NY Stakeholders' Interaction and Feedback on a Coastal Protective Strategy Optimization

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Abstract

As the sea level rises, it is alarming that the threat from flooding induced by tropical cyclones would cause more severe damages to coastal regions worldwide. In order to address this threat, optimizing coastal protective or mitigation strategies is necessary, given limited resources. The optimization methodology must incorporate feedback from stakeholders for practical use. Multiple interviews were conducted by engineering model developers and social scientists with stakeholders who have first-hand knowledge and varied backgrounds in New York. The protective strategies have been tuned to the critical infrastructure's particular and contextual risks due to flood hazards by engaging and integrating stakeholders' knowledge on the interdependency of the infrastructures and other aspects after the first interview. The second interview was conducted for further model improvement.

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Abstract

As the sea level rises, it is alarming that the threat from flooding induced by tropical cyclones would cause more severe damages to coastal regions worldwide. In order to address this threat, optimizing coastal protective or mitigation strategies is necessary, given limited resources. The optimization methodology must incorporate feedback from stakeholders for practical use. Multiple interviews were conducted by engineering model developers and social scientists with stakeholders knowledgeable about different aspects of flooding and critical infrastructure in New York City. Data from the first set of interviews were used to elicit stakeholders' knowledge on the risks posed by flood hazards to interdependent critical infrastructure. This knowledge was then synthesized and integrated into the engineering model and optimization. The second set of interviews was conducted for further model improvement.

Overview of Results from 1st Set of Interviews

Hurricane Sandy's Key Infrastructure Impacts and Concerns about Future Flood Risks

- Transportation service disruption - short and long term (mentioned by interviewees #1,3,4,5,6,7)
- Flooding of subsurface infrastructure, (e.g., subway, building mechanicals) (#1,3,5,6,7)
- Power outage in Manhattan, including specific areas (#1,3,5,6,7)
- Long-term damage to waste water system (#1,6)
- Local economic impact (business disruption) (#1,3,7)
- Power outage and subway transportation, e.g., keep subway pumps running, subways are electrically operated (#3,5,7,8)
- Sea-level rise and climate change (#1,2,4,7,8,9,10)
- Aging above ground infrastructure, especially close to coast (#6,7,8,10)

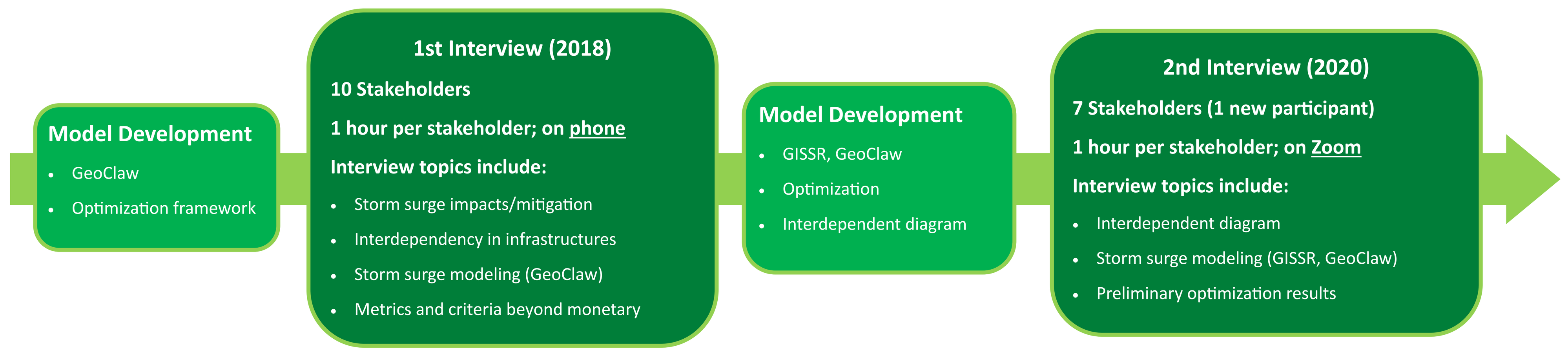
Potential Flood Mitigation Strategies

- Not a single solution (#1,6,7,8)
- Regional storm surge barrier (#1,2,3,4,6,7,9)
- Berms (#1,2,3,5,7)
- Elevate facilities, infrastructures, and mechanicals (#2,4,5,8,9)
- Restore natural ecosystem and wetlands (#2,4,7,10)

