SITE PLAN REVIEW
ARC TECHNOLOGIES, INC.
29 SOUTH HUNT ROAD
AMESBURY, MA. 01913

August 2015

Prepared By:
W. C. Cammett Engineering, Inc.
297 Elm Street
Amesbury, Ma. 01913

Job#: 14061

Civil / Sanitary Municipal Planning
Est. 1975
CAMMETT CE ENGINEERING
Land Survey

Woodbury C. Cammett, PE *MA, NH*
Alan D. Roscoe, PE, *BCEE*
Robert E. Smith, PLS *MA, NH*
Denis Hamel, *CPESC*
Jim Babbin, SIT
Emily Fredette, EIT

Consulting Engineers and Land Surveyors

August 25, 2015

Planning Board
Town Hall
Amesbury, MA. 01913

RE: Site Plan Review Application
Arc Technologies, Inc.
37 South Hunt Road
Amesbury, MA. 01913

Dear Board Members,

On behalf of our client, Arc Technologies, Inc., we are hereby submitting this application for Site Plan Review as required under the Amesbury Zoning Bylaw Section V, Table of Use Regulations for an addition to an existing building and Section XI.C, Site Plan Review. The following documents are submitted as part of the application package:

- Application for Site Plan Review
- Application Fee $10,839.20 ($500 + $0.15(68,928 sf))
- Certified List of Abutters
- Mailing Fee $10.97 (11 abutters x 0.98 = $10.97)
- Stormwater Analysis package
- Long Term Pollution Prevention Plan (LTPPP)
- Site Plans dated August 24, 2015
- Architectural Renderings & Lighting Plan
- Stormwater Pollution Prevention Plan (SWPPP)

If the Board requires additional information or has any questions regarding this application, please contact our office.

Sincerely,
W.C. Cammett Engineering, Inc.

Denis M. Hamel, CPESC
Title:M\Winword\2014\14061\Agency Interface\Planning Board\Site Plan Review cover letter r1.doc

PLANNING BOARD

Town Hall

APPLICATION FOR SITE PLAN REVIEW

Date August 31, 2015

Name ARC Technologies, LLC

Address 37 South Hunt Road

Amesbury, MA 01013

Application is hereby made for a site plan review. Premises affected are situated at 29 and 37 South Hunt Road

_____, Amesbury Massachusetts and on Map # 95, Lot # 15 And 15A

of the Assessor's Map.

1. Owner of Property: 37 Hunt Road, LLC
2. Zoning District: Industrial
3. Lot size: 95/15-6.08 Ac. + 95/15A-4.52 Ac. Total-10.60 Ac.
4. Size of Building, Addition or Area of Proposed Work: Addition - 68,928 SF footprint
5. Occupancy or Use - Existing: Industrial

   Proposed: Industrial
6. Other Permits Required: NPDES-Construction General Permit
7. Submittal:
   * Site Plan - Scale 1" = 40' (Section XI, C-4a of Zoning Bylaw) Ten Copies _____
   * Water and Sewer Plan _____
   * Storm Drainage Plan _____
   * Erosion Control _____
   * Parking Spaces and Plan ____
   * Traffic Plan _____ (If required under C-5d of Zoning Bylaw)
8. Description of Work: Construction of an Addition of 68,928 SF and associated Access drive, Parking, Stormwater Management, Water

Service, Sewer Service, and other utilities.

Daniel P. Kealey III

Signature of Applicant

Owner (if not Applicant)

Filing Fee: $500.00 plus $0.15 per square foot of gross floor area.
Received:_____
Distributed:_____
Hearing:_____

This application must be accompanied by 10 copies of the site plan. Complete details concerning site plan review are in Section XI, Section C - Site Plan Review of the Amesbury Zoning Bylaw.

1073

37 SOUTH HUNT ROAD LLC
37 S HUNT RD
AMESBURY, MA 01913

53-179-113

DATE 27 AUG 2015

PAY TO THE ORDER OF CITY OF AMESBURY $ 10839.20

TEN THOUSAND EIGHT HUNDRED THIRTY NINE & 20/100 DOLLARS

Security Features Included. Details on Back.

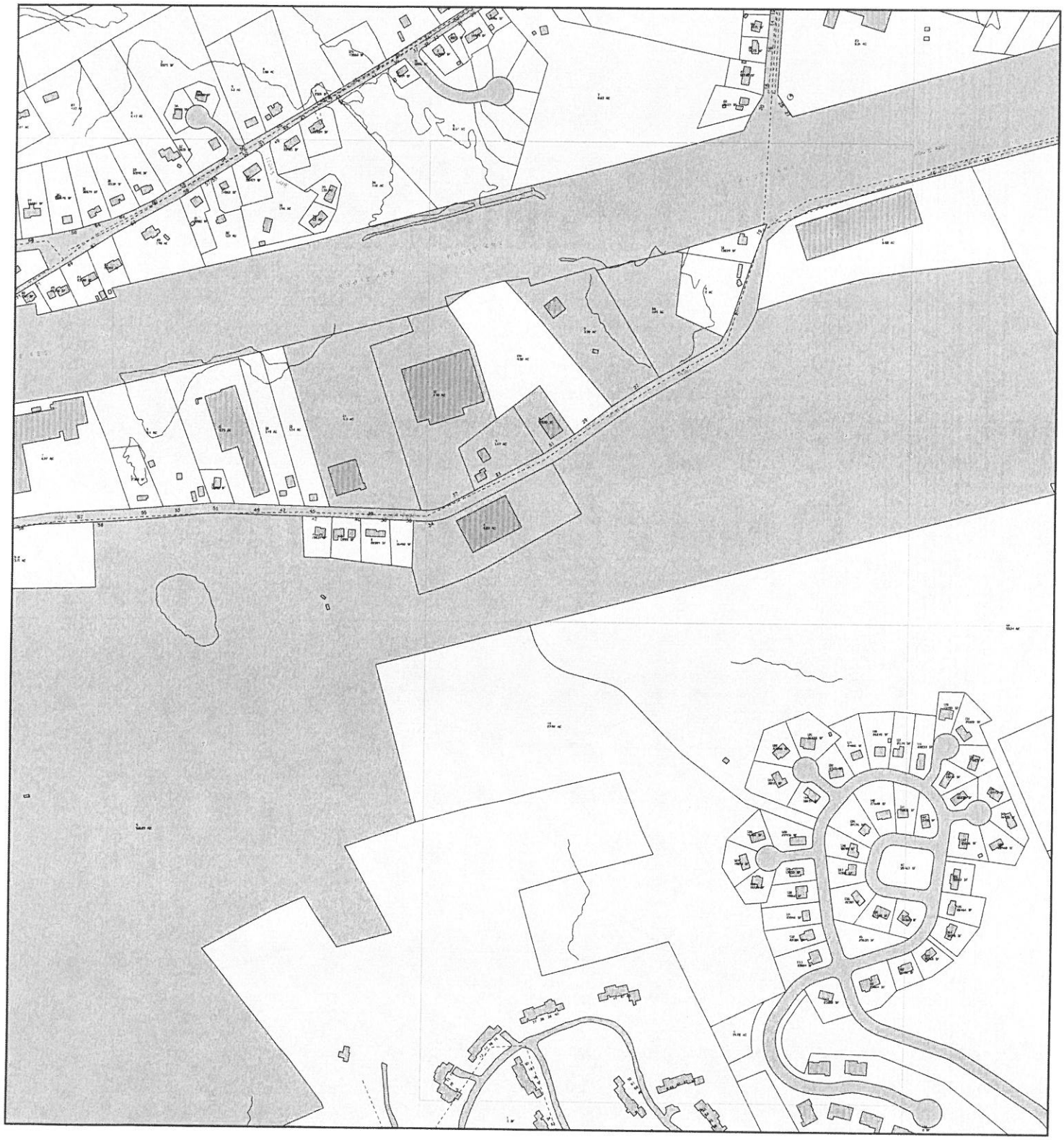
Eastern Bank
Boston, MA 02110
easternbank.com
1-800-EASTERN

FOR _____

MP

⑈001073⑈ ⑆011301798⑆ 0600775134⑈

29 S HUNT RD 95/15A 300 FT



Information on this Map is Compiled and Maintained for Assessing Purposes Only

GEOGRAPHIC INFORMATION SYSTEM
VISION APPRAISAL TECHNOLOGY

N

Property Location: 29 S HUNT RD | MAP ID: 95/ / 15/A / | Bldg Name: | State Use: 4400

Vision ID: 104222 | Account #95//15/A | Bldg #: 1 of 1 | Sec #: 1 of 1 | Card 1 of 1 | Print Date: 08/05/2015 11:37

CURRENT OWNER	TOPO.	UTILITIES	STRT./ROAD	LOCATION
BARTLEY RICHARD J JR & LUCY M C/O 37 SOUTH HUNT ROAD LLC 37 SOUTH HUNT ROAD AMESBURY, MA 01913 Additional Owners:				

SUPPLEMENTAL DATA

Other ID:	95//15/A	Use Change	
Sub-Div	NEW FY09	Original Lot	
Spec.Cond.		NOTES	
OWNER OCCU		STYLE	
ABC		CHAPTER L	
NUMBER			
GIS ID: 104222		*ASSOC PID#*	

CURRENT ASSESSMENT

Description	Code	Appraised Value	Assessed Value
IND LAND	4400	415,600	415,600
		Total 415,600	415,600

101
AMESBURY, MA

VISION

RECORD OF OWNERSHIP

	BK-VOL/PAGE	SALE DATE	q/u	v/i	SALE PRICE	V.C.
37 SOUTH HUNT ROAD LLC	33896/ 601	03/05/2015	Q	V	475,000	00
BARTLEY RICHARD J JR & LUCY M TRS	DOC 485248	12/24/2007	U	V	1	1A
RLS REALTY LLC	DOC483669	10/23/2007	U	V		1G

PREVIOUS ASSESSMENTS (HISTORY)

Yr.	Code	Assessed Value	Yr.	Code	Assessed Value	Yr.	Code	Assessed Value
2015	4400	415,600	2014	4400	415,600	2013	4400	430,900
	Total:	415,600		*Total:*	415,600		*Total:*	430,900

EXEMPTIONS

Year	Type	Description	Amount
		Total:	

OTHER ASSESSMENTS

Code	Description	Number	Amount	Comm. Int.

