Pacific Community
Communauté du Pacifique

Solomon Islands International Waters Ridge to Reef Project

Honiara Coastline Baseline Study Bathymetry and Hydrology Assessment Report

gef

UNDP
Empowered lives. Resilient nations

FAO
FIAT PANIS

UN environment programme

Pacific R2R
Ridge to Reef

Honiara Coastline Baseline Study
Bathymetry and Hydrology Assessment Report

Prepared by Robson Hevalao, Danny Shadrech, Andrew Taraha,
Ronnie Posala, Stephen Mosese and Joseph Airahui

Produced by GEF Pacific International Waters Ridge to Reef Regional Project,
Pacific Community (SPC), Suva, Fiji

Pacific Community
Communauté du Pacifique

Suva, Fiji, 2021

Original text: English

Citation: Hevalao, R, Shadrech, D., Taraha, A., Posala, R., Mosese, S. and Airahui. J. 2021. Honiara Coastline Baseline Study Bathymetry and Hydrology Assessment Report. SPC, 11 pp

Reviewed by George Naboutuiloma, Samasoni Sauni, Fononga Vainga Mangisi-Mafileo and Aliti Vunisea.

Edited by Seema Deo (Footprints in the Sand Consulting)

Produced by GEF Pacific International Waters Ridge to Reef Regional Project, Pacific Community (SPC), Suva, Fiji.

Layout and Design by Navneet Lal/Pacific Community (SPC)

Prepared for publication at SPC's Suva Regional Office, Private Mail Bag, Suva, Fiji, 2021

www.spc.int | spc@spc.int

Printed by Quality Print, Suva, Fiji, 2021

CONTENTS

ABBREVIATIONS

ECD	Environment and Conservation Division
EIA	Environment Impact Assessment
NWMPCS	National Waste Management and Pollution Control Strategy
MECDM	Ministry of Environment, Climate change, Disaster and Management
MID	Ministry of Infrastructure and Development
SINOP	Solomon Island National Ocean Policy
MEA	Middle East and Africa
SPREP	Secretariat of the Pacific Regional Environment Programme
UNCCD	United Nations Convention to Combat Desertification
NCSA	National Capacity Self-Assessment
UNCBD	United Nations Convention on Biological Diversity
IW	International Waters
GEM	Geoscience, Energy and Maritime Division
SPC	The Pacific Community
BoM	Bureau of Meteorology
IBS	Iron Bottom Sound

LIST OF FIGURES

1. EXECUTIVE SUMMARY

This particular baseline study is part of the Ridge to Reef Honiara Coastal Baseline Study focusing on the bathymetry and hydrography of Honiara coast. The relevant legal framework (Annex 1) that guides the activities, and placement of development along the Honiara coastal area will be discussed. Furthermore, this study will look at all the aspects of bathymetry from seafloor features, depth analysis to coastal erosion. An explanation of the surface wind stress that influence surface ocean current movement seasonally for the Solomon Islands will be looked at as well. This study will also discuss erosional areas along Honiara coastlines. Finally, the tidal ranges will be mentioned according to captured data.

2. ASSESSMENT OF HONIARA COASTAL AND MARINE AREAS

2.1 INTRODUCTION

The Honiara coastal area has been used for a range of activities from developments to recreational. Many coastal dwellers use it for fishing, swimming, kayaking and other activities for pleasure. Developments and important infrastructures are also built along the coast. There are a range of conflicting activities from dredging to land reclamation against natural coastal erosion and coastal inundation happening along Honiara coastal. In order to make better and sound decisions on coastal management and better use of the Honiara coastal area for sustainable and resilient communities of Honiara, the Solomon Islands IW Ridge to Reef Project engages a consultant to carry out this assessment.

2.2 METHODOLOGY

Most of the data are obtained online through the previous data collected by the works done by people who have assessing the coast of Honiara. Several qualified works from the Ministry of Infrastructure and Development (MID), Honiara urban planning centers, Ministry of Fisheries and Marine Resources, Ministry of Environment, Climate Change, Disaster Management, and Meteorology (MECDM) and other unnamed co-authors of several papers are all useful in this desktop analysis on Honiara coastal.

