

Results

from the Gloucester County
Focus Group Discussion of
Sea Level Rise
on October 5th, 2012

A Virginia Sea Grant Project

Project partners:

Gloucester County
Middle Peninsula Planning District Commission
Virginia Institute of Marine Science
Wetlands Watch

Report prepared by:

UVa Institute for Environmental Negotiation
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*Report Prepared by Luke Juday and Mariah Gleason
Edited by Tanya Denckla Cobb
Reviewed by Project Partners
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I. Sponsors and Acknowledgements

Sponsors

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- Gloucester County
- Middle Peninsula Planning District Commission
- Virginia Institute for Marine Science
- Virginia Sea Grant
- Wetlands Watch

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II. Executive Summary

Background

Citizens and elected decision-makers in Virginia's coastal communities are increasingly eager to find ways to address sea level rise at the local level. Flooding caused by storms and storm surges is impacting areas that have never previously experienced flooding, as well as reaching new heights. Gloucester County, working with the UVa Institute for Environmental Negotiation and the Middle Peninsula Planning District Commission, convened a special citizen advisory panel to help inform Gloucester County's Comprehensive Plan and its approach to sea level rise.

Goals

A Focus Group was established through the County Board of Supervisors' Volunteer Board Bank, which opened nominations to all citizens. The goals of the Focus Group were to: 1) provide citizens with the latest information about current and projected sea level rise in Gloucester County; 2) identify citizen concerns and issues about sea level rise; 3) prioritize these concerns and explore citizen preferences for who should assume responsibility for addressing these concerns; and lastly, 4) evaluate a range of place-based, pragmatic options for policymakers to address the impacts of sea level rise on Gloucester County. Volunteers for the Focus Group were encouraged to participate through Public Service Announcements, press releases, and through an article in the local newspaper.

Who Attended

Thirteen citizens were selected from those who completed the County's open nomination process. However, due to unrelated events, three were not able to participate. Ten citizens were able to attend the Focus Group meeting. These ten citizens represented a broad range of important local interests – commercial, environmental, and social welfare – and they also brought a variety of views on climate change to the discussion. Sixty percent (6 out of 10) were shoreline property owners.

Findings

The participant feedback during the focus group extended beyond mere ratings for each potential set of policy tools, and provided a rich conversation from which policymakers can draw in considering future alternatives for Gloucester County. Key highlights of the outcomes included:

- **High Awareness:** A strong majority (80%) of focus group participants indicated during the Focus Group that they were “somewhat worried” or “very worried” about sea level rise affecting Gloucester County.
- **Action is Possible:** 9 out of 10 (90%) felt that humans can act to limit the effects of sea level rise.
- **High Priority for Local Government:** While respondents were less interested in federal climate policies, 90% said addressing sea level rise should be a “high” or “very high” priority for local government.

- **Policies *Most Likely to Help Gloucester County* – Safety and Welfare tools, Land Use tools:** Participants discussed ways to improve emergency management in response to sea level rise and were cautiously optimistic about land use tools. Most felt that planners should consider sea level rise in zoning low-lying areas and placing municipal buildings and infrastructure.
- **Policies *Less Likely to Help Gloucester County* – Natural Resource tools and Quality of Life tools:** Most participants felt these tools were less feasible and less likely to help Gloucester County.
- **Practice Fiscal Responsibility:** While participants were often willing to pay more development fees for policy tools that work, they were very cautious about spending others' money and opposed increasing debt or taxes for most actions.
- **Hold Landowners Responsible:** Participants, most of whom were shoreline property owners, felt that most people who own or purchase land on the shore have the resources or knowledge to accommodate risk. Most felt that residents on the shore or in low-lying areas should be expected to take responsibility for their choice of property when flood events occur.
- **One Important Conclusion: *Water is everything in Gloucester County – both its greatest asset and its greatest threat. The county needs a new relationship with the water.***

III. Sea Level Rise in Gloucester County

Existing Conditions

Gloucester County citizens, the built environment, and the natural environment are extremely vulnerable to the combined impacts of relative sea level rise (sea level rise plus land subsidence) and natural coastal hazards. Historical and projected sea level rise are presenting Gloucester, and other coastal localities, with a complex challenge that affects residents and businesses today, as well as planning for future developments and infrastructure. Sea level rise is a long-term process that will affect many decisions that localities and individuals will make, with potentially significant consequences for both private and public investments.

In the Chesapeake Bay Region, relative sea level rise is projected to increase by 2.3 to 5.2 feet by 2100, according to the Chesapeake Bay Program's Scientific and Technical Advisory Committee.¹

- Gloucester County is geographically part of the Virginia Beach-Norfolk Metropolitan Statistical Area, which ranks 10th in the world in value of assets exposed to increased flooding from relative sea level rise, according to an analysis by Risk Management Solutions, RMS, (a catastrophe modeling company).²
- Gloucester County is a neighbor of the Hampton Roads area and part of the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Statistical Area. Hampton Roads is the largest population center at greatest risk from sea level rise outside of New Orleans.³

Causes of Sea Level Rise in Gloucester County

Sea level rise in the Chesapeake Bay region, where Gloucester County is situated, is caused by both global and local forces. Global sea level rise occurs as both the volume and mass of water in the oceans expands. As land-based glaciers melt, they add more water (mass) to our oceans, and as these oceans warm their volume expands, causing sea levels to rise around the world. National and global organizations predict a global sea level rise of approximately 1.5 feet to over 5 feet by 2100. Estimates for predicted rates of sea level rise in the Chesapeake Bay region are slightly higher, between 2.3 and 5.2 feet by 2100.⁴

In the Chesapeake Bay region, global sea level rise is made worse by the movement of the land, a localized geologic condition known as subsidence, creating the proverbial “double-whammy.” This combination of sea level rise and subsidence is termed “*relative sea level rise*.”

Gloucester County and the Hampton Roads region is known to be sinking, or subsiding, due to several processes. Groundwater withdrawals cause the ground to compress, resulting in surface subsidence. Several long-term geological activities are also contributing to local subsidence. These include isostatic rebound, which results from glacial retreat to the north; our location on a passive continental margin; groundwater withdrawal resulting in localized subsidence around developed areas; and the long-term settling of the region resulting from the

Chesapeake Bay Impact Crater. Subsidence has been the major cause of historic local sea level rise in the Chesapeake Bay region.

Because of the region's high rate of subsidence, Gloucester County and its sister localities in the Hampton Roads region are experiencing the highest rate of sea level rise on the east coast, averaging 1.45 feet over the last century. This is also the reason for the higher, predicted rates of sea level rise in this region.⁵

Impacts of Relative Sea Level Rise in Gloucester County

In addition to relative sea level, Gloucester County is also vulnerable to storm surges from hurricanes, nor'easters, and other storms. Storms in the region can cause major damage through flooding, shoreline erosion, and property damage as well as impede traffic and commerce. The implications of storm surges on top of higher sea levels are that inundation zones and floodplains will shift over time (e.g., 100 year floodplains becoming 50 year floodplains) and inundation risk will increase in both frequency and severity. As the region experiences increased vulnerability to storm flooding and storm surge, some areas are expected to experience permanent inundation, other ecologically and economically important areas are expected to lose wetlands, infrastructure and private property. Addressing these impacts requires hard decisions and long-term planning.⁶

Adaptation Strategies

There are three broad types of adaptation strategies: protection, accommodation, and retreat. Protection includes measures like sea walls, dykes, and flood barriers that are built to keep water out. Accommodation basically means allowing water in from time to time; for example, houses can be raised on stilts or parks can be designed to act as floodwater storage during storms. Retreat involves identifying areas that are too costly or infeasible to protect, and could include demolishing structures and allowing wetlands and other vegetation to return.

Regional and State Activities

Virginia's coastal localities are beginning to recognize the vulnerabilities and risks associated with relative sea level rise. Gloucester County's floodplain management plan cites relative sea level rise, as do the Cities of Portsmouth and Poquoson in their floodplain management and hazard mitigation plans. Comprehensive Plans in localities throughout eastern Virginia reference the impacts of sea level rise. Comprehensive Plans are general, long-range policies and guidelines that direct future growth and development of an area. Gloucester County's current Comprehensive Plan was adopted in September 1991 and various sections have been updated and amended as needed. The County is currently in the process of updating the entire plan. The results of surveys, public hearings, and focus groups such as this, help inform new amendments to the Comprehensive Plan to ultimately guide County decision-makers on implementation measures to achieve the community's vision for the future.

The 2009 “State of the Region” report prepared by Old Dominion University cited the economic impacts of sea level rise on Hampton Roads, unless adaptation plans are enacted. The Virginia Department of Transportation’s long-range plan, “VTRANS 2035,” includes a section on the threats to transportation from sea level rise. In 2010, the U.S. Navy released its “Climate Change Roadmap,” which proposes specific actions to address the impacts of sea level rise. Most recently, the 2012 Virginia General Assembly commissioned a \$50,000 study by the Virginia Institute for Marine Science, to address the impacts of recurrent flooding and the need for improved coastal resiliency.⁷

While planning agencies have begun to recognize the urgency of the situation, many policy makers and citizens still have questions about what relative sea level rise really means for their community and what should be done about it. The Sea Level Rise Focus Group in Gloucester County intended to help answer these questions, as well as to advance community discussion about desired responses.

IV. Planning the Focus Group

Several efforts to engage citizens around the issue of sea level rise have also been funded by the Virginia Sea Grant Program and have already taken place in other Virginia coastal communities. The City of Virginia Beach, in partnership with the Hampton Roads Planning District Commission, Wetlands Watch, and the UVa Institute for Environmental Negotiation (IEN), held four citizen listening sessions in 2011, and followed this in 2012 with a representative citizen focus group that discussed the social, economic and political feasibility of specific policy tools. The Accomack-Northampton Planning District on the Eastern Shore, also in partnership with Wetlands Watch and IEN, held a large citizen workshop in June 2012 on coastal flooding, attracting over 200 citizens. IEN, funded by Virginia Sea Grant, worked with each of these communities to design and facilitate the citizen engagement, and used these experiences to help inform the design of the Gloucester County focus group.

The impacts of flooding and sea level rise in Gloucester County are focused in certain low-lying areas of the County and do not directly impact the majority of citizens or commercial interests. However, as discussed above, there are many indirect impacts, particularly economic and environmental impacts, which would affect the county in multiple ways. While the issue of sea level rise has been recognized in various planning documents, the community's expectations of the role local government should play in addressing this issue has been unclear. Gloucester County decided that, to accomplish its goals, it would hold an intensive one-day citizen focus group to discuss sea level rise. Working with the IEN, the Middle Peninsula Planning District Commission (MPPDC) and the Virginia Institute of Marine Science (VIMS), Gloucester County identified the interests that it desired to have represented at this focus group as well as its goals for the focus group. The IEN then submitted a formal request to the Board of Supervisors, requesting authorization for the County Administrator to appoint representatives from the Volunteer Board Bank to constitute a fair and balanced focus group to tackle this issue.

Once approved by the County Board of Supervisors, the citizen advisory panel was assembled by the County Administrator from the Volunteer Board Bank. Thirteen citizens were invited to participate, although three were not able to attend. One crucial factor in organizing the focus group was ensuring that a wide variety of participants were invited and participated. Ultimately, the 13 citizens invited, including the county Supervisors, did represent a broad range of community occupations and expertise. Their interests included shoreline management, real estate and commercial interests, environmental interests, marine engineering, watermen, septic concerns, and emergency management. *(See Figure 1 on page 12, and Appendix E for more details.)*

Another important part in planning the focus group was to identify the sea level rise policies that would likely be most relevant to Gloucester County. The IEN assembled a list of over 50 local government policies (see *Appendix A*) and, working with Gloucester County, the MPPDC and VIMS, grouped them into four broad categories to facilitate citizen discussion. These categories were:

- Land Use Tools;
- Natural Resources Tools;
- Safety and Welfare Tools;
- Quality of Life Tools.

V. Focus Group Format

The focus group meeting was divided into three main segments: education and sharing perspectives; issues and concerns; and potential policies. In the first segment, participants were polled about their experiences with sea level rise. Then, experts from the county, MPPDC and Wetlands Watch shared information about potential threats from sea level rise to Gloucester County and what actions to address these threats are already underway. In the second segment, participants identified their issues and concerns relating to sea level rise, and then worked to identify who should bear principal responsibility for addressing these issues. In the third segment, participants considered the four categories of potential policies that the County might use to address sea level rise. For each group of policies, participants first engaged in a discussion about the policies, with staff from the County, MPPDC, VIMS and Wetlands Watch answering participant technical questions. Then, on a paper survey, participants individually scored each policy group's priority, perceived usefulness in addressing sea level rise, funding options, as well as its political, social and economic feasibility.

Experiences Poll

Participants were polled using a real-time polling program at the beginning of the meeting so the group could gain awareness of their peers' experiences and opinions in regards to sea level rise. In general, participants felt they were more informed about the topic than the general public and were also more likely to be directly affected by sea level rise.

The most significant outcome of this poll was an indication of how informed the participants were in regards to sea level rise.

- **Of the 10 participants, 9 (or 90%) said they were “fairly well informed” or “very well informed” about the causes, consequences, and ways in which we can address sea level rise.**

Participants were more likely than the general public to be affected directly by sea level rise.

- **6 of 10 (or 60%) own shoreline property, and 1 participant was from an area subject to frequent flooding.**
- **7 of 10 (or 70%), had observed changes in habitats or in wildlife migration.**
- **However, only 4 of 10 (or 40%) had changed routes more than once in the last year to avoid flooded roadways.**
- **Only 1 of 10 (or 10%) had experienced a loss of private property insurance.**

In regards to participants' opinions regarding the effects of sea level rise, the majority were unified on the following:

- **9 of 10 (or 90%) believed that humans can *limit* the effects of rising sea levels, and 1 participant felt that humans can *stop* sea levels from rising.**
- **8 of 10 (or 80%) were somewhat or very worried about sea level rise affecting Gloucester County.**

Finally, participants clearly felt addressing sea level rise should be, first and foremost, a local issue.

- 40% thought sea level rise should be a high or very high priority for federal government, versus 50% who thought it should be a low priority.
- 50% thought sea level rise should be a high or very high priority for state government, versus 20% who thought it should be a low priority.
- 90% thought sea level rise should be a high or very high priority for local government, versus 10% who thought it should be a low priority.

