LOWER GUNPOWDER FALLS WATERSHED ASSESSMENT

JUNE 2011

PREPARED FOR:

BALTIMORE COUNTY
MARYLAND

BALTIMORE COUNTY
DEPARTMENT OF ENVIRONMENTAL
PROTECTION AND SUSTAINABILITY
105 W. Chesapeake Ave. Suite 400
Towson, MD 21204

PREPARED BY:

McCormick Taylor
Engineers & Planners Since 1946

509 South Exeter Street, 4th Floor
Baltimore, Maryland 21202
(410) 662-7400

IN ASSOCIATION WITH:

COASTAL RESOURCES INC.

25 Old Solomon Island Road
Annapolis, Maryland 21401
(410) 956-9000

Table of Contents

I. Introduction 1

II. Study Objectives 1

III. Watershed Characteristics 3

1. Lower Gunpowder Falls Watershed 3
2. Mainstem-Perry Hall Tributary Subwatershed 3

IV. Methodology 3

1. Preliminary Field Walk 3
2. Subwatershed Characterization 7
3. Metric Evaluation 7
   a. Geomorphic Evaluation 8
   b. GIS Evaluation 9
   c. Hydrologic Evaluation 10
   d. Data Normalization 11
   e. Connectivity Evaluation 11
   f. Metric Justification 14
   g. Existing Conditions Selected Metrics 14
4. Evaluation of Restoration Opportunities 19
5. Development of Cumulative Ranking System Establishment and Implementation 21
6. Development of Capital Improvement Project Identification and Prioritization 26

V. Drainage Area Assessment Results 27

1. Drainage Area 1 30
2. Drainage Area 2 37
3. Drainage Area 3 44
4. Drainage Area 4 50
5. Drainage Area 5 58
6. Drainage Area 6 65
7. Drainage Area 7 71
8. Drainage Area 8 78
9. Drainage Area 9 86
10. Drainage Area 10 92

11. Drainage Area 11 98
12. Drainage Area 12 105
13. Drainage Area 13 111
14. Drainage Area 14 118
15. Drainage Area 15 124
16. Drainage Area 16 131
17. Drainage Area 17 137
18. Drainage Area 18 143
19. Drainage Area 19 151
20. Drainage Area 20 157
VI. Cumulative Ranking System Results 163
VII. Capital Improvement Project Identification and Prioritization Results 165
VIII. Conclusions and Limitations 172

REFERENCES 174

LIST OF TABLES

Table 1: Summary of Field Data Collected During the Preliminary Field Walk
Table 2: Geomorphic Assessment Sites per Drainage Area
Table 3: Cumulative Scores and Rankings Per Drainage Area
Table 4: Land Use Per Drainage Area
Table 5: Drainage Area 1 – Existing Conditions Assessment Results
Table 6: Drainage Area 1 – Restoration Opportunities Assessment Results
Table 7: Drainage Area 2 – Existing Conditions Assessment Results
Table 8: Drainage Area 2 – Restoration Opportunities Assessment Results
Table 9: Drainage Area 3 – Existing Conditions Assessment Results
Table 10: Drainage Area 3 – Restoration Opportunities Assessment Results
Table 11: Drainage Area 4 – Existing Conditions Assessment Results
Table 12: Drainage Area 4 – Restoration Opportunities Assessment Results
Table 13: Drainage Area 5 – Existing Conditions Assessment Results
Table 14: Drainage Area 5 – Restoration Opportunities Assessment Results
Table 15: Drainage Area 6 – Existing Conditions Assessment Results
Table 16: Drainage Area 6 – Restoration Opportunities Assessment Results
Table 17: Drainage Area 7 – Existing Conditions Assessment Results
Table 18: Drainage Area 7 – Restoration Opportunities Assessment Results
Table 19: Drainage Area 8 – Existing Conditions Assessment Results
Table 20: Drainage Area 8 – Restoration Opportunities Assessment Results
Table 21: Drainage Area 9 – Existing Conditions Assessment Results
Table 22: Drainage Area 9 – Restoration Opportunities Assessment Results
Table 23: Drainage Area 10 – Existing Conditions Assessment Results
Table 24: Drainage Area 10 – Restoration Opportunities Assessment Results
Table 25: Drainage Area 11 – Existing Conditions Assessment Results
Table 26: Drainage Area 11 – Restoration Opportunities Assessment Results
Table 27: Drainage Area 12 – Existing Conditions Assessment Results
Table 28: Drainage Area 12 – Restoration Opportunities Assessment Results
Table 29: Drainage Area 13 – Existing Conditions Assessment Results
Table 30: Drainage Area 13 – Restoration Opportunities Assessment Results
Table 31: Drainage Area 14 – Existing Conditions Assessment Results
Table 32: Drainage Area 14 – Restoration Opportunities Assessment Results
Table 33: Drainage Area 15– Existing Conditions Assessment Results
Table 34: Drainage Area 15– Restoration Opportunities Assessment Results
Table 35: Drainage Area 16 – Existing Conditions Assessment Results
Table 36: Drainage Area 16 – Restoration Opportunities Assessment Results
Table 37: Drainage Area 17 – Existing Conditions Assessment Results
Table 38: Drainage Area 17 – Restoration Opportunities Assessment Results
Table 39: Drainage Area 18 – Existing Conditions Assessment Results
Table 40: Drainage Area 18 – Restoration Opportunities Assessment Results
Table 41: Drainage Area 19 – Existing Conditions Assessment Results
Table 42: Drainage Area 19 – Restoration Opportunities Assessment Results
Table 43: Drainage Area 20 – Existing Conditions Assessment Results
Table 44: Drainage Area 20 – Restoration Opportunities Assessment Results

Table 45: Cumulative Ranking System Results
Table 46: Lower Gunpowder Capital Improvement Project Identification and Prioritization Results
Table 47: Potential Capital Improvement Projects

LIST OF FIGURES

Figure 1: Project Location
Figure 2: Assessment Methodology
Figure 3: Drainage Areas and Geomorphic Site Assessment Locations
Figure 4: Degree of Channel Incision (from WARSSS Manual)
Figure 5: Existing Conditions Ranking per Drainage Area
Figure 6: Opportunities Ranking per Drainage Area
Figure 7: Cumulative Rankings per Drainage Area
Figure 8: Land Use
Figure 9: Drainage Area 1
Figure 10: Drainage Area 1 – Soils
Figure 11: Drainage Area 1 – Existing Conditions
Figure 12: Drainage Area 1 – Opportunities
Figure 13: Drainage Area 2
Figure 14: Drainage Area 2 – Soils
Figure 15: Drainage Area 2 – Existing Conditions
Figure 16: Drainage Area 2 – Opportunities
Figure 17: Drainage Area 3
Figure 18: Drainage Area 3 – Soils
Figure 19: Drainage Area 3 – Existing Conditions
Figure 20: Drainage Area 3 – Opportunities
Figure 21: Drainage Area 4
Figure 22: Drainage Area 4 – Soils
Figure 23: Drainage Area 4 – Existing Conditions
Figure 24: Drainage Area 4 – Opportunities
Figure 25: Drainage Area 5
Figure 26: Drainage Area 5 – Soils
Figure 27: Drainage Area 5 – Existing Conditions
Figure 28: Drainage Area 5 – Opportunities
Figure 29: Drainage Area 6
Figure 30: Drainage Area 6 – Soils
Figure 31: Drainage Area 6 – Existing Conditions
Figure 32: Drainage Area 6 – Opportunities
Figure 33: Drainage Area 7
Figure 34: Drainage Area 7 – Soils
Figure 35: Drainage Area 7 – Existing Conditions
Figure 36: Drainage Area 7 – Opportunities
Figure 37: Drainage Area 8
Figure 38: Drainage Area 8 – Soils

Figure 39: Drainage Area 8 – Existing Conditions
Figure 40: Drainage Area 8 – Opportunities
Figure 41: Drainage Area 9
Figure 42: Drainage Area 9 – Soils
Figure 43: Drainage Area 9 – Existing Conditions
Figure 44: Drainage Area 9 – Opportunities
Figure 45: Drainage Area 10
Figure 46: Drainage Area 10 – Soils
Figure 47: Drainage Area 10 – Existing Conditions
Figure 48: Drainage Area 10 – Opportunities
Figure 49: Drainage Area 11
Figure 50: Drainage Area 11 – Soils
Figure 51: Drainage Area 11 – Existing Conditions
Figure 52: Drainage Area 11 – Opportunities
Figure 53: Drainage Area 12
Figure 54: Drainage Area 12 – Soils
Figure 55: Drainage Area 12 – Existing Conditions
Figure 56: Drainage Area 12 – Opportunities
Figure 57: Drainage Area 13
Figure 58: Drainage Area 13 – Soils
Figure 59: Drainage Area 13 – Existing Conditions
Figure 60: Drainage Area 13 – Opportunities
Figure 61: Drainage Area 14
Figure 62: Drainage Area 14 – Soils
Figure 63: Drainage Area 14 – Existing Conditions
Figure 64: Drainage Area 14 – Opportunities
Figure 65: Drainage Area 15
Figure 66: Drainage Area 15 – Soils
Figure 67: Drainage Area 15 – Existing Conditions
Figure 68: Drainage Area 15 – Opportunities
Figure 69: Drainage Area 16
Figure 70: Drainage Area 16 – Soils
Figure 71: Drainage Area 16 – Existing Conditions
Figure 72: Drainage Area 16 – Opportunities
Figure 73: Drainage Area 17
Figure 74: Drainage Area 17 – Soils
Figure 75: Drainage Area 17 – Existing Conditions
Figure 76: Drainage Area 17 – Opportunities
Figure 77: Drainage Area 18
Figure 78: Drainage Area 18 – Soils
Figure 79: Drainage Area 18 – Existing Conditions
Figure 80: Drainage Area 18 – Opportunities
Figure 81: Drainage Area 19
Figure 82: Drainage Area 19 – Soils
Figure 83: Drainage Area 19 – Existing Conditions
Figure 84: Drainage Area 19 – Opportunities

Figure 85: Drainage Area 20
Figure 86: Drainage Area 20 – Soils
Figure 87: Drainage Area 20 – Existing Conditions
Figure 88: Drainage Area 20 – Opportunities
Figure 89: Individual Restoration Project Identification
Figure 90: Potential Capital Improvement Project Identification

APPENDICES

Appendix A: Field Collected Data Points (Digital GIS Files)
Appendix B: Reference Reach Spreadsheets
Appendix C: Histogram Evaluation
Appendix D: Photographs
Appendix E: SWM and Storm Drain Outfall Assessment
Appendix F: Potential Treatment Types

I. Introduction

McCormick Taylor Inc., in coordination with Coastal Resources Inc., has been contracted by the Baltimore County Department of Environmental Protection and Sustainability (EPS) to assess existing stream conditions and identify potential improvement opportunities within the Mainstem-Perry Hall Tributary subwatershed. This subwatershed located in central Baltimore County, Maryland, is approximately 1,100 acres in size and is contained within the larger Lower Gunpowder Falls Watershed (***Figure 1***), as documented in the Lower Gunpowder Falls Water Quality Management Study (PB, 1999). In the following document, the Mainstem-Perry Hall Tributary subwatershed will be referred to as the "subwatershed".

Over time this subwatershed has undergone a series of changes beginning with rural colonial settlement before transitioning to an agricultural landuse pattern, followed by urbanized residential development with and without the installation of SWM devices. The current urbanized conditions are causing predictable impacts to the stream network within the subwatershed, triggering a stressed environment.

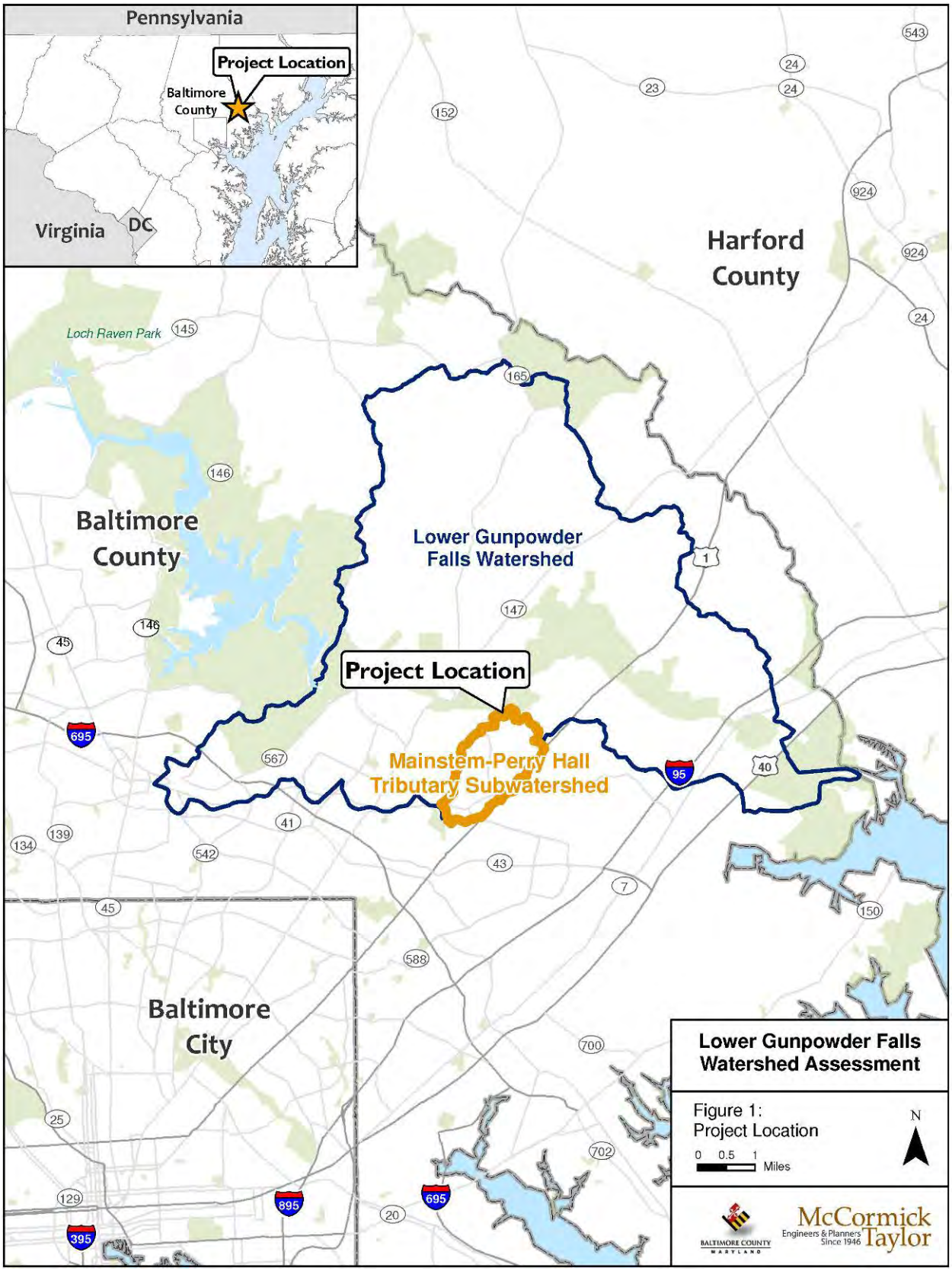
This report extensively documents the existing conditions and describes the methodology and results of a study to prioritize restoration projects in the subwatershed. The subwatershed is evaluated based on geomorphic, ecologic and hydrologic assessments in order to provide a commentary on existing conditions and highlight potential restoration opportunities. The cumulative ranking system that was implemented in order to prioritize locations for opportunity projects is described, along with the identification of potential restoration opportunities that will provide the most benefit within this subwatershed.

II. Study Objectives

There are a number of objectives sought from the development of this report. Determining the existing conditions of the subwatershed as a baseline for the assessment was of foremost importance. Understanding the existing conditions allowed the team to evaluate the predominant needs of the subwatershed by assessing, in detail, the physical characteristics (geomorphic, ecologic and hydrologic) that contribute to its overall condition.

Once the team characterized the condition of the subwatershed, further assessment of the need and location for various restoration initiatives was undertaken. This was completed through a series of detailed evaluations which assessed the restoration potential across the subwatershed, specifically focusing on improving stream stability, aquatic habitat, water quality and ecological connectivity.

The assessments of existing conditions and restoration potential were then collectively reviewed to arrive at the ultimate objective of identifying Capital Improvement Projects in areas of greatest need within the subwatershed. These projects will ultimately be undertaken by EPS and were identified based on a cumulatively ranked prioritization process that focused on achieving the geomorphic, ecologic and hydrologic needs of the subwatershed. An implementation strategy was developed as part of this report that combines SWM, water quality BMPs, and in-stream restorative measures to maximize improvements throughout the subwatershed.


Pennsylvania
Project Location
Baltimore County
Virginia
DC
Harford County
Loch Raven Park
Baltimore County
Lower Gunpowder Falls Watershed
Project Location
Mainstem-Perry Hall Tributary Subwatershed
Baltimore City
Lower Gunpowder Falls Watershed Assessment
Figure 1: Project Location
0 0.5 1 Miles
N
McCormick Taylor
Engineers & Planners Since 1946

III. Watershed Characteristics

III.1 Lower Gunpowder Falls Watershed Characteristics

The Lower Gunpowder Falls Watershed is located in the central eastern portion of Baltimore County, Maryland (***refer to Figure 1***). This watershed is approximately 46 square miles and includes approximately 210 miles of stream draining to the Gunpowder Falls. Major tributaries in this watershed include: Minebank Run, Long Green Creek, Sweathouse Run, Haystack Branch, Jennifer Branch, and Bean Run (PB, 1999). The dominant land uses within the Lower Gunpowder Falls Watershed, as of 2002 include Residential (32%), Forest (32%), and Agriculture (30%).

III.2 Mainstem-Perry Hall Tributary Subwatershed Characteristics

The Mainstem-Perry Hall tributary subwatershed, which is the focus of this assessment, is located in the south central portion of the Lower Gunpowder Falls Watershed bordering US 1 to the east (***refer to Figure 1***). This watershed is approximately two square miles in size and contains approximately 10.5 miles of stream channel. Residential land use makes up 80 percent of this subwatershed followed by forested land at 10 percent.

IV. Methodology

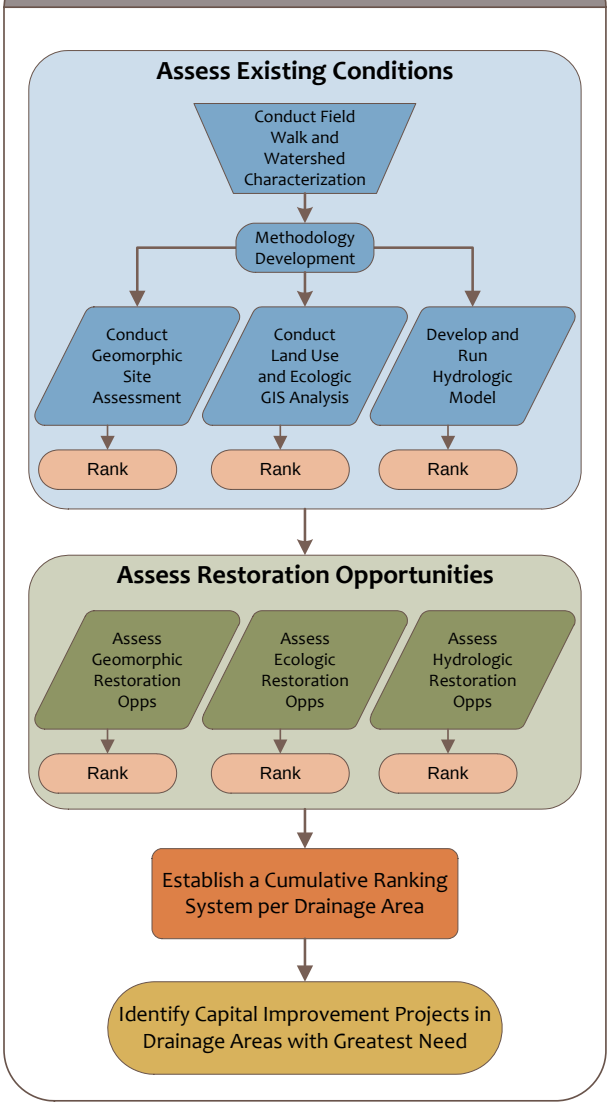
A multi-faceted methodology was implemented (***Figure 2***), first by assessing the existing conditions of the subwatershed. This included conducting a field walk to assess the general health of the system based on physical appearance. The goal was to determine the type of impairments existing in the system in order to better inform the evaluation process. Following the initial assessment, the subwatershed was portioned into a series of 20 smaller drainage areas (***Figure 3***), determined by geomorphic and hydrologic breaks observed during the preliminary assessments. This process is described further in Section IV.2. Once completed, several evaluations were conducted both in the field and using GIS data to further evaluate the separate drainage areas. Following these evaluations, preliminary data review pointed to connectivity as a major watershed issue, including lateral, longitudinal and temporal connectivity, defined further below. With connectivity driving the evaluation, a series of metrics were generated in order to further define and eventually rank each drainage area. Water resource management techniques (e.g. SWM ponds, etc.) existing in the drainage area were examined to assist in the development of recommendations for further action. Finally, each drainage area was ranked by existing conditions impairment based on a set of metrics developed in response to observed subwatershed stressors. Based on this ranking, Capital Improvement Projects were identified in drainage areas with the greatest impairment. This methodology is outlined in ***Figure 2*** and is documented in detail below:

IV.1. Preliminary Field Walk

Stream Corridor Assessment - The preliminary field walk used the Maryland Stream Corridor Assessment (SCA) Survey Protocols (Yetman, 2001) as a general guide in order to catalog and characterize impairments observed within the stream channel network. The SCA is used to rapidly assess the general physical health of a stream system as well as identify specific problem points. This method was originally developed to provide a broad ecosystem based approach to evaluate and restore watersheds in Maryland. It is designed not just to provide information about the location, type, and severity of environmental problems, but inform managers of restoration

opportunities within a watershed. For the purpose of this study, the SCA was used only as a guide to identify and catalog observed impairments within the stream channel network. For further information on the Stream Corridor Assessment, please refer to the Yetman (2001) publication.

Figure 2: Assessment Methodology



Preliminary Field Walk - The preliminary field walk evaluated approximately 54,000 linear feet (nearly 10.5 miles) of channel within the Mainstem Perry Hall Tributary Subwatershed. As described in the SCA, data were collected during the field walk regarding the location, severity, correctability, and accessibility of problem points along the stream network. Environmental problems that were identified include:

- Channel Alterations
- Debris Accumulation Sites
- Erosion Sites
- Exposed or Discharging Pipes
- Fish Barriers
- Headcuts
- Inadequate Stream Buffers
- Longitudinal Interruptions
- Photo Points
- Pipe Outfalls
- Trash Dumping Sites
- Unusual Conditions

See ***Table 1*** for summary of field data collected within each drainage area, which lists the frequency of occurrence of each environmental problem feature. The following data were collected for each problem point identified along the stream network during the field walk: See ***Appendix A*** for detailed field data files collected during the preliminary field walk (includes a CD containing the refined Geographic Information System (GIS) data files).

- Location: A Global Positioning System (GPS) was used to record geographic coordinates at each problem point. Photographs were taken to document location characteristics
- Severity: A number grade was assigned based on a comparison with other problem sites observed in the subwatershed.
- Correctability: A number was assigned based on the extent of the problem and the approximate dollar amount required to correct the observed condition.
- Accessibility: A number grade was assigned based upon distance from roads and property ownership surrounding the problem site.

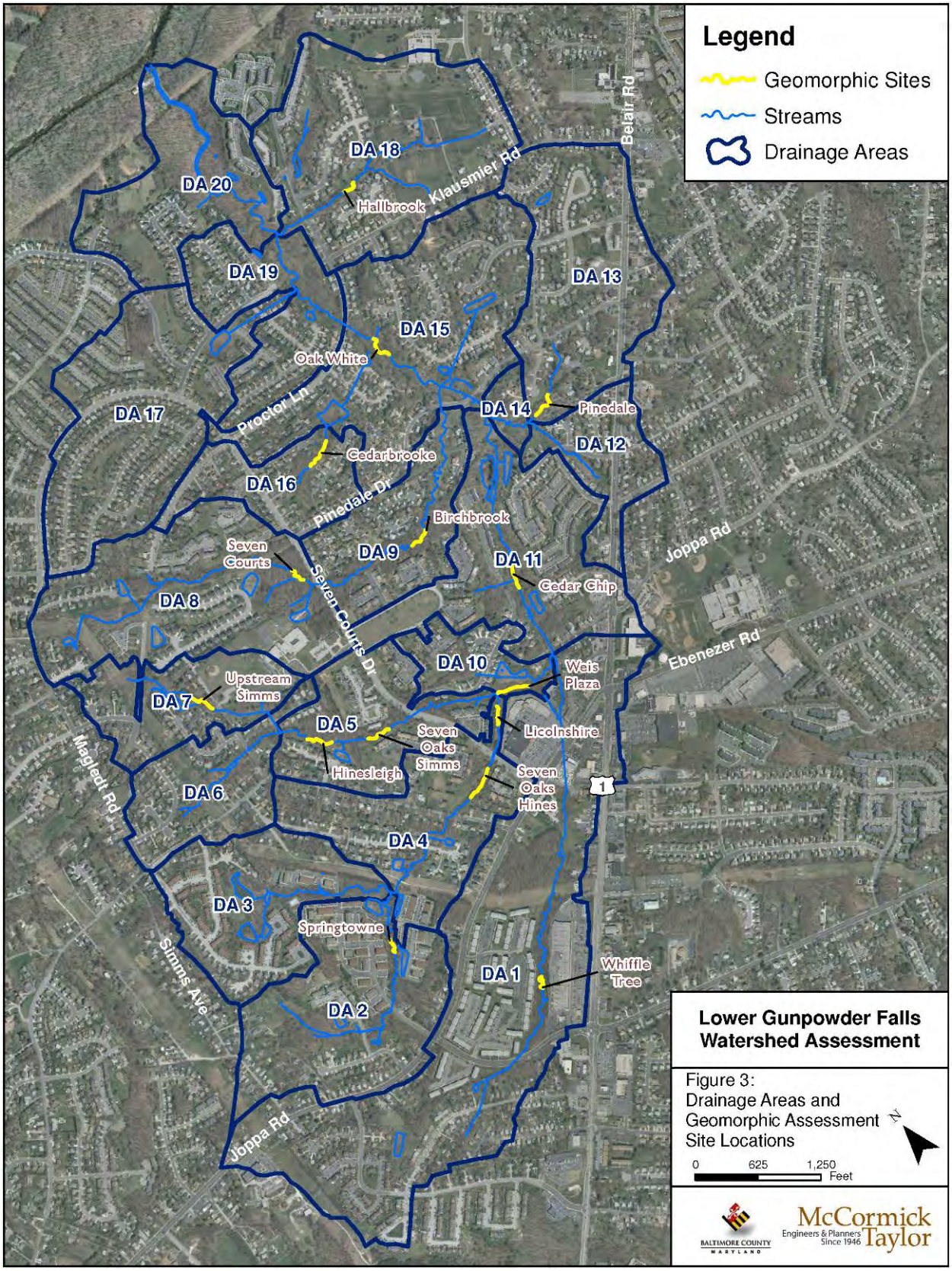

Legend
Geomorphic Sites
Streams
Drainage Areas
DA 18
DA 20
Hallbrook
Klausmier Rd
Belair Rd
DA 19
DA 13
DA 15
Oak White
DA 17
Proctor Ln
DA 14
Pinedale
DA 12
Cedarbrooke
DA 16
Pinedale Dr
Birchbrook
Joppa Rd
Seven Courts
DA 9
DA 11
Cedar Chip
DA 8
Seven Courts Dr
Ebenezer Rd
DA 10
Weis Plaza
Upstream Simms
DA 7
DA 5
Seven Oaks Simms
Licolnshire
Maglett Rd
Hinesleigh
Seven Oaks Hines
1
DA 6
DA 4
DA 3
Springtowne
Simms Ave
DA 1
Whiffle Tree
DA 2
Joppa Rd
Lower Gunpowder Falls Watershed Assessment
Figure 3:
Drainage Areas and Geomorphic Assessment Site Locations
N
0
625
1,250
Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 1
Summary of Field Data Collected During the Preliminary Field Walk

Drainage Area	Channel Alterations	Debris	Erosion	Exposed Pipes	Fish Barriers	Headcuts	Inadequate Buffers	Logitudinal Interruptions	Photo Points	Pipe Outfalls	Trash Dumping	Unusual Conditions
DA 1	6	0	3	4	6	6	7	17	11	11	3	6
DA 2	0	1	0	0	2	3	0	4	7	7	0	4
DA 3	0	0	0	0	3	0	0	3	3	6	0	0
DA 4	1	4	3	2	4	0	2	10	4	4	0	4
DA 5	0	0	8	0	1	0	1	6	3	6	0	2
DA 6	1	0	1	0	2	1	2	5	5	6	0	6
DA 7	0	0	1	0	1	0	3	3	1	5	1	2
DA 8	0	0	4	0	1	8	1	8	5	11	0	7
DA 9	0	0	5	0	5	2	4	4	2	5	0	0
DA 10	0	0	0	0	2	0	1	1	1	1	0	1
DA 11	1	0	5	1	0	0	4	13	8	5	1	5
DA 12	0	0	0	0	0	0	0	1	0	0	0	0
DA 13	1	0	1	0	0	0	3	1	0	2	0	0
DA 14	0	0	2	1	1	0	1	2	0	0	0	1
DA 15	1	0	1	0	0	0	2	10	8	4	0	8
DA 16	0	0	2	0	0	1	0	1	2	4	2	2
DA 17	0	0	1	0	0	0	0	3	0	1	0	0
DA 18	0	0	8	0	3	2	7	7	0	8	0	7
DA 19	0	0	2	0	0	0	2	3	0	3	0	3
DA 20	0	0	4	0	2	0	2	10	1	1	0	3
Total	**11**	**5**	**51**	**8**	**33**	**23**	**42**	**112**	**61**	**90**	**7**	**61**

Deviations from SCA - The SCA methods were generally followed in this study; variations include the omission of representative sites which were generally replaced with photographic documentation of typical channel conditions at varying intervals throughout the field walk. Additionally, site severity is typically described using five categories documented in the SCA but was condensed into three categories (minor, moderate, and severe) for this assessment. This helped to standardize data over field days and between field data collection teams.

IV.2 Subwatershed Characterization

The comprehensive field walks provided valuable insight into the existing conditions and nature of stressors within in the subwatershed. It was immediately apparent that channel and floodplain interruptions were playing a large part in the broad scale geomorphic stability and general reduction of water quality in the subwatershed. Channel and floodplain connectivity has been reduced by on-line SWM ponds, culverts, headcuts, utility right-of-ways and floodplain development. Especially in the upper reaches, these types of interruptions were often identified as the catalyst for broad scale changes in channel type and/or condition.

Drainage Areas - It was determined that the best approach would require strategically breaking the subwatershed into logical yet manageable drainage areas for a more detailed evaluation. Utilizing the information from the preliminary field walks, the subwatershed was subsequently divided into a series of twenty drainage areas (***refer to Figure 3***). These drainage areas were primarily selected based on geomorphic and hydrologic breaks within the subwatershed. Most of the drainage area breaks occur at major confluences or road crossings representing a change in channel and/or floodplain condition. The detailed drainage boundaries of each area were derived by evaluating 2-foot topographic data provided by Baltimore County, as-built plans for SWM devices, and aerial photography. Topography cannot be used alone to delineate drainage boundaries as many SWM devices were constructed that cut across topographic features.

IV.3 Metric Evaluation

In order to compare the drainage areas within the subwatershed, a series of hydrologic, geomorphic and ecologic metrics were generated. These metrics were developed using a number of techniques related to the availability of data. A large portion of these data, mostly related to geomorphic and hydrologic characteristics, required surveying in the field. These data largely refer to small scale details within the stream system and were evaluated using surveying techniques and physical observations of field condition.

Data representing the larger scale characteristics of the watershed, including forest cover, landuse, and utilities, were evaluated using GIS. This analysis was utilized to isolate available data within the 20 separate drainage areas in order to more precisely organize the data and characterize these small areas of interest.

Finally, since the existing watershed management facilities contribute so significantly to the hydrology and thus the geomorphology of the drainage area, an evaluation was completed of the existing SWM facilities. The location, area treated, as well as unique characteristics and potential for retrofitting of these facilities was evaluated in order to approximate their role within the watershed. This included evaluation in the field as well as review of as-built plans and other data provided by Baltimore County. The individual evaluations are described below, which were combined to develop the metrics used to compare and evaluate the drainage areas.

IV.3.a Geomorphic Evaluation

Site Assessment Selection - In order to further characterize the geomorphic condition of the subwatershed, sites were selected to perform detailed geomorphic surveys. The site selection process was initiated with the development of the drainage areas, as the break between many of the drainage areas represents a change in channel morphology. When selecting the specific sites, consideration was given to overall channel condition, location within the drainage network, the problem points occurring within the reach, and the local stressors present. A total of fifteen (15) geomorphic assessment sites were selected and represent the diversity of channel form throughout the subwatershed (***refer to Figure 3***).

Although there are a total of 20 drainage areas, it was determined that the 15 geomorphic sites selected accurately represent the various channel conditions present throughout the subwatershed. Four drainage areas did not require geomorphic site assessments as channel conditions at these sites were considered analogous to other drainage areas that were the focus of geomorphic site assessments. For example, Drainage Area 3 (DA-3) and DA-2 exhibited nearly identical channel morphology, substrate composition and floodplain condition, as identified during the preliminary field walks. As such, it was determined that only one geomorphic assessment site (located within DA-2) was necessary to characterize channel form for both drainage areas. ***Table 2*** identifies the drainage areas where geomorphic site assessments were conducted and the representative sites for the remaining drainage areas.

Table 2
Geomorphic Assessment Sites per Drainage Area

Drainage Area	Geomorphic Assessment Sites	Drainage Area	Geomorphic Assessment Sites
1	Wiffle Tree	11	Cedar Chip
2	Springtowne	12	Pinedale
3	Springtowne	13	Pinedale
4	Seven Oaks Hines, Lincolnshire	14	Pinedale
5	Hinesleigh, Seven Oaks Simms	15	Oak White
6	Upstream Simms	16	Cedarbrooke
7	Upstream Simms	17	N/A*
8	Seven Courts	18	Hallbrook
9	Birchbrook	19	Oak White
10	Weis Plaza	20	N/A*

It is important to note that sites 17 and 20 are not represented by geomorphic assessment data. Drainage area 17 contains less than 200 feet of stream channel downstream of a SWM pond and drainage area 20 includes the largest order channel in the watershed with the highest quality riparian corridor. The specific site conditions evaluated through ecologic and hydrologic parameters of each site dominate the evaluation metrics, therefore geomorphic metric development for these sites was assumed to be the average overall channel condition, allowing the other metrics (discussed in following sections) to dictate the final ranking.

Geomorphic Site Assessment Surveys - Geomorphic field surveys were performed at each of the fifteen sites. The survey consisted of a longitudinal profile up to 300 feet long, three cross sections, and a pebble count of 150 particles. The data generated from the geomorphic site assessments were used during the hydrologic modeling and tied with calculated discharges in order to generate a series of hydrologic variables which can be used to compare conditions in each of the drainage areas.

- **Longitudinal Profile** - The longitudinal profile is designed to record the overall slope of the reach as well as to determine the nature of the smaller scale features, such as pools, riffles, and glides within the channel. The profile follows the thalweg, or the deepest part of the channel. Any apparent points of significant slope break are recorded as well as the water surface elevation in order to determine the depth of the water. This surveying is performed using a laser rod and level accurate to 1/10th of an inch. The length of the longitudinal site varied at each site, generally approaching 300 feet with the bottom and top end located at the start or end point of a riffle feature, respectively.
- **Cross Sections** - The three cross sections in each reach were located both within riffles and pools in order to characterize the shape of the channel and to determine the height of the banks relative to the base of the channel. After the potential discharges are calculated, a number of hydraulic variables can be calculated to determine the stresses occurring in the channel.
- **Pebble Count** - The pebble count assists in providing an estimate of channel roughness and provides insight to channel transport tendencies (armored or mobile bed) when combined with an evaluation of the hydraulic variables such as flow depth, velocity, and shear stress. The pebble count is performed by randomly selecting and measuring the intermediate axis of a series of 150 particles, generally in a riffle. Particle size values generated from the pebble count performed in the channel provide an idea of channel armoring and do not necessarily imply what is transported through the reach during a given storm event. Following hydrologic modeling, comparisons between threshold grain size and existing grain size can be made in order to roughly approximate sediment transport.

IV.3.b GIS Evaluation

While the geomorphic assessment is capable of describing the current condition of the channel, it does not provide information on the factors contributing to current channel characteristics. These characteristics are best explored by analyzing data regarding the contributing watershed, for which the generation of a GIS database is prudent. This includes an analysis of land use, existing SWM patterns, historic aerial photography and other available data to determine changes in land use patterns over time.

The first portion of the GIS analysis focused on determining land use patterns in the watershed. The land use patterns are used to evaluate how areas of impervious surface, forest and fields generate different hydrologic responses in receiving reaches. The data used for this were generally provided by the county and is based on zoning requirements and remotely sensed data collection.

Further, the spatial extent and location of SWM facilities and ponds in relation to the stream network was analyzed. Some portions of the network are heavily managed (as evidenced by a large percentage of land area taken up by SWM ponds) while other areas lack modern SWM devices.

A historical photo analysis was completed to determine historic conditions of the site as well as the timing and nature of land use change in the watershed. It may be possible that historic dams or other features have led to current conditions which may not be readily apparent during the sight walks. This includes the accumulation of “legacy sediments” which may require further

analysis and impact the design of stream restoration measures. Finally, the interconnectedness of large natural areas has been shown to provide important ecological benefits. The GIS analysis will identify areas which may be easy to connect, generally by reforesting floodplain areas.

IV.3.c Hydrologic Evaluation

While understanding the conditions of the contributing watershed is important to assessing conditions within the stream channels, the presence, configuration, and conditions of existing SWM facilities will also contribute greatly to observed channel conditions. This is commonly observed when comparing suburban development prior to the initiation of modern stormwater techniques to development required by law currently. The presence of a large parking lot serving a suburban mall may be negligible if runoff from the lot is directed into a properly designed and properly functioning SWM facility. If the runoff is directed directly into a stream channel, it is expected to increase energy in the stream leading to widening, scour, and excessive erosion. For these reasons, careful analysis of the SWM facilities within the subwatershed was completed.

Existing SWM facilities and storm drain outfalls were identified and evaluated to determine possible opportunities for water quality improvements within the Lower Gunpowder Falls subwatershed basin. The SWM facilities were located using a combination of as-built and/or construction plans provided by the County, GIS mapping, and aerial photos.

Forty-one (41) SWM facilities were identified and assessed. Each facility was inspected to determine its overall condition and whether it is functioning as designed. The investigations followed a similar approach to the Retrofit Reconnaissance Investigation (RRI) as described in the EPA Urban Small Watershed Restoration Manual (USWRM) Series Manual 3. The following factors were investigated and will aid in determining whether a facility would be a suitable retrofit candidate:

- Drainage area (including impervious area) to the facility
- The condition and stability of the structural components (embankment, riser, inflow and outfall, etc.)
- Site constraints (access, utilities, steep slopes, tree/vegetation impacts, etc.)
- Functionality/effectiveness
- Potential for improvement

Unmanaged storm drain outfalls were identified during the preliminary field walk in areas of poor stream condition and from GIS mapping. Sixty-one (61) outfalls were evaluated for stability, proximity to the stream channel and potential for possible BMP implementation. Relative drainage area and condition of the stream channel were taken into consideration when gauging the outfall retrofit potential.

Three additional areas, besides storm drain outfall locations, were identified as potential SWM facility locations. The retrofit potential at these sites was gauged similarly to the unmanaged storm drain outfalls, taking relative drainage area and site constraints into consideration. It was not be determined if the three areas identified had been previously constructed and/or abandoned SWM facilities at some point in the past.

IV.3.d Data Normalization

The development of the hydrologic model focused on comparing conditions which currently exist to those of a certain idealized state. This idealized state represents conditions present at

idealized level of impervious surfaces, approximated by setting impervious surfaces at 10%. This value (10%) is often cited as a threshold which ties urban growth to degraded conditions of stream networks (Hollis, 1975. Macrae and Marsalek, 1992. Center for Watershed Protection, 2000). Using this value accomplished two goals. First, it normalizes the data across the subwatershed allowing us to determine how far away each drainage area is from an idealized condition in order to provide a means of comparison. Additionally, the potential for restoration at an individual site can be determined. By comparing an existing condition to the idealized 10% impervious surface which results in a negligible difference, it is assumed that modifying the input of flow to the channel will not greatly impact observed channel condition. Finally, the modeling software used to evaluate conditions in the subwatershed is capable of modeling shifts in impervious cover, making it well suited to examining this shift in contributing area conditions.

IV.3.e Connectivity Evaluation

Vannote et al. (1980) first presented the idea of the "River Continuum Concept", which describes a stream as an open ecosystem with continuous interaction between the floodplain, the upper and lower reaches, and even the groundwater which may serve as baseflow in a channel. In order for living communities to prosper and the geomorphic system to function properly, connection between these elements must be maintained. The concept generally focuses on the input of organic materials from outside of the stream channel. These materials are then passed down through the ecosystem both by transportation within the fluvial system and through the trophic structure of the ecosystem.

This study focused on lateral, longitudinal, and temporal connectivity in the river system. A prioritization system was developed that identifies projects designed to maximize connectivity in the stream network, which builds upon the River Continuum Concept (RCC). The team understands that significant sediment loads to the Chesapeake Bay have negative impacts on the health of the bay. These significant sediment loads can be attributed to urbanized watersheds, much like the study subwatershed. As such, improving stability has to be considered in the assessment.

Lateral Connectivity

Lateral connectivity relates largely to floodplain accessibility, specifically the ability of flow within the channel to spread out onto the floodplain during storm events. If a stream has access to its floodplain, high velocity peak flows can be spread across the floodplain; and energy, along with volume is dissipated. Floodplains also serve as storage areas for suspended sediments and pollutants, improving water quality. The floodplain of a stream channel should also serve as a buffer for the stream channel which shields the channel from excessive sunlight which can increase water temperatures, acts as a natural filter from contaminants entering the stream channel from upland areas, is a source of groundwater recharge and sustained base flow, and provides habitat for a diverse array of flora and fauna species.

As floodplains are developed, activities such as channelization are undertaken to retain high storm event flows within the main channel thus diminishing the role of the floodplain. Lateral connectivity can also be reduced when a shift in dynamic equilibrium, usually through land use changes, results in downcutting and widening of the channel. This occurs when an excess amount of water is diverted into a channel and the channel is overwhelmed. Both Simon and Hupp (1986) and Schumm (1977) have described channel response to urbanization and

disequilibrium. Generally these models define an initial response of downcutting and widening of the channel, followed by stabilization by bank sloughing and the reestablishment of a new floodplain at a lower elevation than the pre-disturbance floodplain.

It is possible to evaluate and quantify the existing lateral connectivity by evaluating the width of the existing and potential riparian corridor, the percent of the watershed managed using effective SWM techniques, the area of functional SWM facilities per watershed, and the existing land uses. Evaluating these factors will enable the team to determine if lateral connectivity requires improvement and if improvements can be realized based on existing conditions.

Longitudinal Connectivity

As described by the RCC, it is vital that upstream reaches connect to downstream reaches. This connectivity refers to the ability of individuals, nutrients, and sediment to pass longitudinally upstream and downstream. Connectivity of species populations is vital to the long term genetic health of the ecological communities. Sediment prevented from passing through a system, harmful deposits of sediment and downstream erosion may result in impacts to ecological communities as well (Buffington and Montgomery, 1999, Kondolf, 1997, Lisle et al. 2000).

Features that have reduced longitudinal connectivity are the many culverts, piped channels, debris jams and headcuts in the study area. Culverts block upstream passage of fish by creating water depths which may be too low for fish passage and water velocities in the culvert which make it impossible for native species to overcome. These culverts may also pond excess water in upstream reaches by creating a constriction or by being set at an elevation higher than normal baseflow. Headcuts generally prevent longitudinal connectivity by creating steep drops that native fish are unable to navigate. These headcuts are frequently encountered near existing infrastructure which has prevented further migration of the headcut upstream. An in-line SWM pond, or a pond that separates two lengths of channel, can also reduce longitudinal connectivity by presenting infrastructure which leads to ponding and prevents fish passage or by significantly changing channel conditions from a free flowing condition to a ponded condition. It should be noted that such ponding also impacts other endemic free flowing communities such as macroinvertebrates, herps, etc.

The existing longitudinal connectivity can be evaluated by determining the number of road crossings per stream length, the number of utility crossings of the stream bed, headcuts per stream length, and in-line ponds per stream length.

Temporal Connectivity

In the urbanized watershed setting, temporal connectivity is largely related to the extent which drainage areas are connected to the channels in the area. Walsh et al. (2005) refer to this as drainage connection (DC). In this case, DC is defined as the proportion of impervious surfaces directly connected to streams via pipes or open concrete swales. They also suggest that in areas with high DC rates, even small amounts of precipitation will cause a rapid increase in discharges in streams very shortly after and during the rainfall event. The result of this increase is flood flows that are trapped within the channel where they are more able to exert erosive force on bed and banks. This will increase instability, generally when the entrenchment ratio exceeds 1.2 (Rosgen, 2001). This is in comparison to a forested watershed in which small rain events cause very minor changes in base discharge as precipitation is intercepted by tree leaves and natural

ground cover (Walsh et al. 2005). In general, using treatments that promote infiltration will reduce DC.

Metrics that were used to describe temporal connectivity include the ratio of watershed area and the watershed area diverted through SWM, the area of ponds per watershed area, the area of wetlands per watershed area, and the ratio of bank height to the elevation of the 1-year discharge based on existing conditions. In areas with degraded temporal connectivity it is expected that high DC rates will be treated by SWM techniques, and will exhibit a high ratio of bank height to 1-year discharge elevation. The discharges will also be evaluated at the existing levels of imperviousness in order to compare to the idealized 10% impervious surface condition.

