ENVIRONMENTAL CONCEPT PLAN
MONTGOMERY ROAD TOWNHOMES
(SFA RESIDENTIAL)
4281, 4291, 4309, & 4319 MONTGOMERY ROAD
PARCELS 324, 325, 326, & 327
L. 9075 / F. 92, L. 9321 / F. 496,
L. 8770 / F. 163
HOWARD COUNTY, MARYLAND

GENERAL NOTES

1. THE PROJECT IS IN CONFORMANCE WITH THE LATEST HOWARD COUNTY STANDARDS UNLESS WAIVERS HAVE BEEN APPROVED.
2. THE EXISTING TOPOGRAPHY SHOWN HEREON IS BASED ON A TOPOGRAPHIC SURVEY PREPARED BY ROBERT H. VOGEL ENGINEERING, INC., DATED AUGUST 18, 2010. OFFSITE TOPOGRAPHY FROM HOWARD COUNTY GIS.
3. THE PROJECT BOUNDARY IS BASED ON A BOUNDARY SURVEY PREPARED BY ROBERT H. VOGEL ENGINEERING, INC., DATED AUGUST 18, 2010.
4. THE COORDINATES SHOWN HEREON ARE BASED UPON THE HOWARD COUNTY GEODETIC CONTROL WHICH IS BASED UPON THE MARYLAND STATE PLANE COORDINATE SYSTEM. HOWARD COUNTY MONUMENT NOS. 30CC AND 31AC WERE USED FOR THIS PROJECT.
5. THE SUBJECT PROPERTY IS ZONED "RSA-8" IN ACCORDANCE WITH THE 2/2/04 COMPREHENSIVE ZONING PLAN AND THE COMP. LITE ZONING REGULATIONS EFFECTIVE ON COMPREHENSIVE ZONING PLAN AND THE COMP. LITE ZONING REGULATIONS EFFECTIVE ON 7/28/06, AND IS SUBJECT TO THE SUBDIVISION AND LAND DEVELOPMENT REGULATIONS EFFECTIVE 10/2/03 PER COUNCIL BILL 75-2003.
6. NO GRADING, REMOVAL OF VEGETATIVE COVER OR TREES, PAVING AND NEW STRUCTURES SHALL BE PERMITTED WITHIN THE REQUIRED WETLANDS, STREAM(S) OR THEIR BUFFERS, FOREST CONSERVATION EASEMENT AREAS AND 100-YEAR FLOODPLAIN.
7. THIS PROPERTY IS LOCATED WITHIN THE METROPOLITAN DISTRICT.
8. WATER FOR THIS PROJECT IS TO BE PUBLIC EXTENSIONS OF CONTRACT NO. 12-W.
9. SEWER FOR THIS PROJECT IS TO BE PUBLIC EXTENSIONS OF CONTRACT NO. 20-1081-D.
10. EXISTING UTILITIES LOCATED FROM TOPOGRAPHIC SURVEY AND AS-BUILT DRAWINGS. CONTRACTOR SHALL LOCATE EXISTING UTILITIES WELL IN ADVANCE OF CONSTRUCTION ACTIVITIES AND TAKE ALL NECESSARY PRECAUTIONS TO PROTECT THE EXISTING UTILITIES AND TO MAINTAIN UNINTERRUPTED SERVICE.
11. NO FLOODPLAIN IS LOCATED ONSITE.
12. NO STEEP SLOPES OVER 20,000 SF CONTIGUOUS ARE LOCATED ONSITE.
13. FOREST CONSERVATION OBLIGATIONS FOR THIS PROJECT SHALL BE ADDRESSED BY A FOREST CONSERVATION PLAN SUBMITTED WITH A SUBDIVISION OR SITE DEVELOPMENT PLAN.
14. WETLANDS AND STREAMS SHOWN ONSITE ARE BASED ON ECO-SCIENCE PROFESSIONALS, INC. C/O MR. JOHN CANOLES, AUGUST 2011
15. IN ACCORDANCE WITH SECTION 16.121(A)(2) OF THE HOWARD COUNTY SUBDIVISION AND LAND DEVELOPMENT REGULATIONS, THE OPEN SPACE REQUIREMENTS FOR THIS RSA-8 PROJECT IS 25% OF GROSS AREA (5.63 AC. GROSS AREA x 25% = 1.41 AC.). REFER TO OPEN SPACE LOT 45.
16. GEOTECHNICAL INVESTIGATIONS SHALL COMPLETED AS PART OF THE SITE DEVELOPMENT PLAN PACKAGE.
17. A NOISE STUDY SHALL BE PREPARED BY ROBERT H. VOGEL ENGINEERING AS PART OF THE SITE DEVELOPMENT PLAN PACKAGE.
18. FOREST STAND DELINEATION PLAN PREPARED BY ECO-SCIENCE PROFESSIONALS, INC. C/O MR. JOHN CANOLES, AUGUST 2011
19. MONTGOMERY ROAD IS CLASSIFIED AS A MINOR ARTERIAL. THE PROPOSED STREETS ARE CLASSIFIED AS PRIVATE ACCESS STREETS.
20. TO THE BEST OF THE OWNERS KNOWLEDGE, THERE ARE NO BURIAL GROUNDS, CEMETERIES, OR HISTORIC STRUCTURES LOCATED ON THIS PROPERTY.
21. THE PROPOSED UNITS SHALL HAVE AN AUTOMATIC FIRE PROTECTION SPRINKLER SYSTEM.
22. STORMWATER MANAGEMENT FOR THE PROJECT IS PROVIDED BY THE USE OF ALTERNATIVE SURFACES, NON STRUCTURAL PRACTICES & MICRO-SCALE PRACTICES IN ACCORDANCE WITH ENVIRONMENTAL SITE DESIGN CRITERIA. MICRO-SCALE PRACTICES INCLUDE MICRO-BIORETENTION, BIO SWALES AND PERMEABLE SURFACES WITH STONE STORAGE AS WELL AS BIO-RETENTION. THESE FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED.
23. APPROVAL OF THIS ENVIRONMENTAL CONCEPT PLAN (ECP) DOES NOT CONSTITUTE AN APPROVAL OF ANY SUBSEQUENT AND ASSOCIATED SUBDIVISION PLAN/PLAT AND/OR SITE DEVELOPMENT PLAN AND/OR RED-LINE REVISION PLAN. REVIEW OF THIS PROJECT FOR COMPLIANCE WITH THE HOWARD COUNTY SUBDIVISION AND LAND DEVELOPMENT REGULATIONS AND THE HOWARD COUNTY ZONING REGULATIONS SHALL OCCUR AT THE SUBDIVISION PLAN/PLAT AND/OR SITE DEVELOPMENT PLAN AND/OR RED-LINE REVISION PROCESS. THE APPLICANT AND CONSULTANT SHOULD EXPECT ADDITIONAL AND MORE DETAILED REVIEW COMMENTS (INCLUDING COMMENTS THAT MAY ALTER THE OVERALL SITE DESIGN) AS THIS PROJECT PROGRESSES THROUGH THE PLAN REVIEW PROCESS.
24. IN ACCORDANCE WITH SECTION 16.121(A)(4) OF THE HOWARD COUNTY SUBDIVISION AND LAND DEVELOPMENT REGULATIONS, RECREATION OPEN SPACE FOR THIS RSA-8 PROJECT IS 300 SF / UNIT (44 X 300 = 13,200 SF).

ENVIRONMENTAL SITE DESIGN NARRATIVE:

IN ACCORDANCE WITH CHECKLIST ITEM III.K.

III.K.1&2.
A. THE NATURAL AREAS ON THE MONTGOMERY ROAD TOWNHOMES PROJECT SITE ARE LOCATED IN THE NORTHERNMOST PORTION OF THE SITE AND THROUGH THE PANHANDLE PORTION. NO DISTURBANCE TO THE STREAM AND STREAM BUFFER, WETLAND AND WETLAND BUFFER OR THEIR WOODED RESOURCES IS PROPOSED.

B. NO DRAMATIC DISTURBANCE TO THE NATURAL DRAINAGE PATTERNS ARE PROPOSED, PLEASE REFER TO THE PROPOSED GRADING, SHEET 2.

C. THE CONCEPTUAL REDUCTION IN IMPERVIOUS AREA THROUGH BETTER SITE DESIGN IS ACHIEVED THROUGH THE ENVIRONMENTAL SITE DESIGN (ESD) FOR THE PROJECT. THE ESD CONCEPT INCLUDES THE USE OF MICRO-SCALE PRACTICES TO INCLUDE MICRO-BIORETENTION FACILITIES AND BIO-SWALES AS WELL AS NON STRUCTURAL PRACTICES; PERMEABLE SURFACES, ROOFTOP DISCONNECTION INTO PERMEABLE SURFACE SUBBASE AND ROOFTOP DISCONNECTION OVERLAND AND A BIO-RETENTION FACILITY. IN ADDITION A "STORMCEPTOR" SYSTEM OR EQUAL IS PROPOSED FOR A PORTION OF THE PROPOSED MONTGOMERY ROAD / MSHA WIDENING.

D. SEDIMENT CONTROL FOR THIS SPECIFIC SITE PLAN WILL BE PROVIDED THROUGH THE USE A PROPOSED SEDIMENT TRAP (TO BE CONVERTED TO A MICRO-BIORETENTION FACILITY, EARTH DIKES, AND SILT FENCE PERIMETER CONTROLS. SEDIMENT CONTROL SHALL BE IN ACCORDANCE WITH CURRENT REQUIREMENTS AND SHALL BE APPROVED BY THE HOWARD SOIL CONSERVATION DISTRICT.

E. STORMWATER MANAGEMENT FOR THE PROJECT SHALL BE MET THROUGH THE USE OF MICRO-BIORETENTION FACILITIES, A BIORETENTION FACILITY, BIO-SWALES, PERMEABLE SURFACES, ROOFTOP DISCONNECTION INTO PERMEABLE SURFACE SUBBASE AND ROOFTOP DISCONNECT OVERLAND @ < 5%.

