Stormwater Management Facilities

Private Stormwater Report

LMC Office Expansion

HDG Job #: CHA081

Prepared For: CJD Holdings, LLC (LMC Construction)
19200 SW Teton Avenue
Tualatin, OR 97062

Prepared By:

Humber Design Group, Inc.

117 SE Taylor St. Suite 001
Portland, OR 97214
(P) 503 946 6690

'I hereby certify that this Stormwater Management Report for the LMC Office Expansion project has been prepared by me or under my supervision and meets minimum standards of Clean Water Services (CWS) and normal standards of engineering practice.

EXPIRES 6–30–2020

I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.'

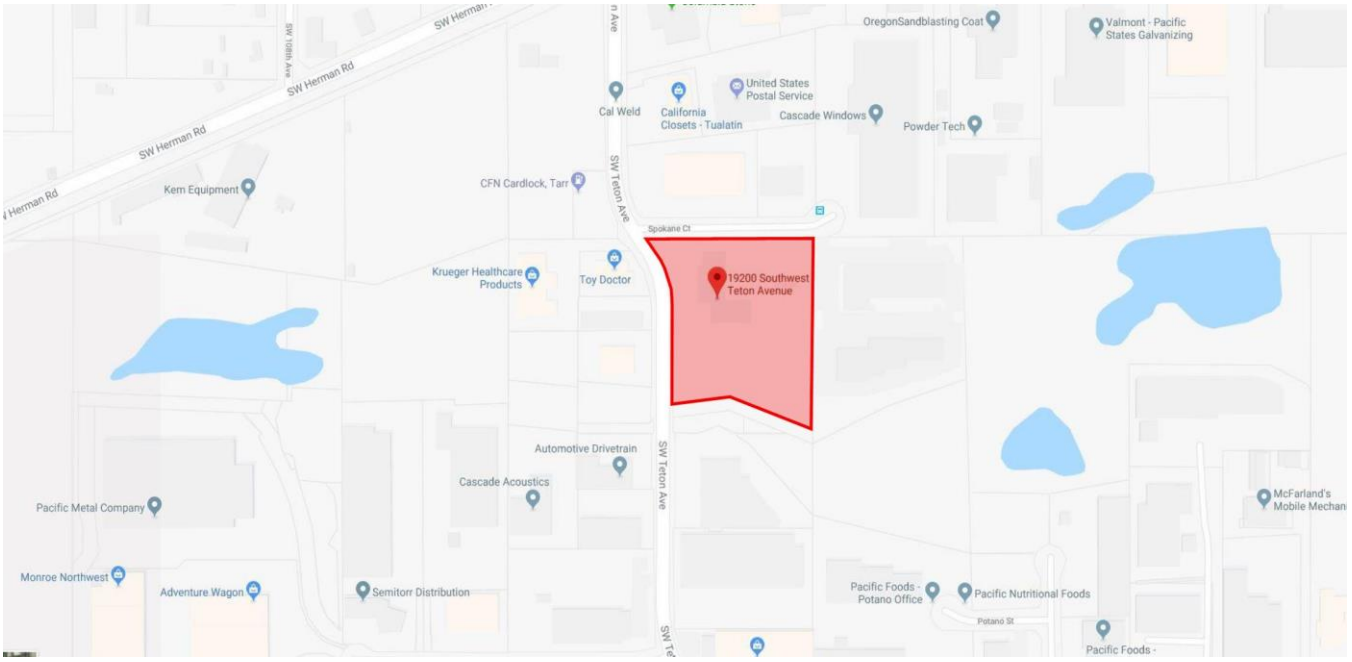
Date: March 29, 2019

Table of Contents

Project Overview and Description

Location of Project	19200 SW Teton Ave, Tualatin, OR
Site Area/Acreage	5 acres (217,627 sf)
Proposed Disturbed Area	42,687 sf
Nearest Cross Street	SW Teton Ave, Spokane Ct
Property Zoning	General Manufacturing (MG)
Existing Conditions	The site is currently occupied by an office building and associated parking lot.
Proposed Development	The project proposes a single-story addition to the east side of the existing office building, which will include parking lot revisions.
Tax Map	2S123CB
Tax Lot	200
Flood Zone	Zone AE, Zone X
Permits Required	Building Permit Grading Permit Public Works Permit

Vicinity Map



Site Location

Methodology

Existing Drainage	Runoff from the existing site is collected via catch basins and piped to the existing wet pond to the south, which is part of a larger sensitive area. Groundwater is very shallow and portions of the parking area spend parts of the year in flood conditions.
Infiltration Results	Infiltration testing was not conducted for this project. However, due to proximity to the existing waterway, assumed shallow groundwater, and location in a flood zone, onsite infiltration will not be possible. In addition, the observable water level of the adjacent waterway (Hedges Creek Marsh), which periodically
PRIVATE Proposed Stormwater Management Techniques	Stormwater will be managed for water quality and quantity using a detention gallery and mechanical filtration system located in the parking area to the north of the proposed building addition.
PUBLIC Proposed Stormwater Management Techniques	Existing curbs and inlets will be protected and improvements will not include additional impervious area. Therefore, no new stormwater management will be required for the public right of way.
Discharge Point	Drainage Way, River, Storm Only Pipe

Analysis

Computational Method Used HydroCAD models of a SBUH Type 1A Storm were used to calculate the stormwater management facility sizes for the catchment areas. See attached calculations. Below is a summary of the results.

Hydrologic Soil Group B/C/D

Hydrologic Soil Types Cove clay, Hillsboro loam, Quatama loam

Table 1 – Curve Numbers

Predeveloped Pervious CN	79
Predeveloped Impervious CN	98
Post-Developed Pervious CN	79
Post-Developed Impervious CN	98

Table 2 – Design Storms

WQ Storm	0.36 inches
2-year	2.50 inches
5-year	3.10 inches
10-year	3.45 inches
25-year	3.90 inches
100-year	4.50 inches

Table 3 – Time of Concentration

Predeveloped TOC	5 min
Post-Developed TOC	5 min

The existing stormwater system connects to the wet pond in the sensitive area to the south of the site, which will be fully protected. This system periodically experiences a backwater condition due to the low elevation of the site and its proximity to Hedges Creek Marsh. The total site development area is 42,687 square feet: 7,794 square feet of landscaping, 9,138 square feet of pavement restoration, and 25,842 square feet improved impervious area.The project proposes a detention gallery with orifice flow control and mechanical treatment to meet CWS water quantity and quality requirements for the improved area.

Water quantity: due to the shallow depth of the existing system to the south of the building, a portion of the proposed parking cannot be detained. The proposed detention gallery and orifice flow control manhole are proposed to the north (the highest portion of the site) of the building in order to reduce the instances of a backwater condition that is regularly experienced by the existing stormwater management system to the south. The proposed system will be sized to detain a combined existing and proposed impervious area equal to 23,600 square feet, in order to offset as much of the area that cannot be detained as possible. Stormwater will be detained to match predeveloped runoff rates for the 2, 5, 10, and 25 year storm events, per CWS requirements.

Water quality: All runoff captured by the detention system will also be treated for water quality using a Bayfilter 530 water quality vault. The shallow existing storm system precludes treating a larger area of the site, because of the cover required for the proposed facilities.

Runoff from areas that cannot be detained or treated will be collected via catch basins. All stormwater will then connect to the existing 15" storm line and discharge to the existing wet pond at the south of the site, which was designed to manage the 25-year storm for the full site. Treatment and detention will meet CWS requirements for maintaining existing conditions and protecting the sensitive area.

Table 4 – Catchment Areas and Facility Table

Catchment/ Facility ID	Source (roof, road, etc.)	Treatment Area (sf)	Ownership (private/ public)	Facility Type/ Function	Facility Size
A	Roof and parking	23,600 sf	Private	Detention gallery & cartridge filter	(21) ADS chambers / (1) bayfilter cartridge
Improved area not managed	Parking	2,242 sf	Private	N/A	
Landscape	Landscape	7,744 sf	Private		
Paving Restoration	Parking	9,138 sf	Private		

Table 5 - Flow Rates

	2-Year Storm	5-Year Storm	10-Year Storm	25-Year Storm
Predeveloped	0.08 cfs	0.13 cfs	0.18 cfs	0.24 cfs
Postdeveloped without detention	0.30 cfs	0.37 cfs	0.44 cfs	0.51 cfs
Postdeveloped with detention	0.08 cfs	0.09 cfs	0.11 cfs	0.24 cfs

Engineering Conclusions

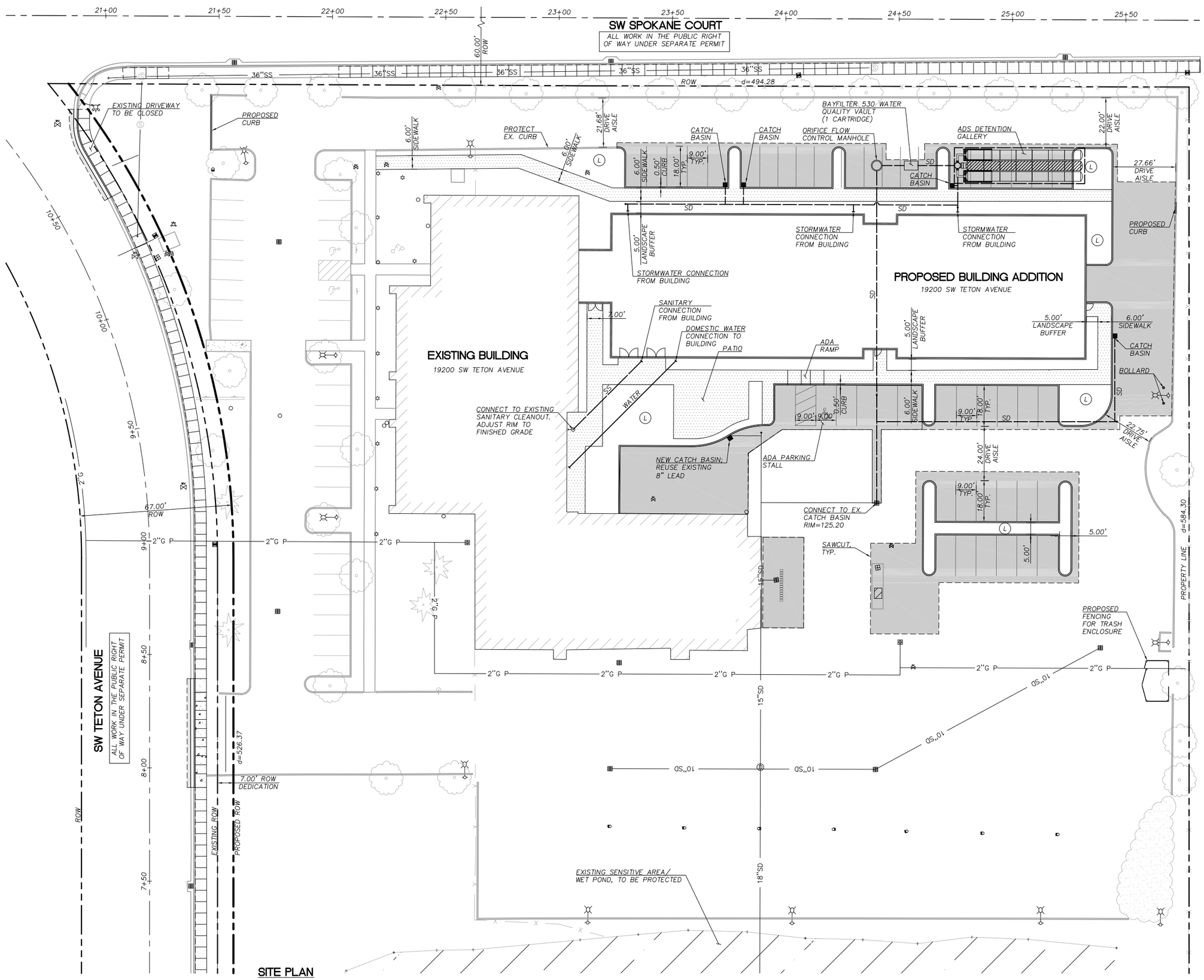
The preceding methodologies and calculations presented indicate compliance with the current jurisdictional stormwater management codes and requirements. A summarized breakdown is presented below:

Water Quality	The proposed development will meet the provisions for water quality per CWS storm code.
Water Quantity	The proposed development will meet the provisions for water quantity per CWS storm code.
Downstream / Upstream Impacts	There are no upstream or downstream impacts created by this proposed development.
100 year storm	Since the entire site is located within the floodplian, site runoff will not be conveyed to an alternative system.

