

# STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE MANUAL

Located at

BLOCK 7, LOT 2.03 501-511 LAKE TERRACE

In

BOROUGH OF BRADLEY BEACH MONMOUTH COUNTY, NJ

Has been prepared for

#### 501 LAKE TERRACE, LLC 1412 MAIN STREET ASBURY PARK, NJ 07712

on

June 1, 2021

Jason L. Fichter, PE, PP, CFM, CME NJPE 43118

Insite Job #: 20-1472-01

**InSite Engineering, LLC** 

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#### I. <u>INTRODUCTION</u>

The proposed project is located at 501 - 511 Lake Terrace in the Borough of Bradley Beach, and is bounded existing residential buildings on all sides. The property is currently fully developed with two existing buildings, walkways and associated parking. The proposed project consists of the reconstruction of concrete walkways, expansion of an existing asphalt parking lot, and associated landscape and lighting improvements.

This manual addresses the maintenance issues for the specific components of the four subsurface infiltration/detention systems. This manual also addresses the functional maintenance category, as represented by the preventative maintenance component and the corrective maintenance component, as well as the aesthetic category of the stormwater management systems.

The primary emphasis of this maintenance program is on Preventative rather than Corrective Maintenance. Aesthetic maintenance will also play a key role on this maintenance program. When performed regularly, Aesthetic maintenance will help reduce the required amount of both Preventative and Corrective maintenance. It will maintain the visual appeal of a Stormwater Management Facility and allow it to reflect positively on the maintenance staff, owner, and community.

Both the Borough and NJDEP require the following procedures be followed as per NJAC 7:8-5.8:

- a. Copies of the maintenance plan must be provided to the owner and operator of the stormwater management measure. Copies must also be submitted to all reviewing agencies as part of each agency's approval process and in some instances recorded with the County Clerk.
- b. The title and date of the maintenance plan and the name, address, and telephone number of the person with stormwater management maintenance responsibility as specified in the plan must be recorded on the deed of the property on which the measure is located. Any change in this information due, for example, to a change in property ownership, must also be recorded on the deed.

- c. The person with maintenance responsibility must evaluate the maintenance plan for effectiveness at least annually and revise as necessary.
- d. A detailed, written log of all preventative and corrective maintenance performed at the stormwater management measure must be kept, including a record of all inspections and copies of maintenance-related work orders.
- e. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

#### II. <u>PROJECT DESCRIPTION</u>

The project is not considered a major development by the Stormwater Control section of the Borough of Bradley Beach Ordinance (Section 396-5) or the NJDEP Stormwater Management requirements (NJAC 7:8) and therefore water quality, water quantity and groundwater recharge measures are not required for the proposed improvements pursuant thereto. Furthermore, since there are no appreciable changes proposed to the land use, land cover, or topography of the site, no changes will occur to the hydrology of the site. Therefore, no additional stormwater management facilities are required. The impervious coverage, site runoff, and grading design closely matches the existing conditions and will have no negative impact on the project. However, to further improve the proposed improved conditions, we have proposed four (4) drywells to collect the roof runoff from the existing buildings to greatly reduce the stormwater runoff from the site.

#### III. <u>RESPONSIBILITY FOR OPERATION AND MAINTENANCE</u>

This manual is prepared by InSite Engineering, LLC to provide a mechanism by which remedial repairs and routine maintenance items can be performed to avoid long term degradation of the stormwater management facilities.

The parties responsible for the shared maintenance repair, and guarantee of the stormwater management facilities onsite will be as follows:

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Contact Person: Peter Siegel PSiegel@rentjerseyshore.com (732) 772-5656

The drainage plan and any future revisions shall be recorded upon the deed of record for the property. The responsible parties, as indicated above, are to contract directly with outside contractors for the maintenance and repair of the stormwater management facilities.

This includes maintenance of onsite landscape areas and required snow removal operations. Periodic maintenance of the stormwater management facilities is to be contracted with and performed by a qualified contractor.

Should ownership of the property change, permanent arrangements shall be made requiring that the operation and maintenance of all facilities shall pass to any successive owner.

#### IV. GENERAL MAINTENANCE INFORMATION

This document has been prepared to provide direction in the maintenance of the Stormwater Management Facilities located at 501-511 Lake Terrace within Block 7, Lot 2.03, situated in the Borough of Bradley Beach, Monmouth County, New Jersey. A well-organized maintenance manual will protect the Stormwater Management Facility against deterioration while prolonging the life of the facility as well. The manual establishes a basic maintenance program based primarily on systematic inspections of the facility by a representative of the property owner.

A regular inspection means the visual inspection of the facilities at scheduled periods to check for any signs of deterioration in the materials or functioning of the constructed systems. The designated inspector shall perform informal inspections, also identified herein as maintenance inspections. Informal inspection means the visual inspection of the onsite facilities by the inspector to detect any deterioration of the facilities.

During each inspection, a checklist of items shall be used. The completed checklist shall be signed by the inspector and appropriately filed by the owner.

This manual is intended as a guide outlining the proper procedure for conducting routine maintenance for the Stormwater Management Facilities. A copy of this manual shall be provided to the appointed individual or company who will perform the onsite inspections. Should the individual/company responsible for the inspections change, a copy of this manual shall be given to the new inspector to maintain consistency of the inspection reports. A continuous record of the operations and maintenance of the facilities must be maintained. The designated inspectors list lists the official and various contractors responsible for inspections. This section shall be updated periodically pending any changes to the list.

This section of the manual has been prepared to provide the Inspector with a simple and systematic method for inspecting, operating and maintaining the stormwater management system. For the most part, the maintenance for the facilities involves observation rather than evaluation. The following sections provide a step-by-step procedure to assist the inspector in performing all duties in a rational and orderly manner. The inspector must become familiar with the background information in this manual.

Finally, prior to conducting an inspection or performing routine maintenance, the inspector must review the Maintenance Tools and Equipment List, and the Inspection and Inspection Checklist located within this manual. Each time an inspection reveals the need for maintenance, the inspector shall notify the owner, who may hire a contractor to perform the work (under the direction of a New Jersey Licensed Professional Engineer as needed). Each time maintenance is performed on the stormwater management facilities, the inspector must record the incident and place a copy of the maintenance checklist on file. Inspections shall be performed a minimum of once every year and after each major storm event of 1 inch of rain or more. Routine maintenance shall be performed after each inspection and each major storm event as required.

This manual addresses the need to properly plan for the maintenance of the Stormwater Management Facilities by addressing the maintenance issues for varying components of the proposed underground detention/infiltration pipes, stormwater structures and basins as they relate to preventative maintenance, corrective maintenance, and aesthetic maintenance. This manual also addresses the costs associated with the maintenance requirements for the facilities.

The primary emphasis of this maintenance program is on Preventative rather than Corrective Maintenance. The goal of this maintenance program is to provide a sufficient amount of Preventative Maintenance to minimize (or entirely eliminate) any Corrective Maintenance procedures.

#### V. <u>DESIGNATED INSPECTORS LIST</u>

This section must be updated periodically to reflect the name(s) and telephone number(s) of the Inspectors and Contractors who are appointed to perform the inspections and maintenance of the Stormwater Management Facilities:

Inspectors Name/Company	Address	Telephone Number
1.		
2.		
3.		
Designated Contractor		
1.		
2.		
3.		
Professional Engineer	Address	Telephone Number
1.		
2.		
3.		
Officers		
1.		
2.		

#### VI. INSPECTION AND INSPECTION CHECKLIST

The proposed Stormwater Management Facilities shall be inspected on a regular basis during informal maintenance procedures and after major rainfall events of 1" or more. Additional regularly scheduled inspections shall also occur by qualified personnel. The inspections shall include, but are not limited to, the following:

#### Informal Inspection:

- a. Inspect inlet structures for debris and trash along pavement areas.
- b. Inspect pavement for signs of settling (depressions) and ponding.
- c. Inspect outlet control structures for debris, trash, external damage to structure, and graffiti.
- d. Inspect system bottoms for standing water within 72 hours after storm event.

#### **Regularly Scheduled Inspections**

- a. All informal inspection items
- b. Inspect pipes for clogging by sediments, garbage, and debris
- c. Inspect outlet control structures interior for sediment, debris, garbage and structural damage.

The inspection checklist and log should be copied and completed for required items every time an inspection is performed. In general, informal inspections should be performed every 2-4 weeks year-round. After each inspection, maintenance operations shall be directed as necessary.

#### VII. <u>FUNCTIONAL MAINTENANCE</u>

#### A. Introduction

Functional Maintenance is the maintenance required to keep a Stormwater Management Facility functional or operational at all times. Functional Maintenance includes both preventative (routine) maintenance and corrective (emergency) maintenance.

#### 1. <u>Preventative Maintenance</u>

Preventative Maintenance includes functional maintenance procedures that are required to maintain a Stormwater Management Facility's intended operation and safe condition by preventing the occurrence of problems and malfunctions. Preventative maintenance will be performed in accordance with the direction presented in this manual. Typical routine procedures include silt and debris removal, and upkeep of moving parts. Since it is performed on a regular basis, preventative maintenance is simpler to schedule and budget for and, ultimately, is easier and less expensive to perform than corrective maintenance.

#### 2. <u>Corrective Maintenance</u>

Corrective maintenance includes the functional maintenance procedures that are required to correct a problem or malfunction at a Stormwater Management Facility and to restore the facility's intended operation and safe condition. Based upon the severity of the problem, corrective maintenance must be performed on an as-needed or emergency basis. By its nature, corrective maintenance is much more difficult to schedule and budget for and, ultimately, is generally more difficult and expensive to perform than preventative maintenance.

