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Stormwater Management Report

For The

Mendham Golf & Tennis Club
Pickleball Courts Project

Kenneday Road, Golf & Corey Lanes
Block 144, Lot 24
Township of Mendham
Morris County, New Jersey

WO # 208056

February 3, 2023

Candice J. Davis, PE
NJPE Lic. No. GE45270

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Note: Refer to site plans entitled, "Mendham Golf & Tennis Club, Preliminary & Final Major Site Plans, Pickleball Courts Project" (8 sheets), as prepared by this firm.

Project Description

The site is known as Block 144, Lot 24, located in the Township of Mendham, Morris County, New Jersey. This lot consists of 123.473 acres, with frontage on Golf Lane, Kenneday Road and Corey Lane. The subject property is developed as a private golf and tennis club facility. The project site includes two clubhouses, a single-family residential dwelling, and accessory buildings appurtenant to the golf and tennis club facility. Two main access drives serve the facility from Golf Land and from Kenneday Road. Additional features on the project site include tennis courts, paddle courts, parking areas and cart paths. Lawn, golf playing areas and isolated areas of woods cover the remaining site.

A large manmade pond, three smaller ponds and various unnamed tributaries to the Passaic River exist throughout the subject property. Freshwater wetlands, transition areas and the riparian zones adjacent to the smaller ponds and unnamed tributaries to the Passaic River encumber portions of the subject property.

The purpose of this project is to install four (4) **pickleball courts** with access walk extensions adjacent to the existing tennis courts on the site. Each pickleball playing court shall be 30 ft. wide and 60 feet long. Additionally, each playing area shall be enclosed by a fence enclosure and noise curtain. Access to the new playing areas shall be provided by walk extensions from the existing access paths. No additional driveway or parking areas are proposed.

The total disturbance proposed for the **pickleball court project** equals 35,625 sq.ft. or 0.82 acres and the total proposed new impervious surface equals 7,544 sq.ft. or 0.173 acres. No regulated motor vehicle surface is proposed.

Previously-approved improvements on this site included building additions to the golf clubhouse (2019, 2022), as well as the new construction of the maintenance building (c.2014) and paddlecourt hut (c.2013). Cumulatively, these previous projects result(ed) in the disturbance of one or more acres of land and more than 0.25 acres of new impervious surface on the site since February 2, 2004. Therefore, collectively with previous projects, this proposed pickleball court project is classified by N.J.A.C. 7:8 Stormwater Management Rules as a 'major development' project.

To comply with N.J.A.C. Stormwater Management rules and as required, stormwater management measures are provided to control stormwater runoff quantity, as well as to provide groundwater recharge. Since less than ¼ acre of regulated motor vehicle surface is proposed, water quality controls are not required.

The proposed stormwater management system for this project consists of non-structural and structural measures. Proposed non-structural measures include grading to divert runoff by sheet flow and minimizing soil disturbance to actively-maintained areas of the site. Proposed structural measures to control stormwater runoff include inlets, piping and a small-scale subsurface infiltration system design to fully capture the 100-year runoff from the proposed increase in impervious surface from this project. The natural drainage characteristics will be maintained as much as possible with the proposed development.

STORMWATER BMP DESIGN CALCULATIONS

STORE 8.3" (100-Year Storm Event) OF RUNOFF FROM NET INCREASE IN IMPERVIOUS COVER:

NET INCREASE IN LOT COVERAGE FOR THE PROJECT = 7,544 SQ.FT.(PICKLEBALL COURTS & NEW WALK SURFACE AREAS)

STORAGE VOLUME REQUIRED = 7,544 SQ.FT. x 8.3"/12 = 5,218 CU.FT.