Stability

In natural stream networks not impacted by urbanization and other natural stressors, natural lateral migration of the stream channel is common and integral to the function of the system. When anthropogenic stressors are introduced, a shift out of equilibrium can be expected. As described previously, during urbanization the percentage of impervious surfaces increases significantly. As more runoff is diverted into stream channels faster, increases in velocity, shear stress, stream power, and a number of other variables linked to erosion potential are observed.

Stability was evaluated by collecting field data from the cross sections, then using hydrologic modeling to develop channel forming discharges followed by calculation of a series of hydrologic variables. Once discharges were calculated, data were entered into Reference Reach Spreadsheets to compare the resulting shifts in hydraulic variables. These variables include the following:

- Discharge
- Roughness
- Threshold Grain Size
- Shear Stress
- Shear Velocity
- Velocity
- Froude Number
- Width to Depth Ratio
- Mean Depth
- Max Depth
- Bank Height Ratio
- Stream Power
- Cross Sectional Area
- Width

This hydraulic analysis was performed using *The Reference Reach Spreadsheet* developed by Dan Mecklenburg with the Ohio Department of Natural Resources for both existing and optimal conditions. The spreadsheet provides a way to organize data collected in the field as well as determines a number of calculations for a range of hydraulic variables. See ***Appendix B*** to view the data compiled for this assessment.

IV.3.f Metric Justification

In some occasions the metrics provided in the hydraulic analysis described above could not be used to compare the drainage areas since there was little variation between the calculated values observed in these drainage areas. In order to determine this variation, the ratio of the calculated value at the existing to the value at the assumed optimal rate was calculated and sorted into a histogram. The 2 Year discharge was used in the calculations of these variables. This both served to further normalize the data as well as allow a determination of the fluctuation of the variable around a mean, expressed using a series of histograms. The histograms are displayed in ***Appendix C,*** followed with a summary of which variables could be used to compare the drainage areas.

The histograms displayed in ***Appendix C*** helped to eliminate those variables which did not vary significantly across the drainage areas and/or those which were not normally distributed. Eliminating these variables is important in determining the potential for erosion and the need for restoration within a specific drainage area. Other variables were eliminated based on professional judgment because it was determined that they provided limited information or were otherwise not appropriate to evaluate. See *Section IV.3.g Existing Conditions Selected Metrics* below for justification on which metrics were selected.

IV.3.g Existing Conditions Selected Metrics

Geomorphic Analyses

Shear Velocity – Shear velocity (u_*) is defined by the following equation:

$$u_* = \sqrt{\tau / \rho}$$

where τ = shear stress (lb/sf) and ρ = fluid density (lb/cf)

Shear velocity represents the amount of turbulence in a fluid and typically is between 5-15% of the fluid velocity (Denny and Shibata, 1989). Shear velocity is important to geomorphic processes in that it describes the velocity profile near the boundary of the flow and has direct application to the diffusion and dispersion of sediment particles in a stream system. Generally streams with higher values of shear velocity are capable of transporting sediment greater lengths and can keep particles in suspension for longer durations. This is evident in its inclusion in the Rouse number, which is used to define a concentration profile of suspended sediment. The Rouse number is defined as:

$$P = \frac{\omega_s}{k u_*}$$

where ω_s = sediment fall velocity and k= von Karman constant

This relationship shows that with higher values of shear velocity, the lower the Rouse number, indicating a larger percentage of suspended and wash load transport. This value was therefore selected as a geomorphic analysis metric as an indicator for increased suspended sediment transport. This is particularly important for water quality improvement and increased stability in threatened watersheds with moderate to high bank and headwater channel erosion rates.

Width Depth Ratio – The width/depth ratio is determined by dividing the channel width by channel depth at a given discharge. Generally channel widths increase downstream as the square root of discharge (Leopold, Wolman and Miller, 1964). Channel depth will typically vary significantly at localized scales based on bed features (riffle, pools, etc) but over the course of an entire channel, network depths gradually increase with increased drainage area. The ratio of these values provides a description of the channel response to the hydraulic forces interaction with its boundary. Width/depth ratios less than 12 are considered low, and the value of 12 is an often used segregation point for channel types within the Rosgen classification system (Wildland Hydrology, 1996). Low values of width/depth ratio indicate systems with a higher level of confinement and therefore a higher level of energy capable of deforming its channel boundary at a more rapid rate than channels with higher values of width/depth ratio. Therefore width/depth ratio was selected as a geomorphic analysis metric to indicate channel form and potential response to the hydraulic forces applied on the channel boundary.

Threshold Grain Size – Threshold Grain Size is the particle size predicted to be at the critical threshold for motion with the calculated shear stress at a given discharge. It is generally expressed as a modification of the Shields parameter (Shields, 1936):

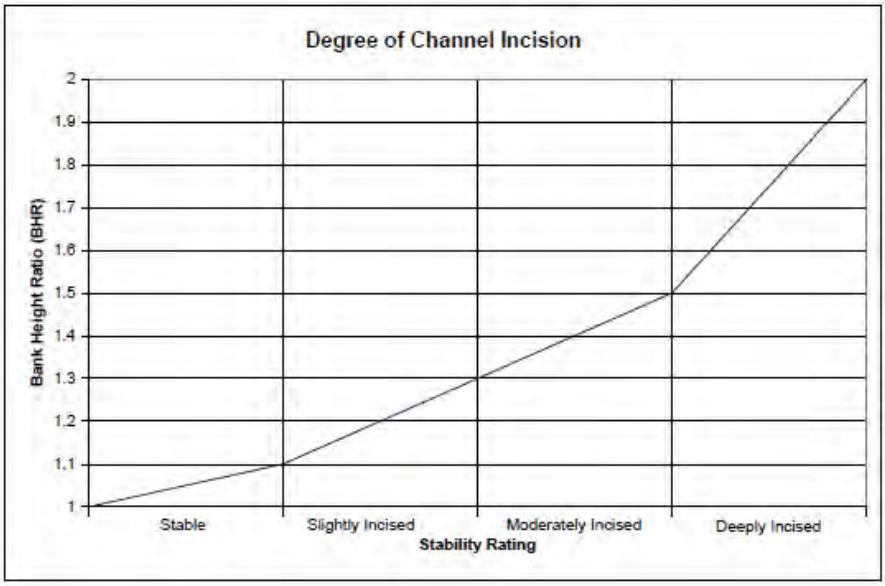
$$D_s = \tau / (\rho_s - \rho) g \tau_{*c}$$

Where ρ_s = density of sediment, g = gravitational acceleration, and τ_{*c} = Shields parameter (generally accepted to be between 0.04-0.06, conservatively assumed to be 0.06 for this study)

The Threshold Grain Size value is of particular importance in comparing existing channel materials to those in motion at a specific discharge. When the grain size in motion exceeds the sizes of material available in the bed, it indicates a potential for deformation of the channel bed. Conversely low values of threshold grain size relative to existing channel material indicate the bed is armored and unlikely to deform. Generally in dynamically stable systems the predicted threshold grain size will fall within the D50 and D84 at a channel forming flow. Many factors influence sediment movement and transport (hiding/exposure effects, sand content, etc.), which can affect the accuracy of this prediction. However, as a general indication of the capability of the channel bed to resist the hydraulic forces applied to it during a range of storm events, threshold grain size is an excellent metric for channel bed stability analysis.

Bank Height Ratio – Bank height ratio relates the depth of water at a given discharge to the height of the lowest channel bank. This value determines the degree of channel incision, as values increasing from 1 indicate increases in channel incision. ***Figure 4***, taken from the EPA Watershed Assessment of River Stability & Sediment Supply (WARSSS) manual, shows the relationship between bank height ratio and the estimated stability rating. As values of bank height ratio increase it is likely that stream banks will contribute greater amounts of sediment from stream banks through fluvial and subaerial processes. In addition, channel incision reduces floodplain functions and flooding frequency, decreasing the value of the resource and limiting natural channel recovery processes. Therefore bank height ratio was selected as a metric to evaluate geomorphic condition as an indicator for potential impairment.

Figure 4
Degree of Channel Incision (from WARSSS Manual)



Ecologic Evaluations

Percent Forest per Drainage Area – There are numerous benefits to a stream system provided by a cover of forest. Forest cover reduces stormwater runoff and flooding by intercepting precipitation and slowing the transfer of water from uplands to stream channels. Stream channel erosion is reduced by the roots of vegetation stabilizing the soil along the bank. Vegetation improves water quality by preventing soil erosion and filtering sediment and other pollutants from runoff. Forested areas provide habitat, food supply, and breeding areas for aquatic and terrestrial wildlife. In addition, forest cover can reduce water temperatures by providing shade to minimize temperature fluctuations and reduce extreme temperatures. The removal of mature forest cover can result in significant changes to stream hydrology and, in turn, to the physical stability of stream channels. Booth (2000) found that forest cover losses can impact watershed hydrology as much as or more than the associated increases in impervious area. Severely degraded stream conditions are observed when forest cover in the watershed went below the threshold of 65% (Booth, 2000).

Forested areas throughout the subwatershed were identified using Maryland Department of Planning 2002 Land Use/Land Cover data. These areas were overlaid with the drainage areas in order to calculate the percent forested within each drainage area. The entire subwatershed contains approximately 10 percent of forested land.

Headcuts per 1000 Linear Feet of Channel – A headcut is the sudden change in elevation at the head of a gully or within a stream channel. A head cut develops at a nick point as the stream channel bed elevation adjusts (lowers) to a natural or human-induced disturbance. An active headcut will migrate upstream as the streambed erodes until it encounters an unerodable barrier (Wilcox et al, 2001). The vertical drop observed at headcuts within the subwatershed ranged from a few inches to several feet. Unerodable barriers consisted of pipe crossings, tree roots,

bedrock and culvert outfalls in the case of several smaller tributaries. The number of headcuts can indicate general disturbance in the watershed and possible future channel incision.

Headcut locations were identified using a GPS during the field walk and were imported as points into the GIS environment. Actively migrating versus fixed interruptions were not indicated separately as they each indicated a disconnect in the system, actively eroding headcut areas were intended to be represented in stability calculations and will be incorporated into Capital Project selection descriptions. Each headcut location was overlaid with the drainage areas to determine the number of headcuts per drainage area. In order to generate a metric to compare drainage areas of differing size, the metric was then calculated per 1000 linear feet of stream length.

Percent Channel with Impaired Riparian – Impaired riparian areas are an indication of a decrease of ecological benefits and can have a negative effect on stream organisms. For this study, impaired areas were noted when the natural buffer width was less than 35-feet beyond the top of bank on either side of the channel. The 35-foot minimum buffer amount follows guidance for the Zone 1 designation of riparian width as set forth by the Natural Resources Conservation Service Conservation Practice Standard (Riparian Forest Buffer - Code 391). Riparian buffers provide a range of social, economic, and environmental benefits, including stabilizing stream banks and reducing channel erosion, trapping and removing contaminants from stormwater, storing flood waters, improving aesthetics, and offering recreational and educational opportunities. The removal of riparian vegetation significantly impacts riverine communities by decreasing detrital inputs, increasing the potential for primary production in aquatic plants, increasing summer temperatures, changing water quality and discharge, and decreasing terrestrial habitat for adult insects (Knight and Bottorff, 1981).

Impaired riparian areas were identified during the field walk and by reviewing aerial mapping of the subwatershed. Once identified the impaired riparian areas were digitized as line features along the channels within the subwatershed. The impaired riparian areas were then overlaid with drainage areas and stream channels per drainage area. This allowed the determination of the percent channel with impaired riparian areas per drainage area.

Longitudinal Interruptions per 1000 Linear Feet of Channel – Longitudinal interruptions include roadway crossings, overhead utility lines and underground utilities, and are an indication of channel manipulation, disturbance and possible future areas of concern. The construction of the crossings may have involved altering the channel, such as channelization or hardening the banks or bed. Future adjustment of the channel (bed channel degradation, channel widening) may have a negative impact on the crossing structure. In addition, the crossing may be a constraint on future restoration planning.

Longitudinal interruptions were identified during the field walk and by reviewing aerial photographs of the subwatershed. Once identified each interruption was digitized as a point feature within the subwatershed. An overlay of the interruptions, drainage areas and stream channels was conducted to determine the number of longitudinal interruptions per 1000 linear feet of channel per drainage area.

Encroachments per 1000 Linear Feet of Channel – The number of encroachments near a stream indicate reduced floodplain width and possibly an increase of polluted run-off. For this study, encroachments are defined as infrastructure, such as parking lots, buildings, and retaining walls within 25-feet of a stream. The encroachment of the stream's floodplain can result in

reduced floodplain width, flow concentration and increased energy which may cause erosion. Impervious surfaces cause more stormwater runoff and pollutant loads than any other type of land use (Rushton, 2001). Polluted runoff from the encroachments consisting of impervious surface, such as parking lots and roof tops, can enter the stream directly with little or no buffering effect. As a result, the encroaching infrastructure may be jeopardized by flooding or natural channel migration.

Encroachment locations were identified using a GPS during the field walk and were imported as points into the GIS environment. Each encroachment location was overlaid with the drainage areas and stream channels to determine the total number of encroachments per 1000 linear feet of channel per drainage area.

Outfalls per Acre of Drainage Area – The number of outfalls within a subwatershed indicate an increase of the timing and the volume of discharge and pollution during run-off events. Outfalls represent a significant potential for increased stream flow fluctuation during wet weather conditions and also an increased pollutant load.

As discussed above the total of number of outfalls was identified as part of the field walk using GPS technology. These sites were imported into the GIS environment as point features and overlaid with the drainage areas. This allowed the determination of the total number of outfalls per acre of drainage area.

Hydrologic Evaluations

Similar to the ecologic evaluation, hydrologic conditions were considered in order to fully assess the existing and future conditions of the stream channel and outfalls. Data that were evaluated for each drainage area included discharge rates, imperviousness, and existing management of stormwater runoff. GIS mapping, aerial photos and as-built plans were utilized in the analysis and all information was field verified. Assessments conducted are discussed below:

2 Year Discharge Ratio (cfs) – After the drainage areas were delineated, discharges were generated for a series of rain events in each area as well as the subwatershed as a whole. The discharge ratio assessment was completed using USDA Natural Resources Conservation Service TR-55 and TR-20 computer modeling. TR-55 and TR-20 are a series of guidelines accompanied with a computer model used to characterize watershed hydrology. The models, accompanied by user input, generate a number of hydrologic variables from land use, hydrologic soil type, precipitation values, slope and drainage area data. Land use and hydrologic soil type are represented by a regional curve number through TR-55 methodologies. The routing of precipitation through a watershed is expressed through time of concentration, which is the time required for runoff to travel from the hydraulically most distant part of the drainage area to a point of investigation. Finally, precipitation data provided by the Atlas 14 NOAA database is used to describe precipitation patterns within the subject drainage areas. The SCS TR-55 and SCS TR-20 computer programming is used to define the 1, 2, 10, and 100 year interval discharges for the existing land use condition. It was found that the 2 Year Discharge Ratio was most effective at comparing drainage areas for this study.

A negligible difference in the existing and idealized conditions was calculated in some drainage areas for a number of reasons including the impacts of current SWM facilities. Though symptoms of degraded channels were observed in these drainage areas, increased SWM is unlikely to improve conditions within the channel. Rather, a focus on instream structures or other

traditional stream restoration techniques may be best to solve the observed problems in these areas. Conversely, in drainage areas which exhibit drastic differences between existing and proposed conditions, the focus on improvement priorities may shift to SWM, whether that is retrofitting existing facilities or assuring that these facilities are functioning as designed. In these areas, the implementation of stream restoration techniques may be less effective.

Percent Impervious per Drainage Area – The Lower Gunpowder Falls Subwatershed consists of urbanized residential and commercial development and contains a high level of impervious surfaces (i.e. roads, parking lots, rooftops, etc.). The impervious surfaces greatly accelerate and intensify the runoff of precipitation directly into storm drain systems preventing infiltration and minimizing abstraction, which would naturally filter pollutants and reduce peak discharges. Untreated runoff also carries pollutants such as automobile oils, fertilizers, sediment and trash into downstream waterways degrading the outfall channels, water quality and natural habitat. Impervious areas throughout the subwatershed were identified using Maryland Department of Planning 2002 Land Use/Land Cover data and aerial photos. These areas were overlaid with the drainage areas in order to calculate the percent impervious within each drainage area.

Percent Drainage Area to SWM Facilities – Many areas within the subwatershed have been developed prior to SWM requirements. Runoff from these areas flows untreated and uncontrolled directly into storm drain systems and ultimately into receiving tributaries. However, a small percentage of the subwatershed area is directed into SWM facilities. These facilities range in type (detention and extended detention ponds, underground storage, and infiltration trenches) and functionality/effectiveness. Based on Baltimore County records, forty-one (41) facilities exist within the subwatershed.

The drainage area to each existing SWM facility was delineated based on a combination of As-Built and/or Construction plans provided by the County, GIS mapping, and field verification. The facility drainage areas were overlaid with the subwatershed drainage areas in order to calculate the percent area treated to SWM facilities.

IV.4 Evaluation of Restoration Opportunities

Geomorphic Evaluations

Percent Bank Stabilization Potential – To determine the potential areas where bank stabilization efforts could be used to reduce bank erosion and downstream sediment inputs, data collected during the preliminary field walk was compiled for site identification. Areas that received moderate to extreme erosion estimates were highlighted for improvement potential, with further consideration given to lengths of channel 100 feet or greater. The sites identified all have the potential to be incorporated into stream restoration projects or outfall stabilization projects. The drainage area metrics were ranked based on percent of the stream network with the potential for bank stabilization efforts.

Percent Floodplain Reconnection Potential – Utilizing cross-sectional data collected during the detailed geomorphic assessment, areas for potential floodplain reconnection were determined. Lengths of channel were identified where opportunities to raise the invert or construction of nested benches could be completed to reconnect the channel to floodplain features. Floodplain width, valley shape, adjacent land use and severity of entrenchment relative to adjacent infrastructure were all considered to determine if floodplain connection could be

achieved while maximizing potential benefits. The drainage area metrics were ranked based on percent of the stream network with the potential for floodplain reconnection efforts.

Ecologic Evaluations

Percent Buffer Improvement Potential – Through GIS analysis, segments of the riparian corridor where at least 35 feet of non-forested, non-encroachment area adjacent to the stream channel existed were identified as potential riparian buffer improvements. Property ownership was not considered, but residential land use was evaluated (during the preliminary field walk) to determine the feasibility of long-term riparian reforestation. The drainage area metrics were ranked based on percent of the stream network with the potential for riparian improvement efforts.

Obstruction Removal Potential per 1000 LF Channel – Data collected during the preliminary field walk on the location of longitudinal interruptions was utilized to develop the obstruction removal metric. This metric is intended to represent areas where ecological and hydrologic connectivity can be improved in each drainage area. Each longitudinal interruption was evaluated to determine if through structural adjustment, site modification, in-stream structure, and/or grading activities the physical connectivity of the system could be restored. If it was feasible to remove, bypass or alter the obstruction, it was listed as an opportunity for removal. As the majority of headcut areas were within storm drain outfall channel networks, those interruptions were often included in the outfall stabilization evaluations and were therefore omitted from this metric.

Hydrologic Evaluations

Percent Outfall Stabilization Potential – Stormdrain outfalls are often sources of channel instability and water quality issues. Erosion in outfall channels can result in excess sediment loading within the downstream tributary and decreased water quality.

In order to quantify a possible sediment load reduction by improved stability, the channel length between the outfall and a defined stream channel or tributary was measured. SWM facility outfall channels were not included in this measurement as the facilities are designed to discharge excess runoff at non-erosive velocities per Baltimore County design criteria and/or discharge directly into a defined stream channel. However, SWM facility outfall channels were evaluated and included in the overall SWM assessment. The length measured represents the available area for possible stabilization and/or BMP implementation. Therefore, outfalls where such improvements were feasible are included in the measurement. In order to normalize the data per drainage area, the measured outfall channel length was divided by the stream channel length within that drainage area.

Water Quantity Improvement Potential – In order to control increased volume and rate of surface runoff caused by man-made changes to the land, Baltimore County requires implementation of water quantity controls. However, much of the development within the subwatershed pre-dated current SWM regulations. In an effort to reduce the peak discharges in the stream channels, several locations were identified as possible locations to implement water quantity controls and/or improve on existing controls.

The improvement potential was evaluated by determining the ratio between the possible SWM facility footprint and the contributing drainage area. Outfalls and existing SWM facilities were

included within the footprint measurements only if they were feasible retrofit candidates. The water quantity treatment is generally computed as a storage volume however, the depth of the facility is dependent on the geotechnical properties of the soils and level of the water table, which are not available at this time.

Water Quality Improvement Potential – Similar to Water Quantity control, Baltimore County requires implementation of water quality controls, however much of the development pre-dates the current SWM regulations. Installation of water quality controls significantly reduces the pollutant and sediment load within stormwater runoff prior to entering the stream channel.

Similar to the Percent Impervious Area per drainage area existing conditions metric, the water quality improvement potential was evaluated by determining the ratio of possible impervious area that could be treated and the contributing drainage area to the SWM facility. As with the quantity metrics noted above, the existing SWM facilities were included within the impervious area measurements only if they were feasible retrofit candidates. Outfalls that were identified as candidates for retrofitting or stabilization were also included in the measurements since both types of enhancements will aid in the reduction of pollutant and sediment load within stormwater runoff.

IV.5 Development of Cumulative Ranking System Establishment and Implementation

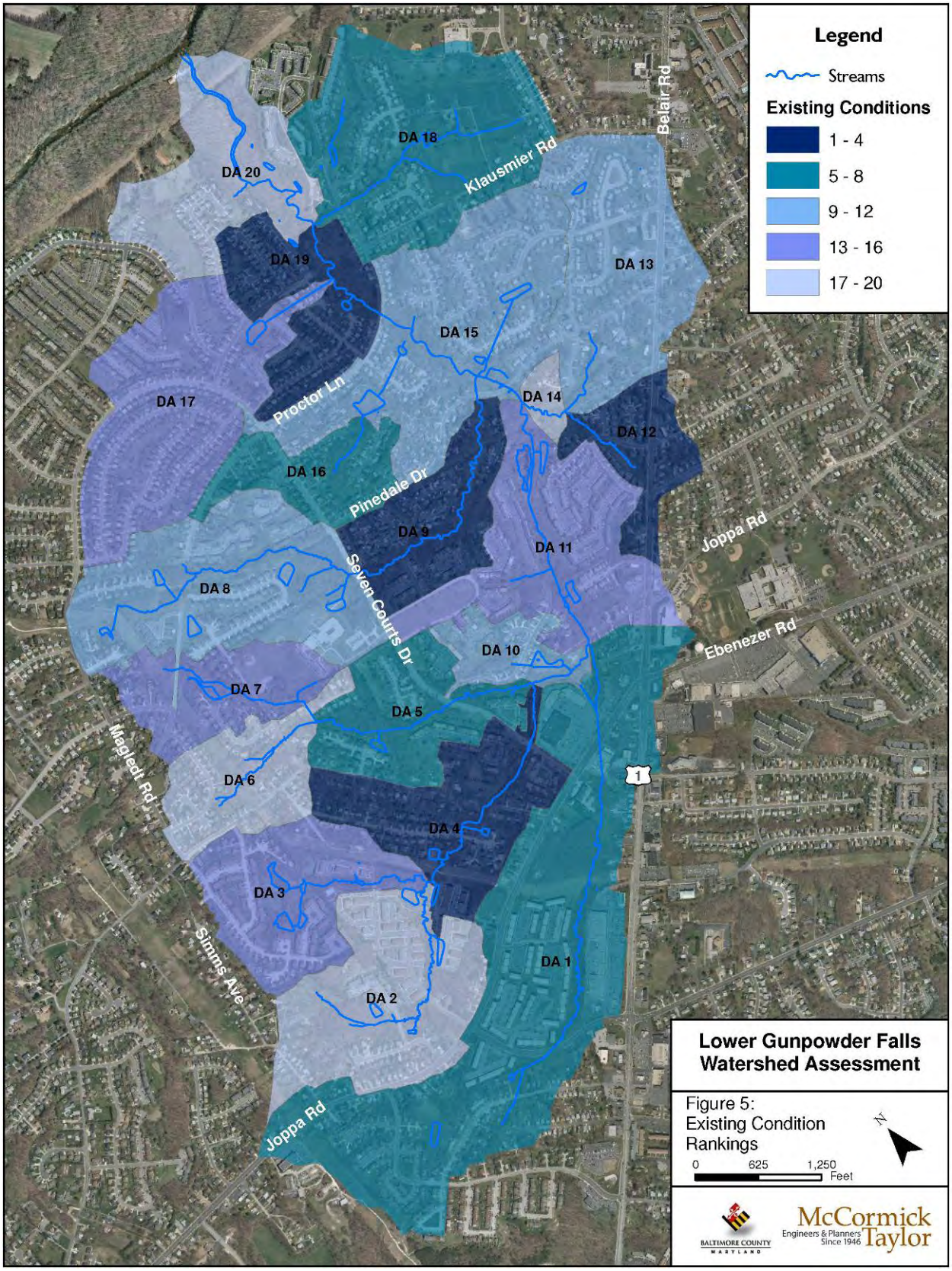
Once the data for each metric was collected and the analysis was conducted within each drainage area, the results were ranked with the lower scores indicating the greatest potential for improvement. Drainage areas with conditions closest to the ideal were ranked the highest (20) and the drainage areas that were the most impaired and /or had capacity for improvements were ranked the lowest (1).

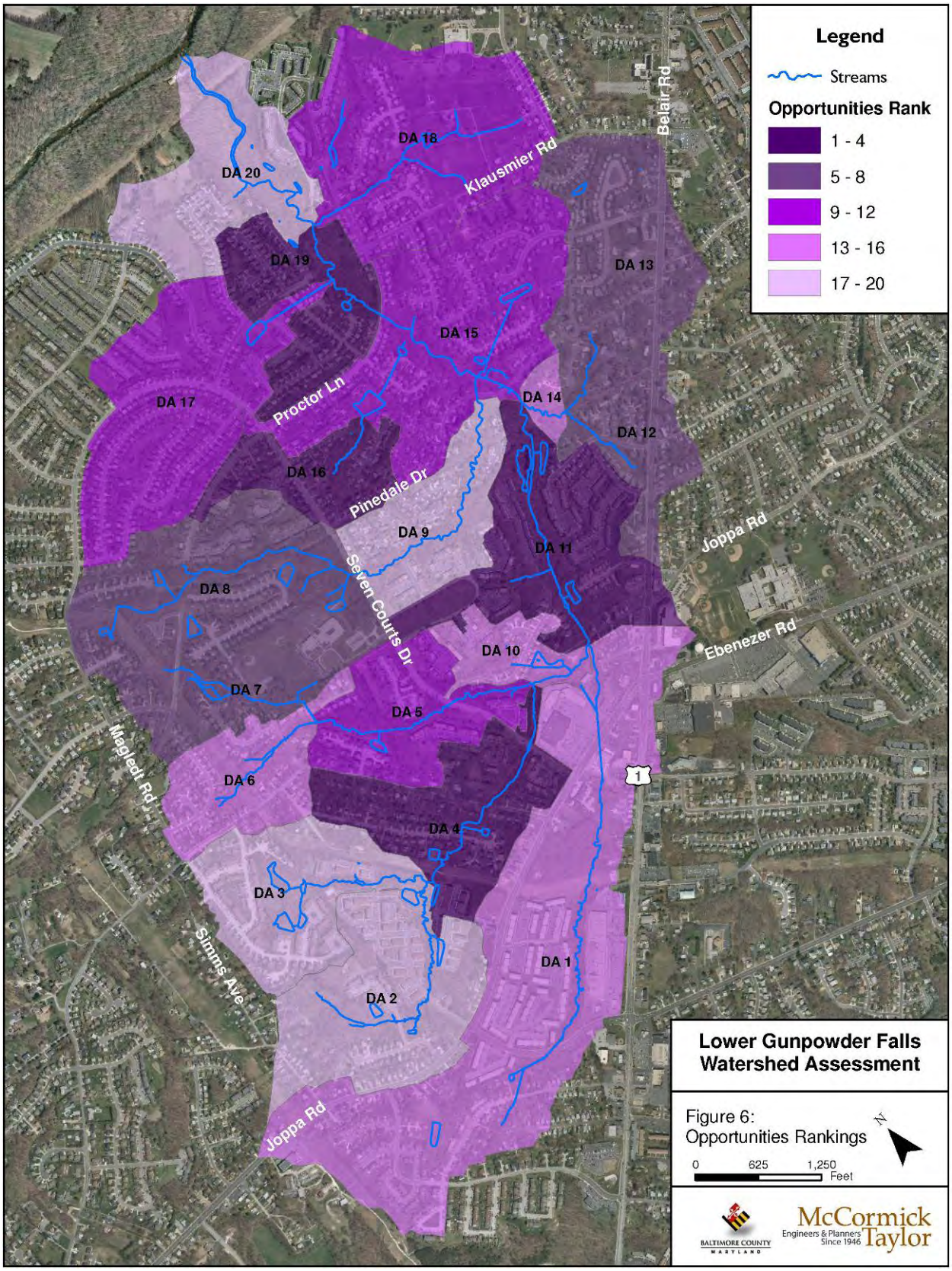
For the existing conditions assessment and rankings, the most desirable condition is indicative of the highest quality existing ecological, geomorphic and hydrologic conditions available in the watershed. Conversely, the least desirable existing condition is the maximum level of ecologic, geomorphic and hydrologic impairment in the watershed. The opportunity assessments rank the greatest opportunities for the most improvement as the lowest scores and where improvement potential was most limited values are the highest. ***Table 3*** and ***Figures 5, 6, and 7*** highlights the existing conditions, restoration opportunities and cumulative ranking scores.

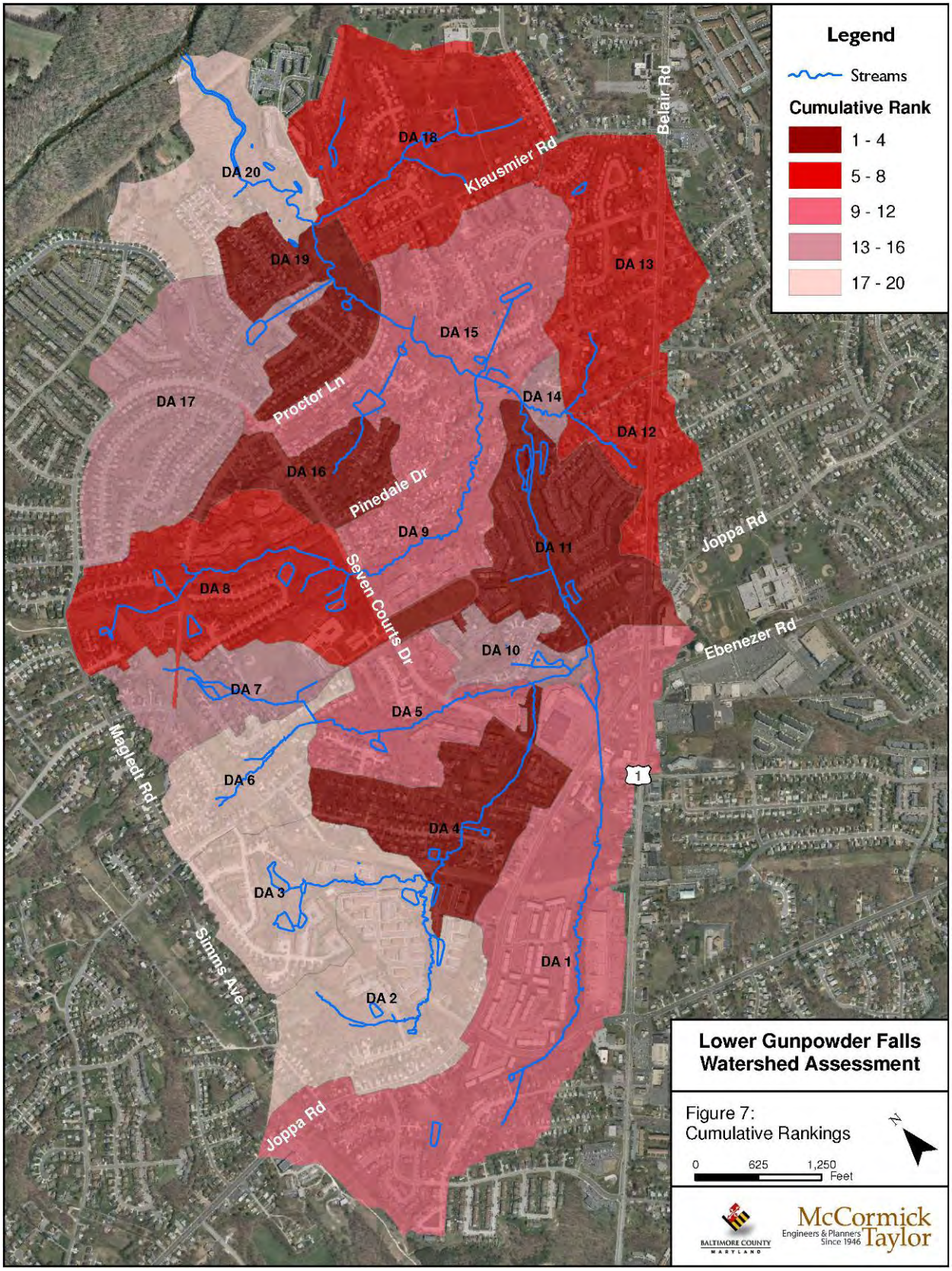
Table 3: Cumulative Scores and Rankings Per Drainage Area

	Existing Conditions		Opportunities		Cumulative	
Drainage Area	Sum of Score Ratio	Rank	Sum of Score Ratio	Rank	Sum of Score Ratio	Rank
1	1.41	7	1.45	14	2.86	11
2	2.13	20	1.75	18	3.88	20
3	1.76	16	1.77	19	3.53	18
4	**0.99**	**1**	**0.84**	**3**	**1.83**	**1**
5	1.42	8	1.36	10	2.78	9
6	1.82	19	1.53	15	3.35	17
7	1.75	15	1.23	7	2.99	13
8	1.52	11	1.16	5	2.68	6
9	**1.28**	**2**	1.70	17	2.98	12
10	1.55	12	1.65	16	3.20	15
11	1.70	14	**0.80**	**2**	2.50	4
12	**1.29**	**3**	1.26	8	2.55	5
13	1.47	9	1.21	6	2.68	7
14	1.80	18	1.43	13	3.23	16
15	1.51	10	1.30	9	2.81	10
16	1.38	6	1.03	4	**2.41**	**3**
17	1.62	13	1.38	11	3.00	14
18	1.33	5	1.38	11	2.72	8
19	1.32	4	**0.71**	**1**	**2.03**	**2**
20	1.78	17	1.85	20	3.63	19

Based on these ranking scores, DA-4, DA-9 and DA-12 contain the least desirable conditions (most impaired existing conditions); DA-19, DA-11, and DA-4 have the most potential for restoration opportunities; and the top three cumulative restoration prioritization areas are: DA-4, DA-19 and DA-16. See Section V for a detailed assessment of each drainage area.


Legend
Streams
Existing Conditions
1 - 4
5 - 8
9 - 12
13 - 16
17 - 20
DA 1
DA 2
DA 3
DA 4
DA 5
DA 6
DA 7
DA 8
DA 9
DA 10
DA 11
DA 12
DA 13
DA 14
DA 15
DA 16
DA 17
DA 18
DA 19
DA 20
Belair Rd
Klausmier Rd
Proctor Ln
Pinedale Dr
Seven Courts Dr
Joppa Rd
Ebenezer Rd
Megledt Rd
Simms Ave
1
Lower Gunpowder Falls Watershed Assessment
Figure 5:
Existing Condition Rankings
0
625
1,250
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946


Legend
Streams
Opportunities Rank
1 - 4
5 - 8
9 - 12
13 - 16
17 - 20
DA 1
DA 2
DA 3
DA 4
DA 5
DA 6
DA 7
DA 8
DA 9
DA 10
DA 11
DA 12
DA 13
DA 14
DA 15
DA 16
DA 17
DA 18
DA 19
DA 20
Belair Rd
Klausmier Rd
Proctor Ln
Pinedale Dr
Seven Courts Dr
Joppa Rd
Ebenezer Rd
Maglett Rd
Simms Ave
1
Lower Gunpowder Falls Watershed Assessment
Figure 6:
Opportunities Rankings
N
0
625
1,250
Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946


Legend
Streams
Cumulative Rank
1 - 4
5 - 8
9 - 12
13 - 16
17 - 20
DA 1
DA 2
DA 3
DA 4
DA 5
DA 6
DA 7
DA 8
DA 9
DA 10
DA 11
DA 12
DA 13
DA 14
DA 15
DA 16
DA 17
DA 18
DA 19
DA 20
Klausmier Rd
Belair Rd
Proctor Ln
Pinedale Dr
Seven Courts Dr
Joppa Rd
Ebenezer Rd
Meglett Rd
Simms Ave
1
Lower Gunpowder Falls Watershed Assessment
Figure 7:
Cumulative Rankings
N
0
625
1,250
Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

IV.6 Development of Capital Improvement Project Identification and Prioritization

Utilizing the results of the opportunities identification effort, actual potential "projects" were then selected as appropriate based on groupings of adjacent and similar opportunities along a given stream reach. The results are presented on ***Table 46*** and **Figure 89**. Most singular projects fell within an individual drainage area however, some, such as DA 13 & 14, and DA 5, 10 & 11, crossed drainages where either the type of opportunity was the same in each and/or logistically it was more efficient to incorporate multiple drainages.

Potential stream restoration projects include: bank stabilization, floodplain reconnection, longitudinal interruption removal, buffer enhancements and invasive species removal. Projects with only riparian enhancement opportunities and no expected earthwork were identified separately.

The primary basis for project selection focused on providing comprehensive improvements and benefits to the fluvial and ecological systems. Constraints such as constructability, property ownership, and cost were not a critical part of the project selection process.

V. Drainage Area Assessment Results

The results of the existing conditions and restoration opportunities assessments are presented in this section. Each assessment is broken down by drainage area and includes a general description of the location, land use and soils within each drainage area. Also included in each assessment is a discussion on existing channel conditions and a SWM assessment of each drainage area. Potential restoration opportunities have also been identified based on the assessment of existing conditions. Each assessment contains a series of tables, which presents the metric assessment results for both existing conditions and restoration opportunities along with descriptive graphics including: existing conditions, soils and restoration opportunities. ***Figure 8*** and ***Table 4*** highlight land use data for the entire subwatershed and are referenced in each drainage area assessment. Please refer to ***Appendix D*** for photographs of existing site conditions. The photographs are grouped into three sections: by drainage area; by site assessment reach and SWM facilities and outfalls. ***Appendix E*** contains the SWM and Storm Drain Outfall Assessments, which provide detailed field notes for each structure and outfall. In addition, information is provided in ***Appendix E-3*** on the recommended maintenance for SWM facilities.

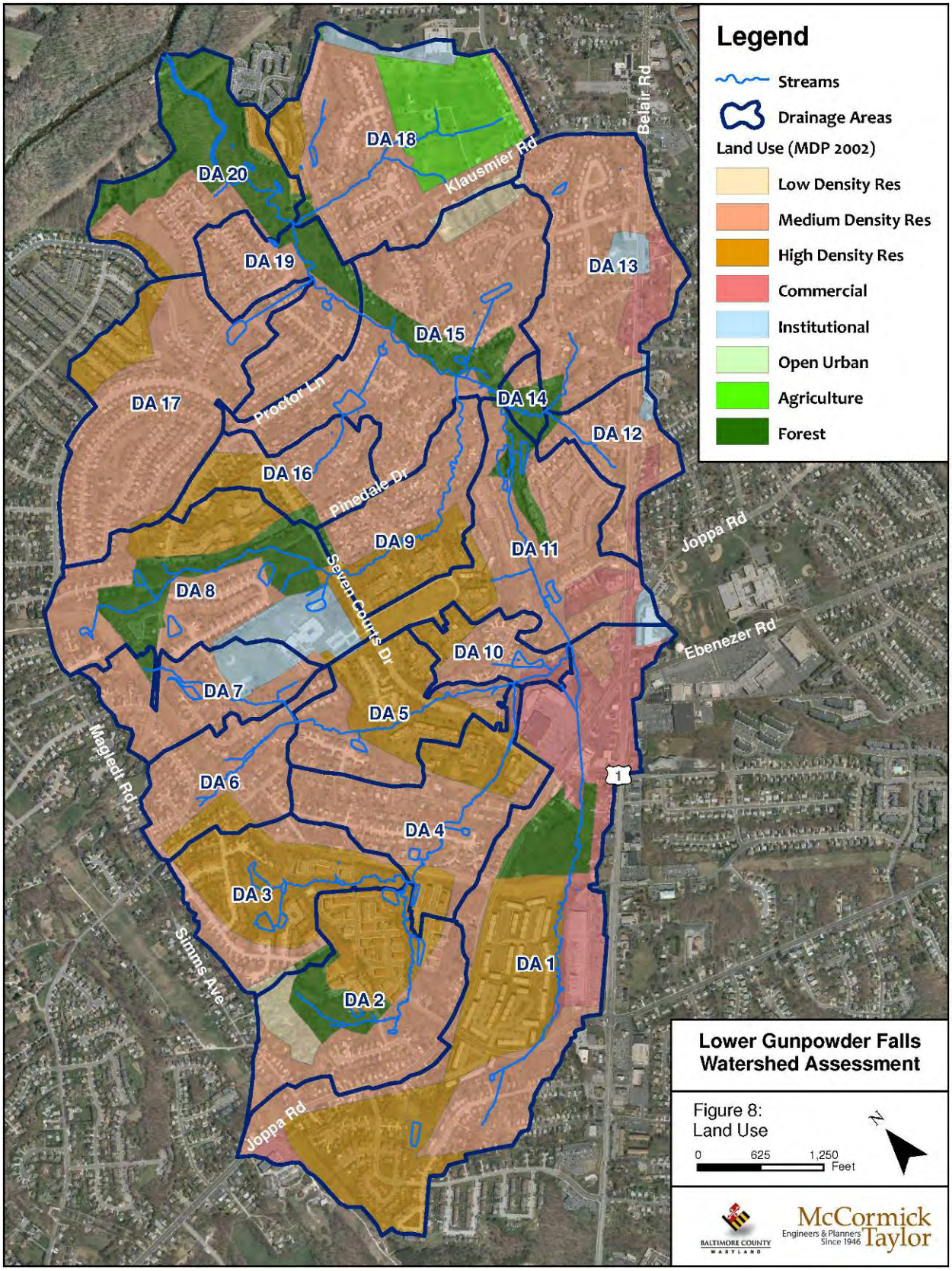

Legend
Streams
Drainage Areas
Land Use (MDP 2002)
Low Density Res
Medium Density Res
High Density Res
Commercial
Institutional
Open Urban
Agriculture
Forest
DA 1
DA 2
DA 3
DA 4
DA 5
DA 6
DA 7
DA 8
DA 9
DA 10
DA 11
DA 12
DA 13
DA 14
DA 15
DA 16
DA 17
DA 18
DA 19
DA 20
Belair Rd
Klausmier Rd
Proctor Ln
Pinedale Dr
Seven Courts Dr
Joppa Rd
Ebenezer Rd
Magledt Rd
Simms Ave
1
Lower Gunpowder Falls Watershed Assessment
Figure 8:
Land Use
0
625
1,250
Feet
N
BALTIMORE COUNTY
MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 4

Land Use Per Drainage Area

Land Use	DA 1		DA 2		DA 3		DA 4		DA 5		DA 6		DA 7		DA 8		DA 9		DA 10	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Low Density Res			6.27	9%	1.11	2%														
Medium Density Res	44.53	25%	32.87	46%	15.21	29%	38.69	68%	18.87	42%	31.44	86%	28.61	78%	33.58	38%	23.76	59%	12.08	64%
High Density Res	73.04	40%	23.89	33%	35.25	67%	17.43	31%	25.92	58%	5.31	14%			17.78	20%	16.19	40%	4.26	23%
Commercial	49.39	27%					0.73	1%	0.03	0%									2.51	13%
Institutional	1.41	1%							0.16	0%			7.22	20%	12.75	15%				
Open Urban	0.01	0%																		
Agriculture																				
Forest	13.02	7%	8.75	12%	1.16	2%							0.82	2%	23.24	27%	0.65	2%		
Total	**181.39**	**100%**	**71.79**	**100%**	**52.72**	**100%**	**56.84**	**100%**	**44.98**	**100%**	**36.75**	**100%**	**36.66**	**100%**	**87.34**	**100%**	**40.61**	**100%**	**18.85**	**100%**

Land Use	DA 11		DA 12		DA 13		DA 14		DA 15		DA 16		DA 17		DA 18		DA 19		DA 20	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Low Density Res					0.27	0%			4.95	5%					1.69	2%				
Medium Density Res	47.63	65%	21.82	81%	56.12	79%	1.75	30%	80.54	83%	18.05	61%	71.00	86%	52.08	56%	35.79	84%	16.77	29%
High Density Res	12.01	16%							0.00	0%	10.34	35%	11.18	14%	4.74	5%			5.62	10%
Commercial	6.05	8%	3.24	12%	9.39	13%														
Institutional			1.14	4%	3.93	6%									4.31	5%				
Open Urban																				
Agriculture	1.64	2%													29.62	32%				
Forest	6.06	8%	0.62	2%	1.55	2%	4.12	70%	11.77	12%	1.11	4%			1.31	1%	6.81	16%	34.63	61%
Total	**73.40**	**100%**	**26.83**	**100%**	**71.26**	**100%**	**5.87**	**100%**	**97.26**	**100%**	**29.50**	**100%**	**82.18**	**100%**	**93.75**	**100%**	**42.60**	**100%**	**57.01**	**100%**

V.1 Drainage Area 1

Introduction

Location: Drainage Area 1 (DA-1) is the southern most and largest drainage area within the subwatershed (***Figure 9***). It is located south of Joppa Road and west of US 1. DA-1 is approximately 181 acres in size or 0.28 square miles and contains approximately 1.19 miles of stream channel, which is the longest channel length of all the drainage areas.