#### 3. Aesthetic Maintenance

Aesthetic maintenance is the maintenance required to enhance or maintain the visual appeal of a facility. The stormwater facilities have been designed to be an integral component of the development. As such, these facilities should not have an impact on the aesthetic quality of the development as a whole.

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#### 4. Procedures

- a. Copies of the maintenance plan must be provided to the owner and operator of the stormwater management measure. Copies must also be submitted to all reviewing agencies as part of each agency's approval process and in some instances recorded with the County Clerk.
- b. The title and date of the maintenance plan and the name, address, and telephone number of the person with stormwater management maintenance responsibility as specified in the plan must be recorded on the deed of the property on which the measure is located. Any change in this information due, for example, to a change in property ownership, must also be recorded on the deed.
- c. The person with maintenance responsibility must evaluate the maintenance plan for effectiveness at least annually and revise as necessary.
- d. A detailed, written log of all preventative and corrective maintenance performed at the stormwater management measure must be kept, including a record of all inspections and copies of maintenance-related work orders.
- e. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

#### B. <u>Underground Detention Systems</u>

The manufacturer of the ADS pipe within the system has their own specific procedure for maintenance, which is included at the end of this manual. At a minimum, however, the following protocol shall be followed.

#### i. <u>Preventative Maintenance Procedures</u>

The purpose of preventative maintenance procedures is to assure the detention systems remains operational and safe at all times, while minimizing the need for emergency or corrective maintenance.

#### 1. Access to Facility

All manholes, risers, cleanouts, etc. shall remain in accessible condition at all times. This includes the prohibition of locking and/or blocking mechanisms.

#### 2. <u>Removal and Disposal of Trash and Debris</u>

A regularly scheduled program of debris and trash removal from the detention and inlet/pipe conveyance system will reduce the chance of outlet structures and other components becoming clogged and inoperable during storm events. The detention and inlet/pipe conveyance systems are to be inspected for clogging and excessive debris and sediment accumulation at least four (4) times annually as well as after every storm exceeding one (1") of rainfall. This inspection should be done at least 2 or 3 days after a rain event so that all of the detention areas have been drained and the water is at the lowest level. Visually inspect the system at all manhole locations. Measure and document the amount of silt at manhole each location. Inspect each pipe opening to ensure that the silt level or any foreign objects are not blocking the pipes. Typically, a majority of the larger materials will be collected in the upstream catch basins, therefore these upstream catch basins should be inspected at the same time that the system is inspected to remove any large sediment or floatables.

Remove any blockages during the inspection process only if you can do so safely from the top of the system without entering into the system. **Do not go into the system under any circumstances** without proper ventilation equipment and training as required by OSHA. Pass the information on for action to the appropriate maintenance personnel if you cannot remove the blockages from above during the inspection process. Be sure to describe which structure and the type of material that needs to be removed.

The sediment level in the underground detention system can be determined from the outside of the system by opening up all the structures and using a long measuring pole (such as a 2" diameter wooden rod) to measure the amount of sediment at each location. Force the pole to the bottom of the system and then remove it and measure the amount of sediment at that location. Again, do not go into the system under any circumstances without proper ventilation equipment and training as required by OSHA.

Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized. Agencies regulating solid waste management should be contacted for information on disposal.

#### 3. Outlet Structure

Any outlet structure shall be inspected for the following items:

- Outlet structure
- All attaching appurtenances
- Outfall pipes

The outlet structure is to be inspected for cracking, spalling or any other signs of degradation. The pop-up emitters are to be inspected to ensure that the plates, fasteners, and gaskets are in good working order. All hinges, angles, bolts, etc. shall be inspected for corrosion or degradation. All items that exhibit severe degradation are to be replaced. The outfall pipe shall be inspected for any visible signs of cracking, spalling, or wear. All degraded portions shall be repaired.

4. <u>Structural Stability</u>

The detention/infiltration system components shall be inspected for signs of degradation including vandalism, animal damage, settlement, any scouring, sloughing, seepage or rotting. Any signs of the above mentioned items shall be recorded on the appropriate form.

#### 5. System Structure Performance

The detention/infiltration system is estimated to completely drain in seventy-two (72) hours for the water quality design storm (1.25 in.) event. This time is used to evaluate the system's performance. If significant increases or decreases in the normal drain time are observed, the basin structures must be evaluated and appropriate measures are to be taken to restore the proper functioning of the system.

#### ii. <u>Corrective Maintenance Procedures</u>

#### 1. <u>Structural Repair Outlet Structure</u>

Structural damage to outlet and inlet structures from vandalism, flood events, or other causes must be repaired promptly. Equipment, materials and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of structural damage and the design and performance of structural repairs should only be undertaken by qualified personnel. A list of qualified consultants and contractors shall be maintained in order to undertake the damage analysis and repairs in a timely fashion.

#### 2. <u>Snow and Ice Removal</u>

Accumulation of snow and ice can threaten the function of the system, particularly at inlets and outlets. Provide the equipment, materials, and personnel to monitor and remove snow and ice from these areas as necessary to assure the continued function of the system during winter months.

#### 3. Removal of Debris and Sediment

Sediment, debris and trash which threaten the discharge capacity of the system should be removed immediately and properly disposed of in a timely manner. Equipment and personnel must be available to perform the removal work on short notice. The lack of an available disposal site should not delay the removal of trash, debris and sediment. Temporary disposal sites should be identified and available for immediate use. A list of qualified contractors shall be maintained in order to respond to this situation.

The detention/infiltration system should be completely cleaned whenever the sediment occupies more than 10 to 15% of the originally designed system's volume or as local code requires (check with your municipality in regards to cleaning criteria as the allowable sediment before cleaning may be more or less then described here).

Do not enter the underground stormwater detention/infiltration system unless you are properly trained, equipped, and qualified to enter a confined space as identified by local occupational safety and health regulations.

Sediment removal should take place when the basin is thoroughly dry. Disposal of debris, trash, sediment, and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.

There are many maintenance companies that are in business to help you clean your underground stormwater detention/infiltration and water quality units.

Maintenance is typically performed using a vacuum truck. Sediment should be flushed towards a vacuum hose for thorough removal. Remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the system. Open up the manhole at the opposite end of the system and use sewer jetting equipment to force water in the same row from one end of the system row to the opposite side.

Place the vacuum hose and the sewer jetting equipment in the next row and repeat the process until all of the rows have been cleaned.

When finished, replace all covers that were removed and dispose of the collected material properly.

#### iii. <u>Aesthetic Maintenance</u>

Aesthetic maintenance is primarily not applicable to underground facilities. However, above ground system components shall be kept clean and replaced in the event of vandalism and/or theft.

#### VIII. MAINTENANCE SCHEDULE

All maintenance shall be completed according to the following schedule. The inspection reports shall be summarized and signed by the inspector. These reports shall include a summary of the performance, condition of the entire stormwater system and recommendations for the repairs and/or replacement of facilities. If any deficiencies are observed in the stormwater management facility, the inspector shall notify the owner that corrective action should be implemented as soon as possible. The inspection reports shall be kept on file by the owners and shall be available for review by governing agencies as required.

Maintenance items required shall be completed as soon as possible after the item is identified for repair. Items under preventative maintenance shall be performed during routine maintenance of the site to ensure that the onsite systems are free of sediments, debris and garbage so that they continue to function in the appropriate manner.

The stormwater management systems shall have informal (preventative maintenance) inspections performed during regularly scheduled landscaping maintenance periods and after significant storm events of 1 inch of rain or more per 1 hour. These inspections shall occur year-round. A regular inspection for the stormwater facilities shall be performed once every year and shall be performed between the months of March and May or between September and November. The enclosed forms shall be used to assist in the inspection procedure. All maintenance repairs must be completed as outlined in this manual and records of it shall be kept as part of the annual inspection and maintenance report.

#### IX. MAINTENANCE TOOLS AND EQUIPMENT

The following is a list of required inspection equipment for routine maintenance procedures and inspections.

- 1. A clipboard, a pencil and the inspection checklist the inspection checklist is included in the Appendix.
- 2. A standard 6-foot collapsible ruler.
- 3. A camera photographs or observed portions of the facilities will provide a measure of performance when comparing past and present maintenance practices or conditions.
- 4. A flashlight a flashlight can be used to observe the inside of the inlets onsite.

The following is a list of tools and machinery that are typically required to maintain a Stormwater Management Facility.

- 1. <u>Transportation Equipment</u>
  - a. Trucks for transportation of materials
  - b. Trucks for transportation of equipment
  - c. Vehicles for transportation of personnel

#### 2. Debris, Trash and Sediment Removal Equipment

- a. Vacuum truck
- b. Water Jetting units
- 3. Miscellaneous Equipment
  - a. Shovels
  - b. Rakes
  - c. Picks
  - d. Wheel Barrows
  - e. Painting Equipment
  - f. Gloves
  - g. Standard Mechanics Tools
  - h. Tools for maintenance of equipment

- i. Safety equipment
- j. Tools for concrete work (mixers, forms, etc.)
- 4. Materials
  - a. Paint
  - b. Paint removers
  - c. Spare parts for equipment
  - d. Concrete

#### X. <u>MAINTENANCE COSTS</u>

In order to properly implement a stormwater management facilities maintenance plan, the costs associated with the maintenance procedures must be budgeted into the overall design of the system. Please refer to the Probable Costs Data Sheet included within this manual for general costs associated with the necessary equipment needed to maintain the system properly.

#### XI. <u>REFERENCES</u>

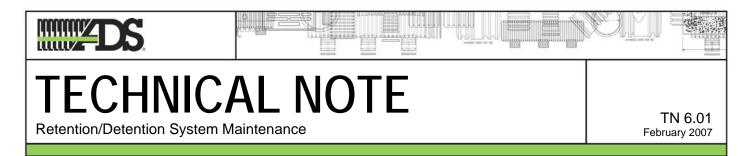
New Jersey Department of Environmental Protection. April 2004/September 2014. New Jersey Stormwater Best Management Practices Manual, as amended.