TYPICAL UNIT : 12'-0" x 12'-0" x 10'-0" DEEP (BELOW OVERFLOW) STONE BED
WITH 8'-0" DIA. x 8'-6" DEEP (BELOW OVERFLOW) PRECAST CONC. SEEPAGE PIT TANK

DISPLACEMENT VOL. OF SEEPAGE TANK:
  $n \times r^2 \times h = \pi (4)^2 \times 8.5 = 427.3$ cu.ft.
STORAGE VOL. OF SEEPAGE TANK
  $n \times r^2 h = \pi \times (3.67)^2 \times 8.5 = 359.7$ cu.ft.
VOL. OF STORAGE BED = $l \times w \times h = 12.0 \times 12.0 \times 10.0 = 1,440$ cu.ft.
STORAGE VOL. OF STONE BED:
  (VOL. STONE - DISP. VOL. TANK) x 0.40 VOIDS = (1,440 - 427.3) x 0.40 = 405.1 CU.FT.
STORAGE VOLUME OF UNIT :
  BED VOL. + TANK VOL. = 405.1 + 359.7 = 764.8 CU.FT./UNIT

  UNITS REQUIRED : STORAGE VOL. REQUIRED/STORAGE VOL.
                     5,218 CU.FT./764.8 CU.FT. = 6.8 UNITS

PROPOSE SEVEN (7) UNITS

Pond 155P: PickleBall BMP

Inflow Area =	0.173 ac,	Inflow Depth > 3.30"	for 2 year event		
Inflow =	0.50 cfs @	12.17 hrs,	Volume=	0.048 af	
Outflow =	0.05 cfs @	11.35 hrs,	Volume=	0.047 af,	Atten= 90%, Lag= 0.0 min
Discarded =	0.05 cfs @	11.35 hrs,	Volume=	0.047 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 535.54' @ 13.28 hrs Surf.Area= 0.023 ac Storage= 0.017 af

Plug-Flow detention time= 114.6 min calculated for 0.047 af (100% of inflow)
Center-of-Mass det. time= 111.9 min (870.7 - 758.8)

Volume	Invert	Avail.Storage	Storage Description
#1	533.80'	0.068 af	**12.00'W x 12.00'L x 10.50'H Prismatoid x 7**
			0.243 af Overall - 0.073 af Embedded = 0.170 af x 40.0% Voids
#2	535.30'	0.073 af	**8.00'D x 9.00'H Vertical Cone/Cylinder x 7 Inside #1**
		0.141 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	546.00'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	543.80'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#3	Discarded	0.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 11.35 hrs HW=533.94' (Free Discharge)
└—**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=533.80' (Free Discharge)
├—**1=Orifice/Grate** (Controls 0.00 cfs)
└—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 155P: PickleBall BMP

Inflow Area =	0.173 ac,	Inflow Depth > 5.00"	for 10 year event
Inflow =	0.74 cfs @ 12.17 hrs,	Volume=	0.072 af
Outflow =	0.05 cfs @ 10.85 hrs,	Volume=	0.067 af, Atten= 93%, Lag= 0.0 min
Discarded =	0.05 cfs @ 10.85 hrs,	Volume=	0.067 af
Primary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 536.48' @ 13.78 hrs Surf.Area= 0.023 ac Storage= 0.030 af

Plug-Flow detention time= 219.7 min calculated for 0.067 af (93% of inflow)
Center-of-Mass det. time= 178.2 min (929.4 - 751.1)

Volume	Invert	Avail.Storage	Storage Description
#1	533.80'	0.068 af	**12.00'W x 12.00'L x 10.50'H Prismatoid x 7**
			0.243 af Overall - 0.073 af Embedded = 0.170 af x 40.0% Voids
#2	535.30'	0.073 af	**8.00'D x 9.00'H Vertical Cone/Cylinder x 7 Inside #1**
		0.141 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	546.00'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	543.80'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#3	Discarded	0.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 10.85 hrs HW=533.95' (Free Discharge)
└—**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=533.80' (Free Discharge)
├—**1=Orifice/Grate** (Controls 0.00 cfs)
└—**2=Orifice/Grate** (Controls 0.00 cfs)

208056-BMPGroundwater-2023
Prepared by {enter your company name here}
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NOAA 24-hr -D 100 year Rainfall=8.35"
Page 3
2/5/2023