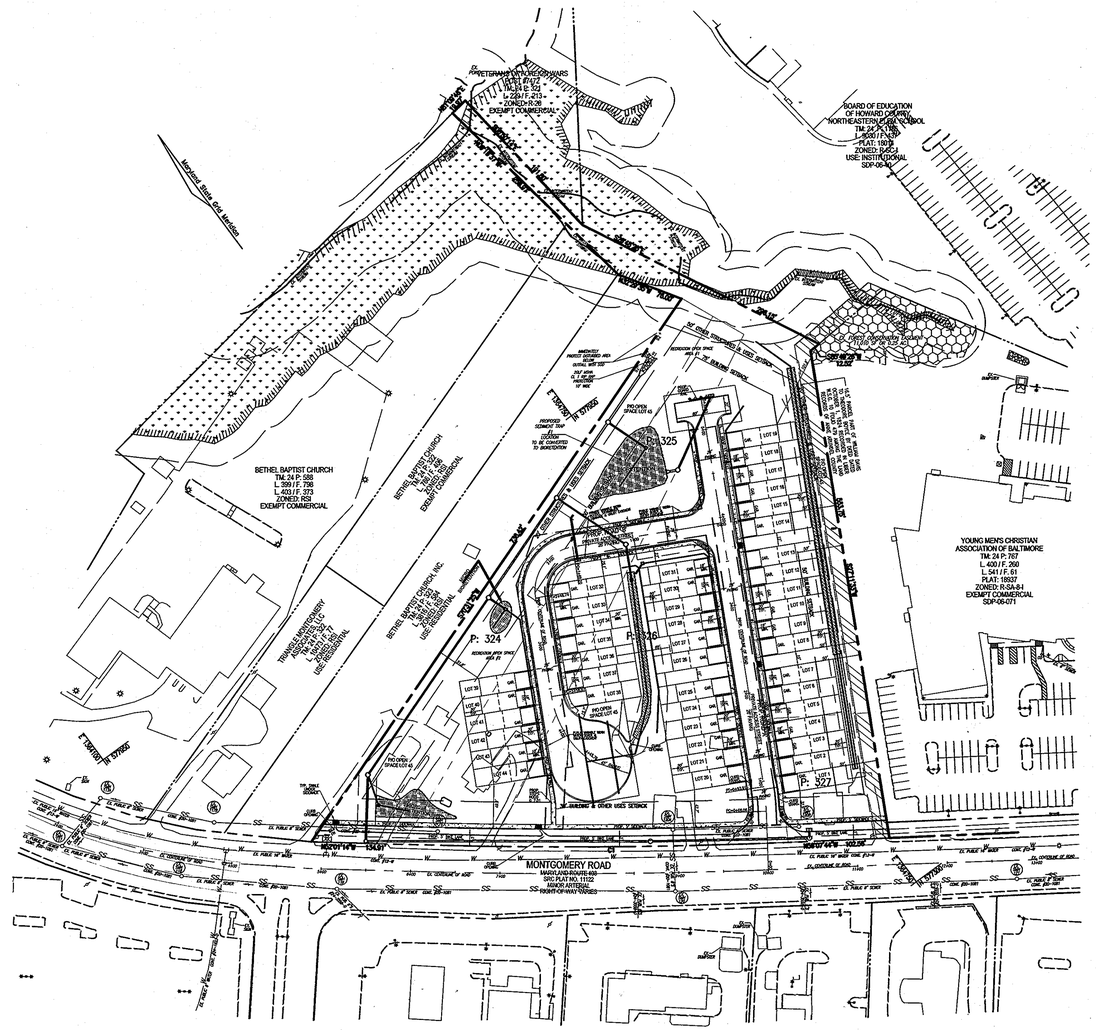
F. THE RESULTS OF THE ENVIRONMENTAL SITE DESIGN FOR THIS PROJECT WILL REFLECT "WOODS IN GOOD CONDITION".

III.K.3.

AT THIS CONCEPT STAGE OF DEVELOPMENT, NO DESIGN MANUAL WAIVERS AND/OR WAIVER PETITIONS FOR ENVIRONMENTAL AND STORMWATER MANAGEMENT DESIGN ARE REQUIRED.

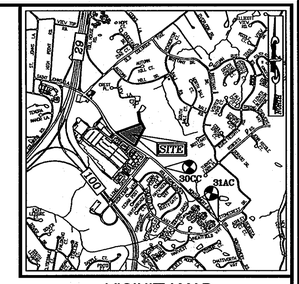
III.K.4.

AT THIS CONCEPT STAGE OF DEVELOPMENT, THIS ITEM IS NOT APPLICABLE TO THIS PROJECT.



LOCATION MAP
SCALE: 1"=80'

80' 0 80' 160' 240'



VICINITY MAP
SCALE: 1"=2000'
ADC MAP COORDINATE: PG. 4815 K10

BENCHMARKS

HOWARD COUNTY BENCHMARK - 30CC (CONC. MONUMENT)
N 576747.03 E 1365563.14 ELEV. 427.32
LOCATION: MONTGOMERY ROAD 1/3 MILE EAST OF LONG GATE PARKWAY

HOWARD COUNTY BENCHMARK - 31AC (CONC. MONUMENT)
N 575223.09 E 1367092.12 ELEV. 432.55
LOCATION: MONTGOMERY ROAD 3/4 MILE EAST OF LONG GATE PARKWAY

LEGEND

- PROPERTY LINE
- RIGHT-OF-WAY LINE
- ADJACENT PROPERTY LINE
- CENTERLINE OF EXISTING STREAM
- 16.5' PARCEL PART OF WILLIAM DAVIS TO THEODORE BOYCE BY DEED DATED OCTOBER 1, 1824 RECORDED IN LIBER W.S.G. 10 FOLIO 479 AMONG THE LAND RECORDS OF ANNE ARUNDEL COUNTY

SHEET INDEX

PERMIT INFORMATION CHART

SUBDIVISION NAME	SECTION/ AREA	LOT/ PARCEL			
MONTGOMERY ROAD TOWNHOMES	-	PARCELS 324, 325, 326, & 327			
PLAT REF.	BLOCK NO	ZONE	TAX MAP	ELECT DIST.	CENSUS TR.
N/A	24	RSA-8	24	2ND	602800

SOILS LEGEND

SYMBOL	NAME / DESCRIPTION	GROUP
LoB	LEGORE-MONTALTO-URBAN LAND COMPLEX, 0 TO 8 PERCENT SLOPES	B
WcB	WATCHUNG SILT LOAM, 3 TO 8 PERCENT SLOPES, STONY	D

NOTE: BASED ON HOWARD SOIL SURVEY

SITE ANALYSIS DATA CHART

A.	TOTAL PROJECT AREA:	245,243 S.F. OR 5.63 AC.
B.	AREA OF PLAN SUBMISSION:	226,471 S.F. OR 5.20 AC.
C.	AREA OF WETLANDS AND BUFFERS:	9,082 S.F. OR 0.21 AC.
D.	AREA OF FLOODPLAIN:	0 S.F. OR 0.00 AC.
E.	AREA OF FOREST:	0 S.F. OR 0.00 AC. (REFER TO FSD)
F.	AREA OF STEEP SLOPES (15% & GREATER):	0 S.F. OR 0.00 AC.
G.	ERODIBLE SOILS:	N/A
H.	LIMIT OF DISTURBED AREA:	226,471 S.F. OR 5.20 AC.
I.	PROPOSED USES FOR SITE AND STRUCTURES:	RESIDENTIAL SINGLE FAMILY ATTACHED HOMES
J.	GREEN OPEN AREA:	140,389 S.F. OR 3.22 AC.
K.	PROPOSED IMPERVIOUS AREA:	104,874 S.F. OR 2.41 AC. (INCLDES MONT. ROAD WIDENING)
L.	PRESENT ZONING DESIGNATION:	RSA-8
M.	OPEN SPACE REQUIRED:	1.41 ACRES (25%)
N.	TOTAL NUMBER OF UNITS ALLOWED:	44
O.	TOTAL NUMBER OF UNITS PROPOSED:	44
P.	DPZ FILE REFERENCES:	-

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING

CHIEF, DEVELOPMENT ENGINEERING DIVISION — DATE 1/18/12

CHIEF, DIVISION OF LAND DEVELOPMENT — DATE 1/13/12

NO.	REVISION	DATE

ENVIRONMENTAL CONCEPT PLAN

COVER SHEET

MONTGOMERY ROAD TOWNHOMES
(SFA RESIDENTIAL)
4281, 4291, 4309, & 4319 MONTGOMERY ROAD
PARCELS 324, 325, 326, & 327
L. 9075 / F. 92, L. 9321 / F. 496,
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2ND ELECTION DISTRICT
TAX MAP: 24 GRID: 24
DPZ REF'S:

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PARCEL: 324, 325, 326, & 327
HOWARD COUNTY, MARYLAND

ROBERT H. VOGEL ENGINEERING, INC.
ENGINEERS • SURVEYORS • PLANNERS
8407 MAIN STREET ELLICOTT CITY, MD 21043
TEL: 410.461.7666 FAX: 410.461.8961

