APPENDIX B

STORMWATER MANAGEMENT PERMIT APPLICATION

Anyone performing a regulated activity must complete the accompanying Stormwater Management Permit Application, and submit it to Exeter Borough. A regulated activity is by this Ordinance as:

Regulated Activity - Any earth disturbance activities or any activities that involve the alteration or development of land in a manner that may affect stormwater runoff.

This includes but is not limited to: the clearing of wooded areas, grading and excavating, placement of pavement (driveways, parking areas, roads), construction of buildings and other structures (homes, sheds, garages, commercial and industrial buildings), and other activities which alter the way stormwater runs off of the landscape. Impervious area is defined by this Ordinance as:

Impervious Surface (Impervious Area) - A surface that prevents the infiltration of water into the ground. Impervious surfaces include, but are not limited to, streets, sidewalks, pavements, parking lots, driveways, roofs, stone patios. See definition of "Gravel (Crushed Stone)," for when gravel classifies as impervious area.

Gravel (Crushed Stone) - Considered to be impervious when the intended use of the stone is for transportation purposes, parking areas, construction areas, trails, or if the gravel is compacted at any time during or after its placement; landscaping stone is not considered as impervious area.

Depending on the amount of impervious area placed and the amount of earth disturbance to the project site, this Ordinance requires different levels of stormwater management, and correspondingly different levels of design and review. The applicant shall be responsible to reimburse Exeter Borough for any review costs incurred by Exeter Borough for the services of a qualified professional.

Level 1: Proposed impervious area is less than 1,000 sq. ft. and total earth disturbance is less than 5,000 sq. ft.

Submit Level 1 Application documenting the proposed impervious area is less than 1,000 sq. ft. Upon providing such documentation, no further application or plan shall be required.

Level 2: Proposed impervious area is between 1,000 sq. ft. and 5,000 sq. ft. or total earth disturbance is between 5,000 sq. ft. and 10,000 sq. ft.

Stormwater Management Controls: Utilize Disconnected Impervious Area (DIA) for stormwater controls as outlined in Ordinance Appendix C.1; if DIA cannot be achieved, utilize stormwater management controls for small projects as outlined in Ordinance Appendix E.
Submission: Submit the Stormwater Management Permit Application and computations for DIA; the worksheet in this Ordinance Appendix C.1 may be used and submitted as is, or may be modified as Exeter Borough sees fit. If DIA cannot be achieved, submit

computations for Stormwater Management for Small Projects; the worksheet in this Ordinance Appendix E may be used and submitted as is, or may be modified as Exeter Borough sees fit; the easiest mechanism is to include the application with Building Permits.
Review: At the sole discretion of Exeter Borough the review of the application and computations may require the services of a qualified professional. The application must be approved prior to the issuance of any building permit.

Level 3: Proposed impervious area is between 5,000 sq. ft. and 10,000 sq. ft. or total earth disturbance is between 10,000 sq. ft. and 20,000 sq. ft.

Stormwater Management Controls: Capture and permanently remove the first 2 inches of runoff over all proposed impervious areas; infiltrate at least the first 0.5 inches.
Submission: Submit the Stormwater Management Permit Application and computations for permanently removing the first 2 inches of runoff over all proposed impervious areas; the worksheet in this Ordinance Appendix D may be used and submitted as is, or may be modified as Exeter Borough sees fit.
Review: Reviewing the application and computations shall be performed by a qualified professional. The application must be approved prior to the issuance of any building permit.

Level 4: Proposed impervious area is greater than 10,000 sq. ft. or total earth disturbance is greater than 20,000 sq. ft.

Stormwater Management Controls: All requirements of this Ordinance are applicable, including water quality and volume controls as found in Article III Section 303 and peak rate controls as found in Article III Section 304.
Submission: Submit the Stormwater Management Permit Application and Stormwater Management (SWM) Site Plan as in Article IV of this Ordinance.
Review: Reviewing the application and SWM Site Plan shall be performed by a qualified professional. The application must be approved prior to the issuance of any building permit.

Level 1
Small Project Stormwater Management Application

Per Exeter Borough's Act 167 Stormwater Management Ordinance, a stormwater management plan is required whenever more than 1,000 square feet of impervious surfaces are proposed. Impervious surfaces are areas that prevent the infiltration of water into the ground and shall include, but not be limited to, roofs, patios, garages, storage sheds and similar structures, and any new streets or sidewalks.

To Calculate Impervious Surfaces Please Complete This Table					
Surface Type	**Length**	X	**Width**	=	**Proposed Impervious Area**
Building (area per downspout)		X X X X		= = = =	
Driveway		X X X		= = =	
Parking Areas		X X X		= = =	
Patios/Walks		X X X X		= = = =	
Other		X X X		= = =	
Total Impervious Surface Area to be managed (sum of all areas)					

If the Total Impervious Surface Area is LESS THAN 1,000 Square Feet, please read, acknowledge and sign below.

Based Upon the information you have provided a ***Stormwater Management Plan IS NOT required*** for this regulated activity. Property Owner Acknowledges that submission of inaccurate information may result in a stop work order or permit revocation. Acknowledgement of such is by signature below. I declare that I am the owner or owner's legal representative. I further acknowledge that the information provided is accurate and employees of Exeter Borough are granted access to the above described property for review and inspection as may be required.

OWNER	ADDRESS	DATE

EXETER BOROUGH
STORMWATER MANAGEMENT PERMIT APPLICATION
USE FOR LEVEL 2, 3 & 4 REGULATED ACTIVITIES

Applicant and Applicant Address:	Nature of Activity (i.e. driveway, single-lot structure, parking lot, road, trail, subdivision, etc.):

Total Proposed Impervious Area (I) (sq. ft.):

Total Proposed Earth Disturbance (ED) (sq. ft.):

Level 1: (I) is less than 1,000 sq. ft. and (ED) is less than 5,000 sq. ft.

Level 2: (I) is between 1,000 sq. ft. and 5,000 sq. ft. or (ED) is between 5,000 sq. ft. and 10,000 sq. ft.

Complete and attach worksheet contained in Ordinance Appendix C.1 or E (or equivalent) → Is worksheet attached? No / Yes

Level 3: (I) is between 5,000 sq. ft. and 10,000 sq. ft. or (ED) is between 10,000 sq. ft. and 20,000 sq. ft.

Complete and attach worksheet contained in Ordinance Appendix D (or equivalent) → Is worksheet attached? No / Yes

Level 4: (I) is greater than 10,000 sq. ft. or (ED) is greater than 20,000 sq. ft.

Complete and submit SWM Site Plan in accordance with Ordinance Article IV → Is a SWM Site Plan included? No / Yes

Show on the accompanying sketch that adverse downstream stormwater impacts are not created or worsened, and that additional stormwater runoff will not discharge towards adjacent property owners.

All requirements of the Ordinance have been met. Applicant Signature:_____ Date:_____

FOR REVIEWER ONLY

This stormwater management permit application has been APPROVED DENIED (circle one)

Reviewed by (print):_____ Reason for Denial:_____

Signature:_____ Date:_____

PROJECT SKETCH

- Show direction of proposed stormwater discharges
- Show all structures within 50 feet of site
- If storm sewers are present, show approximate location of inlets

EXAMPLE

STORMWATER MANAGEMENT PERMIT APPLICATION

Applicant and Applicant Address:	Nature of Activity (i.e. driveway, single-lot structure, parking lot, road, trail, subdivision, etc.):
Joe Homeowner 123 Site Street Anytown, PA 12345	Construction of single-family home, driveway, and stone patio

Total Proposed Impervious Area (I) (sq. ft.): 3,300 square feet

Total Proposed Earth Disturbance (ED) (sq. ft.): 6,000 square feet

Level 1: (I) is less than 1,000 sq. ft. and (ED) is less than 5,000 sq. ft.

Level 2: (I) is between 1,000 sq. ft. and 5,000 sq. ft. or (ED) is between 5,000 sq. ft. and 10,000 sq. ft.

Complete and attach worksheet contained in Ordinance Appendix C.1 or E (or equivalent) → Is worksheet attached? No / Yes (circled)

Level 3: (I) is between 5,000 sq. ft. and 10,000 sq. ft. or (ED) is between 10,000 sq. ft. and 20,000 sq. ft.

Complete and attach worksheet contained in Ordinance Appendix D (or equivalent) → Is worksheet attached? No / Yes

Level 4: (I) is greater than 10,000 sq. ft. or (ED) is greater than 20,000 sq. ft.

Complete and submit SWM Site Plan in accordance with Ordinance Article IV → Is a SWM Site Plan included? No / Yes

Show on the accompanying sketch that adverse downstream stormwater impacts are not created or worsened, and that additional stormwater runoff will not discharge towards adjacent property owners.