*Stormwater Management Facilities Maintenance Manual.* New Jersey Department of Environmental Protection. Trenton, New Jersey.

### APPENDIX I MANUFACTURER'S RECOMMENDED MAINTENANCE PRECEDURE FOR SUBSURFACE INFILTRATION/DETENTION SYSTEM

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This document is provided for informational purposes only and is meant only to be a guide. Individuals using this information should make their own decisions as to suitability of this guideline for their individual projects and adjust accordingly.

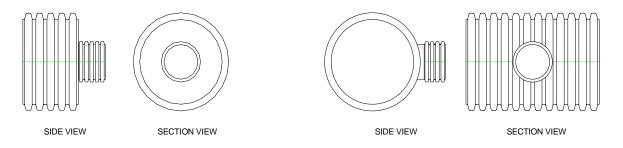
### Introduction

A retention/detention system is comprised of a series of pipes and fittings that form an underground storage area, which retains or detains storm water runoff from a given area. As sediment and debris settle out of the detained stormwater, build up occurs that requires the system to be regularly inspected and cleaned in order for the system to perform as originally designed. The following provides the available fittings and guidelines for inspection and maintenance of an HDPE underground storage system.

### System Accessories and Fittings

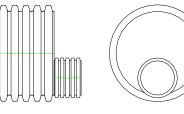
#### **Concentric Reducers**

Concentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The centerlines of the two pipes are at the same elevation. When a concentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will be trapped in the manifold pipe.



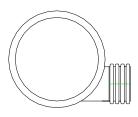
#### **Eccentric Reducers**

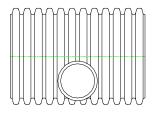
Eccentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The inverts of the two pipes are at the same elevations. When an eccentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will follow the flow of the storm water into the lateral pipes.





SECTION VIEW





SIDE VIEW

SECTION VIEW

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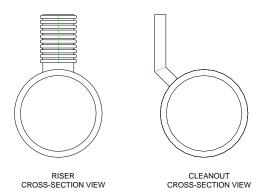


#### Riser

Each retention/detention system typically has risers strategically placed for maintenance and inspection of the system. These risers are typically 24" in diameter or larger and are placed on the manifold fittings.

#### Cleanouts

Cleanout ports are usually 4-, 6-, or 8-in diameter pipe and are placed on the manifold fittings. They are used for entrance of a pipe from a vacuum truck or a water-jetting device.



For a complete listing of available fittings and components please refer to the ADS Fittings Manual.

### Maintenance Overview of a Retention/Detention System

Maintaining a clean and obstruction-free retention/detention system helps to ensure the system performs the intended function of the primary design. Build up of debris may obstruct flow through the laterals in a retention system or block the entranceway of the outlet pipe in a detention system. This may result in ineffective operation or complete failure of the system. Additionally, surrounding areas may potentially run the risk of damage due to flooding or other similar issues.

#### Inspection/Maintenance Frequency

All retention/detention systems must be cleaned and maintained. Underground systems may be maintained more cost effectively if these simple guidelines are followed. Inspection should be performed at a minimum of once per year. Cleaning should be done at the discretion of individuals responsible to maintain proper storage and flow. While maintenance can generally be performed year round, it should be scheduled during a relatively dry season.

#### **Pre-Inspection**

A post-installation inspection should be performed to allow the owner to measure the invert prior to accumulation of sediment. This survey will allow the monitoring of sediment build-up without requiring access to the retention/detention system.

The following is the recommended procedure for pre-inspections:

- 1) Locate the riser section or cleanouts of the retention/detention system. The riser will typically be 24" in diameter or larger and the cleanouts are usually 4", 6" or 8" in diameter.
- 2) Remove the lid of the riser or clean outs.
- Insert a measuring device into the opening and make note to a point of reference on the stick or string. (This is done so that sediment build up can be determined in the future without having to enter the system.)

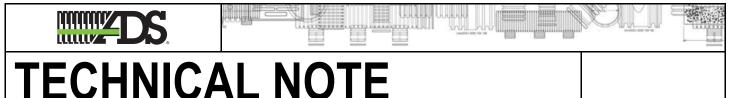


#### Inspection/Maintenance

A retention/detention system should be inspected at a minimum of one time a year or after major rain events if necessary.

The following is the recommended procedure to inspect system in service:

- 1) Locate the riser section of the retention/detention system. The riser will typically be 24" in diameter or larger.
- 2) Remove the lid from the riser.
- 3) Measure the sediment buildup at each riser and cleanout location. Only certified confined space entry personnel having appropriate equipment should be permitted to enter the retention/detention System.
- 4) Inspect each manifold, all laterals, and outlet pipes for sediment build up, obstructions, or other problems. Obstructions should be removed at this time.
- 5) If measured sediment build up is between 5% 20% of the pipe diameter, cleaning should be considered; if sediment build up exceeds 20%, cleaning should be performed at the earliest opportunity. A thorough cleaning of the system (manifolds and laterals) shall be performed by either manual methods or by a vacuum truck.



N-12<sup>®</sup> HP Storm Drainage Pipe Repair Options

TN 5.12 January 2010

## Introduction

ADS N-12 HP for storm drainage is made of polypropylene (PP) resin making the pipe lightweight and very easy to handle. The attributes that make the pipe easy to use can also make it easy to abuse, resulting in damaged pipe or joints. This technical note discusses some of the products available that can be used to repair damaged PP pipe or joints in the field.

## **Repair Options**

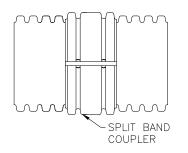
One of the primary considerations in selecting a repair method is the degree of joint performance required. Watertight repairs are generally used on pipe with watertight joints, and soil-tight repairs on pipe with soil-tight joints. This helps keep costs in line and prevents the repair from being the weak area of the pipe system.

The way in which a pipe can be accessed is another primary consideration which influences what type of repair alternative is selected. Pipe that is not yet buried, or can be easily excavated, can be repaired from the exterior. If the pipe is buried and cannot be conveniently excavated, an internal repair may be the best alternative. If the pipe is too small to enter, there are companies with remote controlled equipment that can install the product. Each situation must be considered individually.

The repair options addressed below are divided into external repairs and internal repairs. During any pipe repair, backfill should be placed and compacted per project specifications to provide proper support for the pipe and coupler.

#### **External Mechanical Repairs**

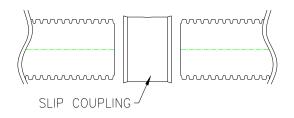
*Mar Mac Polyseal Pipe Coupler*, 12- through 60-inch (300 - 1500 mm), consists of a mastic adhesive base layer, a cross-laminated polyethylene middle layer with a spun-bonded geotextile polypropylene cloth outer layer. The coupler incorporates self-adhering rubberized bonding mastic and securing bands to insure a positive seal around the pipe. If the pipe itself is damaged, the damaged area will need to be removed and a new pipe section spliced in before installing a coupler around both ends. Polyseal Pipe Couplers are reasonably priced, especially when considering the quality of the finished repair, and are typically used with soil-tight smooth interior thermoplastic pipe products. *Note: Mar-Mac bands shall be installed in accordance with manufacturer's recommendations*.

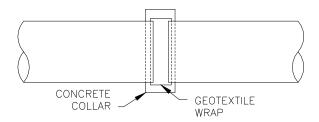


*Split band couplers,* 12- through 60-inch (300 – 1500 mm), will provide a soil-tight repair with or without gaskets. Split band couplers engage the exterior corrugations and therefore can only be used for corrugated exterior pipe. This repair method should only be used if the damaged area is in a non-trafficked green area, is cosmetic in nature, confined to a single corrugation, and is not defined as structural damage. The coupler shall be centered over the damaged area of pipe and tightened down with the nylon straps. If the damaged area is large or significant, the damaged area is to be cut out, and replaced with a new section of pipe. The replacement section is to be 'spliced' in place using split band couplers. They are a convenient, low-cost repair alternative, and are typically used to repair soil-tight thermoplastic pipe products with a corrugated exterior.



Concrete collars also provide a soil-tight repair, dependent on the integrity of the installation. Installing a concrete collar involves building a form around the area to be repaired and encasing it in concrete. A geotextile is usually wrapped around the repair area prior to pouring the collar to keep the concrete from seeping into the pipe. Typically, approximately 6" (0.15m) is excavated beneath the pipe to allow for proper application of the geotextile and concrete encasement. If the pipe itself is damaged, the damaged area shall be removed and a replacement pipe section spliced in prior to pouring the collar. In order to provide a greater level of joint performance, a gasket can be installed on the pipe in the concrete encasement. Concrete collars are typically more costly and time consuming than snap couplers or split band couplers but are reasonable repair options for soil-tight smooth interior thermoplastic pipe products. .





Slip Couplings 12- through 24-inch (300 – 600 mm), provides a watertight repair that will meet most pressure testing requirements, when installed correctly. The slip coupling uses PVC bells with gaskets. The gaskets are placed in the valleys on either side of the section to be repaired and slip couplings are then slid over the gaskets. Due to the exterior gasket, the slip coupling can only be used on pipe with a corrugated exterior. PVC slip couplings are most commonly used with watertight smooth interior, corrugated exterior thermoplastic pipe products.

#### **Internal Repairs**

Internal mechanical repair products generally consist of a flexible cylindrical gasket sleeve, which is expanded to conform to the inner wall of the pipe. The feasibility of this repair method depends on the size of the damaged section or joint and available access into the pipe. Internal mechanical seals slightly restrict the inside diameter of the pipe. This should be considered when assessing the risk of debris obstruction.

