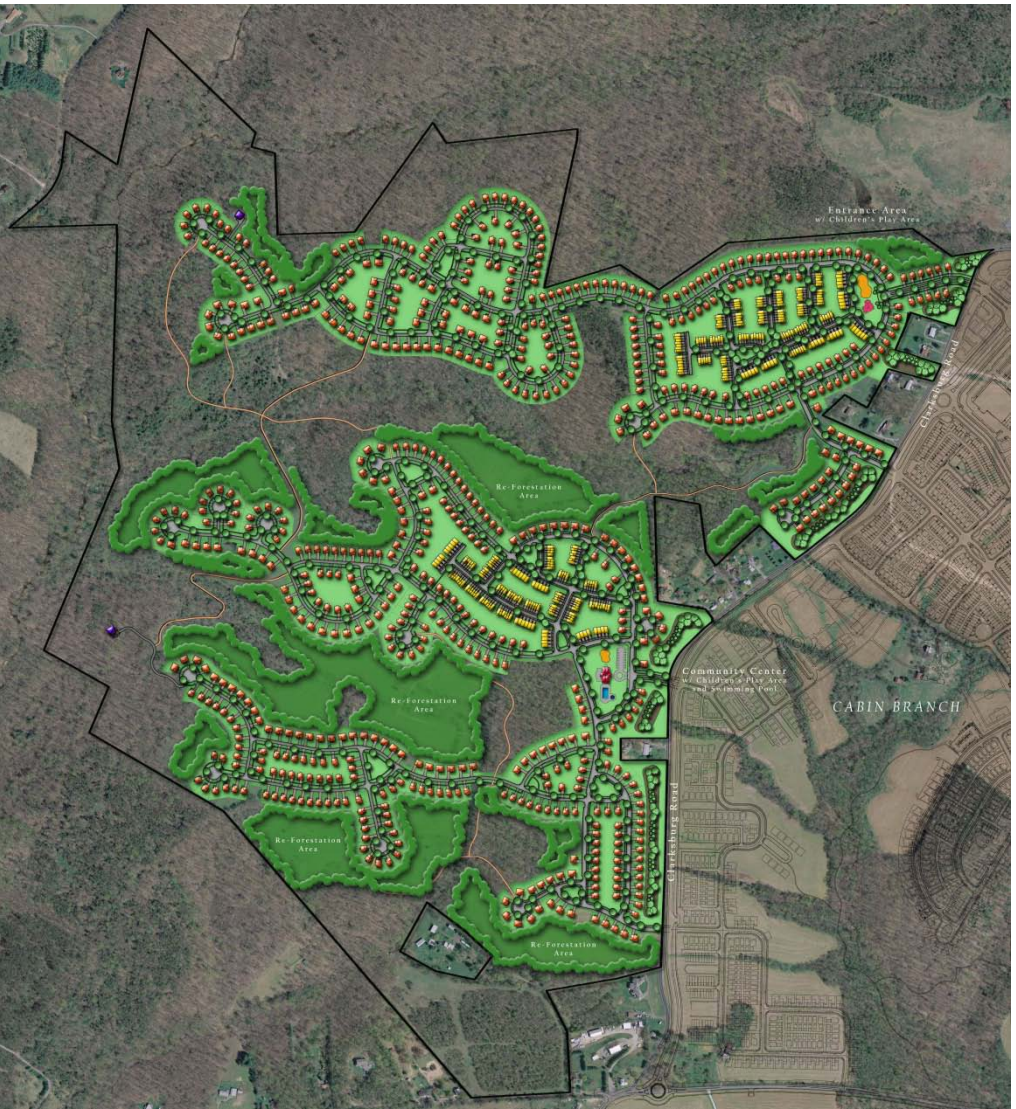
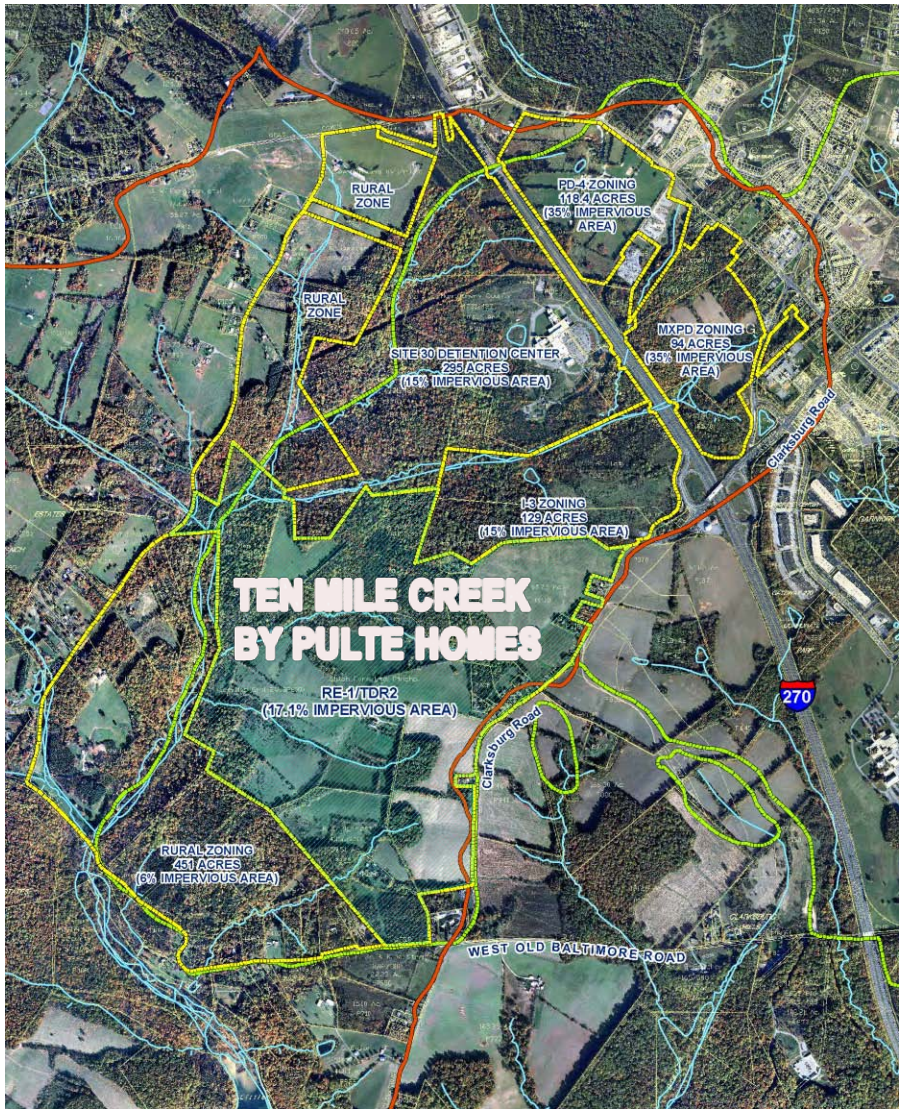
TEN MILE CREEK BY PULTE HOMES
CLARKSBURG, MD