Pond 155P: PickleBall BMP

Inflow Area =   0.173 ac, Inflow Depth > 8.10"   for 100 year event
Inflow   =   1.18 cfs @ 12.17 hrs, Volume=   0.117 af
Outflow   =   0.05 cfs @   9.60 hrs, Volume=   0.075 af, Atten= 96%, Lag= 0.0 min
Discarded =   0.05 cfs @   9.60 hrs, Volume=   0.075 af
Primary   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 538.49' @ 15.03 hrs Surf.Area= 0.023 ac Storage= 0.059 af

Plug-Flow detention time= 243.6 min calculated for 0.075 af (64% of inflow)
Center-of-Mass det. time= 127.3 min (871.5 - 744.1)

Volume	Invert	Avail.Storage	Storage Description
#1	533.80'	0.068 af	**12.00'W x 12.00'L x 10.50'H Prismatoid** x 7
			0.243 af Overall - 0.073 af Embedded = 0.170 af x 40.0% Voids
#2	535.30'	0.073 af	**8.00'D x 9.00'H Vertical Cone/Cylinder** x 7 Inside #1
		0.141 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	546.00'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	543.80'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#3	Discarded	0.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 9.60 hrs HW=533.94' (Free Discharge)
└—3=**Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=533.80' (Free Discharge)
├—1=**Orifice/Grate** (Controls 0.00 cfs)
└—2=**Orifice/Grate** (Controls 0.00 cfs)

Pond 155P: PickleBall BMP

Inflow Area =　　　0.173 ac, Inflow Depth = 1.03"　for W.Q. event
Inflow　　　=　　0.59 cfs @　1.13 hrs, Volume=　　　0.015 af
Outflow　　=　　0.05 cfs @　1.05 hrs, Volume=　　　0.015 af, Atten= 92%, Lag= 0.0 min
Discarded =　　0.05 cfs @　1.05 hrs, Volume=　　　0.015 af
Primary　　=　　0.00 cfs @　0.00 hrs, Volume=　　　0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 534.93' @ 1.62 hrs　Surf.Area= 0.023 ac　Storage= 0.010 af

Plug-Flow detention time= 90.1 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 89.6 min (163.5 - 73.9)

Volume	Invert	Avail.Storage	Storage Description
#1	533.80'	0.068 af	**12.00'W x 12.00'L x 10.50'H Prismatoid x 7**
			0.243 af Overall - 0.073 af Embedded = 0.170 af x 40.0% Voids
#2	535.30'	0.073 af	**8.00'D x 9.00'H Vertical Cone/Cylinder x 7 Inside #1**
		0.141 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	546.00'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	543.80'	**6.0" Horiz. Orifice/Grate**　Limited to weir flow C= 0.600
#3	Discarded	0.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 1.05 hrs HW=533.99' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=533.80' (Free Discharge)
├─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Mendham Golf & Tennis Club
Pickleball Courts

DETENTION DESIGN: DRAIN TIME ANALYSIS

Per NJDEP BMP, Chapter 5, "the duration of the drain time is calculated by using the exfiltration (discarded) volume, the footprint of the basin and the exfiltration rate".

Drain Time = Runoff Volume / (Infiltration Area x Design Permeability Rate)

Pickleball Courts: Proposed BMP

Design permeability rate of the subsoil:

Based on Soil log #1, Test 1B, the permeability rate K = 4.13 in./hr.
Per N.J.A.C. 7:8, apply at least a factor of safety of two.

Design permeability rate :   **2.1**   in/hr.

**DRAIN TIME:**   per NJDEP Stormwater BMP Manual, Chapter 5

Duration of Infiltration = discarded volume via exfiltration (cf) x 12 "/ft.
t (hr.)   infiltration area (sf) x exfiltration rate ("/hr)

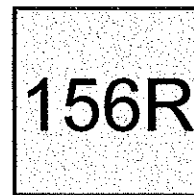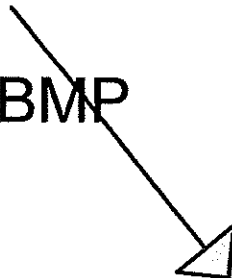|			
discarded volume	=	0.117	ac.ft.
	=	5097	cu.ft.
infiltration area	=	1008	sq.ft.
exfiltration rate	=	2.1	in/hr.
so t =		**29.4**	**hours** < 72 hours max. O.K.

