Low cost, effective stormwater management

High Impact Environmental: Cascading System Chain Filter

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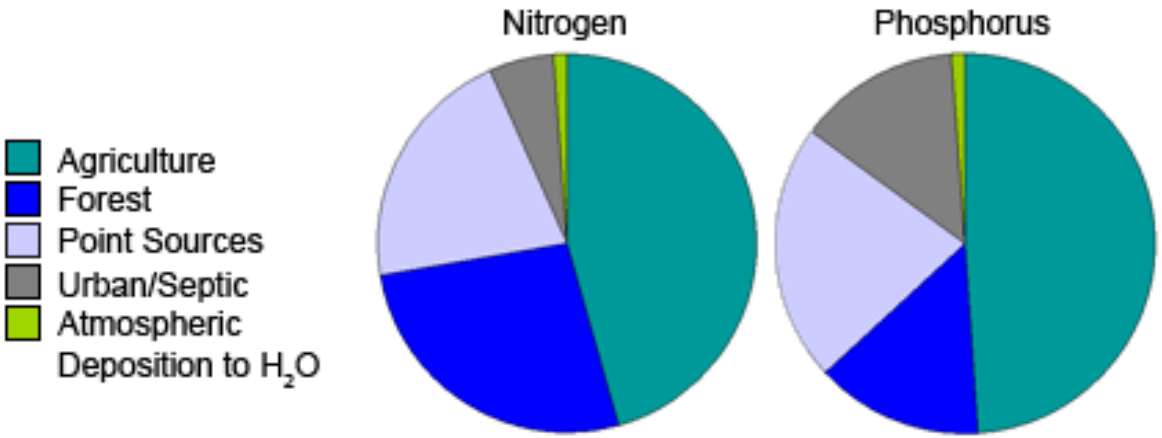
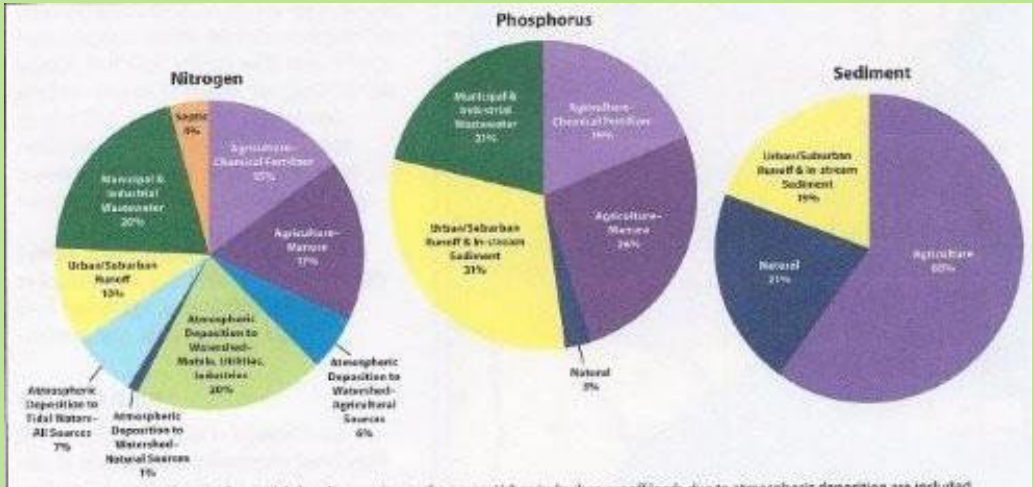
1/4/2014 10:25