INTRODUCTION

Development Team

Steve Collins, Pulte Group

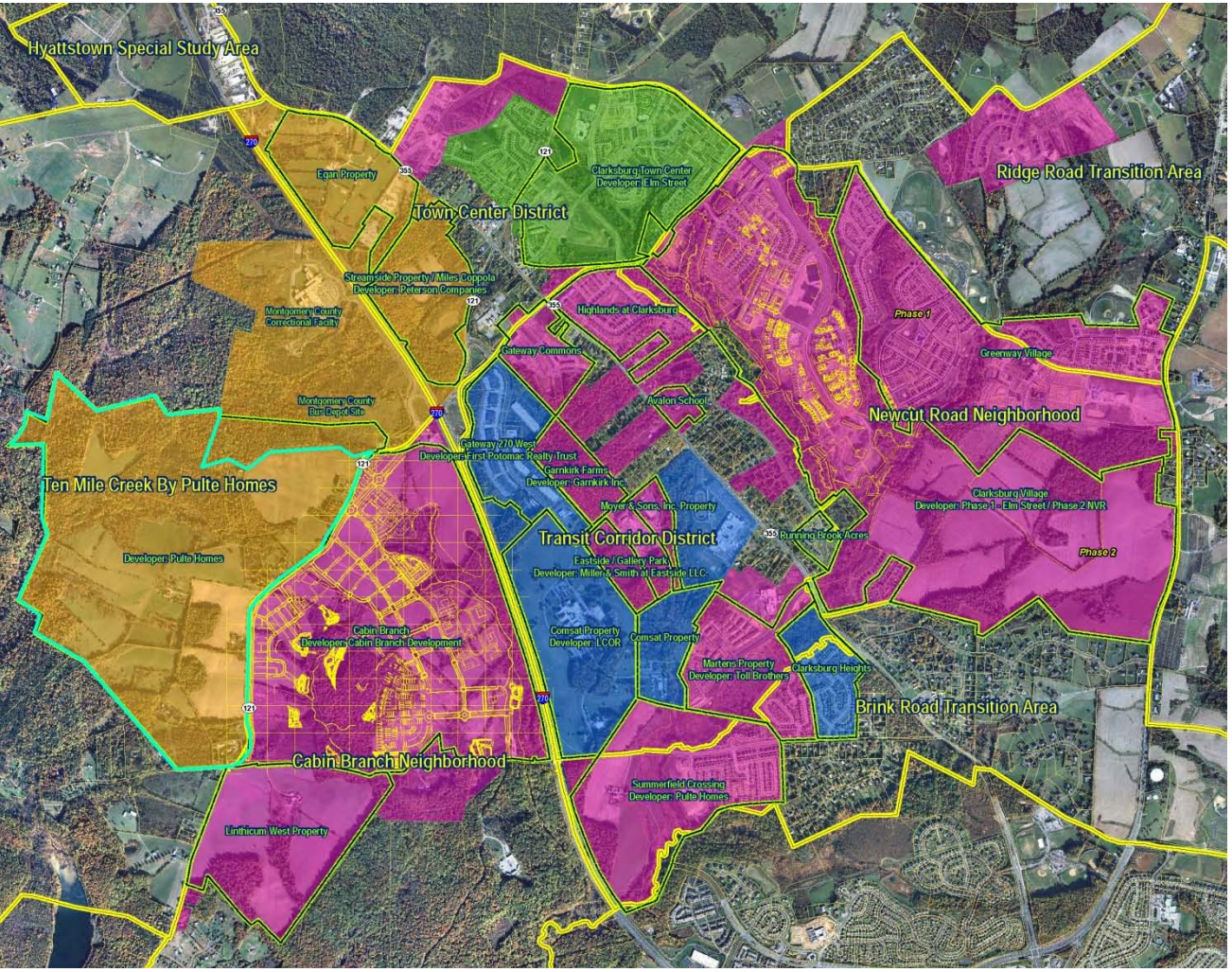
Speakers

Robert R. Harris, Lerch, Early & Brewer

KC Reed, PE, Loiederman Soltesz Associates, Inc.

Chuck Pace, PE, NewFields

Clarksburg Master Plan & Stage 4 Properties



Master Planning Stages

- Stage 1 – Complete
- Stage 2 – Complete
- Stage 3 – Complete
- Stage 4 – Triggers Met/ Implementation in Process

Environmental Site Design
A Holistic Approach

Site Mapping

- 538 acres total
- Open/Rural Area (54%) – 290.4 acres
- Forest Area (45%) – 243.6 acres

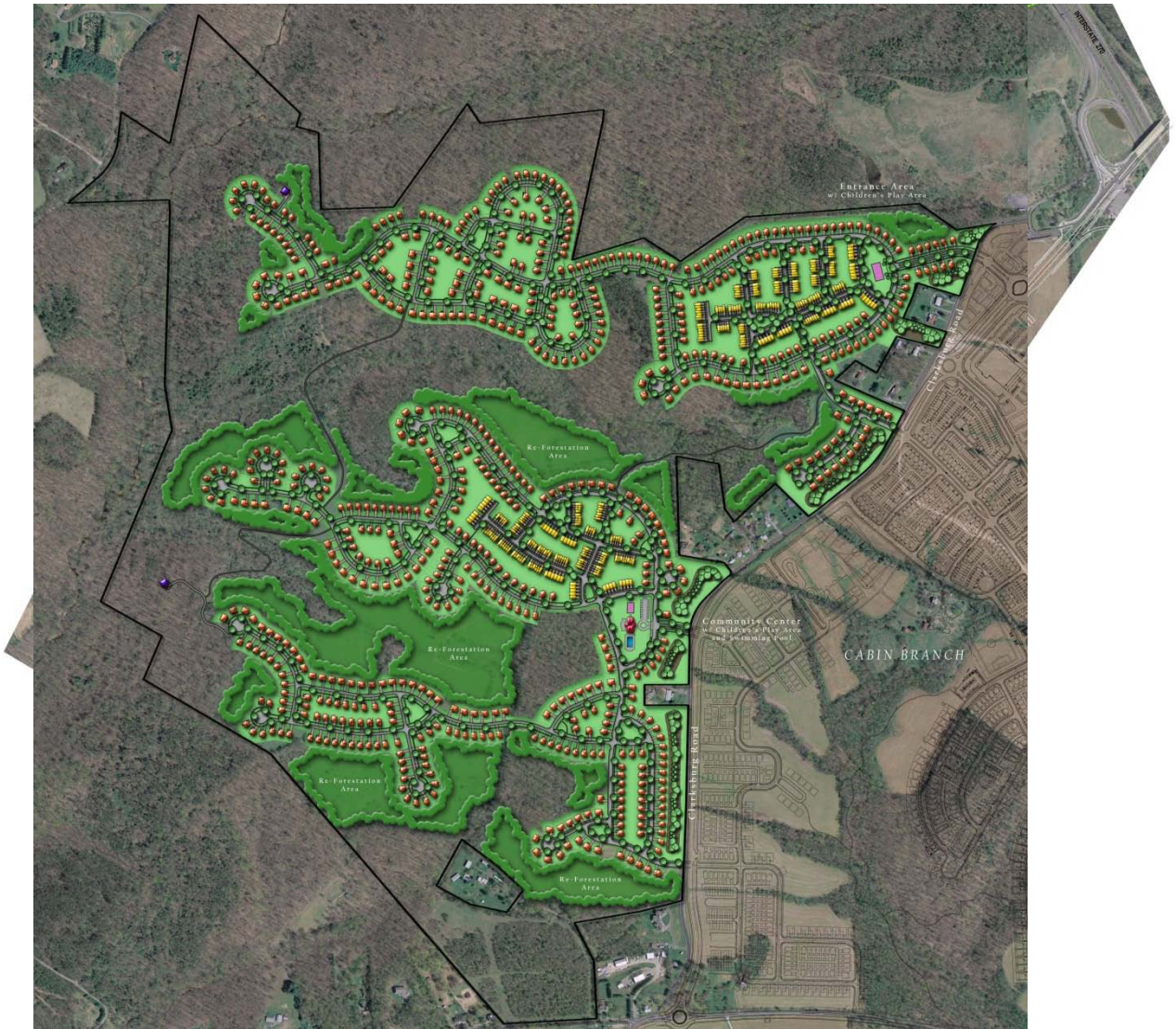
Environmental Site Design
A Holistic Approach