Approximately 39 percent of DA-1 is considered impervious surface. The dominate land use in DA-1 is high density residential, which exists in the central and western portions of the drainage area. Commercial land use exists mainly along US 1; medium density residential exists along the periphery of the drainage area and the remainder is forested land which is located in the central portion of the drainage area. See ***Table 4*** and ***Figure 8*** for details.

Figure 9
Drainage Area 1

Soils: The soils within the drainage area mainly consist of Urban land (Ur) (53%), Issue silt loam (IsA) (7%), Beltsville silty loam (BeB) (6%), and Croom-Urban complex (CoD) (4%) ***(Figure 10)***. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The soil within and adjacent to the stream is Issue silt loam. The series Issue silt loam is somewhat poorly drained soil derived from loamy and sandy alluvium. The floodplain soils consists of Croom-Urban land complex near the headwaters, Urban land along the middle section, and Beltsville silt loam along the lower section. The series Croom consists of well-drained soil from gravelly fluvial deposits. The Beltsville silt loam series is moderately well-drained soil derived from silty eolian over loamy fluviomarine deposits**.**

Existing Conditions

Figure 11 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-1 are highlighted in ***Table 5***.

Channel Conditions: DA-1 begins just south of the India Avenue bridge crossing. The stream valley is relatively narrow and the banks are almost completely covered with vines and other invasive species. The channel appears to have been straightened and is confined by parking lots on both sides up to Joppa Road. Additionally, there are several pipe outfalls and parking lot drains entering the stream along this reach. The section that is piped under parking lots on both sides of Joppa Road is approximately 750 feet long. It appears that over time several different sized pipes and culverts have been spliced together along this section.

Legend
Streams
Soils
Drainage Areas
Perry Hall Square Shopping Center
Joppa Rd
Seven Courts Dr
Cottington Rd
Hines Meadow
Belair Rd
Hines Estates
Spring Hill
Perry Hall Crossing Shopping Center
Turnbrook
Silver Spring Rd
Silver Spring Shopping Center
Simms Ave
Fullerton Farms
Slater Ave
Ridgelys Choice
Ridgelys Choice Dr
BfB
CbB
BfD
CbD
IuA
IsA
KuB
BeC
CoB
BeB
UuB
CnC
CnB
CoD
Ur
SfB
GaB
UcB
SDD
Lower Gunpowder Falls Watershed Assessment
Figure 10:
Drainage Area 1
Soils
0
325
650
Feet
N
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Perry Hall Square Shopping Center
Joppa Rd
Seven Courts Dr
1
Cottington Rd
Hines Meadow
Belair Rd
Hines Estates
Spring Hill
Perry Hall Crossing Shopping Center
Turnbrook
Silver Spring Rd
Simms Ave
Silver Spring Shopping Center
517
Fullerton Farms
Slater Ave
811
Joppa Rd
Ridgelys Choice
Ridgelys Choice Dr
Lower Gunpowder Falls Watershed Assessment
Figure 11:
Drainage Area 1
Existing Conditions
0
325
650
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 5: Drainage Area 1 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.05	11	Score	47
Width/Depth Ratio:	1.00	11	Score/Pot Score	0.59
Threshold Grain Size:	1.10	11	Rank	14
Bank Height Ratio:	1.11	14		

Ecologic		Rank	Score	
Percent Forested per DA	7.7%	8	Score	45
Headcuts per 1000 LF Channel	0.95	6	Score/Pot Score	0.38
Percent Channel w/ Impaired Riparian	53.5%	7	Rank	2
Long Interruptions per1000 LF Channel	2.22	8		
Encroachments per 1000LF Channel	2.38	1		
Outfalls per Acre DA	0.066	15		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.30	14	Score	27
Percent Impervious per DA	39.3%	1	Score/Pot Score	0.45
Percent DA to SWM	37.1%	12	Rank	6

Score Ratio	1.41
Total Rank	8

Above Joppa Road the next 1200 feet of the stream valley still reflect the influences of its agricultural past. The riparian zone alternates between woods and old pasture for the first 800 feet above Joppa Road. There is evidence of old agricultural drainage tiles, channel straightening and bank armoring. The stream is piped under the concrete foundation of an old dairy barn. The gradient is generally lower than upstream reaches. The last 400 feet of this section has complete tree cover until the section ends at a large electrical utility line right of way. Sinuosity and channel incision are more prominent in the open channel and less so in the wooded sections.

Above the electrical utility line right of way the channel and land use characteristics change significantly. The gradient becomes steeper and more sinuous. There is a small wooded buffer on both sides of the channel with good canopy cover. Some debris piles are providing temporary grade control and a young beaver was observed in the stream. Beyond the forest buffer there is large apartment complex on the north side and a shopping center on the south bank. The north bank slopes up to grassed areas behind the apartment complex that has stormwater drain pipes discharging directly into the channel. The south bank is generally higher with a short terrace that abuts a high retaining wall behind shopping center complex. Concentrated overland flow from the shopping center stormwater control structure is apparent on the terrace and is causing bank erosion. Silver Spring Road is the up stream boundary for this section.

Above Silver Spring Road the channel is contained in a 200 foot trapezoid channel until it is piped underground for another 270 foot. The stream emerges from the pipe on the upstream side of Link Avenue. Above Link Avenue the stream channel consists of a small gulley confined between backyard fences in a small lot development. The channel is mostly lined with various debris and vegetation. Several homes have piped roof drains which discharge directly in the gully.

SWM Assessment: Based on the information provided by Baltimore County, six existing SWM facilities are located within DA-1; two detention ponds and four underground storage facilities.

The detention ponds (811 and 517) were overgrown with vegetation and appeared to be holding water. The underground facilities were not inspected due to limited access and location.

Twelve outfall locations were investigated for potential SWM improvements and/or retrofit sites. Based on the condition of the outfalls, three of the locations (Outfalls 10-13) were identified as possible enhancement sites. Outfall 10 is submerged and has no defined outfall channel until the confluence with the stream channel where a headcut has formed. Outfall 11 is the outlet of an underground SWM facility that treats runoff from an adjacent shopping plaza. Flows from this outfall dissipate directly into the floodplain. The banks of the outfall channel at Outfall 12 are slightly eroded; however the channel bottom appears stable and flat.

Restoration Opportunities

Restoration opportunities identified within DA-1 are included in ***Figure 12*** and are described below. ***Table 6*** highlights the assessment results for this drainage area.

Table 6: Drainage Area 1 – Restoration Opportunities Assessment Results

		Rank		Score/Pot Score	Rank
Geomorphic			Score	21	
Percent Bank Stabilization Potential	4.0%	16		0.53	
Percent Floodplain Reconnection Potential	20.9%	5			14
Ecologic			Score	15	
Percent Buffer Improvement Potential	18.0%	7		0.38	
Obstruction Removal Potential per 1000LF	0.318	8			7
Hydrologic			Score	33	
Percent Outfall Stabilization Potential	1.92%	10		0.55	
Water Quantity Improvement Potential	1.42%	12			14
Water Quality Improvement Potential	16.4%	11			

Score Ratio 1.45
Total Rank 14

Cumulative Rank: 11

Channel Improvements: As the drainage area with the longest length of channel, there are multiple opportunities available for restoration. Historic encroachment by the Perry Hall Crossing Shopping center from the east and a large apartment complex from the west have reduced the available flood-prone area, focusing the channel's energies along a narrow riparian swath. This reduction in available flooding area has caused the channel to degrade within this section. Opportunities to improve this condition include measures to reconnect the channel to its floodplain for some targeted (more frequent) recurrence interval. Given the relatively well established wooded corridor, initial investigations for reconnection would consider first the use of bed aggradation structures to raise the channel bed yet protect most of the riparian vegetation. Detailed hydraulic analysis would be required to determine if this option would produce measurable results and whether other options such as floodplain lowering should be considered.

Downstream of the apartments and shopping center, the channel gradient lessens perhaps controlled by an undersized culvert at the old dairy barn. The low gradient channel is also accompanied by wetland areas, some of which appear to have been mowed by adjacent property owners. The opportunities identified in this area include the re-establishment of riparian vegetation to improve channel protection, riparian habitat and also to increase buffer distance to properties along Belair Road.

Additionally, at the downstream limit of DA-1 and extending to within the upstream limit of DA-11, the east bank on the upstream side of the India Avenue bridge is in need of stabilization and potential hardening to arrest encroachment onto the adjacent landowners' property.

SWM Improvements: Based on the initial assessment, existing detention Ponds 811 and 517 within DA-1 were identified as retrofit candidates. Detention facilities have historically been designed for water quantity control only. In order to provide additional treatment of water quality, both existing ponds should be converted into shallow marsh or wetland type facilities. Existing CMP risers should be replaced with risers designed to maximize SWM treatment.

Two outfall locations (Outfalls 10 and 12) were identified as potential enhancement locations. Enhancement options at Outfall 10 include construction of a Best Management Practice (BMP), such as bioretention or small pocket pond/wetland near the outfall and channel stabilization to the confluence with the stream channel. An existing sanitary manhole near the outfall may limit the type and size of BMP that can be installed. Improvements at Outfall 12 include bank stabilization of the outfall channel to reduce the supply of sediment to the stream channel.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Perry Hall Square Shopping Center
Joppa Rd
Seven Courts Dr
1
Cottington Rd
Hines Meadow
Belair Rd
Hines Estates
10
Spring Hill
Perry Hall Crossing Shopping Center
11
Turnbrook
12
Silver Spring Rd
Simms Ave
Silver Spring Shopping Center
517
Fullerton Farms
Slater Ave
811
Joppa Rd
Ridgelys Choice
Ridgelys Choice Dr
Lower Gunpowder Watershed Assessment
Figure 12:
Drainage Area 1
Restoration Opportunities
N
0
325
650
Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.2 Drainage Area 2

Introduction

Location: DA-2 is located in the southern portion of the subwatershed north of Joppa Road and east of Simms Avenue (***Figure 13***). This drainage area is 72 acres in size or 0.11 square miles and contains approximately 0.71 mile of stream length.

Land Use: DA-2 is made up of approximately 23.8 percent of impervious surfaces. The dominate land use within this drainage area is medium density residential which is located along the southern edge of the drainage area. High density residential is also prominent within this drainage area and is located in the northeast portion of the drainage area. Low density residential and forest also exist within the north western portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

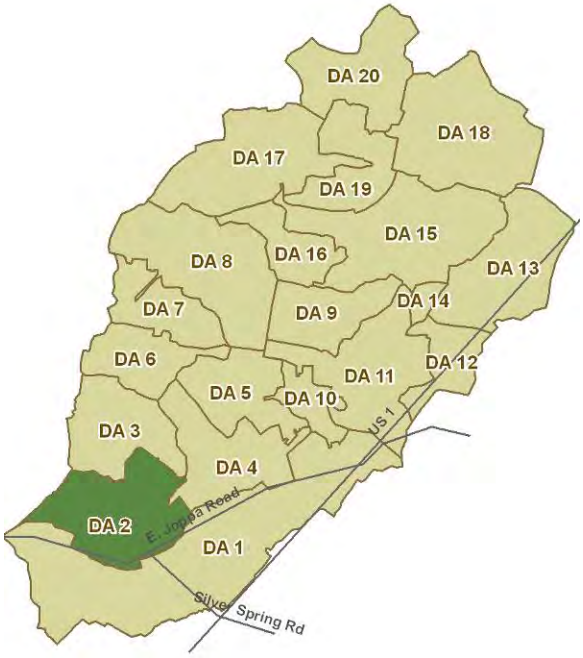
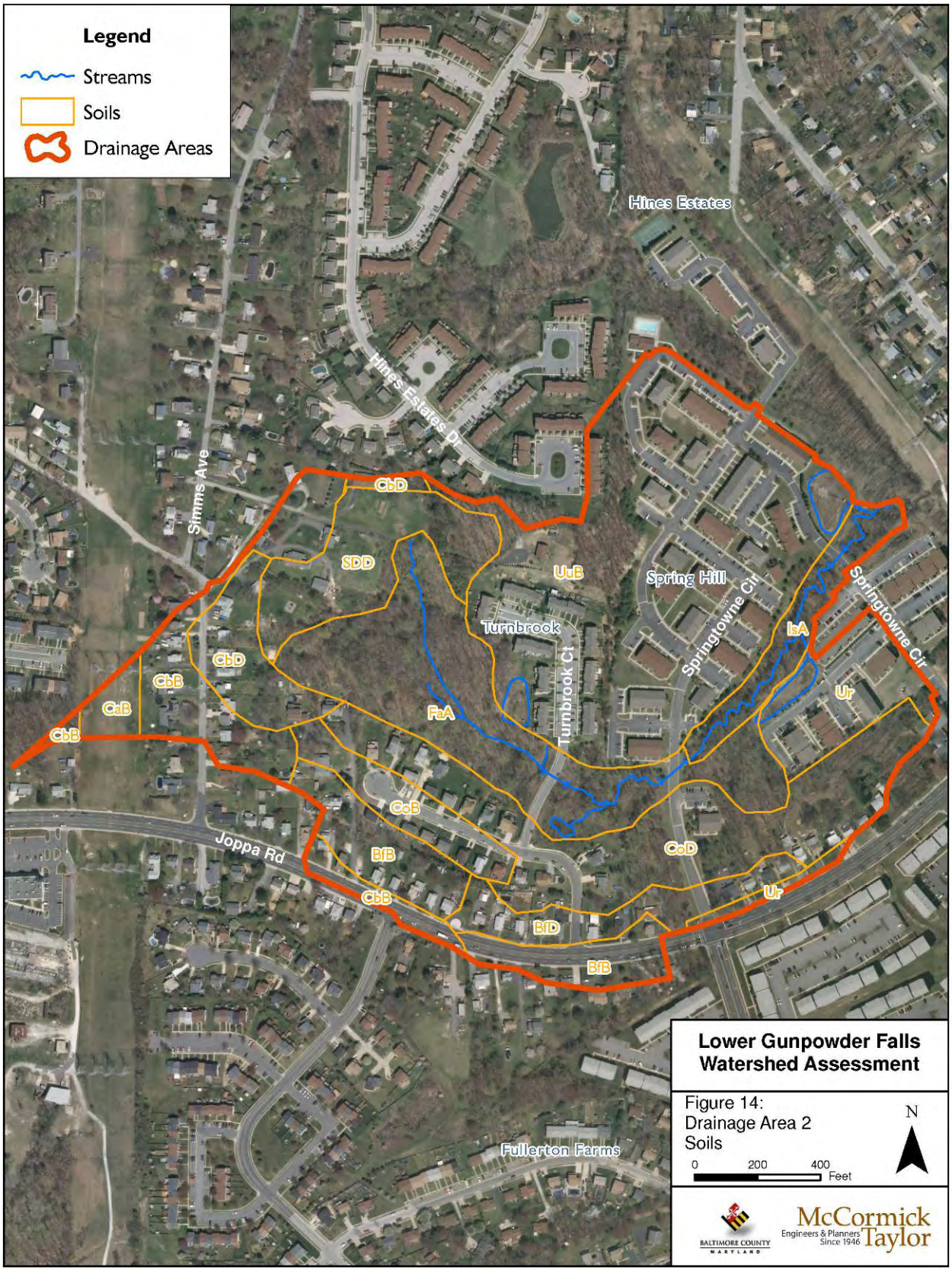


Figure 13
Drainage Area 2

Soils: The soils within the drainage area mainly consist of Urban land-Udorthents (UuB) (31%), Croom-Urban complex (CoB/D) (17%), Fallsington sandy loam (FaA) (15%), Issue silt loam (IsA) (4%) and Sassafras and Croom soils (SdD) (6%) ***(Figure 14)***. The series Urban land-Udorthents are found along the floodplain north of the stream and Croom-Urban land complex soils are found along the floodplain south of the stream. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The series Croom consists of well-drained soil from gravelly fluvial deposits. The soil within and adjacent to the stream is Fallsington sandy loam in the upper area and Issue silt loam in the lower area. The series Fallsington sandy loam is poorly drained soil with parent material consisting of loamy marine and old alluvial sediments. The Issue silt loam series is somewhat poorly drained soil derived from loamy and sandy alluvium. Sassafras and Croom soils are located just above the headwaters. The series Sassafras consists of well-drained soil from sandy marine and old alluvial sediments**.**

Existing Conditions

Figure 15 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-2 are highlighted in the ***Table 7***.


Legend
Streams
Soils
Drainage Areas
Hines Estates
Hines Estates Dr
Simms Ave
CbD
SDD
UuB
Spring Hill
Springtowne Cir
Turnbrook
Turnbrook Ct
IsA
Ur
CbB
CaB
FaA
CoB
BfB
CoD
BfD
Joppa Rd
Fullerton Farms
Lower Gunpowder Falls Watershed Assessment
Figure 14:
Drainage Area 2
Soils
0
200
400
Feet
N
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Hines Estates
Hines Estates Dr
Simms Ave
888
Spring Hill
Springtowne Cir
Turnbrook
1838
Turnbrook Ct
889
755
Joppa Rd
Fullerton Farms
Lower Gunpowder Falls Watershed Assessment
Figure 15:
Drainage Area 2
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 7: Drainage Area 2 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	0.98	1	Score	66
Width/Depth Ratio:	1.32	16	Score/Pot Score	0.83
Threshold Grain Size:	1.00	19	Rank	19
Bank Height Ratio:	1.32	12		

Ecologic		Rank	Score	
Percent Forested per DA	19.3%	17	Score	81
Headcuts per 1000 LF Channel	1.07	4	Score/Pot Score	0.68
Percent Channel w/ Impaired Riparian	13.5%	19	Rank	19
Long Interruptions per1000 LF Channel	1.07	18		
Encroachments per 1000LF Channel	0.27	15		
Outfalls per Acre DA	0.13	8		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.19	17	Score	38
Percent Impervious per DA	23.8%	8	Score/Pot Score	0.63
Percent DA to SWM	40.5%	13	Rank	15

Score Ratio	2.13
Total Rank	20

Channel Conditions: The channel within DA-2 originates in a large beaver pond immediately upstream of a power line right of way. The beaver dam is located at the western limit of the right of way clearing and has created a backwater condition that extends approximately 150 feet up the channel and floodplain after which the channel maintains a single thread up to the Springtowne Circle (East) culvert crossing. The main channel within DA-2 crosses under Springtowne Circle in two locations, East and West, in reference to their respective crossing locations. The short segment of channel downstream of Springtowne Circle East exhibits high sinuosity and bank heights less than one foot. The floodplain is bound on both sides by a large high-density residential complex with SWM ponds on both sides of the channel which restrict available floodplain buffer width. The existing narrow buffer is densely vegetated with young trees and a thick understory.

Between the two Springtowne Circle crossings a sinuous single thread channel meanders through a narrow but densely vegetated floodplain. The gradient gradually increases through this segment. There is a small densely wooded buffer on both sides of the channel with good canopy cover. Bank heights are very low, ranging from a half foot to two feet on average. Beyond the forest buffer the floodplain is still bound by the high density residential development including a SWM pond on the south side of the channel.

The Springtowne Circle West culvert is blocked by an accumulation of woody debris, organic material, and sediment. A defined channel is lacking above the culvert as the blockage has restricted sediment transport and sediment has filled the channel and floodplain upstream of the culvert. Upstream of this depositional area, the channel again maintains a sinuous single thread with banks increasing in height in an upstream direction. Between Springtowne Circle West and Turnbrook Court the buffer width increases to approximately 200 feet with a more mature forest stand than along the downstream segments of DA-2.

The Turnbrook Court culvert is blocked at the upstream end by an accumulation of debris and organic material. An adjacent homeowner noted that beaver have been active in the area and

contributed to the blockage. The reduced capacity of the culvert has created a backwater condition that extends approximately 60 to 80 feet upstream of the culvert. A single thread channel continues beyond this point until it splits, approximately 300 feet upstream of Turnbrook Court. Both channels end in headcuts with limited to no defined channel continuing upstream. The riparian corridor within the upstream extent of the channel network is the widest within DA-2 and consists of a mature hardwood forest.

SWM Assessment: Based on the information provided by Baltimore County, four existing SWM facilities are located within DA-2; three detention ponds (755, 888 and 889) and one extended detention pond (1838). The embankment of pond 755 has failed and the facility no longer retains stormwater runoff. A moderate amount of sediment has accumulated as well. The pond embankments at facilities 888 and 889 appear well maintained; however the ponds are overgrown with phragmites. The riser low flow orifice for pond 888 is clogged. The extended detention pond 1838 appears in good condition with some sediment and debris accumulation.

One outfall location was investigated for potential SWM improvements. Based on the condition of the outfall, this location did not warrant the need for any enhancements at this time.

Restoration Opportunities

Restoration opportunities identified within DA-2 are included in ***Figure 16*** and are described below. ***Table 8*** highlights the assessment results for this drainage area.

Table 8: Drainage Area 2 – Restoration Opportunities Assessment Results

Geomorphic		Rank	Score 25
Percent Bank Stabilization Potential	0.0%	17	Score/Pot Score 0.63
Percent Floodplain Reconnection Potential	0.0 %	8	Rank 18
Ecologic		Rank	Score 25
Percent Buffer Improvement Potential	0.0%	15	Score/Pot Score 0.63
Obstruction Removal Potential per 1000LF	0.00	10	Rank 16
Hydrologic		Rank	Score 30
Percent Outfall Stabilization Potential	0.0%	12	Score/Pot Score 0.50
Water Quantity Improvement Potential	1.89%	9	Rank 12
Water Quality Improvement Potential	20.5%	9	

Score Ratio 1.75
Total Rank 18

Cumulative Rank: 20

Channel Improvements: Based on a stable and functioning existing channel condition, channel improvements are not proposed within DA-2.

SWM Improvements: Based on the initial assessment, existing Ponds 755 and 889 within DA-2 were identified as retrofit candidates. The existing facilities provide minimal to no treatment of stormwater runoff. Improvements to Pond 755 include embankment reconstruction and installation of a riser structure in order to properly function as a SWM pond. Baffle boards or an

earth berm should be constructed within Pond 889 to maximize the flow length within the facility and provide additional water quality treatment. Currently, the inflow point is directly adjacent to the outfall. Existing SWM Ponds 888 and 1838 require maintenance such as vegetation and debris removal and riser structure cleaning.

No outfall enhancements are recommended within DA-2.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Hines Estates
Hines Estates Dr
Simms Ave
Spring Hill
Springtowne Cir
Turnbrook
Turnbrook Ct
889
755
Joppa Rd
Fullerton Farms
Lower Gunpowder Falls Watershed Assessment
Figure 16:
Drainage Area 2
Restoration Opportunities
N
0
200
400
Feet
McCormick Taylor
Engineers & Planners Since 1946

V.3 Drainage Area 3

Introduction

Location: DA-3 is located in the southwest portion of the subwatershed, just east of Simms Avenue (***Figure 17***). This drainage area is 53 acres in size or 0.08 square mile and contains 0.39 mile of stream length.

Land Use: Approximately 21.8 percent of the drainage area is made up of impervious surface. This drainage area is primarily made up of medium and high density residential land uses, with high density being the dominate land use and is located throughout the central portion. Medium density residential land use borders the western and eastern boundaries of the drainage area. Small areas of low density residential and forest are located in the southwest portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

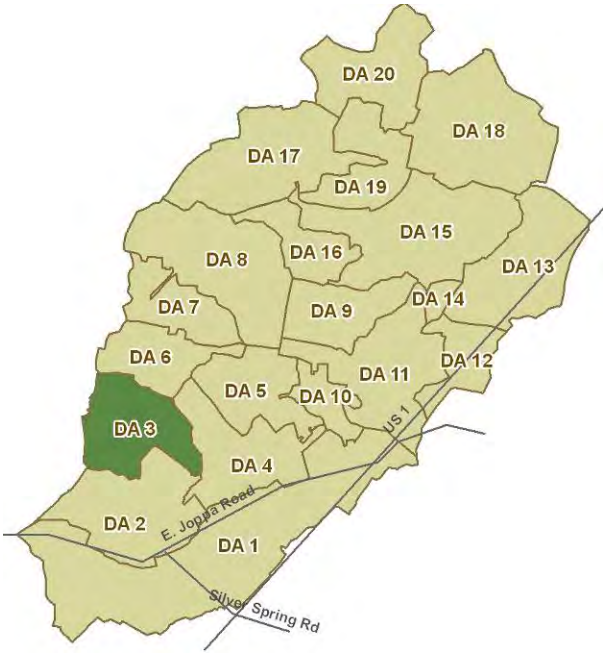
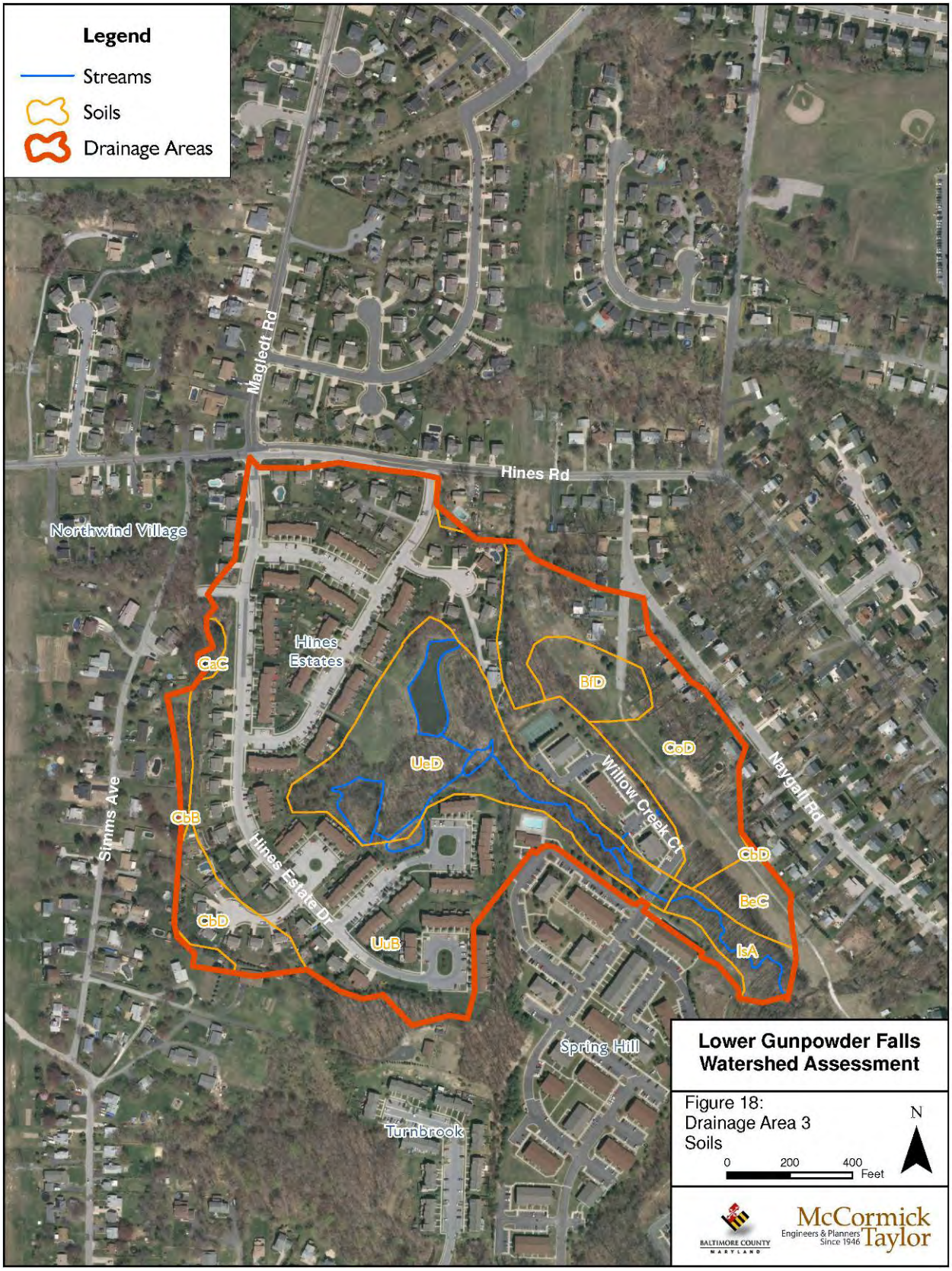


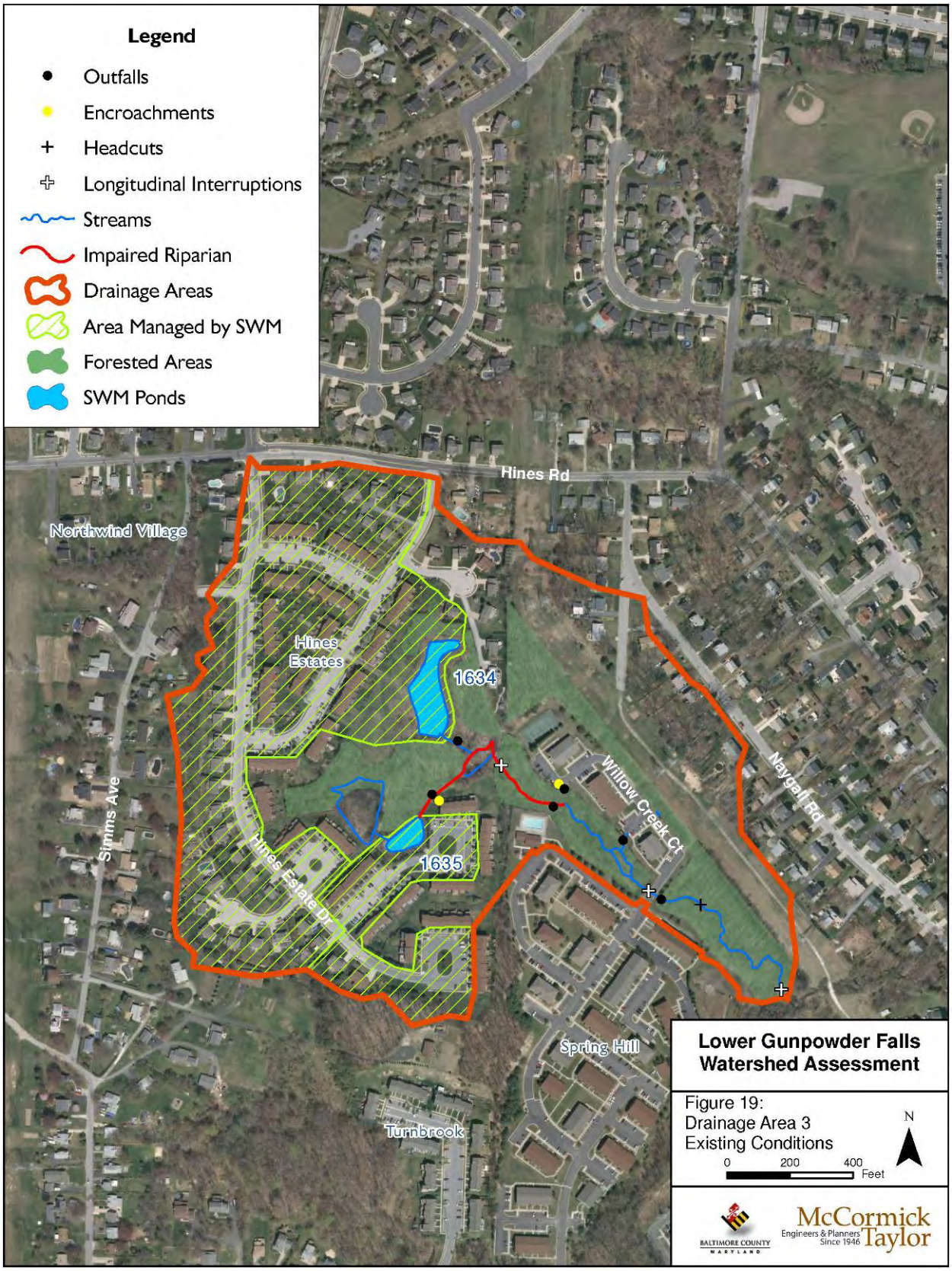
Figure 17
Drainage Area 3

Soils: The soils within the drainage area mainly consist of Urban land-Udorthents (UuB) (58%), Udorthents reclaimed gravel pits (UeD) (15%), Croom-Urban complex (CoD) (14%), and Issue silt loam (IsA) (4%) ***(Figure 18)***. Urban land-Udorthents are found along the floodplain of the stream. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The Croom-Urban complex is located along the east side of the watershed. The Croom series consists of well-drained soil from gravelly fluvial deposits. The soils within and adjacent to the ponds and the upper part of the stream are Udorthents reclaimed gravel pits while the lower part of the stream consists of Issue silt loam. The Issue silt loam series is somewhat poorly drained soil derived from loamy and sandy alluvium**.**

Existing Conditions

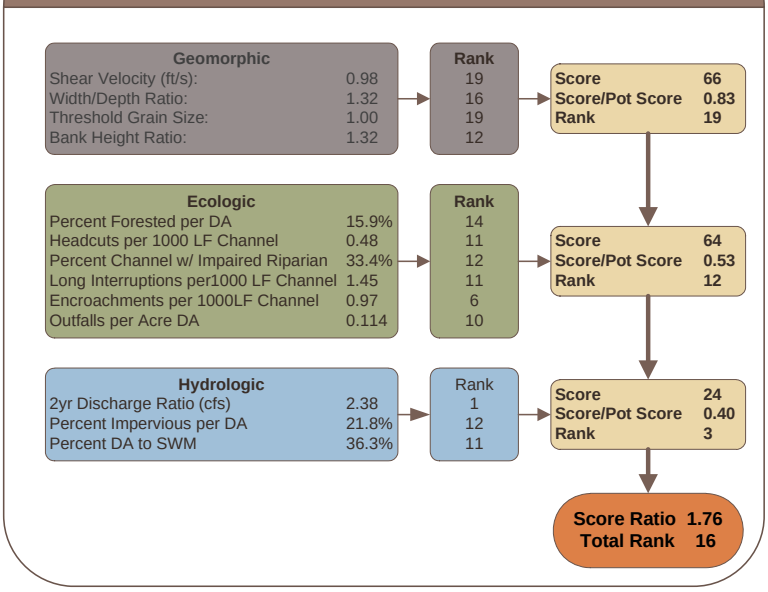
Figure 19 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-3 are highlighted in the ***Table 9***.


Legend
Streams
Soils
Drainage Areas
Magledt Rd
Hines Rd
Northwind Village
Hines Estates
CaC
BfD
CoD
UeD
Willow Creek Ct
Naygell Rd
Simms Ave
CbB
Hines Estate Dr
CbD
BeC
CbD
UuB
IsA
Spring Hill
Turnbrook
Lower Gunpowder Falls Watershed Assessment
Figure 18:
Drainage Area 3
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946


Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Hines Rd
Northwind Village
Hines Estates
1634
1635
Simms Ave
Hines Estate Dr
Willow Creek Ct
Naygall Rd
Spring Hill
Turnbrook
Lower Gunpowder Falls Watershed Assessment
Figure 19:
Drainage Area 3
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Channel Conditions: The channel network within DA-3 originates in a large beaver pond immediately upstream of a power line right of way. The beaver dam is located at the western limit of the right of way clearing and has created a backwater that extends approximately 100 feet up the channel and floodplain. The channel extends approximately 700 feet upstream of the backwater to the Willow Creek Court culvert. Within this segment the left floodplain is bordered by the utility line right of way with buffer widths ranging from 50 to 150 feet. The right floodplain is bordered by a high density residential complex with a SWM pond along the downstream limits of the segment. Buffer widths for the right bank range from 25 to 100 feet. Bank stability is high through this segment with bank heights ranging from one to three feet and dense root mats armoring the banks.

Table 9: Drainage Area 3 – Existing Conditions Assessment Results



The channel extends approximately 600 feet upstream from the Willow Creek Court culvert to a large inline SWM pond. Upstream of Willow Creek Court the gradient becomes steeper and the riparian buffer decreases as the high density residential development encroaches on the stream corridor from both sides of the floodplain. The narrow riparian buffer ranges from 50 to 100 feet with residential community parking and the community pool encroaching upon the stream channel from opposite sides of the floodplain. Though narrow, there is a small wooded buffer on both sides of the channel with good canopy cover.

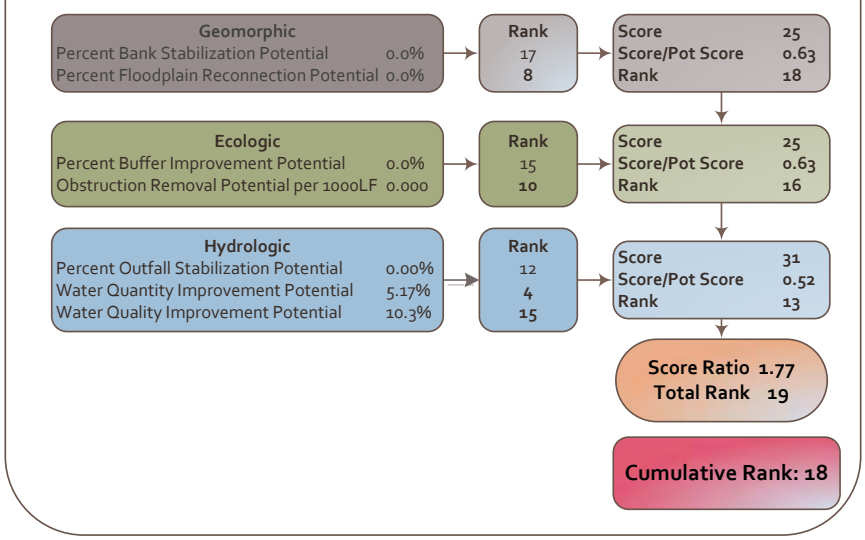
SWM Assessment: Based on the information provided by Baltimore County, two existing extended detention ponds (1634 and 1635) are located within DA-3. A third area located upstream of 1635 appeared to be a potential wetland. Since no as-built or GIS information could be located for this area, it may be a naturally occurring wetland. Pond 1634 is in fair condition as there is excess vegetation around the riser and the riser weirs are clogged. The riser is also missing a manhole cover. Pond 1635 is in good condition with a small amount of sediment accumulation. The potential wetland area upstream of 1635 has no defined outfall structure or spillway.

No outfall locations were investigated for potential SWM improvements and/or retrofitting within this drainage area.

Restoration Opportunities

Restoration opportunities identified within DA-3 are included in ***Figure 20*** and are described below. ***Table 10*** highlights the assessment results for this drainage area.

Table 10: Drainage Area 3 – Restoration Opportunities Assessment Results



Channel Improvements: Based on a stable and functioning existing channel condition, channel improvements are not proposed within DA-3.

SWM Improvements: Based on the initial assessment, the wetland (PR1) area upstream of Pond 1635 should be converted into shallow marsh or wetland type facility. Improvements to the area include construction of a downstream embankment and installation a riser/outfall structure.

Existing Ponds 1634 and 1635 within DA-3 require maintenance. Recommended maintenance activities for the ponds include vegetation and sediment removal, riser structure cleaning and providing a manhole cover for the riser at Pond 1634.

No outfall enhancements are recommended within DA-3.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Hines Rd
Northwind Village
Hines Estates
PRI
Simms Ave
Hines Estate Dr
Willow Creek Ct
Naygall Rd
Spring Hill
Turnbrook
Lower Gunpowder Falls Watershed Assessment
Figure 20:
Drainage Area 3
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.4 Drainage Area 4

Introduction

Location: DA-4 is located in the south central portion of the subwatershed, just north of Joppa Road (***Figure 21***). This drainage area is 57 acres in size or 0.09 square mile and contains 0.58 mile of stream length.

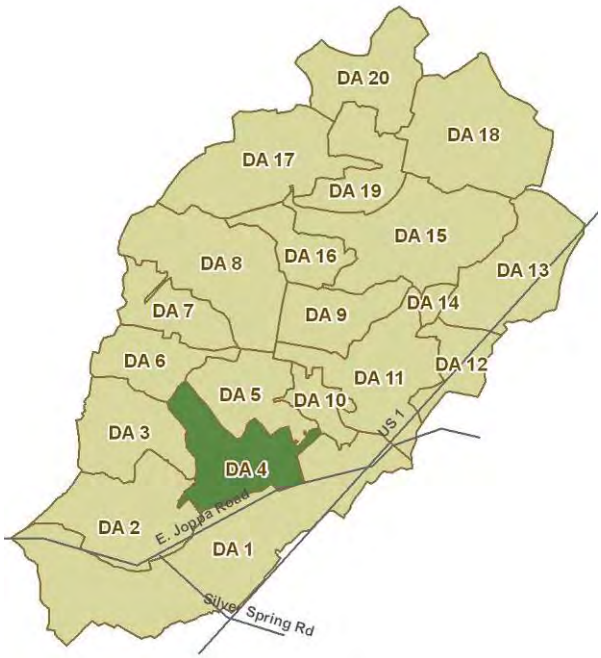


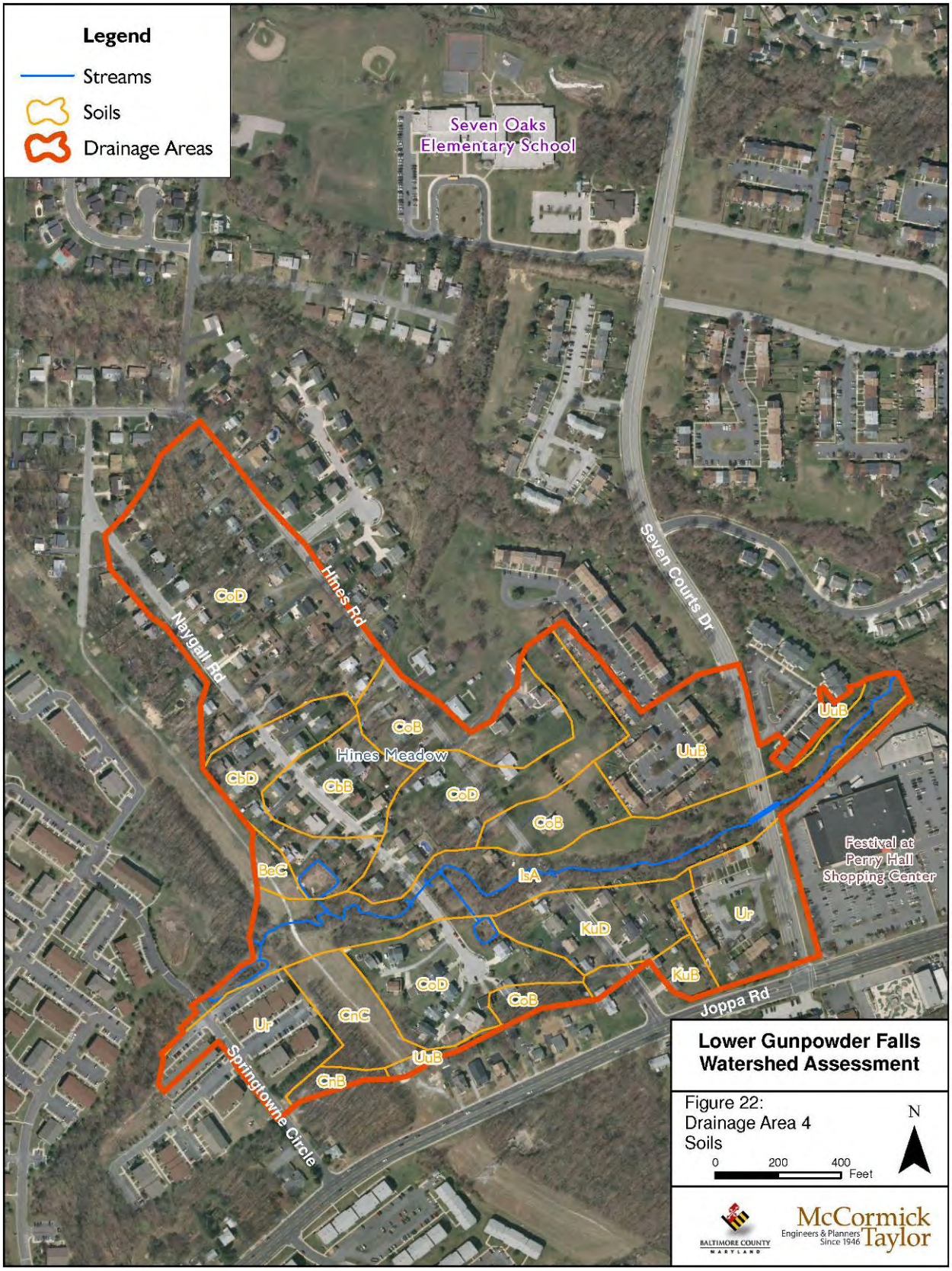
Figure 21
Drainage Area 4

Land Use: Approximately 22.2 percent of this drainage area is made up of impervious surfaces. The dominate land use within this drainage area is medium density residential which runs through the central and southern portions. Portions of high density residential land use also exist in the western and eastern portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soils within the drainage area mainly consist of Croom-Urban complex (CoB/D) (44%), Issue silt loam (IsA) (15%), Urban land (Ur) (11%), Urban land-Udorthents (UuB) (9%) and Keyport-Urban land complex (KuB/D) (7%) ***(Figure 22)***. Most of the soils contain urban land- areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The soil types mostly found along the floodplain include Croom-Urban complex, Urban land, and Urban land-Udorthents. The Croom series consists of well-drained soil from gravelly fluvial deposits. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. The soil within and adjacent to the stream is Issue silt loam, a somewhat poorly drained soil derived from loamy and sandy alluvium**.**

Existing Conditions

Figure 23 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-4 are highlighted in ***Table 11.***


Legend
Streams
Soils
Drainage Areas
Seven Oaks Elementary School
Seven Courts Dr
Hines Rd
Naygall Rd
Hines Meadow
Festival at Perry Hall Shopping Center
Joppa Rd
Springtowne Circle
CoD
CoB
CbD
CbB
BeC
IsA
UuB
Ur
KuD
KuB
CnC
CnB
Lower Gunpowder Falls Watershed Assessment
Figure 22: Drainage Area 4 Soils
0 200 400 Feet
N
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Seven Oaks Elementary School
Seven Courts Dr
Hines Rd
Naygall Rd
Hines Meadow
524
525
890
Festival at Perry Hall Shopping Center
Joppa Rd
Springtowne Circle
Lower Gunpowder Falls Watershed Assessment
Figure 23:
Drainage Area 4
Existing Conditions
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Channel Conditions: The stream channel within DA-4 originates behind the Weis Shopping Market off of Joppa Road. The channel extends approximately 650 feet upstream to Seven Courts Drive. The stream corridor through this segment has been historically altered initially through agriculture and more recently, commercial and residential development. The floodplain width ranges from 70 to 100 feet and is comprised almost entirely of invasive species of vines and shrubs. The parking lot of the Weis Market begins to encroach upon the channel near Seven Courts Drive. A residential property borders the stream corridor to the north but a row of pine trees separates the riparian corridor from mowed lawn. Bank height is relatively consistent along this length ranging from two to four feet high and banks are moderately stable with a dense cover of invasive plant species.

