UNDERSTANDING DRAINAGE & CONVEYANCE IN DELAWARE

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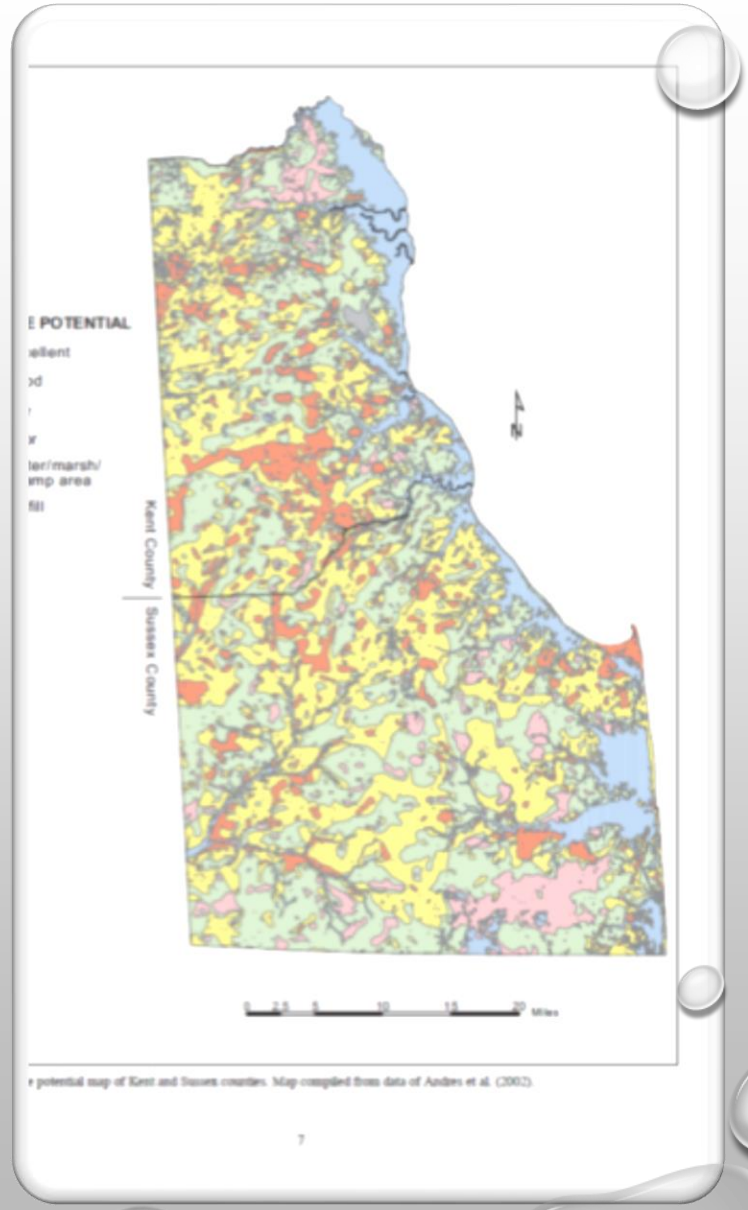
ATLANTIC COASTAL PLAIN

- APPROXIMATELY 94% OF DELAWARE'S LAND AREA IS LOCATED IN THE COASTAL PLAIN PROVINCE
- CONSISTS MAINLY OF MARINE SEDIMENTS OVERLAIN BY COARSE SAND AND GRAVEL DEPOSITED AS GLACIERS RETREATED DURING THE LAST ICE AGE
- EXTREMELY FLAT TERRAIN
- LOW –LYING TOPOGRAPHY ALSO FAVORS HIGH WATER TABLE CONDITIONS.
- SOIL CONDITIONS ARE HIGHLY VARIABLE
    - POORLY DRAINED & WELL DRAINED SOILS



COASTAL PLAIN CHARACTERISTICS & CHALLENGES

- VARIABLE SOIL TYPES, FLAT TOPOGRAPHY, HIGH WATER TABLE ALL LEAD TO DRAINAGE CHALLENGES
- THESE SITE CHARACTERISTICS CAN BE A CHALLENGE FOR ALL LAND USE ACTIVITIES.
- WHETHER YOU ARE A TILLING THE LAND OR JUST WANTING THE YARD TO BE LESS SOGGY – DRAINAGE IS A CHALLENGE FOR ALL

SOIL TYPES ALSO EFFECTS DRAINAGE

- SANDY SOILS ALLOW FOR INFILTRATION
- SOME AREAS HAVE EXTREMELY HIGH INFILTRATION RATES AND THEREFORE DRAINAGE IS NOT A CHALLENGE
- SOILS THAT ARE HIGHLY SUSCEPTIBLE TO WIND AND WATER EROSION

