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Hampton Roads Residents' Perceptions of Sea Level Rise and Flooding Adaptation

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June 30, 2017

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Survey Overview

The survey was conducted online via Qualtrics, and as a paper survey distributed at public locations. The survey opened on May 1, 2016 and closed on July 1, 2017. The link to the online survey was advertised via email through ODU's University Announcements, local civic leagues, homeowner's associations, and community groups, as well as advertised by paper flyers at local community centers and libraries.

The survey instrument was developed by the research team and questions were compiled from other sea level rise and flooding surveys that have been conducted in the mid-Atlantic region and nationwide. For example, several questions about adaptation solutions were adapted from the Stanford University Climate Adaptation National Poll conducted in March 2013. Other questions about the impact of sea level rise were taken from the Fall 2014 Maryland Statewide Survey on 'Adapting to Climate Change and Sea Level Rise,' conducted by the George Mason University Center for Climate Change Communication. Questions about responsibility for and actions taken to address sea level rise were adapted from the 2014 survey on Delaware residents' opinions on climate change and sea level rise. Input into survey development was also provided by the ODU Social Science Research Center.

Paper copies of the survey were handed out and collected at gathering spots such as YMCAs and community music festivals. Participants who completed the survey immediately and in-person (either online through a tablet provided or on paper) were offered a $5 Amazon gift card, and all survey respondents were given the opportunity to enter for a drawing of one of three iPad Minis. There were 2,035 total survey results, with 1,633 sufficiently completed and able to be used for data analysis.

Community Involvement:
Survey participants responded with a very even bell curve distribution from "extremely low" to "extremely high" community involvement, with over 80% of participants reporting "low" to "high" involvement, and 31% reporting "neutral" involvement.

Table 1 Level of community engagement

Extremely low	9.43%
Low	24.31%
Neutral	30.86%
High	27.07%
Extremely high	8.33%

(N=1,633)

Gender, Race and Age:

62% of respondents were female, and 69% of respondents were white, while 17% reported being Black/African American, 5% Asian, 5% Multiracial, 3% "Other", and less than 1% American Indian/Alaskan Native or Native Hawaiian/Pacific Islander. The median age group was 40-49 years.

Table 2. Age categories

Under 20	4.59%
20-29	21.92%
30-39	18.25%
40-49	14.08%
50-59	18.25%
60-69	14.27%
70 and over	8.63%

(N=1,633)

Education and Household Income:

Respondents were highly educated, with almost 75% reporting at least an Associate's degree, and 34% reporting the completion of a graduate degree. Only 6% held a high school diploma/GED or less. The median household income for respondents was $75,000 to $100,000. Households making less than $30,000, $30,000 to $50,000, $50,000 to $75,000, $75,000 to $100,000, and $100,000 to $150,000 each made up between 14% and 18% of all participants, with just over 10% of participants reporting more than $150,000 household income, and 7% reporting that they don't know their household income.

Table 3. Highest level of school completed

High school diploma/GED or less	6.41%
Trade/professional school or some college	18.09%
Associate's or Bachelor's degree	39.82%
Graduate degree	34.09%
Other	1.60%

(N=1,625)

Table 4. Annual household income

Less than $15,000	8.85%
More than $15,000 to $30,000	8.91%
More than $30,000 to $50,000	14.14%
More than $50,000 to $75,000	16.57%
More than $75,000 to $100,000	16.45%
More than $100,000 to $150,000	18.01%
More than $150,000 to $200,000	6.73%
More than $200,000	3.74%
Don't know	6.60%

(N=1,605)

City of Residence:

Participants resided mostly in Virginia Beach and Norfolk (22% and 38% respectively), but represented Hampton (12%) Chesapeake (9%), Portsmouth (7%), Newport News (7%), and Suffolk (3%) as well as Gloucester County, York County, Poquoson, James City County, Currituck County, and Isle of Wight County.

Figure 1. Responses by city of residence
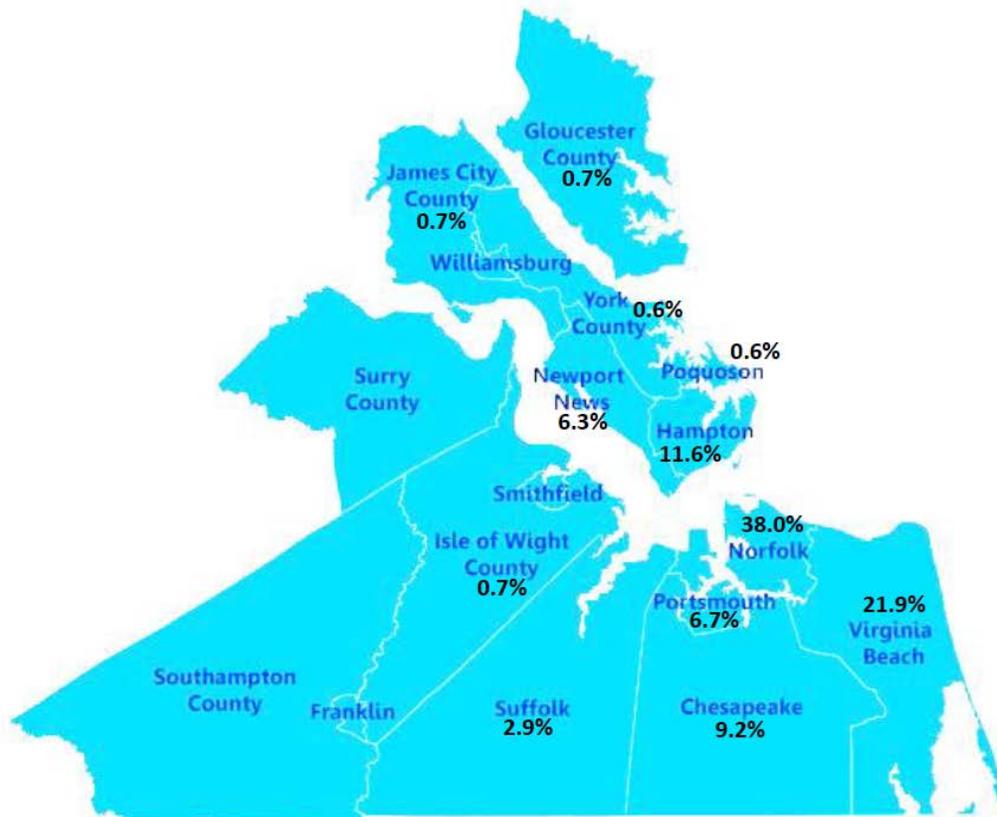
(N=1,633)

