Climate and Disaster Risk Screening Report for a Coastal Flood Protection Project in Samoa: Hypothetical Coastal Flood Protection Project for Samoa[1]

[1] This is the output report from applying the World Bank Group's Climate and Disaster Risk Screening Project Level Tool. The findings, interpretations, and conclusions expressed from applying this tool are those of the individual that applied the tool and should be in no way attributed to the World Bank, to its affiliated institutions, to the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the information included in the screening and this associated output report and accepts no liability for any consequence of its use.

1. Introduction

The project level **Climate and Disaster Risks Screening Tool** provides due diligence on climate and disaster risks at an early concept stage. The tool uses an **exposure – sensitivity – adaptive capacity framework** to consider and characterize risks from climate and geophysical hazards, based on key components of a project and its broader development context (Annex 1). The tool helps inform consultation, dialogue, and further work to be done in the course of project design.

The results of applying the project level tool to screen for climate and disaster risks for "Hypothetical Coastal Flood Protection Project" in Samoa are summarized below.

2. Climate and Disaster Risk Screening Results Summary

2.1 Project Information Summary

Table 1 below provides key project information.

Table 1: Project information

Project Information	
Title	Hypothetical Coastal Flood Protection Project
Number	1111
Region	East Asia and Pacific
Country	Samoa
Type of Assessment	Coastal Flood Protection Projects
Purpose of Screening	
Current Project Phase	
Funding Source	IDA
Keywords	Storm Surge Protection, Land Use Management, Flood Defenses
Location	Coastal communities and mangroves
Built Infrastructure	The project will rehabilitate and improve polders (protected low-lying areas). Specifically, investments include slope protection, increasing embankment height, repairing and upgrading drainage systems and design of new hydrological management infrastructure as needed.
Coastal Ecosystem	The coastline is dominated by beaches and sand dunes. Certain parts of the coast also feature mangroves. There are no coral reefs near the project location. The project is investing in reforestation and preservation of mangroves. Specific species have not been selected at this time.
Outcome / Service Delivery	The project aims to provide direct protection to approximately 1 million people living within polder boundaries. It will do so by upgrading the existing embankments and drainage systems. The level of protection to be provided is intended to be enough to withstand 25-year return period storm surges for the lifetime of the project (up to year 2050).

2.2 Summary of Exposure to Climate and Geophysical Hazards

Table 2 presents a summary description of exposure to climate and geophysical hazards at the project location for the Historical/Current and Future time frames. The Future time frame is based on changes projected to occur between the 1980-1999 average and a future average. This future average is most likely the 2040-2059 average (i.e., the default in the Climate Change Knowledge Portal - CCKP), but the range is dependent upon the specific time frame that the user applied using the CCKP or other climate information. Again, these descriptions, if based on information in the CCKP, may be supplemented by national data sets.

Table 2: Summary of Exposure to Climate and Geophysical Hazards at Project Location

Hazard	Time Frame	Description of hazards for your location
Extreme Temperature	Current	Mean annual temperature has increased by 0.59°C, with the minimum and maximum temperature increasing by 0.67°C and 0.18°C respectively. Meteorological data of Samoa collected over 101 years indicates mean, maximum and minimum temperature increase and a trend decrease in precipitation by 49.28 mm over the same period. The numbers of hot days and hot nights have increased significantly across the Pacific.
	Future	Temperatures in the Pacific are projected to increase between 1.4 and 3.1°C.