POORLY DRAINED SOILS

- LENSES OF LESS PERMEABLE SOIL RESTRICTS INFILTRATION AND RESULTS IN DRAINAGE CHALLENGES
- WET SWALE CONDITIONS
- COMMON DRAINAGE CONCERN IN RESIDENTIAL COMMUNITIES
- CHALLENGE TO MEET PROPERTY OWNER EXPECTATIONS WHERE THERE IS IRRIGATION, HIGH WATER TABLE AND FLAT TOPOGRAPHY
- DEVELOPERS INSTALL CONCRETE VALLEY GUTTERS OR PIPED STORMDRAIN IN ORDER TO AVOID GRASS SWALES. DOWNSIDE IS PIPED SYSTEMS PROVIDE LESS WATER QUALITY.

HIGH GROUNDWATER

- COASTAL AREAS JUST FEET ABOVE SEA LEVEL
- CLOSER TO COAST OR INLAND BAYS AND WATERWAYS, GROUNDWATER CLOSER TO THE SURFACE
- HIGHEST OUTSIDE OF GROWING SEASON (DECEMBER-MARCH)
- MANY RESIDENTS WHO MOVE TO DELAWARE ARE NOT USE TO SEEING WATER PONDING. THESE ARE CHALLENGES WITH LIVING IN AN AREA THAT IS FLAT AND HAS A HIGH WATER TABLE

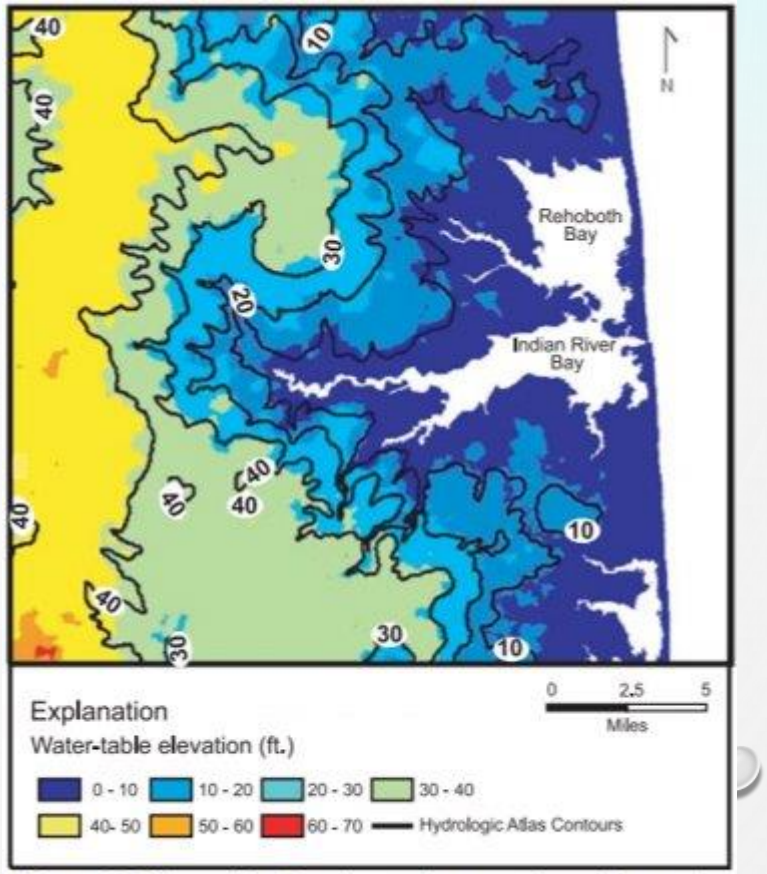


Figure 19. Water-table elevations under normal conditions estimated by ordinary kriging. Water-table contours are from the Hydrologic Atlas Series maps.

HISTORIC WATER MANAGEMENT

- “CROOKED STREAMS ARE A MENACE TO LIFE AND CROPS IN THE AREAS BORDERING THEIR BANKS.”
- MANY OF THE NATURAL STREAMS IN DELAWARE’S COASTAL PLAIN HAVE BEEN CHANNELIZED TO IMPROVE DRAINAGE EFFICIENCY.
- “THE TWISTING AND TURNING OF THE CHANNEL RETARDS THE FLOW….FLOODS RESULT….CROPS ARE RUINED….LIVES ARE LOST…”

August, 1935 AMERICAN FORESTS 385

How DYNAMITE streamlines streams

CROOKED STREAMS are a menace to life and crops in the areas bordering on their banks. The twisting and turning of the channel retards the flow and reduces the capacity of the stream to handle large volumes of water. Floods result. Crops are ruined. Lives are lost. Banks are undermined, causing cave-ins that steal valuable acreage.

In many instances straightening out a stream has doubled its capacity for disposing of run-off water.