This signature acknowledges a visit by a Data Collector or Assessor

APPRAISED VALUE SUMMARY

Appraised Bldg. Value (Card)	0
Appraised XF (B) Value (Bldg)	0
Appraised OB (L) Value (Bldg)	0
Appraised Land Value (Bldg)	415,600
Special Land Value	0
Total Appraised Parcel Value	415,600
Valuation Method:	C
Adjustment:	0
Net Total Appraised Parcel Value	415,600

ASSESSING NEIGHBORHOOD

NBHD/ SUB	NBHD NAME	STREET INDEX NAME	TRACING	BATCH
0001/A				

NOTES

FY16-FKA-S HUNT RD (NO NUMBER)

FROM 95/15 PLAN 410/5 10/4/07 LOT 3A

BUILDING PERMIT RECORD

Permit ID	Issue Date	Type	Description	Amount	Insp. Date	% Comp.	Date Comp.	Comments

VISIT/ CHANGE HISTORY

Date	Type	IS	ID	Cd.	Purpose/Result
3/18/2015			CW	SQ	Sales questionaire returne

LAND LINE VALUATION SECTION

B #	Use Code	Use Description	Zone	D	Frontage	Depth	Units		Unit Price	I. Factor	S.A.	Acre Disc	C. Factor	ST. Idx	Adj.	Notes- Adj	Special Pricing	Adj. Unit Price	Land Value
1	4400	Vacant Land Dev	I				43,560	SF	3.36	1.00	A	1.0000	1.00	0500	1.40	SITE SIZE = 50% COVERA(		4.70	204,900
1	4400	Vacant Land Dev					1.26	AC	146,400.00	1.00	0	1.0000	0.75	0500	1.40	TOPO		153,720.00	193,700
1	4400	Vacant Land Dev	I				2.26	AC	10,000.00	1.00	0	1.0000	0.75		0.00	TOPO		7,500.00	17,000
						Total Card Land Units:	4.52	AC	Parcel Total Land Area:	196,892 SF								Total Land Value:	415,600

ABUTTERS LISTING for 29 S HUNT RD 95/15A 300 FT
AMESBURY, MA

AV PID	Map	Lot	Unit	Location	Owner's Name	Co_Owner's Name	Address	City	ST Zip	Book/Page
101002	96	9	A	25 S HUNT RD	AMESBURY CITY OF		62 FRIEND ST	AMESBURY	MA 01913	15802/ 250
5130	96	8		27 S HUNT RD	NOEL, ROY A & KIMBERLY R LOWEL	TRUSTEES A NOEL ROY LIVING TRU	119 MAIN AVENUE	S HAMPTON	NH 03827	13408/ 482
5125	96	6		31 S HUNT RD	MARILANE LLC	C/O MERRIMAC REAL ESTATE LLC	1 ASHLEY LANE	MERRIMAC	MA 01860	22293/ 552
5124	96	5		33 S HUNT RD	LIGUORI ELIZABETH A	JOSEPH A BARBONE JR TRUSTEES	9 KINGSBURY AVE	BRADFORD	MA 01835	DOC330330
5783	96	4		34 S HUNT RD	THREE PINES LLC		34 S HUNT RD	AMESBURY	MA 01913	16338/ 191
5127	95	15		37 S HUNT RD	37 S HUNT RD, LLC		37 S HUNT RD	AMESBURY	MA 01913	30952/ 189
5123	95	14		39 S HUNT RD	AMESBURY CITY OF	C/O MAYORS OFFICE	62 FRIEND ST	AMESBURY	MA 01913	31726/ 152
5787	95	5		56 S HUNT RD	SCA DISPOSAL SERVICES OF NE	C/O WASTE MANAGEMENT	PO BOX 1450	CHICAGO	IL 60690	05870/0009

Parcel Count: 8

THE BOARD OF ASSESSORS OF THE TOWN OF AMESBURY, MA HEREBY CERTIFIES THAT THIS LIST OF ABUTTERS IS THE MOST RECENT APPLICABLE TAX LIST AS REQUIRED BY CHAPTER 40A, SECTION 11 OF THE MASSACHUSETTS GENERAL LAWS AS AMENDED.

Mary E. Manville

August 5. 2015

101002
AMESBURY CITY OF
62 FRIEND ST
AMESBURY, MA 01913

5130
NOEL, ROY A & KIMBERLY R LOWELL
TRUSTEES A NOEL ROY LIVING TRU
119 MAIN AVENUE
S HAMPTON, NH 03827

5125
MARILANE LLC
C/O MERRIMAC REAL ESTATE LLC
1 ASHLEY LANE
MERRIMAC, MA 01860

5124
LIGUORI ELIZABETH A
JOSEPH A BARBONE JR TRUSTEES
9 KINGSBURY AVE
BRADFORD, MA 01835

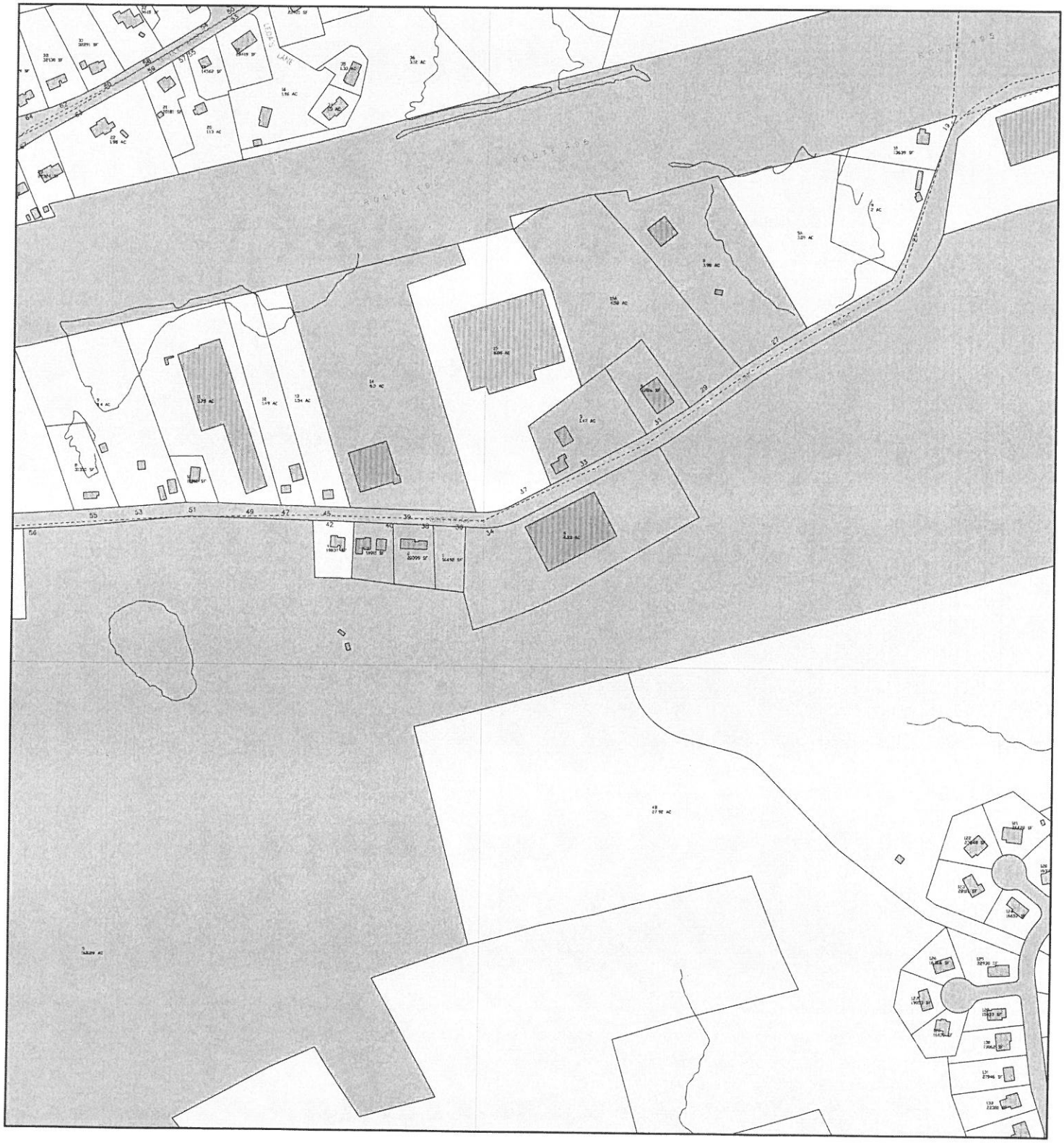
5783
THREE PINES LLC
34 S HUNT RD
AMESBURY, MA 01913

5127
37 S HUNT RD, LLC
37 S HUNT RD
AMESBURY, MA 01913

5123
AMESBURY CITY OF
C/O MAYORS OFFICE
62 FRIEND ST
TOWN HALL
AMESBURY, MA 01913

5787
SCA DISPOSAL SERVICES OF NE
C/O WASTE MANAGEMENT
PO BOX 1450
CHICAGO, IL 60690

37 S HUNT RD 95/15 300 FT



Information on this Map is Compiled and Maintained for Assessing Purposes Only

GEOGRAPHIC INFORMATION SYSTEM
VISION APPRAISAL TECHNOLOGY

N

Property Location: 37 S HUNT RD | MAP ID: 95/ / 15/ / | Bldg Name: | State Use: 4022
Vision ID: 5127 | Account # | Bldg #: 1 of 1 | Sec #: 1 of 1 | Card 1 of 1 | Print Date: 08/05/2015 11:30

CURRENT OWNER	TOPO.	UTILITIES	STRT./ROAD	LOCATION
37 S HUNT RD, LLC		1 All Public	1 Paved	1 Urban
37 S HUNT RD	4 Rolling			5 Industrial
AMESBURY, MA 01913				
Additional Owners:				

SUPPLEMENTAL DATA

Other ID:	00054 00000 00025A	Use Change	
Sub-Div	F00 F03	Original Lot	
Spec.Cond.	F02	NOTES	3/07 FOR RENT 4.95 NNN
OWNER OCCU		STYLE	
ABC		CHAPTER L	
NUMBER	F01;09/140 2010/130/FY		
GIS ID: 5127		ASSOC PID#	

CURRENT ASSESSMENT

Description	Code	Appraised Value	Assessed Value
INDUSTR.	4022	3,491,500	3,491,500
IND LAND	4022	1,117,400	1,117,400
INDUSTR.	4022	190,300	190,300
	Total	4,799,200	4,799,200

101 AMESBURY, MA

VISION

RECORD OF OWNERSHIP

	BK-VOL/PAGE	SALE DATE	q/u	v/i	SALE PRICE	V.C.
37 S HUNT RD, LLC	30952/ 189	12/22/2011	Q	I	4,775,000	00
STAG III AMESBURY LLC	DOC 483669	10/23/2007	U	I	5,700,000	1C
RLS REALTY LLC	DOC366261	01/27/2000	U	V	360,315	1G
AMESBURY IND FNDTN	11024/0244	11/21/1991	U	I	300,000	1B

PREVIOUS ASSESSMENTS (HISTORY)

Yr.	Code	Assessed Value	Yr.	Code	Assessed Value	Yr.	Code	Assessed Value
2015	4022	3,293,600	2014	4022	3,256,500	2013	4022	2,938,000
2015	4022	1,117,400	2014	4022	1,117,400	2013	4022	1,224,800
2015	4022	190,300	2014	4022	190,300	2013	4022	56,100
	Total:	4,601,300		Total:	4,564,200		Total:	4,218,900

EXEMPTIONS

Year	Type	Description	Amount
		Total:	

OTHER ASSESSMENTS

Code	Description	Number	Amount	Comm. Int.