Hazard	Time Frame	Description of hazards for your location
Extreme Precipitation and Flooding	Current	As of yet, it is not possible to get a clear picture for precipitation change, due to large model uncertainties. While average annual and monthly rainfall changes are inconsistent across this region of the Pacific, recent evidence and model simulations point to a more frequent occurrence of El Nino weather patterns, bringing an increase in drought conditions along this region.
	Future	The future of rainfall patterns across the Pacific region is a subject of continued debate, with models projecting +/-25% changes in rainfall. More frequent El Nino events could also increase the intensity of tropical cyclones along the Pacific, with important implications for disaster management and response.
Sea Level Rise	Current	Satellite measurements in this area of the Pacific estimate sea-level increases of 8-10 mm/year, approximately three times the global average rate of increase.
	Future	Sea levels are projected to rise by the end of the century by 0.35 m (0.23 to 0.47 m) although the spatial manifestation of this rise will not be uniform due to circulation changes and ocean density.
Storm Surge	Current	The number of category 4 and 5 storms in the Pacific region has more than doubled in comparison to their frequency and occurrences between 1975-1989 and 1990-2004, increasing damages due to severe storm surges on coastal areas.
	Future	Storm surge height is expected to increase, but estimates are highly uncertain
Strong Winds	Current	Tropical cyclones: increase in frequency of tropical depressions, gale winds forces and tropical cyclones during the cyclone season (December–February).
	Future	The maximum wind speed from tropical cyclones is expected to increase, but estimates are highly uncertain
Earthquake	Current	Samoa is in an area of high techtonic activity.
Tsunami	Current	Samoa is in an area of high techtonic activity and has experienced 115 tsunamis since 1900, 22 of which led to significant damage.

2.3 Summary of Overall Project Risk

Tables 3A and 3B below summarize ratings for project components and/or project subsectors, and outcome/service level for *Historical/Current* and *Future* time frames. The ratings are derived on the basis of the hazard information, subject matter expertise, contextual understanding of the project, and the larger development context.

The results indicate where risks may exist and where further work may be required to reduce or manage these climate and geophysical risks. An ongoing process of monitoring risks, refining climate and other information, and regular impact assessment may also be appropriate.

2.3.1 Results Summary - by Component

Table 3A summarizes the ratings for the project. The results provide a characterization of risks caused by climate and geophysical hazard on project sub-sector and components. The potential impact due to exposure from hazards is modulated by the project's non-physical components (enabling and capacity building activities) and the larger development context to determine overall risk to the intended project outcome.

Table 3A: Results Summary - by Component

Hazard	Project Context								Development Context		Outcome / Service Delivery	
	Location		Built Infrastructure		Coastal Ecosystem		Non-Physical Components (Overall)					
Time Frame	Current	Future	Current	Future	Current	Future	Current	Future	Current	Future	Current	Future
Extreme Temperature							Emergency planning: Significantly Reduces Impact		Population growth: Slightly Increases Impact			
Extreme Precipitation and Riverine Flooding												
Sea Level Rise							Capacity Building, Training and Outreach: Slightly Reduces Impact		Land ownership issues: Slightly Increases Impact			
Storm Surge												
Strong Winds												
Earthquake		X		X		X	Overall: Significantly Reduces Impact		Overall: Slightly Increases Impact			X
Tsunami		X		X		X						X

2.3.2 Results Summary - by Time Frame

The matrix below depicted in Table 3B displays the same results as Table 3A, but does so by time frame.

Table 3B: Results Summary - by Time Frame

Time Frame	Current						Future					
Hazard	Project Context			Non-Physical Components (Overall)	Development Context (Overall)	OUTCOME/ Service Delivery	Project Context			Non-Physical Components (Overall)	Development Context (Overall)	Outcome/ Service Delivery
	Location	Built Infrastructure	Coastal Ecosystem				Location	Built Infrastructure	Coastal Ecosystem			
Extreme Temperature				Emergency planning: Significantly Reduces Impact Capacity Building, Training and Outreach: Slightly Reduces Impact Overall: Significantly Reduces Impact	Population growth: Slightly Increases Impact Land ownership issues: Slightly Increases Impact Overall: Slightly Increases Impact					Emergency planning: Significantly Reduces Impact Capacity Building, Training and Outreach: Slightly Reduces Impact Overall: Significantly Reduces Impact	Population growth: Slightly Increases Impact Land ownership issues: Slightly Increases Impact Overall: Slightly Increases Impact	
Extreme Precipitation and Riverine Flooding												
Sea Level Rise												
Storm Surge												
Strong Winds												
Earthquake							X	X	X			X
Tsunami							X	X	X			X

Insufficient Understanding	Not Exposed No Potential Impact No Risk	Slightly Exposed Low Potential Impact Low Risk	Moderately Exposed Moderate Potential Impact Moderate Risk	Highly Exposed High Potential Impact High Risk

2.4 Key Drivers of Risks

Based on the results above, Table 4 highlights the key drivers of risks for each project component and/or subsector ratings. Specific consideration should be given to those which have high ratings, or are moving from moderate to high ratings. Note also the overall modulating effects of non-physical components and the broader development context to the project outcome.

