Flooding Dynamic Modeling for Optimized Planning of CORE MPO Transportation Infrastructure Systems

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Presentation Outline

- 1. Financial Stewardship & Resiliency Planning
- 2. Sea Level Rise (SLR) Scenarios
- 3. Stormwater Modeling
- 4. Coastal Inundation Modeling & Roadway Vulnerability Assessment

Social Vulnerability

- What is Social Vulnerability?
- The characteristics of individuals and populations affects their ability withstand or recover from the negative impacts of natural disaster or other disturbance.

• Poverty, lack of education, limited access to transportation, and other limiting characteristics can make people more vulnerable.



Hurricane Sandy -Breezy Point, NY

Pauline Tran - Photographer

Social Vulnerability Index (SVI)

- Assesses 16 variables in 4 categories associated with enhanced vulnerability to environmental threats.
- Based on US Census Bureau data complied by the Centers for Disease Control (CDC ATSDR).

CDC SoVI variables used. CDC utilizes data from the American Community Survey.						
Below 150% Poverty						
Unemployed						
Housing Cost Burden						
No High School Diploma						
No Health Insurance						
Aged 65 & Older						
Aged 17 & Younger						
Civilian with a Disability						
Single-Parent Household						
English Language Proficiency						
Hispanic or Latino (of any race) Black or African American, Not Hispanic or Latino Asian, Not Hispanic or Latino American Indian or Alaska Native, Not Hispanic or Latino Native Hawaiian or Pacific Islander, Not Hispanic or Latino Two or More Races, Not Hispanic or Latino Other Races, Not Hispanic or Latino						
Multi-Unit Structures						
Mobile Homes						
Crowding						
No Vehicle						
Group Quarters						

Adapted from: https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/pdf/SVI2020Documentation_08.05.22.pdf





State-Level SVI Analysis

Highlights increased vulnerability of more densely developed area.



Census Tract-Level SVI Analysis

• At the census tract, the SVI variables highlight more specific areas where local vulnerabilities should be considered.

• SVI variables are unavailable at any finer scale, but this analysis can inform specific demographic inquiries.



Connections between SVI and Road Vulnerability

• Many of the most vulnerable road segments are in the most vulnerable communities.

• Identifies potential opportunities to direct investments where they may most impact public safety.



Resilient Infrastructure Funding

Developed a Technical Memo describing appx. **40 grant** funding opportunities to support improving resilience emphasizing use of natural and nature-based features.

