# MATHEWS COUNTY

# RURAL DITCH ENHANCEMENT STUDY

Prepared For:

Mathews County Ditching Committee

and

Middle Peninsula Planning District Commission

**April 7, 2015**

Prepared By:


DAA Project Number: B13172B-01

**Study Comments**

There is general agreement that significant drainage problems exist within Mathews County. The environmental, social and economic challenges associated with drainage problems are widespread. Multiple grants have been awarded to assist the Mathews County Board of Supervisors with developing new approaches to address its drainage problems. This report was funded by the National Fish and Wildlife Foundation, Chesapeake Bay Technical Assistance Grant Program to develop a comprehensive engineering study to provide recommendations and conceptual opinions of probable costs to improve the conveyance of stormwater and water quality through the ditches in Mathews County.

Some citizens have expressed concern about the technical drainage work done to date; these citizens may not be aware that the scope of the project was based on direction provided by Mathews County. Some of the concerns raised are beyond the scope of this study, but need to be addressed in the future. Citizen concerns are important and resources should be dedicated to address these concerns in following studies. This report will be open for public review and comment. Any comments or deficiencies noted should be substantiated, sourced and/or verified for future use and consideration.

# 3RD PARTY REVIEW

This Report has been subjected to technical and quality reviews by:

| Name: Carolyn A. Howard, P.E. | Signature | Date |
|---|---|---|
| Project Manager | | |

| Name: Sheryl S. Stephens | Signature | Date |
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| Quality Reviewer | | |

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# 1.0 PURPOSE

Mathews County lies within the coastal region of the Chesapeake Bay and experiences inadequate conveyance of stormwater through roadside and outfall ditches to receiving bodies of water due to a lack of maintenance, poorly draining soils, and/or topographic constraints. The issues of improving the adequacy of ditches and determining who is responsible for maintenance and/or reconstruction of the ditches is a high priority of the county citizens, since poor drainage has negative impacts on the County's existing and future tax base, business opportunities and health and safety, especially immediately following storm events.

Ownership of public road outfall ditches, which also identifies who is responsible for maintenance and repair, is the issue at the center of the debate in Mathews County and throughout the region. Resolution of this issue is outside the scope of this report. However it is important to recognize the different perspectives regarding ownership of outfall ditches. The position of county citizens is, since the Virginia Department of Transportation (VDOT) required adequate drainage facilities and land for road and outfall ditch construction as a prerequisite for acceptance into the secondary system, VDOT is responsible for maintenance of outfall drainage systems. The VDOT acknowledges responsibility for ditches within their rights-of-way and deeded easements and is willing to work with Mathews County to improve the drainage system.

To provide guidance for this project, the Mathews County Board of Supervisors (BOS) established the Mathews County Ditching Committee (Committee) and appointed members to serve on the Committee. Through collaboration with Middle Peninsula Planning District Commission (MPPDC), Mathews County, the Virginia Department of Transportation (VDOT), and the Committee and using the best available data, including USGS maps, 2010 ARRA LIDAR, VGIN 2013 aerial photography, and FEMA maps, this report is intended to identify potential causes, recommend improvements, and offer a framework for the county to start addressing existing drainage concerns and water quality improvements within Mathews County. Prior to maintenance and/or reconstruction activities, a field topographic survey of the area should be completed to verify recommendation assumptions and to provide a basis for design, as needed.

Additionally, VDOT expects to use the information gathered in this study to determine the best use of the available VDOT funding for implementation of improvement projects within public rights-of-way and easements.

This report focuses on specific drainage problems within four (4) general areas of concern, as previously identified by the county and VDOT (refer to Figure 1). Proposed solutions for each unique drainage issue described in this report will be generalized for consideration and use for similar issues throughout the county and the region. However, it should be noted the recommendations of this report and resulting implementation by VDOT, the county, and/or private citizens will not eliminate all flooding and drainage problems for all storm events and conditions.

Note: Some of the statements included in this report may not reflect the opinions and views of the Mathews County Ditching Committee.

## 2.0 BACKGROUND

Mathews County is almost completely surrounded by water except along its northern border where it is adjacent to Gloucester County (refer to Figure 2). The county's stormwater drainage system primarily consists of ditches, culverts, and natural streams draining both public rights-of-way and private property and ultimately draining into the Chesapeake Bay.

In many cases, the drainage systems are inadequate and, as a result, roads and private properties are frequently flooded after a storm event. Roadway flooding frequently cuts residents and business off from the county and emergency services for extended periods of time. Flooding has also caused the county school system to be closed due safety concerns. Flooding, risks to public health and safety, property damage, and long-term loss of property use and values are consequences of the inadequate drainage systems, all of which ultimately negatively impact the economy of the Mathews County.

Conditions contributing to the failure of the drainage system, include, but are not limited to, the following:

1. A lack of maintenance, including removal of sediment and overgrown vegetation, causing slopes to be inadequate or reverse slope and/or tides not allowed to recede;
2. Insufficient elevation change (topographic constraints);
3. Cross-culverts are filled with sediment, not adequately maintained, damaged, and/or installed with an inadequate / reverse slope;
4. Unclear ownership and ditch maintenance responsibility (VDOT or private);
5. Sea level rise; and
6. Land subsidence.

The scope of this report is limited to review of items 1 through 3 above and will briefly address the issue of ownership and maintenance responsibility, sea level rise, and land subsidence.

## 2.1 Definitions

As per the Commonwealth of Virginia Department of Environmental Quality (DEQ) Guidance Memorandum No. 08-2004 Regulation of Ditches under the Virginia Water Protection (VWP) Program[1] (Appendix A), the following definitions are provided for reference in this report.

**Ditch** is defined as a linear feature excavated for the purpose of draining or directing surface or groundwater. Ditches may also be constructed to collect groundwater or surface water for the purposes of irrigation.

**Drainage System** is defined as a series of watercourses designed to direct excess water.

**Maintenance** is defined as activities that return a feature to its original design standards. Maintenance generally includes, but is not limited to, activities such as:

- Excavation of accumulated sediments
- Re-shaping of side slopes
- Stabilization of side slopes
- Armoring, lining, and/or paving where the ditch was previously armored, lined, or paved.

**Open Water Ditch** is defined as those ditches that are inundated with surface water for a sufficient period of time during a normal year to develop an Ordinary High Water Mark but that do not contain vegetation during all or part of the year.

**Ordinary High Water Or Ordinary High Water Mark (OHWM)** is defined in VWP regulation as "the line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank; shelving; changes in the character of soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas".

[1] Commonwealth of Virginia Department of Environmental Quality Guidance Memorandum No. 08-2004 Regulation of Ditches under the Virginia Water Protection Program, May 13, 2008

**State waters** are defined in statute and regulation as "all water, on the surface and under the ground, wholly or partially within or bordering the Commonwealth or within its jurisdiction, including wetlands".

**Stream** is defined as a natural body of flowing water, such as a brook or a river. Streams do not always contain flowing water but contain flowing water for a significant period of time such that the stream has a defined bed and bank and an ordinary high water mark. The ordinary high water mark does not need to be continuously apparent throughout the stream reach.

**Stream bed** is defined in VWP regulation as "the substrate of a stream, as measured between the ordinary high water marks along a length of stream. The substrate may consist of organic matter, bedrock or inorganic particles that range in size from clay to boulders, or a combination of both. Areas contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed".