54% Agricultural
45% Forested

Natural Resource Mapping

- NRI/FSD per M-NCPPC guidelines
- Hydrologic Features
  - Streams
  - Wetlands
  - Seeps
- Stream Valley Buffer
- On-site Forested Areas
  - Tagging and location of trees

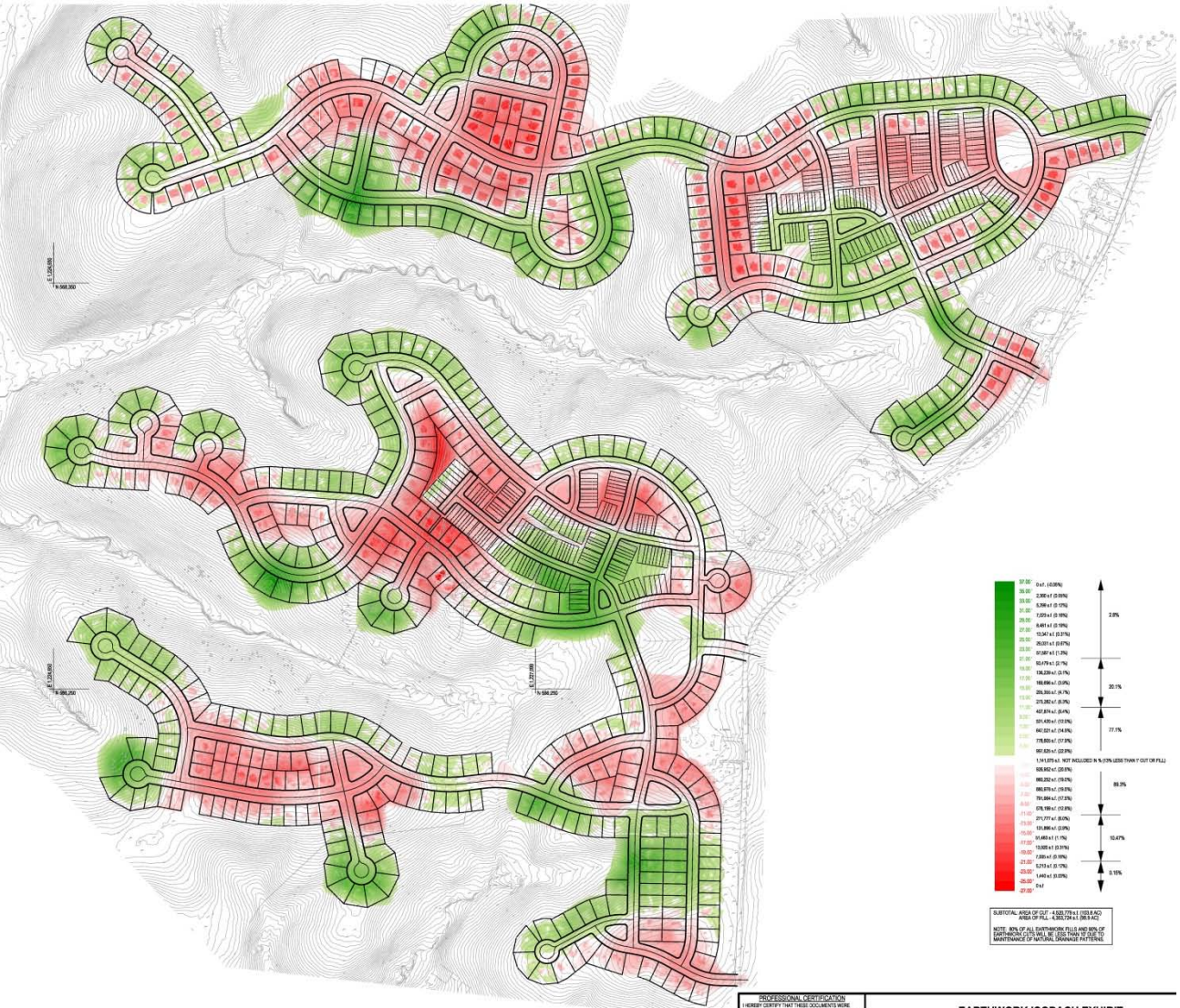
Environmental Site Design
A Holistic Approach



Site Fingerprinting and Development Layout

- Increase Riparian fringe forest cover to 100%
- Increase on-site forest cover for a net increase of approximately 38 acres
- Maintain natural drainage divides with environmentally sound grading practices maintain current riparian fringe which is 79% forested
- Roadway network designed to follow existing ridgelines of site that currently define various stream valleys.

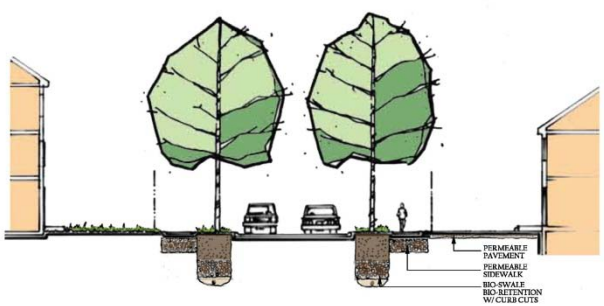
Environmental Site Design
A Holistic Approach



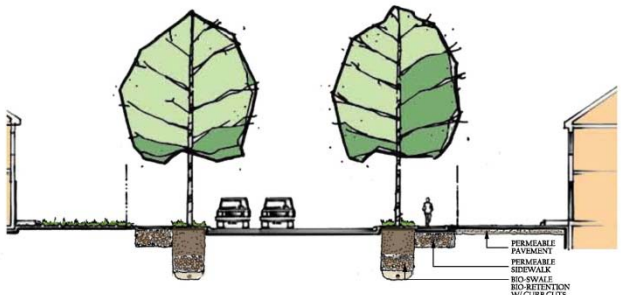
Maintenance of Natural Drainage Patterns/Minimize Terra-forming

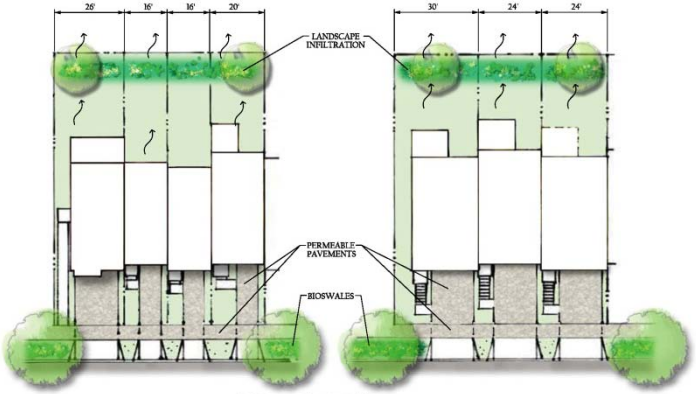
- Mimic and maintain natural drainage patters
- Avoid large scale earth moving practices
- 80% of all earthwork fills & 90% earthwork cuts are less than 10’ due to maintenance of natural drainage patterns
- Carefully designed street networks with existing topography