Sources of Nutrients in the Chesapeake Bay

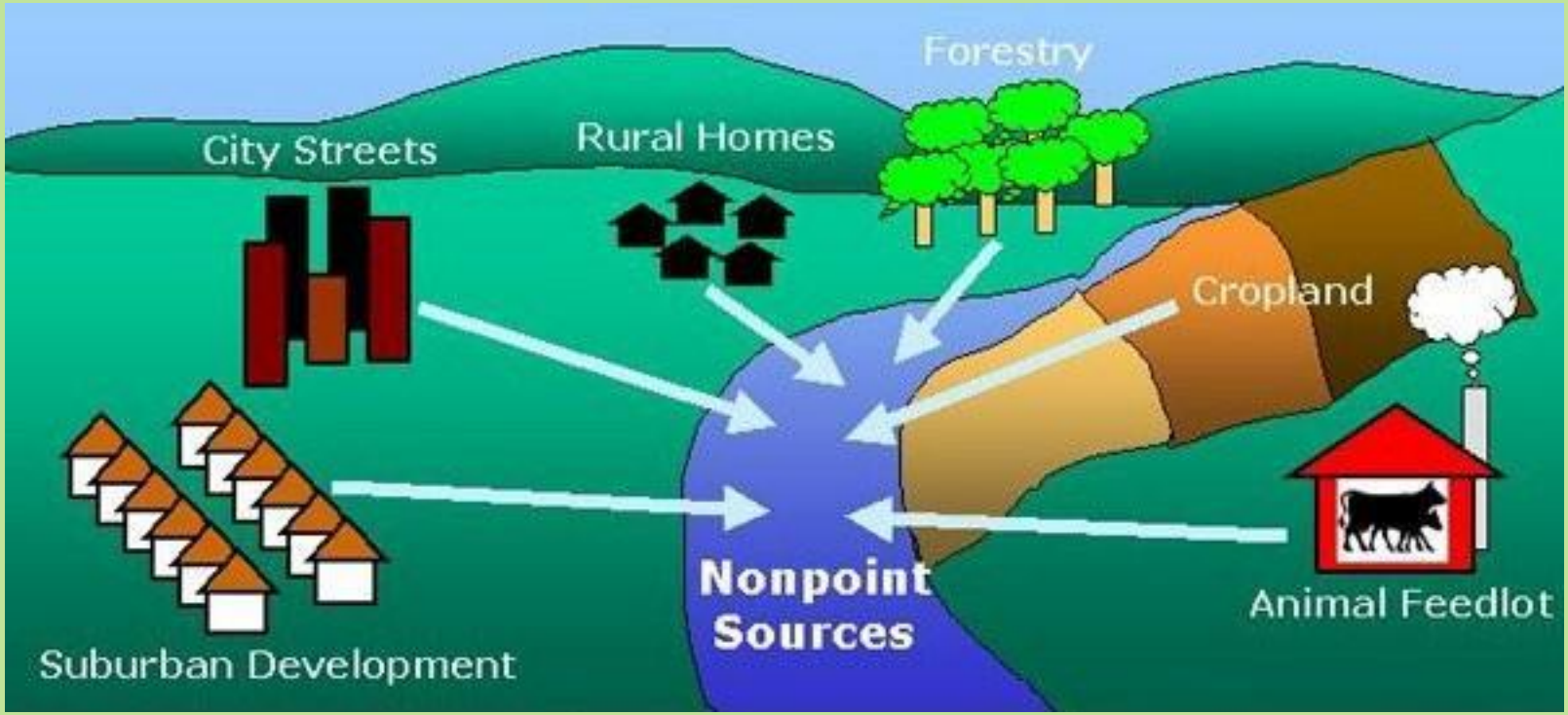


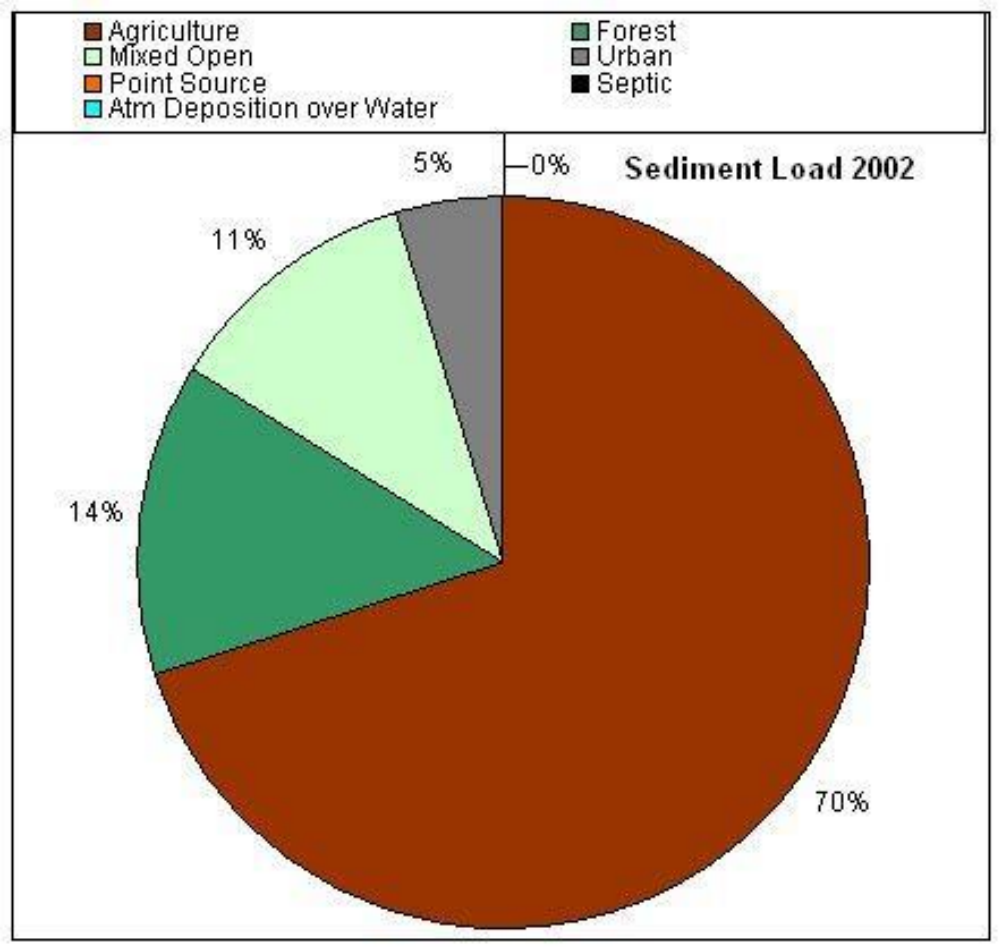
Source: Chesapeake Bay Program, 2004.



