FEMA Response to LOMR Questions sent by South Bethany on May 18, 2021

1. Why have there been three varying coastal FIRMS issued and retracted?

A preliminary FIRM was issued to South Bethany (SB) in August 2013 (see attachment A), another updated FIRM was issued in August 2014 (see attachment B), and yet another was issued in January 2021 (see attachment C). All three of these FIRMS vary along the coastal properties and it is assumed that varying data and methodologies were used to complete these FIRMS. What topographic, water level and wave data is used for each, and what Erosion Methodology was used on each?

A: FEMA issued the 2014 revised preliminary FIRM to address the appeal received from the Town of South Bethany in April 2014 to the 2013 preliminary FIRM for Sussex County, DE, and Incorporated Areas. The 2014 analysis adopted the same topographic, water level, and wave data as the 2013 preliminary FIRM. The erosion method was non-standard.

The 2014 revised preliminary became effective during March 2017 (re-issued as a new preliminary for a PMR in May 2015 with an appeal period between October 2015 and January 2016). The resulting FIRM panel numbers 1005C0514L and 1005C0518L were rescinded during January 2020, and the flood hazards within the Town were reverted to match those shown on the January 6, 2005, FIRM (i.e., the previously effective flood hazards). The 2005 FIRM was based upon a 1992 countywide coastal analysis, which became effective in 1995 and for which topographic maps with contour interval of 5 feet were used to delineate floodplain boundaries.

As that 1995 analysis did not reflect best available data nor current coastal hazards, FEMA initiated a new coastal analysis in May 2020. This analysis produced the FIRM that was updated in January 2021 via a Letter of Map Revision (LOMR). That LOMR was rescinded in February 2021 to allow for additional outreach.

Please see the table below for the sources of the data and erosion methodologies used in the three analyses.

Study	Topographic Data Source	Water Level and Wave Data	Erosion Methodology
2013 Prelim	2005 LiDAR	2011 USACE storm surge study	Standard Erosion Method
2014 Revised Prelim	2005 LiDAR	2011 USACE storm surge study	Non-standard Erosion Method
2020 Coastal Analysis (LOMR)	2017 LiDAR	2011 USACE storm surge study	Modified Erosion Method, also a non-standard erosion method

2. Why do these FIRMS not use the same data and methodologies as the surrounding neighboring communities?

Using different data for SB than for everywhere else raises questions as to compliance with 42 USC 4101b(b)(2)(B)(ii). The language in the code does not differentiate between the two, it requires both.

> Each map updated under this section shall—
>
> (B) develop National Flood Insurance Program flood data on a watershed basis—
>
> (ii) to eliminate, to the maximum extent possible, discrepancies in base flood elevations between adjacent political subdivisions.

If you used the same topographic data for South Bethany as its neighboring communities and then applied wave runup and overland analysis, what would the results be? It is noted in the "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" that FEMA's *Guidance for Flood Risk Analysis and Mapping: Coastal Wave Runup and Overtopping* (2018b) was used at South Bethany (which would be more current than was used in the rest of Sussex County). Is this correct? The wave runup results seem to conflict with the site conditions. For instance, in the study the beach and dune at transect 1595 has the highest wave runup than all dunes in South Bethany and yet it is the furthest from the waterline and several feet higher and wider than all other oceanfront transects along South Bethany's coast. Attached is the topographic survey (see attachment D) of the beach at the north end of South Bethany in front of Sandpiper Village (Sea Side Drive). Additionally attached (see attachment E) is the Topographic Illustration of Transect 1600 taken from the "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021," that clearly indicates a larger more protected beach area (and reason transect 1600 was eliminated and 1595 established). Was the more recent LiDAR data utilized for all of South Bethany (riverine and coastal)? Or just coastal? And why?

