James River Flood Levels and Flooding at HHCA Riverfront Property

In the first half of March 2011 the James River water level rose to flood stage for the second time this year. The airwaves were full of flood warnings using the Westham Gage as reference point. The Westham gage station is the official gage station used by the National Weather Service (NWS). What does the Westham gage level mean relative to the HHCA waterfront? Can the flooding at the HHCA waterfront somehow be correlated with the Westham gage readings?

I took a number of readings at the dock and plotted them against the Westham gage readings.

Test Data taken at HHCA Riverfront

Gage Level at Westham Station	Water Level 1 (Decking of Pier)	Water Level 2 (Grade Level at Stair Case)
ft	ft	ft
8.10	-0.83	-8.00
9.00	0.00	-7.17
9.75	0.75	-6.42
13.00	3.83	-3.33
14.60	5.42	-1.75
14.77	5.58	-1.58

The readings are very close to being a straight line as shown in the chart (ATTACHMENT 1). The readings at the HHCA riverfront (Y-Axis) is plotted against the Westham gage data (X-Axis). The zero on the Y-Axis is defined as the level at which the water level is at the same elevation as the pier planks. I chose this as the reference point since negative values mean that the dock is dry while positive values mean a flooded dock.

NWS defined several flood levels for the Westham gage station:

9 ft - Action Stage ?
12 ft – Flood Stage
15 ft – Moderate Stage

Now take a look at historical flood data:

Estimated Water Levels at HHCA River Property

Use with caution. Data extrapolated from test data.

Year of Flood	Westham Gage	Above Dock Level	Above Grade Level
Assumed	15.6	7.2	0.0
4/27/1937	22.65	15.7	8.5
3/19/1936	23.42	16.7	9.5
11/7/1985	24.77	18.9	11.3
8/29/1969	24.91	18.6	11.4
6/23/1972	28.62	23.7	16.5

The highest flood level occurred in 1972. The official Westham gage reading was recorded as 28.62 ft. What does this translate into at grade level at the HHCA waterfront property? I extrapolated the measurements to 28.62 ft and came up with a level above grade of 16.5 ft. Please keep in mind that extrapolating data is pretty risky and should be taken with a grain of salt.

What does 16.5 ft actually mean relative to houses between the James and Cherokee Road? One needs to know what the elevation at grade level is in topographical elevation. Since I do not have topographical maps of the area I went to Google Earth and determined what the approximate elevations are. The grade level is approximately 120 ft above sea level (asl). I also obtained 100-year flood maps issued by myFloodzone.com (Attachments 2a and 2b). The maps show an elevation of 140 ft asl for the 100-year flood at the boat landing and 139 ft at Darby Drive. The maps also show that the intersection of Cherokee Road and Victoria Lane would be flooded during the 100-Year flood. The intersection is at approx. 133 ft asl and will actually be flooded.

The highest recorded flood (1972) occurred 39 years ago. Recently I interviewed a long-time resident and witness of the flood in 1972. To his recollection both the intersection as well as the first floor of the home at 10700 Cherokee Road were flooded. The house stood in 8 to 10 ft of water. Subsequently the original owner had the entire house lifted to the current level.

The natural drop of the water level during the 100-Year flood as provided by Floodzone.com is 6 ft between the boat landing at Bosher Dam and 1 ft to Darby Drive. Using the extrapolated flood level of 16.5 ft above grade level the flood reached approximately 136.5 ft asl minus 1 ft for water level drop (gravity flow)to Darby Drive. The elevation next to the residence as determined using Google Earth is 129 ft asl. This means that the lower level of the house was actually standing in 6.5 ft of water when using test and calculated data extrapolated to the 1972 flood level. Please note that the calculated value is not an exact figure and may vary by several feet.

The above data consider the impact of the Westham gage being located downstream of Bosher Dam. The crest of the dam is at 112 ft asl (exact figures are unknown). The Westham gage zero datum is at

