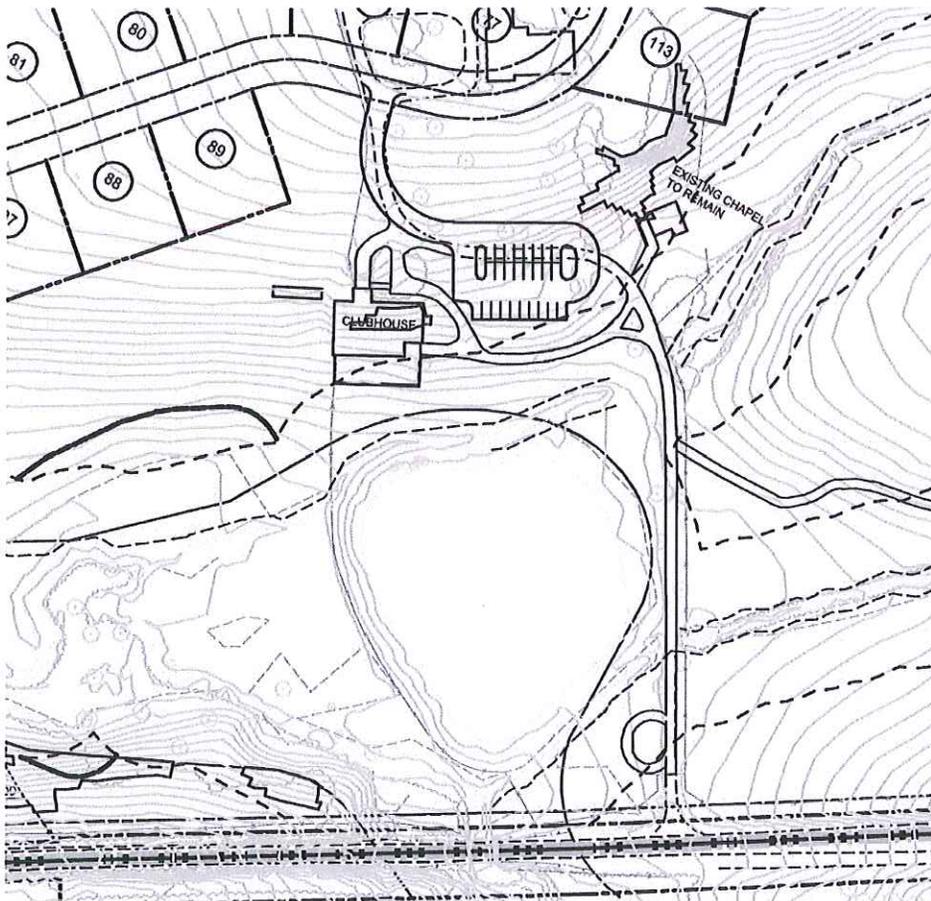




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CONDITIONAL USE
STORMWATER MANAGEMENT NARRATIVE
FOR
CREBILLY FARM



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I

Site Information

Location and Surrounding Uses

The Crebilly Farm Property in Westtown Township, PA comprises a ± 322.4 acre tract also known as tax parcel numbers 67-4-30, 67-4-31, 67-4-32, 64-4-33, 67-4-33.1, 67-4-134, 67-4-29, 67-4-29.1, 67-4-29.2, 67-4-29.3, and 67-4-29.4. This property is located in the A/C Agricultural / Cluster District with a Flexible Development Option. The product mix is 200 single family, 117 single family attached (carriage homes), and 2 existing dwellings to remain. The development also proposes existing barns and buildings to remain and to be converted into community centers with –yet to be determined- outdoor recreational facilities, and common open space. It is located on the southern corners of West Pleasant Grove Road and Wilmington Pike (S.R. 202), and bounded on the south west by South New Street, and Street Road (S.R. 926) on the south west. The project is located in the Brandywine Creek (WWF, MF, western part) and the Darby-Crum Creeks (TSF, MF, easterly part) watersheds.