Note: Does not include loads from tidal shoreline erosion or the ocean. Urban/suburban runoff loads due to atmospheric deposition are included under atmospheric deposition loads. Wastewater loads are based on measured discharges; other loads are based on an average hydrology year using the Chesapeake Bay Program Airshed Model and Watershed Model Phase 4.3.

Figure 2. Relative responsibility for pollution loads to the bay.


Forestry
City Streets
Rural Homes
Cropland
Nonpoint
Sources
Animal Feedlot
Suburban Development

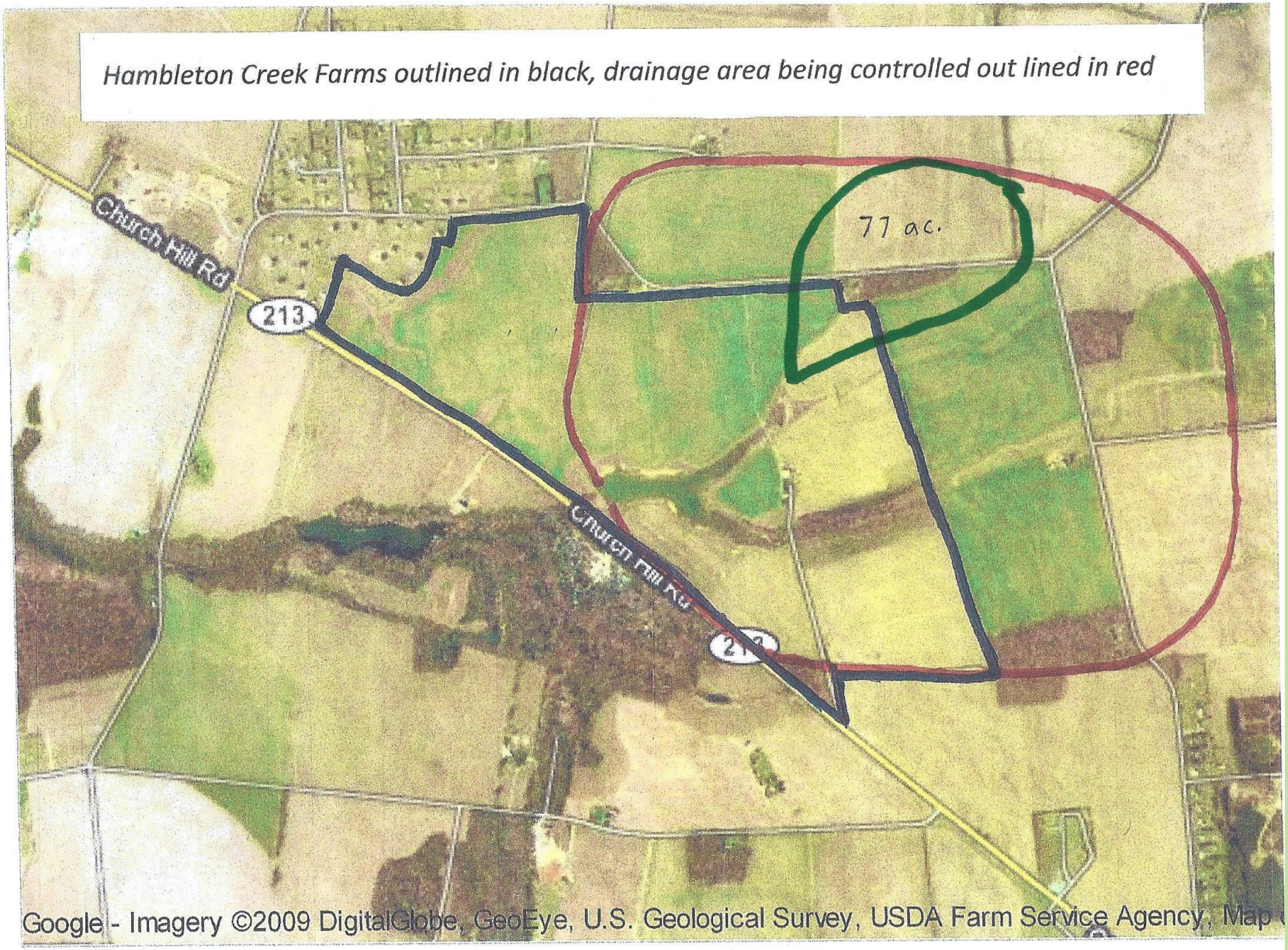

Agriculture
Forest
Mixed Open
Urban
Point Source
Septic
Atm Deposition over Water
Sediment Load 2002
5%
0%
11%
14%
70%

Accurately determine drainage area into HIE's ASCS practices utilizing Queen Anne's County 2013 Aerial LiDAR data