2.3 OCEAN SURFACE CURRENT DATA FOR SOLOMON ISLANDS

The Solomon Islands coastal and off-shore ocean current behavior has been poorly observed. It was poorly covered by remote techniques and *in situ* observational data has been by far hard to get. The reason behind all these hindrances are due to the Solomon Islands remoteness, spatially distribution of islands, intricate geography with remote islands, reefs and shallow passages. Global buoys and floats such as Argo, glider and other remotely controlled oceanographic instruments all find it hard to enter the islands due to the above hinderances. However, there are works on oceanic models to uncover the concealed oceanic data in these early years. The works by the Meteorological, Climatological, and Geophysical Agency (BMKG), Geoscience, Energy and Maritime (GEM) Division of the Pacific Community (SPC), Bureau of Meteorology (BoM) and other organizations through improving oceanic models have uncovered a lot of secrets of the Solomon Islands' ever-changing ocean behavior.

3. RESULT AND DISCUSSION

3.1 WIND STRESS AND SURFACE CURRENT

The Solomon Islands have two distinct seasons: the wet season and the dry season. The wet season, where cyclones and devastating weather behavior occur in the western pacific are from December-May when the South Easterly trade winds weaken. The weakening trade winds allow for the reversal of the wind direction and enhance the westerly winds.

Dry season or sometimes referred to as strong trade wind season is between the months of June-November. During this dry season, the south easterly trade wind strengthens and pushes more water from the southern east region of the country. Studies have shown that there is a relationship between the surface wind stress and ocean current movement, however for the south western pacific there is little of such relationship found to exist (Hristova, Hristina, & Kessler, 2012). The reason is due to the scattering of islands, intricate geographical features, shallow reefs and the alignment of the countries scattering islands.