All requirements of the Ordinance have been met. Applicant Signature Joseph Homeowner Date: 6/30/2010

FOR REVIEWER ONLY

This stormwater management permit application has been (APPROVED) DENIED (circle one)

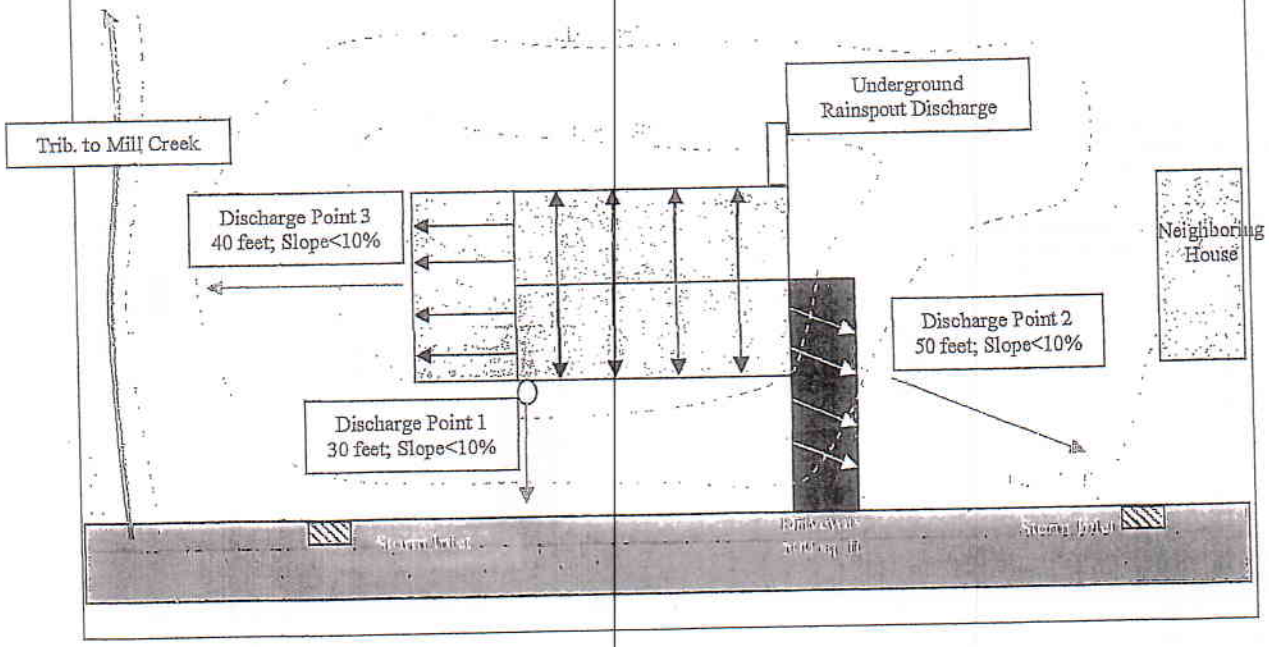
Reviewed by (print): Municipal Official Reason for Denial: N/A

Signature: Municipal Official Date: 6/30/2010

EXAMPLE 1 PROJECT SKETCH – Homeowner opted to utilize the worksheet provided in Appendix C.1 to show stormwater management for DIA.

Applicant Address: Joe Homeowner 123 Site Street Anytown, PA 12345	**Brief Description of Project:** Construction of 2,000 sq. ft. (40' x 50') single-family home with 500 sq. ft. driveway (10' x 50') and 800 sq. ft. stone patio (20' x 40'). The back half of the house discharges to rainspouts underground.				
Nearest waterbody: Tributary to Mill Creek	**No more than 1,000 sq. ft. can discharge to one point on the surface.** **Number of surface discharge points required:** 3				
Total Proposed Impervious Area (A): 3,300 sq. ft. **Total Earth Disturbance:** 6,000 sq. ft.	**Discharge Point 1:** Front of Home	**Discharge Point 2:** Driveway	**Discharge Point 3:** Patio	**Discharge Point 4:** N/A	**Discharge Point 5:** N/A
	Area: 1,000 sq. ft.	**Area:** 500 sq. ft.	**Area:** 800 sq. ft.	**Area:** N/A	**Area:** N/A
Are rainspouts discharged underground? (Y/N) Yes **If yes, contributing impervious area (B):** 1,000 sq. ft.	**Impervious Path Length:** 20 ft	**Impervious Path Length:** 10 ft	**Impervious Path Length:** 20 ft	**Impervious Path Length:** N/A	**Impervious Path Length:** N/A
	Pervious Path Length: 30 ft	**Pervious Path Length:** 50 ft	**Pervious Path Length:** 40 ft	**Pervious Path Length:** N/A	**Pervious Path Length:** N/A
Total Impervious Area Discharged on Surface (A) – (B): 3,300 – 1,000 = 2,300 sq. ft.	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** N/A	**Pervious Path Slope <10%? (Y/N)** N/A
HSG Soil Group from Appendix F.2 Hydrologic Soils Group Map (Cannot be "D" Soils): HSG "C"					

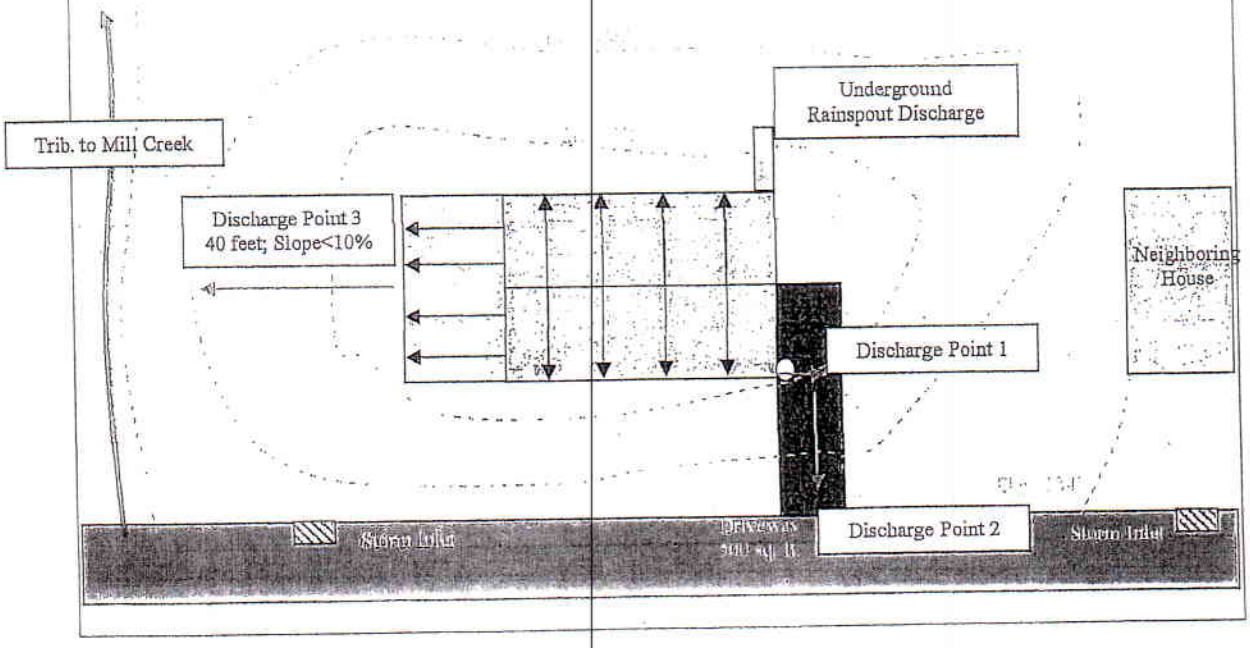
Project sketch:



EXAMPLE 2 PROJECT SKETCH – Homeowner opted to utilize the worksheet provided in Appendix C.1 to show stormwater management for DIA.

Applicant Address: Joe Homeowner 123 Site Street Anytown, PA 12345	**Brief Description of Project:** Construction of 2,000 sq. ft. (40' x 50') single-family home with 500 sq. ft. driveway (10' x 50') and 800 sq. ft. stone patio (20' x 40'). The back half of the house discharges to rainspouts underground.				
Nearest waterbody: Tributary to Mill Creek	**No more than 1,000 sq. ft. can discharge to one point on the surface.** **Number of surface discharge points required:** 3				
Total Proposed Impervious Area (A): 3,300 sq. ft. **Total Earth Disturbance:** 6,000 sq. ft.	**Discharge Point 1:** Front of Home	**Discharge Point 2:** Driveway	**Discharge Point 3:** Patio	**Discharge Point 4:** N/A	**Discharge Point 5:** N/A
	Area: 1,000 sq. ft.	**Area:** 500 sq. ft.	**Area:** 800 sq. ft.	**Area:** N/A	**Area:** N/A
Are rainspouts discharged underground? (Y/N) Yes **If yes, contributing impervious area (B):** 1,000 sq. ft.	**Impervious Path Length:** 20 ft	**Impervious Path Length:** 50 ft	**Impervious Path Length:** 20 ft	**Impervious Path Length:** N/A	**Impervious Path Length:** N/A
	Pervious Path Length: N/A	**Pervious Path Length:** N/A	**Pervious Path Length:** 40 ft	**Pervious Path Length:** N/A	**Pervious Path Length:** N/A
Total Impervious Area Discharged on Surface (A) – (B): 3,300 – 1,000 = 2,300 sq. ft.	**Pervious Path Slope <10%? (Y/N)** N/A	**Pervious Path Slope <10%? (Y/N)** N/A	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** N/A	**Pervious Path Slope <10%? (Y/N)** N/A
HSG Soil Group from Appendix F.2 Hydrologic Soils Group Map (Cannot be "D" Soils): HSG "C"					

Project sketch:



APPENDIX C.1

DISCONNECTED IMPERVIOUS AREA (DIA) AND WORKSHEET

When a regulated activity creates impervious areas between 1,000 sq. ft. and 5,000 sq. ft., or total earth disturbance between 5,000 and 10,000 sq. ft., the stormwater management requirements follow Appendix C.1 – Disconnected Impervious Areas (DIAs), of this Ordinance. If site conditions prevent the requirements of Appendix C.1 from being met, then the first 1 inch of runoff shall be captured and controlled in a manner consistent with Appendix E – Stormwater Management for Small Projects, of this Ordinance.