This signature acknowledges a visit by a Data Collector or Assessor

ASSESSING NEIGHBORHOOD

NBHD/ SUB	NBHD NAME	STREET INDEX NAME	TRACING	BATCH
0001/A				

NOTES

CK FY16 - 28X36 GARAGE
3/07 FOR RENT 18040 SF 4.95 NNN
ANDREW
BLDG FOR SUB-LEASE OR SALE 978-373-3897
ELECTRONIC RECYCLING
AREA CHG LOT 2A PLAN 410/5 10/4/07

APPRAISED VALUE SUMMARY

Appraised Bldg. Value (Card)	3,432,400
Appraised XF (B) Value (Bldg)	59,100
Appraised OB (L) Value (Bldg)	190,300
Appraised Land Value (Bldg)	1,117,400
Special Land Value	0
Total Appraised Parcel Value	4,799,200
Valuation Method:	C
Adjustment:	0
Net Total Appraised Parcel Value	4,799,200

BUILDING PERMIT RECORD

Permit ID	Issue Date	Type	Description	Amount	Insp. Date	% Comp.	Date Comp.	Comments
20130868	10/17/2013	CM	Commercial	306,000		0		INTERIOR PETITIONS
20130867	10/17/2013	NC	New Construct	15,940		0		MAINTENANCE SHED
01-166	09/19/2000	CM	Commercial	8,658	06/26/2001	100	10/30/2000	FREE STANDING SIGN
01-114	08/28/2000	AD	Addition	44,000	07/14/2000	100	06/30/2000	INST. PAINT RM
00-392	03/10/2000	NC	New Construct	1,950,000	07/14/2000	100	06/30/2000	MANUC.FACILITY
00-291	11/18/1999	NC	New Construct	19,000	07/14/2000	100	06/30/2000	NEW MANUF. FACILI
92-D8	09/15/1992	DE	Demolish	0		0		DEMOLITION

VISIT/ CHANGE HISTORY

Date	Type	IS	ID	Cd.	Purpose/Result
4/22/2014			CL	EI	Exterior Inspection
3/7/2007			RD	01	Measur+1Visit
3/7/2007			RD	02	Measur+2Visit - Info Car
6/26/2001			HF	BP	Building Permit
7/14/2000			HF	RS	Review Sale

LAND LINE VALUATION SECTION

B #	Use Code	Use Description	Zone	D	Frontage	Depth	Units		Unit Price	I. Factor	S.A.	Acre Disc	C. Factor	ST. Idx	Adj.	Notes- Adj	Special Pricing	Adj. Unit Price	Land Value
1	4022	Industrial Building	I		326		43,560	SF	3.36	1.00	A	1.0000	1.00	0500	1.40	SITE SIZE = 3X L/B		4.70	204,900
1	4022	Industrial Building	I				4.42	AC	146,400.00	1.00	0	1.0000	1.00	0500	1.40			204,960.00	905,900
1	4022	Industrial Building					0.66	AC	10,000.00	1.00	0	1.0000	1.00		0.00			10,000.00	6,600

Total Card Land Units: 6.08 AC | Parcel Total Land Area: 264,845 SF | Total Land Value: 1,117,400

ABUTTERS LISTING for 37 S HUNT RD 95/15 300 FT
AMESBURY, MA

AV PID	Map	Lot	Unit	Location	Owner's Name	Co_Owner's Name	Address	City	ST Zip	Book/Page
5130	96	8		27 S HUNT RD	NOEL, ROY A & KIMBERLY R LOWEL	TRUSTEES A NOEL ROY LIVING TRU	119 MAIN AVENUE	S HAMPTON	NH 03827	13408/ 482
104222	95	15	A	29 S HUNT RD	BARTLEY RICHARD J JR & LUCY M	C/O 37 SOUTH HUNT ROAD LLC	37 SOUTH HUNT ROAD	AMESBURY	MA 01913	DOC 485248
5125	96	6		31 S HUNT RD	MARILANE LLC	C/O MERRIMAC REAL ESTATE LLC	1 ASHLEY LANE	MERRIMAC	MA 01860	22293/ 552
5124	96	5		33 S HUNT RD	LIGUORI ELIZABETH A	JOSEPH A BARBONE JR TRUSTEES	9 KINGSBURY AVE	BRADFORD	MA 01835	DOC330330
5783	96	4		34 S HUNT RD	THREE PINES LLC		34 S HUNT RD	AMESBURY	MA 01913	16338/ 191
5854	95	1		36 S HUNT RD	KIBILDIS ROBERT G & ALICE T, T	KIBILDIS REALTY TRUST	38 S HUNT RD	AMESBURY	MA 01913	27329/ 555
5785	95	2		38 S HUNT RD	KIBILDIS ROBERT G & ALICE T TR	KIBILDIS REALTY TRUST	38 S HUNT RD	AMESBURY	MA 01913	27329/ 554
5123	95	14		39 S HUNT RD	AMESBURY CITY OF	C/O MAYORS OFFICE	62 FRIEND ST	AMESBURY	MA 01913	31726/ 152
5855	95	3		40 S HUNT RD	HRENCECIN CHAD D		40 S HUNT RD	AMESBURY	MA 01913	26698/ 129
5787	95	5		56 S HUNT RD	SCA DISPOSAL SERVICES OF NE	C/O WASTE MANAGEMENT	PO BOX 1450	CHICAGO	IL 60690	05870/0009

Parcel Count: 10

THE BOARD OF ASSESSORS OF THE TOWN OF AMESBURY, MA HEREBY CERTIFIES THAT THIS LIST OF ABUTTERS IS THE MOST RECENT APPLICABLE TAX LIST AS REQUIRED BY CHAPTER 40A, SECTION 11 OF THE MASSACHUSETTS GENERAL LAWS AS AMENDED

Mary E Maurice

August 5, 2015

5130
NOEL, ROY A & KIMBERLY R LOWELL
TRUSTEES A NOEL ROY LIVING TRU
119 MAIN AVENUE
S HAMPTON, NH 03827

104222
BARTLEY RICHARD J JR & LUCY M TRS
C/O 37 SOUTH HUNT ROAD LLC
37 SOUTH HUNT ROAD
AMESBURY, MA 01913

5125
MARILANE LLC
C/O MERRIMAC REAL ESTATE LLC
1 ASHLEY LANE
MERRIMAC, MA 01860

5124
LIGUORI ELIZABETH A
JOSEPH A BARBONE JR TRUSTEES
9 KINGSBURY AVE
BRADFORD, MA 01835

5783
THREE PINES LLC
34 S HUNT RD
AMESBURY, MA 01913

5854
KIBILDIS ROBERT G & ALICE T, TRS
KIBILDIS REALTY TRUST
38 S HUNT RD
AMESBURY, MA 01913

5785
KIBILDIS ROBERT G & ALICE T TRS
KIBILDIS REALTY TRUST
38 S HUNT RD
AMESBURY, MA 01913

5123
AMESBURY CITY OF
C/O MAYORS OFFICE
62 FRIEND ST
TOWN HALL
AMESBURY, MA 01913

5855
HRENCECIN CHAD D
40 S HUNT RD
AMESBURY, MA 01913

5787
SCA DISPOSAL SERVICES OF NE
C/O WASTE MANAGEMENT
PO BOX 1450
CHICAGO, IL 60690

Amesbury

Community & Economic Development
Planning – Conservation – Appeals
Tel: (978) 388-8110
Fax: (978) 388-6727

62 Friend Street
Second Floor
Amesbury, MA 01913

ABUTTER NOTIFICATION
POSTAGE FEES

The following is the formula used for determining the postage costs for each application:

Number of Certified Abutters
(including applicant and representative) 11 x .98 = 10.78

TOTAL AMOUNT OWED FOR POSTAGE: $ 10.78

Please remit a check payable to the **City of Amesbury** for the total amount owed for postage. Also, please be advised that your postage fee must be paid prior to you being scheduled for a meeting date.

NOTE: Postage fee subject to change with postage increase.

Effective date: 02/27/2009
Revised: January 2014

Note: there are multiple duplicates due to the side by side parcels. The number of abutters is based on sending the notice to each abutter only once.

1074

37 SOUTH HUNT ROAD LLC
37 S HUNT RD
AMESBURY, MA 01913

53-179-113

DATE 27 AUG 2015

PAY TO THE ORDER OF CITY OF AMESBURY $ 10.97

TEN DOLLARS 97/100 DOLLARS

Security Features Included. Details on Back.

Eastern Bank
Boston, MA 02110
easternbank.com
1-800-EASTERN

FOR _____

MP

⑈001074⑈ ⑆011301798⑆ 0600775134⑈

Stormwater Analysis

Project #14061

Arc Technologies
37 South Hunt Road
Amesbury, Ma.

W.C. Cammett Engineering, Inc.
297 Elm Street - Amesbury, MA
Date: 08/24/15

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICIES

SITE DESCRIPTION

GENERAL

The 3.1 ± acre project site (SITE) is located at 29&37 South Hunt Road in Amesbury, Ma. 37 Hunt Road is developed with an Industrial building with associated parking and utilities. Tha abutting parcel, 29 South Hunt Road, is undeveloped primarily comprised of a scrub shrub vegetation area and the remaining area is lightly wooded. Both parcels are nearly level for the majority of the site with sloping areas down to abutting properties. There is an area of Bordering vegetated wetlands at the bottom of slope near South Hunt Road. A municipal sewer pumping station esxists on the street frontage for 29 South Hunt Road.

Slopes on the Site range from 3% to 33%. Soils on the Site are comprised of Windsor, a loamy sand, hydrologic group A, Hinckley, a loamy sand, hydrologic group A and Whately, hydrologic group C, a silt loam. These soil types are from the NRCS, of the USDA. See Appendix B. Based on actual deep observation holes conducted on-site, actual soil conditions verify the mapped soil types. Bordering vegetated wetlands (BVW) are present at the southeasterly corner of the site along South Hunt Road.

PRE-DEVELOPMENT DRAINAGE CONDITIONS

The site consists of six drainage subcatchment areas for stormwater analysis purposes, E1, to E6. Each subcatchment is runoff to abbuters and to the existing infiltration basin located on 37 South Hunt Road parcel. Refer to the Pre-Development Drainage Zone Map Figure 1.

PROJECT DESCRIPTION

GENERAL

The proposed project is for construction of an addition to the existing building along with an access drive and additional parking. The proposed access drive and parking will be constructed with porous pavement. Each subcatchment from D1 to D6 corresponds to the existing subcatchments E1 to E6. Subcatchment D8 is the roof area that discharges into the proposed infiltration basin wich is analyzed as subcatchment D7. All the area that drain to the porous pavement is subcatchment D9. Refer to Figure 2, Developed Drainage Zones, for a summary of the proposed drainage subcatchments and their locations.