Grant/Program teams	Canadonies of a maturage	Agricy	STATE FOR THE	Papar	anglority	Descars.	Application Comments	America the Deautiful Challenge	Environmental	NEWE	Federal	America the Reautiful Challenge funding allows applicants to implement landscape-leve	State government agencies, territories of the United States,	Closed for FY 2023, Pre-	
Rebuilding American I inhertructure with Statianability and Equaty (RAISE) Grants	Transportation	US Department of Transportation (USDOT)	Pedenki	Beloalding American Interstructures with Dashinabidity and Equity(UADE) Control and for antice transponsition interimitary target points that will improve safety: environmental restanability quality of its probability and community connectivity: economic competitivenes and cogniturativi solutioning totations state of good repart; partnership and collaborations; and innovaction.	Date and the District of Columbias anythemitery or possession of the United States; a unit of Goal government a public agency or publicly chartered authority established by one or more States; aspecial purpose district or public authority with a transportation function, including a port authority.	FT socyappiontone are done, but Raise Grant funds will be dispersed yearly until 2027						proposal that address conservation and public across nords. Project orner cumilators burnels to final and wald its, sported curbon expected trained and benefits, suggest with and benefit underserved communities, sugport community across to nature, and help safeguard ecosystems through conservation and resilience focused and nature- band solutions.	Non-profit 504(c) organizations, local governments, manacipal governments, Indian Tribes, and educational institutions.	Proposal's usually due in April each year.	
SM ART Orietts - Justionap	Transportation	USDOT	Federal	Othergebrang Mobility and Revolutionizing Transportion (IMART) are availed to conduct demonstration projects focused on advanced many other commanity technologies and systems to improve transportation efficiency and addry. The papers of the IMART Equity and Justice an Interaction is in the approximation and common promotions investite half commodations are available and projectsDate well common protections investite half commodations are available.	State, political subdiversion of a State, public tenzest agency or authority, metropolitan planning organization	Sep 29th, 2023		Publing Resident Infrastructure and Communities Program	Environmental	FEMA	Pedemi	BBC program supports takes and look communities to undertake haved mitigation projects to reduce the statis from statement and haved. Support project designed to increase residences and public address reducing using and reduce damage and destruction to property, critical services, facilities, and infrastructure	(Ratne)	Looke like they dain't do this is acay but in the few years before they had applicants and funding? Not sure if this is still going.	
Promoting Resistent Operations for Transformative, Efficient, and Cost- Saving Transportation (PROTECT)	Transportation	National Wildlafe Federation (NWF)	Federal	departies to all populations in a project area." PROTECT Discretionary-Orante Program finds projects on a competitive basis that address the clambe cisis by tomproving the availance of the surface transportation system, including highways, public transportation, porty, and internity passenger real.	State and local governments, metropolites planning organizations, special purpose distincts or public authorities with a transportation function.	\$ 300M available for FT 2024, NOPO has not been published yet,		Flood Histgation Assertance	Enveronmentel	Federal Emergency M asagmont Agency (FEM A)	Pedechi	provides hundigative projects that reduce or examinist the resk of repetitive fixed during to building insured by the national flood insurances programs can support community flood matigation projects, individual flood instigation projects, provide project scoping and technical assistance as well as flood has and mitigation planning.	a fante end soone go vertamente	Nothing posted for next year, but normally opens at the end of September for the next year fiscal year with apps due at the end of jarnawy.	
Discretionary Grans Program		4.4.40		Forume cased solutions, start as protected version counters and coverus, are englishen this programs. The Programsalies seeks to award projects that well increase equitable access to project benefits.				Hazard Mitigation Grant Program	Environmental	FEMA	Federal	Provides funding to state, local, tribal, and territorial governments to support hazard mitigation planning and mitigation activities to reduce future disaster losses in their overnmented.	State governments (local governments apply through the states; local governments can apply on behalf of private brainwave (landowners).		Requires FEMA approved has and mitigation plan
Promoting Resistent Operations for Transformative, Efficient, and Cost- Saving Transportation (PROTECT/Formula Program	Tresportation	NWP	Pedros	Same purpose as the FROTECT becreationary clearly program (other FROTECT umbrella). The PROTECTF formula Programs designed for Date agencies to help communities and first responders prepare for national disasters and enterne weather intensified by climate change. Nature-based solutions, such as protective welland	States and State Agencies	3 LogB avecade for FT 2024, NOPO has not been published yet.		Longlesf Landscape Stewardship Fund	Environmental	MEME	Federal	If there is a longlest pine population that will be effected in this area, can receive grant money for "enhancing, establishing, and mainteiring longlest pine end/or bottomland hardwood forests"	state and local governments and agencies, manicipal governments	Closed this year, has opened in February for that year in the past	
National Culwert Removal, Replacement & Restoration Granits	Transportation	TODEU	Federal	buffers and culverts are eigs bit for the program. An annual competitive grant program that awards finding for projects to replace, memore, and repart colverts or wars in a way that measurgfully improves or restores fully assays for anadromous field, (field born in freshwater who spend most of their lows	States and Municipalities	Apps due annually in February	'	National Coastal Wetlands Conservation Grants Program Section 3x0 Noncount Source Grant	Environmental	USPWF	Federal	Provides funding for the restoration, enhancement, or management of coastal vetlands ecceptemas. Section and Morroant assume Clause Presence recorder fundance for investmenters	Coastal state governments and agencies	Yearly, closed this year but should open in January for 2024 (due dates are in June) Applications due based on	
