stone, amended soil, hardwood mulch, and plantings. Restoration of disturbed areas is addressed in Section 33 92 00 Lawns and Grasses.

1. GENERAL
	1. DESCRIPTION
		1. Rain gardens are best management practices (BMPs) which are designed to enhance infiltration of storm water runoff. The plantings within the rain gardens aid in the uptake of nutrients found in storm water runoff and enhancing soil quality, water holding capacity, evapotranspiration and infiltration.
		2. Under this section, the Contractor shall furnish all labor, materials, and equipment necessary to construct the rain garden, as specified on the plans.
		3. Scope
			1. The Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install rain garden(s).
			2. Rain garden(s) shall be installed at the locations specified on the plans.

NTS: Edit section as required to describe project.

* + - 1. Rain garden(s) shall include an underdrain system set in a stone base, an outlet structure with discharge piping, amended soil, double shredded hardwood mulch, and plantings as specified on the plans.
		1. Types of products specified:
			1. Perforated and non-perforated pipe
			2. Filter Aggregate
			3. Revetment Stone
			4. Erosion Control Fabric
			5. Geotextile Fabric
			6. Amended Soil
			7. Double Shredded Hardwood Mulch
			8. Plantings
			9. Overflow Structure
			10. Topsoil
			11. Fescue Seed Mix

NTS: If this is a project for rain gardens only the previous items may be included in this specification section. Overflow structure will typically be in Section 33 05 13 Concrete Manholes and Structures. Topsoil, seeding and sodding will typically be in Section 32 92 00 Lawns and Grasses.

* + 1. Related Sections

NTS: List below only sections covering products that a user may expect to find in this section, but are specified elsewhere.

* + - 1. Section 31 00 00 - Earthwork
			2. Section 33 05 13 – Concrete Manholes and Structures
			3. Section 32 92 00 – Lawns and Grasses

NTS: Section “1.2” is to be included if project is bid on unit price basis. Section to be deleted or revised if project is to be bid on lump sum basis.

NTS: Insert at (--1--) and (--2--) below the various pipe, stone, geotextile fabric, amended soil, mulch, and plantings, types and/or sizes to be used for project. Adjust Section “1.9” below for additional work item numbers as needed.

* 1. MEASUREMENT AND PAYMENT
		1. Perforated and Non-Perforated Pipe
			1. Work Item Number and Title

 **33 47 32-A (--1--) Perforated Pipe**

 **33 47 32-B (--2--) Non-Perforated Pipe**

* + - 1. Pipe will be measured by the linear foot installed, tested, and backfilled as measured from outside wall of structure to structure, as measured along the centerline of the pipe.
			2. The accepted quantities of pipe will be paid for at the contract unit price per linear foot for each type and size successfully installed. Payment for any backfill or associated restoration shall be paid for under their respective bid items.
		1. Filter Aggregate
			1. Work Item Number and Title

 **33 47 32-C (--1--) INDOT #5 Stone**

 **33 47 32-D (--2--) INDOT #11 Stone**

* + - 1. Filter aggregate will be measured by the cubic yard installed.
			2. Filter aggregate will be paid at the contract unit price per cubic yard, complete in place.
		1. Revetment Stone
			1. Work Item Number and Title

 **33 47 32-E (--1--) Revetment Stone**

* + - 1. Revetment Stone will be measured by the square yard or cubic yard installed.
			2. Revetment Stone will be paid for at the contract unit price per square yard or per cubic yard, complete in place.
		1. Geotextile Fabric
			1. Work Item Number and Title

 **33 47 32-F (--1--) Geotextile Fabric**

* + - 1. Geotextile fabric will be measured by the square yard installed.
			2. Geotextile fabric will be paid at the contract unit price per square yard, complete in place.
		1. Amended Soil
			1. Work Item Number and Title

 **33 47 32-G (--1--) Amended Soil**

* + - 1. The amended soil will be measured by the cubic yard installed.
			2. The amended soil will be paid at the contract unit price per cubic yard, complete in place.
		1. Mulch
			1. Work Item Number and Title

 **33 47 32-H (--1--) Mulch**

* + - 1. Mulch will be measured by the cubic yard installed.
			2. The mulch will be paid for at the contract unit price per cubic yard, complete in place.
		1. Plantings
			1. Work Item Number and Title