STORMWATER MANAGEMENT SYSTEM

The stormwater management system includes areas of porous pavement.

The basis of the overall design of the system is to safely control stormwater runoff from the proposed development including peak rate and volume of runoff. The runoff from the rooftop is directed to the proposed infiltration basin. The proposed parking area/access drives is captured and infiltrated to the ground using porous pavement.

Refer to the site plans for specific details related to each stormwater component.

POST-DEVELOPMENT DRAINAGE CONDITIONS

Drainage patterns resulting from the proposed development are delineated on Figure 2, *Development Drainage Zones*. The site consists of 9 post-developed subcatchment areas.

Exfiltration rate for the porous pavement base and the infiltration basin utilized in the calculations is 2.41 in/hr for the Hydrologic Group A Soils underlaying these structures.

The porous pavement is modeled to accept all of the runoff from subcatchment D9. To do this, an evaluation of the "runoff" that is penetrating through the pavement is required. To evaluate this runoff in the drainage model, a Curve Number of 50 is used to evaluate water hitting the porous pavement. The water will take time to travel through the base layers of the access drive before ponding in the Reservoir Course.
Reference: "Urban Waterways" Permeable Pavement: Research Update and Design Implications, fron North Carolina Cooperative Extension Service,

DESIGN OBJECTIVES / METHODOLOGY

STORMWATER MANAGEMENT SYSTEM

The drainage system was designed to accommodate runoff resulting from 2, 10, 25, and 100 year frequency design storms. The general pattern of the runoff from the Site will remain similar to existing conditions, with runoff generally flowing, under certain storm conditions, to locations identified at each discharge point where stormwaterflows offsite.

RUNOFF QUANTIFICATION

The stormwater analysis was performed using pre-and post-development site criteria to estimate the effects of the proposed development on stormwater runoff conditions. Stormwater runoff rates and volumes were calculated for the 2, 10, 25, and 100 year design storm events. The analysis was performed using HydroCAD^{tm,} a computerized stormwater modeling system that combines SCS hydrology techniques with standard hydraulic equations.

Total site runoff figures were obtained by summing hydrographs and not by direct addition of peak flows from individual subcatchments. Since peak flows from the individual subcatchments occur at different times, the total runoff figure listed may not equal the sum of the individual peak flows from the various subcatchments. This method provides a more realistic total flow figure than that obtained by direct addition of peak flows.

SUMMARY

STORMWATER RUNOFF COMPARISON

The following tables summarize hydrologic conditions resulting from pre and post development peak storm water runoff.

Table 1: Comparison Point Peak Runoff
2 Year Storm

Site Condition	Runoff Rate (CFS)		Runoff Volume (AF)	
Location	Pre-Dev	Post-Dev	Pre-Dev	Post-Dev
E1/D1	0.0	0.0	0.0	0.0
E2/D2	0.0	0.0	0.0	0.0
E3/D3	0.0	0.0	0.0	0.0
E4/D4	0.0	0.0	0.0	0.0
E5/D5	0.0	0.0	0.0	0.0
E6/D6	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0

Table 2: Comparison Point Peak Runoff
10 Year Storm

Site Condition	Runoff Rate (CFS)		Runoff Volume (AF)	
Location	**Pre-Dev**	**Post-Dev**	**Pre-Dev**	**Post-Dev**
E1/D1	0.0	0.0	0.01	0.0
E2/D2	0.0	0.0	0.0	0.0
E3/D3	0.0	0.0	0.0	0.0
E4/D4	0.0	0.0	0.0	0.0
E5/D5	0.0	0.0	0.0	0.0
E6/D6	0.0	0.0	.001	.001
TOTAL	0.0	0.0	0.002	0.001

Table 3: Comparison Point Peak Runoff
25 Year Storm

Site Condition	Runoff Rate (CFS)		Runoff Volume (AF)	
Location	**Pre-Dev**	**Post-Dev**	**Pre-Dev**	**Post-Dev**
E1/D1	0.01	0.0	0.002	0.0
E2/D2	0.0	0.0	0.0	0.0
E3/D3	0.0	0.0	0.0	0.0
E4/D4	0.01	0.0	0.003	0.0
E5/D5	0.0	0.0	0.0	0.0
E6/D6	0.01	0.01	0.002	0.002
TOTAL	0.03	0.01	0.007	0.002

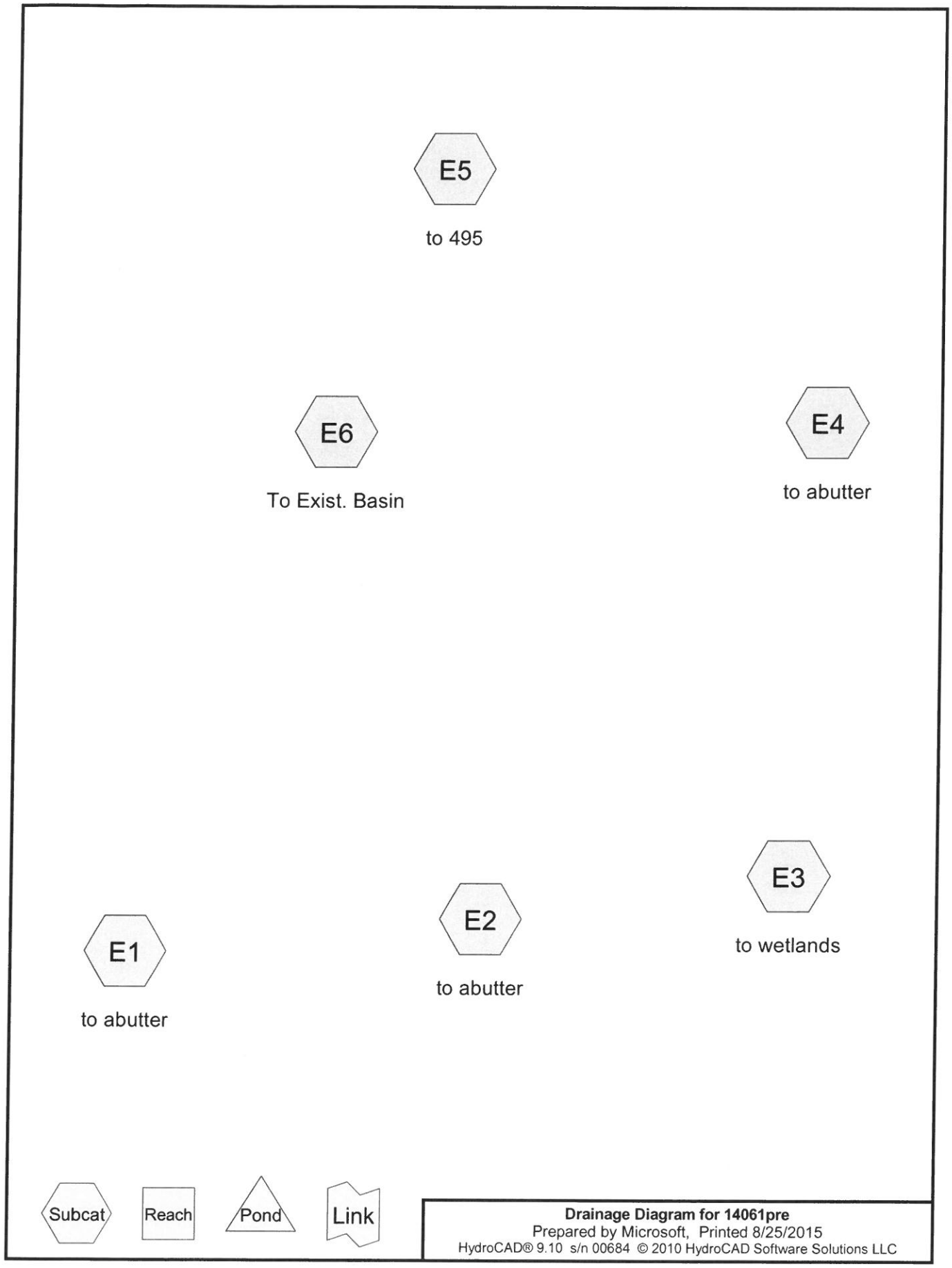
Table 4: Comparison Point Peak Runoff
100 Year Storm

Site Condition	Runoff Rate (CFS)		Runoff Volume (AF)	
Location	**Pre-Dev**	**Post-Dev**	**Pre-Dev**	**Post-Dev**
E1/D1	0.04	0.0	0.012	0.001
E2/D2	0.01	0.0	0.004	0.001
E3/D3	0.01	0.1	0.004	0.003
E4/D4	0.07	0.01	0.032	0.004
E5/D5	0.0	0.0	0.001	0.001
E6/D6	0.05	0.03	0.012	0.004
TOTAL	0.18	0.05	0.065	0.014

Note:

Developed drainage zones D7 and D8 flow to the proposed infiltration basin and no runoff leaves the site for up to and including the 100 year storm event. The entire volume infiltrates into the soil.

Developed drainage zone D9 flows to the porous pavement area and there is no runoff leaving the site for up to and including the 100 year storm event. The entire volume infiltrates into the soil.



Drainage Diagram for 14061pre
Prepared by Microsoft, Printed 8/25/2015
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.865	30	Woods, Good, HSG A (E1, E2, E3, E4, E5, E6)
0.807	35	Brush, Fair, HSG A (E4, E6)
0.184	39	>75% Grass cover, Good, HSG A (E1)
3.856		**TOTAL AREA**

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: to abutter Runoff Area=0.443 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=180' Slope=0.0050 '/' Tc=27.9 min CN=34 Runoff=0.00 cfs 0.000 af

Subcatchment E2: to abutter Runoff Area=0.389 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E3: to wetlands Runoff Area=0.350 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E4: to abutter Runoff Area=2.123 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=350' Slope=0.0050 '/' Tc=13.3 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment E5: to 495 Runoff Area=0.115 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E6: To Exist. Basin Runoff Area=0.436 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=125' Tc=6.1 min CN=34 Runoff=0.00 cfs 0.000 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
100.00% Pervious = 3.856 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1: to abutter

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.10"

Area (ac)	CN	Description
0.259	30	Woods, Good, HSG A
0.184	39	>75% Grass cover, Good, HSG A
0.443	34	Weighted Average
0.443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
6.1	130	0.0050	0.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.9	180	Total			

Summary for Subcatchment E2: to abutter

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.10"

Area (ac)	CN	Description
0.389	30	Woods, Good, HSG A
0.389		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
9.4	200	0.0050	0.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
31.2	250	Total			

Summary for Subcatchment E3: to wetlands

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.10"

Area (ac)	CN	Description
0.350	30	Woods, Good, HSG A
0.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
9.4	200	0.0050	0.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
31.2	250	Total			

Summary for Subcatchment E4: to abutter

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.10"

Area (ac)	CN	Description
1.651	30	Woods, Good, HSG A
0.472	35	Brush, Fair, HSG A
2.123	31	Weighted Average
2.123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.0050	0.09		**Sheet Flow,** Range n= 0.130 P2= 3.10"
4.4	300	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.3	350	Total			

