Stormwater Operation and Maintenance Manual
Proposed Residential Development
Township of Verona, Essex County, NJ



Submitted To:

DMH2, LLC
3155 Route 10 East – Suite 214
Denville, NJ 07834

STATE OF NEW JERSEY
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Responsible Parties

The person or responsible party for the maintenance and operation of the facilities shall provide ample manpower, materials, and equipment to facilitate the annual inspection of these facilities by the municipality. This manual shall be updated by the Owner as needed.

OWNER	CONTACT(S)
DMH2, LLC 3155 Route 10 East – Suite 214 Denville, NJ 07834	Michael Harrison Owner Cell: 973-361-9271

If the person responsible for maintenance identified under above is not a public agency, the maintenance plan and any future revisions shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

The person responsible for maintenance identified above shall

1. Maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.
2. Evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.
3. Retain and make available, upon request, by any public entity with administrative, health, environmental or safety authority over the site, the maintenance plan and the documentation required.

General Information

This Stormwater Management Operation and Maintenance Manual was prepared for the DMH2, LLC Proposed Residential Development project. The project site is located at 176-200 Bloomfield Avenue in the Township of Verona, Essex County, NJ. It is designated as Block 202, Lots 1 & 23 on the Township of Verona Tax Map Sheet #2. The 1.64-acre site is currently wooded with concrete foundation remains. Existing access to the site consists of one driveway fronting Westview Road. The project proposes to demolish the existing site features and construct a 11,821 SF, 3-story residential apartment building with associated parking and sidewalk areas. Additional improvements include grading, drainage, utilities, lighting, and landscaping. Two new driveways are proposed for site access, one (1) on Bloomfield Avenue and one (1) on Westview Road.

To provide onsite stormwater management and offset the increase in runoff caused by the increase in impervious surface coverage for the post-construction condition, four (4) pervious pavement basins with ADS Detention Systems are proposed. The new pervious pavement systems were designed in accordance with the NJ BMP Manual to meet the standards for Green Infrastructure as required by NJAC 7:8. The post-construction stormwater management measures were designed to meet the peak flow reduction factors as required by NJAC 7:8-5.6(b)3.

Basin #1 – Permeable Asphalt and Pavers

Basin #1 is a permeable asphalt basin with an ADS N-12 48" detention system with a system size of 117.00' X 18.00' X 6.29'. It is designed as an on-line system with underdrain piping and filter fabrics placed along the bottom and sides of the basin. Runoff from Basin #4 is conveyed into Basin #1 in a 15" HDPE pipe while surface runoff enters the gravel layer through the pervious asphalt.

- Basin #1 is designed with an ADS N-12 48" detention system with a system size of 117.00' X 18.00' X 6.29'
- Basin #1 discharges through outlet control structure OCS-1
- Basin #1 includes:
  - 6" Pervious Asphalt Surface Course
  - 2" Choker Course (Clean, Washed, AASHTO #57 Broken Stone)
  - 6.29' Storage Bed (Clean, Washed, Open Graded, AASHTO #2 Broken Stone)
- Designed to drain within 72-hours maximum.
- Permeable asphalt surface course to have 15-25% porosity. Pervious asphalt surface course to have minimum tested infiltration rate of 6.4 in/hr (20 in/hr if used for stormwater quality control).
- Inspection ports provided at each end of the underdrain system for cleaning.
- The basin bottom and sides are lined with an impermeable liner and filter fabric to prevent infiltration from the shallow seasonal high-water table.

Table 1: Basin #1 Elevations

Storm (yr)	Current (ft)	Future (ft)
	Basin Elevations	
2	446.73	446.99
10	447.60	448.14
100	449.56	450.34

Basin #2 – Permeable Asphalt and Pavers

Basin #2 is a permeable asphalt basin with an ADS N-12 60" detention system with a system size of 116.17' X 18.00' X 8.17'. It is designed as an on-line system with underdrain piping and filter fabrics placed along the bottom and sides of the basin. Runoff from Basin #3 is conveyed into Basin #2 in a 15" HDPE pipe while surface runoff enters the gravel layer through the pervious asphalt.

- Basin #2 is designed with an ADS N-12 60" detention system with a system size of 116.17' X 18.00' X 8.17'
- Basin #2 discharges through outlet control structure OCS-2
- Basin #2 includes:
  - 6" Pervious Asphalt Surface Course
  - 2" Choker Course (Clean, Washed, AASHTO #57 Broken Stone)
  - 8.17' Storage Bed (Clean, Washed, Open Graded, AASHTO #2 Broken Stone)
- Designed to drain within 72-hours maximum.
- Permeable asphalt surface course to have 15-25% porosity. Pervious asphalt surface course to have minimum tested infiltration rate of 6.4 in/hr (20 in/hr if used for stormwater quality control).
- Inspection ports provided at each end of the underdrain system for cleaning.
- The basin bottom and sides are lined with an impermeable liner and filter fabric to prevent infiltration from the shallow seasonal high-water table.

Table 2: Basin #2 Elevations

Storm (yr)	Current (ft)	Future (ft)
	Basin Elevations	
2	445.74	446.12
10	446.81	446.92
100	447.45	448.28

Basin #3 – Permeable Asphalt and Pavers

Basin #3 is a permeable asphalt basin with an ADS N-12 60" detention system with a system size of 62.17' X 18.00' X 10.08'. It is designed as an on-line system with underdrain piping and filter fabrics placed along the bottom and sides of the basin. Surface runoff enters the gravel layer through the pervious asphalt.

- Basin #2 is designed with an ADS N-12 60" detention system with a system size of 62.17' X 18.00' X 10.08'
- Basin #2 discharges through outlet control structure OCS-3
- Basin #2 includes:
  - 6" Pervious Asphalt Surface Course
  - 2" Choker Course (Clean, Washed, AASHTO #57 Broken Stone)
  - 10.08' Storage Bed (Clean, Washed, Open Graded, AASHTO #2 Broken Stone)
- Designed to drain within 72-hours maximum.
- Permeable asphalt surface course to have 15-25% porosity. Pervious asphalt surface course to have minimum tested infiltration rate of 6.4 in/hr (20 in/hr if used for stormwater quality control).
- Inspection ports provided at each end of the underdrain system for cleaning.
- The basin bottom and sides are lined with an impermeable liner and filter fabric to prevent infiltration from the shallow seasonal high-water table.

Table 3: Basin #3 Elevations

Storm (yr)	Current (ft)	Future (ft)
	Basin Elevations	
2	448.10	448.64
10	449.84	450.65
100	452.23	454.22

Basin #4 – Permeable Asphalt and Pavers

Basin #4 is a permeable asphalt basin with an ADS N-12 48" detention system with a system size of 33.00' X 18.00' X 5.83'. It is designed as an on-line system with underdrain piping and filter fabrics placed along the bottom and sides of the basin. Surface runoff enters the gravel layer through the pervious asphalt.

- Basin #4 is designed with an ADS N-12 48" detention system with a system size of 33.00' X 18.00' X 5.83'
- Basin #4 discharges through outlet control structure OCS-4
- Basin #4 includes:
  - 6" Pervious Asphalt Surface Course
  - 2" Choker Course (Clean, Washed, AASHTO #57 Broken Stone)
  - 5.83' Storage Bed (Clean, Washed, Open Graded, AASHTO #2 Broken Stone)
- Designed to drain within 72-hours maximum.
- Permeable asphalt surface course to have 15-25% porosity. Pervious asphalt surface course to have minimum tested infiltration rate of 6.4 in/hr (20 in/hr if used for stormwater quality control).
- Inspection ports provided at each end of the underdrain system for cleaning.
- The basin bottom and sides are lined with an impermeable liner and filter fabric to prevent infiltration from the shallow seasonal high-water table.

