Primary Objective Of The SLR & SS Committees Recommendations To Adapt To SLR & SS

- Substantially reduce potential damage due to future floods

South Bethany Has Not Been Prepared In The Past

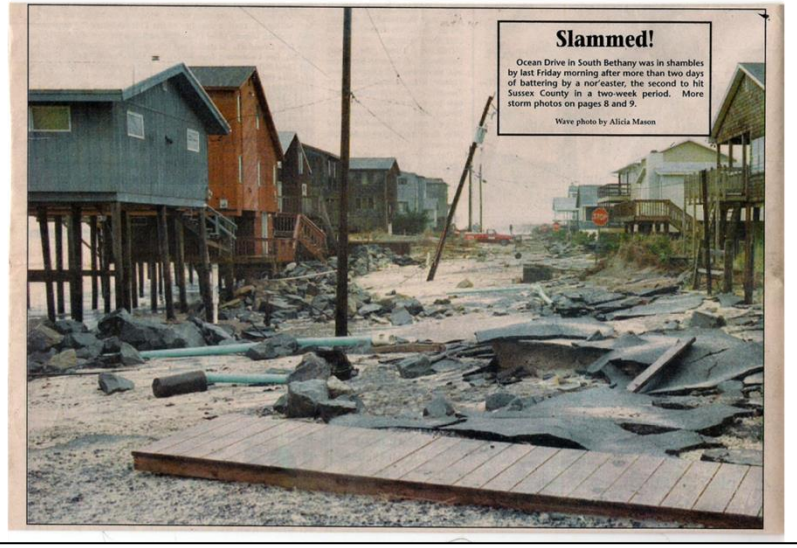
1962 Nor'easter

2012 Hurricane Sandy

The Recommendations that are being presented are consistent with the goal of the SLR & SS Committee which is the future protection of both the property owners' and the Town's assets

Numerous Nor'easters Have Damaged Ocean Front Homes Built To The Minimum FIRM Requirements

Ocean Front Homes And Ocean Drive Were "Slammed" In 1998



Slammed!

Ocean Drive in South Bethany was in shambles by last Friday morning after more than two days of battering by a nor'easter, the second to hit Sussex County in a two-week period. More storm photos on pages 8 and 9.

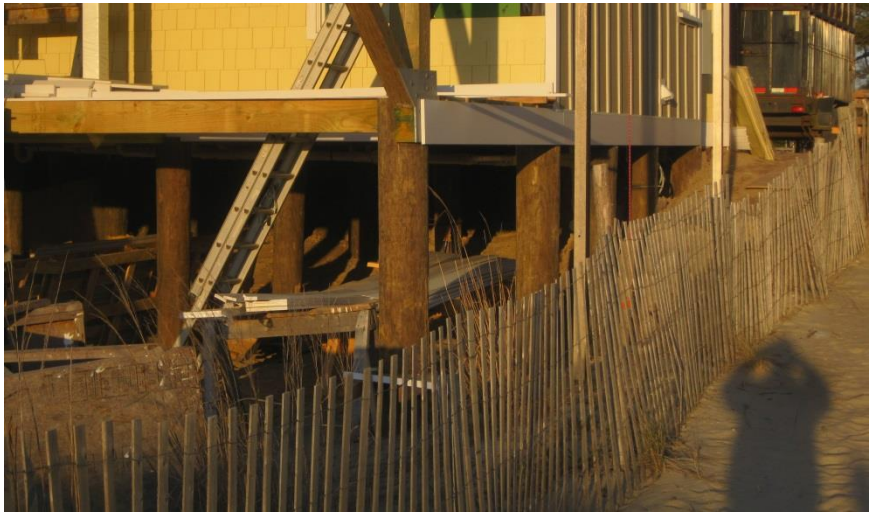
Wave photo by Alicia Mason

Ocean Front Was Again "Slammed" In 2003

Wave photos by Angela Andriola

THE AFTERMATH — The Valentine's-Presidents' Day weekend storm wreaked havoc on coastal Delaware, especially in South Bethany. Clockwise from top left: Delaware Department of Transportation crews were out plowing the major roadways; oceanfront homes on Ocean Drive in South Bethany sustained damage from encroaching waves; the Delaware National Guard was called in to evacuate several South Bethany homes Monday morning; and sand piled up on roads and walkways, making some areas impassable. Center: The entire length of Ocean Drive in South Bethany was littered with sand and debris after two high tides brought floodwaters on land. Five homes on the east side of Route 1 in the town were evacuated Monday morning.

Newer Homes Are Being Built Right At 12.0 Feet NAVD
They Must Think That The Dune Will Save Them
Older Homes Were Higher



Ducts below joists will be washed away.

FEMA Is Providing Grants To Raise Homes Higher Than The BFE

A grant is in process for the home on the left. Its current elevation is 4.2’ NAVD and the current BFE is 5.0’ NAVD. The grant that is in process required that it be raise 1.0’ higher than the proposed new BFE of 6.0’ NAVD. The grant would raise it to >7.0’ NAVD

The house to the right was raised with a previous grant.

Communications From Michael Powell, Manager of DNREC Flood Mitigation Program, Relative To The Flood Risks To Ocean Front Homes

- "The Base Flood Elevation for the ocean front was +13 NGVD (+12.2 NAVD) going back as far as June 1995.
- "In February 1998, a significant northeaster caused significant damage to numerous houses along the oceanfront, nearly all of all of which are above 12.2 NAVD 88.
- "This storm was determined by FEMA to have had a return frequency of 25-35 years according to a report from FEMA
- "FEMA elevated two oceanfront repetitive loss houses at 400 and 402 North Ocean Drive through the Flood Mitigation Assistance Program. Both of these two properties had their lowest horizontal structural member of their lowest floor at 11.8 NAVD 88.
- "At the time, in 1999 FEMA concluded that it was cost effective to raise these two houses to avoid future damages, and provided grant money to raise the houses even higher.
- "See attached picture of house being raised from +11.8 NAVD to +16 NAVD BY FEMA to avoid future damages."