				in safewater and return to freehwater to spawn, such as safirated and increases culwert and wair resilience to increased flooding events due to the impacts of climate change or weather and proceptations.				Program				activities that restore impaired waters or protect unimpaired and high quality waters.	paras (all set he j d set e	Georgia's Statewide Nonpoint Source Management Plan	
Neighborhood Access and Equity Program	Transportation	USDOT	Federal	Provides grants to help reconcrete neighborhood divided byindnetrustnee through lookly tailend projects and additionally across to mitigate or remediate negative impacts on human and natural environment.	states, units of local government political subdivisions of states, special purpose dutract or public authority with immerportation function, metropolitican planning orga- metro and found formations.	Apps due annually at the end of September, NOFO published around July	6	Watershed and Flood Prevention Operations Program	Environmental	US Department of Agnositure (USDA)	Pedemi	Program offers insenses and sectances assume for websited protection, wher quality improvements, erosion and sediment control, and habitat enhancement	Courty agencies, soil and water conservation districts, Boo preventions and flood courted districts, or other subanits of state geovernments with authority and capacity to cerryout, operate, and maintain installed works of improvement.	Continuous application cycle	
Reconnecting Communities Filot	Transportation	USDOT	Federal	provises because instanting cases may be used by release an accurate on the standard strength transportation model. Although an information projects are an analogable use of finada. JUster may brandler golv of their technical assistance funds from their STBO funds to provide technical assistance for PROTECT grants. Pleasing and construction geneta are available under the RCP program to address	States and local governments, Metropolitan planning orgo,	at or and quarter of each fiscal year, determined by State Due in October anzually	1	Environmental Jurice Collaborative Problem Solving (EJCPS)	Environmental	SPA .	Federal	Program provides financial assistance to organizations working to address look environmental or public health issues in their communities. The program assists recipients in building collaborative partnerships withother stalesholders (e.g., look buildings and industry, look givernment, nucleido servers provides, academics, etc.) to	Community-based nonprofitorganizations or a partnership of community-based nonprofit organizations are eligible for funding.	Applications are due annually in April	
Program (RCP Program)				infinitructure barriers, resonance commanities, and improve quality of lab. Bigble projects can include high-quality public transportation and infinitructure removal. Natural infinitructure, labe linear pasks and trails, roadway molesigns, complete street	non-profitorge			Processory Coastal Decision of David	Protection	MPAR	Defend	develop solutions to environmental or public health issue(s) at the community level. Driverting nature, hand entreption environt that achieve dual reserves make (s) the	States units of local assessment rolitical solutions of	Depinder renovan that is active	
Water Infinitructure Finance and Innovation Act (WIFIA)	Transportation	EPA	Federal	conversions, and main street revitalization, also qualify for funding. Designed to fast-track water, waterwater, and stormwater infrastructure funding by providing long-term, low-cost, supplemental credit assistance in the form of direct loar	Local, state, trabal, and federal government entries are all eligible recipients, including partnerships and joint	Submit letter of interest to EPA considered on rolling basis	·					project benefits coastal communities by reducing impact of future storms and other natural heards to properties, community infinitructure, assets of economic importance, and health and safety assets and (2) enhances ecological integrity and economics functionality to enhance full hand wild is halted.	states, special purpose district or public authority with transportation function, metropolitions planning orga	onkywith supplemental disaster appropriation, application cycles and details are subject to change.	
Fish and Wildlife Service Coastal Program	Environmental	US Fiels and Wildlife Service (USFWF)	Federal	or ison guarantees. The U.S. Fish and Wildlife Service (Brovice) Coarts! Program is a voluntary, community based program that provides technical and firmancial assistance through cooperative	 State and Local Governments, Public and State institutions of higher learning, nonprofite, individuals 	Sep 30th, 2023	Over for 2023, but is an annual program so should be	Wetland Reserve Easement	Environmental	USDA	Federal	Part of Agricultural Essemant Program, provides financial and technical assistance to help conserve wellands and their mixed benefits.	Individuals, state and local governments	Apply anytime through local USDA service center	
				agreements to coastal communities, conservation partners, and landowners to restore and protect fish and veldifie babitst on public and private lands.			opportunities in 2024.	Five Star Wetland and Urban Waters Restoration Program	Environmental	NFWF	Pederal	Joint collaboration between the National Fish and Wildlife Federation, EFA, and USD A and provides financial assistance to grantoschap for welland, formet, roperat- and coartal habitar reformation, formaring management, outreach and stewardshap with a particular focus on water quality, watershads and the habitate theysupport.	State and Local Governments, acadmeic institutions, and non-profits	Doe in Jamaeyan maily	
Coartal Habitat Restrention and Resilience Grazis for Tribes and Underserved commanities	Environmental	National Constance and Atmospheric Administration (NOAA)	Pedeni	The principal objective of this funding opportantity is is support opportunities	Underserved communities, or entities that partner with tribes, tribed centities, and/or underserved communities such as institutions of higher education, non-profit organizations, commercial (for profit) organizations (U.S. territories, and state, local, and Natwe American and	Dec 19th, 2023		Georgas Outdoor Stewardship Program	Environmental	GA.Dep. Of Natural Resources	State	Duppened for the purpose of proveding stawardship to state parker, state lands and waldlife management areas; to support local parks and tradis; and to protect critical conservation lands.	Local governments, recreation authorities, state agencies and NOOs with conservation core mission	Pre-application doese Oct 13	