Existing Conditions

The site is generally gently sloped with some steeper areas towards the on-site Radley Run and the Tributary 00074 to Radley Run. A small section of the site drains towards an unnamed tributary of the Chester Creek across S.R. 202. The site is currently used for crop farming and includes an equestrian facility with stables, barns, and a chapel. The site also includes two existing residence with ancillary buildings that will remain. Existing site cover consists of Cultivated Land, and impervious areas including existing house, ancillary structures, the equestrian buildings and portions of the surrounding roads as described above..

Soil Types

The soils information for the project is found in the USDA-NRCS Custom Soil Resource Report for Chester County, Pennsylvania. A copy of the Custom Soil Resource Report is included as appendix 1. The following soil types are found on the site:

Soil Type	Symbol	Soil Group
Baile Silt Loam	Ba	D
Chester Silt Loam, 3 to 8 percent slopes	CdB	B
Chrome Silt Loam, 3 to 8 percent slopes	ChB	D
Chrome Silt Loam, 8 to 15 percent slopes	ChC	D
Chrome Silt Loam, 15 to 25 percent slopes	ChD	D
Codorus Silt Loam	Co	C
Gaila Silt Loam, 15 to 25 percent slopes	GaD	B
Gladstone Gravelly Loam, 3 to 8 percent slopes	GdB	B
Gladstone Gravelly Loam, 8 to 15 percent slopes	GdC	A
Gladstone Gravelly Loam, 15 to 25 percent slopes	GdB	A
Glenelg Silt Loam, 3 to 8 percent slopes	GgB	C
Glenelg Silt Loam, 8 to 15 percent slopes	GgC	B
Glenville Silt Loam, 3 to 8 percent slopes	GIB	D
Glenville Silt Loam, 8 to 15 percent slopes	GIC	D
Hatboro Silt Loam	Ha	D
Water	W	

II

Hydrology

Stormwater Management Design Criteria

The Stormwater Management Plan described herein has been designed according to the following publications and criteria:

- Chapter 144, Stormwater Management of the Township of Westtown Ordinance, adopted by the BOS 12-16-2013 by Ord. No 2013-5, with amendments as noted where applicable. Chapter 149, Subdivision of Land of the Township of Westtown Ordinance, adopted by the BOS 8-21-1995, with amendments as noted where applicable. Any and all ordinance chapters of the Township of Westtown where applicable.
- Pennsylvania Stormwater Best Management Practices Manual – Final Draft -April 2006
- "Urban Hydrology for Small Watersheds" (Technical Release No. 55), published by the United States Department of Agriculture, Soil Conservation Service, dated June 1986.

Site Hydrology

The site is currently being farmed for crops, and contains an equestrian facility. The site is traversed by the Radley Run flowing west. The majority of the site (POI A, POI B, and POI D) drains towards the Brandywine Creek watershed and has a Chapter 93 classification of WWF, MF. A smaller portion (POI C) of the site drains across S.R. 202 to a tributary (00615) to Chester Creek watershed and has a Chapter 93 classification of TSF, MF.

Drainage Areas

The site has been analyzed using 4 main study points, POI A, POI B, POI D (Brandywine Creek watershed), and POI C (Chester Creek watershed). There is no offsite area analyzed because it flows through the existing creek and bypasses the area used for the development. The portion of the site located along West Street Road, south of the Bradley Creek area is not being developed and has therefore not been included in the overall Stormwater Management Analysis.

Per Chapter 144 of the ordinance, the reductions shown in the table below have been applied to the Brandywine Watershed.

Predevelopment Design Storm	Post-Construction Design Storm (new Development)
2-year	1-year
5-year	5-year
10-year	10-year
25-year	25-year
50-year	50-year
100-year	100-year

Per the Chester Creek Act 167, there must be a 50% reduction in the rate to the Chester Creek.

The 'Crebilly Farm – Watershed Summaries' table, included in the appendix section, summarizes the peak runoff

rates and reductions for each point of interest and each separate watershed. As demonstrated in the table, the post-developed peak rate has been reduced per the above table for each study point and each watershed.