Appendix A

Stormwater Facility Details / Exhibits

Utility Plan
Predevelopment Impervious Area
Catchment Map
ADS Detention Gallery Detail
Flow Control Manhole Detail
Bayfilter 530 Vault Detail



SITE PLAN
1"=20'

SHEET LEGEND

	ONSITE CONCRETE PAVING
	ONSITE ASPHALT PAVING
	PUBLIC ASPHALT PAVING
	PUBLIC CONCRETE PAVING
4" 4"	PUBLIC CONCRETE DRIVEWAY
L	SEE LANDSCAPE PLANS

NOTES:

1. ALL WORK IN THE PUBLIC RIGHT OF WAY UNDER SEPARATE PERMIT.

SITE DATA

PLANNING DISTRICT DESIGNATION:
GENERAL MANUFACTURING (MG)

TOTAL SITE AREA:
214,110 SF

SITE DEVELOPMENT AREA:
42,687 SF

MODIFIED IMPERVIOUS AREA:
23,600 SF

PAVEMENT RESTORATION AREA:
9,138 SF

PROPOSED BUILDING AREA:
13,646 SF

PROPOSED LANDSCAPE AREA:
7,744 SF

PROPOSED PARKING SPACES:
STANDARD: 44
ADA: 1

EXISTING PARKING AREA TO BE REMOVED:
6,064 SF

PROPOSED PARKING AREA:
7,336 SF

STORMWATER NARRATIVE

THE PROPOSED ADDITION TO THE EXISTING BUILDING WILL RESULT IN A NET REDUCTION OF ON-SITE IMPERVIOUS AREA. RUNOFF FROM THE PROPOSED ADDITION, MODIFIED PORTION OF THE PARKING AREA, AND SIDEWALKS WILL BE MANAGED FOR WATER QUANTITY USING A DETENTION SYSTEM AND ORIFICE FLOW-CONTROL MANHOLE. A CARTRIDGE FILTER SYSTEM WILL BE USED FOR WATER QUALITY. DISCHARGE FROM THE PROPOSED SYSTEM WILL BE DIRECTED TO THE EXISTING WET POND, WHICH CURRENTLY MANAGES THE SITE.

ATTENTION:
OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THE RULES BY CALLING THE CENTER.
(NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS (503)-232-1987).

GRAPHIC SCALE
0 20 40
1 inch = 20 ft.

REGISTERED PROFESSIONAL ENGINEER 76,071 PRELIMINARY OREGON JULY 12, 2005 MARTHA WILLIAMSON
EXPIRES 6-30-2020

Humber Design Group, Inc.
Portland, OR
503.946.6690
hdgpdx.com

TETON BUILDING ADDITION
19200 SW TETON AVE. TUALATIN, OR
LMC CONSTRUCTION
ARCHITECTURAL REVIEW APPLICATION

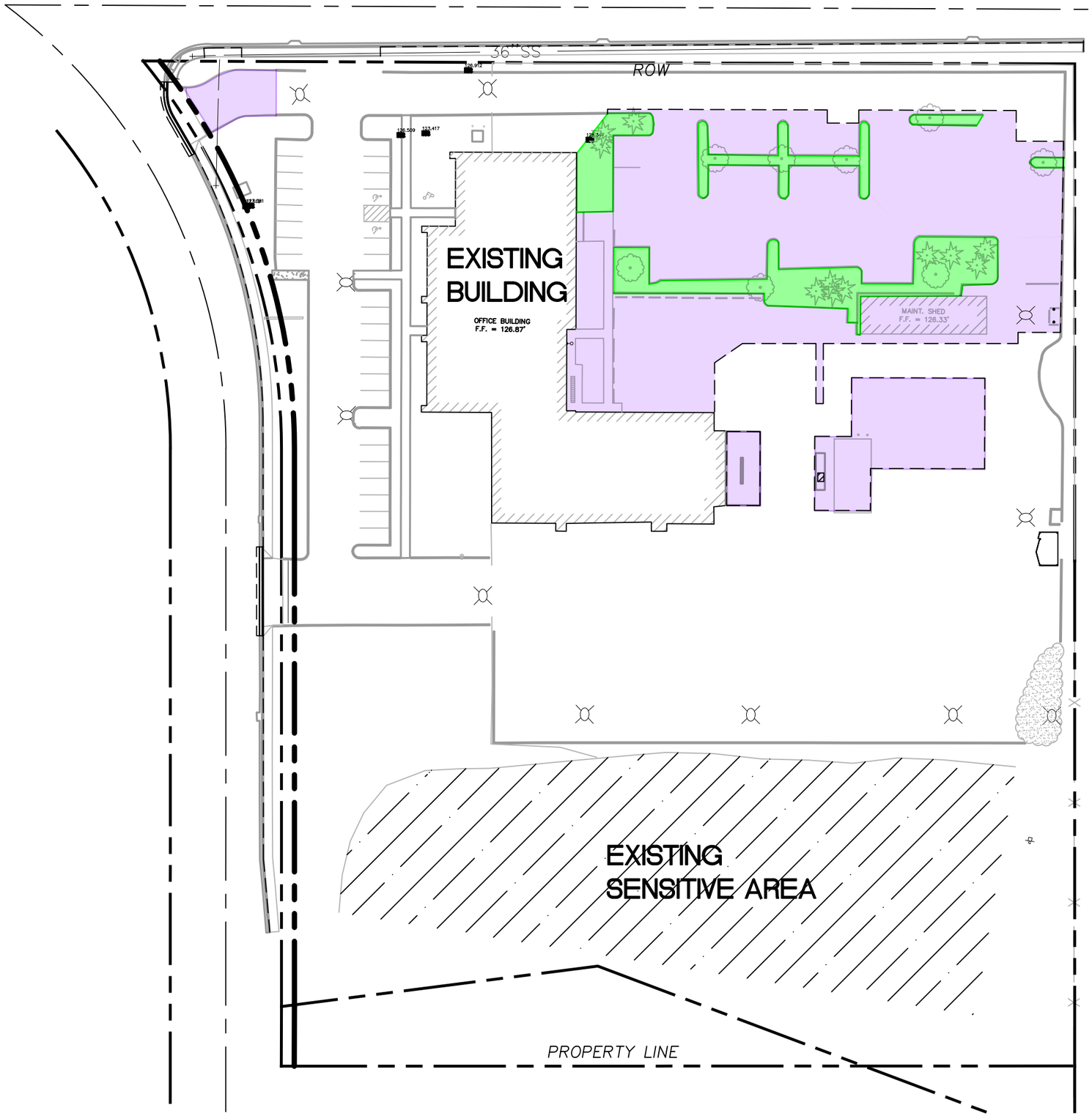
SITE PLAN

PROJECT NO.
18005

3.15.2019

REVISIONS: A

C0.50



PREDEVELOPED SITE LEGEND

	SITE DEVELOPMENT AREA: 43,219 SF
	IMPERVIOUS AREA: 36,599 SF
	PERVIOUS AREA: 6,088 SF

GRAPHIC SCALE

0 60 120

1 inch = 60 ft.

LMC OFFICE EXPANSION

PREDEVELOPED IMPERVIOUS AREA

PROJECT NO.:	CHA081
DRAWN BY:	BAH
DESIGN BY:	AFW
REVIEWED BY:	MSW
DATE:	3/29/2019

Humber Design Group, Inc.
Portland, OR ▪ 503.946.6690 ▪ hdgpdx.com

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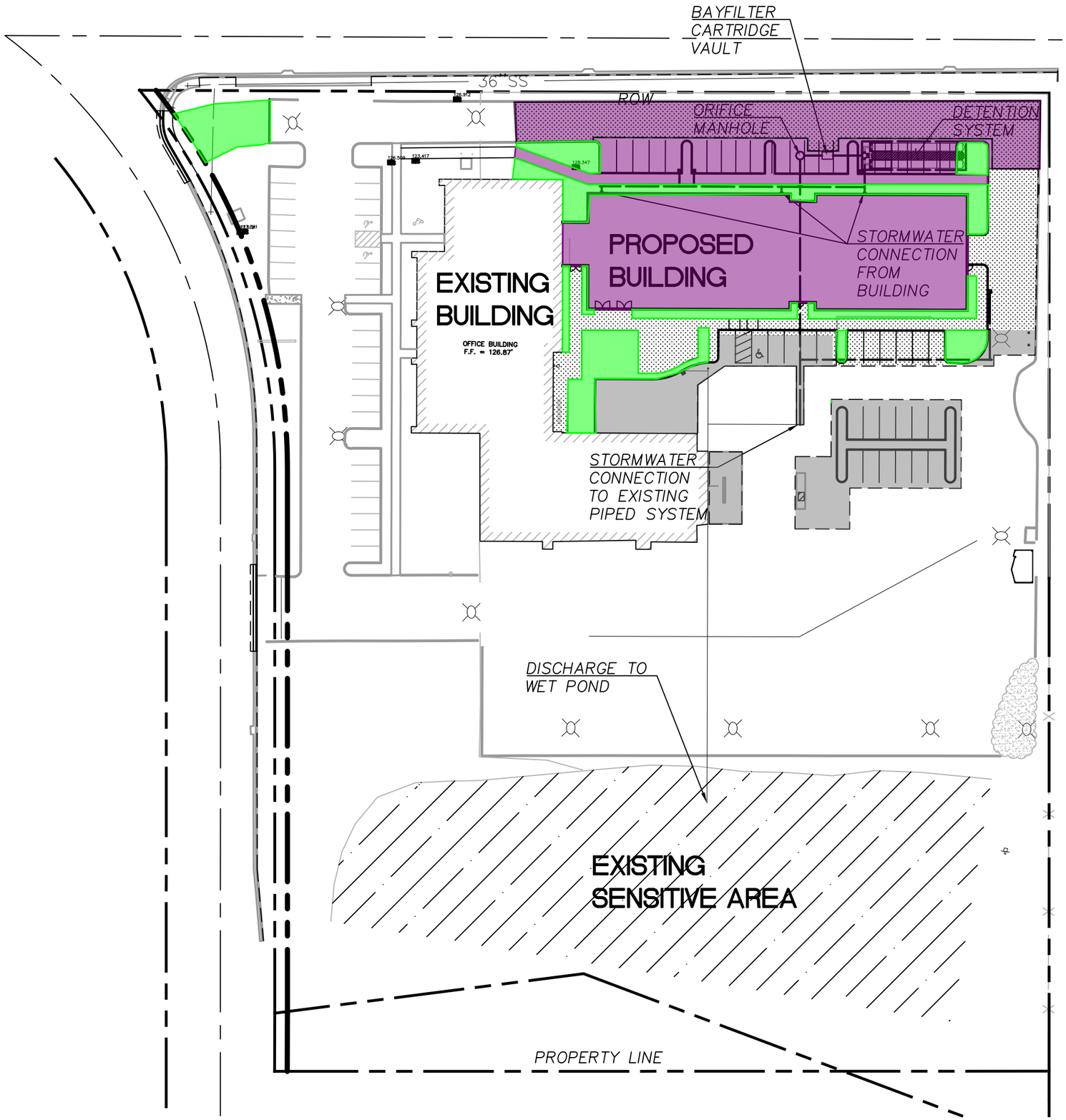

LEGEND

	CATCHMENT A 23,600 SF
	EXISTING AREA TO BE MANAGED IN CATCHMENT A
	AREA NOT DETAINED
	PAVEMENT RESTORATION AREA 9,138 SF
	LANDSCAPE AREA 7,744 SF

GRAPHIC SCALE

0 60 120

1 inch = 60 ft.

LMC OFFICE EXPANSION

CATCHMENT MAP

PROJECT NO.:	CHA081
DRAWN BY:	BAH
DESIGN BY:	AFW
REVIEWED BY:	MSW
DATE:	3/29/2019

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ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST by StormTech
FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

LMC Teton Expansion

Tualatin

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740, SC-310, OR APPROVED EQUAL.
2. CHAMBERS SHALL BE MANUFACTURED FROM VIRGIN POLYPROPYLENE OR POLYETHYLENE RESINS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
5. CHAMBERS SHALL MEET ASTM F2922 (POLYETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 OR ASTM F2922 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310/SC-740 SYSTEM

1. STORMTECH SC-310 & SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 & SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS.

   STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm).
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-310 & SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-310 & SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

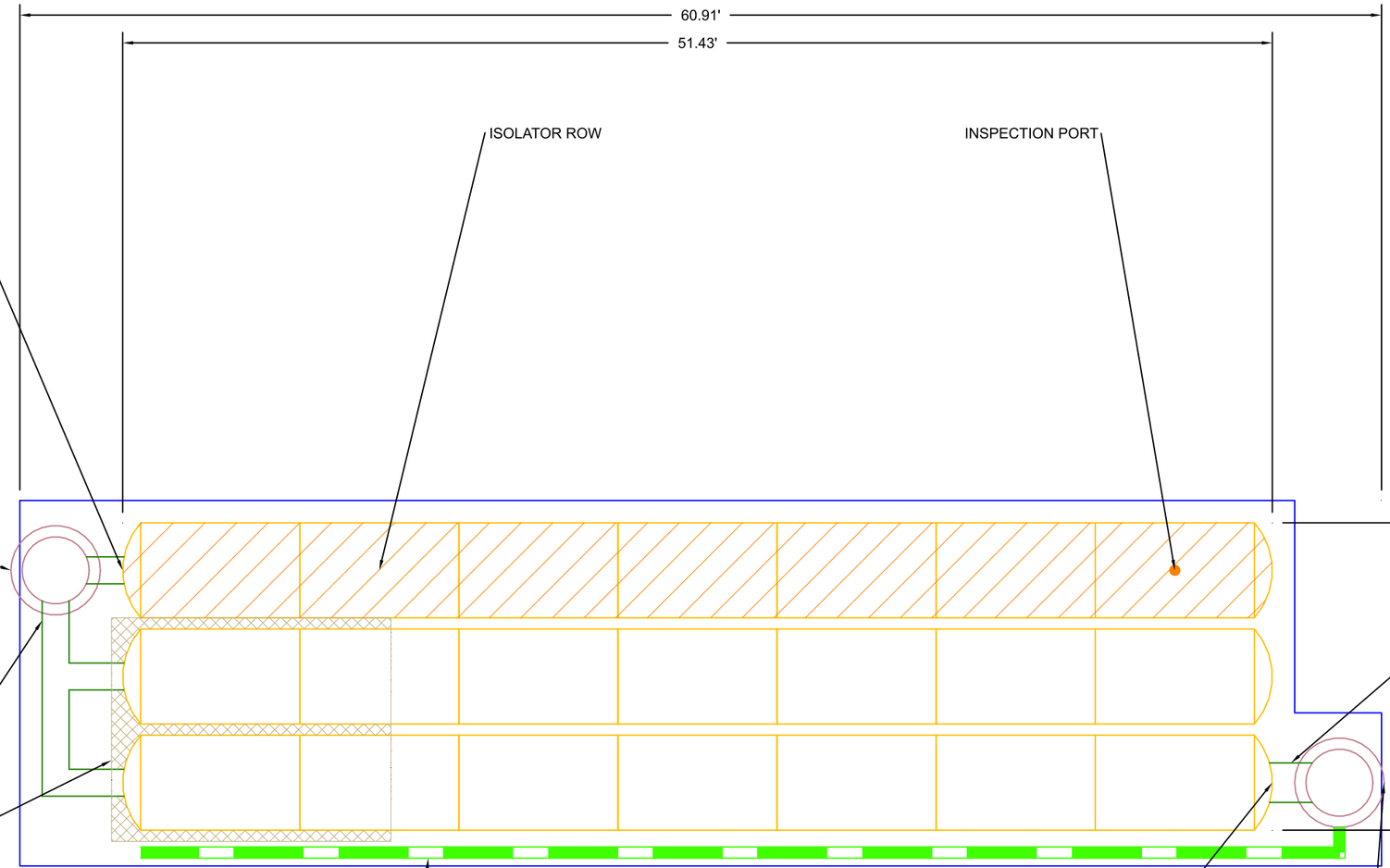
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