 **33 47 32-I (--1--) Plantings**

* + - 1. Plantings shall be measured on a unit price basis for each type indicated and installed.
			2. Plantings shall be paid for at the contract unit price complete in place.
	1. QUALITY ASSURANCE
		1. The Contractor shall use qualified laborers who have at least three years experience with native planting and shall have successfully performed at least five native planting projects similar in size and scope to the current project. The Contractor shall provide an on-site supervisor experienced in native planting with a minimum 4 year degree in natural resources, biology, or related field. As part of the bid submittal, the Contractor shall submit a statement of qualifications, including project summaries with contact names and information, and resumes of field installation personnel who will be working on the project.
	2. REFERENCES
		1. ANSI Z60.1 – American Standard for Nursery Stock
		2. ASTM C33 – Standard Specification for aggregates.
		3. ASTM D4491 – Standard Test Methods for water permeability of geotextiles by permittivity.
		4. ASTM F2648 – Standard Specification for 2 to 60 inch Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage.
		5. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
	3. SUBMITTALS
		1. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.
		2. Submit list of plant life sources.
	4. DELIVERY, STORAGE, AND HANDLING
		1. Deliver plant life materials immediately prior to placement. Keep plants moist.
		2. Protect and maintain plant life until planted.
	5. ENVIRONMENTAL REQUIREMENTS
		1. Do not install plant life when ambient temperatures may drop below 35o F or rise above 90o F.
		2. Do not install plant life when wind velocity exceeds 30 mph.
	6. WARRANTY
		1. Provide one year warranty for all plants. By the end of the first growing season, the rain garden and surrounding disturbed areas shall show a uniform density of healthy specimens of the plants indicated on the planting plan. The rain gardens shall be free of weeds and trash and covered in a uniform layer of mulch not greater than 3 inches in depth.
		2. Successful plantings shall be based on the minimum percentage of live plants after one complete growing season. A minimum of 80 percent of all species installed shall be present and alive.
		3. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.
		4. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.
		5. Survival percentages shall be established by visual inspection.
		6. If these standards are not met, the Contractor shall be responsible for supplemental planting in accordance with the specifications and with input from a restoration ecologist, if necessary. All replanting shall be at the Contractor’s expense. Losses due to animal depredation, extremes in weather or precipitation, or lack of water control shall not be covered under this warranty.
	7. MAINTENANCE SERVICE
		1. The Contractor shall maintain plant life for three months after date of Substantial Completion.
		2. The Contractor shall maintain plant life immediately after placement until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of warranty period.
		3. Maintenance to include:
			1. Cultivation and weeding plant beds.
			2. Irrigating sufficient to saturate root system.
			3. Disease control.
			4. Replacement of mulch.
			5. Repair any erosion resulting from watering.
1. PRODUCTS
	1. MATERIALS
		1. Perforated and Non-Perforated Pipe
			1. All non-perforated storm water and perforated underdrain piping shall be flexible, dual wall (pipe meeting ASTM F2648) or equivalent as approved by the engineer. Pipe joints shall meet ASTM F477.
			2. Underdrain piping will consist of flexible, perforated dual wall HDPE piping with smooth interior walls unless otherwise noted on the plans.
			3. The preferred perforations shall be slits in the corrugations spaced every 4 inches, such as ADS 401 perforated pipe or an equivalent approved by the project designer. An acceptable alternative would be 3 holes at the bottom of the pipe, equivalent to ADS 402 leach bed pipe.
			4. The rigid HDPE pipe joints shall be premium joints and shall be silt-tight and leak resistant with a rubber gasket
			5. Underdrain clean-outs shall be the same pipe material. Bends shall be 90-degreee sweeps that are capped at grade. Caps shall be placed by hand and not glued.
		2. Filter Aggregate
			1. Pipe filter aggregate shall consist of one 6 inch layer of washed INDOT #5 Stone and one 4 inch layer of washed INDOT #11 Stone, as shown on the plans. The material shall contain no more than 1% silt, clay or organic material. No Pre-Cenozoic limestone, dolomite, or stone containing phosphate shall be used.
		3. Revetment Stone
			1. INDOT Revetment stone shall be installed over forebays, weirs, and spillways. Revetment stone shall be washed and contain no more than 1% silt, clay or organic material.
		4. Geotextile Fabric
			1. The geotextile fabric shall have a maximum apparent opening size according to the American Society of Testing and Materials (ASTM) D 4751 or 0.21 mm. The permittivity, according to ASTM D 4491, shall be a minimum of 0.5 per second. In order to determine the latest version of the listed specifications and standards, please consult the ASTM web page (www.astm.com).
			2. Recommended filter fabric is Mirafi 140N or equivalent as approved by the Engineer.
		5. Amended Soil
			1. Rain gardens shall have a minimum of 24 inches of amended soils to be graded in accordance with the plan details.
			2. The amended soil shall consist of a homogenous mixture of 50 percent course sand and 50 percent compost in accordance with this paragraph.
			3. Compost shall be aged yard-leaf compost and shall be free of deleterious materials including but not limited to clay, silt, manure solids, woody debris, plastics, construction debris, or other materials that may negatively affect infiltration. The pH shall be between 5.5 and 8.5. Particles shall be able to pass through a 1-inch screen or smaller. Compost that smells putrid, has an ammonia odor, or shows visible signs of mold is unacceptable. A sample of the compost shall be made available to the project designer or authorized representative prior to mixing the amended soils.
			4. Sand shall be clean construction sand, free of deleterious materials, and shall conform to the grading requirements of the American Society of Testing and Materials (ASTM) C33 as shown in Table 1. In order to determine the latest version of the listed specifications and standards, please consult the ASTM web page ([www.astm.com](http://www.astm.com)).

