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PROJECT HYDROLOGY NARRATIVE

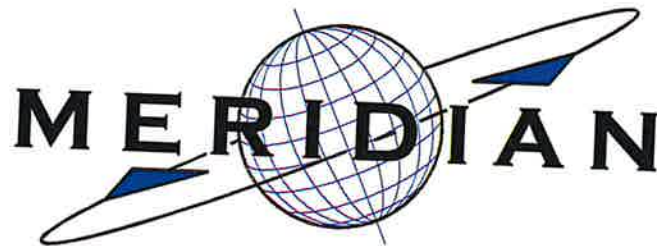
Prepared For

**LOT 33 IN BLOCK 26.02
2900 WEST BANGS AVENUE**

Situated In

**TOWNSHIP OF NEPTUNE
MONMOUTH COUNTY, NEW JERSEY**

Prepared By



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A handwritten signature in blue ink, appearing to read "LAW", is written over a horizontal line.

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Purpose of Narrative

The purpose of this narrative is to present a stormwater analysis for the proposed site improvements for a building designated as a place of worship, including parking lot updates and a stormwater management facility. This narrative has been prepared in conjunction with the plans entitled "Site Improvement Plan prepared for Lot 33 in Block 26.01 2900 West Bangs Avenue situated in Township of Neptune, Monmouth County, New Jersey" dated 02/27/23.

Project Location

The entire parcel is known as Lot 33 in Block 26.01 and is located on the corner of West Bangs Avenue and Wayside Road, Neptune, New Jersey. The total site contains 5.39 acres and is shown on Tax Map sheet 26 for the Township of Neptune, Monmouth County, New Jersey. The flag shaped parcel is bounded to the north by West Bangs Avenue ROW to the east by Wayside Road ROW and to the south and west by residential properties.

Project Improvements

There is one building (to remain) onsite being a place of worship, Kingdom Hall of Jehovah Witnesses. There is a current surrounding parking lot for the facility which shall remain, however the applicant wishes to add additional parking spaces by means of expansion. Also, the applicant proposes to install a solar canopy over the southern-most row of parking spaces. The increase in stormwater due to the increase in impervious surface shall be mitigated by an open detention basin. Additionally, the existing roof drainage collection system shall be intercepted to discharge at the proposed basin. And finally, the existing concentrated discharge points shall be upgraded to facilitate the proposed discharge flows.

Soils

Published soils surveys indicate that the following soil types are located within the site. The linework and symbology for the soil types was determined by the NRCS Web Soil Survey, as specified in the New Jersey Department of Agriculture Technical Bulletin 2006-1.0, dated June 1, 2006.

Symbol	Description	Slopes	HSG
EvuB	Evesboro-Urban land complex	0 to 5%	A



Disturbance and Impervious Coverage

Total Disturbance Areas = 0.83 ac (excludes the existing pavement upgrade)

The following table indicates the net impervious coverage within the impacted drainage area, both existing and proposed conditions.

Summary of Net Impervious within the Property Limit		
	Existing	Proposed
Total Impervious Coverage	1.38 ac	1.55 ac
Total Building Coverage	0.20 ac	0.20 ac
Total Non-Vehicle Impervious Coverage (ie, sidewalk)	0.08 ac	0.13 ac
Total Vehicle Impervious Coverage (ie, pavement)	1.10 ac	1.22 ac

Land Cover

The following table demonstrates the land cover of the existing and proposed as defined by drainage areas (see attached map).

Existing Drainage Areas (Hydrologic Soils Group "A")

Name	Area	Building Roof	Non-Vehicle Impervious	Vehicle Impervious	Grass	Woods	CN	"c"
		98	98	98	39	30		
Existing Area A	2.40 ac	0.20 ac	0.08 ac	1.10 ac	1.02 ac	-	73	0.50
Existing Area B	0.38 ac	-	-	-	0.34 ac	0.04 ac	38	0.25
Total Areas	2.78 ac	0.20 ac	0.08 ac	1.10 ac	1.36 ac	0.04 ac		

Proposed Drainage Areas (Hydrologic Soils Group "A")