**Surface water** is defined in statute and regulation as "all state waters that are not ground water as defined in § 62.1-255 of the Code of Virginia". Thus, ditches that contain and/or convey surface water are considered state waters.

## 3.0 RESPONSIBLE PARTIES

In 2013 the MPPDC contracted with Beale, Davidson, Etherington, & Morris, P.C. to research the legal and ownership issues of roadside and outfall ditches within the Middle Peninsula region; the results of this research are detailed in The Roadside and Outfall Drainage Ditches report dated September 3, 2013 (Appendix B).

**Property owners are solely responsible for the maintenance of ditches within their property, exclusive of easements.**

From the legal references provided in this report, current laws state property owners are solely responsible for the maintenance of ditches within their property, exclusive of easements. Property owners can relocate a ditch on their site, with proper permitting, as required, if the points of entry and discharge from their property are at the original locations. If a drainage easement exists over private property, the grantee of the easement is responsible for maintenance. VDOT is responsible for maintenance of ditches within public rights-of-way and recorded drainage easements, where VDOT is the grantee.

The report also states that, due to insufficient elevation change along the ditch system, "no party is responsible for (a) lack of flow, if it has not taken some action that impedes the flow in the natural watercourse." However, no owner can obstruct the flow of water through a drainage system.

Members of the Committee provided copies of deeds from their individual research for our review and information. This data is provided in Appendix I.

The issues of ditch ownership and maintenance responsibility still need to be addressed, but are outside the scope of this study. The MPPDC is currently seeking grant funding to further investigate roadside ditch issues in the county through mapping and research of property deeds and document ownership of ditches and outfalls to plan for needed maintenance of failing ditches and design of a framework for a database to house information on failing ditches.

# 4.0 ENVIRONMENTAL CONCERNS

According to the Chesapeake Bay Program, "over the past century, Chesapeake Bay waters have risen about one foot…." The sea level rise is caused by a number of factors including climate change, tidal influences, degradation of wetlands, and the region's subsidence. In 2010, the *Chesapeake Bay Land Subsidence and Sea Level Change: An Evaluation of Past and Present Trends and Future Outlook*[2] report estimated that sea level rise in the Chesapeake Bay between 1976-2007 was approximately 1.8 mm per year and the rate of subsidence ranged from -1.3 mm per year to -4.0 mm per year; this results in a total possible sea level rise of 0.12 to 0.22 inches per year in the Mathews County area. Using this rate, from 1980 to 2014 there was approximately 5 inches of sea level rise in this area.

Note: 1980 is used as a reference date to correspond with the date of the maps referenced in this report; the maps were included in the Drainage Study of the Garden Creek Area prepared by Shore Engineering Company, Inc. in June 1980.

[2] Chesapeake Bay Land Subsidence and Sea Level Change: An Evaluation of Past and Present Trends and Future Outlook ,Virginia Institute of Marine Science, John D. Boon, John M. Brubaker, David R. Forrest, November 2010

# 5.0 AREA 1 – ONEMO

## 5.1 Existing Conditions

Study Area 1A: Canoe Yard Trail

Canoe Yard Trail (Route 677) and the adjacent areas from 400 feet east of Tabernacle Road (Route 611) to a point approximately 1,700 feet east are relatively flat at elevation 3 feet. Stormwater runoff from adjacent properties and the road appear to be designed to flow south to an outfall along Bethel Beach Road (Route 609) to Winter Harbor. The drainage outfall for Route 677 and areas upstream starts a point along Route 677 approximately 1,000 feet east of Route 611 south through private property approximately 720 feet, then east approximately 1,260 feet to two (2) large outfall ditches. These outfall ditches run north to south from Route 677 crossing Bethel Beach Road to its outfall at Winter Harbor. Refer to Figure 3 for locations and additional detail.

Study Area 1B: Route 609

As shown on Figure 4, there are several culverts with reverse slopes along Route 609 from Piney Point east approximately 760 feet to the outfall toward Winter Harbor. Also, as noted in section 4.0, the estimated total sea level rise in this area is approximately 5 inches or 0.42 feet since 1980. The difference in sea level is a potential factor in increased flooding of Route 609 in the area of the outfall toward Winder Harbor, since the elevations in this area are at approximately 1 foot. The reverse slopes of the culverts and ditches and the rise of sea level are contributing factors to flooding in this area of Route 609.

## 5.2 Recommendations

Study Area 1A: Canoe Yard Trail (Route 677)

The ditch along and from Route 677 south and along the entire length of the outfall ditch system to Winter Harbor should be reconstructed to original conditions; refer to Figure 3. The slope of this swale from Route 677 will be minimal - approximately 0.1 percent, but provide positive drainage toward Winter Harbor. The ditch side-slopes and flow-lines, if dry, should be seeded with water-tolerant, erosion-resistant grass, such as Bermudagrass or Kentucky bluegrass, and protected by a biodegradable erosion control fabric to provide immediate stabilization of the channel bed and banks.

Route 677 is a dedicated public right-of-way; the roadside ditches and culvert maintenance / improvements within the rights-of-way should be completed by VDOT. A cursory review of county plat books is inconclusive regarding the existence of public easements for the outfall ditches through private property; additional deed and legal research should be completed to determine the existence of easements. Refer to Appendix D for plat book information reviewed on November 20, 2014.

Study Area 1B: Bethel Beach Road (Route 609) – Refer to Figure 4

The roadside ditches along Route 609 from Kings Landing Road east to the outfall toward Winter Harbor should be maintained and/or reconstructed to provide positive drainage. Additionally, along Route 609, culverts A and B appear to have reverse slopes and other culverts have been damaged; these culverts need to be replaced to facilitate adequate drainage. Route 609 is a dedicated public right-of-way; the roadside ditches and culvert maintenance / improvements in this area should be completed by VDOT.

### 5.3 Conceptual Opinion of Probable Project Costs

The following conceptual opinion of probable project costs are based on the information collected during preparation of this study and assume the work will be completed by a third party contractor. Project area field topographic surveys and detailed designs should be performed prior to construction to confirm the recommendations included in this report and to obtain the necessary permits for construction.

| Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|
| ***Study Area 1A: Canoe Yard Trail (Route 677)*** | | | | |
| Mobilization | 1 | LS | $ 2,300.00 | $ 2,300 |
| Construction Surveying | 1 | LS | $ 600.00 | $ 600 |
| Geotechnical & Compaction Testing | 1 | LS | $ - | $ - |
| Clearing & Grubbing | 1 | LS | $ 4,000.00 | $ 4,000 |
| Traffic Control | 1 | LS | $ 1,000.00 | $ 1,000 |
| Silt Fence | 950 | LF | $ 3.50 | $ 3,325 |
| Stone Construction Entrance | 1 | LS | $ 2,500.00 | $ 2,500 |
| Culvert Inlet/Outlet Protection | 2 | EA | $ 200.00 | $ 400 |
| Permanent Seeding | 0.4 | AC | $ 2,500.00 | $ 1,000 |
| Erosion Control Mulch | 2100 | SY | $ 3.00 | $ 6,300 |
| Soil Stabilization Mat EC-3, Type B | 600 | SY | $ 10.00 | $ 6,000 |
| Ditch Reconstruction | 1900 | LF | $ 18.00 | $ 34,200 |
| | | | | |
| | | | *Total:* | $ 61,625 |
| | | | *20% Construction Contingency* | $ 12,325 |
| | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 73,950*** |
| | | | | |
| | | | Estimate of Professional Surveying and Design Services: | $ 11,100 |
| | | | Estimate of Potential Easement Acquistion: | TBD |
| | | | | |
| | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 85,050** |

| Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|
| ***Study Area 1B: Bethel Beach Road (Route 609)*** | | | | |
| Mobilization | 1 | LS | $ 1,800.00 | $ 1,800 |
| Construction Surveying | 1 | LS | $ 750.00 | $ 750 |
| Geotechnical & Compaction Testing | 1 | LS | $ 500.00 | $ 500 |
| Clearing & Grubbing | 1 | LS | $ 500.00 | $ 500 |
| Traffic Control | 1 | LS | $ 2,500.00 | $ 2,500 |
| Silt Fence | 500 | LF | $ 3.50 | $ 1,750 |
| Stone Construction Entrance | 0 | LS | $ 2,500.00 | $ - |
| Culvert Inlet/Outlet Protection | 12 | EA | $ 200.00 | $ 2,400 |
| Permanent Seeding | 0.2 | AC | $ 2,500.00 | $ 500 |
| Erosion Control Mulch | 600 | SY | $ 3.00 | $ 1,800 |
| Soil Stabilization Mat EC-3, Type B | 200 | SY | $ 10.00 | $ 2,000 |
| Ditch Reconstruction | 1000 | LF | $ 12.00 | $ 12,000 |
| 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| 18-inch Culvert with Backfill | 0 | LF | $ 95.00 | $ - |
| 15-inch Culvert with Backfill | 70 | LF | $ 85.00 | $ 5,950 |
| Pavement Restoration, Complete | 60 | TN | $ 250.00 | $ 15,000 |
| | | | | |
| | | | *Total:* | $ 47,450 |
| | | | *20% Construction Contingency* | $ 9,490 |
| | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 56,940*** |
| | | | | |
| | | | Estimate of Professional Surveying and Design Services: | $ 8,500 |
| | | | Estimate of Potential Easement Acquistion: | $ - |
| | | | | |
| | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 65,440** |

# 6.0 AREA 2 - DIGGS

## 6.1 Existing Conditions

The Diggs study area is along Aarons Beach Road (Route 645) near the intersection with Gullwing Cove Road. Route 645 has well-defined ditches on both sides of the roadway and cross-culverts that ultimately outfall to a Garden Creek tributary; refer to Figure 9 for existing drainage areas and patterns. Significant flooding is reported at the intersection of Route 645 and Gullwing Cove Road.

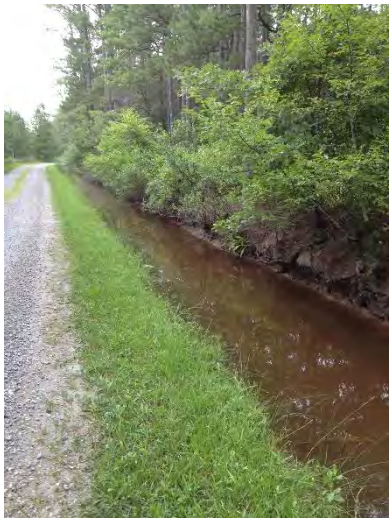

**Photo 1 - Route 645 Roadside Ditch**

At Gullwing Cove Road, the ditch on the north side of Route 645 from both east and west of the intersection crosses Route 645 and drains south to a ditch on the east side of the road. The ditch from the west on the south side of Route 645 crosses the road via a culvert to the ditch east of the road. The Gullwing Cove Road ditch flows on the east side for approximately 300 feet, then crosses the road via a culvert to the southwest towards the Garden Creek Tributary through the woods to a stream that runs to the marsh, and from the marsh to Garden Creek. As shown in Figure 9, the culverts crossing Route 645 to the ditch east of Gullwing Cove Road are approximately 0.18 feet below the culvert crossing Gullwing Cove Road. The outfall ditch from Gullwing Cove Road is also shown on Cadastral Maps of Mathews County (Section 27) dated June 16, 1982 (Figure 10).

**Photo 2 - Route 645 Outfall Ditch**

Site observations on July 16, 2014, indicate VDOT has replaced culverts in this area since the 1980 mapping, as shown in Figure 9. Maintenance of the roadside ditches and culverts does not appear to be a contributing factor to the flooding in this area. Standing water with minimal flow velocity was observed in the roadside and outfall ditches. As per the definitions in Section 2.0, these ditches are open water ditches and are very likely state waters and jurisdictional under Virginia DEQ and U.S. Army Corps of Engineers.

Additionally, as per site observations on December 11, 2014, the ditch upstream of proposed culvert D (refer to Figure 9), does not appear to directly connect to the ditch system towards Garden Creek. This could be a possible source of flooding along Route 645. It was also observed that, near the confluence with the Garden Creek tributary, the outfall ditch appears to have significant sediment build up, which is obstructing the flow toward Garden Creek during low tide.

Upon review of historical and current USGS topographic maps, 2011 VGIN LIDAR, and Figure 9, the elevations of this area are at or below 3 feet and 1980 elevations of the ditch from approximately 1,000 feet northwest and 200 feet of the intersection are at or below 0.50 feet. As noted in section 4.0, the estimated total sea level rise in this area is approximately 5 inches or 0.42 feet. The difference in sea level is a possible explanation for the minimal (or negative) hydraulic slope toward Garden Creek.

### 6.2 Recommendations

It is unlikely the standing water within the ditches can be eliminated and the reduction of the hydraulic slope of the drainage system improved significantly due to changes in sea level, subsidence and tidal influence.

Inspection, maintenance and removal of the sediment build up in the outfall ditch A1 (refer to Figure 9) is the first step to reduce the frequency of flooding at the intersection and along Route 645; this would allow surface water flow and tides to recede toward Garden Creek. A cursory review of county plat books is inconclusive regarding the existence of a public easement for outfall ditch A1 through private property; additional deed and legal research should be completed to determine the existence of easements. Refer to Appendix E for plat book information reviewed on November 20, 2014.

Other recommended improvements include the following: (Refer to Figure 9.)

1. Approximately 600 feet east of the intersection: Install a new 18-inch culvert D (sized for 25-year storm event) across the existing driveway north of Route 645 to connect to ditch D2; and restore ditches D2 and D3 to original conditions and remove sediment and

vegetative growth to facilitate positive drainage and minimize roadway and driveway flooding. Route 645 is a dedicated public right-of-way; the roadside ditches and culvert maintenance / improvements in this area should be completed by VDOT.

2. West of the intersection: Install two (2) 18-inch culverts B (sized for the 25-year storm event) crossing Route 645, approximately 50 feet west of the intersection, and construct a new ditch A2 along the west side of Gullwing Cove Road 400 feet south to the existing outfall ditch A1 to Garden Creek. Drainage easements and/or land acquisition will likely be required for this improvement.