Utilizing a different erosion method for South Bethany than neighboring areas, but keeping all of the other study methods used in this LOMR analysis the same, would and has resulted in drastically different results. South Bethany, Middlesex Beach, Sea Colony, Bethany Beach, Fenwick Beach, all have the same type of topography, and exposure, as well as have historically had similar damages during major storms. (see attachment F – South Bethany and Bethany Beach Coastal View). Why are changes being made to how South Bethany is being evaluated, when utilizing this modified erosion method along with different topographical data will obviously result in major differences between neighboring communities? This is not permitted based on Title 42 U.S. Code § 4101b - National Flood Mapping Program:

> (b),(2),
>
> (B) develop National Flood Insurance Program flood data on a watershed basis—
>
> (i) to provide the most technically effective and efficient studies and hydrologic and hydraulic modeling; and
>
> *(ii) to eliminate, to the maximum extent possible, discrepancies in base flood elevations between adjacent political subdivisions.*
>
> (C) Standards
>
> In updating and maintaining maps under this section, the Administrator shall—
>
> (1) establish standards to—

(A) ensure that maps are adequate for—

- (i) flood risk determinations; and
- (ii) use by State and local governments in managing development to reduce the risk of flooding; and

(B) facilitate identification and use of consistent methods of data collection and analysis by the Administrator, in conjunction with State and local governments, in developing maps for communities with similar flood risks, as determined by the Administrator;

Why was new LiDAR used when it will most likely result in discrepancies between flood elevations between adjacent political subdivisions? Title 42 of U.S. Code § 4101b - National Flood Mapping Program directs to:

> **(b),(2), (B),** *(ii) to eliminate, to the maximum extent possible, discrepancies in base flood elevations between adjacent political subdivisions.*

A: Considering FEMA's evaluation of need to re-map the subject areas through its CNMS, these particular panels have a much higher need to be updated than those of the neighboring communities, since the current effective maps were from flood studies undertaken in 2005, with underlying data from the 1990s, while neighboring communities maps are based on the aforementioned 2011 USACE Storm Surge Study.

If FEMA were to adopt the questioner's position that the use of knowingly out-of-date (and thus less accurate) topographical data was required, that would force FEMA to either publish knowingly defective flood hazard data or defer the publication of updated data until such time as FEMA is undertaking a larger study of an entire watershed.

FEMA coastal FIRMs depict whole-foot BFEs and it is common for LOMRs to revise small areas, often just one property with different BFEs compared to adjacent unrevised properties. Further and due to mapping scale and varying shoreline characteristics, having continuous tie-ins on FIRMs along coastal floodplains, even on the order of 1 foot, is also not always feasible for coastal studies. Please see below an example from the current effective York County, VA, FIRM published in 2015. Due to the varying shoreline slopes, the BFEs of the VE zones along the shore have large changes in BFE up to 5 feet between neighboring zones. Please note there is not a 5-foot waterfall in between those zones, but rather a steep decline in wave heights of 5 feet across a relatively small area that cannot be reasonably depicted at whole-foot increments on the FIRM. This common mapping convention results in some of the differences in BFEs between the jurisdictional boundaries, but supporting modeling identifies the intermediate BFE zones that are not shown due to scaling.