STATE OF MARYLAND — ROBERT H. VOGEL — No. 16193 — PROFESSIONAL ENGINEER — 1/13/12

ROBERT H. VOGEL, PE No.16193

DESIGN BY: RHV / EDS
DRAWN BY: JMR / EDS
CHECKED BY: RHV
DATE: OCTOBER 2011
SCALE: AS SHOWN
W.O. NO.: 08-48

PROFESSIONAL CERTIFICATE
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 16193 EXPIRATION DATE: 09-27-2012

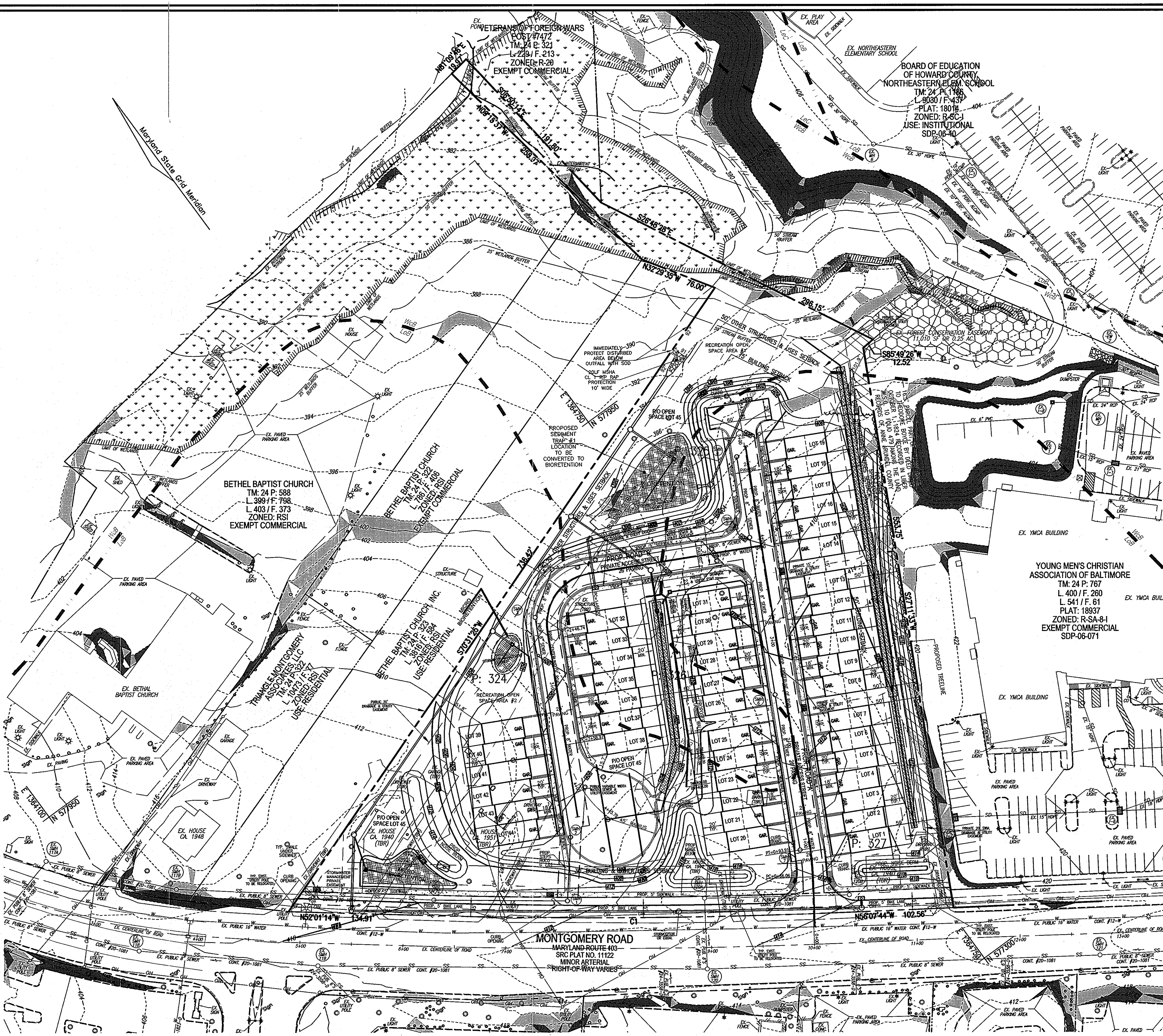
SHEET 1 OF 5

OWNER/DEVELOPER

TRIANGLE MONTGOMERY ASSOCIATES, LLC.
TRIANGLE OLD ANNAPOLIS ASSOCIATES, LLC.
MR. CHRIS J. PIPPEN
453 SOUTH POLK DRIVE
SARASOTA, FL 34236
PHONE: (41C) 404-8246

K:\PROJECTS\08-48\ENGR\DWG\ECP\01_COVER.DWG

ECP-12-016



LAYOUT PLAN
SCALE: 1"=50'

50' 0 50' 100' 150'

LEGEND:

- PROPERTY LINE
- RIGHT-OF-WAY LINE
- ADJACENT PROPERTY LINE
- EXISTING CURB AND GUTTER
- EXISTING UTILITY POLE
- EXISTING LIGHT POLE
- EXISTING MAILBOX
- EXISTING SIGN
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY LINE
- EXISTING CLEANOUT
- EXISTING FIRE HYDRANT
- EXISTING WATER LINE
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- PROPOSED STEEP SLOPES
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SOILS LEGEND

SYMBOL	DESCRIPTION	TYPE
LeC	LEGORE SILT LOAM, 8 TO 15 PERCENT SLOPES, STONY	B
LoB	LEGORE-MONTALTO-URBAN LAND COMPLEX, 0 TO 8 PERCENT SLOPES	B
WcB	WATCHUNG SILT LOAM, 3 TO 8 PERCENT SLOPES, STONY	D

CURVE DATA

CURVE	ARC	RADIUS	TANGENT	DELTA	CHORD
C1	408.68'	5,699.58'	204.43'	04°06'30"	N54°04'29"W 408.59'

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING

[signature] 1/18/12
CHIEF, DEVELOPMENT ENGINEERING DIVISION — DATE

[signature] 1/13/12
CHIEF, DIVISION OF LAND DEVELOPMENT — DATE

OWNER/DEVELOPER
TRIANGLE MONTGOMERY ASSOCIATES, LLC.
TRIANGLE OLD ANNAPOLIS ASSOCIATES, LLC.
MR. CHRIS J. PIPPEN
4291 MONTGOMERY ROAD
ELLICOTT CITY, MD 21043
PHONE: (410) 404-8246

NO.	REVISION	DATE

ENVIRONMENTAL CONCEPT PLAN

OVERALL PROJECT SITE PLAN

MONTGOMERY ROAD TOWNHOMES
(SFA RESIDENTIAL)
4281, 4291, 4309, & 4319 MONTGOMERY ROAD
PARCELS 324, 325, 326, & 327
L. 9075 / F. 92, L. 9321 / F. 496,
L. 8770 / F. 163

2ND ELECTION DISTRICT
TAX MAP: 24 GRID: 24
DPZ REF'S:

ZONED: RSA-8
PARCEL: 324, 325, 326, & 327
HOWARD COUNTY, MARYLAND

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ELLICOTT CITY, MD 21043
TEL: 410.461.7666
FAX: 410.461.8961

STATE OF MARYLAND — ROBERT H. VOGEL — No. 16193 — PROFESSIONAL ENGINEER — 1/9/12
ROBERT H. VOGEL, PE No.16193

DESIGN BY: RHV / EDS
DRAWN BY: JMR / EDS
CHECKED BY: RHV
DATE: NOVEMBER 2011
SCALE: AS SHOWN
W.O. NO.: 08-48

PROFESSIONAL CERTIFICATE
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 16193 EXPIRATION DATE: 09-27-2012

ECP-12-016

LEGEND:

- PROPERTY LINE
- RIGHT-OF-WAY LINE
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- EXISTING SIGN
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- EXISTING FIRE HYDRANT
- EXISTING WATER LINE
- EXISTING 10' CONTOUR
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- PROPOSED CURB
- PROPOSED STREET LIGHT
- RECREATIONAL OPEN SPACE
- PROPOSED 10' CONTOUR
- PROPOSED 2' CONTOUR
- PROPOSED STABILIZED CONSTRUCTION ENTRANCE
- PROPOSED SILT FENCE
- PROPOSED SUPER SILT FENCE
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED MODERATE SLOPES
- PROPOSED STEEP SLOPES
- NON-STRUCTURAL PROP. PERMEABLE SURFACE ROAD OR DRIVEWAY OR ROOFTOP TO PERMEABLE SURFACE SUBBASE
- NON-STRUCTURAL ROOFTOP DISCONNECTIONS
- MICRO-SCALE PRACTICE BIO-SWALE
- MICRO-SCALE PRACTICE MICRO BIORETENTION / BIORETENTION

NOTE
FOR REMAINDER OF PROPERTY OUTSIDE OF THE LIMITS OF DISTURBANCE, REFER TO SHEET 2 FOR A "50 SCALE" OVERALL PLAN VIEW

CURVE DATA					
CURVE	ARC	RADIUS	TANGENT	DELTA	CHORD
C1	408.68'	5,699.58'	204.43'	04°06'30"	N54°04'29"W 408.59'

SOILS LEGEND		
SYMBOL	DESCRIPTION	TYPE
LeC	LEGORE SILT LOAM, 8 TO 15 PERCENT SLOPES, STONY	B
LoB	LEGORE–MONTALTO–URBAN LAND COMPLEX, 0 TO 8 PERCENT SLOPES	B
WcB	WATCHUNG SILT LOAM, 3 TO 8 PERCENT SLOPES, STONY	D

30' 0 30' 60' 90'

NO.	REVISION	DATE

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING

CHIEF, DEVELOPMENT ENGINEERING DIVISION — DATE 1/18/12

CHIEF, DIVISION OF LAND DEVELOPMENT — DATE 1/13/12

SITE LAYOUT AND GRADING PLAN
SCALE: 1"=30'

OWNER/DEVELOPER
TRIANGLE MONTGOMERY ASSOCIATES, LLC.
TRIANGLE OLD ANNAPOLIS ASSOCIATES, LLC.
MR. CHRIS J. PIPPEN
4291 MONTGOMERY ROAD
ELLICOTT CITY, MD 21043
PHONE: (410) 404-8246

ENVIRONMENTAL CONCEPT PLAN

SITE LAYOUT AND GRADING PLAN

MONTGOMERY ROAD TOWNHOMES

(SFA RESIDENTIAL)
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STATE OF MARYLAND — ROBERT HARRIS VOGEL — No. 16193 — PROFESSIONAL ENGINEER
ROBERT H. VOGEL, PE No.16193

DESIGN BY:	RHV / EDS
DRAWN BY:	JMR / EDS
CHECKED BY:	RHV
DATE:	NOVEMBER 2011
SCALE:	AS SHOWN
W.O. NO.:	08-48

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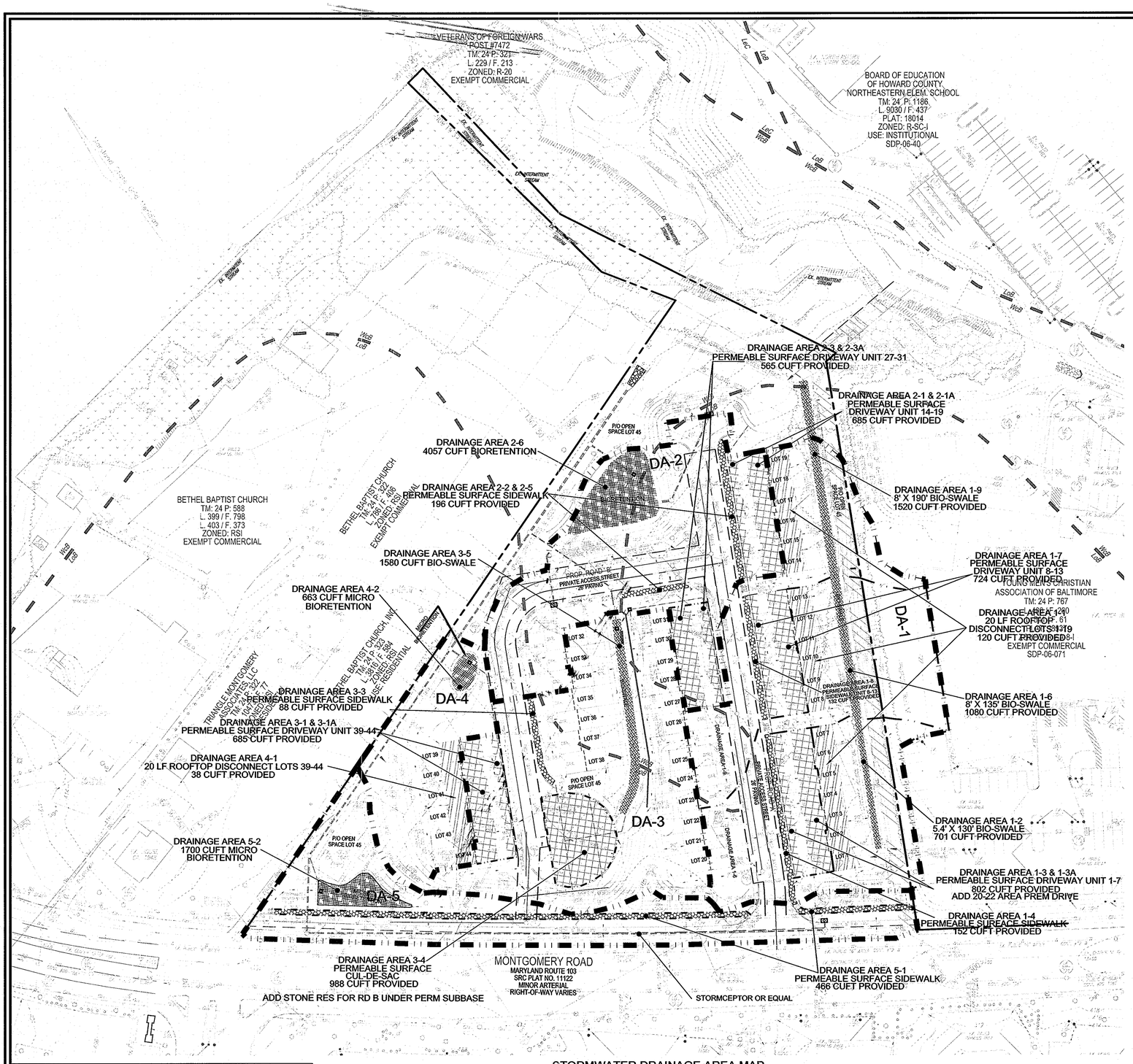
SHEET 3 OF 5