Table 11: Drainage Area 4 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.09	5	Score	19
Width/Depth Ratio:	0.88	4	Score/Pot Score	0.24
Threshold Grain Size:	1.20	5	Rank	2
Bank Height Ratio:	2.7	5		

Ecologic		Rank	Score	
Percent Forested per DA	5.6%	6	Score	34
Headcuts per 1000 LF Channel	0.98	5	Score/Pot Score	0.28
Percent Channel w/ Impaired Riparian	63.7%	4	Rank	1
Long Interruptions per1000 LF Channel	2.29	5		
Encroachments per 1000LF Channel	2.29	2		
Outfalls per Acre DA	0.106	12		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.59	9	Score	28
Percent Impervious per DA	22.2%	11	Score/Pot Score	0.47
Percent DA to SWM	23.0%	8	Rank	8

Score Ratio	1.99
Total Rank	1

The channel condition changes upstream of Seven Courts Drive as high density residential development confines the channel and floodplain along both banks. Buffer clearing and poor homeowner practices (composting and disposing of debris on the banks and in the channel) have led to instabilities along the right bank. The channel has been straightened historically and fill has been placed along the left bank raising the top of bank above the floodplain elevation, essentially creating a levee. This berm feature is 60 to 100 feet beyond the property lines and backyard fences of the townhome community. This straightening and confinement have likely contributed to channel incision extending upstream to Hines Road. Bank heights through this reach range from five to eight feet with near vertical slopes and sparse vegetative cover.

Adjacent landuse again directly influences channel conditions between Hines Road and Naygall Road. The channel planform and both banks have been historically altered along the entire length between the road crossings. A grouted stone wall in various stages of disrepair extends along nearly 300 feet of the left bank. The confinement and channel alteration has led to channel incision and subsequent widening with significant bank erosion along the right bank. Severe geometry with a sharp meander bend approximately 150 feet upstream of Hines Road has resulted in a right bank height of five to seven feet with a vertical face and evidence of active slumping and block failure.

Upstream of Naygall Road the channel resumes a natural planform meandering through a native riparian corridor for approximately 400 feet before entering a power line right of way. Buffer widths along this reach range from 25 to 100 feet prior to the power line clearing. Understory vegetation consists mostly of adolescent beech trees, small holly trees, greenbriar and limited ground cover typical of a beech forest. Though bank vegetation is sparse, root structures of mature trees are prevalent within the bank profile. Some bank instabilities do exist in approach of the power line clearing upstream as increased energy from the straightening and confinement of the utility crossing have led to alternating bend erosion downstream. These instabilities are mostly minor to moderate in severity as bank heights are relatively low with an average of two to four feet.

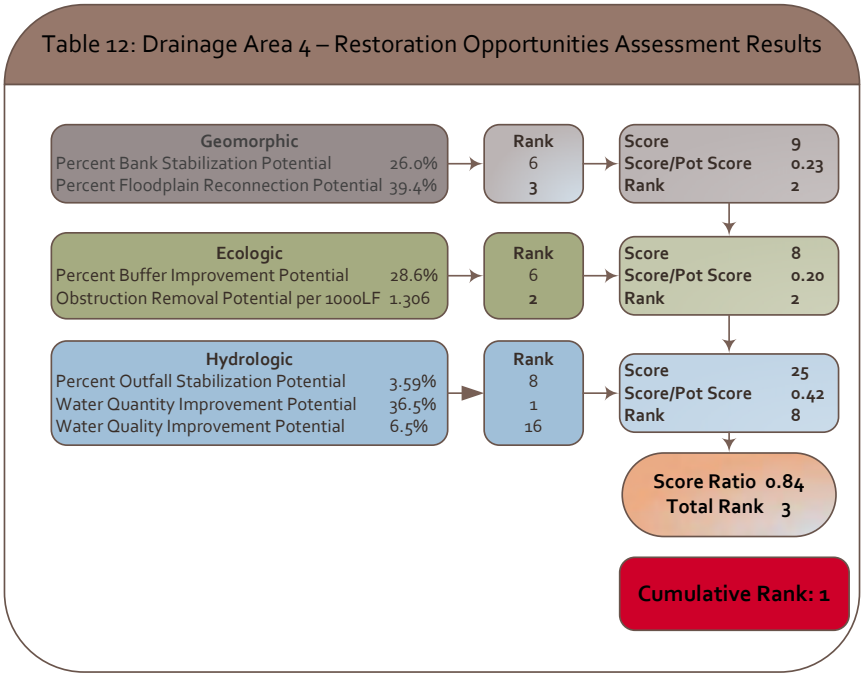
The power line clearing and access road crossing has interrupted the natural pattern and bank stability is significantly decreased within the right of way as the channel lacks a riparian buffer. A corrugated metal pipe was installed to convey the channel under the access road and it appears as though the pipe was placed in the existing stream channel and simply backfilled with crushed stone. The pipe appears to be adequately sized as backwater conditions are not evident upstream of the culvert however the channel constriction and resulting expansion downstream have led to localized bed and bank erosion.

SWM Assessment: Based on the information provided by Baltimore County, three existing extended detention ponds (524, 525 and 890) are located within DA-4. Pond 524 is in good condition and is holding a small amount of water. Pond 525 is holding a considerable amount of water as the stand pipe is clogged, which appears to be contributing to upstream storm drain flooding issues. The riser is also missing a manhole cover. Pond 890 is in fair condition. The outfall is filled with debris and sediment and the facility bottom is overgrown, however the embankments appear to be well maintained.

One outfall location was investigated for potential SWM improvements. Outfall 13 is submerged and has no defined outfall channel until the confluence with the stream channel where a headcut has formed.

Restoration Opportunities

Restoration opportunities identified within DA-4 are included in ***Figure 24*** and are described below. ***Table 12*** highlights the assessment results for this drainage area.



Channel Improvements: DA-4 ranked as the drainage area with the most impaired existing condition. Due to this high level of observed impairment within the drainage network, numerous channel improvements opportunities were identified.

The most downstream section of DA-4 has the opportunity to be incorporated into a combined project with DA-5 and DA-10 where floodplain reconnection and riparian buffer enhancements are recommended. This could entail floodplain lowering, invasive eradication and subsequent riparian re-establishment with native species.

The section of channel between Seven Courts and Hines Road has been historically straightened and confined by floodplain filling adjacent to this channel. As such, this section has become incised and can only focus its energies on the bed and banks. Opportunities exist here to provide more floodplain access for the channel and re-establish a more natural planform. These modifications would greatly lessen the channel's erosive capability and improve instream and riparian habitat.

Channel modification and confinement continue upstream of Hines Road, where grouted stone walls (in various stages of disrepair) have been constructed along the perimeter of the adjacent properties. Improvements here would include the removal of the wall and replacement with a bank stability treatment such as Toe Boulders with Bio-engineering.

Approximately 400 feet above Naygall Road, the channel planform is confined by a utility crossing culvert. This restriction in the system has created instabilities in the channel upstream and downstream of the culvert. Replacement of the culvert with a more appropriate crossing in conjunction with channel stabilization upstream and downstream are necessary at this location to restore the system.

SWM Improvements: Based on the initial assessment, existing detention Ponds 525 and 890 within DA-4 require maintenance. Recommended maintenance activities for the ponds include

vegetation and debris removal, riser structure cleaning and providing a manhole cover for the riser at Pond 525.

One outfall (13) was identified as a potential enhancement location. Enhancement options at this outfall include the construction of a pocket pond/wetland BMP near the outfall and establishing a stable outfall channel for proper conveyance of runoff to the stream channel. The area surrounding the outfall is relatively wet and may limit the type of BMP that can be installed at this location.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Hines Rd
Naygall Rd
Seven Courts Dr
Hines Meadow
13
Festival at Perry Hall Shopping Center
Joppa Rd
Springtowne Circle
Lower Gunpowder Falls Watershed Assessment
Figure 24:
Drainage Area 4
Restoration Opportunities
0 200 400 Feet
N
McCormick Taylor
Engineers & Planners Since 1946

V.5 Drainage Area 5

Introduction

Location: DA-5 is located in the south central portion of the subwatershed (***Figure 25***) and is 45 acres in size or 0.07 square mile and contains approximately 0.53 mile of stream channel.

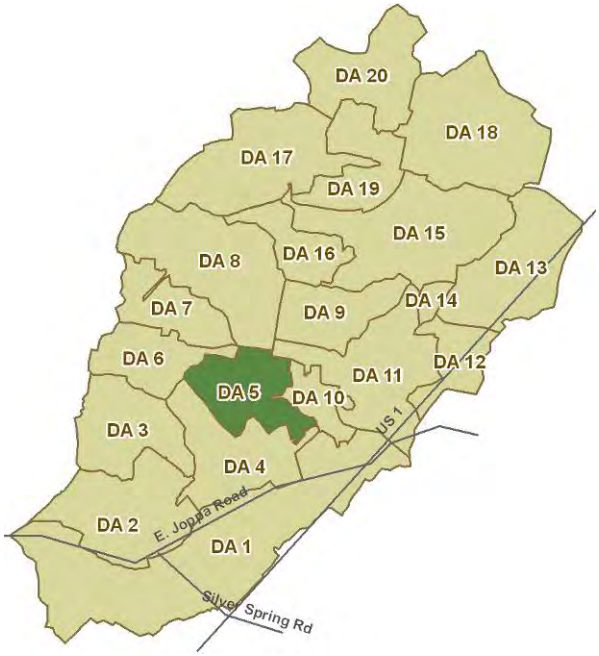


Figure 25
Drainage Area 5

Land Use: Approximately 23.5 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is high density residential, which is located through out the center of the drainage area. Smaller areas of medium density residential land use are located in the western and eastern portions of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soils within the drainage area mainly consist of Croom-Urban complex (CoB/D) (28%), Issue silt loam (IsA) (20%), Beltsville-Urban land complex (BfB) (19%), and Urban land-Udorthents (UuB) (17%) ***(Figure 26)***. Most of the soils contain urban land- areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The soil types mostly found along the floodplain include Croom-Urban complex, Beltsville-Urban land complex, and Urban land-Udorthents. The Croom series consists of well-drained soil from gravelly fluvial deposits. The series Beltsville soils are moderately well-drained and are derived from silty eolian over loamy fluviomarine deposits. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. The soil within and adjacent to the stream is Issue silt loam, a somewhat poorly drained soil derived from loamy and sandy alluvium**.**

Existing Conditions

Figure 27 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-5 are highlighted in ***Table 13.***

Legend
Streams
Soils
Drainage Areas
Seven Oaks Elementary School
Seven Courts Dr
Tila Rd
CbB
CbB
CbB
CbD
BfB
Hineslaigh Ct
CoD
IsA
MgB
MgB
Cedar Chip Ct
UuB
CoB
Festival at Perry Hall Shopping Center
Hines Rd
Hines Meadow
Joppa Rd
Lower Gunpowder Falls Watershed Assessment
Figure 26:
Drainage Area 5
Soils
0
200
400
Feet
N
McCormick Taylor

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Seven Oaks
lementary School
Seven Courts Dr
Tila Rd
Hinesleigh Ct
1233
Cedar Chip Ct
Festival at
Perry Hall
Shopping Center
Hines Rd
Hines Meadow
Joppa Rd
Lower Gunpowder Falls
Watershed Assessment
Figure 27:
Drainage Area 5
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY
MARYLAND
McCormick
Engineers & Planners
Since 1946
Taylor

Table 13: Drainage Area 5 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.03	11	Score	42
Width/Depth Ratio:	0.98	8	Score/Pot Score	0.53
Threshold Grain Size:	1.06	16	Rank	11
Bank Height Ratio:	2.36	7		

Ecologic		Rank	Score	
Percent Forested per DA	17.0%	15	Score	47
Headcuts per 1000 LF Channel	0.72	8	Score/Pot Score	0.39
Percent Channel w/ Impaired Riparian	34.6%	9	Rank	3
Long Interruptions per1000 LF Channel	2.16	9		
Encroachments per 1000LF Channel	1.44	4		
Outfalls per Acre DA	0.156	2		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.44	13	Score	29
Percent Impervious per DA	23.5%	9	Score/Pot Score	0.48
Percent DA to SWM	19.0%	7	Rank	9

Score Ratio	1.40
Total Rank	7

Channel Conditions: The stream channel within DA-5 originates at the downstream end behind the Weis Shopping Market. It is at this point where the main channel segments of DA-5 and DA-4 converge into DA-10. Extending upstream along the channel within DA-5 canopy cover is almost entirely non-existent within the first 100 feet as the floodplain is dominated by invasive species of vines and shrubs. The channel extends for approximately 900 feet upstream to Seven Courts Drive. The stream corridor through this length has been historically altered, initially through agriculture and more recently, medium to high density residential development. The riparian buffer is limited to a narrow strip separating both sides of the channel from residential properties. Stream bank stability is high throughout the downstream portion of this section reach with low bank heights and solid root mass within the bank margins. Channel gradient and sinuosity begin to increase and bank erosion has occurred along a series of meander bends approximately 200 feet downstream of Seven Courts Drive. Bank heights within these localized areas of erosion range from four to six feet.

A large debris accumulation exists immediately upstream of Seven Courts Drive. This accumulation consists of yard waste, lumber, and natural woody debris. The blockage is creating a backwater condition upstream which has led to a significant level of sand and gravel deposition within the channel. This deposition extends approximately 150 feet upstream of the debris accumulation. Channel conditions change above this point as high density residential development confines the channel and floodplain along both banks. Buffer clearing and poor homeowner practices (i.e. mowing to top of bank and disposing of debris on the banks and in the channel) have led to instabilities along the stream banks. The right bank is almost completely lacking in riparian buffer for continuous length of approximately 600 feet behind the residences of Bourbon Court. The residential community maintains a grass lot upstream of the individual properties.

Beyond the cleared lot adjacent to Bourbon Court the channel enters a dense riparian corridor. While the channel follows the valley wall and subsequent edge of buffer along the right side of the floodplain, the left bank has a wooded buffer width of up to 200 feet as the channel parallels

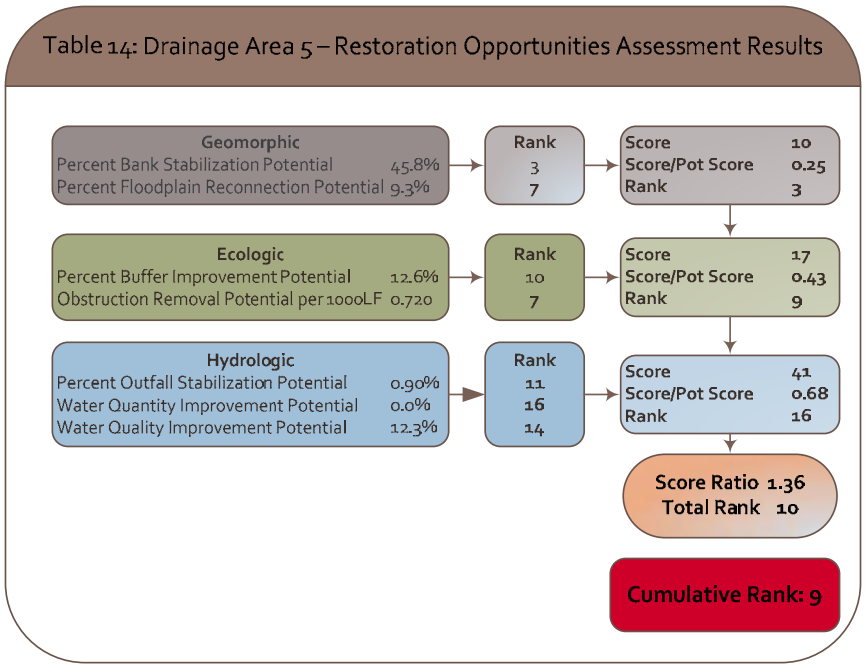
Hinesleigh Court. Right bank heights increase dramatically as the channel encroaches on the valley wall. Channel gradient increases dramatically over this reach particularly as the valley narrows approaching the upstream limit of the drainage area. At the upstream limit of DA-5, the channel splits into two branches. One branch is DA-6 and the other branch is DA-7.

SWM Assessment: Based on the information provided by Baltimore County, one existing extended detention pond (1233) and one underground storage facility are located within DA-5. The underground facility was not inspected due to limited access and location. Pond 1233 is in fair condition with a moderate amount of woody vegetation throughout the facility and surrounding the riser. The outfall channel is severely eroded downstream of the riprap outfall.

Four outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, only one of the locations (Outfall 23) was identified as a possible enhancement site. The outfall channel has significantly eroded causing the end section to be undermined. The adjacent tree roots appear to support the end section approximately 3' above the existing channel bed.

Restoration Opportunities

Restoration opportunities identified within DA-5 are included in ***Figure 28*** and are described below. ***Table 14*** highlights the assessment results for this drainage area.



Channel Improvements: DA-5 offers opportunities for enhancement primarily for bank stabilization. The section of channel behind Bourbon and Hinesleigh Courts exhibits fairly continuous and severe channel bank erosion. A potential project could extend from the outfall enhancement opportunity (#23), upstream approximately 1000 feet to the western edge of DA-5. Within the upstream limits, improvements may include a channel shift away from the valley wall (to reduce stress and increase buffer) in addition to bank stabilization along the entire length. This location also appears to have relatively straightforward construction access.

A minor bank stabilization opportunity exists just downstream of the Seven Courts Drive crossing where alternating meander bend erosion exhibits migration potential. In addition, the most downstream section of DA-5 has the opportunity to be incorporated into a combined project with DA-4 and DA-10 where floodplain reconnection and riparian buffer enhancements are recommended.

SWM Improvements: Based on the initial assessment, existing extended detention Pond 1233 within DA-5 requires maintenance. Recommended maintenance activities include vegetation removal and stabilization of the outfall channel to reduce the supply of sediment to the stream channel.

One outfall (23) was identified as a potential enhancement location. Enhancement options at this outfall include channel stabilization to support the end section and prevent future upstream storm drain pipe disconnections.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Seven Oaks Elementary School
Seven Courts Dr
Tila Rd
Hinesleigh Ct
23
Cedar Chip Ct
Festival at Perry Hall Shopping Center
Hines Rd
Hines Meadow
Joppa Rd
Lower Gunpowder Falls Watershed Assessment
Figure 28:
Drainage Area 5
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.6 Drainage Area 6

Introduction

Location: DA-6 is located in the central western portion of the subwatershed (***Figure 29***). This drainage area is 37 acres in size or 0.06 square mile and contains approximately 0.42 mile of stream channel.

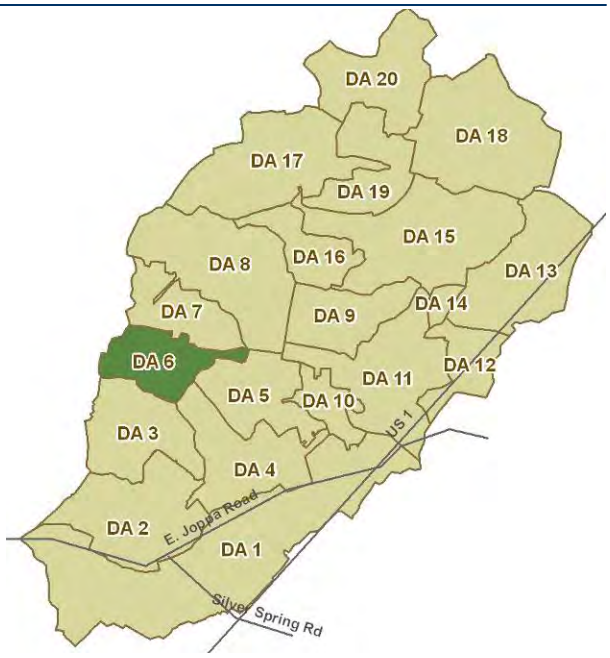


Figure 29
Drainage Area 6

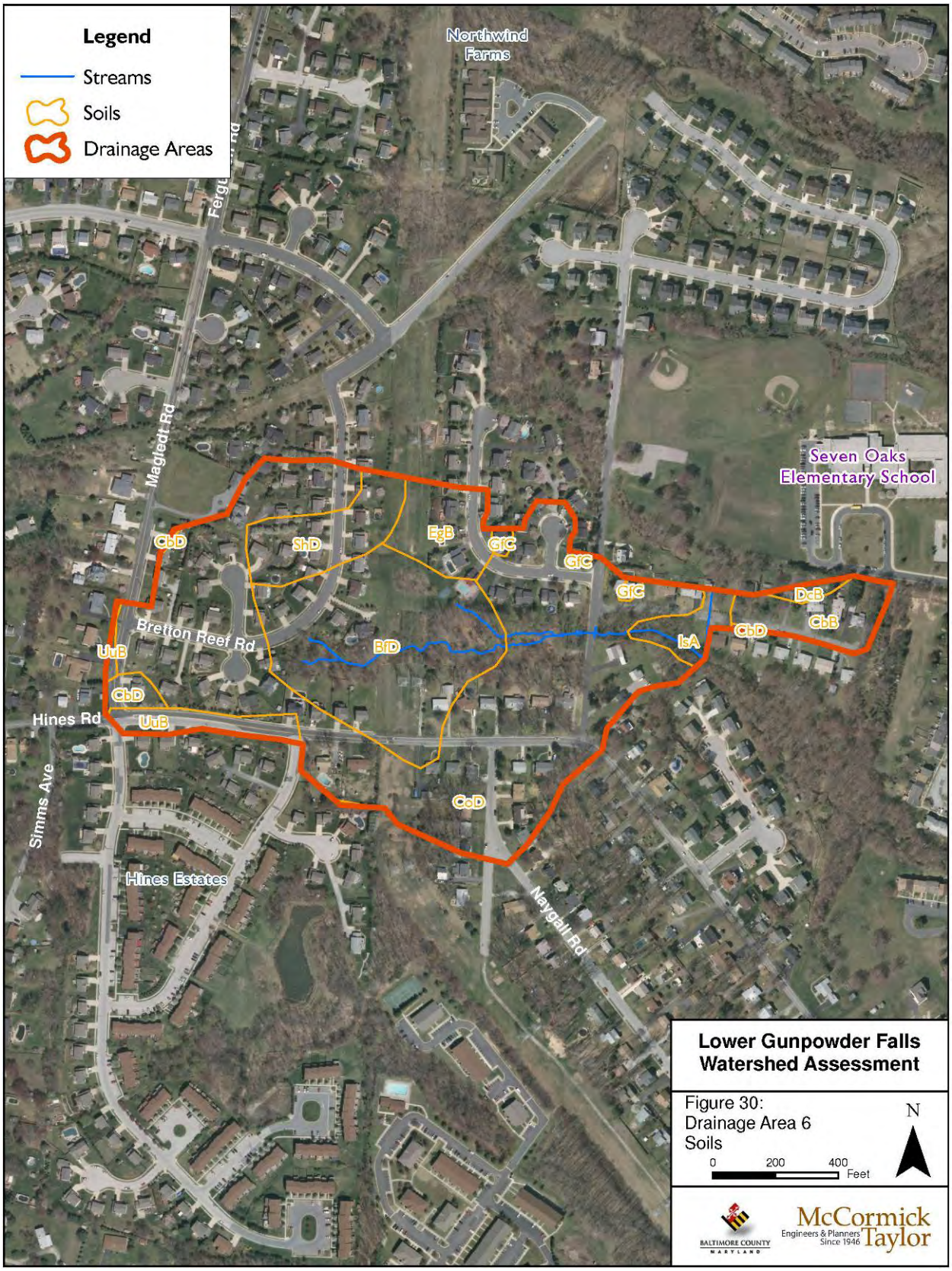
Land Use: Approximately 23.1 percent of this drainage area contains impervious surfaces. The dominate land use is medium density residential which encompasses the majority of the drainage area, except for a small portion of high density residential in the southwest portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soils within the drainage area mainly consist of Croom-Urban complex (CoB/D) (55%) and Beltsville-Urban land complex (BfB) (22%) ***(Figure 30)***. A small area of Issue silt loam (IsA) (2%), a somewhat poorly drained soil derived from loamy and sandy alluvium, is located along the stream near the bottom of the drainage site. The Croom-Urban complex is found along the upper area of the stream and floodplain while the Beltsville-Urban land complex is located along the middle and lower area of the stream and floodplain. The series Croom consists of well-drained soil from gravelly fluvial deposits. The Beltsville soils are moderately well-drained and are derived from silty eolian over loamy fluviomarine deposits. Urban land is area covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development.

Existing Conditions

Figure 31 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-6 are highlighted in ***Table 15.***

Channel Conditions: DA-6 originates at the Simms Road culvert. The stream segment then progresses upstream through an in-line SWM pond. This pond has filled in with a significant volume of debris and sediment accumulations. The deposition has led to a very low gradient and limited channel definition for approximately 200 feet upstream of the pond embankment. Above this point, the valley divides with a small channel extending to the northwest while the main channel continues to the west.


Legend
Streams
Soils
Drainage Areas
Northwind Farms
Seven Oaks Elementary School
Magledt Rd
Bretton Reef Rd
Hines Rd
Simms Ave
Hines Estates
Naygall Rd
CbD
ShD
EgB
GfC
GfC
GfC
DcB
CbB
CbD
IsA
BfD
UtB
CbD
UtB
CoD
Lower Gunpowder Falls Watershed Assessment
Figure 30:
Drainage Area 6
Soils
0
200
400
Feet
N
BALTIMORE COUNTY
MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Northwind Farms
Seven Oaks Elementary School
Magfield
Bretton Reef Rd
Hines Rd
Simms Ave
Hines Estates
Naygall Rd
1473
Lower Gunpowder Falls Watershed Assessment
Figure 31:
Drainage Area 6
Existing Conditions
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 15: Drainage Area 6 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.02	17	Score	45
Width/Depth Ratio:	0.98	9	Score/Pot Score	0.56
Threshold Grain Size:	1.03	17	Rank	12
Bank Height Ratio:	4.11	2		

Ecologic		Rank	Score	
Percent Forested per DA	11.6%	11	Score	61
Headcuts per 1000 LF Channel	0.90	7	Score/Pot Score	0.51
Percent Channel w/ Impaired Riparian	29.2%	14	Rank	11
Long Interruptions per1000 LF Channel	2.25	6		
Encroachments per 1000LF Channel	0.90	9		
Outfalls per Acre DA	0.082	14		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.15	18	Score	45
Percent Impervious per DA	23.1%	10	Score/Pot Score	0.75
Percent DA to SWM	65.2%	17	Rank	19

Score Ratio	1.82
Total Rank	19

The smaller channel extends approximately 180 feet to a piped section that crosses under a residential lawn area. The stream loses a defined cross section upstream of the piped section and disappears into what is likely an emergent wetland. The left bank immediately downstream of the piped section has been stabilized with a stone wall and mulched landscape bed along top of bank. The piped section and stone bank stabilization appear to be homeowner improvements as they are limited to an individual property footprint and seemingly not executed per standard channel stabilization methods. The riparian buffer is insufficient along the left bank as residential properties and mowed lawns encroach upon the channel.

The mainstem channel within DA-6 extends west approximately 750 feet from the previously mentioned valley divide to its origination at Bretton Reef Road. The riparian buffer condition is good with a mature stand of trees upstream of Simms Road but the buffer is significantly interrupted by a cleared power line right of way approximately 500 feet upstream. The channel upstream of the power line extends through a narrow riparian buffer reduced by residential development on both sides of the stream channel. The channel becomes more incised with higher banks as it progresses upstream. Bank heights between the power line right of way and Bretton Reef Road are up to nine feet high. Channel incision is arrested at the upstream end by gabion and riprap stabilization within the channel immediately below Bretton Reef Road.

Evidence of potential previous restoration efforts was observed within the channel immediately above the power line right of way. Degraded soil stabilization matting was noted in the banks and riprap was distributed throughout the channel bed with some stone having the appearance of embedment at the toe of the banks.

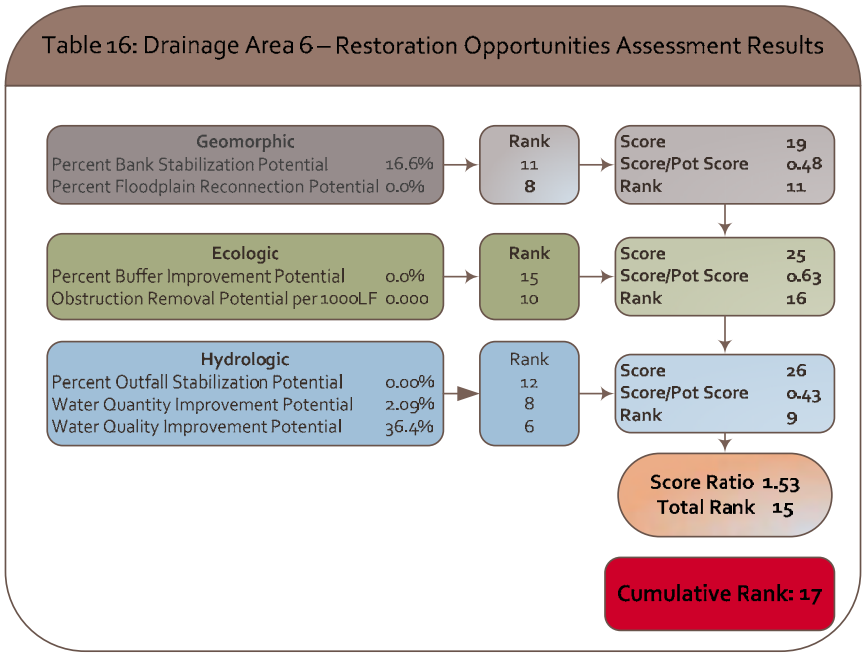
SWM Assessment: Based on the information provided by Baltimore County, one existing detention pond (1473) is located within DA-6. It appears that major excavation and/or stabilization work was recently completed within the area of the pond. According to the as-built plans, the pond was constructed online with the stream channel. An inlet has been installed to bypass the existing stand pipe and connects into the concrete riser structure. Currently, the

stream channel flows into the inlet and through the riser structure, providing no retention of stormwater runoff or stream flow.

Six outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, these locations did not warrant the need for any enhancements at this time.

Restoration Opportunities

Restoration opportunities identified within DA-6 are included in ***Figure 32*** and are described below. ***Table 16*** highlights the assessment results for this drainage area.



Channel Improvements: As the drainage area with the second shortest length of channel and a low level of existing conditions impairment, limited channel improvement potential was identified. A potential project could extend from the just east of the power line right of way, upstream approximately 400 feet to the western edge of DA-6. As discussed in the existing conditions above, the mainstem channel within DA-6 extends through a power line right of way where the buffer is significantly interrupted and it is from this section extending upstream that the channel exhibits signs of channel incision and bank instability. Channel bed and bank stabilization are recommended to prevent further incision and widening.

SWM Improvements: Based on the initial assessment, existing detention Pond 1473 within DA-6 was identified as retrofit candidate. The existing facility is an online system that provides minimal treatment of stormwater runoff. Improvements include creation an off-line shallow marsh/wetland facility with a bypass system for larger storm events. The existing riser structure and perforated CMP stand pipe should be replaced with a single riser structure designed to maximize treatment. The facility can be easily accessed from Simms Road and the downstream embankment is in good condition.

No outfall enhancements are recommended within DA-6.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Magledt Rd
Seven Oaks Elementary School
I473
Bretton Reef Rd
Hines Rd
Simms Ave
Hines Estates
Naygall Rd
Lower Gunpowder Falls Watershed Assessment
Figure 32:
Drainage Area 6
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.7 Drainage Area 7

Introduction

Location: DA-7 is located in the central western portion of the subwatershed (***Figure 33***). This drainage area is 37 acres in size or 0.06 square mile and contains approximately 0.41 mile of stream channel.

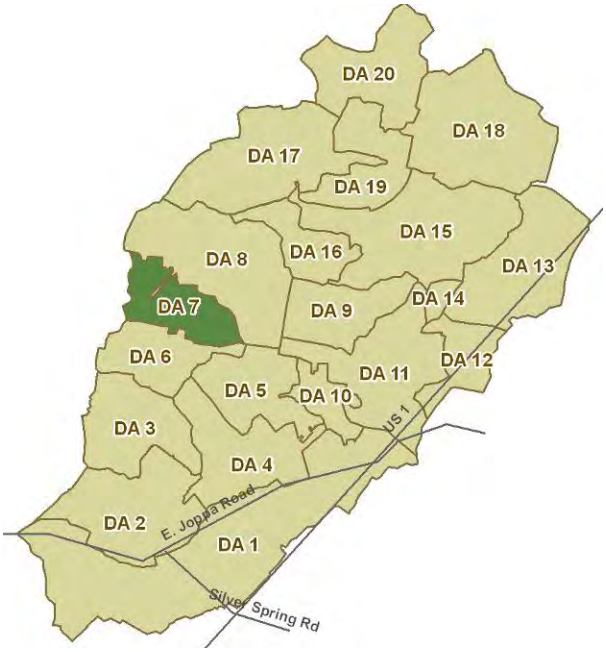


Figure 33
Drainage Area 7

Land Use: Approximately 16.4 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential. A portion of the Seven Oaks Elementary School, which is classified as institutional land use, is located in the north eastern portion of the drainage area. There is also a small area of forest in the northern portion. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soils within the drainage area mainly consist of Glenelg-Urban land complex (GfC/B) (37%), Croom-Urban complex (CoD) (16%) and Issue silt loam (IsA) (16%) ***(Figure 34)***. The Glenelg-Urban land complex series is found along the floodplain areas and along a small section of stream. The Glenelg series consists of fine-loamy well drained soil formed in residuum weathered from micaceous schist. Urban land is area covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The series Issue silt loam, a somewhat poorly drained soil derived from loamy and sandy alluvium, is found along the stream channel**.**

Existing Conditions

Figure 35 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-7 are highlighted in ***Table 17.***

Channel Conditions: The channel segment within DA-7 initiates within a piped segment that crosses under Tila Road. Upstream of Tila Road the channel extends approximately 450 feet to Simms Road. The riparian buffer has been cleared completely for the first 200 feet and the adjacent homeowner maintains a closely mowed lawn up to the edge of water. The channel is stable along this length with a bedrock cascade holding grade and low banks of only one to two feet in height. The remaining channel length extending to Simms Road travels through a narrow riparian corridor bound by a residential property to the south and recreational fields to the north. The banks throughout this length are densely vegetated with invasive vines and shrubs. A small stand of Phragmites exists immediately downstream of the Simms culvert.

Legend
Streams
Soils
Drainage Areas
Quail Run
Northwind Farms
Ferguson Ave
Northwind Rd
Walther Blvd
Cody Ave
Magledt Rd
Montauk Ct
Simms Rd
Hines Rd
Seven Oaks Elementary School
CoD
ShD
IsA
GfC
CbD
EgB
GfB
MeD
MeB
DcB
CbB
Lower Gunpowder Falls Watershed Assessment
Figure 34:
Drainage Area 7
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Quail Run
Northwind Farms
Ferguson Ave
Northwind Rd
Walther Blvd
Cody Ave
729
Seven Oaks Elementary School
Magledt Rd
Montauk Ct
Simms Rd
Hines Rd
Lower Gunpowder Falls Watershed Assessment
Figure 35:
Drainage Area 7
Existing Conditions
0
200
400
Feet
N
McCormick Taylor
Engineers & Planners Since 1946

Table 17: Drainage Area 7 – Existing Conditions Assessment Results

Geomorphic		Rank
Shear Velocity (ft/s):	1.02	17
Width/Depth Ratio:	0.98	9
Threshold Grain Size:	1.03	17
Bank Height Ratio:	4.11	2

Score	45
Score/Pot Score	0.56
Rank	12

Ecologic		Rank
Percent Forested per DA	1.8%	1
Headcuts per 1000 LF Channel	0.46	13
Percent Channel w/ Impaired Riparian	57.3%	5
Long Interruptions per1000 LF Channel	1.39	12
Encroachments per 1000LF Channel	0.46	13
Outfalls per Acre DA	0.136	5

Score	49
Score/Pot Score	0.41
Rank	4

Hydrologic		Rank
2yr Discharge Ratio (cfs)	1.08	19
Percent Impervious per DA	16.4%	18
Percent DA to SWM	30.7%	10

Score	47
Score/Pot Score	0.78
Rank	20

Score Ratio	1.75
Total Rank	15

Upstream of Simms Road the channel exhibits a moderate level of incision with bank heights increasing as the channel progresses upstream. Channel incision is arrested by a large gabion at the confluence of a pond outfall and the stream channel approximately 230 feet upstream of Simms Road. The gabion is undermined and slumping with a drop of approximately five feet from the top of the gabion basket to the stream bed downstream. A narrow riparian buffer of mature trees exists along the channel over this length.

The channel and buffer condition change dramatically upstream of the slumped gabion outlet protection. Bank heights of one to two feet extend for a length of approximately 200 feet upstream of the slumped gabion basket. The riparian buffer has been completely removed along this length as the property owner maintains a mowed grass yard up to the edge of water. If the gabion were to completely fail downstream there is limited resistance to prevent headcut migration through this reach.

Upstream of the cleared buffer the channel continues for approximately 400 feet to Walther Boulevard. The valley width narrows and gradient increases along this length. The riparian buffer along the left bank ranges in width from 30 to 50 feet with residential properties and mowed lawns encroaching on this width. The right floodplain and streambank is defined by the berm for a SWM pond located at the end of Montauk Court. The pond footprint has reduced the mature riparian buffer width to as low as 30 feet. An early succession forest is beginning to establish with a dense understory where the buffer was previously narrowed.

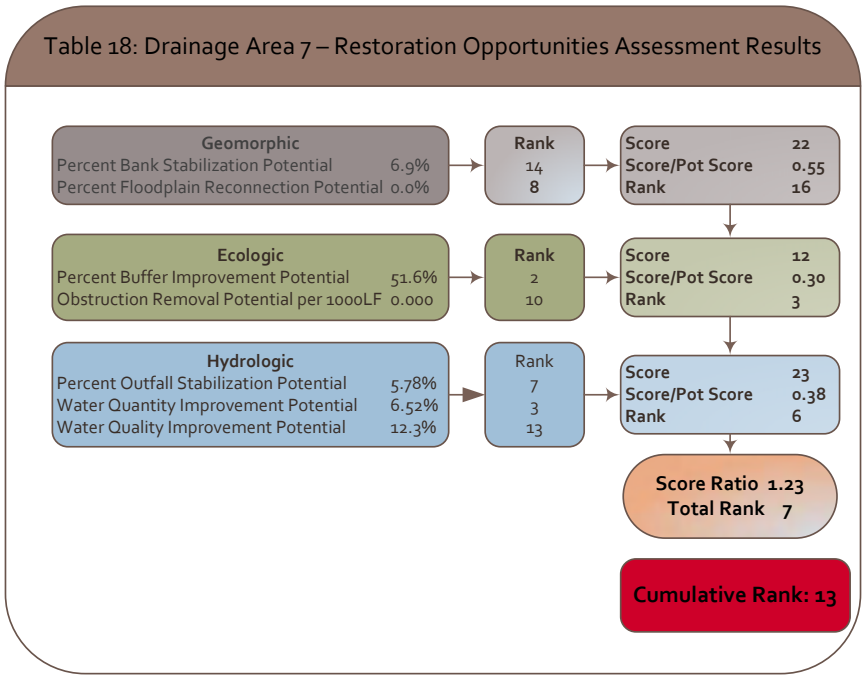
The stream loses channel definition upstream of Walther Boulevard disappearing into a broad stand of cattails within the power line right of way at the upstream extent of the drainage area.

SWM Assessment: Based on the information provided by Baltimore County, one existing detention pond (729) is located within DA-7. The inflow channel is slightly incised and the facility is moderately overgrown. Based on the As-Built plans, the low flow orifice is 15” in diameter, which provides little to no retention of stormwater runoff. The outfall pipe discharges into a gabion lined channel which is deteriorating at the confluence with the stream channel.

Two outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, only one of the locations (Outfall 16) was identified as a possible enhancement site. Outfall 16 discharges into an existing forebay area and grass swale. The forebay contains gravel and sediment.

Restoration Opportunities

Restoration opportunities identified within DA-7 are included in ***Figure 36*** and are described below. ***Table 18*** highlights the assessment results for this drainage area.



Channel Improvements: Recommended improvements in DA-7 include the removal of gabion baskets and addressing localized incision in the channel upstream of Simms Road. The observed "slumping" condition of the gabion baskets may be indicative of its instability and potential for a future headcut if it fails. Likely restoration solutions here would be to either replace the gabions with a step pool system to minimize longitudinal impacts or replace with a more extensive, lower gradient riffle-pool complex.

The opportunities identified in this area also include the re-establishment of riparian vegetation to improve channel protection, instream (shading) and riparian habitat.

SWM Improvements: Based on the initial assessment, existing detention Pond 729 within DA-7 was identified as retrofit candidate. The pond embankments are stable however minimal water quality treatment is provided. The existing riser structure should be modified or replaced to maximize water quality treatment and the inflow channel stabilized. The excess vegetation should be removed from the facility to prevent clogging of the riser structure. Gabions along the pond outfall channel should be stabilized.

One outfall (16) was identified as a potential enhancement location. Enhancement options at this outfall include widening the existing grass channel and/or installing small check dams or berms to provide additional retention of stormwater runoff. Based on the results of a geotechnical

analysis, a small BMP such as a rain garden or bioretention facility may also be installed. This facility could serve as an educational opportunity for the adjacent school.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Bank Stabilization Potential
Riparian Buffer Establishment
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Ferguson Ave
Northwind Rd
Walther Blvd
Cody Ave
729
Seven Oaks Elementary School
16
Magledt Rd
Montauk Ct
Simms Rd
Hines Rd
Lower Gunpowder Falls Watershed Assessment
Figure 36:
Drainage Area 7
Restoration Opportunities
0 200 400 Feet
N
McCormick Taylor

V.8 Drainage Area 8

Introduction

Location: DA-8 is located in the north western portion of the subwatershed (***Figure 37***). This drainage area is 87 acres in size or 0.14 square mile and contains approximately 0.86 mile of stream channel.

Land Use: Approximately 21.7 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential, which is located in the central and north-western portions of the drainage area. Forested land traverses the central portion of the drainage area with high density residential land to the north. The Seven Oaks Elementary School is also partially located in the south-east portion of this drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

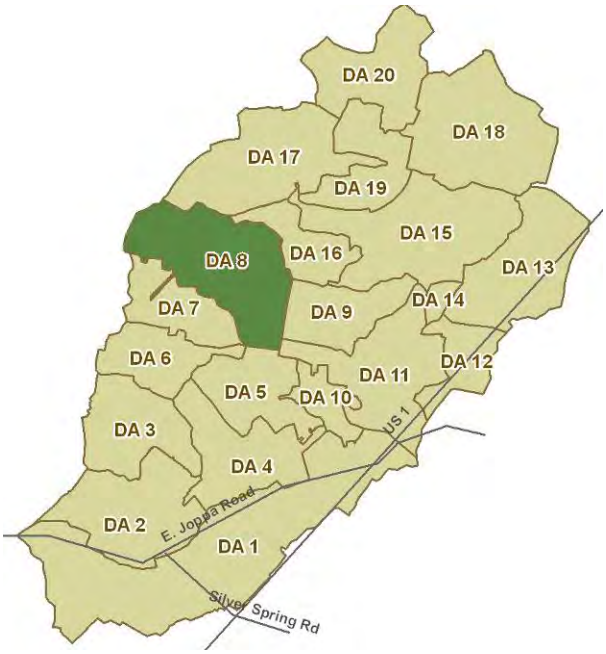


Figure 37
Drainage Area 8

Soils: The soils within the drainage area mainly consist of Urban land-Udorthents (UuB) (33%), Glenelg-Urban land complex (GfB/C) (17%), Comus silt loam (CgA) (16%) and Sassafras-Croom-Urban land complex (ShD) (11%) ***(Figure 38)***. The floodplain consists mainly of Urban land-Udorthents and Sassafras-Croom-Urban land complex. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. The series Sassafras consists of well-drained soil from sandy marine and old alluvial sediments. The Croom series consists of well-drained soil from gravelly fluvial deposits. Urban land is area covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The series Comus silt loam series is found along and adjacent to the stream channel. It consists of well drained soils that are formed in alluvium high in mica.

