Game of Extremes Adaptation Cost Estimate References			
Strategy	**Cost Estimate**	**Source**	**Notes (when applicable)**
Living levee	$ 60 M per 10,000 linear feet *($6,000 per ft)*	NYC Coastal Climate Resilience Urban Waterfront Adaptive Strategies: pg 85 https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf	Used the average from the range ($2,000 and $10,000 per foot = $6,000 per foot, then calculated out to 10,000 feet). Costs will vary by height, width, wave strength/energy, foundation type, and erosion.
Seawall	$100 M per 10,000 linear foot	NYC Coastal Climate Resilience Urban Waterfront Adaptive Strategies: pg 57 https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf	$5,000 to $15,000 per linear foot; Average = $10,000 per linear foot, calculated for 10,000 linear feet
Raising	Burns Estates / Riverwalk Residences : 130k/home	NYC Coastal Climate Resilience Urban Waterfront Adaptive Strategies: pg 57 https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf	To elevate an entire 1-2 family detached building it may cost approximately $60,000 to $200,000, depending on site-specific factors. Used average
	Public School: $1.5M	AECOM costing expert advice	
	Riverwalk: $150k	AECOM costing expert advice	
	Light Rail – 10,000 linear feet: $3M	AECOM costing expert advice	
	Roadway - 10,000 linear feet: $2M	AECOM costing expert advice	
Relocation	Burns Estates / Riverwalk Residences: $225k/home	AECOM costing expert advice	
	Riverwalk: $50k	AECOM costing expert advice	
	Light Rail – 10,000 linear feet: $800k	AECOM costing expert advice	
	Roadway - 10,000 linear feet: $250k	AECOM costing expert advice	
Solar / Wind Farms	$500,000 per acre of solar $3 million per 2 MW wind turbine	Solar: http://innovativesolarfarms.com/solar-farm-cost-per-acre/ Wind: http://www.windustry.org/how_much_do_wind_turbines_cost	
Constructed wetlands	$850,000 per acre	NYC Coastal Climate Resilience Urban Waterfront Adaptive Strategies: pg 91 https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf	Average of estimated range - $700,000 and $1M
Temporary flood protection	$700,000 per 10,000 linear ft, 3 ft tall wall	Port of Long Beach Climate Adaptation and Coastal Resiliency Plan: pg 144 http://www.polb.com/civica/filebank/blobdload.asp?BlobID=13799	$65,000 for 950 ft -- > $68.42/ft * 10,000 ft = $684,211/10,000 ft; Rounded to $700,000
New / Restoration of habitats	$100,000 per acre	NOAA Estimating Wetland Restoration Costs at an Urban and Regional Scale https://www.st.nmfs.noaa.gov/st5/Salmon_Workshop/23_Steere.pdf	Complex tidal wetland restorations can cost $100,000 or more per acre
Solar PV and storage	$36,000 for a 5kW system including storage	https://www.solarpowerauthority.com/how-much-does-it-cost-to-install-solar-on-an-average-us-house/ https://www.energysage.com/solar/solar-energy-storage/what-do-solar-batteries-cost/	Average cost for storage from range in source
Diesel generators	$20,000 per commercial generator	https://priceithere.com/commercial-generator-prices/	Average cost of commercial generator
Raising key components	$5,100 to raise 3 electrical outlets	https://www.improvenet.com/r/costs-and-prices/install-electrical-outlet	
Add shade to destinations	$6,000 per structure	https://www.theparkcatalog.com/flat-roof-2-opening-smoking-bus-shelter-with-bench?gclid=EAIaIQobChMI4vGRounJ3AIVlvhkCh1_Ewa5EAYYBiABEgIJufD_BwE	
Rainwater harvesting	$15,000 for 5,000 gallon cistern	https://www.epa.gov/sites/production/files/2015-11/documents/rainharvesting.pdf	Cisterns range in price depending on the material, size, and shape but costs are typically between $1.50 and $3.00 per gallon of storage, with per gallon costs generally decreasing with increasing tank size.