*NPC Internal Joint Seal*, 18- through 60-inch (450 – 1500 mm), consists of an EPDM rubber seal and stainless steel bands. The rubber seal is inserted into the pipe and positioned over the joint. A torque wrench is used to expand the bands against the inner wall of the pipe. The Internal Joint Seal is designed to seal joints – not repair damaged pipe sections. The damaged area of the pipe must be removed and a replacement section spliced in if necessary in order to use the Internal Joint Seal. This system may provide a watertight joint when installed as recommended. The manufacture should be contacted to verify the product meets the specific application requirements including test requirements, if specified. If pressure tests are required, NPC should be contacted to ensure that the product is suitable for the specific test criteria.

Internal mechanical seals will slightly restrict the inside diameter of the pipe. This should be considered when assessing the risk of debris obstruction.

*Link Pipe Grouting Sleeve*<sup>TM</sup>, 12- through 60-inch (100 – 1500 mm), is a stainless steel grouting sleeve that is installed with an inflatable plug. The sleeve may be used to seal a joint or repair short sections of damaged pipe. The manufacture should be contacted to verify the product meets the specific application requirements including test requirements, if specified.



Internal chemical sealing is another method of internal joint repair using chemically activated gel or grout to minimize joint leakage. The grout is typically applied with specialized remote-controlled equipment. Test/seal packer is used to remotely seal a joint. The grouting chemicals are forced through the joint out into the surrounding soil where they gel with the soil. The gelled mass forms a waterproof collar around the pipe. The result is significantly reduced leakage. There are several types of chemical grouts available and the manufacturer should be contacted to review the specific situation and any joint tightness or pressure test criteria. Companies such as Avanti International, Strata Tech Inc., and Carylon Corporation manufacture and/or install chemical grout. Stephen's Technologies New Life Coatings and NewLife Liner Systems as well as Avast Hydro-Lining International, are examples of companies that offer cured in place epoxy lining systems that have been effectively used with HDPE pipe. Most pipe diameters can be chemically grouted provided the grouting contractor has the appropriate equipment.

## **Manufacturer Contact Information**

Contact the Regional Engineer or Application Engineering Department for assistance with other unique conditions or for contact information regarding any companies listed in this technical note.

Note: Thermoplastic pipe products are solely intended for the conveyance of fluids. Access into this product for maintenance, inspection, repair, or other reason should be done in strict accordance with OSHA recommendations for confined space entry.



### APPENDIX II SAMPLE MAINTENANCE WORK ORDER, LOG, AND CHECKLIST

#### **InSite Engineering, LLC**

1955 Route 34, Suite A1 • Wall, NJ 07719 732-531-7100 (ph) • 732-531-7344 (fx) • InSite@InSiteEng.net • www.InSiteEng.net Licensed in NJ, PA, DE, NY, CT, NC, DC, & CO

Maintenance Work Order, Log, and Checklist for **Stormwater Facilities** Located at 501 Lake Terrace, LCC; Block 7, Lot 2.03 Date: **Preventative Maintenance** (place check in box of completed items for each date) Items Items Work Item Required Done **Comments and Special Instructions** Trash and Debris Removal Bottom of Subsurface Basin Perimeter Areas Access Areas and Roads Outlet Structure and Trash Racks Inlets Discharge Pipe Other Sediment Removal Inlets Outlet Structure Discharge Pipe Trash Rack Bottom of Subsurface Basin (Performed by Vacuum Truck) Mechanical Components Locks Access Hatches Other Preventative Maintenance

### **Corrective Maintenance**

(place check in box of completed items for each date)

Removal of Debris &			
Sediment			
Structural Repairs			
Dewatering			
Erosion Repair			
Snow & Ice Removal			

Additional Maintenance Remarks and Notes:

### APPENDIX III SAMPLE INSPECTION CHECKLIST

#### **InSite Engineering, LLC**

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#### Inspection Checklist for Stormwater Facilities Located at 501 Lake Terrace, LCC; Block 7, Lot 2.03

Facility Item	O.K.	Routine	Urgent	Comments
Bottom of Subsurface Basin				
Standing Water				
Settlement				
Trash and Debris				
Sediment				
Aesthetics				
Other				
Inlet Structure				·
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Aesthetics				
Other				
Outlet Structure				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Mechanical Components				
Aesthetics				
Other				
Other				
Miscellaneous			•	·

Effectiveness of Existing Maintenance Program		

OK-The item checked is in good condition, and the maintenance program is adequate.

Routine-The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.

Urgent-The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

Comments-Provide explanation and details if columns 2 or 3 are checked

Additional Maintenance Remarks and Notes:

### APPENDIX IV SAMPLE INSPECTION LOG

#### **InSite Engineering, LLC**

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#### Inspection Log for Stormwater Facilities Located at 501 Lake Terrace, LCC; Block 7, Lot 2.03

(place check in box of completed items for each date)

Date:					
Bottom of Subsurface Basin			I		L]
Standing Water					
Settlement					
Trash and Debris					
Sediment					
Aesthetics					
Other					
Inlet Structure					
Condition of Structure					
Erosion					
Trash and Debris					
Sediment					
Aesthetics					
Other					
Outlet Structure					
Condition of Structure					
Erosion					
Trash and Debris					
Sediment					
Mechanical Components					
Aesthetics					
Other					
			1		·
Miscellaneous	1	1	1	1	
Effectiveness of Existing					

Effectiveness of Existing				
Maintenance Program				
	1			1

Additional Maintenance Remarks and Notes:

### APPENDIX V OPINION OF PROBABLE COSTS

#### **InSite Engineering, LLC**

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#### ENGINEERS OPINION OF PROBABLE COSTS FOR MAINTENCE OF STORMWATER MANAGMENT FACILITIES PREPARED FOR 501 - 511 Lake Terrace BLOCK 7; LOT 2.03

	ESTIMATED ANNUAL COST OF STORMWATER SYSTEMS MAINTENACE									
FREQUENCY	DESCRIPTION	CREW	COST PER HOUR PER CREW	EQUIPMENT	COST PER HOUR	EST. HOURS	COST	COST PER YEAR		
Monthly	Litter pickup and grounds repair at and around systems, remove sediment/debris from systems	1 Laborer	\$40.00	Hand tools	\$40.00	6.0	\$240.00	\$2,880.00		
Quarterly	Clean outlet control structures, system bottoms, repair any damage	2 Laborers	\$80.00	Water jet and vacuum trucks, pick-up truck and hand tools	\$160.00	8.0	\$1,280.00	\$5,120.00		
TOTAL PER YEAR	ז:							\$8,000.00		

Notes:

1. This engineer's estimate has been prepared based upon review of plans entitled "Preliminary & Final Major Site Plan for 501-511 Lake Terrce" as prepared this office.

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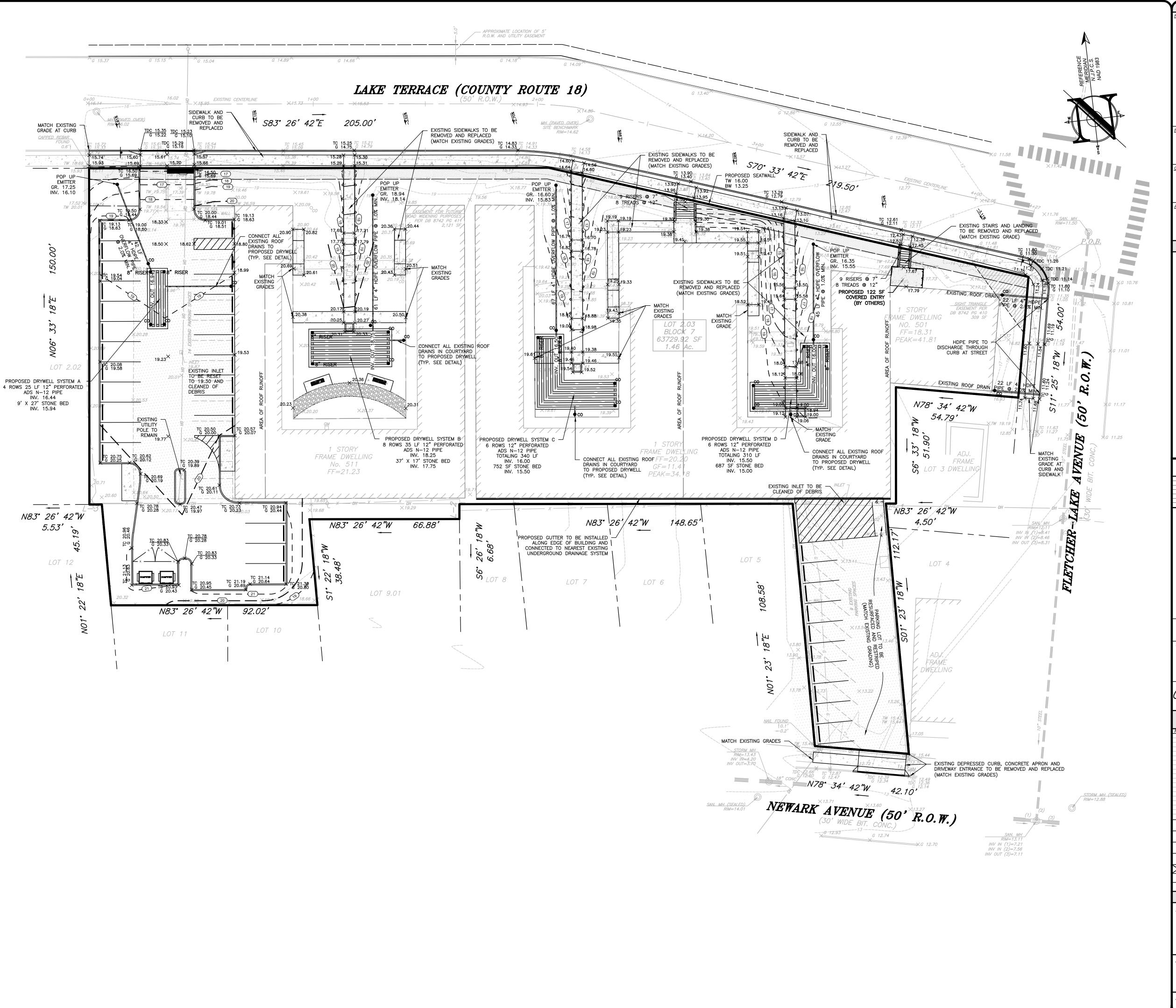
### APPENDIX VI GRADING AND DRAINAGE PLAN, LANDSCAPE PLAN, AND CONSTRUCTION DETAILS