CONCEPTUAL LAYOUT

(21) STORMTECH SC-740 CHAMBERS
(6) STORMTECH SC-740 END CAPS
INSTALLED WITH 6 " COVER STONE, 6 " BASE STONE, 40% STONE VOID
INSTALLED SYSTEM VOLUME: 1922 CF
AREA OF SYSTEM: 959 **FT²**
PERIMETER OF SYSTEM: 155 **FT**

COMPUTER GENERATED CONCEPTUAL LAYOUT - NOT FOR CONSTRUCTION



LMC Teton Expansion
Tualatin

DATE: 03/28/2019 | DRAWN: BH | CHECKED: ---
PROJECT #: Tool

REV	DESCRIPTION	CHK	DRW

StormTech®
Detention- Retention- Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 |888-892-2694 | WWW.STORMTECH.COM

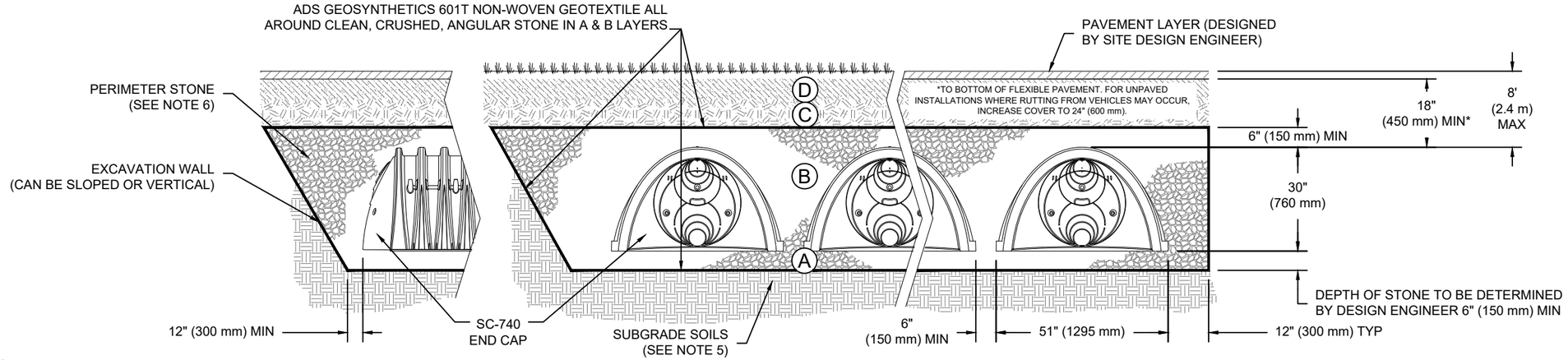
ADS®
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

NOT TO SCALE

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. [2] [3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

1. SC-740 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS", OR ASTM F2922 "STANDARD SPECIFICATION FOR POLYETHYLENE (PE) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

LMC Teton Expansion
Tualatin

DATE: 03/28/2019 | DRAWN: BH | PROJECT #: Tool | CHECKED: ---

REV	DRW	CHK	DESCRIPTION

StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
ADVANCED DRAINAGE SYSTEMS, INC.
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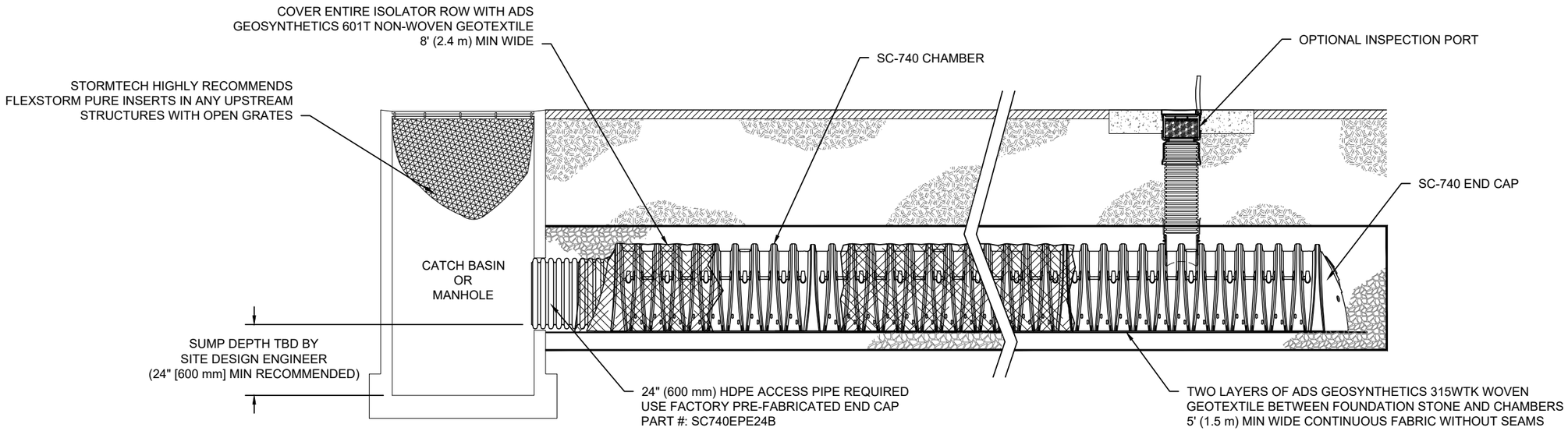


SC-740 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

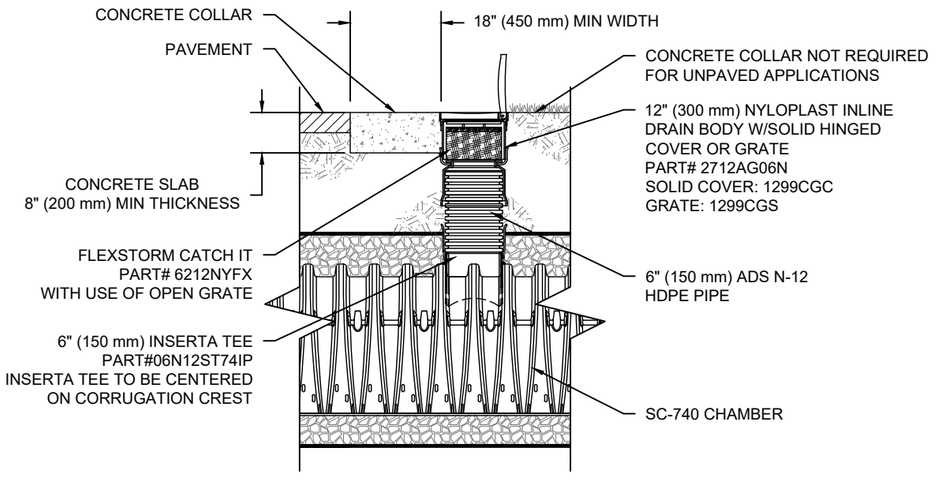
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



SC-740 6" INSPECTION PORT DETAIL
NTS

LMC Teton Expansion
Tualatin

DATE: 03/28/2019 | DRAWN: BH | CHECKED: ---
PROJECT #: Tool

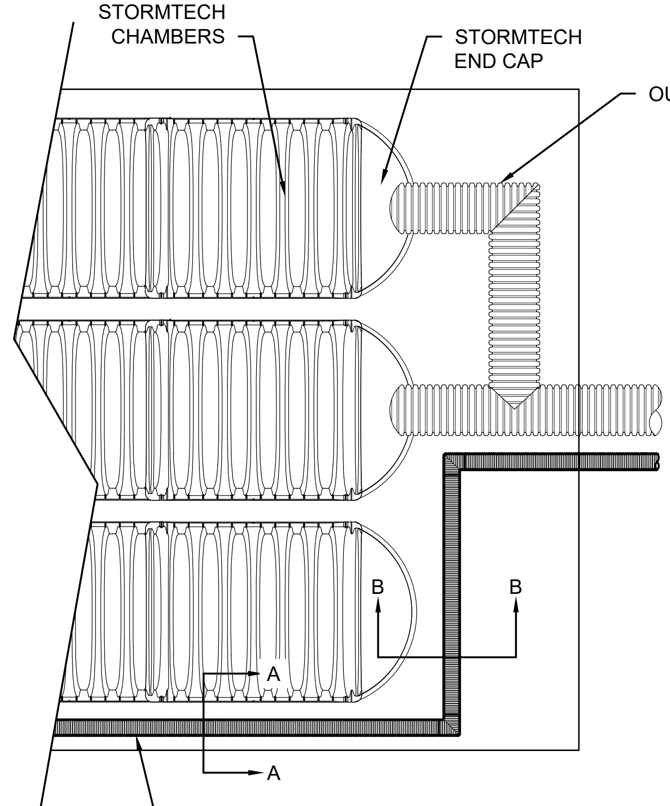
REV	DRW	CHK	DESCRIPTION

StormTech
Detention•Retention•Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

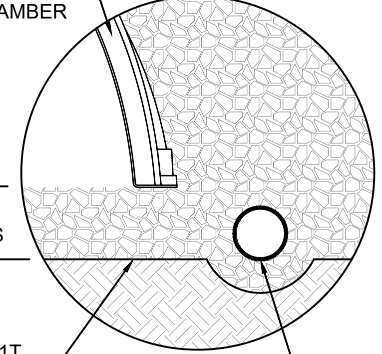
ADS
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

UNDERDRAIN DETAIL

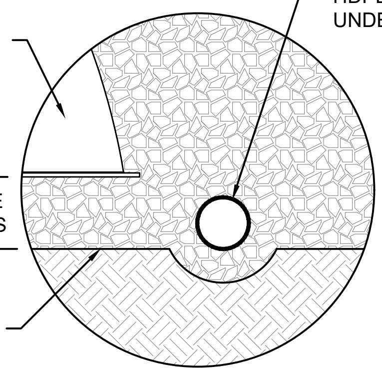
NTS



NUMBER AND SIZE OF UNDERDRAINS PER SITE DESIGN ENGINEER
4" (100 mm) TYP FOR SC-310 SYSTEMS
6" (150 mm) TYP FOR SC-740, DC-780, MC-3500 & MC-4500 SYSTEMS



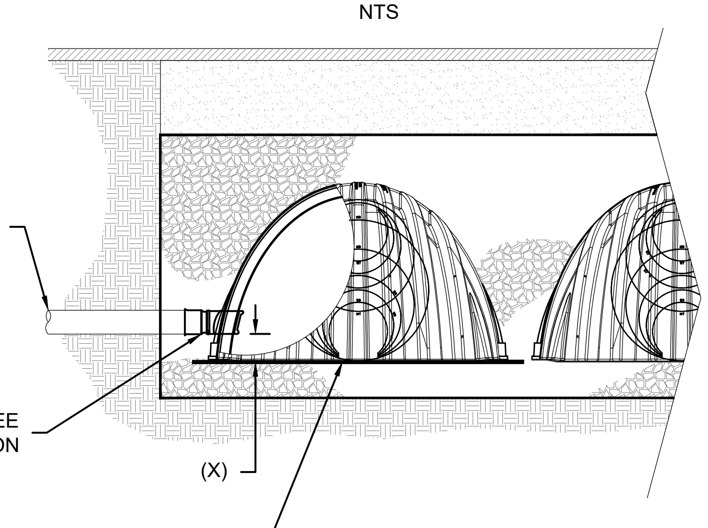
SECTION A-A



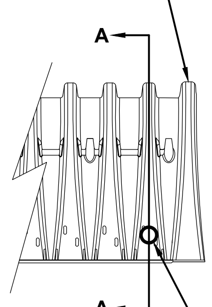
SECTION B-B

INSERTA TEE DETAIL

NTS



SECTION A-A



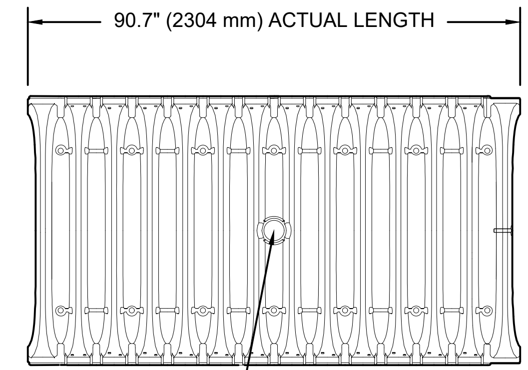
SIDE VIEW

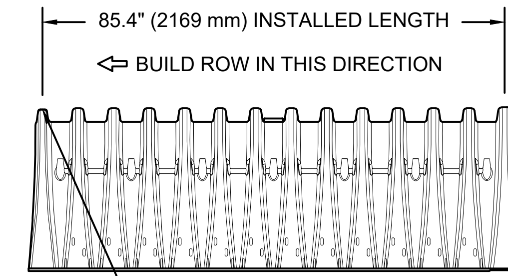
CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