ECP-12-016



STORMWATER DRAINAGE AREA MAP
SCALE: 1"=50'

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- PROPERTY LINE
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- MICRO-SCALE PRACTICE MICRO BIORETENTION / BIORETENTION
- PROP. PERMEABLE CONCRETE SIDEWALK
- DRAINAGE DIVIDE

SOILS LEGEND		
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APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING

CHIEF, DEVELOPMENT ENGINEERING DIVISION — DATE 1/18/12

CHIEF, DIVISION OF LAND DEVELOPMENT — DATE 1/13/12

NO.	REVISION	DATE

ENVIRONMENTAL CONCEPT PLAN

STORMWATER MANAGEMENT DRAINAGE AREA MAP

MONTGOMERY ROAD TOWNHOMES
(SFA RESIDENTIAL)

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STATE OF MARYLAND — ROBERT HARRIS VOGEL — No. 16193 — PROFESSIONAL ENGINEER
ROBERT H. VOGEL, P.E. No.16193

DESIGN BY:	RHV / EDS
DRAWN BY:	JMR / EDS
CHECKED BY:	RHV
DATE:	NOVEMBER 2011
SCALE:	AS SHOWN
W.O. NO.:	08-48

PROFESSIONAL CERTIFICATE
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 16193 EXPIRATION DATE: 09-27-2012

SHEET 4 OF 5

ECP-12-016

APPENDIX B.4.C SPECIFICATIONS FOR MICRO-BIORETENTION. RAIN GARDEN, LANDSCAPE INFILTRATION & INFILTRATION BERMS

1. MATERIAL SPECIFICATIONS

THE ALLOWABLE MATERIALS TO BE USED IN THESE PRACTICES ARE DETAILED IN TABLE B.4.1.

2. FILTERING MEDIA OR PLANTING SOIL

THE SOIL SHALL BE A UNIFORM MIX, FREE OF STONES, STUMPS, ROOTS OR OTHER SIMILAR OBJECTS LARGER THAN TWO INCHES. NO OTHER MATERIALS OR SUBSTANCES SHALL BE MIXED OR DUMPED WITHIN THE MICRO-BIORETENTION PRACTICE THAT MAY BE HARMFUL TO PLANT GROWTH, OR PROVE A HINDRANCE TO THE PLANTING OR MAINTENANCE OPERATIONS. THE PLANTING SOIL SHALL BE FREE OF BERMUDA GRASS, QUACKGRASS, JOHNSON GRASS, OR OTHER NOXIOUS WEEDS AS SPECIFIED UNDER COMAR 15.08.01.05.

THE PLANTING SOIL SHALL BE TESTED AND SHALL MEET THE FOLLOWING CRITERIA:

* SOIL COMPONENT – LOAMY SAND OR SANDY LOAM (USDA SOIL TEXTURAL CLASSIFICATION).
* ORGANIC CONTEN – MINIMUM 10% BY DRY WEIGHT (ASTM D 2974). IN GENERAL, THIS CAN BE MET WITH A MIXTURE OF LOAMY SAND (60%-65%) AND COMPOST (35% TO 40%) OR SANDY LOAM (30%), COARSE SAND (30%), AND COMPOST (40%).
* CLAY CONTENT – MEDIA SHALL HAVE A CLAY CONTENT OF LESS THAN 5%.
* PH RANGE – SHOULD BE BETWEEN 5.5 – 7.0. AMENDMENTS (E.G., LIME, IRON SULFATE PLUS SULFUR) MAY BE MIXED IN TO THE SOIL TO INCREASE OR DECREASE PH.

THERE SHALL BE AT LEAST ONE SOIL TEST PER PROJECT. EACH TEST SHALL CONSIST OF BOTH THE STANDARD SOIL TEST FOR PH, AND ADDITIONAL TESTS OF ORGANIC MATTER, AND SOLUBLE SALTS. A TEXTURAL ANALYSIS IS REQUIRED FROM THE SITE STOCKPILED TOPSOIL. IF TOPSOIL IS IMPORTED, THEN A TEXTURE ANALYSIS SHALL BE PERFORMED FOR EACH LOCATION WHERE THE TOPSOIL WAS EXCAVATED.

3. COMPACTION

IT IS VERY IMPORTANT TO MINIMIZE COMPACTION OF BOTH THE BASE OF BIORETENTION PRACTICES AND THE REQUIRED BACKFILL. WHEN POSSIBLE, USE EXCAVATION HOES TO REMOVE ORIGINAL SOIL. IF PRACTICES ARE EXCAVATED USING LOADER, THE CONTRACTOR SHOULD USE WIDE TRACK OR MARSH TRACK EQUIPMENT, OR LIGHT EQUIPMENT WITH TURF TYPE TIRES. USE OF EQUIPMENT WITH NARROW TRACKS OR NARROW TIRES, RUBBER TIRES WITH LARGE LUGS, OR HIGH-PRESSURE TIRES WILL CAUSE EXCESSIVE COMPACTION RESULTING IN REDUCED INFILTRATION RATES AND IS NOT ACCEPTABLE. COMPACTION WILL SIGNIFICANTLY CONTRIBUTE TO DESIGN FAILURE.

COMPACTION CAN BE ALLEVIATED AT THE BASE OF THE BIORETENTION FACILITY BY USING A PRIMARY TILLING OPERATION SUCH AS CHISEL PLOW, RIPPER, OR SUBSOILER. THESE TILLING OPERATIONS ARE TO REFRACTURE THE SOIL PROFILE THROUGH THE 12 INCH COMPACTION ZONE. SUBSTITUTE METHODS MUST BE APPROVED BY THE ENGINEER. ROTOTILLERS TYPICALLY DO NOT TILL DEEP ENOUGH TO REDUCE THE EFFECTS OF COMPACTION FROM HEAVY EQUIPMENT.

ROTOTILL 2 TO 3 INCHES OF SAND INTO THE BASE OF THE BIORETENION FACILITY BEFORE BACKFILLING THE OPTIONAL SAND LAYER. PUMP ANY PONDED WATER BEFORE PREPARING (ROTOTILLING) BASE.

WHEN BACKFILLING THE TOPSOIL OVER THE SAND LAYER, FIRST PLACE 3 TO 4 INCHES OF TOPSOIL OVER THE SAND, THEN ROTOTILL THE SAND/TOPSOIL TO CREATE A GRADATION ZONE. BACKFILL THE REMAINDER OF THE TOPSOIL TO FINAL GRADE.

WHEN BACKFILLING THE BIORETENTION FACILITY, PLACE SOIL IN LIFTS 12" TO 18". DO NOT USE HEAVY EQUIPMENT WITHIN THE BIORETENTION BASIN. HEAVY EQUIPMENT CAN BE USED AROUND THE PERIMETER OF THE BASIN TO SUPPLY SOILS AND SAND. GRADE BIORETENTION MATERIALS WITH LIGHT EQUIPMENT SUCH AS A COMPACT LOADER OR A DOZER/LOADER WITH MARSH TRACKS.

4. PLANT MATERIAL

RECOMMENDED PLANT MATERIAL FOR MICRO-BIORETENTION PRACTICES CAN BE FOUND IN APPENDIX A, SECTION A.2.3.

5. PLANT INSTALLATION

COMPOST IS A BETTER ORGANIC MATERIAL SOURCE, IS LESS LIKELY TO FLOAT, AND SHOULD BE PLACED IN THE INVERT AND OTHER LOW AREAS. MULCH SHOULD BE PLACED IN SURROUNDING TO A UNIFORM THICKNESS OF 2" TO 3". SHREDDED OR CHIPPED HARDWOOD MULCH IS THE ONLY ACCEPTED MULCH. PINE MULCH AND WOOD CHIPS WILL FLOAT AND MOVE TO THE PERIMETER OF THE BIORETENTION AREA DURING A STORM EVENT AND ARE NOT ACCEPTABLE. SHREDDED MULCH MUST BE WELL AGED (6 TO 12 MONTHS) FOR ACCEPTANCE.

ROOTSTOCK OF THE PLANT MATERIAL SHALL BE KEPT MOIST DURING TRANSPORT AND ON-SITE STORAGE. THE PLANT ROOT BALL SHOULD BE PLANTED SO 1/8TH OF THE BALL IS ABOVE FINAL GRADE SURFACE. THE DIAMETER OF THE PLANTING PIT SHALL BE AT LEAST SIX INCHES LARGER THAN THE DIAMETER OF THE PLANTING BALL. SET AND MAINTAIN THE PLANT STRAIGHT DURING THE ENTIRE PLANTING PROCESS. THOROUGHLY WATER GROUND BED COVER AFTER INSTALLATION. TREES SHALL BE BRACED USING 2" BY 2" STAKES ONLY AS NECESSARY AND FOR THE FIRST GROWING SEASON ONLY. STAKES ARE TO BE EQUALLY SPACED ON THE OUTSIDE OF THE TREE BALL.

GRASSES AND LEGUME SEED SHOULD BE DRILLED INTO THE SOIL TO A DEPTH OF AT LEAST ONE INCH. GRASS AND LEGUME PLUGS SHALL BE PLANTED FOLLOWING THE NON-GRASS GROUND COVER PLANTING SPECIFICATIONS.