Table 4: Basin #4 Elevations

Storm (yr)	Current (ft)	Future (ft)
	Basin Elevations	
2	453.59	453.90
10	454.35	454.68
100	455.69	456.74

Preventative and Corrective Maintenance Tasks

Catch Basins, Manholes, Vaults, and Outfalls/Riprap

1. Inspect for evidence of and/or remove spills within catch basins quarterly.
2. Inspect for evidence of and/or remove spills within vaults within truck loading areas after heavy rainstorm events. Open check valves and drain any sump after confirming free of pollutants and spills.
3. Inspect for evidence of and/or remove heavy sedimentation and/or organic buildup within catch basins and manholes quarterly
4. Inspect for evidence of and/or remove any blockages or structural damage to catch basins, manholes, and outfalls quarterly
5. Remove weeds, vegetation, debris, and sediment from riprap aprons quarterly.
6. Record all results on inspection logs

Permeable Asphalt and Pavers

1. Inspect rip-rap aprons, outlet control structures, and trash racks for clogging, excessive debris, and sediment accumulation at least four times annually and after every storm exceeding 1 inch of rainfall.
2. Inspect pavement for excessive debris and sediment accumulation monthly and after every storm exceeding 1 inch of rainfall.
3. Inspect surface, at least once annually, for cracking, subsidence, spalling, erosion, deterioration, and unwanted vegetation. Apply remedial measures as soon as possible. Do not use herbicides.
4. The surface course of a pervious paving system must be vacuum swept, not power swept, at least four times per year. Vacuum sweeping must be followed by either air blowing or high-pressure power washing performed in accordance with the specifications recommended for the particular type of system. All dislodged material must be promptly removed.
    a. The first annual maintenance must be performed in the spring.
    b. Maintenance must additionally be performed in the autumn, after the fallen leaves are collected and removed.
5. Each spring, after the last snow or ice event, the infiltration rate of the surface course must be tested in accordance with the methods of either ASTM C1701 or C1781, as corresponds to the post-construction test performed for the system. At least 3 locations must be tested. One of the locations must be in an area where sediment is most likely to be deposited, such as, but not limited to, the entrance. The other test locations must be evenly spaced across the system surface. The locations and results obtained must be recorded in the maintenance plan for future reference and compared to the as-built testing results as a metric for determining if a system requires corrective action. The chart provided below shows the approximate infiltration rate based upon the time it takes to infiltrate either 8 or 40 pounds of water specified in the above-cited tests. This chart should be included in the maintenance plan for future reference. The infiltration rate, I, is based upon the following calculation:

$$I = (K * M) / (D^2 * t), \text{ where}$$

K = 126,870 in-lbs
M = water mass, lbs
D = ring diameter = 12 inches
t = time, in seconds

Test Methods Per ASTM C1701 or C1781		
Time to Infiltrate the Specified Amount of Water (sec)	Approximate Surface Infiltrate Rate (inches per hour)	
	M = 8lbs	***M = 40lbs***
30	235	1175
60	118	587
100	70.5	352
200	35.2	176
350	20.1	100.7

360	19.6	97.9
380	18.5	92.7
900	7.8	39.2
1760	4.0	20.0
1910	3.7	18.5
3600	2.0	9.8
5400	1.3	6.5
5470	1.3	6.4
6000	1.2	5.9

Take note that should the test be performed with a different quantity of water, the values in the chart above cannot be used.

6. Corrective action must be immediately taken to restore the infiltration capacity of the pervious paving system under the following scenarios:
    a. Standing water is observed on the surface course; or
    b. The testing methods above show an infiltration rate of 20 inches per hour or less for a system designed for quantity control or 6.4 or less for a system designed for water quality control only.
7. Disposal of debris, trash, sediment and other waste material must be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.
8. Under no circumstances may any sealants or coatings be applied to pervious paving systems, except for those approved by the manufacturer to improve surface course resistance to de-icing chemicals or refresh traffic striping.
9. Over the lifetime of the surface course, no more than 10% of its surface area may be patched with impervious material such as bituminous asphalt or concrete. All patching must be recorded in the maintenance manual for future reference to prevent exceedance of this maximum
10. Record all results on inspection logs.

Cold Weather Maintenance

1. Care must be taken when removing snow from the surface course; pervious paving surface courses may be damaged by snowplows or loader buckets set too low to the ground or not equipped with a rubber blade guard. Sand, grit or cinders may not be used on surface courses for snow/ice control.
2. De-icing chemicals may not be used on pervious concrete less than one year old.
3. De-icers containing magnesium chloride, calcium magnesium acetate or potassium acetate may never be used on pervious concrete

Maintenance Schedule

The following schedule is a recommendation as to when maintenance activities shall be performed:

Monthly:	1st of each month.
Quarterly:	January 1, April 1, July 1 and October 1
Semi-Annually:	January 1, July 1
Annually:	July 1

Training and Equipment

Refer to Section 2 General Information for description of stormwater management measures and components. It is the responsibility of the Owner to ensure maintenance personnel are familiarized with the contents of this manual and to properly train, employ, or contract qualified personnel to inspect and maintain all stormwater management systems and their associated components. Personnel shall be properly trained and certified as needed for operation of equipment.

Personnel shall be educated and trained in proper safety procedures and measures, such as fall safety. Personnel inspecting confined spaces, such as manholes, shall be OSHA certified in confined space entry. Personnel maintaining landscape and vegetation shall be trained or familiarized with native vegetation and bioretention plant species.

Recommended equipment for maintaining these stormwater management systems includes, but is not limited to, the following:

- Tape Measure
- Lawn Mower
- Shovel
- Rake
- Flashlight
- Vacuum Truck
- Lightweight Backhoe
- Personal Protective Equipment
- Debris Containers
- Ventilation Equipment
- First Aid Materials

Cost Estimate

Description	Amount	Unit	Unit Cost	Total Cost
Activity			***($)***	***($)***
Monthly Inspections	8.00	HRS	50.00	400
Quarterly Inspections	8.00	HRS	50.00	400
Semi-Annual Inspections	8.00	HRS	50.00	400
Annual Inspection	4.00	HRS	50.00	200
Removal of sediment/debris	4.00	LS	600.00	2,400
Removal/Replacement of Filters	1.00	LS	3000.00	3,000
Disposal of sediment/debris	1.00	LS	100.00	100
Training	8.00	HRS	50.00	400

STORMWATER MANAGEMENT FACILITIES INSPECTION CHECKLIST

Instructions: This inspection record will be completed and filed with all other inspection forms. Further description or comments shall be attached on a separate sheet of paper if necessary. Any "NO" answer requires Corrective action.

Type of inspection (circle all that apply) Monthly/Quarterly/Semi-Annual/Annual

BASIN #1 – PERMEABLE ASPHALT AND PAVERS GRAVEL BASIN

	Circle One		Date/Description/Comment
MONTHLY INSPECTION			
Asphalt Inspected	YES	NO	
Damaged Asphalt Replaced	YES	NO	
Removed any vegetation growth	YES	NO	
Inspected for standing water and ponding	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
QUARTERLY INSPECTION			
Basin inlets free of debris/clogging/excessive sediments	YES	NO	
Inspect and cleaned underdrain cleanouts	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	

	Circle One		Date/Description/Comment
SEMI ANNUAL INSPECTION			
Basin grass free of weeds, bare spots, diseased areas	YES	NO	
Inspected and confirmed adequate basin permeability	YES	NO	

ANNUAL INSPECTION

Basin free of unwanted growth	YES	NO	
Spillway free of unwanted growth	YES	NO	
Basin free of scour/erosion	YES	NO	
Structural components free of cracking/deterioration/ Subsidence/spalling	YES	NO	

ADDITIONAL MAINTENANCE AND INSPECTION NOTES

Instructions: This inspection record will be completed and filed with all other inspection forms. Further description or comments shall be attached on a separate sheet of paper if necessary. Any "NO" answer requires Corrective action.