Vulnerability to and Impacts of Sea Level Rise

The majority of Hampton Roads' residents clearly perceive themselves to be vulnerable to flooding and feel the impacts of SLR. More than half of residents in the survey responded as being "highly vulnerable" (39% rated their personal vulnerability as high and 12% as extremely high). At the other end of the spectrum, 24% of residents rated their personal vulnerability to flooding due to SLR as "low" or "extremely low". An interesting finding is that residents' perceived vulnerability to SLR is not correlated with their household income.

In terms of the immediacy of SLR impact, 61% of residents surveyed stated that SLR "is having impacts now." In contrast, 5% of respondents considered SLR having impacts in the longer term of 50 years or more.

Table 5. When SLR will have an impact on Hampton Roads

It is having impacts now	60.99%
In 5 years	7.78%
In 10 years	10.66%
In 25 years	8.45%
In 50 years	3.12%
In 100 years	2.20%
Never / sea levels are not rising	1.59%
Don't know	5.21%

(N=1,633)

Survey respondents indicated that there is a significant impact of SLR on infrastructure in Hampton Roads (see Table 6). In terms of infrastructure impacts, private property damage or loss, damage or loss of public infrastructure, problems with stormwater drainage, higher storm surge, and shoreline erosion and loss of lands were primary concerns of more than 60% of the residents surveyed. From a quality of life perspective, respondents were primarily concerned with increased frequency/severity of flooding, increased insurance rates, increased traffic congestion, and associated health risks.

Slightly over half of residents (53%) reported not having flood insurance through the federal government's National Flood Insurance Program (NFIP). Not surprisingly, there is variation in flood insurance commitment, depending on the residents' perceived vulnerability to flooding. Those who perceived their vulnerability to SLR as "low" or "medium" were less likely to have food insurance, compared to those who perceived themselves to be highly vulnerable. 19% and 24% of those who categorizes their vulnerability as "low" and "medium", respectively, had flood insurance, while 46% of those in the highly vulnerable category had flood insurance.

Table 6. Residents' concerns about impacts of SLR in Hampton Roads

Infrastructure Impacts		Quality of Life Impacts	
Private property damage or loss	74.74%	Increased frequency and severity of flooding	78.66%
Problems with stormwater drainage	70.20%	Increased insurance rates	67.87%
Shoreline erosion and loss of land	69.04%	Increased health risks (such as through water borne diseases, mold and mildew, etc.)	62.23%
Damage or loss of public infrastructure	63.95%	Increased traffic congestion, delays, etc.	62.23%
Higher storm surge	63.46%	Permanently flooded areas	53.34%
Habitat loss	56.96%	Loss of quality of life	52.91%
Loss or damage of sewage and septic systems	55.43%	Increased taxes to support measures to reduce flooding	51.62%
Rebuilding of infrastructure	44.76%	Contamination of freshwater wells	51.26%
		Business closures or reduced business activities	42.61%
		Reduced military or Department of Defense presence	31.45%
		Loss of recreational opportunities	27.77%
		Shrinkage of population	17.90%

(N=1,631)

Support for Adaptation Actions

Survey respondents were asked to indicate who they thought should take the lead in addressing the risks posed by flooding due to SLR. As shown in Figure 2, the large majority of respondents thought that the lead role should be borne by local governments (81%) and state government (72%). 45% of residents indicated a federal role in leading efforts to address flooding and SLR risks.

Figure 2. Lead responsibility for addressing SLR in Hampton Roads
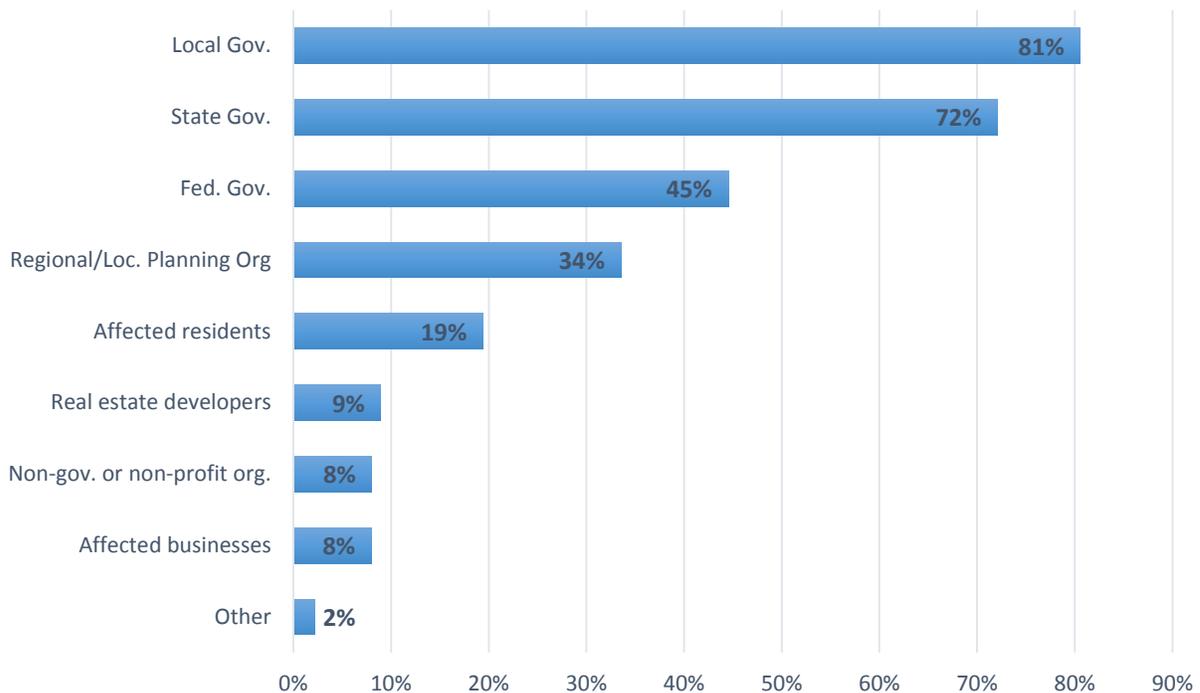
(N=1,628)