Houses Along Ocean Drive Have Seen Repetitive Damage From Storm Surge. Below Is One That Was Raised From 11.8 Feet NAVD To 16 Feet NAVD BY FEMA To Avoid Future Damages.

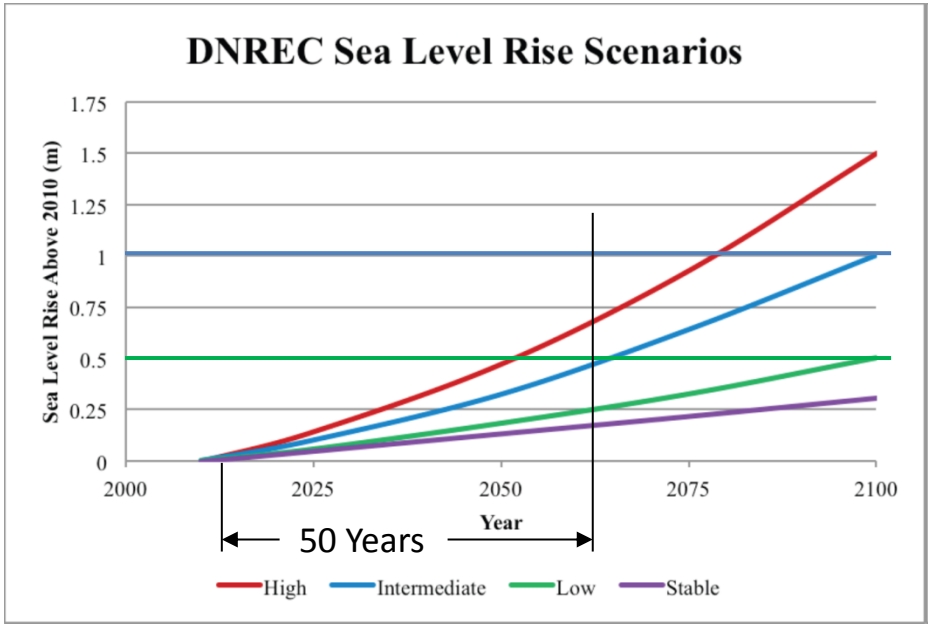
The SLR & SS Committee Recommends That The Town Code Should Be Modified As Follows To Mitigate Effects Of SLR & SS

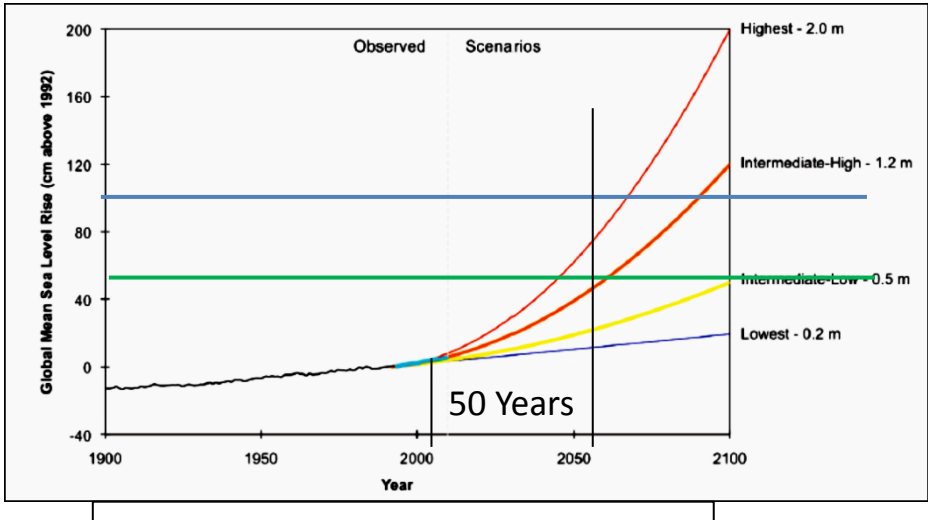
1. Require 3 feet of elevation above that required by the FEMA Flood Insurance Rate Map (FIRM). This would make SB's Design Flood Elevation (DFE) equal to 3.0 feet plus Base Flood Elevation as defined by the FIRM. This is the most important item to protect new construction from damage due to SLR & SS.
2. To allow space for this DFE and to allow additional height in low lying areas, make the height restriction the higher of 34 feet above the road or 38 feet NAVD.
3. To protect facilities that are permitted below the DFE [Parking, Storage and an Entrance to the home] , require that construction comply with *FEMA Technical Bulletin 02 – Flood Damage – Resistant Materials Requirements*.
4. Relative to bulkhead height (Current bulkheads range from 0.5 feet to 4.0 feet.)
   - Maximum bulkhead height should be limited to the BFE as documented on the most current FEMA Map.
   - Any bulkheads that require replacement should have a height of at least 3.0 feet NAVD.

Why Make These Changes To The Code?