Type of inspection (circle all that apply) Monthly/Quarterly/Semi-Annual/Annual

BASIN #2 – PERMEABLE ASPHALT AND PAVERS GRAVEL BASIN

	Circle One		Date/Description/Comment
MONTHLY INSPECTION			
Asphalt Inspected	YES	NO	
Damaged Asphalt Replaced	YES	NO	
Removed any vegetation growth	YES	NO	
Inspected for standing water and ponding	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
QUARTERLY INSPECTION			
Basin inlets free of debris/clogging/excessive sediments	YES	NO	
Inspect and cleaned underdrain cleanouts	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
	Circle One		**Date/Description/Comment**
SEMI ANNUAL INSPECTION			
Basin grass free of weeds, bare spots, diseased areas	YES	NO	
Inspected and confirmed adequate basin permeability	YES	NO	

ANNUAL INSPECTION

Basin free of unwanted growth	YES	NO	
Spillway free of unwanted growth	YES	NO	
Basin free of scour/erosion	YES	NO	
Structural components free of cracking/deterioration/ Subsidence/spalling	YES	NO	

ADDITIONAL MAINTENANCE AND INSPECTION NOTES

Instructions: This inspection record will be completed and filed with all other inspection forms. Further description or comments shall be attached on a separate sheet of paper if necessary. Any "NO" answer requires Corrective action.

Type of inspection (circle all that apply) Monthly/Quarterly/Semi-Annual/Annual

BASIN #3 – PERMEABLE ASPHALT AND PAVERS GRAVEL BASIN

	Circle One		Date/Description/Comment
MONTHLY INSPECTION			
Asphalt Inspected	YES	NO	
Damaged Asphalt Replaced	YES	NO	
Removed any vegetation growth	YES	NO	
Inspected for standing water and ponding	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
QUARTERLY INSPECTION			
Basin inlets free of debris/clogging/excessive sediments	YES	NO	
Inspect and cleaned underdrain cleanouts	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
	Circle One		**Date/Description/Comment**
SEMI ANNUAL INSPECTION			
Basin grass free of weeds, bare spots, diseased areas	YES	NO	
Inspected and confirmed adequate basin permeability	YES	NO	

ANNUAL INSPECTION

Basin free of unwanted growth	YES	NO	
Spillway free of unwanted growth	YES	NO	
Basin free of scour/erosion	YES	NO	
Structural components free of cracking/deterioration/ Subsidence/spalling	YES	NO	

ADDITIONAL MAINTENANCE AND INSPECTION NOTES

Instructions: This inspection record will be completed and filed with all other inspection forms. Further description or comments shall be attached on a separate sheet of paper if necessary. Any "NO" answer requires Corrective action.

Type of inspection (circle all that apply) Monthly/Quarterly/Semi-Annual/Annual

BASIN #4 – PERMEABLE ASPHALT AND PAVERS GRAVEL BASIN

	Circle One		Date/Description/Comment
MONTHLY INSPECTION			
Asphalt Inspected	YES	NO	
Damaged Asphalt Replaced	YES	NO	
Removed any vegetation growth	YES	NO	
Inspected for standing water and ponding	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
QUARTERLY INSPECTION			
Basin inlets free of debris/clogging/excessive sediments	YES	NO	
Inspect and cleaned underdrain cleanouts	YES	NO	
	YES	NO	
	YES	NO	
	YES	NO	
	Circle One		**Date/Description/Comment**
SEMI ANNUAL INSPECTION			
Basin grass free of weeds, bare spots, diseased areas	YES	NO	
Inspected and confirmed adequate basin permeability	YES	NO	

ANNUAL INSPECTION

Basin free of unwanted growth	YES	NO	
Spillway free of unwanted growth	YES	NO	
Basin free of scour/erosion	YES	NO	
Structural components free of cracking/deterioration/ Subsidence/spalling	YES	NO	

ADDITIONAL MAINTENANCE AND INSPECTION NOTES

CATCH BASINS, MANHOLES, VAULTS, AND OUTFALLS/RIPRAP

	Circle One		Date/Description/Comment
QUARTERLY INSPECTION			
Catch Basins/Vaults shows evidence of spills	YES	NO	
Catch Basins, Vaults and Manholes free of heavy sediments and/or organic materials	YES	NO	
Catch basins, Vaults, Manholes, and outfalls free of blockages and structural damage	YES	NO	
Riprap free of debris/clogging/excessive sediments	YES	NO	
Riprap free of weeds and invasive plants	YES	NO	

ADDITIONAL MAINTENANCE AND INSPECTION NOTES

ADDITIONAL MAINTENANCE AND INSPECTION NOTES

Supervisor Representing Owner/Responsible Party:

Name / Title
Name of Person Performing Inspection:

Signature: *Date:*

Name / Title
Name of Person Performing Inspection:

Signature: *Date:*

ADS TECHNICAL NOTE – STORM CONVEYANCE SYSTEM MAINTENANCE

TECHNICAL NOTE

HDPE Pipe Repair Options

TN 5.03
January 2010

Introduction

High-density polyethylene (HDPE) pipe is 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 bulletin discusses some of the products available that can be used to repair damaged HDPE pipe or joints in the field.

Repair Options

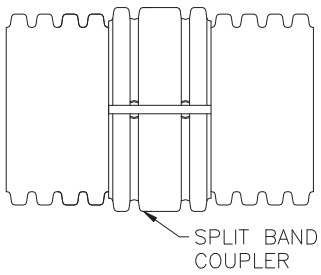
One of the primary considerations in selecting a repair method is the degree of joint performance required. Watertight repairs are generally used on pipe with watertight joints, and soil-tight repairs on pipe with soil-tight joints. This helps keep costs in line and prevents the repair from being the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

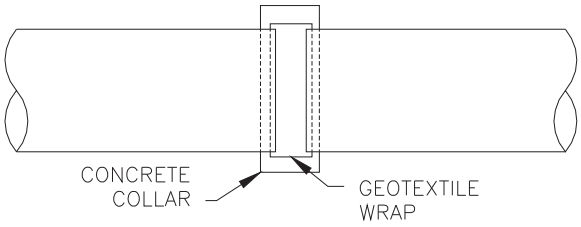
Mar Mac Polyseal Pipe Coupler, 4- through 60-inch (100 - 1500 mm), consists of a mastic adhesive base layer, a cross-laminated polyethylene middle layer with a spun-bonded geotextile polypropylene cloth outer layer. The coupler incorporates a self-adhering rubberized bonding mastic and securing bands 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 corrugated HDPE pipe products. *Note: Mar-Mac bands shall be installed in accordance with manufacturer's recommendations.*

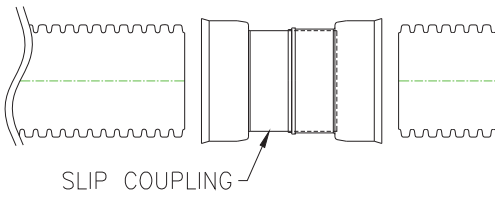


Snap couplers, 4- through 8-inch (100 – 200 mm), and *split band couplers,* 10- through 30-inch (250 – 750 mm), will provide a soil-tight repair with or without gaskets. This repair method should only be used if the damaged area is in a non-trafficked green area, is cosmetic in nature, confined to a single corrugation, and is not defined as structural damage. The coupler shall be centered around 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 snap or split band couplers. They are a convenient, low-cost repair alternative, and are typically used to repair soil-tight smooth interior corrugated HDPE pipe products.