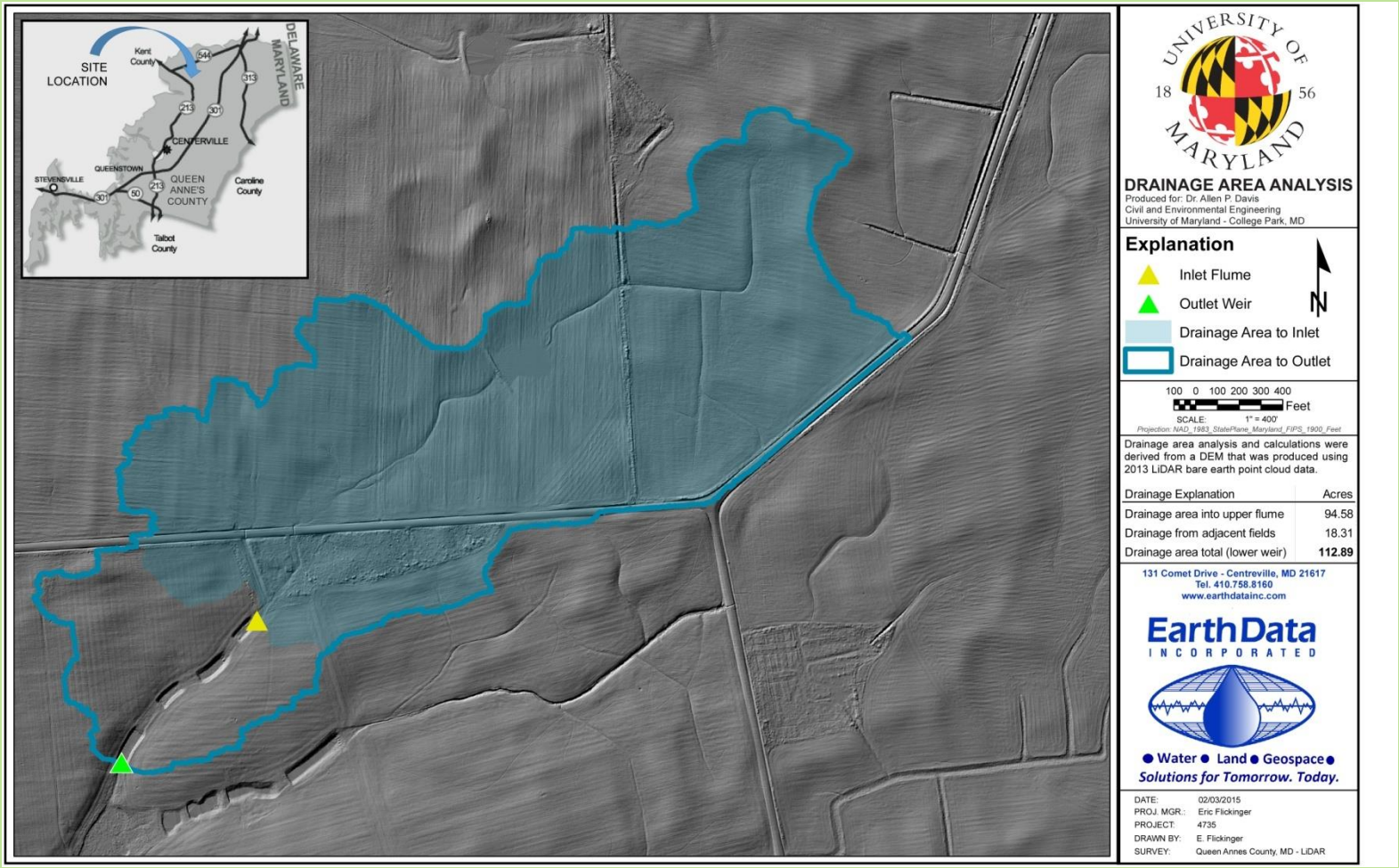
National Fish and
Wildlife Foundation

Chesapeake Bay Technical Capacity Grants Program - Agricultural Conservation

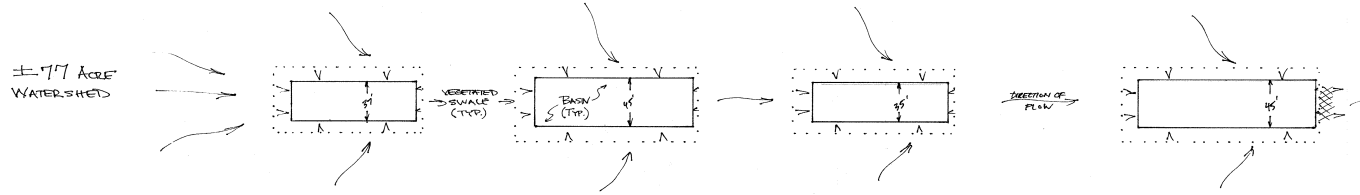
Earth Data/HIE Collaboration to develop a "Design Guidance Manual" for the Agricultural Stormwater Conveyance System

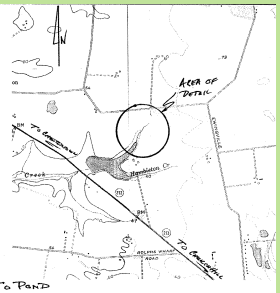

Hambleton Creek Farms outlined in black, drainage area being controlled out lined in red
77 ac.
Church Hill Rd
213
Church Hill Rd
Google - Imagery ©2009 DigitalGlobe, GeoEye, U.S. Geological Survey, USDA Farm Service Agency, Map