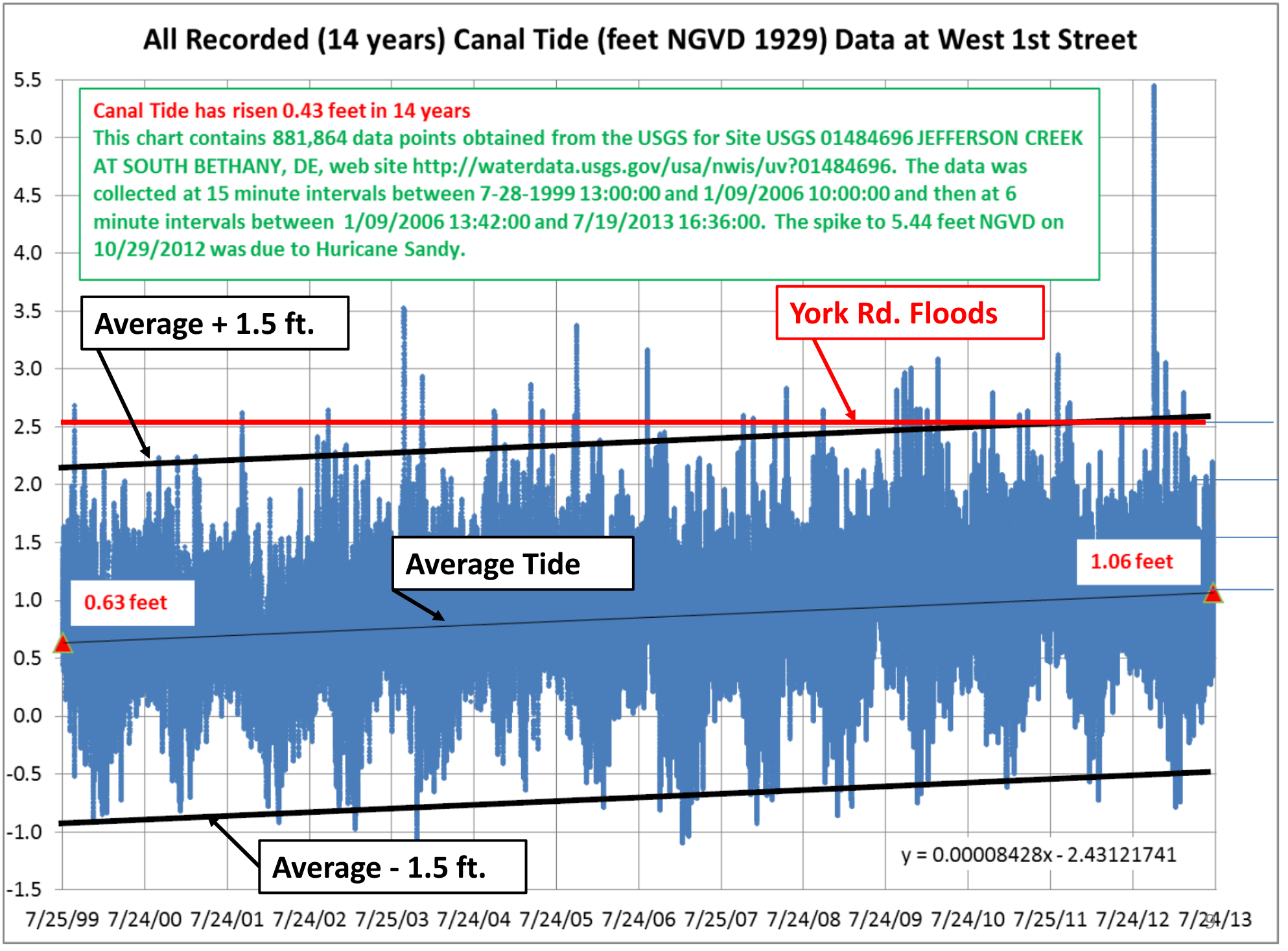
SLR Is Going To Occur

- The average tide in SB Canals has risen 0.43 feet over the last 14 years (Approximately 2 inches every five years) (or **0.5 meters in 50 years**).
- This is consistent with State and NOAA Predictions for the near term.
- Based on the above predictions, it is reasonable to assume that the SB Canals will rise at greater than two inches every five years.
- Sandy showed that SB is vulnerable to real life storm events.
- Increasing height restrictions would be helpful for homeowners who wish to raise their homes.
- The changes to the code would provide more protection for new homes against damage due to SLR & SS.
- The changes to the code would increase our rating in the CRS, thus reducing flood insurance for all homeowners.
- Home owners who built to the "new" DFE would see an additional reduction in their flood insurance.