Affiliations and Interests Survey

Participants were surveyed on their affiliations and interests prior to the focus group and most had multiple affiliations. Most participants were interested in environmental issues and many had significant training in environmental science topics. Many were shoreline owners and were knowledgeable about and/or interested in septic and floodplain issues. One participant identified as a waterman and one identified as a real estate agent with a strong interest in financial issues. Participant responses are shown in the table below:

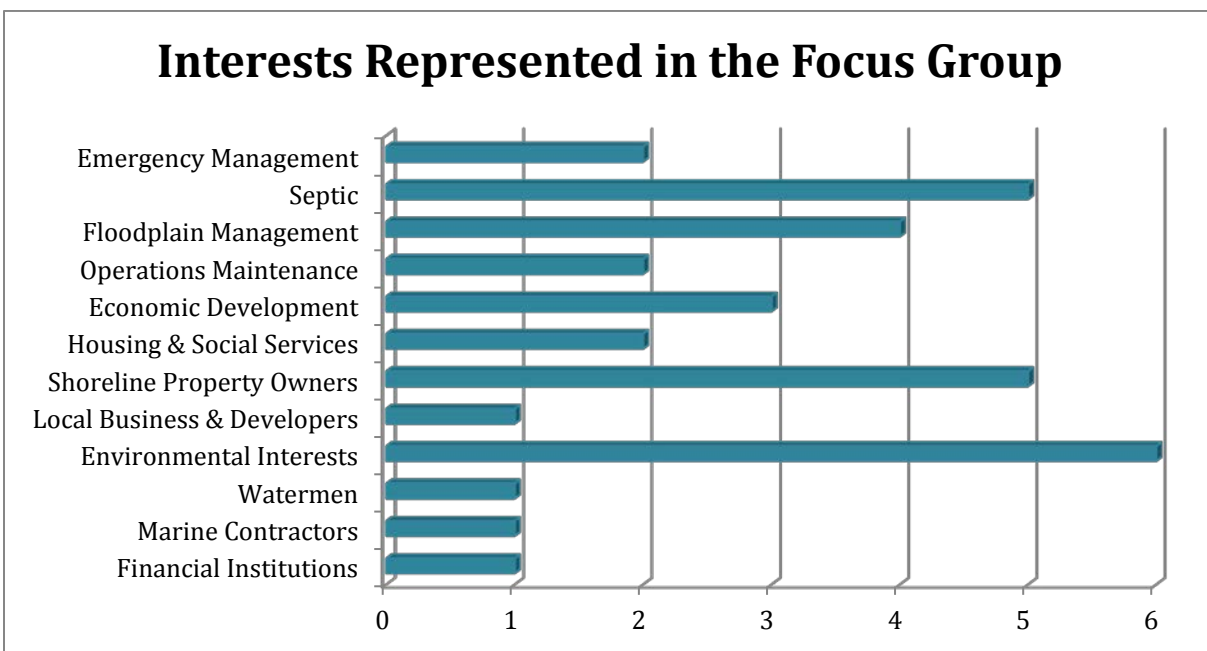


Figure 1: Number of people who represented different interests

VI. Focus Group Issues and Concerns

The second segment of the Focus Group asked participants to identify “top issues” and citizen concerns about increased flooding and sea level rise events. Issues were then ranked by the Focus Group and organized into the four categories of policy tools: Land Use, Natural Resources, Safety and Welfare and Quality of Life. Below provides a list of participant concerns ranked from highest to lowest concern.

Land Use Issues

1. **Compensate property owners in low lying areas** if the properties were lost due to consistent flooding, reclamation, or rezoning. Generally, participants were in favor of government compensation for existing property owners but were wary of potentially detrimental effects on government coffers. With regard to new property owners, participants did not want to impede property sales but were in favor of making sure potential buyers were aware of any risks associated with properties.
2. Be cautious of **undue “hysteria” surrounding sea level rise issues**. Some Focus Group members were afraid of a potential over-reaction by government to sea level rise that might lead to over-regulation and loss of property rights.
3. **Develop restrictions for future buildings and removing existing structures** before they are inundated, particularly derelict and sanitation-related structures. There was concern that as current structures are flooded more consistently and then abandoned, potentially harmful materials and utility and sewage infrastructures should be removed before such a time that the property is permanently inundated.
4. **Protect property legacy and inheritance**. Some participants were concerned that if their land was seen to be threatened by sea level rise, government action and intervention would impede their ability to transfer lands to future generations. They explained that, for many, land may be the principal, or only, inheritance they can leave to their offspring.
5. **Allow property owners to take responsibility for their own property**. Most Focus Group members favored educating landowners about engineering and environmental options for protecting their property from flooding, including strategic fortifications that diminish and/or control flood impacts such as moat and ditch systems.
6. **Protect coastal properties**. This point encapsulated a core underlying theme of participant concerns during the discussion of land use policy tools. Focus Group members were acutely aware of the vulnerability of coastal property as well as the natural assets of Gloucester County, and consistently voiced interest in protecting the built and natural amenities of the area.

Natural Resource Issues

7. **Protect ecologically important resources.** Most participants expressed that ecological resources and wetland areas need to be protected.
8. **Educate the public on historic flood-prevention techniques.** One participant expressed that increased flooding could be caused and exacerbated by failing to protect creeks from being silted in.

Safety and Welfare Issues

9. **Practice fiscal responsibility** when dealing with limited government reserves, local industries, or Gloucester County residents. This point was identified as the most prevalent concern of Focus Group participants. As identified through anonymous surveys, members were hesitant to raise taxes and even more hesitant to raise local government debt.
10. **Ensure safety and security of citizens in low-lying areas.** Several Focus Group members agreed that there should be a policy to encourage people to leave high risk areas during emergency events. They also agreed that if residents decided to stay, the government, and its tax reserves, should then be free of the obligation to provide emergency services. Comments surrounding establishment of a fine for those who choose not to leave was also discussed. This could act as an alternative to suspending emergency service for residents who choose to stay after an evacuation is issued.

Quality of Life Tools

11. **Fight loss of economic opportunities.** Participants were concerned future government policies may negatively impact military investment in the area, watermen, local businesses, coastal harbors (specifically Newport News Harbor), and the waterfront. Some participants also voiced that there is currently too much reliance on foreign foods and services, and any policies should help encourage more self-reliance in the area to stimulate and support local economic growth.
12. **Maintain focus on end goals.** Focus Group members were concerned about detrimental overreactions to sea level rise issues. Participants wanted to ensure that attention remained focused on the right issues and that there were no missed opportunities in the process.
13. **Private sector support is needed for government initiatives to be successful.** Participants felt that the government cannot enact successful policies without support from the private sector. The group also thought new policies should ultimately support and protect private citizens and coastal properties.

Of the thirteen concerns participants identified above, three were of concern to half or more of Focus Group participants. These three key concerns are listed below in order of highest to lowest importance to the group.

- **Fiscal discipline**
- **Compensation for property owners in low lying areas**
- **Loss of economic opportunities**

The first concern listed above was identified by the Focus Group as an overarching concern for all of the discussions. Generally all concerns of greatest importance to Focus Group participants were those surrounding economic and financial matters.

Responsible Groups for Addressing Concerns

After Focus Group members identified their concerns surrounding sea level rise, they were asked to collectively decide who should bear principal responsibility for addressing these issues. The group decided between different levels of government (local, state, and federal), non-government organizations (NGOs), private citizens, or other entities identified by participants. If multiple parties worked together to address a concern, participants were sometimes asked to identify the group to take the lead on addressing that issue. The resulting chart, reproduced below, depicts Focus Group member's desire for public-private partnerships in future sea level rise work.

* Denotes the entity that Focus Group members identified as the most appropriate to take the lead on the issue.

• Denotes entities that should have responsibility or be involved

Land Use Issues	Local Government	State Government	Federal Government	NGOs	Private Citizens	Other
1. Compensation for property owners in low-lying areas	•	•	•		• (Insurance Companies)	• (Attorneys)
2. Be cautious of undue “hysteria” surrounding sea level rise	•				•*	
3. Develop restrictions for future buildings and removing current built-in structures	•*		• (Provides Funding)			
4. Protect property legacy and inheritance	•				•	
5. Allow property owners to take responsibility for their own property	•*	•	•		•*	
6. Protect coastal properties	•*		•		• (Property Owners)	

Natural Resource Issues	Local Government	State Government	Federal Government	NGOs	Private Citizens	Other
7. Protect ecologically important resources	•	•	•	•	•	
8. Educate the public on historical flood-prevention techniques	•	•	• (Should Be)			
Safety and Welfare Issues	Local Government	State Government	Federal Government	NGOs	Private Citizens	Other
9. Practice fiscal responsibility	•	•	•	•	•	
10. Ensure safety and security of citizens in low-lying areas	• *	•	•	•	• *	
Quality of Life Issues	Local Government	State Government	Federal Government	NGOs	Private Citizens	Other
11. Fight loss of economic opportunities	• *	•	•		•	(Private Companies and Citizens)
12. Maintain focus on end goals				• *	• *	
13. Private sector support is needed for government initiatives to be successful		•	•		• *	(Banks, Developers, Insurance Companies)

VII. Focus Group Outcomes on Potential Sea Level Rise Policy Tools

In the third segment of the Focus Group, participants considered potential policies within the four policy categories that the County might use to address sea level rise issues. This section gives an overview of the Focus Group discussions and sentiments pertaining to each policy tool type.

Policy Tool #1: Land Use Tools

Land use tools are used to protect a property from coastal changes. Participants discussed the list of ten possible land use tools provided to them in a handout, which included items such as inclusion of sea level rise in the Comprehensive Plan and overlay districts (see *Appendix A*). An example of a “reasonable restriction” tool adopted in Worcester County, Maryland is a 100-foot building setback from the mean high tide. Rolling easements are another new regulatory mechanism that allows wetlands or beaches to migrate inland as sea levels rise by transferring the risk from the public to the property owner. In Virginia, however, rolling easements are not currently enabled and can only be voluntary.

Participants were cautiously optimistic about a variety of land use tools available. Most felt that future planning should take sea level rise into account and discourage development in low-lying areas through conventional means like zoning and placement of utilities. Participants also thought that sea level rise should be a factor when doing due diligence for infrastructure and public projects. However, **most participants emphasized that land use programs affecting private landowners should be voluntary programs that offered incentives rather than strict codes that might violate property rights.** Participants also expressed concern about cost and feasibility, saying county officials should ensure that programs are fiscally responsible and have public support. They should also ensure that land value assessments reflect changes in development rights as a result of land use policies.

For more complete survey results, see Appendix F. Key responses to survey questions are listed below:

- 6 (or 60%) said land use tools should be a high or very *high priority* for local government.
- 6 (or 60%) said land use tools are somewhat or highly *likely to help* the County mitigate the hazards of coastal flooding and sea level rise.
- 5 (or 50%) said it is somewhat or very important to *raise funds or increase staff* for implementation of land use tools.
- 6 (or 60%) are willing or somewhat willing to *pay an additional tax* to implement land use tools.

Policy Tool #2: Natural Resources Tools

The focus group examined a range of 12 potential natural resources tools, most designed to protect the shoreline and enhance natural habitats and wetlands. These areas help drain water during flooding and provide a natural filter, hence their protection is considered an important local management tool. Many of these potential policy tools directly affect property owners on the shoreline, who are able to directly care for and protect their stretch of the shore.

The creation of “living shorelines” is one such tool, and was discussed as a way to bring back a dynamic, natural barrier against sea level rise. **Participants felt that most of these natural resource tools were helpful, and that it might be useful to articulate them clearly in a long-range plan.** Shoreline owners also discussed the problem of neighbors who do not do their part to protect against erosion, allowing the water to make inlets onto other properties. As decades-long owners of shoreline property, these citizens had observed rising sea levels. Some were also interested in seeing more consistent efforts by coastal property owners to maintain and support a continuous hardened shoreline.

Other participants felt county regulations were strict enough and that property owners were individually incentivized to protect their shore, since erosion directly affects their property. One shoreline owner felt that government employees enforcing these regulations were not always experienced or well-trained, and would try to implement them in clumsy ways without knowledge of the natural processes present on each property. Another participant with experience in marine engineering felt that it would be extremely expensive to do things right and any solution the county could manage to pass would inevitably be low-quality and temporary. Participants who were focused on environmental issues worried that these policies only dealt with erosion and might distract from the problem of flooding due to sea level rise. These participants expressed a desire to see a dynamic and living shoreline that could change in response to rising sea levels rather than being subject to property owners.

For complete survey results, see Appendix G. Key responses to survey questions are listed below:

- **5 (or 50%) said natural resources tools should be a high or very high *priority* for local government.**
- **4 (or 40%) said natural resources tools are somewhat or highly *likely* to help the County mitigate the hazards of coastal flooding and sea level rise.**
- **6 (or 60%) said it is somewhat or very *important* to raise funds or hire staff for implementation of natural resources tools.**
- **6 (or 60%) are somewhat or very willing to *pay an additional tax* to implement natural resource tools.**

Tool #3: Safety and Welfare Tools

Participants considered ways to adjust county safety and welfare infrastructure in response to sea level rise. This group of 10 policy tools included withdrawing or limiting services in low-lying areas, as well as requiring residents of flood-prone areas to pay special district taxes to compensate for the high cost of responding to emergencies in these areas. County permitting requirements could also require builders to make plans for sea level rise and keep impermeable structures from dominating low-lying landscapes. Emergency management authorities could revamp evacuation and route guidelines to ensure residents can escape inundation zones.

Opinions on these safety and welfare tools were varied, but a number of themes were evident. **Most felt that shoreline owners should assume the brunt of responsibility for limiting erosion of the shoreline since they have chosen to live on the shore and have the most to gain from protecting property.** Participants were more divided on whether this responsibility should come in the form of withdrawing emergency services or raising taxes. Some supported the idea of a special high-risk area tax district or, alternatively, the option for property owners in these areas to opt out of receiving emergency services during major storms. One participant said that those who have lived on the shore for generations understand when to get out and do not require emergency vehicles to come pick them up, while most people that have moved to the area can afford to pay an additional tax.