#### **InSite Engineering, LLC**

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732-531-7100 (ph) • 732-531-7344 (fx) • InSite@InSiteEng.net • www.InSiteEng.net Licensed in NJ, PA, DE, NY, CT, NC, DC, & CO

### GRADING AND DRAINAGE NOTES

- . ALL PROPOSED ON-SITE CURBING TO BE VERTICAL CURB WITH 6" REVEAL, UNLESS OTHERWISE STATED.
- 2. ALL CURBS SHALL BE DEPRESSED AT CROSSWALKS AND CONFORM TO APPLICABLE STATE AND FEDERAL BARRIER FREE DESIGN STANDARDS.
- FOR ALL AREAS LOCATED WITHIN THE PUBLIC RIGHT-OF-WAY, ACCESSIBILITY SHALL BE IN ACCORDANCE WITH THE CURRENT PUBLIC RIGHTS-OF-WAY ACCESS ADVISORY COMMITTEE GUIDELINE (PROWAG).
   a. ALL WALKING SURFACES TO HAVE A MAXIMUM RUNNING SLOPE OF 1:20 (5%).
- b. ALL WALKING SURFACES GREATER THAN 1:20 (5%) WILL REQUIRE HANDRAILS.
- c. RAMP RUNS SHALL HAVE A MAXIMUM CROSS SLOPE OF 1:12 (8.3%).
- d. ALL WALKING SURFACES TO HAVE A MAXIMUM CROSS SLOPE OF 1:48 (2%).e. ALL CROSSWALKS SHALL HAVE A MAXIMUM CROSS SLOPE OF 1:48 (2%).
- ALL GRADING WITHIN GRASSED AREAS TO BE A MINIMUM OF 2% AND A MAXIMUM OF 3:1 SLOPE UNLESS OTHERWISE NOTED.
- 5. POSITIVE DRAINAGE TO BE MAINTAINED FROM ALL BUILDINGS IN ACCORDANCE WITH APPLICABLE REGULATIONS AND BUILDING CODE.
- 6. ALL EXCAVATED SOIL TO BE DISPOSED SHALL BE PROPERLY CLASSIFIED, HANDLED, AND DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS.
- 7. ALL GRASSED AREAS TO HAVE A MINIMUM OF 4" CLEAN TOP SOIL, WHEN SOD IS BEING INSTALLED, OR 6" CLEAN TOP SOIL FOR SEEDING APPLICATIONS.
- 8. ALL IMPORTED SOILS MUST BE CERTIFIED CLEAN FILL IN ACCORDANCE WITH THE NJDEP "ALTERNATIVE AND CLEAN FILL GUIDANCE FOR SRP SITES", LATEST EDITION. IMPORTED SOILS SHALL BE PLACED IN ACCORDANCE WITH THE GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT. ALL IMPORTED MATERIAL REQUIRES APPROVAL BY OWNER PRIOR TO PLACEMENT ONSITE.
- 9. SHOP DRAWINGS AND PRODUCT CATALOG INFORMATION FOR ALL STORM SEWER STRUCTURES, CONDUITS, MATERIALS, AND APPURTENANCES, TO BE PROVIDED TO THE PROJECT ENGINEER FOR REVIEW AND APPROVAL PRIOR TO PURCHASING.
- 10. BUILDING ROOF LEADERS TO CONNECT TO SITE STORM SEWER SYSTEM.
- 11. STORMWATER MANAGEMENT FACILITIES SHALL BE REGULARLY MAINTAINED TO INSURE THEY FUNCTION AT DESIGN CAPACITY AND TO PREVENT HEALTH HAZARDS ASSOCIATED WITH DEBRIS BUILDUP AND STAGNANT WATER.
- 12. RESPONSIBILITY FOR OPERATION AND MAINTENANCE OF THE STORMWATER FACILITIES, INCLUDING PERIODIC REMOVAL AND DISPOSAL OF ACCUMULATED PARTICULATE MATERIAL AND DEBRIS, SHALL REMAIN WITH THE OWNER OR OWNERS OF THE PROPERTY. MAINTENANCE SHALL FOLLOW THE OPERATIONS MAINTENANCE MANUAL APPROVED BY THE BOARD ENGINEER.
- 13. IN THE EVENT THAT THE FACILITY BECOMES A DANGER TO PUBLIC SAFETY OR PUBLIC HEALTH, OR IF IT IS NEED OF MAINTENANCE, THE OWNER SHALL AFFECT SUCH MAINTENANCE AND REPAIR OF THE FACILITY IN A MANNER THAT IS APPROVED BY THE BOROUGH ENGINEER.



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	SWALE CENTER LINE	

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	ERRACE, LLC						
ASBURY PA	N STREET RK, NJ 07712 72-5656						
. ,	ROFESSIONALS						
ATTORNEY:	ROFESSIONALS						
FOX ROTHSCHILD, LLI 49 MARKET STREET	D						
MORRISTOWN, NJ 0790	60						
<u>ARCHITECT:</u> MICHAEL SAVARESE A	ASSOCIATES						
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LANDSCAPE ARCH							
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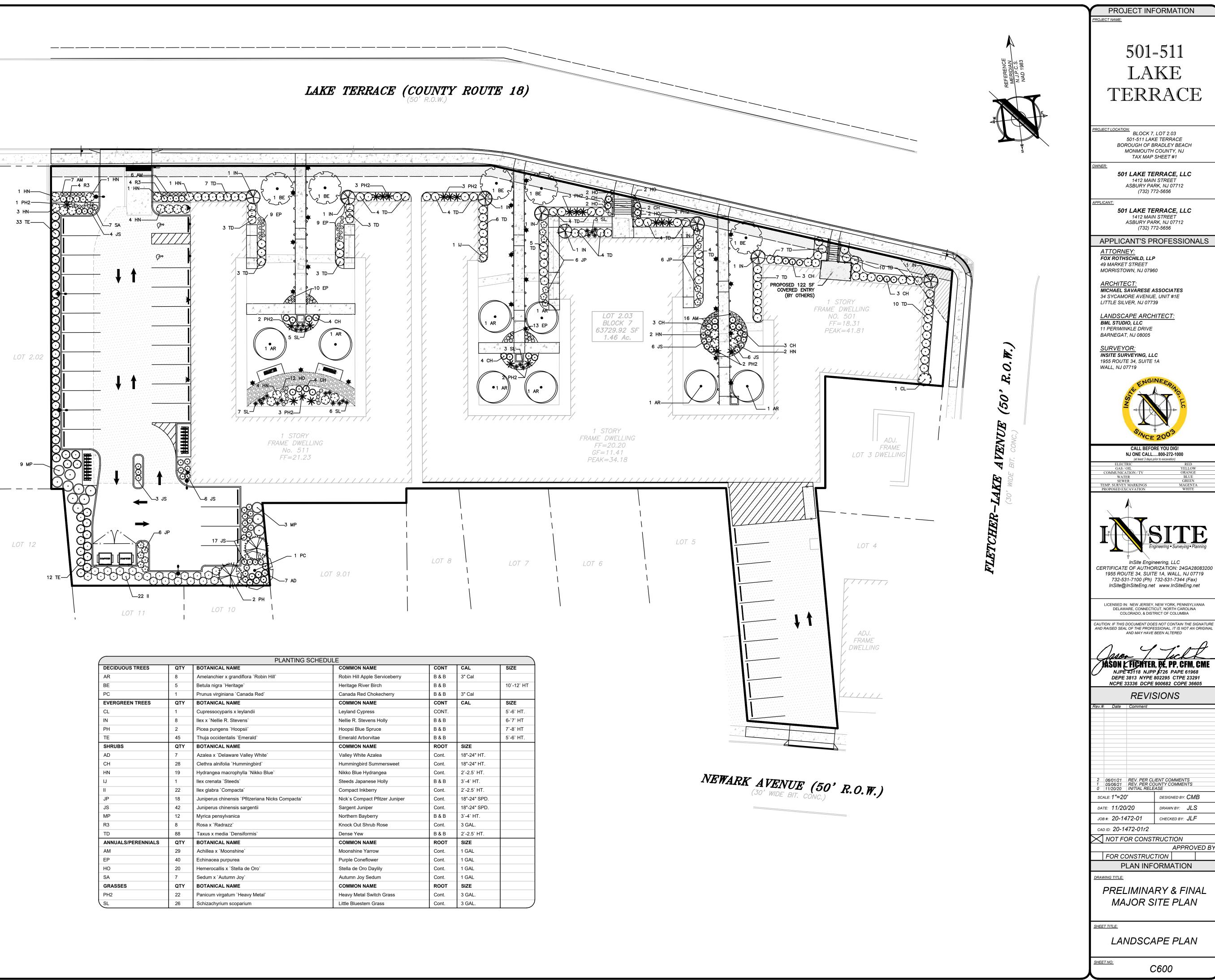
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### GENERAL LANDSCAPE NOTES