Environmental Site Design
A Holistic Approach



50 FT. TERTIARY STREET SECTION





TOWNHOME LOTS

Better Site Design Techniques/Reduction of Impervious Area

- Stormwater Management
  - Landscape Infiltration
  - Bioswales
  - Micro-Bioretention
  - Dry Wells
  - Level Speaders at Outfalls
  - Permeable Pavements

  73 individual Study Points

  614 ESD devices treating 92 impervious areas
- Impervious Area Reduction Techniques:
  - Open section road where feasible
  - Single side sidewalk
  - Limited on street parking
  - Permeable pavements where feasible

Quantification of ESD and BMP Effects/Modeling Results

Water Treatment Modeling

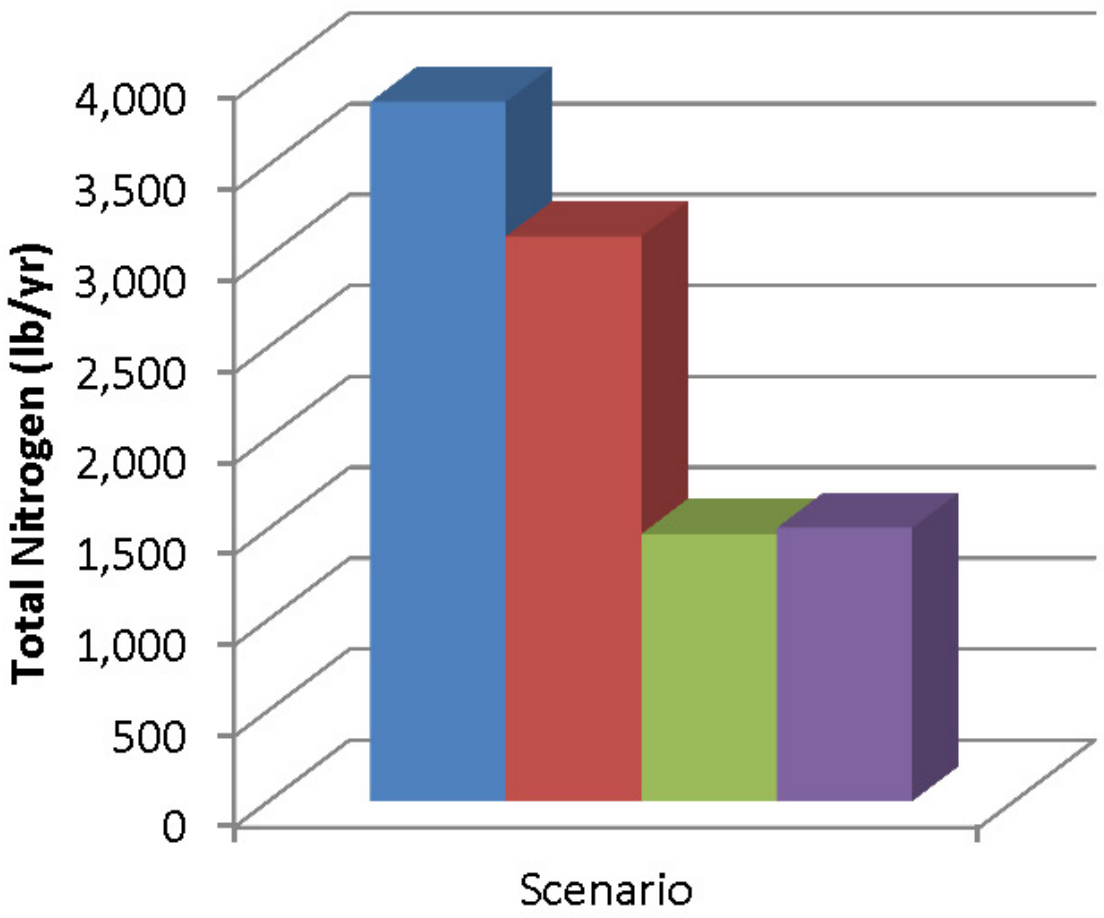
- Prepared site wide WTM with
  - Center for Watershed Protection data
  - MDE Watershed Implementation Plan Program
- WTM took into effect
  - Proposed land use
  - ESD SWM practices
  - Excluded post-construction nutrient reduction program
  - Compared Land Use to 'All Forested' Condition

QUANTIFICATION OF ESD AND BMP EFFECTS/MODELING RESULTS

SUMMARY OF ALL LOADS

LAND USE CONDITION		TN lb/year	TP lb/year	TSS lb/year	Bacteria billion/year
Existing	Total Load to Surface Waters	3848	486	75246	27943
Proposed Condition (Assuming no ESD Measures)	Total Load to Surface Waters	3108	510	112312	97615
ESD Measures	Total Load to Surface Waters	-1638	-349	-59507	-78295
Proposed Condition (with ESD Measures)	Total Load to Surface Waters	1470	161	52806	19320
NET DIFFERENCE OF DEVELOPMENT IMPACT (Ex Cond - Prop Cond w ESD Benefits)	Total Load to Surface Waters	-2378	-325	-22440	-8623
All Forested Condition	Total Load to Surface Waters	1504	138	74926	12654

