

STORMWATER MANAGEMENT

Stormwater management and drainage was ranked as the second highest priority of Bethany Beach citizens in the Town's 2004 Survey, behind beach replenishment.

- The sources and causes of the Town's flooding;
- How much has already been done to alleviate flooding;
- How much can realistically be accomplished using existing resources; and the role citizens play in preserving the existing drainage network.

I. BACKGROUND

Here are some of the facts:

- Bethany Beach is almost entirely surrounded by tidal waters. These are:
 - The Atlantic Ocean on the east;
 - The Assawoman Canal on the west, separating Bethany from Ocean View. The Canal is part of the system of waterways connecting the Indian River and the Little Assawoman Bays.
 - The Loop Canal on the north, separating Lake Bethany from the Salt Pond. The Loop Canal branches off from the Assawoman Canal, and flows east, ending at North Pennsylvania Avenue and First Street. The Loop Canal also has a branch leading to the Salt Pond on the north.
 - A large man-made drainage ditch on the south, running from the Assawoman Canal almost to Kent Avenue. It separates Bethany West from Sea Colony.
 - The Town is mostly at sea level with very little grade difference throughout town.
 - Because it is almost entirely surrounded by tidal waters and because it is close to sea level, Bethany Beach will *always* be susceptible to flooding. Therefore, while the Town's flood mitigation efforts will not eliminate flooding entirely, the goal is to drain water as *quickly* as possible.
- A stormwater sewer system would not be effective in many areas of Bethany Beach because a large number of the pipes installed would be at or below sea level at higher tides.
- All of the rain drainage from Bethany streets finds its way into the bays through either the Bethany Loop Canal or the Assawoman Canal. The southwest portion of Bethany West and Turtle Walk drain into the Assawoman Canal. All other drainage flows to the Loop Canal. Both canals have close to the same water level as larger bodies of water such as the Salt Pond and the Indian River Bay.

There are two sources of flooding. One is caused by rain alone (***rain events***) and the other is caused by a combination of rain and tide (***tidal events***). The most severe flooding is caused by tidal events.

Rain Event Flooding

- ***Rain event flooding*** can be caused by several factors. In some cases, the sheer volume of rain makes it impossible to drain the system quickly. In other cases, ***rain event flooding*** occurs when the swales, ditches and pipes that direct storm water to one of the canals become clogged, or when pipes become damaged. Sometimes residents create problems by allowing vegetation to grow into the swales, by landscaping and/or filling in their lots and blocking the swales. This blocks or restricts drainage and causes flooding. Portions of North Pennsylvania Avenue and other streets, experience ***rain event flooding***. In addition, Bethany West experiences primarily ***rain event flooding***.
- The Town has made significant progress in mitigating ***rain event*** flooding where the causes of the problem can be addressed using existing financial and human resources.

Tidal Event Flooding

- ***Tidal event flooding*** is generally caused by a combination of heavy rains and wind driven higher-than-normal tides. ***Tidal event flooding*** usually occurs in connection with nor'easters. These storms, with their accompanying heavy rains and winds, drive waters into the Indian River Bay, White's Creek and Cove Bay. These waters are eventually driven into the Assawoman Canal and the Bethany Loop Canal, causing higher tides than normal.
- The streets and areas closest to the Loop Canal are, for the most part, lower than the areas from which the rain is draining. Catch basins and pipes are generally set at the same level as the Loop Canal. Therefore, the collected rainwater cannot drain into the Loop Canal during a ***tidal event***. The only place the rainwater can go is over nearby streets and lots.
- The banks of the Loop Canal are not as high or as steep as those of the Assawoman Canal. Therefore, the flooding situation is further compounded during severe nor'easters when the wind driven tides overflow the banks of the Loop Canal and flood the surrounding areas with salt water, in addition to the rainwater.
- Because of its location at the end of the Loop Canal, North Pennsylvania Avenue is especially susceptible to ***tidal event flooding***. During nor'easters, the wind- driven tide of the Loop Canal comes to a dead end at North Pennsylvania Avenue where it has no place to go except to empty onto North Pennsylvania, as well as other low-lying streets along its path.
- Engineering studies have been commissioned to examine and determine the feasibility of proposed solutions to ***tidal/event flooding***. However, to date, no viable solutions to ***tidal event flooding*** have been identified.