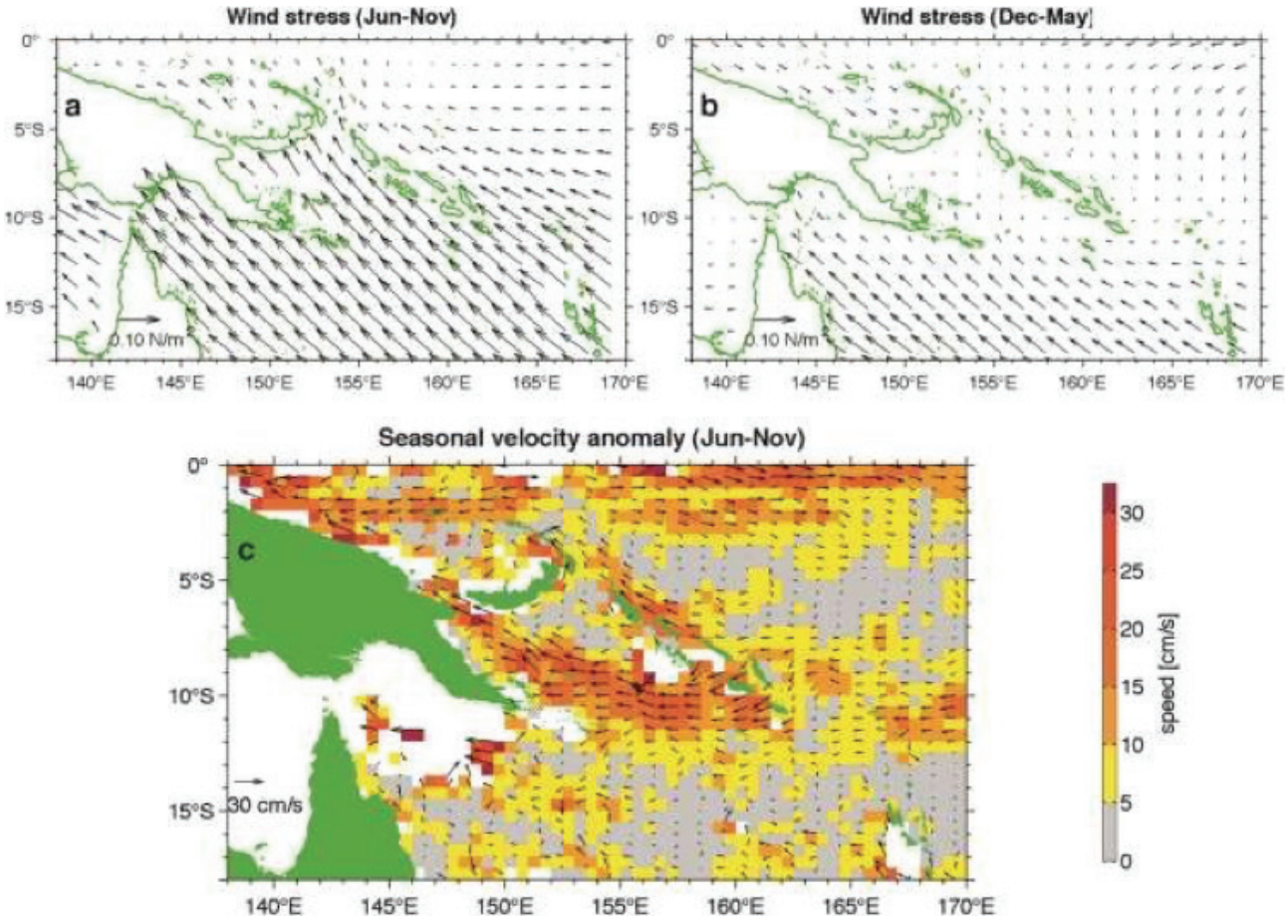


Figure 1: Seasonally averaged wind stress over the Solomon sea during (a) June–November (the strong- trades season) and (b) December–may (the weak-trades season), based on the wind climatology (c) drifter-estimated surface

Surface current movement within the Solomon Islands waters varies in direction and magnitude over different seasons. During the wet season, the westerly strengthens and pushes more waters from the northern part of the Solomon Islands whilst during the dry season more waters have been pushed from the south.

Iron Bottom Sound (IBS) is the stretch of water at the southern end of the slot between Guadalcanal, Savo Island, and Florida Island. Honiara is located in the north of Guadalcanal Island, and the area of study will be within the Honiara vicinity. During wet season, surface currents from westerly wind stress draws waters westward from the Solomon sea and pushes it right through the channel between Savo and Guadalcanal. This is when most high swells from westerly winds rushes through and bifurcating through IBS affecting the coastal areas of Honiara.

For the dry season, the weakening westerly draws less water from the north, allowing the current through the channel to weakened resulting in calm waters. The south easterly is usually strong but it only affects the southern part of Guadalcanal while the Iron Bottom Sound facing north is away from the incoming wave actions.