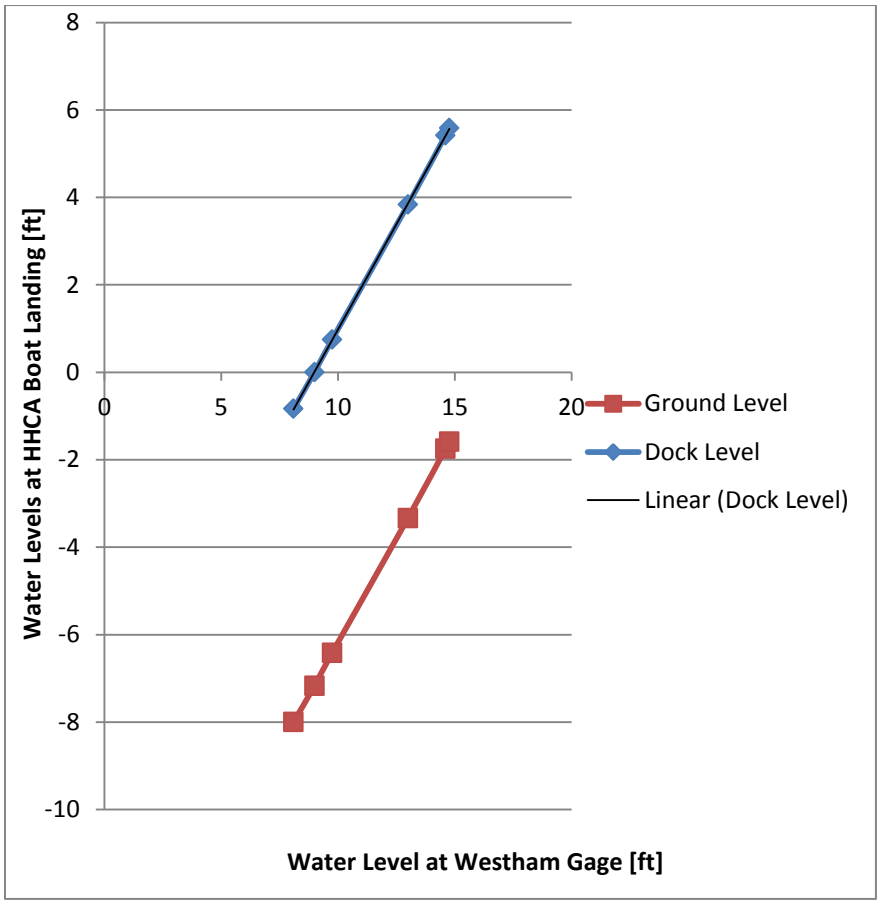
98.8 ft asl. Up to a gage reading of approximately 13 ft the backwater level is below the crest of the dam. This explains the straight line relationship between the Westham gage reading and the measured levels at the boat landing.

Once the back water level increases above the crest of the dam one can longer assume that the dam acts like a weir but rather turns into a flume. This changes the hydraulics of the water flow over