For complete survey results, see Appendix H. Key responses to survey questions are listed below:

- 6 (or 60%) believe safety and welfare tools should be a high or very high *priority* for local government.
- 7 (or 70%) believe safety and welfare tools are somewhat or highly *likely to help* the County mitigate the hazards of coastal flooding and sea level rise.
- 6 (or 60%) believe it is somewhat or very *important to raise funds or hire staff* for implementation of safety and welfare tools.
- 7 (or 70%) are *not willing to pay an additional tax* to implement safety and welfare tools.

Tool #4: Quality of Life tools

This category encompassed a range of 18 policy tools that could be used to maintain quality of life in the face of sea level rise. Some of the tools discussed included instituting a Purchase of Development Rights or Transfer of Development Rights program that would shift development away from coastal areas to more optimal areas. Other tools in this category included purchasing flooded parcels from landowners, educating local officials, and organizing homeowners and leaders to appeal for more media coverage of sea level rise issues, as well as advocating for more affordable rates from insurers.

This category was a broad one and participants were confused about how to tie the discussion together, with some saying they felt these tools had little to do with quality of life. Several people supported a proposal to add signage or other warnings to low-lying areas that would ensure that homebuyers understand the risks of purchasing flood-prone real estate. Some thought cluster development could help to preserve important wetlands for absorbing storm water. **Making good information available to citizens was largely seen as positive.** Some participants also expressed concerns about the negative impacts on property values and the source of this information, warning that many in the county are skeptical of large global warming advocates like the International Panel for Climate Change.

The group also identified numerous problems with this category. Transfer of Development Rights and Purchase of Development Rights were largely deemed to be unworkable and not helpful in this region. Citizens were also concerned about the effect of unintended consequences from large programs. Most felt it is not the role of the local government to organize people to petition the government. Instead, citizens should take responsibility for things like encouraging media attention. One person commented that warnings to new homebuyers in hurricane-prone areas of Florida have been largely ineffective. Others warned that adding signage and warnings to flood-prone areas would reduce property values in those areas without compensation to current owners. In general, tools in this category received the lowest ratings for feasibility.

For complete survey results, see Appendix I. Key responses to survey questions are listed below:

- **3 (or 30%) said quality of life tools should be a high or very high *priority* for local government**
- **4 (or 40%) said quality of life tools are somewhat or very *likely to help* Gloucester County mitigate the hazards of coastal flooding and sea level rise.**
- **6 (or 60%) said it is somewhat or very *important to raise funds or hire staff* for implementation of quality of life tools.**
- **3 (or 30%) are somewhat or very willing to *pay additional taxes* to assist implementation of these tools.**

VIII. Focus Group Conclusion

Towards the end of the focus group discussion, a participant summarized the feelings of most members of the focus group in a sentiment that was repeated several times on surveys. *The water is everything in Gloucester County – both its greatest asset and its greatest threat. The county needs a new relationship with the water.* Citizens wrestled throughout the day with what kind of relationship that should be and what kind of competing concerns should undergird it.

The interplay of these values became most pronounced during the discussion of quality of life policy tools. At one point, the facilitator asked participants to write what they felt quality of life meant to them in the context of sea level rise. The answers provided an excellent summary of the values and themes that drove discussion throughout the focus group. Some of their responses include:

- “Quality of life is: fiscal responsibility, self-education, preemptive action”
- “I want to be left alone, to enjoy my home and my surroundings.”
- “Quality of life is being able to use and enjoy your own land and pass on your heritage to your children and grandchildren.”
- “Quality of life: stars at night, meadows and woods, diverse wildlife and vegetation, arts and sciences, healthcare availability, libraries.”
- “Property rights balanced with sensible means to mitigate impacts of sea level rise over the long haul.”
- “We must allow the evolution of a dynamic shoreline that responds to the variations of the sea level. Such an undeveloped shoreline can become a public space so that many more Gloucester citizens can have access to the water.”
- “There is great joy in watching the sun go down over the river, however the river will rise and blow occasionally. Buyer beware. Government's role should be minimal in protecting the citizen waterfront owner. If we are wealthy enough to afford to be there, we should be able to afford the consequences.”
- “More access to water, connectivity to water, knowledge of water issues, idea that we need to fundamentally change our relationship to water and ideas about development along coast.”
- “If I can go home and feel safe and secure and know that my neighbors care about the same and local government feels the same, this is quality of life.”

While Gloucester County has many unique challenges and competing interests to weigh in responding to sea level rise, it also has a motivated citizenry who are interested in seeing life on and near the water prosper for generations. As the county prepares its long-range plans and looks at future infrastructure and land use policy, it should take into account these considerations to ensure that all citizens are able to enjoy a dynamic shoreline in the years to come.

IX. Endnotes

¹ Pyke, C.R., R.G. Najjar, M.B. Adams, D. Breitburg, M. Kemp, C. Hershner, R. Howarth, M. Mulholland, M. Paolisso, D. Secor, K. Sellner, D. Wardrop, and R. Wood. 2008. Climate change and the Chesapeake Bay: State-of-the-science review and recommendations. A Report from the Chesapeake Bay Program Science and Technical Advisory Committee (STAC), Annapolis, MD. 59 pp.

See also: the Governor's Commission on Climate Change. 2008. Final Report: A Climate Action Plan, http://www.sealevelrisevirginia.net/docs/homepage/CCC_Final_Report-Final_12152008.pdf

² Nicholls, R.J., Hanson, S., Herweijer, C., Patmore, N., Hallegatte, S., Corfee-Morlot, J., Château, J., Muir-Wood, R. 2008. Ranking Port Cities With High Exposure and Vulnerability to Climate Extremes. Organization for Economic Cooperation and Development. Paris, France.

³ Wetlands Watch. 2007. Letter to Virginia Governor Tim Kaine. May 31, 2007.

http://www.wetlandswatch.org/Portals/3/WW%20documents/kaine_letter_053107.pdf

⁴ Pyke et. al (see endnote 1)

⁵ Boon, J.D., J.M. Brubaker and D.R. Forrest. 2010. Chesapeake Bay land subsidence and sea level change: An evaluation of past and present trends and future outlook. Virginia Institute of Marine Science, Special Report No. 425 in Applied Marine Science and Ocean Engineering. Gloucester Point, VA. 41 pp. plus appendices.

⁶ Middle Peninsula Planning District Commission (MPPDC) 2010. Middle Peninsula climate change adaptation. An assessment of potential anthropogenic and ecological impacts of climate change on the Middle Peninsula. Report for DEQ, Coastal Zone Management Program. 90 pp.

⁷ Regional Studies Institute. 2009. The State of the Region: Hampton Roads 2009. Old Dominion University, Norfolk, VA. http://bpa.odu.edu/forecasting/sor/2009/2009_sor_cover.pdf

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Appendix A: Local government tools list used by focus group participants

Local Government Tools for Addressing Sea Level Rise in Virginia

Planning Tools To Be Considered for Discussion at Focus Groups

Compiled by the University of Virginia Institute for Environmental Negotiation

Sources cited below

January 2012

LAND USE: Examples of tools relating to land use concerns

1. **Update the local Comprehensive Plan** to:
 - a. Establish the rate of estimated sea level rise and time period over which it may occur.
 - b. Designate areas vulnerable to sea level rise.
 - c. Site future public infrastructure and capital improvements out of harm's way.
 - d. Provide the scientific basis to justify changes in land use decision-making, including an analysis of likely sea level rise hazards (inundation, flooding, erosion), and vulnerabilities (to specific areas, populations, structures and infrastructure).
 - e. Plan responses to sea level rise.¹
2. Using data gathered on potential sea level rise and predicted flooding, **update existing or designate new inundation zones or flood plain areas.**²
3. **Integrate vulnerability assessments and sea level rise considerations** into the locality's existing Wetlands Ordinance.³
4. Revise local zoning and permitting ordinances to **require that projected sea level rise impacts be addressed** to minimize threats to life, property, and public infrastructure and ensure consistency with state and local climate change adaptation plans.⁴
5. Use **overlay zoning to protect shorelines and other vulnerable areas.** Overlay districts could prohibit shoreline protection structures, implement shoreline setbacks, restrict future development, lower non-conforming use thresholds, or raise "free board" building code requirements. Shoreline overlay districts could take the form of either:
 - a. A fixed-distance zone along the shoreline that would extend across all existing shoreline zoning districts; or

¹ Georgetown Climate Center, *Stemming the Tide: How Local Governments Can Manage Rising Flood Risks – Review Draft 3* 11 (May 2010), on file with author.

² *See id.* at 9-10.

³ Virginia Polytechnic Institute and State University ("Virginia Tech"), Building Resilience to Change: Developing Climate Adaptation Strategies for Virginia's Middle Peninsula – DRAFT 16 (October 2011), on file with author.

⁴ L. Preston Bryant, Jr., Governor's Commission on Climate Change, Final Report: A Climate Change Action Plan 35 (Dec. 15, 2008), on file with author.

- b. A variable, resource-based zone, based on a scientific inventory of existing shoreline resources. The zone would vary in distance from the water line according to the identified resources.⁵
6. Designate **specific thresholds of land disturbance** in square footage or acres that trigger a Water Quality Inventory Assessment.⁶
7. Under section 15.2-2286 of the Virginia Code, **offer tax credits to landowners** who agree to voluntarily “downzone” their property.⁷
8. Offer **Use Value Assessments for owners who preserve shoreline property** as open space or Wetlands Tax Exemptions to owners who agree to preserve wetlands and riparian buffers. These strategies are authorized under Virginia Code sections 58.1-3230 and 58.1-3666, respectively.⁸
9. Enter into voluntary agreements with landowners to establish **“rolling easements”** with boundaries that shift as the mean low sea level rises. These would allow landowners to continue with their current land uses until sea level rise actually occurs. At this time, the concept of “rolling easements” is still relatively new.⁹
10. **Extend Resource Protection Area and Resource Management Areas** under the Chesapeake Bay Preservation Act (CBPA) ordinance. These areas can be extended if specific performance criteria that contribute to the stated goals of the CBPA (pollution reduction, erosion and sediment control, stormwater management) are established.¹⁰

⁵ Virginia Tech, *supra* note 2 at 13, 32, 43.

⁶ *Id.* at 16.

⁷ Georgetown Climate Center, *supra* note 1 at 18.

⁸ Virginia Tech, *supra* note 3 at 43.

⁹ *Id.* at 36, 43; *see also* Georgetown Climate Center, *supra* note 1 at 19-23.

¹⁰ Virginia Tech, *supra* note 1 at 43.

NATURAL RESOURCES: Examples of tools relating to concerns

1. Prevent the erosion of storm water canals and shoreline by **regularly removing trash, vegetation, sands, and other debris**.¹¹
2. **Restore prior-converted wetlands** to provide storage and filtration and mitigate storm flows and nutrient loading.¹²
3. **Require new landscaping** to incorporate flood and salt-water tolerant species and focus on creating buffers and living shorelines to reduce erosion.¹³
4. Continue implementing **beach replenishment and nourishment** efforts.¹⁴
5. Where possible, **adopt shoreline protection policies** that encourage the use of living shorelines rather than shoreline hardening.¹⁵ Where this is not feasible, protect land and buildings from erosion and flood damage using dikes, seawalls, bulkheads, and other hard structures.¹⁶
6. Encourage shoreline property owners to implement shoreline management practices, including managing marshland and constructing stone sills, breakwater systems, revetments, and spurs.¹⁷
7. Expand the adoption of accepted soil-conservation agricultural management practices to reduce erosion and polluted runoff.¹⁸
8. Institute engineering strategies to mitigate saltwater intrusion into freshwater aquifers, including the construction of subsurface barriers, tide control gates, and artificially recharging aquifers.¹⁹
9. Establish and maintain corridors of contiguous habitat along natural environmental corridors to provide for the migration and local adaptation of species to new environmental conditions.²⁰
10. Develop a price-based accounting system for ecosystem services.²¹
11. Provide local businesses with information on the importance of maintaining the health of shorelines.²² (good voluntary approach if the case can be made “why do this”)
12. Remain aware of the effects that flood mitigation strategies, such as beach replenishment, have on wildlife.²³

¹¹ Institute for Environmental Negotiation (“IEN”), Sea Level Rise in Hampton Roads: Findings from the Virginia Beach Listening Sessions, March 30-31, 2011, Final Report 61, available at http://www.virginia.edu/ien/docs/Sea_Level_Rise%20final%20report%207-19.pdf.

¹² Virginia Tech, *supra* note 3 at 27.

¹³ IEN, *supra* note 11 at 57.

¹⁴ *Id.* at 59, 65.

¹⁵ See Bryant, *supra* note 4 at 36.

¹⁶ Virginia Tech, *supra* note 3 at 35.

¹⁷ *Id.* at 42.

¹⁸ *Id.* at 28.

¹⁹ *Id.* at 13.

²⁰ IEN, *supra* note 11 at 64.

²¹ Virginia Tech, *supra* note 3 at 21.

²² IEN, *supra* note 11 at 61.

²³ *Id.* at 64.

SAFETY AND WELFARE: Examples of tools relating to safety and welfare concerns

1. Develop sea level rise action plans for critical local infrastructure. If existing transportation infrastructure is at risk, “develop plans to minimize risks, move infrastructure from vulnerable areas when necessary and feasible, or otherwise reduce vulnerabilities.”²⁴
2. Implement an early warning system for flooding that would monitor rainfall and water levels and notify relevant government agencies and the general public in the event of an emergency.²⁵
3. Improve the ability of local infrastructure to efficiently handle drainage in the event of increased flooding. This could involve minimizing the construction of new impervious surfaces in flood-prone areas.²⁶
4. Amend existing zoning ordinances to require increased building elevations and setbacks, flood-proofing, and reduced density for new construction within flood zones.²⁷
5. Improve and enhance traffic rerouting and emergency evacuation protocols related to flooding events.²⁸ (First responders love this stuff)
6. Ensure that hospitals, evacuation refuge sites, fire and emergency rescue facilities, and key transportation routes are outside of inundation zones or are secured against projected flooding.²⁹
7. Redirect new infrastructure development away from low-lying neighborhoods and other at-risk areas, and elevate and armor existing critical infrastructure.³⁰
8. Require private sector owners of infrastructure to conduct sea level rise vulnerability assessments and develop their own sea level rise adaptation plans as a condition for permit approval.³¹
9. Encourage the graduated repurposing of structures that are rendered unsuitable for their current use by sea level rise.^{32 33}
10. Gradually withdraw public services in flooded areas.^{34 35}

²⁴ Bryant, *supra* note 4 at 35; *see also* IEN, *supra* note 2 at 64-65.

