Sea Level Wise – A vibrant future for Virginia Beach

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Shanda Davenport, PE, CFM, AICP
Outline

- Three-pronged approach
- Virginia Beach’s resiliency stance
- Overview of Comprehensive SLR Study
Capital Improvement Plan

Synergized Activities

Stormwater Master Plan

Resilient Planning and Infrastructure

Water Quality

Sea Level Rise Comp. Study

Capital Improvement Plan

Synergized Activities

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Sea Level Rise Comp. Study
Moody’s Questionnaire to VB

• Does the existing/future CIP include spending for mitigation or resiliency?

• Has your governing body discussed the capital or financial implications of rising sea levels?

• Has there been an estimate on potential impacts from rising sea levels or flooding?

• Please discuss how flooding has impacted the city’s budget and how flood mitigation efforts may impact future budgets?

• Have there been any zoning /long-term planning adjustments downtown and along the waterfront to mitigate future flooding impacts?

• What is management’s current view on the potential impact/vulnerabilities in your community from rising sea levels and a heightened risk of extreme weather events?
Resiliency Viewpoint

“Ensure the vibrant future of Virginia Beach”

• Engage in Systems Thinking
• Achieve Multiple Positive Outcomes
• Maintain a Long-Term View
• Create an Accurate, Positive Community Image
• Ensure Sustainability
• Create Relationships and Partnerships
• Value and Promote Diversity
• Be Proactive and prevent problems
Flood Complaints

Ocean Park Flooding

During the November and December 2009 northeasters, extreme flooding due to abnormally high storm tides and heavy rainfall occurred which impacted the Ocean Park neighborhood, among others. The City of Virginia Beach commissioned a study of these occurrences and the Draft report from Parsons Brinckerhoff was received and made available in May 2010, may be viewed by clicking...

Virginia Beach looks for long-term Shore Drive flooding fixes

The Virginian-Pilot

Va. Beach residents seek answers about flooding

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What are the costs?

7-041 Central Resort District Drainage Imp

Total Project Cost: > $100M

- Study drainage issues and develop alternative solutions
- Review interim improvements to improve drainage in area around Baltic Avenue and 21st Street
- Current Programmed Funding $300K
What are the costs?

7-151 Eastern Shore Drive Drainage

- Drainage study completed July 2012 – June 2014
- Current Programmed Funding $18.9M
- Phases I and II design underway, Phases I and II construction not funded
- Phases III and IV not funded

Total Project Cost: > $70M
What are the costs?

7-028  Windsor Woods Drainage

- Drainage improvements to alleviate widespread repetitive storm water flooding
- Tidally influenced
- First Phase includes improvements to Presidential Canal and Northgate Ditch (Under Design)
- Current Programmed Funding $10.5M

Total Project Cost: $40M
Southern Watershed Challenges

- Low Lying Terrain
- Diverse Land Ownership
- Lack of Historical Water Elevation Data
- High Groundwater Table
- Regulatory Floodplain

Cost Estimate not yet available
Water Quality Challenges

Compliance

Issues

- Climate Change: ↑ Sea Level & Precip
- BMP Impacts
- Reduced Treatment Capacity
- DEQ Flexibility/Constraints

Water Quality Regs
Comprehensive Stormwater Master Plan

- Stormwater management and flood mitigation
- Stormwater quality improvement
  - TMDLs (TN, TP, TSS, bacteria)
- Regulatory compliance
  - NPDES MS4, TMDLs
- Sea level rise and tidal surge
- Capital improvement planning and funding
Comprehensive SLR/Recurrent Flooding Study

• Flood risk assessment
• Adaptation strategy formulation
  • Policy and Planning
  • Risk Aggregation
• Strategy evaluation
  • Feasibility
  • Return on Investment
• Watershed-based adaptation plans
  • Policy, Comprehensive Plan
  • Capital improvement planning and funding
Comprehensive SLR Study Approach