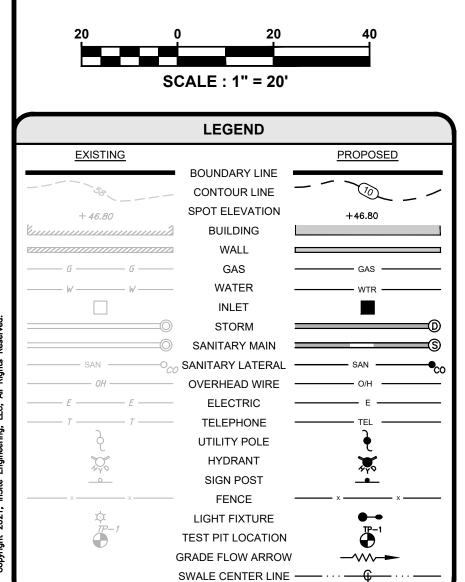
- THIS WORK INCLUDES, BUT IS NOT LIMITED TO THE FURNISHING OF ALL LABOR, MATERIALS, EQUIPMENT, FINAL GRADING, SEEDING, SOIL AMENDMENTS, ETC., AS MAY BE REQUIRED FOR A COMPLETE INSTALLATION.
- AN AGRONOMIC SOILS REPORT SHALL BE PREPARED BY THE OWNER AND FURNISHED TO THE CONTRACTOR, AND ALL RECOMMENDATIONS FROM SUCH REPORT SHALL BE INCORPORATED BY THE CONTRACTOR INTO INSTALLATION OF ALL PLANTING AREAS.
- QUANTITIES SHOWN IN PLANT LISTS ARE FOR CONVENIENCE ONLY, PLANS SHALL GOVERN.
- THE LANDSCAPE CONTRACTOR SHALL NOTIFY THE UNDERSIGNED OF ANY DISCREPANCIES IN PLANT LOCATIONS OR INSUFFICIENT PLANT QUANTITIES DUE TO DIFFERENCES IN PLAN AND ACTUAL FIELD CONDITIONS.
- ALL TREE AND SHRUB MATERIAL SPECIFIED MUST MEET STANDARD INDUSTRY SPECIFICATIONS FOR THE CONTAINER SIZE INDICATED. DOWNSIZING OR SUBSTITUTION OF PLANT MATERIAL WITHOUT PRIOR APPROVAL OF UNDERSIGNED WILL NOT BE ALLOWED.
- ALL LANDSCAPE AREAS SHALL BE GRADED TO A SMOOTH EVEN SURFACE PRIOR TO ANY PLANT INSTALLATION. ALL PLANT MATERIALS SHALL BE INSTALLED USING GOOD HORTICULTURAL PRACTICES IN ACCORDANCE WITH THE PLANS AND DETAILS.
- TREES SHALL NOT BE PLANTED CLOSER THAN FOUR (4) FEET FROM ANY WALKWAY OR PUBLIC SIDEWALK EXCEPT WHERE TREE WELLS OR PARKWAYS ARE PROVIDED IN THE SIDEWALK AREA. ALL TREES PLANTED WITHIN FIVE (5) FEET OF WALKS OR PUBLIC UTILITIES SHALL RECEIVE DEEP ROOT BARRIERS
- TREE LOCATIONS SHOWN ON PLAN MAY REQUIRE ADJUSTMENT IN THE FIELD. WHENEVER FEASIBLE, TREES SHOULD BE PLANTED A MINIMUM OF TEN (10) FEET FROM ALL UNDERGROUND UTILITIES, STREETLIGHTS, HYDRANTS, AND OUT OF DRAINAGE FLOW LINES. SHOULD THIS NOT BE POSSIBLE, CONTACT THE UNDERSIGNED FOR DECISION ON PLACEMENT.
- ALL TREES IN TURF AREAS SHALL HAVE 12" MIN. CLR. CIRCUMFERENCE AROUND THE TRUNK BASE. PROVIDE 3" MIN. THK. MULCH AT BASE OF TRUNK.
- GROUNDCOVER TYPE SHOWN SHALL BE PLANTED IN ALL SHRUB AREAS AS SPECIFIED ON PLANS. GROUNDCOVER SHALL BE PLANTED AT 18" ON-CENTER UNIFORM TRIANGULAR SPACING, AND SHALL BE CONTINUOUS UNDER ALL TREE AND SHRUB MASSES AS SHOWN ON PLAN.
- MATURE PLANTINGS SHALL NOT INTERFERE WITH UTILITIES AND TRAFFIC SIGHT LINES.
- 12. ALL TURF AREAS ARE TO BE SODDED WITH AN APPROVED GRASS MIXTURE. 13. ALL TURF AREAS AND PLANTING AREAS ARE TO IRRIGATED. THE CONTRACTOR IS
- TO PROVIDE A DETAILED IRRIGATION PLAN AND GAIN TOWNSHIP APPROVAL PRIOR TO INSTALLATION. ALL PLANT MATERIAL SHALL BE GUARANTEED FOR A 1-YEAR PERIOD FROM THE RELEASE OF THE PERFORMANCE BOND. THE CONTRACTOR, AT NO COST TO THE OWNER, SHALL REPLACE ANY MATERIAL THAT FAILS TO GROW THROUGH THE
- SPECIFIED MAINTENANCE AND GUARANTEE PERIOD. PLANTING AREA BETWEEN THE SIDEWALK AND CURB SHALL REMAIN NATURAL

GRASS.

16. SEE LANDSCAPING DETAIL SHEET FOR ADDITIONAL PLANTING NOTES AND DETAILS.



PLANTING SCHEDULE								
DECIDUOUS TREES	QTY	BOTANICAL NAME	COMMON NAME	CONT	CAL	SIZE		
AR	8	Amelanchier x grandiflora `Robin Hill`	Robin Hill Apple Serviceberry	B & B	3" Cal			
BE	5	Betula nigra `Heritage`	Heritage River Birch	B & B		10`-12` HT		
PC	1	Prunus virginiana `Canada Red`	Canada Red Chokecherry	B & B	3" Cal			
EVERGREEN TREES	QTY	BOTANICAL NAME	COMMON NAME	CONT	CAL	SIZE		
CL	1	Cupressocyparis x leylandii	Leyland Cypress	CONT.		5`-6` HT.		
IN	8	llex x `Nellie R. Stevens`	Nellie R. Stevens Holly	B & B		6-`7` HT		
PH	2	Picea pungens `Hoopsii`	Hoopsi Blue Spruce	B & B		7`-8` HT		
TE	45	Thuja occidentalis `Emerald`	Emerald Arborvitae	B & B		5`-6` HT.		
SHRUBS	QTY	BOTANICAL NAME	COMMON NAME	ROOT	SIZE			
AD	7	Azalea x `Delaware Valley White`	Valley White Azalea	Cont.	18"-24" HT.			
СН	28	Clethra alnifolia `Hummingbird`	Hummingbird Summersweet	Cont.	18"-24" HT.			
HN	19	Hydrangea macrophylla `Nikko Blue`	Nikko Blue Hydrangea	Cont.	2`-2.5` HT.			
IJ	1	llex crenata `Steeds`	Steeds Japanese Holly	B & B	3`-4` HT.			
II	22	llex glabra `Compacta`	Compact Inkberry	Cont.	2`-2.5` HT.			
JP	18	Juniperus chinensis `Pfitzeriana Nicks Compacta`	Nick`s Compact Pfitzer Juniper	Cont.	18"-24" SPD.			
JS	42	Juniperus chinensis sargentii	Sargent Juniper	Cont.	18"-24" SPD.			
MP	12	Myrica pensylvanica	Northern Bayberry	B & B	3`-4` HT.			
R3	8	Rosa x `Radrazz`	Knock Out Shrub Rose	Cont.	3 GAL.			
TD	88	Taxus x media `Densiformis`	Dense Yew	B & B	2`-2.5` HT.			
ANNUALS/PERENNIALS	QTY	BOTANICAL NAME	COMMON NAME	ROOT	SIZE			
AM	29	Achillea x `Moonshine`	Moonshine Yarrow	Cont.	1 GAL			
EP	40	Echinacea purpurea	Purple Coneflower	Cont.	1 GAL			
НО	20	Hemerocallis x `Stella de Oro`	Stella de Oro Daylily	Cont.	1 GAL			
SA	7	Sedum x `Autumn Joy`	Autumn Joy Sedum	Cont.	1 GAL			
GRASSES	QTY	BOTANICAL NAME	COMMON NAME	ROOT	SIZE			
PH2	22	Panicum virgatum `Heavy Metal`	Heavy Metal Switch Grass	Cont.	3 GAL.			
SL	26	Schizachyrium scoparium	Little Bluestem Grass	Cont.	3 GAL.			



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### **GENERAL SITE PLANTING**

THE OWNER SHALL HAVE A SOIL ANALYSIS MADE AFTER COMPLETION OF THE ROUGH GRADING. THE CONTRACTOR SHALL INCORPORATE ALL SOIL AMENDMENTS AND FERTILIZERS DESCRIBED HEREIN. THE SOIL PREPARATION SPECIFIED BELOW SHALL BE ADJUSTED ACCORDING TO THE ANALYSIS, FOLLOWING APPROVAL FROM THE UNDERSIGNED.