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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 corrugated HDPE pipe products. .





Slip Couplings 4- through 24-inch (100 – 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. PVC slip couplings are most commonly used with watertight smooth interior corrugated HDPE 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™, 4 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

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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: The HDPE 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.

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STORMWATER DESIGN GRADING AND DRAINAGE PLANS AND DRAINAGE DETAILS



AERIAL LOCATION MAP

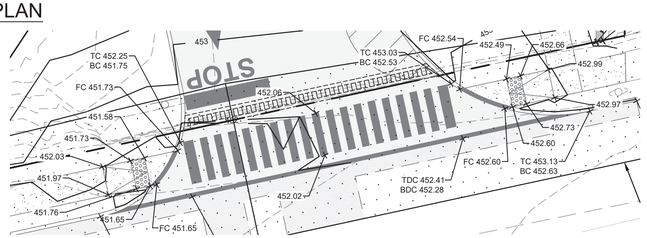
1"=200'

GRADING LEGEND

84	PROPOSED CONTOUR
84	EXISTING CONTOUR
84.00	SPOT ELEVATION
	STORM INLET
	STORM MANHOLE
TC / BC	TOP OF CURB / BOTTOM OF CURB
TS / BS	TOP OF STEP / BOTTOM OF STEP
TW / BW	TOP OF WALL / BOTTOM OF WALL
RIM / GR	RIM / GRATE ELEVATION
INV	INVERT
DMH-1	DRAINAGE MANHOLE
I-1	INLET
FFE	FINISHED FLOOR ELEVATION
RD	ROOF DRAIN

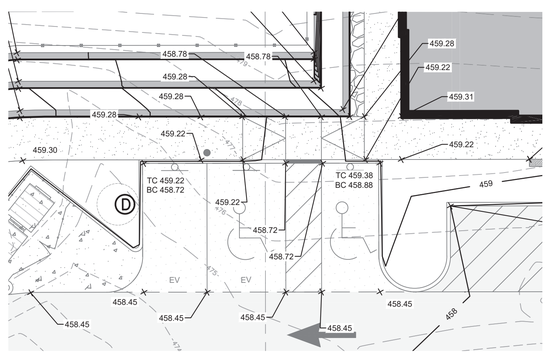
GRADING PLAN

1" = 20'



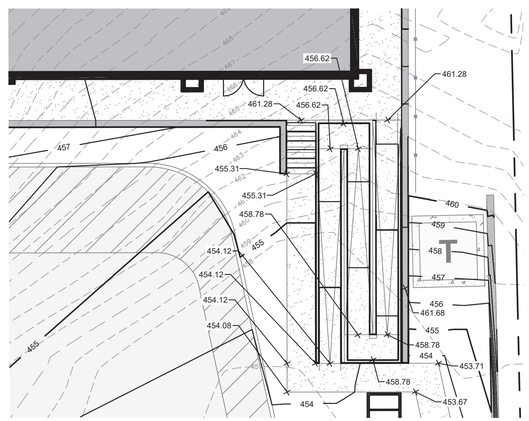
SECTION 2

1" = 10'



SECTION 3

1" = 10'



SECTION 1

1" = 10'

0 20' 40'

NOT FOR CONSTRUCTION

GENERAL NOTES:

1. EXISTING BOUNDARY, TOPOGRAPHIC, AND SITE INFORMATION SHOWN HEREIN OBTAINED FROM A PLAN ENTITLED "BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY KENNON SURVEYING SERVICES INC. DATED 04/23/2026, LAST REVISED 05/15/2026. REFER TO EXISTING CONDITIONS PLAN FOR ADDITIONAL NOTES.
2. REFER TO SHEET CS1001 FOR ADDITIONAL GENERAL NOTES

GRADING NOTES:

1. ALL SOIL AND MATERIAL REMOVED FROM THE SITE SHALL BE DISPOSED OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS. DE-WATERING PRACTICES SHALL BE PERFORMED UNDER THE SUPERVISION OF A QUALIFIED PROFESSIONAL. THE CONTRACTOR IS REQUIRED TO OBTAIN ALL NECESSARY PERMITS FOR THE DISCHARGE OF DE-WATERED GROUNDWATER. ALL SOIL IMPORTED TO THE SITE SHALL BE CERTIFIED CLEAN FILL. CONTRACTOR SHALL MAINTAIN RECORDS OF ALL FILL MATERIALS BROUGHT TO THE SITE.
2. THE CONTRACTOR IS REQUIRED TO PROVIDE TEMPORARY AND/OR PERMANENT SHORING WHERE REQUIRED DURING EXCAVATION ACTIVITIES, INCLUDING BUT NOT LIMITED TO UTILITY TRENCHES, TO ENSURE THE STRUCTURAL INTEGRITY OF NEARBY STRUCTURES AND STABILITY OF THE SURROUNDING SOILS.
3. CONTRACTOR SHALL ADJUST AND CUT EXISTING PAVEMENT AS NEEDED TO ASSURE SMOOTH FIT AND CONTINUOUS GRADE.
4. ALL SIDEWALKS SHALL HAVE A MAXIMUM 2.0% CROSS SLOPE AND THE CONTRACTOR SHALL ASSURE POSITIVE DRAINAGE AWAY FROM BUILDINGS.

ADA INSTRUCTIONS TO CONTRACTORS

1. CONTRACTORS SHALL UTILIZE APPROPRIATE CARE AND PRECISION IN CONSTRUCTION OF ANY ADA ACCESSIBLE COMPONENTS FOR THE SITE. THESE COMPONENTS, AS CONSTRUCTED, MUST COMPLY WITH THE NJ UNIFORM CONSTRUCTION CODE SUBCHAPTER 7 BARRIER FREE ACCESS. FINISHED SURFACES ALONG THE ACCESSIBLE ROUTE OF TRAVEL FROM PARKING SPACES, PUBLIC TRANSPORTATION, PEDESTRIAN ACCESS, INTER-BUILDING ACCESS, TO POINTS OF ACCESSIBLE BUILDING ENTRANCE/EGRESS, SHALL COMPLY WITH THESE ADA CODE REQUIREMENTS. THESE INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   - A. PARKING SPACES AND PARKING AISLES- SLOPE SHALL NOT EXCEED 2.00% IN ANY DIRECTION.
   - B. CURB RAMPS - SLOPE SHALL NOT EXCEED 8.33%.
   - C. LANDINGS - SHALL BE PROVIDED AT EACH END OF RAMPS, SHALL PROVIDE POSITIVE DRAINAGE, AND SHALL NOT EXCEED 2.00% CROSS SLOPE IN ANY DIRECTION.
   - D. PATH OF TRAVEL ALONG ACCESSIBLE ROUTE - PROVIDE A 36 INCH MININMUM UNOBSTRUCTED WIDTH OF TRAVEL, (CAR OVERHANGS CANNOT REDUCE THIS MINIMUM WIDTH), THE SLOPE SHALL BE NO GREATER THAN 5.00% IN THE DIRECTION OF TRAVEL, AND SHALL NOT EXCEED 2.00% IN CROSS SLOPE.
   - E. WHERE PATH OF TRAVEL WILL BE GREATER THAN 1:20 (5.00%), AN ADA RAMP WITH A MAXIMUM SLOPE OF 8.33% SHALL BE PROVIDED.
   - F. DOORWAYS SHALL HAVE A "LEVEL" LANDING AREA ON THE EXTERIOR SIDE OF THE DOOR THAT IS SLOPED NO MORE THAN 2.00% FOR POSITIVE DRAINAGE. THIS LANDING AREA SHALL BE NO LESS THAN 60 INCHES (5 FEET) LONG, EXCEPT WHERE OTHERWISE PERMITTED BY ADA STANDARDS FOR ALTERNATIVE DOORWAY OPENING CONDITIONS (SEE ICC/ANSI A117.1-2003 AND OTHER REFERENCES INCORPORATED BY CODE).