the dam and the effect on water levels upstream of the dam. Using flume formulas and taking the eyewitness report into account the water level can reach 136.5 ft asl or 6 ft above ground level at 10700 Cherokee Road. That is right in line with about 8 ft reported by the eyewitness for the flood for the maximum Westham gage reading of 28.62 ft.

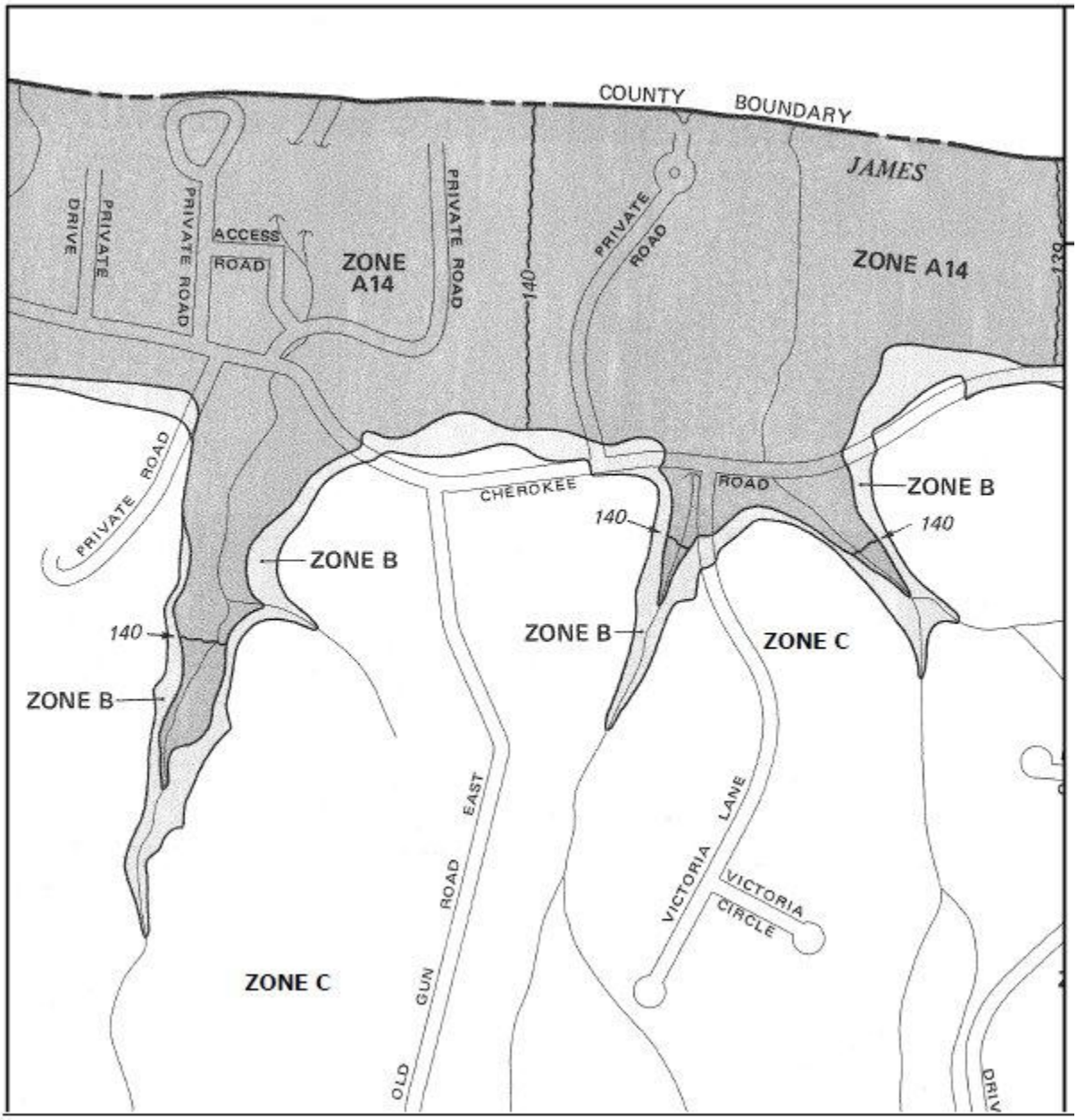
A chart showing water levels between 5 ft and 28.62 ft is shown in Attachment 3.