The survey also asked respondents to select up to three actions that were most feasible for improving their community's resilience to SLR and flooding. As shown in Figure 3, the top three actions identified by respondents were clear. They were: (1) floodplain policy and management solutions such as preserving open space, managing development in flood-prone areas, or having higher standards for development or construction; (2) natural solutions such as dunes and beaches, wetlands, oyster reefs, maritime forests and shrubs; and (3) improving drainage systems. Other resilience-improving actions such as flood-proofing buildings and educating residents were noted by fewer than 30% of respondents.

Figure 3. Actions most feasible for improving community resilience to SLR and/or flooding

Action	Percentage
Floodplain policy and management	50%
Natural solutions	49%
Improve drainage systems	49%
Flood-proofing buildings	30%
Educate residents on sea level rise and/or flooding	26%
Flood warning systems and preparedness	25%
Storm surge barriers	23%
Levees/floodwalls/dikes	17%
Relocation	9%
I don't know	2%
None of the above	0%
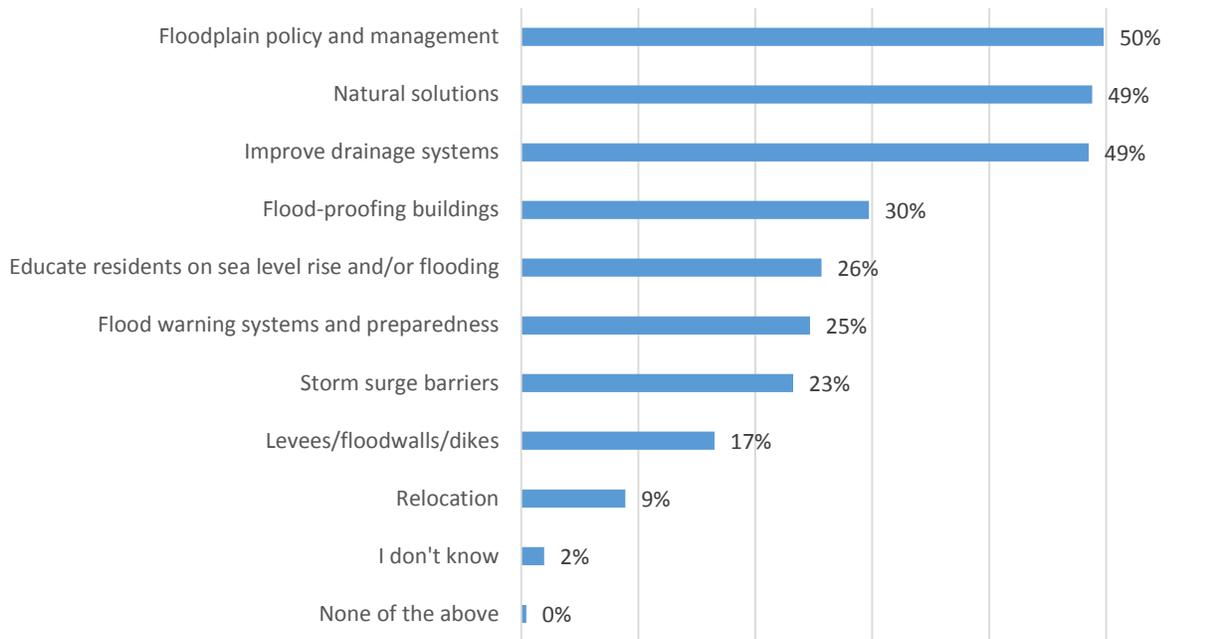
(N=1,629)

Residents were asked to indicate their level of support for 10 possible adaptation solutions for addressing SLR and associated flooding. Table 7 summarizes the different adaptation solutions presented to residents in the survey.

Table 7. Ten possible adaptation solutions posed to residents

Building sea walls	To reduce the damage from sea level rise and more severe storms and flooding along the coast, the government could build sea walls of reinforced concrete, steel, or boulders along the shore to protect infrastructure and buildings. Building sea walls along the shore has been done successfully in the past to reduce and/or prevent damage. Walls like this have often resulted in smaller beaches in front of the walls or, occasionally, the disappearance of those beaches. These walls are costly to build and maintain.
Replenishing sand on beaches	Sea level rise and storms can wash away sand and cause beaches to become smaller or to disappear. The government could replenish sand on beaches after they have been eroded. Adding sand to damaged beaches would allow people to continue to use the beaches and will protect infrastructure and buildings along the shore. Severe storms could cause erosion and the sand would need to be replenished regularly.

Table 7. Ten possible adaptation solutions posed to residents (cont.)

