

# **Climate Changes Impact to Archaeological Sites in Delaware: A Proactive Approach to Historic Preservation**

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## **SLIDE 1**

I want to thank Bernard for co-chairing this session with me, as I have been a bit of the silent partner on this one. We were both extremely surprised and excited about the turn-out for presenters in this session. Thanks to all the presenters! I also want to thank Bernard for presenting my paper for me, as I am unable to attend MAAC this year. I don't think my wife would agree that missing our second child's birth is a good enough excuse to spend a weekend at the beach with a bunch of Archaeologists! This paper will examine the impacts of sea level rise to known Archaeological sites in Delaware. A proactive approach to Historic preservation will be explored to address a number of ethical and methodological questions under the National Historic Preservation Act: What can we do / what should we do? As stated in the Society for American Archaeologist's Principles of Ethics: "It is the responsibility of all Archaeologists to work for the long-term conservation and protection of the Archaeological record by practicing and promoting stewardship of the Archaeological record. Stewards are both caretakers of and advocates for the Archaeological record for the benefit of all people; as they investigate and interpret the record, they should use the specialized knowledge they gain to promote public understanding and support for its long-term preservation."

## **SLIDE 2**

The overall design for my research began quite simplistically in that I wanted to combine reliable sea level rise / climate change data from Delaware and overlay cultural resource points from the

Delaware CHRS data system our SHPO operates. Then once I saw areas of the state where cultural resources will be directly impacted by sea level rise due to climate change, I could provide guidance to my agency the Department of Transportation, about what we need, must, can, and should do under Section 106 the National Historic Preservation Act when we have a project in areas where cultural resources might be negatively impacted by seal level rise due to climate change. I'm currently still in the beginning stages of my research, but wanted to present today about some enlightening insights I have gained so far. The first step in my research is to get reliable data sets on Delaware climate change and sea level rise. Let me begin with a few insights, in that most people think sea level rise will have the biggest impact to the Atlantic Coast of Delaware. Actually the biggest impact of sea level rise due to climate change will be on the Delaware Bay Coastline due to the large amount of non-tidal and tidal wetlands that will be inundated.

### **USE LASER POINTER TO POINT OUT BLUE AND GREEN AREAS**

Here we see the Delaware Bay Coast line, and some basic elevation data. I want to highlight the blue areas that are tidal wetlands and the green areas that are 0-2 meters above sea level. These are the areas that will be directly impacted by sea level rise due to climate change, and as you can see that is a very large area that will be impacted. The area I've circled in red is where I'm going to focus on today, as the entire coast line is just too big to go over in this venue.

### **SLIDE 3**

Here we see an image depicting wetlands that will be converted into open water. This slide comes from EPA data and states that at current sea level rise rates, the wetlands in green will not be converted into open water. The wetlands in brown will be converted into open water at

current sea level rise rates + 7mm per year, and the red wetlands will be converted into open water at current sea level rise rates +2mm per year.

### **POINT OUT THE RED AREA**

As you can see in this image there is a pretty big red area circled on the Delaware Bay that will be directly impacted. This is where I have focused my research, and per this EPA data decided ok, this is great, but I need more detailed mapping about the potential sea level rise impacts to this area, but before I get to that I want to go over a very sobering data set.

### **SLIDE 4**

Here we see a graph from NOAA showing the mean sea level change from Reedy Point Delaware, which is smack dab in the middle of the red area we just saw. This graph shows a 3.46 millimeter per year sea level rise change with a 95% confidence interval of +/- 0.66 millimeters at this location. I'm really showing this as a confirmation to the EPA mapping I just showed you, in that both the EPA and NOAA are independently confirming that certain areas along the Delaware Bay Coast will be impacted by sea level rise due to climate change and we can use this reliable data to make informed decisions about these impact areas. Now even though we will only see about a 1 foot sea level increase over the next 100 years in this area, that is more than enough to change our tidal wetlands to open water and our non-tidal wetlands to tidal wetlands. Now I'm going to use this data in combination with Delaware SHPO data to make informed decisions about how to handle cultural resources that will be impacted by sea level rise due to climate change in these areas for both the Department of Transportation and the State of Delaware.

## **SLIDE 5**

Ok, we are back to more maps. After realizing the EPA mapping was not accurate enough for my research, I began to utilize these more detailed maps, which show two important things. First we see the areas in green – tidal wetlands; these are the areas that will become open water, and the areas in purple will become tidal wetlands. And, as we just saw at 3.46 millimeter per year increase, all the green will be under water and all the purple will be tidal wetlands. Now with that knowledge, let's see what cultural resources are in my research area circled in red.

## **SLIDE 6**

Here we see a Google Earth image from July 4<sup>th</sup> 2010 of the research area I have chosen and we have seen in previous slides circled in red. Let me highlight the amazing utility of Google Earth now that the entire state of Delaware has been mapped in high resolution on July 4<sup>th</sup> 2010. This allows me to show reliable recent images of the research area, and current land conditions.

## **POINT OUR THESE AREAS**

That being said we see here the C and D canal, St. Georges Bridge, Route 9 corridor, and the Historic Town of Port Penn. These are all within the impact area for sea level rise over the next 100 years, and possibly sooner.

