HG 225-06 WWTP Expansion Site Plan

Commant 4/1 9/06 NJ 8/24/07

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Martin O'Malley Governor

Anthony G. Brown Lt. Governor



Margaret G. McHale Chair

> Ren Serey Executive Director

#### STATE OF MARYLAND CRITICAL AREA COMMISSION CHESAPEAKE AND ATLANTIC COASTAL BAYS

1804 West Street. Suite 100. Annapolis, Maryland 21401 (410) 260-3460 Fax: (410) 974-5338 www.dnr.state.md.us/criticalarea/

#### **MEMORANDUM**

To: Mr. George Keller, Program Administrator, MDE Water Management Administration

From: Marshall Johnson, Natural Resources Planner, Critical Area Commission

Date: August 24, 2007

#### RE: FONSI # 107, Havre De Grace Wastewater Treatment Plant Upgrade/Expansion Harford County

This office has received the notice of a project for City of Havre De Grace wastewater treatment plant upgrade and expansion. This proposal is required to comply with COMAR 27.02.02 - State and Local Agency Actions Resulting in Development of Local Significance on Private Lands or Lands Owned by Local Jurisdictions. A previous review by this office of an upgrade and expansion of the plant resulted in concurrence that the project is consistent with the City's Critical Area Program. However, as stated in the May 15, 2006 letter from my office (attached), any changes in the development plan described in that letter, or expansion of disturbance area on this site, will require additional review by my office. In order to be consistent with the City Program, development activity proposed in the Critical Area must meet all requirements of the Town's Ordinance and COMAR, including the policies and criteria for habitat protection areas in COMAR 27.01.09. The proposed project is in the IDA (Intensely Developed Area) of the Critical Area, which requires documentation that the 10% pollution reduction standard will be met.

Thank you for the opportunity to comment. Please contact me at (410) 260-3479 if you have any questions.

cc: HG 225-06

Attachment)

Robert L. Ehrlich, Jr. Governor

Michael S. Steele Lt. Governor



Martin G. Madden Chairman

> Ren Serey Executive Director

#### STATE OF MARYLAND CRITICAL AREA COMMISSION CHESAPEAKE AND ATLANTIC COASTAL BAYS

1804 West Street, Suite 100, Annapolis, Maryland 21401 (410) 260-3460 Fax: (410) 974-5338 www.dnr.state.md.us/criticalarea/

May 15, 2006

Mr. Jay Bautz Deputy Director Department of Economic and and Planning City of Havre de Grace Havre de Grace, Maryland 21078

RE: City of Havre de Grace Wastewater Treatment Plant Consistency Report

Dear Mr. Bautz:

Thank you for providing "Notification of Certification" that the above project is consistent with the City's Critical Area program. The City's Department of Public Works is proposing to expand an existing wastewater treatment plant in order to accommodate new development in the City. The project will be built in two phases. The first phase will include the addition of a tank, compost storage pad, pumping station and flow equalization vault. Site clearing will take place in the southern portion of the site to allow for construction of the flow equalization and compost pad storage area and the oxidation ditch reactor. The second phase will include additional structures such as aerations tanks, filters and pumping stations. The plant is in an Intensely Developed Area; the expansion will not impact the 100-foot Buffer.

This office understands:

1. That stormwater will be mitigated on-site by reducing pollutant loadings. Dry swales will meet the 10 % pollutant reduction requirement; and,

2. The City is proposing to use an open space area at the site for tree planting to offset the impacts of clearing 4.45 acres.

Continued, Page Two City of Havre de Grace WWTP Consistency May 15, 2006

The Commission staff has determined that the above proposed development: 1) has environmental or economic consequences that will largely be confined to the immediate area of the site on which the development is located, 2) does not substantially affect the Critical Area program of the local jurisdiction, and 3) is not considered by the Commission as major development. (See COMAR: Chapter Two, Regulations for Development in the Critical Area Resulting from State and Local Agency Programs).

Therefore, approval of the above project by the Commission is not necessary. If there are any changes in development that may affect the habitat within the area on site, this office would like to be notified immediately at (410) 260-3483.

Sincerely,

Dawnn McCleary

Natural Resources Planner

cc: Al Henry Regina Esslinger HG 225-06



## City of Havre de Grace

711 PENNINGTON AVENUE, HAVRE DE GRACE, MARYLAND 21078 www.havredegracemd.com

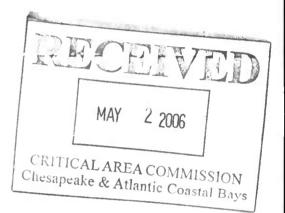
225-06

(4|0) 939-1800 (4|0) 575-7043 FAX(4|0) 939-3692

May 1, 2006

Ms. Dawnn McCleary State of Maryland Chesapeake Bay Critical Area Commission 1804 West Street Annapolis, MD 21401

RE: City of Havre de Grace Waist Water Treatment Plant Expansion Project Consistency with Local Critical Area Program



Dear Ms. McCleary:

The City of Havre de Grace is proposing to expand its existing waist water treatment plant (WWTP) located with the Chesapeake Bay Critical Area. The tremendous residential growth taking place in the City is estimated at approximately 3,500 dwelling units between the years 2004 and 2012. The current processing ability of the WWTP is 1.89 million gallon per day (mgd). Build out of the proposed dwelling increase will require the WWTP processing to be increased to about 3 mgd. The proposed expansion will'provide a processing capacity of 3.3 mgd.

The existing WWTP is located in the Intensely Developed Area of the Critical Area and a very small section within the 100 foot buffer. No portion of the expansion of the WWTP is proposed within the buffer zone. The WWTP is classified as a Water Dependent Facility by the intrinsic nature of its design and use. The impacts of storm water associated with the expansion will be mitigated on-site through Best Management Practices (BMPs) in accordance with the 2000 Maryland Stormwater Design Manual to achieve compliance with the 10% pollutant reduction requirements within the Critical Area.

Clearing of 4.45 acres is not located in a non-tidal wetland, riparian forest, Critical Area Buffer or region of threatened or endanger wildlife. The City is considering utilizing the minimal available open space on the project property for tree planting to offset the impacts of the clearing. In conclusion, a review of the WWTP project finds the proposal to be compliant and consistent with the City of Havre de Grace Critical Area Program. Should you have any questions regarding this matter, please contact me at 410-939-1800 extension 120.

Sincerely,

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Donald J. Bautz Jr. Deputy Director Department of Economic Development and Planning

CC: Al Henry, Director, Dept. of Economic Development and Planning Donna Costango, Deputy Director, Dept. of Public Works



## City of Havre de Grace

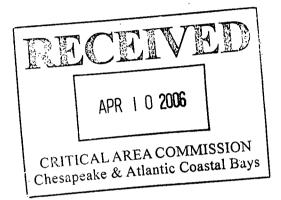
711 PENNINGTON AVENUE, HAVRE DE GRACE, MARYLAND 21078 www.havredegracemd.com

(410) 939-1800 (410) 575-7043 FAX(410) 939-3692

April 5, 2006

Dawnn McCleary State of Maryland Chesapeake Bay Critical Area Commission 1804 West Street, Suite 100 Annapolis, MD 21401

RE: City of Havre de Grace Waist Water Treatment Plant (WWTP) Enhanced Nutrient Removal Expansion Project



Dear Ms. McCleary:

Enclosed please find a report prepared by a consulting engineer, Stearns & Wheler, LLC on behalf of the City of Havre de Grace which outlines a proposal to expand the existing City WWTP in order to accommodate proposed new development in the City. The WWTP currently has a capacity of 1.89 million gallons per day treatment; the expansion will increase this to 3.3 million gallons per day treatment.

A majority of the development expansion comes from several residential projects including:

Bulle Rock	2,129 dwellings	15% built
Greenway Farms	692 dwellings	
Scenic Manor	90 dwellings	
Chesapeake Townhomes	114 dwellings	
Bulle Rock Yacht Club	37 dwellings	
Grace Manor	78 dwellings	built out
Havre de Hills	96 dwellings	85 % built
• Fenner	44 dwellings	
Mount Pleasant	11 dwellings	
• Tranquility Redevelopment	330 dwellings	100 units net increase
Heron Harbor	60 dwellings	2% built

In addition to the above there are several single in-fill residential dwellings proposed and a new retail shopping center on Pulaski Highway comprising of 18 businesses and one food chain retailer. Build out of the above projects would exceed the current capacity of the City's WWTP and the timing for the plant expansion completion would accommodate the number of units listed. The WWTP is located in the Intensely Development Area of the City's Critical Area and is a water dependant facility. The City requests that your agency review this report as it applies to Critical Area regulation and provide comment in a written response to me at your earliest convenience. This project is scheduled to begin construction in July, 2006. A meeting with the consultant, City staff and Critical Area staff can be arranged to further discuss the project if so desired. Should you have any immediate questions, please contact me at 410-939-1800 extension 1120.

Sincerely,

Donald Mait

Donald J. Bautz Jr. Deputy Director Department of Economic Development and Planning

CC: Al Henry – Director Department of Economic Development and Planning Donna Costango – Deputy Director, Department of Public Works

# Havre de Grace Wastewater Treatment Plant

# **ENR Upgrade and Expansion**

City of Havre de Grace Contract No. 1-45-9010-06

### **Critical Area Report**

Submitted to: Department of Economic Development & Planning City of Havre de Grace

> Submitted by: STEARNS & WHELER, LLC 4201 Northview Drive Suite 404 Bowie, MD 20716

> > March 24, 2006

S&W No. 40139.30

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Appendix A Worksheet A: Standard Application Process

Appendix B Photos - Tree Removal/Clearing

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#### LIST OF DRAWINGS

\* Note that drawings are presented under separate cover. These 50% design drawings represent the "Interim Improvements for Facility Re-Rating" project only.

- G-1 Cover Sheet, Vicinity Map
- C-1 Overall Site and Grading Plan

C-2 Partial Site and Grading Plan - 1

C-3 Partial Site and Grading Plan - 2

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#### **EXECUTIVE SUMMARY**

The Havre de Grace Wastewater Treatment Plant (HDG WWTP) is located in Harford County, Maryland. The ENR Upgrade and Expansion Project was initiated by the City of Havre de Grace Department of Public Works in response to a projected increase in flow (1.89 mgd to 3.3 mgd) and to meet enhanced nutrient reduction (ENR) standards under the Bay Restoration Act. The project will be built in two phases – an interim expansion phase which will expand the plant capacity from 1.89 mgd to 2.3 mgd (Phase I) followed by the ENR Upgrade and Expansion (Phase II) which will upgrade the existing biological nutrient removal (BNR) plant for enhanced nutrient removal (ENR) and expand the WWTP to 3.3 mgd.

#### 1. INTRODUCTION

The ENR Upgrade and Expansion project will include an upgrade of the existing BNR plant for ENR and expansion of capacity from 1.9 mgd to 3.3 mgd. The project will be built in two phases – an interim expansion phase (Phase I) followed by the ENR Upgrade and Expansion (Phase II). During the Interim Improvements Project all clearing necessary for both construction projects will take place. The project schedules are as outlined below:

#### Phase I- Interim Improvements Project

- Bid Documents May 2006
- Bids Received May 2006
- Notice to Proceed June 2006
- Construction Completed January 2007 (7 months)

#### Phase II- ENR Upgrade and Expansion

- Bid Documents August 2006
- Bids Received October 2006
- Notice to Proceed January 2007
- Construction Completed January 2009 (24 months)

These schedules show that Phase II will begin almost immediately after Phase I is completed.