Summary for Subcatchment E5: to 495

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.10"

Area (ac)	CN	Description
0.115	30	Woods, Good, HSG A
0.115		100.00% Pervious Area

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

Summary for Subcatchment E6: To Exist. Basin

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.10"

Area (ac)	CN	Description
0.101	30	Woods, Good, HSG A
0.335	35	Brush, Fair, HSG A
0.436	34	Weighted Average
0.436		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	25	0.0050	0.08		**Sheet Flow,** Range n= 0.130 P2= 3.10"
1.0	100	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.1	125	Total			

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: to abutter Runoff Area=0.443 ac 0.00% Impervious Runoff Depth>0.02"
Flow Length=180' Slope=0.0050 '/' Tc=27.9 min CN=34 Runoff=0.00 cfs 0.001 af

Subcatchment E2: to abutter Runoff Area=0.389 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E3: to wetlands Runoff Area=0.350 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E4: to abutter Runoff Area=2.123 ac 0.00% Impervious Runoff Depth>0.00"
Flow Length=350' Slope=0.0050 '/' Tc=13.3 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment E5: to 495 Runoff Area=0.115 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E6: To Exist. Basin Runoff Area=0.436 ac 0.00% Impervious Runoff Depth>0.02"
Flow Length=125' Tc=6.1 min CN=34 Runoff=0.00 cfs 0.001 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.002 af Average Runoff Depth = 0.00"
100.00% Pervious = 3.856 ac 0.00% Impervious = 0.000 ac

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: to abutter Runoff Area=0.443 ac 0.00% Impervious Runoff Depth>0.07"
Flow Length=180' Slope=0.0050 '/' Tc=27.9 min CN=34 Runoff=0.01 cfs 0.002 af

Subcatchment E2: to abutter Runoff Area=0.389 ac 0.00% Impervious Runoff Depth>0.01"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E3: to wetlands Runoff Area=0.350 ac 0.00% Impervious Runoff Depth>0.01"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E4: to abutter Runoff Area=2.123 ac 0.00% Impervious Runoff Depth>0.02"
Flow Length=350' Slope=0.0050 '/' Tc=13.3 min CN=31 Runoff=0.01 cfs 0.003 af

Subcatchment E5: to 495 Runoff Area=0.115 ac 0.00% Impervious Runoff Depth>0.01"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E6: To Exist. Basin Runoff Area=0.436 ac 0.00% Impervious Runoff Depth>0.07"
Flow Length=125' Tc=6.1 min CN=34 Runoff=0.01 cfs 0.002 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.008 af Average Runoff Depth = 0.03"
100.00% Pervious = 3.856 ac 0.00% Impervious = 0.000 ac

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: to abutter Runoff Area=0.443 ac 0.00% Impervious Runoff Depth>0.32"
Flow Length=180' Slope=0.0050 '/' Tc=27.9 min CN=34 Runoff=0.04 cfs 0.012 af

Subcatchment E2: to abutter Runoff Area=0.389 ac 0.00% Impervious Runoff Depth>0.14"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.01 cfs 0.004 af

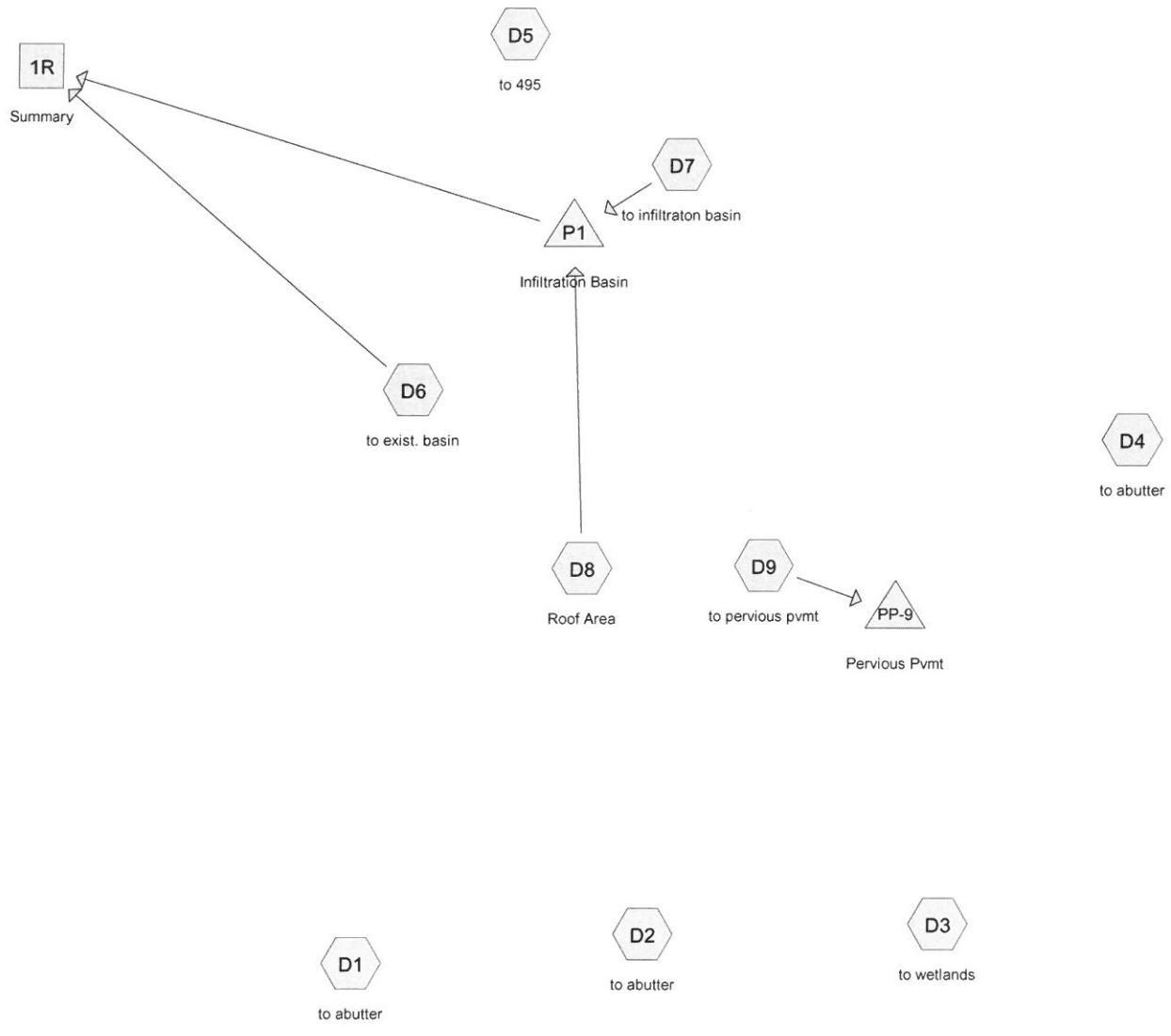
Subcatchment E3: to wetlands Runoff Area=0.350 ac 0.00% Impervious Runoff Depth>0.14"
Flow Length=250' Slope=0.0050 '/' Tc=31.2 min CN=30 Runoff=0.01 cfs 0.004 af

Subcatchment E4: to abutter Runoff Area=2.123 ac 0.00% Impervious Runoff Depth>0.18"
Flow Length=350' Slope=0.0050 '/' Tc=13.3 min CN=31 Runoff=0.07 cfs 0.032 af

Subcatchment E5: to 495 Runoff Area=0.115 ac 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment E6: To Exist. Basin Runoff Area=0.436 ac 0.00% Impervious Runoff Depth>0.32"
Flow Length=125' Tc=6.1 min CN=34 Runoff=0.05 cfs 0.012 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.065 af Average Runoff Depth = 0.20"
100.00% Pervious = 3.856 ac 0.00% Impervious = 0.000 ac



Subcat Reach Pond Link

Drainage Diagram for 14061post
Prepared by Microsoft, Printed 8/25/2015
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.368	30	Woods, Good, HSG A (D1, D4, D5)
0.116	32	Woods/grass comb., Good, HSG A (D3)
0.029	35	Brush, Fair, HSG A (D2)
0.879	39	>75% Grass cover, Good, HSG A (D6, D7, D9)
0.874	50	Pervious pavement (D9)
1.582	98	Roofs, HSG A (D8)
0.008	98	Sidewalks, HSG A (D9)
3.856		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to abutter Runoff Area=0.033 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D2: to abutter Runoff Area=0.029 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0.000 af

Subcatchment D3: to wetlands Runoff Area=0.116 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment D4: to abutter Runoff Area=0.256 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D5: to 495 Runoff Area=0.079 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D6: to exist. basin Runoff Area=0.071 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment D7: to infiltraton basin Runoff Area=0.331 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment D8: Roof Area Runoff Area=1.582 ac 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=4.65 cfs 0.378 af

Subcatchment D9: to pervious pvmt Runoff Area=1.359 ac 0.59% Impervious Runoff Depth>0.05"
Tc=6.0 min CN=46 Runoff=0.01 cfs 0.005 af

Reach 1R: Summary Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond P1: Infiltration Basin Peak Elev=98.76' Storage=8,139 cf Inflow=4.65 cfs 0.378 af
Discarded=0.29 cfs 0.316 af Primary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.316 af

Pond PP-9: Pervious Pvmt Peak Elev=101.00' Storage=0 cf Inflow=0.01 cfs 0.005 af
Outflow=0.01 cfs 0.005 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.383 af Average Runoff Depth = 1.19"
58.77% Pervious = 2.266 ac 41.23% Impervious = 1.590 ac

Summary for Subcatchment D1: to abutter

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.033	30	Woods, Good, HSG A
0.033		100.00% Pervious Area

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

Summary for Subcatchment D2: to abutter

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.029	35	Brush, Fair, HSG A
0.029		100.00% Pervious Area

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

Summary for Subcatchment D3: to wetlands

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.116	32	Woods/grass comb., Good, HSG A
0.116		100.00% Pervious Area

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

Summary for Subcatchment D4: to abutter

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.256	30	Woods, Good, HSG A
0.256		100.00% Pervious Area

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

Summary for Subcatchment D5: to 495

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.079	30	Woods, Good, HSG A
0.079		100.00% Pervious Area

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

Summary for Subcatchment D6: to exist. basin

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.071	39	>75% Grass cover, Good, HSG A
0.071		100.00% Pervious Area

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

Summary for Subcatchment D7: to infiltraton basin

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
0.331	39	>75% Grass cover, Good, HSG A
0.331		100.00% Pervious Area

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

Summary for Subcatchment D8: Roof Area

Runoff = 4.65 cfs @ 12.09 hrs, Volume= 0.378 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (ac)	CN	Description
1.582	98	Roofs, HSG A
1.582		100.00% Impervious Area