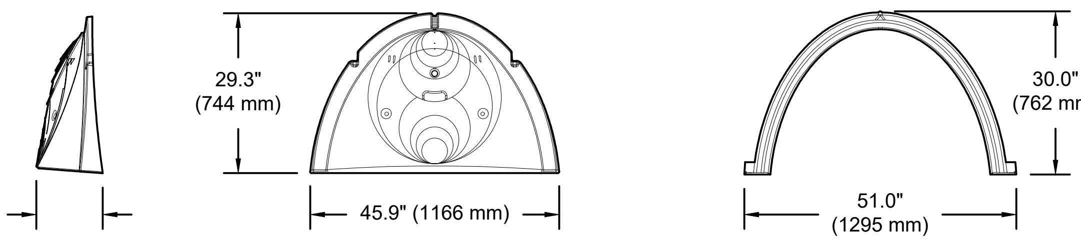
NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

SC-740 TECHNICAL SPECIFICATION

NTS



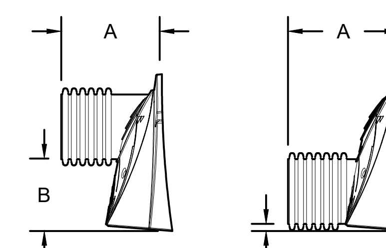




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

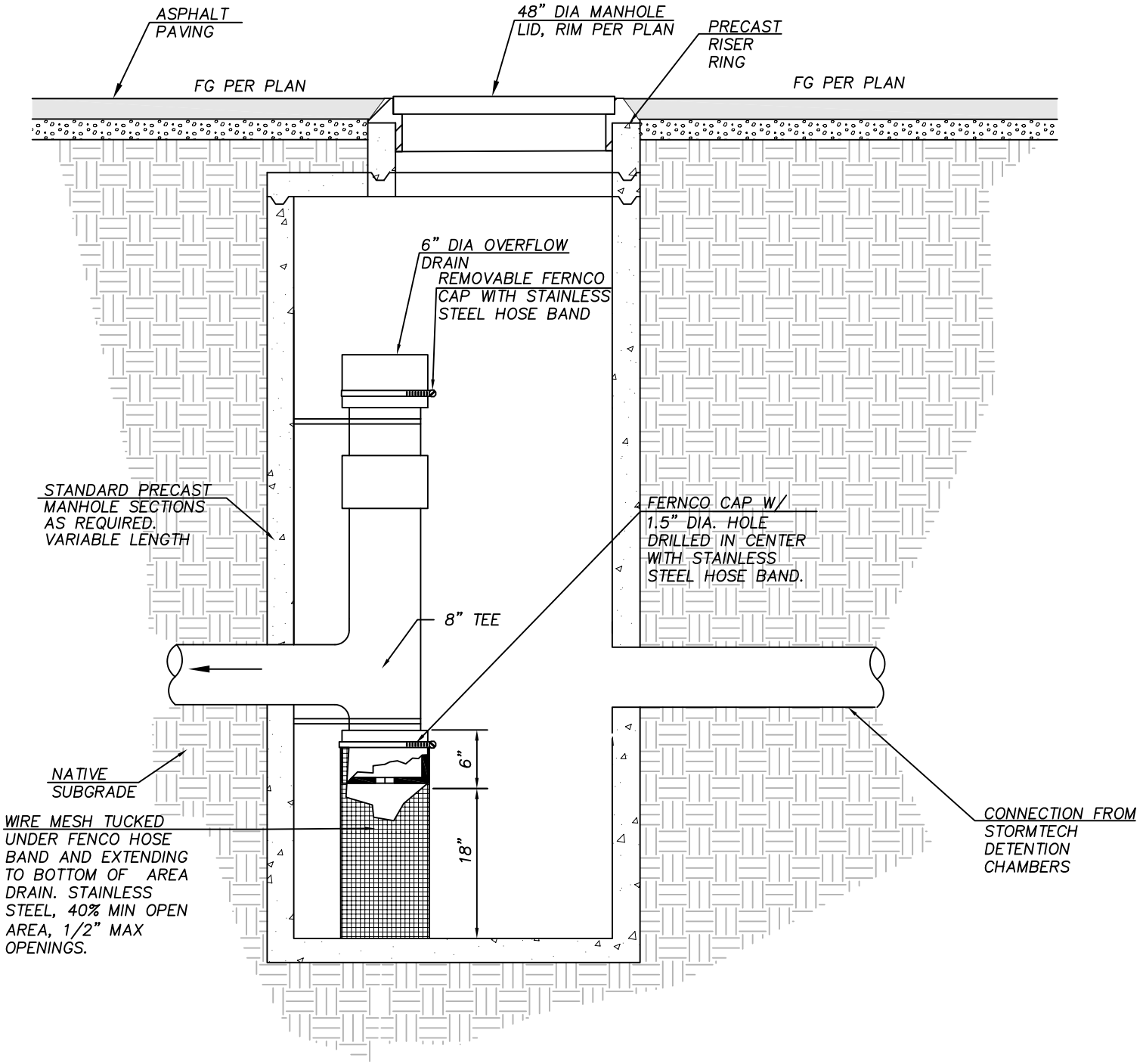
LMC Teton Expansion
Tualatin

DATE:	03/28/2019	DRAWN:	BH
PROJECT #:	Tool	CHECKED:	---

REV	DRW	CHK	DESCRIPTION

StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

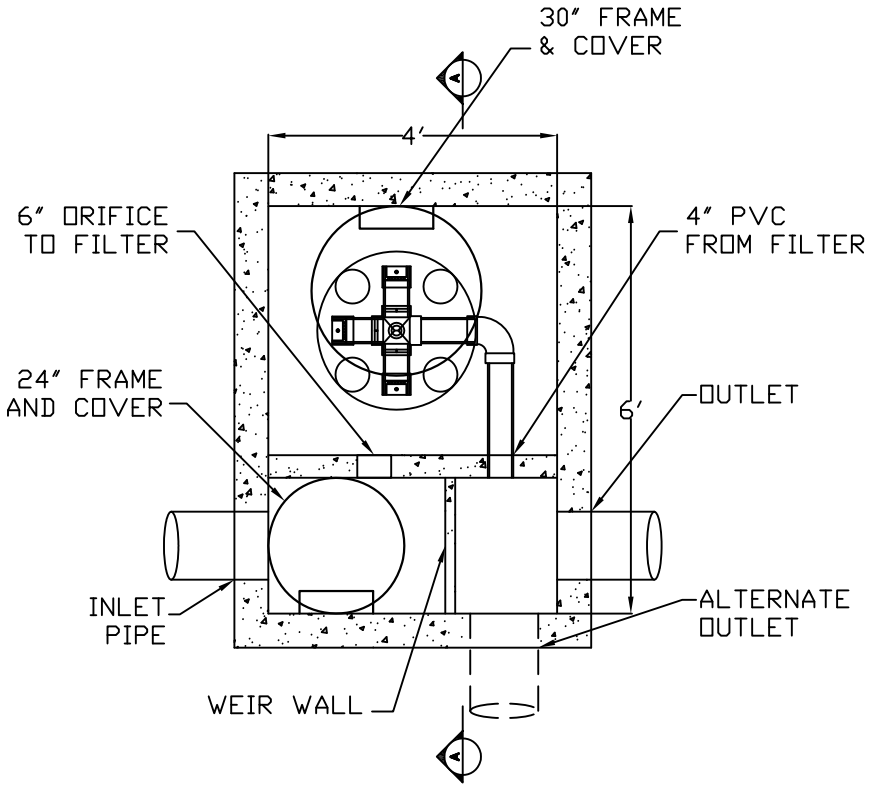
ADS
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473



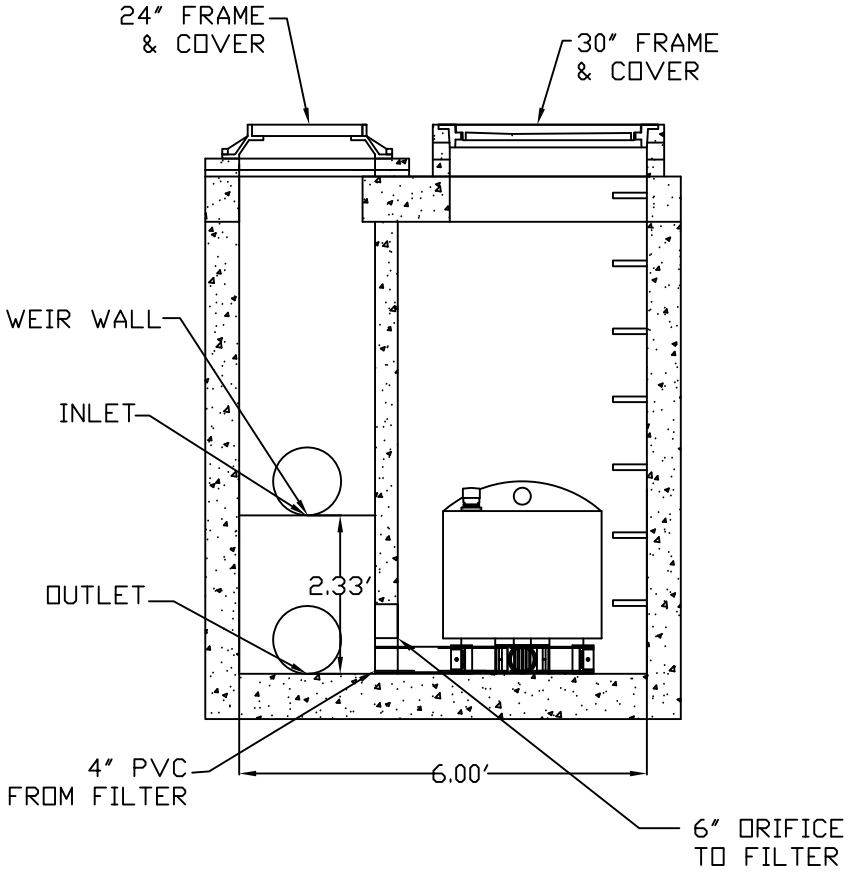
MANHOLE W/ DETENTION PIPE

NTS

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



PLAN VIEW



SECTION A–A

REV	DESCRIPTION	DATE	APPR

NOTES:
1. FRAME AND COVERS SHALL BE H–20 TRAFFIC RATED.
2. WEIR WALL SHALL BE SEALED ONTO WALLS.
3. VAULT INSIDE HEIGHT SHOULD BE 44" MINIMUM.

BAYSAVER TECHNOLOGIES
800-829-7283
WWW.BAYSAVER.COM

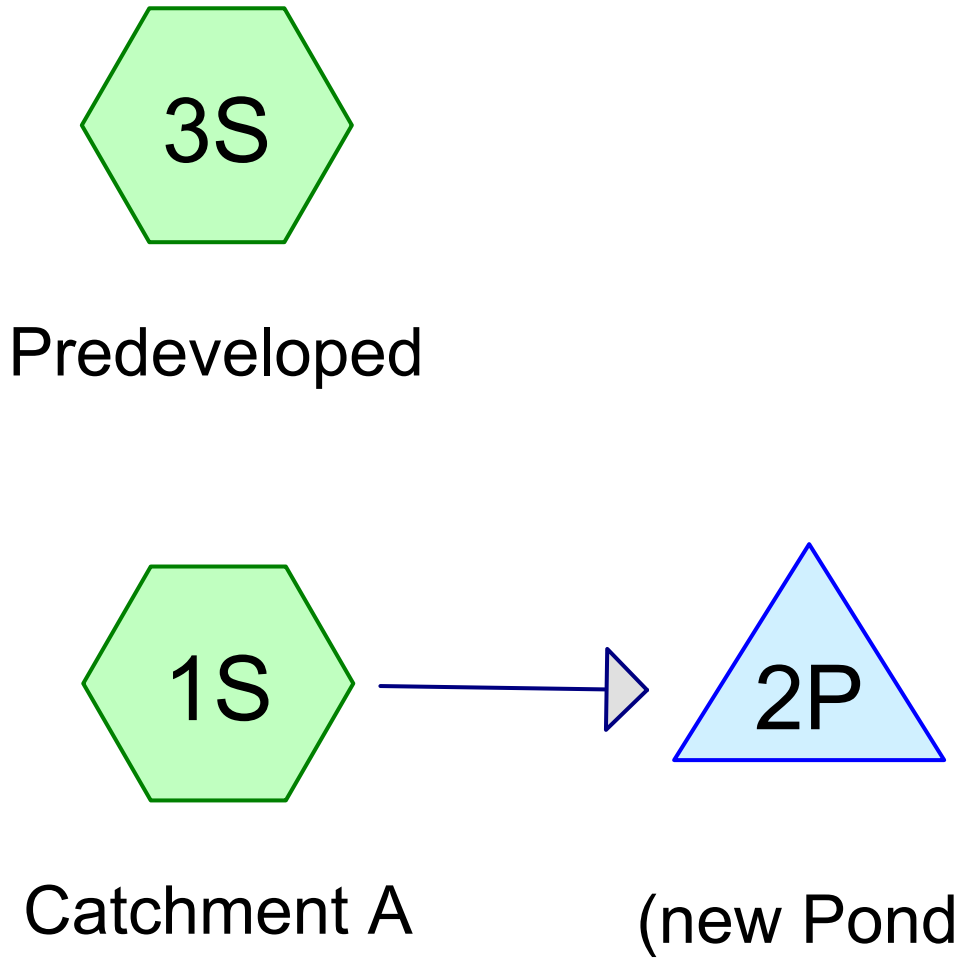
DESIGNED:	TEP	DATE:	12/14/09
DRAWN:	PR	SCALE:	N.T.S.
CHECKED:	PR	DWG NO:	