Reducing new building on the coast	Local governments can pass laws and regulations that dictate where new buildings can be built along the coast. These laws and regulations will reduce the number of buildings that are damaged by sea level rise, storms, and flooding. By reducing the construction of new buildings in these flood-prone areas, there may be a decrease in total property values of existing buildings, which may reduce the amount of money the government gets from property taxes from that location.
Building sand dunes	To protect people, infrastructure and buildings from damage from rising sea levels and storms, the government could put large mounds of sand and plants, called "sand dunes", along the shore. Having sand dunes along the coast can block people's views and access to the beach.
Offering money to people and businesses to move inland	To prevent damage from storms and flooding from hurting people and businesses, the government can offer money to people and businesses who live and work near the coast to move inland. Paying them to move might save the government money in the long run, since the government (for example, through the Federal Emergency Management Agency) may pay to help people and businesses recover from storm and flooding events.
Limiting rebuilding in locations seriously damaged by flooding or storms	To prevent sea level rise, storms, and flooding from hurting people and businesses, the government can pass laws saying that if a building near the coast is seriously damaged by flooding or storms, no one can rebuild in that location. Laws like this will reduce the number of buildings built near the coast and will reduce the amount of money that the government gets in property taxes from that location.
Changing building codes and increasing construction standards in vulnerable areas	Governments can change building codes and construction standards to reduce the amount of potential damage from sea level rise, storms and flooding. These laws would mean that people and businesses would have to comply with codes and standards that can result in higher construction and/or maintenance costs.
Providing tax incentives for taking actions to reduce risks of flood damage	Property owners can take actions that reduce the risks of damage due to flooding from sea level rise. For example, homeowners can elevate their HVAC or water heater units, or install flood vents. Governments can encourage such actions by providing tax incentives. The tax incentives will reduce the amount of money that the government gets in taxes.
Constructing public buildings and structures to better withstand flooding and storms	To protect public infrastructure from damage, the government could construct buildings, roads and sewer systems to better withstand rising sea levels, flooding and storms. This may be more expensive than using traditional construction practices, but may save money in the long run.
Using green infrastructure	Government can use green infrastructure to reduce and treat rain stormwater at its sources by using vegetation, soil, and other elements. Examples of green infrastructure include rain gardens and planter boxes that collect and absorb runoff, and rainwater harvesting such as rain barrels and cisterns. Green infrastructure is designed to provide flood protection, cleaner water, and a habitat for existing wildlife. Green infrastructure may incur higher planning, design, installation, construction, and operation and maintenance costs than current construction approaches.

Respondents were asked to indicate their level of support on a 5-point scale ranging from 1 or 'strongly oppose' to 5 or ' strongly support.' Table 7 shows levels of support for the ten different adaptation actions according to the average score on this 5-point scale. These actions are listed in decreasing order of support. Four adaptation solutions had support levels exceeding 80%. The two highest rated solutions were constructing public buildings and structures to better withstand flooding and storms (87% support), and using green infrastructure to reduce and treat stormwater using vegetation, soil, and other natural elements (86% support). More than 84% of respondents supported policies that would change building codes and increase construction standards for all buildings in areas vulnerable to flooding and storms. Providing tax incentives to property owners for taking action to reduce flooding and potential damage of SLR was supported by 80% of respondents.

Table 8. Support for different adaptation actions (in order of decreasing public support)

	Somewhat/ Strongly support	Mean [a] (Std Dev)
Using Green Infrastructure (N=1,630)	86.32%	4.376 (0.859)
Constructing Public Buildings and Structures to Better Withstand Flooding and Storms (N=1,627)	86.66%	4.314 (0.860)
Changing Building Codes and Increasing Construction Standards in Vulnerable Areas (N=1,619)	84.49%	4.240 (0.900)
Building Sand Dunes (N=1,629)	76.38%	4.210 (0.946)
Providing Tax Incentives for Taking Actions to Reduce Risks of Flood Damage (N=1,621)	80.19%	4.122 (1.023)
Reducing New Building on the Coast (N=1,629)	78.08%	4.082 (1.016)
Limiting Rebuilding in Locations Seriously Damaged by Flooding or Storms (N=1,628)	71.31%	3.851 (1.129)
Replenishing Sand on Beaches (N=1,627)	69.08%	3.783 (1.156)
Offering Money to People and Businesses to Move Inland (N=1,630)	51.53%	3.296 (1.196)
Building Sea Walls (N=1,630)	42.52%	3.055 (1.264)

a. On a 5-point scale with 1 being strongly oppose and 5 being strongly support

Conclusion and Recommendation

The adaptation survey results reveal that more than half of the residents in the Hampton Roads region consider themselves highly vulnerable to flooding. The residents are equally concerned about the impacts to infrastructure as well as to their quality of life in terms of socio-economic impacts. The results are particularly important from a local government standpoint since more than 80 percent of residents indicate that they think local government should play the lead role in addressing flooding and sea level rise risks. The survey results have indicated the type of actions local governments can feasibly take; the top solutions are related to making floodplain policy changes and using green and natural solutions. This feedback is useful for the local governments in guiding their response to the flooding issue and to initiate institutional level changes.

One of the major drawbacks of public participatory exercise is that governments collect resident feedback but may not use it in decision-making or even inform residents about how and why the feedback was (or was not) used. This affects residents' trust and accountability perceptions about the government. Basing their response on the survey results, local governments have the opportunity to inform residents about the actions they have taken so far and the actions they will take in future to tackle the wicked problem of flooding and SLR. Local governments can inform residents of the government's perspective regarding preferred solutions and bring the residents up-to-date on the political and financial challenges, if any, vis-à-vis the solutions. These actions will go a long way in building resident trust and active citizen involvement in future policy debates.