1. Sea Level Rise/ Recurrent Flooding Impacts
   Defining the problem

2. Adaptation Strategies
   Tailoring the solutions

3. Implementation
   Planning the actions
The Problem

Relative Sea Level Change Projections - Gauge: 8638610, Sewells Point, VA (05/01/2014)

- USACE/NOAA Low Rate
- USACE Int, NOAA Int Low
- NOAA Int High Rate
- USACE High Rate
- NOAA High Rate

8638610 Sewells Point, Virginia
4.57 +/− 0.24 mm/yr

Linear Mean Sea Level Trend
Upper 95% Confidence Interval
Lower 95% Confidence Interval
Monthly mean sea level with the average seasonal cycle removed

Year

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15
Selected Scenarios vs Federal Curves

Relative Sea Level Change Projections - Gauge: 8638610, Sewells Point, VA (05/01/2014)

- Evaluate for Adaptive Capacity
- Action

RSLC in feet (LML)

- 1.5 ft
- 3 ft


- USACE/NOAA Low Rate
- USACE Int, NOAA Int Low
- NOAA Int High Rate
- USACE High Rate
- NOAA High Rate
<table>
<thead>
<tr>
<th>Life Cycle Alignment</th>
<th>Time Horizon/Time Period</th>
<th>SLR Value</th>
<th>Relevance</th>
<th>Use</th>
</tr>
</thead>
</table>
| Municipal Planning        | 20-40 years 2035-2055   | 1.5 ft    | Comprehensive Plan & Outcomes                                                             | Vulnerability assessment  
Basis for evaluation of all adaptation strategies |
|                           |                          |           | Short end of Commercial and Utility life-cycles                                           | Key planning value                                                                                      |
| Critical Infrastructure   | 50-80 years 2065-2085   | 3.0 ft    | Utility Infrastructure life-cycle  
Transportation infrastructure lifecycles  
Residential structure lifecycles | Secondary vulnerability assessment to provide insight into long-term risk  
Basis for long-term infrastructure decisions  
Evaluate cost-effectiveness of additional protection for adaptable resilience strategies |
| Long-term awareness       |                          |           |                                                                                            |                                                                      |
| Adaptive Capacity         |                          |           |                                                                                            |                                                                      |
Phase 1: Impact Assessment

• How will vulnerability change with increasing flood levels due to SLR?
• Where will we see the flood footprint expand?
• How much more frequent will flooding occur?
• What assets are vulnerable?
• How will losses change?
• How will insurance requirements change?
• What assets are at the highest risk?
Assessment Conditions

- Tidal
  - Future permanent inundation

- Nuisance
  - Repetitive losses/issues

- Storm Surge
  - Regulatory, disaster scenarios, economics
Risk Assessment Focus Areas:

- Shoreline/Land Vulnerability
- Building Exposure
- Future Development
- Stormwater
- Public Utilities
- Groundwater
- Agricultural
- Societal
Insurance Economic Analysis

• Current Conditions:
  • Policy/claim concentration in and outside the SFHA
  • Identify under-insurance issues on current policies in force
  • Allow estimation of risk estimation

• Increased Policy Penetration:
  • Tools to encourage flood insurance penetration
  • Prioritize risk mitigation or transference for current assets at risk

• Future Conditions & Regulatory Changes:
  • Identify and prioritize mitigation of high risk assets
  • Changes to insurance liabilities and residual risks
  • Promotion of increased flood insurance penetration outside existing SFHA

• Flood Insurance Affordability:
  • cost burden of flood insurance to socio-economic vulnerable areas
Loss Estimation Process