Therefore, the duration for infiltration of the 100-year storm event is less than
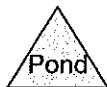*the max. allowed duration of 72 hours for the BMP.*
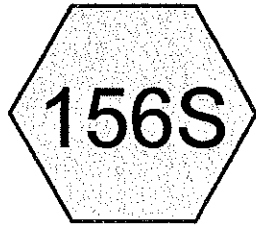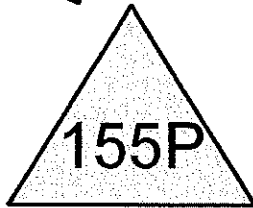
8

156S

Net Impervious

155P

PIckleBall BMP

156R

6"Overflow

Subcatchment 156S: Net Impervious

Runoff   =   1.18 cfs @ 12.17 hrs, Volume=   0.117 af, Depth= 8.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
NOAA 24-hr -D 100 year Rainfall=8.35"

Area (ac)	CN	Description
0.173	98	Paved parking & roofs
0.173		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Sheet**
6.0	0				Total, Increased to minimum Tc = 10.0 min

Pond 155P: PickleBall BMP

Inflow Area =	0.173 ac,	Inflow Depth = 8.11"	for 100 year event	
Inflow =	1.18 cfs @	12.17 hrs, Volume=	0.117 af	
Outflow =	0.05 cfs @	9.60 hrs, Volume=	0.117 af, Atten= 96%, Lag= 0.0 min	
Discarded =	0.05 cfs @	9.60 hrs, Volume=	0.117 af	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 538.49' @ 15.03 hrs   Surf.Area= 0.023 ac   Storage= 0.059 af

Plug-Flow detention time= 442.7 min calculated for 0.117 af (100% of inflow)
Center-of-Mass det. time= 442.9 min (1,188.0 - 745.2)

Volume	Invert	Avail.Storage	Storage Description
#1	533.80'	0.068 af	**12.00'W x 12.00'L x 10.50'H Prismatoid x 7**
			0.243 af Overall - 0.073 af Embedded = 0.170 af x 40.0% Voids
#2	535.30'	0.073 af	**8.00'D x 9.00'H Vertical Cone/Cylinder x 7 Inside #1**
		0.141 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	546.00'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	543.80'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#3	Discarded	0.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 9.60 hrs HW=533.94' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=533.80' (Free Discharge)
├─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Point of Discharge Stability Analysis

Project: Mendham Golf & Tennis Club
Pickleball Courts
Mendham Township, Morris County

Area of Concern: **Point of Discharge from BMP Overflow**

Receiving Soil :   Vegetated Loam, Silt Loam
(Edneyville soil type)

SESC Standards: *Allowable velocity:*   3.0   *fps (per 25-year storm event)*
(from NJSESC Manual, Table 12-1)
Allowable slope: 2.5   *% (per 25-year storm event)*
(from NJSESC Manual, Table 21-1)

Pipe Design: Section of Proposed Overflow Pipe
Pipe Length: 74 ft.
Pipe Size: 6"   dia.
Pipe Slope: 1.35%   %
Max. Full-Pipe Capacity :   0.85   cfs

SESC Compliance: Max. Full-Pipe Velocity :   4.85   *fps > Max. Allow. SESC Velocity*
Propose pre-formed scour hole for discharge.
Receiving Slope: 6.5   *% > Max. Allow.SESC Slope*
Propose pre-formed scour hole for discharge.

Note: SESC Compliance conservatively analyzed for max. full-pipe capacity. See following HydroCad output.