Name	Area	Building Roof	Non-Vehicle Impervious	Vehicle Impervious	Grass	Woods	CN	"c"
		98	98	98	39	30		
Proposed Area A	1.45 ac	-	0.06 ac	0.75 ac	0.64 ac	-	72	0.49
Proposed Area B1	0.80 ac	-	0.03 ac	0.46 ac	0.31 ac	-	75	0.55
Proposed Area B2	0.20 ac	0.20 ac	-	-	-	-	98	0.99
Proposed Area B3	0.38 ac	-	-	-	0.34 ac	0.04 ac	38	0.25
Total Areas	2.83 ac	0.20 ac	0.09 ac	1.21 ac	1.29 ac	0.04 ac		

Note: In post conditions, the overall drainage area increases by 0.05 ac due to slight increases in the periferal boundary caused by the detention basin and parking area expansion.



Hydrology

Design Methodologies - The NRCS Unit Hydrograph Method was utilized to calculate the stormwater runoff volumes and rates from the project site. Technical Release No. 55 (TR55) was utilized to obtain runoff curve numbers (CNs) for the land cover type of each drainage area. The hydrologic model was analyzed and designed with the Hydraflow Hydrographs software program.

Key Hydrologic Design Points:

- Storm distribution: NRCS Type 3, Shape Factor 484
- Curve Numbers (CN): 'D' soils – impervious surface: 98
- 24-hr Intensity: Middlesex County, NJ 2-, 10-, 25- & 100-year storm events
- Time of Concentration: assumed 10 minutes minimum.
- Permeability has been included in the hydrologic design.
- All stored water shall be detained by controlled release via an outflow structure device.

Below is a table indicating the roof drains are designed to carry 6 in/hr.

HORIZONTAL ROOF HEADER DRAIN DESIGN

Coefficient of Roughness (n): **0.010**


Drain Diameter (in)	Allowable Roof Area (ac.) (0.5% Drain Slope at a Rainfall Rate of 6" per hr.)	Allowable Roof Area (ac.) (1% Drain Slope at a Rainfall Rate of 6" per hr.)	Allowable Roof Area (ac.) (2% Drain Slope at a Rainfall Rate of 6" per hr.)	Allowable Roof Area (ac.) (3% Drain Slope at a Rainfall Rate of 6" per hr.)
3	0.01	0.02	0.03	0.03
4	0.03	0.05	0.06	0.08
6	0.09	0.12	0.17	0.21
8	0.20	0.29	0.41	0.50
10	0.34	0.47	0.67	0.82
12	0.55	0.78	1.10	1.35
15	1.00	1.41	2.00	2.45
18	1.63	2.30	3.25	3.98

Roof Area =	0.20 Ac.			
Area Divisions =	2	Existing Roof Collector Line (1/2 of roof) @ 1% min.		
Partial Roof Area =	0.10 Ac.			
Use Highlighted Diameter =		8	6	6
Min. Design Drain Slope =	1 %			
Roof Area =	0.20 Ac.			
Area Divisions =	1	Proposed Roof Discharge Line (entire roof) @ 0.8%		
Total Roof Area =	0.20 Ac.			
Use Highlighted Diameter =		8	8	8
Min. Design Drain Slope =	0.5 %			6



Below is a table indicating the for the conduit outlet protection and stone flumes.