Because this is a cluster-style design, where a large area of the site is to remain as open space (min. 60%) the areas within the drainage areas that are located outside of the Limit-Of-Disturbance (LOD) are not included in the area to be reduced. The '*Allowable Post Developed Flows – SCS*' located in the appendix section, shows how the weighted allowable has been calculated.

Preliminary Infiltration Testing

Preliminary infiltration testing has been performed in the general locations of the basin. General testing results are listed in the Preliminary Geotechnical Exploration Report, and range from 0.5"/hr to 4"/hr. For the purpose of this preliminary analysis, a minimum 0.5"/hr infiltration rate has been used, which is generally consistent with the test-results. The test results are included in the appendix section.

Additional impervious surface

To allow for additional impervious on-lot surfaces that might be requested by future home owners, additional impervious is proposed on top of the base footprints. Below is the list of impervious used for each dwelling type for this preliminary analysis:

Estate Lots:

Minimum lot size is 115'x125' = 14,375 sf

Impervious proposed per lot = 2,400 sf base house, 1,350 sf options, 1,200 sf driveway, 170 sf service walk, 630 sf additional impervious for a total of 5,750 sf, or 40% of the lot size.

Executive lots:

Minimum lot size is 90'x125' = 11,250 sf

Impervious proposed per lot = 2,400 sf base house, 800 sf options, 530 sf driveway, 80 sf service walk, 690 sf additional impervious for a total of 4,500 sf, or 40% of the lot size.

Carriage Homes:

Assumed lot size is 30'x110' = 3,300 sf

Impervious proposed per unit = 2,200 sf base house, 500 sf driveway, 100 sf service walk, 500 sf additional impervious for a total of 3,300 sf.

Water Quality Management

Infiltration is provided in all proposed basins. Per section 144-305.A of the Stormwater Management Ordinance, "the post-construction total runoff volume shall not exceed the predevelopment total runoff volume for all storms equal to or less than the two-year, twenty-four-hour duration precipitation (design storm)."

The watershed volume summary can be found in the appendix section. The volumes have been taken from the Hydrograph Summary reports, also located in the appendix section of this report.

Thermal Effects

Thermal effects will be taken into consideration during the design. In order to eliminate raising temperatures, the following (not limited to) will be proposed:

- Rooftop disconnection. The rainfall falling on the roofs is dispersed through the gutter system onto the lawn areas, where it will be cooled by the soil and grass cover before it enters the subsoil storm system.
- Subsoil storm sewer system. Water coming from lawn areas and paved road/parking areas is diverted into the subsoil storm sewer where it will be cooled by the pipe system before it enters the pond areas.
- Plantings along the pond perimeter will provide shading to help keep the water cool.

III

Closed Conveyance System

Design Criteria

All closed conveyances will be designed according to Section 144-311 of the Westtown Township Stormwater Management Ordinance.

Storm pipes are required to be designed for a 25-year-return frequency storm. No pipes were designed under pressure flow. Closed conveyances are limited to a minimum 0.5% longitudinal slope to promote adequate flow velocities within the system, which are required by code to be a minimum of three (3) feet per second, and a maximum of eleven (11) feet per second. Storm sewer will be reinforced concrete (RCP) and will be in accordance with the requirements of PennDOT Pub 408 and PennDOT Pub 72, latest editions. The minimum diameter will be fifteen inches (15"). Storm sewer cover will be a minimum of 24". A minimum one foot of freeboard between the HGL of the design storm and the ground elevation will be provided throughout all proposed storm sewer conveyance systems.

IV

Open Conveyance System

Design Criteria and Methodology

Wherever possible, overland runoff will be directed to the discharge points via open channels or swales.

All swales will be lined with NA-Green S75 or C125 lining where required (or equal after township engineer approval).