When rooftop or pavement runoff is directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, the contributing rooftop or pavement area may qualify as a Disconnected Impervious Area (DIA). A rooftop or pavement area is considered to be a DIA if it meets the requirements listed below:

- The soil, in proximity of the discharge area, is not designated as hydrologic soil group "D" or equivalent (see Appendix F.2. Hydrologic Soil Group Map);
- The overland flow path (pervious area serving as BMP) from discharge area has a positive slope of 10% or less;
- The length of overland flow path (pervious area serving as BMP) is greater than or equal to the contributing rooftop or pavement length;
- The length of overland flow path (pervious area serving as BMP) is greater than 25 feet.

If the discharge is concentrated at one or more discrete points, no more than 1,000 square feet of impervious area may discharge to any one point. In addition, a gravel strip or other spreading device is required for concentrated discharges. For non-concentrated discharges along the edge of the pavement, this requirement is waived; however, there must be a provision for the establishment of vegetation along the pavement edge and temporary stabilization of the area until vegetation becomes stabilized.

If rainspouts are discharged underground to provide infiltration, the portion of the impervious area draining to those rainspouts is waived from the DIA discharge requirements. Rainspouts discharged underground which are directly connected to a storm sewer system are not waived from the DIA requirements.

Computations for DIA as a BMP must be submitted to Exeter Borough. This worksheet is provided as an example, or may be used for the computations.

<table>
<tr><td>Applicant Address:</td><td colspan="5">Brief Description of Project:</td></tr>
<tr><td>Nearest waterbody:</td><td colspan="5">No more than 1,000 sq. ft. can discharge to one point on the surface.

Number of discharge points required:</td></tr>
<tr><td rowspan="2">Total Proposed Impervious Area (A):

Total Earth Disturbance:</td><td>Discharge Point 1</td><td>Discharge Point 2</td><td>Discharge Point 3</td><td>Discharge Point 4</td><td>Discharge Point 5</td></tr>
<tr><td>Area:</td><td>Area:</td><td>Area:</td><td>Area:</td><td>Area:</td></tr>
<tr><td rowspan="2">Are rainspouts discharged underground? (Y/N)

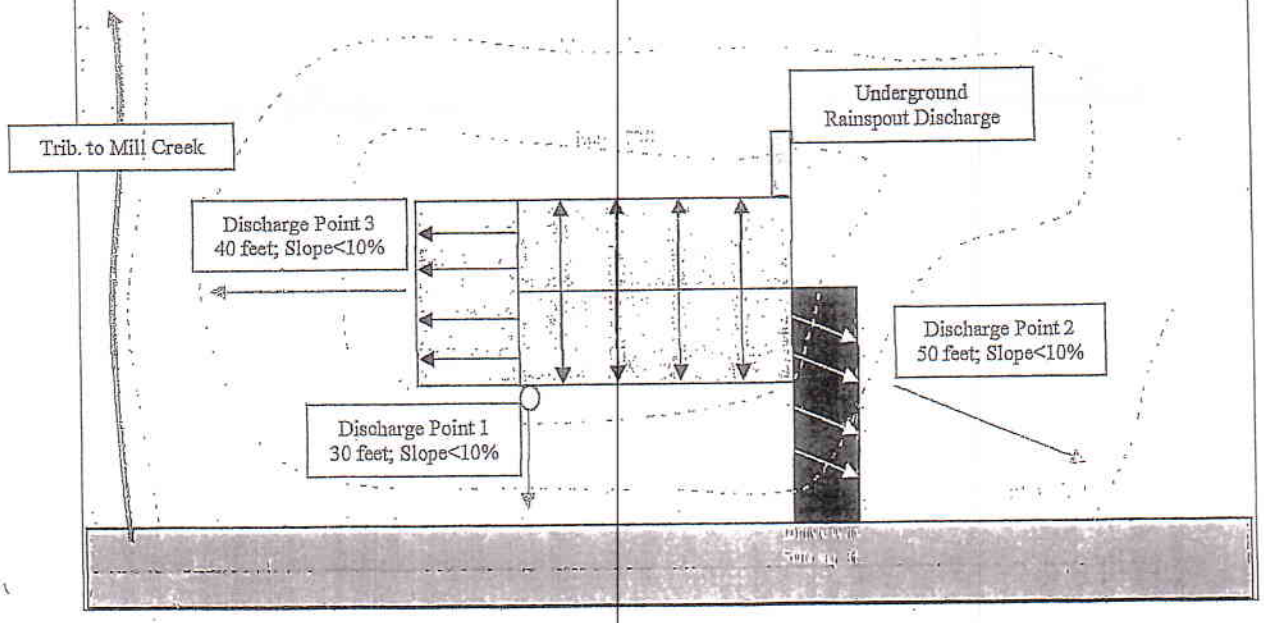
If yes, contributing impervious area (B):</td><td>Impervious Path Length:</td><td>Impervious Path Length:</td><td>Impervious Path Length:</td><td>Impervious Path Length:</td><td>Impervious Path Length:</td></tr>
<tr><td>Pervious Path Length:</td><td>Pervious Path Length:</td><td>Pervious Path Length:</td><td>Pervious Path Length:</td><td>Pervious Path Length:</td></tr>
<tr><td>Total Impervious Area Discharged on Surface (A) – (B):</td><td>Pervious Path Slope <10%? (Y/N)</td><td>Pervious Path Slope <10%? (Y/N)</td><td>Pervious Path Slope <10%? (Y/N)</td><td>Pervious Path Slope <10%? (Y/N)</td><td>Pervious Path Slope <10%? (Y/N)</td></tr>
<tr><td colspan="6">HSG Soil Group from Appendix F.2 Hydrologic Soils Group Map (Cannot be "D" Soils):</td></tr>
<tr><td colspan="6">Project sketch:</td></tr>
</table>

EXAMPLE:

Example: Joe Homeowner would like to build a single-family home, with a driveway and backyard stone patio. The home is 2,000 sq. ft., the stone patio is 800 sq. ft., and the asphalt driveway is 500 square feet.

Applicant Address: Joe Homeowner 123 Site Street Anytown, PA 12345	**Brief Description of Project:** Construction of 2,000 sq. ft. (40' x 50') single-family home with 500 sq. ft. driveway (10' x 50') and 800 sq. ft. stone patio (20' x 40'). The back half of the house discharges to rainspouts underground.				
Nearest waterbody: Tributary to Mill Creek	**No more than 1,000 sq. ft. can discharge to one point on the surface.** **Number of surface discharge points required:** 3				
Total Proposed Impervious Area (A): 3,300 sq. ft. **Total Earth Disturbance:** 6,000 sq. ft.	**Discharge Point 1:** Front of Home	**Discharge Point 2:** Driveway	**Discharge Point 3:** Patio	**Discharge Point 4:** N/A	**Discharge Point 5:** N/A
	Area: 1,000 sq. ft.	**Area:** 500 sq. ft.	**Area:** 800 sq. ft.	**Area:** N/A	**Area:** N/A
Are rainspouts discharged underground? (Y/N) Yes **If yes, contributing impervious area (B):** 1,000 sq. ft.	**Impervious Path Length:** 20 ft	**Impervious Path Length:** 10 ft	**Impervious Path Length:** 20 ft	**Impervious Path Length:** N/A	**Impervious Path Length:** N/A
	Pervious Path Length: 30 ft	**Pervious Path Length:** 50 ft	**Pervious Path Length:** 40 ft	**Pervious Path Length:** N/A	**Pervious Path Length:** N/A
Total Impervious Area Discharged on Surface (A) – (B): 3,300 – 1,000 = 2,300 sq. ft.	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** Yes	**Pervious Path Slope <10%? (Y/N)** N/A	**Pervious Path Slope <10%? (Y/N)** N/A
HSG Soil Group from Appendix F.2 Hydrologic Soils Group Map (Cannot be "D" Soils): HSG "C"					

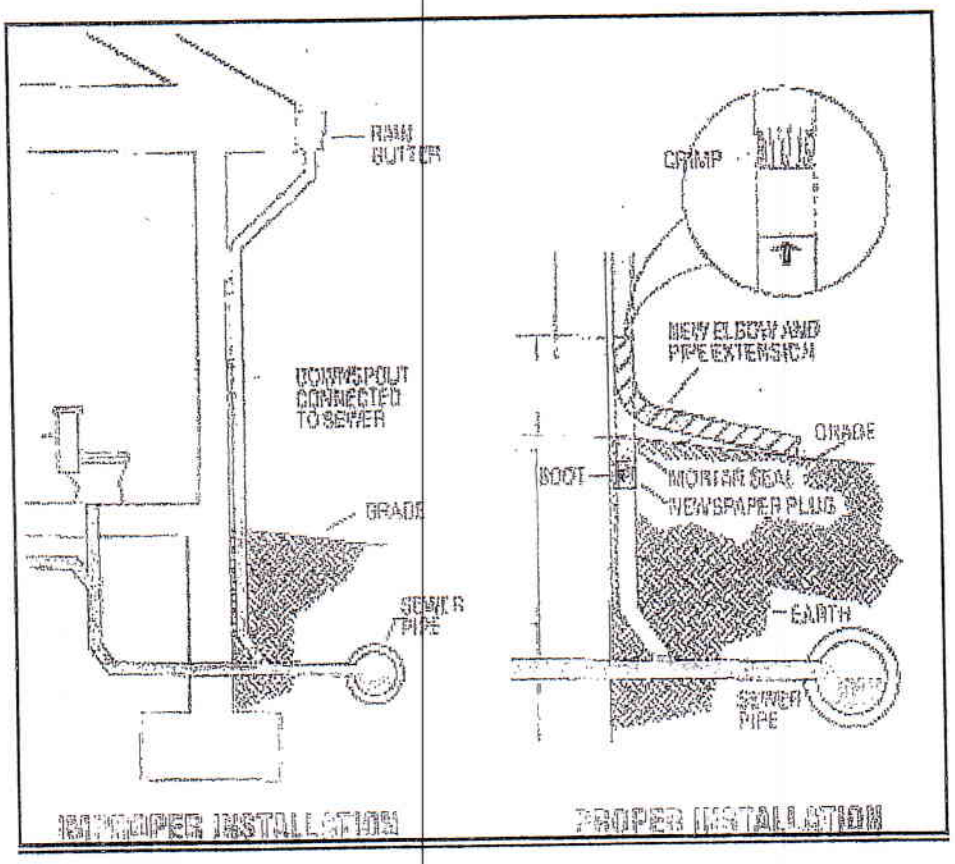
Project sketch:



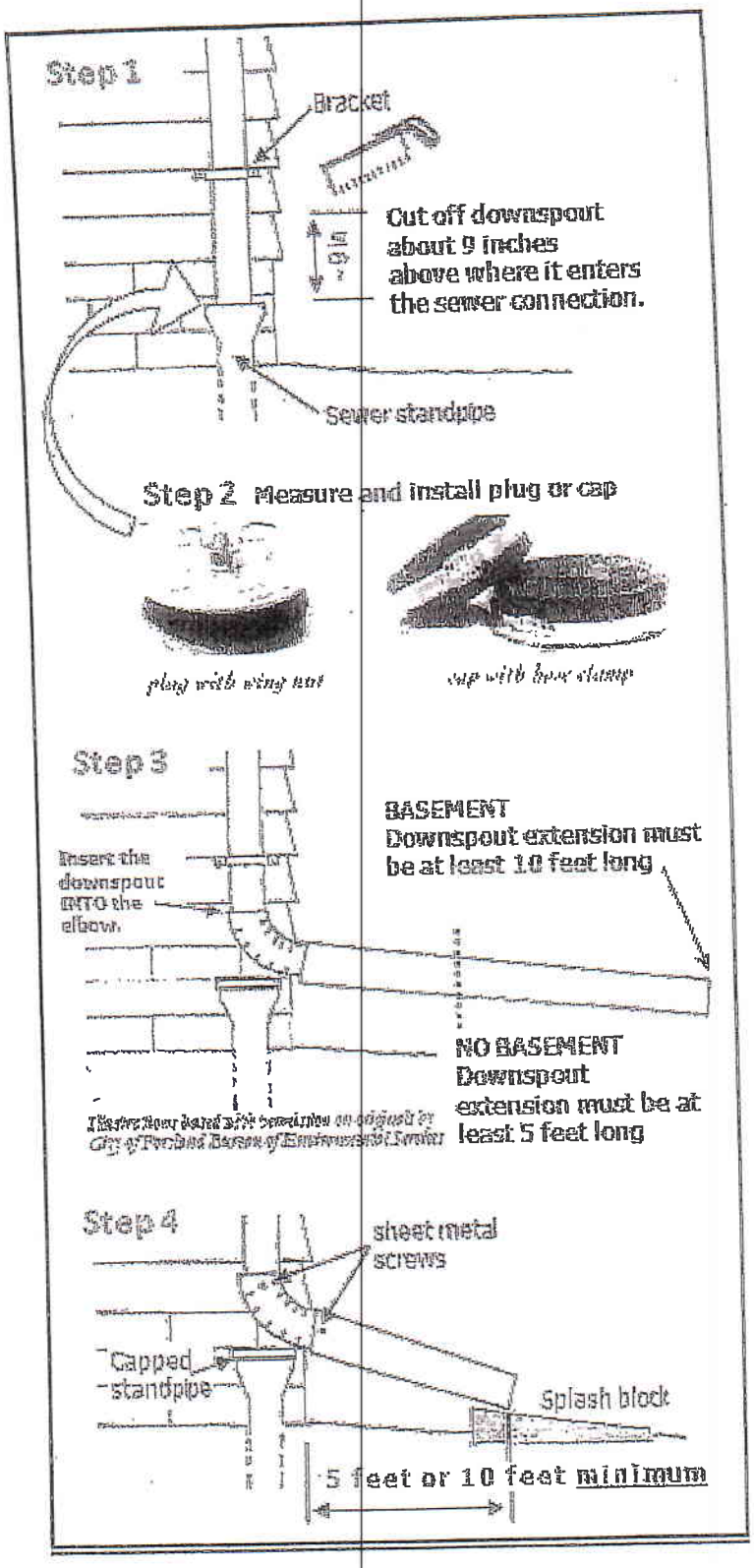
APPENDIX C.2

RAINSPOUT DISCONNECTION FROM SANITARY SEWER SYSTEMS

When roofs are being replaced, rainspouts must be disconnected from sanitary sewer systems. The following guidance is provided to enforce this requirement as part of this Ordinance, and is subject to the municipal engineer's discretion. When rainspouts are disconnected from sanitary sewer systems, it must be shown that adverse stormwater impacts are not created downstream.



Source of image: www.munciesanitary.org/stormwater-managment



Source of image: rainwise.seattle.gov/solution_brochures

APPENDIX D

PROJECTS MEETING REQUIREMENTS IN SECTION 303 SUBSECTION B

When a regulated activity creates impervious areas between 5,000 sq. ft. and 10,000 sq. ft., or total earth disturbance between 10,000 and 20,000 sq. ft., the stormwater management requirements follow Section 303 Subsection B of this Ordinance.

Section 303 Subsection B is duplicated below:

B. When CG-1 guidelines are not used, the *Simplified Method* (CG-2 in the BMP Manual[1]) has been modified to accommodate 2" of permanently removed runoff volume. This method (provided below) is independent of site conditions and should be used if the *Design Storm Method* is not followed. For new impervious surfaces:

1. The first 2 inches of runoff from new impervious surfaces shall be permanently removed from the runoff flow (i.e., it shall not be released into the surface waters of this Commonwealth). Removal options include reuse, evaporation, transpiration, and infiltration.

2. Wherever possible, infiltration facilities should be designed to accommodate infiltration of the entire permanently removed runoff; however, in all cases at least the first 0.5 inch of the permanently removed runoff should be infiltrated.

1. Facilities, to the greatest extent possible and subject to the Municipal Engineer's discretion, shall be designed to drain the permanently removed runoff volume in a period no less than 24 hours and no greater than 72 hours.

2. Runoff volume in excess of 2 inches shall be safely conveyed to existing stormwater collection systems or streams, in the direction of the existing drainage course.

5. This method is exempt from the requirements of Section 304, Rate Controls.

LEVEL 3 & 4 COMPUTATIONS FOR ALL STORMWATER FACILITIES

Computations for all stormwater facilities must be submitted to Exeter Borough. This worksheet is provided as an example, or may be used for the computations.

Applicant Address:	**Brief Description of Project:**		
Nearest waterbody:	**Permanently Removed Volume = (2 inches / 12) x (Impervious Area)** =		
Total Proposed Impervious Area:	**A Factor of Safety of 2 is applied to the Tested Infiltration Rate. Design Infiltration Rate = Tested Infiltration Rate / 2** =		
Total Earth Disturbance:	**Components of the project may be directed to multiple facilities.** Number of facilities used:		
Soil Testing Method:	Facility #1	Facility #2	Facility #3
	Component of Project: Volume Collected:	Component of Project: Volume Collected:	Component of Project: Volume Collected:
Tested Infiltration Rate (in/hr):	**Type of Facility:** **Volume of Facility*:** Area of Facility: Depth of Facility:	**Type of Facility:** **Volume of Facility*:** Area of Facility: Depth of Facility:	**Type of Facility:** **Volume of Facility*:** Area of Facility: Depth of Facility:
Additional Calcs/Notes:	Drawdown Time = Depth of Facility / Design Infiltration Rate =	Drawdown Time = Depth of Facility / Design Infiltration Rate =	Drawdown Time = Depth of Facility / Design Infiltration Rate =
	Loading Ratio = Impervious Area Controlled : Area of Facility =	Loading Ratio = Impervious Area Controlled : Area of Facility =	Loading Ratio = Impervious Area Controlled : Area of Facility =
	Existing Discharge Point (Inlet/Sewer/Stream):	Existing Discharge Point (Inlet/Sewer/Stream):	Existing Discharge Point (Inlet/Sewer/Stream):
	Discharge Method for Runoff in Excess of 2": Capacity**:	Discharge Method for Runoff in Excess of 2": Capacity**:	Discharge Method for Runoff in Excess of 2": Capacity**:
*Infiltration facilities with stone beds: 40% void space, multiply volume in stone portion by 0.4. Calculations:			
**If a grass spillway is used: Capacity (cfs) = 2.5 x Length x Freeboard$^{1.5}$ **If an orifice structure is used: Capacity (cfs) = 0.6 x Orifice Area x (2 x 32.2 x Flow Depth Above Orifice)$^{0.5}$ Capacity Calculations:			

Example: A doctor's office is proposed for a site. The building is 5,000 sq. ft. and the parking lot is 3,000 sq. ft.