## **SLIDE 7**

Again here is the same Google Earth image from July 4<sup>th</sup> 2010 zoomed in to show the relationship between the Historic Town of Port Penn, the Delaware Bay, the Route 9 corridor and one of many pinch points along the Delaware Bay coastline that will be greatly expanded over the next 100 years due to sea level rise. Basically, I can refine my research even further by looking along the coastline for pinch points where sea level rise will have the greatest impact.

## **SLIDE 8**

Here we see one my previous slides zoomed in to show areas in green that are currently tidal wetlands that will become open water. You don't have to be a rocket scientist to see how the Historic Town of Port Penn and areas within the Route 9 corridor and route 9 itself will be impacted by sea level rise.

## **SLIDE 9**

Now that I've bored you enough with sea level rise data and maps we are almost ready to add into the mix the cultural resource data. But not just yet! Here is an image from the Web Soil Survey, and again similar to the July 4<sup>th</sup> 2010 Google Earth data, I'm a big fan and proponent of the new online web soil survey put out by the department of agriculture. What I wanted to show in this slide is that we see portions of the route 9 corridor and the Port Penn area soils being mapped as frequently flooded and tidally influenced. This is just yet another confirmation of what other data sets are telling me: that this area is a direct hit for sea level rise and it's only a question of when. I also wanted to highlight the web soil survey as an extremely useful tool that I feel is underutilized by a lot of Archaeologist. So check it out, it has limitless applications for professionals in our field.

## **SLIDE 10**

Ok, our short journey has finally taken us to a point where I'm ready to bring in the cultural resource data set and add that to the mix of sea level rise data I have just presented. What we are looking at is a portion of the Route 9 corridor and known cultural resource management points in blue. These are Archaeological sites, historic structures, and historic districts. This is image is from the GIS based data from the Delaware State Historic Preservation Office's CHRS system. I won't differentiate between the points or zoom in to any due to their potentially culturally

sensitive nature. However, from this view you can see that these cultural resources are within the impact area I have previously shown will be directly impacted by sea level rise due to climate change. So now that I have established there are areas in the State of Delaware where sea level rise due to climate change will happen and in those areas there are cultural resources. The next logical question is what do we do? Again I'm using the area around the historic town of Port Penn as a cast study for the entire state, since as you see by this image, there are a large number of cultural resources including historic buildings, bridges, historic districts, and archaeological sites that will be directly and negatively impacted by sea level rise due to climate change.

### **SLIDE 11**

Now what? So now what do we do with this wealth of knowledge about cultural resources that will be impacted by sea level rise due to climate change? And this brings me back to Section 106 compliance and SAA Archaeological ethics. I can't emphasize enough how important the SAA principles of Archaeological Ethics are and want to read again this quote, and yes I know this is the worst power point slide ever!

### **READ QUOTE SLOWLY**

“It is the responsibility of all Archaeologists to work for the long-term conservation and protection of the Archaeological record by practicing and promoting stewardship of the Archaeological record. Stewards are both caretakers of and advocates for the Archaeological record for the benefit of all people; as they investigate and interpret the record, they should use the specialized knowledge they gain to promote public understanding and support for its long-term preservation.” With this quote in mind and my preliminary research I have some ideas and opinions for state and federal agencies and the advisory council on historic preservation to consider.

## **SLIDE 12**

First, each state or the federal government needs to assess and identify areas / regions and transportation corridors that will be directly impacted by climate change, and to some extent this is going on via NOAA, FEMA, and other agencies. Second, and this is what is not going on that should be, anytime there is an action that requires Section 106 compliance the state historic preservation office should be advising the client, which is usually the DOT or Army Corps of Engineers, to look to see if the project falls within one of the areas / regions that will be impacted by climate change. If the project does fall within an area that will be affected by climate change, then the state historic preservation office should advise the client to consider the primary, secondary, and cumulative effects to cultural resources within the projects area of potential affect. The next logical step would be on the client, and this is what I plan to do at my agency the Delaware Department of Transportation the next time we have a project in the Port Penn area, which as we have seen will be impacted by sea level rise and does have cultural resources there. I'm going to advise my agency to take a proactive approach and design a long term management plan on how to and when to address the primary, secondary, and cumulative effects of climate change on the cultural resources in the project's area of potential effect.

## **SLIDE 13**

One example would be a 3 tiered system. The first tier is cultural resources where no action is taken, basically we let nature take its course and walk away. The second tier is cultural resources where we do something, maybe minimal excavation / recordation. And the third tier is cultural resources we must save / protect / mitigate at all cost prior to climate change impacting them. There could also be a clause for monitoring, as part of a management plan; maybe the client and the SHPO visit the project area each year to assess the impacts of climate change and then when

the water's too close for comfort enact the management plan or a portion of it. I know this may sound complex and lofty, and it's supposed to be. The main point of my research and this discussion is to get people thinking about cultural resources that will be impacted by climate change and how we should handle this in our section 106 compliance projects.

**SLIDE 14**

Maybe there could be a programmatic agreement or memorandum of agreement between the SHPO, ACHP, and a client like FHWA to handle this? And for Delaware's historic Port Penn area, I'm not sure what we are going to do, but I know the next time we have a DOT project there with Section 106 compliance, I'm definitely going to bring up sea level rise due to climate change and its potential impacts to cultural resources with both the SHPO and FHWA and try to come up with a long term management plan for these cultural resources. THANK YOU!