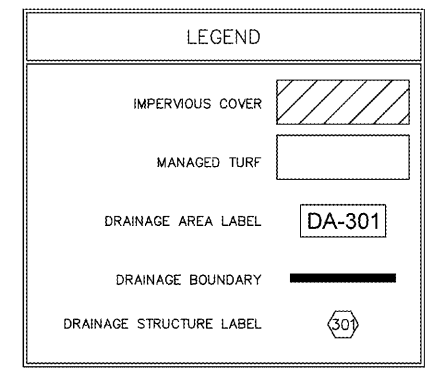
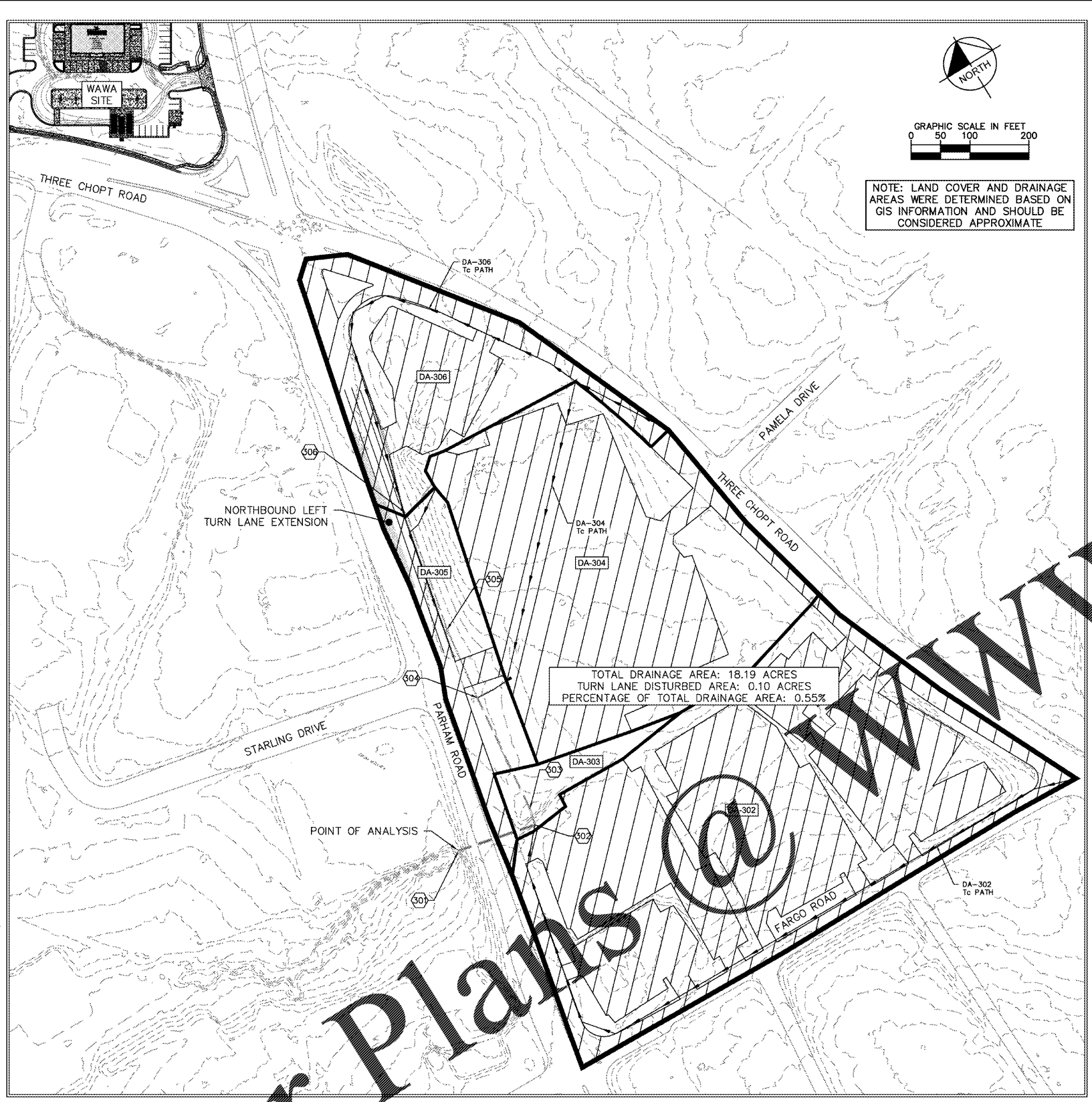