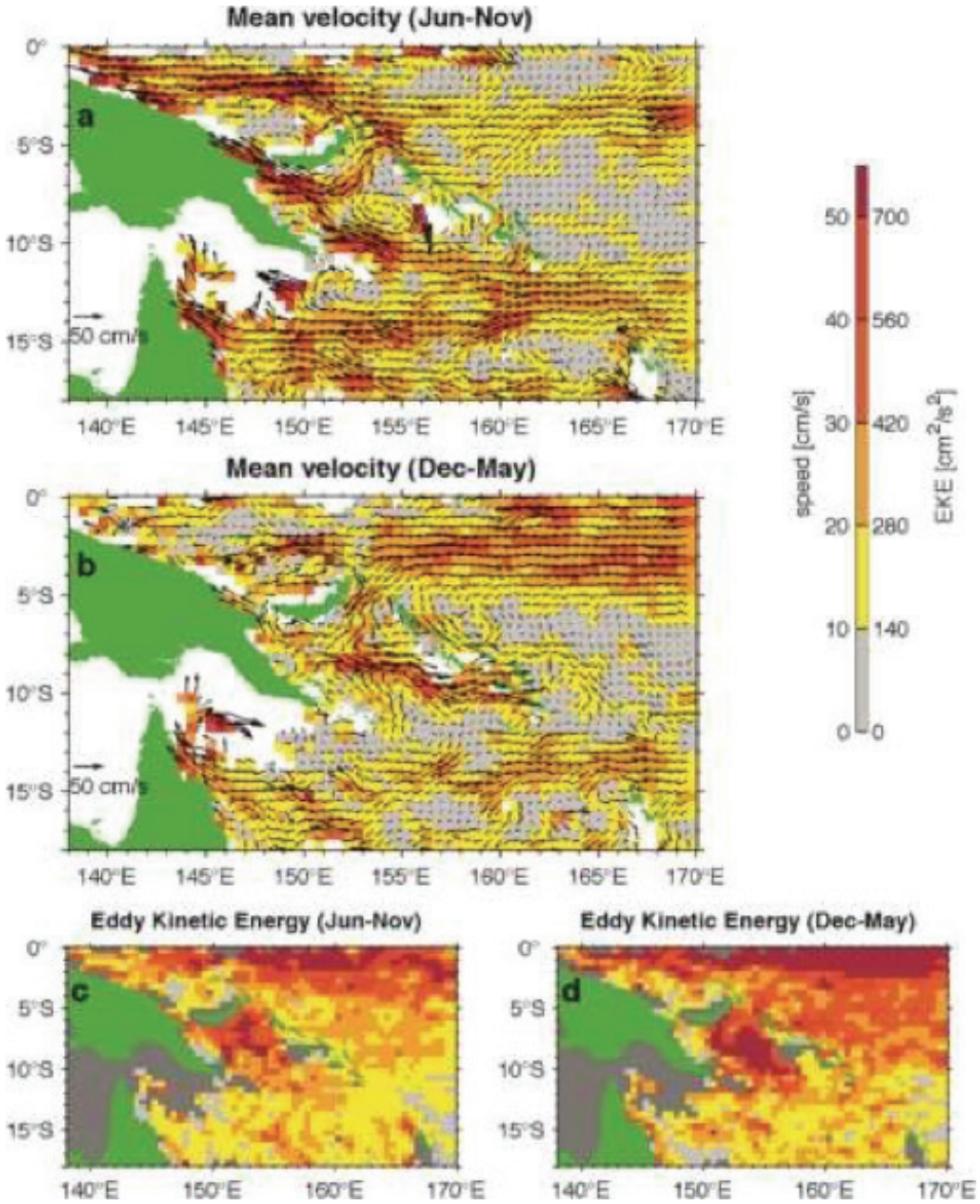


FIGURE 2: (Top) Mean velocity of surface current during the dry season. A strong easterly generates more surface current south of Solomon Islands. (Mid) Mean velocity of surface current during wet season and it shows strong westerly where it pushes more water north of the Solomon Islands. (Bottom left) Weak eddy kinetic energy during dry season. (Bottom right) Strong eddy kinetic energy.

3.2 BATHYMETRIC AND COASTAL INUNDATION ON HONIARA COAST

3.2.1 INTERTIDAL AND OFFSHORE BATHYMETRY

Honiara coastal has different characteristics of shoreline from Lunga river mouth to Whiteriver. The western half of the city from White River to Point Cruz wharf and the central section from Baha'i to Kukum Panatina are the only areas where submerged reefs on the lower water mark are found. Towards the eastern part of Honiara coastal, there are no reefs found and the seabed is made up of sand and gravel.

Offshore bathymetry shows that the eastern part of Iron Bottom Sound has a much flatter and wider seafloor with depth of 100m extending to about 1km off from the shoreline. The western end of the sound has a much narrower and close to shoreline drop zone from reef edge. In general, the bathymetry of Iron Bottom Sound has an Eastward elevated side with the raised eastern half sloping down towards the west to about 1000m depth beyond Savo Island. The 100-150m drop zone outside of White River reef edge is a mini canyon that leads towards the seafloor.