Metrics and Criteria beyond Monetary, to Incorporate into Optimization

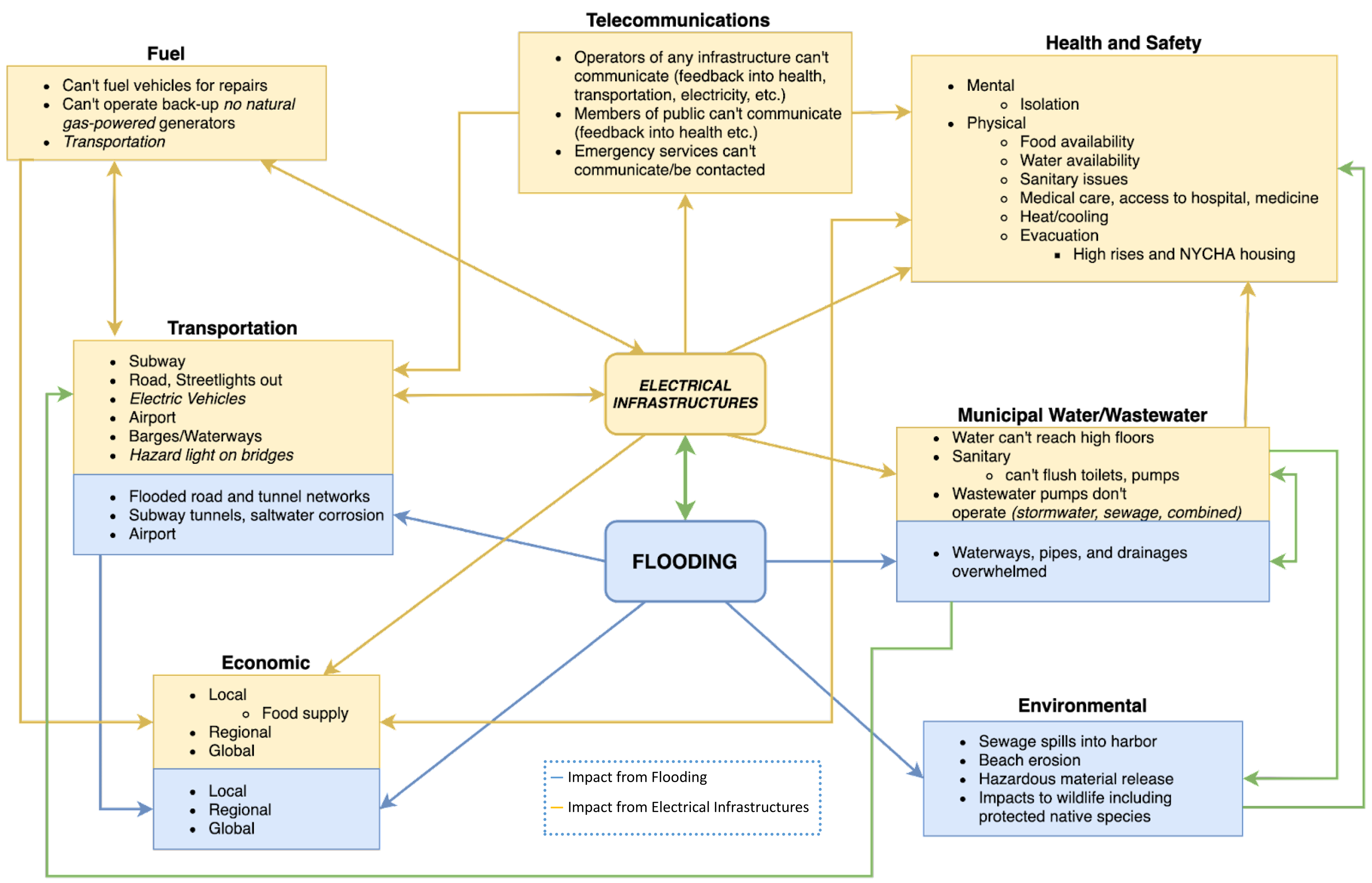
- Impacts on people, including health and safety (#1,4,5,6)
- Services for vulnerable populations (#1,6,7)
- Restoring service (e.g., power, transportation) (#2,3,8,10)
- Sewer backups and overflow (#2)
- Operational service loss (#1,7)