II. STEPS TAKEN TO DATE TO ADDRESS FLOODING

In the 1995 Comprehensive Plan for Bethany Beach, Harry Steele addressed the issues of flooding and drainage. Since then, Harry has chaired the Flood Mitigation and Drainage Committee. With the approval of Town Council, various engineering studies have been commissioned to address both *rain* and *tidal event flooding*.

Rain Event Flooding

- In 2002 an engineering study was undertaken to examine the Town's existing drainage system and to identify and evaluate areas which flooded because of *rain events*. The Study, completed in December 2002, identified some 80 locations throughout the Town and provided recommendations regarding how *rain event* flooding could be alleviated in each location.
- Recommendations were prioritized based on the severity of the deficiency problem, the number of property owners affected and the feasibility of addressing the problem with existing staff and resources. Recommendations regarding the Town's drainage system ranged from clearing, establishing or reestablishing swales, culverts and ditches to replacing entire sections of pipes. The Study also addressed issues relating to catch basins, as well as the canals, tide gates, and Tide Flex valves. The Study was significant in that it provided the Town with an overall plan to address issues relating to *rain event* flooding.
- Through the efforts of the Flood Mitigation and Drainage Committee, the approval of Town Council, and the work of the Town Manager and Public Works Department, there has been a great deal of progress made over the past four years in implementing the Study's recommendations with regard to projects which can be completed within the existing budget.

Ongoing Maintenance

Because an ongoing program is essential to maintaining an effective drainage system, the Study also recommended that sufficient resources be employed to ensure that ditches and swales throughout the Town receive regular attention. As a result, personnel were added to the Town's Public Works Department, so that the equivalent of 2.5 persons a year are now devoted to monitoring the Town's drainage system and maintaining it clear of debris and obstructions. This work includes all catch basins, open swales, ditches, inlets, outlets, culverts and Tide Flex valves. In all, approximately 160 locations are periodically monitored and maintained.

What We Can Do ?

To alleviate *rain related flooding*, the Study recommended that citizens be educated regarding the role they play in preserving the existing drainage network. Therefore, all property owners are reminded:

- To keep all swales and ditches on their property and any public property running along their property free of vegetation and landscaping.
- Do not place any obstacles, such as trash receptacles, in the way of the free flow of water in ditches and swales belonging either to them or to the Town.
- Keep all driveway pipes in good repair. Check to be sure they have not collapsed or otherwise interfere with the free flow of water.

III. PROPOSED PROJECT SOLUTIONS

These include recommendations by engineers, as well as concepts proposed to alleviate ***rain event flooding and/or tidal event flooding*** in certain areas. Some cannot be addressed within the existing budget, while others have not proven viable. They include:

Rain Related Flooding

- North Pennsylvania Avenue. Replacing and re-grading existing pipes on North Pennsylvania Avenue. These pipes are deteriorated, separated and/or collapsed. In effect, there is currently no drainage system on North Pennsylvania Avenue and the water lies on top of the road and lots. This project would cost approximately two million dollars to complete. Replacing pipes on North Pennsylvania Avenue would help alleviate flooding caused by ***rain events*** only. It would not address flooding caused by a combination of ***rain*** and ***tidal events***. Therefore, North Pennsylvania Avenue would still experience flooding from these combination ***rain/tidal events***. However, flooding would not occur as frequently or last as long.
- There have been other concepts and suggested solutions discussed to address problems in areas that continue to experience ***rain related flooding*** because of their lower elevations and other characteristics. These projects could cost at least \$2 million each.

Tidal Related Flooding

As stated above, engineering studies have been commissioned to examine and determine the feasibility of proposed solutions to ***tidal event flooding***. However, to date, no viable solutions to tidal event flooding have been identified.

IV. SUMMARY AND CONCLUSION

- Bethany Beach property owners listed stormwater management and drainage as the second highest priority in the recent Town survey. The Town has implemented a plan based on a 2002 engineering study which proposed solutions to ***rain event flooding***. The Town has made significant progress in completing those projects that can be accomplished using existing staff and resources. In addition, it has added staff to maintain the system and reminds citizens of their obligation to help by maintaining portions of the drainage system that cross their property as well as any adjacent public property. North Pennsylvania Avenue remains a visible reminder to us all of that the most costly remaining projects that address ***rain event flooding*** can only be completed if Bethany Beach citizens believe these projects are important enough to complete. The Town continues to seek effective solutions to ***tidal event flooding***. However, proposals for tidal event flooding would be costly and require additional evaluation.