²⁵ *See* Virginia Tech, *supra* note 3 at 22.

²⁶ IEN, *supra* note 11 at 57, 61.

²⁷ *Id.* at 43; Georgetown Climate Center, *supra* note 1 at 11.

²⁸ William A. Stiles, “A ‘Toolkit’ for Sea Level Rise Adaptation in Virginia” 4.1.3, on file with author.

²⁹ *Id.*

³⁰ *Id.* at 3.1.

³¹ Bryant, *supra* note 4 at 35.

³² IEN, *supra* note 11 at 60.

³³ Bryant, *supra* note 4 at 35.

³⁴ *Id.* at 81.

³⁵ Bryant, *supra* note 4 at 35.

QUALITY OF LIFE: Examples of tools to address quality of life concerns

1. Involve businesses in the planning process to prevent the loss of shoreline business and to mitigate the impacts of increased flooding and sea level rise.³⁶ (could be a good voluntary strategy for public awareness.)
2. Establish a Transfer of Development Rights program to allow the owners of at-risk shoreline properties to sell development rights to upland landowners.³⁷
3. Permit the use of Onsite Density Transfers, which allow developers to subdivide lots into smaller and denser parcels if they preserve a portion of the lot as open space and cluster the subdivided parcels.³⁸
4. Purchase flooded property from landowners.³⁹
5. Organize coastal businesses and homeowners to appeal to insurance companies for affordable rates and deductibles.⁴⁰
6. Organize coastal businesses and homeowners to petition local, state, and federal politicians to address sea level rise.⁴¹
7. Require realtors to disclose the threat of sea level rise and the responsibilities of shoreline owners to potential purchasers of shoreline properties.⁴²
8. Implement special taxing districts that cover the real, life-cycle costs of providing government services in high-risk flood zones, resulting in higher taxes for property-owners in those zones.⁴³
9. Use a financial regulatory program to discourage increasingly risky investments along the shoreline. Examples of existing programs with similar aims include:
 - a. The state regulation of the property loss insurance sector to reflect higher risk from sea level rise, and
 - b. Placing conditions on economic development to require the completion of a long-range vision and plan that addresses sea level rise and flood risk.⁴⁴
10. Hold a series of meetings with stakeholder groups to discuss and gauge potential sea level rise impacts to the region or locality.⁴⁵
11. **Educate local elected officials** on sea level rise, and the predicted impacts to the region or locality.⁴⁶
12. **Present data in easily-understood terms**, such as X acres will be flooded, X homes lost, and X impacts to wildlife.⁴⁷

³⁶ *Id.* at 27.

³⁷ Georgetown Climate Center, *supra* note 1 at 17.

³⁸ Virginia Tech, *supra* note 3 at 40.

³⁹ IEN, *supra* note 11 at 81.

⁴⁰ *Id.* at 58-59.

⁴¹ *Id.* at 60.

⁴² *Id.* at 63.

⁴³ Stiles, *supra* note 24 at 4.1.2.

⁴⁴ *Id.* at 4.1.4.

⁴⁵ Virginia Tech, *supra* note 3 at 7-8.

⁴⁶ *Id.* at 9. For specific training and funding opportunities, *see id.* at 44-45; *see also* IEN, *supra* note 11 at 67.

⁴⁷ IEN, *supra* note 11 at 64.

13. [Extend media coverage](#) to issues related to sea level rise to increase public awareness and to help citizens prepare for emergencies. This can include the use of social media, such as Facebook, as well as traditional media, including radio, television, and newspapers.⁴⁸
14. Increase public outreach, including press conferences, information sessions, community events, public meetings, and exhibits on sea level rise at libraries, aquariums, and museums.⁴⁹
15. Using modern technologies such as GIS mapping software, develop education programs for residents as well as students in local and regional schools.⁵⁰
16. Educate residents about the role that fertilizing, vegetation removal, and litter play in increasing flooding, erosion, and property damage.⁵¹
17. Provide landowners with accurate data on the current and future vulnerability of their property to sea level rise as well as best managing practices for mitigating the effects of increased flooding.⁵²
18. Raise public awareness of areas prone to flooding through increased signage.⁵³

OTHER TOOLS to consider

1. Craft a “Community Resilience” policy statement emphasizing the need for science-based vulnerability assessments, adaptation planning, education and public engagement, and the development of flexible regulatory and non-regulatory strategies for addressing sea level rise.⁵⁴
2. Compile a sea level rise impact assessment. This is often a long-term, multi-phase effort. Steps can include:
 - a. Assembling an advisory workgroup.⁵⁵
 - b. Identifying flood zones and at-risk populations.
 - c. Mapping regional and county sea level rise predictions to show impacts to existing development and natural areas; and
 - d. Assessing and prioritizing economic and ecological vulnerabilities to sea level rise.⁵⁶
3. Create adaptation plans for areas at early risk from sea level rise.⁵⁷ This could involve an evaluation of adaptation strategies implemented by other U.S. jurisdictions and by foreign governments.⁵⁸

⁴⁸ *Id.* at 66, 68.

⁴⁹ *See id.* at 62-63, 66-67.

⁵⁰ *See Virginia Tech, supra* note 3 at 45.

⁵¹ IEN, *supra* note 11 at 63.

⁵² *Id.* at 59; Bryant, *supra* note 4 at 37.

⁵³ IEN, *supra* note 11 at 57.

⁵⁴ Virginia Tech, *supra* note 3 at 34.

⁵⁵ IEN, *supra* note 11 at 57.

⁵⁶ Stiles, *supra* note 24 at 3.1.; Virginia Tech, *supra* note 3 at 8.

⁵⁷ *See generally* Stiles, *supra* note 24; Virginia Tech, *supra* note 3 at 2.

⁵⁸ IEN, *supra* note 11 at 57.

4. Investigate how to address sea level rise in other planning strategies, including transportation plans, regional economic development plans, and regional hazard mitigation.⁵⁹
5. Identify the financial resources needed to meet adaptation needs.⁶⁰

⁵⁹ See Stiles, *supra* note 24 at 4.1.1.

⁶⁰ *Id.* at 3.2.

Gloucester County Focus Group on Sea Level Rise

October 5
10:00AM – 3:45 PM
Gloucester Point

Facilitated by the University of Virginia Institute for Environmental Negotiation

In Partnership with
Gloucester County, Middle Peninsula Planning District,
Virginia Institute of Marine Science, Wetlands Watch

Supported by a Virginia Sea Grant

Location: VIMS, Gloucester Point Facility, Waterman's A/B (B56)

Parking: Triangle Lot next to B134

[Directions to VIMS](#)

[Map of VIMS](#)

DRAFT AGENDA

10:00 Welcome, Introductions and Goals for Focus Group

Anne Ducey, Planning Director/ Interim Zoning Administrator, Gloucester County
Tanya Denckla Cobb, Associate Director, Institute for Environmental Negotiation
Lewie Lawrence, Director, Middle Peninsula Planning District Commission

- ❖ Electronic Poll: What are your flooding/ SLR experiences in Gloucester?

10:30 Historic, Current and Future Sea Level Changes & Potential Impacts on Gloucester County

Skip Stiles, Executive Director, Wetlands Watch

- ❖ Questions & Discussion

Appendix B: Focus group agenda

11:00 Brainstorming & Prioritizing Issues / Concerns Related to Sea Level Rise

Facilitated discussion will elicit, then narrow, group and prioritize concerns into the following four categories:

- ❖ Land Use/ Regulations
- ❖ Natural Resources
- ❖ Safety and Welfare
- ❖ Quality of Life

12:00 What are the Best Groups to Address These Concerns?

- ❖ Matrix of 7 different groups

12:15 Lunch – working lunch

12:45 Assessment of Potential Land Use Policies

1:15 Scoring

- ❖ *Questions & Discussion of potential policies, their potential impacts and feasibility*
- ❖ *Paper scoring*

1:25 Assessment of Potential Land Use Policies

1:55 Scoring

2:05 Mini-Break

2:15 Assessment of Potential Natural Resources Policies

2:45 Scoring

2:55 Assessment of Potential Safety and Welfare Policies

3:25 Scoring

3:30 Wrap Up and Next Steps

3:45 Adjourn



Sea Level Rise: Local Fact Sheet for the Middle Peninsula, Virginia

Statement of the Problem

A look at the geologic record of Chesapeake Bay shows a long and dynamic history - from the bolide (asteroid or comet) impact about 35 million years ago which formed the Chesapeake Bay impact crater, to the melting of glaciers beginning about 18,000 years ago, resulting in a continued rise of sea level and drowning of the Susquehanna River valley. Given that the rise in sea level has been occurring for thousands of years and is fundamental to the present formation of the Chesapeake Bay and our local tidal waters, why is there a recent heightened level of concern regarding this phenomenon? Concern is justified given that current and projected rates of sea level rise represent a significant increase over what we experienced during the last century. There is general consensus that rise in sea level will continue for centuries to come, and that human and natural communities within the Middle Peninsula will be vulnerable. Understanding the challenge is vital for local government to develop strategies to reduce the regions vulnerability to sea level rise.

Causes and Current Rates of Local Sea Level Rise

Processes responsible for rising sea levels are complex. To help simplify the matter, it is useful to make a distinction between the concepts of eustatic and relative sea level (RSL) change. Eustatic change, which can vary over large spatial scales, describes sea level changes at the oceanic to global scale that result from changes in the volume of seawater or the ocean basins themselves. The two major processes responsible for eustatic change are the thermal expansion of seawater due to warming and the melting and discharge of continental ice (i.e., glaciers and ice sheets) into the oceans. The global average for current (2003-mid 2011) eustatic sea level change is 0.11 in/yr (2.8 mm/yr) (NOAA Laboratory for Satellite Altimetry) with estimates for the Chesapeake Bay region on the order of 0.07 in/yr (1.8 mm/yr; Boon et al. 2010) for the approximate same time period.



Coastal flooding at Gloucester Point during Hurricane Isabel, 2003. Photo credit: VIMS.

RSL change describes the observed change in water level at a particular location and represents the sum of eustatic sea level change and local vertical land movement (subsidence or uplift) at that location. Within the Chesapeake Bay region, land subsidence represents a significant component of RSL change. Processes contributing to land subsidence include tectonic (movement of the earth's crust) and man-induced impacts (e.g., groundwater withdrawal, hydrocarbon removal). During the last glacial period (maximum extent approximately 20,000 yr BP), the southern East Coast limit of the Laurentide ice sheet coincided with northern portions of Pennsylvania (Mickelson and Colgan 2003). As a consequence, land subsided under the ice load and, in turn, created a fore-bulge or upward displacement of lands south of the ice load. Upon retreat of the glacier, the land continued to redistribute, rebounding in previously glaciated areas and subsiding in the more southern forebulge region. Land subsidence rates on the order of 0.05-0.06 in/yr (1.2-1.4 mm/yr) are attributed to the postglacial forebulge collapse within the Bay region (Douglas 1991). It can take many thousands of years for impacted regions to reach isostatic equilibrium.

At a more local level, overdrafting of groundwater is a significant factor driving land subsidence rates. Within the Eastern Virginia Groundwater Management Area, large industrial and domestic use groundwater withdrawals from the Potomac aquifer series occur in the areas of Franklin, Suffolk and West Point, VA. Elevated subsidence rates, which integrate both regional and local causes, were first observed near the centers of large groundwater withdrawals through repetitive high-precision relevelings and analysis of tide records, and later through studies that directly measured aquifer system compaction. Land subsidence rates within the Middle Peninsula, based on releveling analysis, vary between 0.09-0.15 in/yr (2.4-3.8 mm/yr) with maximum values being observed at West Point (Holdahl and Morrison 1974; Davis 1987). Pope and Burbey (2004) reported average aquifer system compaction rates of 0.06 in/yr (1.5 mm/yr; 1979-1995) and 0.15 in/yr (3.7 mm/yr; 1982-1995) near the Franklin and Suffolk pumping centers, respectively, and that compaction appeared to correlate with groundwater withdrawal; West Point was not included as part of this study. It has been suggested that the Chesapeake Bay impact structure, whose outer rim traverses the lower Middle Peninsula (Powars and Bruce 1999) may contribute to local land subsidence. While observations suggest postimpact subsidence at a geologic scale (Johnson et al. 1998), present day influence is currently unknown.

RSL rise rates at the local level are derived from accurate time series of water level measurements spanning several decades or more. A recent analysis of tide gauge data by the Virginia Institute of Marine Science reported RSL rise rates ranging from 0.11-0.23 in/yr (2.9-5.8 mm/yr; period: 1976-2007; 10 stations) within the Chesapeake Bay region, with a number of the values representing the highest rates reported along the U.S. Atlantic coast (Boon et al. 2010). With respect to the Middle Peninsula, the two nearest stations located at Gloucester Point and Lewisetta, VA indicate current RSL rise rates of 0.17 (4.30 mm/yr) and 0.20 in/yr (5.15 mm/yr), respectively (see Figure 1). Although there are no additional adequate tidal records available for the Middle Peninsula's bordering rivers (i.e., York and Rappahannock Rivers), one would expect RSL rise rates to increase as one approached areas of elevated land subsidence such as West Point, VA. Based on land subsidence and eustatic sea level information, the RSL rise rate would be expected to be on the order of 0.22 in/yr (5.6 mm/yr) at or near West Point, VA.

Extrapolating current Gloucester Point and Lewisetta rates, RSL would increase by another 0.7-0.8 ft (21-25 cm) by 2050 and 1.4-1.7 ft (43-51 cm) by 2100; this represents a conservative and low-end estimate. There is growing concern that RSL rise rates will accelerate in the future with projections of sea level increases in the Bay region of approximately 2.3-5.3 ft (70-160 cm) by 2100 (Pyke et al. 2008).