#### **1.1 Property Description**

The Havre de Grace WWTP is 19.4-acre site located at 1 Jerry Foster Way in Havre de Grace, MD. The site is owned and operated by the City of Havre de Grace and is used for municipal wastewater treatment.

### 1.2 Building/Structure Description

The following structures/buildings will be constructed as part of the Interim Improvements Project as well as ENR Upgrade and Expansion Project, and are presented on the Drawings.

<b>Construction Phase</b>	Structure	Covered / Uncovered
	Flow Equalization Tank	Uncovered Open Tank
Phase I	Compost Storage Pad	Uncovered
Interim Improvements	Compost Pad Pumping Station	Covered
	Flow Equalization Metering Vault	Covered
	Headworks	Covered (enclosed building)
	Oxidation Ditch (Reactor)	Uncovered Open Tank
	Post Anoxic – Re-Aeration Tank	Uncovered Open Tank
	Final Clarifier Distribution Box	Uncovered Open Tank
	Final Clarifiers	Uncovered Open Tank
Phase II	Effluent Filters	Covered
ENR Upgrade and Expansion	UV System	Covered
	Chemical Storage Facility	Covered
	Methanol Storage Building	Uncovered
	Blower and Electrical Building	Covered (enclosed building)
	Filter Reject Pumping Station	Covered
	Influent Flow Metering Vault	Covered

**Table 1: Structures** 

#### **Description of Main Process Flow Structures**

- Headworks and Grit Removal Tank
  - Influent screening channels and a grit removal tank will be built to facilitate the removal of larger debris and grit before the wastewater is sent to the biological treatment process.
- Oxidation Ditch (Reactor)
  - Following screening and grit removal, flow will be conveyed to the reactor for biological treatment. The reactor is an open tank structure that will be constructed under the ENR Upgrade and Expansion Project.
- Post Anoxic Re-Aeration Tank
  - Once treated in the oxidation tank the process continues to another open tank structure, the post anoxic re-aeration tank. Here the wastewater will go through

an anoxic zone to promote denitrification. Then the wastewater will enter the reaeration tank where nitrogen gas will be released from the process.

- Final Clarifier Flow Distribution Box
  - Flow will enter the final clarifier distribution box from the post anoxic re-aeration tank where flow will be split between the final clarifiers. This structure will also house a scum pump which will pump scum from the two new final clarifiers to the waste sludge holding tank.
- Final Clarifiers
  - Two new 80 ft final clarifiers will be constructed. These two new tanks will process approximately 2/3 of the flow while the other 1/3 will be offloaded to the existing final clarifiers. The final clarifiers will separate the biomass from the treated effluent.
- Effluent Filters
  - New effluent filters will be constructed. The effluent filters are required to achieve the states ENR goal for phosphorus reduction to 0.3 mg/L. This structure will be covered.

UV System

 After exiting the filters the process will enter a UV disinfection system which will decrease the fecal concentration to permitted levels before entering the Chesapeake Bay. The UV structure will also be covered.

#### **Other Process Structures**

- Flow Equalization Tank
  - In order to help offload peak flows from the process, a new 1.65 million gallon flow equalization tank will be constructed. This tank will be built during the Interim Improvements Project to provide additional process flexibility until the ENR Upgrade and Expansion Project is completed. During storms, peak flows can be offloaded to the flow equalization tank and then metered slowly back through the system.

- Chemical Storage Facility
  - A chemical storage area will be constructed under the ENR Upgrade and Expansion Project for storage of the following chemicals: sodium hypochlorite, alum and caustic. All chemicals will be located in a single open walled structure under a common roof. Each chemical will be located in a chemical storage tank and surrounded by a separate concrete containment area. The chemicals will be fed into the process at various locations to aid in the treatment process.
- Methanol (Supplemental Carbon) Storage Facility
  - A methanol storage facility will be built adjacent to the Chemical Storage Facility. This structure will contain a methanol storage tank and on a concrete pad. Methanol will be fed by a chemical feed pump to the post anoxic zone.
- Blower and Electric Building
  - A new building labeled as the Blower and Electric Building will be built under the ENR Upgrade and Expansion Project and will house three different rooms: a chemical pump room, a blower room and an electric room. The chemical pumps will pump chemicals from the chemical storage tanks into the process stream. The blower room will house the re-aeration blowers which will feed air to the re-aeration zone as well as an air compressor which will feed compressed air to the effluent filters. The building will also contain an electrical room.
- Compost Storage Pad
  - Under the Interim Improvements Project a new 55,000 square foot compost storage pad will be built to facilitate the storage of wood chips, sludge, and finished piles. The compost storage pad will be a contained system that drains to the compost pad pumping station.
- Compost Pad Pumping Station
  - In order to ensure runoff from the compost pad is directed back into the process, the compost pad pumping station will be built during the Interim Improvements Project. This pump station will pump all flow from the compost pad into the flow equalization tank. From the flow equalization, tank the flow can then be directed back into the process.

- Filter Reject Pumping Station
  - As part of the effluent filter process a filter reject (backwash) pump station must be built. This pump station will direct any filter reject back to the headworks and re-entered into the process stream.
- Below grade vaults:
  - Flow Equalization Metering Vault Flows from the equalization tank will be measured.
  - Influent Flow Measuring Vault This vault will be used to meter the influent flows from the pumps stations that feed the plant.

### 1.3 Site Clearing

As part of the Interim Improvements Project all site clearing necessary for construction for the Interim Improvements project as well as the ENR Upgrade and Expansion Project will be completed. Site clearing will take place primarily on the southern portion of the site (Refer to Photo Key in Appendix B). The majority of the clearing will take place to allow for construction of the flow equalization and compost pad storage area (constructed under the Interim Improvements Project) and the oxidation ditch reactor (constructed under the ENR Upgrade and Expansion Project). The clearing will include approximately 194,000 square feet (4.45 acres) of tree removal in a sparsely populated region. Refer to photos in Appendix B.

#### 2. METHODOLOGY

#### 2.1 Chesapeake Bay Critical Area (CBCA)

The Maryland General Assembly passed the CBCA in 1984 to address the noticeable decline in the natural resources associated with the Chesapeake Bay and its tributaries. The Act created a 27-member Commission and gave it authority to regulate activities within the Critical Area. The Commission requires all State agencies to minimize adverse impacts to water quality caused by stormwater as required by applicable State laws.

The project is located within the CBCA, which is defined as all land within 1,000 feet of the Mean High Water Line of tidal waters or the landward edge of tidal wetlands and all waters of and lands under the Chesapeake Bay and its tributaries. The Critical Area Buffer (Buffer) consists of all land within 100 feet landward from the Mean High Water Line of tidal waters or the edge of tidal wetlands and tributary streams.

In the Critical Area in Maryland, development or redevelopment activities in Intensely Developed Areas (IDAs) must be designed with appropriate Best Management Practices (BMPs) that must achieve at least a 10% reduction of pre-development pollutant loadings (10% rule). Because the project is designated in an IDA zone, the development plan is required to comply with the 10% rule. The "Maryland Chesapeake and Atlantic Coastal Bays, Critical Area 10% Rule Guidance Manual" published in 2003 and the Maryland Department of the Environment (MDE) "2000 Maryland Stormwater Design Manual" were used as a basis for this report.

#### 2.2 Site Information

Existing site topography shown on the Drawings is based on a 2005 topographic survey performed by MRA, Inc. and obtained from available contract and record drawings. Anticipated surface water flow is to the east, towards the Chesapeake Bay.

The *Soil Survey of Harford County, Maryland* was utilized for information regarding soils within the property limits. The majority of the soil types within the property limits include Matapeake silt loam (MkA and MkB), and Sassafras and Joppa soils SsD and SsE, which are classified in hydrologic group "B". A small percentage of the soil type includes Mattapex silt loam (M1A) which is classified in hydrologic soil group "C".

The Federal Emergency Management Agency (FEMA) floodplain maps for this area indicate that the 100-year flood elevation is approximately 11.5-feet above mean sea level. Therefore, all proposed development is not within the 100-year floodplain.

#### 2.3 Drainage Areas

The property limits comprise of approximately 19.4 acres (approximately 10 acres are within the limit of disturbance). The proposed site consists of 20 individual drainage areas; only <u>seven</u> of these require <u>stormwater management to treat runoff from the proposed impervious areas</u>. Because there is no disturbance in the other 13 drainage areas, a stormwater management quality waiver will be requested. Also, because this project has direct discharge to tidally influenced receiving waters, a quantity volume (channel protection volume) waiver will be requested as well. The seven drainage areas total 4.71 acres. Because the property area is considerably larger than the proposed impervious area, these seven drainage areas were used to break-up the site into workable units (as described in Section 7.0 of the guidance manual).

The drainage areas were delineated for existing and proposed drainage areas using site topography and the locations of the proposed impervious areas. Table 2 presents the drainage area number, size, existing and proposed impervious areas, and the total area requiring water quality treatment.

Drainage	Site	Imperviou	s Area (ac)	Total Area Requiring Water Quality
Area No.	Drainage Area (ac)	Existing	Proposed	Treatment (ac)
1	0.45	0.36	0.36	0
2	0.73	0.12	0.16	0.04
3	0.88	0	0.35	0.35
4	0.57	0	0.22	0.22
5	1.90	0.12	0.51	0.39
6	0.25	0	0.04	0.04
11	1.09	0.35	0.38	0.03

 Table 2: Drainage Areas

The remaining drainage areas were not analyzed because either the areas drained directly to the compost pad/plant drain system or to open tanks. These collection systems direct the runoff back through the wastewater treatment plant. All stormwater entering these systems will be collected, treated, and discharged through the treatment plant outfall. The WWTP will be designed to achieve an effluent total phosphorus concentration of less then 0.3 mg/L. Therefore, these areas

were not included in the drainage area calculations. There are approximately 2.47 acres of compost pad/plant drain area and 2 acres of open tank area.

#### 3. **RESULTS**

#### 3.1 Summary of Unified Sizing Criteria

For conceptual sizing of the Stormwater Management (SWM) Best Management Practices (BMPs), the water quality (WQv) and recharge (Rev) volume requirements for each of the seven drainage areas were calculated according to MDE's 2000 Maryland Stormwater Design Manual See Table 3 below for the summary of these requirements.

Drainage Area No.	Site Drainage Area (ac)	Site Drainage Area (sf)	WQv (cf)	Rev (cf)
11	0.45	19,795	330	19
2	0.73	31,799	530	61
3	0.88	38,333	1,318	342
4	0.57	25,046	822	213
5	1.90	82,764	1,648	428
6	0.25	10,822	191	50
11	1.09	47,480	791	78

**Table 3: Unified Sizing Criteria** 

Note:

1. Drainage area does not include any new impervious areas. Water quality requirement based on changes in grading only.

#### 3.2 Critical Area 10% Rule

Worksheet A for development within the CBCA was completed for each drainage area as individual workable units. Dry swales will provide both water quality treatment and phosphorus removal required by the 10% rule. See required removal rates for each drainage area and associated loading removal rates in the table below.