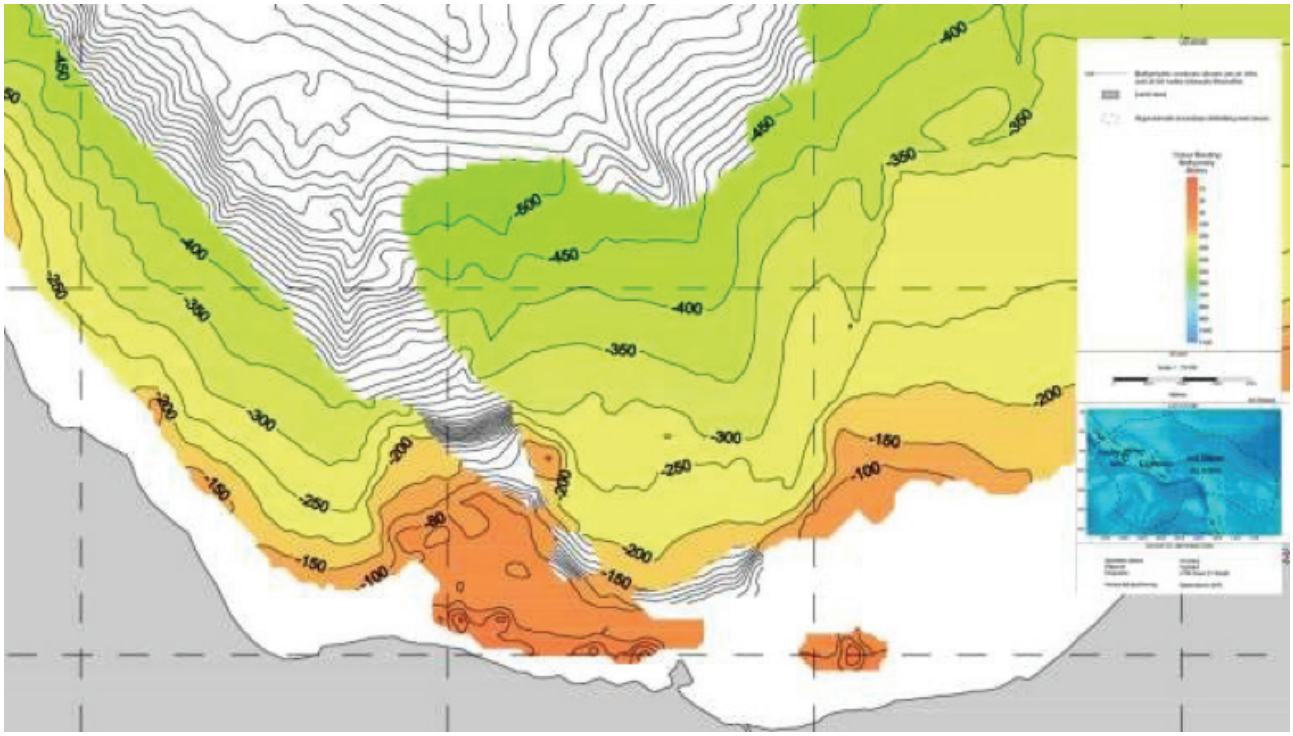
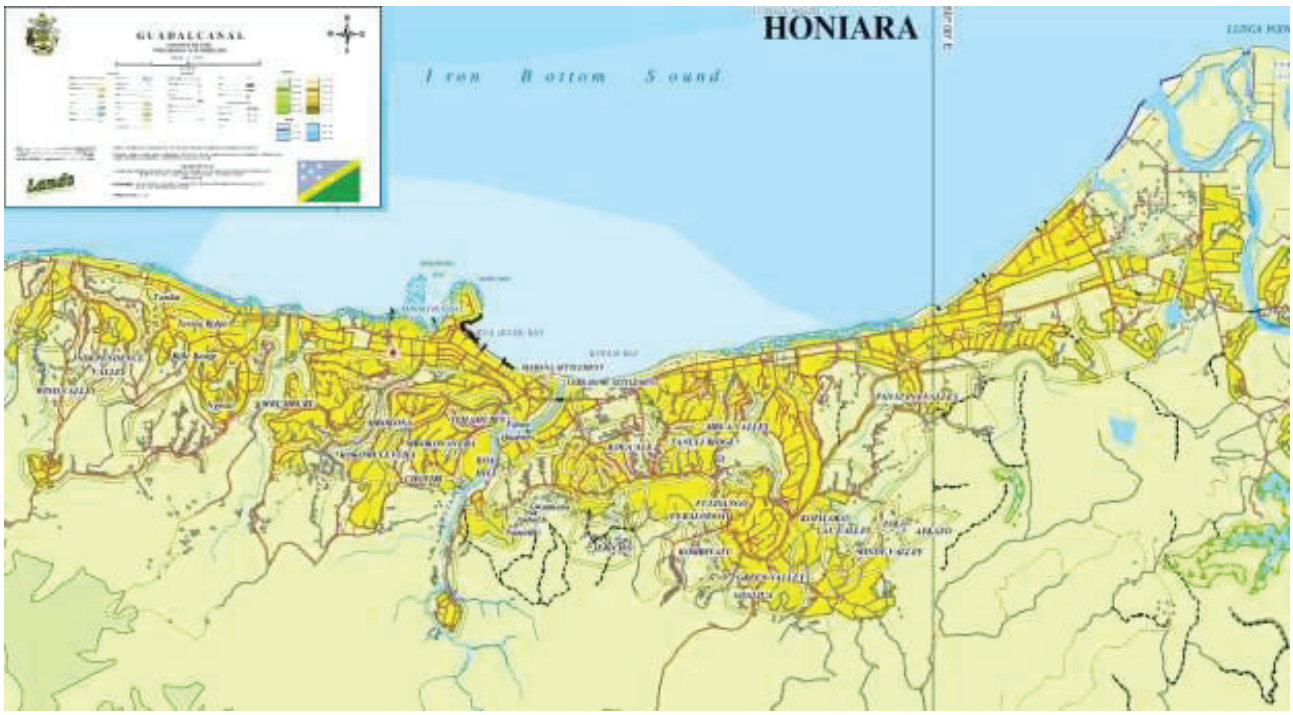


Figure 3: Iron Bottom Sound bathymetry showing the eastward elevation of the seafloor. The brown indicates the shallower (100m- 250m) and the green to blue indicates the deeper seafloor depths. (Source: s2004 bathymetry - Marks, K.M., and W.H.F. Smith, 2006. An Evaluation of Publicly available global bathymetry grids. Marine geophysical research,27, 19-34.)