BAYFILTER PVF–4–6–1
STANDARD DETAILS

Appendix B

Support Calculations

HydroCAD Report



Subcat Reach Pond Link

Routing Diagram for LMC
Prepared by Hewlett-Packard Company, Printed 3/28/2019

Summary for Subcatchment 3S: Predeveloped

[49] Hint: Tc<2dt may require smaller dt

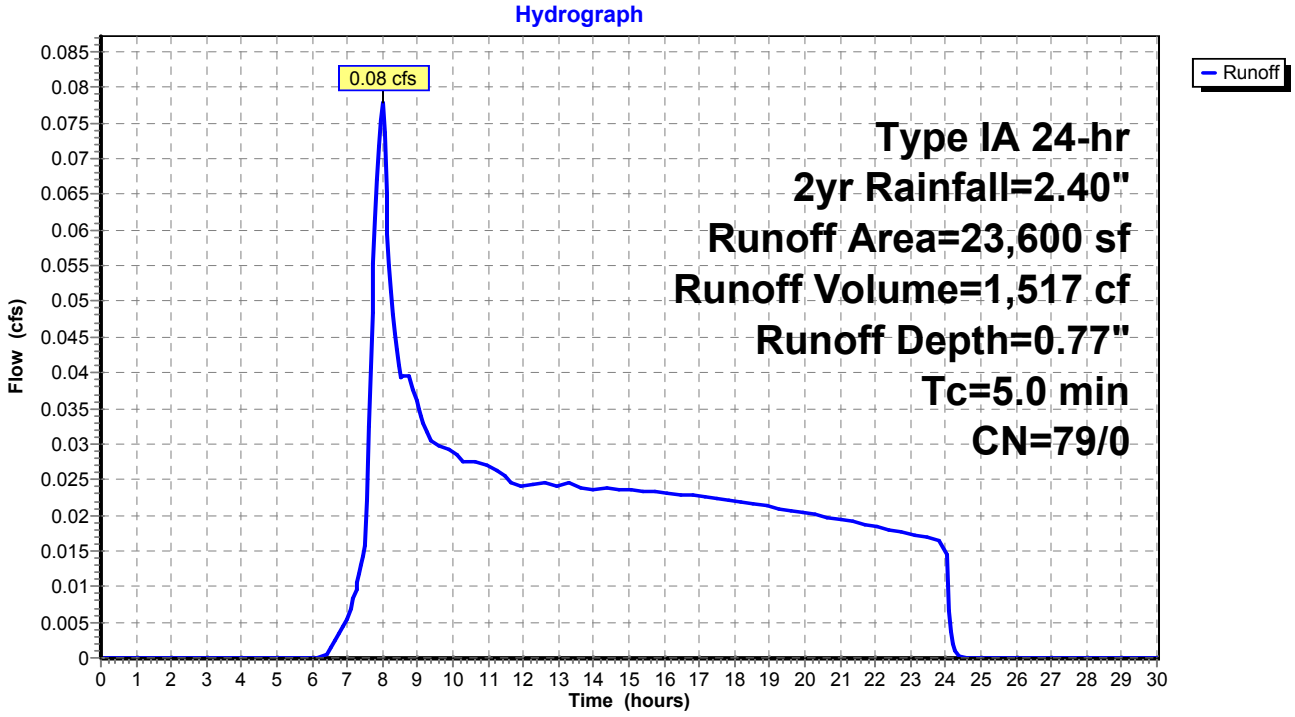
Runoff = 0.08 cfs @ 7.99 hrs, Volume= 1,517 cf, Depth= 0.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2yr Rainfall=2.40"

Area (sf)	CN	Description
23,600	79	Pasture/grassland/range, Poor, HSG B
23,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Predeveloped



Summary for Subcatchment 1S: Catchment A

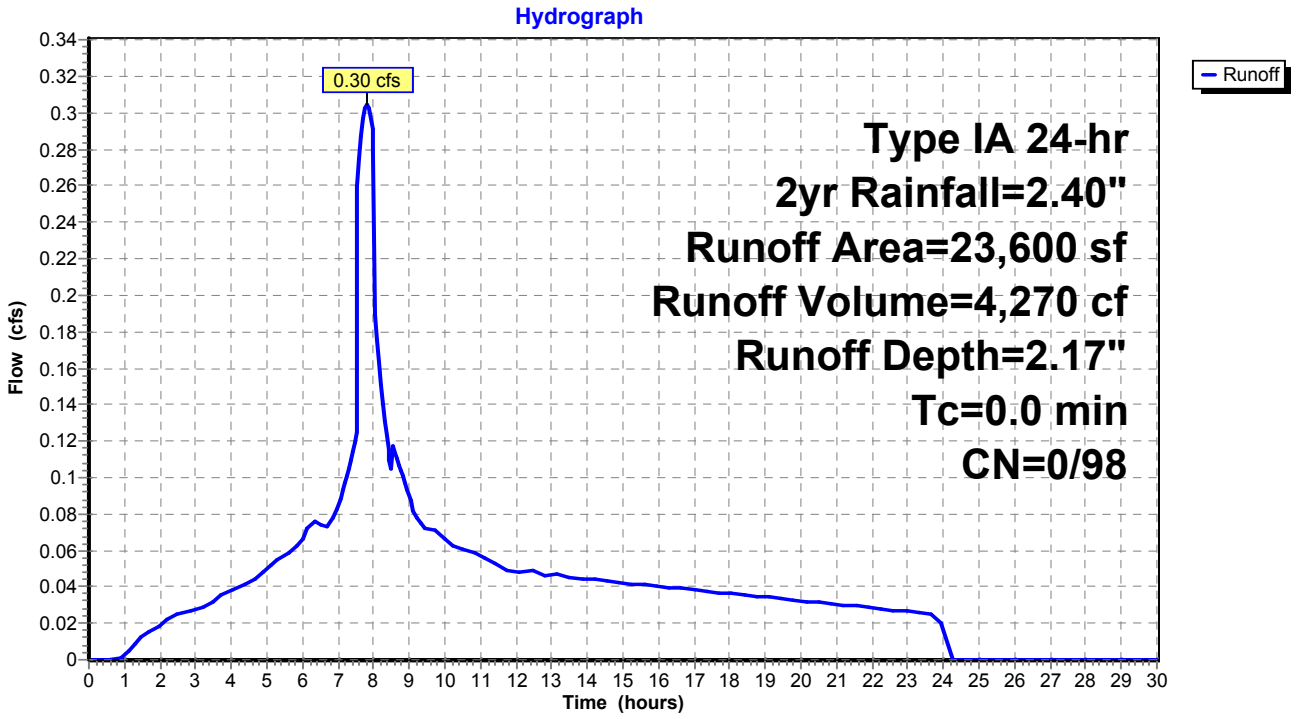
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.30 cfs @ 7.81 hrs, Volume= 4,270 cf, Depth= 2.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2yr Rainfall=2.40"

	Area (sf)	CN	Description
*	23,600	98	
	23,600		100.00% Impervious Area

Subcatchment 1S: Catchment A



Summary for Pond 2P: (new Pond)

Inflow Area = 23,600 sf,100.00% Impervious, Inflow Depth = 2.17" for 2yr event
Inflow = 0.30 cfs @ 7.81 hrs, Volume= 4,270 cf
Outflow = 0.08 cfs @ 9.17 hrs, Volume= 4,270 cf, Atten= 74%, Lag= 81.9 min
Primary = 0.08 cfs @ 9.17 hrs, Volume= 4,270 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 125.01' @ 9.17 hrs Surf.Area= 823 sf Storage= 906 cf

Plug-Flow detention time= 114.7 min calculated for 4,270 cf (100% of inflow)
Center-of-Mass det. time= 114.5 min (784.7 - 670.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	123.17'	675 cf	**15.75'W x 52.28'L x 3.67'H Field A** 3,019 cf Overall - 973 cf Embedded = 2,046 cf x 33.0% Voids
#2A	123.84'	973 cf	**ADS_StormTech SC-740** x 21 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 3 rows
		1,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	123.17'	**1.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Tertiary	126.75'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.08 cfs @ 9.17 hrs HW=125.01' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.08 cfs @ 6.53 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.17' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: (new Pond) - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 3 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

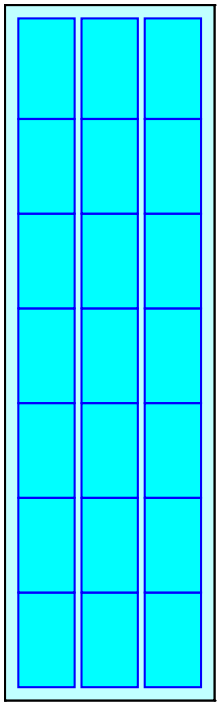
7 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 50.28' Row Length +12.0" End Stone x 2 = 52.28' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
8.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.67' Field Height

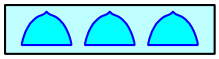
21 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 3 Rows = 973.2 cf Chamber Storage

3,019.1 cf Field - 973.2 cf Chambers = 2,045.8 cf Stone x 33.0% Voids = 675.1 cf Stone Storage

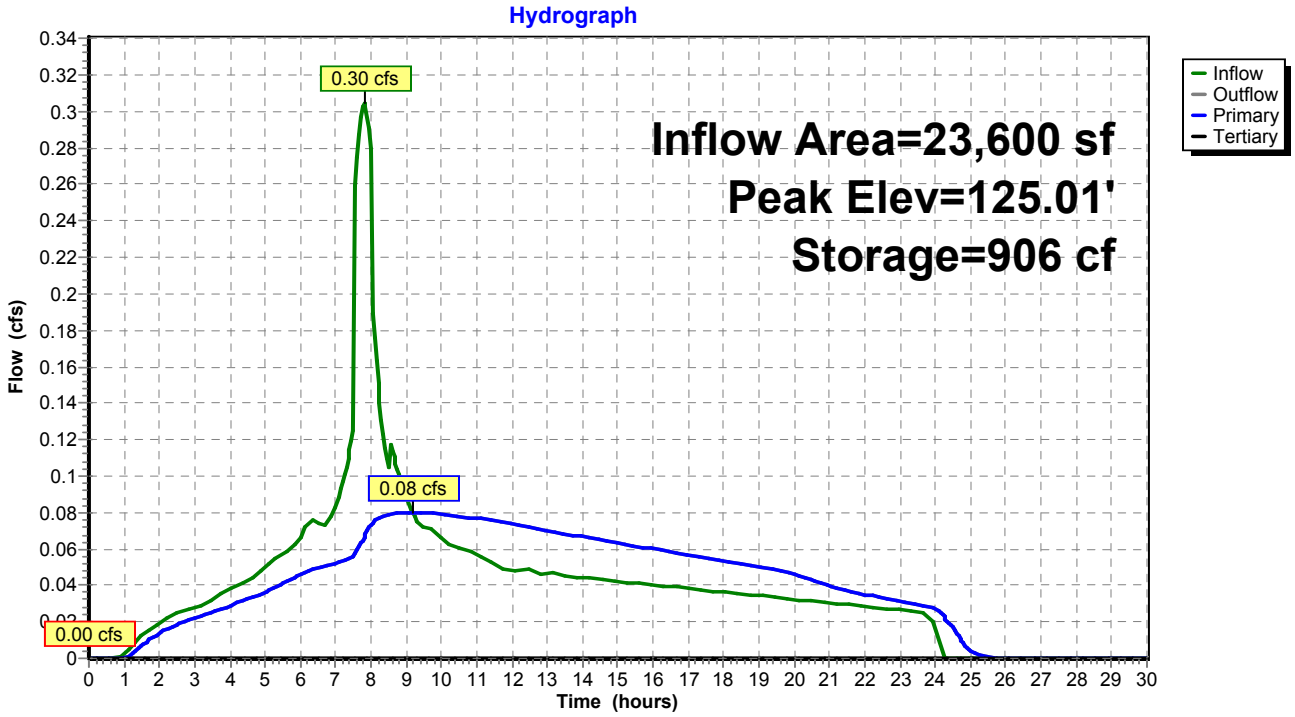
Chamber Storage + Stone Storage = 1,648.4 cf = 0.038 af
Overall Storage Efficiency = 54.6%

21 Chambers
111.8 cy Field
75.8 cy Stone





Pond 2P: (new Pond)