Drainage Area No.	Site Drainage Area (ac)	Removal Requirement (lbs/yr of total P)	Load Removed (lbs/yr of total P)	Requirement met?
11	0.45		0.55	
2	0.73	0.12	0.29	Yes
• 3	0.88	0.48	0.57	Yes
4	0.57	0.30	0.36	Yes
5	1:90	0.50	0.88	Yes
6	0.25	0.01	0.08	Yes
11	1.09	0.16	0.16	Yes
TOTAL	5.87	1.57	2.89	Yes

#### **Table 4: Phosphorus Removal Rates**

Note:

1. Drainage Area No. 1 does not include any new impervious areas.

The total removal requirement is 1.57 lbs/yr of total phosphorus. Using dry swales, the total load removed is 2.89 lbs/yr of total phosphorus. This results in a removal surplus of 1.32 lbs/year.

#### 4. CONCLUSIONS

The proposed development is located in the CBCA. The proposed dry swales, throughout the affected drainage areas, will treat stormwater as well as exceed the phosphorus removal requirements set forth by the Commission.

Appendix A

Worksheet A: Standard Application Process

Environmental	LC	Havre de Grace	e WWTP	3/6/2006	40139
Funite same conditions of		Subject		Date	Job No
Engineers and Scienti	sts	Critical Area C	alculations - DA 1	BSR Comp By	Checked By
				comp by	Chickey by
	Works	neet A: Standard A	pplication Process		
			oval Requirements*		
					· · · · · · · · · · · · · · · · · · ·
Step 1:	Calculate Existing and	Proposed Site Impe	erviousness		
A. Calculate Perce	ent Imperviousness				
1) Site Area within t	the Critical Area IDA, A =		0.45 acres		
	Surface Area, Existing and Pro	oposed, (See Table 4.1			
	(no point manipul)			· · · · · · · · · · · · · · · · · · ·	
		) Existing (acres)	b) Proposed (acre	s)	
	Roads	0.36	0.36		
	Parking Lots	0	0		
	Driveways	0	0		
	Sidewalks/paths	0	0		
	Rooftops	0	0		
	Decks	0	0		
and the same of the	Swimming pools/ponds	0	. 0		
	Other	0	0		1
	Impervious Surface				
	Area	0.36	0.36	1	
	(1)				
) Imperviousness (	(1)		·		
	Existing Imperviousness, I	= Impenvious	Surface Area/Site Area		
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	Post Imperviousness, Ipost	= Impervious	Surface Area/Site Area		
	posi	= (Step 2b)/(S	and a second sec	0.00 %	
		- (O(cp 20)/(0		0.00 /0	
	ment Category (circle)				
3 Define Develop	(en elle)				
B. Define Develop					
	nt: Existing imperviousness le	iss than 15% L (Go to St	(ep 2A)		·
1) <u>New Developme</u>	nt: Existing imperviousness le			······	· · · · · · · · · · · · · · · · · · ·
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1) <u>New Developme</u> 2) <u>Redevelopment</u> 3) <u>Single Lot Resid</u>	: Existing imperviousness ential Development: Single lo	of 15% I or more (Go to t being developed or imp	o Step 2B) proved; single family resden		
1) <u>New Developmen</u> 2) <u>Redevelopment</u> 3) <u>Single Lot Resid</u> and more than 250	: Existing imperviousness ential Development: Single lo square feet of impervious are	of 15% I or more (Go to t being developed or imp	o Step 2B) proved; single family resden		
1) <u>New Developmen</u> 2) <u>Redevelopment</u> 3) <u>Single Lot Resid</u> and more than 250	: Existing imperviousness ential Development: Single lo	of 15% I or more (Go to t being developed or imp	o Step 2B) proved; single family resden		
1) <u>New Developmen</u> 2) <u>Redevelopment</u> 3) <u>Single Lot Residu</u> and more than 250 for detailed criteria	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements).	of 15% I or more (Go to t being developed or im a and associated disturt	o Step 2B) proved; single family resden bance (Go to Section 5, Res		
<ol> <li><u>New Development</u></li> <li><u>Redevelopment</u></li> <li><u>Single Lot Residu</u></li> <li>and more than 250</li> <li>for detailed criteria</li> </ol>	: Existing imperviousness ential Development: Single lo square feet of impervious are	of 15% I or more (Go to t being developed or im a and associated disturt	o Step 2B) proved; single family resden bance (Go to Section 5, Res		
1) New Development 2) Redevelopment 3) Single Lot Reside and more than 250 or detailed criteria NOTE: All acreage	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t	of 15% I or more (Go to t being developed or im a and associated disturt o areas within the IDA c	o Step 2B) proved: single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Reside and more than 250 or detailed criteria NOTE: All acreage	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements).	of 15% I or more (Go to t being developed or im a and associated disturt o areas within the IDA c	o Step 2B) proved: single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Residuand and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve	of 15% I or more (Go to t being developed or im a and associated disturt o areas within the IDA c	o Step 2B) proved: single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Residuand and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve	of 15% I or more (Go to t being developed or im a and associated disturt to areas within the IDA of elopment Load (Lpre	o Step 2B) proved: single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Residuand and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve	of 15% I or more (Go to t being developed or im a and associated disturt to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5)^{*} (A)$	o Step 2B) proved; single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Residu and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve	of 15% I or more (Go to t being developed or im a and associated disturt to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5)^{*} (A)$	o Step 2B) proved: single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Residuand and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve ent	of 15% I or more (Go to t being developed or im a and associated disturt to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5)^{*} (A)$	o Step 2B) proved; single family resden bance (Go to Section 5, Res of the Critical Area only.		
1) New Development 2) Redevelopment 3) Single Lot Residu and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve	of 15% I or more (Go to t being developed or im a and associated disturt to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5) * (A)$ = N/A Ib	o Step 2B) proved; single family resden bance (Go to Section 5, Res of the Critical Area only.	idential Approach	
1) New Development 2) Redevelopment 3) Single Lot Residuand and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve ent	of 15% I or more (Go to t being developed or implication a and associated disturb to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5) * (A)$ = N/A Ib $L_{pre} = Average annu-$	o Step 2B) proved; single family resden bance (Go to Section 5, Res of the Critical Area only. e) as / year of total phosphorus	idential Approach	
1) New Development 2) Redevelopment 3) Single Lot Residu and more than 250 or detailed criteria NOTE: All acreage Step 2:	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve ent	of 15% I or more (Go to t being developed or imp a and associated disturt to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5) * (A)$ = N/A Ib $L_{pre} = Average annu-to developme$	o Step 2B) proved; single family resden bance (Go to Section 5, Res of the Critical Area only. e) os / year of total phosphorus ual load of total phosphorus int (Ibs/year)	idential Approach	e site prior
1) <u>New Developmen</u> 2) <u>Redevelopment</u> 3) <u>Single Lot Residu</u> and more than 250 for detailed criteria	: Existing imperviousness ential Development: Single lo square feet of impervious are and requirements). e used in this worksheet refer t Calculate the Pre-deve ent	of 15% I or more (Go to t being developed or imp a and associated disturt to areas within the IDA of elopment Load (Lpre $L_{pre} = (0.5) * (A)$ = N/A Ib $L_{pre} = Average annu-to developme0.5 = Annual total p$	o Step 2B) proved; single family resden bance (Go to Section 5, Res of the Critical Area only. e) as / year of total phosphorus	exported from the	e site prior

v

Stearns & Wheler	LLC	1	Havre de Grac	e WWTP			3/6/2006	40139
Environmental			Subject				Date	Job No
Engineers and Scier	itists		Critical Area C	alculatio	ons - DA 1		BSR Comp By	MmW Checked By
Step 5:	Identify Feasible Urb	an BMP	(s)					
Select BMP Optio the load removed	ns using the screening matric for each option.	es provid	ed in the Chapte	er 4 of th	ne 2000 Marylan	d Stormw	ater Design M	anual. Calcula
BMP Type	(L <sub>post</sub> )	x	(BMP <sub>RE</sub> )	x	(% DA Served)	=	LR	
Dry Swale	0.85	Х	65%	X	100%	Ξ		lbs/year
		X		Х		=		lbs/year
		Х		X		=	0	lbs/year
		Section 1			ed, LR (total)	=	0.55	lbs/year
	Poll	utant Rer	noval Requirem	ent, RR	(from Step 4)	=	0.08	lbs/year
	where:							
		oved, LR	= Annual total p (lbs/year)	hospho	rus load remove	d by the p	proposed BMP	
		Lpost	= Average annu	ual load	of total phospho	rus expor	ted from the p	ost-
			development					
		BMPRE			cy for total phos	phorus. T	able 4.8 (%)	
	% DA				ea within the crit			
			the BMP (%)					
	1	RR		oval req	uirement (Ibs/ye	ar)		
If the Load Remove with the 10% Rule	ved is equal to or greater than	the Pollu	tant Removal R	equirem	ent computed in	Step 4, t	hen the on-site	e BMP complie
	stopt removal service		10					
has the KK (poin	utant removal requirement)	veen me	tr Y	es				· · · · · · · · · · · · · · · · · · ·