Plotted By: Westwood, Kelsey, Smet, SHELFIN Layout: CR-106 P: PARHAM ROAD TURN LANE STORMWATER QUANTITY January 17, 2018 04:28:53pm K: VRC-CIV1313ED - Wawa - Revision: 005 Platform: and Three Chopt - Henrico VADs - 1/17/2018
 User: kelsey.smet
 Title: WAWA @ PARHAM ROAD TURN LANE STORMWATER QUANTITY - CR-106
 Project: WAWA @ PARHAM ROAD TURN LANE STORMWATER QUANTITY
 Date: 1/17/2018
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DRAINAGE AREA SUMMARY

DRAINAGE AREA LABEL	INLET	TOTAL AREA (AC.)	IMPERVIOUS AREA (AC.)	MANAGED TURF AREA (AC.)	FOREST/ OPEN SPACE AREA (AC.)	C	CN	CA	TIME OF CONC. Tc (min)
DA-302	302	8.19	6.40	1.79	0.00	0.77	92.8	5.30	14.0
DA-304	304	0.41	0.00	0.41	0.00	0.30	74.0	0.12	
DA-305	305	5.68	4.40	1.28	0.00	0.76	92.6	4.34	7.0
DA-306	306	1.30	0.56	0.74	0.00	0.56	84.3	0.73	
Post Total		15.58	12.16	3.42	0.00	0.74			

STORMWATER QUANTITY NARRATIVE

TO ADDRESS STORMWATER QUANTITY REQUIREMENTS FOR PROPOSED TURN LANE EXTENSION OF PARHAM ROAD, THE 1% RULE WAS CHOSEN. THE POINT OF ANALYSIS HAS A TOTAL DRAINAGE AREA OF 18.19 ACRES AND THE PROPOSED DISTURBED AREA CONTRIBUTES 0.10 ACRES (0.55% OF THE TOTAL DRAINAGE AREA). SINCE THE CONTRIBUTING AREA IS LESS THAN 1% OF THE TOTAL AREA AND EXISTING PIPELINES WERE ANALYZED TO REACH THE ULTIMATE POINT OF ANALYSIS, ADEQUATE CHANNEL AND FLOOD PROTECTION HAVE BEEN PROVIDED IN COMPLIANCE WITH THE VIRGINIA PART 2 STORMWATER REGULATIONS.

VDOT HYDRAULIC GRADE LINE CALCULATIONS - 2-YEAR STORM

INLET	0.8D+ INV (OUT)	ACTUAL OUTLET WSE	DESIGN OUTLET WSE	D _s	Q _s	L _s	S ₀	H _t	JUNCTION LOSS														FINAL H	INLET WSE	F/L ELEV
									V _e	H _o	Q _o	V _i	Q _v	1/2 g	H _i	Angle	H _s	H _f	Surface Runoff Factor ¹	1.3 H _i	15-17	0.5 H _i			
(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)			
302	243.69	243.69	243.69	60	47.71	140	0.0003	0.05	8.66	0.29	25.20	19.43	489.64	5.86	2.05	90	4.10	6.45	YES	8.38	YES	4.19	4.24	247.93	263.36
303	246.60	247.93	247.93	30	25.20	29	0.0038	0.11	19.43	1.47	25.05	9.40	235.47	1.37	0.48	15	0.26	2.21	NO	2.21	YES	1.10	1.21	249.14	254.73
304	248.98	249.14	249.14	27	25.05	209	0.0065	1.37	9.40	0.34	9.54	6.27	59.82	0.61	0.21	0	0.00	0.56	YES	0.72	YES	0.36	1.73	250.87	256.60
305	251.13	251.13	251.13	21	9.54	127	0.0036	0.46	6.27	0.15	6.98	7.42	51.79	0.85	0.30	0	0.00	0.45	YES	0.59	YES	0.29	0.75	251.88	255.53
306	251.92	251.92	251.92	18	6.98	205	0.0044	0.90	7.42	0.21	0.00	0.00	0.00	0.00	0.00	0	0.00	0.21	YES	0.28	YES	0.14	1.04	252.96	256.68

NOTE: BASED ON A SITE VISIT, THE BOX CULVERT (STRUCTURE 302 TO 301) IS A FREE OUTFALL; THE TAILWATER IS SHOWN EQUAL TO THE INVERT.