DYNAMITE may be used most efficiently and economically in taking the kinks out of a crooked stream. The dynamite is loaded along the length of "cut-off" channel. When fired, the dirt and other debris is heaved high in the air and is scattered over the adjoining territory—leaving practically no spoil-banks. In addition to the material actually thrown out, much dirt is loosened and is later scoured out by the water which rushes swiftly through the straightened channel.

Straightening of Pequest River in New Jersey by CCC workers stopped its yearly [illegible] of new pasture to some as right. Note temporary dam at left to provide volume of water for scouring blasted channel.

Explosion of dynamite charge by propagation excavates new channel.

Immediately after explosion, water is entering new channel, whose banks will be smoothed and "stream-lined" by the speedier flow of water.

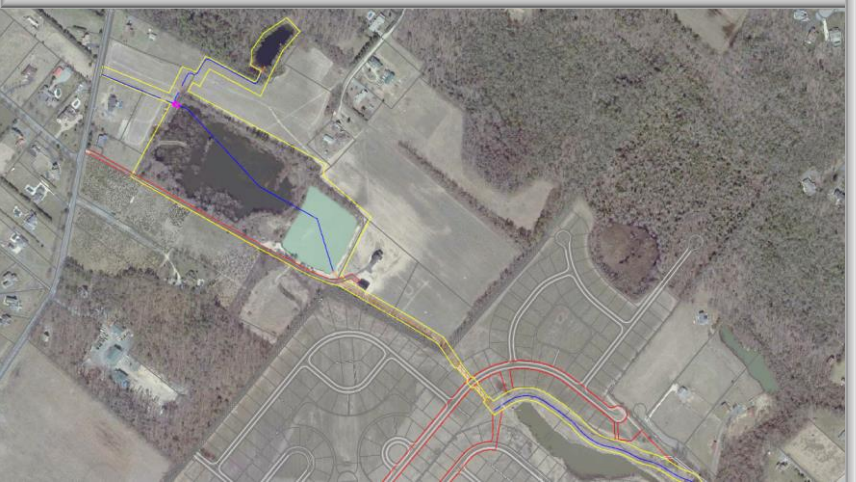
Du Pont Dynamite has straightened many thousands of miles of crooked streams. Du Pont engineers have worked for years to develop the best blasting methods for the cleaning out and straightening of streams. All their data is in a 48-page book, "Ditching with Dynamite." It is for your use. Write for it.

Dynamite can help you do other jobs, too. It can help you build highways, dams; fight soil erosion; work quarries. Du Pont has an explosive for every purpose.

DU PONT

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
1107 du Pont Building
Wilmington, Del.

DuPont Advertisement, American Forests Magazine (1935)



FLAT TOPOGRAPHY

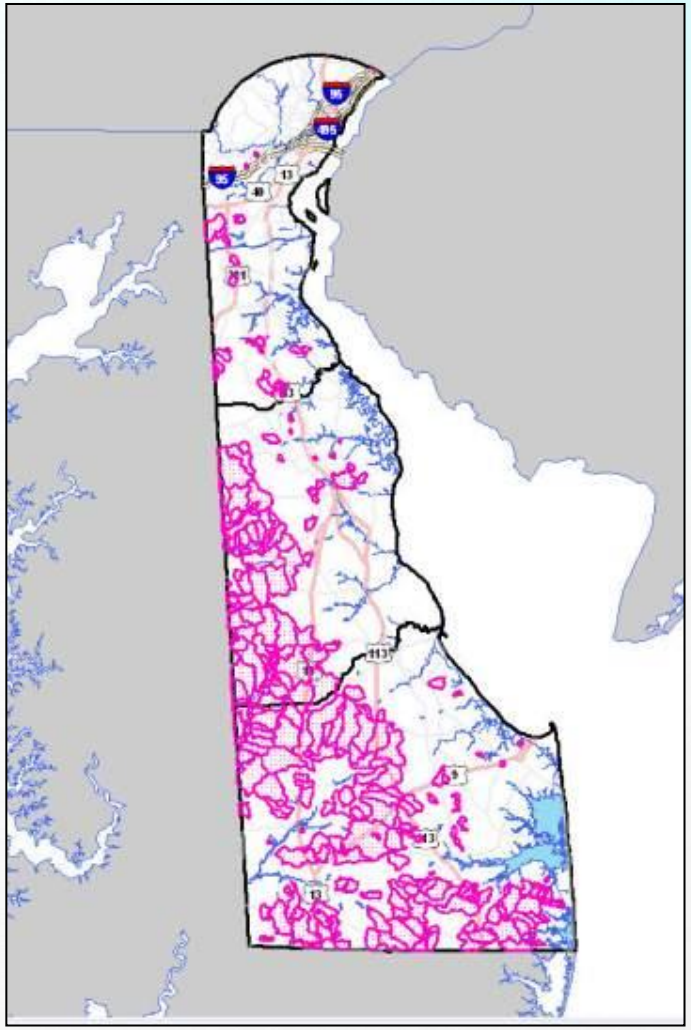
- AREAS HAVE BEEN DITCHED IN ORDER TO LOWER GROUNDWATER SO THAT THE LAND CAN BE FARMED OR DEVELOPED. MANY OF THESE DITCHES WERE ORIGINALLY JUST INTENDED FOR AGRICULTURE BUT AS THE LAND HAS BECOME DEVELOPED, THESE DITCHES HAVE BECOME OUTLETS FOR STORMWATER RUNOFF.
- IN DELAWARE, YOU ARE NEVER VERY FAR FROM WATER WHEN LAND IS DEVELOPED. THE POTENTIAL FOR IMPACTS TO ECOSYSTEMS AND NATURAL AREAS IS SIGNIFICANT.