Existing Conditions

Figure 39 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-8 are highlighted in ***Table 19.***

Legend
Streams
Soils
Drainage Areas
Seven Courts Dr
Proctor Ln
Quail Run
Quails Nest Ct
Northwind Farms
Simms Rd
Walther Blvd
Ferguson Rd
Seven Oaks Elementary School
DcB
GfB
CbB
CbD
CbB
DcB
MeC
UuB
MeD
MeB
CgA
ShD
GfB
GfC
UuB
ShD
IsA
GfC
EgB
ShD
GoD
ShD
Lower Gunpowder Falls Watershed Assessment
Figure 38:
Drainage Area 8
Soils
N
0
200
400
Feet
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Seven Courts Dr
Proctor Ln
1786
2209
Seven Oaks Elementary School
1003
2180
Simms Rd
Quail Run
Quails Nest Ct
Seven Courts Dr
Northwind Farms
Walther Blvd
215
Lower Gunpowder Falls Watershed Assessment
Figure 39:
Drainage Area 8
Existing Conditions
N
0 200 400 Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Channel Conditions: The main channel for DA-8 starts at Seven Courts Drive and extends up to Fergusson Drive. The channel is deeply incised with very steep stream banks on both sides of the channel, from Seven Courts Drive up to a power line right of way road near the end of Hoban Court. The channel is surrounded by a mature hardwood forest.

There is a small tributary drainage way leading from the Seven Oaks Elementary School stormwater facility which connects with the main channel just before it goes under Seven Courts Drive. The drainage channel is steep and highly incised with significant erosion at the outfall stone apron.

Table 19: Drainage Area 8 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.08	6	Score	24
Width/Depth Ratio:	0.89	6	Score/Pot Score	0.30
Threshold Grain Size:	1.17	6	Rank	3
Bank Height Ratio:	2.57	6		

Ecologic		Rank	Score	
Percent Forested per DA	18.3%	16	Score	68
Headcuts per 1000 LF Channel	1.76	2	Score/Pot Score	0.57
Percent Channel w/ Impaired Riparian	33.3%	13	Rank	15
Long Interruptions per1000 LF Channel	1.32	16		
Encroachments per 1000LF Channel	0.44	14		
Outfalls per Acre DA	0.126	7		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.48	12	Score	39
Percent Impervious per DA	21.7%	13	Score/Pot Score	0.65
Percent DA to SWM	40.7%	14	Rank	16

Score Ratio	1.52
Total Rank	11

On the main stem, the power line right of way road is functioning as a berm for overland runoff and discharges from a street drain on Hoban Court on the north side of the main stream channel. This surface water crosses the berm in several places and then flows through the woods towards the stream. This flow has caused a series of bank head cuts as the water drops four to five feet into the incised stream bed. On the south side of the main channel there is stormwater facility at the end of Chatham Court. The discharge from the outfall pipe flows over a level spreader and then transforms into a single thread channel through the woods. As a progressively developing headcut, the water drops approximately seven feet to reconnect to the stream bed.

The power line right of way road crossing creates a significant break in the stream corridor. The road bed and undersized pipes are held in place by a large amount of rubble fill. A backwater condition has been created above the undersized pipes. The banks are less than six inches high on the upstream side of the road. The streambed drops approximately six feet downstream of the road. Above the right of way, the stream gradient is relatively flat with very low streambanks and evidence of frequent overbank flow. The riparian zone in this area is inadequate.

Approximately 350 feet above the right of way two stormwater outfall pipes enter the channel from opposite banks. Moving further upstream, the remnants of an old concrete dam and a bedrock outcrop are the next significant streambed features. These features coincide with a natural steep break in the valley gradient. From this point, the stream gradient is reduced and the

stream banks are less steep for approximately one-thousand feet. The riparian zone has been impacted by the utility line which runs parallel to the stream channel. It appears that vegetation maintenance has disturbed much of the riparian zone and allowed multiflora rose and other vines to dominate the understory between Chatham and Sandstone Courts.

As the steam valley approaches Proctor Lane and Walther Boulevard the stream bed crosses under the right of way. For approximately 380 feet there are a variety of impacts including: eroding outfalls from the end of Proctor Lane, Quails Nest Court, and Walther Boulevard, undersized pipes on the right of way and streambank and bed erosion.

Upstream from Proctor Lane the stream traverses a mature hardwood forest. The channel is relatively steep and narrow but the banks are stabilized with tree roots. As the stream approaches the end of the forested segment it crosses the east west power line right of way and another larger high tension power line right of way that runs north/south across the top of the drainage basin.

It appears that the original stream valley ran parallel to Quails Nest Court up to Ferguson Drive, however, mass grading of the right of way has cut off the headwaters of the original channel. The top of the existing flow path observed in the field originates from a stormwater basin off Morn Mist Court. Surface flow from the basin is running across the north/south right of way before it enters the head of the ravine. There are several headcuts and erosion areas that are caused by stormwater outfalls that drain into the top of the wooded ravine.

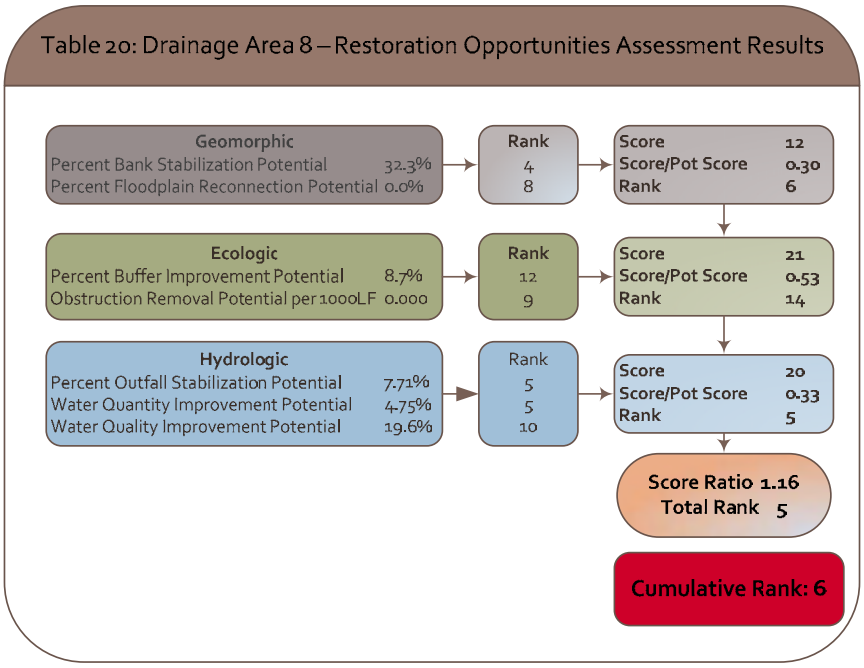
SWM Assessment: Based on the information provided by Baltimore County, six existing SWM facilities are located within DA-8; two detention ponds (215 and 757) and four extended detention ponds (1003, 1786, 2180 and 2209). Pond 215 is in poor condition. The inflow point is heavily silted, the outflow is littered with trash and debris and the low flow pipe acts as a berm within the pond. Based on adjacent property owner information, the pond shape has been altered since the original construction and no longer functions properly. Pond 757 does not exist. Construction Plans were available but it is unclear if the pond was ever constructed. Ponds 1003 and 2209 appear in good condition, however they contain a moderate amount of vegetation and sediment accumulation within the inflow pipes, low flow pipes and facility bottoms. Pond 2209 shows evidence of burrowing along the embankments. Pond 1786 is in fair condition. The riser access road acts as a berm within the facility and there are no defined forebay or treatment areas. The invert of the outfall pipe has completely rusted out and a large headcut has formed downstream. Pond 2180 is in very good condition with stable inflow points.

Four outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, two of the locations (Outfalls 18-19) were identified as a possible enhancement sites. Outfall 18 is located where pond 757 should be (based on Construction Plan information) and is experiencing erosion at the confluence with the stream channel. Outfall 19 is located at the end of a dead end street where sheet flow from the roadway concentrates into a riprap channel upstream of a wetland area.

Restoration Opportunities

Restoration opportunities identified within DA-8 are included in ***Figure 40*** and are described below. ***Table 20*** highlights the assessment results for this drainage area.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Bank Stabilization Potential
Riparian Buffer Establishment
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Proctor Ln
18
19
1786
Seven Oaks Elementary School
Simms Rd
Quail Run
Quails Nest Ct
Seven Courts Dr
Northwind Farms
215
Walther Blvd
Ferguson Rd
Lower Gunpowder Falls Watershed Assessment
Figure 40:
Drainage Area 8
Restoration Opportunities
N
0 200 400
Feet
McCormick Taylor
Engineers & Planners Since 1946



Channel Improvements: The channel system within DA-8 is in a relatively precipitous area of the watershed and exhibits a very complex and interrupted drainage network comprised of multiple head cuts and eroding channels from stormwater ponds. The lower section of the main channel just upstream of Seven Courts Drive is deeply incised and in need of bank stabilization. Pond 1786 is in need of repair as well as its receiving channel down to the mainstem. Similar stabilization is required of the outfall channel from Pond 2209, particularly near the main channel confluence.

As noted in the existing conditions assessment above, headcuts along the powerline corridor roadway have created significant breaks in the system. Above the headcuts an emergent and scrub shrub wetland has established along the power line corridor and extending upstream towards the Hoban Ct. townhomes. Opportunities along this section include the improvement and proper stabilization of the headcut locations and minor channel re-aligment away from the rear of the townhouses. Additional bank stabilization opportunities exist upstream and behind the townhomes along Sandstone Court as well as an outfall and channel stabilization near Walther Boulevard and the power line right-of-way.

Of note on the property adjacent to the Seven Oaks Elementary School was the observation of trail markers and what appeared to be abandoned trails. It appears due to the severity of the channel incision in this lower section that the trail system may not be getting as much use as intended. There is an opportunity here to both improve the channel stability and provide for a better environment for the trail system and associated crossings.

SWM Improvements: Based on the initial assessment, existing detention Pond 215 and existing extended detention Pond 1786 were identified as retrofit candidates. Pond 215 will require major embankment reconstruction and installation of a new riser designed to increase retention capacity and maximize treatment. Improvements to Pond 1786 include removal of the access berm located within the facility in order to re-establish treatment cell reconnection. The separate cells should be re-graded into shallow wetland areas to maximize treatment. A new riser

structure and outfall pipe should be installed and the outfall channel stabilized. This facility could serve as an educational opportunity for the adjacent school. Existing Ponds 1003, 2180 and 2209 require maintenance. Recommended maintenance activities include vegetation and debris removal, riser structure cleaning and minor outfall channel stabilization.

Two outfalls locations (18 and 19) were identified as potential enhancement locations. Enhancement options at Outfall 18 include construction of a pocket pond or bioretention facility BMP near the storm drain end section and channel stabilization to the confluence with the stream channel. Prior to constructing any improvements at this location, it should be determined if pond 757A was constructed and/or removed from this site and for what reason. The riprap at Outfall 19 should be replaced with a grass swale or bioswale BMP with check dams or berms to provide additional retention of stormwater runoff.

V.9 Drainage Area 9

Introduction

Location: DA-9 is the most centrally located of all the drainage areas (***Figure 41***). It is 41 acres in size or 0.06 square mile and contains approximately 0.58 mile of stream channel.

Figure 41
Drainage Area 9

Land Use: Approximately 19.3 percent of this drainage area contains impervious surfaces. The dominate land use is medium density residential with a smaller area in the southern portion of the drainage area designated as high density residential. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soils within the drainage area mainly consist of Urban land-Udorthents (UuB) (42%), Comus silt loam (CgA) (17%), Glenelg-Urban land complex (GfB) (16%), Manor-Urban land complex (MeB/D) (15%) and Delanco-Urban land complex (DcB) (9%) ***(Figure 42)***. Most of the soils contain urban land- areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The northern floodplain consists of Urban land-Udorthents and the southern floodplain consist mainly of the Delanco-Urban land complex and the Manor-Urban land complex. Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. The Delanco series consists of moderately well-drained and somewhat poorly drained soil formed in alluvium washed from areas of micaceous crystalline rocks. The Manor coarse loam series is a well-drained soil derived from residuum weathered from micaceous schist. The Comus silt loam series is found along and adjacent to the stream channel. It consists of well drained soils that are formed in alluvium high in mica**.**

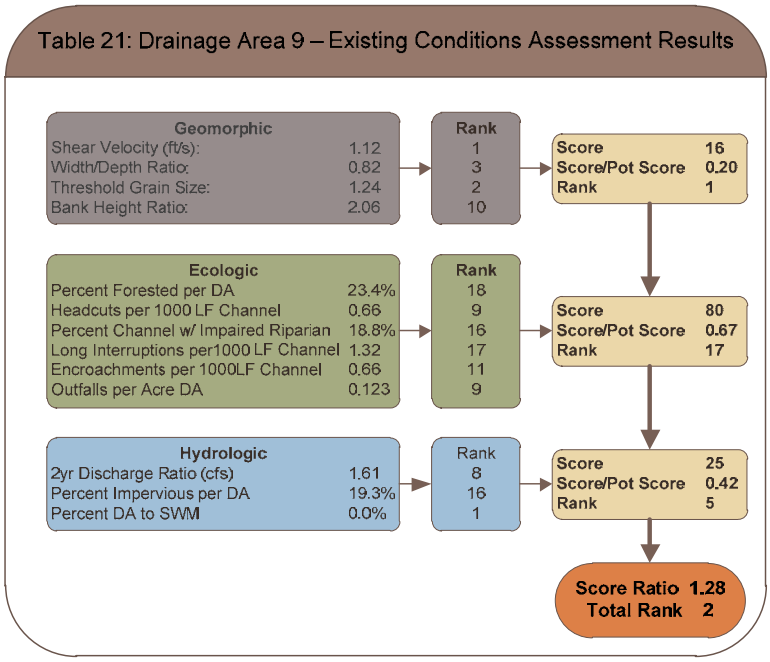
Existing Conditions

Figure 43 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-9 are highlighted in ***Table 21.***

Channel Conditions: Extending from the downstream limit at the culvert under Pinedale Drive to the power line crossing approximately 500 feet upstream, the stream channel meanders between a forested slope on the left and backyard lawns on the right. Stream banks are up to seven feet high in places, and bank erosion is occurring at the meander bends, particularly where bends are adjacent to lawn areas.

Legend
Streams
Soils
Drainage Areas
Pinedale Dr
Seven Courts Dr
Romanoff Ct
Plantagenet Circle
UuB
MeB
MeD
MeD
CgA
DcB
GlB
MeB
CbB
CbB
Lower Gunpowder Falls Watershed Assessment
Figure 42:
Drainage Area 9
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Pinedale Dr
Seven Courts Dr
Romanoff Ct
Plantagenet Circle
Lower Gunpowder Falls Watershed Assessment
Figure 43:
Drainage Area 9
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946



About 500 feet upstream from Pinedale Drive, the stream is conveyed through a culvert comprised of two corrugated metal pipes under the power line right of way. There is a 3 to 4 foot drop in grade between the upstream and downstream sides of the culvert. Additionally, a large amount of debris has collected at the upstream side of the culvert, mostly obscuring the culvert openings. A gully has formed along the left side of the culvert, where water flows over the crossing due to water backup from the clogging debris. Upstream of the culvert, the channel is aggrading due to sand deposition from the backwater. However, the channel also has better access to the floodplain upstream of the culvert. Riparian forest buffers upstream of the culvert range from 10 to 40 feet wide, and the forest is encroached by backyard lawns, particularly along the right side of the stream.

Between the power line right of way and Seven Courts Drive, the stream meanders through a wide forested corridor. Backyard lawns extend close to the stream channel in some locations, and moderate bank erosion occurs along the lawn areas. Banks typically average three feet high in this reach, and minor erosion is occurring at meander bends. The sewer line crosses the stream channel in three locations. The sewer line is protected with riprap at these crossings, creating large grade changes in the streambed that effectively act as a progressive stepping down of the stream. The riprap areas also create fish migration barriers due to the large drop at the downstream end of each riprap section, and minor bank erosion occurs along both banks downstream of each riprap section. Outfalls on either side of the channel throughout this reach are causing gullies and headcuts in the floodplain.

SWM Assessment: Based on the information provided by Baltimore County, there is no existing SWM facilities located within DA-9.

Five outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, only one of the locations (Outfall 17) was identified as a possible enhancement site. The end section and several upstream pipe sections have disconnected at this

outfall. There is a steep grade from the outfall invert to the stream channel lined with riprap however no headcutting or erosion was observed.

Restoration Opportunities

Restoration opportunities identified within DA-9 are included in ***Figure 44*** and are described below. ***Table 22*** highlights the assessment results for this drainage area.

Table 22: Drainage Area 9 – Restoration Opportunities Assessment Results

Geomorphic		Rank	Score	20
Percent Bank Stabilization Potential	11.5%	12	Score/Pot Score	0.50
Percent Floodplain Reconnection Potential	0.0%	8	Rank	13
Ecologic		Rank	Score	18
Percent Buffer Improvement Potential	2.8%	14	Score/Pot Score	0.45
Obstruction Removal Potential per 1000LF	0.988	4	Rank	11
Hydrologic		Rank	Score	45
Percent Outfall Stabilization Potential	0.0%	12	Score/Pot Score	0.75
Water Quantity Improvement Potential	0.0%	16	Rank	17
Water Quality Improvement Potential	0.0%	17		

Score Ratio 1.70
Total Rank 17

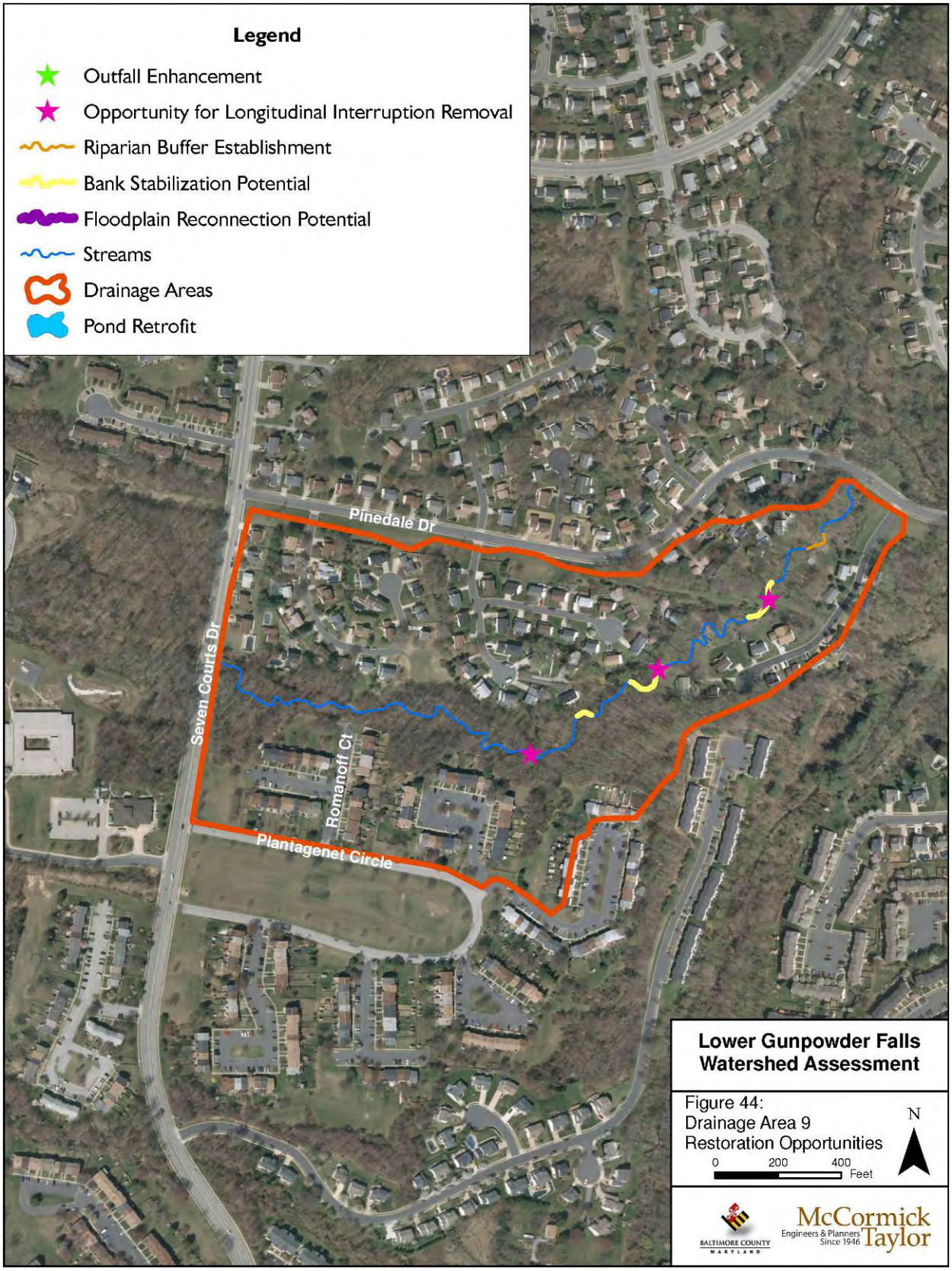
Cumulative Rank: 12

Channel Improvements: Initial desktop evaluations of floodplain reconnection potential in Drainage area 9 indicated the site offered reconnection opportunities. However, the main section from Seven Courts Drive downstream to the powerline right-of-way appears to be in relatively stable condition with evidence of recent floodplain access. A severely eroded bank at the outfall from Romanoff Ct., however, does offer a stabilization opportunity.

Upstream of the Pinedale Drive crossing, a Longitudinal Interruption Removal in the form of an undersized culvert along the powerline right-of-way provides an opportunity to improve the connectedness of the stream system and reduce erosion.

SWM Improvements: There are no existing SWM facilities located within DA-9.

Outfall 17 was identified as a site with structural issues. Recommended improvements include repair of the pipe joint disconnection at the end section to prevent future pipe and stream bank failures. Channel stabilization and/or BMP installation was not feasible at this location due to the steep slopes, limited space between the outfall and stream bed and utility conflicts.


Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Pinedale Dr
Seven Courts Dr
Romanoff Ct
Plantagenet Circle
Lower Gunpowder Falls Watershed Assessment
Figure 44:
Drainage Area 9
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.10 Drainage Area 10

Introduction

Location: DA-10 is located in the south eastern portion of the subwatershed (***Figure 45***) and is one of the smaller drainage areas. It is 19 acres in size or 0.03 square miles and contains approximately 0.28 mile of stream channel.

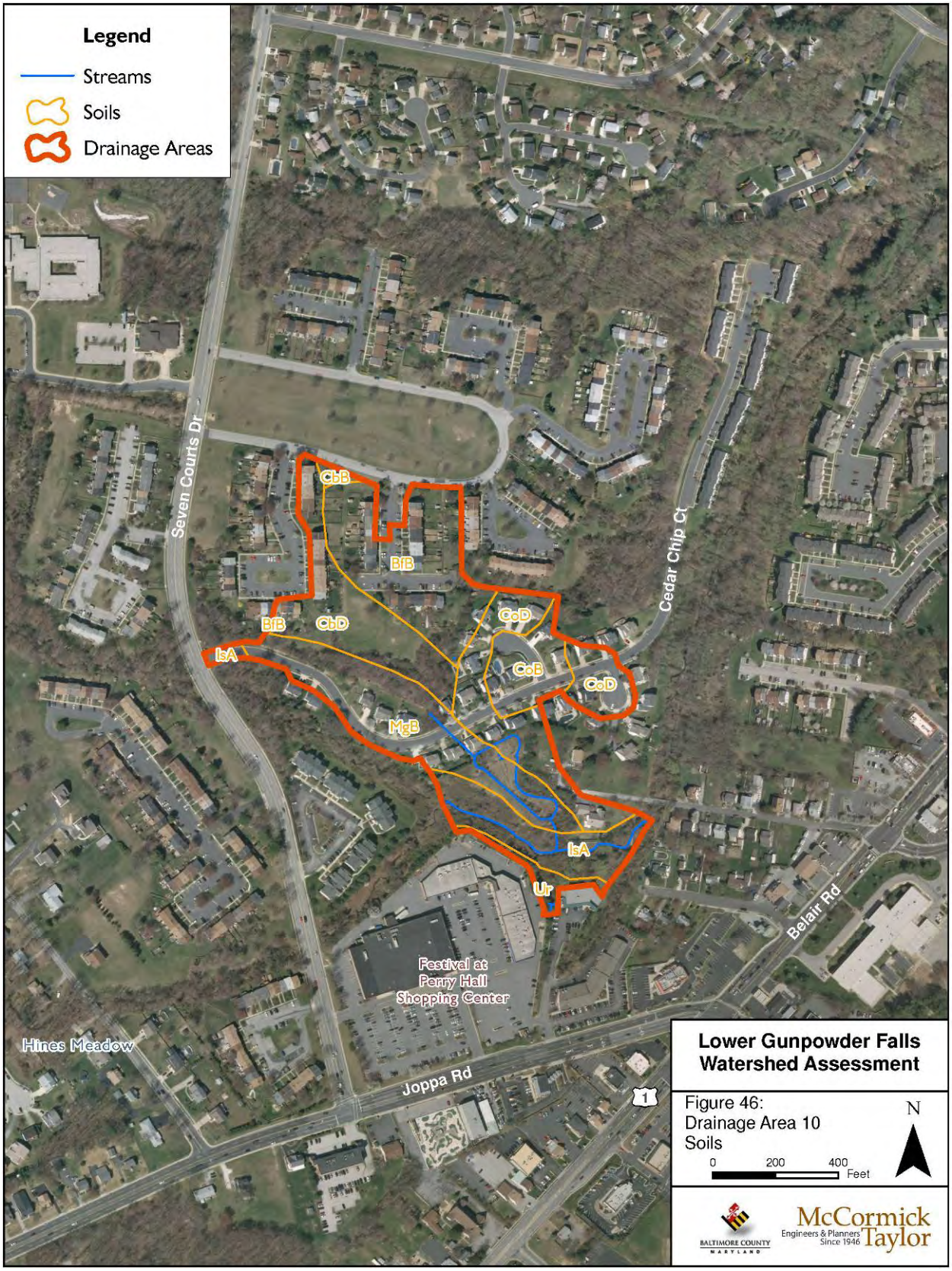
Figure 45
Drainage Area 10

Land Use: Approximately 21.1 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential. Smaller areas of commercial and high density residential are located in the south-eastern and north western portion of the drainage area, respectively. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soils within the drainage area mainly consist of Croom-Urban complex (CoB/D) (26%), Metapeake-Urban complex (MgB) (22%), Beltsville-Urban land complex (BfB) (22%), and Christiana-Urban land complex (CbD) (16.5%) and Issue silt loam (IsA) (12%) ***(Figure 46)***. Most of the soils contain urban land- areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The soil series located along the floodplain consists mostly of Croom-Urban complex and Christiana-Urban land complex. The Croom series consists of well-drained soil from gravelly fluvial deposits. The Christiana soils are moderately well-drained and are derived from clayey fluviomarine deposits. The stream channel and areas directly adjacent to the channel consist mainly of Metapeake-Urban complex and Issue silt loam. The Metapeake series consist of well drained soils derived from silty eolian sediments underlain by coarser fluvial or marine sediments. The Issue silt loam series is somewhat poorly drained soil derived from loamy and sandy alluvium**.**

Existing Conditions

Figure 47 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-10 are highlighted in ***Table 23.***


Legend
Streams
Soils
Drainage Areas
Seven Courts Dr
Cedar Chip Ct
Belair Rd
Joppa Rd
Festival at Perry Hall Shopping Center
Hines Meadow
CbB
BfB
CbD
IsA
CoD
CoB
MgB
Ur
Lower Gunpowder Falls Watershed Assessment
Figure 46:
Drainage Area 10
Soils
0 200 400 Feet
N

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Seven Courts
Cedar Chip Ct
I744
Belair Rd
Festival at Perry Hall Shopping Center
Hines Meadow
Joppa Rd
1
Lower Gunpowder Falls Watershed Assessment
Figure 47:
Drainage Area 10
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 23: Drainage Area 10 – Existing Conditions Assessment Results

Geomorphic		Rank
Shear Velocity (ft/s):	1.11	2
Width/Depth Ratio:	0.88	5
Threshold Grain Size:	1.25	1
Bank Height Ratio:	0.73	20

Ecologic		Rank
Percent Forested per DA	6.9%	7
Headcuts per 1000 LF Channel	0.000	15
Percent Channel w/ Impaired Riparian	50.5%	8
Long Interruptions per1000 LF Channel	1.34	15
Encroachments per 1000LF Channel	0.67	10
Outfalls per Acre DA	0.159	1

Hydrologic		Rank
2yr Discharge Ratio (cfs)	1.49	11
Percent Impervious per DA	21.1%	15
Percent DA to SWM	78.7%	18

Score	28
Score/Pot Score	0.35
Rank	7

Score	56
Score/Pot Score	0.47
Rank	9

Score	44
Score/Pot Score	0.73
Rank	18

Score Ratio	1.55
Total Rank	12

Channel Conditions: The mainstem channel extends for approximately 750 feet through DA-10. The stream corridor appears to have been historically altered as the channel exhibits low sinuosity and lacks a mature riparian buffer. The floodplain buffer width ranges from 100 to 150 feet, comprised almost entirely of invasive species of vines and shrubs. A residential property encroaches on the stream channel near the downstream end of the reach and the homeowner has placed riprap in the streambed and along the left bank facing downstream. Overall the channel exhibits a high level of vertical stability particularly within the upstream most 200 feet where a smooth bedrock cascade exists. Bank height increases from downstream to upstream ranging from approximately two to four feet and banks are moderately stable with a dense cover of invasive plant species.

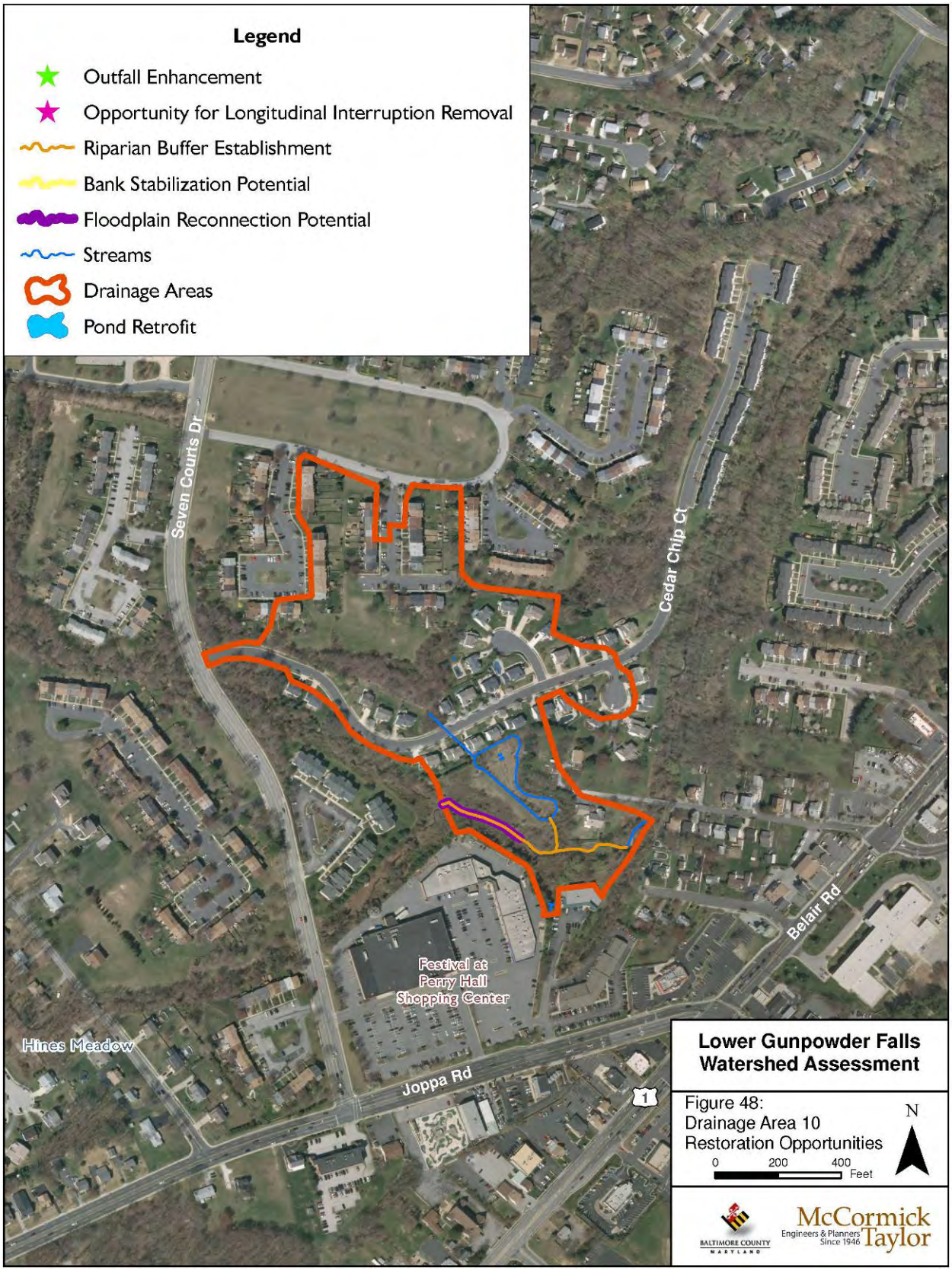
The upstream limit of DA-10 was established at the convergence of two tributaries, DA-4 from the south and DA-5 from the north.

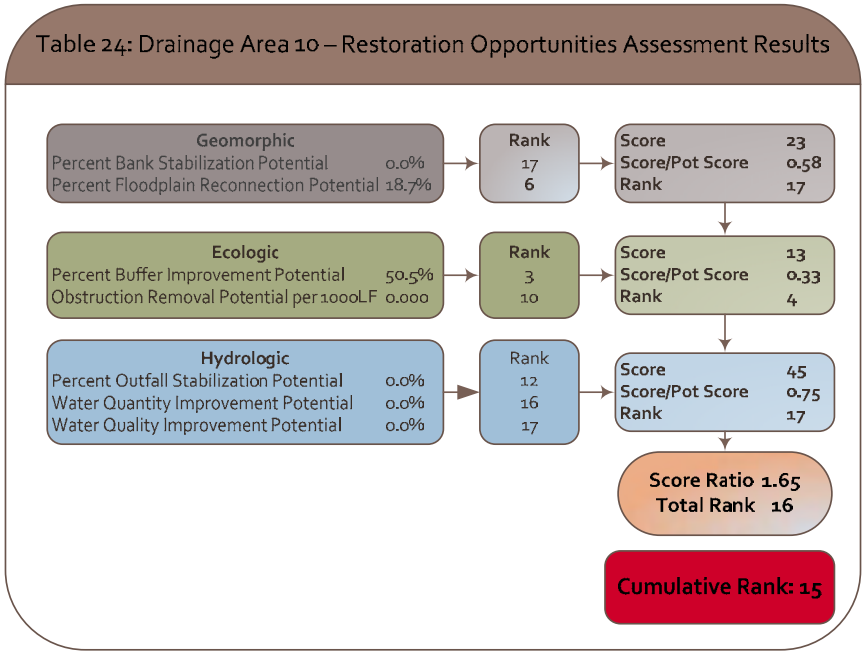
SWM Assessment: Based on the information provided by Baltimore County, one existing extended detention pond (1744) is located within DA-10. The forebay has some sediment accumulation which is causing modest ponding at the gabion weir. However, the riser is in good condition and functioning properly.

No outfall locations were investigated for potential SWM improvements and/or retrofitting within this drainage area.

Restoration Opportunities

Restoration opportunities identified within DA-10 are included in ***Figure 48*** and are described below. ***Table 24*** highlights the assessment results for this drainage area.


Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Seven Courts Dr
Cedar Chip Ct
Belair Rd
Festival at Perry Hall Shopping Center
Hines Meadow
Joppa Rd
1
Lower Gunpowder Falls Watershed Assessment
Figure 48:
Drainage Area 10
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946



Channel Improvements: Behind the Weis Market, there is potential to increase the floodplain connection by grading down the overbank areas and replanting with native species. It is likely this effort will require mechanical and chemical means of eradication of the invasives with a goal to incorporate design features making the site less suitable for non-desirable plants (e.g. increase flood recurrence and attenuation). This work would extend into DA-5 and DA-4.

SWM Improvements: Based on the initial assessment, existing extended detention Pond 1744 within DA-10 requires maintenance. Recommended maintenance activities include removal of sediment accumulation in the forebay and minor fence repair.

No outfall enhancements are recommended within DA-10.

V.11 Drainage Area 11

Introduction

Location: DA-11 is located in the eastern central portion of the subwatershed (***Figure 49***), west of US 1. This drainage area is 73 acres in size or 0.11 square mile and contains approximately 0.65 mile of stream channel.

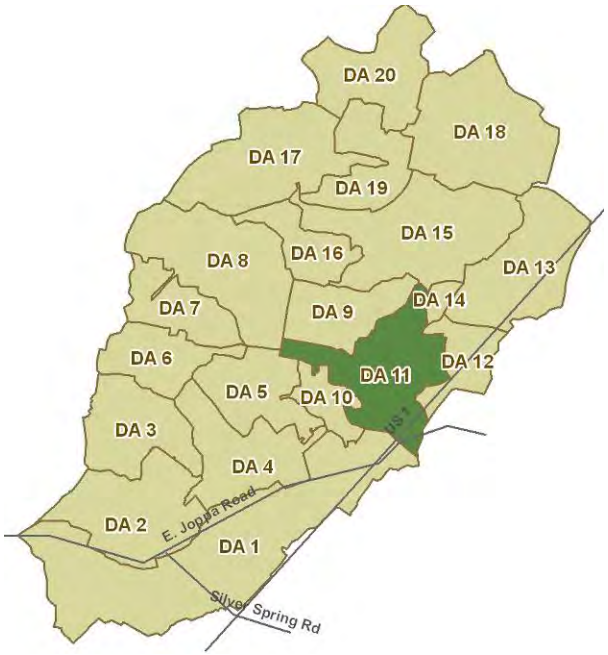
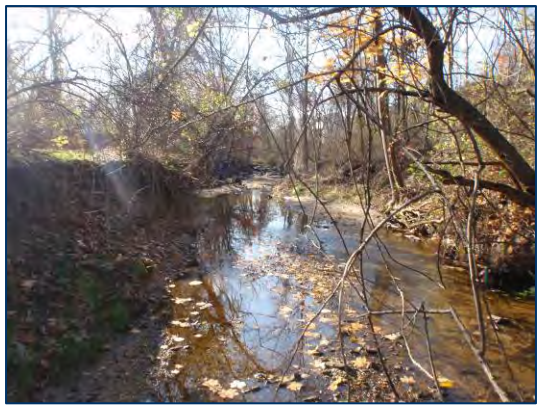


Figure 49
Drainage Area 11

Land Use: Approximately 28.1 percent of this drainage area contains impervious surfaces. The dominate land use in this drainage area is medium density residential. However, a small area of commercial land use is located in the southern portion of the drainage area along US 1. Additionally, high density residential land use is located in the western portion of the drainage area and a small track of forested land traverses down the middle of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area mainly consists of Urban land-Udorthents complex (UuB) (25%), Beltsville-Urban land complex (BfB/D) (15%), Issue silt loam (IsA) (15%), Manor-Urban land complex (MeB/D) (12%), Chillum-Urban land complex (CbB/D) (11%), and Croom-Urban land complex (CoB/D) (9%) **(*Figure 50*)**. The soil adjacent to the stream is Issue silt loam; a somewhat poorly drained soil derived from loamy and sandy alluvium. The floodplain soils consist of Croom-Urban land complex near the western headwaters and Manor-Urban land complex along the western lower floodplain. The northeastern floodplain is primarily Urban land-Udorthents complex while the southeastern floodplain is primarily composed of Beltsville-Urban land complex. Chillum-Urban land complex is found within the drainage area, west of the stream, outside of the floodplain. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The Urban land-Udorthents complex consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Beltsville silty loam is moderately well-drained soil derived from silty eolian over loamy fluviomarine deposits. The series Croom consists of well-drained soil from gravelly fluvial deposits. Manor coarse loam is a well-drained soil derived from residuum weathered from micaceous schist. Chillum silt loam is a well-drained soil derived silty eolian material underlain by loamy marine sediments**.**



Existing Conditions

Figure 51 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-11 are highlighted in ***Table 25.***

Legend
Streams
Soils
Drainage Areas
Cedarside Farm
MeD
MeD
MeB
IsA
OuB
CbB
GfB
CbB
CbD
UuB
Seven Courts Dr
BfB
BfB
CoD
CoB
Minte Dr
BfD
CbB
Cedar Chip Ct
CoB
IuA
CbD
India Ave
Ur
Joppa Rd
Belair Rd
Perry Hall Elementary School
CbB
Festival at Perry Hall Shopping Center
Joppa Rd
1
Perry Hall Square Shopping Center
Lower Gunpowder Falls Watershed Assessment
Figure 50:
Drainage Area 11
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
393
Cedarside Farm
631
Minte Dr
Seven Courts Dr
Cedar Chip Ct
India Ave
Joppa Rd
Belair Rd
Perry Hall Elementary School
Festival at Perry Hall Shopping Center
Perry Hall Square Shopping Center
1
Lower Gunpowder Falls Watershed Assessment
Figure 51:
Drainage Area 11
Existing Conditions
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 25: Drainage Area 11 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.04	12	Score	53
Width/Depth Ratio:	1.15	15	Score/Pot Score	0.66
Threshold Grain Size:	1.08	15	Rank	15
Bank Height Ratio:	1.66	11		

Ecologic		Rank	Score	
Percent Forested per DA	15.6%	13	Score	65
Headcuts per 1000 LF Channel	0.58	10	Score/Pot Score	0.54
Percent Channel w/ Impaired Riparian	24.5%	15	Rank	13
Long Interruptions per1000 LF Channel	2.91	2		
Encroachments per 1000LF Channel	0.58	12		
Outfalls per Acre DA	0.095	13		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.23	16	Score	30
Percent Impervious per DA	28.1%	15	Score/Pot Score	0.50
Percent DA to SWM	24.6%	9	Rank	10

Score Ratio	1.70
Total Rank	14

Channel Conditions: The channel within DA-11 originates approximately 150 feet upstream of Pinedale Drive within a fragmented yet mature riparian corridor. The banks are moderately stable along the first 200 feet of channel with an average bank height of four feet. Immediately beyond this reach the channel crosses through a power line right of way which has been cleared of vegetation. The clearing not only interrupts the riparian buffer width but stream bank stability dramatically decreases within the right of way with the lack of vegetative protection.

Upstream of the power line right of way an abandoned stream crossing with concrete abutments presents a significant channel constriction. Immediately upstream of the abandoned crossing appears as though the channel has been straightened to follow the right valley wall while a large pond/wetland complex occupies the remainder of the floodplain width to the left. The left bank of the stream channel is actually the constructed embankment for the pond over a length of approximately 500 feet. Along this length the channel confinement has disconnected the channel from its floodplain. Channel and floodplain manipulations continue upstream through much of the remainder of the drainage area as the channel appears unnaturally straight and evidence of past and recent infrastructure is identified throughout the channel length. The resulting channel incision and floodplain disconnection are the dominant channel impairments extending upstream to Minte Drive. Along this length a mature forest stand provides a healthy riparian buffer width extending the entire floodplain width ranging from 150 to 200 feet wide.

Changes in floodplain and buffer conditions begin near the SWM pond at the end of Minte Drive as this SWM facility encroaches on the channel from the east and the residential properties along Mapledale Court encroach from the west. A bedrock knick point exists near the confluence of the SWM pond with the mainstem and serves to arrest the level of channel incision extending up from the downstream reach. Channel and floodplain confinement with reduced buffer widths are the dominant channel impairments extending to the upstream limit of the drainage area.

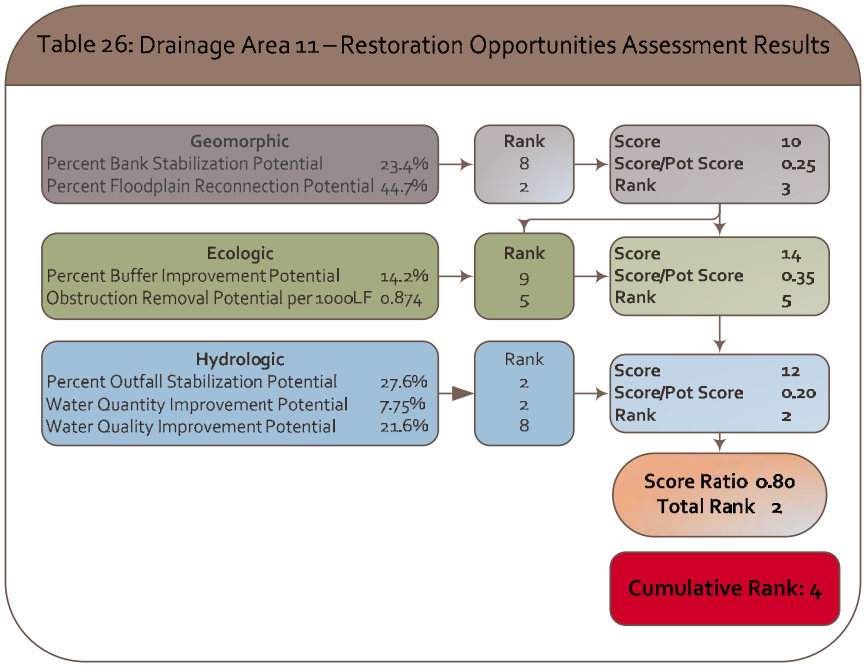
The upstream limit of DA-11, just south of India Avenue, was established at the convergence of two tributaries, DA-1 from the south and DA-10 from the west.

SWM Assessment: Based on the information provided by Baltimore County, one existing extended detention pond (393) and one existing detention pond (631) are located within DA-11. A third area located across the stream channel from 393 appears to have been an old SWM wetland; however, no As-Built or GIS information could be located for this area. Pond 393 has some sediment accumulation but appears dry. The low flow pipe and gravel are clogged but the facility appears functional. Pond 631 appears well maintained with trees recently cut along the embankment. However, the low flow pipe is clogged causing excess ponding. The wetland area across from 393 appears to have experienced an embankment failure. No riser structure or pipe outfall was observed. It is unclear if the wetland area was constructed as a SWM feature or is a remnant of an old farm pond.