TABLE 1

BEDDING SAND GRADING REQUIREMENTS

|  |
| --- |
| ASTM C33 |
| Sieve Size | Percent Passing |
| 3/8 in. (9.5 mm) | 100 |
| No. 4 (4.75 mm) | 95 to 100 |
| No. 8 (2.36 mm) | 85 to 100 |
| No. 16 (1.18 mm) | 50 to 85 |
| No. 30 (600 µm) | 25 to 60 |
| No. 50 (300 µm) | 10 to 30 |
| No. 100 (150 µm) | 2 to 10 |

* + 1. Double Shredded Hardwood Mulch
			1. Mulch shall be applied to all rain gardens. Depth of mulch shall be less than or equal to 3 inches. The mulch shall be composed of shredded hardwood bark and shall not contain colored dyes or other chemical treatments. Mulch shall not contain any foreign material, debris, or compounds that may be detrimental to plant growth.
		2. Plantings
			1. Native plants shall be true to species, and cultivars and hybrids must not be permitted. Species substitutions must be approved by the project designer with input from a restoration ecologist at least two weeks before the planting is scheduled.
			2. Plant plugs shall be at least 2.25” in diameter and 4.75” deep and have well developed root systems filling the soil but not be overly root bound. Plant tops shall be well developed, healthy, viable, and adequately hardened off for outdoor planting. Plug planting soil shall be inoculated with mycorrhizal fungi at the nursery at time of seeding. Plugs must be delivered to the planting site with adequate soil moisture, free of diseases, mold, insect infestations, or other defects.
			3. A representative plant plug shall be submitted to the Owner or authorized representative prior to planting. The placement of the plant plugs shall be as shown on the plans. Refer to Plans for planting plans and plant schedule.
			4. All plugs shall be planted in an amended soil mixture in conformance with this specification.
			5. Mulch shall be applied where plant plugs are installed. Depth of mulch shall be less than or equal to 3 inches. Mulch shall conform to this specification.
1. EXECUTION

The work to be performed under this contract includes, but is not limited to, constructing the work described below and all appurtenances related to the work. The work shall be as follows:

* 1. PRE-CONSTRUCTION
		1. The Contractor shall submit to the project designer sources for plants 21 days after the contract award.
		2. The Contractor shall submit to the Owner or authorized representative a plan and schedule for construction and planting at least 21 days prior to the scheduled commencement of work.
		3. The Contractor shall submit to the Owner or authorized representative sources for aggregate, mulch, and amended soil mixture.
		4. The Contractor shall submit to the Owner or authorized representative material cut sheets for erosion control and geotextile fabrics, and HDPE pipe.
	2. RAIN GARDEN CONSTRUCTION
		1. Install erosion control measures around the perimeter of the work area as deemed necessary by the Owner or authorized representative.
		2. Direct the use of heavy equipment and construction traffic around rain gardens so as to avoid compaction, to the extent possible.
		3. After initial site grading, the Contractor shall provide temporary protection from curb cuts and other potential inflow entrances so that runoff drainage does not enter the rain gardens during construction and installation.
			1. Rain gardens may be used as sediment settling facilities during mass excavation and commensurate construction activities.
			2. Prior to commencing work in rain gardens, the Contractor shall remove and properly dispose of all accumulated sediments.
		4. The Contractor shall stabilize all grading within the drainage area of the rain gardens. Stabilize here means: 1) all pervious areas are stabilized with >95% vegetative cover. This means planted root stock and/or seed that has germinated and sprouted and is healthy; or 2) all pervious areas are protected with properly trenched silt fence that is not removed until vegetative cover is established; or 3) impervious areas are protected with proper erosion control measures. It is imperative that fine particles are not allowed to run into areas with amended soils. If the Owner or Owner’s Representative determines that these surfaces have been contaminated or sealed the Contractor shall be directed to remove and replace this unacceptable material at his/her own expense.
		5. The Contractor shall excavate rain gardens to the elevations and dimensions specified on the plans and scarify the existing soils surfaces. In-situ soils shall not be further compacted.
		6. The Contractor shall over excavate by a minimum of 6” using a toothed bucket and loosely fill to the final grade of rain garden areas so as to promote subsurface infiltration. Contractor may use roto-tiller or other soil scarification device in lieu of over excavation.
		7. Excavated soils shall be placed with stockpiled fill and properly disposed and stabilized by the Contractor.
		8. Underdrain Installation
			1. Underdrain pipes shall be capped (at structures) until completion of site. Underdrains connected directly to a storm drainage structure shall be non-perforated for a distance of at least 3 feet from the structure interface to avoid possible piping problems. The free end of the underdrains shall be permanently capped.
			2. For connections of the perforated drain pipes to storm drainage structures, appropriately sized holes shall be cut in the structures at the correct invert elevation specified by the project designer or authorized representative. The connections shall be sealed sediment-tight and secured in place with mortar or other approved joint sealant compatible with HDPE materials.
			3. Underdrain gravel blanket material shall meet the requirements of this specification and shall be placed around the pipe in accordance with the plan details. Crushed stone shall not be used around the underdrain.
			4. Geotextile fabric, as specified herein, shall be cut to appropriate width and placed in accordance with the plan details. The cut width must be of sufficient size to conform to trench perimeter irregularities and allow for a minimum overlap of 6 inches. The area between the amended soil and the top of the gravel bed shall remain open, without geotextile fabric. When overlaps are required between rolls, the uphill roll should lap a minimum of two feet over the downhill roll in order to provide a shingled effect.
			5. Care shall be exercised to prevent natural or fill soils from intermixing with the stone aggregate surrounding the underdrain. All contaminated stone aggregate shall be removed and replaced with uncontaminated stone aggregate.
		9. Install overflow structure at the elevation and location specified on the plans. Attach non-perforated HDPE piping from overflow structure to the underdrain.
		10. Connect underdrain to appropriate feature according to the site design specifications.
		11. Install revetment stone, as specified herein, over forebays, weirs, and spillways at the locations and depths specified on the plans.
		12. Backfill rain gardens with amended soil to the depth specified on the plans. Depth of backfill shall be verified by the project designer or authorized representative.
		13. No equipment shall be driven over the amended soils.
		14. Under no circumstance shall amended soil be installed during saturated conditions. All soil media must be installed with at least 2 days of antecedent dry weather.
		15. Pre-soak soils at least 24 hours prior to vegetation installation to aid in settling and to increase probability of vegetative success.
		16. Complete final grading of soils by hand or manually operated walk-behind equipment to achieve proposed design elevations. The final grade in the planting areas after installing the amended soils shall correspond to the elevations specified on the drawings within a tolerance of +/- 0.10 ft.
		17. Place double shredded hardwood mulch across the surface of the rain garden to a maximum depth of 3 inches.
		18. Plant Installation
			1. Plants shall be installed from April 1 through July 1. Written permission from the Owner is required to vary from this planting window.
			2. Plant plugs must be delivered and stored in such a way as to be protected from drying winds and direct sunlight. Plugs shall be staged in shaded locations and watered as needed to maintain soil in a moist condition throughout the planting operation. Excessively dry planting substrates shall be watered by irrigation, sprinklers, or flooding to moisten soil to a depth of 3” prior to planting.
			3. Plants shall be installed in holes drilled with an auger the same diameter and depth as the plug within +0.75”/- 0.25”.
			4. Install plant plugs an average of 18 inches on center spacing using cluster planting methodologies. However, if there is any discrepancy between the plans and this specification, whichever specifies the tighter spacing shall be the over-riding plant spacing.
			5. Mulch shall be spread evenly with extreme care so as to leave the planted areas with a minimum amount of damage.
		19. All downspouts, curb cuts, overland flow or other hydrologic inputs shall be brought online and allowed to enter rain gardens no longer than 7 days following plant installation. The receiving drainage areas must be permanently stabilized before any drainage from these areas can run into the rain gardens without soil erosion and sediment control measures in place. If the Contractor allows any fine solids to get into the rain gardens, they will be removed at the discretion of the Owner or Engineer and at the Contractor’s expense.

+ + END OF SECTION + +