HISTORIC WATER MANAGEMENT

- The Delaware Tax Ditch Law was passed in 1951 to establish a process to manage and maintain the ditch system by the affected landowners.
- Tax Ditch watersheds range in size from the 2 acre Alban Park TD to the 56,000 acre Marshyhope Creek TD.
- The Tax Ditch system consists of over 2000 miles of ditches with a total drainage area of over 600 sq. mi., most of which drains to the Chesapeake Bay.
- Over 230 organizations in the State manage 2,000+ miles of ditch channels.

County Breakdown:

- New Castle County – 26
- Kent County – 78
- Sussex County – 137
- Formed through Superior Court



Delaware Environmental Navigator, Tax Ditch Layer

WHICH IS A TAX DITCH?

Answer? <u>They all are!</u>

WHAT IS A TAX DITCH?

Tax Ditches are organizations formed on a watershed basis to construct and maintain a drainage system. The organizations are managed by officers elected by the taxables

Law Declared:

"… that the drainage and the prevention of flooding of lands and the management of water for resource conservation shall be considered a public benefit and conducive to the public health, safety and welfare."

- Formed under Title 7, Chapter 41 of the Delaware Code
- "Drainage of Lands and Management of Waters; Tax Ditches"
- Governmental Subdivision of the State
- Levy taxes
- Sue & be sued
- Make & execute contracts
- Borrow money
- Permanent Right of Way for Maintenance
- Receive administrative and technical assistance from DNREC Division of Watershed Stewardship

TAX DITCH ORGANIZATION FUNCTION

- COLLECT TAXES SUFFICIENT TO PROVIDE FUNDING REQUIRED FOR MAINTENANCE
- MAINTAIN THE DRAINAGE SYSTEM:
  - CONTROL VEGETATION ON DITCH BOTTOM AND SLOPES
    - DONE EVERY 1-3 YEARS
    - MOWING
    - WEED WIPER BAR
- DIP OUTS: RESTORES CHANNELS TO THE DESIGNED LINES AND GRADES
- REMOVAL OF BEAVERS AND BEAVER DAMS