THE TOPSOIL SPECIFICATIONS PROVIDE ENOUGH ORGANIC MATERIAL TO ADEQUATELY SUPPLY NUTRIENTS FROM NATURAL CYCLING. THE PRIMARY FUNCTION OF THE BIORETENTION STRUCTURE IS TO IMPROVE WATER QUALITY. ADDING FERTILIZERS DEFEATS, OR AT A MINIMUM, IMPEDES THIS GOAL. ONLY ADD FERTILIZER IF WOOD CHIPS OR MULCH ARE USED TO AMEND THE SOIL. ROTOTILL UREA FERTILIZER AT A RATE OF 2 POUNDS PER 1000 SQUARE FEET.

6. UNDERDRAINS

UNDERDRAINS SHOULD MEET THE FOLLOWING CRITERIA:

* PIPE – SHOULD BE 4" TO 6" DIAMETER, SLOTTED OR PERFORATED RIGID PLASTIC PIPE (ASTMF 758, TYPE PS 28, OR AASHTO-M-278) IN A GRAVEL LAYER. THE PREFERRED MATERIAL IS SLOTTED, 4" RIGID PIPE (E.G., PVC OF HDPE).
* PERFORATIONS – IF PERFORATED PIPE IS USED, PERFORATIONS SHOULD BE 3/8" DIAMETER LOCATED 6" ON CENTER WITH A MINIMUM OF FOUR HOLES PER ROW. PIPE SHALL BE WRAPPED WITH A 1/4" (NO. 4 OR 4x4) GALVANIZED HARDWARE CLOTH.
* GRAVEL – THE GRAVEL LAYER (NO. 57 STONE PREFERRED) SHALL BE AT LEAST 3" THICK ABOVE AND BELOW THE UNDERDRAIN.
* THE MAIN COLLECTOR PIPE SHALL BE AT A MINIMUM 0.5% SLOPE.
* A RIGID, NON-PERFORATED OBSERVATION WELL MUST BE PROVIDED (ONE PER EVERY 1,0000 SQUARE FEET) TO PROVIDE A CLEAN-OUT PORT AND MONITOR PERFORMANCE OF THE FILTER.
* A 4" LAYER OF PEA GRAVEL (1/8" TO 3/8" STONE) SHALL BE LOCATED BETWEEN THE FILTER MEDIA AND UNDERDRAIN TO PREVENT MIGRATION OF FINES IN TO THE UNDERDRAIN. THIS LAYER MAY BE CONSIDERED PART OF THE FILTER BED WHEN BED THICKNESS EXCEEDS 24".

THIS MAIN COLLECTOR PIPE FOR UNDERDRAIN SYSTEMS SHALL BE CONSTRUCTED AT A MINIMUM SLOPE OF 0.5%. OBSERVATION WELLS AND/OR CLEAN-OUT PIPES MUST BE PROVIDED (ONE MINIMUM PER EVERY 1000 SQUARE FEET OF SURFACE AREA).

7. MISCELLANEOUS

THESE PRACTICES MAY NOT BE CONSTRUCTED UNTIL ALL CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED.

OPERATION AND MAINTENANCE SCHEDULE FOR MICROBIORETENTION AREAS

1. ANNUAL MAINTENANCE OF PLANT MATERIAL, MULCH LAYER AND SOIL LAYER IS REQUIRED. MAINTENANCE OF MULCH AND SOIL IS LIMITED TO CORRECTING AREAS OF EROSION OR WASH OUT. ANY MULCH REPLACEMENT SHALL BE DONE IN THE SPRING. PLANT MATERIAL SHALL BE CHECKED FOR DISEASE AND INSECT INFESTATION AND MAINTENANCE WILL ADDRESS DEAD MATERIAL AND PRUNING. ACCEPTABLE REPLACEMENT PLANT MATERIAL IS LIMITED TO THE FOLLOWING: 2000 MARYLAND STORMWATER DESIGN MANUAL VOLUME II, TABLE A.4.1 AND 2.
2. SCHEDULE OF PLANT INSPECTION WILL BE TWICE A YEAR IN SPRING AND FALL. THIS INSPECTION WILL INCLUDE REMOVAL OF DEAD AND DISEASED VEGETATION CONSIDERED BEYOND TREATMENT, TREATMENT OF ALL DISEASED TREES AND SHRUBS AND REPLACEMENT OF ALL DEFICIENT STAKES AND WIRES.
3. MULCH SHALL BE INSPECTED EACH SPRING. REMOVE PREVIOUS MULCH LAYER BEFORE APPLYING NEW LAYER ONCE EVERY 2 TO 3 YEARS.
4. SOIL EROSION TO BE ADDRESSED ON AN AS NEEDED BASIS WITH A MINIMUM OF ONCE PER MONTH AND AFTER HEAVY STORM EVENTS.

B.4.B SPECIFICATIONS FOR PERMEABLE PAVEMENTS & REINFORCED TURF

THESE SPECIFICATIONS INCLUDE INFORMATION ON ACCEPTABLE MATERIALS FOR TYPICAL APPLICATIONS AND ARE NOT EXCLUSIVE OR LIMITING. THE DESIGNER IS RESPONSIBLE FOR DEVELOPING SPECIFICATIONS FOR INDIVIDUAL PROJECTS AND SPECIFIC CONDITIONS.

1. PERVIOUS CONCRETE SPECIFICATIONS

DESIGN THICKNESS – PERVIOUS CONCRETE APPLICATIONS SHALL BE DESIGNED SO THAT THE THICKNESS OF THE CONCRETE SLAB SHALL SUPPORT THE TRAFFIC AND VEHICLE TYPES THAT WILL BE CARRIED. APPLICATIONS MAY BE DESIGNED USING EITHER STANDARD PAVEMENT PROCEDURES (E.G., AASHTO, ACI 325.9R, ACI 330R) OR USING STRUCTURAL VALUES DERIVED FROM FLEXIBLE PAVEMENT DESIGN PROCEDURES.

MIX & INSTALLATION – TRADITIONAL PORTLAND CEMENTS (ASTM C 150, C 1157) MAY BE USED IN PERVIOUS CONCRETE APPLICATIONS. PHOSPHORUS ADMIXTURES MAY ALSO BE USED. MATERIALS SHOULD BE TESTED (E.G., TRIAL BATCHING) PRIOR TO CONSTRUCTION SO THAT CRITICAL PROPERTIES (E.G., SETTLING TIME, RATE OF STRENGTH DEVELOPMENT, POROSITY, PERMEABILITY) CAN BE DETERMINED.

AGGREGATE – PERVIOUS CONCRETE CONTAINS A LIMITED FINE AGGREGATE CONTENT. COMMONLY USED GRADATIONS INCLUDE ASTM C 33 NO. 67 (3/4 IN. TO NO. 4), NO. 8 (3/8 IN. TO NO.16) AND NO. 89 (3/8 IN. TO NO.50) SIEVES. SINGLE-SIZED AGGREGATE (UP TO 1 INCH) MAY ALSO BE USED.

WATER CONTENT – WATER-TO-CEMENT RATIOS BETWEEN 0.27 AND 0.30 ARE USED ROUTINELY WITH PROPER INCLUSION OF CHEMICAL ADMIXTURES. WATER QUALITY SHOULD MEET ACI 30A. AS A GENERAL RULE, POTABLE WATER SHOULD BE USED ALTHOUGH RECYCLED CONCRETE PRODUCTION WATER MEETING ASTM C 94 OR AASHTO M 157 MAY ALSO BE USED.

ADMIXTURES – CHEMICAL ADMIXTURES (E.G., RETARDERS OR HYDRATION-STABILIZERS) ARE USED TO OBTAIN SPECIAL PROPERTIES IN PERVIOUS CONCRETE. USE OF ADMIXTURES SHOULD MEET ASTM C 494 (CHEMICAL ADMIXTURES) AND ASTM C 260 (AIR ENTRAINING ADMIXTURES) AND CLOSELY FOLLOW MANUFACTURER'S RECOMMENDATIONS.

BASE COURSE – THE BASE COURSE SHALL BE AASHTO NO. 3 OR 4 COURSE AGGREGATE WITH AN ASSUMED OPEN PORE SPACE OF 30% (n=0.30).

2. PERMEABLE INTERLOCKING CONCRETE PAVEMENTS (PICP)

PAVER BLOCKS – BLOCKS SHOULD BE EITHER 3? IN. OR 4 IN. THICK, AND MEET ASTM C 936 OR CSA A231.2 REQUIREMENTS. APPLICATIONS SHOULD HAVE 20% OR MORE (40% PREFERRED) OF THE SURFACE AREA OPEN. INSTALLATION SHOULD FOLLOW MANUFACTURER'S INSTRUCTIONS, EXCEPT THAT INFILL AND BASE COURSE MATERIALS AND DIMENSIONS SPECIFIED IN THIS APPENDIX SHALL BE FOLLOWED.

INFILL MATERIALS AND LEVELING COURSE – OPENINGS SHALL BE FILLED WITH ASTM C-33 GRADED SAND OR SANDY LOAM. PICP BLOCKS SHALL BE PLACED ON A ONE-INCH THICK LEVELING COURSE OF ASTM C-33 SAND.

BASE COURSE – THE BASE COURSE SHALL BE AASHTO NO. 3 OR 4 COURSE AGGREGATE WITH AN ASSUMED OPEN PORE SPACE OF 30% (n=0.30).

3. REINFORCED TURF

REINFORCED GRASS PAVEMENT (RGP) – WHETHER USED WITH GRASS OR GRAVEL, THE RGP THICKNESS SHALL BE AT LEAST 1-3/4" THICK WITH A LOAD CAPACITY CAPABLE OF SUPPORTING THE TRAFFIC AND VEHICLE TYPES THAT WILL BE CARRIED.