3.2.2 EROSIONAL SITES

There are clear indication and physical environmental signs showing parts of the Honiara coastal areas that are at risk of coastal inundation (Figure 5). Different factors with influences range from astronomical effects such as tides to the local effects brought about by climate, weather, and ocean contributed to the gradually washing away of coastal sandy shores of Honiara. As indicated on the map by the UN – Habitat (2016a), weather related storm surge and cyclones are the major contributors for most of these inevitable erosions. Areas along the Kukum coastal and Ranadi industrial coastal areas are the most vulnerable.

Image 1: Bahai road highway exposed to coastal inundation. Strong waves from cyclones and storm surges causes the built stone seawalls to rumbles away exposing the Main road connecting Honiara CBD and Ranadi. Image Courtesy: Danny Shadrech)



FIQURE 4: Honiara coastal showing various features of the coast such as reef, coastal composition of sand and other coastal features spanning Lunga to white river. (source: Ministry of Lands, Housing and Surveying)

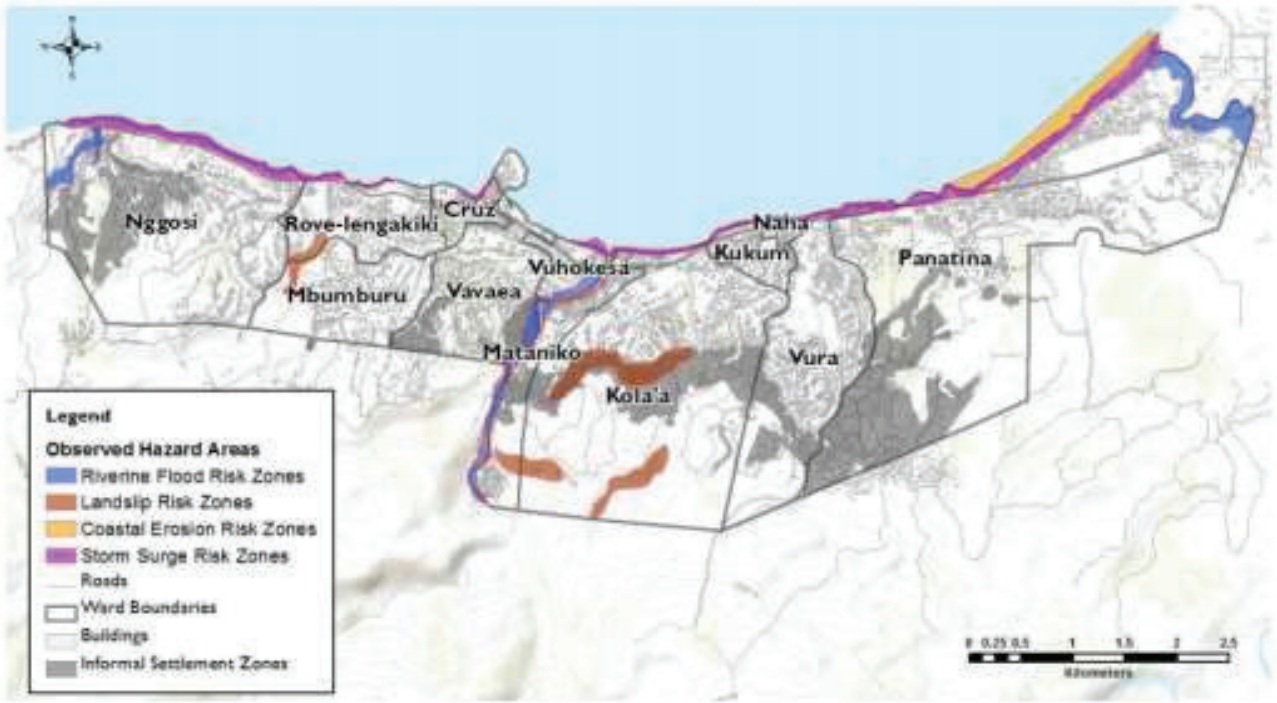


FIGURE 5: Map showing the most vulnerable areas to erosion along the coast of Honiara from Lunga to White River.