#### WEED CONTROL FOR LAWN, SHRUB & GROUND COVER AREAS (EXCEPT SLOPES) REMOVE ALL EXISTING WEEDS FROM SURFACE AND DISPOSE OFFSITE

- IRRIGATION IS TO BE INSTALLED WHERE NOTED ON PLAN ACCORDING TO SHOP DRAWINGS. FERTILIZE ALL SHRUB/GROUND COVER AREAS. APPLY 10LBS. OF 16-20-0 COMMERCIAL FERTILIZER PER 1,000 SQ. FT. OR AS DIRECTED BY SOILS
- WATER ALL SHRUB/GROUND COVER AREAS FOR THREE (3) WEEKS TO GERMINATE WEED SEEDS. APPLY WATER AT LOW RATE TO AVOID EROSION. 5. LICENSED APPLICATOR SHALL APPLY SYSTEMIC WEED KILLER TO ALL PLANTING AREAS PER MANUFACTURER'S SPECIFICATIONS.
- DPSOIL MOVED DURING THE COURSE OF CONSTRUCTION SHALL BE REDISTRIBUTED ON ALL REGARDED SURFACES, AT LEAST THREE (3) INCHES OF EVEN COVER SHALL BE PROVIDED TO ALL DISTRIBUTED AREAS OF THE DEVELOPMENT AND SHALL BE STABILIZED BY SEEDING OR PLANTING. IF EXCESS TOPSOIL REMAINS, THE THICKNESS SHALL BE INCREASED. IF ADDITIONAL IS REQUIRED, THE DEVELOPER SHALL PROVIDE IT. REMOVAL OF

## EXCESS TOPSOIL SHALL ONLY BE PERMITTED IN ACCORDANCE WITH A PLAN APPROVED BY THE MUNICIPAL AGENCY.

- ALL STUMPS AND OTHER TREE PARTS, LITTER, BRUSH, WEEDS, EXCESS OR SCRAP BUILDING MATERIALS, OR OTHER DEBRIS SHALL BE REMOVED FROM THE SITE AND DISPOSED OF. NO TREE STUMPS, PORTIONS OF TREE TRUNKS OR LIMBS SHALL BE BURIED ANYWHERE IN THE DEVELOPMENT. ALL DEAD OR DYING TREES, STANDING OR FALLEN, SHALL BE REMOVED FROM THE SITE. ROUGH GRADE: SITE TO BE RECEIVED BY LANDSCAPE CONTRACTOR, TO WITHIN 1/10 FOOT PLUS OR MINUS, BY OWNER BASED UPON GRADING
- PI AN FINAL GRADE: FINAL GRADE TO CONSIST OF GRADING, RAKING AND HAND WORK NECESSARY TO ACHIEVE DESIRED CONTOUR AND FLOW LINE
- PATTERNS RESULTING IN EVENLY FINISHED SURFACES FREE OF DEBRIS AND LITTER. SPREAD OVER ALL LAWN, SHRUB AND GROUND COVER AREAS, AMENDMENTS AND FERTILIZER PRESCRIBED IN SOILS REPORT. THOROUGHLY MIX INTO SOIL TO DEPTH OF 6" OR MORE AND FINE GRADE. CONTRACTOR TO IMPORT SOIL NECESSARY TO ATTAIN DESIGN GRADES AND BERMS. ALL IMPORTED SOIL SHALL BE FREE OF WEEDS AND DEBRIS AND HAVE BALANCED PH., SMOOTH AND EVEN GRADING FOR PROPER DRAINAGE. FINAL GRADE SHALL BE 1" BELOW WALK/TOP OF CURB. REMOVE FROM THE SITE ALL STONES OVER 2" IN SIZE.

## PLANT TREES, SHRUBS AND GROUND COVER AS CALLED FOR WHERE INDICATED ON PLANTING PLAN AND AS DETAILED ON PLANTING DETAIL SHEET.

- GROUND COVER FLATS AND/OR CUTTINGS: ALL PLANT MATERIALS SPECIFIED AS PLUGS OR FLAT STOCK ON PLANTING PLAN SHALL REMAIN IN THE FLATS UNTIL TIME OF TRANSPLANTING. THE FLAT SOIL SHALL CONTAIN SUFFICIENT MOISTURE SO THAT SOIL DOES NOT FALL APART WHEN LIFTING PLANT FROM FLAT. GROUND COVER PLANTS SHALL NOT BE ALLOWED TO DRY OUT BEFORE OR DURING PLANTING. ROOTS SHALL NOT BE EXPOSED TO THE AIR EXCEPT WHILE ACTUALLY BEING PLANTED. WILTED PLANTS WILL NOT BE ACCEPTED. AT THE TIME OF PLANTING, THE SOIL AROUND EACH PLANT SHALL BE FIRMED SUFFICIENTLY TO FORCE OUT AIR POCKETS. PLANTS TO BE PLANTED IN TRIANGULAR SPACING AS SPECIFIED O.C. (ON CENTER). ALL CUTTINGS SHALL BE MINIMUM OF 6" LONG, WATER IMMEDIATELY AFTER EACH PLANTING UNTIL ONE INCH OF WATER PENETRATION IS OBTAINED. CARE SHALL BE EXERCISED AT ALL TIMES TO PROTECT THE PLANTS AFTER PLANTING, ANY DAMAGE TO PLANTS BY TRAMPLING OR OTHER OPERATIONS OF THIS CONTRACT SHALL BE REPAIRED IMMEDIATELY. SHRUBS:
- PLANT ALL CONTAINER GROWN PLANTS IN PLANTING PITS AS DIRECTED ON TREE AND SHRUB PLANTING AND STAKING DETAIL. THOROUGHLY MIX BACKFILL ACCORDING TO TREE AND SHRUB PLANTING AND STAKING DETAIL. CONTRACTOR SHALL CONSTRUCT BASINS AROUND ALL TREES; BASINS SHALL NOT EXCEED TOP OF ROOT BALL CROWN. TREES:
- ALL TREES SHALL HAVE A CALIPER OF TWO AND ONE-HALF (2 1/2) INCHES OR SPECIFIED CALIPER IN PLANTING SCHEDULE AND THEY SHALL BE NURSERY GROWN, OF SUBSTANTIALLY UNIFORM SIZE AND SHAPE, AND HAVE STRAIGHT TRUNKS, TREES SHALL BE PROPERLY PLANTED AND STAKED ACCORDING TO TREE AND SHRUB PLANTING AND STAKING/ EVERGREEN PLANTING & STAKING DETAIL AND PROVISION MADE BY THE APPLICANT FOR REGULAR WATERING AND MAINTENANCE UNTIL THEY ARE ESTABLISHED. THE APPLICANT SHALL REPLACE DEAD OR DYING TREES DURING THE NEXT PLANTING SEASON.
- TOP DRESSING: TOP DRESS ALL GROUND COVER AND SHRUB AREAS WITH 2" THICK LAYER OF OGC (ORGANIC GROUND COVER) AS SPECIFIED ON PLANTING PLAN.
- AREAS SHALL HAVE A SMOOTH CONTINUAL GRADE BETWEEN EXISTING OF FIXED CONTROLS, SUCH AS: WALKS, CURBS, CATCH BASINS. ROLL, SCARIFY. RAKE AND LEVEL AS NECESSARY TO OBTAIN TRUE, EVEN SOIL STRUCTURE. APPLY FERTILIZERS AS SPECIFIED BY SOIL ANALYSIS TO DEPTH OF 6".
- SOD SHALL BE INSTALLED THE SAME DAY AS IT IS DELIVERED. SOD SHALL NOT BE LEFT ON PALLETS IN THE HOT SUN. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY AND ALL DAMAGE TO SOD NOT INSTALLED ON DAY OF DELIVERY.
- UNROLL SOD CAREFULLY AND PLACE IN STAGGERED PATTERN OF STRIPS. SOD SHALL BE INSTALLED AGAINST ADJACENT STRIPS TO ELIMINATE JOINTS AND EDGES. FOLLOWING INSTALLATION, SOD SHALL BE IRRIGATED THOROUGHLY TO PROVIDE MOISTURE PENETRATION TO AT LEAST 6" INTO PREPARED SOIL.
- ALL SOD SHALL BE HANDLED AND LAID IN A HIGH STANDARD OF WORKMANSHIP MANNER. ALL ENDS, JOINTS, AND CUTS SHALL FIT TIGHTLY SO THAT THERE ARE NO VOIDS. THE FINAL APPEARANCE SHALL BE ONE OF A CONTINUOUS LAWN. SECTIONS OF SOD LESS THAN 18" LONG OR 9" WIDE SHALL NOT BE USED NO SOD AREA WILL BE ACCEPTED UNTIL APPROVED BY AUTHORITY HAVING JURISDICTION OR THE UNDERSIGNED, AS REQUIRED.