Stearns & Wheler LLC			Havre de Grace WWTP	3/6/2006	40139
Invironmental			Subject	Date	Job No
Engineers and Scientists			Critical Area Calculations - DA 2	BSR	mmw
				Comp By	Checked By
3. Redevelopment				and a second s	
5. Redevelopment		Lara =	(R <sub>v</sub> )(C)(A)(8.16)		after annote a strandar
	THE R LEWIS CO.		$0.05 + 0.009 (I_{pre})$		
and the second s			0.197945		
			and the second of a second of the second of		
		L <sub>pre</sub> =	0.35 ibs/year of total phosphorus		
· \	where:				
		1 =	Average annual load of total phosphorus ex	ported from the	site prior
	and the second	-pre	to development (lbs/year)	ported ironi the	Site piter
	ver same to a	R =	Runoff coefficient, which expresses the fract	tion of rainfall w	which is
	1.00 × mounts 1.00mm <sup>-1</sup> 7007.00 ×	T NV -	converted into runoff		
	and a second	1 -	Pre-development (existing) site imperviousn	OFF (10 1-75 )	if cito
		pre -	is 75% impervious)	1035 (1.0., 1-731	ii alte
		C -	Flow-weighted mean concentration of the po	allutant (total of	osphorus) in
		0-	urban runoff (mg/l) = 0.30 mg/l	Silutant (total pi	iosphorus/in
	· · · · · · · · · · · · · · · · · · ·	A =	Area of the site within the Critical Area IDA (	acres)	
			Includes regional constants and unit convers		
Step 3:	Calculate the Post-dev	elopme	nt Load (Lpost)		
A. New Development a	and Redevelopment				
A. New Development	and redevelopment.				
		L <sub>post</sub> =	(R <sub>v</sub> )(C)(A)(8.16)		
			$0.05 + 0.009 (I_{post})$		
			0.24726	· · · · · · · · · ·	
		L <sub>post</sub> =			
		-post		1	
	whore:				
- income and a					
	where:	L =	Average annual load of total phosphorus ex	ported from the	e post-
	Miere.	L <sub>post</sub> =	Average annual load of total phosphorus ex	ported from the	e post-
			development site (lbs/year)		· · · · · · · · · · · · · · · · · · ·
			development site (lbs/year) Runoff coefficient, which expresses the frac		· · · · · · · · · · · · · · · · · · ·
		R, =	development site (lbs/year) Runoff coefficient, which expresses the frac converted into runoff	tion of rainfall w	vhich is
		R, =	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou	tion of rainfall w	vhich is
		R <sub>v</sub> =	development site (lbs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious)	tion of rainfall w usness (i.e., I=7	vhich is 75 if site
		R <sub>v</sub> =	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou	tion of rainfall w usness (i.e., I=7	vhich is 75 if site
		R <sub>v</sub> = I <sub>post</sub> = C =	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po	tion of rainfall w usness (i.e., I=7 bllutant (total pt	vhich is 75 if site
		R <sub>v</sub> = I <sub>post</sub> = C = A =	development site (lbs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po urban runoff (mg/l) = 0.30 mg/l	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
		R <sub>v</sub> = I <sub>post</sub> = C = A = 8.16 =	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA Includes regional constants and unit conver	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
	Calculate the Pollutan	R <sub>v</sub> = I <sub>post</sub> = C = A = 8.16 =	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA Includes regional constants and unit conver	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
		$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Removes}$	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA Includes regional constants and unit conver val Requirement (RR)	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
		$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Removes}$	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA Includes regional constants and unit conver	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
Step 4:	Calculate the Pollutan	$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Removes}$	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA ( Includes regional constants and unit conver ral Requirement (RR) L <sub>post</sub> - (0.9)(L <sub>pre</sub> )	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
Step 4:		$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Remov}$ $RR =$ $=$	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA ( Includes regional constants and unit conver <b>ral Requirement (RR)</b> L <sub>post</sub> - (0.9)(L <sub>pre</sub> ) 0.12 Ibs/year of total phosphorus	tion of rainfall w usness (i.e., I=7 bllutant (total pt (acres)	vhich is 75 if site
Step 4:	Calculate the Pollutan	$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Remov}$ $RR =$ $=$ $RR =$	development site (Ibs/year) Runoff coefficient, which expresses the frac converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA ( Includes regional constants and unit conver <b>ral Requirement (RR)</b> L <sub>post</sub> - (0.9)(L <sub>pre</sub> ) 0.12 Ibs/year of total phosphorus Pollutant removal requirement (Ibs/year)	tion of rainfall w usness (i.e., I=7 ollutant (total pr (acres) sion factors	vhich is 75 if site nosphorus) in
Step 4:	Calculate the Pollutan	$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Remov}$ $RR =$ $=$ $RR =$	development site (Ibs/year) Runoff coefficient, which expresses the fract converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA ( Includes regional constants and unit converted <b>a Requirement (RR)</b> L <sub>post</sub> - (0.9)(L <sub>pre</sub> ) 0.12 Ibs/year of total phosphorus Pollutant removal requirement (Ibs/year) Average annual load of total phosphorus ex	tion of rainfall w usness (i.e., I=7 ollutant (total pr (acres) sion factors	vhich is 75 if site nosphorus) in
Step 4:	Calculate the Pollutan	$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Remov}$ $RR =$ $=$ $RR =$ $=$ $L_{post} =$	development site (lbs/year) Runoff coefficient, which expresses the fract converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA ( Includes regional constants and unit conver- val Requirement (RR) L <sub>post</sub> - (0.9)(L <sub>pre</sub> ) 0.12 lbs/year of total phosphorus Pollutant removal requirement (lbs/year) Average annual load of total phosphorus ex- development site (lbs/year)	tion of rainfall w usness (i.e., I=7 billutant (total pt (acres) sion factors	vhich is 75 if site nosphorus) in e post-
Step 4:	Calculate the Pollutan	$R_v =$ $I_{post} =$ $C =$ $A =$ $8.16 =$ $t \text{ Remov}$ $RR =$ $=$ $RR =$ $=$ $L_{post} =$	development site (Ibs/year) Runoff coefficient, which expresses the fract converted into runoff Post-development (proposed) site imperviou is 75% impervious) Flow weighted mean concentration of the po- urban runoff (mg/l) = 0.30 mg/l Area of the site within the Cirtical Area IDA ( Includes regional constants and unit converted <b>a Requirement (RR)</b> L <sub>post</sub> - (0.9)(L <sub>pre</sub> ) 0.12 Ibs/year of total phosphorus Pollutant removal requirement (Ibs/year) Average annual load of total phosphorus ex	tion of rainfall w usness (i.e., I=7 billutant (total pt (acres) sion factors	vhich is 75 if site nosphorus) in e post-

Stearns & Wheler	r LLC	Havre de Gra	ce WWTP	.3/6/2006	40139
Environmental		Subject		Date	Job No
Engineers and Scie	ntists	Critical Area	Calculations · DA 3	BSR Comp By	mmw Checked By
				Comp by	C DCLNCQ DY
	Worksho	ot A. Standard	Application Process		
			Application Process noval Requirements*		
	Calculati	ng Foliutarit Ker	noval Requirements		
Step 1:	Calculate Existing and P	roposed Site Im	Derviousness		
A. Calculate Per	cent Imperviousness				
1) Site Area withi	n the Critical Area IDA, A =		0.880 acres		
	s Surface Area, Existing and Propo	sed, (See Table 4.			
					-
		xisting (acres)	b) Proposed (acre	s)	
	Roads	0	0.35		
-	Parking Lots	0	0		
	Driveways Sidewalks/paths	0	0		
	Rooftops	0	0 0.000		
	Decks	$-\frac{0}{0}$	0.000		
	Swimming pools/ponds	0	0		
	Other	0	0		
	Impervious Surface				
	Area	0	0.35		
<ol><li>Imperviousnes</li></ol>	ss (I)				÷
					1 al a ta a
	Existing Imperviousness, Ipre	The second second second second	s Surface Area/Site Area		
		= (Step 2a)/(	Step 1) =	0.00 %	
	Post Imperviousness, Ipost		Currence Area/Cite Area		
	FOST IMPERVIOUSNESS, Ipost		Surface Area/Site Area	0.77.0	
		= (Step 2b)/(	Step 1) = 3	9.77 %	
B Define Develo	opment Category (circle)		and the second	+	
D. Denne Develo	prineit Gategory (Circle)		anne active and a second	a 1 m 4 m m	
1) New Develop	ment: Existing imperviousness I	ess than 15% L (Go	to Sten 2A)		
	t: Existing imperviousness of 15%				
	idential Development: Single lot be			tial development:	when some states at the
	50 square feet of impervious area a			a and and a second processing the second party of the second party	A A DOMESTIC A AND AN AND AN ADDRESS OF A DOMESTIC ADDRESS AND ADDRESS
	a and requirements).		······································		· · · · · · · · · · · · · · · · · · ·
		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·
NOTE: All acrea	ge used in this worksheet refer to a	reas within the IDA	of the Critical Area only.		
Stop 2:	Coloulate the Day down law				
Step 2:	Calculate the Pre-develo	pinent Load (Lpr	e)		
A. New Develop	ment				
n. New Develop	ment	(0 E) + (A)			
-		$L_{pre} = (0.5)^{*} (A)$			
	-	= 0.44	bs / year of total phosphoru	IS	
	where:		···· ·		
	where:	1 = Augeran			
		And and a second s	ual load of total phosphorus e	exported from the	site prior
1007 + 1 Mart		to developm	ent (lbs/year)	lavad lavat (II)	
		0.5 = Annual total	phosphorus load from undeve ite wihtin the Critical Area IDA	eloped land (lbs/a	icre/year)

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Environmental			Subject				Date	Job No
Engineers and Scientists			Critical Area C	alculation	ns - DA 3		BSR Comp By	MMW Checked By
Step 5:	Identify Feasible Urba	n BMP(s	)			· · · · · · · · · · · · · · · · · · ·		ng n. m-s
Select BMP Options us the load removed for each	ing the screening matrices ach option.	provideo	I in the Chapte	er 4 of th	e 2000 Marylan	d Stormw	ater Design Ma	anual. Calculate
BMP Type	(L <sub>post</sub> )	х	(BMP <sub>RE</sub> )	х	(% DA Served)	=	LR	- 7
Dry Swale	0.88	Х	65%	Х	100%	=		lbs/year
		Х		Х		=	0	lbs/year
		X		Х		=	0	lbs/year
			Load	Remove	ed, LR (total)	Ξ	0.57	lbs/year
	Pollut	ant Remo	val Requirem	ent, RR	(from Step 4)	=	0.48	lbs/year
						a approximation of the second		
	where:	od IP -	Appual total r	bosobo	rus load remove	d by the	proposed BMP	
	Load Remov	eu, LIN -	(lbs/year)	nosprio	103 1080 1011000	u by the	proposed bivin	
		1 =	a new col manuface a com	heol leu	of total phospho		ted from the p	nst-
		-post	development			nus capoi	ico nom ino p	
		BMP -	pro	and a survey descent of	cy for total phos	oborus T	able 4 8 (%)	
					ea within the cri	And and a second	the state of the second s	
	% DA S	served =	the BMP (%)	e site ai	ea wiunin uie ch	lical alea	IDA served by	
		DD -	particular and a second	oval rea	uirement (lbs/ye	ar		
	·		Foliulant Tem	ovarieq	unement (ibs/ye			
If the Load Removed is with the 10% Rule.	s equal to or greater than the	ne Polluta	int Removal R	equirem	ent computed in	n Step 4, I	then the on-site	BMP complies
Has the RR (pollutant	removal requirement) be	een met?	Y	es				