Summary Report

1

Allowable Post Developed Flows - SCS

Area Summaries

Area	Pre Q -1 yr (cfs)	Pre Q -2 yr (cfs)	Pre Q -5 yr (cfs)	Pre Q -10 yr (cfs)	Pre Q -25 yr (cfs)	Pre Q -50 yr (cfs)	Pre Q -100 yr (cfs)	Pre Total Area (Ac.)	Total Area Disturbed (Ac.)	% of shed (%)	Total Area Undisturbed (Ac.)	% of shed (%)
POI A1	50.81	105.89	210.38	308.95	467.02	609.39	769.95	199.69	126.86	63.5%	72.83	36.5%
POI A2	21.45	39.52	71.49	100.64	146.73	188.06	233.90	47.92	13.69	28.6%	34.23	71.4%
POI A - Total	70.42	142.43	276.50	402.78	604.70	786.16	988.96	247.61	140.55	56.8%	107.06	43.2%
POI B1	1.23	3.89	9.74	15.65	25.42	34.42	44.64	11.60	0.51	4.4%	11.09	95.6%
POI B2	1.18	3.04	6.84	10.53	16.53	22.00	28.21	6.79	4.83	71.1%	1.96	28.9%
POI B - Total	2.41	6.92	16.56	26.17	41.95	56.42	72.83	18.39	5.34	29.0%	13.05	71.0%
POI C1	4.02	8.06	15.39	22.16	32.94	42.59	53.42	9.95	8.13	81.7%	1.82	18.3%
POI D1	0.43	1.40	3.37	5.34	8.57	11.54	14.89	2.81	0.64	22.8%	2.17	77.2%

Weighted Allowable

Area	Post Q-2 yr (cfs)	Post Q-5 yr (cfs)	Post Q-10 yr (cfs)	Post Q-25 yr (cfs)	Post Q-50 yr (cfs)	Post Q-100 yr (cfs)
POI A1	70.90	210.38	308.95	467.02	609.39	769.95
POI A2	34.36	71.49	100.64	146.73	188.06	233.90
POI A - Total	101.56	276.50	402.78	604.70	786.16	988.96
POI B1	3.77	9.74	15.65	25.42	34.42	44.64
POI B2	1.72	6.84	10.53	16.53	22.00	28.21
POI B - Total	5.61	16.56	26.17	41.95	56.42	72.83
POI C1	4.76	15.39	22.16	32.94	42.59	53.42
POI D1	1.18	3.37	5.34	8.57	11.54	14.89

Note 1: The allowable post developed flow for the 2-year post developed storm is calculated by using the 1-year pre developed design flow multiplied with the percent **UN**-disturbed of the shed. That number is then added to the product of the actual year frequency storm multiplied by the percent disturbed of the shed.

As follows: $(Q-1\text{-pre} * \% \text{ disturbed}) + (Q-2\text{-pre} * \% \text{ undisturbed}) = Q-2 \text{ post-allowable}$

Note 2: Per Table 308.1 of Chapter 144, Stormwater Management, the peak rate control standards are 2-year post reduced to the 1-year pre, and for the 5-, 10-, 25-, 50-, and 100-year post developed storms are to be reduced to the 5-, 10-, 25-, 50-, and 100-year pre development runoff, respectively.