Quantification of ESD and BMP Effects/Modeling Results

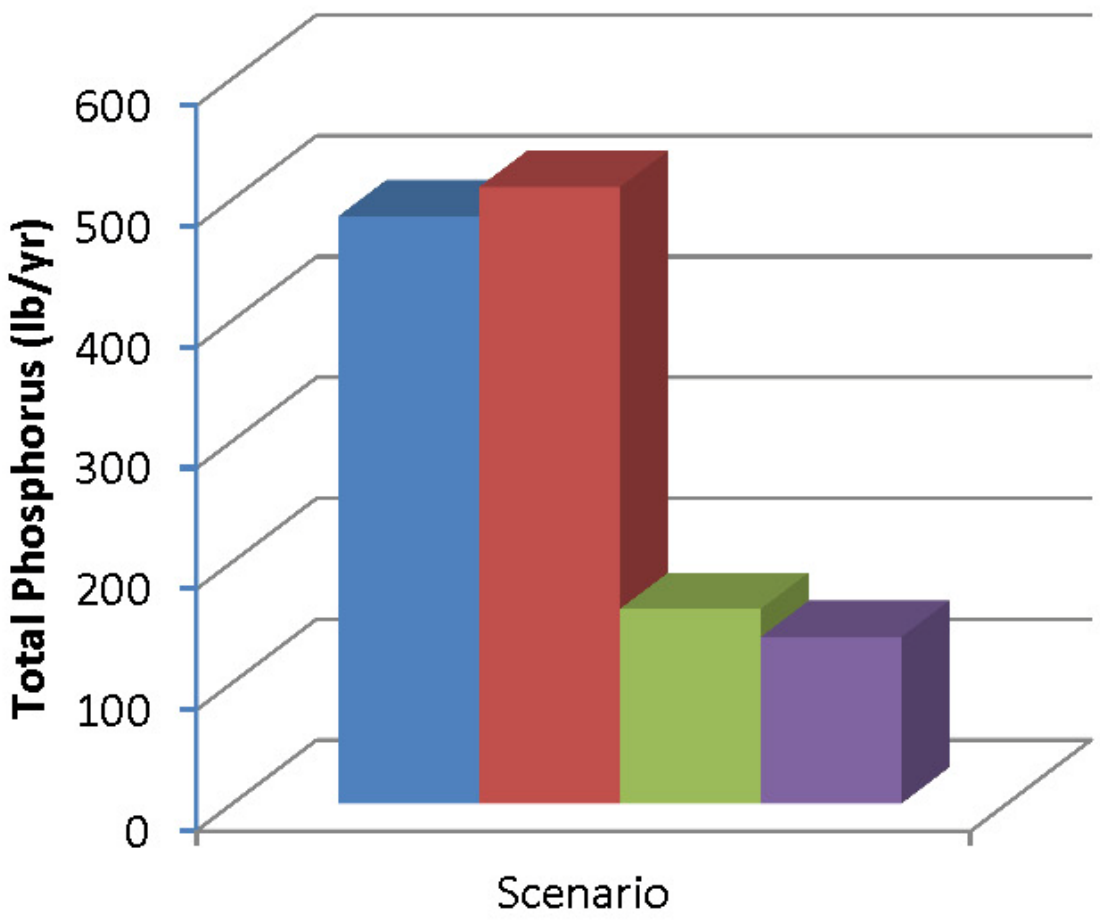


Nitrogen

62% reduction from existing

- Existing Conditions
- Proposed Conditions (no ESD measures)
- Proposed Conditions (with ESD measures)
- All Forested Condition

Quantification of ESD and BMP Effects/Modeling Results

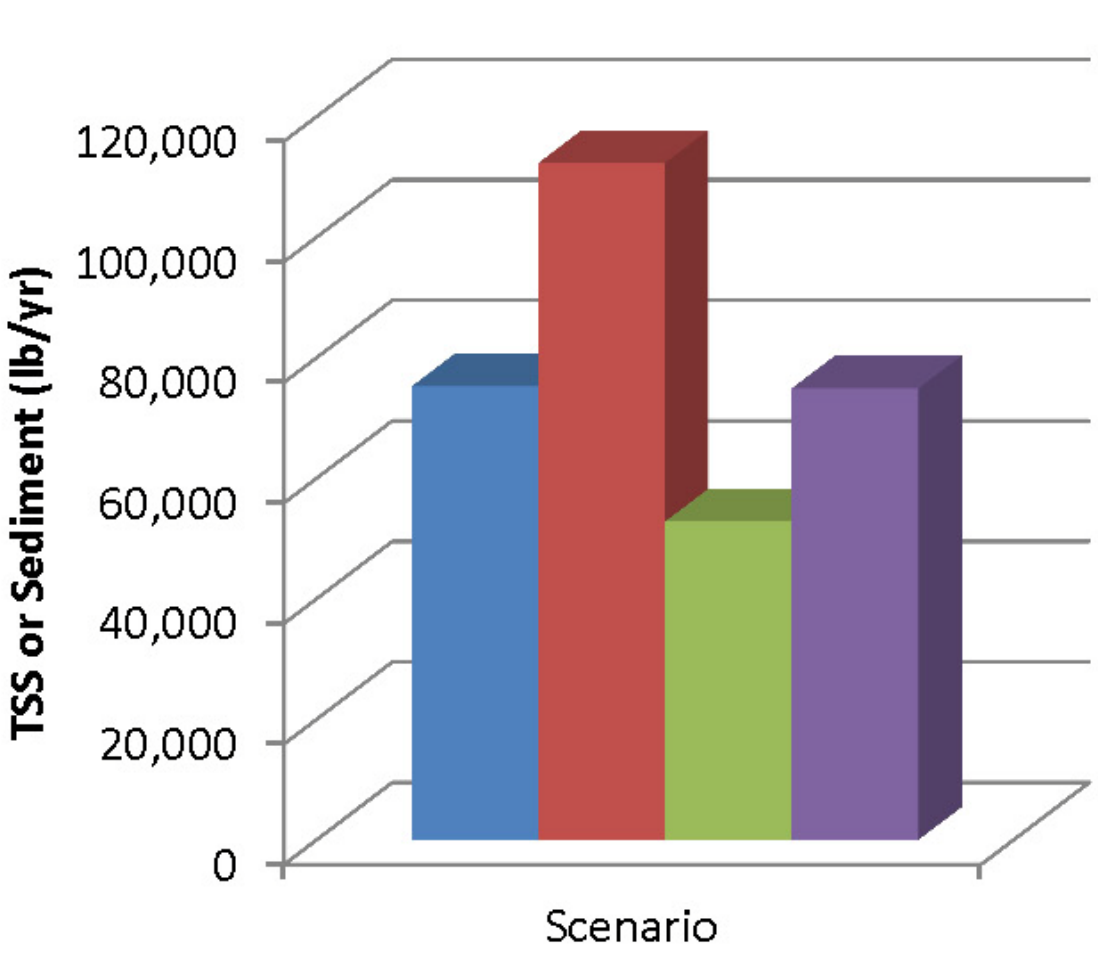


Phosphorus

66% reduction from existing

- Existing Conditions
- Proposed Conditions (no ESD measures)
- Proposed Conditions (with ESD measures)
- All Forested Condition