Please keep in mind that the calculations are based on various assumptions. There are no actual measurements available above 14.77 ft gage reading. Always keep in mind that the 100-year flood level is expected at 140 ft asl at the boat landing and 139 ft asl at 10700 Cherokee Road.

Attachment 1 – Actual Water Levels Measured in March 2011

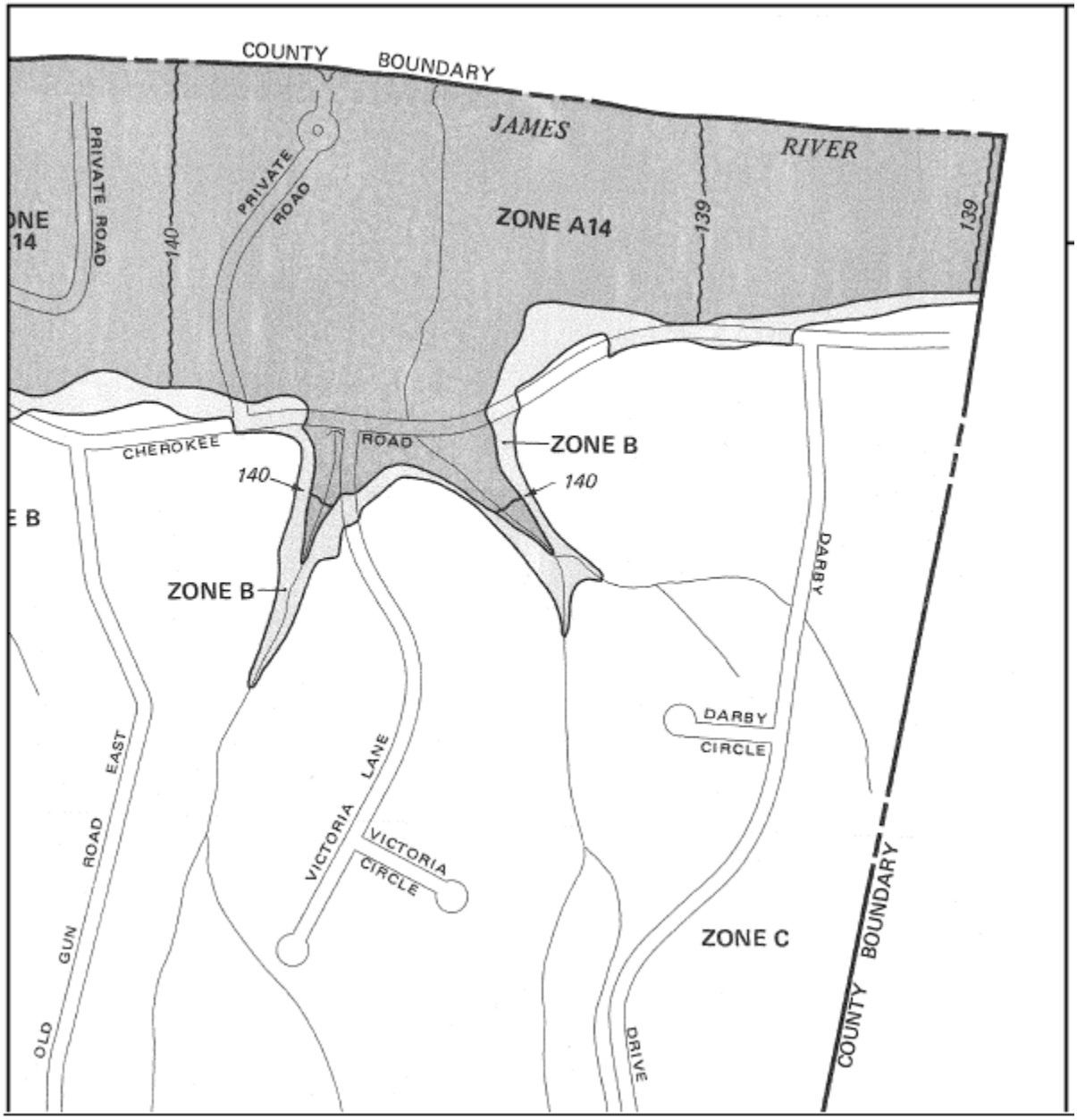


Attachment 2a – 100-Year Flood Map

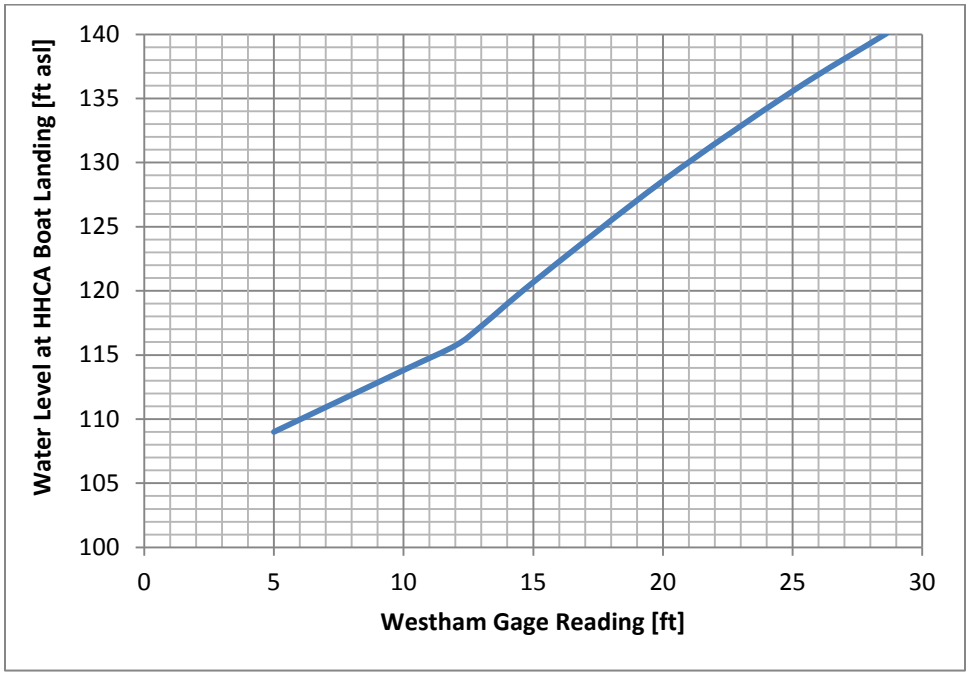


Maps can be ordered at http://www.myfloodzone.com/_vti_bin/shtml.dll/fema-flood-maps.htm

Attachment 2b - 100-Year Flood Map



Attachment 3 – Water Levels at HHCA Boat Landing



120 ft asl = Ground Level at HHCA Property

140 ft asl = 100-Year Flood Level

Attachment 4

Flood Zone Definitions

100 Year Flood: As determined by the Federal Emergency Management Agency, a flood event of a magnitude expected to be equaled or exceeded once on the average during any 100-year period. The term "100-year flood" is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance.

Base Flood Elevation: The expected flood height measured in feet above mean sea level (NGVD 1929 Datum)

Zone A: Flood hazard areas inundated by the 100 Year Flood, no base flood elevations determined.

Source: http://www.chathamcounty.org/fz_defined.html