NOTE: *To slow runoff discharge and prevent future soil erosion, a pre-formed scour hole is proposed for this overflow pipe.
See the following 'Conduit Outlet Protection Calculations'.*

208056-BMPExfiltrate-2023
Prepared by {enter your company name here}
HydroCAD® 8.00 s/n 003860 © 2006 HydroCAD Software Solutions LLC

Reach 156R: 6"Overflow

Inflow Area =	0.173 ac,	Inflow Depth > 8.10"	for 100 year event	
Inflow =	1.18 cfs @	12.17 hrs,	Volume=	0.117 af
Outflow =	0.85 cfs @	12.15 hrs,	Volume=	0.117 af, Atten= 28%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.85 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.6 min

Peak Storage= 15 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.85 cfs

6.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 74.0'   Slope= 0.0135 '/'
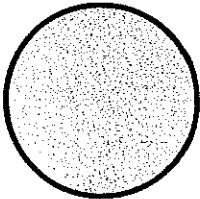Inlet Invert= 543.80', Outlet Invert= 542.80'

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
Sand	1.8
Sandy loam	2.5
Silt loam (also high lime clay), loam	3.0
Sandy clay loam	3.5
Clay loam	4.0
Clay, fine gravel, graded loam to gravel	5.0
Cobbles	5.5
Shale (non-weathered)	6.0

A.   Horizontal Riprap Apron (fig. 12-1, 12-2)

Apron Dimensions – unconfined outlet

1.   The length and width of the apron shall be determined from the formulas:

$$TW < \tfrac{1}{2}D_o \qquad La = 1.8\left(\frac{q}{Do^{0.5}}\right) + 7Do \qquad Wa = 3Wo + La$$

$$TW \geq \tfrac{1}{2}D_o \qquad La = 3\left(\frac{q}{Do^{0.5}}\right) \qquad\qquad Wa = 3Wo + 0.4La$$

$$\text{where } q = \frac{Q}{Wo}$$

Where D_o is the maximum inside culvert height in feet, W_o is the maximum inside culvert width in feet, q is the unit discharge, $= Q/W_o$ in cfs per foot for the conduit design storm or the 25 year storm, whichever is greater and L_a is the length of the apron determined from the formula and W_o is the culvert width.

The width of the apron at the culvert outlet shall be at least 3 times the culvert width.

2.   Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel; and the structural lining shall extend at least one foot above the tailwater elevation but no lower than two-thirds of the vertical conduit dimension above the conduit invert.

3.   The side slopes shall be 2:1 or flatter.

4.   The bottom grade shall be 0.0% (level).

5.   There shall be no over fall at the end of the apron or at the end of the culvert.

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Point of Discharge - Methods for Achieving Stability

1.   **No well-defined waterway below the point of discharge:**

Stability cannot be achieved by the allowable velocity method since there can be no determination where the runoff will concentrate. A land-form not previously subjected to concentrated water flow will become unstable.

Stability can be achieved by one of the following alternatives:

a.   Retain pre-existing runoff characteristics. Do not increase the amount and rate of runoff for the development and **do not concentrate flows.**

b.   Where there is no well defined channel, no sandy condition, no trees or brush to substantially concentrate the flows and it can be reasonably assumed that the flow will disperse over a broad area. The combinations of slopes and soils in table 21-1 and the following criteria are considered stable for flows of 10cfs or less for a 25 year, 24hr design storm.

Table 21-1 Non-Erosive Conditions for Point Discharges

Maximum Stable Slope for Point Discharges for Various Soils	
Soil Type	**Perennial, Natural Vegetation**
	Maximum Slope (%)
Sands	1.8
Sandy loam	2.0
Silt loam, loam	2.5
Sandy clay loam	3.5
Clay loam	5.0
Graded loam to gravel	8.0

Stability Criteria (in conjunction with table 21-1)

i.   The maximum discharge rate shall be 10 cfs or less for the twenty-five (25) year storm.

ii.   Multiple outlets may be utilized to reduce individual outlet flow rates to levels below the thresholds noted above. Outlets should be spaced no closer than 50 ft horizontally to avoid re-mixing of flows

iii. Flow over the outlet area shall be less than 0.5 cfs/ft. Designers shall not design excessive widths which will cause flows to concentrate.

iv should state either use COP or reduce outlet V to 2fps or less.

iv.   Conduit outlet protection shall be provided in accordance with that Standard and may include: flat aprons, preformed scour holes, impact basins, stilling wells, plunge pools, etc. **Level spreaders are not an acceptable design.**

v.   Topography shows broad uniform outlet area where flows will not concentrate.