Summary for Subcatchment 3S: Predeveloped

[49] Hint: Tc<2dt may require smaller dt

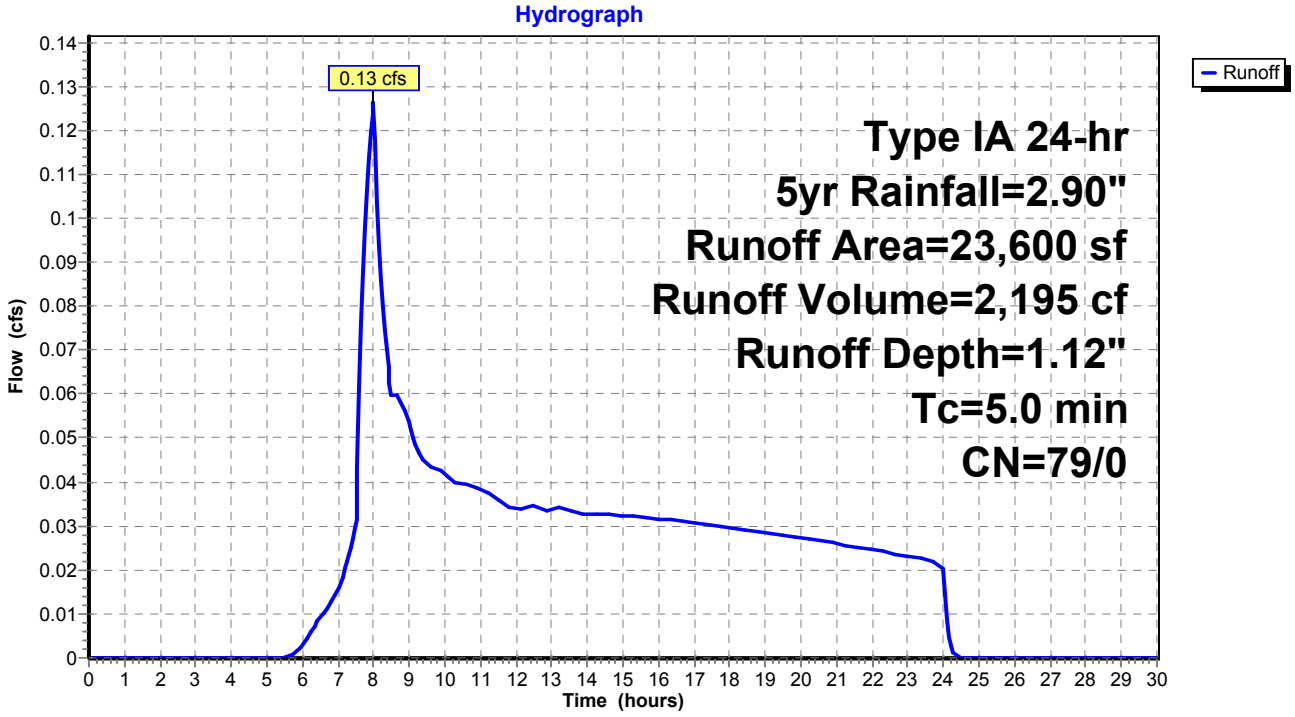
Runoff = 0.13 cfs @ 7.99 hrs, Volume= 2,195 cf, Depth= 1.12"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5yr Rainfall=2.90"

Area (sf)	CN	Description
23,600	79	Pasture/grassland/range, Poor, HSG B
23,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Predeveloped



Summary for Subcatchment 1S: Catchment A

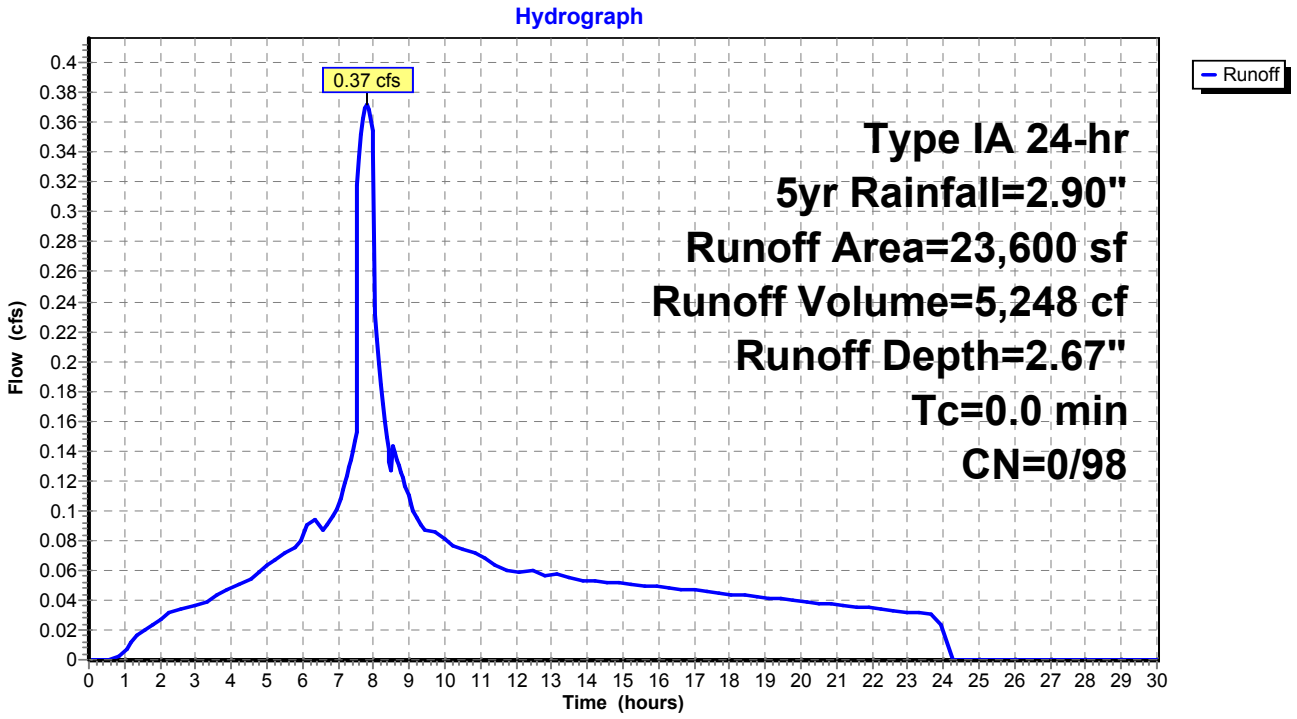
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.37 cfs @ 7.81 hrs, Volume= 5,248 cf, Depth= 2.67"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5yr Rainfall=2.90"

	Area (sf)	CN	Description
*	23,600	98	
	23,600		100.00% Impervious Area

Subcatchment 1S: Catchment A



Summary for Pond 2P: (new Pond)

Inflow Area = 23,600 sf,100.00% Impervious, Inflow Depth = 2.67" for 5yr event
Inflow = 0.37 cfs @ 7.81 hrs, Volume= 5,248 cf
Outflow = 0.09 cfs @ 9.30 hrs, Volume= 5,248 cf, Atten= 75%, Lag= 89.7 min
Primary = 0.09 cfs @ 9.30 hrs, Volume= 5,248 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 125.59' @ 9.30 hrs Surf.Area= 823 sf Storage= 1,218 cf

Plug-Flow detention time= 145.7 min calculated for 5,248 cf (100% of inflow)
Center-of-Mass det. time= 145.5 min (809.7 - 664.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	123.17'	675 cf	**15.75'W x 52.28'L x 3.67'H Field A** 3,019 cf Overall - 973 cf Embedded = 2,046 cf x 33.0% Voids
#2A	123.84'	973 cf	**ADS_StormTech SC-740** x 21 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 3 rows
		1,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	123.17'	**1.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Tertiary	126.75'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.09 cfs @ 9.30 hrs HW=125.59' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.09 cfs @ 7.49 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.17' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: (new Pond) - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 3 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

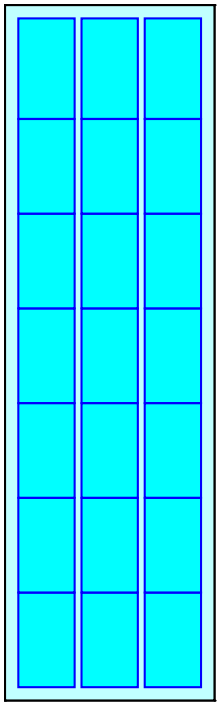
7 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 50.28' Row Length +12.0" End Stone x 2 = 52.28' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
8.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.67' Field Height

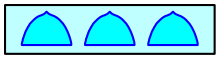
21 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 3 Rows = 973.2 cf Chamber Storage

3,019.1 cf Field - 973.2 cf Chambers = 2,045.8 cf Stone x 33.0% Voids = 675.1 cf Stone Storage

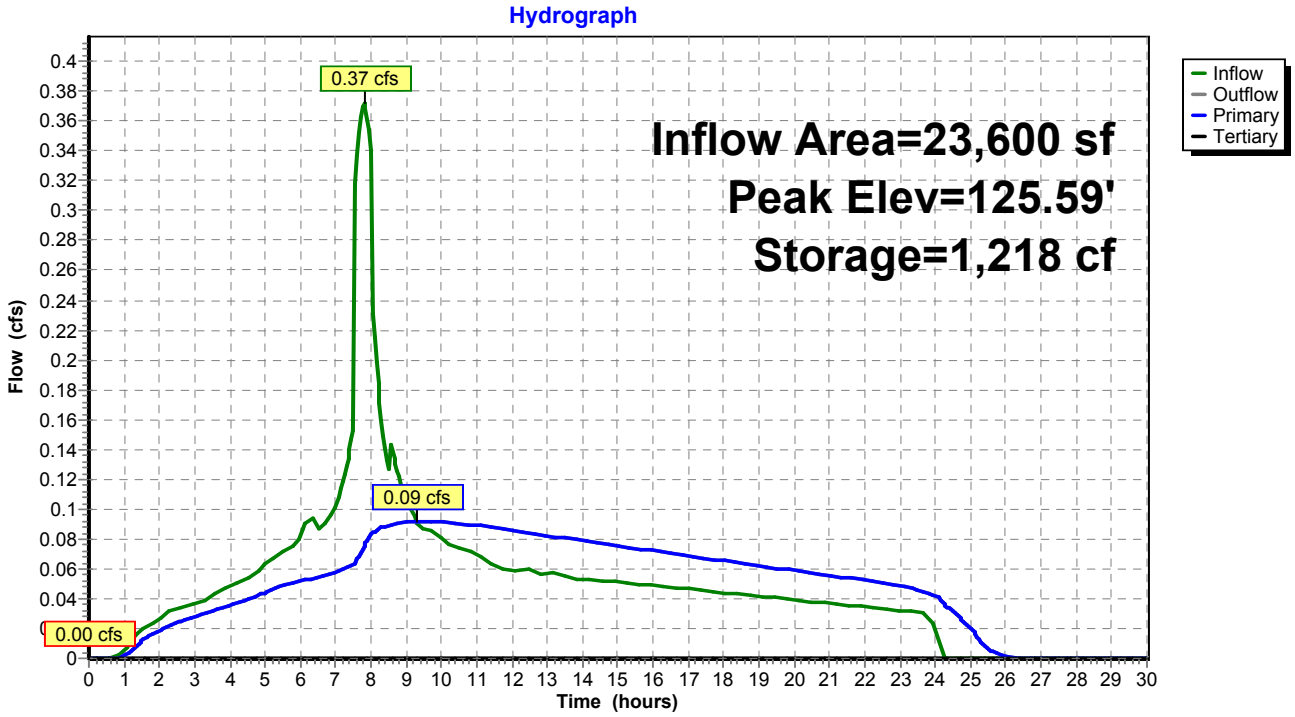
Chamber Storage + Stone Storage = 1,648.4 cf = 0.038 af
Overall Storage Efficiency = 54.6%

21 Chambers
111.8 cy Field
75.8 cy Stone





Pond 2P: (new Pond)



Summary for Subcatchment 3S: Predeveloped

[49] Hint: Tc<2dt may require smaller dt

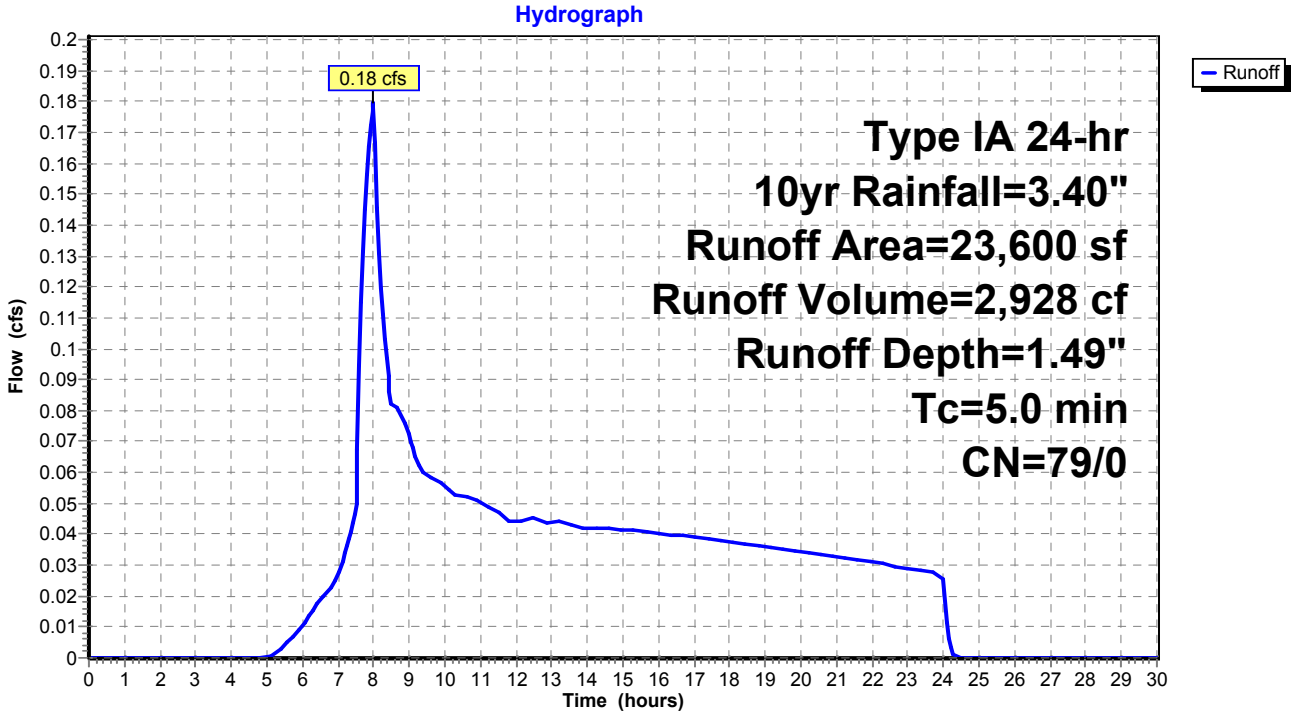
Runoff = 0.18 cfs @ 7.98 hrs, Volume= 2,928 cf, Depth= 1.49"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10yr Rainfall=3.40"