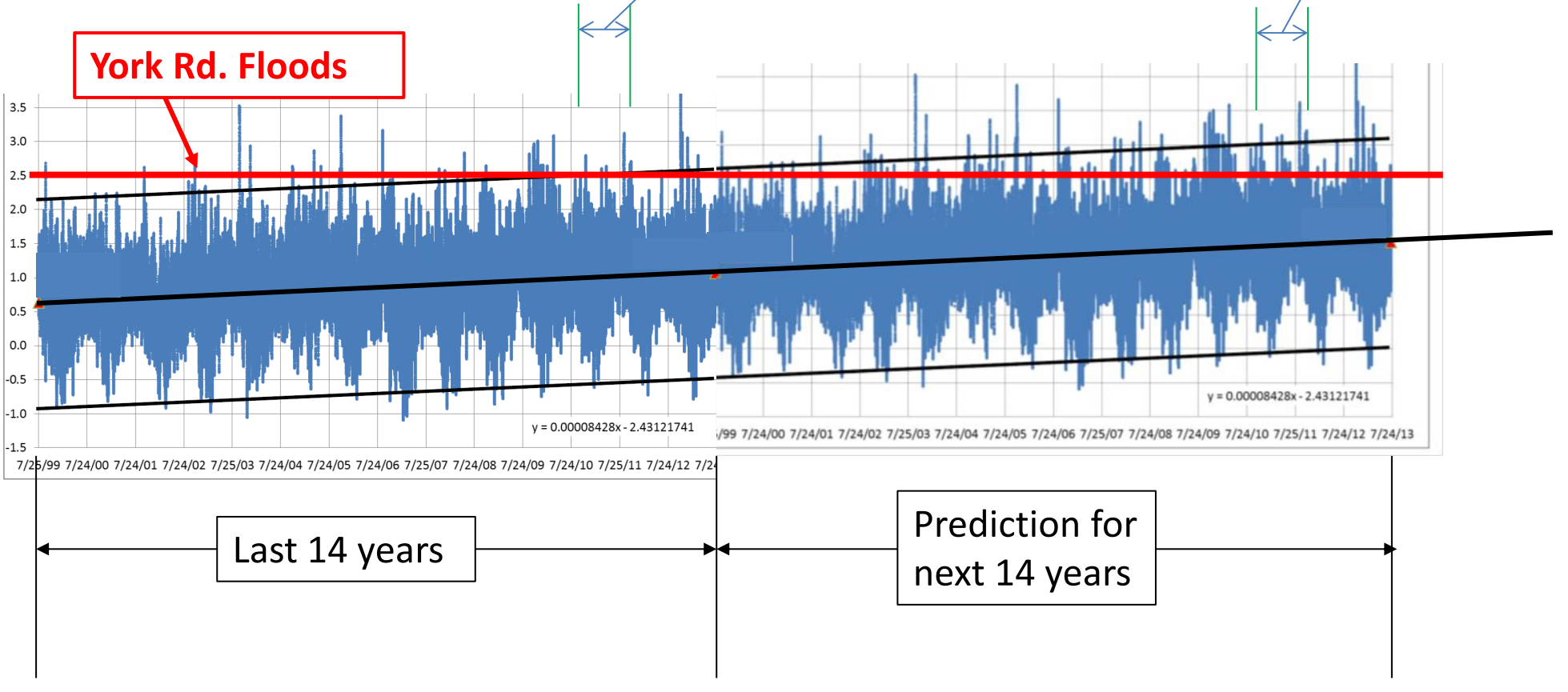
NOAA Predictions


All Recorded (14 years) Canal Tide (feet NGVD 1929) Data at West 1st Street
Canal Tide has risen 0.43 feet in 14 years
This chart contains 881,864 data points obtained from the USGS for Site USGS 01484696 JEFFERSON CREEK AT SOUTH BETHANY, DE, web site http://waterdata.usgs.gov/usa/nwis/uv?01484696. The data was collected at 15 minute intervals between 7-28-1999 13:00:00 and 1/09/2006 10:00:00 and then at 6 minute intervals between 1/09/2006 13:42:00 and 7/19/2013 16:36:00. The spike to 5.44 feet NGVD on 10/29/2012 was due to Huricane Sandy.
Average + 1.5 ft.
York Rd. Floods
Average Tide
0.63 feet
1.06 feet
Average - 1.5 ft.
y = 0.00008428x - 2.43121741
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
7/25/99 7/24/00 7/24/01 7/24/02 7/25/03 7/24/04 7/24/05 7/24/06 7/25/07 7/24/08 7/24/09 7/24/10 7/25/11 7/24/12 7/24/13

A Linear Extrapolation of the Past 14 Years To the Next 14 Years Shows That Flooding of SB Roads Would Increase Significantly

10/01/10 to 09/31/11 York Rd. flooded 7 times.
York Rd. was flooded for a total of 31 hours.

10/01/24 to 09/31/25 York Rd. floods 41 times.
York Rd. would be flooded for a total of 163 hours.



If the average canal tide continues to rise by 2 inches per every 5 years, in 50 years the average tide in the canals will be 1.06’ + 20/12’ = 2.73’ NGVD.

This means that the average tide would always flood York Rd. which has a elevation of about 2.5’ NGVD.

It means that the storm surges that currently flood York Rd. would be at a level of 4.4’ NGVD and cause the flooding shown to the left. This is 1.0 foot less than the tide that was seen during Hurricane Sandy.

We Must Protect Future Homes From This Level of Flooding

Freeboard Makes a Significant Difference in Insurance Costs

- **CRS Credit Points for Freeboard**

FRB = as shown below, based on the required freeboard			
Freeboard	No filling restrictions	Compensatory storage required	Fill prohibited
1 foot	100	110	120
2 feet	225	250	280
3 feet	375	440	500

- **Individual Homeowners Insurance**

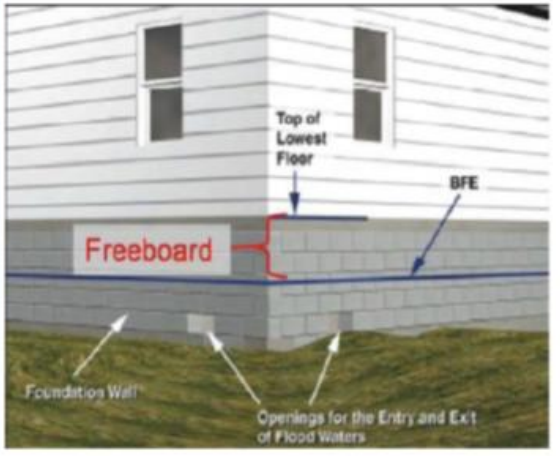
Examples of savings on NFIP1 with freeboard

		Annual savings in NFIP premiums	Savings over 30-year mortgage
Zone V[2]	1' freeboard	$2,565 (33%)	$76,950
	2' freeboard	$4,310 (56%)	$129,300
	3' freeboard	$5,160 (67%)	$154,800
Zone A[3]		$725 (46%)	$21,750
		$984 (63%)	$29,520
		$1,074 (68%)	$32,220