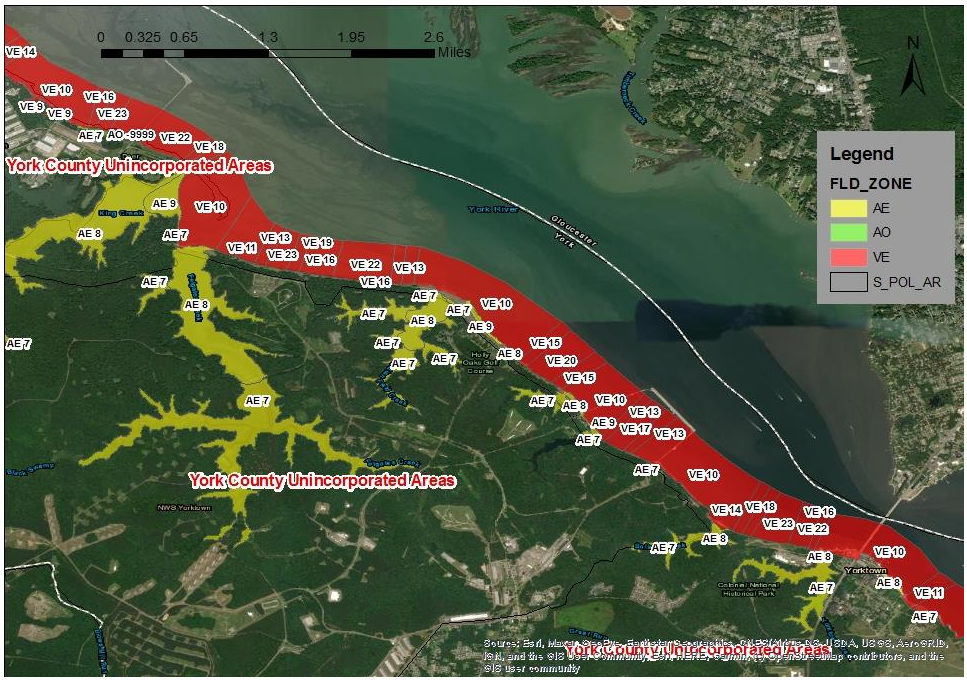


Figure – York County, Virginia, Coastal BFE Transitions

In addition, to avoid discrepancies in BFEs with adjacent political subdivisions and ensure that the residences north of Ocean Drive are represented in the modeling, the study team placed Tr. 1595 near the northern town border as shown in the figure below.

Figure – Transect Layout for South Bethany, DE

Given the analysis conducted and what is standard for FEMA coastal studies, FEMA has eliminated, to the maximum extent possible, discrepancies in BFEs between the Town and adjacent communities.

3. What is the difference between FEMA's "Standard Erosion Methodology" and the non-standard "Modified Erosion Methodology" used in the South Bethany LOMR?

The Modified Erosion Methodology diverges widely from the Standard Erosion Methodology. As shown below, the Modified Erosion Methodology begins erosion at approximately -2.0 feet, rather than at the toe of the U.S. Army Corps of Engineers dune which is set at 7 feet under FEMA's guidelines under the standard methodology. So, instead of starting erosion at the toe of a dune (at an elevation of more than seven feet), it starts erosion below sea level. The Modified Erosion Methodology removes an extraordinary amount of sand from the beach relative to the amount that would be removed under the Standard Erosion Methodology for the Atlantic Ocean and Gulf of Mexico coasts. This is clearly noted when you compare the inserted Figure 23 image below of transect 1610 taken from "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" with the one below that of the Modified Erosion Methodology.