Two outfall locations (Outfalls 14-15) were investigated for potential SWM improvements and/or retrofit sites. Outfall 14 is submerged and has no defined outfall channel. Flow from the outfall appears to dissipate into the adjacent wooded area. Outfall 15 is located near 14 and discharges into a highly eroded channel.

Restoration Opportunities

Restoration opportunities identified within DA-11 are included in ***Figure 52*** and are described below. ***Table 26*** highlights the assessment results for this drainage area.



Channel Improvements: Opportunities were identified over a majority of the channel length within DA-11. Within the downstream limits of DA-11 utility line interruption and additional historic manipulations led to interruptions in the form and function of the riparian corridor. Bank stabilization potential is identified for the section of channel extending from the power line right of way upstream to the outlet of Pond 393. Given that the mainstem of DA-11 consists of the main tributary to the Lower Gunpowder Falls, the altered condition of the channel segment between Pond 393 and Minte Drive presents a significant opportunity to restore both this reach

and the receiving Lower Gunpowder. Options here include a combination of bank stabilization efforts and a larger scale floodplain reconnection. Consideration would have to be given to the well established riparian area and whether the reconnection option should focus on bed raising to minimize riparian disturbance.

Additionally, at the upstream limit of DA-11 and extending to within the downstream limit of DA- 1, the east bank on the south side of the India Avenue bridge is in need of stabilization and potential hardening to arrest encroachment onto the adjacent landowners' property.

SWM Improvements: Based on the initial assessment, the wetland (PR2) area, across the stream channel of pond 393, should be converted into shallow marsh or wetland type facility. Improvements to the area include reconstruction of a downstream embankment and installation a riser/outfall structure to maximize SWM treatment.

Existing Ponds 393 and 631 require maintenance. Recommended maintenance activities include removal of vegetation and minimal sediment and riser structure cleaning.

Two outfalls locations (Outfalls 14 and 15) were identified as potential enhancement locations. Due to the close proximity of the outfalls to each other, enhancement recommendations include directing flow from both outfalls to a single pocket pond or bioretention BMP and stabilizing the outfall channel to the confluence with the stream channel. The existing invert elevations of the outfall pipes may hinder the combination of treatment.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
PR2
Cedarside Farm
I5
I4
Seven Courts Dr
Minte Dr
Cedar Chip Ct
India Ave
Joppa Rd
Belair Rd
Perry Hall Elementary School
Festival at Perry Hall Shopping Center
Perry Hall Square Shopping Center
1
Lower Gunpowder Falls Watershed Assessment
Figure 52:
Drainage Area 11
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.12 Drainage Area 12

Introduction

Location: DA-12 is located in the eastern central portion of the drainage area and straddles US 1 (***Figure 53***). It is 27 acres in size or 0.04 square miles and contains approximately 0.20 mile of stream channel.

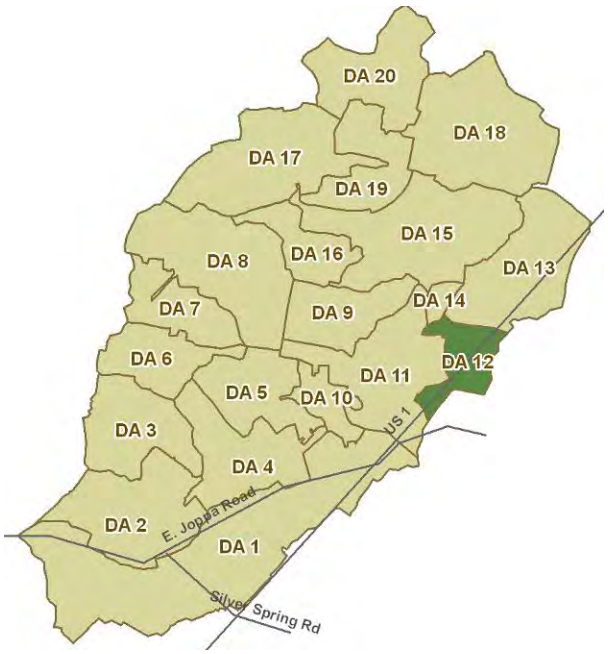


Figure 53
Drainage Area 12

Land Use: Approximately 30.6 percent of the drainage area contains impervious surfaces. The dominate land use in this drainage area is medium density residential with a small portion of commercial land use along US 1. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area mainly consists of Chillum-Urban land complex (CbB/D) (47%), Beltsville-Urban land complex (BfB/D) (27%), Othello-Urban land complex (OuB) (14%), Urban land-Udorthents (UuB) (10%), and Issue silt loam (IsA) (1%) **(*Figure 54*)**. The soil adjacent to the stream is Othello-Urban land complex; a poorly drained soil derived from silty eolian deposits and/or fluviomarine sediments. The floodplain soils consist of Beltsville-Urban land complex at the tributary headwaters. Areas of Chillum-Urban and Urban land-Udorthents run along the eastern and western sides of the tributary, respectively. Issue silt loam is found at the most downstream end of the tributary. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. Beltsville silty loam is moderately well-drained soil derived from silty eolian over loamy fluviomarine deposits. Chillum silt loam is a well-drained soil derived silty eolian material underlain by loamy marine sediments. The Urban land-Udorthents series consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Issue silt loam is a somewhat poorly drained soil derived from loamy and sandy alluvium**.**

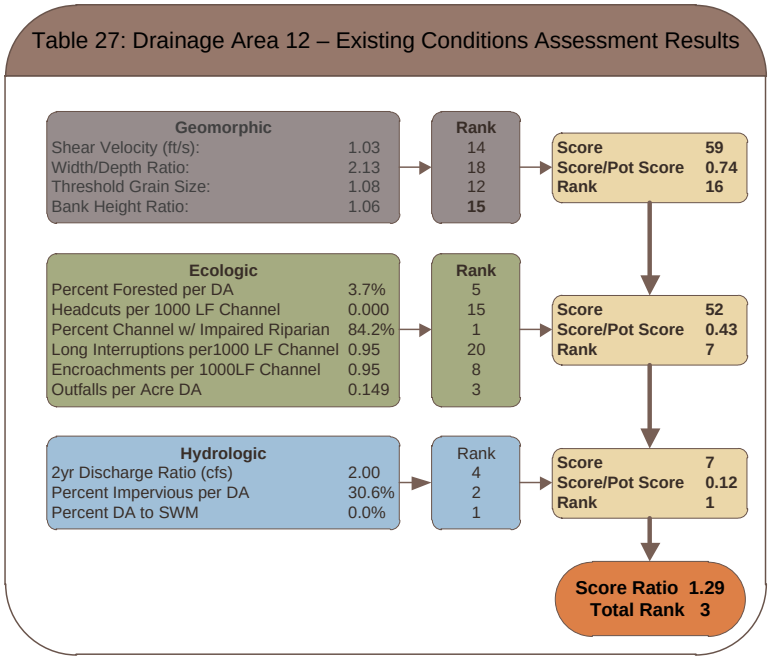
Existing Conditions

Figure 55 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-12 are highlighted in ***Table 27.***

Legend
Streams
Soils
Drainage Areas
Cedarside Farm
IsA
UtB
CbD
Cedarside Dr
Farmside Dr
OuB
UtB
BfB
CbB
Penn Ave
Soth Ave
BfD
CbB
Ur
Belair Rd
Joppa Rd
Perry Hall Elementary School
Joppa Rd
1
Lower Gunpowder Falls Watershed Assessment
Figure 54:
Drainage Area 12
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Cedarside Farm
1
Cedarside Dr
Farmside Dr
Penn Ave
Soth Ave
Belair Rd
Joppa Rd
Perry Hall Elementary School
Joppa Rd
Lower Gunpowder Falls Watershed Assessment
Figure 55:
Drainage Area 12
Existing Conditions
0
200
400
Feet
N
McCormick Taylor
Engineers & Planners Since 1946

Table 27: Drainage Area 12 – Existing Conditions Assessment Results



Channel Conditions: The channel in DA-12 is located in a steep, narrow corridor with an average of 40 feet of riparian buffer on either side of the channel. Stream bank vegetation is mostly composed of multiflora rose. An old wooden bridge structure has collapsed into the channel approximately 150 feet upstream from the confluence with DA-13 and DA-14. On the downstream side of the culvert under Cedarside Drive, the stream bed is protected with gabion baskets that have been in place long enough that trees with six to ten inch DBH are growing on top of the gabion. Upstream of Cedarside Drive, the channel originates in what appeared to be a large SWM facility with wetland characteristics and full of dense common reed or phragmites. The stream channel was only a foot wide through the wetland at the time of the site visit. Upon further evaluation of SWM within the watershed it was discovered that this area was not designed as a SWM facility but is simply a shallow basin which collects and conveys stormflow from multiple outfalls.

SWM Assessment: Based on the information provided by Baltimore County, there is no existing SWM facilities located within DA-12.

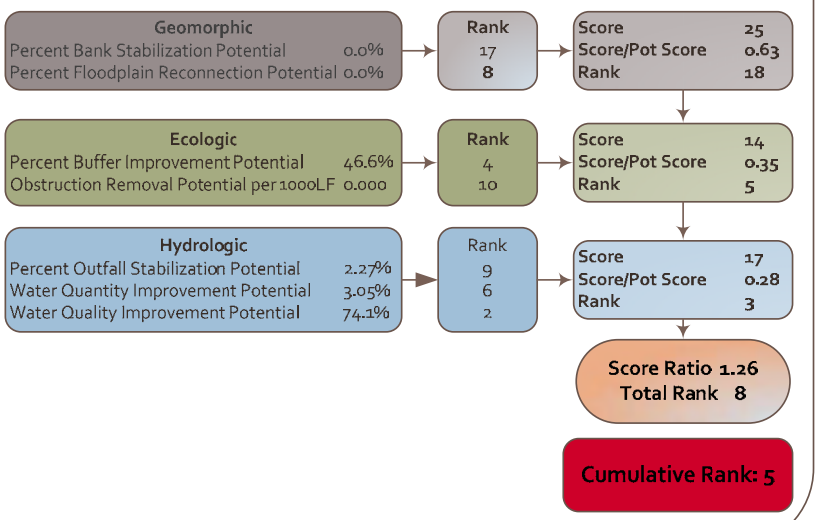
Four outfall locations (Outfalls 1-4) were investigated for potential SWM improvements and/or retrofit sites. The four outfalls currently discharge into a wetland type area with a defined pilot channel. Each outfall appears stable.

Restoration Opportunities

Restoration opportunities identified within DA-12 are included in ***Figure 56*** and are described below. ***Table 28*** highlights the assessment results for this drainage area.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Cedarside Farm
1
4
3
2
Cedarside Dr
Farmside Dr
Penn Ave
Soth Ave
Belair Rd
Joppa Rd
Perry Hall Elementary School
Joppa Rd
Lower Gunpowder Falls Watershed Assessment
Figure 56:
Drainage Area 12
Restoration Opportunities
0 200 400 Feet
N
McCormick Taylor
Engineers & Planners Since 1946

Table 28: Drainage Area 12 – Restoration Opportunities Assessment Results



Channel Improvements: Opportunities for channel improvement in DA-12 are limited, however, could be paired with any recommended improvements to the stormwater structure between Cedarside and Farmside Drives. The phragmites within the stormwater structure is of low quality from a habitat perspective and could be considered for eradication and replacement with native species.

SWM Improvements: There are no existing SWM facilities located within DA-12.

Four outfall locations (Outfalls 1-4) were identified as potential enhancement locations. The existing marshy area that all four outfalls discharge into should be converted into a shallow marsh or wetland facility. Installation of a riser/outfall structure at the outflow point would be required to control the pond discharge and maximize SWM treatment.

V.13 Drainage Area 13

Introduction

Location: DA-13 is located in the north eastern portion of the study area, along US 1 (***Figure 57***). This drainage area is 71 acres in size or 0.11 square mile and contains approximately 0.18 mile of stream channel.

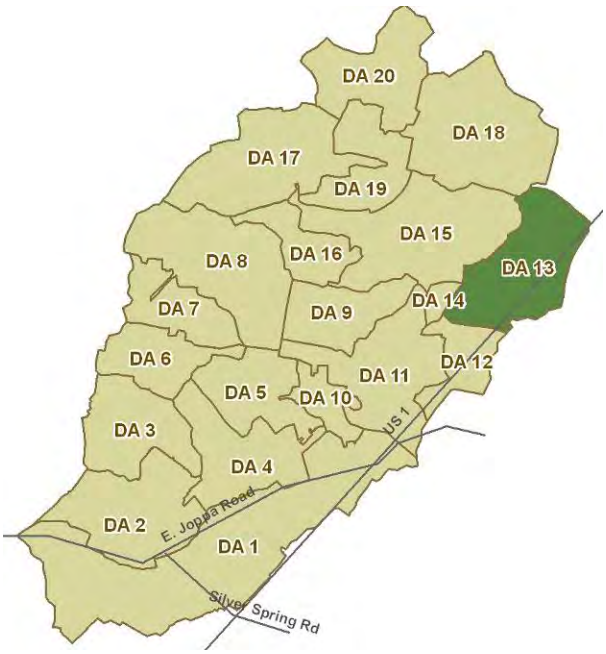


Figure 57
Drainage Area 13

Land Use: Approximately 27.4 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential. Small areas of commercial and institutional (Heritage Montessori School) land uses are located along US 1 and a small portion of forested land is located in the far western corner of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area mainly consists of Beltsville-Urban land complex (BfB/D) (44%), Chillum-Urban land complex (CbB/D) (37%), Issue-Urban land complex (IuA) (5%), Issue silt loam (IsA) (5%), and Legore-Montalto-Urban land complex (LgB/C) (5%) **(*Figure 58)***. The soil adjacent to the stream is Issue silt loam; a somewhat poorly drained soil derived from loamy and sandy alluvium. The floodplain soils at the tributary headwaters consist of Issue-Urban land complex. Chillum-Urban and Legore-Montalto-Urban land complexes lay along the southern and northern sides of the tributary floodplain, respectively. Outside of the floodplain, on all directions, are areas of Chillum-Urban land complex. Areas of Beltsville-Urban land complex soils lay in the most upstream reaches of the drainage area. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. Beltsville silty loam is moderately well-drained soil derived from silty eolian over loamy fluviomarine deposits. Chillum silt loam is a well-drained soil derived silty eolian material underlain by loamy marine sediments. Legore gravelly silty clay loam is a well drained soil consisting of material weathered from diabase, diorite, and related rocks. Montalto silt loam is a well drained soil consisting of residuum weathered from basic (gabbro) rocks**.**

Existing Conditions

Figure 59 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-13 are highlighted in ***Table 29.***

Channel Conditions: The main channel segment within DA-13 initiates just west of the dead end of Pine Hill Road. The channel extends upstream (east) from this point into a residential area. Near the downstream limit, the right floodplain of the channel is mostly lawn, and stormwater runoff has consolidated to form an incised gully that is eroding through the grass.

Legend
Streams
Soils
Drainage Areas
Perryview
Pinedale
Klausmier Rd
Belair Rd
Walter Ave
Pinedale Dr
Horn Ave
Cedarside Farm
Penn Ave
1
BfB
GfB
GkB
LgB
CbB
UuB
CbD
BfD
IuA
LgC
IsA
Lower Gunpowder Falls Watershed Assessment
Figure 58:
Drainage Area 13
Soils
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Perryview
Klausmier Rd
Belair Rd
439
Pinedale
Walter Ave
Pinedale Dr
Horn Ave
Cedarside Farm
1
Penn Ave
Lower Gunpowder Falls Watershed Assessment
Figure 59:
Drainage Area 13
Existing Conditions
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 29: Drainage Area 13 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.03	14	Score	59
Width/Depth Ratio:	2.13	18	Score/Pot Score	0.74
Threshold Grain Size:	1.08	12	Rank	16
Bank Height Ratio:	1.06	15		

Ecologic		Rank	Score	
Percent Forested per DA	2.2%	3	Score	60
Headcuts per 1000 LF Channel	0.00	15	Score/Pot Score	0.50
Percent Channel w/ Impaired Riparian	68.2%	3	Rank	10
Long Interruptions per1000 LF Channel	1.04	19		
Encroachments per 1000LF Channel	2.08	3		
Outfalls per Acre DA	0.056	17		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	2.29	2	Score	14
Percent Impervious per DA	27.4%	6	Score/Pot Score	0.23
Percent DA to SWM	7.0%	6	Rank	2

Score Ratio	1.47
Total Rank	9

Approximately 160 feet upstream (east) from the downstream limit of DA-13, the stream goes through a corrugated iron culvert under a dirt road that is being used as a pedestrian path. The iron pipe has rusted through the bottom, and poorly directed flow is eroding the left bank downstream of the culvert, undercutting trees growing along the streambank. Upstream of the culvert, the channel is confined between backyards, and the riparian buffer is reduced to five feet on the left side of the channel and 40 feet on the right. The stream bank along the left side of the channel is up to eight feet high and eroding.

About 300 feet upstream of the pedestrian path crossing, the stream channel becomes smaller, the stream banks are lower, and the corridor is more confined as the houses are closer to the stream. From this area to the headwater, the stream is channelized with gabion baskets and concrete. In many places, the gabion baskets are broken, or the stream is eroding around the baskets. Water flows out of two concrete outfall pipes on the left bank.

At the head of the drainage area, the stream disappears into a stabilized area comprised of riprap covered with invasive species. The riparian buffer in this headwater area is only five to 30 feet wide.

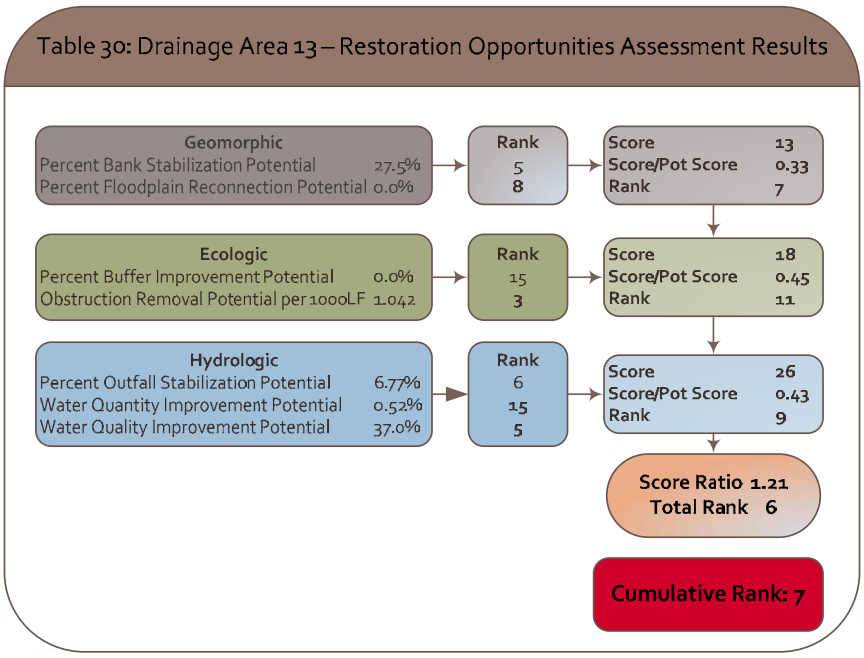
SWM Assessment: Based on the information provided by Baltimore County, one existing detention pond (439) is located within DA 13. The pond is extremely overgrown and has accumulated sediment. The pond discharges into a closed storm drain system and has a well defined and maintained grass swale emergency spillway.

Four outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, three of the locations (Outfalls 5-7) were identified as a possible enhancement sites. The end section and several upstream pipe sections have disconnected at Outfall 5. The gabion baskets at the toe of the slope have washed away, however the downstream channel contains large amounts of broken up concrete and appears relatively stable. Outfall 6 is located within a small triangle of land at the convergence of two small channels.

Outfall 7 is submerged. Flow from the outfall appears to dissipate into a small grass swale and wooded area adjacent to the stream channel.

Restoration Opportunities

Restoration opportunities identified within DA-13 are included in ***Figure 60*** and are described below. ***Table 30*** highlights the assessment results for this drainage area.



Channel Improvements: Opportunities within DA-13 include the improvement of debilitated outfalls (#5 and #6) (east of Dawn Drive) and the immediate receiving channel segments currently lined with gabions and concrete. Downstream, between the terminus of Pine Hill Road and the Dawn Hill cul-de-sac, an abandoned road crossing with culvert provides opportunity for Longitudinal Interruption Removal. At this location, the culvert and old roadbed could be removed and re-graded which would provide both improved aquatic habitat passage as well as improved hydraulic efficiency and channel stability. Riparian corridor planting enhancements are also opportunities along the entire system.

It is likely that this project, at least from the abandoned road location, could be linked with improvements in DA-14.

SWM Improvements: Based on the initial assessment, existing detention Pond 439 within DA-13 requires maintenance. Recommended maintenance activities include removal of vegetation, debris and sediment within the facility.

Outfalls 6 and 7 were identified as potential enhancement locations. Enhancements at outfall 6 include installation of a small pocket pond immediately upstream of the convergence of two small channels. The size and type of BMP will be limited by the available space, soil conditions and flood elevations. Enhancement recommendations at outfall 7 include a wet swale or bioswale BMP with check dams or berms, parallel to the stream channel, to provide additional retention of stormwater runoff. Outfall 7 is easily accessed from the Dawn Drive cul-de-sac.

Outfall 5 was identified as a site with structural issues. Recommended improvements include repair of the pipe joints and end section disconnection and possible installation of a drop structure to prevent future pipe failures. Channel stabilization and/or BMP installation was not feasible at this location due to the steep slopes and limited space between the outfall and stream bed.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Perryview
Klausmier Rd
Belair Rd
Pinedale
Walter Ave
Pinedale Dr
Horn Ave
6
5
7
Cedarside Farm
1
Penn Ave
Lower Gunpowder Falls Watershed Assessment
Figure 60:
Drainage Area 13
Restoration Opportunities
0 200 400 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.14 Drainage Area 14

Introduction

Location: DA-14 is located in the north eastern portion of the subwatershed and is the smallest of the drainage areas (***Figure 61***). It is 6 acres in size or 0.01 square mile and contains approximately 0.12 mile of stream channel.

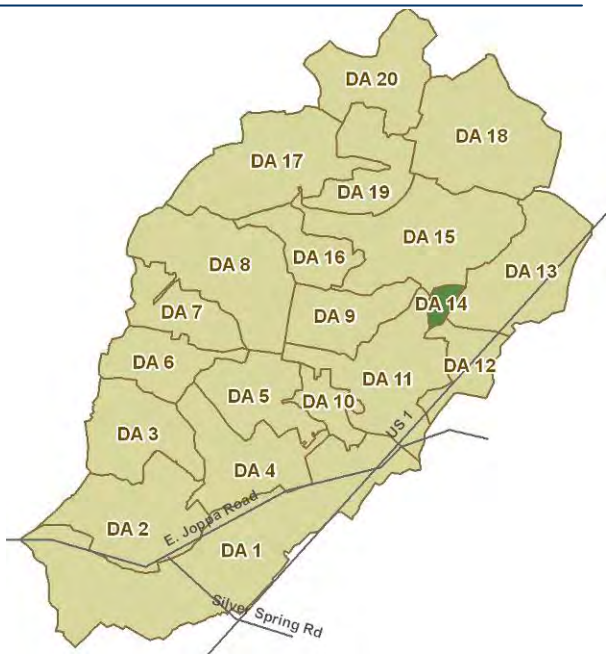


Figure 61
Drainage Area 14

Land Use: Approximately 7.1 percent of this drainage area contains impervious surfaces. The dominate land use is forested land with a small area of medium density residential land to the east. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area mainly consists of Issue silt loam (IuA) (42%), Legore-Montalto-Urban land complex (LgC) (40%), and Urban land-Udorthents (UuB) (11%) **(*Figure 62)***. The soil adjacent to the stream is Issue silt loam; a somewhat poorly drained soil derived from loamy and sandy alluvium. The floodplain soils consist of Legore-Montalto-Urban and Urban land-Udorthents along the northern and southern sides of the tributary, respectively. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. Legore gravelly silty clay loam is a well drained soil consisting of material weathered from diabase, diorite, and related rocks. Montalto silt loam is a well drained soil consisting of residuum weathered from basic (gabbro) rocks. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development.

Existing Conditions

Figure 63 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-14 are highlighted in ***Table 31.***

Legend
Streams
Soils
Drainage Areas
Pinedale Dr
Dawn Dr
CbD
LgC
IsA
UuB
Cedarside Farm
Cedarside Dr
Farmside Dr
Belair Rd
1
Lower Gunpowder Falls Watershed Assessment
Figure 62:
Drainage Area 14
Soils
0
125
250
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Pinedale Dr
Dawn Dr
Cedarside Farm
Cedarside Dr
Farmside Dr
Belair Rd
1
Lower Gunpowder Falls Watershed Assessment
Figure 63:
Drainage Area 14
Existing Conditions
0
125
250
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Channel Conditions: From the confluence with the main tributary to the Lower Gunpowder Falls, this tributary extends for approximately 600 feet through DA-14. This reach of channel has torturous meander bends with severely eroding banks up to four or five feet high. The meander bends have a particularly low radius of curvature under the power line right of way, which has been cleared of vegetation. A channel avulsion is starting to form in this area. The meander bends throughout the DA-14 reach exhibit severe erosion, and woody debris jams are common.

Towards the upstream end of this reach, the riparian buffer along the right floodplain is reduced to only 40 feet wide. An old bridge crossing has collapsed into the stream, causing a blockage and collecting debris. The upstream limit of DA-14 is just upstream of this former bridge, located at the convergence of two tributaries, DA-12 from the south and DA-13 from the east.

Table 31: Drainage Area 14 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.03	14	Score	59
Width/Depth Ratio:	2.13	18	Score/Pot Score	0.74
Threshold Grain Size:	1.08	12	Rank	16
Bank Height Ratio:	1.06	15		

Ecologic		Rank	Score	
Percent Forested per DA	41.4%	19	Score	80
Headcuts per 1000 LF Channel	0.000	15	Score/Pot Score	0.67
Percent Channel w/ Impaired Riparian	39.5%	9	Rank	17
Long Interruptions per1000 LF Channel	3.27	1		
Encroachments per 1000LF Channel	0.00	16		
Outfalls per Acre DA	0.000	20		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	2.16	3	Score	24
Percent Impervious per DA	7.1%	20	Score/Pot Score	0.40
Percent DA to SWM	0.0%	1	Rank	3

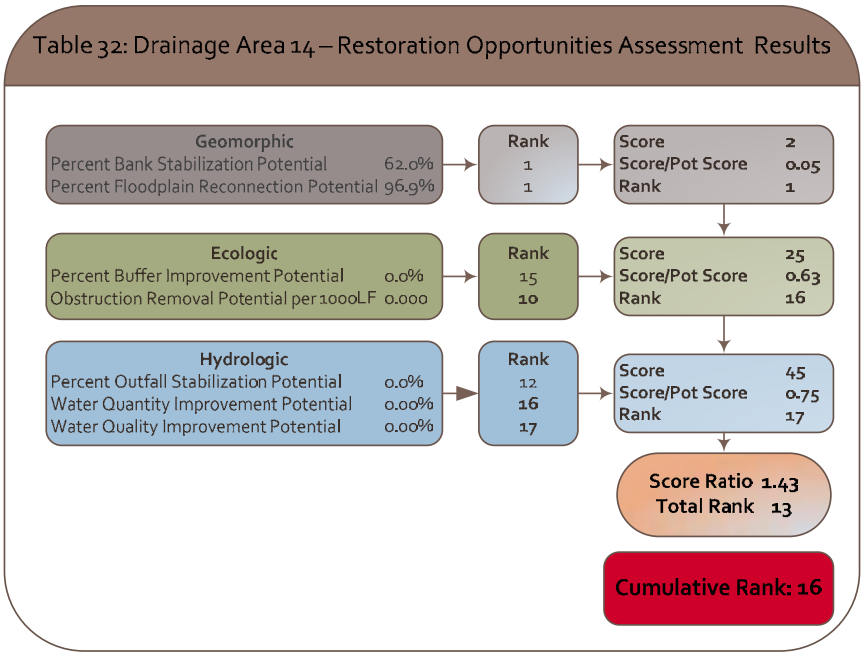
Score Ratio	1.80
Total Rank	18

SWM Assessment: Based on the information provided by Baltimore County, there is no existing SWM facilities located within DA-14.

No storm drain outfalls are located within DA-14.

Restoration Opportunities

Restoration opportunities identified within DA-14 are included in ***Figure 64*** and are described below. ***Table 32*** highlights the assessment results for this drainage area.

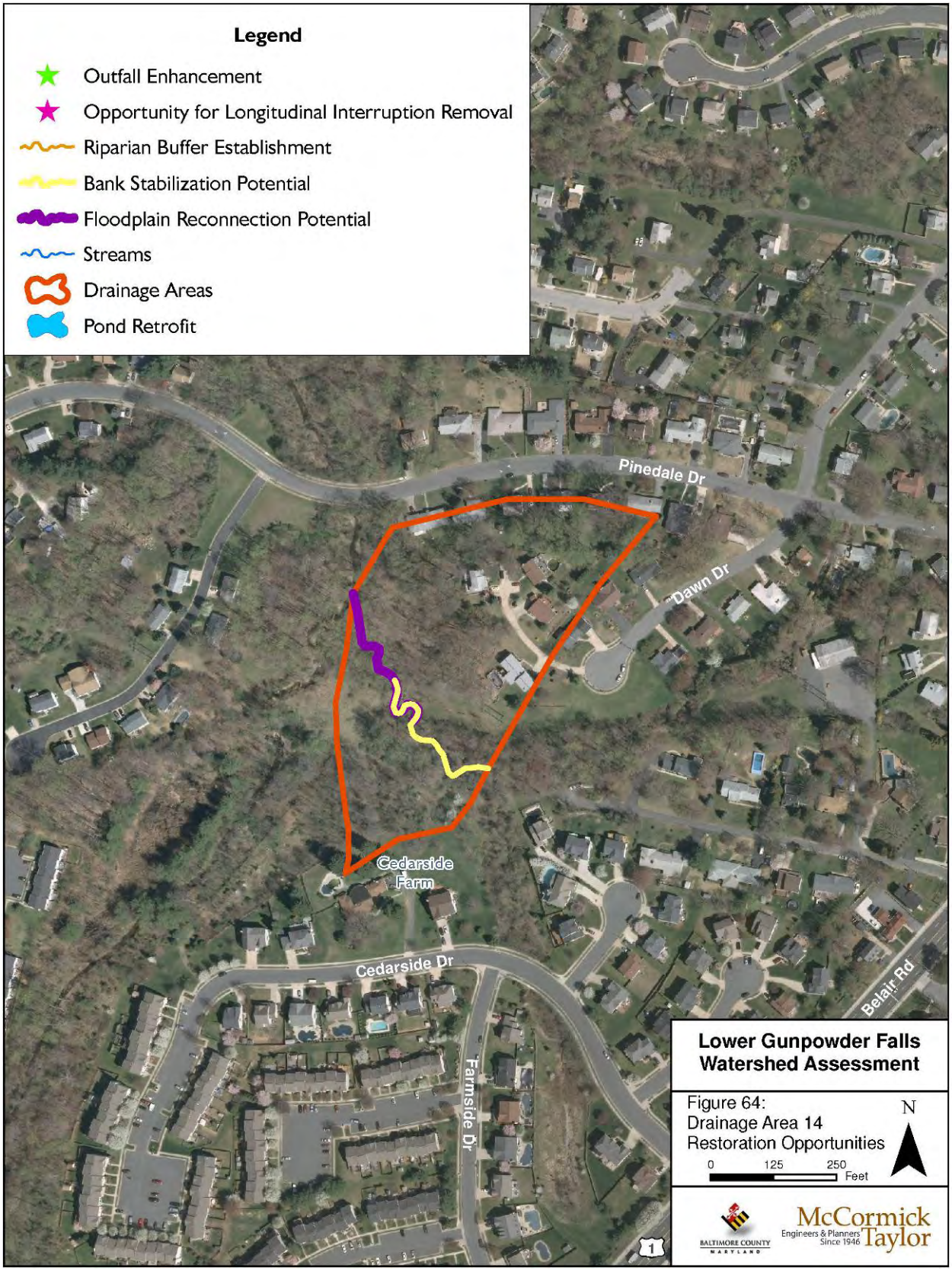


Channel Improvements: Continuing downstream from DA-13 and onto DA-14, the system exhibits opportunities for bank stabilization potential down to the powerline right-of-way. Within this segment, a collapsed small bridge structure with the remains of concrete abutments are impeding channel flow and causing localized scour. Removal of the structure and associated re-grading of banks would immediately improve channel stability and provide a more natural hydraulic conveyance environment.

Further downstream, the channel segment under the powerline right-of-way exhibits tortuous meanders with high potential for avulsions. From this location downstream to the confluence with the Lower Gunpowder River, opportunities for both re-alignment and improvements to floodplain reconnection are prevalent. Pending detailed site evaluations, efforts here would like incorporate structures to raise the channel invert.

SWM Improvements: There are no existing SWM facilities located within DA-14.

No storm drain outfalls are located within DA-14.


Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Pinedale Dr
Dawn Dr
Cedarside Farm
Cedarside Dr
Farmside Dr
Belair Rd
1
Lower Gunpowder Falls Watershed Assessment
Figure 64:
Drainage Area 14
Restoration Opportunities
0
125
250
Feet
N
McCormick Taylor
Engineers & Planners Since 1946

V.15 Drainage Area 15

Introduction

Location: DA-15 is located in the north central portion of the subwatershed (***Figure 65***). This drainage area is the second largest drainage area at 97 acres in size or 0.15 square mile and contains 0.68 mile of stream channel.

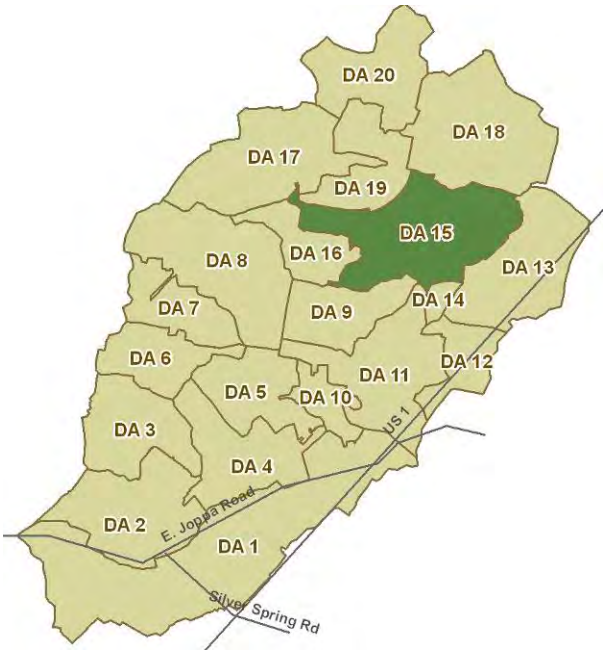


Figure 65
Drainage Area 15

Land Use: Approximately 21.6 percent of this drainage area contains impervious surfaces. The dominate land use in this drainage area is medium density residential. A linear strip of forested land use traverses the middle of this drainage area. Additionally, there is a small area of low density residential in the eastern portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area mainly consists of Urban land-Udorthents (UuB) (36%), Legore-Montalto-Urban land complex (LgB/C) (25%), Glenelg-Urban (GfB/C) (15%), Glenville-Urban land complex (GkB) (8%), and Comus-silt loam (CgA) (8%) ***(Figure 66)***. The soil adjacent to the stream is Comus-silt loam; a well drained soil formed in alluvium high in mica. Soils in the drainage area south of the stream consist of Urban land-Udorthents while Legore-Montalto-Urban and Glenelg-Urban land complexes are mixed together in the drainage area lands north of the stream. Glenville-Urban land complex soils extend north from the stream along tributary waters. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. The Urban land-Udorthents series consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Legore gravelly silty clay loam is a well drained soil consisting of material weathered from diabase, diorite, and related rocks. Montalto silt loam is a well drained soil consisting of residuum weathered from basic (gabbro) rocks. The Glenelg series consists of fine-loamy well drained soil formed in residuum weathered from micaceous schist. Glenville silt loam is a moderately well drained soil formed primarily in colluvium or residuum affected by soil creep that is weathered from phyllite, micaceous schist, granitic gneiss and other acid crystalline rocks**.**

Existing Conditions

Figure 67 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-15 are highlighted in ***Table 33.***

Legend
Streams
Soils
Drainage Areas
Klausmier Rd
Pinedale
Proctor Ln
Seven Courts Dr
Pinedale Dr
Cedarside Farm
EgB
SbB
BfB
GdB
SfB
GfC
GfB
MeC
GfB
LgC
LgB
LgB
LgB
GkB
GbD
LgC
CgA
UuB
MeB
MeD
MeD
IsA
Lower Gunpowder Falls Watershed Assessment
Figure 66: Drainage Area 15 Soils
0 225 450 Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Klausmier Rd
Pinedale
1210
1842
955
757c
Proctor Ln
Cedarside Farm
Seven Courts Dr
Pinedale Dr
Lower Gunpowder Falls Watershed Assessment
Figure 67:
Drainage Area 15
Existing Conditions
0
225
450
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 33: Drainage Area 15 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.10	3	Score	25
Width/Depth Ratio:	0.24	1	Score/Pot Score	0.31
Threshold Grain Size:	1.22	3	Rank	4
Bank Height Ratio:	1.01	18		

Ecologic		Rank	Score	
Percent Forested per DA	11.1%	10	Score	74
Headcuts per 1000 LF Channel	0.28	14	Score/Pot Score	0.62
Percent Channel w/ Impaired Riparian	9.8%	20	Rank	16
Long Interruptions per1000 LF Channel	2.51	3		
Encroachments per 1000LF Channel	0.00	16		
Outfalls per Acre DA	0.113	11		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.73	5	Score	35
Percent Impervious per DA	21.6%	14	Score/Pot Score	0.58
Percent DA to SWM	54.7%	16	Rank	13

Score Ratio	1.51
Total Rank	10

Channel Conditions: The mainstem channel segment within DA-15 originates at Gunview Drive, the upstream limit of DA-19. Though the channel meanders through a wide floodplain averaging around 200 feet in width, channel incision and subsequent widening have resulted in disconnection of the channel from its floodplain at low recurrence interval storms. Channel incision is arrested by a riprap sanitary line crossing approximately 300 feet downstream of Pinedale Drive. Above this point the banks are very low and stable with dense riparian vegetation extending to the edge of water.

Bank heights reach their highest point (seven feet) where the channel encroaches on the right valley slope roughly half way between Gunview Road and Pinedale Drive. Average bank height across DA-15 is approximately three to five feet.

Riparian buffer impairment is also an issue in three locations where homeowners have cleared and/or mowed within 25 feet of the channel banks. These areas are relatively minor in severity as each of these areas has at least a sparse cover of bank vegetation and streambank stability is not an immediate concern.

The upstream limit of DA-15 was established at the convergence of two tributaries. The main tributary to the Lower Gunpowder falls extends upstream (south) through DA-11 while a smaller tributary extends to the southeast into DA-14.

SWM Assessment: Based on the information provided by Baltimore County, four existing SWM facilities are located within DA-15; three detention ponds (757C, 955 and 1842) and one extended detention pond (1210). Pond 757C is located within DA-15; however the contributing drainage area is comprised entirely of DA-16. The pond is extremely overgrown with moderate sediment accumulation at the inflow point. The riser has been completely knocked over and is lying on its side within the facility. Pond 955 has accumulated large amount of silt and sediment, approximately 1-2' based on the As-Built plans. The low flow orifice is completely buried and a pilot channel has formed within the sediment build-up. Pond 1210 is a fairly large facility with steep side slopes and moderate sediment and debris accumulation. Pond 1842 is wet, extremely

silty and swampy. The riser is leaning over and algae is present within the facility. The upstream flow splitter is clean and appears to be functioning properly.

Five outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, two of the locations (Outfalls 8 and 20) were identified as a possible enhancement sites. Outfall 8 discharges into pond 757C (located within DA-16) and is highly eroded. The end section and several upstream pipe sections have disconnected at Outfall 20. The outfall discharges into a wide stable riprap channel with evidence of erosion at the confluence with the stream channel.

Restoration Opportunities

Restoration opportunities identified within DA-15 are included in ***Figure 68*** and are described below. ***Table 34*** highlights the assessment results for this drainage area.

Table 34: Drainage Area 15 – Restoration Opportunities Assessment Results

Geomorphic		Rank	Score 19
Percent Bank Stabilization Potential	5.6%	15	Score/Pot Score 0.48
Percent Floodplain Reconnection Potential	28.6%	4	Rank 11
Ecologic		Rank	Score 17
Percent Buffer Improvement Potential	9.8%	11	Score/Pot Score 0.43
Obstruction Removal Potential per 1000LF	0.837	6	Rank 9
Hydrologic		Rank	Score 24
Percent Outfall Stabilization Potential	9.18%	4	Score/Pot Score 0.40
Water Quantity Improvement Potential	1.18%	13	Rank 7
Water Quality Improvement Potential	27.4%	7	
			Score Ratio 1.30
			Total Rank 9
			Cumulative Rank: 10

Channel Improvements: The channel system through DA-15 contains a relatively long portion of the mainstem of the Lower Gunpowder. The riparian corridor is fairly wide (approximately 400 feet) and wooded and the channel appears to be highly active across the valley bottom. The channel transitions in and out of high stress/ high bank areas to low stress and low gradient sections where occasional lateral sanitary crossings offer grade control. There are therefore sections which could benefit from bank stabilization and some which may be enhanced through a more intervening approach to improve floodplain connection. Longitudinal improvements for fish and general aquatic passage and could also be improved at blockage locations.

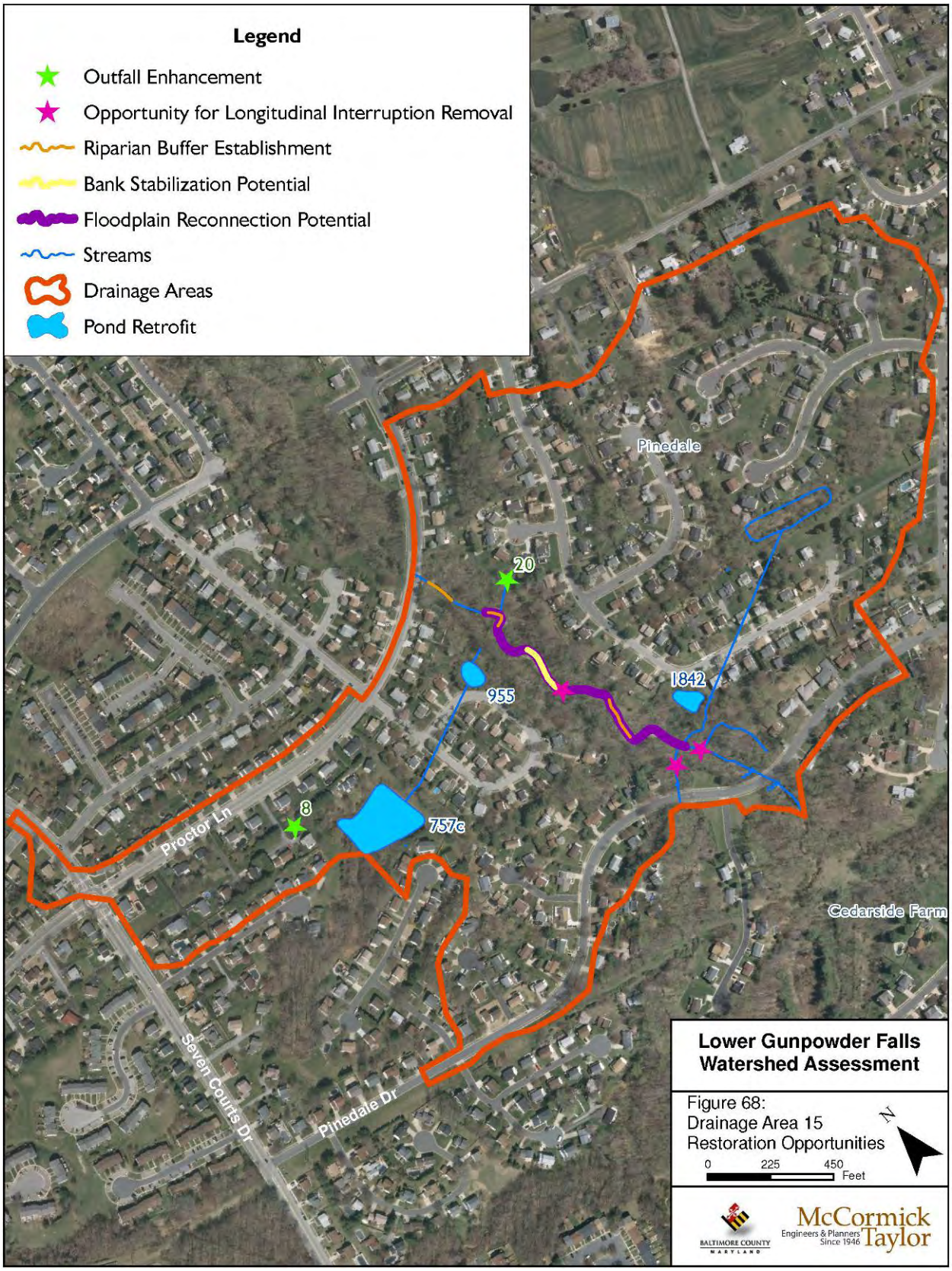
The variability of problem areas and opportunities seem to be reflected in the drainage areas opportunity ranking of 12 or roughly within the middle of the pack. It is likely this site would require a more detailed assessment to effectively narrow down the most feasible restoration solutions.