Appendix A. Survey Instrument

Q1 How would you rate your level of engagement in the community? Engagement could include involvement in your civic league or neighborhood association, volunteering with community or nonprofit organizations.
- ○ Extremely low
- ○ Low
- ○ Neutral
- ○ High
- ○ Extremely high

Q2 How would you rate your personal vulnerability to flooding due to sea level rise? Personal vulnerability could include damage to personal property such as car or home, disruptions to driving or commuting, or threats to health, etc.
- ○ Extremely low
- ○ Low
- ○ Neutral
- ○ High
- ○ Extremely high

Q3 When do you think sea level rise will start to have impacts in the Hampton Roads region? That is, is it having impacts now, or will it start to have impacts in 5 years, 10 years, 25 years, 50 years, or in 100 years, or will it never have impacts?
- ○ It is having impacts now
- ○ In 5 years
- ○ In 10 years
- ○ In 25 years
- ○ In 50 years
- ○ In 100 years
- ○ Never/sea levels are not rising
- ○ Don't know

Q4 Which infrastructure impacts from sea level rise in Hampton Roads, if any, are you most concerned about? (Please choose ALL THAT APPLY)
- ❑ Shoreline erosion and loss of land
- ❑ Habitat loss
- ❑ Private property damage or loss
- ❑ Damage or loss of public infrastructure
- ❑ Rebuilding of infrastructure
- ❑ Loss or damage of sewage and septic systems
- ❑ Higher storm surge
- ❑ Problems with stormwater drainage
- ❑ Other (please specify) _____
- ❑ Not concerned about any impacts

Q5 Which quality of life impacts from sea level rise in Hampton Roads, if any, are you most concerned about? (Please check ALL THAT APPLY)
- ❑ Business closures or reduced business activities
- ❑ Reduced military or Department of Defense presence
- ❑ Contamination of freshwater wells
- ❑ Increased frequency and severity of flooding
- ❑ Increased health risks (such as through water borne diseases, mold and mildew, etc.)
- ❑ Increased insurance rates
- ❑ Permanently flooded areas
- ❑ Loss of recreational opportunities
- ❑ Increased traffic congestion, delays, etc.
- ❑ Increased taxes to support measures to reduce flooding
- ❑ Shrinkage of population
- ❑ Loss of quality of life
- ❑ Other (please specify) _____
- ❑ Not concerned about any impacts

Q6 Resilience refers to the ability to bounce back following an extreme event such as major flooding or a storm. Which of the following actions are most feasible for improving your community's resilience to sea level rise and/or flooding? (Please select UP TO 3)
- ❑ Natural solutions (dunes and beaches, wetlands, oyster reefs, maritime forests and shrubs, etc.)
- ❑ Floodplain policy and management (preserve open space, manage development in flood-prone areas, higher standards for development or construction)
- ❑ Flood-proofing buildings (elevate whole or parts of building, flood vents, etc.)
- ❑ Flood warning systems and preparedness
- ❑ Relocation
- ❑ Levees/floodwalls/dikes
- ❑ Storm surge barriers (floodgate with opening to allow access)
- ❑ Improve drainage systems
- ❑ Educate residents on sea level rise and/or flooding
- ❑ None of the above
- ❑ I don't know

Q7 Which of the following actions would help you adapt to sea level rise and/or flooding? (Please select UP TO 3)
- ❑ Find out more about different adaption actions
- ❑ Talk to public officials about allocating resources for implementing adaption
- ❑ Learn more about what my city is doing to address flooding and/or sea level rise
- ❑ Talk to my family and friends about the problems
- ❑ Talk to my family and friends about how to adapt
- ❑ Learn what others in my community are doing to adapt
- ❑ Learn more about sea level rise and/or flooding
- ❑ Learn more about how to adapt
- ❑ None of the above
- ❑ I don't know

Q8 Who do you think should take the lead to address the risks posed by flooding due to sea level rise in Hampton Roads? (Please select UP TO 3)
- ❑ Federal government
- ❑ State government
- ❑ Local governments
- ❑ Affected residents
- ❑ Affected businesses
- ❑ Real estate developers
- ❑ Non-governmental or non-profit organizations
- ❑ Regional/local planning organizations
- ❑ Other (please specify) _____

Q9 To reduce the damage from sea level rise and more severe storms and flooding along the coast, the government could build sea walls of reinforced concrete, steel, or boulders along the shore to protect infrastructure and buildings. The photo below shows a sea wall.   Building sea walls along the shore has been done successfully in the past to reduce and/or prevent damage. Walls like this have often resulted in smaller beaches in front of the walls or, occasionally, the disappearance of those beaches. These walls are costly to build and maintain. Do you support or oppose the government building walls like this along shores where damaging flooding is likely to increase in the future due to sea level rise?
- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q10 Sea level rise and storms can wash away sand and cause beaches to become smaller or to disappear. The government could replenish sand on beaches after they have been eroded. Adding sand to damaged beaches would allow people to continue to use the beaches and will protect infrastructure and buildings along the shore. Severe storms could cause erosion and the sand would need to be replenished regularly. Do you support or oppose the government replenishing sand on beaches?

- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q11 Local governments can pass laws and regulations that dictate where new buildings can be built along the coast. These laws and regulations will reduce the number of buildings that are damaged by sea level rise, storms, and flooding. By reducing the construction of new buildings in these flood-prone areas, there may be a decrease in total property values of existing buildings, which may reduce the amount of money the government gets from property taxes from that location. Do you support or oppose the government passing laws and regulations to reduce the number of new buildings that people and businesses can build on the coast?

- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q12 To protect people, infrastructure and buildings from damage from rising sea levels and storms, the government could put large mounds of sand and plants, called "sand dunes", along the shore. The photo below shows a beach with sand dunes and plants. Having sand dunes along the coast can block people's views and access to the beach. Do you support or oppose the government building sand dunes to protect people, infrastructure, and buildings?

- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q13 To prevent damage from storms and flooding from hurting people and businesses, the government can offer money to people and businesses who live and work near the coast to move inland. Paying them to move might save the government money in the long run, since the government (for example, through the Federal Emergency Management Agency) may pay to help people and businesses recover from storm and flooding events. Do you support or oppose the government offering money to people and businesses near the coast if they move further inland?

- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q14 To prevent sea level rise, storms, and flooding from hurting people and businesses, the government can pass laws saying that if a building near the coast is seriously damaged by flooding or storms, no one can rebuild in that location. Laws like this will reduce the number of buildings built near the coast and will reduce the amount of money that the government gets in property taxes from that location. Do you support or oppose the government passing laws that limit rebuilding in locations where buildings were seriously damaged by flooding or storms?
- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q15 Governments can change building codes and construction standards to reduce the amount of potential damage from sea level rise, storms and flooding. These laws would mean that people and businesses would have to comply with codes and standards that can result in higher construction and/or maintenance costs. Do you support or oppose the government changing building codes and having higher construction standards for all buildings in areas vulnerable to flooding and storms?
- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q16 Property owners can take actions that reduce the risks of damage due to flooding from sea level rise. For example, homeowners can elevate their HVAC or water heater units, or install flood vents. Governments can encourage such actions by providing tax incentives. The tax incentives will reduce the amount of money that the government gets in taxes. Do you support or oppose the government providing tax incentives to property owners for taking action to reduce flooding and potential damage of sea level rise?
- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q17 To protect public infrastructure from damage, the government could construct buildings, roads and sewer systems to better withstand rising sea levels, flooding and storms. This may be more expensive than using traditional construction practices, but may save money in the long run. Do you support or oppose the government constructing public buildings and structures to withstand or accommodate rising sea level, flooding and storms?
- ○ Strongly oppose
- ○ Somewhat oppose
- ○ Neither oppose nor support
- ○ Somewhat support
- ○ Strongly support

Q18 Government can use green infrastructure to reduce and treat rain stormwater at its sources by using vegetation, soil, and other elements. Examples of green infrastructure include rain gardens and

planter boxes that collect and absorb runoff, and rainwater harvesting such as rain barrels and cisterns. Green infrastructure is designed to provide flood protection, cleaner water, and a habitat for existing wildlife. The photos below show a rain garden and cistern.   Green infrastructure may incur higher planning, design, installation, construction, and operation and maintenance costs than current construction approaches.   Do you support or oppose the use of green infrastructure?

○ Strongly oppose
○ Somewhat oppose
○ Neither oppose nor support
○ Somewhat support
○ Strongly support

Q19 What is your gender?
○ Male
○ Female

Q20 What is your age? _____

Q21 How would you describe your race/ethnicity?
○ White
○ Black/African American
○ American Indian/Alaskan Native
○ Asian
○ Native Hawaiian/Pacific Islander
○ Multiracial
○ Other (please specify) _____

Q22 What is the highest level of school you have completed?
○ Some grade school
○ Some high school
○ High school diploma or GED
○ Completed trade/professional school
○ Some college
○ Associate's degree
○ Bachelor's degree
○ Graduate degree (Master's, PhD, Doctorate, MD, JD)
○ Other (please specify) _____

Q23 What is your annual household income?
○ Less than $15,000
○ More than $15,000 to $30,000
○ More than $30,000 to $50,000
○ More than $50,000 to $75,000
○ More than $75,000 to $100,000
○ More than $100,000 to $150,000
○ More than $150,000 to $200,000
○ More than $200,000
○ Don't know

Q24 What is your zipcode? _____

Q25 How long have you lived (in years) in Hampton Roads? _____

Q26 What city do you live in?
○ Virginia Beach
○ Norfolk
○ Chesapeake
○ Portsmouth
○ Suffolk
○ Newport News
○ Hampton
○ Other (please specify) _____

Q27 Do you and your family own your home or apartment, pay rent, or have some other arrangement?
○ Own or in the process of buying
○ Rent
○ Other arrangement (please specify) _____

Q28 Standard homeowner's or renter's insurance does not cover flood loss. Flood insurance is offered through the federal government's National Flood Insurance Program (NFIP). Do you have an NFIP flood insurance policy?
○ Yes
○ No
○ Don't know

Appendix B. Tabulations of Results

(Data is for the extended Hampton Roads MSA)

Q1 How would you rate your level of engagement in the community? Engagement could include involvement in your civic league or neighborhood association, volunteering with community or nonprofit organizations. (N=1,633)	
Extremely low	9.43%
Low	24.31%
Neutral	30.86%
High	27.07%
Extremely high	8.33%

Q2 How would you rate your personal vulnerability to flooding due to sea level rise? Personal vulnerability could include damage to personal property such as car or home, disruptions to driving or commuting, or threats to health, etc. (N=1,632)	
Extremely low	5.15%
Low	19.55%
Neutral	23.77%
High	39.15%
Extremely high	12.38%

Q3 When do you think sea level rise will start to have impacts in the Hampton Roads region? That is, is it having impacts now, or will it start to have impacts in 5 years, 10 years, 25 years, 50 years, or in 100 years, or will it never have impacts? (N=1,633)	
It is having impacts now	60.99%
In 5 years	7.78%
In 10 years	10.66%
In 25 years	8.45%
In 50 years	3.12%
In 100 years	2.20%
Never / sea levels are not rising	1.59%
Don't know	5.21%