Pennoni
NJ COA GA28033300
PENNONI ASSOCIATES INC.
1085 Raymond Boulevard, Suite 2102
Newark, NJ 07102
T 973.265.9775 F 973.265.9774

ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

NJ CERTIFICATE OF AUTHORIZATION NO. 24GA28033300

RICHARD N. PROCANIK, PE
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE NO. 24GE05407700

DATE:

NOTE: THIS DRAWING IS NOT A LEGAL DOCUMENT WITHOUT THE SIGNATURE AND RAISED SEAL OF A PROFESSIONAL ENGINEER

PROPOSED RESIDENTIAL DEVELOPMENT
176-200 BLOOMFIELD AVENUE (BLOCK 202, LOTS 1 & 23)
TOWNSHIP OF VERONA, ESSEX COUNTY, NEW JERSEY

GRADING PLAN

DMH2, LLC
3155 ROUTE 10 EAST - SUITE 214
DENVILLE, NJ 07834

NO.	DATE	REVISIONS	BY

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON THE EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATE, AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

PROJECT	DMH2C26001
DATE	2026-08-17
DRAWING SCALE	1"=20'
DRAWN BY	JD
APPROVED BY	RP

CS1501

SHEET 5 OF 19

PLOTTED: 4/30/2014 1:23 PM, BY: John DeMarnis PLOTSTYLE: Pennoni NCS.stb
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AERIAL LOCATION MAP
1"=200'

GENERAL NOTES:

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2. REFER TO SHEET CS1001 FOR ADDITIONAL GENERAL NOTES

DRAINAGE NOTES:

1. CONTRACTOR SHALL REFER TO ARCHITECTURAL AND/OR MEP PLANS AND SPECIFICATIONS FOR ACTUAL LOCATIONS AND SIZES OF ROOF LEADERS AND COORDINATE WITH THE NEW STORMWATER SYSTEM PRIOR TO INSTALLATION.
2. ALL SOIL AND MATERIAL REMOVED FROM THE SITE SHALL BE DISPOSED OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS. DE-WATERING PRACTICES SHALL BE PERFORMED UNDER THE SUPERVISION OF A QUALIFIED PROFESSIONAL. THE CONTRACTOR IS REQUIRED TO OBTAIN ALL NECESSARY PERMITS FOR THE DISCHARGE OF DE-WATERED GROUNDWATER. ALL SOIL IMPORTED TO THE SITE SHALL BE CERTIFIED CLEAN FILL. CONTRACTOR SHALL MAINTAIN RECORDS OF ALL FILL MATERIALS BROUGHT TO THE SITE.
3. THE CONTRACTOR IS REQUIRED TO PROVIDE TEMPORARY AND/OR PERMANENT SHORING WHERE REQUIRED DURING EXCAVATION ACTIVITIES, INCLUDING BUT NOT LIMITED TO UTILITY TRENCHES, TO ENSURE THE STRUCTURAL INTEGRITY OF NEARBY STRUCTURES AND STABILITY OF THE SURROUNDING SOILS.
4. EXISTING PIPES (IF ANY) ARE TO BE MAINTAINED AND NEW PIPES (ONCE INSTALLED) SHALL BE PROTECTED WITH A MINIMUM 2.0' COVER DURING CONSTRUCTION.
5. ALL NEW STORM PIPES AND STRUCTURES ARE TO BE HS-25 LOADING QUALIFIED.
6. THE CONTRACTOR IS RESPONSIBLE TO SET ALL NEW UTILITY COVERS AND RESET ALL EXISTING UTILITY COVERS WITHIN THE PROJECT LIMITS TO FINAL GRADE IN ACCORDANCE WITH ANY APPLICABLE MUNICIPAL, COUNTY, STATE, AND/OR UTILITY AUTHORITY REGULATIONS.

DRAINAGE LEGEND

D	STORM PIPE
	STORM INLET
D	STORM MANHOLE
RIM / GR	RIM / GRATE ELEVATION
INV	INVERT
DMH-1	DRAINAGE MANHOLE
I-1	INLET
FFE	FINISHED FLOOR ELEVATION

0 20' 40'

NOT FOR CONSTRUCTION

Pennoni
NJ COA GA28033300
PENNONI ASSOCIATES INC.
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Newark, NJ 07102
T 973.265.9775 F 973.265.9774

ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

N.J CERTIFICATE OF AUTHORIZATION NO. 24GA28033300

RICHARD N. PROCANIK, PE
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE NO. 24GE04047

DATE:

NOTE: THIS DRAWING IS NOT A LEGAL DOCUMENT WITHOUT THE SIGNATURE AND RAISED SEAL OF A PROFESSIONAL ENGINEER

PROPOSED RESIDENTIAL DEVELOPMENT
176-200 BLOOMFIELD AVENUE (BLOCK 202, LOTS 1 & 23)
TOWNSHIP OF VERONA, ESSEX COUNTY, NEW JERSEY

DRAINAGE PLAN

DMH2, LLC
3155 ROUTE 10 EAST - SUITE 214
DENVILLE, NJ 07834

NO.	DATE	REVISIONS	BY

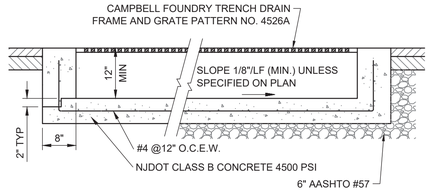
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PROJECT	DMH2C26001
DATE	2026-08-17
DRAWING SCALE	1"=20'
DRAWN BY	JD
APPROVED BY	RP

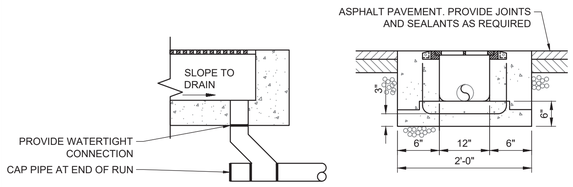
CS1601

SHEET 6 OF 19

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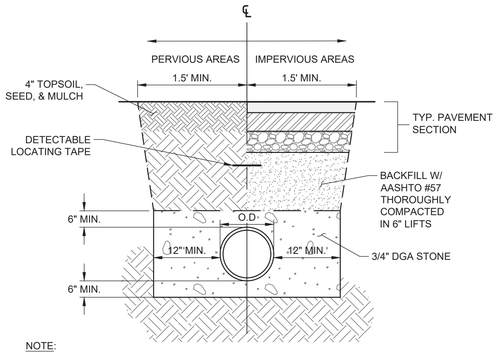
SECTION A-A



SECTION B-B

HEAVY DUTY TRENCH DRAIN

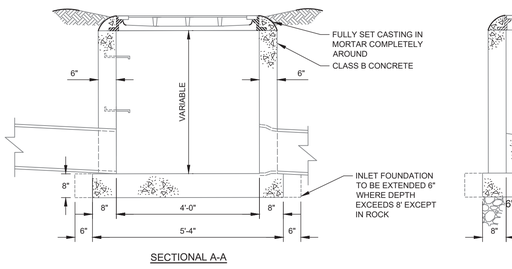
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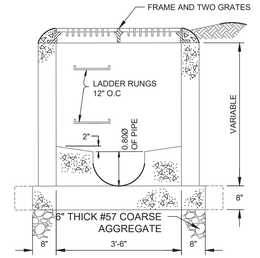
NOTE:
1. PAVEMENT SECTION TO MATCH, AT MINIMUM, ADJOINING PAVEMENT.
2. CONTRACTOR TO BRACE TRENCH IN ACCORDANCE WITH OSHA REQUIREMENTS.
3. AT ROADWAY INSTALLATIONS THE CONTRACTOR SHALL PROVIDE A CLEAN AND SMOOTH TRANSITION TO EXISTING PAVEMENT.
4. TRENCH SHALL BE 3' WIDE MINIMUM.
5. HDPE PIPE INSTALLATION SHALL CONFORM TO ASTM D2321, LATEST EDITION.