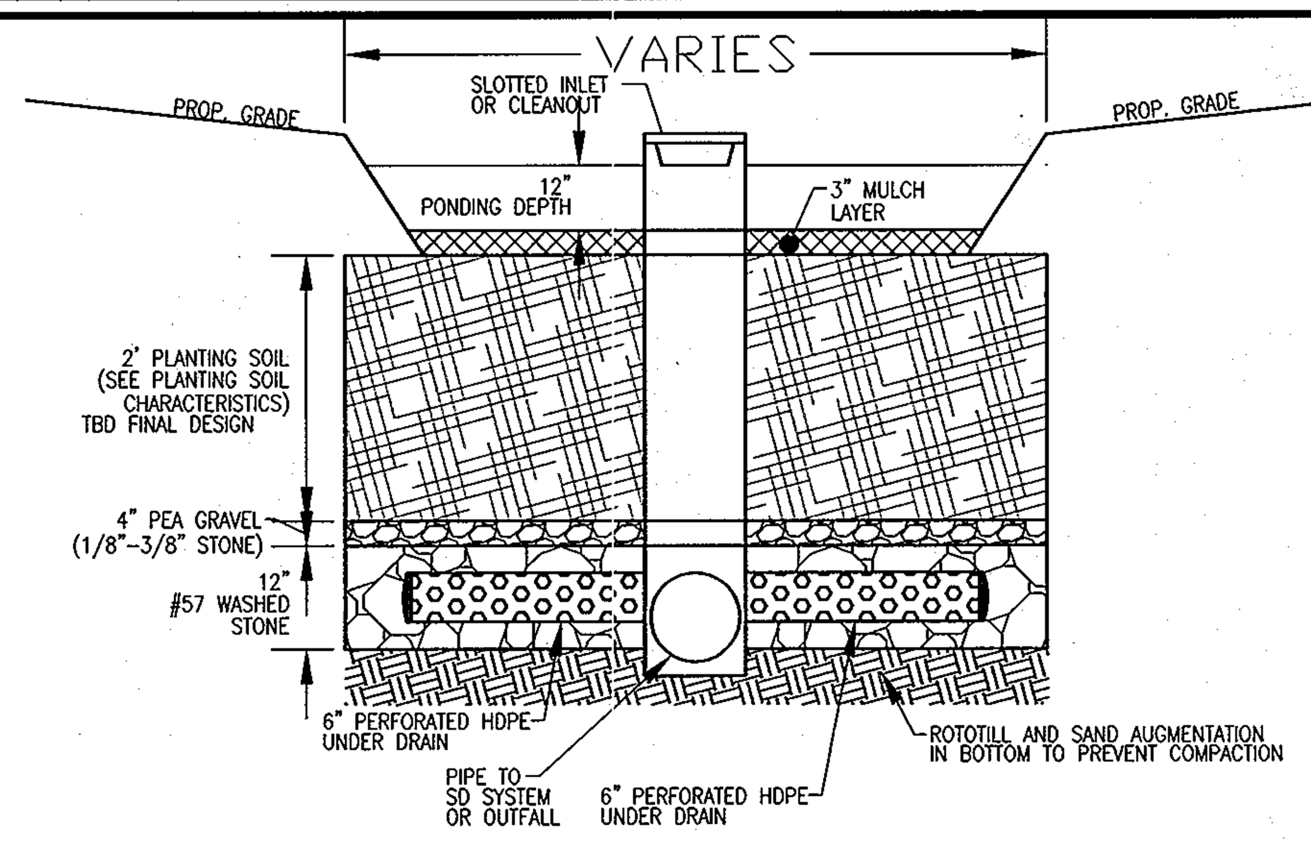
OPERATION AND MAINTENANCE SCHEDULE FOR BIO-RETENTION AREAS

1. ANNUAL MAINTENANCE OF PLANT MATERIAL, MULCH LAYER AND SOIL LAYER IS REQUIRED. MAINTENANCE OF MULCH AND SOIL IS LIMITED TO CORRECTING AREAS OF EROSION OR WASH OUT. ANY MULCH REPLACEMENT SHALL BE DONE IN THE SPRING. PLANT MATERIAL SHALL BE CHECKED FOR DISEASE AND INSECT INFESTATION AND MAINTENANCE WILL ADDRESS DEAD MATERIAL AND PRUNING.
2. SCHEDULE OF PLANT INSPECTION WILL BE TWICE A YEAR IN SPRING AND FALL. THIS INSPECTION WILL INCLUDE REMOVAL OF DEAD AND DISEASED VEGETATION CONSIDERED BEYOND TREATMENT. TREATMENT OF ALL DEFICIENT STAKES AND WIRES.
3. MULCH SHALL BE INSPECTED EACH SPRING. REMOVE PREVIOUS MULCH LAYER BEFORE APPLYING NEW LAYER ONCE EVERY 2 TO 3 YEARS.
4. SOIL EROSION TO BE ADDRESSED ON AN AS NEEDED WITH A MINIMUM OF ONCE PER MONTH AND AFTER HEAVY STORM EVENTS.

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING

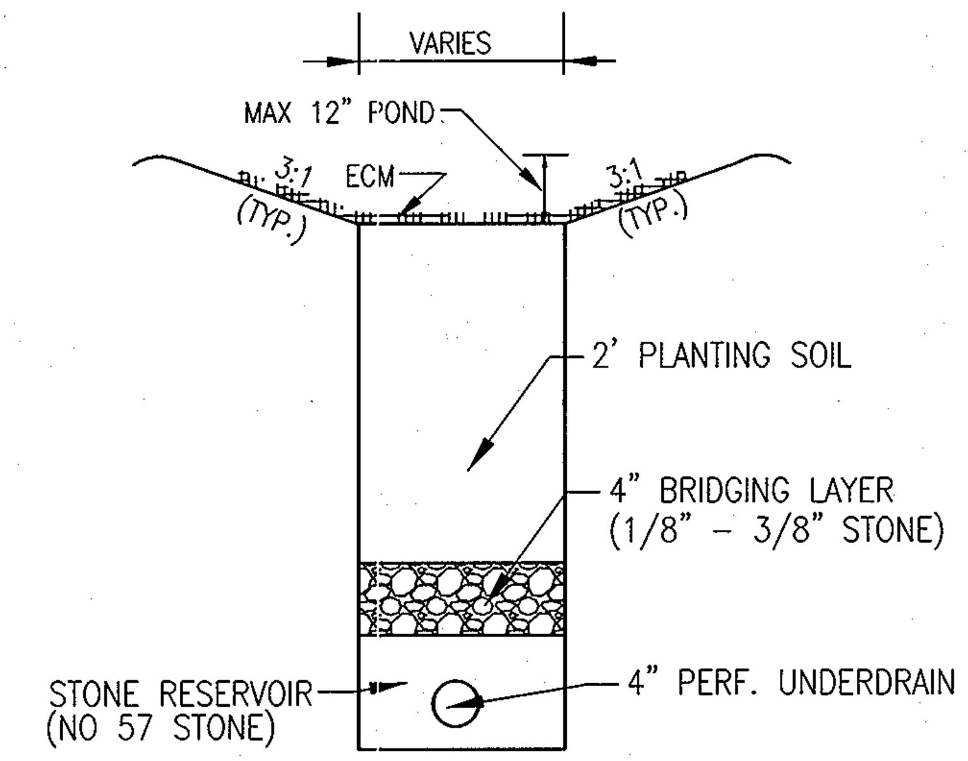
CHIEF, DEVELOPMENT ENGINEERING DIVISION — DATE 1/18/12

CHIEF, DIVISION OF LAND DEVELOPMENT — DATE 1/13/12



MICRO-BIORETENTION

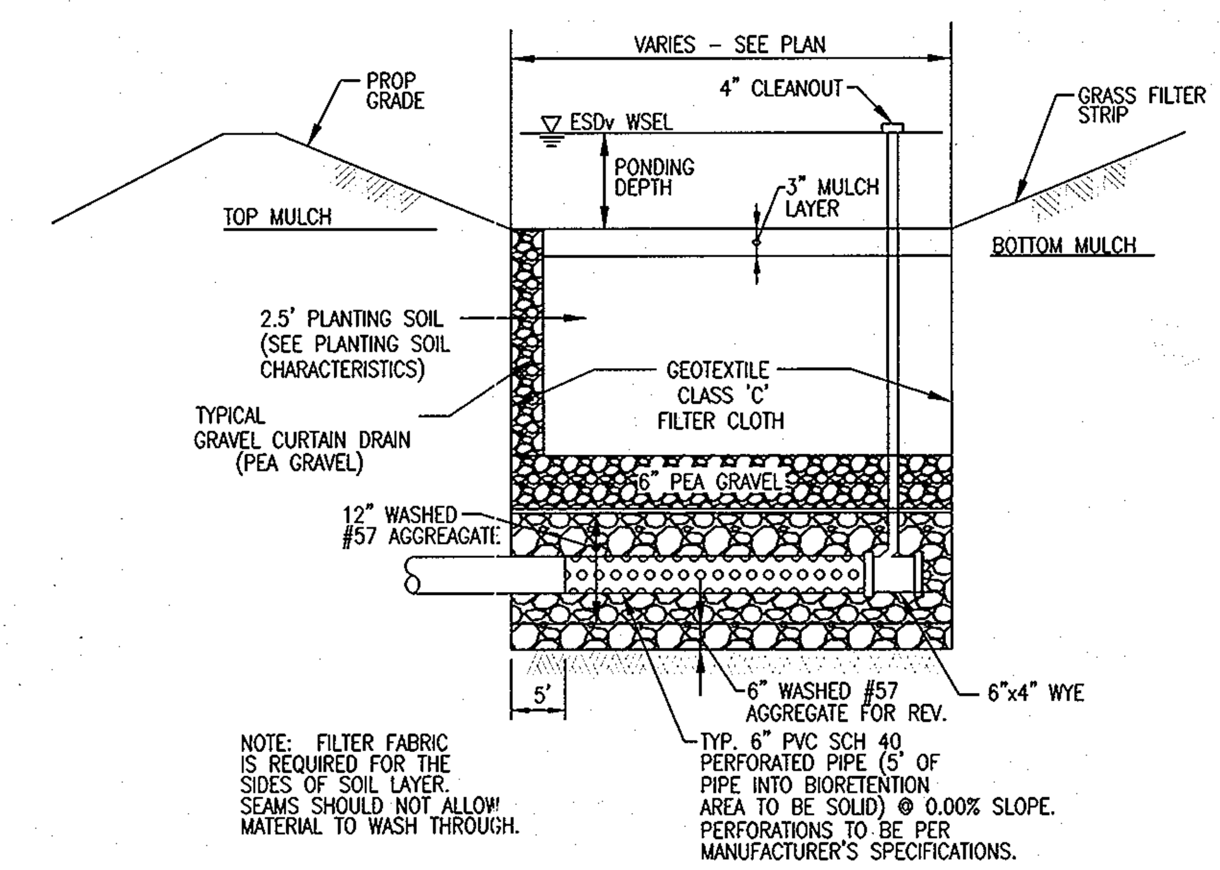
NOT TO SCALE



BIO SWALE

TYPICAL CROSS SECTION

(NOT TO SCALE)



TYP. BIORETENTION DETAIL

NOT TO SCALE

Appendix B.4. Construction Specifications for Environmental Site Design Practices