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

Summary for Subcatchment D9: to pervious pvmt

Runoff = 0.01 cfs @ 15.28 hrs, Volume= 0.005 af, Depth> 0.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (ac)	CN	Description
*	0.874	50	Pervious pavement
	0.477	39	>75% Grass cover, Good, HSG A
*	0.008	98	Sidewalks, HSG A
	1.359	46	Weighted Average
	1.351		99.41% Pervious Area
	0.008		0.59% Impervious Area

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

Summary for Reach 1R: Summary

Inflow Area = 1.984 ac, 79.74% Impervious, Inflow Depth = 0.00" for 2 Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond P1: Infiltration Basin

Inflow Area = 1.913 ac, 82.70% Impervious, Inflow Depth > 2.37" for 2 Year event
Inflow = 4.65 cfs @ 12.09 hrs, Volume= 0.378 af
Outflow = 0.29 cfs @ 13.72 hrs, Volume= 0.316 af, Atten= 94%, Lag= 97.7 min
Discarded = 0.29 cfs @ 13.72 hrs, Volume= 0.316 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 98.76' @ 13.72 hrs Surf.Area= 5,115 sf Storage= 8,139 cf

Plug-Flow detention time= 254.0 min calculated for 0.315 af (83% of inflow)
Center-of-Mass det. time= 186.6 min (943.3 - 756.6)

Volume	Invert	Avail.Storage	Storage Description
#1	96.49'	42,205 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.49	0	0	0
96.50	2,022	10	10
98.00	4,115	4,603	4,613
100.00	6,731	10,846	15,459
102.00	9,550	16,281	31,740
103.00	11,380	10,465	42,205

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.49'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	101.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	103.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.29 cfs @ 13.72 hrs HW=98.76' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=96.49' TW=0.00' (Dynamic Tailwater)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond PP-9: Pervious Pvmt

Inflow Area = 1.359 ac, 0.59% Impervious, Inflow Depth > 0.05" for 2 Year event
Inflow = 0.01 cfs @ 15.28 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 15.28 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.01 cfs @ 15.28 hrs, Volume= 0.005 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 101.00' @ 0.00 hrs Surf.Area= 37,810 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	10,133 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
101.00	37,810	0.0	0	0
101.67	37,810	40.0	10,133	10,133

Device	Routing	Invert	Outlet Devices
#1	Discarded	101.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 15.28 hrs HW=101.00' (Free Discharge)
↑**1=Exfiltration** (Passes 0.00 cfs of 2.11 cfs potential flow)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to abutter Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D2: to abutter Runoff Area=0.029 ac 0.00% Impervious Runoff Depth>0.05"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0.000 af

Subcatchment D3: to wetlands Runoff Area=0.116 ac 0.00% Impervious Runoff Depth>0.01"
Tc=6.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment D4: to abutter Runoff Area=0.256 ac 0.00% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D5: to 495 Runoff Area=0.079 ac 0.00% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D6: to exist. basin Runoff Area=0.071 ac 0.00% Impervious Runoff Depth>0.15"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.001 af

Subcatchment D7: to infiltraton basin Runoff Area=0.331 ac 0.00% Impervious Runoff Depth>0.15"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.004 af

Subcatchment D8: Roof Area Runoff Area=1.582 ac 100.00% Impervious Runoff Depth>4.51"
Tc=6.0 min CN=98 Runoff=7.17 cfs 0.595 af

Subcatchment D9: to pervious pvmt Runoff Area=1.359 ac 0.59% Impervious Runoff Depth>0.41"
Tc=6.0 min CN=46 Runoff=0.24 cfs 0.046 af

Reach 1R: Summary Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Pond P1: Infiltration Basin Peak Elev=99.80' Storage=14,150 cf Inflow=7.17 cfs 0.599 af
Discarded=0.36 cfs 0.422 af Primary=0.00 cfs 0.000 af Outflow=0.36 cfs 0.422 af

Pond PP-9: Pervious Pvmt Peak Elev=101.00' Storage=0 cf Inflow=0.24 cfs 0.046 af
Outflow=0.24 cfs 0.046 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.646 af Average Runoff Depth = 2.01"
58.77% Pervious = 2.266 ac 41.23% Impervious = 1.590 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to abutter Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>0.02"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D2: to abutter Runoff Area=0.029 ac 0.00% Impervious Runoff Depth>0.12"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0.000 af

Subcatchment D3: to wetlands Runoff Area=0.116 ac 0.00% Impervious Runoff Depth>0.05"
Tc=6.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment D4: to abutter Runoff Area=0.256 ac 0.00% Impervious Runoff Depth>0.02"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D5: to 495 Runoff Area=0.079 ac 0.00% Impervious Runoff Depth>0.02"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment D6: to exist. basin Runoff Area=0.071 ac 0.00% Impervious Runoff Depth>0.26"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment D7: to infiltraton basin Runoff Area=0.331 ac 0.00% Impervious Runoff Depth>0.26"
Tc=6.0 min CN=39 Runoff=0.02 cfs 0.007 af

Subcatchment D8: Roof Area Runoff Area=1.582 ac 100.00% Impervious Runoff Depth>5.06"
Tc=6.0 min CN=98 Runoff=8.01 cfs 0.667 af

Subcatchment D9: to pervious pvmt Runoff Area=1.359 ac 0.59% Impervious Runoff Depth>0.59"
Tc=6.0 min CN=46 Runoff=0.46 cfs 0.067 af

Reach 1R: Summary Inflow=0.01 cfs 0.002 af
Outflow=0.01 cfs 0.002 af

Pond P1: Infiltration Basin Peak Elev=100.12' Storage=16,289 cf Inflow=8.01 cfs 0.674 af
Discarded=0.39 cfs 0.454 af Primary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.454 af

Pond PP-9: Pervious Pvmt Peak Elev=101.00' Storage=0 cf Inflow=0.46 cfs 0.067 af
Outflow=0.46 cfs 0.067 af

Total Runoff Area = 3.856 ac Runoff Volume = 0.744 af Average Runoff Depth = 2.32"
58.77% Pervious = 2.266 ac 41.23% Impervious = 1.590 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to abutter Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>0.19"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment D2: to abutter Runoff Area=0.029 ac 0.00% Impervious Runoff Depth>0.45"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0.001 af

Subcatchment D3: to wetlands Runoff Area=0.116 ac 0.00% Impervious Runoff Depth>0.28"
Tc=6.0 min CN=32 Runoff=0.01 cfs 0.003 af

Subcatchment D4: to abutter Runoff Area=0.256 ac 0.00% Impervious Runoff Depth>0.19"
Tc=6.0 min CN=30 Runoff=0.01 cfs 0.004 af

Subcatchment D5: to 495 Runoff Area=0.079 ac 0.00% Impervious Runoff Depth>0.19"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment D6: to exist. basin Runoff Area=0.071 ac 0.00% Impervious Runoff Depth>0.71"
Tc=6.0 min CN=39 Runoff=0.03 cfs 0.004 af

Subcatchment D7: to infiltraton basin Runoff Area=0.331 ac 0.00% Impervious Runoff Depth>0.71"
Tc=6.0 min CN=39 Runoff=0.12 cfs 0.020 af

Subcatchment D8: Roof Area Runoff Area=1.582 ac 100.00% Impervious Runoff Depth>6.61"
Tc=6.0 min CN=98 Runoff=10.38 cfs 0.871 af

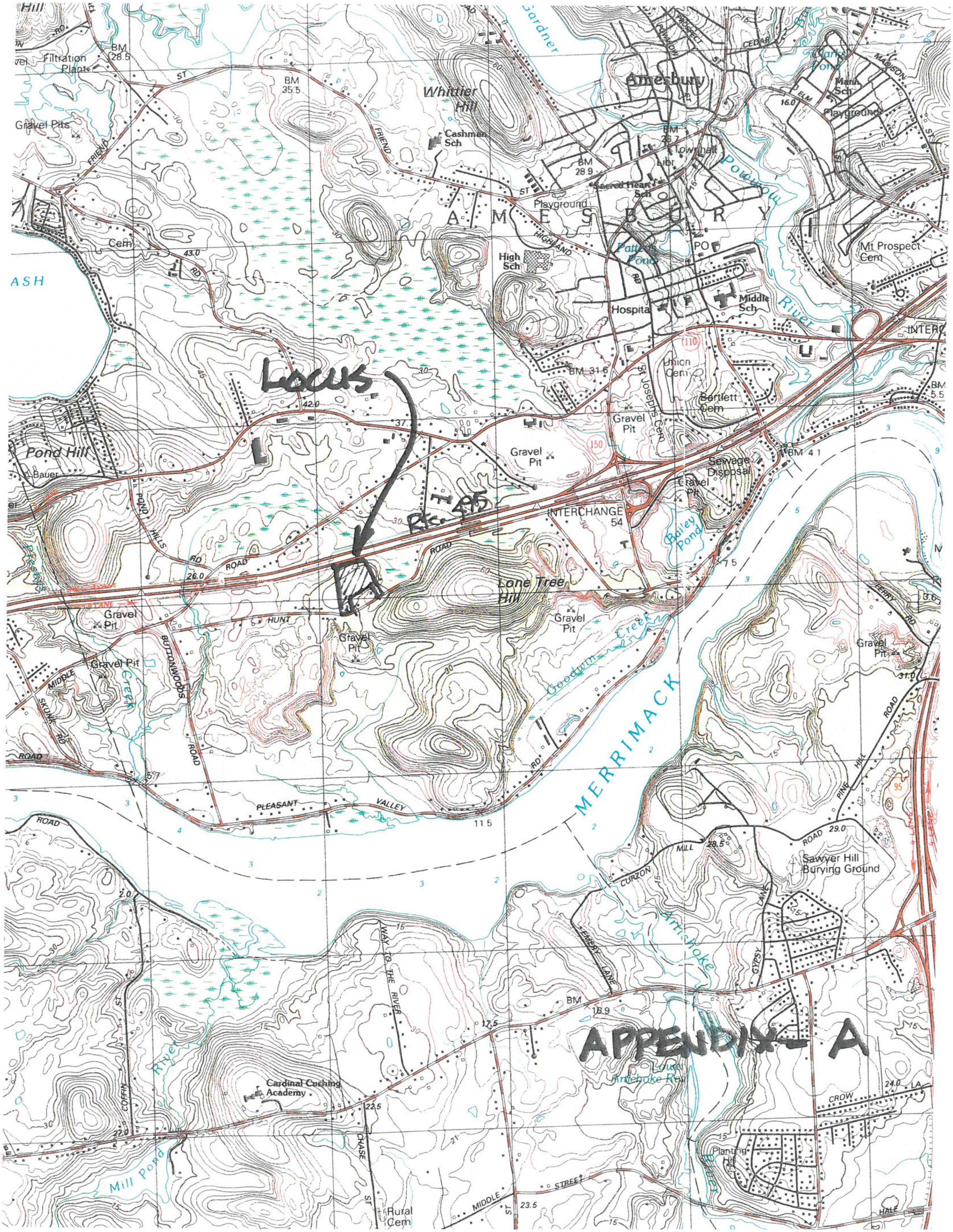
Subcatchment D9: to pervious pvmt Runoff Area=1.359 ac 0.59% Impervious Runoff Depth>1.25"
Tc=6.0 min CN=46 Runoff=1.51 cfs 0.141 af