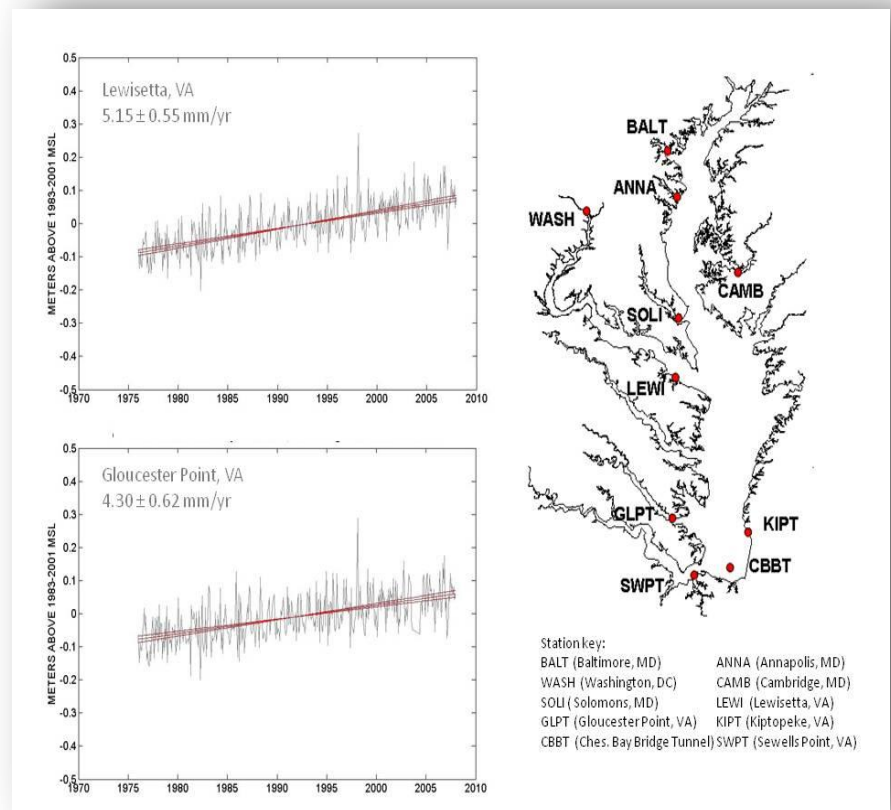


Figure 1. RSL trends and 95% confidence intervals for Lewisetta, VA and Gloucester Point, VA (after removal of seasonal cycle and decadal signal) for the 1976-2007 period and location map for Chesapeake Bay National Water Level Observation Network stations (Boon et al. 2010; reprinted with permission).

Why You Should Care: Examples of Impending Risks

Sea level rise, along with direct influences on inundation of low-lying lands, coastal erosion and flooding from storms, and saltwater intrusion into coastal freshwater/low salinity water bodies and groundwater aquifers represent significant threats to the people, public and private property, and natural resources of the Middle Peninsula.

- ***Increased Inundation and Land Conversion.***

The Middle Peninsula is rich in gently sloping, low elevation uplands and wetlands immediately adjacent to or in close proximity to tidal waters. Lands exhibiting these characteristics are at risk to increased frequency of high-tide flooding and gradual inundation from rising sea levels. Within the Middle Peninsula, vulnerable lands include but are not limited to New Point Comfort, Bohannon, Retz, Onemo, Diggs, Roane, Heart Quake Trail area, Deltaville, Locklies, West Point, Romancoke, Winona Park Road, Pamunkey Tribe Reservation, Ware Neck, Nexara, Guinea, Purtan Bay, Catlett Islands, Tappahannock, Gynnfield Subdivision, Lower Essex, Kendall Road, and Layton Peninsula (MPPDC, 2010).



Marsh regression into an adjacent low-lying pine forest on the York River. Photo credit: W. Reay.

In developed areas, the combined effect of rising sea level and water tables can have profound consequences on underground (e.g., onsite wastewater disposal systems, fuel storage tanks) and ground-level (e.g., building structures, roads, drainage ditches) infrastructure. In contrast to developed areas where some protection measures may be feasible, vast expanses of natural and agricultural areas will remain exposed to the consequences of a rising sea level. Tidal wetlands within the Middle Peninsula region are already responding to sea level rise and associated salt intrusion. Observed responses include elevated erosion rates, inundation of fringing marshes and marsh interiors, transgression of marshes into adjacent coastal forests, and conversion of freshwater to brackish water vegetation communities.

- ***Increased Storm Damage.*** Elevated sea levels will intensify storm impacts due to increases in damaging wave energy and risks of severe flooding further inland. Comparisons between two locally relevant storms whose storm surges peaked near high tide illustrate the impact of sea level rise on coastal flooding. The more powerful 1933 hurricane produced a storm surge 1.0 ft (0.3 m) greater than Hurricane Isabel in 2003, yet the high water mark or storm tide elevation (sum of storm surge and astronomical tide), was comparable to Hurricane Isabel's 7.9 ft (2.4 m) above mean lower low water. A rise in sea level over the 70 year period between storms, on the order of 1.0 ft (30 cm), is attributed to allowing the weaker storm to produce an equivalent storm tide (Boon 2005). In light of rising sea levels, significant property and infrastructure damage from erosion, wave action and flooding is likely to occur from severe storm events such as hurricanes and nor'easters, as well as less powerful storm systems.



Storm damage incurred on the York River during Hurricane Isabel, 2003. Photo credit: J. Rickards.

- ***Increased Saltwater Intrusion.*** Rising sea levels and associated saltwater intrusion can raise the salt content of Chesapeake Bay proper, its tidal tributaries and groundwater aquifers. Under various sea level rise scenarios ranging from 0.5-5.5 ft (18-167 cm), Hilton et al. (2008) estimated Chesapeake Bay salinity changes

of 0.4-12 by 2100. If such large-scale changes in Bay salinity are realized, both coastal natural resources and society would suffer. Saltwater intrusion is problematic for surface and groundwater domestic, irrigation and industrial water sources. In the Middle Peninsula, where nearly all water for domestic and business use is groundwater sourced, wells have already been contaminated by saltwater to the point of being unusable or requiring expensive reverse osmosis treatment (MPPDC 2010). In addition to saltwater intrusion into freshwater aquifer systems, inundation and storm induced flooding of wellheads and shallow wells can contaminate and jeopardize the dependability of wells and groundwater sources.

References and Pertinent Links

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Prepared by:

William G. Reay, Ph.D., CBNERRVA, Virginia Institute of Marine Science and Sandra Y. Erdle, CBNERRVA, Virginia Institute of Marine Science. September 2011.



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Appendix D: Attendees

Focus Group Participants, Residents of Gloucester County:

Bethany Balmer
Chris Clifford
Doug Dwoyer
Willard Grant
Ryan Haywood
Jessica Hendricks
Marcia Mickle
JJ Orth
Charles Villa
Ralph Williams

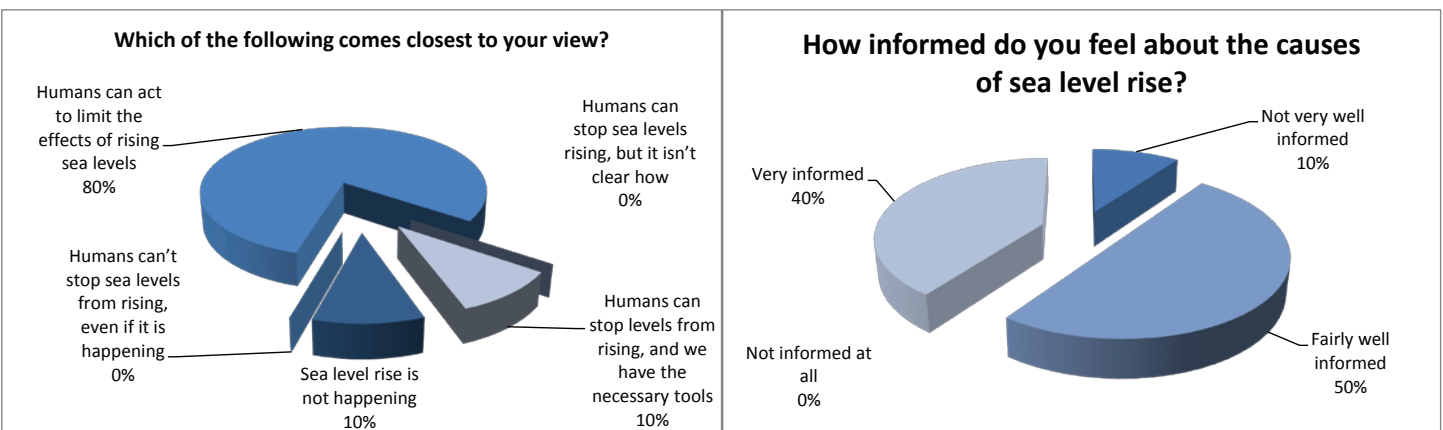
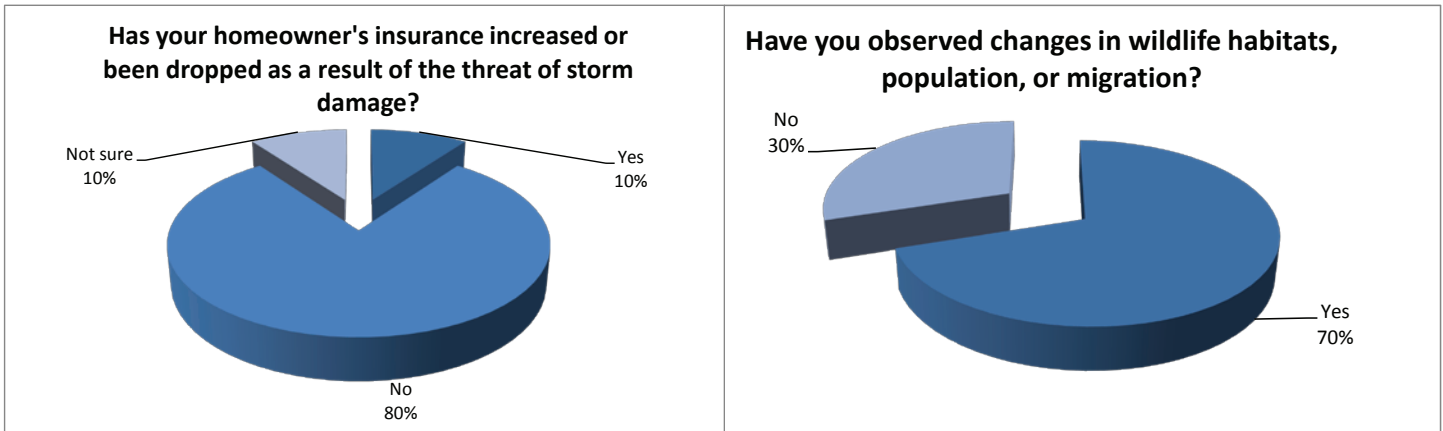
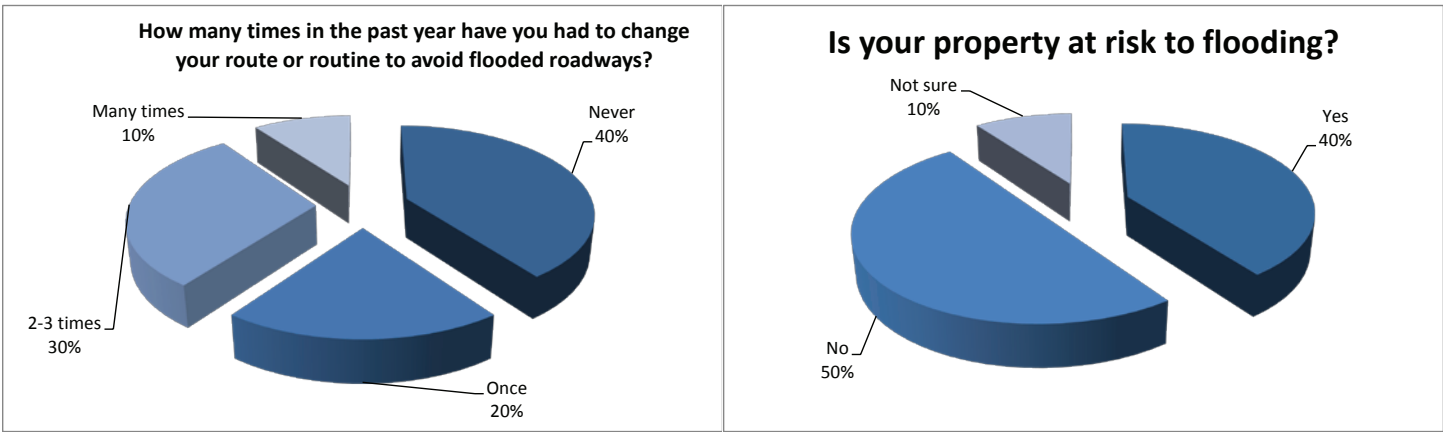
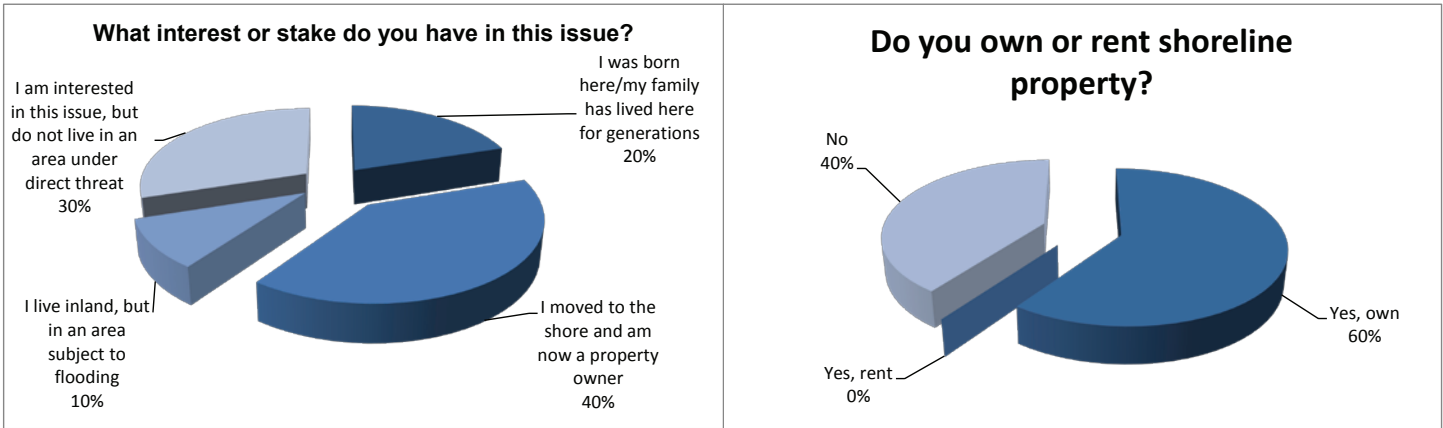
Facilitator and Assistants from the UVA Institute for Environmental Negotiation:

Tanya Denckla Cobb
Mariah Gleason
Luke Juday

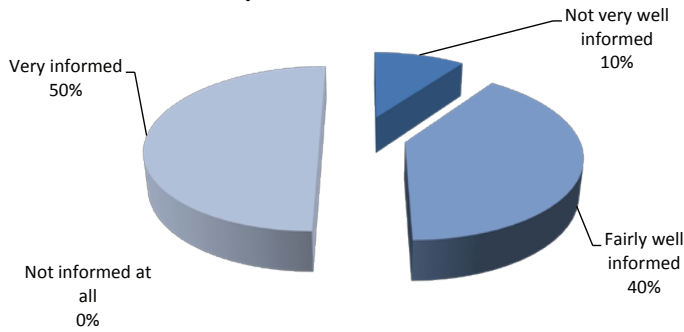
Support Personnel:

Anne Ducey-Ortiz, Gloucester County
Carl Hershner, Institute of Marine Science
Shereen Hughes, Wetlands Watch
Shannon Hulst, Wetlands Watch
Paul Koll, Gloucester County
Lewis Lawrence, MPPDC
Molly Mitchell, Virginia Institute of Marine Science
Brent Payne, Gloucester County
Scott Rae, Gloucester County
Skip Stiles, Wetlands Watch

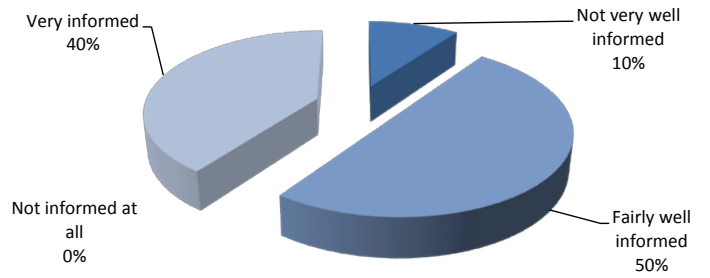
Appendix E: Electronic Poll Results



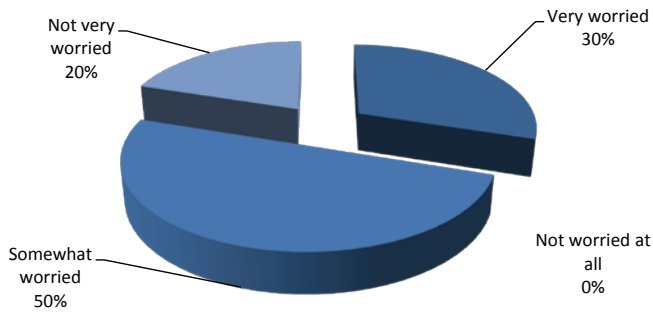
How informed do you feel about the consequences of sea level rise?



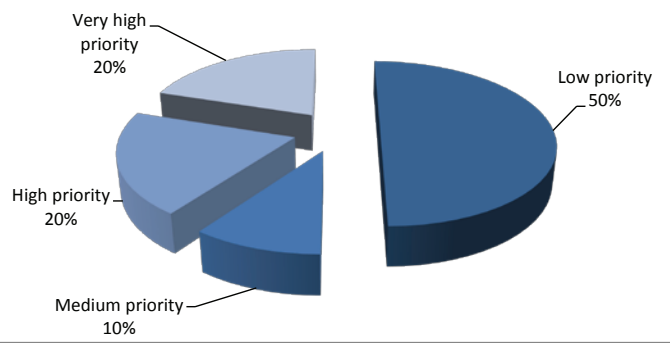
How informed do you feel you are about ways we can address sea level rise?



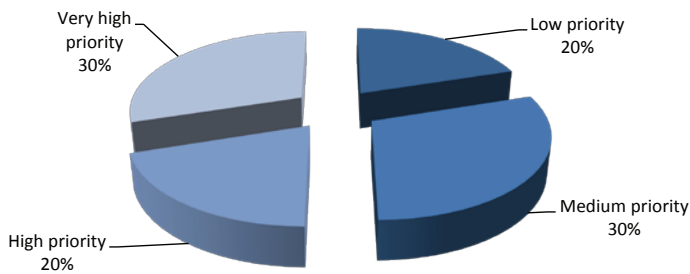
How worried are you about sea level rise affecting Gloucester County?



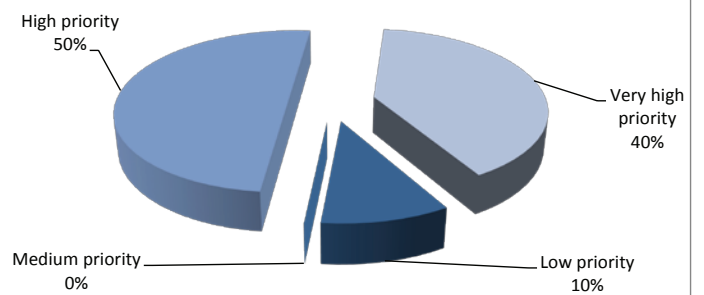
Do you think addressing sea level rise should be a low/high priority for FEDERAL government?



Do you think addressing sea level rise should be a low/high priority for STATE government?

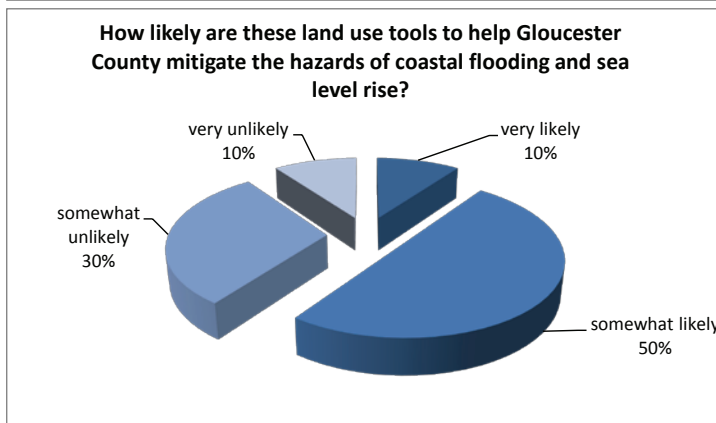
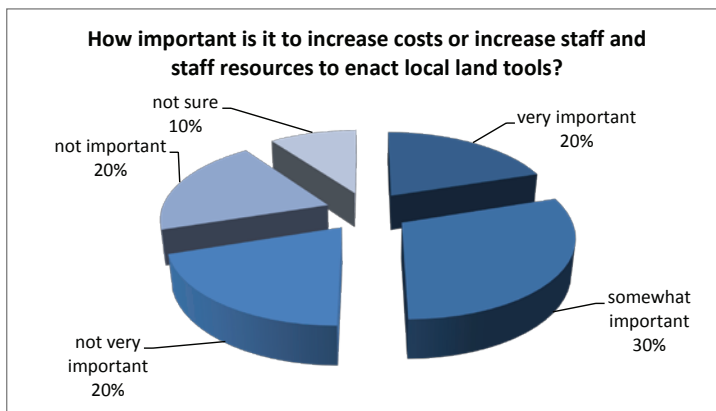
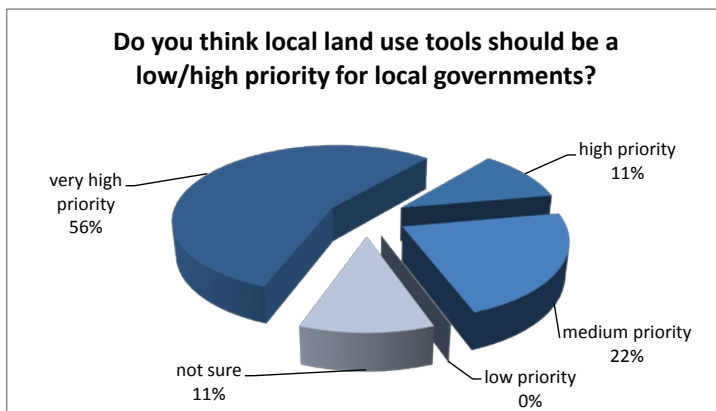
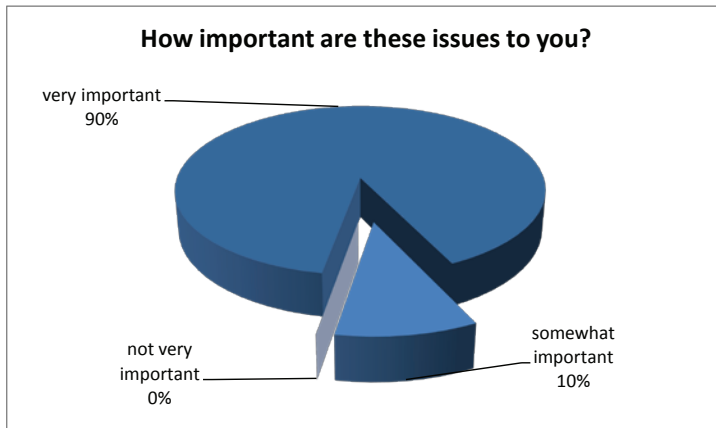


Do you think addressing sea level rise should be a low/high priority for LOCAL government?



Appendix F: Land Use Tools Survey Results

Survey Results



Comments

- Good ideas: exit strategy, due diligence on siting new facilities and infrastructure, be careful of using Bay Act as model for handling SLR, Bad ideas: everything else
- Land use policy is critical to management of long-term risk
- Localities need to look forward and plan on future land use: facilities, zoning, etc., and incorporate SLR into the process
- Not enough science exists to enforce new regulations on property owners who have too many wetlands regulations already
- Carefully assess the costs and benefits of any proposed actions, publish results widely
- We should focus on the fiscal responsibilities of land use policy

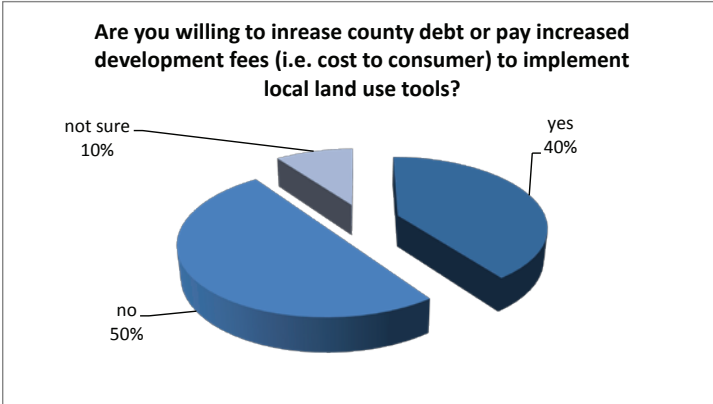
- Be sure the public is behind any tools to be applied.

- But this is the primary flow of elective gov't, they cannot spend money now to save money in the future.
- Needs to be sustainable
- So long as the money is spent reasonably and with transparency.
- As a believer in property rights and a tax payer, I am not in favor of more bureaucracy - the onus for good land use should come from good planning and the willingness of the property owner to follow the plan.
- Based on return on investment.

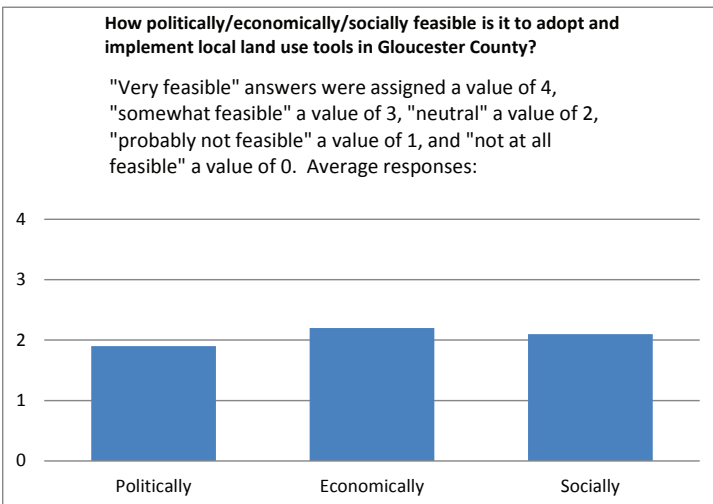
- Good ideas, well intentioned, watch for overreach and get public input
- Given elective government's inability to manage risk (especially long-term), it is unlikely that Gloucester Co. will adopt the kinds of policies that effectively manage risk
- Most of these are based on future building/use, we also need to address existing homes and businesses
- They are based on altered data
- All depends on how well they are thought out and implemented
- What would be the state input?
- Usually officials hear from "disgruntled" residents who may or may not be well-informed. Elected officials make decisions based on this feedback.