TAX DITCH DIPOUT

MOWING & WEED WIPER BAR

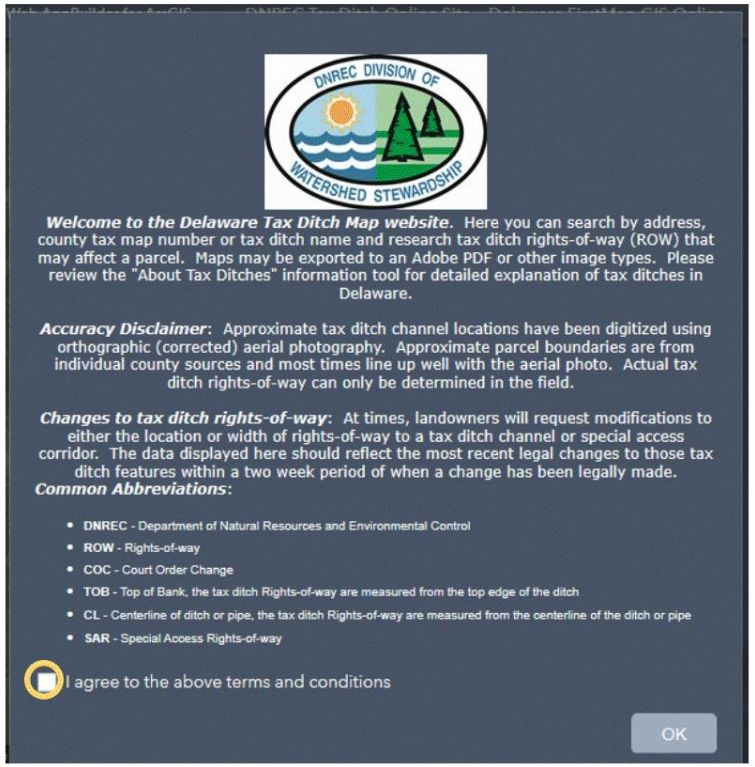
DNREC DRAINAGE SECTION PROVIDES TECHNICAL ASSISTANCE

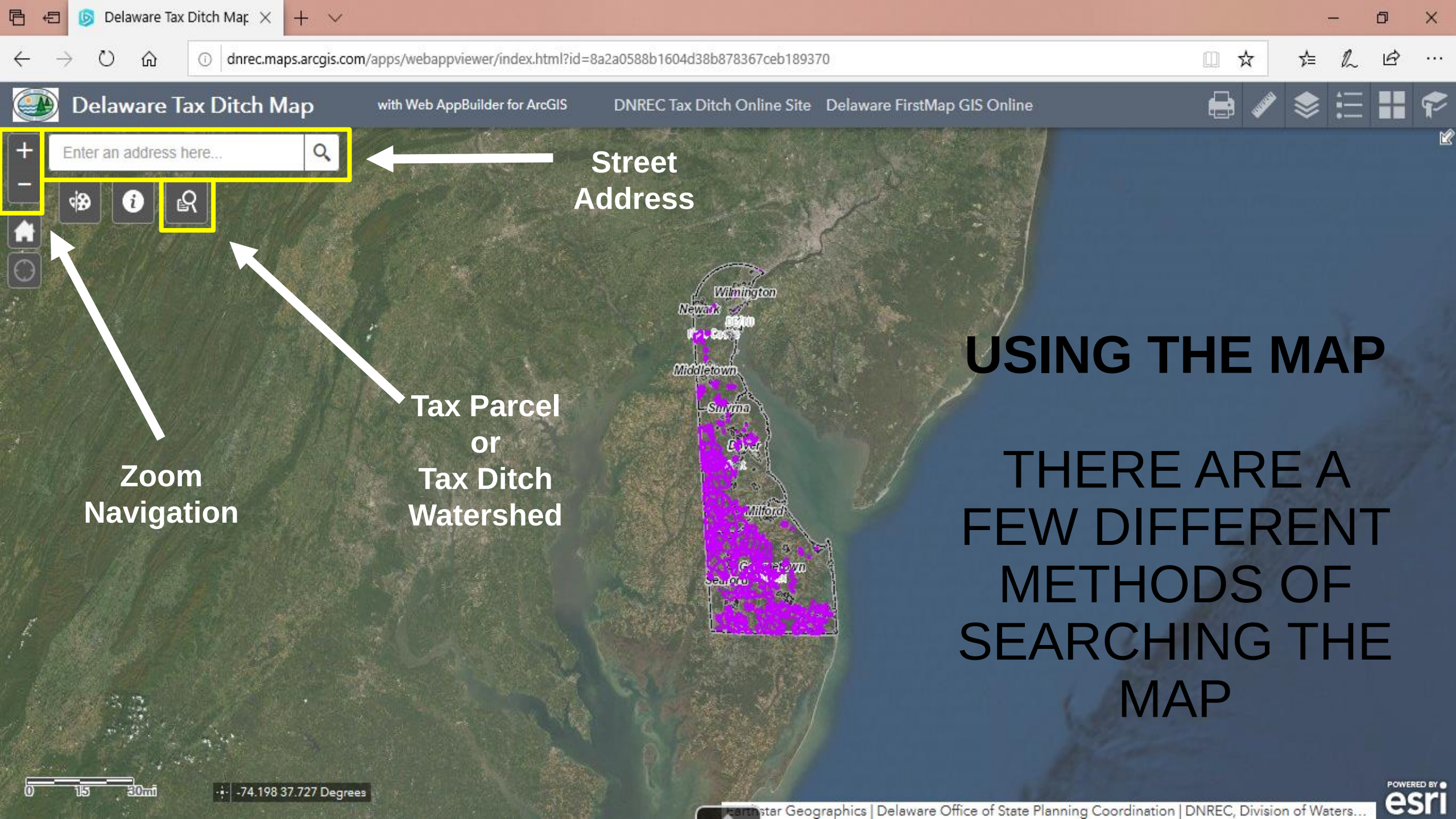
- PROVIDES BOTH FEDERAL AND DNREC PERMITTING ASSISTANCE
  - TAX DITCH DIPOUTS
  - CULVERT PIPES
  - BANK STABILIZATION
  - INVASIVE SPECIES MANAGEMENT
  - PROVIDES TAX DITCH MANAGERS WITH DOCUMENTS TO HELP WITH TAX DITCH BUSINESS