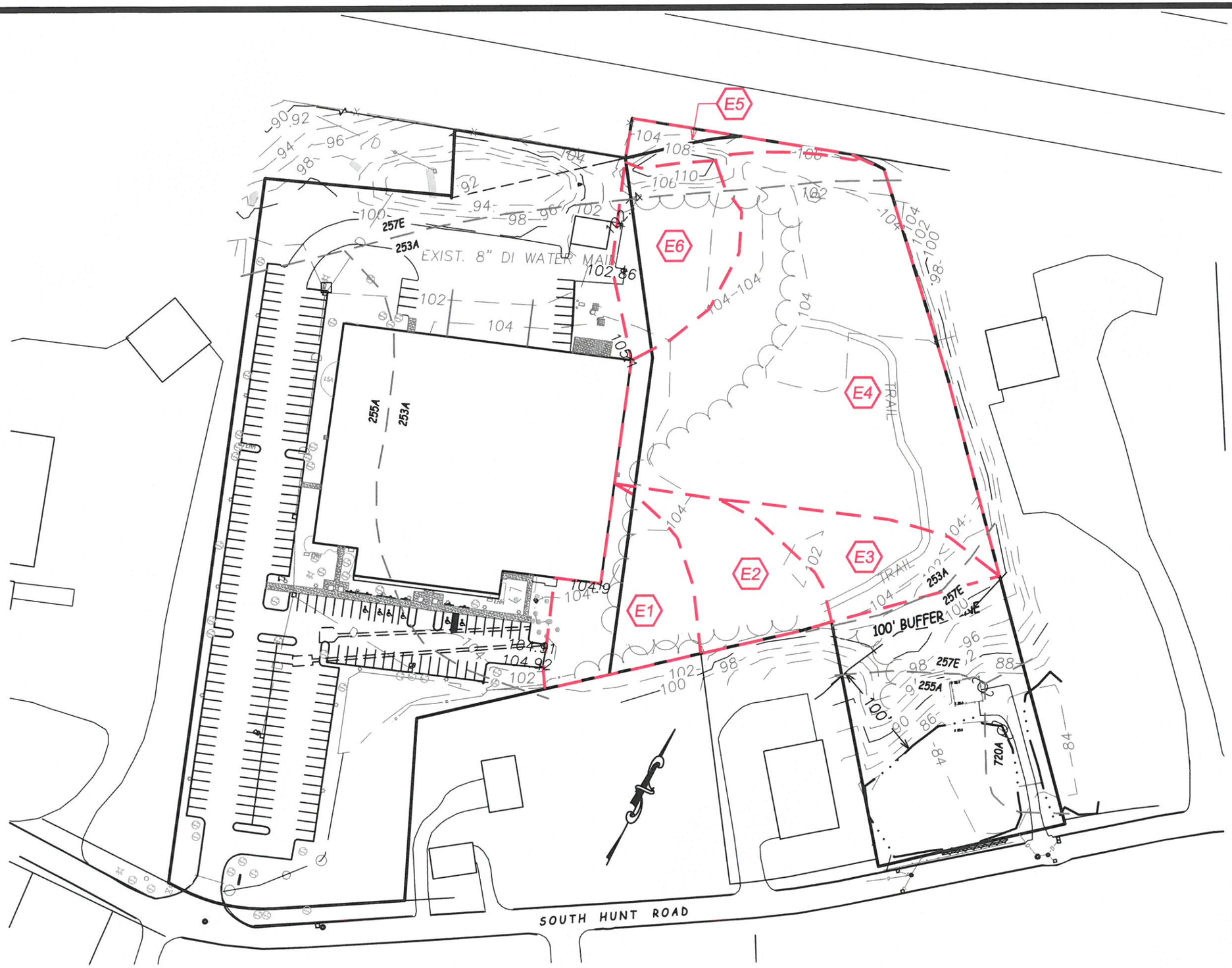
Reach 1R: Summary Inflow=0.03 cfs 0.004 af
Outflow=0.03 cfs 0.004 af

Pond P1: Infiltration Basin Peak Elev=100.97' Storage=22,636 cf Inflow=10.47 cfs 0.891 af
Discarded=0.45 cfs 0.541 af Primary=0.00 cfs 0.000 af Outflow=0.45 cfs 0.541 af

Pond PP-9: Pervious Pvmt Peak Elev=101.00' Storage=0 cf Inflow=1.51 cfs 0.141 af
Outflow=1.51 cfs 0.141 af

Total Runoff Area = 3.856 ac Runoff Volume = 1.046 af Average Runoff Depth = 3.25"
58.77% Pervious = 2.266 ac 41.23% Impervious = 1.590 ac


LOCUS
Rt. 495
APPENDIX - A
Amesbury
AMESBURY
Whittier Hill
Cashman Sch
Filtration Plants
Gravel Pits
Playground
High Sch
Sacred Heart Sch
Town hall
Libr
Patten Pond
PO
Hospital
Middle Sch
Powwow River
Clarks Pond
Mann Sch
Mt Prospect Cem
Union Cem
Bartlett Cem
St Josephs Cem
Gravel Pit
Sewage Disposal
INTERCHANGE 54
Bailey Pond
Pond Hill
Bauer
Lone Tree Hill
Goodwin Creek
MERRIMACK
PLEASANT VALLEY
HUNT
BUTTONWOODS ROAD
POND HILLS RD
MIDDLE
SKUNK RD
FERRY RD
PINE HILL ROAD
CURZON MILL ROAD
Sawyer Hill Burying Ground
Artichoke
Lower Artichoke Res
EMERY LANE
GYPSY LANE
CROW LA
Plant Hill
WAY TO THE RIVER
Cardinal Cushing Academy
CHASE ST
COFFIN ST
Mill Pond
MIDDLE STREET
Rural Cem
HALE



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Sheet Title:

Drainage Zones Existing

Project Title:

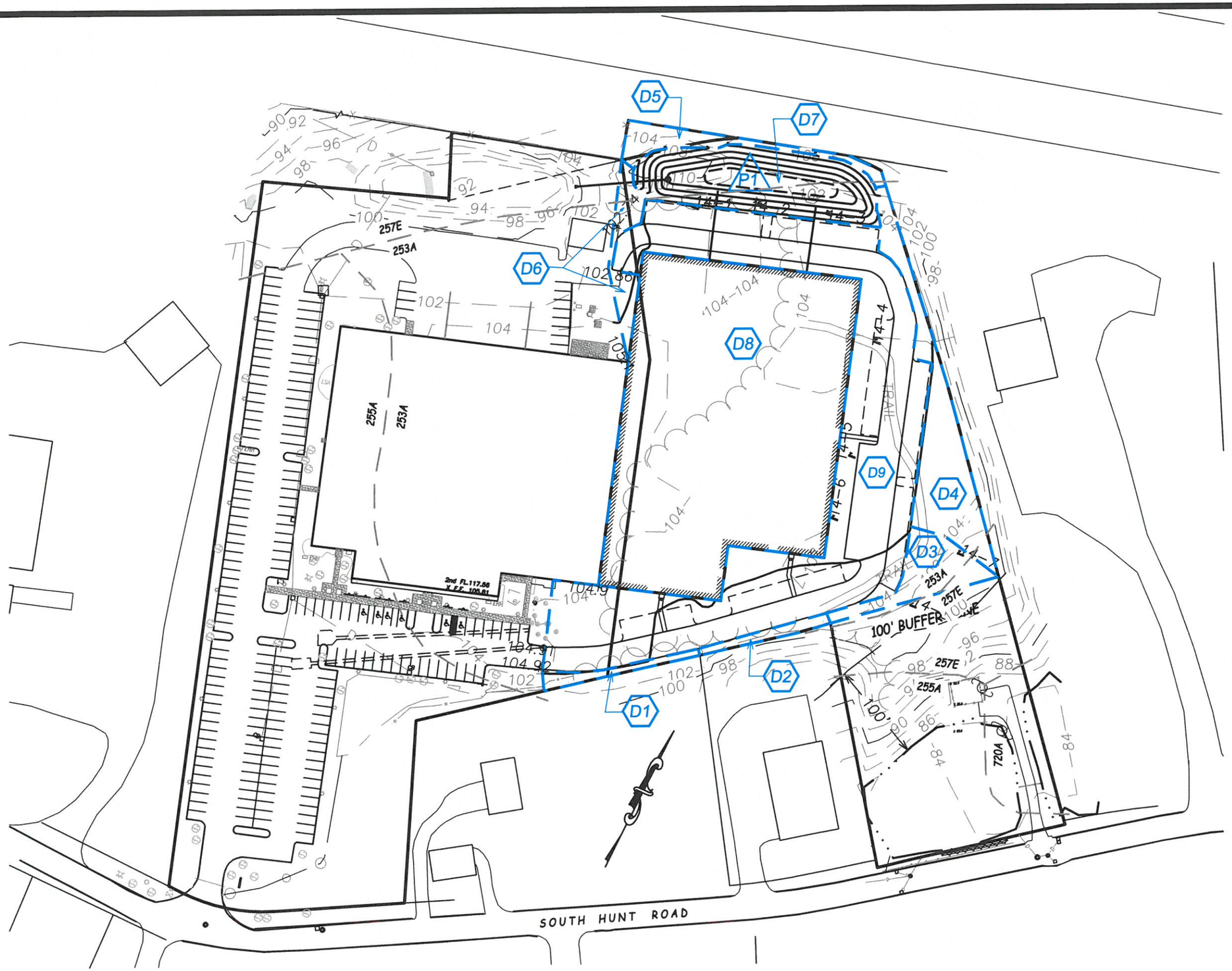
Arc Technologies, Inc.
29 South Hunt Road
Amesbury, Ma.

REVISION

NO.	DATE	DESCRIPTION	BY

PROJ. MGR.:	D. Hamel
FIELD:	R. Brown, M. Michaud
DESIGN:	D. HAMEL
DRAWN:	D. HAMEL
CHECKED:	A. ROSCOE, W. CAMMETT
DATE:	08-24-2015
FILE:	K:\...\C3D\14061FE.dwg
FBK:	671
JOB #:	14061

SHEET Figure 1



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Sheet Title:

Drainage Zones Developed

Project Title:

Arc Technologies, Inc.
29 South Hunt Road
Amesbury, Ma.

REVISION

NO.	DATE	DESCRIPTION	BY

PROJ. MGR.:	D. Hamel
FIELD:	R. Brown, M. Michaud
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FILE:	K:\...\C3D\14061FE.dwg
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SHEET Figure -2

Appendix - B

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part

August 25, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:15,800.

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: http://websoilsurvey.nrcs.usda.gov
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 10, Sep 19, 2014

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

Date(s) aerial images were photographed: Mar 30, 2011—Apr 8, 2011

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.