Drainage Area



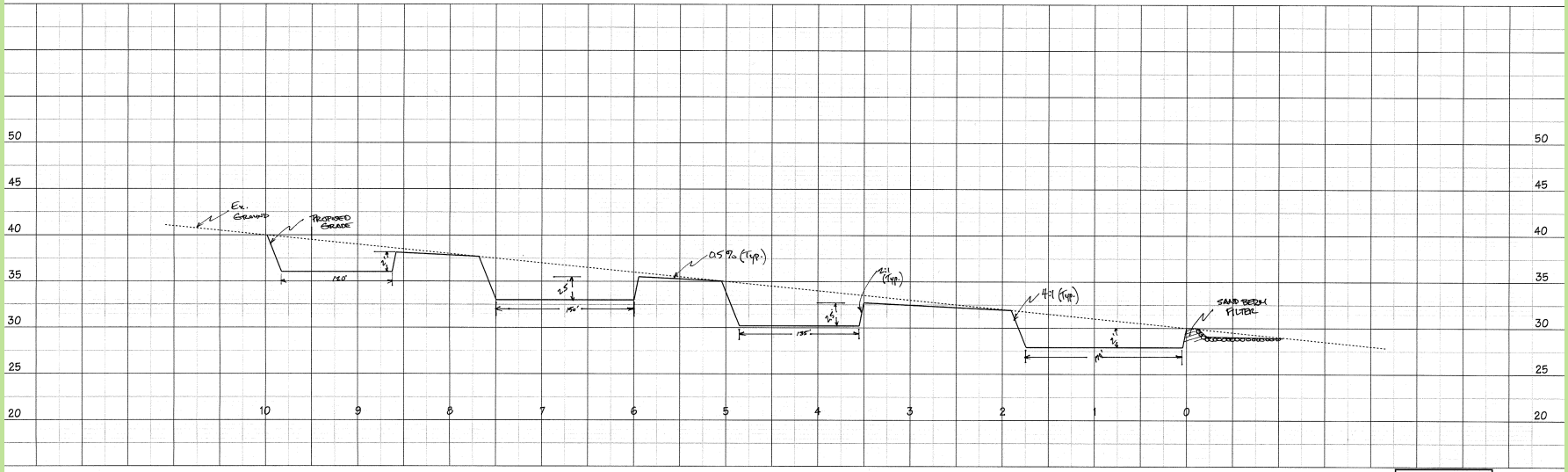
Phase I: High Impact Environmental's Model Project





PLAN

1"=50'



PROFILE

SCALE: HORIZ. 1"=50'
VERT. 1"=5'

High Impact Environmental, Inc.
301 Pond Lane
Chestertown, MD 21620
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http://highimpactenvironmental.org/

"Cascading System" with
"Floodway Stormwater Containment Basins"

Total Stormwater Capacity = ±396,500 gallons (±1.22 acre feet)

HIE's Phase I, Stormwater Cascading System Volume/Quantity

Basin 1- 37' wide x 120' long x 1.8' depth = 7992 cu. ft. or 59,780 gal. or 271,999 liters

Basin 2- 45' wide x 150' long x 2.8' depth = 18,900 cu. ft. or 141,372 gal. or 643,242 liters

Basin 3- 35' wide x 135' long x 2.9' depth = 13,702 cu. ft. or 102,494 gal. or 466,347 liters

Basin 4- 45' wide x 170' long x 1.8' depth = 13,770 cu. ft. or 102,999 gal. or 468,645 liters

Total liters = 1,850,233

Total gallons = 406,645

Before

After


5/8/2011 17:47


5/10/2011 3:30

Advantages of the cascading system

- Easily duplicated
- Cost feasible
- Uses no tillable land
- Traps and filters sediment, nitrogen, phosphorus
- Instant gratification
- Simple materials – grass seed, starter fertilizer, curlex
- Replenishes groundwater
- Creates wildlife habitat
- Produces top soil, a sellable byproduct
- Recycles Phosphorus by spreading it back on farm fields


4/13/2013 22:06


10/11/2013 11:37


10/11/2013 11:43


2/13/2014 17:50


2/13/2014 17:41


12/2/2013 16:59

UNIVERSITY OF MARYLAND
STORMWATER & BIORETENTION RESEARCH

Treatment of Agricultural Stormwater Runoff by a Cascading System of Floodway Stormwater Containment Basins

Final Data Report

Table 4-8. Reductions Based on Total Volume and Mass Measured Into and Out of the Basin System and Including the Drainage Area Ratio

	Volume (L)	TSS (kg)	TP (g)	PP (g)	DP (g)	DIP (g)	DOP (g)
Total Volume/Mass in	40.7×10^6	21,800	64,800	43,100	17,300	14,200	3,500
Total Volume/Mass Out	17.9×10^6	7,700	25,900	18,300	6,300	4,800	1,600
Reduction	56%	65%	60%	57%	63%	66%	54%

Table 4-12 Summary of Nitrogen Speciation Masses Measured Into and Out of the Basin System and the Associated Removals for Each Species for Ten Events With Complete Nitrogen Speciation Data