CONDUIT OUTLET PROTECTION AND STONE FLUME DESIGN

Reference	Q _{design} (CFS)	D _o (Inches)	W _o (Inches)	Pipe Slope (%)	Invert (Feet)	WSE (if ** (M)ultiple or (H)oriz. or Applic.) (S)ingle Conduit (Feet) (M<, M> or S)	(H)oriz. or (C)hannel (H or C)	 MERIDIAN ENGINEERING GROUP, INC. 1199 Amboy Avenue, Suite 1D Edison, New Jersey 08837 (732) 205-8288	
Riprap Apron 3 Design 25yr (Area B1)	2.25	0.5	36	8.3	94.60	96.25	S		H
Riprap Apron 2 Design 25yr (Area B2)	0.9	8	8	1	94.60	96.25	S	H	* TW Elevation: 96.25 La (Ft): 5 W (Ft): 4 3Wo (Ft): 2 D50 (In): 0 Comment: Use 3Wo=3' Full Flow Vel (FPS): 3.4 Use 4 In. Min.
Riprap Apron 1 Design 100yr (Area A+basin)	8.11	15	15	0.8	94.60	94.60	M<	H	* TW Elevation: 94.85 La (Ft): 19 W (Ft): 23 3Wo (Ft): 4 D50 (In): 9 Comment: Use 9" Reno Mat Full Flow Vel (FPS): 4.7 Use 3Wo=9'
Rip Rap Flume Design 10yr (Area A)	$D50 = [q(S)^{1.5}/4.75(10)^{-3}]^{1/1.89} = [(2.94 \text{ cfs}/3 \text{ ft})(0.083)^{1.5}/0.00475]^{0.5291} = 2.3 \text{ in} = \text{use three layers of min. 3" D50 (see detail)}$								
Rip Rap Flume Design 10yr (Area B1)	$D50 = [q(S)^{1.5}/4.75(10)^{-3}]^{1/1.89} = [(1.78 \text{ cfs}/3 \text{ ft})(0.083)^{1.5}/0.00475]^{0.5291} = 1.8 \text{ in} = \text{use three layers of min. 3" D50 (see detail)}$								
Note: Rip Rap Apron 3 discharge point is a 3' wide curb opening connected to a stone flume, this exasperates the D50 stone size calculation to an impractical proportion. Since the 25-yr discharge rate is only 2.21 cfs and the flow will be completely contained within the stone flume and stone channel below, 3 layers of 4" D50 stone is proposed.									

* "TW Elevation" = greater value of (0.2xD_o) and (2-Yr WSE - use invert or 1-Yr if 2-Yr is n/a).

** "M<" or "M>" = separation of multiple conduits is < or > (0.25xW_o).

Computed sizes are minimum values (see details for actual design).

Stormwater Quantity

The following table lists the final peak discharge rates, both existing and proposed computed discharge rates. As the table indicates, there is an increase in post conditions due to the slight increase in impervious surface. However, a proposed open detention basin is proposed to mitigate the increase and effectively decrease the overall runoff rates.



Allowable Peak Discharge Rates

cubic feet per second (cfs)

	Area	Reduction %		Reduction %		Reduction %		Hyd
		2 year	10 year	25 year	100 year			
Ex. Area A without detention	2.40 ac	3.26	5.01	6.29	9.02			Hyd 3
Ex. Area B without detention	0.38 ac	0.00	0.01	0.06	0.28			Hyd 4
Total Existing Study Area	2.78 ac	3.26	5.01	6.30	9.18			Hyd 5
Prop. Area A without detention	2.85 ac	1.91	2.94	3.69	5.31			Hyd 8
Prop. Area B with detention	1.38 ac	1.63	2.51	3.18	4.80			Hyd 14
Total Proposed Study Area	2.83 ac	3.17 97%	4.91 98%	5.92 94%	8.11 88%			Hyd 15 Hyd 16

Stormwater Quality

Treat runoff volume generated by the NJDEP 1.25-inch per 2-hour water quality storm by utilizing stormwater management methods that reduce the developed site's average annual total suspended solids (TSS) load by at least 80% for all new pavement areas, per <http://www.njstormwater.org> website, Section 4.0.

The table below is the determination of the required TSS removal rate based on proposed land cover:

Required TSS Removal Rate (Weighted)		
Land Cover	Area	TSS Required Removal Rate
New Pavement	0.12 ac	80% Required
Existing Pavement	1.10 ac	0% Required
Total	1.22 ac	8% TSS Removal Rate

$$[(0.12 \text{ ac} \times 0.8) + (1.10 \text{ ac} \times 0.0)] / 1.23 \text{ ac} = \underline{8\% \text{ TSS Removal Rate}}$$

Due to the de minimis rate of 8%, water quality can be assumed to be provided within the detention basin, which has a minimum treatment percentage of 40% per Chapter 11.2 of the NJ Stormwater Best Management Practices Manual.



Conclusion

The improvements to this site are relatively minor and cause very little impact to the current stormwater conditions.

The proposed stormwater detention will mitigate the minor increase in peak runoff for the 2-, 10-, 25- and 100-year storm events for the overall site. At completion of the project, all target flows will be met.

In summary, the decrease in proposed peak discharge rates by means of stormwater detention is a positive improvement to the site. Based on the results of this study, Meridian anticipates no adverse impact to the site or to downstream properties.