C2M Habitat Protection and	Environmental	NOAA	Federal	burntomes, coastal storms, flooding, and sea level rise. Projects must be within the coastal ione management boundary or coastal watershed	Alaska Native tribal governments. The Georgia Coastal Zone Management Program would be	Jan 10th, 2024		Program		Protection Initiative (REPI)/ Office of Local Defense Community Cooperation (CLDCC)		community infrastructure, supports so of a military installation, to enhance military value, installation resilience, and military family could resel fife.	profit, member overaed utility services are eligible, and then utilities may partner with a state or local government as a subrecisient.	2024 in March-April	
Restoration Bipartisan Infrastructure Law (SIL) Competition				county. Eligible project types include habitat restoration; habitat restoration planning engineering, and design; ecception conservation; and program capacity support.	primery applicant, but funding could be passed to other partners through them.			Installation Resilience Program	DoD	REFI - OLDOC	Federal	The CLDCC's Installation Residence programpresents states and communities with the opportunity to partner with their local	States, counties, manicipalities, other political subdivisions of a state; special purpose units of a state or local	Each year (typically in Spring); closed this year.	
National Oceans and Coastal Security Fund	Environmental	NOAA	Federal	National Coartal Resilience Fund (NCRF) reviores, increases and strengthene natural infinitructure to protect communities while also enhancing habitats for fish and wildlife. Emphasis on natural and nature based features.	Non profits orga, state and territorial government agencies local governments, municippal governments, education mathotoca.	 Currently 2023 funding is close but allocted \$492 million over years. 	ed, Projects "in the vicinity of" a 5 DoD installation can qualify for up to \$15 million of matching funds.					imitatiations and the MaineyService to support the corparing paraneng, and implementation actions necessary to faster, protect, and enhance the sustainability of installations. It merges previous installation resilience and compatible use (formerly a Joint Land Use Stavid secrets into one handler remomenced many.	go waranest; go waranest;	come from Installation Commanders	
Imperimetornational Paoline Grants	LEVAPOLETIKIEN	NUMA	24000L	The periodipal objective of this solutions is its support multiantimutation is notice resolutions incycled that multine manning, which and the constraints and the completence, using approaches that enhances commanyly and ecceptences. Hence to dimete baseds	Figure excession, non-prome, commercial (or prom) organization, U.E. territories, and state, look, and tribal governments	167 170, 2023	focus is consideration if the focus is considerative, not super clear if that would fit under this would probably need some creative writing	Continuing Authorities Program	DoD	US Army Corps of Engineers	Federal	CoPP is a group of rank legislative surface velocity to UDACE can plan, design, and implement contain types of velocitorators projects without congressional authonation. Can do project for emergency treatmank and schemissing protectors back erossion and harmonic and storm damage reduction; regional estiment management and beneficial users of design in schemist is quarket converting retroted	States, local governments, and agencies	No set timeline. Apply to CAP program when you have an eligible project	
National Coartal Reellemor Pund	Endronnvertal) IF WF	Federal	The National Coatal Resistance Fund negotes the implementation of nature-based polations to enhance the resistance of coatal commanders and coorsystems to these thanks. We strategically inner in projects that construct creative coatal habitat the increase the capacity of commanders and habitats to withstand and recover from disruptions and adapt to changing erestrumental conditions. Observy focus on nature have down form)	Otate, political subdivision of a Slote, public transit agency or softwority, metropolitan planning organization t			Special Purpose Local Option Sales Tax	State and Local Funding	Local Government	State	Special Purpose Local Option Soles Tarc(SPLCGT) - sh sales tax that is used to final copital estisyprojects' and asthonized by Os ustryBoard of commissioners and enabled through wher referendum. Capital OxfayProjects are major, permanent, or local lovel improvements or bettermentsinclude Luttor tarint do p. roda, streets.	To levya ISLOT, a municipalitymust be a "qualified" manacipality under $O.C.G.A.5, d \ominus \Theta$ soc(a). To be "qualified" a municipalitymat offer at least 30 fibs following services: Law enforcement, Pure protection and	N/A	
Cimate Resilence Regional Challenge	Environmental	NOA	Føderal	Baports graves for projects that back the reading of outsits constantion to network weaklow and impacts of classical backgravity (main leaf network) (constantiation to design d) registed a classical backgravity and transported provide the research afternoon neutring performations and many outside constantiation down to action to all implementations of many and adaptation actions (during projects to implement, coordinated adaptation efficient).	Coastal states, courses, cates, or other political inded visions of a coastal state or territory, statisticors of lagher education, non-profit orga	Closed that year, will likely also open sometime next year (application deadline for 2023 was end of august)						lendge mad deur engewennetzt jangewennet of undere veter deningeljoù wet reparis/totter meint ensemser/br provention, auf meijne kolde formn veter deninge projects.Can be und to mpair roeds/street daraged or destroyed by naturi daater.	safety: Solid water management, Road and street construction or maintenance, Water supply or distribution, or both, Waterseafer treatment, Stormwater collection and disposal, Electric or gas validay services, Electronic oter, Planarag and basiling/housing/planakage/service.		
North American Wetlands Conservations Grants: US Standard	Environmental	USFWF	Federal	Grazits program to support forthering goals of the North American Wetlands Conservation Act; focus is on enhancement/restoration/portection of wetlands for the benefit of all veltands-associated migratory birds		Closed in July this year, expects to open early next year	bed	Transportation - Special Purpose Local Option Sales Tax	State and Local Funding	Local Government	State	T-SPLCGT- can be an additional tax on top of the SPLCGT, up to sN-additional for the purpose of supporting transportion posjects (roads, bridges, etc) and can be used for improvement/repair	Same ai a SPLOST	Ы/Л.	