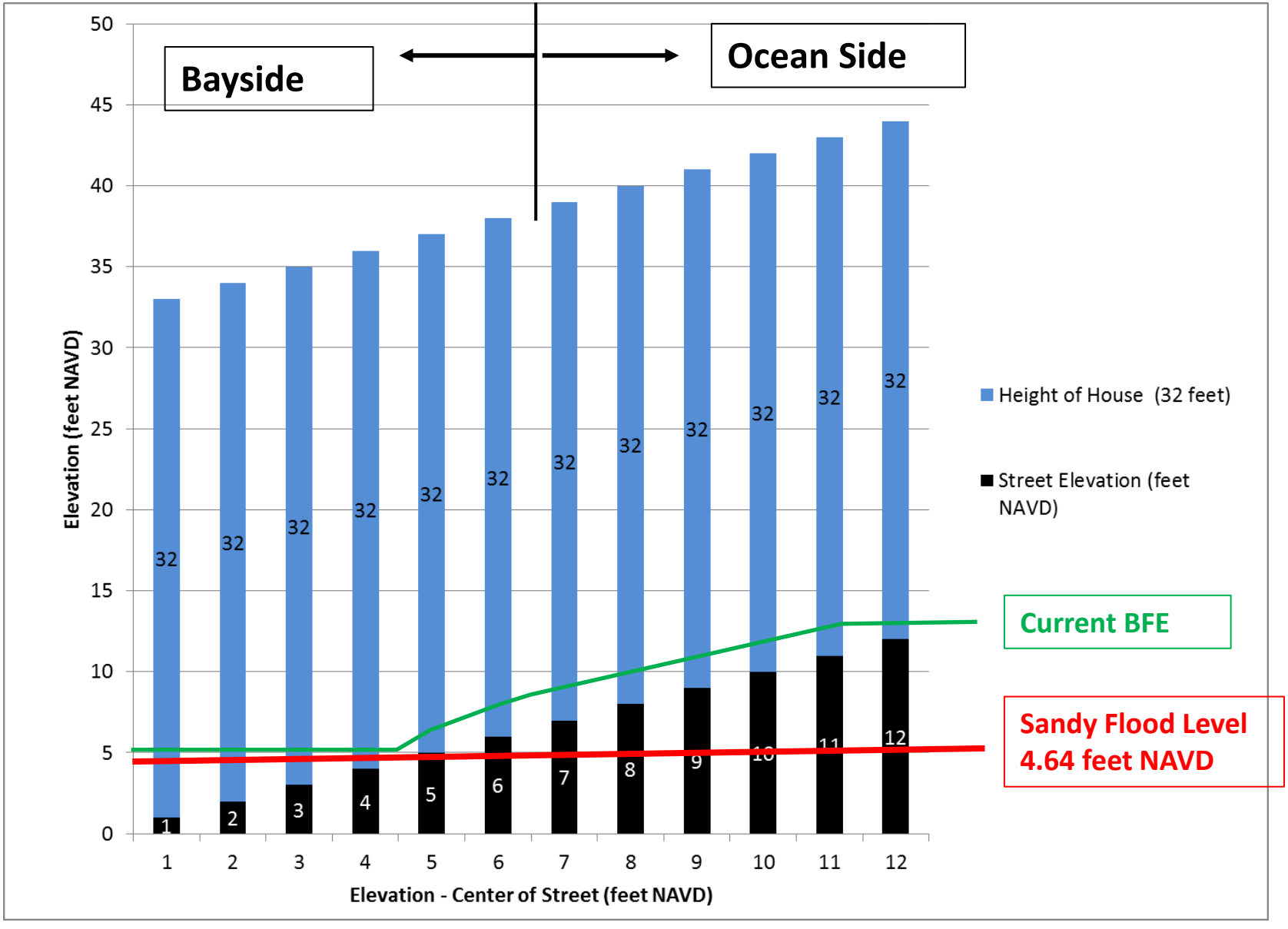
[1] NFIP premiums based on October 2010 rates for a one-floor residential structure with no basement built after a FIRM was issued for the community (post-FIRM rates differ from pre-FIRM rates). $500 deductible/$250,000 coverage for the building/$100,000 for contents.

[2] Zone V: This Flood Insurance Rate Map (FIRM) designation refers to coastal areas that are subject to the highest levels of wave energy and flooding.

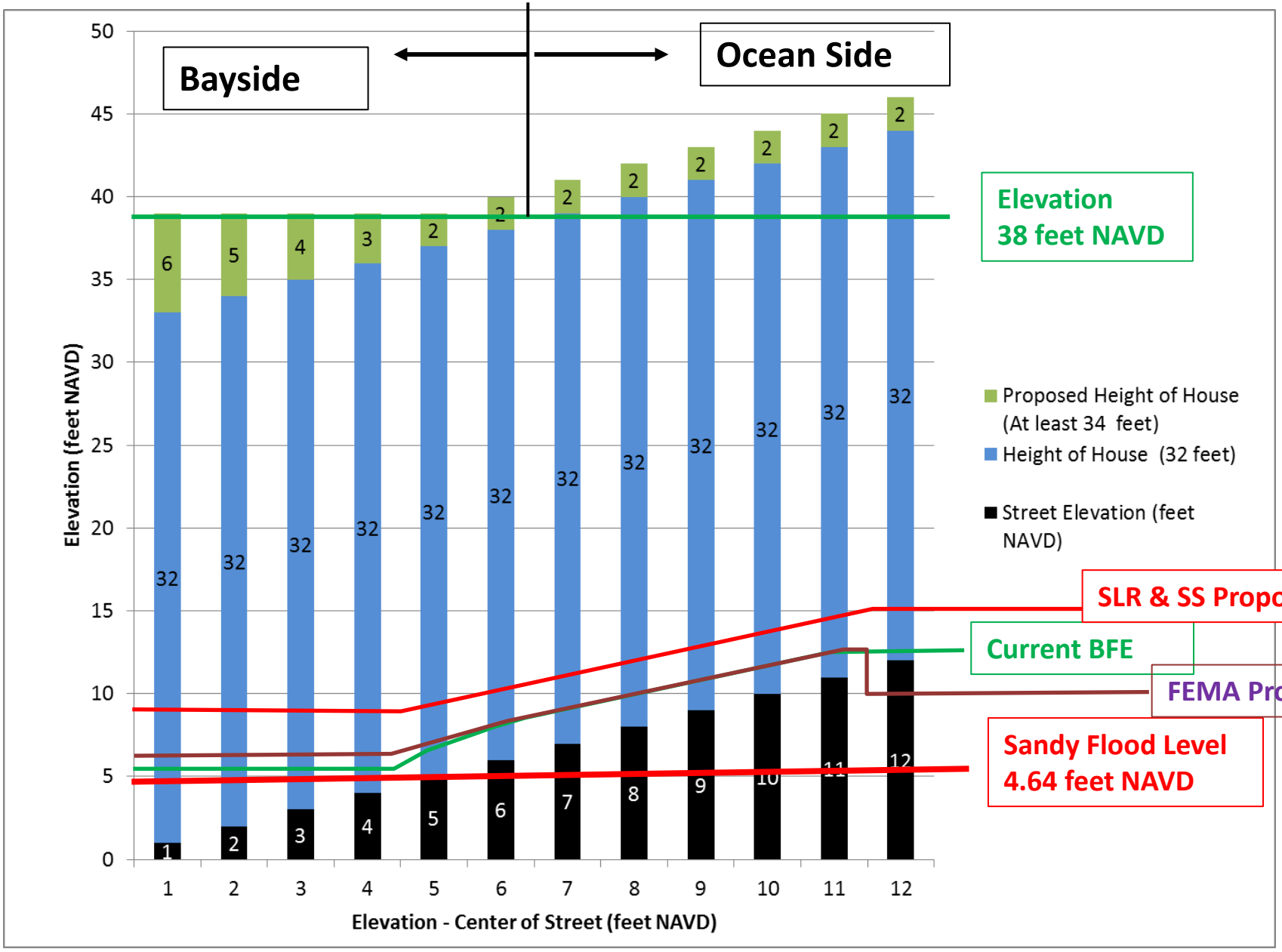
[3] Zone A: Also a FIRM designation, these areas are subject to flooding but with less wave energy than Zone V (i.e., wave heights less than 3 feet).