Area (sf)	CN	Description
23,600	79	Pasture/grassland/range, Poor, HSG B
23,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Predeveloped



Summary for Subcatchment 1S: Catchment A

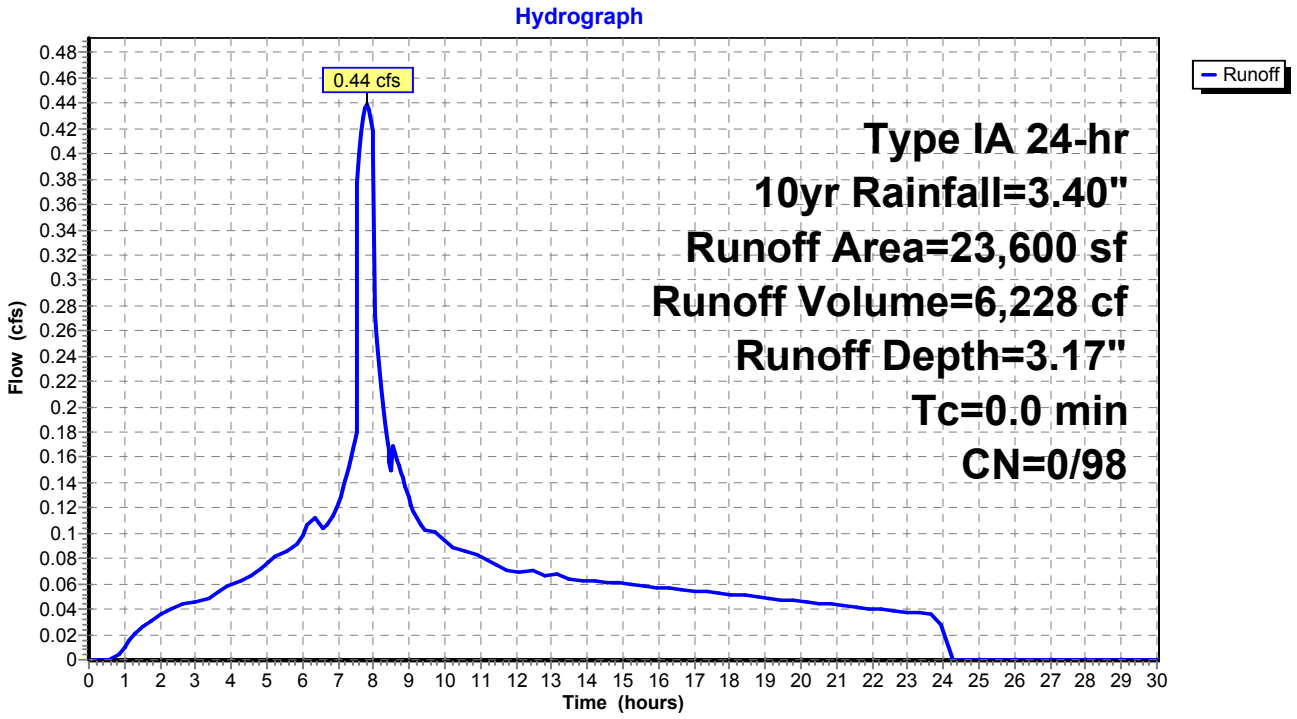
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.44 cfs @ 7.80 hrs, Volume= 6,228 cf, Depth= 3.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10yr Rainfall=3.40"

	Area (sf)	CN	Description
*	23,600	98	
	23,600		100.00% Impervious Area

Subcatchment 1S: Catchment A



Summary for Pond 2P: (new Pond)

Inflow Area = 23,600 sf,100.00% Impervious, Inflow Depth = 3.17" for 10yr event
Inflow = 0.44 cfs @ 7.80 hrs, Volume= 6,228 cf
Outflow = 0.11 cfs @ 9.33 hrs, Volume= 6,228 cf, Atten= 76%, Lag= 91.7 min
Primary = 0.11 cfs @ 9.33 hrs, Volume= 6,228 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 126.43' @ 9.33 hrs Surf.Area= 823 sf Storage= 1,538 cf

Plug-Flow detention time= 171.4 min calculated for 6,228 cf (100% of inflow)
Center-of-Mass det. time= 171.3 min (831.1 - 659.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	123.17'	675 cf	**15.75'W x 52.28'L x 3.67'H Field A** 3,019 cf Overall - 973 cf Embedded = 2,046 cf x 33.0% Voids
#2A	123.84'	973 cf	**ADS_StormTech SC-740** x 21 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 3 rows
		1,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	123.17'	**1.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Tertiary	126.75'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 9.33 hrs HW=126.43' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.11 cfs @ 8.69 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.17' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: (new Pond) - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 3 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

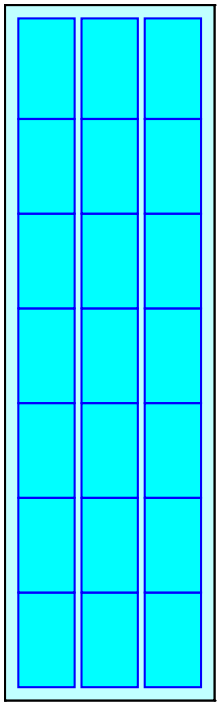
7 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 50.28' Row Length +12.0" End Stone x 2 = 52.28' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
8.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.67' Field Height

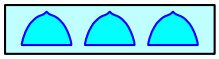
21 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 3 Rows = 973.2 cf Chamber Storage

3,019.1 cf Field - 973.2 cf Chambers = 2,045.8 cf Stone x 33.0% Voids = 675.1 cf Stone Storage

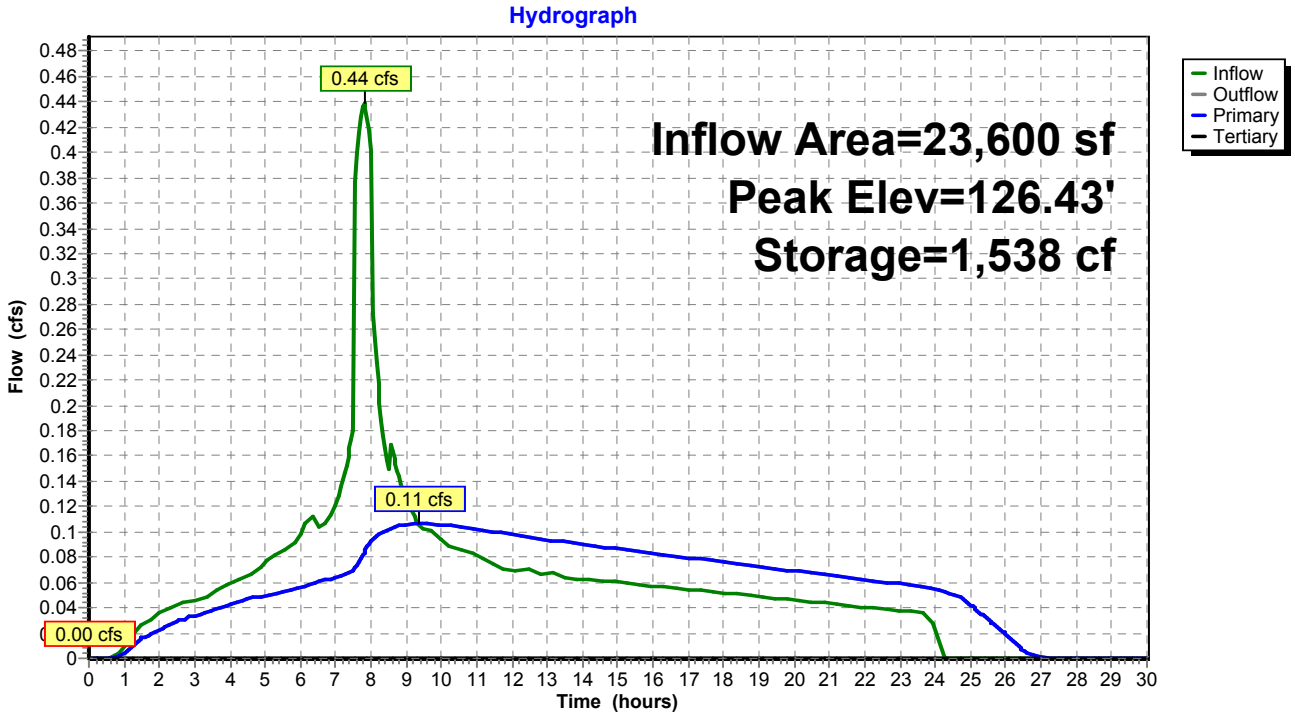
Chamber Storage + Stone Storage = 1,648.4 cf = 0.038 af
Overall Storage Efficiency = 54.6%

21 Chambers
111.8 cy Field
75.8 cy Stone





Pond 2P: (new Pond)



Summary for Subcatchment 3S: Predeveloped

[49] Hint: Tc<2dt may require smaller dt

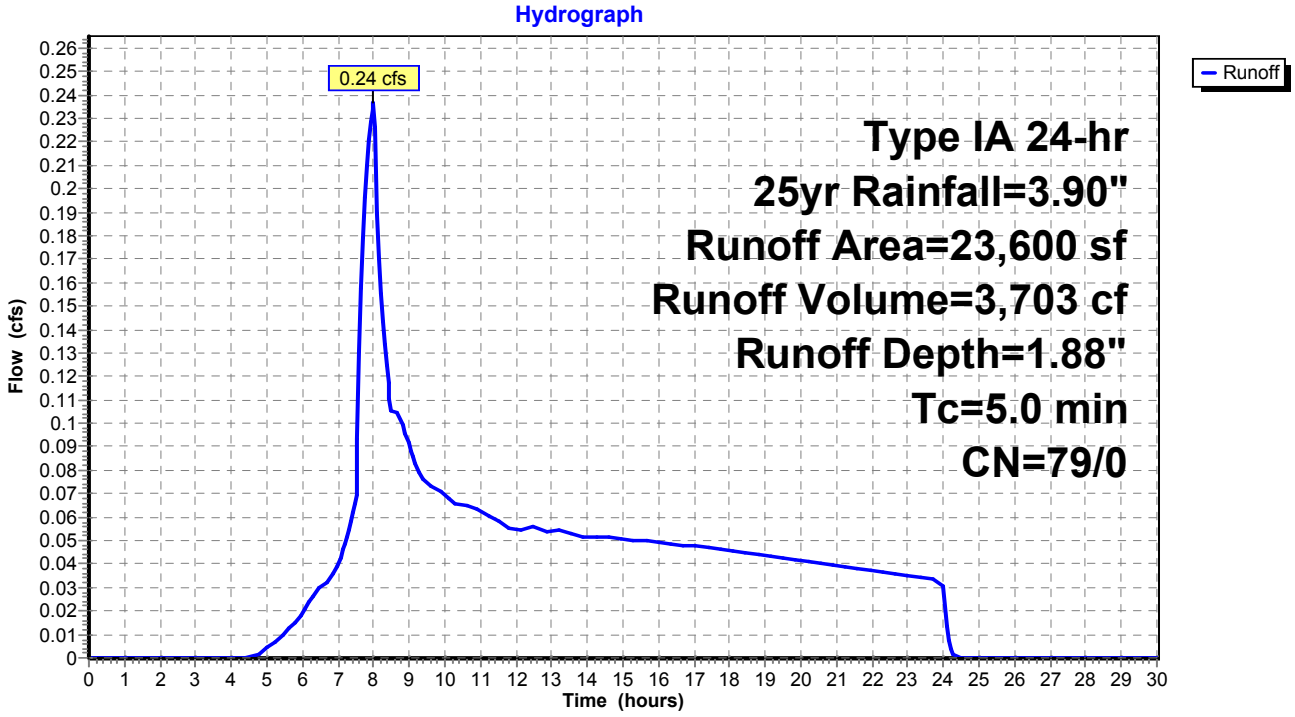
Runoff = 0.24 cfs @ 7.98 hrs, Volume= 3,703 cf, Depth= 1.88"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25yr Rainfall=3.90"