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nvironmental		Su	bject	Date	Job No
Engineers and Scientists		C	ritical Area Calculations - DA 4	BSR	mmw
				Comp By	Checked By
3. Redevelopment		1			-
			R <sub>v</sub> )(C)(A)(8.16)	•	
		$R_v = 0$	.05 + 0.009 (I <sub>pre</sub> )		u tele se an e suit concernance
	anti-citi 4 (10000 1-00 4	=	0.05		
		L <sub>pre</sub> = N	I/A Ibs/year of total phosphoru	S	
	where:		· · · · · · · · · · · · · · · · · · ·		
			verage annual load of total phosphore	us exported from the	e site prior
			o development (lbs/year)		
			unoff coefficient, which expresses the	e fraction of rainfall w	which is
		and a second sec	onverted into runoff		
			re-development (existing) site imperv	iousness (i.e., I=75 i	if site
			75% impervious)		- i
			low-weighted mean concentration of t	the pollutant (total ph	nosphorus) in
	*		rban runoff (mg/l) = 0.30 mg/l	104 (	
and the second second			rea of the site within the Critical Area		
	······	0.10 = 11	ncludes regional constants and unit co	inversion factors	-
Step 3:	Calculate the Post-de	velopment	Load (Lpost)		
				and a second	
A. New Development	and Redevelopment:				1
		was a solution if his any da			
		$L_{post} = (1)$	R <sub>v</sub> )(C)(A)(8.16)		
		when it is represent	entrantice and a state of the s		
		R <sub>v</sub> = 0	R <sub>v</sub> )(C)(A)(8.16) .05 + 0.009 (I <sub>post</sub> ) 0.397368		
		R <sub>v</sub> = 0 =	.05 + 0.009 (I <sub>post</sub> ) 0.397368	brus	
		R <sub>v</sub> = 0	.05 + 0.009 (I <sub>post</sub> )	prus	
	where:	R <sub>v</sub> = 0 =	.05 + 0.009 (I <sub>post</sub> ) 0.397368	prus	
	where:	R <sub>v</sub> = 0 = L <sub>post</sub> =	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phospho		e post-
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phospho werage annual load of total phosphor		e post-
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phospho werage annual load of total phosphor evelopment site (Ibs/year)	us exported from the	
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = F$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phospho werage annual load of total phosphor	us exported from the	
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = F$ $c$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff	us exported from the	which is
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = R$ $C$ $L_{post} = F$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp	us exported from the	which is
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = R$ $C$ $I_{post} = R$ is	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site impose 575% impervious)	us exported from the e fraction of rainfall w erviousness (i.e., 1=7	which is
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = F$ $I_{post} = F$ $is$ $C = F$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) low weighted mean concentration of t	us exported from the e fraction of rainfall w erviousness (i.e., 1=7	which is
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = F$ $I_{post} = F$ $C$ $C = F$ $U$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) low weighted mean concentration of t rban runoff (mg/l) = 0.30 mg/l	us exported from the e fraction of rainfall w erviousness (i.e., 1=7 the pollutant (total ph	which is
	where:	$R_{v} = 0$ $=$ $L_{post} =$ $d$ $R_{v} = F$ $I_{post} = F$ $C = F$ $U$ $A = A$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) low weighted mean concentration of t	us exported from the e fraction of rainfall w erviousness (i.e., 1=7 the pollutant (total ph TDA (acres)	which is
		$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = F$ $I_{post} = F$ $C = F$ $U$ $A = A$ $8.16 = 11$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp is 75% impervious) low weighted mean concentration of to rban runoff (mg/l) = 0.30 mg/l wrea of the site within the Cirtical Area includes regional constants and unit co	us exported from the e fraction of rainfall w erviousness (i.e., 1=7 the pollutant (total ph TDA (acres)	which is
Step 4:	where: Calculate the Pollutar	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $d$ $R_{v} = F$ $I_{post} = F$ $C = F$ $U$ $A = A$ $8.16 = 11$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp is 75% impervious) low weighted mean concentration of to rban runoff (mg/l) = 0.30 mg/l wrea of the site within the Cirtical Area includes regional constants and unit co	us exported from the e fraction of rainfall w erviousness (i.e., 1=7 the pollutant (total ph TDA (acres)	which is
Step 4:		$R_{v} = 0$ $=$ $L_{post} =$ $d$ $R_{v} = F$ $d$ $C = F$ $U$ $A = A$ $8.16 = In$ $T Remova$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) low weighted mean concentration of t irban runoff (mg/l) = 0.30 mg/l wea of the site within the Cirtical Area ncludes regional constants and unit co I Requirement (RR)	us exported from the e fraction of rainfall w erviousness (i.e., 1=7 the pollutant (total ph TDA (acres)	which is
Step 4:		$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $R_{v} = R$ $C$ $I_{post} = R$ $C = R$ $A = A$ $8.16 = 1n$ $RR = L$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) Iow weighted mean concentration of to irban runoff (mg/I) = 0.30 mg/I wrea of the site within the Cirtical Area ncludes regional constants and unit co I Requirement (RR)	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) priversion factors	which is
Step 4:		$R_{v} = 0$ $=$ $L_{post} =$ $d$ $R_{v} = F$ $d$ $C = F$ $U$ $A = A$ $8.16 = In$ $T Remova$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) low weighted mean concentration of t irban runoff (mg/l) = 0.30 mg/l wea of the site within the Cirtical Area ncludes regional constants and unit co I Requirement (RR)	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) priversion factors	which is
Step 4:	Calculate the Pollutar	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} = A$ $R_{v} = R$ $C$ $I_{post} = R$ $C = R$ $A = A$ $8.16 = 1n$ $RR = L$	.05 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imp s 75% impervious) Iow weighted mean concentration of to irban runoff (mg/I) = 0.30 mg/I wrea of the site within the Cirtical Area ncludes regional constants and unit co I Requirement (RR)	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) priversion factors	which is
Step 4:		$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} =$ $R_{v} = R$ $I_{post} = R$ $C = R$ $U$ $A = A$ $8.16 = In$ $RR = L$ $=$	0.55 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site implest s 75% impervious) Iow weighted mean concentration of to irban runoff (mg/I) = 0.30 mg/I wrea of the site within the Cirtical Area includes regional constants and unit co I Requirement (RR) post - (0.9)(L <sub>pre</sub> ) 0.30 Ibs/year of total phosphor	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) priversion factors	which is
Step 4:	Calculate the Pollutar	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} =$ $R_{v} = R$ $C = R$ $C = R$ $A = A$ $8.16 = R$ $RR = L$ $=$ $RR = R$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imples 75% impervious) Iow weighted mean concentration of to irban runoff (mg/l) = 0.30 mg/l virea of the site within the Cirtical Area includes regional constants and unit co I Requirement (RR) post - (0.9)(L <sub>pre</sub> ) 0.30 Ibs/year of total phosphor Pollutant removal requirement (Ibs/year	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) proversion factors	which is 75 if site nosphorus) in
Step 4:	Calculate the Pollutar	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} =$ $R_{v} = R$ $C$ $R_{v} = R$ $C$ $R_{v} = R$ $C$ $R = R$ $RR = R$ $L_{post} = A$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imposed s 75% impervious) Iow weighted mean concentration of to irban runoff (mg/l) = 0.30 mg/l wrea of the site within the Cirtical Area includes regional constants and unit co I Requirement (RR) post - (0.9)(L <sub>pre</sub> ) 0.30 Ibs/year of total phosphor Pollutant removal requirement (Ibs/yea Average annual load of total phosphor	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) proversion factors	which is 75 if site nosphorus) in
Step 4:	Calculate the Pollutar	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} =$ $R_{v} = R$ $C$ $I_{post} = R$ $C = R$ $A = A$ $8.16 = In$ $RR = L$ $=$ $RR = R$ $L_{post} = A$ $C$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imposed s 75% impervious) Iow weighted mean concentration of to irban runoff (mg/l) = 0.30 mg/l wrea of the site within the Cirtical Area includes regional constants and unit co I Requirement (RR) post - (0.9)(L <sub>pre</sub> ) 0.30 Ibs/year of total phosphor Pollutant removal requirement (Ibs/year werage annual load of total phosphor levelopment site (Ibs/year)	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) proversion factors prus	which is 75 if site hosphorus) in
Step 4:	Calculate the Pollutar	$R_{v} = 0$ $=$ $L_{post} =$ $L_{post} =$ $R_{v} = R$ $C$ $I_{post} = R$ $C = R$ $U$ $A = A$ $8.16 = In$ $RR = L$ $=$ $RR = R$ $L_{post} = A$ $C$ $I_{pre} = A$	0.5 + 0.009 (I <sub>post</sub> ) 0.397368 0.55 Ibs/year of total phosphor evelopment site (Ibs/year) Runoff coefficient, which expresses the onverted into runoff Post-development (proposed) site imposed s 75% impervious) Iow weighted mean concentration of to irban runoff (mg/l) = 0.30 mg/l wrea of the site within the Cirtical Area includes regional constants and unit co I Requirement (RR) post - (0.9)(L <sub>pre</sub> ) 0.30 Ibs/year of total phosphor Pollutant removal requirement (Ibs/yea Average annual load of total phosphor	us exported from the e fraction of rainfall w erviousness (i.e., I=7 the pollutant (total ph IDA (acres) proversion factors prus	which is 75 if site hosphorus) in