SWM Improvements: Based on the initial assessment, existing detention Ponds 757C, 955 and 1842 within DA-15 were identified as retrofit candidates. Detention facilities have historically

been designed for water quantity control only. In order to provide additional treatment of water quality, all three ponds should be converted into shallow marsh or wetland type facilities. Existing CMP risers should be replaced with riser structures designed to maximize treatment. The existing CMP riser at Pond 757C is no longer attached to the outfall pipe and is lying on its side. The inflow for Pond 757C should be stabilized. The flow splitter upstream of Pond 1842 should be modified in order to maximize SWM treatment within the facility. Excessive vegetation and sediment accumulation should be removed from all ponds to prevent clogging of the new riser structures. Upstream outfall enhancements will aid in the reduction of sediment supplied to these facilities and prevent further pond failures.

Existing Pond 1210 requires maintenance. Recommended maintenance activities include removal of vegetation, debris and sediment within the facility.

Outfalls 8 and 20 were identified as potential enhancement locations. Enhancements at Outfall 8 include channel stabilization and/or step pool installation. The severe channel erosion at this outfall has contributed to the sediment accumulation in the downstream ponds (757C and 955). The riprap at Outfall 20 should be replaced with a grass swale or bioswale BMP with check dams or berms to provide additional retention of stormwater runoff. The existing pipe disconnection at the end section should also be repaired to prevent further failure.


Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Pinedale
20
955
1842
8
757c
Proctor Ln
Seven Courts Dr
Pinedale Dr
Cedarside Farm
Lower Gunpowder Falls Watershed Assessment
Figure 68:
Drainage Area 15
Restoration Opportunities
0
225
450
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.16 Drainage Area 16

Introduction

Location: DA-16 is located in the north central portion of the subwatershed (***Figure 69***). This drainage area is 30 acres in size or 0.05 square mile and contains 0.14 mile of stream channel.

Land Use: Approximately 29.3 percent of this drainage area contains impervious surface. The dominate land use in this drainage area is medium density residential. Additionally, high density residential is contained to the west of this drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area is completely Urban land-Udorthents (UuB) (100%) ***(Figure 70)***. Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development.

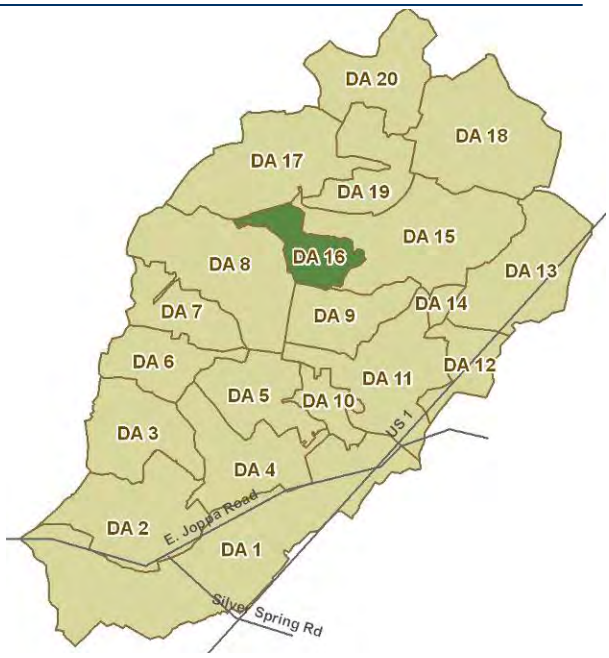


Figure 69
Drainage Area 16

Existing Conditions

Figure 71 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-16 are highlighted in ***Table 35.***

Legend
Streams
Soils
Drainage Areas
Proctor Ln
UuB
Pinedale Dr
Seven Courts Dr
Seven Oaks Elementary School
Lower Gunpowder Falls Watershed Assessment
Figure 70:
Drainage Area 16
Soils
N
0
200
400
Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Proctor Ln
Pinedale Dr
Seven Courts Dr
Seven Oaks Elementary School
Lower Gunpowder Falls Watershed Assessment
Figure 71:
Drainage Area 16
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 35: Drainage Area 16 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.07	7	Score	30
Width/Depth Ratio:	1.11	12	Score/Pot Score	0.38
Threshold Grain Size:	1.11	10	Rank	8
Bank Height Ratio:	8.16	1		

Ecologic		Rank	Score	
Percent Forested per DA	8.6%	9	Score	55
Headcuts per 1000 LF Channel	6.93	1	Score/Pot Score	0.46
Percent Channel w/ Impaired Riparian	38.2%	10	Rank	8
Long Interruptions per1000 LF Channel	1.39	13		
Encroachments per 1000LF Channel	0.00	16		
Outfalls per Acre DA	0.136	6		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.56	10	Score	33
Percent Impervious per DA	29.3%	3	Score/Pot Score	0.55
Percent DA to SWM	100%	20	Rank	12

Score Ratio 1.38
Total Rank 6

Channel Conditions: DA-16 consists of approximately 600 feet of stream channel upstream of a large inline SWM pond. The point at which the channel joins the SWM pond is armored with a segment of gabion channel protection which extends approximately 45 feet upstream along the channel. The channel is littered with yard waste, lumber and miscellaneous refuse. It is apparent that numerous homeowners along Cedarbrooke Place use the channel and stream banks for yard waste and refuse disposal.

Channel incision increases in an upstream direction extending from the gabions approximately 300 ft to a series of significant headcuts where channel incision is arrested once reaching bedrock. Bank heights range from four feet near the gabions to upwards of eight feet just downstream of the headcuts. There are two outfall channels that confluence with the stream channel within this length and channel incision has extended up both of these channels as well. The outfall originating from Cedarbrooke Place is of concern as a four to five foot headcut within the outfall channel appears to have significant migration potential as it is currently stabilized with only geotextile fabric and surface root mass.

Additionally, a manhole stack exposed to a height of four to five feet within the left bank adjacent to the series of headcuts is of concern as the sanitary line also crosses the channel at this location.

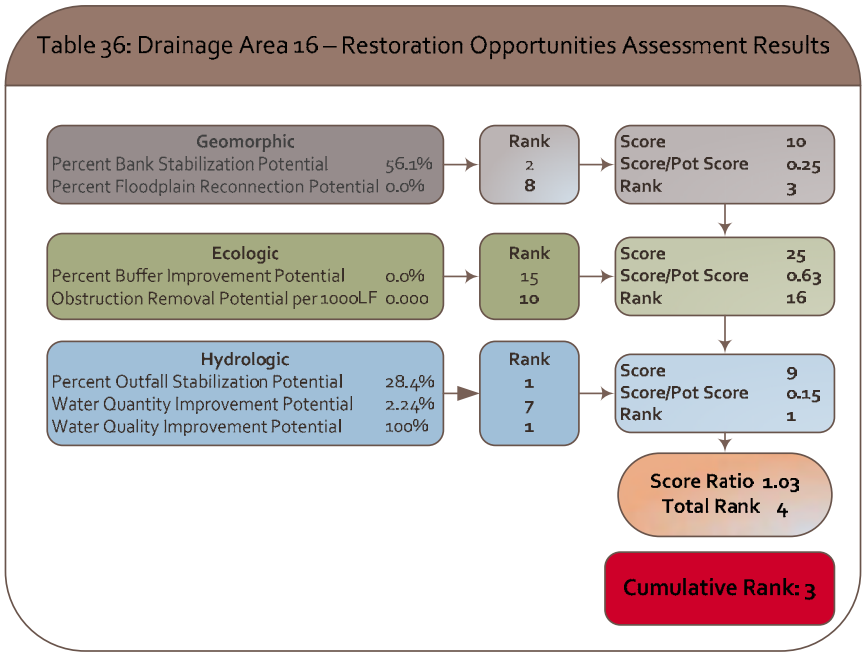
The stream channel continues for an additional 300 feet upstream of the pronounced headcuts meandering through a narrow riparian buffer with bank heights of three to six feet. Homeowner buffer practices continue to be an issue with multiple properties mowing to top of bank and disposing of debris within the stream channel. The channel again exhibits some incision and bank instability over the upstream 100 feet of channel length with raw vertical banks.

SWM Assessment: Based on the information provided by Baltimore County, there is no existing SWM facilities located within DA-16. However, the entire drainage area flows into an existing detention Pond 757C located within DA-15.

Five outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, two of the locations (Outfalls 9 and 24) were identified as possible enhancement sites. Outfall 9 discharges into pond 757C and is highly eroded. It appears that the channel is headcutting from downstream. The geotextile fabric is exposed and the banks are severely eroded. The headwall of Outfall 24 appears stable however the outfall channel is severely eroded and lacks vegetation.

Restoration Opportunities

Restoration opportunities identified within DA-16 are included in ***Figure 72*** and are described below. ***Table 36*** highlights the assessment results for this drainage area.



Channel Improvements: Channel improvement opportunities exist in the form of bank stabilization through much of the length of channel within DA-16. The channel segment within DA-16 presents a significant erosion potential as the channel exhibits signs of evolution from an incising condition to widening. Bank materials appear to be highly erodible and vegetation is generally lacking within bank margins. Outfall channel stabilization is also proposed adjacent to the limits of work for the main channel and is discussed below.

SWM Improvements: There are no existing SWM facilities located within DA-16.

Outfalls 9 and 24 were identified as potential enhancement locations. Improvements at Outfall 9 include channel stabilization and/or step pool installation. Outfall 24 is stable at the endwall, however channel bank and bed stabilization is recommended from the pipe outfall to the confluence with the stream channel. Severe channel erosion at both outfalls has contributed to the sediment accumulation in the downstream ponds (757C and 955).

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Proctor Ln
24
9
Pinedale Dr
Seven Courts Dr
Seven Oaks Elementary School
Lower Gunpowder Falls Watershed Assessment
Figure 72:
Drainage Area 16
Restoration Opportunities
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.17 Drainage Area 17

Introduction

Location: DA-17 is located in the north western portion of the subwatershed (***Figure 73***). This drainage area is 82 acres in size or 0.13 square mile and contains 0.16 mile of stream length.

Land Use: Approximately 28.1 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential land use. Additionally, a smaller portion of high density residential land use exists in the northern portion of this drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area is mainly Urban land-Udorthents (UuB) (96%) ***(Figure 74)***. The Urban land-Udorthents series consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development.

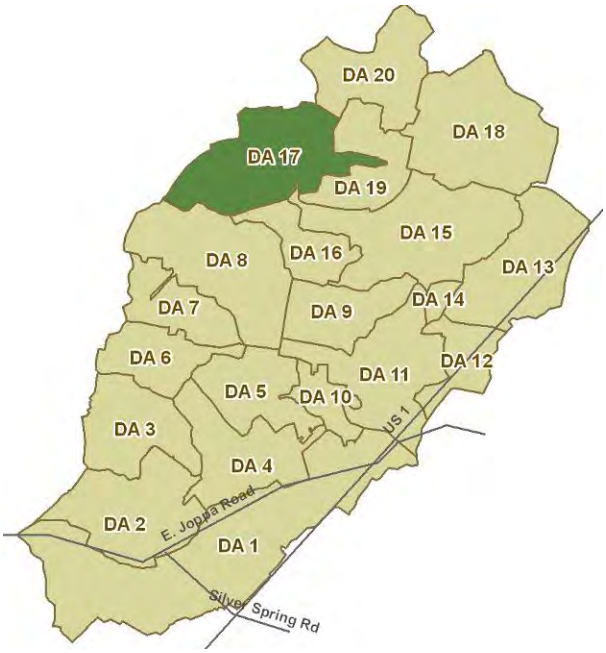


Figure 73
Drainage Area 17

Existing Conditions

Figure 75 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-17 are highlighted in ***Table 37.***

Legend
Streams
Soils
Drainage Areas
Oakhurst
Hallhurst Rd
NcC
LcE
CeD
CgA
Klausmier Rd
Oak White Rd
Perryoak Pl
UuB
Proctor Ln
Seven Courts Dr
CgA
Quail Run
Lower Gunpowder Falls Watershed Assessment
Figure 74:
Drainage Area 17
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Oakhurst
Hallhurst Rd
Klausmier Rd
Oak White Rd
Perryoak Pl
734
Proctor Ln
Seven Courts Dr
Quail Run
Lower Gunpowder Falls
Watershed Assessment
Figure 75:
Drainage Area 17
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY
MARYLAND
McCormick
Engineers & Planners
Since 1946
Taylor

Table 37: Drainage Area 17 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.05	9	Score	38
Width/Depth Ratio:	1.11	13	Score/Pot Score	0.48
Threshold Grain Size:	1.11	8	Rank	9
Bank Height Ratio:	2.26	8		

Ecologic		Rank	Score	
Percent Forested per DA	2.7%	4	Score	51
Headcuts per 1000 LF Channel	1.2	3	Score/Pot Score	0.43
Percent Channel w/ Impaired Riparian	17.8%	17	Rank	6
Long Interruptions per1000 LF Channel	2.39	4		
Encroachments per 1000LF Channel	1.20	5		
Outfalls per Acre DA	0.024	18		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.00	20	Score	43
Percent Impervious per DA	28.1%	4	Score/Pot Score	0.72
Percent DA to SWM	95.9%	19	Rank	17

Score Ratio	1.62
Total Rank	13

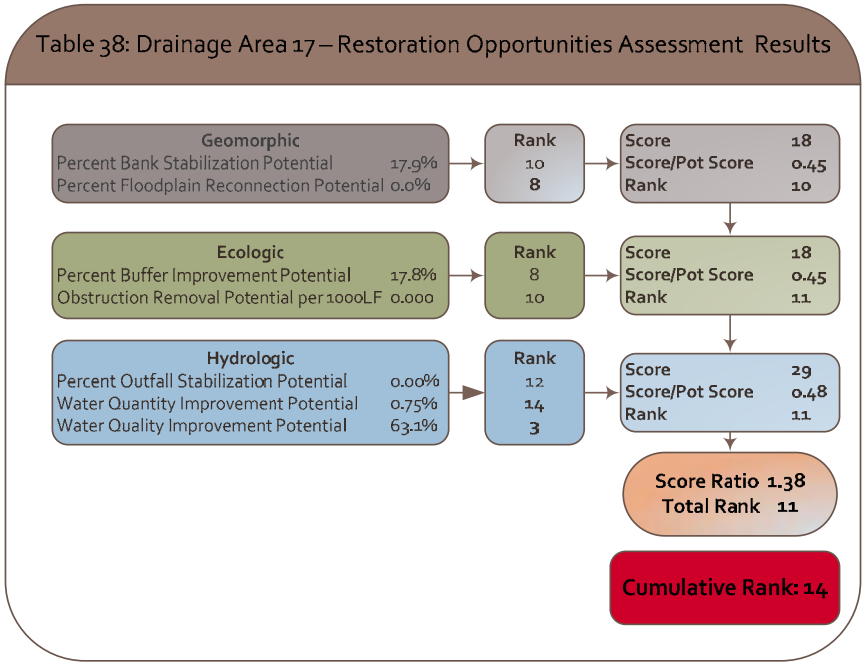
Channel Conditions: DA-17 is comprised of only 130 feet of channel which serves as the conveyance from a SWM pond outfall to the project mainstem within DA-19. The channel has incised at the downstream end, likely the result of base level lowering. Tree roots and riprap appear to be holding grade and preventing upstream migration of a headcut. There is a partially exposed manhole stack within the left bank and the sanitary line crosses the channel at this point. The wingwall extending from the right side of the outfall is tied into a timber retaining wall. There are two segments of timber wall with the one immediately adjacent to the wingwall appearing much older than the second segment which appears to be a recent homeowner addition.

SWM Assessment: Based on the information provided by Baltimore County, one existing detention pond (734) is located within DA-17. The large pond is in moderate condition. The banks appear stable however, the pond is overgrown with Phragmites and the low flow grate is clogged.

One outfall location was investigated for potential SWM improvements. Based on the condition of the outfall, this location did not warrant the need for any enhancements at this time.

Restoration Opportunities

Restoration opportunities identified within DA-17 are included in ***Figure 76*** and are described below. ***Table 38*** highlights the assessment results for this drainage area.



Channel Improvements: From the confluence with the mainstem, extending up to the back yards of the houses along Wood Oak Court and Klausmier Road, this incised channel section could be restored though bank stabilization and riparian buffer establishment. Lawn maintenance activities up to the stream banks would need to be curtailed in order to protect this system from future erosion problems.

SWM Improvements: Based on the initial assessment, existing detention Pond 734 was identified as a retrofit candidate. Detention facilities have historically been designed for water quantity control only. In order to provide additional treatment of water quality, the existing pond should be converted into shallow marsh or wetland type facility. The existing riser should be retrofitted or replaced with a riser designed to maximize SWM treatment. Due to the large contributing drainage area, a complete pond retrofit may be a large scale project.

No outfall enhancements are recommended within DA-17.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Klausmier Rd
Oak White Rd
Perryoak Pl
734
Proctor Ln
Seven Courts Dr
Quail Run
Lower Gunpowder Falls Watershed Assessment
Figure 76:
Drainage Area 17
Restoration Opportunities
0
200
400
Feet
N
McCormick Taylor
Engineers & Planners Since 1946

V.18 Drainage Area 18

Introduction

Location: DA-18 is located in the northern portion of the subwatershed (***Figure 77***). It is 94 acres in size or 0.15 square mile and contain approximately 0.79 mile of stream channel.

Land Use: Approximately 17.1 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential land use. A large portion of the drainage area contains agricultural land use due to the existing farmland in the eastern portion of the drainage area. A small portion of the drainage area to the north is characterized as institutional as it contains the Gunpowder Elementary School. There are also small areas of high density residential and forested land uses in the western portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

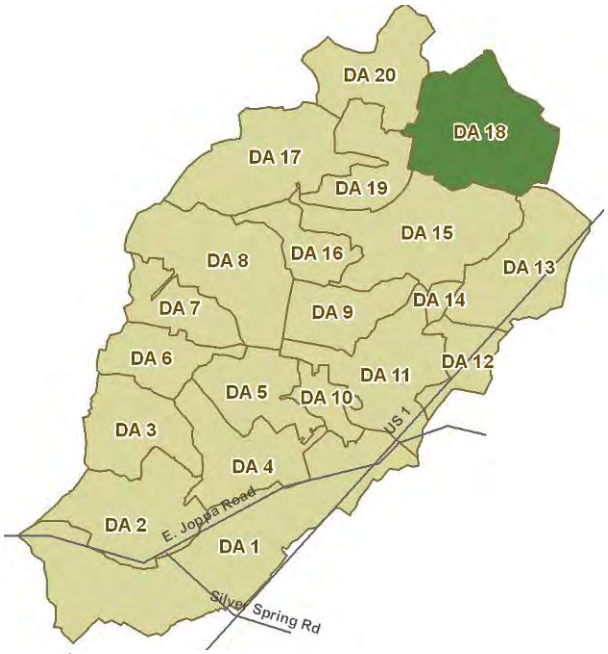


Figure 77
Drainage Area 18

Soils: The soil within the drainage area mainly consists of Glenelg-Urban land complex (GfB/C) (24%), Legore-Montalto-Urban land complex (LgB/C) (17%), Glenville silt loam (GhC) (11%), Legore silt loam (LeB/C) (10%), and Beltsville-Urban land complex (BfB) (9%) ***(Figure 78)***. A majority of the soil adjacent to the tributary is Glenville silt loam; a moderately well drained soil formed primarily in colluvium or residuum affected by soil creep that is weathered from phyllite, micaceous schist, granitic gneiss and other acid crystalline rocks. The eastern-most headwaters of the tributary consist of Beltsville-Urban land complex. Legore-Montalto-Urban land complex and areas of Legore silt loam are found in the north/northwestern headwaters of the drainage area. Areas with Glenelg-Urban soils are found along the northern edges of the drainage area, extending to the stream bed. Urban land consists of areas covered by asphalt roadways or parking lots, concrete structures, buildings and other impervious surfaces. Legore silt loam is a well drained soil consisting of material weathered from diabase, diorite, and related rocks. Montalto silt loam is a well drained soil consisting of residuum weathered from basic (gabbro) rocks. The Glenelg series consists of fine-loamy well drained soil formed in residuum weathered from micaceous schist. Beltsville silty loam is moderately well-drained soil derived from silty eolian over loamy fluviomarine deposits**.**

Existing Conditions

Figure 79 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-18 are highlighted in ***Table 39.***

Lower Gunpowder Falls Watershed Assessment

Figure 78:
Drainage Area 18
Soils

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Perry Hall Estates
Gunpowder Elementary School
Hickory Manor Rd
806b
Perryview
Gunview Rd
Pergolen Rd
Klausmier Rd
Pinedale
Lower Gunpowder Falls Watershed Assessment
Figure 79:
Drainage Area 18
Existing Conditions
N
0
225
450
Feet
McCormick Taylor
Engineers & Planners Since 1946

Table 39: Drainage Area 18 – Existing Conditions Assessment Results

Geomorphic		Rank
Shear Velocity (ft/s):	1.05	8
Width/Depth Ratio:	0.90	7
Threshold Grain Size:	1.12	7
Bank Height Ratio:	3.24	4

Ecologic		Rank
Percent Forested per DA	2.0%	2
Headcuts per 1000 LF Channel	0.48	12
Percent Channel w/ Impaired Riparian	79.2%	2
Long Interruptions per1000 LF Channel	1.67	10
Encroachments per 1000LF Channel	0.95	7
Outfalls per Acre DA	0.064	16

Hydrologic		Rank
2yr Discharge Ratio (cfs)	1.24	15
Percent Impervious per DA	17.1%	17
Percent DA to SWM	2.0%	4

Score	26
Score/Pot Score	0.33
Rank	6

Score	49
Score/Pot Score	0.41
Rank	4

Score	36
Score/Pot Score	0.60
Rank	14

Score Ratio	1.33
Total Rank	5

Channel Conditions: From the confluence with the main tributary to the Lower Gunpowder Falls, the DA-18 tributary extends approximately 270 feet upstream to a culvert under Gunview Road. In this segment of stream, the channel is eroding somewhat at tight bends, but is fairly well connected to the floodplain. There is a large riparian buffer on the left floodplain of large trees, but the understory is being maintained as lawn. Approaching the culvert, backyards are closer to the bank and riparian buffer is reduced to 30 feet on either side of the channel. Adjacent to the culvert, a residential roof gutter outlet along the right bank is contributing to a headcut in the right stream bank and floodplain. The culvert under Gunview Road is a large concrete pipe. Water through the culvert is fast and shallow, creating a fish blockage during base flow.

Upstream of Gunview Road, the channel becomes tightly confined between backyards on both sides of the channel. This reach of channel, nearly 900 feet in length, has riparian buffers of only five to 30 feet on both sides of the channel. Bank vegetation is dominated by multiflora rose or lawn grass. Moderate bank erosion is occurring on alternating banks in smaller segments of the reach, exposing a manhole stack along the right bank and undercutting the concrete apron of an outfall on the left bank. Progressing upstream, the channel becomes more incised with higher banks.

Approaching the segment of stream between Hallbrook Court and Lovebird Court, stream banks lessen to about three feet, and the masonry of an old stream crossing traverses the channel bed. Two outfalls along the left bank are causing localized erosion at and upstream of the masonry structure. The channel becomes more incised and eroded upstream of the masonry structure.

The confluence of a small headwater branch of the stream exists just upstream of the masonry structure. The channel along this small branch follows the edge of residential yards for about 250 feet, and then crosses into an active farm field for about 500 feet to the channel origin at the edge of Klausmier Road. The channel has a minor riparian buffer about 15 feet wide on either side of the channel through the residential segment, and no riparian buffer on either side of the

channel through the farm fields. Moderate erosion and a headcut have formed in the transition area from riparian buffer to active farm field. The upstream end of this channel segment is a 15-inch diameter concrete pipe under Klausmier Road. There was not any flow through the concrete pipe at the time of the site visit.

Approximately 150 feet upstream of Hallbrook and Lovebird Courts, the stream channel is detained in a large farm pond. The pond is bound by an earthen dam which outlets through a corrugated pipe into the channel downstream. At the time of the site visit, the pond water was very green in color, indicating the likelihood of high eutrophication.

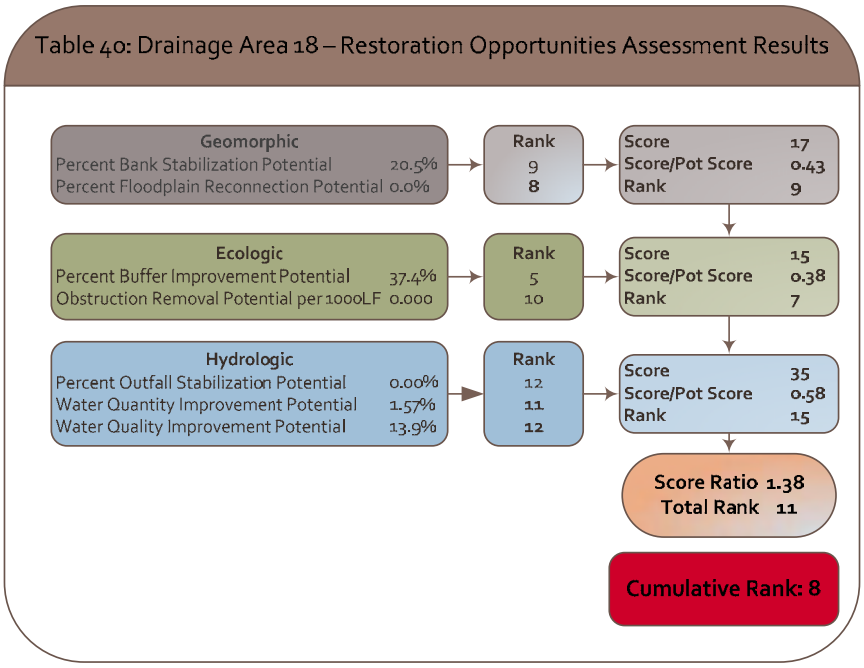
Upstream of the pond, the channel extends through a short wooded area with riparian buffer widths of 10 to 15 feet on either side of the channel. The stream channel in this reach appears to be both widening and aggrading. The channel splits into two branches, one of which ends at the farmhouse driveway. The other branch extends through a culvert under the farm road and across the field to a stormwater outfall at Holiday Manor Road. The stream does not have a riparian buffer through the farm field.

SWM Assessment: Based on the information provided by Baltimore County, one infiltration trench (806B) is located within DA-18. The trench has accumulated a significant amount of trash and sediment and no longer functions properly. The inflow pipe is completely buried and woody vegetation was observed in the facility.

Three outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, only two of the locations (Outfalls 21 and 25) were identified as possible enhancement sites. Outfall 21 discharges into a grass channel. The channel bottom is eroded and the banks are heavily vegetated. Flow from the outfall is conveyed through the grass channel into a downstream farm pond. Outfall 25 discharges directly into the stream channel approximately 10 feet above the stream bed. The concrete flume has broken in half and a portion has slid down the stream bank.

Restoration Opportunities

Restoration opportunities identified within DA-18 are included in ***Figure 80*** and are described below. ***Table 40*** highlights the assessment results for this drainage area.



Channel Improvements: Opportunities in Drainage Area 18 include relatively passive approaches of riparian buffer establishments along the headwater tributaries draining through the existing farm operation at Perryview to the stabilization of the deeply incised sections upstream of Gunview Road. Based on the lengths and locations of potential enhancements, riparian re-establishment on the Perryview Farm would provide substantial improvements to sediment stabilization, in-channel sedimentation and habitat connectivity.

The section from the Gunview Road crossing upstream approximately 900 feet is very confined from the adjacent developments and is in need of bank stabilization and riparian re-establishment. Many of the landowners appear to either maintain lawns beyond their property line and or have placed structures such as sheds within the buffer and easement. Construction access here would be challenging perhaps considering access from Lovebird Court versus Gunview Road.

SWM Improvements: Based on the initial assessment, existing SWM facility 806B within DA-18 was identified as a retrofit candidate. Proposed enhancements include installation of a pocket pond or bioretention BMP. However, this site has accumulated a significant amount of sediment. Unless the upstream sediment supply is controlled, any proposed BMP may become clogged similar to the existing facility. The woody flat area (PR3) across Gunview Road from Pond 806B should be converted into shallow marsh or wetland type facility by constructing embankments and installing a riser/outfall structure.

Outfall 21 was identified as a potential enhancement location. Enhancement options at this outfall include stabilizing the channel bed and banks to prevent sediment from entering the downstream farm pond. Based on the slope of the channel, step pools may be recommended as a stabilization method.

Outfall 25 was identified as a site with structural issues. Recommended improvements include removal of the existing concrete flume and installation of a drop structure to prevent further stream bank erosion and future pipe failure.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Perry Hall Estates
Gunpowder Elementary School
Hickory Manor Rd
806b
PR3
25
Perryview
21
Gunview Rd
Pergalen Rd
Klausmier Rd
Pinedale
Lower Gunpowder Falls Watershed Assessment
Figure 80:
Drainage Area 18
Restoration Opportunities
0
225
450
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

V.19 Drainage Area 19

Introduction

Location: DA-19 is located in the north central portion of the subwatershed (***Figure 815***). It is 43 acres in size or 0.07 square mile and contains approximately 0.28 mile of stream channel.

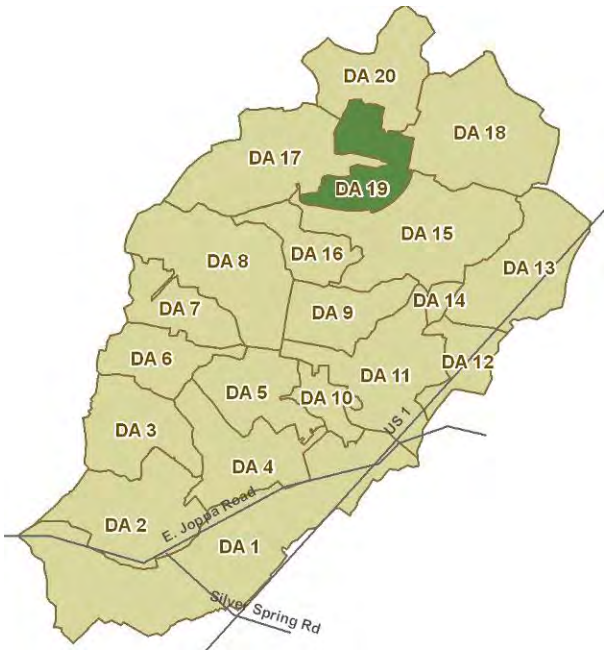


Figure 81
Drainage Area 19

Land Use: Approximately 25.8 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is medium density residential. There is also a small portion of forested land within the eastern portion of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

Soils: The soil within the drainage area mainly consists of Urban land-Udorthents (UuB) (79%), Comus-silt loam (CgA) (16%), and Delanco silt loam (CgA) (4%) ***(Figure 82)***. The soil adjacent to the stream is Comus-silt loam; a well drained soil formed in alluvium high in mica. The eastern and western floodplains of the stream are composed of Delanco silt loam and Urban land Udorthents, respectively. The Urban land-Udorthents series consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Delanco silt loam is a moderately well drained soil formed in alluvium washed from areas of micaceous crystalline rocks**.**

Existing Conditions

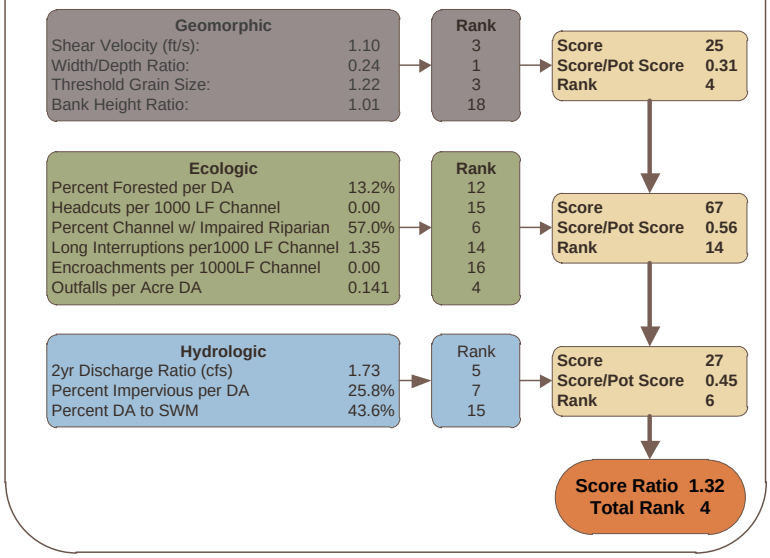
Figure 83 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-19 are highlighted in ***Table 41.***

Channel Conditions: The mainstem channel segment within DA-19 originates from the upstream end of DA-20. The floodplain width ranges from 200 to 300 feet within this drainage area. Although a contiguous tract of mature forest cover has been maintained along the majority of the floodplain corridor, insufficient buffer conditions exist in several locations. Riparian buffer impairments are present within the downstream half of the drainage area in the form of cleared sanitary easements while in the upstream half they are the result of lateral channel migration extending to and exceeding the limits of the forested floodplain.

Legend
Streams
Soils
Drainage Areas
Oakhurst
Hallhurst Rd
UuB
Gunview Rd
DbC
CgA
Klausmier Rd
LgB
UuB
Proctor Ln
Seven Courts Dr
Oak White Rd
Lower Gunpowder Falls Watershed Assessment
Figure 82:
Drainage Area 19
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Oakhurst
Halthurst Rd
806a
954
Gunview Rd
Klausmier Rd
Proctor Ln
Seven Courts Dr
Oak White Rd
Lower Gunpowder Falls Watershed Assessment
Figure 83:
Drainage Area 19
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 41: Drainage Area 19 – Existing Conditions Assessment Results



The confluence with the drainage channel from DA-17 occurs along the left bank between Klausmier Road and Wood Oak Court. The left bank upstream of this confluence point is severely eroded for approximately 300 feet with the adjacent homeowner reporting lateral bank migration in the range of two to three feet during significant storm events. The bank is four to six feet high with a near vertical face devoid of vegetation. There is a significant amount of gravel deposition primarily in the form of multiple large gravel bars. The abrupt transition to a depositional reach suggests a dramatic hydraulic control reducing the sediment transport capacity within this length. The occurrence and size of gravel bars decreases in an upstream direction as the channel straightens and narrows approaching Gunview Road.

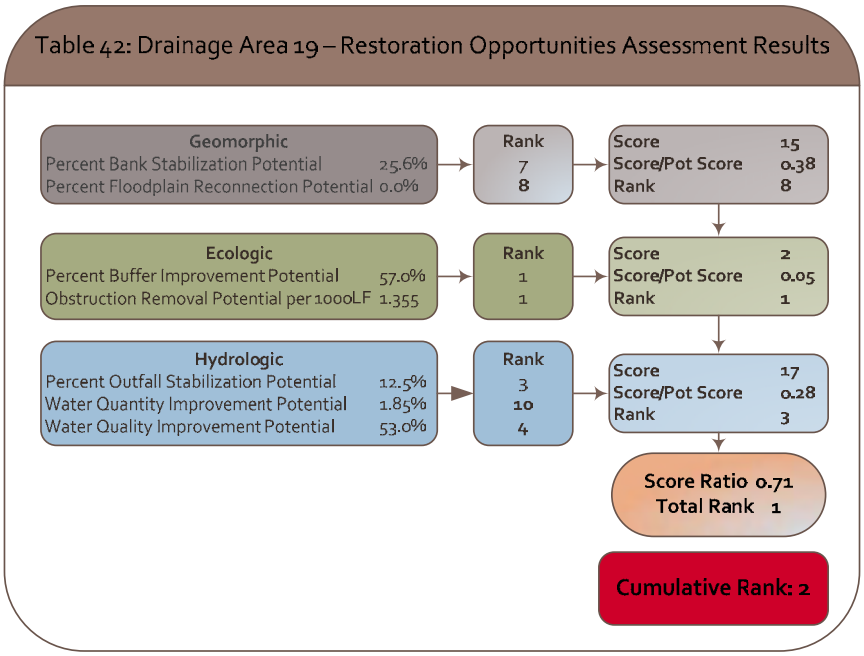
SWM Assessment: Based on the information provided by Baltimore County, two existing detention ponds (806A and 954) are located within DA-19. Pond 806A is holding stormwater runoff and is very overgrown but appears stable. No riser was located; however the riprap spillway appears stable. Pond 954 is in good condition with well maintained and stable banks. There is minimal sedimentation on the low flow grate.

Two outfall locations were investigated for potential SWM improvements. Based on the condition of the outfalls, only one of the locations (Outfall 22) was identified as a possible enhancement site.

Restoration Opportunities

Restoration opportunities identified within DA-19 are included in ***Figure 84*** and are described below. ***Table 42*** highlights the assessment results for this drainage area.

Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Halburst Rd
806a
Gunview Rd
22
Klausmier Rd
954
Proctor Ln
Seven Courts Dr
Oak White Rd
Lower Gunpowder Falls Watershed Assessment
Figure 84:
Drainage Area 19
Restoration Opportunities
N
0
200
400
Feet
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946



Channel Improvements: Opportunities for restoration in DA-19 include bank stabilization along the western flanking channel banks adjacent to the maintained properties of White Wood and Wood Oak Courts. It appears general channel base lowering, large transient gravel bars and lack of riparian buffer have led to moderate to high levels of bank erosion in this area. Restoration could include bank stabilization, potential channel shift to increase riparian protection, riparian enhancements and potentially some floodplain access improvements. Lawn maintenance activities up to the stream banks would need to be curtailed in the future to protect this system from future erosion problems.

SWM Improvements: Based on the initial assessment, existing detention Ponds 806A and 954 within DA-19 were identified as retrofit candidates. Improvements to Pond 806A include removal of vegetation and sediment and installation of a riser structure designed to maximize SWM treatment. Baffle boards or an earth berm should be constructed within Pond 954 to maximize the flow length within the facility providing additional water quality treatment. Currently, the inflow is directly adjacent to the outfall. A riser structure could also be installed maximize treatment.

Outfall 22 is identified as potential enhancement location. Enhancement options at Outfall 22 include construction of a pocket pond/wetland BMP near the outfall and channel stabilization to the confluence with the stream channel. This site is easily accessed off Klausmier Road and has a fairly large contributing drainage area.

V.20 Drainage Area 20

Introduction

Location: DA-20 is the northern most drainage area within the subwatershed (***Figure 85***). This drainage area is 57 acres in size or 0.09 square mile and contains approximately 0.59 mile of stream channel.

Land Use: Approximately 9.9 percent of this drainage area contains impervious surfaces. The dominate land use within this drainage area is forest as a portion of this drainage area is within the Gunpowder Falls State Park. Other land uses present include medium density residential in the central portion of the drainage area and high density residential land use in the eastern and western portions of the drainage area. Refer to ***Table 4*** and ***Figure 8*** for details.

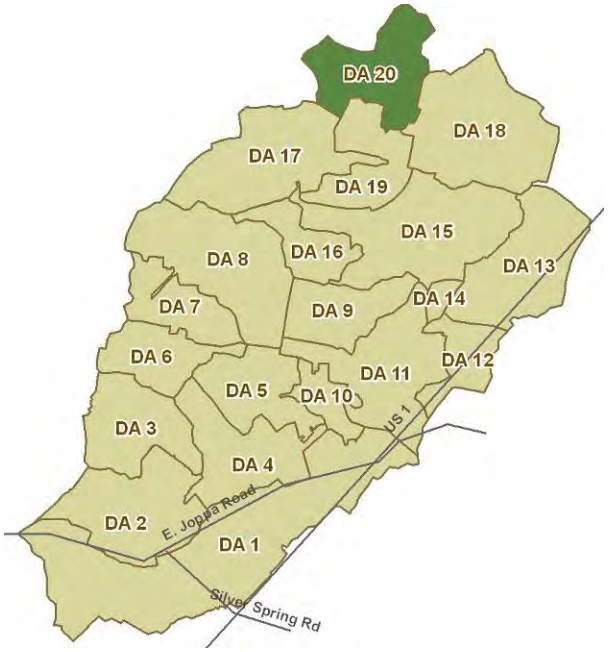


Figure 85
Drainage Area 20

Soils: The soil within the drainage area mainly consists of Urban land-Udorthents (UuB) (30%), Comus-silt loam (CgA) (16%), Legore silt loam, very stony (LfC/D/E) (14%), Neshaminy silt loam (NeC) (13%), Manor loam (MaC) (8%), Manor-Bannertown sandy loam (McD) (4%), and Manor-Brinklow complex (MdE) (3%) ***(Figure 86)***. The soil primarily adjacent to the stream is Comus-silt loam; a well drained soil formed in alluvium high in mica. The eastern floodplain along the stream is composed of Legore silt loam. The southwestern floodplain along the stream is composed of Urban land-Udorthents and the northwestern floodplain is composed of Manor loam, Manor-Bannertown sandy loam, and Manor-Brinklow complex. Further into the western portion of the drainage area, outside of the floodplain, is an area of Neshaminy silty loam. The series Urban land-Udorthents consists of land that has been smoothed after the original soil has been destroyed, filled over, or otherwise damaged prior to development. Legore silt loam is a well drained soil consisting of material weathered from diabase, diorite, and related rocks. Neshaminy silt loan is a well drained soil formed in materials weathered from diabase and other dark colored basic rocks. Manor loam is a well drained soil consisting of residuum weathered from micaceous schist. Bannertown coarse loam is a somewhat excessively drained soil consisting of residuum from felsic metamorphic or igneous rock. Brinklow fine loam is a well drained soil with moderately slow permeability formed partly in slope creep materials and partly in residuum weathered from phyllite and schist in the Piedmont Plateau**.**

Existing Conditions

Figure 87 highlights existing conditions that were either captured during the field walk or developed utilizing GIS data. Assessment results for DA-20 are highlighted in ***Table 43.***

Legend
Streams
Soils
Drainage Areas
Gunpowder Falls State Park
W
EgB
CfA
LeD
LeC
MdE
LfD
LfC
MoB
NeC
LfE
UuB
LeE
Oakhurst
MaC
McD
UuB
NeC
UuB
Hickoryhurst Dr
Gunview Rd
CgA
GfB
EgB
Hallhurst Rd
Klausmier Rd
Lower Gunpowder Falls Watershed Assessment
Figure 86:
Drainage Area 20
Soils
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

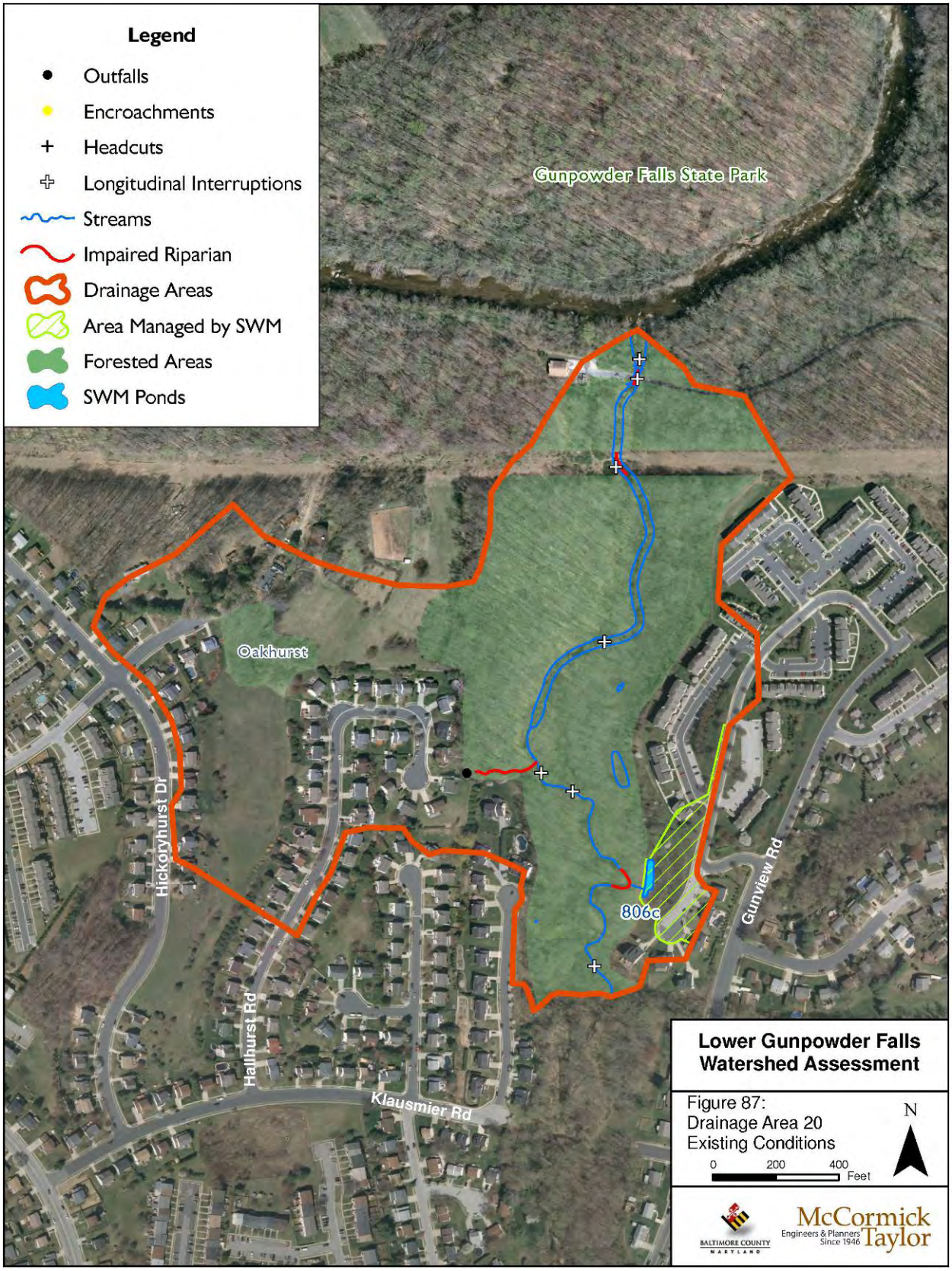

Legend
Outfalls
Encroachments
Headcuts
Longitudinal Interruptions
Streams
Impaired Riparian
Drainage Areas
Area Managed by SWM
Forested Areas
SWM Ponds
Gunpowder Falls State Park
Oakhurst
Hickoryhurst Dr
Hallhurst Rd
Klausmier Rd
Gunview Rd
806c
Lower Gunpowder Falls Watershed Assessment
Figure 87:
Drainage Area 20
Existing Conditions
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

Table 43: Drainage Area 20 – Existing Conditions Assessment Results

Geomorphic		Rank	Score	
Shear Velocity (ft/s):	1.05	9	Score	38
Width/Depth Ratio:	1.11	13	Score/Pot Score	0.48
Threshold Grain Size:	1.11	8	Rank	9
Bank Height Ratio:	2.26	8		

Ecologic		Rank	Score	
Percent Forested per DA	45.8%	20	Score	95
Headcuts per 1000 LF Channel	0.00	15	Score/Pot Score	0.79
Percent Channel w/ Impaired Riparian	15.0%	18	Rank	20
Long Interruptions per1000 LF Channel	2.24	7		
Encroachments per 1000LF Channel	0.00	16		
Outfalls per Acre DA	0.018	19		

Hydrologic		Rank	Score	
2yr Discharge Ratio (cfs)	1.69	7	Score	31
Percent Impervious per DA	9.9%	19	Score/Pot Score	0.52
Percent DA to SWM	2.9%	5	Rank	11

Score Ratio	1.78
Total Rank	17

Channel Conditions: From the confluence with the Lower Gunpowder Falls, the reach extends for approximately 2300 feet upstream through DA-20. With the exception of an access road crossing and power line right of way near the confluence with the Lower Gunpowder Falls, the channel extends with an uninterrupted floodplain and riparian buffer over the majority of the drainage area length. Floodplain widths range from 100 to 250 feet with the channel naturally meandering between the steeply sloped valley walls. The channel appears to be well connected to its floodplain with low banks and consistent rack lines and debris accumulations observed within the floodplain.