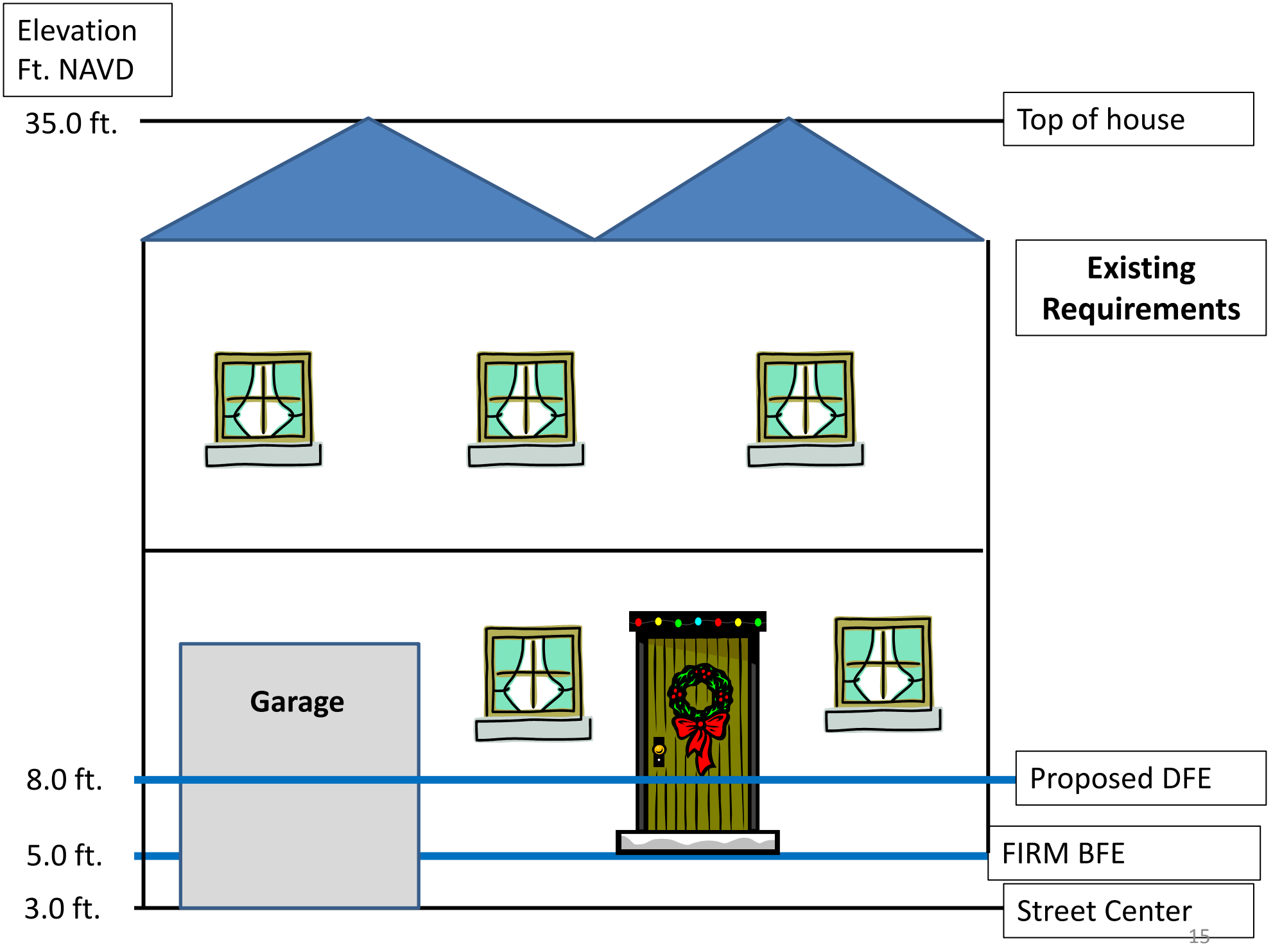


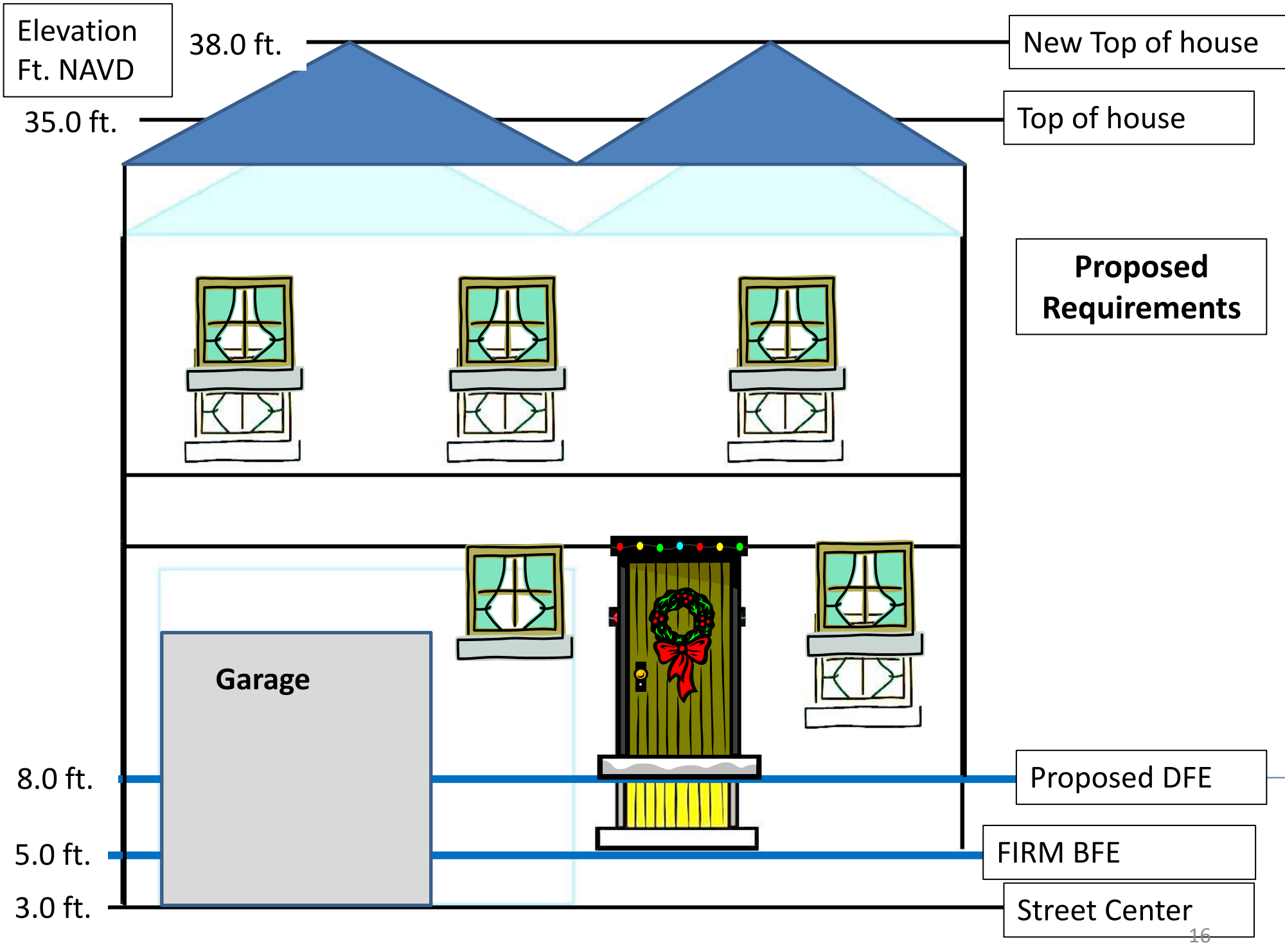
Current Code and Current BFE



SLR & SS Committee Proposed Code and FEMA Proposed BFE

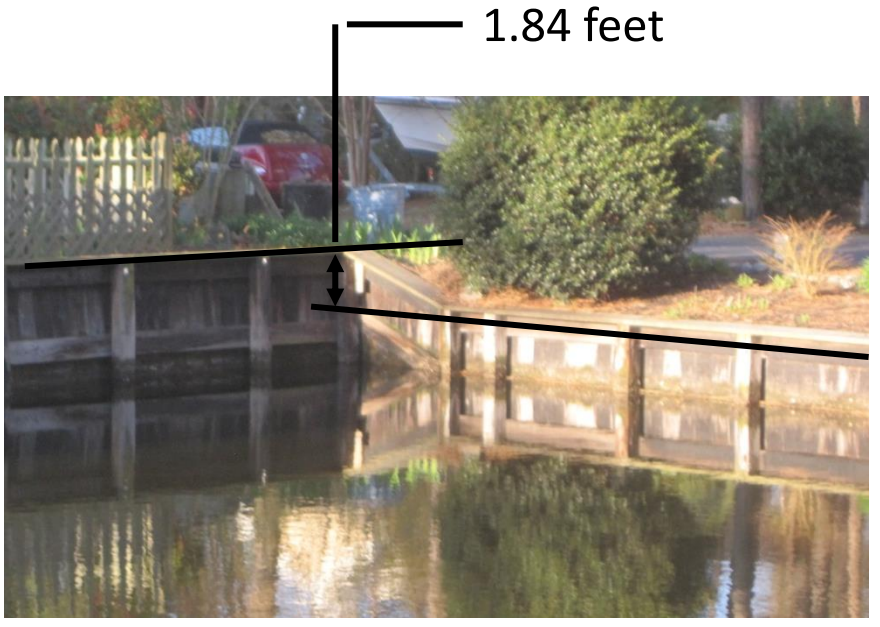