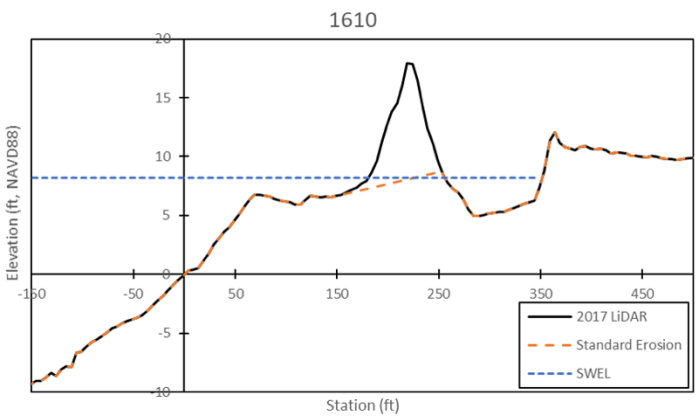


Figure 23. Standard removal erosion geometry example for Transect 1610

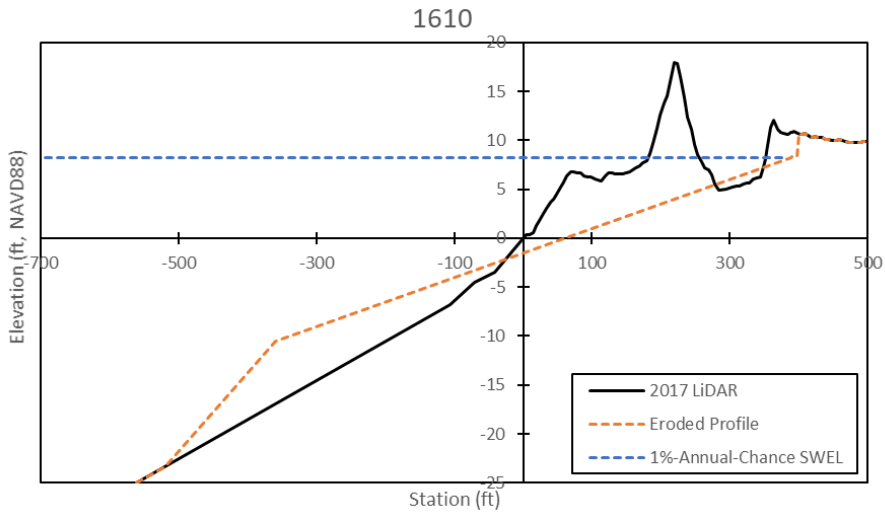
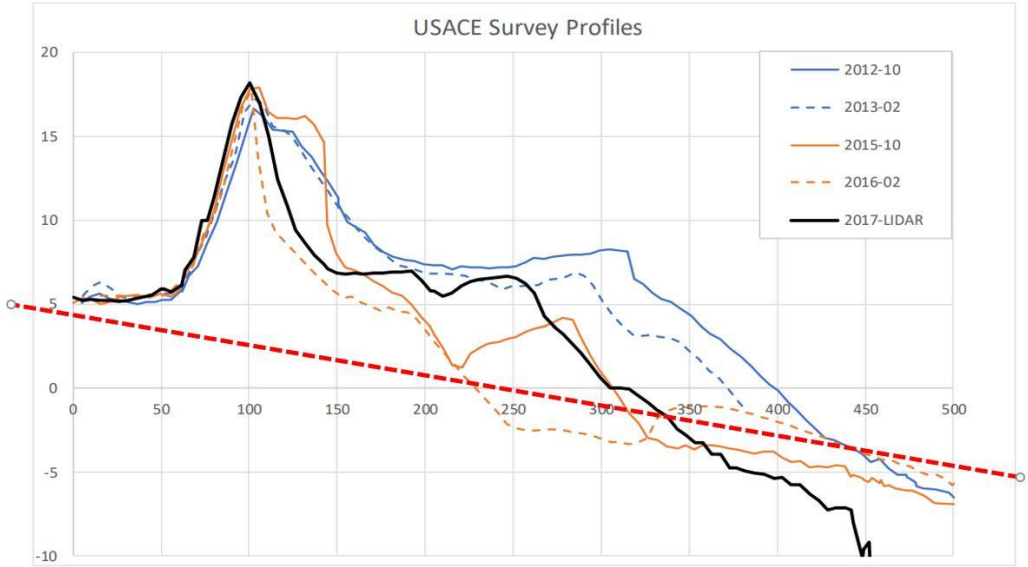


Illustration of Modified Erosion Methodology at South Bethany Transect 1610

In addition, "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" Modified Erosion Method removes approximately 1,660 square feet from the Transect 1610 profile and eroded a constant-slope (40:1) surface from a point at elevation minus 2 feet on the 2017 profile for a landward distance of about 430 feet stopping at Ocean Drive. However, the assumed volume of erosion and configuration of the assumed eroded surface bear no relation to historical experience on this maintained profile, even considering the most extreme effects documented by the January 2016 storm.