	Volume	TSS	Total N	Organic N	Nitrate	Ammonium
Mass In*(kg)	24×10^6 L	20,000	151	77	61	14
Mass Out (kg)	11×10^6 L	6,000	53	36	18	2.5
Removal	54%	68%	65%	54%	70%	82%

*Mass In includes drainage area correction factor of 112/90 (See Section 1.3.2)

Prepared for Sam Owings, High Impact Environmental

Maryland Industrial Partnerships (MIPS)
Maryland Technology Enterprise Institute
University of Maryland, College Park

Rosemary Myers & Dr. Allen P. Davis
Civil & Environmental Engineering
University of Maryland
College Park, MD 20742

Tropical storm Andrea 6/7/2013

- Event "Andrea (tropical storm)"6-7-13, 3.2" rain, started as a drizzle before dawn, rain slowly increased reaching heavy downpours for several hours during early afternoon, rain stopped before sundown. 8:30 PM basin 1 full and discharging, basin 2 full, basin 3 holding 12", basin 4 holding 12"
- Overnight another .4" rain for a event total 3.6" rain in a 24 hour period. In the morning of 6-8-13, basin 1 holding 22", basin 2 holding 20", basin 3 holding 6", basin 4 holding 12."
-
- There was **zero discharge** from this event.
-
- Event 6-11-13, .8" rain, basin 1 holding 22", basin 2 holding 20", basin 3 puddles, basin 4 holding 4". **Zero discharge.**
- 6-12-2013 installed flume
-
- Event 6-13-2013, 1" rain, torrential rain fell in 5 minutes around 10:00 AM, all basins full, no discharge. Flume held in place, soil on both sides washed out.
-
- **Total 5.4" rain in 6 days, zero discharge.**

Chain Filter

A chain filter system can be established across a slope such as an agricultural field or municipal park. The system includes a series of earthen basins oriented so that their upstream borders are aligned to capture variously directed stormwater runoff from the field or park. An earthen berm is extended along each basin border opposite the upstream border to prevent basin overflow. Each earthen basin is further defined by lateral side borders that interconnects the basin upstream border and basin opposite border. Each earthen berm extends beyond the basin lateral sides to conjoin berms of adjacent basins, so as to avoid loss of runoff from and around the basins.

Before

After

After

West view

West view

Fig. 1

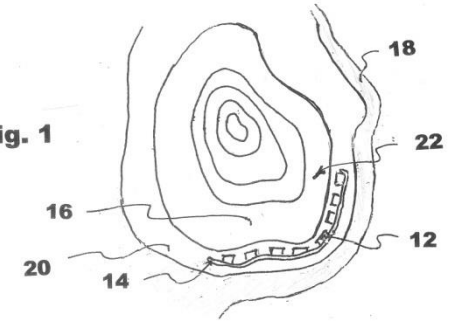
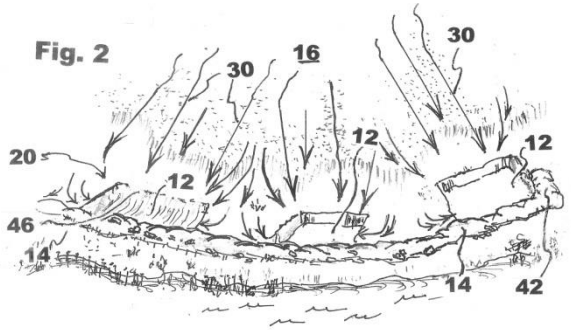