Map Unit Legend

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
253A	Hinckley loamy sand, 0 to 3 percent slopes	5.9	50.4%
255A	Windsor loamy sand, 0 to 3 percent slopes	3.2	27.3%
257E	Hinckley and Windsor loamy sands, steep	2.4	20.6%
720A	Whately variant fine sandy loam, 0 to 3 percent slopes	0.2	1.7%
Totals for Area of Interest		**11.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic

classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

253A—Hinckley loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vj83
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Deltas on terraces, outwash plains on terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy and gravelly glaciofluvial deposits

Typical profile

O - 0 to 1 inches: muck
H2 - 1 to 8 inches: loamy sand
H3 - 8 to 20 inches: very gravelly loamy sand
H4 - 20 to 60 inches: stratified cobbly coarse sand to very gravelly loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Minor Components

Windsor

Percent of map unit: 12 percent

Sudbury

Percent of map unit: 3 percent

Wareham
Percent of map unit: 2 percent
Landform: Terraces

Carver
Percent of map unit: 2 percent

Swansea
Percent of map unit: 1 percent
Landform: Bogs

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2svkg
Elevation: 0 to 1,160 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting
Landform: Outwash plains, deltas, outwash terraces, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile
O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A

Minor Components

Deerfield, loamy sand

Percent of map unit: 10 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear

Hinckley, loamy sand

Percent of map unit: 5 percent
Landform: Outwash plains, eskers, deltas, kames
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex

257E—Hinckley and Windsor loamy sands, steep

Map Unit Setting

National map unit symbol: vjc8
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 60 percent
Windsor and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Eskers, terraces, kames
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, riser

Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy and gravelly glaciofluvial deposits

Typical profile

O - 0 to 1 inches: muck
H2 - 1 to 6 inches: gravelly loamy sand
H3 - 6 to 16 inches: very gravelly loamy sand
H4 - 16 to 60 inches: stratified cobbly coarse sand to very gravelly loamy fine sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Description of Windsor

Setting

Landform: Kames, eskers, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: loamy sand
H2 - 3 to 17 inches: loamy sand
H3 - 17 to 28 inches: stratified sand
H4 - 28 to 60 inches: stratified sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Minor Components

Carver

Percent of map unit: 20 percent

720A—Whately variant fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjxy
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Whately variant and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whately Variant

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits over hard clayey glaciolacustrine deposits

Typical profile

O - 0 to 4 inches: muck
H2 - 4 to 12 inches: fine sandy loam
H3 - 12 to 27 inches: loamy sand
H4 - 27 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs

Swanton

Percent of map unit: 10 percent
Landform: Depressions

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Long Term Pollution Prevention Plan

Operator:

Arc Technologies, Inc.
37 South Hunt Road
Amesbury, MA 01913

LTPPP Preparation Date:

August, 2015

Job # 14061

1.1 Contact Information/Responsible Parties

Project Information:

Operator(s):
ARC Technologies, Inc.
37 South Hunt Road
Amesbury, MA 01913
Phone: (978) 388-2993

Project Manager(s) or Site Supervisor(s):
Dan Healey
ARC Technologies, Inc.
37 South Hunt Road
Amesbury, MA 01913
Phone: (978)-388-2993
Email: danhealey@arc-tech.com

Emergency 24 hour contact:
Dan Healey (On-site Daily)
ARC Technologies, Inc.
Phone: (978) 388-2993

1.2 Good Housekeeping Practices

Project Information:

a. Material Handling and Waste Management:

1. Dumpster is to be provided on-site for disposal of trash.

b. Hazardous Waste

1. Hazardous waste materials shall be stored in a dry area protected from precipitation. Hazardous waste materials will be disposed of in accordance with local, state and federal regulations. Hazardous waste material shall not be disposed of in on-site dumpsters.

2. The hazardous waste storage area shall be developed prior to hazardous materials being stored on the site.

3. The storage area will be inspected during the regular monitoring inspections required by the NPDES permit. MSD sheets for all materials shall be located on site.

c. Fertilizers and Pesticides and Herbicides

1. Fertilizer, pesticide, and herbicide should be used sparingly and to manufactures instruction and shall be stored in a dry area protected from precipitation. Emphasis should be given to using low nitrogen fertilizers and organic pesticides.

d. Pavement Sweeping

1. Pavement sweeping / vacuuming shall be performed quarterly. Pavement sweeping / vacuuming will remove accumulated sediment from the site and leaves, debris from the fall.

2. Pavement sweeping / vacuuming shall occur at least once in March and once in October.

3. Property owner or owner's maintenance contractor will be responsible for scheduling the activity each year.

4. Pavement sweeping will be performed with a vacuum sweeper.

e. Snow Removal Management

1. Snow stockpile areas are provided on-site at areas designated on the site plans.

2. D-icing compounds to be utilized on-site shall consist of $CaCl_2$ and calcium magnesium acetate (CMA).

3. Property owner or owner's maintenance contractor will be responsible for the snow and de-icing operations.

4. Snow shall not be plowed into stormwater management areas.

f. Stormwater Operation & Maintenance

1. Inspect the condition of the Infiltration Basin and the outlet for erosion and grass cover. Mow the basin side slopes at least two times each year to rove woody vegetation.

2. Remove any accumulated silts and sands as well as debris from the basin bottom.

OPERATION AND MAINTENANCE PLAN

FOR THE STORMWATER MANAGEMENT FACILITIES

Owner and Responsible Party for Drainage utilities, located on locus property, Operation and Maintenance Plan after completion of project:

Property Owner or Owner's Maintenance Contractor

Arc Technologies, Inc. has certified that the requirements have been read and understood and that Arc Technologies, Inc. will implement this Operation and Maintenance Plan. Arc Technologies, Inc. is willing to provide the necessary financial backing to implement said plan.

SEE ATTACHED LETTER LETTER DATED 8-25-2015

Schedule for Inspection and Maintenance:

This inspection and maintenance schedule has been prepared to ensure that the proposed Stormwater Management Facility functions as designed according to the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection. The Policy defines Stormwater Management Standards as guidelines for stormwater management. The Standards address water quality and quantity using non-structural measures, site planning, and Best Management Practices or BMP's. An inspection and maintenance schedule is necessary for the BMP's to continue to function properly and as designed.

During construction, stormwater management facilities will be inspected once every seven days and after every rainfall event of 0.50 in. or more. Stormwater Management Facility will be cleaned/maintained as required based upon inspection. The cleaning and maintenance of all BMP's during construction includes removing sediment, replacing or repairing any damaged structure or pipe, and ensuring that soil erosion is kept to a minimum. (See accompanying Stormwater Pollution Prevention Plan - SWPPP) The property operator will be responsible for inspection and maintenance during construction.

After construction is complete and the site has been stabilized, the following BMP maintenance schedule is proposed.

BMP: **Infiltration Basin**

Location – Rear of building near Rte. 495

The Infiltration Basin area shall be inspected monthly for any areas of erosion, sediment accumulation, woody vegetation or void of grass. Grass shall be reseeded as needed. Eroded areas shall be filled with topsoil, lightly compacted, and seeded. The grass shall be mowed 3-4 times a year at a minimum to keep the woody vegetation from establishing. Accumulation of silts shall be removed by hand and the area repaired to a fully established grass surface.
Estimated cost of annual maintenance is $150.

BMP: **Porous Pavement**

Location – Access drive and parking around new addition building.

The porous pavement needs frequent cleaning and maintenance to prevent clogging. For proper maintenance:

1. Post signs identifying porous pavement areas.
2. Minimize salt use during winter months and *never* use sand.
3. Keep landscaped areas well maintained to prevent soil from being transported onto pavement.
4. Clean the surface using jet washing to dislodge trapped particles and sweep with a high efficiency vacuum sweeper on a quarterly basis.
5. Regularly monitor the paving surface to make sure it drains properly.
6. Never reseal or repave with impermeable materials.
7. Inspect the surface annually for deterioration or spalling and repair as necessary.
8. If repairs are needed, then an approved porous asphalt mix must be used.
9. Surface should be checked for ponding after rainfall events greater than 3.5".

BMP: **Snow Removal Management**

Location – Parking lots and access drives

1. Generally, snow removal from the site will not be required. Snow stockpile areas are provided on-site at areas designated on the site plans.
2. D-icing compounds to be utilized on-site shall consist of $CaC1_2$ and calcium magnesium acetate (CMA).
3. Snow shall not be plowed into stormwater management areas. Snow removal shall be in accordance with Mass DEP Bureau of Resource Protection – Snow Disposal guidelines – No. BRPG01-01.
4. Snow shall be plowed into the areas indicated on the plans for snow storage.
5. Accumulate sediment and debris shall be removed in the spring and disposed of in accordance with all local, state and federal laws and regulations.

6. Landscaped areas damaged by sediment removal shall be restored to original conditions.

1.3 Spill Prevention and Control Plan:

a. *Spill Prevention Procedures*

Spills will be contained and cleaned up immediately. All cleaning materials, rags, etc. shall be disposed of in a proper manner. Spill kits shall be provided on-site in areas easily accessible for personnel to access.

MSD sheets for all materials will be retained on-site in the construction trailer.

If a spill is found to be extensive, the appropriate authorities shall be notified for proper cleanup.

b. *Illicit Discharges*

All illicit discharges to the stormwater management system are prohibited. These discharges include, but are not limited to, wastewater, stormwater contaminated by contact with process waste, raw materials, toxic pollutants, hazardous substances, oil, or grease. To my knowledge, there are no existing illicit discharges on the site.

STREET SWEEPING LOG

Project Name: Arc Technologies

Project Location: 37 South Hunt Road, Amesbury, MA 01913

Owner: Arc Technologies, Inc.

SWEEP DATE	TYPE OF SWEEPER	LOCATIONS

INSPECTION AND MAINTENANCE CHECKLIST

ITEM	DATE OF INSPECTION AND REQUIRED MAINTENANCE	MAINTENANCE TO BE PROVIDED / COMMENT	DATE MAINTENANCE COMPLETE
Infiltration Basin			
Porous Pavement			
Snow Storage Areas			

Inspected By:_____ Date:_____

August 25, 2015

City of Amesbury
62 Friend Street
Amesbury, Ma. 01915

To Whom It May Concern,

This letter is to verify that I'm in receipt of the Long Term Pollution Prevention Plan (LTPPP) that was approved by the City for the proposed hotel and I acknowledge all the perpetual responsibilities and requirements of said plan. As the facility operator/manager and to the best of my ability, I intend to adhere to its Best Management Practices to prevent any stormwater contamination and control sedimentation and erosion.

Please let me know if you have any questions or require any further information regarding the above.

Yours truly,

Daniel P. Healey III

Dan Healey
ARC Technologies, Inc.

Title:M/Winword/201/14061/engineeringlandscapearchitecture/stormwatermanagementdrainage/.14061lettertocityofamesburyltppp081315