Return to TOC

Mendham Golf & Tennis Club
Pickleball Courts
Block 144, Lot 24

Conduit Outlet Protection Calculations : PreFormed Scour Hole for 6" HDPE Overflow

I. Preformed Scour Hole – Equation

$D_{50} =$ (0.0082 / Tw) q^1.33
where Y = D_o
TW = 0.2 D_o
q = Q / D_o

II. Preformed Scour Hole – Design of Stone

Structure	Discharge From HydroCad Node #	Outlet Size dia.	Full Cap.Flow Q * (cfs)	D_o (ft)	Unit Flow q (f^2/s)	Tailwater TW (ft)	Depth Y (ft)	Stone Dia. D_{50} (ft)	Stone Dia. D_{50} (in) **	Rip-Rap th (in.)
6" HDPE Scour Hole	156R	6"	0.85	0.50	1.7	0.1	0.50	0.17	6	12

Note: * denotes 'capacity at bank-full' per HydroCAD output.

Note: * denotes stone diameter increased to 6" min. per Morris County Soil Conservation.

Preformed Scour Hole – Dimensions

L =   (3 Do) + 2 (3 Y)

W =   (2 Do) + 2 (3 Y)

Structure	Outlet Size	D_o (ft)	Depth Y (ft)	L (ft)	W (ft)
6" HDPE Scour Hole	6" Dia.	0.50	0.50	4.50	4.00

Reach 156R: 6"Overflow
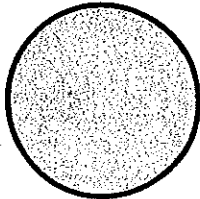
Inflow Area =   0.173 ac, Inflow Depth > 8.10"   for 100 year event
Inflow   =   1.18 cfs @   12.17 hrs, Volume=   0.117 af
Outflow   =   0.85 cfs @   12.15 hrs, Volume=   0.117 af, Atten= 28%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
→ Max. Velocity= 4.85 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.6 min

Peak Storage= 15 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.85 cfs

6.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 74.0'   Slope= 0.0135 '/'
Inlet Invert= 543.80', Outlet Invert= 542.80'

Mendham Golf & Tennis Club
Pickleball Courts Project

GROUNDWATER RECHARGE ANALYSIS

Proposed BMP: Small-Scale Subsurface Infiltration System

"....Demonstrate....that the increase of the stormwater runoff volume from the pre-construction to post-construction for the two-year storm is infiltrated."

Pre-Construction, Two-Year Storm Inflow:	0.008 ac.ft.	(see following HydroCad output).
Post-Construction, Two-year Storm Inflow:	0.048 ac.ft.	
Increase in Stormwater Runoff Volume:	0.040 ac.ft.	

Infiltration by Proposed BMP (2-Year Storm):	0.047 ac.ft.	**> Increase so Complies**