VDOT STORM DRAIN DESIGN CALCULATIONS - 2-YEAR STORM

FROM POINT	TO POINT	DRAINAGE AREA acres	RUNOFF COEFFICIENT C	CA		INLET TIME min	RAINFALL in/hr	RUNOFF cfs	INVERT ELEVATIONS		LENGTH ft	SLOPE %	SIZE in	PIPE CAPACITY cfs	Q / Q _r %	VELOCITY fps	FLOW TIME	
				inlet	accum				upper end	lower end							incr	accum
				ft	ft				ft	ft							min	min
306	305	2.61	0.72	1.879	1.879	14.00	3.68	6.98	253.78	250.72	205	1.49%	18	12.84	54%	7.42	0.46	14.00
305	304	1.30	0.56	0.728	2.607	7.00	3.63	9.54	250.72	249.73	127	0.78%	21	14.02	68%	6.27	0.34	14.46
304	303	5.68	0.76	4.317	6.924	13.00	3.59	25.05	249.73	247.18	209	1.22%	27	34.20	73%	9.80	0.37	14.80
303	302	0.41	0.30	0.123	7.047	5.00	3.55	25.20	247.08	244.60	29	8.66%	30	120.70	21%	19.43	0.02	15.17
302	301	8.19	0.77	6.306	13.353	14.00	3.55	47.71	244.60	243.69	140	0.65%	4'x5' Box	210.14	23%	8.66	0.27	15.19

VDOT HYDRAULIC GRADE LINE CALCULATIONS - 10-YEAR STORM

INLET	0.8D+ INV (OUT)	ACTUAL OUTLET WSE	DESIGN OUTLET WSE	D _s	Q _s	L _s	S ₀	H _t	JUNCTION LOSS														FINAL H	INLET WSE	F/L ELEV
									V _e	H _o	Q _o	V _i	Q _v	1/2 g	H _i	Angle	H _s	H _f	Surface Runoff Factor ¹	1.3 H _i	15-17	0.5 H _i			
(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)			
302	243.69	243.69	243.69	60	63.55	140	0.0006	0.08	9.37	0.34	33.56	21.05	705.44	6.88	2.41	90	4.82	7.57	YES	9.83	YES	4.92	5.00	248.69	263.36
303	246.60	248.69	248.69	30	33.56	29	0.0067	0.19	21.05	1.72	33.33	9.80	326.63	1.49	0.52	15	0.28	2.53	NO	2.53	YES	1.26	1.45	250.14	254.73
304	248.98	250.14	250.14	27	33.33	209	0.0116	2.42	9.80	0.37	12.70	5.28	67.06	0.43	0.15	0	0.00	0.52	YES	0.68	YES	0.34	2.76	252.92	256.60
305	251.13	252.91	252.91	21	12.70	177	0.0064	0.81	5.28	0.11	9.28	7.92	73.50	0.97	0.34	0	0.00	0.45	YES	0.58	YES	0.29	1.10	254.01	255.53
306	251.92	254.01	254.01	18	9.28	205	0.0078	1.60	7.92	0.24	0.00	0.00	0.00	0.00	0.00	0	0.00	0.24	YES	0.32	YES	0.16	1.76	255.77	256.68

NOTE: BASED ON A SITE VISIT, THE BOX CULVERT (STRUCTURE 302 TO 301) IS A FREE OUTFALL; THE TAILWATER IS SHOWN EQUAL TO THE INVERT.