Resilient infrastructure design policy	$150,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimated cost of consultant to revise green building standards
Resilience design transit	$150,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimated cost of consultant to revise green building standards
Green design guidance document	$150,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimated cost of consultant to revise green building standards
Cool pavement requirement	$15,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop a policy - 1/7 FTE of $100k employee total cost
Building/zoning code water level rise	$15,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop a policy - 1/7 FTE of $100k employee total cost
New development runoff requirement	$15,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop a policy - 1/7 FTE of $100k employee total cost

Heat/Flood evaluation criteria in capital planning process	$15,000	Fremont Climate Action Plan - page 6-11 https://fremont.gov/DocumentCenter/View/19837/Climate-Action-Plan	"Very Low" <$10,000, AECOM expertise bumped up a bit. Including a provision in contracts. Decided to increase it slightly based off of internal team recommendation of likely increased staff time to complete.
Monitor city funds spent on response to heat/flood	$15,000	Fremont Climate Action Plan - page 6-11 https://fremont.gov/DocumentCenter/View/19837/Climate-Action-Plan	"Very Low" <$10,000, AECOM expertise bumped up a bit. Including a provision in contracts. Decided to increase it slightly based off of internal team recommendation of likely increased staff time to complete.
Cost of inaction study relating to flood risk	$100,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop a policy - 1/7 FTE of $100k employee total cost
Tree planting	$700,000 per 1,000 trees	https://healthyplacesindex.org/wp-content/uploads/2018/02/san_francisco_cost_benefits_comprehensive_municipal_street_tree_program.pdf	Cost in Options sheet based on USDN suggestion; no source provided; link in column to the left provides other cost estimate.
Community resilience hubs	$287,000	*[USDN requested $287,000]*	
Stormwater retention credit trading implementation	$250,000	AECOM costing expert advice	
Microgrid feasibility study	$100,000	*[USDN requested $100,000]*	
Flush WTP distribution system	$75,000	http://h2o-model.com/wp-content/uploads/2012/03/1_UDF_Presentation.pdf City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517 Heat Watch/Warning Systems Save Lives (American Meteorological Society, 2004) http://www1.udel.edu/SynClim/BAMS_Ebi_Kalkstein.pdf	Derived from information from PPT and previously established costs above: Staffing - Flush Program Coordinator, Flushing Crew (Crew leader, utility worker), Routining Crew (Crew leader, utility crew) - 5 people full time for estimated 5 days a year following low pressure events. $50,000 a piece - ~$190/day = $4,750 Program Development - $10,000 (based on other establishment costs above) City Notification - Awareness - $40,000 (based on energy response awareness program above) Cost of running flushing equipment/processing water/etc - $6,000 estimate
Energy demand response program	$40,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	based on estimate of cost of staff time to develop and implement an employee information/education program per year - 1/4 FTE of $100k employee total cost
Small business resilience campaign	$30,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	based on estimate of cost of staff time to develop and implement an employee information/education program per year - 1/3 FTE of $100k employee total cost
Residential weatherization	$30,000	*[USDN requested $30,000]*	
Heat / Flood response program	$10,000	http://www1.udel.edu/SynClim/BAMS_Ebi_Kalkstein.pdf	Heat Watch/Warning Systems Save Lives (American Meteorological Society, 2004) Establishment cost doubled for potential cost of software
Write a grant proposal	$10,000	AECOM costing expert advice	
Climate Action or Resilience plan	$200,000	AECOM costing expert advice	
New staff position for resilience	$100,000	AECOM costing expert advice.	
Update policies to respond to risks from climate projections	$40,000	AECOM costing expert advice.	
Update zoning to respond to risks from climate projections	$40,000	AECOM costing expert advice.	
Green streets into streetscape plans	$10,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop and implement an employee information/education program per year - 1/10 FTE of $100k employee total cost
Update health & safety plan requirements for heat	$10,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop and implement an employee information/education program per year - 1/10 FTE of $100k employee total cost
Develop a nutrient management plan	$10,000	City of Mountain View, Municipal Operations Climate Action Plan -Appendix C https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=19517	Based on estimate of cost of staff time to develop and implement an employee information/education program per year - 1/10 FTE of $100k employee total cost

Note: All costs provided are estimates developed for the purpose of the game only. Where possible, they are derived from reports and case studies. They are illustrative only, and will vary greatly depending on location, exact design of strategy, permitting requirements, construction costs, and vulnerability of the asset (among other variables).