<table>
<tr><td>Applicant Address:
Dr. Office
123 Site Street
Anytown, PA 12345</td><td colspan="3">Brief Description of Project: A proposed doctor's office consisting of 5,000 sq. ft. building (50' x 100') and 3,000 sq. ft. parking lot (30' x 100'). The building drains to the back of the property to an infiltration facility, and the parking lot drains to an infiltration facility adjacent the parking lot.</td></tr>
<tr><td>Nearest waterbody:

Trib. to Mill Creek</td><td colspan="3">Permanently Removed Volume = (2 inches / 12) x (Impervious Area)
= (2 inches / 12) x (8,000 sq. ft.)
= 1,333 cu. ft.</td></tr>
<tr><td rowspan="2">Total Proposed Impervious Area:
8,000 sq. ft.

Total Earth Disturbance:
12,000 sq. ft.</td><td colspan="3">A Factor of Safety of 2 is applied to the Tested Infiltration Rate.
Design Infiltration Rate = Tested Infiltration Rate / 2
= 1 in/hr / 2
= 0.5 in/hr</td></tr>
<tr><td colspan="3">Components of the project may be directed to multiple facilities.

Number of facilities used: 2</td></tr>
<tr><td rowspan="5">Soil Testing Method:

Percolation Test</td><td>Facility #1</td><td>Facility #2</td><td>Facility #3</td></tr>
<tr><td>Component of Project:
Building
Volume Collected:
5,000 x 2/12 = 833 cu. ft.</td><td>Component of Project:
Parking Lot
Volume Collected:
3,000 x 2/12 = 500 cu. ft.</td><td>Component of Project:
N/A
Volume Collected:
N/A</td></tr>
<tr><td>Tested Infiltration Rate (in/hr):

1 in/hr</td><td>Type of Facility:
Infiltration
Volume of Facility*:
1,133 cu. ft.
Area of Facility:
50' x 10' = 500 sq. ft.
Depth of Facility:
1 ft. stone + 1.3 ft. = 2.3 ft.</td><td>Type of Facility:
Infiltration
Volume of Facility*:
590 cu. ft.
Area of Facility:
30' x 10' = 300 sq. ft.
Depth of Facility:
½ ft. stone + 1.3 ft. = 1.8 ft.</td><td>Type of Facility:
N/A
Volume of Facility*:
N/A
Area of Facility:
N/A
Depth of Facility:
N/A</td></tr>
<tr><td rowspan="3">Additional Calcs/Notes:

Facilities have 2:1 horizontal:vertical side slopes. Therefore, actual volumes are greater which provides some additional storage for larger events.

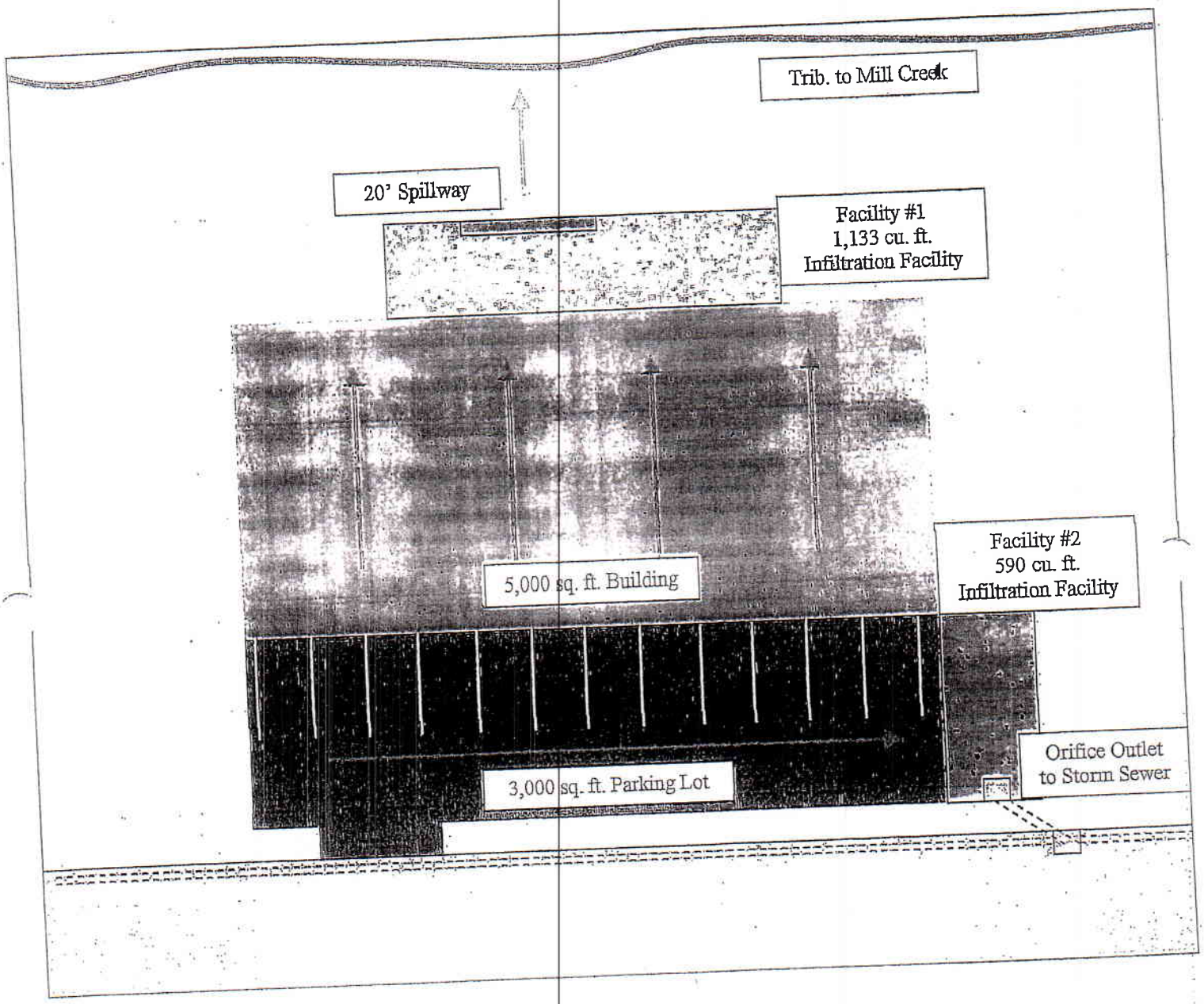
Both facilities have 1 foot of freeboard. This volume is additional to the volume provided in the calculations.</td><td>Drawdown Time = Depth of Facility / Design Infiltration Rate =
2.3 ft. x 12 in. / 0.5 in/hr = 55.2 hrs</td><td>Drawdown Time = Depth of Facility / Design Infiltration Rate =
1.8 ft. x 12 in. / 0.5 in/hr = 43.2 hrs</td><td>Drawdown Time = Depth of Facility / Design Infiltration Rate =
N/A</td></tr>
<tr><td>Loading Ratio = Impervious Area Controlled : Area of Facility =
5,000 sq. ft. : 500 sq. ft. = 10:1</td><td>Loading Ratio = Impervious Area Controlled : Area of Facility =
3,000 sq. ft. : 300 sq. ft. = 10:1</td><td>Loading Ratio = Impervious Area Controlled : Area of Facility =
N/A</td></tr>
<tr><td>Existing Discharge Point (Inlet/Sewer/Stream):
Stream

Discharge Method for Runoff in Excess of 2":
Spillway
Capacity**:
50 cfs</td><td>Existing Discharge Point (Inlet/Sewer/Stream):
Inlet/Sewer System

Discharge Method for Runoff in Excess of 2":
Orifice Outlet
Capacity**:
77 cfs</td><td>Existing Discharge Point (Inlet/Sewer/Stream):
N/A

Discharge Method for Runoff in Excess of 2":
N/A
Capacity**:
N/A</td></tr>
<tr><td colspan="4">*Infiltration facilities with stone beds: 40% void space, multiply volume in stone portion by 0.4. Calculations:
Facility #1 has 1 ft. of stone: 500 ft^2 x 1 ft. stone x 0.4 = 200 ft^3 in stone portion; Volume = 500 ft^3 stone + (833 – 200) = 1,133 cu. ft.
Depth = 1 ft. stone + (833 – 200) / 500 ft^2 = 1 ft. + 1.3 ft = 2.3 ft.
Facility #2 has ½ ft. of stone: 300 ft^2 x ½ ft. stone x 0.4 = 60 ft^3 in stone portion; Volume = 150 ft^3 stone + (500 – 60) = 590 cu. ft.
Depth = ½ ft. stone + (500 – 60) / 300 sq. ft. = ½ ft. + 1.3 ft. = 1.8 ft.</td></tr>
<tr><td colspan="4">**If a grass spillway is used: Capacity (cfs) = 2.5 x Length x Freeboard$^{1.5}$
**If an orifice structure is used: Capacity (cfs) = 0.6 x Orifice Area x (2 x 32.2 x Flow Depth Above Orifice)$^{0.5}$
Capacity Calculations:
Facility #1 spillway: Capacity = 2.5 x (20 ft.) x (1 ft.)$^{1.5}$ = 50 cfs
Facility #2 orifice outlet: Use 1 ft. high by 2 ft. wide orifice; Capacity = 0.6 x (2 ft^2) x (2 x 32.2 x 1)$^{0.5}$ = 77 cfs</td></tr>
</table>

Project Sketch



APPENDIX E

STORMWATER MANAGEMENT FOR SMALL PROJECTS

Applicability: Stormwater management procedures for projects between 1,000 sq. ft. and 5,000 sq. ft. of proposed impervious area or total earth disturbance between 5,000 sq. ft. and 10,000 sq. ft. for which site conditions prevent the use of Ordinance Appendix C.1 - Disconnected Impervious Area (DIA) as a BMP.