OPEN ACCESS TAX DITCH MAP

Use your Web Browser to Visit

https://de.gov/taxditchmap




Delaware Tax Ditch Map
dnrec.maps.arcgis.com/apps/webappviewer/index.html?id=8a2a0588b1604d38b878367ceb189370
Delaware Tax Ditch Map
with Web AppBuilder for ArcGIS
DNREC Tax Ditch Online Site
Delaware FirstMap GIS Online
Enter an address here...
Street Address
Zoom Navigation
Tax Parcel or Tax Ditch Watershed
Wilmington
Newark
Middletown
Smyrna
Dover
Milford
USING THE MAP
THERE ARE A FEW DIFFERENT METHODS OF SEARCHING THE MAP
0 15 30mi
-74.198 37.727 Degrees
Delaware Office of State Planning Coordination | DNREC, Division of Waters...
POWERED BY esri

NOT ALL DITCHES ARE TAX DITCHES

- NON-TAX DITCHES – DITCHES THAT WERE ORIGINALLY USED TO FARM THE LAND
  - NOT LOCATED IN AN EASEMENT
  - NO DESIGNATED ROW FOR MAINTENANCE/ACCESS
  - NOT REGULARLY MAINTAINED
  - USED AS AN OUTLET FOR STORMWATER FACILITIES
  - CAN BE CLOGGED/OBSTRUCTED

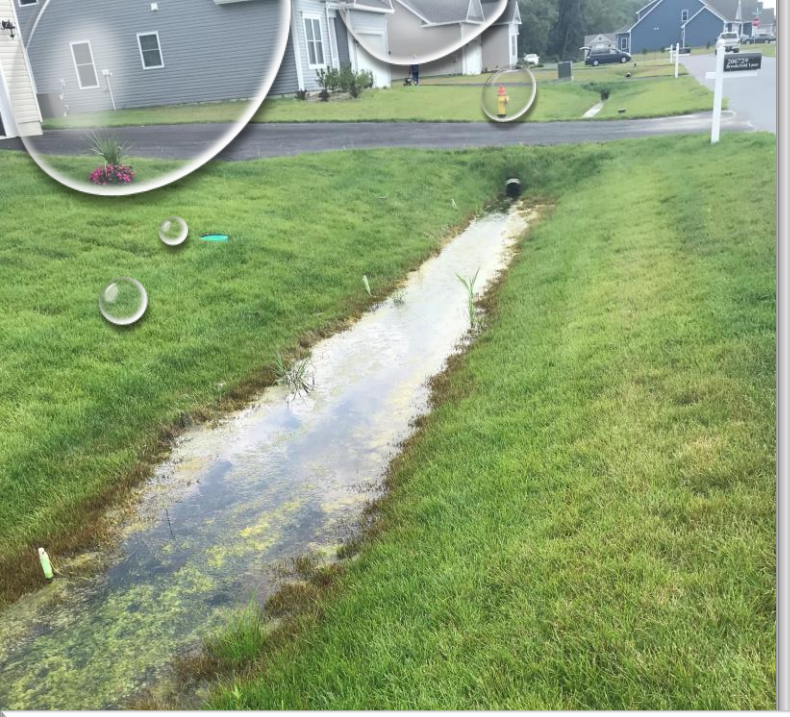
BLOCKED DRAINAGE CONVEYANCES

WITH A HIGH GROUND WATER TABLE AND VERY LITTLE TOPOGRAPHIC RELIEF, IT DOES NOT TAKE MUCH TO BLOCK DRAINAGE.

- RESTRICTIONS CAN INCLUDE:
  - GRASS & SEDIMENT
  - LACK OF MAINTENANCE
  - TREES
  - DEBRIS
  - LANDSCAPING/HOMEOWNER IMPROVEMENTS
  - IMPROPER GRADING OR CULVERT PIPES SET INCORRECTLY
  - EROSION

PREVENTIVE AND ROUTINE MAINTENANCE

- INSPECT DITCHES REGULARLY AND BEFORE AND AFTER LARGE STORM EVENTS
- CLEAN CULVERTS AND REMOVE VEGETATION/TRASH WHEN FLOW IS BLOCKED
- MONITOR FOR EROSION AND WASH OUTS
- PROPERLY DISPOSE OF LANDSCAPE/VEGETATION



ROADSIDE & REAR SWALE CONVEYANCE

DRAINAGE IS ALREADY A CHALLENGE AND THEN WE ADD:

- IRRIGATION
- COMPACTED/FILLED SOILS
- IMPERVIOUS COVER
- MOWERS

SUMP PUMPS & HOW TO DISCHARGE

- SUMP PUMPS ARE NOT REGULATED
- USED IN CRAWLSPACES/BASEMENTS
- SOME HOMES HAVE MULTIPLE SUMP PUMPS
- DURING THE WET SEASON (DEC – MARCH) WHEN GROUNDWATER IS HIGH, SUMP PUMPS WILL DISCHARGE FREQUENTLY
- COMMON DRAINAGE COMPLAINT IN RESIDENTIAL COMMUNITIES AND CAN BECOME A NUISANCE ISSUE
- WE CAN ONLY MAKE RECOMMENDATIONS TO IMPROVE THESE SITUATIONS

HOW ARE WIDESPREAD DRAINAGE ISSUES ADDRESSED?