Fig. 2



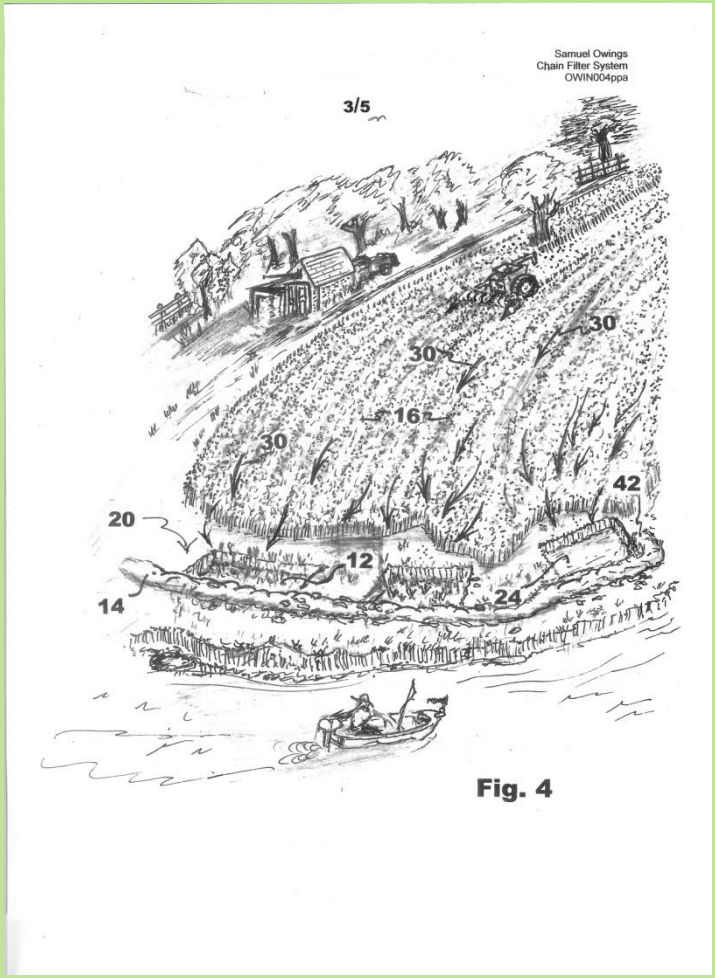
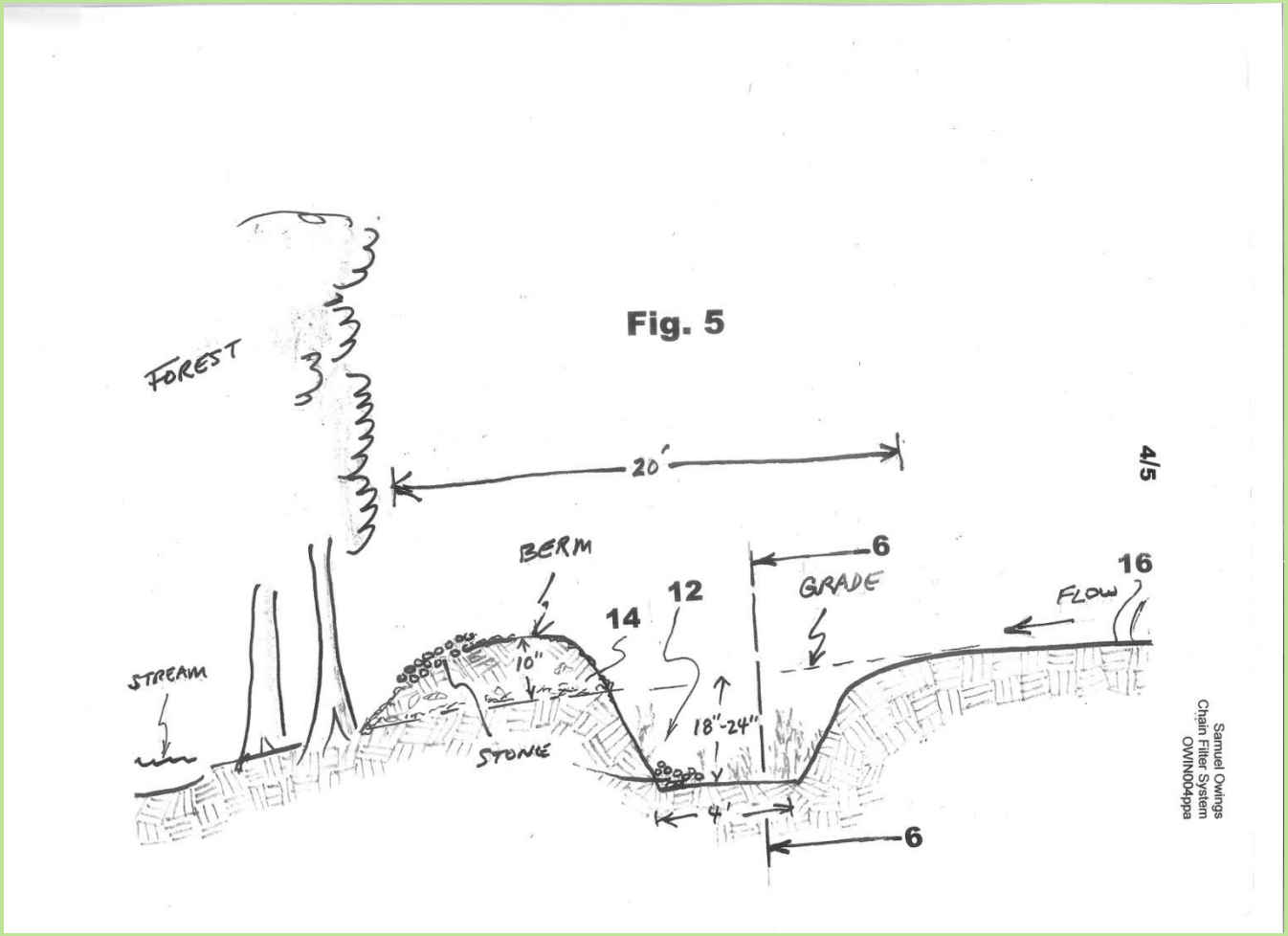
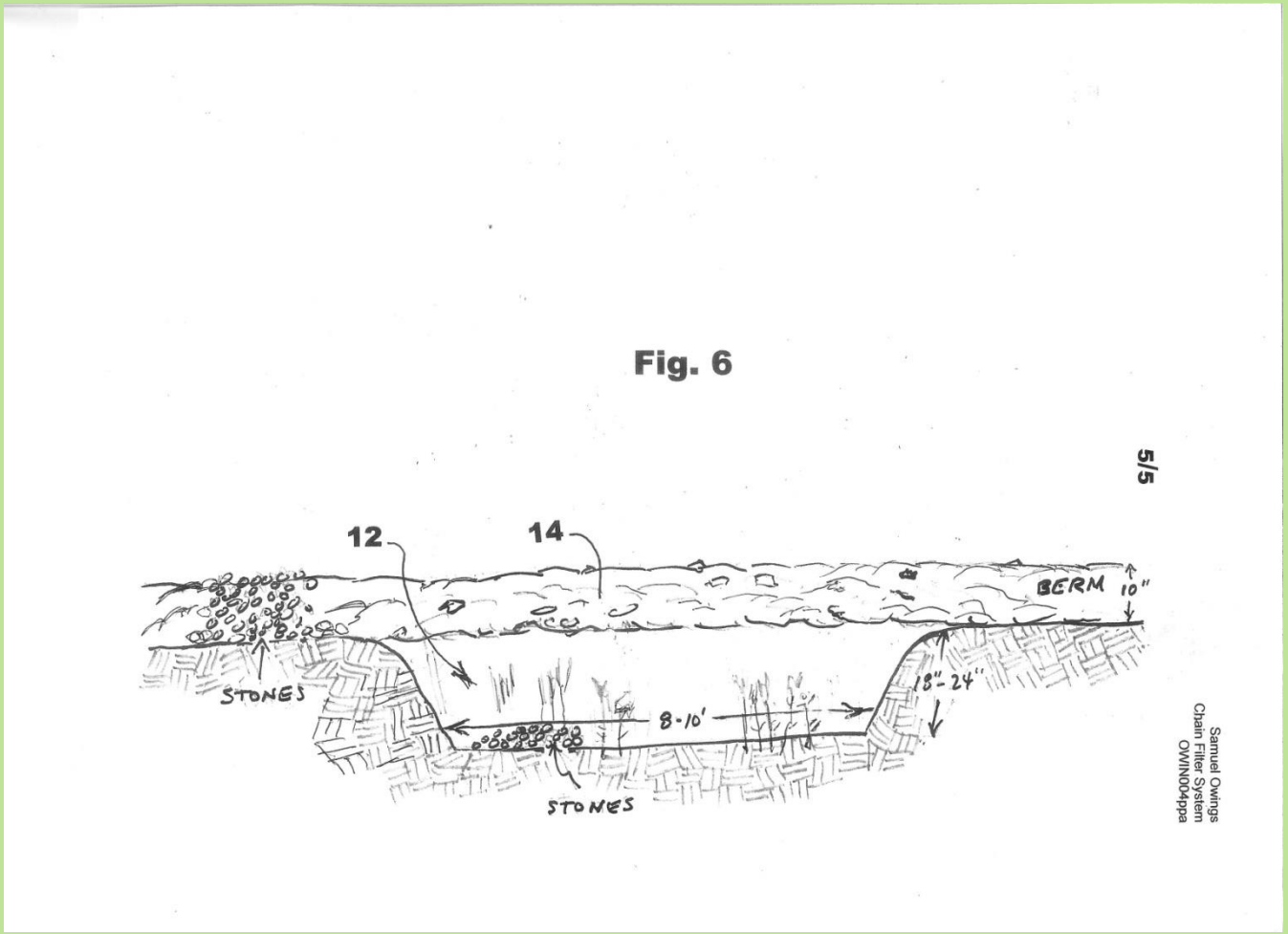