Note: This small projects document is not to be used to plan for multiple lots without obtaining prior written approval from Exeter Borough. Approvals and actions associated with this document do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other code, law or ordinance.

E.1 Introduction

These methods have been developed to allow homeowners to comply with stormwater management criteria for new projects to meet the requirements of the Act 167 Stormwater Management Ordinance of Exeter Borough including sizing, designing, locating, and installing on-lot measures, referred to herein as "Best Management Practices" (BMPs). Pennsylvania Act 167 was authorized on October 4, 1978 (32 P.S., P.L. 864) and gave Pennsylvania municipalities the power to regulate activities that affect stormwater runoff and surface and groundwater quantity and quality.

Individual home construction projects on single-family lots which result in 1,000 sq. ft. to 5,000 sq. ft. of proposed impervious area (including the building footprint, driveway, sidewalks, and parking areas) are not required to submit formal stormwater management (SWM) site plans to Exeter Borough; however, they must address water quality and infiltration goals, and submit the worksheet as outlined in this small projects document. If the guidelines presented in this brochure are followed, the individual homeowner will not require professional services to comply with these water quality and infiltration goals.

Section E.2 presents options of BMPs that can be considered for on-lot stormwater management. Section E.3 describes requirements and outlines the method for designing a suitable BMP, and a description of what needs to be included on the simple sketch plan, and the Small Projects Worksheet in Table E.4. Section E.4 contains an example of how to obtain the size and dimensions of the BMPs, complete the site sketch, and prepare the Small Project Worksheet.

The stormwater management method for small projects requires:

- The first 1" of rainfall runoff from proposed impervious surfaces to be captured (see definition of captured in Article II of the Ordinance).

The purpose of this small projects document is to help reduce stormwater runoff in the community, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality, and to otherwise protect water resources and public safety.

What needs to be sent to Exeter Borough?

Stormwater computations and a sketch plan must be submitted to Exeter Borough. The small projects worksheet found in Table E.4 and a simple sketch plan containing the features described in Step 5 of Section E.3 is provided as an example, or may be used for submission to Exeter Borough, and if applicable, the contractor prior to construction.

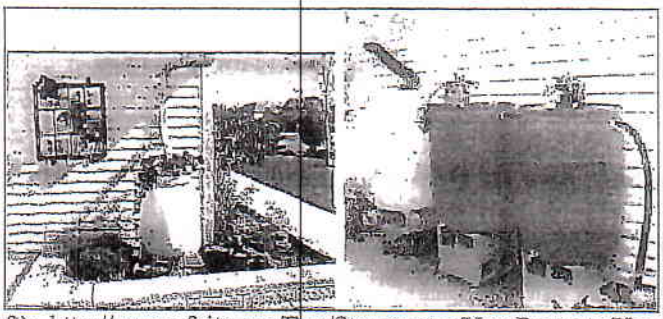
E.2 Description of BMPs

The following is a description of several types of BMPs that could be implemented. Refer to Chapter 6 of the PA BMP Manual which can be found on the PA Department of Environmental Protection's website for specifications and steps for construction for the following BMPs. A list of routine maintenance for each of the BMPs described below is also included at the end of this section.

Rain Barrels/Cisterns

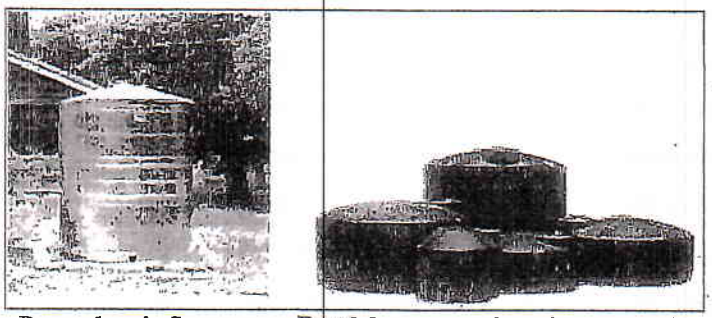
- Rain barrels and cisterns are large containers that collect drainage from roof leaders and temporarily store water to be released to lawns, gardens, and other landscaped areas; rain barrels are typically less than 50 gallons in size, and cisterns typically have volumes of up to 1,000 gallons or more, and can be placed on the surface or underground.

Figure E.1. Rain Barrels.



Source (left): http://www.rfcity.org/Eng/Stormwater/YourProperty/YourProperty.htm
Source (right): http://www.floridata.com/tracks/transplantedgardener/Rainbarrels.cfm

Figure E.2. Cisterns.

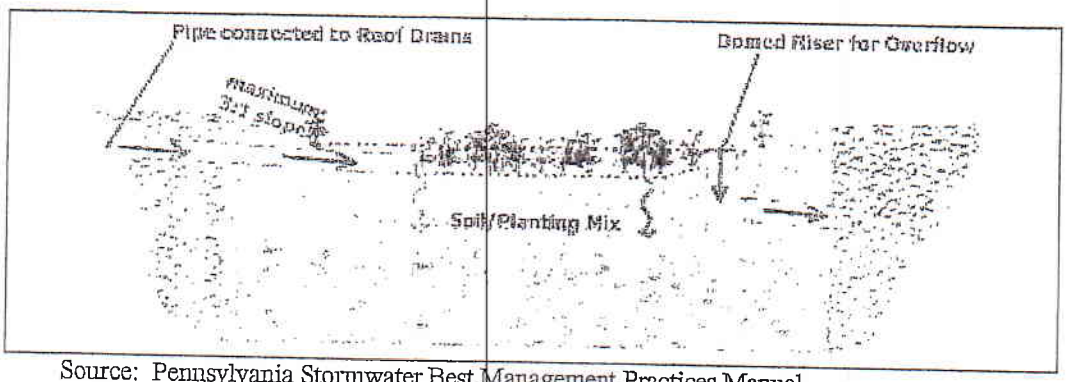


Source: Pennsylvania Stormwater Best Management Practices Manual.

Rain Garden/Bioretention Area

- A rain garden/bioretention area is an excavated depression area on the surface of the land in which native vegetation is planted to filter and use stormwater runoff; depths of 1.0 foot or less are recommended. Planting species should be native to Pennsylvania.

Figure E.3. Typical Rain Garden/Bioretention Area.



Source: Pennsylvania Stormwater Best Management Practices Manual.

Table E.1. Sample Plant List for Use in a Rain Garden/Bioretention Area.

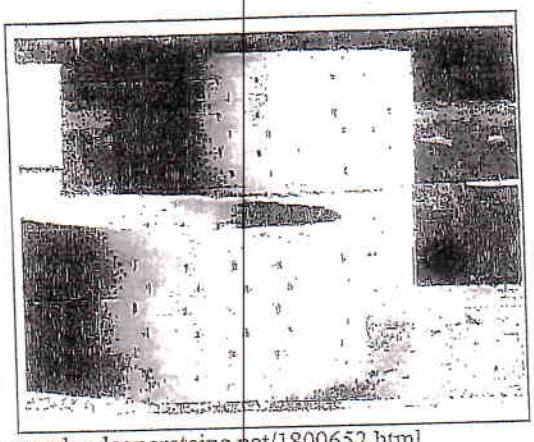
Common Name	Scientific Name	Plant Type
Red Maple	Acer rubrum	Tree
Grey Birch	Betula populifolia	Tree
Shadbush Serviceberry	Amelanchier canadensis	Tree
Eastern Cotton-wood	Populus grandidentata	Tree
Virginia Sweetspire	Itea virginica	Shrub
Red-Twig Dogwood	Cornus sericea (stolonifera) 'Arctic Fire'	Shrub
Southern Arrow-wood	Viburnum dentatum	Shrub
Black Choke Berry	Aronia melanocarpa	Shrub
Great Blue Lobelia	Lobelia siphilitica	Perennial
Dwarf Pink false aster	Boltonia asteroides 'Nana'	Perennial
White false aster	Boltonia asteroides 'Snowbank'	Perennial
Switchgrass	Panicum virgatum	Grass

Source: Pennsylvania Stormwater Best Management Practices Manual.

Dry Wells

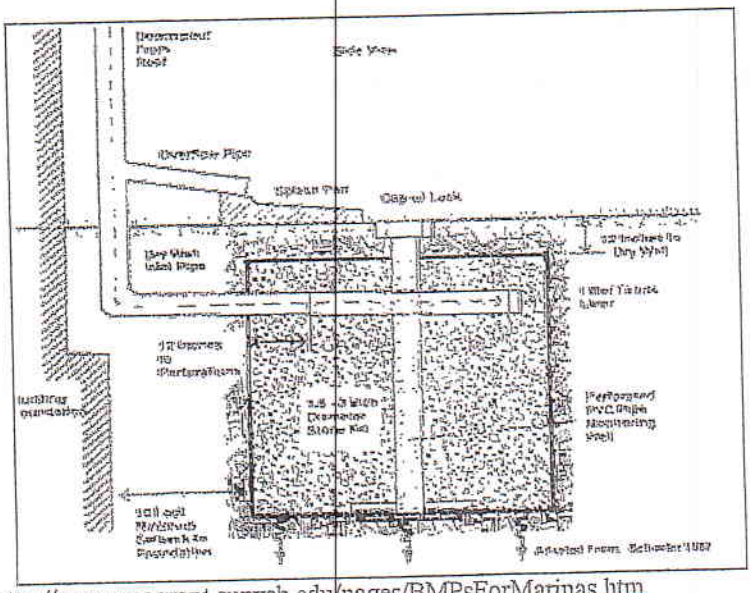
- A dry well, also referred to as a seepage pit is a subsurface storage facility that temporarily stores and infiltrates runoff from the roofs of buildings or other impervious surfaces; recommended depth of dry well is between 1.0 and 4.0 feet.
- Dry Well #1 – structural prefabricated chamber; no stone fill.
- Dry Well #2 – excavated pit filled with stone fill.