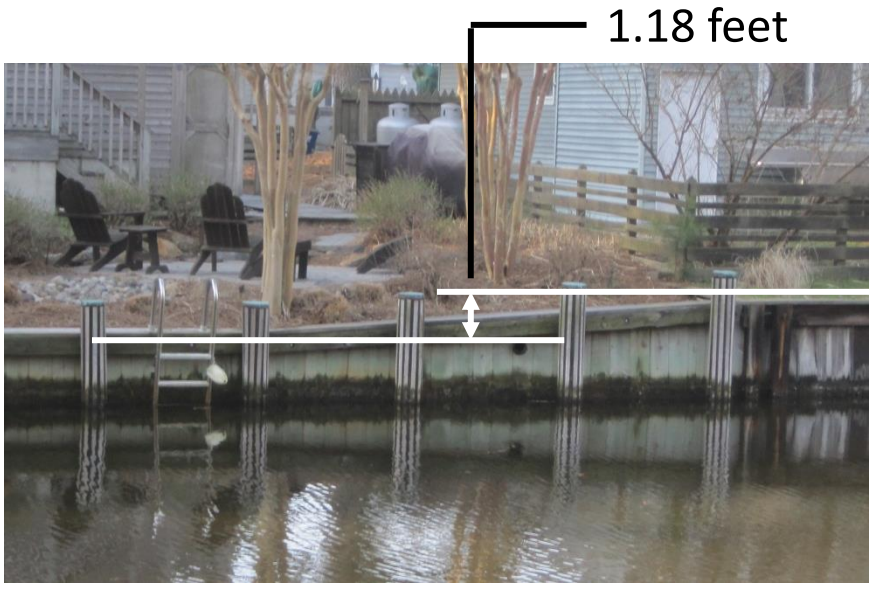

Elevation
Ft. NAVD
35.0 ft.
Top of house
Existing
Requirements
Garage
8.0 ft.
Proposed DFE
5.0 ft.
FIRM BFE
3.0 ft.
Street Center