Quantification of ESD and BMP Effects/Modeling Results

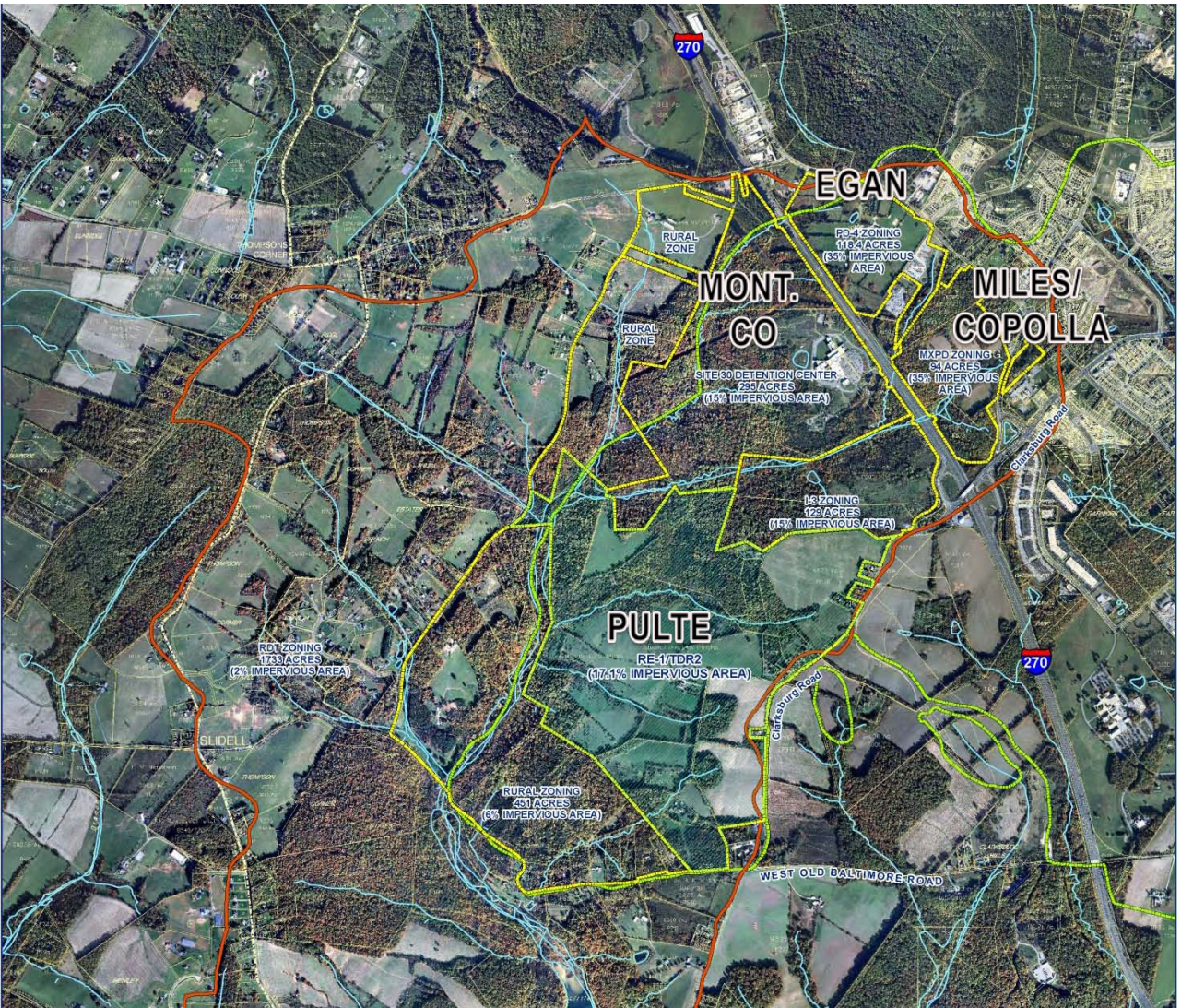


Sediment

30% reduction from existing

- Existing Conditions
- Proposed Condtions (no ESD measures)
- Proposed Conditions (with ESD measures)
- All Forested Condition

Impervious Areas at Watershed Level



Stage 4 Development Impervious Percentages

- Pulte – 17.1%
- Miles/Copolla – 35%
- Egan Property – 35%
- Montgomery County Property – 15%

- Future Watershed Imp. Area – 355 acres
- Watershed Area – 3,590 acres
- Watershed Imp % – 9.9%

Applicability of Impervious Cover Caps to Ten Mile Creek by Pulte Homes Property

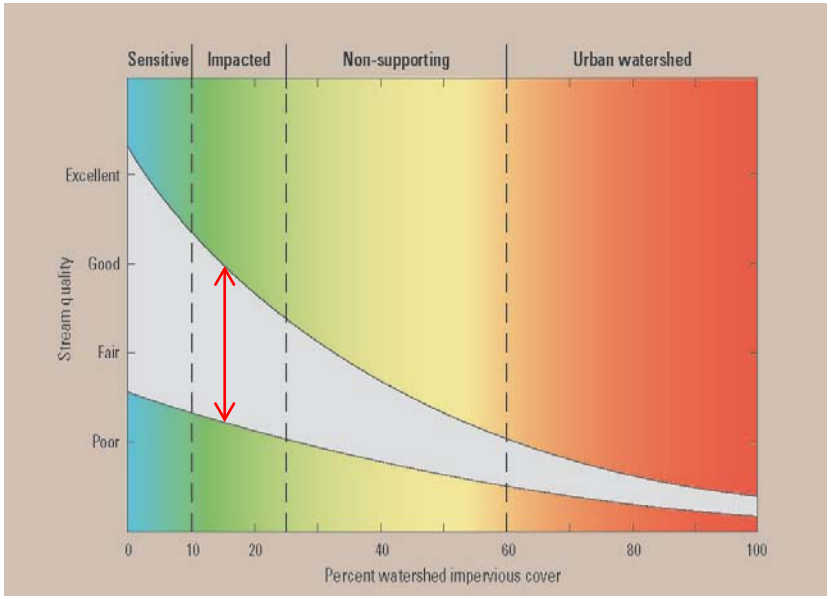
NewFields

Chuck Pace, MEM, MS, PE

The Use of ICM as a Land Management Tool

Impervious Cover Model (ICM):

- Originally developed in the mid 1990s and subsequently reviewed in mid 2000s
- Based on observational data linking stream health and impervious cover within a drainage basin
- Identifies effect levels associated with varying degrees of imperviousness



Relationship between Total Impervious Cover and Stream Quality - modified from Schueler et al. (2009).

Deficiencies of ICM

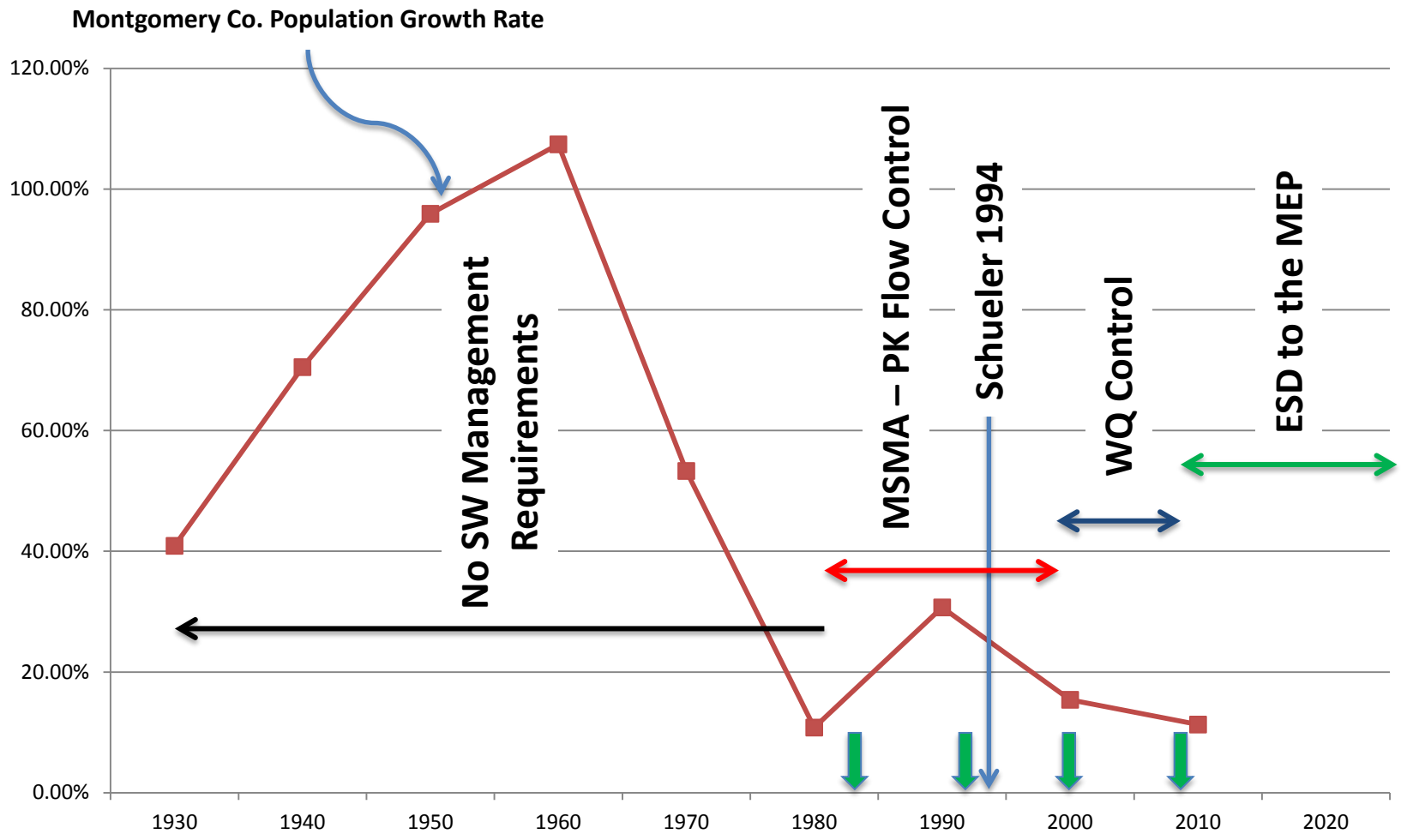
ICM is based on construction and SW management practices that are no longer in use in Maryland