Q4 Which infrastructure impacts from sea level rise in Hampton Roads, if any, are you most concerned about? (Please choose ALL THAT APPLY) (N=1,631)	
Shoreline erosion and loss of land	69.04%
Habitat loss	56.96%
Private property damage or loss	74.74%
Damage or loss of public infrastructure	63.95%
Rebuilding of infrastructure	44.76%
Loss or damage of sewage and septic systems	55.43%
Higher storm surge	63.46%
Problems with stormwater drainage	70.20%
Other (please specify) _____	7.11%
Not concerned about any impacts	1.23%

Q5 Which quality of life impacts from sea level rise in Hampton Roads, if any, are you most concerned about? (Please check ALL THAT APPLY) (N=1,631)	
Business closures or reduced business activities	42.61%
Reduced military or Department of Defense presence	31.45%
Contamination of freshwater wells	51.26%
Increased frequency and severity of flooding	78.66%
Increased health risks (such as through water borne diseases, mold and mildew, etc.)	62.23%
Increased insurance rates	67.87%
Permanently flooded areas	53.34%
Loss of recreational opportunities	27.77%
Increased traffic congestion, delays, etc.	62.23%
Increased taxes to support measures to reduce flooding	51.62%
Shrinkage of population	17.90%
Loss of quality of life	52.91%
Other (please specify) _____	3.62%
Not concerned about any impacts	1.35%

Q6 Resilience refers to the ability to bounce back following an extreme event such as major flooding or a storm. Which of the following actions are most feasible for improving your community's resilience to sea level rise and/or flooding? (Please select UP TO 3) (N=1,629)	
Natural solutions (dunes and beaches, wetlands, oyster reefs, maritime forests and shrubs, etc.)	48.80%
Floodplain policy and management (preserve open space, manage development in flood-prone areas, higher standards for development or construction)	49.79%
Flood-proofing buildings (elevate whole or parts of building, flood vents, etc.)	29.71%
Flood warning systems and preparedness	24.68%
Relocation	8.90%
Levees/floodwalls/dikes	16.51%
Storm surge barriers (floodgate with opening to allow access)	23.23%
Improve drainage systems	48.50%
Educate residents on sea level rise and/or flooding	25.66%
None of the above	0.43%
I don't know	1.96%

Q7 Which of the following actions would help you adapt to sea level rise and/or flooding? (Please select UP TO 3) (N=1,625)	
Find out more about different adaption actions	42.71%
Talk to public officials about allocating resources for implementing adaption	29.97%
Learn more about what my city is doing to address flooding and/or sea level rise	61.05%
Talk to my family and friends about the problems	5.72%
Talk to my family and friends about how to adapt	5.97%
Learn what others in my community are doing to adapt	29.97%
Learn more about sea level rise and/or flooding	40.06%
Learn more about how to adapt	33.42%
None of the above	3.14%
I don't know	2.52%

Q8 Who do you think should take the lead to address the risks posed by flooding due to sea level rise in Hampton Roads? (Please select UP TO 3) (N=1,628)	
Federal government	44.53%
State government	72.11%
Local governments	80.59%
Affected residents	19.41%
Affected businesses	7.99%
Real estate developers	8.97%
Non-governmental or non-profit organizations	8.05%
Regional/local planning organizations	33.54%
Other (please specify) _____	2.21%

Q9 To reduce the damage from sea level rise and more severe storms and flooding along the coast, the government could build sea walls of reinforced concrete, steel, or boulders along the shore to protect infrastructure and buildings. The photo below shows a sea wall. Building sea walls along the shore has been done successfully in the past to reduce and/or prevent damage. Walls like this have often resulted in smaller beaches in front of the walls or, occasionally, the disappearance of those beaches. These walls are costly to build and maintain. Do you support or oppose the government building walls like this along shores where damaging flooding is likely to increase in the future due to sea level rise? (N=1,630)

Strongly oppose	14.11%
Somewhat oppose	21.84%
Neither oppose nor support	21.53%
Somewhat support	29.45%
Strongly support	13.07%

Q10 Sea level rise and storms can wash away sand and cause beaches to become smaller or to disappear. The government could replenish sand on beaches after they have been eroded. Adding sand to damaged beaches would allow people to continue to use the beaches and will protect infrastructure and buildings along the shore. Severe storms could cause erosion and the sand would need to be replenished regularly. Do you support or oppose the government replenishing sand on beaches? (N=1,627)

Strongly oppose	5.35%
Somewhat oppose	11.19%
Neither oppose nor support	14.38%
Somewhat support	37.92%
Strongly support	31.16%

Q11 Local governments can pass laws and regulations that dictate where new buildings can be built along the coast. These laws and regulations will reduce the number of buildings that are damaged by sea level rise, storms, and flooding. By reducing the construction of new buildings in these flood-prone areas, there may be a decrease in total property values of existing buildings, which may reduce the amount of money the government gets from property taxes from that location. Do you support or oppose the government passing laws and regulations to reduce the number of new buildings that people and businesses can build on the coast? (N=1,629)

Strongly oppose	2.70%
Somewhat oppose	6.20%
Neither oppose nor support	13.01%
Somewhat support	36.34%
Strongly support	41.74%

Q12 To protect people, infrastructure and buildings from damage from rising sea levels and storms, the government could put large mounds of sand and plants, called "sand dunes", along the shore. The photo below shows a beach with sand dunes and plants.   Having sand dunes along the coast can block people's views and access to the beach. Do you support or oppose the government building sand dunes to protect people, infrastructure, and buildings? (N=1,629)

Strongly oppose	1.78%
Somewhat oppose	4.97%
Neither oppose nor support	10.87%
Somewhat support	35.17%
Strongly support	41.21%

Q13 To prevent damage from storms and flooding from hurting people and businesses, the government can offer money to people and businesses who live and work near the coast to move inland. Paying them to move might save the government money in the long run, since the government (for example, through the Federal Emergency Management Agency) may pay to help people and businesses recover from storm and flooding events. Do you support or oppose the government offering money to people and businesses near the coast if they move further inland? (N=1,630)