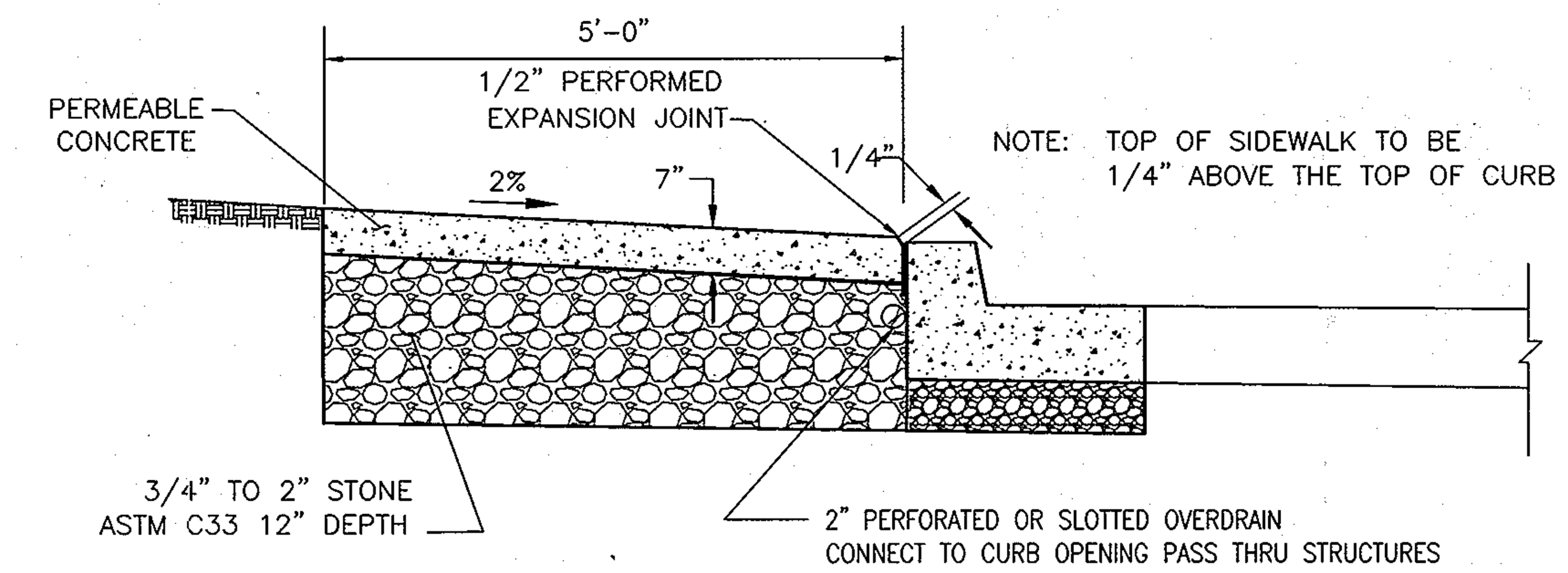
Table B.4.1 Materials Specifications for Micro-Bioretention, Rain Gardens & Landscape Infiltration-			
Material	**Specification**	**Size**	**Notes**
Plantings	see Appendix A, Table A.4	n/a	plantings are site-specific
Planting soil [2' to 4' deep]	loamy sand (60 - 65%) & compost (35 - 40%) or sandy loam (30%), coarse sand (30%) & compost (40%)	n/a	USDA soil types loamy sand or sandy loam; clay content < 5%
Organic content	Min. 10% by dry weight (ASTM D 2974)		
Mulch	shredded hardwood		aged 6 months, minimum; no pine or wood chips
Pea gravel diaphragm	pea gravel: ASTM-D-448	NO. 8 OR NO. 9 (1/8" TO 3/8")	
Curtain drain	ornamental stone: washed cobbles	stone: 2" to 5"	
Geotextile		n/a	PE Type 1 nonwoven
Gravel (underdrains and infiltration berms)	AASHTO M-43	NO. 57 OR NO. 6 AGGREGATE (3/8" to 3/4")	
Underdrain piping	F 758, Type PS 28 or AASHTO M-278	4" to 6" rigid schedule 40 PVC or SDR35	Slotted or perforated pipe; 3/8" perf. @ 6" on center, 4 holes per row; minimum of 3" of gravel over pipes; not necessary underneath pipes. Perforated pipe shall be wrapped with ¼-inch galvanized hardware cloth
Poured in place concrete (if required)	MSHA Mix No. 3; f'_c = 3500 psi @ 28 days, normal weight, air-entrained; reinforcing to meet ASTM-615-60	n/a	on-site testing of poured-in-place concrete required: 28 day strength and slump test; all concrete design (cast-in-place or pre-cast) *not using previously approved State or local standards* requires design drawings sealed and approved by a professional structural engineer licensed in the State of Maryland - design to include meeting ACI Code 350.R/89; vertical loading [H-10 or H-20]; allowable horizontal loading (based on soil pressures); and analysis of potential cracking
Sand	AASHTO-M-6 or ASTM-C-33	0.02" to 0.04"	Sand substitutions such as Diabase and Graystone (**AASHTO**) #10 are not acceptable. No calcium carbonated or dolomitic sand substitutions are acceptable. No "rock dust" can be used for sand.

MONTGOMERY ROAD TOWNHOMES

Rv=0.05+0.009XI
V min=1.0" rainfall (1.0x0.95xA)/12
Vmax= 1yr rainfall=2.6" (2.6x0.95xA)/12

DA #	% IMPERV	Rv	DA (SF)	DA (AC)	MINIMUM VOLUME	MAXIMUM VOLUME	1.8" VOLUME	VOLUME PROVIDED	IMPERV (SF)	IMPERV (AC)	GREEN AREA	
STUDY AREA # 1												
1-1	100.0	0.9500	7600	0.17	-	-	-	120	7600	0.17	0.00	ROOFTOP DISCONNECT (REAR HSE 1-19) @ 20LF (PE = 0.2)
1-2	19.58	0.2262	14300	0.33	270	701	485	701	2800	0.06	0.26	BIO-SWALE FACILITY # 1-2 (REAR 1-7) 5.4' X 130'
												VOLUME = PONDING DEPTH = 702 SF X 1.0
1-3	100.0	0.9500	2664	0.06	211	548	380	226	2664	0.06	0.00	PERMEABLE SURFACE DRIVEWAY (UNITS 1-7)
												VOLUME = .196 X 1152 SF DW ONLY
1-3A	100.0	0.9500	2800	0.06	222	576	399	576	2800	0.06	0.00	ROOFTOP TO PERMEABLE SURFACE DRIVEWAY (UNITS 1-7)
												18 X 8 X 7 UNITS X 1.5 X 0.4
1-4	100.0	0.9500	775	0.02	61	160	110	152	775	0.02	0.00	PERMEABLE SURFACE SIDEWALK (UNITS 1-7)
												VOLUME = .196 X 775 SF
1-6	43.55	0.4419	19500	0.45	718	1867	1293	1080	8492	0.19	0.25	BIO-SWALE FACILITY # 1-6 (REAR 8-13) 8' X 135'
												VOLUME = PONDING DEPTH = 1080 SF X 1.0
1-7	100.0	0.9500	2376	0.05	188	489	339	230	2376	0.05	0.00	PERMEABLE SURFACE DRIVEWAY (UNITS 8-13)
												VOLUME = .196 X 1176 SF DW ONLY
1-7A	100.0	0.9500	2400	0.06	190	494	342	494	2400	0.06	0.00	ROOFTOP TO PERMEABLE SURFACE DRIVEWAY (UNITS 8-13)
												18 X 8 X 6 UNITS X 1.5 X 0.4
1-8	100.0	0.9500	675	0.02	53	139	96	132	675	0.02	0.00	PERMEABLE SURFACE SIDEWALK (UNITS 8-13)
												VOLUME = .196 X 675 SF
1-9	56.79	0.5611	17462	0.40	816	2123	1470	1520	9916	0.23	0.17	BIO-SWALE FACILITY # 1-9 (REAR 14-19) 8' X 190'
												VOLUME = PONDING DEPTH = 1520 SF X 1.0
1	64.2	0.6276	63100	1.45	3300	8581	5940	5232	40498	0.93	0.52	TOTALS
STUDY AREA # 2												
2-1	100.0	0.9500	2052	0.05	162	422	292	191	2052	0.05	0.00	PERMEABLE SURFACE DRIVEWAY (UNITS 14-19)
												VOLUME = .196 X 972 SF DW ONLY
2-1A	100.0	0.9500	2400	0.06	190	494	342	494	2400	0.06	0.00	ROOFTOP TO PERMEABLE SURFACE DRIVEWAY (UNITS 14-19)
												18 X 8 X 6 UNITS X 1.5 X 0.4
2-2	100.0	0.9500	675	0.02	53	139	96	132	675	0.02	0.00	PERMEABLE SURFACE SIDEWALK (UNITS 14-19)
												VOLUME = .196 X 675 SF
2-3	100.0	0.9500	1728	0.04	137	356	246	162	1728	0.04	0.00	PERMEABLE SURFACE DRIVEWAY (UNITS 27-31)
												VOLUME = .196 X 828 SF DW ONLY
2-3A	100.0	0.9500	2000	0.05	158	412	285	403	2000	0.05	0.00	ROOFTOP TO PERMEABLE SURFACE DRIVEWAY (UNITS 27-31)
												18 X 8 X 5 UNITS X 1.4 X 0.4
2-5	100.0	0.9500	800	0.02	63	165	114	64	800	0.02	0.00	PERMEABLE SURFACE SIDEWALK (ROAD B 0+13 - 1+10 LT & RT)
												VOLUME = .196 X 325 SF
2-6	47.47	0.4772	39233	0.90	1560	4057	2808	4057	18624	0.43	0.47	BIORETENTION FACILITY # 2
												VOLUME = SF X PONDING DEPTH = 4150 SF X 1.0'
												REQ = 75% OF 2808 = 2106 REQ.
2	63.7	0.6237	44360	1.02	2306	5995	4150	5503	28279	0.65	0.37	TOTALS
STUDY AREA # 3												
3-1	100.0	0.9500	972	0.02	77	200	139	191	972	0.02	0.00	PERMEABLE SURFACE DRIVEWAY (UNITS 39-44)
												VOLUME = .196 X 972 SF DW ONLY
3-1A	100.0	0.9500	2400	0.06	190	494	342	494	2400	0.06	0.00	ROOFTOP TO PERMEABLE SURFACE DRIVEWAY (UNITS 39-44)
												18 X 8 X 6 UNITS X 1.5 X 0.4
3-3	100.0	0.9500	450	0.01	36	93	64	88	450	0.01	0.00	PERMEABLE SURFACE SIDEWALK (UNITS 35-38)
												VOLUME = .196 X 450 SF
3-4	64.3	0.6289	22950	0.53	1203	3127	2165	988	14761	0.34	0.19	PERMEABLE PAVEMENT CUL-DE-SAC
												VOLUME = .196 X 5043
3-5	31.7	0.3357	23940	0.55	670	1741	1206	1580	7600	0.17	0.38	BIO-SWALE FACILITY # 3 (REAR 20-38)
												VOLUME = PONDING DEPTH = 1580 SF X 1.0
3	51.0	0.5092	51312	1.18	2178	5662	3920	3341	26183	0.60	0.58	TOTALS
STUDY AREA # 4												
4-1	100.00	0.9500	2400	0.06	-	-		38	2400	0.06	0.00	ROOFTOP DISCONNECT REAR HSE @ 20LF (PE = 0.2)
4-2	13.30	0.1697	18040	0.41	255	663	459	663	2400	0.06	0.36	MICRO-BIORETENTION FACILITY # 4-2
												VOLUME = SF X PONDING DEPTH = 663 SF X 1.0
												REQ = 75% OF 459 = 344 REQ.
4	11.7	0.1557	20440	0.47	265	689	477	701	2400	0.06	0.41	TOTALS
STUDY AREA # 5 (MSHA WIDENING)												
5-1	100.00	0.9500	2375	0.05	188	489	338	466	2375	0.05	0.00	PERMEABLE SURFACE SIDEWALK (MONT RD / PRIVATE SIDE R/W LINE)
												VOLUME = .196 X 2375 SF
5-2	34.23	0.3580	27319	0.63	815	2119	1467	1700	9350	0.21	0.41	MICRO-BIORETENTION FACILITY # 5
												VOLUME = SF X PONDING DEPTH = 1700 SF X 1.0
												REQ = 75% OF 1467 = 1100 REQ.
5	39.5	0.4054	29694	0.68	1003	2608	1806	2166	11725	0.27	0.41	TOTALS
PROJECT TOTALS												
DA #	% IMPERV	Rv	DA (SF)	DA (AC)	MINIMUM VOLUME	MAXIMUM VOLUME	1.8" VOLUME	VOLUME PROVIDED	IMPERV (SF)	IMPERV (AC)	GREEN AREA	
	52.2	0.5200	208906	4.80	9052	23535	16293	16942	109085	2.50	2.29	
		ESDv =	16293.27	CU.FT.						2.50	2.29	4.80 CHECK