Flood Hazard Data

Data Improvement

Model Built Environment

Perform Damage/Loss Estimation

Assign Depth Damage Function

Summarize Results

Evaluate Economic and Social Impacts
## Environmental, Economic Diversity

<table>
<thead>
<tr>
<th>Planning Area/ Natural Resources</th>
<th>Defining Characteristics</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynnhaven / Tidal sheltered bay, estuarine, fringing marsh</td>
<td>Mixed residential, military, commercial, lower elevation properties with high tax base. High quality natural resources. Assets at vulnerable elevations.</td>
<td>Addressing repetitive losses from recurrent flooding and preservation of low-lying natural resources.</td>
</tr>
<tr>
<td>Oceanfront / Ocean, headland beaches, tidal inlet, bay</td>
<td>Dense commercial and residential development. Tourism as primary economic driver. Re-development opportunities. USACE Civil Works flood risk reduction project.</td>
<td>Protecting existing development and economic base while instilling resilience as a keystone in re-development.</td>
</tr>
<tr>
<td>Elizabeth River / Estuarine, fringing marshes</td>
<td>Dense residential, commercial, industrial development. Aging infrastructure.</td>
<td>Upgrading infrastructure and maintaining water-based industrial economy with higher sea levels.</td>
</tr>
<tr>
<td>Southern / Ocean, barrier beaches, bays and extensive marshes</td>
<td>Light residential, military, rural, recreational, waterfowl and land preserves. Agriculture important economic concern. Low elevation gradients.</td>
<td>Establishing land use strategies that preserve resources and limit new development and infrastructure in areas susceptible to future flooding.</td>
</tr>
</tbody>
</table>
Phase 2: Adaptation Strategies

- Objective: Develop, assess and prioritize a range of adaptation strategies through feasibility and performance metrics that incorporate stakeholder input to inform climate adaptation and resilience plans across the City’s diverse geography.

- What strategies are needed to address the risk portfolio?
  - What policy has to be created or changed?
  - How can land use be managed?
  - Where do structural solutions make sense?
  - What’s the return on investment?
  - What strategies work best?
  - When should implementation occur?
Adaptation Tools

<table>
<thead>
<tr>
<th>Planning Tools</th>
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<tbody>
<tr>
<td>Update Comprehensive Plan</td>
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<tr>
<td>Update Hazard Mitigation Plan</td>
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<tr>
<th>Regulatory Tools</th>
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<tbody>
<tr>
<td>Extend Floodplain Boundaries and Freeboard Requirements</td>
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<tr>
<td>Designate Targeted Redevelopment</td>
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<tr>
<td>Require Flood-proofing</td>
</tr>
<tr>
<td>Encourage Cluster Development</td>
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<tr>
<td>Require Setbacks, Buffers, or Rolling Conservation Easements</td>
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<tr>
<td>Restrict Rebuilding in High Hazard Areas</td>
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<tr>
<td>Require Mitigation through Site Plan Review</td>
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<tr>
<th>Incentives and Fees</th>
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<tbody>
<tr>
<td>Create Transferable Development Rights Program</td>
</tr>
<tr>
<td>Use Conditional Zoning, Exactions and Impact Fees</td>
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</table>
Objective: Integrate the best-performing adaptation strategies in actionable watershed-based climate adaptation and resilience plans that include funding and monitoring mechanisms to stimulate follow-on implementation.

- How do we move forward with the preferred solutions?
  - What are the costs and design features?
  - How do we fund?
  - What is our action plan for each watershed?
  - How do we get public buy-in, sponsors, and/or regional support?
Outreach - Integration

• Engage – Coordinate – Leverage

Partners:

• HRPDC
• ODU/Virginia Sea Grant
• Georgetown Climate Center
• NOAA
## Schedule

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
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<tbody>
<tr>
<td>Q2</td>
<td>Q1</td>
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<td>Q3</td>
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<tr>
<td>Q1</td>
<td>Q4</td>
<td>Q1</td>
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### Lynnhaven
- Risk Portfolio (In-Kind)
- Objective 1: Strategy Evaluation
- Objective 2: Adaptation Plans

### Southern
- Risk Portfolio (In-Kind)
- Objective 1: Strategy Evaluation
- Objective 2: Adaptation Plans

### Elizabeth River
- Risk Portfolio (In-Kind)
- Objective 1: Strategy Evaluation
- Objective 2: Adaptation Plans

### Oceanfront
- Risk Portfolio (In-Kind)
- Objective 1: Strategy Evaluation
- Objective 2: Adaptation Plans

### Objective 3: Outreach, Coordination, Dissemination
Questions?

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