Also of note, Transect 1595 or 1600 are ignored in this analysis and should be considered, as well as treated differently based on the large expanse of beach and healthy condition of existing dunes (again see attachments D and E). The depth of this beach and the extreme size of the dunes shows that the topographic site plan indicating the height and width of dunes and beaches in this area are substantial.

South Bethany FEMA Transect Layout

A: The Modified Erosion Methodology is a variation of the Standard Erosion methodology and relies upon similar underlying geometric and volumetric principles as the FEMA Standard Erosion analysis. Such variations are deemed appropriate according to FEMA mapping guidance.

The Modified Erosion method differs from the Standard Erosion method only in its treatment of the dune removal profile. For the Modified Erosion method calculates dune removal with a profile that better matches the observed post-nourishment erosion geometry. The Modified Erosion profile preserves most characteristics of the standard "retreat" profile: it applies the same

dune toe elevation and erosion slopes as the Standard Erosion method and, like the Standard Erosion method, conserves sediment across the beach profile.

The water level of the January 2016 winter storm roughly corresponded to a 10-percent-annaul-chance flood level at the Town of South Bethany, the eroded profile of which certainly should not be considered as "most extreme effects." FEMA Flood Insurance Studies (FISs) analyze 1-percent-annual-chance floods, which simulate more severe erosion scenarios than 10-percent-annual-chance storms. How the eroded areas from the recorded storms were used in the 2020 coastal analysis is explained in the Section 4.1.4 of the "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" report.

Transect 1595 was not removed from the 2020 coastal analysis. The modeling results and mapping summary of Tr. 1595 are listed in Table 7 and Table 8 of the "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" report, respectively.

Tr. 1600 was removed from the 2020 coastal analysis as the large dune feature at this location is not representative of conditions to the north and south of this transect. Figure 2 in the "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" report illustrates this point.

4. How has the Modified Erosion Methodology been used in other FEMA coastal flood studies applicable to South Bethany?

All of these examples previously provided are not relative to South Bethany Beach and may not share basic characteristics. There is no unusual site geometry and the historical erosion profiles are not vastly different in South Bethany than they are in neighboring communities. It is quite the contrary in South Bethany (in particular around Transects 1595 and 1600), as the beaches are extremely healthy with little additional sand provided on the beach near the waterline only in this area in the latest replenishment project this past winter.

A: The shared examples demonstrate that the methodologies of FEMA FISs are not rigid and can be revised based on local geographic characteristics and historical data. For the Town of South Bethany, the Standard Erosion methodology failed to simulate the erosion profile in two aspects:

1) The Standard Erosion geometry did not account for the shoreline retreat and berm erosion observed in South Bethany from the historical data.
2) The Standard Erosion methodology underestimated the quantity of historical erosion observed in South Bethany. More detailed information is presented in Section 4.1.4.2 of the "Coastal Hazard Analysis Project Narrative: South Bethany, February 2021" report.

Because of the above, the 1992 study, the 2014 revised preliminary, and this new 2020 coastal analysis all adopted a non-standard erosion method. Additional details from 1992 study, conducted by the U.S. Army Corps of Engineers (USACE), follows.

> The screenshot below was taken from the transect profile of Tr. 39, the only transect in Town of South Bethany from the 1992 study. The dune reservoir was less than 540 square feet (the 1-percent annual chance Still Water Elevation was 8.8 feet, the peak elevation of the dune was approximately 12.5 feet, and the length of the reservoir was

about 120 feet); specifically, the area of the reservoir was approximately 444 sq. ft [(12.5′ - 8.8′) × 120′ = 444 sq. ft.]. As such, the dune would typically be removed for the analysis. The erosion profile, however, appears to be a “retreat” case with a steep eroded slope starting near the dune peak and eroded materials deposited offshore; therefore, it is considered a non-standard erosion.