CREBILLY FARM - WATERSHED SUMMARIES to Brandywine Creek Watershed								
WATERSHED DESCRIPTION		PEAK RUNOFF RATES (CFS)						
		1 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
POI A1	Pre-Developed Study Point No. A1 (Hyd. No. 1)	50.81	105.89	210.38	308.95	467.02	609.39	769.95
	Post Developed flow to POI A1 (Hyd. No. 54)	--	58.47	106.23	152.33	227.25	293.79	366.58
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	70.90	210.38	308.95	467.02	609.39	769.95
POI A2	Pre-Developed Study Point No. A2 (Hyd. No. 2)	21.45	39.52	71.49	100.64	146.73	188.06	233.90
	Post Developed flow to POI A2 (Hyd. No. 60)	--	41.47	69.05	93.89	132.90	167.15	205.07
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	34.36	71.49	100.64	146.73	188.06	233.90
POI A - TOTAL	Pre-Developed Study Point No. A (Hyd. No. 3)	70.42	142.43	276.50	402.78	604.70	786.16	988.96
	Post Developed flow to POI A (Hyd. No. 62)	--	79.51	142.40	203.41	300.94	388.17	486.86
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	101.56	276.50	402.78	604.70	786.16	988.96
POI B1	Pre-Developed flow to POI B1 (on-site) (Hyd. No. 4)	1.23	3.89	9.74	15.65	25.42	34.42	44.64
	Total flow to POI B1 (Hyd. Nos. 64)	--	3.77	9.39	15.04	24.40	33.00	42.76
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	3.77	9.74	15.65	25.42	34.42	44.64
POI B2	Pre-Developed Study Point No. B2 (Hyd. No. 5)	1.18	3.04	6.84	10.53	16.53	22.00	28.21
	Post Developed flow to POI B2 (Hyd. No. 66)	--	0.87	1.87	2.84	4.41	5.83	7.43
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	1.72	6.84	10.53	16.53	22.00	28.21
POI B - TOTAL	Pre-Developed Study Point No. B (Hyd. No. 6)	2.41	6.92	16.56	26.17	41.95	56.42	72.83
	Post Developed flow to POI B (Hyd. No. 68)	--	4.17	10.42	16.70	27.09	36.64	47.56
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	5.61	16.56	26.17	41.95	56.42	72.83
POI D1	Pre-Developed Study Point No. D1 (Hyd. No. 8)	0.43	1.40	3.37	5.34	8.57	11.54	14.89
	Post Developed flow to POI D1 (Hyd. No. 72)	--	1.04	2.50	3.95	6.32	8.49	10.96
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	1.18	3.37	5.34	8.57	11.54	14.89

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
TOTAL PRE DEVELOPED	150.75	296.43	434.29	655.22	854.12	1076.68
TOTAL ALLOWABLE POST DEVELOP	108.35	296.43	434.29	655.22	854.12	1076.68
TOTAL POST DEVELOPED	84.72	155.32	224.06	334.35	433.30	545.38

CREBILLY FARM - WATERSHED SUMMARIES to Chester Creek Watershed								
WATERSHED DESCRIPTION		PEAK RUNOFF RATES (CFS)						
		1 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
POI C1	Pre-Developed Study Point No. C1 (Hyd. No. 7)	4.02	8.06	15.39	22.16	32.94	42.59	53.42
	Post Developed flow to POI C1 (Hyd. No. 70)	--	3.67	6.63	9.33	13.58	17.36	21.54
	ALLOWABLE POST DEVELOPED FLOW (from allowable excel sheet)	--	4.76	15.39	22.16	32.94	42.59	53.42

CREBILLY FARM - WATERSHED VOLUME SUMMARIES to Brandywine Creek Watershed		
WATERSHED DESCRIPTION		2 Year
POI A1	Pre-Developed Study Point No. A1 (Hyd. No. 1)	445,689
	Post Developed flow to POI A1 (Hyd. No. 54)	411,150
POI A2	Pre-Developed Study Point No. A2 (Hyd. No. 2)	129,157
	Post Developed flow to POI A2 (Hyd. No. 60)	136,523
POI A - TOTAL	Pre-Developed Study Point No. A (Hyd. No. 3)	574,846
	Post Developed flow to POI A (Hyd. No. 62)	547,673
POI B1	Pre-Developed flow to POI B1 (on-site) (Hyd. No. 4)	16,711
	Total flow to POI B1 (Hyd. Nos. 64)	16,087
POI B2	Pre-Developed Study Point No. B2 (Hyd. No. 5)	11,562
	Post Developed flow to POI B2 (Hyd. No. 66)	2,211
POI B - TOTAL	Pre-Developed Study Point No. B (Hyd. No. 6)	28,274
	Post Developed flow to POI B (Hyd. No. 68)	18,297
POI D1	Pre-Developed Study Point No. D1 (Hyd. No. 8)	3,994
	Post Developed flow to POI D1 (Hyd. No. 72)	2,954
		2-year
TOTAL PRE DEVELOPED		1,210,233
TOTAL POST DEVELOP		1,134,895

CREBILLY FARM - WATERSHED VOLUME SUMMARIES to Chester Creek Watershed		
WATERSHED DESCRIPTION		2 Year
POI C1	Pre-Developed Study Point No. C1 (Hyd. No. 7)	22,859
	Post Developed flow to POI C1 (Hyd. No. 70)	8,026