STORM PIPE TRENCH AND BEDDING DETAIL

N.T.S



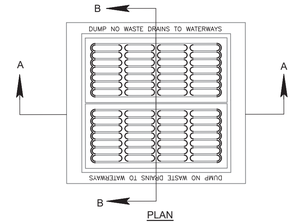
SECTIONAL A-A



SECTIONAL B-B

NJDOT TYPE "E" INLET DETAIL

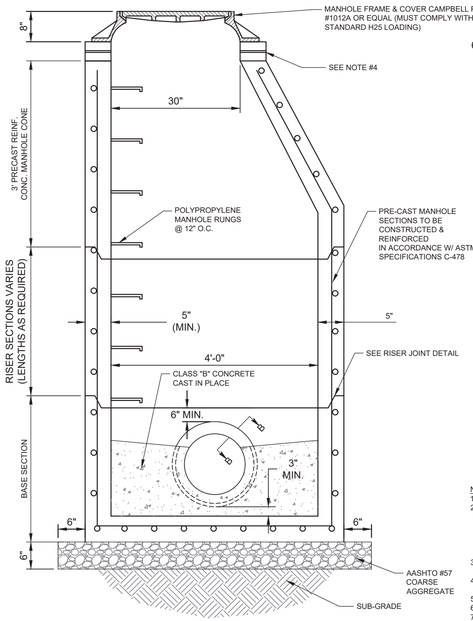
SCALE: NTS



PLAN

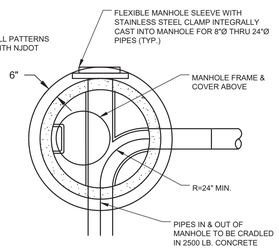
INLET GENERAL NOTES:
1. INVERTS, FOUNDATIONS, AND FOOTINGS SHALL BE NJDOT CLASS B CONCRETE
2. FRAME AND GRATE TO BE No. 2618 AS MANUFACTURED BY CAMPBELL FOUNDRY CO. OR EQUAL BICYCLE TYPE GRATE.
3. WALLS BELOW THE DEPTH OF 8'-0" MEASURED FROM THE INLET GUTTER TO INVERT, SHALL BE 12" THICK. THE FOUNDATION DIMENSION SHALL BE INCREASED 12" IN WIDTH AND TO 12" IN DEPTH.
3. INVERTS TO BE ELIMINATED IN BOTTOM OF TERMINAL INLET.
4. BOTTOMS SHALL BE DISHED AND SLOPED TOWARD THE OUTLET.
5. FRAME AND GRATES SHALL BE CAMPBELL FOUNDRY PATTERN No. 3425 BICYCLE AND ADA COMPLIANT OR APPROVED EQUAL
6. MINIMUM REINFORCEMENT REQUIRED:

DEPTH BELOW TOP OF GRATE	HORIZONTAL REINF.	VERTICAL REINF.
0' - 10'-0"	#13 @ 10" C.C	#13 @ 18" C.C
10'-1" - 15'-0"	#13 @ 8" C.C	#13 @ 18" C.C
15'-1" - 20'-0"	#13 @ 6" C.C	#13 @ 18" C.C



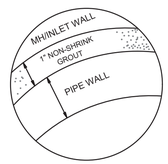
STORM MANHOLE DETAIL

N.T.S.



SECTIONAL PLAN

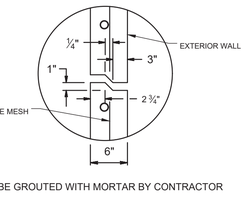
N.T.S.



CONNECTION OF PIPE AND MANHOLE/INLET

SECTION B-B

N.T.S.

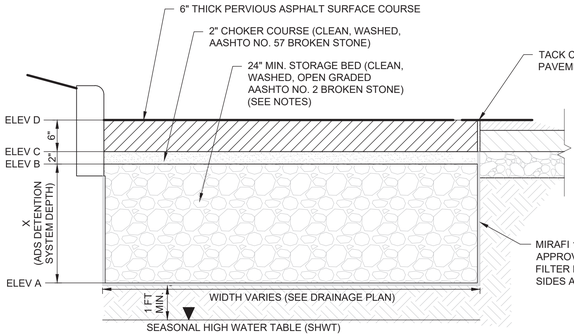


NOTE:
JOINT TO BE GROUTED WITH MORTAR BY CONTRACTOR

RISER JOINT DETAIL FOR PRECAST MANHOLES

N.T.S.

NOTES:
1. MANHOLES SHALL BE CONSTRUCTED OF PRECAST CONCRETE.
2. WHEN THE DEPTH OF A MANHOLE EXCEEDS 10 FEET AS MEASURED FROM THE TOP OF COVER TO THE INVERT THE WALLS BELOW A DEPTH OF 8 FEET SHALL BE 12 INCHES THICK. THE OVERALL HORIZONTAL DIMENSIONS SHALL BE INCREASED 12 INCHES AND THE DEPTH OF THE FOUNDATION INCREASED TO 12 INCHES. WHEN ROCK IS ENCOUNTERED, THE HORIZONTAL DIMENSION AND DEPTH OF THE FOUNDATION SHALL NOT BE INCREASED. THE THICKNESS OF PRECAST CONCRETE MANHOLE WALLS DOES NOT HAVE TO BE INCREASED IF THE DEPTH OF THE MANHOLE EXCEEDS 10 FEET.
3. CASTINGS OF PRECAST MANHOLES SHALL BE ADJUSTED TO GRADE WITH COURSES OF CONCRETE BLOCK, AS REQUIRED, 12' MAXIMUM.
4. AS AN ALTERNATE TO THE STANDARD MANHOLE FRAME AND COVER, A 39" DIAMETER FRAME WITH 4' FLANGE MAY BE FURNISHED WITH ALL OTHER DIMENSIONS AND WEIGHTS REMAINING THE SAME.
5. INVERTS SHALL BE CONSTRUCTED IN TWO STAGES.
6. AS AN ALTERNATE, COPOLYMER POLYPROPYLENE PLASTIC LADDER RUNGS MAY BE FURNISHED.
7. ALL PIPES ENTERING OR LEAVING THE STRUCTURE SHALL BE INSTALLED WITH AN ANTI-LEAK COLLAR.
8. MANHOLE COVER SHALL READ IN ALL CAPITAL LETTERS STORM.