Therefore, proposed stormwater management BMP meets the required groundwater recharge standard for this project.
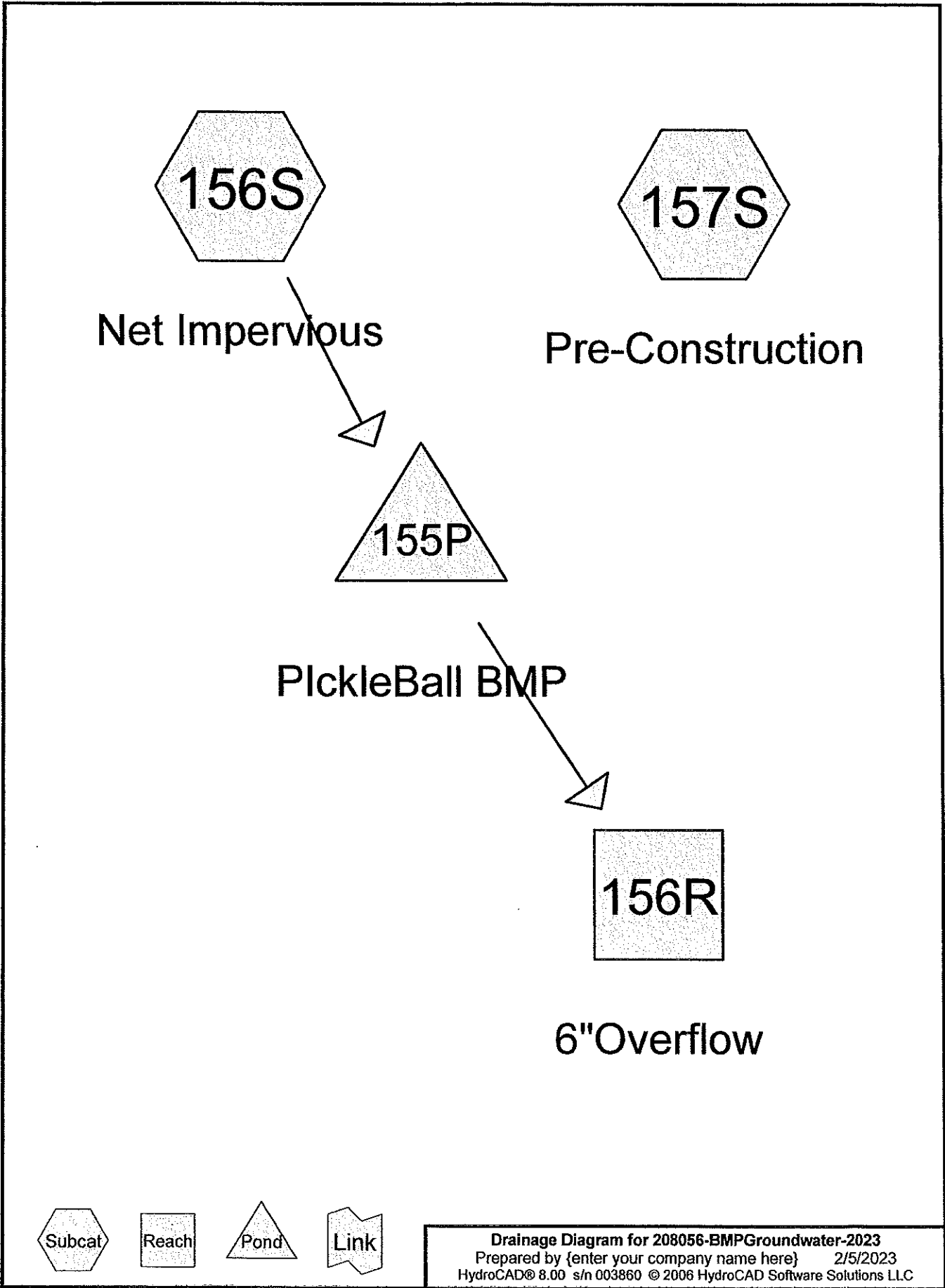
Net Impervious

Pre-Construction

PIckleBall BMP

6"Overflow

Subcat Reach Pond Link

Subcatchment 157S: Pre-Construction

Runoff   =   0.08 cfs @   12.20 hrs, Volume=   0.008 af, Depth> 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr -D 2 year Rainfall=3.54"

Area (ac)	CN	Description
0.173	61	>75% Grass cover, Good, HSG B
0.173		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Sheet**
6.0	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment 156S: Net Impervious

Runoff   =   0.50 cfs @ 12.17 hrs, Volume=   0.048 af, Depth> 3.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr -D 2 year Rainfall=3.54"