Strongly oppose	9.94%
Somewhat oppose	16.63%
Neither oppose nor support	21.90%
Somewhat support	36.87%
Strongly support	14.66%

Q14 To prevent sea level rise, storms, and flooding from hurting people and businesses, the government can pass laws saying that if a building near the coast is seriously damaged by flooding or storms, no one can rebuild in that location. Laws like this will reduce the number of buildings built near the coast and will reduce the amount of money that the government gets in property taxes from that location. Do you support or oppose the government passing laws that limit rebuilding in locations where buildings were seriously damaged by flooding or storms? (N=1,628)

Strongly oppose	5.04%
Somewhat oppose	9.21%
Neither oppose nor support	14.43%
Somewhat support	38.14%
Strongly support	33.17%

Q15 Governments can change building codes and construction standards to reduce the amount of potential damage from sea level rise, storms and flooding. These laws would mean that people and businesses would have to comply with codes and standards that can result in higher construction and/or maintenance costs. Do you support or oppose the government changing building codes and having higher construction standards for all buildings in areas vulnerable to flooding and storms? (N=1,619)

Strongly oppose	1.67%
Somewhat oppose	3.77%
Neither oppose nor support	10.07%
Somewhat support	37.86%
Strongly support	46.63%

Q16 Property owners can take actions that reduce the risks of damage due to flooding from sea level rise. For example, homeowners can elevate their HVAC or water heater units, or install flood vents. Governments can encourage such actions by providing tax incentives. The tax incentives will reduce the amount of money that the government gets in taxes. Do you support or oppose the government providing tax incentives to property owners for taking action to reduce flooding and potential damage of sea level rise? (N=1,621)

Strongly oppose	3.33%
Somewhat oppose	5.24%
Neither oppose nor support	11.23%
Somewhat support	36.27%
Strongly support	43.92%

Q17 To protect public infrastructure from damage, the government could construct buildings, roads and sewer systems to better withstand rising sea levels, flooding and storms. This may be more expensive than using traditional construction practices, but may save money in the long run. Do you support or oppose the government constructing public buildings and structures to withstand or accommodate rising sea level, flooding and storms? (N=1,627)

Strongly oppose	1.48%
Somewhat oppose	2.77%
Neither oppose nor support	9.10%
Somewhat support	36.20%
Strongly support	50.46%

Q18 Government can use green infrastructure to reduce and treat rain stormwater at its sources by using vegetation, soil, and other elements. Examples of green infrastructure include rain gardens and planter boxes that collect and absorb runoff, and rainwater harvesting such as rain barrels and cisterns. Green infrastructure is designed to provide flood protection, cleaner water, and a habitat for existing wildlife. The photos below show a rain garden and cistern. Green infrastructure may incur higher planning, design, installation, construction, and operation and maintenance costs than current construction approaches. Do you support or oppose the use of green infrastructure? (N=1,630)	
Strongly oppose	1.47%
Somewhat oppose	2.09%
Neither oppose nor support	10.12%
Somewhat support	30.00%
Strongly support	56.32%

Q19 What is your gender? (N=1,619)	
Male	37.99%
Female	62.01%

Q20 What is your age? (N=1,633)	
Under 20	4.59%
20-29	21.92%
30-39	18.25%
40-49	14.08%
50-59	18.25%
60-69	14.27%
70 and over	8.63%

Q21 How would you describe your race/ethnicity? (N=1,613)	
White	68.82%
Black/African American	16.74%
American Indian/Alaskan Native	0.62%
Asian	5.21%
Native Hawaiian/Pacific Islander	0.81%
Multiracial	4.84%
Other (please specify) _____	2.98%

Q22 What is the highest level of school you have completed? (N=1,625)	
Some grade school	0.25%
Some high school	0.62%
High school diploma or GED	5.54%
Completed trade/professional school	1.66%
Some college	16.43%
Associate's degree	9.97%
Bachelor's degree	29.85%
Graduate degree (Master's, PhD, Doctorate, MD, JD)	34.09%
Other	1.60%

Q23 What is your annual household income? (N=1,605)	
Less than $15,000	8.85%
More than $15,000 to $30,000	8.91%
More than $30,000 to $50,000	14.14%
More than $50,000 to $75,000	16.57%
More than $75,000 to $100,000	16.45%
More than $100,000 to $150,000	18.01%
More than $150,000 to $200,000	6.73%
More than $200,000	3.74%
Don't know	6.60%

Q25 How long have you lived (in years) in Hampton Roads? (N=1,633)	
2 years and less	10.04%
Between 2 and 5 years	9.92%
Between 5 and 10 years	11.51%
Between 10 and 15 years	8.82%
Between 15 and 20 years	10.72%
Between 20 and 25 years	9.43%
Between 25 and 30 years	8.76%
Between 30 and 40 years	12.37%
Between 40 and 50 years	7.90%
More than 50 years	10.53%

Q26 What city do you live in? (N=1,633)	
Virginia Beach	21.92%
Norfolk	37.97%
Chesapeake	9.19%
Portsmouth	6.74%
Suffolk	2.88%
Newport News	6.25%
Hampton	11.57%
Gloucester County	0.67%
York County	0.61%
Poquoson	0.61%
James City County	0.73%
Currituck County	0.12%
Isle of Wight County	0.73%

Q27 Do you and your family own your home or apartment, pay rent, or have some other arrangement? (N=1,624)	
Own or in the process of buying	68.97%
Rent	28.57%
Other arrangement (please specify) _____	2.46%

Q28 Standard homeowner's or renter's insurance does not cover flood loss. Flood insurance is offered through the federal government's National Flood Insurance Program (NFIP). Do you have an NFIP flood insurance policy? (N=1,622)	
Yes	33.79%
No	52.96%
Don't know	13.26%