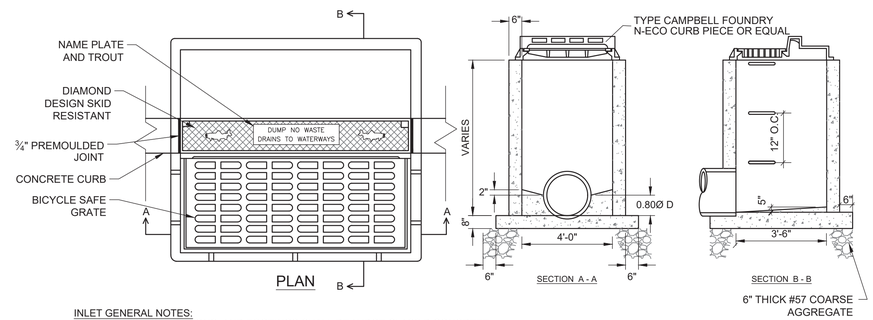


NOTES:
1. STORAGE BED AGGREGATE MUST BE PLACED IN LOOSE LIFTS NOT TO EXCEED 6 INCHES AND COMPACTED USING PLATE COMPACTORS PER NJ SW BMP MANUAL.
2. SEALANT, TOP COAT, AND OTHER TREATMENTS SHALL NOT BE USED ON THE PERVIOUS ASPHALT SURFACE COURSE. CONSTRUCTION MAY NOT TAKE PLACE DURING RAIN OR SNOW, NOR WHEN THE SUBSOIL IS FROZEN.
3. THE CONTRACTOR SHALL PERFORM POST-CONSTRUCTION TESTING OF THE PERMEABLE ASPHALT SURFACE COURSE IN ACCORDANCE WITH EITHER ASTM C1701: STANDARD TEST METHOD FOR INFILTRATION RATE OF IN-PLACE PERVIOUS CONCRETE OR ASTM C1781: STANDARD TEST METHOD FOR SURFACE INFILTRATION RATE OF PERMEABLE UNIT PAVEMENT SYSTEMS. AT LEAST THREE LOCATIONS MUST BE USED FOR THE TEST, AND THEY SHOULD BE SPACED EVENLY ACROSS THE PERVIOUS PAVING SYSTEM. FAILURE TO ACHIEVE THE MINIMUM DESIGN INFILTRATION RATE OF THE SURFACE COURSE AT ONE OR MORE LOCATION INDICATES THE SYSTEM CANNOT BE PUT IN SERVICE UNTIL THE SYSTEM IS CORRECTED TO YIELD ALL PASSING VALUES. UNLIKE THE TEST METHODOLOGY OUTLINED IN THE ASTM STANDARDS, THE TEST RESULTS MUST NOT BE AVERAGED. INCLUDE A LOG FOR RECORDING EACH LOCATION AND ITS TEST RESULT FOR FUTURE REFERENCE IN THE MAINTENANCE PLAN.
4. PERVIOUS ASPHALT SURFACE AREA SHALL BE PROTECTED FROM SEDIMENT-LADEN RUNOFF DURING CONSTRUCTION TO AVOID REDUCED POROSITY.

ELEVATION TABLE					
BASIN	DEPTH OF STORAGE BED, X FT	ELEV A	ELEV B	ELEV C	ELEV D
1	6.29	445.45	451.74	451.91	452.41
2	8.17	442.94	451.11	451.28	451.78
3	10.08	445.44	455.52	455.69	456.19
4	5.83	451.95	457.78	457.95	458.45

PERVIOUS ASPHALT DETAIL

N.T.S.

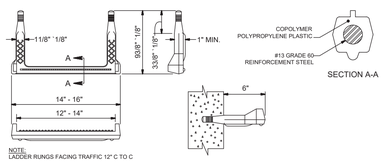


INLET GENERAL NOTES:
1. INVERTS, FOUNDATIONS, AND FOOTINGS SHALL BE NJDOT CLASS B CONCRETE
2. FRAME AND GRATE TO BE No. 2618 AS MANUFACTURED BY CAMPBELL FOUNDRY CO. OR EQUAL BICYCLE SAFE GRATE TYPE N ECO PHASE II.
3. WALLS BELOW THE DEPTH OF 8'-0" MEASURED FROM THE INLET GUTTER TO INVERT, SHALL BE 12" THICK. THE FOUNDATION DIMENSION SHALL BE INCREASED 12" IN WIDTH AND TO 12" IN DEPTH.
4. FOUNDATIONS AND INVERTS SHALL BE CONSTRUCTED IN TWO STAGES, AND THE BOTTOM OF THE FOOTINGS SHALL BE 8" BELOW THE OUTER WALL OF THE LOWEST PIPE IN THE INLET.
5. MNIMUM REINFORCEMENT REQUIRED:

DEPTH BELOW TOP OF GRATE	HORIZONTAL REINF.	VERTICAL REINF.
0' - 10'-0"	#13 @ 10" C.C	#13 @ 18" C.C
10'-1" - 15'-0"	#13 @ 8" C.C	#13 @ 18" C.C
15'-1" - 20'-0"	#13 @ 6" C.C	#13 @ 18" C.C

NJDOT TYPE "B" INLET DETAIL

N.T.S.



COPOLYMER POLYPROPYLENE PLASTIC LADDER RUNG DETAIL

N.T.S.

NOT FOR CONSTRUCTION

Pennoni
PENNONI ASSOCIATES INC.
1085 Raymond Boulevard, Suite 2102
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NJ COA GA28033300

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TOWNSHIP OF VERONA, ESSEX COUNTY, NEW JERSEY

DRAINAGE DETAILS I

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3155 ROUTE 10 EAST - SUITE 214
DENVILLE, NJ 07834

NO.	DATE	REVISIONS	BY

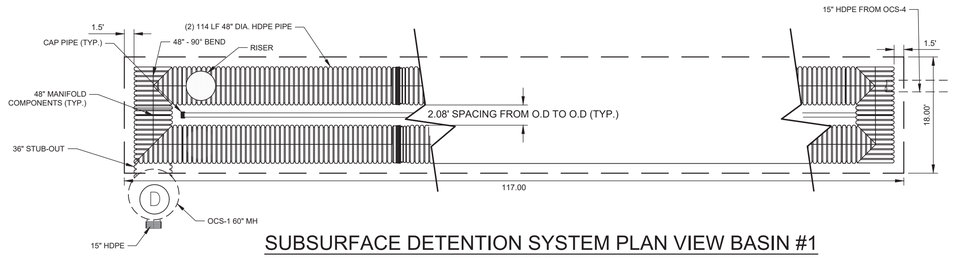
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PROJECT	DMH2C26001
DATE	2026-08-17
DRAWING SCALE	AS SHOWN
DRAWN BY	JD
APPROVED BY	RP

CS6021

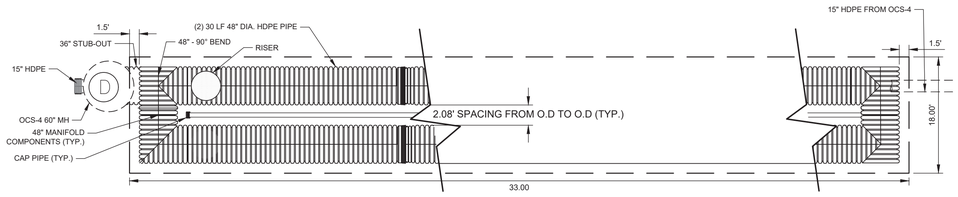
SHEET 12 OF 19

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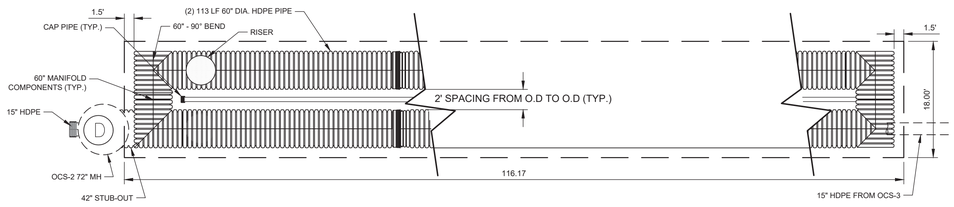
SUBSURFACE DETENTION SYSTEM PLAN VIEW BASIN #1

N.T.S.