The erosion profile is very similar to that of the 2020 coastal analysis except that the erosion of the 2020 coastal analysis stops at seaward of Ocean Drive, considering the protection from the revetment that was completed in 1999. For the 2014 revised preliminary FIRM, the study team considered Ocean Drive as eroded as the team was not aware of the existence of the revetment along seaward of Ocean Drive when the analysis was conducted.

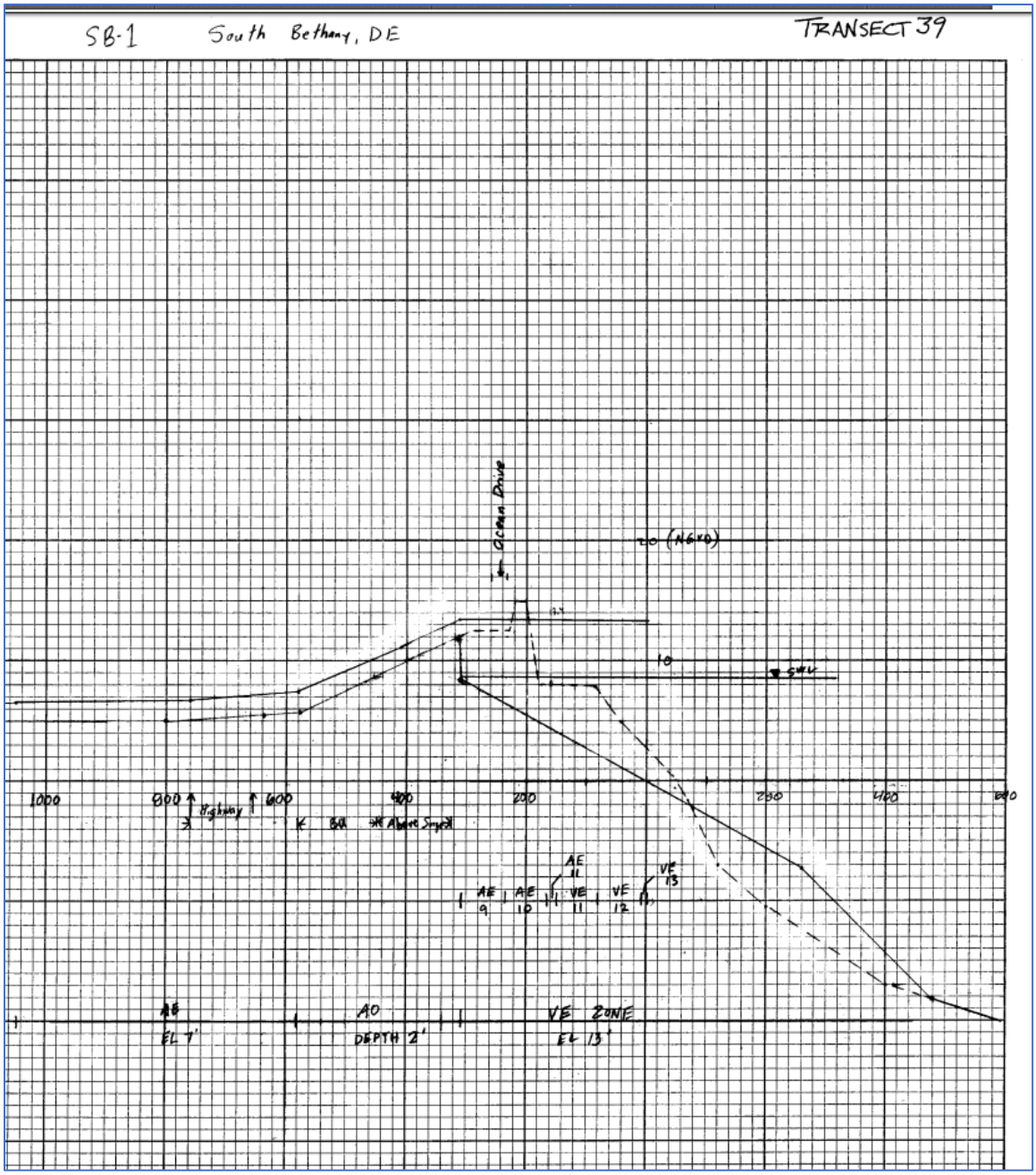


Figure – Transect 39 from 1992 USACE Coastal Study

5. Do flood zones and BFEs have to match across community boundaries? How are differences handled?

The process for South Bethany started at the exact same time as the process for the neighboring communities and the LOMR for South Bethany should be treated the same as its neighboring communities using the same data and erosion methodologies (see attachment G - 2013 Preliminary Firm Panel overlay of current Firm Panel 10005C0518K). When the revision to the Firm Panel for Sussex County began in 2013, South Bethany received a Preliminary Firm Panel. This FIRM panel has been inserted on the current FIRM Panel 10005C0518K, where all BFE's

and flood zones align on both the coastal and the riverine north and south borders of South Bethany. It is our belief that this panel uses the same data and methodologies of our neighboring communities and clearly reflects the Flood Risks in South Bethany Beach.

Please reconsider FIRM Panel 10005C0518K (see attachment G) to be reinstated and published as our current LOMR for both the Coastal and Riverine sides of South Bethany.

A: There are data and methodology differences between the Town and the adjacent Sussex County communities as these are two different analyses performed approximately 10 years apart. Different flood zone delineations and BFEs are possible at LOMR boundaries and, as such, an outcome such as what is found at the northern Town boundary is not unexpected. Please see the table below for different sources of the data and methodologies adopted. Many factors, not limited to the ones listed in the table, contribute to having different BFEs at the Town border. For example, the 2017 LiDAR contained part of the nourished beach profile while the 2005 LiDAR had pre-nourished profile. We recommend reviewing the project narrative for this LOMR to understand the factors that influenced modeling and mapping in this area.