### **GENERAL SLOPE PLANTING**

PLANTING PREPARATION

- a. CUT SLOPES: THESE SURFACES SHALL BE ROUGHENED IN A HORIZONTAL DIRECTION FOLLOWING THE CONTOUR OF THE SLOPE. THE ROUGHENED TEXTURE SHALL BE MADE BY HAND RAKING OR SIMILAR MECHANICAL MEANS. b. FILL SLOPES: THESE SURFACES SHALL BE COMPACTED AND FINISHED AND ALSO ROUGHENED IN A HORIZONTAL DIRECTION FOLLOWING THE CONTOUR OF THE SLOPE. THE ROUGHENED TEXTURE SHALL BE MADE BY HAND RAKING OR SIMILAR MECHANICAL MEANS.
- WEED ERADICATION
- a. MANUALLY REMOVE EXISTING VEGETATION WHERE NOTED ON PLAN AND DISPOSE OFFSITE. b. FERTILIZE ALL PLANTING AREAS BASED UPON SOIL ANALYSIS. BEGIN WATERING PROCESS TO ACTIVATE FERTILIZER AND ADDITIVE CHEMICALS. c. WATER ALL PLANTING AREAS THOROUGHLY FOR A PERIOD OF TWO (2) CONSECUTIVE WEEKS. THE UNDERSIGNED SHALL APPROVE SPECIFIC WATERING DURATION AND FREQUENCY DESIGNED TO GERMINATE ALL RESIDUAL WEED SEEDS
- d. IF PERENNIAL WEEDS APPEAR, DISCONTINUE WATERING PROCESS FOR TWO (2) DAYS, THEN APPLY RECOMMENDED HERBICIDE BY LICENSED APPLICATOR IF ANNUAL WEEDS APPEAR. USE STRAIGHT CONTACT HERBICIDE AS PER THE LICENSED APPLICATOR'S RECOMMENDATIONS. NO WATER SHALL BE APPLIED FOR A MINIMUM OF FOUR (4) DAYS FOLLOWING APPLICATION CONTACT WEED KILLER. e. ALLOW SUFFICIENT PERIOD OF TIME TO INSURE THAT ALL WEEDS ARE DEAD.
- f. WATER ALL PLANTING AREAS THOROUGHLY FOR A PERIOD OF THREE (3) WEEKS. A SHORTER WATERING PERIOD MAY BE PERMISSIBLE AT THE DISCRETION OF THE UNDERSIGNED AND/OR THE PEST CONTROL ADVISOR. DISCONTINUE WATERING FOR ONE (1) DAY PRIOR TO THE SECOND APPLICATION OF THE HERBICIDE. RE-APPLY A STRAIGHT CONTACT WEED KILLER, AS PER THE PEST CONTROL ADVISOR'S RECOMMENDATIONS. FOR EFFECTIVE WEED ERADICATION, ALLOW A MINIMUM OF FOUR (4) DAYS WITHOUT IRRIGATION.RO . REMOVE ALL DESICCATED WEEDS FROM SLOPES.
- PLANT TREES AND SHRUBS AS INDICATED ON PLANTING PLAN AND AS DETAILED ON PLANTING DETAIL SHEET. SUBSTITUTIONS OF PLANTS WILL NOT BE ACCEPTED UNLESS APPROVED IN WRITING BY THE UNDERSIGNED. INSTALL ALL CONTAINER GROWN PLANTS ACCORDING TO TREE AND SHRUB PLANTING AND STAKING DETAIL. THOROUGHLY MIX THE SPECIFIED MATERIALS FOUND IN THE SOIL ANALYSIS AND THOSE SPECIFIED IN THE PLANTING DETAIL SHEET WITH THE SITE SOIL PRIOR TO BACKFILLING OF PLANTING PITS.

### **GENERAL LANDSCAPING NOTES**

- AFTER ALL INSTALLATION OPERATIONS HAVE BEEN COMPLETED, REMOVE ALL RUBBISH, EXCESS SOIL, EMPTY PLANT CONTAINERS AND TRASH FROM THE SITE DAILY. ALL SCARS, RUTS AND OTHER MARKS IN THE AREA CAUSED BY THIS WORK SHALL BE REPAIRED AND THE GROUND LEFT IN A NEAT, ORDERLY CONDITION. LEAVE SITE IN BROOM-CLEAN CONDITION AT THE END OF EACH DAY.
- DURING INSTALLATION, THE CONTRACTOR SHALL MAINTAIN A SUFFICIENT NUMBER OF LABORERS AND ADEQUATE EQUIPMENT TO PERFORM THE WORK HEREIN SPECIFIED. PLANT MAINTENANCE SHALL CONSIST OF WATERING, WEEDING, CARING OF PLANTS, INCLUDING GROUND COVERS, SHRUBS, VINES AND TREES, EDGING AND MOWING LAWNS, FERTILIZING, CONTROL OF PESTS AND DISEASES, AND MAINTAINING WALKS FREE OF DEBRIS AND DIRT. UPON COMPLETION OF EACH AREA, THE CONTRACTOR, THE UNDERSIGNED, THE OWNER, ALONG WITH THE OWNER'S MAINTENANCE REPRESENTATIVE SHALL CONDUCT AN INSPECTION OF COMPLETED AREA. AT THIS TIME, A LIST OF CORRECTIONS, IF ANY, SHALL
- BE MADE. ALL CORRECTIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. AFTER ALL WORK HAS BEEN COMPLETED, INSPECTED AND ACCEPTED, ALL AREAS WILL BE MAINTAINED FOR A PERIOD OF NINETY (90) CALENDAR DAYS OR AS LONG AS IS NECESSARY TO ESTABLISH THRIVING TREES, SHRUBS, TURF AND GROUND COVER WITHOUT BARE SPOTS.
- KEEP ALL AREAS WEED-FREE, ADEQUATELY WATERED AND NEATLY CULTIVATED FOR THE NINETY (90) PERIOD. REMOVE ALL DEBRIS FROM SITE AND KEEP THE ENTIRE SITE BROOM-CLEAN. TURF AREAS ARE TO BE MOWED WEEKLY. RE-SEED ALL BARE SPOTS IN TURF AREAS AT TWO (2) WEEK INTERVALS AND MAINTAIN UNTIL AN EVEN STAND OF TURF IS OBTAINED. RE-SEED ALL SLOPE AREAS THAT FAIL TO GERMINATE EVENLY. REPAIR ALL ERODED SURFACES AT NO COST TO THE OWNER.
- DAMAGE TO ANY PLANTED AREA SHALL BE REPAIRED IMMEDIATELY. DEPRESSIONS CAUSED BY VEHICLES OR FOOT TRAFFIC SHALL BE FILLED WITH TOPSOIL, LEVELED AND REPLANTED. THE PROJECT SHALL BE SO CARED FOR THAT A NEAT, CLEAN CONDITION WILL BE PRESENTED AT ALL TIMES TO THE SATISFACTION OF THE
- OWNER AND THE UNDERSIGNED. THE LANDSCAPE CONTRACTOR SHALL BE EXPECTED TO MAKE A MINIMUM OF ONE (1) VISIT PER WEEK FOR MAINTENANCE PURPOSES DURING THE MAINTENANCE PERIOD (90 DAYS).
- AT THE END OF THE MAINTENANCE PERIOD, ALL AREAS THAT HAVE BEEN PLANTED SHALL BE FERTILIZED WITH COMMERCIAL FERTILIZER. ANALYSIS AND RATE OF APPLICATION SHALL BE PER THE SOILS REPORT. THE CONTRACTOR SHALL REQUEST A FINAL SITE VISIT SEVEN (7) DAYS PRIOR TO THE END OF THE MAINTENANCE PERIOD (90 DAYS). THIS
- REQUEST SHALL BE WRITTEN AND DIRECTED TO THE OWNER AND THE UNDERSIGNED. UPON WRITTEN ACCEPTANCE OF THE PROJECT BY THE OWNER AND THE UNDERSIGNED, THE CONTRACTOR SHALL BE RELIEVED OF ANY FURTHER MAINTENANCE.
- GUARANTEE ALL TURF, GROUND COVER AND SHRUBS SHALL BE GUARANTEED TO LIVE AND GROW THROUGH THE FIRST GROWING SEASON. TREES SHALL BE GUARANTEED FOR A PERIOD OF ONE (1) YEAR. THE CONTRACTOR, AT NO COST TO THE OWNER, SHALL REPLACE ANY MATERIAL THAT FAILS TO GROW THROUGH THE SPECIFIED MAINTENANCE AND GUARANTEED.
- INSPECTION DURING CONSTRUCTIO OBSERVATION VISITS SPECIFIED HEREIN SHALL BE MADE BY THE UNDERSIGNED OR HIS REPRESENTATIVE. THE CONTRACTOR SHALL REQUEST OBSERVATION AT LEAST TWO (2) WORKING DAYS IN ADVANCE OF THE TIME THAT THE OBSERVATION IS REQUESTED. A
- OBSERVATION VISITS ARE SUGGESTED FOR THE FOLLOWING PARTS OF THE WORK: a. UPON COMPLETION OF GRADING AND SOIL CONDITIONING PRIOR TO PLANTING.
- b. WHEN TREES ARE SPOTTED FOR PLANTING, BUT PRIOR TO WHEN PLANTING HOLES ARE EXCAVATED. c. WRITTEN ACCEPTANCE OF THE PROJECT TO RELEASE THE CONTRACTOR FROM FURTHER MAINTENANCE SHALL OCCUR AFTER FINAL OBSERVATION WITH THE OWNER OR HIS REPRESENTATIVE AT THE END OF THE MAINTENANCE PERIOD.
- VERIFICATION OF DIMENSION
- ALL SCALED DIMENSIONS ARE APPROXIMATE. PRIOR TO PROCEEDING WITH ANY WORK, THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND QUANTITIES, AND SHALL IMMEDIATELY NOTIFY THE UNDERSIGNED OF ANY DISCREPANCY BETWEEN THE DRAWINGS AND/OR SPECIFICATIONS AND ACTUAL CONDITIONS. NO WORK SHALL BE DONE IN ANY AREA WHERE THERE IS SUCH A DISCREPANCY UNTIL APPROVAL FOR SAME HAS BEEN GIVEN BY THE UNDERSIGNED.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UNDERGROUND UTILITY LINES PRIOR TO ANY CONSTRUCTION. SO THAT PROPER PRECAUTIONS MAY BE TAKEN NOT TO DAMAGE SUCH LINES AND PLANT LOCATIONS. PROMPTLY NOTIFY THE UNDERSIGNED TO ARRANGE FOR RELOCATIONS OF UTILITIES OR PLANTING LOCATIONS. FAILURE TO FOLLOW THIS PROCEDURE PLACES UPON THE CONTRACTOR THE RESPONSIBILITY FOR, AT HIS OWN EXPENSE, MAKING ANY AND ALL REPAIRS FOR DAMAGES RESULTING FROM HIS WORK.
- CONTRACTOR IS TO TAKE CARE IN PRESERVING ANY EXISTING TREES GREATER THAN OR EQUAL TO 6" ON THE SITE. DAMAGE OR LOSS OF THESE TREES WILL RESULT IN REPLACEMENT OF EQUAL SIZE BY THE LANDSCAPE CONTRACTOR.