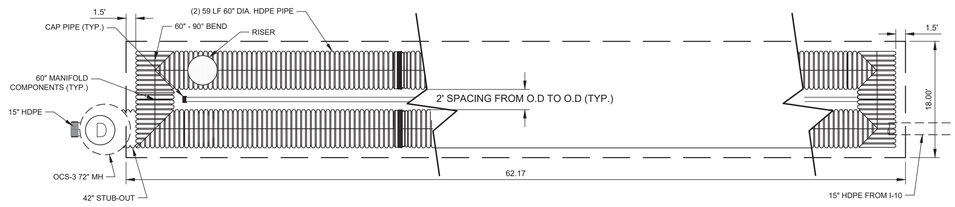
SUBSURFACE DETENTION SYSTEM PLAN VIEW BASIN #4

N.T.S.



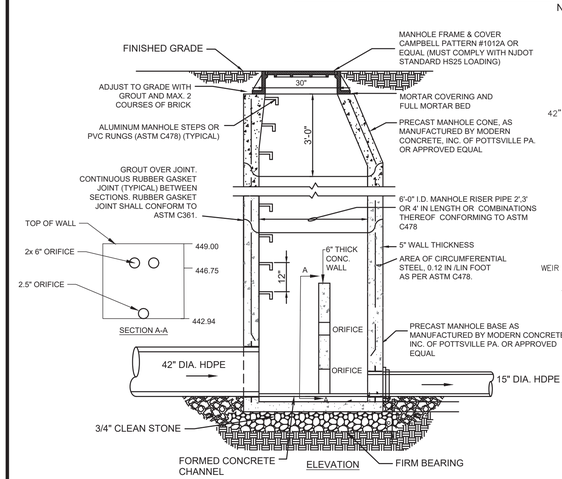
SUBSURFACE DETENTION SYSTEM PLAN VIEW BASIN #2

N.T.S.



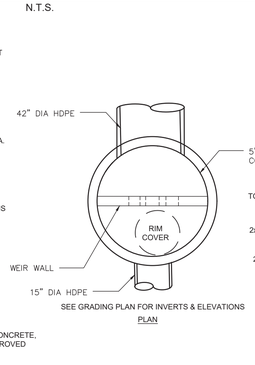
SUBSURFACE DETENTION SYSTEM PLAN VIEW BASIN #3

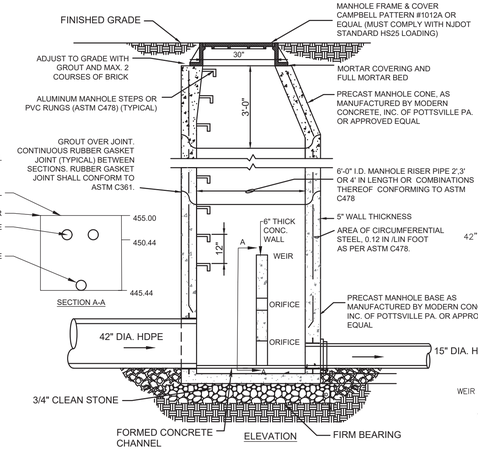
N.T.S.



OCS-2 OUTLET CONTROL STRUCTURE - 72" MANHOLE DETAIL

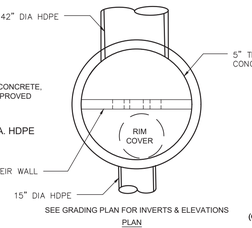
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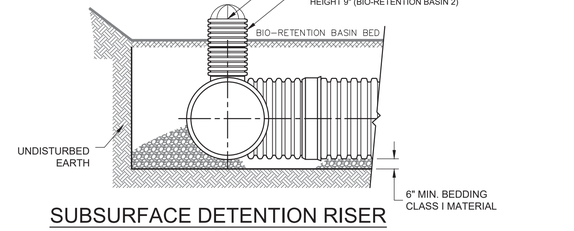




OCS-3 OUTLET CONTROL STRUCTURE - 72" MANHOLE DETAIL

N.T.S.





SUBSURFACE DETENTION RISER

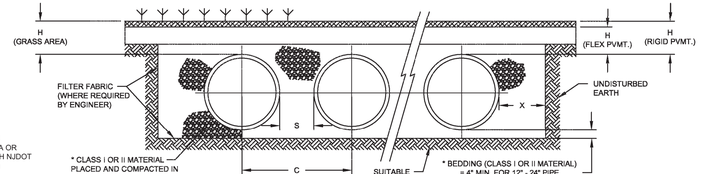
N.T.S.

OCS-1 OUTLET CONTROL STRUCTURE - 60" MANHOLE DETAIL

N.T.S.

OCS-4 OUTLET CONTROL STRUCTURE - 60" MANHOLE DETAIL

N.T.S.



NOMINAL DIAMETER	NOMINAL O.D.	TYPICAL SPACING "S"	NOMINAL SPACING "C"	TYPICAL SIDE WALL "X"	H (NON-TRAFFIC)	H (TRAFFIC)
48" (1200mm)	54" (1372mm)	25" (635mm)	75.5" (1994mm)	18" (457mm)	12" (305mm)	24" (610mm)
60" (1500mm)	67" (1702mm)	24" (610mm)	90" (2286mm)	18" (457mm)	12" (305mm)	24" (610mm)

SUBSURFACE DETENTION SYSTEM CROSS-SECTION

N.T.S.

NOTES:

1. ALL REFERENCES TO CLASS I OR II MATERIAL ARE PER ASTM D2321 "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST EDITION.
2. ALL RETENTION AND DETENTION SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, LATEST EDITION AND THE MANUFACTURER'S PUBLISHED INSTALLATION GUIDELINES.
3. MEASURES SHOULD BE TAKEN TO PREVENT THE MIGRATION OF NATIVE FINES INTO THE BACKFILL MATERIAL, WHEN REQUIRED. SEE ASTM D2321.
4. FILTER FABRIC: A GEOTEXTILE FABRIC MAY BE USED AS SPECIFIED BY THE ENGINEER TO PREVENT THE MIGRATION OF FINES FROM THE NATIVE SOIL INTO THE SELECT BACKFILL MATERIAL.
5. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER, AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.
6. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I OR II. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 4"-24" (100mm-600mm); 6" (150mm) FOR 30"-60" (750mm-1500mm).
7. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I OR II IN THE PIPE ZONE EXTENDING NOT LESS THAN 6" ABOVE CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.
8. MINIMUM COVER: MINIMUM COVER OVER ALL RETNETION/DETENTION SYSTEMS IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" FROM TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOATATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER IS 12" UP TO 36" DIAMETER PIPE AND 24" OR COVER FOR 42" - 60" DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT.

NOT FOR CONSTRUCTION

Pennoni
N.J COA GA28033300
PENNONI ASSOCIATES INC.
1085 Raymond Boulevard, Suite 2102
Newark, NJ 07102
T 973.265.9775 F 973.265.9774

ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

N.J CERTIFICATE OF AUTHORIZATION NO. 24GA28033300

RICHARD N. PROCANIK, PE
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE NO. 24GE05457700

DATE:

NOTE: THIS DRAWING IS NOT A LEGAL DOCUMENT WITHOUT THE SIGNATURE AND RAISED SEAL OF A PROFESSIONAL ENGINEER

PROPOSED RESIDENTIAL DEVELOPMENT
176-200 BLOOMFIELD AVENUE (BLOCK 202, LOTS 1 & 23)
TOWNSHIP OF VERONA, ESSEX COUNTY, NEW JERSEY

DRAINAGE DETAILS II

DMH2, LLC
3155 ROUTE 10 EAST - SUITE 214
DENVILLE, NJ 07834

NO.	DATE	REVISIONS	BY

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PROJECT	DMH2C26001
DATE	2026-08-17
DRAWING SCALE	1"=
DRAWN BY	JD
APPROVED BY	RP

CS6022

SHEET 13 OF 19

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POST-CONSTRUCTION AS-BUILT