   Prior to construction, this project will likely require a Joint Permit Application (JPA) and approval through Virginia DEQ, Virginia Marine Resources Commission, and the U.S. Army Corps of Engineers. A delineation and determination of the state waters will need to be completed as part of the design process to confirm whether a JPA is required.

### 6.3 Conceptual Opinion of Probable Project Cost

The following conceptual opinion of probable project cost is based on the information collected during preparation of this study and assumes the work will be completed by a third party contractor. Project area field topographic surveys and detailed designs should be performed prior to construction to confirm the recommendations included in this report and to obtain the necessary permits for construction.

| Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|
| Mobilization | 1 | LS | $ 2,200.00 | $ 2,200 |
| Construction Surveying | 1 | LS | $ 1,500.00 | $ 1,500 |
| Geotechnical & Compaction Testing | 1 | LS | $ 750.00 | $ 750 |
| Clearing & Grubbing | 1 | LS | $ 1,000.00 | $ 1,000 |
| Traffic Control | 1 | LS | $ 2,500.00 | $ 2,500 |
| Silt Fence | 615 | LF | $ 3.50 | $ 2,153 |
| Stone Construction Entrance | 1 | LS | $ 2,500.00 | $ 2,500 |
| Culvert Inlet/Outlet Protection | 14 | EA | $ 200.00 | $ 2,800 |
| Permanent Seeding | 0.3 | AC | $ 2,500.00 | $ 750 |
| Erosion Control Mulch | 700 | SY | $ 3.00 | $ 2,100 |
| Soil Stabilization Mat EC-3, Type B | 200 | SY | $ 10.00 | $ 2,000 |
| Ditch Maintenance | 850 | LF | $ 6.00 | $ 5,100 |
| Ditch Reconstruction | 350 | LF | $ 12.00 | $ 4,200 |
| Ditch Construction | 380 | LF | $ 15.00 | $ 5,700 |
| 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| 18-inch Culvert with Backfill | 90 | LF | $ 95.00 | $ 8,550 |
| 15-inch Culvert with Backfill | 0 | LF | $ 85.00 | $ - |
| Pavement Restoration, Complete | 90 | TN | $ 180.00 | $ 16,200 |
| | | | | |
| | | | *Total:* | $ 60,000 |
| | | | *20% Construction Contingency* | $ 12,000 |
| | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 72,000*** |
| | | | | |
| | | | Estimate of Professional Surveying and Design Services: | $ 10,800 |
| | | | Estimate of Potential Easement Acquistion: | TBD |
| | | | | |
| | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 82,800** |

# 7.0 AREA 3 – GWYNNS ISLAND

## 7.1 Existing Conditions

Study Area 3A: Peachie Lane

This study area is along Peachie Lane south of the intersection with Route 633. Significant flooding occurs in the area of Route 633 and Peachie Lane. The ditch on the east side of Peachie Lane receives runoff from a channel on the south side of Route 633 from the west and the east.

**Photo 3 - Peachie Ln. Ditch Looking South**

Review of historical aerial photography (2009) indicates a portion of the ditch has been cleared of overgrown vegetation and potentially re-shaped within the past 5 to 10 years. Field observations on September 2, 2014 revealed deceased vegetation within the drainage system both in the ditch along Peachie Lane and east of Peachie Lane on the south side of Route 633; this could be due to long-term standing water following storm events and/or recent maintenance activities to control vegetative growth. Standing water likely evaporates and infiltrates into the soil instead of discharging into a drainage system. The photos included for this area were taken on September 2, 2014 during a dry period in the region.

**Photo 4 - Collapsed Culvert Along Peachie Lane**

Based on site observations on December 11, 2014 and review of 2011 VGIN LIDAR mapping, the ditch line along Peachie Lane has an isolated low point approximately 200 feet south of and a high point, with collapsed culverts, approximately 500 feet south of Route 633.

Study Area 3B/3C:  North and South Bay Haven Roads

**Photo 5 - Bay Haven Road Ditch**

The second study area is North and South Bay Haven Road at the intersection with Old Ferry Road (Route 633). Citizens frequently report roadway flooding along North and South Bay Haven Roads and at the intersection of Route 633, near the Gwynn Post Office.

Based on site observations and review of historical and current USGS topographic maps and 2011 VGIN LIDAR, ditches exist in these areas, but have minimal slopes and are blocked with sediment and vegetation to impeding drainage.  The elevations along Bay Haven Road from Mad Calf Lane south to Pineneedle Lane (a distance of 3,300 feet) are approximately elevation 6 feet with minimal variation; refer to Figure 13.

## 7.2 Recommendations

Study Area 3A:  Peachie Lane

The ditch along the east side of Peachie Lane should be maintained and reconstructed, specifically the segment from 200 to 1,200 feet south of Route 633, to provide positive drainage toward the outfall ditch; refer to Figure 13.  The slope of this ditch will be minimal - approximately 0.3 percent, but provide positive drainage toward Edwards Creek.  Additionally, the driveway culvert located approximately 500 feet south of Route 633 should be removed and replaced with two (2) 18-inch culverts placed at elevations to provide positive drainage.  Disturbed areas and excavated ditch sections should be seeded with water-tolerant, erosion-resistant grass, such as Bermudagrass or Kentucky bluegrass, and protected by a biodegradable erosion control fabric to provide immediate stabilization of the channel bed and banks.

A cursory review of county plat books indicates Peachie Lane, the roadside ditch and its outfall ditch lie within private property; additional deed and legal research should be completed to determine the existence of easements in this area.

Study Area 3B: North Bay Haven Road

The existing ditch along the west side of North Bay Haven Road, north of the Route 633 intersection, should be regraded to remove built-up sediment and vegetation and provide positive drainage. The roadside ditch was originally constructed to flow north for a distance of approximately 1,400 feet to an existing drainage ditch (3B1) that flows east to the Chesapeake Bay; refer to Figure 13. Members of the Committee expressed concern over maintaining the original design flow to the northeast due to more frequent storm events causing significant tidal flows from the northeast that continually deposit sand blocking the opening of the outfall to the Bay; refer to Photo 6 above. If the ditch was regraded north toward the Bay, the slope of this ditch will be minimal - approximately 0.2 percent, but would provide positive drainage.

**Photo 6 - Existing N. Bay Haven Rd. Outfall at Bay**

Alternatively, to lessen the impacts of northeast storms, the roadside ditches from approximately 300 feet north of Duck Pond Lane south to Route 633 (ditch 3B2) could be regraded to drain south towards Edwards Creek. The capacity of the downstream ditches would need to be evaluated to determine whether this is a viable alternative. Regardless, the roadside and outfall ditches 3B1 and 3B3 need to be regraded and frequently inspected and maintained, particularly the opening to the Bay.

Regraded ditches and adjacent disturbed areas should be seeded with water-tolerant, erosion-resistant grass, such as Bermudagrass or Kentucky bluegrass and protected by a biodegradable erosion control fabric to provide immediate stabilization of the channel bed and banks.

Bay Haven Drive is within a dedicated public right-of-way; the roadside ditches and culvert maintenance / improvements should be completed by VDOT. The outfall ditch appears to be within private property; additional deed and legal research should be completed to determine the existence of easements in this area.