AGENCY COLLABORATION

DNREC DRAINAGE SECTION

- TAX DITCH TECHNICAL ASSISTANCE
- DRAINAGE CONCERNS LOCATED IN DEVELOPMENTS CONSTRUCTED PRIOR TO THE SEDIMENT AND STORMWATER REGULATIONS (1991) ARE DIRECTED TO DNREC DRAINAGE SECTION

DELDOT

- DRAINAGE CONCERNS LOCATED IN DELDOT ROW INCLUDING DITCH AND PIPE CROSSING MAINTENANCE
- FLOODING IN DELDOT ROW

SUSSEX COUNTY PUBLIC WORKS

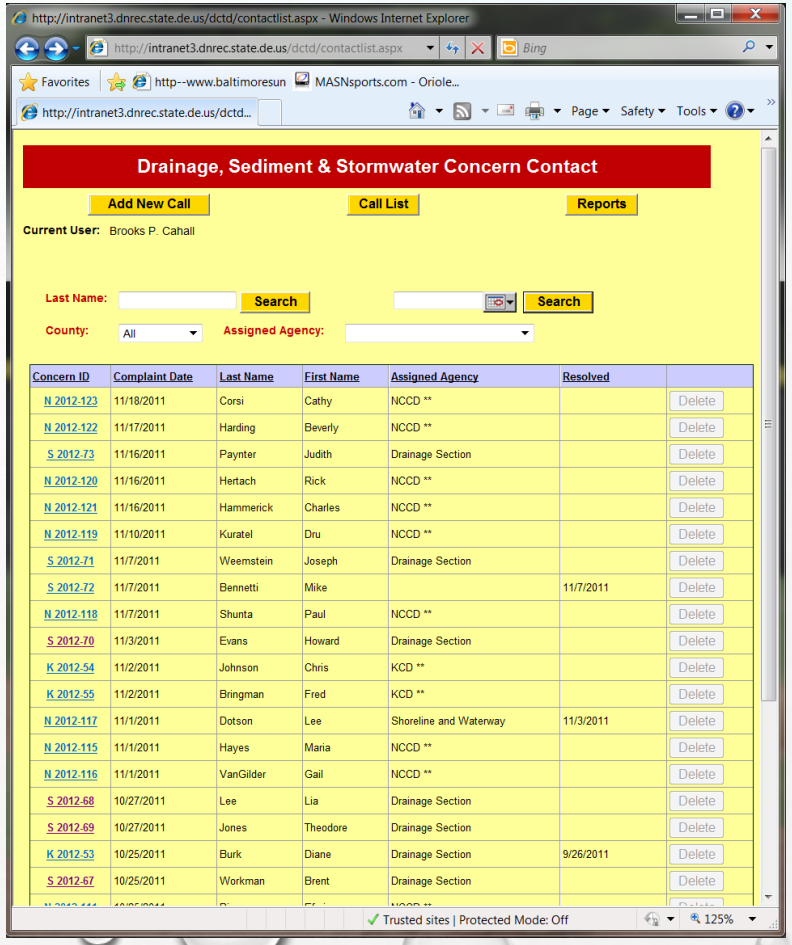
- DRAINAGE CONCERNS PERTAINING TO THE ROADSIDE SWALE IN RESIDENTIAL COMMUNITIES ARE DIRECTED TO SUSSEX COUNTY PUBLIC WORKS

SUSSEX CONSERVATION DISTRICT

- DRAINAGE CONCERNS PERTAINING TO THE FUNCTION OF THE STORMWATER FACILITIES ARE ADDRESSED BY THE SUSSEX CONSERVATION DISTRICT

DRAINAGE AND STORMWATER PUBLIC CONTACTS DATABASE

- Statewide Single Point of Contact and tracking database a result of Gov. Minner's Surface Water Task Force.
- System was launched in early 2007
- Only Tracks concerns from DNREC and partners like NCCD, KCD, SCD