Table 4: Key Drivers of Risk

	Historical/Current Drivers	Future Drivers
Hazards and Location	Sea Level Rise Storm Surge Strong Winds Tsunami	Extreme Temperature Extreme Precipitation and Flooding Sea Level Rise Storm Surge Strong Winds
Physical Components	Extreme Precipitation and Flooding - Coastal Ecosystem Sea Level Rise - Built Infrastructure Sea Level Rise - Coastal Ecosystem Storm Surge - Built Infrastructure Storm Surge - Coastal Ecosystem Strong Winds - Built Infrastructure Strong Winds - Coastal Ecosystem Earthquake - Built Infrastructure Tsunami - Built Infrastructure Tsunami -Coastal Ecosystem	Strong Winds - Coastal Ecosystem Extreme Precipitation and Flooding - Coastal Ecosystem Sea Level Rise - Built Infrastructure Sea Level Rise - Coastal Ecosystem Storm Surge - Built Infrastructure Storm Surge - Coastal Ecosystem Strong Winds - Built Infrastructure Extreme Precipitation and Flooding - Built Infrastructure
Outcome / Service Delivery	Extreme Precipitation and Flooding Storm Surge Sea Level Rise Strong Winds	Sea Level Rise Extreme Precipitation and Flooding Strong Winds Storm Surge

Key: High Risk Moderate Risk

* No high or moderate risks identified for this particular portion of the project.

- Overall, the Non-physical Components : **Significantly Reduces Impact**
- Overall, the Broader Development Context : **Slightly Increases Impact**

3. Next Steps

Table 5A provides some general guidance on follow-up based on the risk ratings for the Outcome/Service Delivery. Table 5B lists some climate risk management measures for your consideration. Visit the "Next steps" page of the tool for guidance and a list of useful resources.

Please recall that that this is a high-level due diligence tool, and the characterization of risks should be complemented with more detailed work.

Table 5A: General Guidance Based on Risk Ratings for Outcome/Service Delivery

Insufficient Understanding	Gather more information to improve your understanding of climate and geophysical hazards and their relationship to your project.
No Risk	If you are confident that climate and geophysical hazards pose no risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented.
Low Risk	If you are confident that climate and geophysical hazards pose low risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented. You may also consider gathering additional information to increase your level of confidence in your rating.
Moderate Risk	For areas of Moderate Risk, you are encouraged to build on this screening through additional studies, consultation, and dialogue. This initial screening may be supplemented with a more detailed risk assessment to better understand the nature of the risk to the project.
High Risk	For areas of High Risk, you are strongly encouraged to conduct a more detailed risk assessment and to explore measures to manage or reduce those risks.

Table 5B: Types of Climate Risk Management Measures for typical Coastal Flood Protection Projects