Area (ac)	CN	Description
0.173	98	Paved parking & roofs
0.173		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Sheet**
6.0	0				Total, Increased to minimum Tc = 10.0 min

Pond 155P: PickleBall BMP

Inflow Area =	0.173 ac, Inflow Depth > 3.30" for 2 year event
Inflow =	0.50 cfs @ 12.17 hrs, Volume= 0.048 af
Outflow =	0.05 cfs @ 11.35 hrs, Volume= 0.047 af, Atten= 90%, Lag= 0.0 min
Discarded =	0.05 cfs @ 11.35 hrs, Volume= 0.047 af
Primary =	0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 535.54' @ 13.28 hrs   Surf.Area= 0.023 ac   Storage= 0.017 af

Plug-Flow detention time= 114.6 min calculated for 0.047 af (100% of inflow)
Center-of-Mass det. time= 111.9 min (870.7 - 758.8)

Volume	Invert	Avail.Storage	Storage Description
#1	533.80'	0.068 af	**12.00'W x 12.00'L x 10.50'H Prismatoid x 7**
			0.243 af Overall - 0.073 af Embedded = 0.170 af x 40.0% Voids
#2	535.30'	0.073 af	**8.00'D x 9.00'H Vertical Cone/Cylinder x 7 Inside #1**
		0.141 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	546.00'	**24.0" Vert. Orifice/Grate C= 0.600**
#2	Primary	543.80'	**6.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600**
#3	Discarded	0.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 11.35 hrs HW=533.94' (Free Discharge)
└—**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=533.80' (Free Discharge)
├—**1=Orifice/Grate** (Controls 0.00 cfs)
└—**2=Orifice/Grate** (Controls 0.00 cfs)

Mendham Golf & Tennis Club: Pickleball Courts
Block 144, Lot 24, Mendham Township, Morris County
Soil Logs
August 8, 2022

Soil Log #1

0"-6"	Topsoil
6"-18"	Yellow (10YR 7/8), subangular blocky, friable, silt loam, 10% gravel
18"-42"	Strong brown (7.5YR 5/6), subangular blocky, friable, loam, 10% gravel, 10% stones
42"-120"	Strong brown (7.5YR 4/6), subangular blocky, friable, loamy sand, 10% cobbles, 10% stones
120"-216"	Reddish-yellow (7.5YR 7/6), loose, single grain, loamy sand, 10% cobbles, 10% stones

No mottles; no groundwater

Percolation Test 1A
Depth of Test = 96"
Bottom width = 8"
Parameter 'a' =22
Percolation Rate (pm) = 5.33 min/inch.
Permeability Rate $K = a/pm = 22/5.33 = 4.13$ in/hr.

Percolation Test 1B
Depth of Test = 132"
Bottom width = 8"
Parameter 'a' =22
Percolation Rate (pm) = 5.0 min/inch.
Permeability Rate $K = a/pm = 22/5.0 = 4.4$ in/hr.

Soil Log #2

0"-8"	Topsoil
8"-20"	Yellow (10YR 7/8), subangular blocky, friable, silt loam, 10% gravel
20"-46"	Strong brown (7.5YR 5/6), subangular blocky, friable, loam 10% gravel, 10% stones
46"-126"	Strong brown (7.5YR 4/6), subangular blocky, friable, loamy sand, 10% cobbles, 10% stones
126"-218"	Reddish-yellow (7.5YR 7/6), loose, single grain, loamy sand, 10% cobbles, 10% stones

No mottles; no groundwater

Percolation Test 2A
Depth of Test = 96"
Bottom width = 8"
Parameter 'a' =22
Percolation Rate (pm) = 4.67 min/inch.
Permeability Rate $K = a/pm = 22/4.67 = 4.72$ in/hr.

Percolation Test 2B
Depth of Test = 138"
Bottom width = 8"
Parameter 'a' =22
Percolation Rate (pm) = 4.83 min/inch.
Permeability Rate $K = a/pm = 22/4.83 = 4.55$ in/hr.