Study Area 3C: South Bay Haven Road

The existing ditch along the west side of South Bay Haven Road, south of the Route 633 intersection, should be maintained and regraded to remove built-up sediment and vegetation that impedes the flow south toward Edwards Creek; refer to Figure 13. This ditch is approximately 1,800 feet; the resultant slope of this ditch will be minimal - approximately 0.1 percent, but should provide positive drainage toward the Creek. The ditch and any disturbed areas should be seeded with water-tolerant, erosion-resistant grass, such as Bermudagrass or Kentucky bluegrass, and protected by a biodegradable erosion control fabric to provide immediate stabilization of the channel bed and banks.

Bay Haven Drive is within a dedicated public right-of-way; the roadside ditches and culvert maintenance / improvements should be completed by VDOT. The outfall ditch appears to be within private property; additional deed and legal research should be completed to determine the existence of easements in this area.

Refer to Appendix F for Area 3 Mathews County plat book information reviewed on November 20, 2014.

Maintenance Plan

A regular maintenance plan for each recommended improvement shall be established and implemented to assure the improvements will function beyond installation. Refer to Section 9.1 for detailed information.

## 7.3 Conceptual Opinion of Probable Project Costs

The following conceptual opinion of probable project costs are based on the information collected during preparation of this study and assume the work will be completed by a third party contractor. Project area field topographic surveys and detailed designs should be performed prior to construction to confirm the recommendations included in this report and to obtain the necessary permits for construction.

| | Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|---|
| ***Study Area 3A: Peachie Lane*** | | | | | |
| | Mobilization | 1 | LS | $ 1,000.00 | $ 1,000 |
| | Construction Surveying | 1 | LS | $ 750.00 | $ 750 |
| | Geotechnical & Compaction Testing | 1 | LS | $ 500.00 | $ 500 |
| | Clearing & Grubbing | 1 | LS | $ 500.00 | $ 500 |
| | Traffic Control | 1 | LS | $ 500.00 | $ 500 |
| | Silt Fence | 500 | LF | $ 3.50 | $ 1,750 |
| | Stone Construction Entrance | 0 | LS | $ 2,500.00 | $ - |
| | Culvert Inlet/Outlet Protection | 4 | EA | $ 200.00 | $ 800 |
| | Permanent Seeding | 0.2 | AC | $ 2,500.00 | $ 500 |
| | Erosion Control Mulch | 670 | SY | $ 3.00 | $ 2,010 |
| | Soil Stabilization Mat EC-3, Type B | 185 | SY | $ 10.00 | $ 1,850 |
| | Ditch Maintenance | 450 | LF | $ 6.00 | $ 2,700 |
| | Ditch Reconstruction | 550 | LF | $ 12.00 | $ 6,600 |
| | 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| | 18-inch Culvert with Backfill | 60 | LF | $ 95.00 | $ 5,700 |
| | 15-inch Culvert with Backfill | 0 | LF | $ 85.00 | $ - |
| | Gravel Drive Restoration, Complete | 20 | TN | $ 120.00 | $ 2,400 |
| | | | | | |
| | | | | *Total:* | $ 27,600 |
| | | | | *20% Construction Contingency* | $ 5,500 |
| | | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 33,100*** |
| | | | | | |
| | | | | Estimate of Professional Surveying and Design Services: | $ 5,000 |
| | | | | Estimate of Potential Easement Acquistion: | TBD |
| | | | | | |
| | | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 38,100** |

| | Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|---|
| ***Study Area 3B: North Bay Haven Road*** | | | | | |
| | Mobilization | 1 | LS | $ 1,100.00 | $ 1,100 |
| | Construction Surveying | 1 | LS | $ 750.00 | $ 750 |
| | Geotechnical & Compaction Testing | 1 | LS | $ - | $ - |
| | Clearing & Grubbing | 1 | LS | $ 500.00 | $ 500 |
| | Traffic Control | 1 | LS | $ 1,500.00 | $ 1,500 |
| | Silt Fence | 850 | LF | $ 3.50 | $ 2,975 |
| | Stone Construction Entrance | 0 | LS | $ 2,500.00 | $ - |
| | Culvert Inlet/Outlet Protection | 4 | EA | $ 200.00 | $ 800 |
| | Permanent Seeding | 0.2 | AC | $ 2,500.00 | $ 500 |
| | Erosion Control Mulch | 760 | SY | $ 3.00 | $ 2,280 |
| | Soil Stabilization Mat EC-3, Type B | 220 | SY | $ 10.00 | $ 2,200 |
| | Ditch Maintenance | 700 | LF | $ 6.00 | $ 4,200 |
| | Ditch Reconstruction | 1000 | LF | $ 12.00 | $ 12,000 |
| | 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| | 18-inch Culvert with Backfill | 0 | LF | $ 95.00 | $ - |
| | 15-inch Culvert with Backfill | 0 | LF | $ 85.00 | $ - |
| | Gravel Drive Restoration, Complete | 0 | TN | $ 120.00 | $ - |
| | | | | | |
| | | | | *Total:* | $ 28,800 |
| | | | | *20% Construction Contingency* | $ 5,800 |
| | | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 34,600*** |
| | | | | | |
| | | | | Estimate of Professional Surveying and Design Services: | $ 5,200 |
| | | | | Estimate of Potential Easement Acquistion: | TBD |
| | | | | | |
| | | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 39,800** |

| | Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|---|
| ***Study Area 3C: South Bay Haven Road*** | | | | | |
| | Mobilization | 1 | LS | $ 1,000.00 | $ 1,000 |
| | Construction Surveying | 1 | LS | $ 750.00 | $ 750 |
| | Geotechnical & Compaction Testing | 1 | LS | $ - | $ - |
| | Clearing & Grubbing | 1 | LS | $ 500.00 | $ 500 |
| | Traffic Control | 1 | LS | $ 1,500.00 | $ 1,500 |
| | Silt Fence | 1150 | LF | $ 3.50 | $ 4,025 |
| | Stone Construction Entrance | 0 | LS | $ 2,500.00 | $ - |
| | Culvert Inlet/Outlet Protection | 6 | EA | $ 200.00 | $ 1,200 |
| | Permanent Seeding | 0.2 | AC | $ 2,500.00 | $ 500 |
| | Erosion Control Mulch | 800 | SY | $ 3.00 | $ 2,400 |
| | Soil Stabilization Mat EC-3, Type B | 110 | SY | $ 10.00 | $ 1,100 |
| | Ditch Maintenance | 1300 | LF | $ 6.00 | $ 7,800 |
| | Ditch Reconstruction | 500 | LF | $ 12.00 | $ 6,000 |
| | 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| | 18-inch Culvert with Backfill | 0 | LF | $ 95.00 | $ - |
| | 15-inch Culvert with Backfill | 0 | LF | $ 85.00 | $ - |
| | Gravel Drive Restoration, Complete | 0 | TN | $ 120.00 | $ - |
| | | | | | |
| | | | | *Total:* | $ 26,800 |
| | | | | *20% Construction Contingency* | $ 5,400 |
| | | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 32,200*** |
| | | | | | |
| | | | | Estimate of Professional Surveying and Design Services: | $ 4,800 |
| | | | | Estimate of Potential Easement Acquistion: | $ - |
| | | | | | |
| | | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 37,000** |

# 8.0 AREA 4 – CHAPEL NECK

## 8.1 Existing Conditions

Study Area 4A: Route 620 and Private Drive

This study area is located at the intersection of Chapel Neck Road (Route 620) and a private drive located approximately 1,430 feet east of Northview Lane (refer to Figure 16). Significant flooding of Route 620 occurs at this location.