Impervious cover is rarely the most important or the only predictor of stream health

ICM fails to differentiate between effective and in-effective impervious cover

Recent regulations require SW management practices specifically designed to address environmental effects associated with effective impervious cover

Historic and Current SW Management



Ten Mile Creek by Pulte Homes Development Practices

The concept plan utilizes environmental site design practices to the maximum extent practical in accordance with the Stormwater Management Act of 2007.

The 2007 Act is the most restrictive and progressive SW management regulation to date.

For the Ten Mile Creek by Pulte Homes development:

- A total of 614 individual ESD/stormwater management devices are proposed.
- These devices will collect, infiltrate and treat stormwater from 92 acres of impervious area.
- The drainage area for each ESD water quality structure ranges from 0.02 to 1 acre and averages 0.38 acres per ESD device.
- Based on impervious area alone, each ESD device collects stormwater runoff from approximately 0.15 acres of impervious surface on average.

How Important is Impervious Cover?

Rarely the most important or only predictor of stream quality.

Other factors include:

- Location of Impervious Area
- Connectivity of Impervious Areas to Stream
- Road Density
- Number of Road/Stream Crossings
- Percent Stream Buffer in Forest

Ten Mile Creek by Pulte Homes Development Practices

Forest Cover is maintained within Riparian Area

Minimal disturbance within Riparian Area

Riparian areas are protected and enhanced

No Road/Stream Crossings

Impervious Areas are Disconnected from Receiving Waters

Ten Mile Creek by Pulte Homes Development

ICM Fails to Differentiate between Effective and In-Effective Impervious Area

Effective Impervious Area (EIA) – those impervious areas in which stormwater is conveyed through SW pipes directly to the receiving water

EIA has a better correlation to stream quality than Total Impervious Area

Studies utilized in developing ICM effect thresholds did not differentiate between EIA and TIA. This uncertainty introduces an error of potentially 2x.

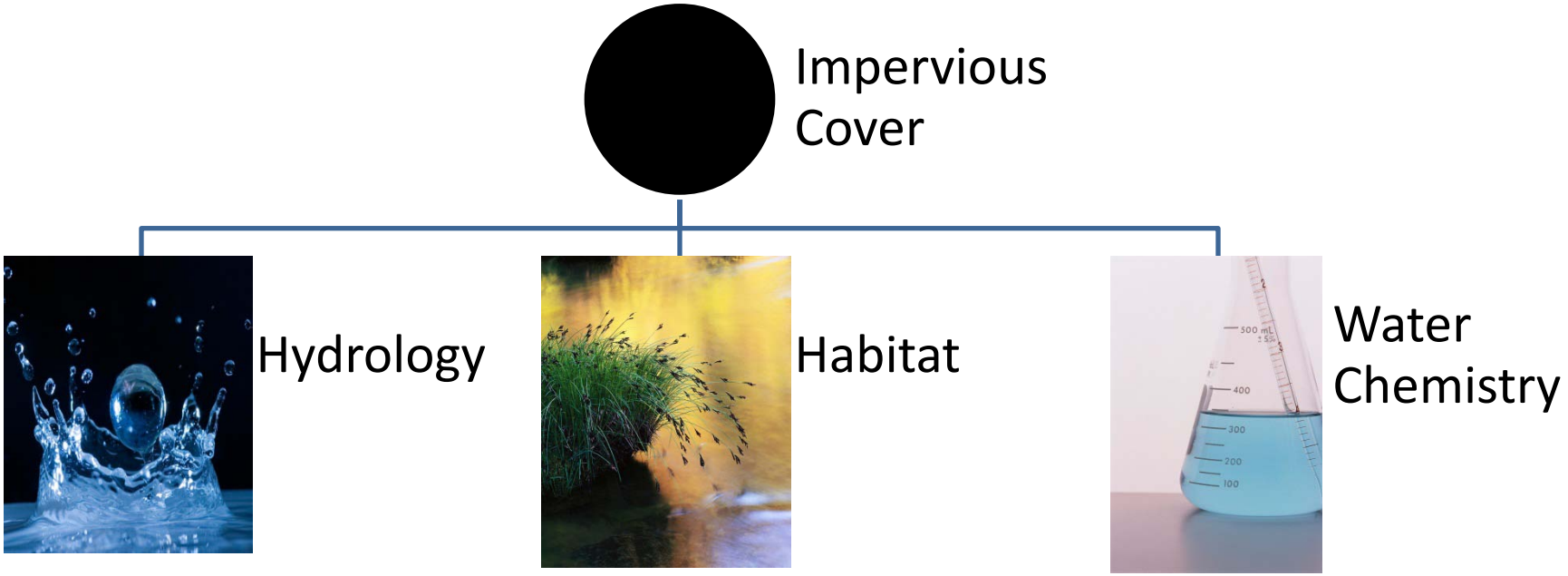
Thresholds relating impervious area to stream health based on traditional development practices do not apply to developments using ESD to the MEP.

Ten Mile Creek by Pulte Homes Development Practices

For the proposed development within Ten Mile Creek, total impervious area within the Ten Mile Creek watershed is predicted to be less than 10% and is based on a total impervious area within the proposed development area of 17%.

Because none of the impervious surfaces are directly connected directly to the channel drainage system, the effective impervious area within the Ten Mile Creek watershed would be much less than 10%.

ESD to the MEP is Designed to Directly Address the Effects of Impervious Area



ESD Practices address Hydrologic Concerns

Changes to stormwater hydrology (rate, frequency and volume of flow) have been identified as the most likely dominant process degrading stream community.