Samuel Owings
Chain Filter System
OWIN004ppa
3/5
30
30
16
30
42
20
12
14
24

Fig. 4

Chain Filter Side View



Chain Filter Front View



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Maryland's Estimated Phase II WIP Implementation Costs
($ in Millions)

Source Sector	2010-2017 Cost	Total 2010-2025 Cost
Agriculture	**$498**	**$928**
Municipal Wastewater	**$2,368**	**$2,368**
Major Municipal Plants	2,306	2,306
Minor Municipal Plants	62	62
Stormwater	**$2,546**	**$7,388**
Maryland Department of Transportation	467	1,500
Local Government	2,079	5,888
Septic Systems	**$824**	**$3,719**
Upgrades	562	2,358
Connections	237	1,273
Pumping	25	88
Total	**$6,236**	**$14,403**

WIP: Watershed Implementation Plan

Note: The exhibit does not reflect costs associated with controlling combined sewer and sanitary overflows or the implementation of the Healthy Air Act. The exhibit reflects the final Phase II WIP estimate released October 26, 2012.

Source: *Phase II Watershed Implementation Plan*; Maryland Department of the Environment

Farmer/Landowner Budget Scenario

- A landowner with 200 tillable acres, conserves 5% or 10 acres@10K per acre easement payment:
- $100,000 or $500 per acre.
-
- ***Implementation cost:***
- $92,000 or $460 per acre.
- ***Engineering/Administrative fees:***
- $25,000 or $125 per acre.
-
- Total: $217,000 or $1089 per acre
-
- 4,000,000 acres crop land in the Chesapeake Bay Watershed.
-
- 4 million @ $1089 = $4.4 billion
-
- ***Over 10 years is $436 million per year***