Survey Results

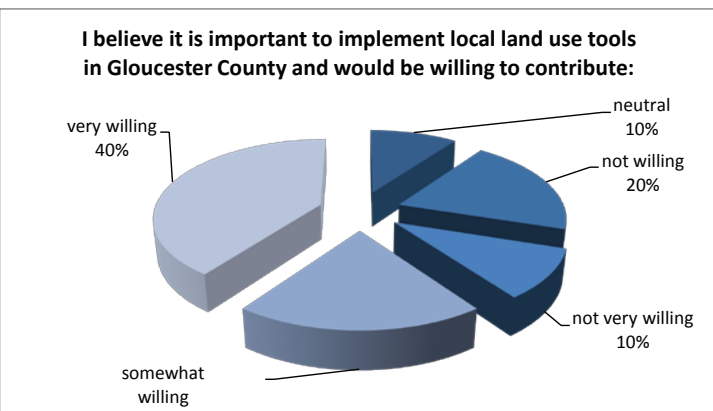
Comments



- Debt no, increased development fees yes
- I think our comprehensive plan as well as suitable economic circumstances will usher in new development and consistent growth



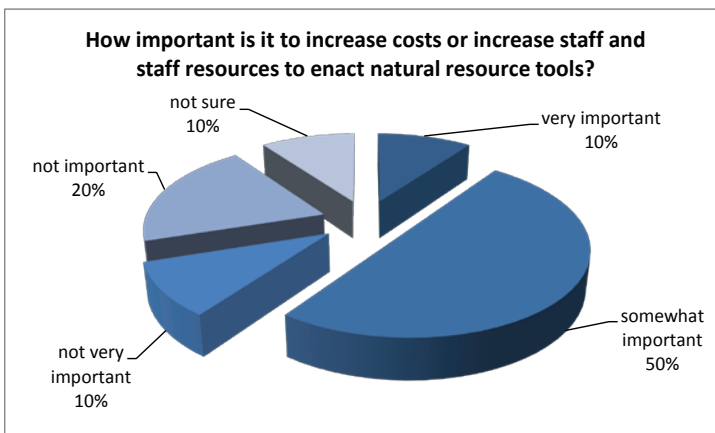
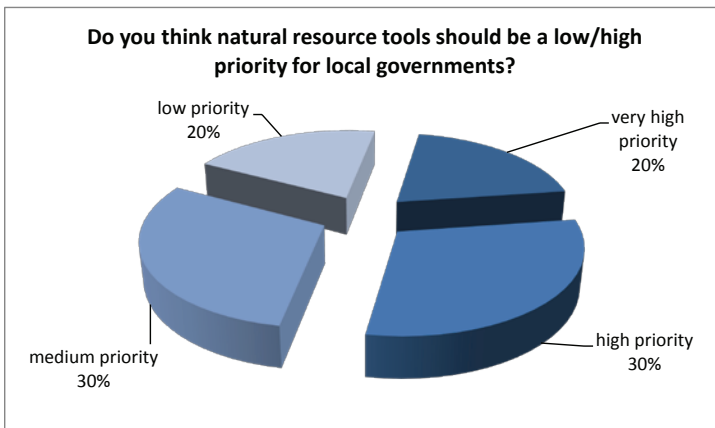
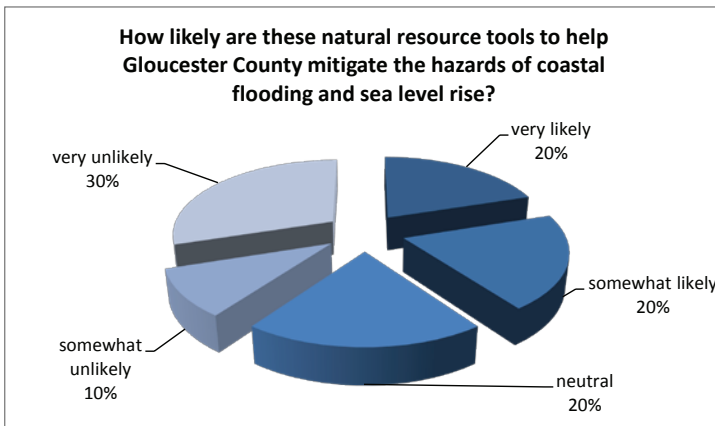
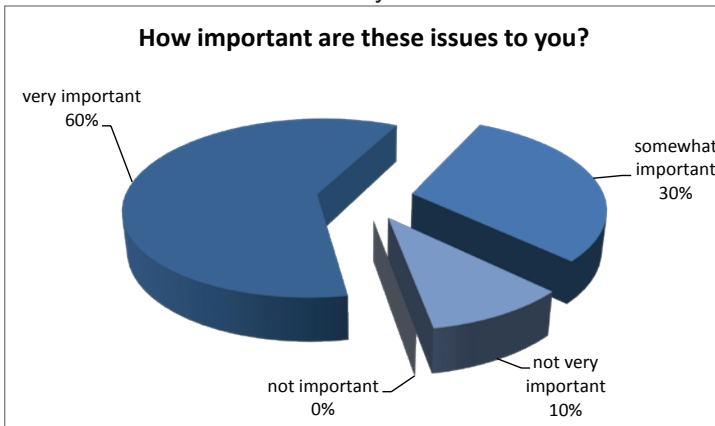
- Too vague to make any meaningful assessment
- Feasibility is fighting against resistance to increased costs in the short term
- Gloucester has very diverse households
- All government land use tools require sufficient public revisions and support



- If the local land use tools make sense, I'll pay for them, if not, I'll fight them
- As long as these include careful consideration and protection of our natural resources/environment
- I already pay taxes that benefit others and that I get nothing back from
- Again, so long as it is spent responsibly and for real effects
- I believe departmental cost-cutting and fiscal responsibility will enable us to stay within budget

Appendix G: Natural Resource Tools Survey Results

Survey Results



Comments

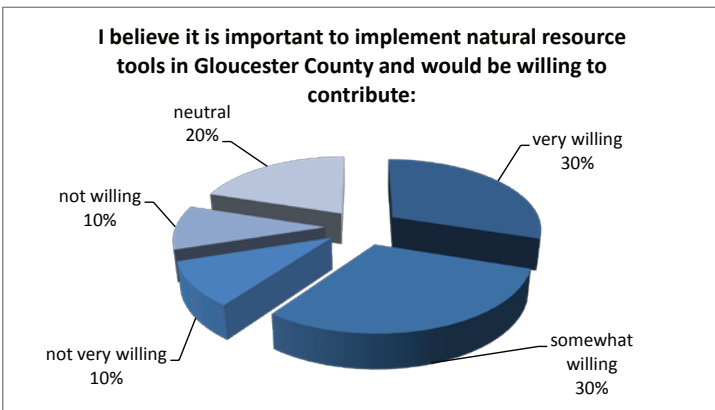
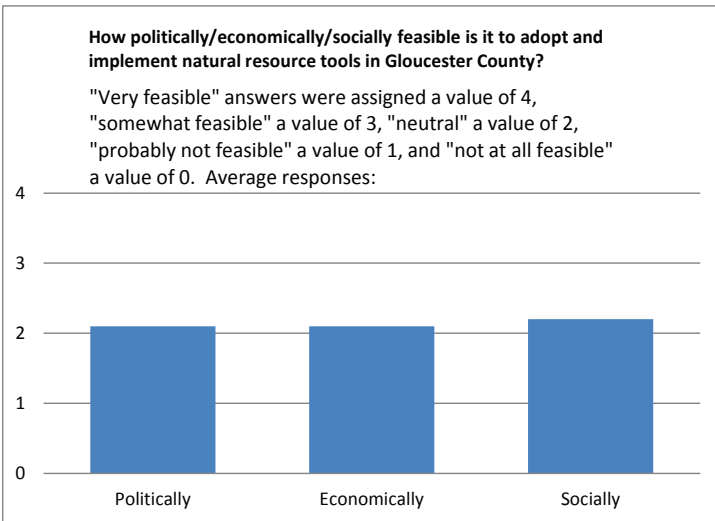
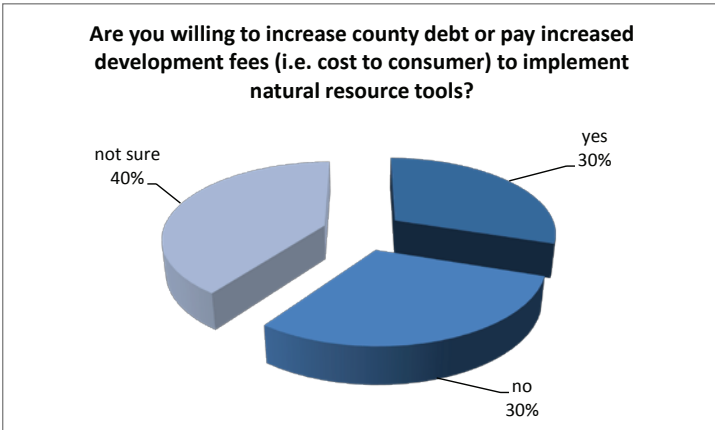
- We do have several shore management practices codified and in full regulatory use. Essentially we are effectively managing shorelines on an individual basis
- Good ideas: numbers 1, 2, 3, 5, and 10 (but 10 is easily corrupted) - bad ideas: 4, 6 (keep it voluntary), 7, 8, 9, 11, 12
- More education is necessary for the shoreline owner, regulatory agents
- What is important to me is to move toward a mutual, dynamic shoreline that will respond naturally to inundation and naturally absorb and dissipate wave energy
- All need to be balanced against cost to implement vs cost of not doing it to the county, homeowners need to accept risk

- Too many probabilities
- Rules are focused on erosion control which is already well managed, tools do not mention sea level rise.
- Wait til the big storm... underdesigned cheap shoreline treatment will be in trouble.
- If implemented in a way that recognizes the long term risk is inundation and not erosion.

- Major fiscal problems could evolve.
- Need to address real needs.
- If such policies are not implemented on a regional level, e.g. the Chesapeake Bay watershed, it is more likely to happen. A community that aggressively develops such policies finds itself at a short term economic competitiveness disadvantage.

- We have the necessary staff in place to manage the county's natural resource needs.
- Why is more staff required?
- If the state adopts policies (in light of my regional argument), the county will have to provide staff.
- Only if done effectively using common sense.

Survey Results



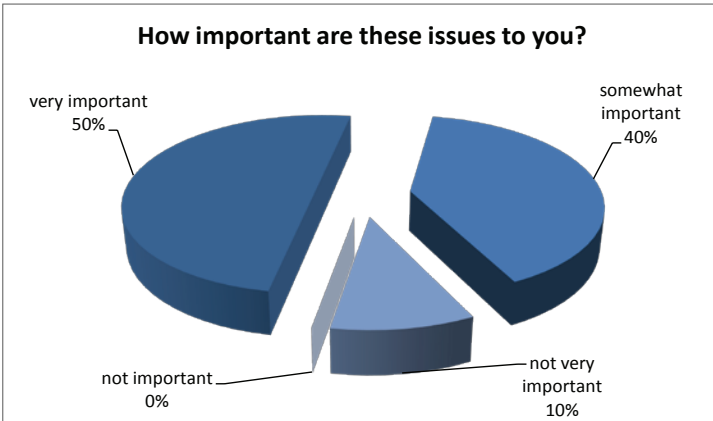
Comments

- Shoreline management is the responsibility of individual property owners unless public land is involved.
 - As long as it works to protect the natural resources of the county.
 - Who dictates the standards?
 - Don't understand question - I am taxed on my shoreline improvements already.
 - No to debt, yes to development fees.
 - No to debt, yes to development fees.
-
- Sensible rules will be adopted.
-
- I would hope that our current fiscal year budget and future ones contain the necessary line item for addressing shoreline management.
 - As long as it is commonsensical, protects natural resources, including wildlife habitat, and the money is used smartly and effectively.
 - Not \$500 for each survey, but \$500 for focus group initiatives.
 - Only if I see a benefit.
 - If done effectively and transparently.

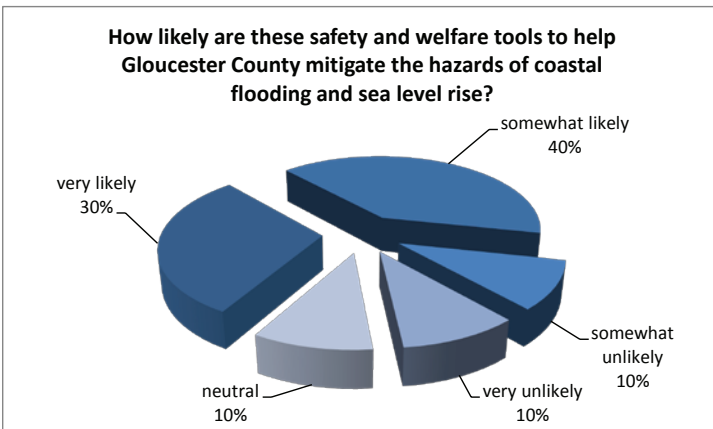
Appendix H: Safety and Welfare Tools Survey Results

Survey Results

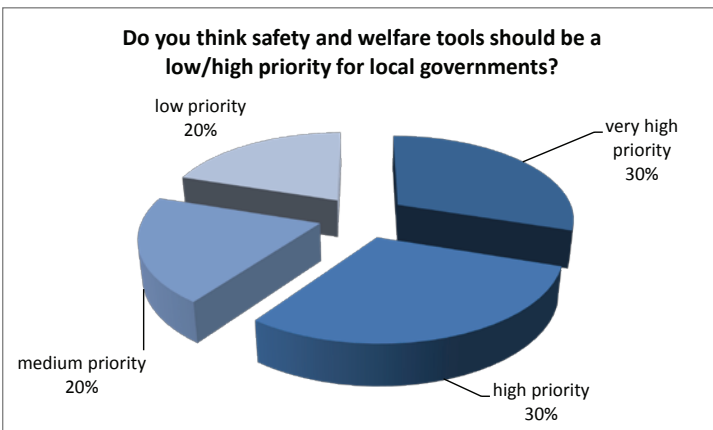
Comments



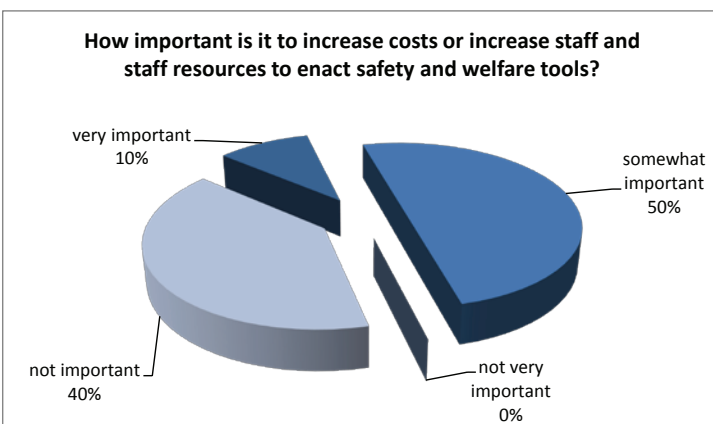
- I give this a slightly lower rating because if land use and natural resources are handled well, risk to safety and welfare will automatically be minimized.
- I feel that a property owner who is busy on the water should understand the potential predicament of a big storm. It should not be up to government to protect him (unless he wants to pay for it).
- Good ideas: 1, 2, 3, 4, 5, 6, 7, 8, 10 (given sufficient time to adjust) - Bad ideas: 9.