NOTE: ROOFTOP TO PERMEABLE SURFACE DRIVEWAY
PROVIDES TYPICAL 18' X 8' (MIN) X 1.0' DEEP STONE RESERVOIR BELOW PERMEABLE SURFACE 12" SUBBASE TO MEET ESDv REQUIREMENT FOR EACH 20' X 20' ROOFTOP

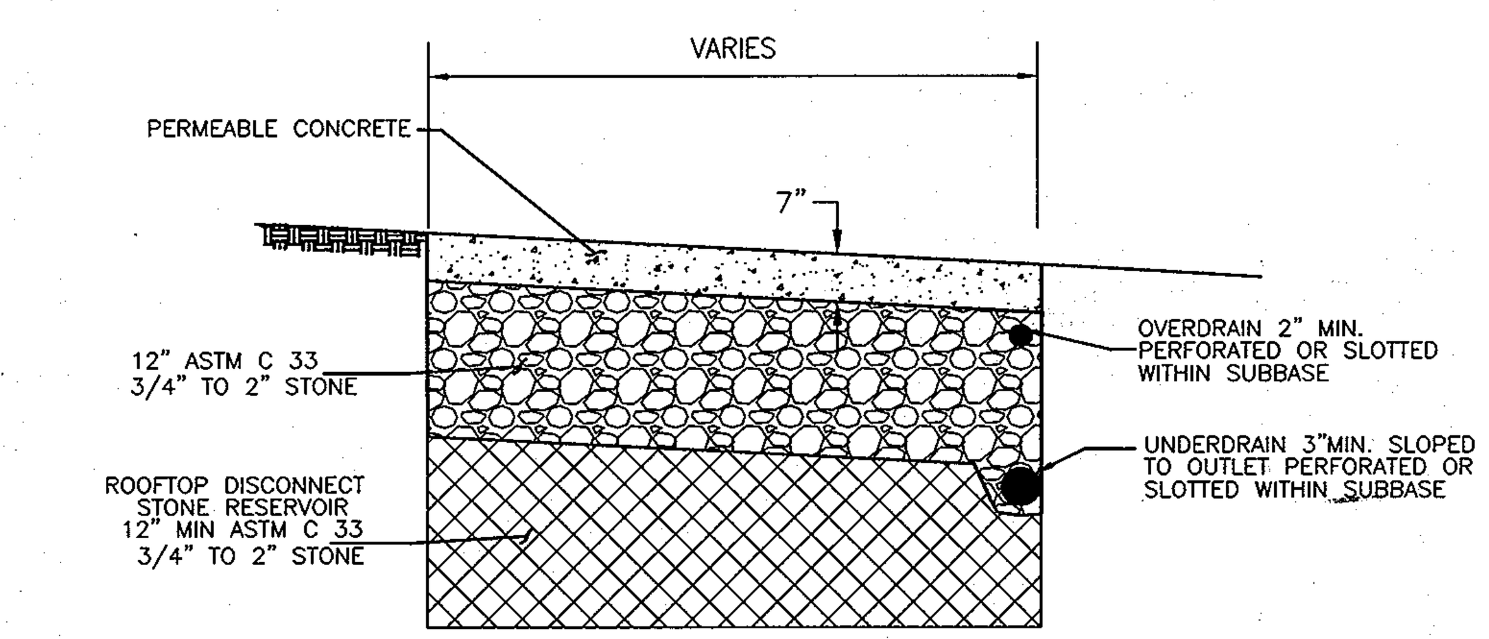


DETAIL - PERMEABLE CONCRETE WALK

NOT TO SCALE

NOTES

1. SIDEWALK TO BE SCRIBED IN 5'-0" MAXIMUM SQUARES.
2. EXPANSION JOINTS ACROSS THE SIDEWALK NOT TO BE MORE THAN 15' APART.
3. 1/2" PREFORMED EXPANSION MATERIAL IN EXPANSION JOINTS TO BE KEPT 1/4" BELOW SURFACE OF SIDEWALK.
4. WHEN SIDEWALK ABUTS CURB, SIDEWALK SHALL BE 1/4' ABOVE CURB WITH 1/2" PREFORMED EXPANSION JOINT BETWEEN SIDEWALK AND CURB.
5. ON LONGITUDINAL SIDEWALK GRADES OF 5 OR GREATER. A CONCRETE HEADER. 6 THICK AND 6" DEEP BELOW THE NORMAL 4" SIDEWALK THICKNESS SHALL BE CONSTRUCTED FOR THE FULL WIDTH OF THE SIDEWALK AT INTERVALS OF 48 FEET. THE HEADERS SHALL BE PLACED AT THE EXPANSION JOINT LOCATIONS AND SHALL BE MONOLITHIC WITH THE SIDEWALK.
6. SIDEWALK WIDTH ADJACENT TO CURB SHALL BE 5 MINIMUM EXCEPT SIDEWALK ADJACENT TO CURB IN CUL-DE-SAC BULBS MAY BE 4'-0 WIDE.
7. Cement shall be per AASHTO M85 Air Entraining – Type II Portland type, gray color. Mix and Deliver concrete in accordance with ASTM C94/C94M, Opt:on C with the following criteria: Tensile Strength: 500 psi at 28 days, Compressive Strength: 3000 psi at 28 days,Unit Weight: 130 pounds/cf. Stoen shall be No. 8 coarse aggregate per ASTM C33
8. CONCRETE MIX SHALL BE DESIGNED BY GEO TECHNICAL CONSULTANT.
9. BASE BELOW THE CURB SHALL CONSIST OF GRADED AGGREGATE BASE(GAB).



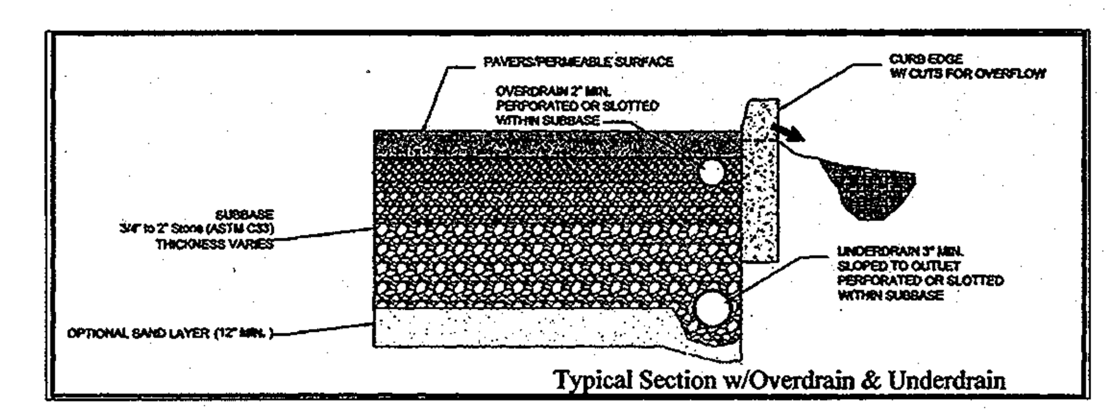
PAVEMENT CROSS SECTION TO BE CONFIRMED BY GEOTECHNICAL ENGINEER

UNDERDRAIN SHALL BE LOCATED SUCH THAT IT CAN DAYLIGHT THE CURB OR TO THE REAR OF THE LOT.

DETAIL - PERMEABLE CONCRETE DRIVEWAY

NOT TO SCALE

ALL PERMEABLE CONCRETE THICKNESS, MIX AND SUB-BASE TO BE DETERMINED BY GEOTECHNICAL ENGINEER ONSITE.



PERMEABLE SURFACE TYPICAL SECTION

NOT TO SCALE

NO.	REVISION	DATE

OWNER/DEVELOPER

TRIANGLE MONTGOMERY ASSOCIATES, LLC.
TRIANGLE OLD ANNAPOLIS ASSOCIATES, LLC.
MR. CHRIS J. PIPPEN
4291 MONTGOMERY ROAD
ELLICOTT CITY, MD 21043
PHONE: (410) 404-8246

ENVIRONMENTAL CONCEPT PLAN

STORMWATER MANAGEMENT NOTES AND DETAILS

MONTGOMERY ROAD TOWNHOMES

(SFA RESIDENTIAL)
4281, 4291, 4309, & 4319 MONTGOMERY ROAD
PARCELS 324, 325, 326, & 327
L. 9075 / F. 92, L. 9321 / F. 496,
L. 8770 / F. 163

2ND ELECTION DISTRICT
TAX MAP: 24 GRID: 24
DPZ REF'S:

ZONED: RSA-8
PARCEL: 324, 325, 326, & 327
HOWARD COUNTY, MARYLAND

ROBERT H. VOGEL ENGINEERING, INC.
ENGINEERS • SURVEYORS • PLANNERS
8407 MAIN STREET
ELLICOTT CITY, MD 21043
TEL: 410.461.7666
FAX: 410.461.8961

STATE OF MARYLAND — ROBERT H. VOGEL — No. 16193 — PROFESSIONAL ENGINEER — 1/9/12
ROBERT H. VOGEL, PE No.16193

DESIGN BY: RHV / EDS
DRAWN BY: JMR / EDS
CHECKED BY: RHV
DATE: NOVEMBER 2011
SCALE: AS SHOWN
W.O. NO.: 08-48

PROFESSIONAL CERTIFICATE
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 16193 EXPIRATION DATE: 09-27-2012

SHEET 5 OF 5

ECP-12-016

K:\PROJECTS\08-48\ENGR\DWG\ECP\05_SWMDETAILS.DWG