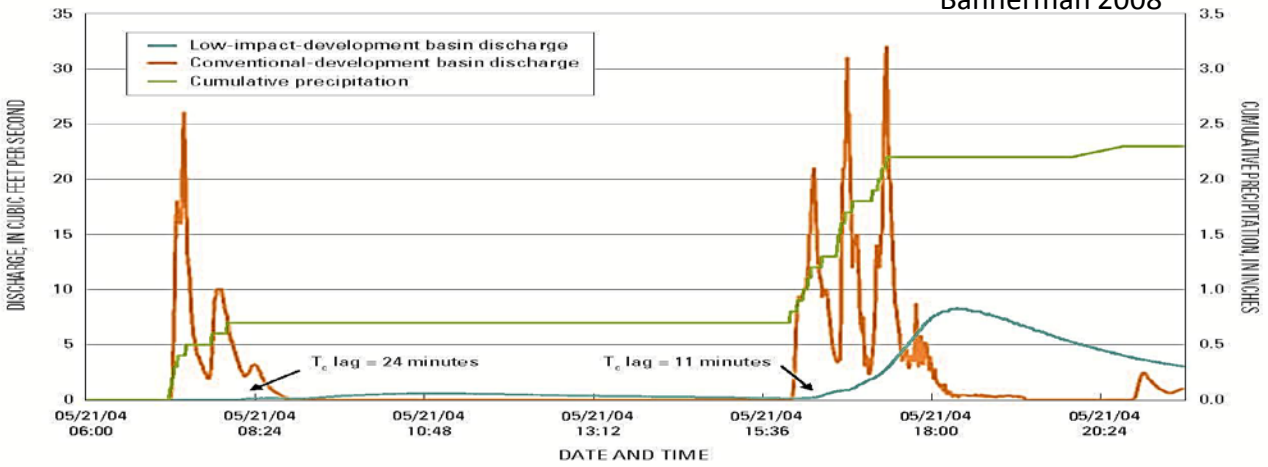
ESD practices address the following effects associated with increased impervious cover:

- Increased frequency of high flows
  - ESD Practices
    - Retain water on site
    - Reduce peak flow rates which scour stream channels
- Redistribution of water from base to peak stream flow
  - ESD Practices
    - Facilitate infiltration into groundwater to maintain pre-development base flows

ESD Practices address Hydrologic Concerns

- Increased daily variation in stream flow
  - ESD Practices
    - Reduce stream 'flashiness'
    - Result in flow hydrographs similar to that of woods in good condition
    - Minimize changes to the timing of runoff events
- Reduction in low flow
  - ESD Practices
    - Maintain base flow due to infiltration of stormwater into groundwater

Cross Plains WI, From Selbig and Bannerman 2008



ESD Practices address Habitat Concerns

ESD includes the conservation of natural features, minimizing impervious surfaces and slowing down runoff to maintain discharge timing and to increase infiltration.

To protect stream channels from degradation, ESD devices are designed to capture, store and gradually release runoff such that critical erosive velocities would seldom be exceeded in downstream channels.

Sensitive resources such as wetlands, floodplains, stream buffers, and critical areas are protected.

Ten Mile Creek by Pulte Homes Development Habitat Protection

The ESD devices for each drainage area are designed according to the Reduced Runoff Curve Number method thereby meeting the channel protection volume (Cpv) obligations.

Grading and drainage designs were created to mimic and maintain natural drainage patterns and minimize large scale earth moving.

Discharges from the stormwater drainage system, when they occur, will follow existing drainage patterns and will flow over hundreds of feet of un-impacted pervious soil and the forested riparian zone before entering the receiving waters.

Within the TMC property, a riparian buffer of 175 ft will be maintained of which 79% is forested riparian area. In addition, reforestation plans for the TMC property will increase, not reduce, forest cover by 38 acres (increasing forest cover to 52% of the property).

ESD Addresses Water Chemistry

Numerous studies have demonstrated the pollution reduction benefits associated with ESD practices

Research on the effectiveness of common stormwater management BMP has shown that high removal rates for total suspended solids, total phosphorus and total nitrogen can be achieved through the use of filtering, biodetention and infiltration devices

MDE has established BMP performance goals of 80% removal for TSS, 40% removal for TP and capability to capture and treat the required water quality volume (WQv).

Ten Mile Creek by Pulte Homes Property

Development plans have incorporated extensive use of micro-bioretention, bioswale and other treatment practices to:

- capture and treat the required water quality volume (WQv),
- infiltrate the required recharge volume (Rev) and
- create stormwater flows which mimic those expected from woods in good condition.

These practices will result in the substantial reduction of TSS, TP and TN discharged to the receiving water.

Ten Mile Creek by Pulte Homes Property

Watershed Treatment Model (WTM) was utilized to evaluate stormwater loads for TSS, TN, and TP from three scenarios:

- Existing conditions
- Fully developed conditions and
- Fully forested

For each contaminant, estimated pollutant loadings from the fully developed property were substantially lower than the existing property and were either similar to or performed better than an all-forested condition

Current Land Use should be considered in Land Use Planning

Agricultural and urban/surburban development of land have an impact on water quality.

Nitrogen loads from pasture/agricultural uses (median values range from 6.2 to 11.6 lbs/acre) are similar to nitrogen loads associated with urban development (median values range from 9.9 – 11.2 lbs/acre).

More aggressive agricultural practices (e.g. conventional till) have nitrogen loadings 3-4 times that of urban development.

Ten Mile Creek by Pulte Homes Property

Of the 538-acre development site, approximately 290 acres are in agricultural production.

- approximately 100 acres are utilized for tilled crop production whereas the remainder is utilized for pasture/hay production

Residential development is proposed primarily within existing pasture/crop land thereby minimizing loss of forest resources.

An additional 38 acres will be reforested

- This increases (not decreases) the total amount of forest area within the developed area.

Achievement of SPA Development Objectives

Performance Goal	Design Aspect
Protect stream/aquatic life habitat	ESD has been utilized to the MEP
Maintain stream base flow	ESD practices have been designed to achieve the required recharge volume (Re_v)
Protect seeps, springs and wetlands	A Natural Resource Inventory / Forest Stand Delineation plan was prepared and all sensitive resources (streams, wetlands, seeps) were identified to determine the extent of buffer required.
Maintain natural on-site stream channels	The grading and drainage designs for the project were created under the requirement to mimic and maintain natural drainage patterns, to reduce Terra-forming and to avoid large scale earth moving practices to produce the final site grades.
Minimize storm flow runoff increases	ESD practices have been designed to mimic runoff conditions similar to woods in good condition.
Identify and protect stream banks prone to erosion and slumping.	A 175 ft riparian buffer has been provided and construction impacts within the riparian zone will be minimized.
Minimize increases to ambient water temperature	Capture and treatment of the initial portion of stormwater will minimize temperature impacts. Further, stormwater detention ponds which could result in increased water temperatures are not proposed.
Minimize sediment loading/minimize nutrient loading.	ESD practices which have been identified as meeting MDE removal efficiency requirements are proposed.
Control insecticides, pesticides and toxic substances	There are no direct discharges of stormwater from impervious surfaces to the receiving water. Riparian buffers and overland flow will allow for soil absorption, filtration and degradation processes which will minimize impacts associated with these compounds.

Conclusions

The Ten Mile Creek by Pulte Homes property will be developed using ESD to the MEP

The ESD practices proposed for this property directly and specifically address the effects of impervious cover

- Hydrology
- Habitat
- Water Chemistry

All impervious areas will be disconnected from the receiving streams and riparian buffer areas will be retained and enhanced thereby protecting water quality and habitat.

Therefore, the use of an impervious cover cap is inappropriate because it does not consider new development practices required by the MSMA 2007

QUESTIONS?