VDOT STORM DRAIN DESIGN CALCULATIONS - 10-YEAR STORM

FROM POINT	TO POINT	DRAINAGE AREA acres	RUNOFF COEFFICIENT C	CA		INLET TIME min	RAINFALL in/hr	RUNOFF cfs	INVERT ELEVATIONS		LENGTH ft	SLOPE %	SIZE in	PIPE CAPACITY cfs	Q / Q _r %	VELOCITY fps	FLOW TIME	
				inlet	accum				upper end	lower end							incr	accum
				ft	ft				ft	ft							min	min
306	305	2.61	0.72	1.879	1.879	14.00	4.90	9.28	253.78	250.72	205	1.49%	18	12.84	73%	7.92	0.43	14.00
305	304	1.30	0.56	0.728	2.607	7.00	4.83	12.70	250.72	249.73	127	0.78%	21	14.02	91%	5.28	0.40	14.43
304	303	5.68	0.76	4.317	6.924	13.00	4.78	33.33	249.73	247.18	209	1.22%	27	34.20	97%	9.80	0.36	14.83
303	302	0.41	0.30	0.123	7.047	5.00	4.73	33.56	247.08	244.60	29	8.66%	30	120.70	28%	21.05	0.02	15.19
302	301	8.19	0.77	6.306	13.353	14.00	4.72	63.55	244.60	243.69	140	0.65%	4'x5' Box	210.14	30%	9.37	0.25	15.21

POST-DEVELOPMENT INLET TIME OF CONCENTRATION CALCULATIONS

DRAINAGE AREA LABEL	INLET	TOTAL AREA (AC.)	IMPERVIOUS AREA (AC.)	MANAGED TURF AREA (AC.)	FOREST/ OPEN SPACE AREA (AC.)	C	CN	CA	TIME OF CONC. Tc (min)	TREATMENT VOLUME Tv (cu ft)	OVERLAND FLOW TIME (SE/VE)			SHALLOW CONCENTRATED FLOW TIME (TR-55)			CHANNEL FLOW TIME (KIRKPICHT)					
											T _{ov} = 0.225 L ^{0.54} S ^{-0.16} C ^{1.49}			S _{avg} = 1.3455 S ^{0.17} (UNPAVED), V = 29.3282 S ^{0.38} (PAVED)			T _{ch} = 0.009488 H ^{1.49} L ^{1.13}					
											L (ft)	C	S (ft/ft)	T _{ov} (min)	L (ft)	V (ft/s)	L (ft)	T _{ch} (min)	H (ft)	L (ft)	T _{ch} (min)	
DA-302	302	8.64	6.85	1.79	0.00	0.78	93.0	6.70	15.0	24,328	50	0.90	0.020	2.72	P	0.000	0.00	50	0.00	13	1200	10.79
DA-304	304	5.68	4.40	1.28	0.00	0.76	92.6	4.34	13.0	15,769	50	0.30	0.020	8.16	P	0.000	0.00	50	0.00	11	550	4.76
DA-305	305	1.63	0.89	0.74	0.00	0.63	87.1	3.02	7.0	3,713	50	0.30	0.150	5.58	P	0.020	2.87	200	1.16	0	0	0.00
DA-306	306	2.61	1.83	0.78	0.00	0.72	90.8	1.88	14.0	6,828	50	0.90	0.008	3.24	P	0.010	2.03	0	0.00	7	900	9.86

NOTE: ALL REMAINING INLETS HAVE A Tc OF 5 MINUTES

Order Plans

1/07/18 RFP
02/03/18 RFP
01/03/19 RFP
01/14/19 RFP
01/17/19 RFP

1 OIL WATER SEPARATOR REVISIONS
2 OIL WATER SEPARATOR REVISIONS
3 UNDERGROUND PIPE CONNECTIONS
4 PHASE II EAS REVISIONS
5 BID SET REVISIONS

No.
REVISIONS
DATE

Kimley»Horn
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RYAN R. PERKINS
Lic. No. 046685
11/09/2018
PROFESSIONAL ENGINEER

PARHAM ROAD TURN LANE STORMWATER QUANTITY

WAWA AT PARHAM AND THREE CHOPT LANE STORMWATER QUANTITY

PREPARED FOR **REBEEK CO.**

HENRICO COUNTY VIRGINIA

POD# 2018-00101 & 00196

SHEET NUMBER
CR-106