Stakeholders' Interviews

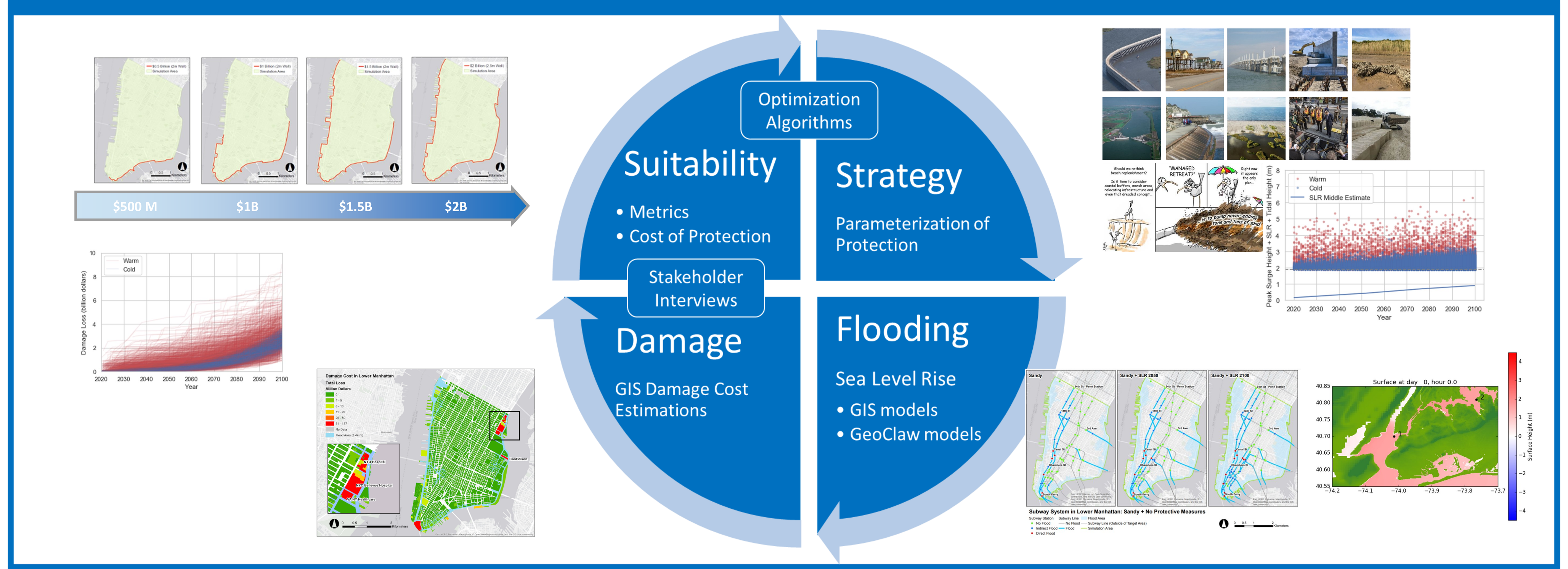


Stakeholders Interview Number and Sector:

Stakeholder	#1	#2	#3	#4	#5	#6
Sector	Emergency Management	Water Management	Transportation	Local Government	Transportation	Local Government
Stakeholder	#7	#8	#9	#10	#11	# joined both sets of interviews
Sector	Local Government	Energy	Transportation	Housing	Emergency Management	



Optimization Methodology



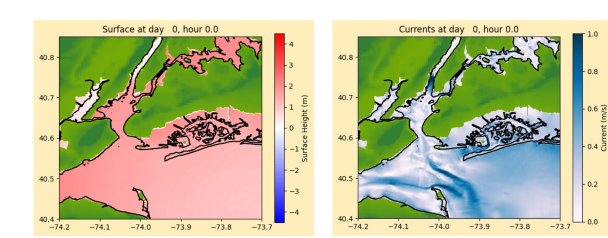
Overview of results from 2nd Set of Interviews

Comments on Interdependent Infrastructure Diagram

- It covers a lot and makes sense (all interconnected) (mentioned by interviewees #1,2,4)
- Add more components (e.g., sewage, pumps, electric vehicles, hazard lights) (#2,3,7,10)

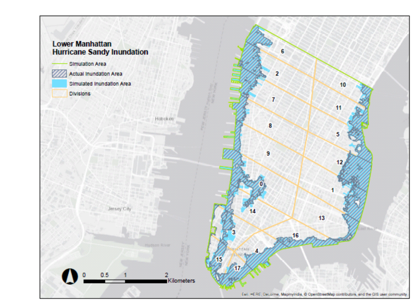
Suggestions on Storm Surge Modeling

GeoClaw



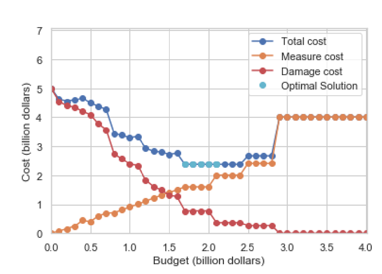
- The animation of how storm unfolds looks real (#2)
- The difficulty is to know how exactly wet it is (#1)
- Currents are not much of concerns (#1,3,7)

GISSR



- Fast model like this is very useful (#2,3,4,7)
- Add inland mitigations (#1,7)
- Add sewage components (#2)

Comments on Preliminary Optimization Methodology and Results



- The model is great; it will help in decision-makings (#1,2,4)
- The construction cost should be updated (maybe refer to ESCR & BMCR projects) (#1,10)
- Try different scales (e.g., neighborhood level) (#10)
- Add more strategies (e.g., buy-out, sealing openings) (#3,4)
- Consider different time horizon (e.g., 24 or 48 hours) (#10,11)

Additional Comments

- Many funding resources require to protect vulnerable populations (e.g., the Housing Urban Development), and sometimes resilient efforts can be conflict (#4)
- It is difficult to convince the general public about future risk; they do not believe it (#4,10)
- **Everyone has their own idea of what optimal is (#7)**
- Integrated model that runs at any given time for decision making (#2)
- Cost change due to pandemic (#3)

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- Miura, Y., Dinenis, P. C., Mandli, K. T., Deodatis, G., & Bienstock, D. (2021). Optimization of coastal protections in the presence of climate change. *Frontiers in Climate*, *3*, 83.
- Miura, Y., Mandli, K. T., & Deodatis, G. (2021). High-Speed GIS-Based Simulation of Storm Surge–Induced Flooding Accounting for Sea Level Rise. *Natural Hazards Review*, *22*(3), 04021018.