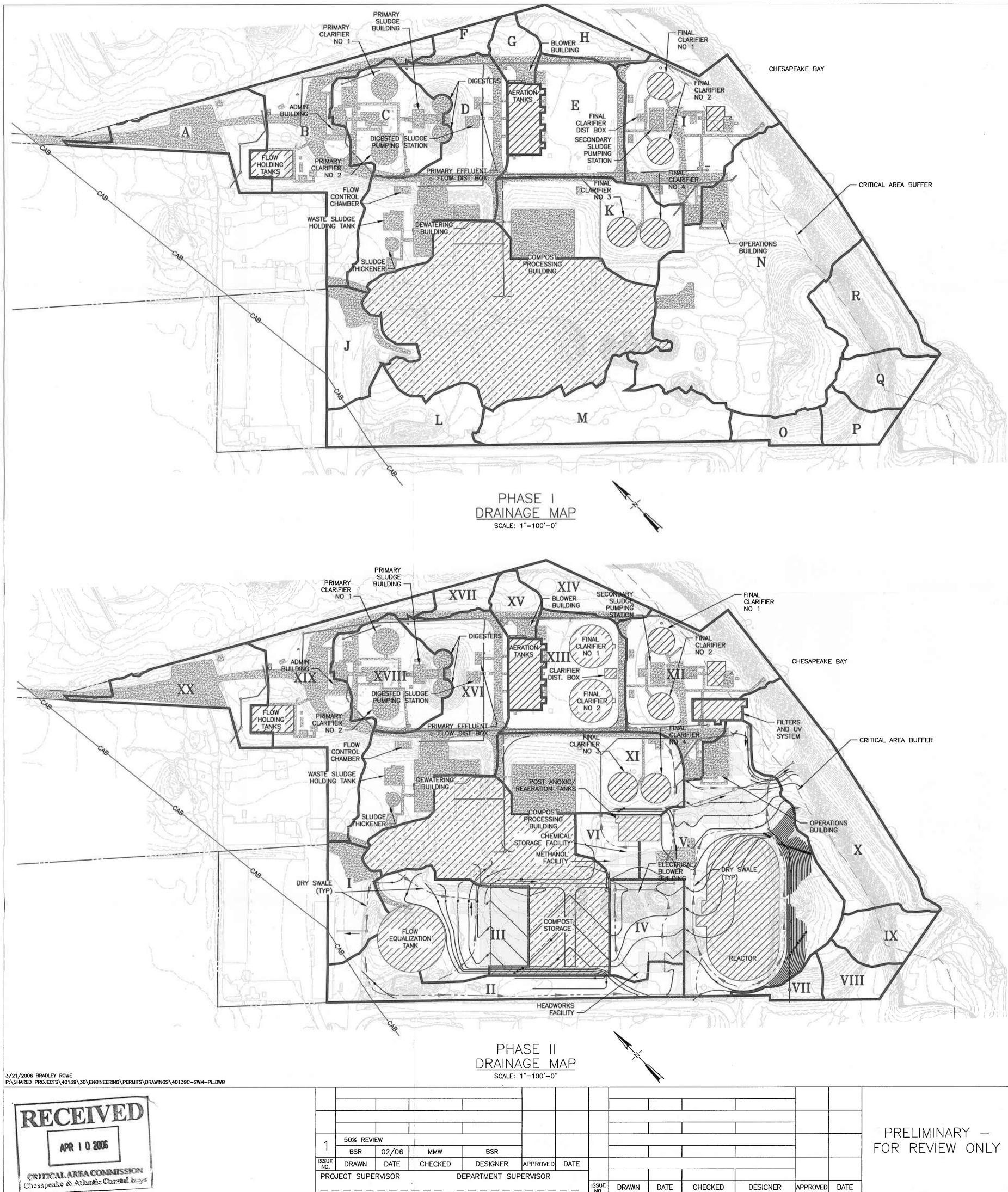
Stearns & Wheler LLC		Havre de Grace	WWTP	3/6/2006 40139		
invironmental		Subject		Date	Job No	
Engineers and Scientists		Critical Area C	alculations - DA 5	BSR Comp By	Checked By	
	Workshe	et A: Standard A	pplication Process	ala min a mini a mini		
			oval Requirements*			
		9	Annual costs in a cost of the			
Step 1:	Calculate Existing and F	roposed Site Imp	erviousness			
				4	· · · ·	
A. Calculate Percent	Imperviousness					
1) Site Area within the	e Critical Area IDA, A =		1.90 acres			
	rface Area, Existing and Prop	osed, (See Table 4.1	for details)		the second second second	
	0) [	winting (paras)	b) Proposed (perce			
	Roads	Existing (acres) 0.09	b) Proposed (acres	/		
	Parking Lots	0	0.40	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
	Driveways	0	0			
	Sidewalks/paths	0	0			
	Rooftops	0.03	0.03			
	Decks Swimming pools/ponds	0	0			
	Other	0	0.02			
a set and the second						
	Impervious Surface	And the second s				
	Area	0.12	0.51		- l	
3) Imperviousness (I)	CITED IN COMPANY					
5) imperviousness (i)						
	Existing Imperviousness, Ipre	= Impervious	Surface Area/Site Area			
		= (Step 2a)/(	Step 1) = 6	5.32 %		
	De la companya de la		0. (			
	Post Imperviousness, Ipost		Surface Area/Site Area	0 4 0/		
a. 1 an m	in .	= (Step 2b)/(	Step 1) =	5.84 %		
B. Define Developm	ent Category (circle)					
	t: Existing imperviousness					
2) <u>Redevelopment</u> : t	Existing imperviousness of 159 ntial Development: Single lot b	% I or more (Go to St	ep 26) proved: single family resdent	ial developmen	t'	
and more than 250 s	quare feet of impervious area	and associated distur	bance (Go to Section 5, Resi	dential Approac	:h,	
for detailed criteria an						
NOTE: All acreage u	used in this worksheet refer to	areas within the IDA	of the Critical Area only.			
Ston 2:	Calculate the Pre-develo	onment Load /Lor				
Step 2:	Calculate the Fle-deven	opinent coad (cpi	6)			
A. New Developmen	nt			unger a		
		$L_{pre} = (0.5) * (A)$	ang			
		and the second sec	bs / year of total phosphoru	IS		
	- valence descet ( )		An			
	where:					
	a second being and		ual load of total phosphorus e	exported from th	ne site prior	
			ent (lbs/year) phosphorus load from undeve	loned land (lbe	(acre/year)	
	and the state of the second second		site wihtin the Critical Area ID/		ruoreryeary	
	-					

Stearns & Wheler	Havre de Grace WWTP Subject				3/6/2006	40139		
Environmental					Date	Job No		
Engineers and Scien	Critical Area C	alculatio	ns - DA 5		BSR	mmw		
							Comp By	Checked By
Step 5:	Identify Feasible Urba	n BMP(s	5)	_				· · · · · · · · · · · · · · · · · · ·
Select BMP Option the load removed	ns using the screening matrices for each option.	s provide	d in the Chapte	er 4 of th	e 2000 Marylan	d Stormwa	ater Design M	anual. Calculat
BMP Type	(L <sub>post</sub> )	х	(BMP <sub>RE</sub> )	х	(% DA Served)	=	LR	
Dry Swale	1.36	X	65%	Х	100%	=		lbs/year
		Х		Х		=		lbs/year
		Х		X		=		Ibs/year
					ed, LR (total)	=		Ibs/year
	Pollut	ant Rem	oval Requirem	ent, RR	(from Step 4)	=	0.50	Ibs/year
	where;							
and the second second second second		ed LR =	Annual total r	hospho	rus load remove	d by the r	roposed BMP	
			(lbs/year)				op oc o Binn	
		L <sub>post</sub> =	Average annu	ual load	of total phospho	rus export	ted from the p	ost-
		post	development					p
		BMPPE =			a farmer and the state of the s	ohorus T	able 4.8 (%)	a manage data to a serie and an and a series to
			= BMP removal efficiency for total phosphorus, Table 4.8 (%) Fraction of the site area within the critical area IDA served by					
			the BMP (%)					
		RR =		oval req	uirement (Ibs/ye	ar)		-
f the Load Removith the 10% Rule	ved is equal to or greater than the	ne Polluta	ant Removal R	equirem	ent computed in	n Step 4, th	nen the on-site	e BMP complie
as the RR (poll	utant removal requirement) be	een met	Y	es	and the second			

Stearns & Wheler	<u>LLC</u>		Havre de Grace WWTP	3/6/2006	40139
Environmental			Subject	Date	Job No
Engineers and Scient	ntists		Critical Area Calculations - DA 6	BSR Comp By	Checked By
3. Redevelopme	ent			and the second	- dlinger war and
		Loro =	(R <sub>v</sub> )(C)(A)(8.16)		
			$0.05 + 0.009 (l_{pre})$	A	
		=	the second se	a literature de la companya de la co	
			••		
	In the contract of the second	L <sub>pre</sub> =	N/A lbs/year of total phosphoru	15	
	where:				
	WINCIC.		Average annual load of total phosphor	up oxported from the	
		⊂pre −	to development (lbs/year)	us exported from the	e site prior
		D -	Runoff coefficient, which expresses the	o fraction of rainfall u	thich is
		rx <sub>v</sub> =	and a second		
			converted into runoff	10000000 (i = 1-75)	f aita
	and the second second second		Pre-development (existing) site imperv	viousness (i.e., I=75 i	i site
			is 75% impervious) Flow-weighted mean concentration of	the pollutant (total at	
		0-	urban runoff (mg/l) = 0.30 mg/l	the polititarit (total pr	iosphorus) in
		A =	Area of the site within the Critical Area	IDA (acres)	
			Includes regional constants and unit of		
Step 3:	Calculate the P	ost-developme	nt Load (Lpost)		de la construction de la construction
A. New Developr	ment and Redevelopm	nent:			
		L <sub>post</sub> =	(R <sub>v</sub> )(C)(A)(8.16)	+	
		R, =	$0.05 + 0.009 (I_{post})$	a cadar a secondar con a	· · · ·
		=	0.194	wa w da da a i	
		L <sub>post</sub> =	0.12 lbs/year of total phospho	Drus	
	where:				
	WHELE.	1	Average annual load of total phosphor	us exported from the	post.
		-post	development site (lbs/year)	us exported nom the	post-
		R =	Runoff coefficient, which expresses the	e fraction of rainfall w	hich is
		$1X_{v} =$	converted into runoff		101110
			Post-development (proposed) site imp	enviousness (i.e. 1-3	5 if cite
		post -	is 75% impervious)	erviousriess (i.e., I=7	5 II SILE
-	1111 1	C -	Flow weighted mean concentration of	the pollutant (total ph	osphorus) in
			urban runoff (mg/l) = 0.30 mg/l	the polititarit (total pr	iosphorus) in
		A =	Area of the site within the Cirtical Area	IDA (acres)	1
			Includes regional constants and unit of		
Step 4:	Calculate the P	ollutant Remov	al Requirement (RR)		
					1
	ter	RR =	L <sub>post</sub> - (0.9)(L <sub>pre</sub> )		1 1 11 1 W1 - HARD
			0.01 lbs/year of total phospho	orus	
	where:		Internet and a second		
		RR =	Pollutant removal requirement (lbs/yea	ar)	
			Average annual load of total phosphor		post-
		te transmission	development site (lbs/year)		
		l <sub>ore</sub> =	Average annual load of total phosphor	us exported from the	site
		pro			
			prior to development (lbs/year)	na nan an	

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Environmental		Subject		Date	Job No	
Engineers and Sci	entists	Critical Area Calculations	- DA 11	BSR Comp. By	Checked By	
	Workshe	et A: Standard Applicati	on Process			
		ng Pollutant Removal Rec				
Step 1:	Calculate Existing and P	roposed Site Imperviousn	ess	· · · · · ·		
A. Calculate Pe	rcent Imperviousness				1	
	in the Critical Area IDA, A =		acres	1		
2) Site Impervio	us Surface Area, Existing and Propo	sed, (See Table 4.1 for details	)		all a stars and a second	
and the second	a) E	xisting (acres)	b) Proposed (acres)		more for a source (in a splay page 1	
	Roads	0.07	0.1			
	Parking Lots	0	0			
	Driveways	0	0			
	Sidewalks/paths	0.01	0.01			
	Rooftops	0.26	0			
	Decks Swimming pools/ponds	0	0			
	Other	0.01	0.01		· · · · · · · · · · · · · · · ·	
	Impervious Surface			· · · · · · · · · · · · · · · · · · ·	1	
1.14	Area	0.35	0.38			
3) Imperviousne	ee (I)	e angere en a se camada an es es				
of imperviousite		· · • • • · · · · · · · · · · · · · · ·				
	Existing Imperviousness, Ipre	= Impervious Surface A	rea/Site Area			
		= (Step 2a)/(Step 1) =	32.11	%		
	Doct Impositioned and					
	Post Imperviousness, Ipost	= Impervious Surface A			1	
	and the second second	= (Step 2b)/(Step 1) =	34.86	. %		
B. Define Devel	opment Category (circle)	La construction de la constructi				
Ny F F F M district data				· · · · · · · · · · · · ·		
	ment: Existing imperviousness less					
	ent: Existing imperviousness of					
3) Single Lot Re	sidential Development: Single lot be 50 square feet of impervious area a	eing developed or improved; si	ngle family residential of	ticl Accession		
	ria and requirements).	ind associated disturbance (GC	to Section 5, Residen	tial Approach	1 1	
for detailed crite	na and requirements).	······································			A second contraction of	
NOTE: All acres	age used in this worksheet refer to a	reas within the IDA of the Critic	cal Area only.			
			······································			
Step 2:	Calculate the Pre-develo	pment Load (Lpre)				
A. New Develop	oment					
. HOW Develop	stricting and a	$L_{pre} = (0.5) * (A)$				
			total phosphorus			
				····		
	where:					
	where:	L <sub>pre</sub> = Average annual load of	total phosphorus expo	orted from the	site prior	
	where:	to development (lbs/yea	ar)	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
	where:		ar) s load from undevelop	ed land (lbs/a	· · · · · · · · · · · · · · · · · · ·	