- Most of these rules deal with reaction to SLR not prevention/mitigation.
- Focus more on commercial and county infrastructure development. Let the private property owners take responsibility for their own well being.
- I think waterfront property owners bear the risk when they purchase the property and are required to undergo due diligence efforts.



- Added costs end up falling to taxpayers and government.
- Have to integrate within existing needs.

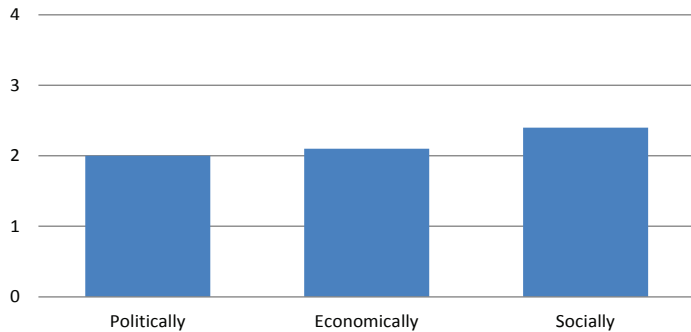


- We have the necessary staff already.
- Location, location
- Use existing personnel.

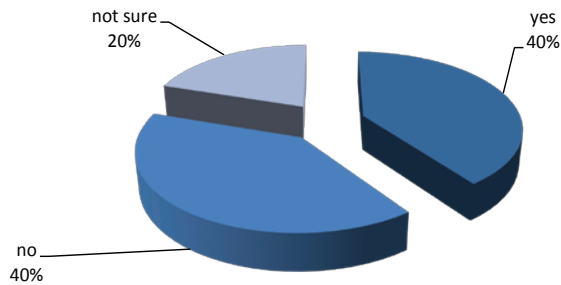
Survey Results

How politically/economically/socially feasible is it to adopt and implement safety and welfare tools in Gloucester County?

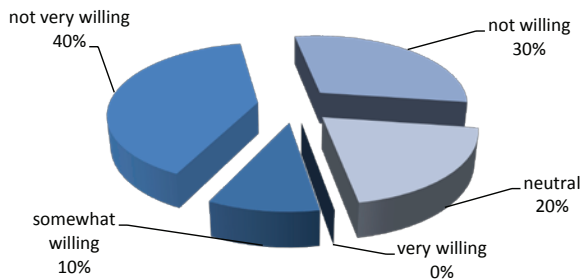
"Very feasible" answers were assigned a value of 4, "somewhat feasible" a value of 3, "neutral" a value of 2, "probably not feasible" a value of 1, and "not at all feasible" a value of 0. Average responses:



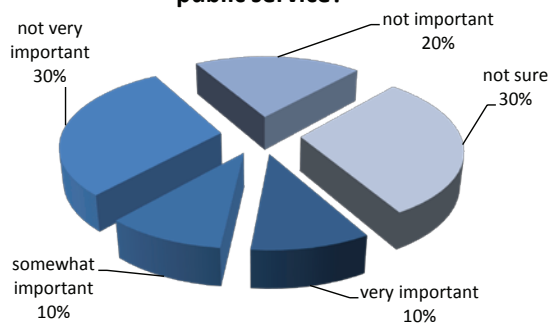
Are you willing to increase county debt or pay increased development fees (i.e. cost to consumer) to implement safety and welfare tools?



I believe it is important to implement safety and welfare tools in Gloucester County and would be willing to contribute:



How important is it to maintain current levels of public service?



Comments

- Opportunities to implement are strongest in the wake of major storms.
- Diversity in county.
- Process will take care of itself.

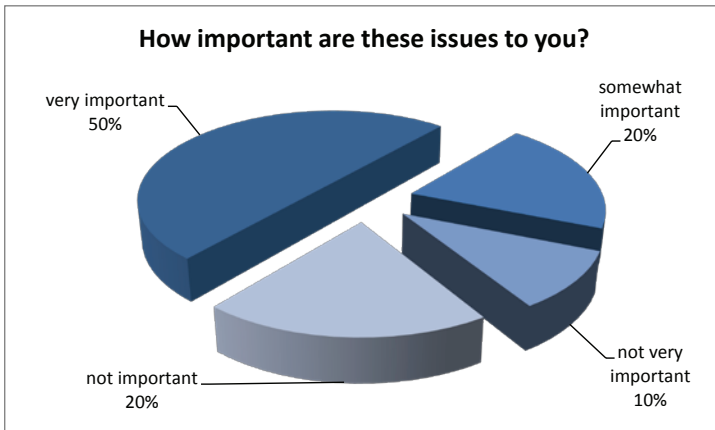
- Citizens recently have been damaged.
- I don't want to have to pay for other people to develop poorly-planned houses in low-lying areas. People in these areas should bear the burden.
- Only if it is reasonable and necessary.

- Waterfront property owner should maintain their structures.
- Again, I don't want to have to pay for other people to build in low-lying areas and to maintain services in those areas.

- Not for current levels, but yes for increased lands.
- Taxes should only be raised to mitigate the effects of inflation.

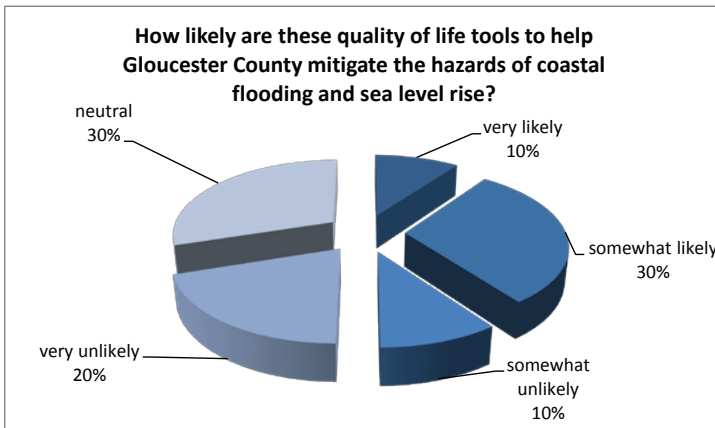
Appendix I: Quality of Life Tools Survey Results

Survey Results

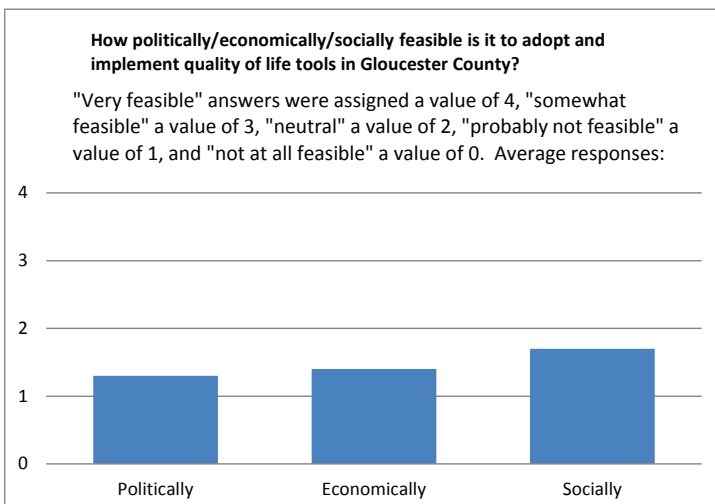


Comments

- The issues presented are not quality of life issues. My sense is that these issues promote SLR advocates employment programs - improving their quality of life, but not mine. My quality of life is: I want to be left alone, to enjoy my home and my surroundings. Put SLR in perspective with the rest of my life. SLR is not on my quality of life radar.
- Education for purposes of future planning is very important.
- I would be in favor of flood zone signage in high risk areas for the benefit of the public.
- The fundamental Hampton Roads dilemma is that the water contributes to QoL but is also a threat. We need a new relationship with the water. We must allow the evolution of a dynamic shoreline that responds to the variations of the sea level. Such an undeveloped shoreline can become a public space so that many more Gloucester citizens can have access to the water.
- Quality of life is intertwined with property rights. balanced with sensible means to mitigate impacts of sea level rise over the long haul.
- Quality of life: stars at night, meadows and woods, diverse wildlife and vegetation, arts and sciences, healthcare availability, libraries.



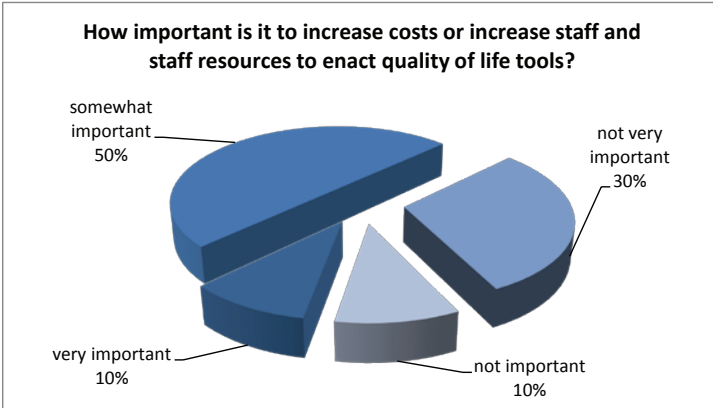
- Totally misses the point. Question is one [participant] raised: water is the source of quality of life in Gloucester, it's also the biggest threat. We need to invent new ways to relate to the water.
- A citizen group should be gathered to study what other localities, countries are doing.
- Some of these are not really under purview of government - e.g. extend media coverage - the government doesn't control media outlets.
- I believe that coastal property owners understand the risks and cost potentials of waterfront living. Also, owners or potential buyers need to educate themselves.
- If my answer to 1 is realized.



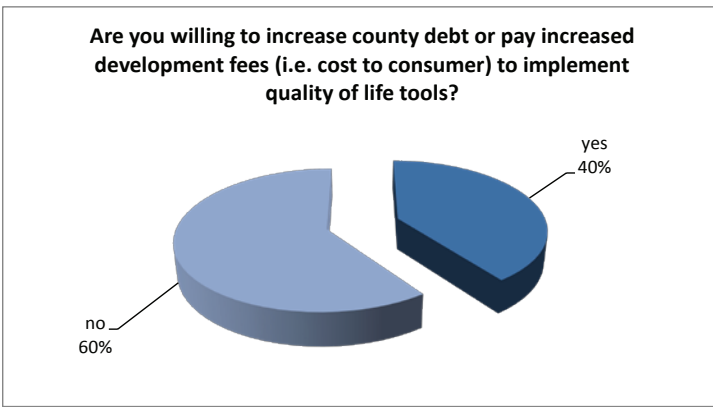
- As presented, there is zero chance ideas will be implemented.
- Tremendous diversification in background and experience.

Survey Results

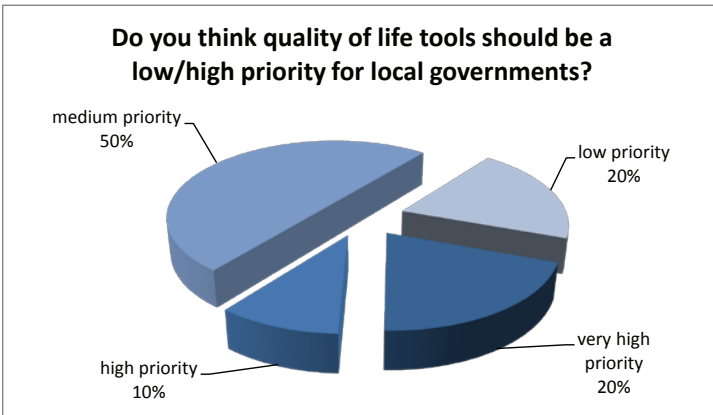
Comments



- Don't see much county involvement.
- Let citizen volunteers figure this out.
- Tools selection is important for all areas.
- We have a beautiful and varied locality. We should work to keep it that way.

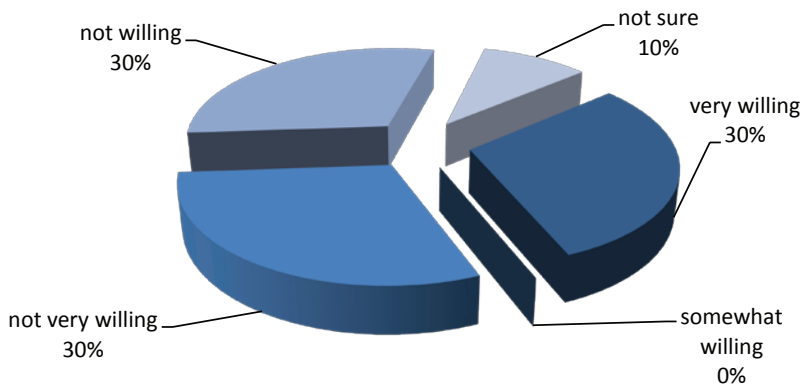


- Whole concept needs work
- Based on years of experience
- Yes, if we move towards 1



- Personal issue
- A board of supervisor's decisions should be made based on QoL questions. Is my vote on this improving the Q of Life of our citizens?

**I believe it is important to implement quality of life tools
in Gloucester County and would be willing to contribute:**



Comments

- I keep coming back to the people living/building on the water being responsible for themselves. They made the choice to be on the river and they will suffer the consequences. They should understand that up front. There is great joy in watching the sun go down over the river however the river will rise and blow occasionally. Buyer beware. Government's role should be minimal in protecting the citizen waterfront owner. If we are wealthy enough to afford to be there, we should be able to afford the consequences.
- Quality of life is being able to use and enjoy your own land and pass on your heritage to your children and grandchildren.
- Should efficiently utilize present taxes and fees.
- More access to water, connectivity to water, knowledge of water issues, 2nd idea that we need to fundamentally change our relationship to water and ideas about development along coast.
- Quality of life: fiscal responsibility, self-education, Preemptive action.
- But not for all surveys.
- If I can go home and feel safe and secure and know that my neighbors care about the same and local government feels the same, this is quality of life.