A very steep and narrow tributary extends approximately 200 feet from an outfall near the end of Hallhurst Road to its confluence with the mainstem approximately 1500 feet upstream of the Gunpowder Falls. The riparian buffer is impaired along the right bank of this tributary as a private residential property borders the channel with a maintained lawn and mulched landscape bed extending to within five feet of top of bank. The right bank also appears to exhibit increased erosion rates as a result of the cleared bank margins with root structures absent or minimal.

Within the mainstem of DA-20 a berm approximately two to three feet above the adjacent floodplain elevation bisects the floodplain at the end of the Midaro Court cul-de-sac. It seems likely that this is a historic impoundment and/or farm road. Channel gradient decreases and sinuosity increases along the main channel upstream of this berm. Gravel and sand deposition is also evident within the channel margins where there was little to no bar development within the downstream channel. It appears the channel continues to be well connected to its floodplain with low banks and multiple drainage paths evident within the floodplain extending from the berm to the upstream end of the drainage area. At the upstream limit of DA-20, the channel splits into two branches. The mainstem continues upstream through DA-19 while a tributary extends to the east through DA-18.

SWM Assessment: Based on the information provided by Baltimore County, one infiltration trench (806C) is located within DA-20. The trench is no longer functioning properly as

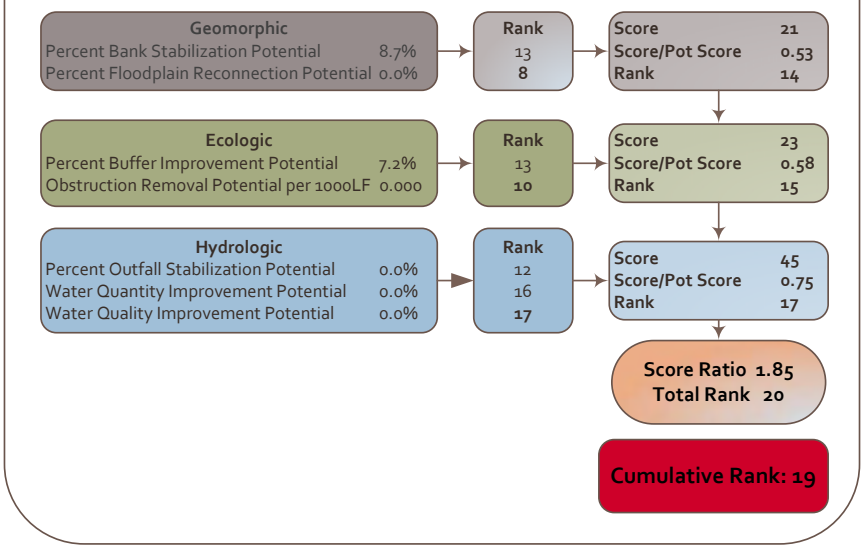
stormwater runoff is ponding within the facility. There is a partial disconnection of the inflow pipe joints and the facility is overgrown. This facility is in close proximity to the stream channel.

No outfall locations were investigated for potential SWM improvements and/or retrofitting within this drainage area.

Restoration Opportunities

Restoration opportunities identified within DA-20 are included in ***Figure 88*** and are described below. ***Table 44*** highlights the assessment results for this drainage area.

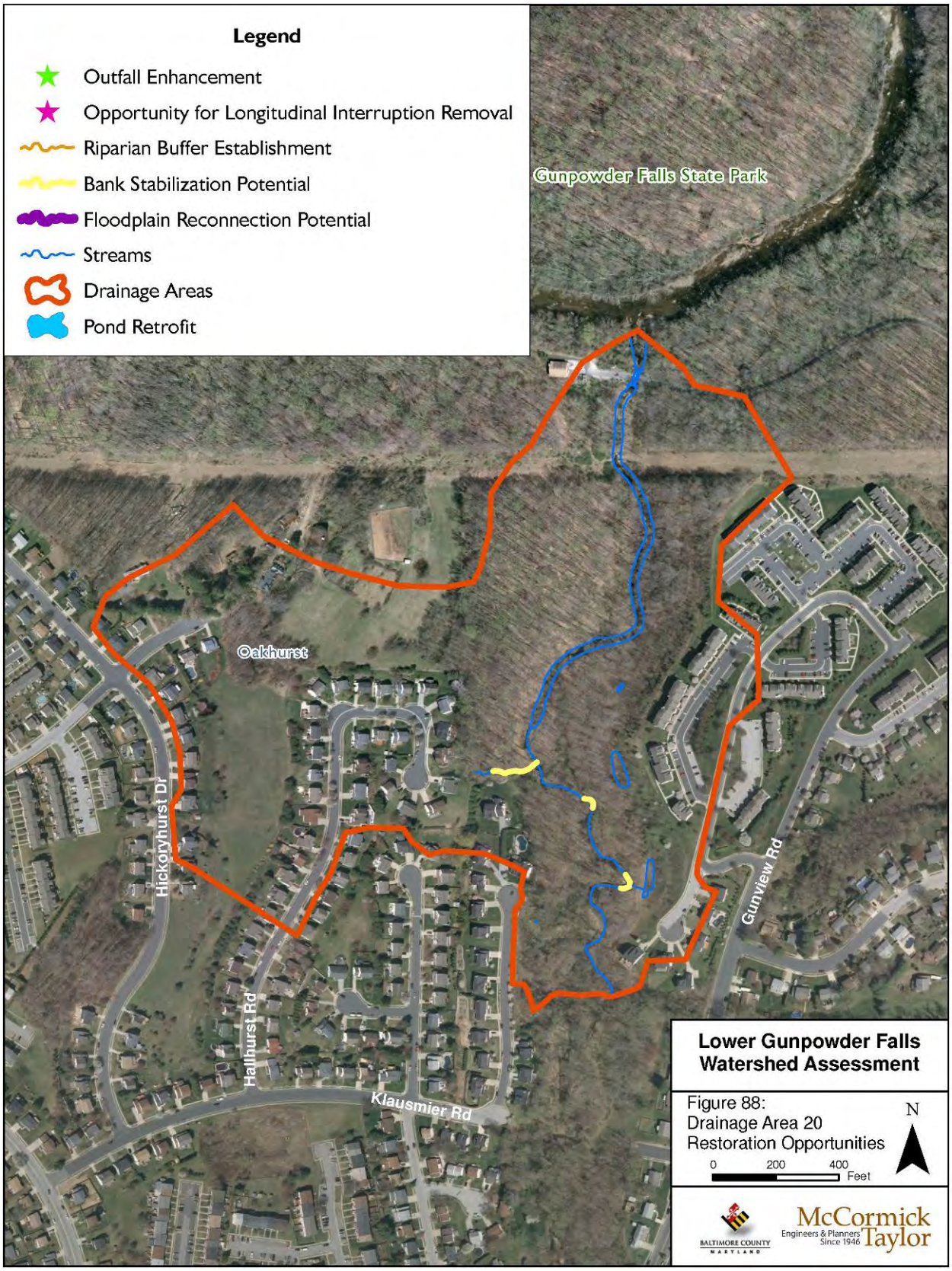
Table 44: Drainage Area 20 – Restoration Opportunities Assessment Results



Channel Improvements: Due to a lack of significant impairment, limited restoration opportunities were identified within DA-20. There are two short segments along the mainstem of DA-20 where meander bends encroach upon the valley margins leading to a minor to moderate level of bank erosion. These areas are localized and exhibit little potential for migration. An additional opportunity for bank stabilization was identified along a tributary to the mainstem which extends east from the cul-de-sac at the end of Hallhurst Road. This tributary is very steep and channel velocities will likely necessitate armoring of the bank toe in addition to vegetative stabilization.

SWM Improvements: Based on the initial assessment, existing SWM facility 806C within DA-20 requires maintenance. Recommended maintenance activities include removal of vegetation and sediment and pipe joint repair. This site was not suited for retrofit based on the proximity to the stream channel and potential stream bank impacts.

No outfall enhancements are recommended within DA-20.


Legend
Outfall Enhancement
Opportunity for Longitudinal Interruption Removal
Riparian Buffer Establishment
Bank Stabilization Potential
Floodplain Reconnection Potential
Streams
Drainage Areas
Pond Retrofit
Gunpowder Falls State Park
Oakhurst
Hickoryhurst Dr
Hallhurst Rd
Klausmier Rd
Gunview Rd
Lower Gunpowder Falls Watershed Assessment
Figure 88:
Drainage Area 20
Restoration Opportunities
0
200
400
Feet
N
BALTIMORE COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

VI. Cumulative Ranking System Results

Utilizing information from preliminary field walks, the Lower Gunpowder Falls Watershed was divided into twenty drainage areas for assessment and ranking. Fifteen channel segments were surveyed in greater detail, 41 SWM facilities were identified and assessed, and 61 outfalls were evaluated. This data was used to develop a set of Geomorphic, Ecologic and Hydrologic metrics with which to evaluate the individual drainage areas for their existing condition and restoration potential. A ratio of the measured metric to the potential score was then used to develop a Score Ratio for both the existing conditions and restoration opportunities. Summed scores that represented conditions least like the potential were considered most favorable as having restoration opportunities. ***Table 45*** summarizes the results of the ranking efforts for each Drainage Area (DA).

Table 45: Cumulative Ranking System Results

Rank	Sum of Score Ratio	Drainage Area
1	2.67	4
2	2.74	19
3	3.43	16
4	3.30	11
5	3.80	12
6	3.83	8
7	3.89	13
8	4.10	18
9	4.13	5
10	4.11	15
11	4.31	1
12	4.68	9
13	4.22	7
14	4.38	17
15	4.85	10
16	4.65	14
17	4.89	6
18	5.29	3
19	5.48	20
20	5.63	2

From ***Table 45***, DA-4 was determined to have the most optimal opportunities for restoration and DA-2 contained the least opportunities and/or least potential for restoration lift. The top five drainage areas identified as having the most potential for benefits from restoration are:

1. DA-4
2. DA-19
3. DA-16
4. DA-11
5. DA-12

The high degree of both historical and recent channel and floodplain manipulation in DA-4 was primarily the reason for the highest impaired ranking. The available and potential improvements to this system from both a geomorphic and ecologic perspective are very high.

In DA-19, poor buffer condition and overly-maintained residential properties, an incised channel and an opportunity to remove a longitudinal interruption near Klausmier Road were causes for the highly impaired ranking. A retrofit of Pond 954 in DA-19 to increase flow length would also be recommended to improve flow conditions to the receiving streams.

Unstable and highly erodible bed and bank conditions with bank heights up to 8 feet, headcutting channels leading to contributing outfalls (#'s 9 and 24) and overly maintained lawn buffers are the primary reasons for the relatively high score for DA-16. Restoring these eroding channels and drainages would both improve their individual physical ad biological condition as well as reduce sediment loading to pond 757c in downstream DA-15.

In DA-11, a need to reconnect the channel to the floodplain, multiple longitudinal interruptions and the potential for water quality and outfall stabilization improvements resulted in this watersheds high ranking for restoration potential. At approximately 2,210 linear feet, Stream Restoration opportunity SR-7, is one of the longest continuous restoration reaches in the entire study area.

The lack of SWM and potential for outfall stabilization are the primary reasons DA-12 is in the top five of the scored restoration opportunities. Stormwater improvements at this location may provide benefits of water quality and water quantity (e.g timing/ volume) to receiving waters. In addition, opportunities exist to eradicate a stand of the invasive plant Common Reed (Phragmites).

VII. Capital Improvement Project Identification and Prioritization Results

In total, **23,675** linear feet of impaired channel; **24** outfall improvements; **15** pond retrofit opportunities; and **3** areas with potential and need for additional SWM opportunities were identified during the investigations. From these identified sites, individual projects within the Lower Gunpowder Falls Watershed are highlighted and summarized on ***Figure 89 (Individual Restoration Project Identification)*** and ***Table 46.***

Table 46 summarizes the results of the drainage area prioritization and associated project identification. Individual projects have been identified within each drainage area alpha-numerically and match ***Figure 89.*** The table provides descriptions of project type, approximate size, location, proposed action, potential benefits, known constraints and estimated cost.

Figure 90* (*Potential Capital Improvement Project Identification) and ***Table 47*** is a consolidation of the individually identified projects from ***Figure 89*** and ***Table 46*** and provides suggested potential Capital Improvement Projects (CIP). These represent selected major potential projects which may include a grouping or combination of stream and storm water drainage work based on proximity, type of treatment and/or proposed accessibility for construction. The estimated total cost for all of the identified 12 potential CIP's is **$7,518,635.**

Potential treatment types for restoration, stormwater and drainage work have been provided as graphics in ***Appendix F***. The selection of the appropriate treatment depends on the goals of the projects and results of detailed site assessments. For simple bank treatment options, stabilization types can range from bioengineering to rock structures with the latter likely a requirement in areas of utility or property constraints and /or high stress fluvial environments. Where there is a goal to increase instream habitat and less concern for near bank stresses, soft engineering techniques could also be considered. Given there were many areas in this watershed identified as having incised conditions, typical techniques for those conditions may include grade controls structures such as riffle grade control in conjunction with general cross-section geometry modifications to increase floodplain connectivity. The BMP graphic in ***Appendix F*** is representative of options to create shallow wetlands or ponds as either a pond retrofit or new facility.

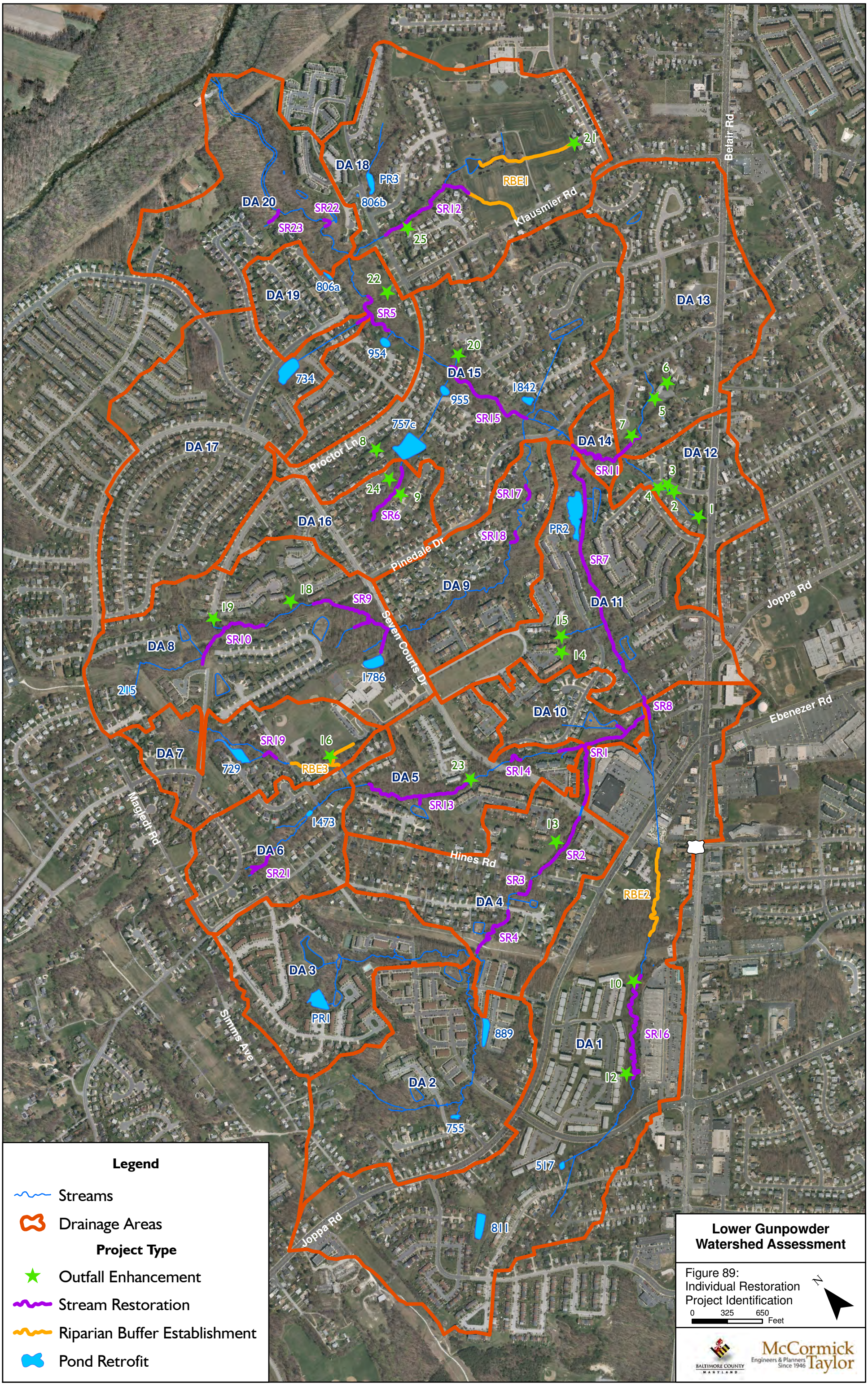

Legend
Streams
Drainage Areas
Project Type
Outfall Enhancement
Stream Restoration
Riparian Buffer Establishment
Pond Retrofit
Lower Gunpowder Watershed Assessment
Figure 89: Individual Restoration Project Identification
0 325 650 Feet
N
Baltimore County Maryland
McCormick Taylor
Engineers & Planners Since 1946
Belair Rd
Klausmier Rd
Proctor Ln
Pinedale Dr
Seven Courts Dr
Joppa Rd
Ebenezer Rd
Hines Rd
Magledt Rd
Simms Ave
DA 1
DA 2
DA 3
DA 4
DA 5
DA 6
DA 7
DA 8
DA 9
DA 10
DA 11
DA 12
DA 13
DA 14
DA 15
DA 16
DA 17
DA 18
DA 19
DA 20
SR1
SR2
SR3
SR4
SR5
SR6
SR7
SR8
SR9
SR10
SR11
SR12
SR13
SR14
SR15
SR16
SR17
SR18
SR19
SR21
SR22
SR23
RBE1
RBE2
RBE3
PR1
PR2
PR3
806a
806b
757c
954
955
1842
734
729
1473
1786
215
889
755
517
811

Table 46: Lower Gunpowder Capital Improvement Project Identification and Prioritization Results

Stream Restoration	Pond Retrofit/Construction
Outfall Enhancement	Riparian Buffer Est.

Rank	Drainage Area	Project ID	Project Type	Location	Proposed Action	Benefits	Known Utilities and/or Constraints	Estimated Cost*	Additional Notes
1	4	SR1*	Stream Restoration	Behind Weis Market	Invasive Species Removal, Bank Stabilization, Floodplain Reconnection, Riparian Buffer Establishment (1600 LF*)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Line in Lt Floodplain, Private Property	$640,000	Includes work in DA5 and DA10
		SR2	Stream Restoration	Between Seven Courts Dr. and Hines Rd.	Bank Stabilization, Floodplain Reconnection, Riparian Buffer Establishment (655 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Line in Lt Floodplain, Private Property	$262,000	
		Outfall 13	Outfall Enhancement	Southwest of Bourbon Ct.	Retrofit - Pocket wetland/pond, Channel Stabilization	Improve Water Quality and Quantity control	Sanitary Line, Private Property	$77,272	Outfall 13 - could be lumped with stream restoration
		SR3	Stream Restoration	Between Hines Rd. and Naygall Rd.	Bank Stabilization (200 LF)	Reduce stream bank erosion	Private Property	$80,000	
		SR4	Stream Restoration	West of Naygall Rd.	Bank Stabilization, Riparian Buffer Establishment (615 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Power Line ROW	$246,000	
2	19	SR5*	Stream Restoration	East of Wood Oak Ct.	Bank stabilization, floodplain reconnection (680 LF*)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Line in Rt Floodplain, Sanitary Crossing at downstream limit	$272,000	DA17 outfall channel work should be included in this project
		Pond 954	Pond retrofit	North of White Wood Ct.	Retrofit - Install baffles or berms	Improve Water Quality and Quantity control		$76,518	
		Pond 806a	Pond retrofit	East of Midaro Ct.	Retrofit - Shallow wetland/marsh, riser replacement	Improve Water Quality and Quantity control	Private Property	$118,300	
		Outfall 22	Outfall Enchancement	West of Klausmier Rd. and Gunview Rd. intersection	Retrofit - Pocket wetland/pond	Improve Water Quality and Quantity control		$90,090	
3	16	SR6	Stream Restoration	North of Cedarbrooke Pl.	Channel Stabilization (615 LF)	Improve stream stability, arrest channel incision, reduce stream bank erosion, improve public safety, protect infrastructure	Private Property, Sanitary Line crossing and exposed manhole	$246,000	Potential homeowner education on poor buffer practices - they are dumping in-stream
		Outfall 24	Outfall Enhancement	End of Brigantine Ct.	Channel Stabilization	Reduce outfall channel erosion	Private Property	$48,750	
		Outfall 9	Outfall Enhancement	North of Cedarbrooke Pl.	Channel Stabilization	Reduce outfall channel erosion	Private Property	$32,500	
4	11	SR7	Stream Restoration	East of Cedar Chip Ct.	Bank stabilization, floodplain reconnection, longitudinal interruption removal (2210 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Private Property, Sanitary Line in Rt Floodplain and multiple crossings likely	$884,000	
		SR8*	Stream Restoration	South of India Ave.	Bank stabilization (215 LF*)	Reduce stream bank erosion, improve public safety	Sanitary Line in Lt Floodplain, Private Property	$86,000	Includes work in DA1
		Outfalls 14 & 15	Outfall Enhancement	East of Borgia Ct.	Retrofit - Pocket pond or bioretention, Channel Stabilization	Improve Water Quality and Quantity control	Private Property	$229,606	
		Pond PR2	Proposed Pond	Northeast of Cedar Chip Ct.	Retrofit - Wetland, embankment reconstruction, riser replacement	Improve Water Quality and Quantity control	Private Property	$372,450	
5	12	Outfalls 1-4	Outfall Enhancement	South of Cedarside Dr.	Retrofit - Shallow wetland/marsh, install riser	Improve Water Quality and Quantity control		$395,200	
6	8	SR9	Stream Restoration	West of Seven Courts Dr.	Bank Stabilization, Longitudinal Interruption removal (1220 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Power Line ROW, Sanitary at Seven Courts	$488,000	extends upstream from Seven Courts, includes 2 headcuts near powerline ROW
		Outfall 18	Outfall Enhancement	Southwest of Hoban Ct.	Retrofit - Pocket pond or bioretention	Improve Water Quality and Quantity control	Private Property	$66,066	Detemine why Pond 757A does not exist
		Outfall 19	Outfall Enhancement	South of Proctor Ln.	Retrofit - Grass swale or bioswale with check dams	Improve Water Quality and Quantity control		$34,164	Sandstone Court
		SR10	Stream Restoration	Northwest of Cody Ave.	Bank Stabilization, Riparian Buffer Establishment (825 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Private Property	$330,000	
		Pond 1786	Pond retrofit	North of Seven Oaks Elementary	Retrofit - Shallow wetland/marsh, riser replacement, Channel Stabilization	Improve Water Quality and Quantity control		$131,950	Potential education opportunity for Seven Oaks Elementary
		Pond 215	Pond retrofit	North of Morn Mist Ct.	Retrofit - Embankment reconstruction, riser replacement	Improve Water Quality and Quantity control	Private Property	$98,800	

Rank	Drainage Area	Project ID	Project Type	Location	Proposed Action	Benefits	Known Utilities and/or Constraints	Estimated Cost*	Additional Notes
7	13	SR11*	Stream Restoration	Southwest of Dawn Dr.	Bank Stabilization, Longitudinal Interruption removal (865 LF*)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat		$346,000	Includes work in DA 14
		Outfall 5	Structural Improvements	Southwest of Dawn Dr.	Structural Improvements - Repair pipe, install drop structure	Reduce outfall channel erosion	Private Property, Steep stream bank	$32,500	
		Outfall 6	Outfall Enhancement	Southwest of Dawn Dr.	Retrofit - Pocket pond or online facility	Improve Water Quality and Quantity control	Private Property, Flooding possiblities	$339,066	
		Outfall 7	Outfall Enhancement	East of Dawn Dr.	Retrofit - wet swale or bioswale with check dams	Improve Water Quality and Quantity control	Private Property	$47,736	
8	18	RBE1	Riparian Buffer Establishment	North of Klausmier	Riparian Buffer Establishment (1510 LF)	Improve instream (shading) and riparian habitat		$604,000	Perryview farm
		SR12	Stream Restoration	North of Perry Brook Ct.	(1030 LF)	Improve channel bed and bank stability, reduce stream bank erosion	Steep slope left bank, Sanitary at right bank, Poor access from Gunview	$412,000	Perryview farm
		Outfall 21	Outfall Enhancement	West of Farmdale Rd.	Channel Stabilization	Reduce outfall channel erosion		$32,500	
		Pond 806B	Pond retrofit	West of Gunview Rd.	Retrofit - Pocket pond or bioretention	Improve Water Quality and Quantity control	Private Property	$101,010	
		Pond PR3	Proposed Pond	East of Jason Ln.	Retrofit - Shallow wetland/marsh, install riser	Improve Water Quality and Quantity control	Private Property	$212,745	
		Outfall 25	Structural Improvements	Northwest of Perry Brook Ct.	Structural Improvements - Remove concrete flume, install drop structure	Improve storm drain outfall stability	Steep stream bank	$32,500	
9	5	SR1*	Stream Restoration	Northeast of Lincolnshire Ct.	Invasive Species Removal, Bank Stabilization, Floodplain Reconnection, Riparian Buffer Establishment (1600 LF*)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Line Right Bank	$640,000	Includes work in DA4 and DA10
		SR13	Stream Restoration	East of Hinesleigh Ct.	Bank Stabilization, floodplain reconnection (1125 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Line Left Bank	$450,000	
		SR14	Stream Restoration	East of Seven Courts Dr.	Bank Stabilization (150 LF)	Reduce stream bank erosion, improve public safety		$60,000	Downstream of Seven Courts Drive
		Outfall 23	Outfall Enhancement	South of Hapsburg Ct.	Channel Stabilization	Reduce outfall channel erosion		$16,250	
10	15	SR15	Stream Restoration	Northeast of Oak White Rd.	Bank Stabilization, Floodplain reconnection, Longitudinal Interruption removal, Buffer establishment (1020 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Pressurized Main Sanitary by Right Bank	$408,000	
		Pond 1842	Pond retrofit	South of Perglen Rd.	Retrofit - Shallow wetland/marsh, riser replacement	Improve Water Quality and Quantity control		$82,550	
		Outfall 20	Outfall Enhancement	Southwest of Perdale Ct.	Retrofit - Grass swale or bioswale with check dams, Pipe repair	Improve Water Quality and Quantity control		$40,625	
		Pond 955	Pond retrofit	Northeast of Oak White Rd.	Retrofit - Shallow wetland/marsh, riser replacement	Improve Water Quality and Quantity control		$143,000	
		Pond 757C	Pond retrofit	West of Oak White Rd	Retrofit - Shallow wetland/marsh, riser replacement	Improve Water Quality and Quantity control	Private Property	$239,850	
		Outfall 8	Outfall Enhancement	South of Proctor Ln.	Channel Stabilization	Reduce outfall channel erosion	Private Property	$65,000	
11	1	SR8*	Stream Restoration	South of India Ave.	Bank stabilization (215 LF*)	Reduce stream bank erosion, improve public safety	Sanitary Line Right Bank	$86,000*	Likely Combined with DA11
		SR16	Stream Restoration	East of Blairwood Rd.	Bank Stabilization, Buffer establishment, floodplain reconnection (1345 LF)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Line Left Bank	$538,000	
		RBE2	Riparian Buffer Establishment	North of Belair Rd.	Riparian Buffer Establishment (955 LF)	Improve instream (shading) and riparian habitat	Sanitary Line Left Bank	$382,000	Planting only
		Outfall 10	Outfall Enhancement	East of Blairwood Rd.	Retrofit - Pocket wetland/pond or bioretention, Channel Stabilization	Improve Water Quality and Quantity control	Private Property, Sanitary	$153,166	
		Outfall 12	Outfall Enhancement	East of Blairwood Rd.	Channel Stabilization	Reduce outfall channel erosion	Private Property	$32,500	
		Pond 811	Pond retrofit	North of Link Ave.	Retrofit - Shallow wetland/marsh, riser replacement	Improve Water Quality and Quantity control		$215,800	
		Pond 517	Pond retrofit	South of Joppawood Ct.	Retrofit - Shallow wetland/marsh or bioretention, riser replacement	Improve Water Quality and Quantity control		$85,800	

Rank	Drainage Area	Project ID	Project Type	Location	Proposed Action	Benefits	Known Utilities and/or Constraints	Estimated Cost*	Additional Notes
12	9	SR17	Stream Restoration	Northwest of Silverwood Ct.	Bank Stabilization, Longitudinal Interruption removal (150 LF)	improve stream bank stability, reduce stream bank erosion, improve instream habitat	Sanitary Line Right Bank	$60,000	In powerline ROW, removal or replacement of powerline culvert
		SR18	Stream Restoration	East of Hollybrook Ct.	Bank Stabilization (150 LF)	improve stream bank stability, reduce stream bank erosion	Sanitary Line Left Bank	$60,000	Off Romanoff Court
		Outfall 17	Structural Improvements	Northwest of W. Orange Ct.	Structural Improvements - Repair pipe joint disconnection	Improve storm drain system stability	Private Property, Steep stream bank	$26,000	
13	7	SR19	Stream Restoration	West of Simms Rd.	(150 LF)	improve channel stability, arrest channel incision, reduce stream bank erosion		$60,000	
		RBE3	Riparian Buffer Establishment	North of Tila Rd.	(785 LF)	Improve instream (shading) and riparian habitat		$314,000	
		Outfall 16	Outfall Enhancement	North of Tila Rd.	Retrofit - Bioretention or rain garden	Improve Water Quality and Quantity control		$40,404	Potential education opportunity for Seven Oaks Elementary
		Pond 729	Pond retrofit	North of Montauk Ct.	Retrofit - Replace riser, stabilize inflow points	Improve Water Quality and Quantity control	Large contributing drainage area	$239,200	
14	17	SR5*	Stream Restoration	North of Wood Oak Ct.	(680 LF)	improve channel stability, arrest channel incision	Sanitary Line Left Bank	$272,000*	stabilization of pond outlet channel to be performed in concert with stream restoration project within DA19
		Pond 734	Pond retrofit	South of Klausmier Rd.	Retrofit - Shallow wetland/marsh, modify or replace riser	Improve Water Quality and Quantity control		$189,540	
15	10	SR1*	Stream Restoration	Behind Weis Market	Invasive Species Removal, Bank Stabilization, Floodplain Reconnection, Riparian Buffer Establishment (1600 LF*)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Private Property, Sanitary Crossing at DA5	$640,000	Includes work in DA4 and DA5
16	14	SR11*	Stream Restoration	West of Dawn Dr.	Bank stabilization (865 LF*)	Improve Stream Stability, Reduce stream bank erosion, improve instream and riparian habitat	Sanitary Crossing Western Portion	$346,000	Includes work in DA 13
17	6	Pond 1473	Pond retrofit	West of Simms Rd.	Retrofit - Off-line shallow wetland/marsh, modify or replace riser	Improve Water Quality and Quantity control		$200,850	
		SR21	Bank Stabilization	East of Bretton Reef Rd.	Bank stabilization (370 LF)	Improve stream stability, reduce stream bank erosion		$148,000	
18	3	Pond PR1	Proposed Pond	Northeast of Fawn Spring Ct.	Retrofit - Wetland, install berm and riser	Improve Water Quality and Quantity control	Private Property	$96,642	
19	20	SR22	Stream Restoration	West of Fox Farm Rd.	Bank stabilization (125 LF)	improve stream stability, reduce stream bank erosion		$50,000	
		SR23	Stream Restoration	North of Midaro Ct.	Bank stabilization (150 LF)	improve stream stability, reduce stream bank erosion	Sanitary Line at Right Bank	$60,000	
20	2	Pond 755	Pond retrofit	North of Perry Woods Ct.	Retrofit - Reconstruct embankment, install riser	Improve Water Quality and Quantity control		$141,960	
		Pond 889	Pond retrofit	North of Springtime Way	Retrofit - Install baffles or berms	Improve Water Quality and Quantity control	Private Property	$42,120	

*Project is listed in multiple Drainage Areas

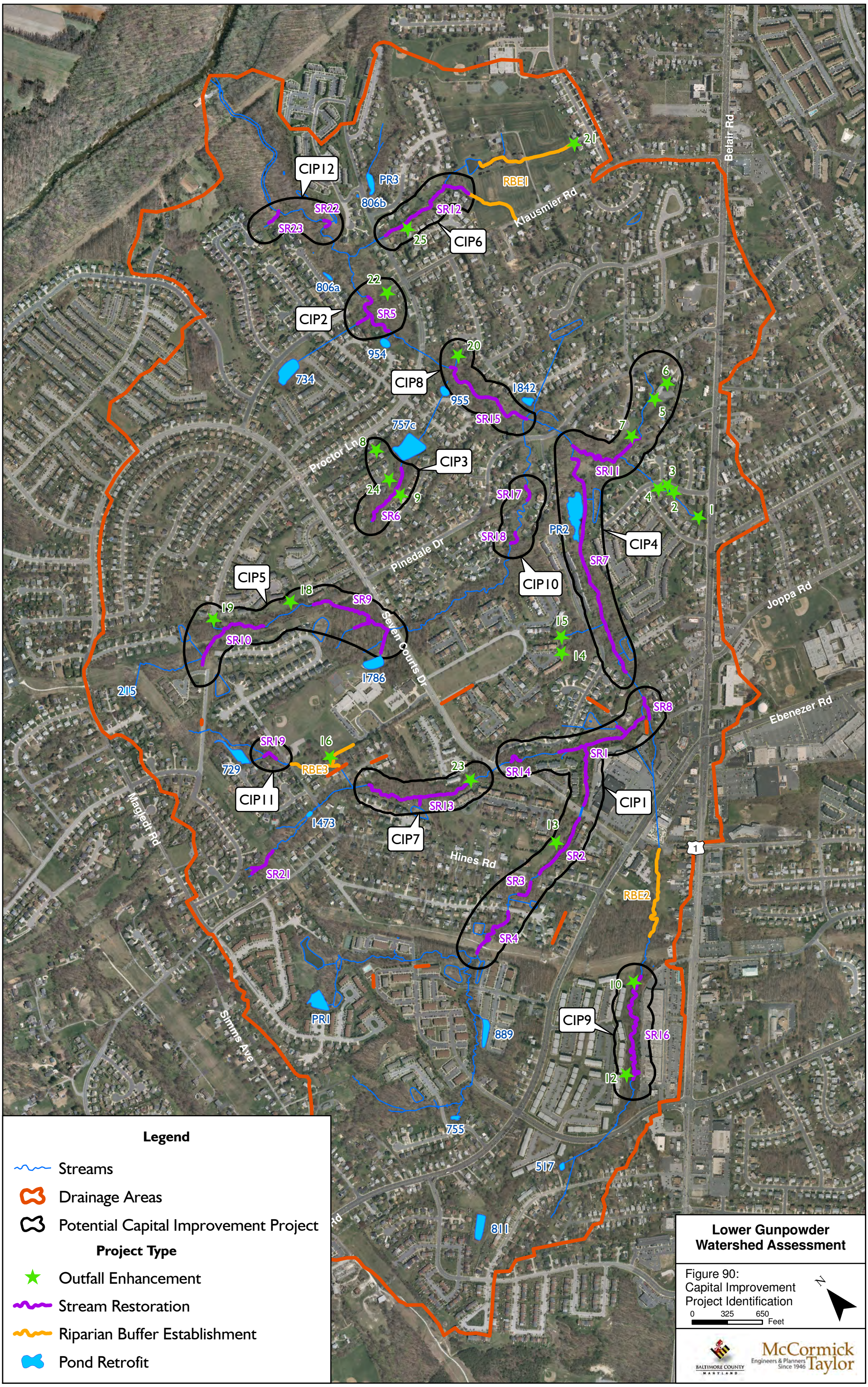

Legend
Streams
Drainage Areas
Potential Capital Improvement Project
Project Type
Outfall Enhancement
Stream Restoration
Riparian Buffer Establishment
Pond Retrofit
Lower Gunpowder Watershed Assessment
Figure 90: Capital Improvement Project Identification
0 325 650 Feet
N
McCormick Taylor
Engineers & Planners Since 1946
BALTIMORE COUNTY MARYLAND
CIP1
CIP2
CIP3
CIP4
CIP5
CIP6
CIP7
CIP8
CIP9
CIP10
CIP11
CIP12
RBE1
RBE2
RBE3
Klausmier Rd
Belair Rd
Proctor Ln
Pinedale Dr
Seven Courts Dr
Joppa Rd
Ebenezer Rd
Hines Rd
Maglett Rd
Simms Ave

Table 47
Potential Capital Improvement Projects

Potential Capital Improvement Project	Projects	Cost	Total Cost
CIP1	SR1	$640,000	$1,451,272
	SR2	$262,000	
	SR3	$80,000	
	SR4	$246,000	
	SR8	$86,000	
	SR14	$60,000	
	Outfall 13	$77,272	
CIP2	SR5	$272,000	$362,090
	Outfall 22	$90,090	
CIP3	SR6	$246,000	$392,250
	Outfall 8	$65,000	
	Outfall 9	$32,500	
	Outfall 24	$48,750	
CIP4	SR7	$884,000	$2,021,752
	SR11	$346,000	
	Outfall 5	$32,500	
	Outfall 6	$339,066	
	Outfall 7	$47,736	
	Pond PR2	$372,450	
CIP5	SR9	$488,000	$918,230
	SR10	$330,000	
	Outfall 18	$66,066	
	Outfall 19	$34,164	
CIP6	SR12	$412,000	$444,500
	Outfall 25	$32,500	
CIP7	SR13	$450,000	$466,250
	Outfall 23	$16,250	
CIP8	SR15	$408,000	$448,625
	Outfall 20	$40,625	
CIP9	SR16	$538,000	$723,666
	Outfall 10	$153,166	
	Outfall 12	$32,500	
CIP10	SR17	$60,000	$120,000
	SR18	$60,000	
CIP11	SR19	$60,000	$60,000
CIP12	SR22	$50,000	$110,000
	SR23	$60,000	
		Total	$7,518,635

VIII. Conclusions and Limitations

The Lower Gunpowder Falls Watershed Assessment Report prioritized and ranked the restoration opportunities of the twenty drainage areas investigated. Utilizing rating criteria from established metrics for each category of site ecology, hydrology and geomorphology, project identification and associated "need" for restoration in the watershed represents a means to holistically connect and restore these watershed systems. On a larger scale, the selected Potential Capital Improvement Projects ***(Table 47)*** represent opportunities to effectively restore the ecosystem components of entire sub-watersheds and in some cases, larger groupings of adjacent sub-sheds of the Lower Gunpowder Falls. Successful implementation of these projects would effectively restore the natural ecologic continuum endemic to the region and greatly benefit the receiving Gunpowder River system to the north.

Opportunities identified within the proposed stream restoration projects include: bank stabilization, floodplain reconnection, channel re-alignment, longitudinal interruption removal, buffer enhancements and invasive species removal. Single projects may incorporate a combination of these identified opportunities. Projects with only riparian enhancement opportunities and no expected earthwork were identified separately. Some projects grouped adjacent impaired areas and may cross over drainage area boundaries. Property ownership and constructability (e.g. access, proximity to utilities, etc.) were not considered in project prioritization, however, it is understood this may be a controlling factor in project implementation.

Pond and outfall retrofits ranged from installation of new BMP facilities requiring major grading and/or embankment reconstruction to riser replacement or modification. Recommendations that required engineering design were considered retrofits or structural repairs. Action items including removal of vegetation, debris or minor sediment and/or cleaning risers or outfall pipes were considered maintenance ***(Appendix E)***, as they do not require a detailed design.

The retrofit recommendations for SWM facilities were based on the existing construction plans, GIS information and field reconnaissance. The concepts may be modified once additional information is obtained including geotechnical analysis results, underground utility information, property ownership, possibly permit requirements and site accessibility for construction and/or maintenance.

Costs for stream projects were based on an estimate of $400 per linear foot for design and construction. This estimate is somewhat variable depending on the type and quantity of treatment proposed, degree of site assessment (e.g. additional sediment studies) ease of access, site constraints and general constructability. Construction costs for the SWM and outfall retrofits were based on the amount of impervious area treated as detailed in Center for Watershed Protection Urban Subwatershed Restoration Manual 3. Examples of SWM and drainage construction estimates include:

- Outfall channel stabilization: $250/LF
- Bioretention, Pocket ponds, berm and riser installation: $42,000/imp acre treated
- Swales, grass channels, bioswales, baffle installation: $36,000/imp acre treated
- Shallow wetland/marsh or new ponds: $50,000/imp acre treated

True costs of retrofits and restoration projects vary significantly with site conditions and may increase if additional effort is needed to prepare geotechnical reports, work around utilities or specimen trees or perform additional grading based on field elevations. A design fee estimate of 30% for the construction cost was used for each of the above construction activities.

Potential Capital Improvement Projects are summarized on ***Table 47*** and ***Figure 90***. The table summarizes the individual projects, their estimated costs and total cost for each grouping. It should be noted that project groupings of CIP1 through CIP12 are generally ranked in that order from those with the highest to lowest need based on the metric evaluation.

REFERENCES

Buffington, J.M. and D.R. Montgomery. 1999. *Effects of sediment supply on surface textures of gravel bed rivers*. Water Resources Research. 35(11):3523-3530.

Hollis, G. 1975. *The effect of urbanization on floods of different recurrence intervals.* Water Resources Research. 11(3): 431-435.

Knight, A.W and R.L. Bottorff. 1981. *The Importance of Riparian Vegetation to Stream Ecosystems*. Paper presented at the California Riparian Systems Conference. University of California, Davis, September 17-19, 1981.

Kondolf, G.M. 1997. *Hungry Water: Effects of dams and gravel mining on river channels*. Environmental Management. 21(4): 533-551.

Leopold, L. B. 1968. *Hydrology for urban land planning: a guidebook on the hydrologic effects of urban land use*. Geological Survey Circular 554. US Geological Survey, US Department of the Interior, Washington, DC.

Lisle, T.E., J.M. Nelson, J. Pitlick, M.A. Madej, and B.L. Barkett. 2000. *Variability of bed mobility in natural, gravel-bed channels and adjustments to sediment load at local and reach scales*. Water Resources Research. 36(12):3743-3755.

Macrae, C. and J. Marsalek. 1992. *Relative fish use in urban and non-urban streams.* Proceedings Canadian Hydrology Symposium. Winnipeg, Canada.

Parsons Brinckerhoff, Inc. (PB). 1999. *Lower Gunpowder Falls Water Quality Management Study*. Baltimore, MD.

Rosgen, D.L., 2001. *A Stream Channel Stability Assessment Methodology*. 7th Federal Interagency Sedimentation Conference. March 25-29. Reno, Nevada.

Rushton, B.T. 2001. *Low-Impact parking lot design reduces runoff and pollution loads*. Journal of Water Resources Planning and Management. May/June:172-179.

Schueler, Thomas R. *The Practice of Watershed Protection.* 2000. T. Schueler and H. Holland, eds. Center for Watershed Protection. Ellicott City, MD.

Schumm, S.A. *The Fluvial System*. 1977. Wiley Interscience. New York, NY.

Simon, A. and C.R. Hupp. 1987. *Geomorphic and vegetative recovery processes along modified Tennessee streams: An interdisciplinary approach to disturbed fluvial systems.* Proceedings of the Forest Hydrology and Watershed Management Symposium, Vancouver, August 1987. Publication No. 167:251-261.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. *The River Continuum Concept*. Canadian Journal of Fish and Aquatic Sciences. 37:130-137.

Walsh, C.J., T.D. Fletcher, A.R. Ladson. 2005. *Stream restoration in urban catchments through redesigning stormwater systems: looking to the catchment to save the stream.* Journal of the North American Benthological Society. 24(3):690-705.

Yetman, K.T. 2001. *Stream Corridor Assessment Survey Protocols*. Watershed Restoration Division, Maryland Department of Natural Resources. Annapolis, MD.