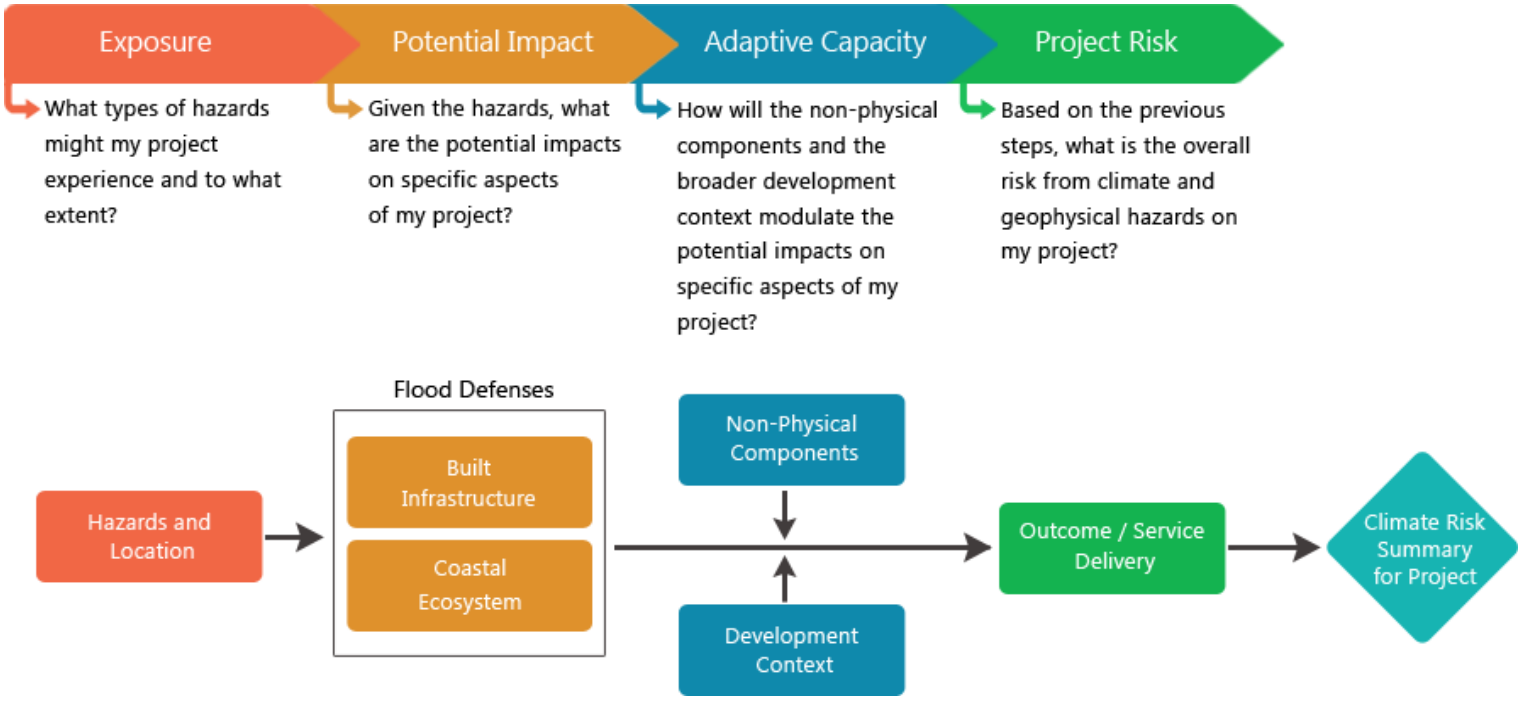
CATEGORY	PROS	CONS	Examples
Accommodate and Manage	• Flexible • Typically low-cost • Useful when risk is low, but projected to rise in the future	• Temporary solution • Can be insufficient in preventing losses	• Increasing repair and maintenance budgets • Instituting policies for proactive rerouting during severe weather
Protect and Harden	• Can be used for existing and new assets • Responds to immediate risks	• High cost • Inflexible • Effectiveness may decrease over time	• Elevating a roadway • Expanding buffer zones • Designing roads with larger drainage systems • Engineering bridges with elements of seismic-resistant design
Retreat and Relocate	• Long-term solution • Responds to immediate risk	• High cost • Inflexible	• Moving a road alignment away from a river • Moving infrastructure further inland or onto higher ground

Annex 1: Tool Approach

Tool Approach

The framework below describes the approach taken to screen the project. Climate and natural hazards information used to screen the project is obtained from the World Bank's Climate Change Knowledge Portal, which houses numerous global data sets with historical records and future projections as well as country-specific adaptation profiles.

Figure 1: Project Level Climate and Disaster Risk Screening Tool: Approach for Coastal Flood Protection projects



Annex 2: Notes

Table A2-1 summarizes the sub-national locations of high risk noted during the assessment, if the user entered these sub-national locations. Table A2-2 summarizes all the notes entered by user for each section while completing the assessment, if the user elected to enter notes. These notes can help shed light on specific ratings as well as considerations and limitations of the user's expertise.

Table A2-2 Summary of Comments by Section

Section	Notes