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Environmental Engineers and Scient:		Critical Area C	`alaulaa'	DA LL			Job No	
Engineers and Science	1515	Critical Area C	alculation	15 - DA 11		BSR Comp By	Checked By	
						-		
Step 5:	Identify Feasible Urba	n BMP(	s)		- An		and the second sec	·
Select BMP Option the load removed for	s using the screening matrice or each option.	s provide	ed in the Chapte	er 4 of th	e 2000 Marylan	d Stormw	vater Design M	anual. Calcul
ВМР Туре	(L <sub>post</sub> )	×	(BMP <sub>RE</sub> )	Х	(% DA Served)	=	LR	
Dry Swale	0.97	Х	65%	Х	25%	=	0.16	lbs/year
		X		Х		=		lbs/year
		Х		Х		=	the second se	lbs/year
					d, LR (total)	=		lbs/year
	Pollu	tant Rem	noval Requirem	ent, RR	(from Step 4)	=	0.16	lbs/year
	where:							
		ved, LR	= Annual total p (lbs/year)	phosphor	us load remove	d by the	proposed BMP	
		L <sub>post</sub> :	= Average annu	ual load o	of total phospho	rus expo	rted from the p	ost-
			development				The state of the s	,- ·
		BMPRE :	= BMP removal	the second s		phorus. 7	able 4.8 (%)	é n
	% DA :		Fraction of th					
			the BMP (%)					
	-1 -	RR	= Pollutant rem	oval requ	uirement (Ibs/ye	ar)	1	
						· ·		1.
If the Load Remove with the 10% Rule.	ed is equal to or greater than t	he Pollul	ant Removal R	equirem	ent computed in	Step 4, 1	then the on-site	e BMP compl
	tant removal requirement) b		- · · · · · · · · · · · · · · · · · · ·	es				



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PHASE I I ARE			
DRAINAGE AREA NO.	AREA (ACRES)		
A	0.68		
В	1.13		
С	0.83		
D	1.54		
E	0.89		
F	0.16		
G	0.21		
Н	0.31		
I	1.22		
J	0.52		
К	1.11		
L	0.70		
М	1.11		
N	3.49		
0	0.23		
Р	0.24		
Q	0.37		
R	0.66		
PLANT DRAIN	3.02		
*OPEN TANKS	0.56		
TOTALS	18.98		

BEEN INCLUDED FOR QUANTITATIVE PURPOSES.

1 5.5.91

% OF DA SERVED (OVERALL SITE)

1.2%

3.8%

4.6%

SECONDARY FINAL SLUDGE CLARIFIER	· · · · · · · · · · · · · · · · · · ·
SECONDARY SLUDGE PUMPING STATION	
FINAL	
IER 1 CLARIFIER NO 2	
CHESAPEAKE BAY	
FILTERS AND UV SYSTEM CLARIFIER NO 4	
FILTERS	
CLARIFIER SYSTEM CRITICAL AREA BUFFER	
OPERATIONS	
OPERATIONS BUILDING	
V. X	
ELECTRIGAL BLOWER BUILDING DIFUEDING DIFUEDING	
FISTER XXX///A	
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	すいね
REACTOR	1111
VII VIII	2.971
	V / BI II

F	PHASE II D	RAINAGE A	REAS
DRAINAGE AREA NO.	AREA (ACRES)	BMP DEVICE	% OF (OVEF
I	0.45	DRY SWALE	
п	0.73	DRY SWALE	
m	0.88	DRY SWALE	
IV	0.57	DRY SWALE	
v	1.90	DRY SWALE	
VI	0.25	DRY SWALE	
VII	0.14	N/A	
VIII	0.25	N/A	
IX	0.37	N/A	
x	1.53	N/A	
XI	1.09	DRY SWALE	
хп	1.29	N/A	
XIII	0.63	N/A	
XIV	0.31	N/A	
XV	0.21	N/A	
XVI	1.54	N/A	
XVII	0.16	N/A	
XVIII	0.83	N/A	-
XIX	1.13	N/A	
XX	0.68	N/A	
Compost Pad AND Plant DRAIN	2.04	N/A	
*OPEN TANKS	2.00	N/A	
TOTALS	18.98	N/A	:

\*OPEN TANK STRUCTURES HAVE BEEN INCLUDED FOR QUANTITATIVE PURPOSES.

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					_		
[							F
-					-		FC
SSUE NO.	DRAWN	DATE	CHECKED	DESIGNER	APPROVED	DATE	



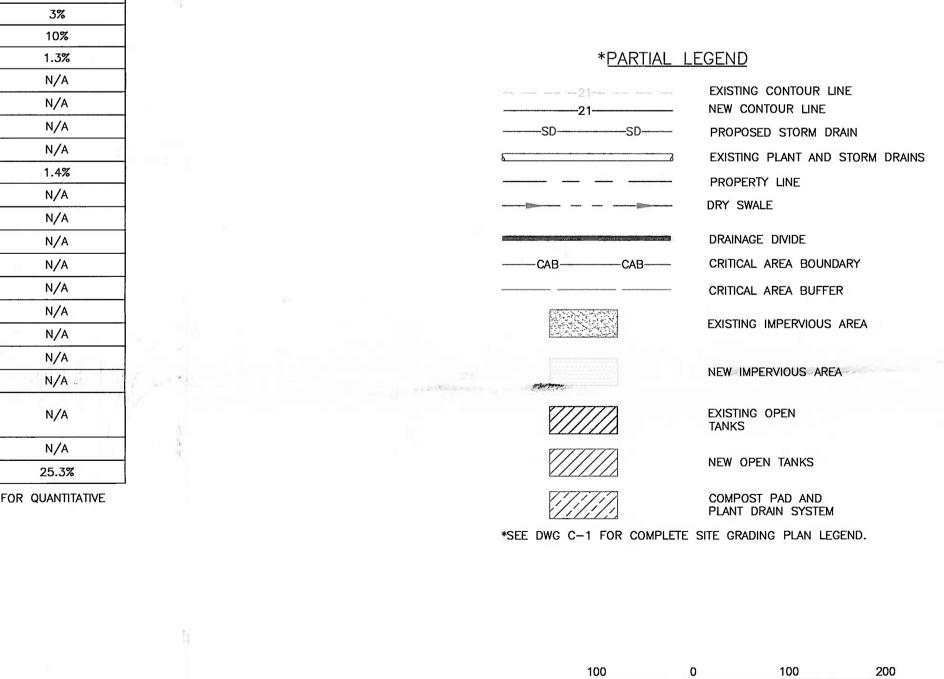
IMPERVIOUS AREA CALCULATIONS									
TYPE	EXISTING (ACRES)	PROPOSED (ACRES)	TOTAL (ACRES)						
ROADWAYS	1.45	0.52	1.97						
PARKING	0.22	0.18	0.40						
BUILDINGS	0.62	0.41	1.03						
SIDEWALKS	0.19	N/A	0.19						
MISC. STRUCTURES	0.28	0.05	0.33						
TOTALS	2.76	1.16	3.92						

Schwart A., Mikor Jappin, and Aller M. and Social Mathematical Activity and Mathematical Activity. In Neuroscience 2010;101(1):101(1

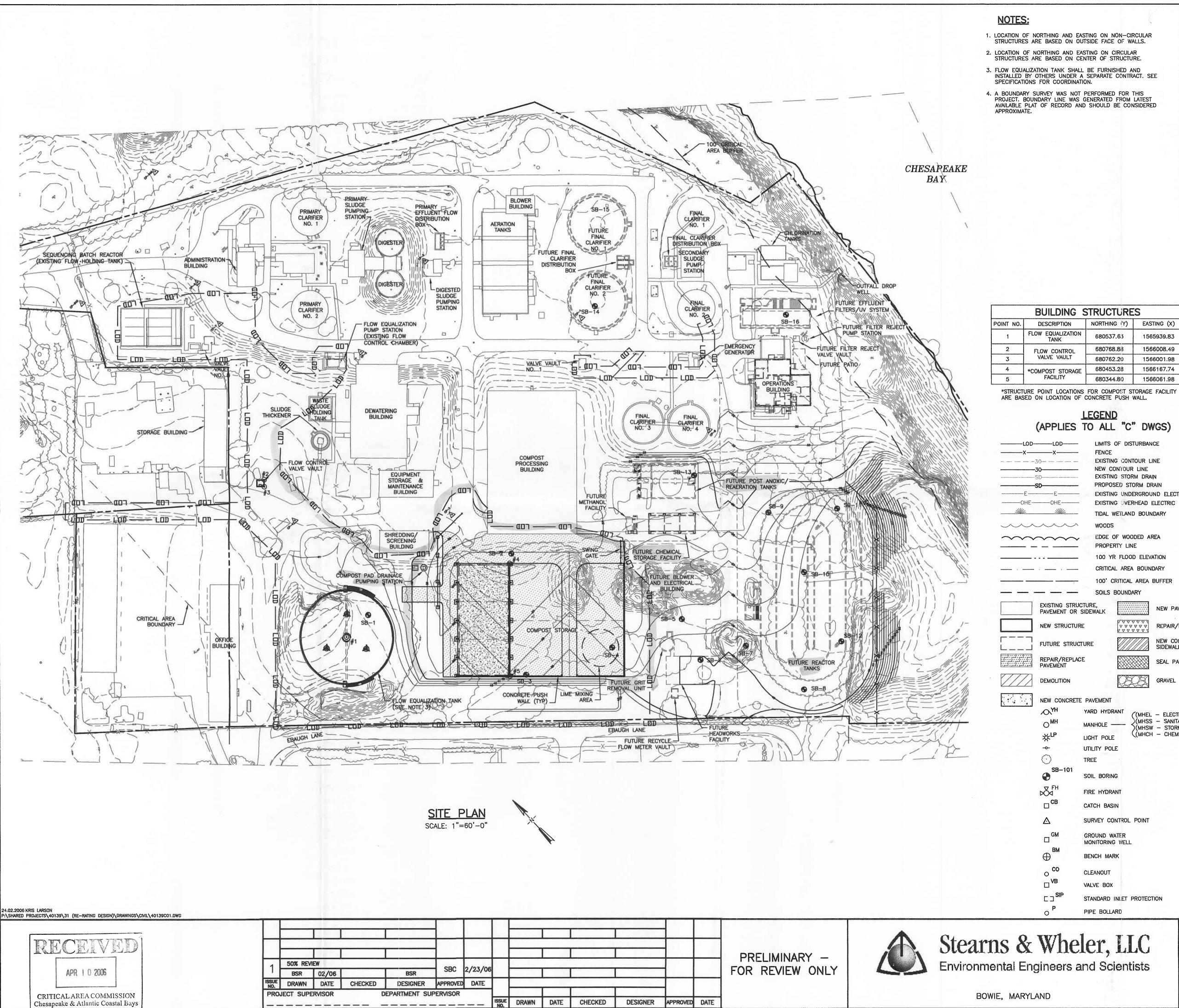
NOTE: COMPOST PAD AND OPEN TANK STRUCTURES ARE EXCLUDED FROM IMPERVIOUS AREA CALCULATIONS.