**Photo 7 - Route 620 Looking West**

Well-defined ditches along the north of Route 620 discharge through a 15-inch culvert crossing the road to the southeast corner of the intersection (refer to Figure 16). Based on site observations on September 2, 2014, the ditch south of Route 620 parallel to the private drive becomes undefined and the elevations appear to rise resulting in an inadequate outfall from Route 620.

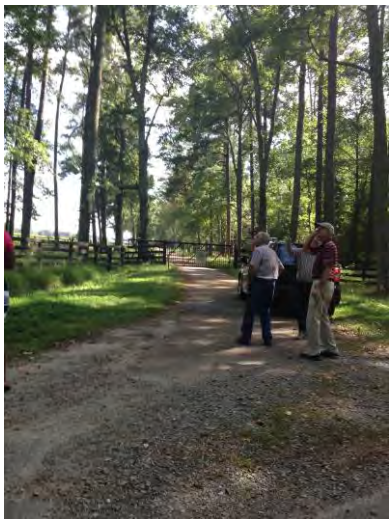

**Photo 8 – Private Drive Looking South**

The Cadastral Maps of Mathews County (Section 23) dated June 3, 1982 (Figure 15) show a drainage system running north to south toward the North River from north of Route 620 south along the west side of the private drive. From previously mentioned field observations and review of historical and current USGS topographic maps and 2011 VGIN LIDAR, the defined drainage system appears to no longer exist south of Route 620; refer to Figures 16 through 19.

Study Area 4B: Route 620 and Old Auburn Road

This study area is located in the area of Chapel Neck Road (Route 620) and Old Auburn Road; refer to Figure 16. Significant flooding of Route 620, Auburn Road, and adjacent parcels occurs at this location. The farm at the northeast corner of Route 620 and Old Auburn Road reportedly has approximately 6-inches or greater of flooding during rainfall events.

**Photo 9 – Old Auburn Road**

Based on site observations on September 2, 2014, the ditches along Old Auburn Road north of Swans Way are shallow and flat, with vegetative growth blocking flow along the west side. South of Swans Way, the ditches along Old Auburn Road are defined and appear well-maintained.

From review of historical and current USGS topographic maps and 2011 VGIN LIDAR, Old Auburn Road and its adjacent areas from Sanders Landing Road to Cradle Point Lane have very little topographic relief with an elevation of approximately 8 feet; refer to Figure 16. Flooding in this area appears to result from both the lack of topographic relief and inadequate outfalls.

**Photo 10 – Old Auburn Road**

There is an outfall ditch flowing west from Old Auburn Road located approximately 1,250 feet north of Route 620, as noted on the Cadastral Maps (Section 23 – Figure 15) and the current USGS topographic maps and 2011 VGIN LIDAR. However, the existing roadside ditches need to be improved to drain from Route 620 north to the outfall.

Outfall ditches south of Route 620 are located on private property. USGS topographic and VGIN LIDAR information indicate existence of ditch sections along Old Auburn Road with two (2) apparent outfall points at Swans Way and approximately 650 feet north of Cradle Point Lane. There are several ditches perpendicular to and at the west end of Swans Way and flowing both north and west toward the North River (refer to Figure 16); however, because of the flat topography, runoff from Old Auburn Road does not appear to be directed to these outfalls.

South of Swans Way and north of Cradle Point Lane, there appears to be one major outfall ditch running northeast from the North River crossing Cradle Point and through private property.

Old Auburn Road south of Route 620, Swans Way, and Cradle Point Lane are on private property; Old Auburn Road north of Route 620 is appears to be within a 30-foot public right-of-way; however, additional research is required to confirm. Refer to Figure 16 – Section 23 of the Cadastral Maps of Mathews County dated June 3, 1982.

## 8.2 Recommendations

Study Area 4A: Route 620 and Private Drive

To alleviate the flooding at this location, a ditch should be constructed along the west side of the private drive and south of the Route 620, as per original conditions, to allow runoff to flow south toward the North River; refer to Figure 16. This ditch will be approximately 2,600 feet; the resultant slope of this ditch should be approximately 0.1 percent, but should provide positive drainage toward the river. The ditch and adjacent disturbed areas should be seeded with water-tolerant, erosion-resistant grass, such as Bermudagrass or Kentucky bluegrass, and should be protected by a biodegradable erosion control fabric to provide immediate stabilization of the channel bed and banks. A drainage easement and/or land acquisition will be required to complete this work.

Study Area 4B: Route 620 and Old Auburn Road

From Route 620 north along Old Auburn Road, parabolic ditches should be constructed / regraded on both sides of the road with cross culverts, as needed, to provide positive drainage toward the outfall ditch approximately 1,250 feet north of Route 620 and west of Old Auburn Road; refer to Figure 16. The resultant slope of the roadside ditches will be minimal - approximately 0.1 percent, but should provide positive drainage toward the North River. The ditch should be seeded with water-tolerant, erosion-resistant grass, such as Bermudagrass or Kentucky bluegrass, and should be protected by a biodegradable erosion control fabric to provide immediate stabilization of the channel bed and banks.

Along Old Auburn Road from Route 620 south to Swans Way, existing ditches should be regraded, as needed, to provide positive drainage toward the existing outfall ditch north of Cradle Point Road. A 15-inch culvert should be installed to carry flow from the east to the west side of Old Auburn Road at the location of the outfall point; refer to Figure 16.

The roadside ditches along Old Auburn Road north of Route 620 may be within a public right-of-way or private property; the roads and roadside ditches south of Route 620 and the outfall ditch are within private property; additional deed and legal research should be completed to determine the existence of drainage easements in this area. Temporary construction and/or permanent drainage easements will likely be required for construction of proposed improvements.

Refer to Appendix G for Area 3 Mathews County plat book information reviewed on November 20, 2014.

### 8.3 Conceptual Opinion of Probable Project Costs

The following conceptual opinion of probable project costs are based on the information collected during preparation of this study and assume the work will be completed by a third party contractor. Project area field topographic surveys and detailed designs should be performed prior to construction to confirm the recommendations included in this report and to obtain the necessary permits for construction.

| | Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|---|
| ***Study Area 4A: Route 620 and Private Drive*** | | | | | |
| | Mobilization | 1 | LS | $ 2,700.00 | $ 2,700 |
| | Construction Surveying | 1 | LS | $ 1,000.00 | $ 1,000 |
| | Geotechnical & Compaction Testing | 1 | LS | $ 500.00 | $ 500 |
| | Clearing & Grubbing | 1 | LS | $ 500.00 | $ 500 |
| | Traffic Control | 1 | LS | $ 750.00 | $ 750 |
| | Silt Fence | 1300 | LF | $ 3.50 | $ 4,550 |
| | Stone Construction Entrance | 0 | LS | $ 2,500.00 | $ - |
| | Culvert Inlet/Outlet Protection | 4 | EA | $ 200.00 | $ 800 |
| | Permanent Seeding | 0.6 | AC | $ 2,500.00 | $ 1,500 |
| | Erosion Control Mulch | 1730 | SY | $ 3.00 | $ 5,190 |
| | Soil Stabilization Mat EC-3, Type B | 865 | SY | $ 10.00 | $ 8,650 |
| | Ditch Maintenance | 0 | LF | $ 8.00 | $ - |
| | Ditch Construction | 2600 | LF | $ 15.00 | $ 39,000 |
| | 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| | 18-inch Culvert with Backfill | 0 | LF | $ 95.00 | $ - |
| | 15-inch Culvert with Backfill | 40 | LF | $ 85.00 | $ 3,400 |
| | Gravel Drive Restoration, Complete | 30 | TN | $ 120.00 | $ 3,600 |
| | | | | | |
| | | | | *Total:* | $ 72,100 |
| | | | | *20% Construction Contingency* | $ 14,400 |
| | | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 86,500*** |
| | | | | | |
| | | | | Estimate of Professional Surveying and Design Services: | $ 13,000 |
| | | | | Estimate of Potential Easement Acquistion: | TBD |
| | | | | | |
| | | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 99,500** |

| | Description | Quantity | Unit | Unit Price | Total Price |
|---|---|---|---|---|---|
| | ***Study Area 4B: Route 620 and Old Auburn Road*** | | | | |
| | Mobilization | 1 | LS | $ 3,100.00 | $ 3,100 |
| | Construction Surveying | 1 | LS | $ 1,500.00 | $ 1,500 |
| | Geotechnical & Compaction Testing | 1 | LS | $ 500.00 | $ 500 |
| | Clearing & Grubbing | 1 | LS | $ 500.00 | $ 500 |
| | Traffic Control | 1 | LS | $ 1,000.00 | $ 1,000 |
| | Silt Fence | 2315 | LF | $ 3.50 | $ 8,103 |
| | Stone Construction Entrance | 1 | LS | $ 2,500.00 | $ 2,500 |
| | Culvert Inlet/Outlet Protection | 4 | EA | $ 200.00 | $ 800 |
| | Permanent Seeding | 0.6 | AC | $ 2,500.00 | $ 1,500 |
| | Erosion Control Mulch | 2060 | SY | $ 3.00 | $ 6,180 |
| | Soil Stabilization Mat EC-3, Type B | 500 | SY | $ 10.00 | $ 5,000 |
| | Ditch Maintenance | 2380 | LF | $ 8.00 | $ 19,040 |
| | Ditch Reconstruction | 2250 | LF | $ 12.00 | $ 27,000 |
| | 24-inch Culvert with Backfill | 0 | LF | $ 120.00 | $ - |
| | 18-inch Culvert with Backfill | 0 | LF | $ 95.00 | $ - |
| | 15-inch Culvert with Backfill | 30 | LF | $ 85.00 | $ 2,550 |
| | Gravel Drive Restoration, Complete | 30 | TN | $ 120.00 | $ 3,600 |
| | | | | | |
| | | | | *Total:* | $ 82,900 |
| | | | | *20% Construction Contingency* | $ 16,600 |
| | | | | ***Conceptual Opinion of Probable Construction Cost:*** | ***$ 99,500*** |
| | | | | | |
| | | | | Estimate of Professional Surveying and Design Services: | $ 14,900 |
| | | | | Estimate of Potential Easement Acquistion: | TBD |
| | | | | | |
| | | | | **Overall Conceptual Opinion of Probable Project Cost:** | **$ 114,400** |

# 9.0 RECOMMENDED STRATEGIES

Mathews County and the region experience significant flooding issues that have a negative impact on quality of life, the economy, and property value / use. A long-term, sustainable program must be established to implement projects, provide regular maintenance, and educate private land owners of their rights and obligations. The program could be administered by the county or regional authority with one of its primary functions being to coordinate with VDOT. Steps required for the development of the program include the following:

1. Research and determine ownership of roadside and outfall ditches;
2. Research/create a legal entity to manage the program;
3. Establish a revenue source(s);
4. Institute an inspections and maintenance plan;
5. Implement maintenance and improvement projects; and, most importantly,
6. Continually educate the public.

## 9.1 Determination of Outfall Ditch Ownership and Maintenance Responsibility

As noted previously, ownership of and legal statutes regarding public road outfall ditches, which indicates responsibility for maintenance, is the issue at the center of the debate in Mathews County. The first and most critical step in the development of a sustainable program is to provide answers based on legal research to share with Mathews County citizens regarding the existence of VDOT/public drainage easements across private property and VDOT's responsibilities for maintenance of outfall ditches outside of VDOT rights-of-way and known deeded easements. Extensive deed and legal research, including the development of a comprehensive GIS map showing the results of the research for public review, is recommended. This GIS map could be colored coded showing specific locations of VDOT rights-of-way and drainage easements and outfall ditches with notations of public and private maintenance responsibilities. As previously noted, the MPPDC is currently seeking grant funding to complete the above tasks.

## 9.2 Legal Authority

The region's drainage and ditching issues could be actively managed and supported by the local government or through a new county or regional Ditching Authority. The MPPDC recently obtained funding through the 2014 Virginia Coastal Zone Management Program to explore the enabling mechanism in which a Ditching Authority may be developed and create a framework for the authority. Ultimately, each county or this authority should be responsible for prioritizing ditch improvement needs, partnering with and leveraging Virginia Department of Transportation (VDOT) funding, administering other funding mechanisms to implement projects and complete routine inspections and maintenance, and continually educating the public on proper ditch maintenance and water quality issues. The MPPDC is scheduled to complete this study in September 2015.

## 9.3 Funding

A sustainable source of revenue is needed to support administration of the program, implement ditch improvement projects and complete regular inspections and maintenance. The *Septic System Repair and Ditch Maintenance: Sustaining Permanent Funding* report prepared by the Virginia Costal Policy Clinic at the College of William & Mary Law School outlines grant funding options for private drainage maintenance (Appendix C). VDOT plans to use revenue sharing funds and include projects in the 6-year plan to implement improvement projects within VDOT rights-of-way and easements, including new outfall easements granted to VDOT. VDOT and grant funding, however, will not provide sufficient or sustainable funds to address the drainage ditch improvement needs in Mathews County and the region.

In addition to VDOT and grant funding, additional revenue could be generated through County general funds, nutrient credit bank revenues for facilities owned in whole or in part by a public agency, and/or implementation of an enterprise fund (with associated utility fees) by Mathews County or a public authority.

The Code of Virginia, Section 15.2-2114, Regulation of Stormwater (Stormwater Utility Law), allows for the creation of an enterprise fund (with utility fees or service charges) to support a local stormwater management program including,

1. Acquisition of property to construct, operate and maintain stormwater control facilities;

2. Cost of administration of such programs;
3. Engineering and design, debt retirement, construction costs for new facilities and enlargement or improvement of existing facilities; and
4. Facility maintenance.

Revenues generated through the enterprise fund can be used only for stormwater management purposes. The legislation also states that the program must be "…consistent with Article 2.3 (§ 62.1-44.15:24 et seq.) of Chapter 3.1 of Title 62.1 or any other state or federal regulation governing stormwater management." In Virginia, these service charges are typically used by localities to manage stormwater runoff, both quality and quantity, from construction projects and meet the Chesapeake Bay and local Total Maximum Daily Load (TMDL) requirements, which is compliant with Article 2.3 (§ 62.1-44.15:24 et seq.) of Chapter 3.1 of Title 62.1 of the Code of Virginia.