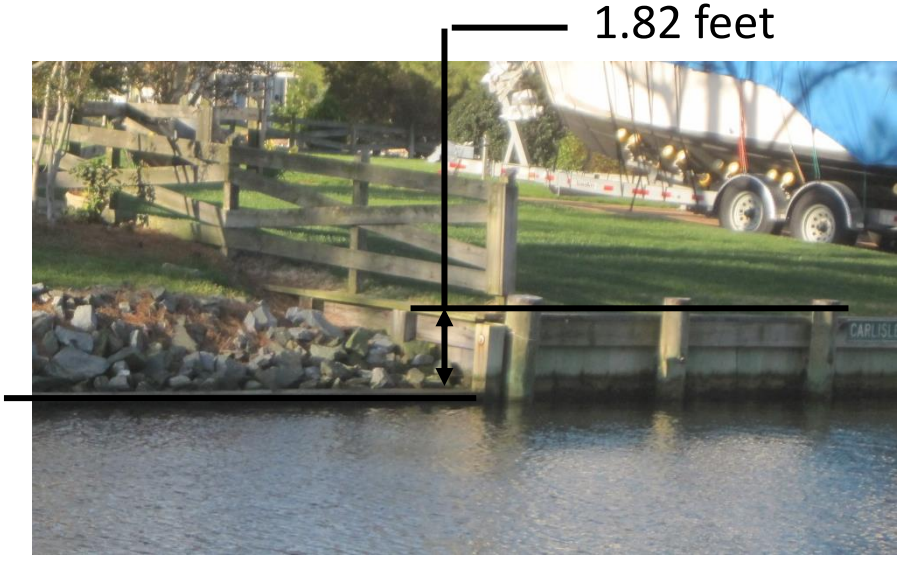

Elevation
Ft. NAVD
38.0 ft.
New Top of house
35.0 ft.
Top of house
Proposed
Requirements
Garage
8.0 ft.
Proposed DFE
5.0 ft.
FIRM BFE
3.0 ft.
Street Center

Backup Slides

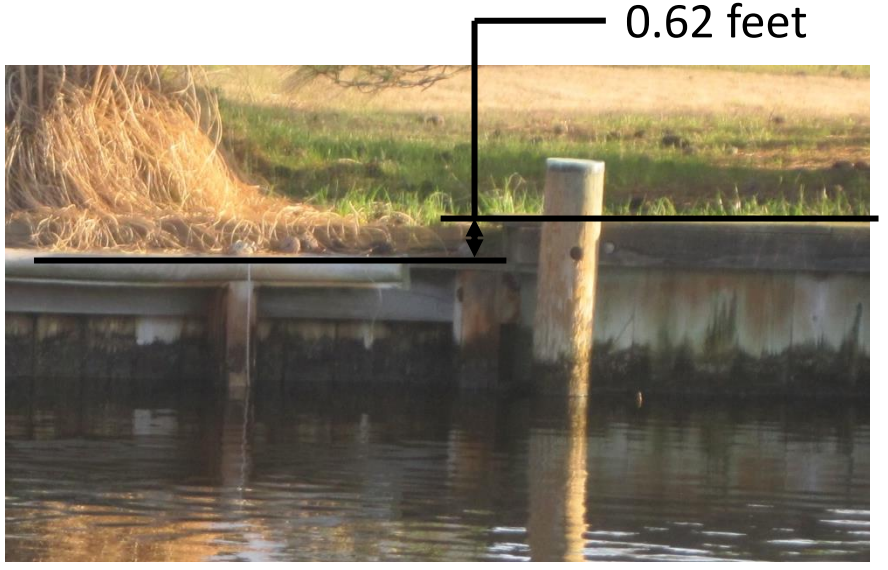
There Currently Are Steps In Bulkhead Heights

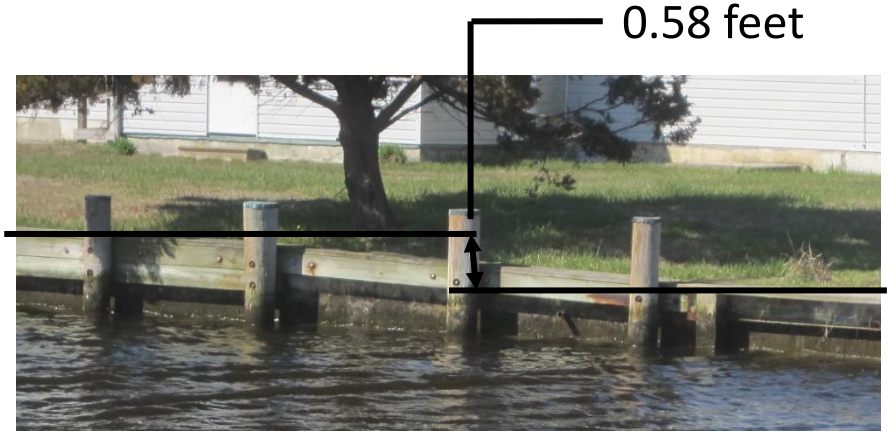






There Currently Are Steps In Bulkhead Heights





This homeowner came to SLR & SS Committee and asked if he could build his bulkhead 5.5 inches higher than the 2.5 NAVD Height. The answer was that the code did not allow it. He is paying $110/ft. for a heavy duty bulkhead (10' pilings, 8'vertical planks that have 2" tongue & groove). It would have cost $5/ft. more to make it 2' higher (12'pilings and 10' planks.) Source of data J&J Bulkheading.