NOTES:

1. OPEN TANKS AND COMPOST PAD AREAS CREATE ZERO RUNOFF ON SITE AND HAVE BEEN EXCLUDED FROM IMPERVIOUS AREA CALCULATIONS. 2. PLANT DRAIN SYSTEM AND COMPOST PAD AREA DRAINAGE WILL BE CAPTURED AND TREATED THROUGH THE PROPOSED WASTEWATER TREATMENT PROCESS ON-SITE.



			100 1"=100'-0"	0		100	200
		CITY OF	HAVRE DE	GRACE,	MARYLA	ND	
Vheler, LLC		INTERIM IMPRO	VEMENTS I	FOR FACI	_ITY RE	RATIN	G
eers and Scientists		TICAL AREA DRAINAGE A					
	JOB NO.	40139.31	CONTRACT 1-4	45-9010-06	SHEET	FIGL	JRE 1



									Stearr
23/06								PRELIMINARY - FOR REVIEW ONLY	Environme
DATE	П					- 1			
	ISSUE	DRAWN	DATE	CHECKED	DESIGNER	APPROVED	DATE		BOW

VIE, MARYLAND

1. LOCATION OF NORTHING AND EASTING ON NON-CIRCULAR STRUCTURES ARE BASED ON OUTSIDE FACE OF WALLS. 2. LOCATION OF NORTHING AND EASTING ON CIRCULAR STRUCTURES ARE BASED ON CENTER OF STRUCTURE. 3. FLOW EQUALIZATION TANK SHALL BE FURNISHED AND INSTALLED BY OTHERS UNDER A SEPARATE CONTRACT. SEE SPECIFICATIONS FOR COORDINATION.

4. A BOUNDARY SURVEY WAS NOT PERFORMED FOR THIS PROJECT. BOUNDARY LINE WAS GENERATED FROM LATEST AVAILABLE PLAT OF RECORD AND SHOULD BE CONSIDERED

BUILDING STRUCTURES

DESCRIPTION

TANK

FLOW CONTROL

VALVE VAULT

FACILITY

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EXISTING STRUCTURE,

NEW STRUCTURE

REPAIR/REPLACE

PAVEMENT

DEMOLITION

V/H

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SB-101

FUTURE STRUCTURE

NEW CONCRETE PAVEMENT

YARD HYDRANT

MANHOLE -----

LIGHT POLE

UTILITY POLE

SOIL BORING

FIRE HYDRANT

CATCH BASIN

GROUND WATER

BENCH MARK

CLEANOUT

VALVE BOX

MONITORING WELL

SURVEY CONTROL POINT

TREE

PAVEMENT OR SIDEWALK

NORTHING (Y)

680537.63

680768.88

680762.20

680453.28

680344.80

LEGEND

(APPLIES TO ALL "C" DWGS)

FENCE

WOODS

LIMITS OF DISTURBANCE

EXISTING CONTOUR LINE

EXISTING STORM DRAIN

PROPOSED STORM DRAIN

EXISTING UNDERGROUND ELECTRIC

EXISTING WERHEAD ELECTRIC

TIDAL WEILAND BOUNDARY

EDGE OF WOODED AREA

100 YR FLOOD ELEVATION

CRITICAL AREA BOUNDARY

100' CRITICAL AREA BUFFER

NEW PAVEMENT

REPAIR/REPLACE SIDEWALK

SIDEWALK

(MHEL - ELECTRICAL)

((MHCH - CHEMICAL)

(MHSS - SANITARY SEWER)

JOB NO.

(MHSW - STORM WATER)

GRAVEL

NEW CONCRETE

PROPERTY LINE

SOILS BOUNDARY

NEW CONTOUR LINE

EASTING (X)

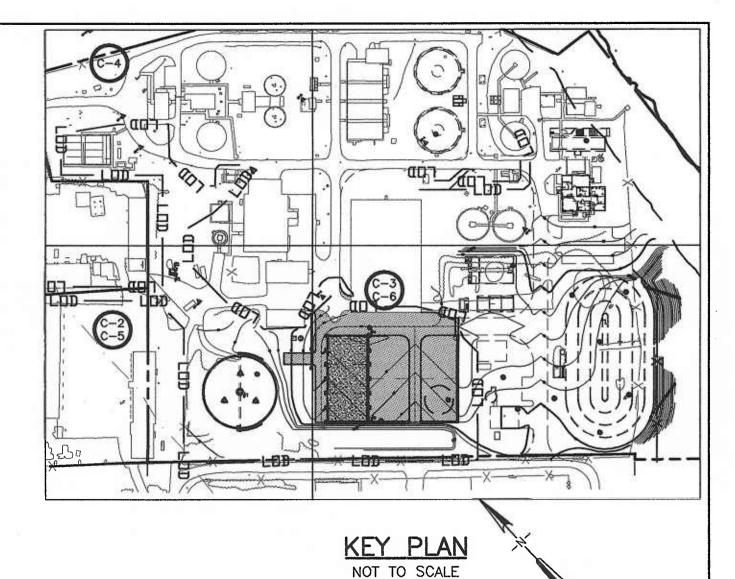
1565939.83

1566008.49

1566001.98

1566167.74

1566061.98



				r			
SURVEY CONTROL POINTS							
POINT NO.	DESCRIPTION	NORTHING (Y)	EASTING (X)	ELEVATION (ft)			
CP-1	PIN & CAP SET	680622.99	1566471.97	29.77			
CP-2	BM XCUT FOUND	680826.51	1566373.89	30.45			
CP-3	TR-MAGSET	680555.37	1566158.53	38.90			
CP-4	TR-MAGSET	680699.84	1565999.44	44.19			
CP-5	TR-MAGSET	680800.15	1566225.06	31.25			
CP-6	TR-MAGSET	681023.48	1566131.09	30.66			
CP-7	TR-MAGSET	680962.35	1566113.93	31.31			
CP-8	XCUTSET BM	680393.88	1566489.83	32.45			
CP-64 0	FP	681112.66	1565999.65	35.47			
CP-64 9	FP	681170.23	1566194.82	32.42			

### GENERAL NOTES (APPLY TO ALL DRAWINGS)

1. EXISTING FACILITIES AND PIPING SHOWN LIGHT. NEW FACILITIES AND PIPING SHOWN DARK.

- 2. EXISTING CONDITIONS SHOWN ON THESE CONTRACT DRAWINGS ARE BASED ON A 2005 TOPOGRAPHIC SURVEY PERFORMED BY MRA, INC. AND OBTAINED FROM AVAILABLE CONTRACT AND RECORD DRAWINGS. THEREFORE, LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY.
- 3. 100-YEAR FLOOD ELEVATION IN THIS AREA IS APPROXIMATELY 11.5-FEET ABOVE MEAN SEA LEVEL.
- 4. SOIL BORINGS MADE NOVEMBER 2005 BY GTA, INC. AND USED AS BASIS FOR JANUARY 2006 GEOTECHNICAL ENGINEERING REPORT.
- 5. ALUMINUM IN CONTACT WITH CONCRETE SHALL BE PAINTED WITH BITUMINOUS COATING IN ACCORDANCE WITH SPECIFICATION SECTION 09900.
- 6. CONTRACTOR SHALL FIELD VERIFY AND COORDINATE ALL EXISTING PIPING ELEVATIONS, LOCATIONS, SIZE AND TYPE OF MATERIAL WITH NEW PIPING PRIOR TO CONSTRUCTION. CONTRACTOR SHALL FIELD VERIFY AND COORDINATE ALL EXISTING EQUIPMENT, BUILDING, ROOM, AND TANK DIMENSIONS AND ELEVATIONS PRIOR TO ORDERING NEW EQUIPMENT, REPORT DISCREPENCIES TO THE ENGINEER IMMEDIATELY.
- 7. FOR PIPE HANGERS AND SUPPORTS, SEE SPECIFICATION SECTION 15140.
- 8. MOWING STRIPS NOT SHOWN FOR CLARITY. CONTRACTOR SHALL PROVIDE MOWING STRIPS AROUND ALL NEW STRUCTURES AND PIPING IN ACCORDANCE WITH THE DETAIL SHOWN ON DRAWING C-XX.
- 9. ELEVATIONS OF V-NOTCH WEIRS ARE BASED ON THE BOTTOM OF THE NOTCH. 10. CONTRACTOR SHALL PERFORM EXPLORATORY EXCAVATIONS AS NECESSARY TO VERIFY LOCATIONS OF EXISTING UNDERGROUND PIPING AND UTILITIES PRIOR TO
- CONSTRUCTING NEW FACILITIES. 11. CONTRACTOR SHALL SUPPLY HANDRAIL AS SHOWN ON STRUCTURAL AND MECHANICAL
- DRAWINGS. 12. WHERE OPENINGS ARE LEFT IN STRUCTURE WALLS FROM DEMOLITION OF EQUIPMENT, CONTRACTOR SHALL SEAL WITH MATERIALS THAT MATCH THE EXISTING CONSTRUCTION. TOOTH ALL MASONRY CONSTRUCTION TO EXISTING.
- 13. WHEN NEW ELECTRICAL CONDUIT IS SHOWN ON PROFILES, IT IS FOR INFORMATION ONLY. REFER TO ELECTRICAL DRAWINGS FOR LOCATION, SIZE AND NUMBER. NOT ALL NEW CONDUIT IS SHOWN ON THE PROFILES.
- 14. WHERE SHEETING IS SHOWN, CONTRACTOR IS REQUIRED TO INSTALL SHEETING TO PROTECT EXISTING FACILITIES, UTILITIES, WETLANDS, ETC. WHERE SHEETING IS NOT SHOWN, SHEETING SHALL BE USED AT THE DISCRETION OF THE CONTRACTOR. REFER TO SPECIFICATION SECTION 02161 - SHEETING AND BRACING FOR OTHER REQUIREMENTS.
- 15. CONTRACTOR SHALL REPLACE ALL PAVEMENT THAT IS 1) SHOWN AS REPAIR/REPLACE ON THE CONTRACT DRAWINGS, 2) IMPACTED BY NEW CONSTRUCTION, AND 3) IMPACTED BY CONTRACTOR'S OPERATIONS.
- 16. PAINT PARKING LINES AT THE OPERATIONS BUILDING AS SHOWN ON THE SITE PLAN. HANDICAPPED PARKING SPACES SHALL BE MARKED IN ACCORDANCE WITH MARYLAND DOT REGULATIONS.
- 17. CONTRACTOR SHALL NOTE THERE ARE SEVERAL INSTANCES WHERE NEW UNDERGROUND PIPING IS CONNECTED TO EXISTING UNDERGROUND PIPING. CONTRACTOR IS REQUIRED TO PERFORM EXPLORATORY EXCAVATIONS IN THESE AREAS, AS REQUIRED, TO CONFIRM EXISTING PIPING LOCATIONS AND ELEVATIONS. REFER TO SPECIFICATION SECTION 01010.

		STANDARD	INLET	PROTECT	101
	0 <b>P</b>	PIPE BOLL	ARD		
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ental Engineers and Scientists

# OVERALL SITE AND GRADING PLAN

CITY OF HAVRE DE GRACE, MARYLAND

INTERIM IMPROVEMENTS FOR FACILITY RE-RATING

40139.31 CONTRACT 1-45-9010-06 SHEET

1"=60'-0"

C-1

120