Study	Topo Data Source	Bathy Data Source	Erosion Method Applied	Runup?
Town of South Bethany	2017 LiDAR	2017 Topobathy, National Ocean Service hydrographic survey and beach profile survey	Non-Standard Method	Yes
Transect Just North of Town Boundary	2005 LiDAR	Coastal Process Branch of the Flood and Storm Protection Division, U.S. Army Engineer Research and Development Center	Standard Method	No

Being a coastal study, there is no natural break such as a basin or watershed boundary in between the Town of South Bethany and the neighboring communities that could be adopted as a study limit as is typically done for a riverine analysis. In addition, coastal studies are different from riverine studies in that for a riverine study, the mapping can be linearly interpolated between the WSELs of cross-sections located upstream or downstream of a study area as exemplified by a flood profile. For coastal studies, each transect represents a reach of the shoreline and models the specific geographic characteristics such as land use, topographic elevation, and slope of that particular reach of shoreline; the mapping in between transects cannot be linearly interpolated as is done on a riverine flood profile. In summary, coastal study limits are not defined based on a "watershed" and using political boundaries as a study limit is considered reasonable for purposes of FEMA coastal studies, to include related due process.

The current effective FIS for the rest of Sussex County, having just been published in 2015, is relatively new and is not presently scheduled in the near future for a revision of the coastal flood hazards (the lifespan of a coastal study is approximately 20 to 30 years due to its high cost and long duration to complete). Presently, FEMA considers the coastal hazards for the rest of Sussex County as "compliant" within its Coordinated Needs Management Strategy (CNMS) database, indicating that the study is still valid and no timeframe has been set for additional study updates. The mapping of the area to the north of the Town of South Bethany could be different than that currently shown, based on the newer input data used in this LOMR; however, the nature and extent of any differences are unknown at this time as FEMA has not extended the study into this area as part of this revision based in part on the earlier discussion of appropriate study limits for coastal studies.