Resilient Infrastructure Funding

Grant/Program Name	Categories of Funding	Agency	State/Federal	Purpose	Eligibility	Deadline	Additional Comments
Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants	Transportation	US Department of Transportation (USDOT)	Federal	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants are for surface transportation infrastructure projects that will improve: safety; environmental sustainability; quality of life; mobility and community connectivity; economic competitivenes and opportunity including tourism; state of good repair; partnership and collaboration; and innovaction.	States and the District of Columbia; any territory or possession of the United States; a unit of local government; a public agency or publicly chartered authority established by one or more States; a special purpose district or public authority with a transportation function, including a port authority	FY 2023 applications are done, but Raise Grant funds will be dispersed yearly until 2027	
SMART Grants - Justice40	Transportation	USDOT	Federal	Strengthening Mobility and Revolutionizing Transporation (SMART) are awarded to conduct demonstration projects focused on advanced smart city or community technologies and systems to improve transportation efficiency and safety. The purpose of the SMART Equity and Justice40 Initiative is, "to award projectsthat will create proportional impacts to all populations in a project area, remove trnsportation-related disparities to all populations in a project area"	State, political subdivision of a Sate, public transit agency or authority, metropolitan planning organization	Sep 29th, 2023	
Promoting Resliient Operations for Transformative, Efficient, and Cost- Saving Transportation (PROTECT) Discretionary Grants Program	Transportation	National Wildlife Federation (NWF)	Federal	PROTECT Discretionary Grants Program funds projects on a competitive basis that address the climate crisis by improving the resilience of the surface transportation system, including highways, public transportation, ports, and intercity passenger rail. Nature-based solutions, such as protective wetland buffers and culverts, are eligible for this program. The Program also seeks to award projects that will increase equitable access to project benefits.	State and local governments, metropolitan planning organizations, special purpose districts or public authorities with a transportaiton function	\$300M available for FY 2024, NOFO has not been published yet.	

Sea Level Rise Scenarios

Year	CRD Low (ft)	CRD High (ft)
2050	1.23	2.18
2075	2.14	4.08
2100	3.28	6.56

SLR scenarios were obtained from the Chatham County Stormwater System Sea-Level-Rise Vulnerability Assessment (2020)

Stormwater Drainage Modeling

- Considerations
 - enough stormwater infrastructure data
 - Direct connection to Savannah River or tidal creek
- Opportunity to expand to the entire county
 - Employ a more robust model



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Stormwater Drainage Modeling

Stormwater Management Model (SWMM)



https://www.epa.gov/water-research/storm-water-management-model-swmm

2019 GA Coastal DEM (Elevation NAVD88, ft)



Road Network (Elevation NAVD88, ft)



1% AEP Simulated Water Levels (NAVD88, ft)



Roadway Vulnerability

- Low: The Depth Above Road was not within 3 feet of the road.
- Moderate: The Depth Above Road was between -3 and 0.
- High: The Depth Above Road exceeded 0.



Roadway Vulnerability – 1% AEP (712 miles)



Roadway Vulnerability – Present Tides (142 miles)



Roadway Vulnerability – CRD High 2100 (6.56 ft, 567 miles)



SVI + 2050 High SLR Road Vulnerability



Roadway Vulnerability

Scenario	Moderate Vulnerability (miles)	High Vulnerability (miles)	Total (miles)
Present-Day Tides	50.7	91.0	141.7
Tides 2050 DNR Low (1.23 ft)	47.5	151.0	198.5
Tides 2050 DNR High (2.18 ft)	40.8	202.5	243.3
Tides 2075 DNR Low (2.14 ft)	42.0	199.4	241.4
Tides 2075 DNR High (4.08 ft)	40.3	318.5	358.9
Tides 2100 DNR Low (3.28 ft)	35.2	274.8	309.9
Tides 2100 DNR High (6.56 ft)	44.1	523.5	567.5
0.1% AEP	73.3	638.9	712.2
0.2% AEP	116.2	948.8	1,065.0

ESRI Dashboard DEMO









Thank You

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