Figure E.4. Dry Well #1 – Structural Prefabricated Chamber.



Source: http://www.copelandconcreteinc.net/1800652.html

Figure E.5. Dry Well #2 – Excavated Pit Filled with Stone Fill.

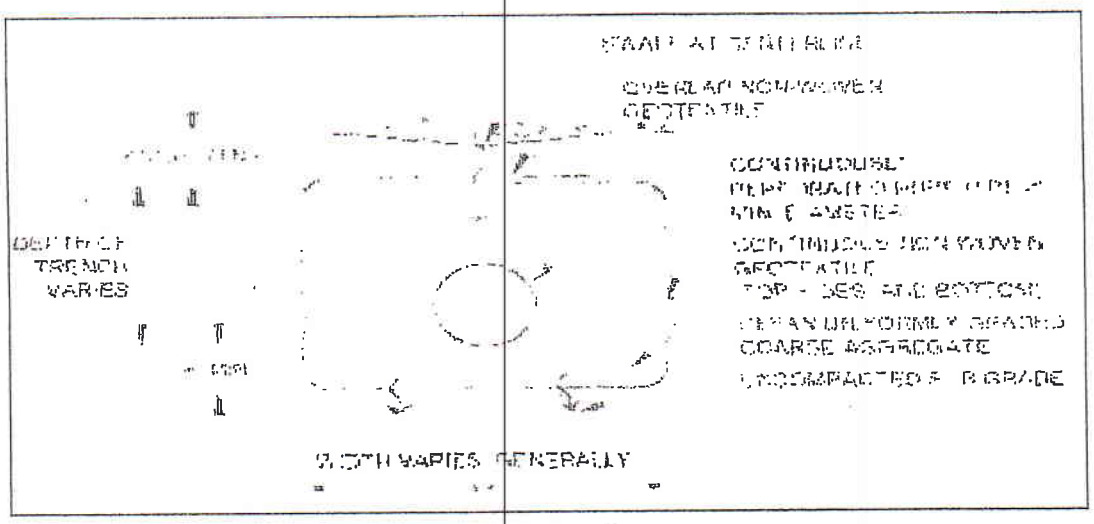


Source: http://www.seagrant.sunysb.edu/pages/BMPsForMarinas.htm

Infiltration Trench

- An infiltration trench is a long, narrow, rock-filled trench with or without a perforated pipe that receives stormwater runoff and has no outlet.
- Runoff is stored in the void space between the stones and in the pipe and infiltrates through the bottom and into the underlying soil matrix.
- The width is limited to between 3 and 8 feet, and the depth ranges from 2 to 5 feet.

Figure E.6. Infiltration Trench.



Source: Pennsylvania Stormwater Best Management Practices Manual.

Routine Maintenance for BMPs

- Vegetation along the surface of an infiltration trench should be maintained in good condition, and any bare spots should be revegetated as soon as possible.
- Vehicles shouldn't be parked or driven on an infiltration trench, and care should be taken to avoid excessive compaction by mowers.
- Any debris such as leaves blocking flow from reaching an infiltration trench or bioretention/rain garden should be routinely removed.
- While vegetation is being established, pruning and weeding may be required for a bioretention/rain garden.
- Mulch in a bioretention/rain garden needs to be re-spread when erosion is evident. Once every two to three years or after major storms the entire area may require mulch replacement.
- At least twice a year the landowner needs to inspect the bioretention/rain garden for sediment buildup and vegetative conditions.
- During periods of extended drought, the bioretention/rain garden requires watering.
- Trees and shrubs in a bioretention/rain garden need to be inspected at least twice per year by the landowner to evaluate their health. If they are in poor health, they need to be replaced.
- Dry wells need to be inspected by the landowner at least four times a year and after significant rainfalls, and debris/trash, sediment, and any other waste material need to be removed and disposed of at suitable disposal/recycling sites and in compliance with local, state, and federal waste regulations.
- For dry wells, gutters need to be regularly cleaned out, and proper connections must be maintained to facilitate the effectiveness of the dry well.
- The filter screen for the dry well that intercepts roof runoff must be replaced as necessary.
- Dry wells that are damaged need to be fixed or replaced immediately.
- If an intermediate sump box exists in conjunction with a dry well, it must be cleaned out at least once per year.
- Rain barrels and cisterns need to be cleared of debris routinely at least every three months and after significant storms to allow stormwater from gutters to enter them.
- Gutters that directly convey rain water to dry wells, rain barrels, and cisterns need to be routinely cleared of trash and debris at least every three months and after significant storms.
- Rain barrels and cisterns must be kept covered.
- Rain barrels and cisterns should be routinely emptied so that they are only ¼ of the way full to allow for storage of additional rainwater.
- Overflow outlets from rain barrels and cisterns must be kept free and clear of debris.
- Rain barrels and cisterns that are damaged need to be fixed or replaced immediately.

E.3. Determination of BMPs and Volume Requirements

All proposed impervious areas must be included in the determination of the amount of new impervious areas and the size of proposed BMPs needed to control stormwater.

Proposed impervious areas on an individual residential lot include:

- Roof area
- Pavement
- Sidewalks
- Driveways
- Patios
- Porches
- Permanent pools
- Parking areas

Sidewalks, driveways, or patios that are constructed with gravel or pervious pavers that will not be converted to an impervious surface in the future need not be included in this calculation. Therefore, the amount of proposed impervious area can be reduced for proposed driveways, patios, and sidewalks through the use of gravel, pervious pavement, and turf pavers. All proposed impervious areas must be constructed so that runoff is conveyed to a BMP; no runoff can be directed to storm sewers, inlets, or other impervious areas (i.e., street).

All new construction should incorporate design techniques that include: minimizing the amount of land disturbance, reducing impervious cover, disconnecting gutters and directing runoff to vegetated areas to infiltrate, and redirecting the flow of runoff from impervious driveways to vegetated areas instead of to the street or gutter.

Below are the steps that must be undertaken to meet the Ordinance requirements. The results obtained for each step must be included in the Small Projects Worksheet found in Table E-4:

STEP 1 – Determine the total area of all proposed impervious surfaces (square feet) that will need to drain to one or more BMPs.

STEP 2 – Determine locations where BMPs need to be placed, and the contributing impervious area "***I***" (square feet) to each.

STEP 3 – Select the BMPs to be used and determine the requirements of each from Section E.3.

STEP 4 – Obtain the required storage volume "*V*" (cubic feet) and surface area "*A*" (square feet) needed for each of the proposed BMPs from the appropriate heading below.

Note: all calculations are based on 1 inch of rainfall.

For Rain Barrels/Cisterns

- The typical volume of a rain barrel is less than 50 gallons; if a greater volume is required, more than one rain barrel will be needed or a cistern may be used.
- For calculations, assume the rain barrel is already 25% full.
- Calculate volume in Cubic Feet:

$$V_{cf} = (1 \text{ inch} \times 1/12 \times I) / 0.75$$

- Convert to Gallons:

$$V_{gal} = V_{cf} \times 7.48$$

For Rain Gardens/Bioretention or Dry Well #1:

- Rain gardens and bioretention areas are only used for depths less than or equal to 1.0 feet; a dry well #1 is used for depths between 1.0 and 4.0 feet.
- Select the depth "***D***" (feet) for the facility.
- For calculations, assume the facility is empty (0% full).
- Calculate volume in Cubic Feet:

$$V_{cf} = (1 \text{ inch} \times 1/12 \times I)$$

- Calculate surface area of the facility in Square Feet:

$$A_{sf} = V_{cf} / D$$

For Dry Well #2 or Infiltration Trench:

- A dry well #2 is used for depths between 1.5 feet and 4.0 feet; an infiltration trench is used for depths between 2.0 and 5.0 feet.
- Select the depth "***D***" (feet) for the facility.
- For calculations, assume the void ratio of the stone is 40%.
- Calculate volume in Cubic Feet:

$$V_{cf} = (1 \text{ inch} \times 1/12 \times D) / 0.4$$

- Calculate surface area of the facility in Square Feet:

$$A_{sf} = V_{cf} / D$$

- Determine the dimensions of the facility based on "***A***" calculated.

STEP 5 - Sketch a simple site plan that includes:

- Name and address of the owner of the property, and or name and address of the individual preparing the plan, along with the date of submission.
- Location of proposed structures, driveways, or other paved areas with approximate size in square feet.
- Location, orientation, and dimensions of all proposed BMPs. For all rain gardens/bioretention, infiltration trenches, and dry wells, the length, width, and depth must be included on the plan. For rain barrels or cisterns the volume must be included.
- Location of any existing or proposed on-site septic system and/or potable water wells showing rough proximity to infiltration facilities.
- Location of any existing waterbodies such as; streams, lakes, ponds, wetlands, or other waters of the Commonwealth within 100 feet of the project site, and the distance to the project site and/or BMPs. It is recommended that the project or BMPs be located at least than fifty (50) feet away from a perennial or intermittent stream. If an existing buffer is legally prescribed (i.e., deed, covenant, easement, etc.), the existing buffer shall be maintained.
- Location of all existing structures including buildings, driveways, and roads within fifty (50) feet of the project site.