Area (sf)	CN	Description
23,600	79	Pasture/grassland/range, Poor, HSG B
23,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Predeveloped



Summary for Subcatchment 1S: Catchment A

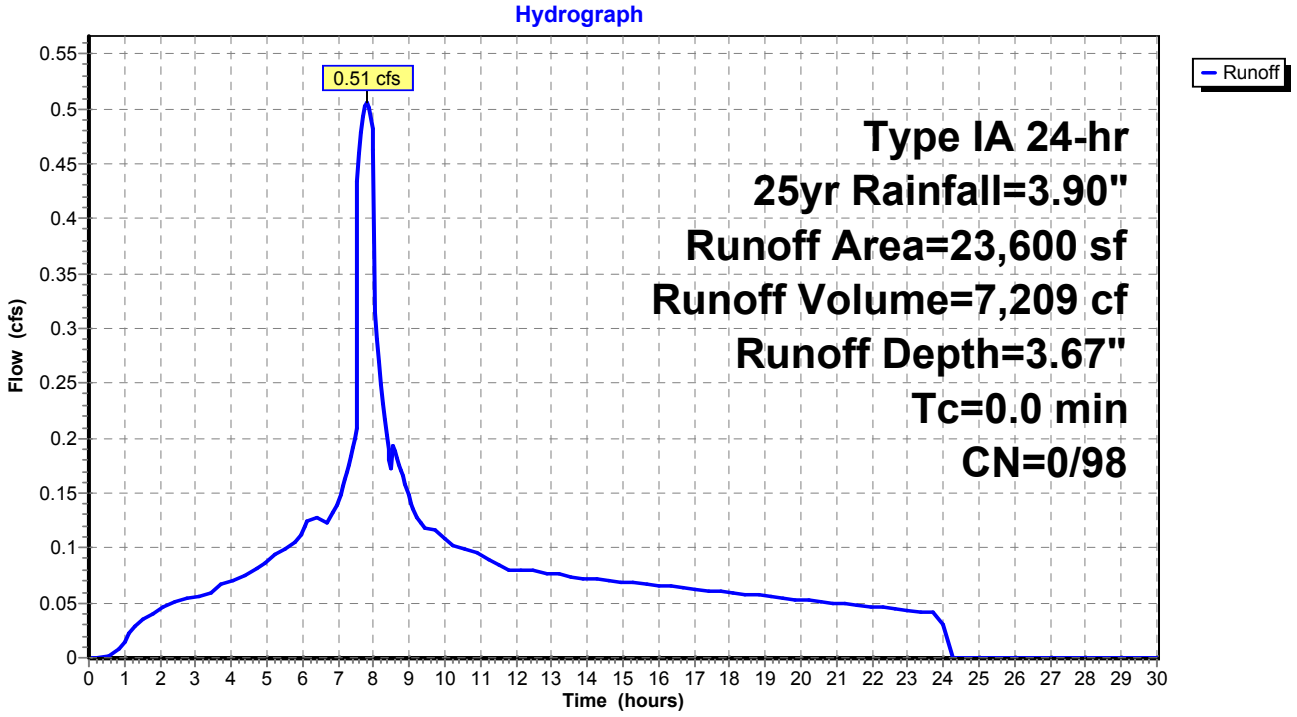
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.51 cfs @ 7.80 hrs, Volume= 7,209 cf, Depth= 3.67"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25yr Rainfall=3.90"

	Area (sf)	CN	Description
*	23,600	98	
	23,600		100.00% Impervious Area

Subcatchment 1S: Catchment A



Summary for Pond 2P: (new Pond)

Inflow Area = 23,600 sf,100.00% Impervious, Inflow Depth = 3.67" for 25yr event
Inflow = 0.51 cfs @ 7.80 hrs, Volume= 7,209 cf
Outflow = 0.24 cfs @ 8.26 hrs, Volume= 7,209 cf, Atten= 53%, Lag= 27.3 min
Primary = 0.11 cfs @ 8.26 hrs, Volume= 6,940 cf
Tertiary = 0.12 cfs @ 8.26 hrs, Volume= 268 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 126.83' @ 8.26 hrs Surf.Area= 823 sf Storage= 1,647 cf

Plug-Flow detention time= 176.9 min calculated for 7,197 cf (100% of inflow)
Center-of-Mass det. time= 177.0 min (833.3 - 656.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	123.17'	675 cf	**15.75'W x 52.28'L x 3.67'H Field A** 3,019 cf Overall - 973 cf Embedded = 2,046 cf x 33.0% Voids
#2A	123.84'	973 cf	**ADS_StormTech SC-740** x 21 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 3 rows
		1,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	123.17'	**1.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Tertiary	126.75'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 8.26 hrs HW=126.83' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.11 cfs @ 9.21 fps)

Tertiary OutFlow Max=0.12 cfs @ 8.26 hrs HW=126.83' (Free Discharge)
2=Orifice/Grate (Weir Controls 0.12 cfs @ 0.94 fps)

Pond 2P: (new Pond) - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 3 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

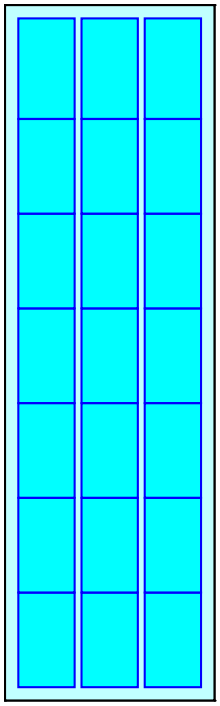
7 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 50.28' Row Length +12.0" End Stone x 2 = 52.28' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
8.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.67' Field Height

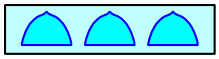
21 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 3 Rows = 973.2 cf Chamber Storage

3,019.1 cf Field - 973.2 cf Chambers = 2,045.8 cf Stone x 33.0% Voids = 675.1 cf Stone Storage

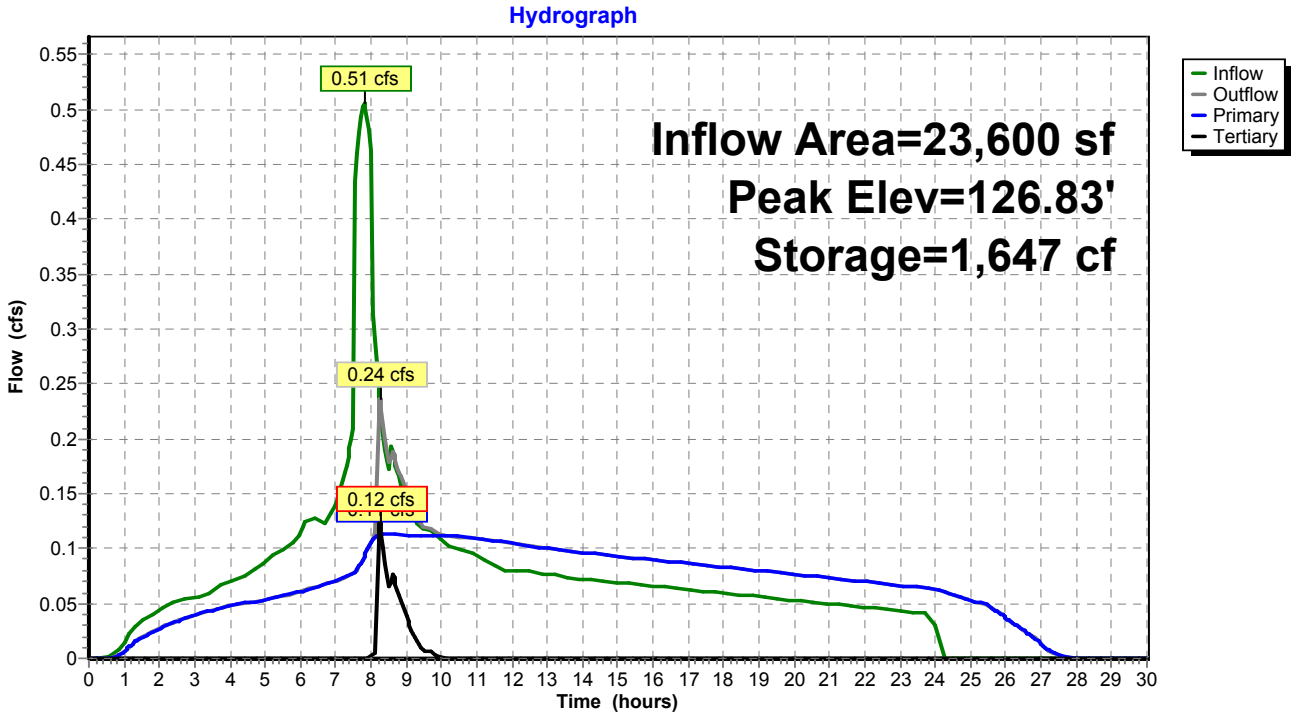
Chamber Storage + Stone Storage = 1,648.4 cf = 0.038 af
Overall Storage Efficiency = 54.6%

21 Chambers
111.8 cy Field
75.8 cy Stone





Pond 2P: (new Pond)



Appendix D

Additional Forms & Associated Reports

Hydrologic Soil Report

FEMA Flood Map

Hydrologic Soil Group—Washington County, Oregon
(LMC Office)

Map Scale: 1:1,190 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 16, Sep 18, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 3, 2014—Aug 23, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
14	Cove clay	D	1.2	22.3%
21B	Hillsboro loam, 3 to 7 percent slopes	B	2.5	47.1%
37B	Quatama loam, 3 to 7 percent slopes	C	1.6	30.6%
Totals for Area of Interest			**5.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

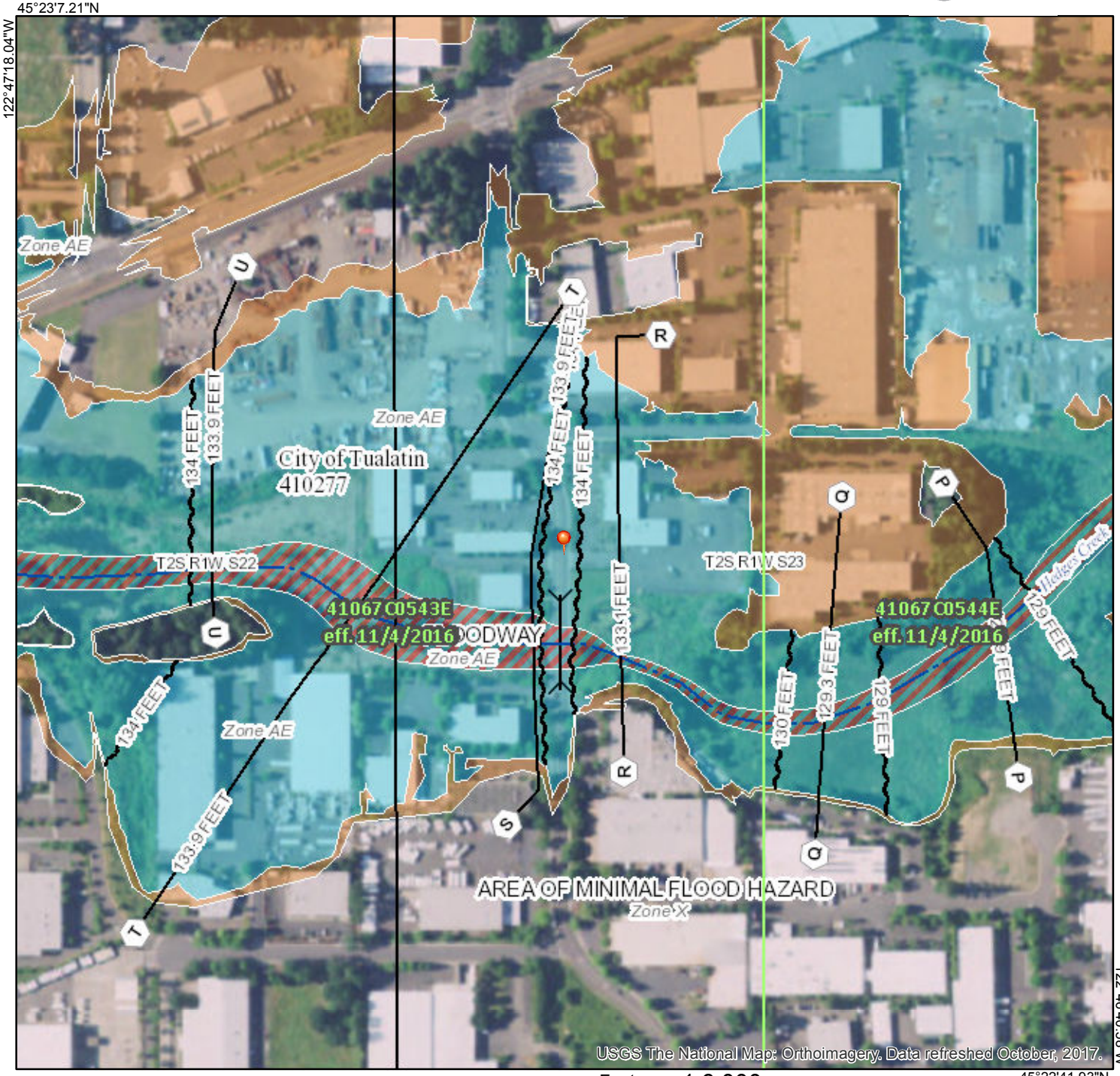
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/25/2019 at 1:48:22 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.