The county or a public authority could establish an enterprise fund with associated fees for ditch improvements. Fees could be charged to each property owner within the county based on linear feet of ditches within and adjacent to their property as a flat annual fee to all residential properties, or some other set of fees. VDOT is exempt from local fees, as per the Stormwater Utility Law, since VDOT has a municipal separate storm sewer system (MS4) permit.

Recommended steps to determining whether an enterprise fund is a viable option as a revenue source are as follows:

1. Identify the state or federal regulation governing maintenance of ditches; if found,
2. Prepare a budget for the program, including administrative costs, maintenance, equipment, etc. based on up to three (3) level of service scenarios;
3. Determine the preferred level of service;
4. Explore various methodologies to calculate the fee; and
5. Obtain buy-in from the governing authority.

**Level of Service** is the desired performance of a program and/or system (i.e., a drainage system). A high level of service for the program may include a goal to eliminate all outfall issues in the County. A low level of service may include a goal to just maintain existing ditches.

## 9.4 Project Implementation

The county or public authority should establish an annual budget for ditch improvement projects and inspection and maintenance activities. To assist with the annual expenditures, identified projects should be scored and prioritized based on selected criteria and/or a weighting factor for each criteria. Criteria should include frequency of flooding, location of flooding (e.g. over roadway, private property, and private property including structures) extent of prior property damage ($ amount), ownership (e.g. public right-of-way, public drainage easement, or private property), state waters status, estimated project cost, and expected percent of reduction of flooding. Exhibit A is a prioritization matrix with the criteria listed; the Committee and/or the public authority should assign weight factors as recommended below.

1. Frequency of Flooding

   1 - Once every one (1) to five (5) years

   2 - Once per year

   3 - Several times per year

2. Public Safety Impacts: Location of Flooding

   1 - Private and/or public lands with no structure impact

   2 - Roadway with alternate route available

   3 - Structures and/or substantial roadway with no alternative route available

3. Land Use Affected By Flooding

   1 - Vacant

   2 - Agriculture

   3 - Residential / Commercial

4. Ownership of Ditch

   1 - Private property

   2 - Public drainage easement

   3 - Public right-of-way

5. Anticipated Reduction of Flooding and Property Damage

   1 - Less than 25%

   2 - Less than 75%

   3 - Greater than 75%

6. Anticipated Water Quality Improvement: Aquaculture Influences

   1 - Marginal

   2 - Some

   3 - Significant

## 9.5 Inspections and Maintenance

The county and/or authority responsible for the drainage system should develop inspection and maintenance plans for each type of ditch (e.g. cross section type, jurisdictional classification, and other special conditions). The plans should include an inspection schedule, details of proper ditch construction, and specify best management practices for maintenance.[3]

Typical best management practices for maintenance may include the following[4];

1. Reshape the ditch to original dimensions;
2. Mow ditches to control vegetation rather than mechanically cleaning ditches with heavy equipment to minimize soil disturbance;
3. Dredge / clean, repair, or replace ditches / culverts only during periods of low water flow and not during intense rainfall events; and

[3] Evaluation of Problems and Solutions relating to Stormwater Runoff from Roadside Ditches, Valerie Brady and Dan Breneman, Natural Resources Research Institute, University of Minnesota Duluth, October 31, 2008
[4] Chapter 10 - Roadside Management and Maintenance: Beyond Vegetation, Center for Environmental Excellence by AASHTO, 2014

4. Retain existing vegetation, if possible, especially along the ditch slopes to maintain slope stability. Consider excavating only the first three quarters of the ditch and retaining vegetation in the remainder.

Ditches excavated through wetlands and surface waters are jurisdictional. However, as per Virginia DEQ Guidance Memorandum No. 08-2004[5], "maintenance of existing drainage and irrigation ditches is excluded from regulation...the maintenance dredging of existing ditches is included in this exclusion provided that the final dimensions of the maintained ditch do not exceed the designed cross-sectional dimensions of the original ditch. The construction of new drainage ditches is not excluded, nor is the filling of existing ditches in accordance with this guidance."

Also noted in Virginia DEQ Guidance Memorandum No. 08-2004, "in order for a maintenance activity to be excluded from VWP regulation, a project proponent shall demonstrate that the ditch is included in an existing drainage or irrigation easement, an existing drainage or irrigation system, on an existing drainage or irrigation map, or that the ditch has historically been maintained for the purpose of drainage or irrigation. If they cannot provide this demonstration, a VWP permit may be required to establish the ditch as a drainage or irrigation ditch. Once a ditch is established as a drainage or irrigation ditch, it shall be classified as such for all future maintenance activities. The project proponent must maintain documentation establishing the ditch as a drainage or irrigation ditch and must make this documentation available to DEQ upon request."

[5] Commonwealth of Virginia Department of Environmental Quality Guidance Memorandum No. 08-2004 Regulation of Ditches under the Virginia Water Protection Program, May 13, 2008

## 10.0 ACKNOWLEGEMENTS

The Mathews Ditching Committee members were invaluable to the development of this report providing first-hand background information and candid input. Committee members include Gene Jarvis, GC Morrow, Tolar Nolley, Neena Putt, Leigh Ramos, and O.J. Cole, the Mathews County Board of Supervisors liaison. Draper Aden Associates would also like to thank Mindy Moran, the Mathews County Administrator, for her assistance with the Committee and coordinating our meetings; Lewis Lawrence and Marquitrice Wright from the Middle Peninsula Planning District Commission for their support and guidance throughout the project; and Sean Trapani and Jasmine Brown from the Virginia Department of Transportation for their participation and insights.

A special 'thank you' goes out to GC Morrow for sharing his research, observations, and the history of Mathews County ditches and for spending several hours out in the field walking the ditches with our team.

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# 11.0 REFERENCES


1. Chesapeake Bay Land Subsidence and Sea Level Change: An Evaluation of Past and Present Trends and Future Outlook ,Virginia Institute of Marine Science, John D. Boon, John M. Brubaker, David R. Forrest, November 2010
2. NOAA Frequently Asked Questions 5.1 "Is Sea Level Rising?" IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
3. Chesapeake Bay Geology and Sea Level Rise, virginiaplaces.org
4. Drainage Study of the Garden Creek Area, Mathews County, Virginia, Shore Engineering Company, June 1980
5. Commonwealth of Virginia Department of Environmental Quality Guidance Memorandum No. 08-2004 Regulation of Ditches under the Virginia Water Protection Program, May 13, 2008
6. Roadside and Outfall Drainage Ditches Report, Beale, Davidson, Etherington, & Morris, P.C., September 3, 2013
7. Septic System Repair and Ditch Maintenance: Sustaining Permanent Funding Report, Virginia Costal Policy Clinic at the College of William & Mary Law School, July 2014
8. Evaluation of Problems and Solutions relating to Stormwater Runoff from Roadside Ditches, Valerie Brady and Dan Breneman, Natural Resources Research Institute, University of Minnesota Duluth, October 31, 2008
9. Chapter 10 - Roadside Management and Maintenance: Beyond Vegetation, Center for Environmental Excellence by AASHTO, 2014