Fill in the small projects worksheet found in Table E.4, then submit the worksheet and the simple site sketch (or equivalent) to Exeter Borough.

Table E.4. Small Projects Worksheet.

Small Projects Worksheet					
STEP 1					
Component #1 of Project	**Impervious Area from Component #1**	**Component #2 of Project**	**Impervious Area from Component #2**	**Component #3 of Project**	**Impervious Area from Component #3**
	sq. ft.		sq. ft.		sq. ft.
Total Impervious Area =		sq. ft.			
STEP 2					
BMP #1		**BMP #2**		**BMP #3**	
Captures:		**Captures:**		**Captures:**	
Impervious Area I_1:	sq. ft.	**Impervious Area I_2:**	sq. ft.	**Impervious Area I_3:**	sq. ft.
STEP 3					
BMP #1		**BMP #2**		**BMP #3**	
Type:		**Type:**		**Type:**	
STEP 4					
BMP #1		**BMP #2**		**BMP #3**	
Volume:		**Volume:**		**Volume:**	
Dimensions:		**Dimensions:**		**Dimensions:**	
Note: For additional BMPs, use additional sheets					

E.4. Example

Joe Homeowner wants to build an 800 sq. ft. two car garage, and a 700 sq. ft. impervious driveway. Site conditions in the urban setting prevent the use of Disconnected Impervious Area (DIA) as a BMP.

STEP 1 – Determine the total area of all proposed impervious surfaces that will need to drain to one or more BMPs.

- Garage roof: 20 ft. x 40 ft. = 800 sq. ft.
- Driveway: 50 ft. x 14 ft. = 700 sq. ft.
- Total proposed impervious surface = 800 + 700 = **1,500 sq. ft.**

STEP 2 – Determine locations where BMPs need to be placed, and the contributing impervious area "***I***" to each.

- Use BMP #1 to capture runoff from the garage (I_1 = 800 sq. ft.)
- Use BMP #2 to capture runoff from the driveway (I_2 = 700 sq. ft.).

STEP 3 – Select the BMPs to be used and determine the requirements of each from Section E.3.

- BMP #1 – rain barrel/cistern
- BMP #2 – infiltration trench

STEP 4 – Obtain the required storage volume "***V***" and surface area "***A***" needed for each of the proposed BMPs from the appropriate heading below.

For Rain Barrel/Cistern (BMP #1)

- Calculate volume in cubic feet:

$$V_{cf} = (1 \text{ inch} \times 1/12 \times I_1) / 0.75$$
$$= (1 \text{ inch} \times 1/12 \times 800) / 0.75$$
$$= \mathbf{88.89 \text{ cubic feet}}$$

- Convert to gallons:

$$V_{gal} = V_{cf} \times 7.48$$
$$= 88.89 \times 7.48$$
$$= 664.8 \text{ gallons} \rightarrow \textbf{round up to 665 gallons}$$

For Infiltration Trench (BMP #2)

- Select depth "***D***" for the facility of **2 feet** (between 2.0 feet and 5.0 feet).
- Calculate volume in cubic feet:

$$V_{cf} = (1 \text{ inch} \times 1/12 \times I_2) / 0.4$$
$$= (1 \text{ inch} \times 1/12 \times 700) / 0.4$$
$$= 145.8 \text{ cubic feet} \rightarrow \text{round up to } 150 \text{ cubic feet}$$

- Calculate surface area of the facility in square feet:

$$A_{sf} = V_{cf} / D$$
$$= 150 / 2$$
$$= 75 \text{ square feet}$$

- The driveway is 50 feet long, so using the upper 30 feet of the driveway as the length of the infiltration trench, the width of the trench =

$$75 \text{ square feet} / 30 \text{ feet} = 2.5 \text{ feet}$$

- Use a **2.5 ft. wide x 30 ft. long x 2 ft. deep** infiltration trench.

STEP 5 – Prepare a simple site sketch (Figure E.7) and complete Small Projects Worksheet (Table E.4) to send to Municipality.

Figure E.7. Simple Site Sketch of Proposed Project and Proposed BMPs.

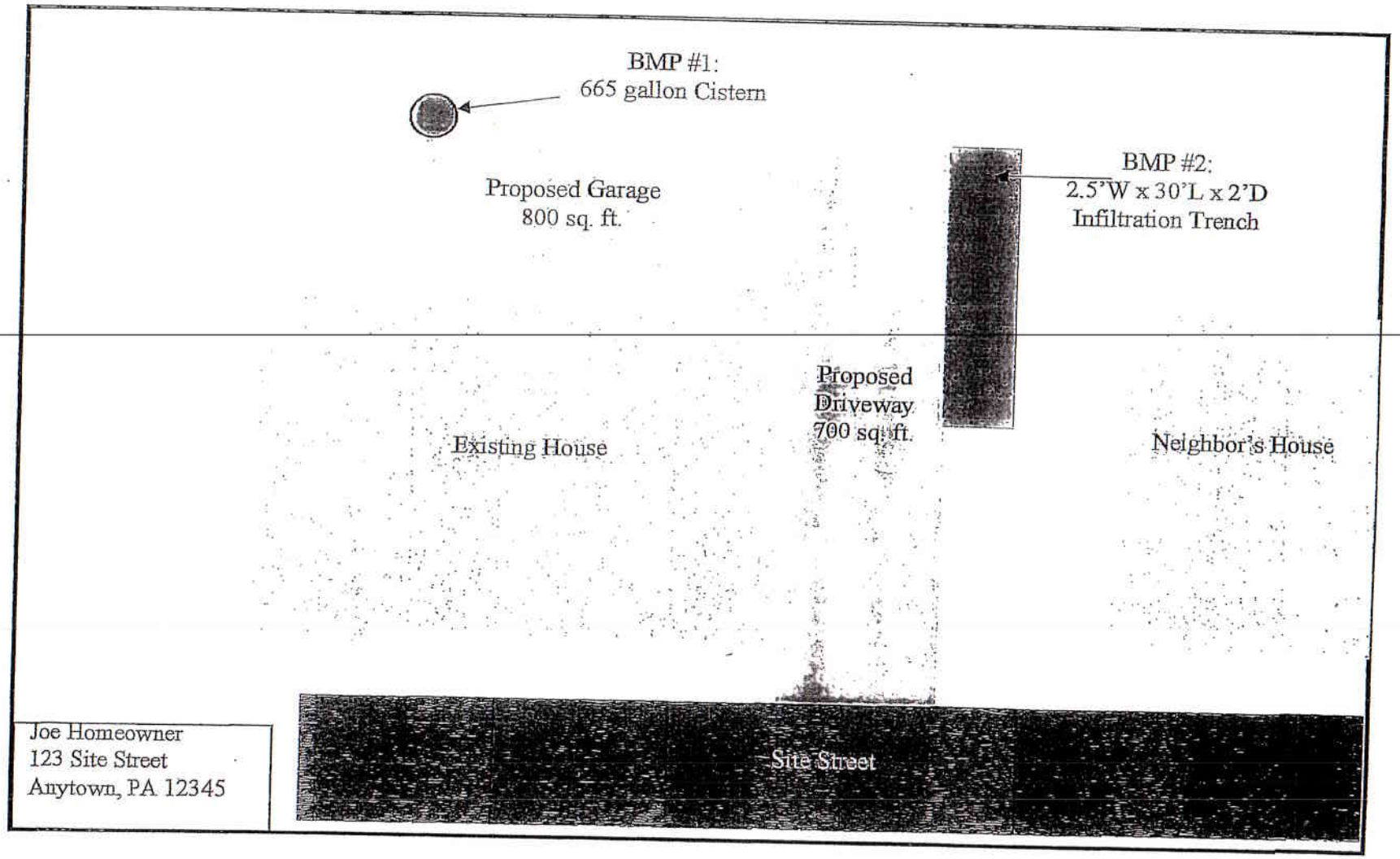


Table E.4. Small Projects Worksheet.

Small Projects Worksheet					
STEP 1					
Component #1 of Project	**Impervious Area from Component #1**	**Component #2 of Project**	**Impervious Area from Component #2**	**Component #3 of Project**	**Impervious Area from Component #3**
Garage Roof	800 sq. ft.	Driveway	700 sq. ft.	N/A	N/A
Total Impervious Area =		1,500 sq. ft.			
STEP 2					
BMP #1		**BMP #2**		**BMP #3**	
Captures:	Garage Roof	**Captures:**	Driveway	**Captures:**	N/A
Impervious Area I_1:	800 sq. ft.	**Impervious Area I_2:**	700 sq. ft.	**Impervious Area I_3:**	N/A
STEP 3					
BMP #1		**BMP #2**		**BMP #3**	
Type:	Cistern	**Type:**	Infiltration Trench	**Type:**	N/A
STEP 4					
BMP #1		**BMP #2**		**BMP #3**	
Volume:	88.89 cu. ft.	**Volume:**	150 cubic feet	**Volume:**	N/A
Dimensions:	665 gallons	**Dimensions:**	2.5' W x 30'L x 2' D	**Dimensions:**	N/A
Note: For additional BMPs, use additional sheets					