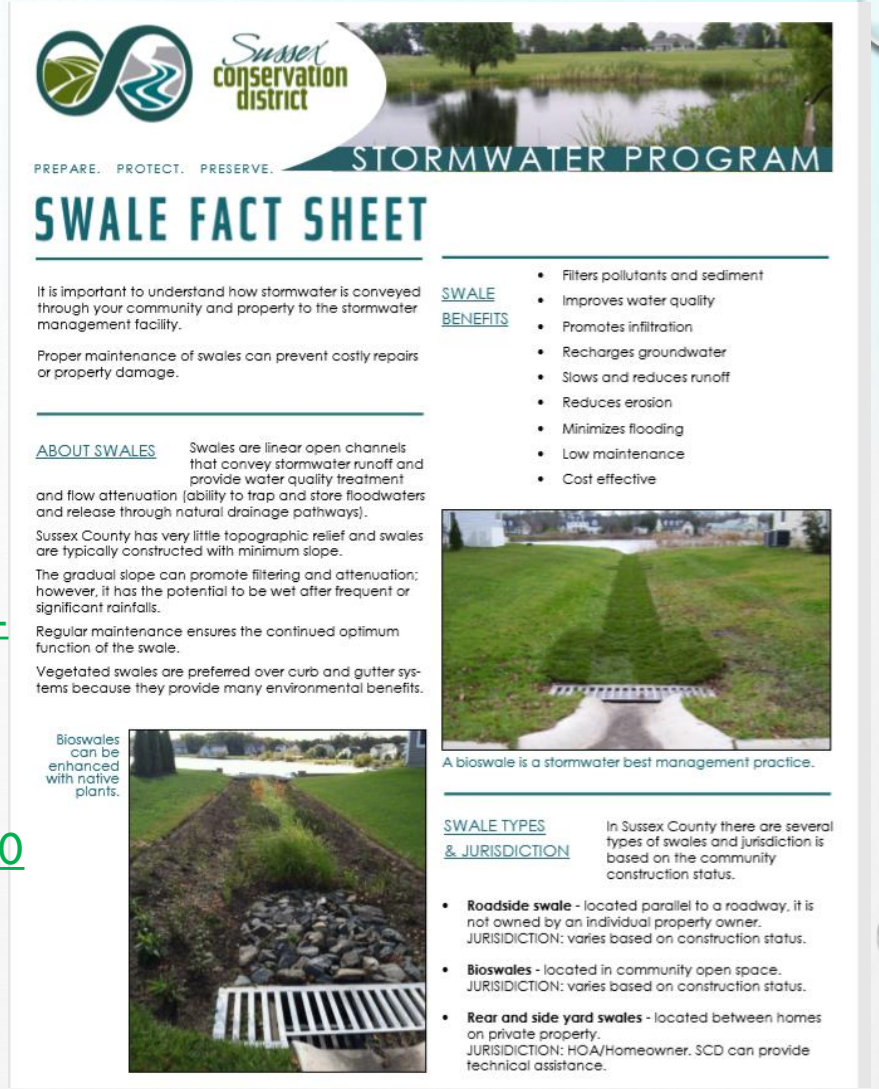
TECHNICAL RESOURCES & QUESTIONS

DNREC DRAINAGE SECTION – 302-855-1930

SUSSEX CONSERVATION DISTRICT 302-856-2105

HOMEOWNER & HOA'S FACT SHEETS
https://www.sussexconservation.org/services/stormwater/homeowners-hoa-s.html

SWALE FACT SHEET
https://www.sussexconservation.org/images/Stormwater_Workshop/2020_02_20_SW/Swale_Fact_Sheet_2020_02_19.pdf



Sussex conservation district

PREPARE. PROTECT. PRESERVE.

STORMWATER PROGRAM

SWALE FACT SHEET

It is important to understand how stormwater is conveyed through your community and property to the stormwater management facility.

Proper maintenance of swales can prevent costly repairs or property damage.

ABOUT SWALES

Swales are linear open channels that convey stormwater runoff and provide water quality treatment and flow attenuation (ability to trap and store floodwaters and release through natural drainage pathways).

Sussex County has very little topographic relief and swales are typically constructed with minimum slope.

The gradual slope can promote filtering and attenuation; however, it has the potential to be wet after frequent or significant rainfalls.

Regular maintenance ensures the continued optimum function of the swale.

Vegetated swales are preferred over curb and gutter systems because they provide many environmental benefits.

Bioswales can be enhanced with native plants.

SWALE BENEFITS

- Filters pollutants and sediment
- Improves water quality
- Promotes infiltration
- Recharges groundwater
- Slows and reduces runoff
- Reduces erosion
- Minimizes flooding
- Low maintenance
- Cost effective

A bioswale is a stormwater best management practice.

SWALE TYPES & JURISDICTION

In Sussex County there are several types of swales and jurisdiction is based on the community construction status.

- **Roadside swale** - located parallel to a roadway, it is not owned by an individual property owner. JURISIDICTION: varies based on construction status.
- **Bioswales** - located in community open space. JURISIDICTION: varies based on construction status.
- **Rear and side yard swales** - located between homes on private property. JURISIDICTION: HOA/Homeowner. SCD can provide technical assistance.