Image 2: The typical sandy coastal at Ranadi industrial areas that are exposed to high swell waves and storm surges (image courtesy: Danny Shadrech)

Image 3: Aerial view of the defenseless coastal areas on the western half of Mataniko river mouth to Wesley United Church shoreline along Mendana Avenue. (Image Courtesy: Danny Shadrech)

3.3 SEDIMENT DISTRIBUTION

3.3.1 SEDIMENTS EXTENT OFF RIVER MOUTHS

Two major rivers discharge sediments along the coast of Honiara. These are Mataniko river and Lunga river. The Mataniko River is more significant and will have a major impact to the residents of central Honiara coastal areas due to its location being at the Centre of the city. All the suspended silt, clay and soil that are discharged from this river is distributed along the coast both eastward and westward. The bathymetry of the shoreline to the seafloor off the coastline along Honiara plays a very important role in resettling, moving, and depositing these sediments. Another is the longshore drift – the shifting of sediments along the coast by coastal wave action. During the strong westerlies, sediments are forced away to the eastern end of Honiara. The opposite happens where sediments are being moved westward during easterlies. The long shore drift is the major driver of sediments along Honiara coastline.

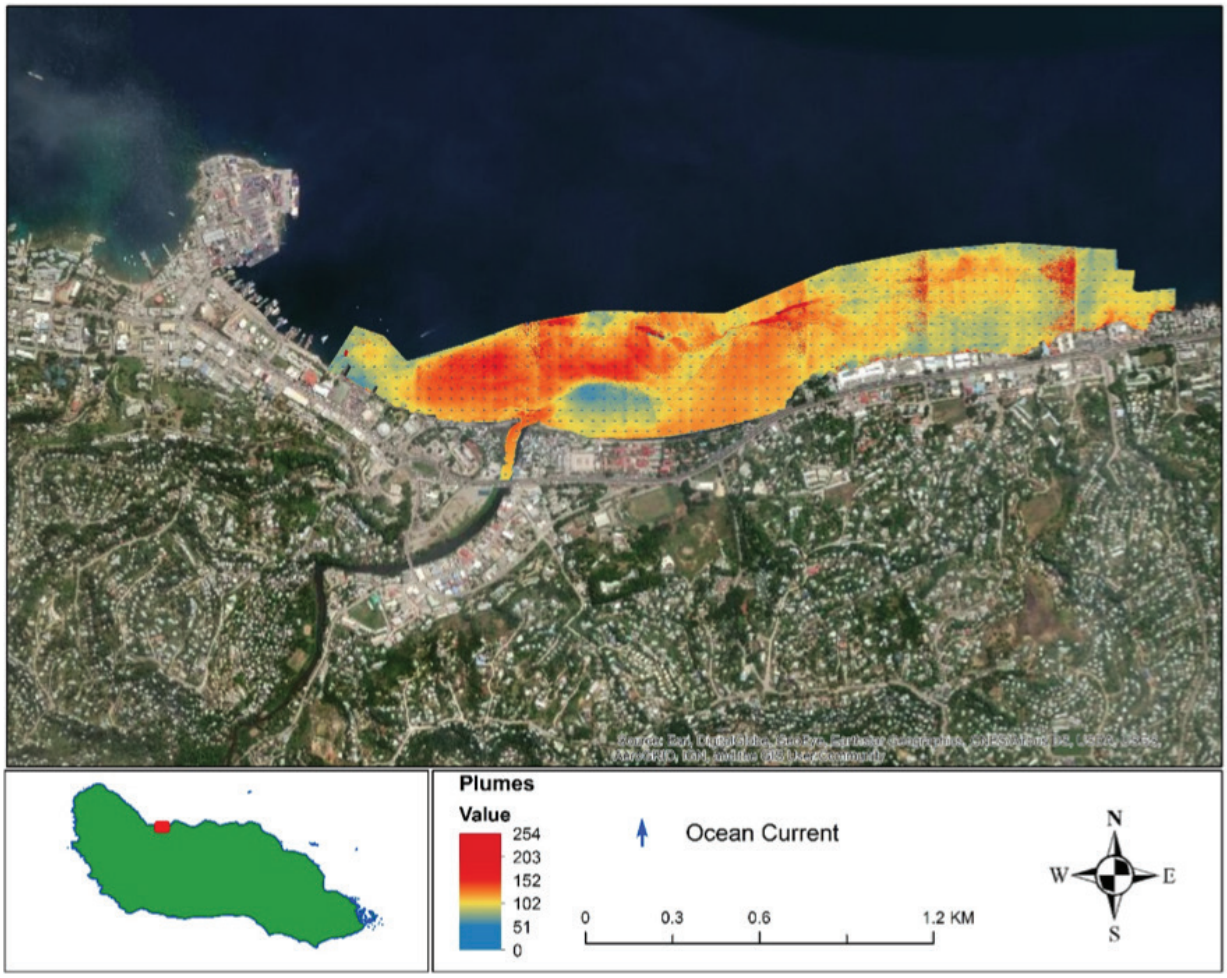


FIGURE 6: sediment distribution off the coast of Honiara. The distribution of sediment covers the eastern part of Honiara coast due to longshore drift

3.3.2 TIDAL RANGES FOR HONIARA

The tide for Honiara coastal varies throughout the year. The tidal range from the tidal calendar for Honiara Solomon Islands shows the difference of the highest and the lowest tide of each month from 2018 to 2020 staying below 1m. Greater variation of tide is experienced in June, July and August and in December, January and February late each year, while the minimal range of tidal variation is experienced in the months of March, April, May and September, October and November. The highest astronomical tide for Honiara is predicted to rise up to 1.023 m for the year 2020. This will have significant effects on coastal erosion and higher waters is expected to overflow toppings of the coastal zones along Honiara.

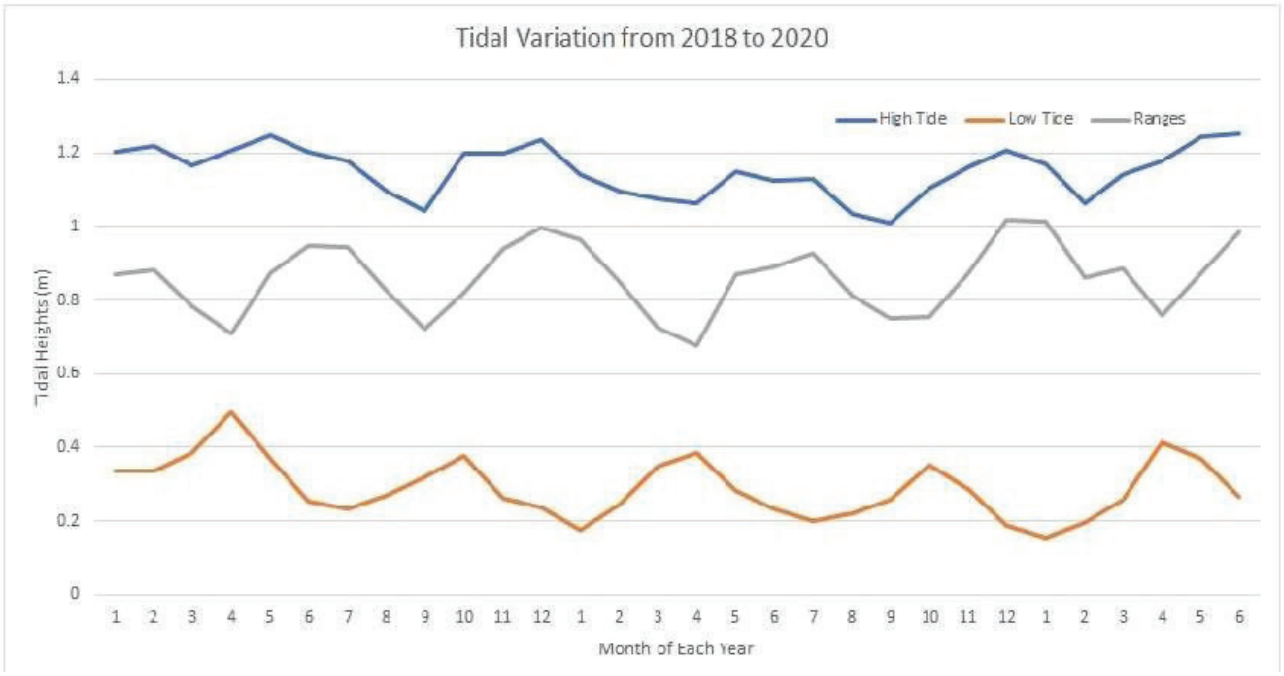


Figure 7: The difference between the highest and lowest tide of each month from January 2018-June 2020

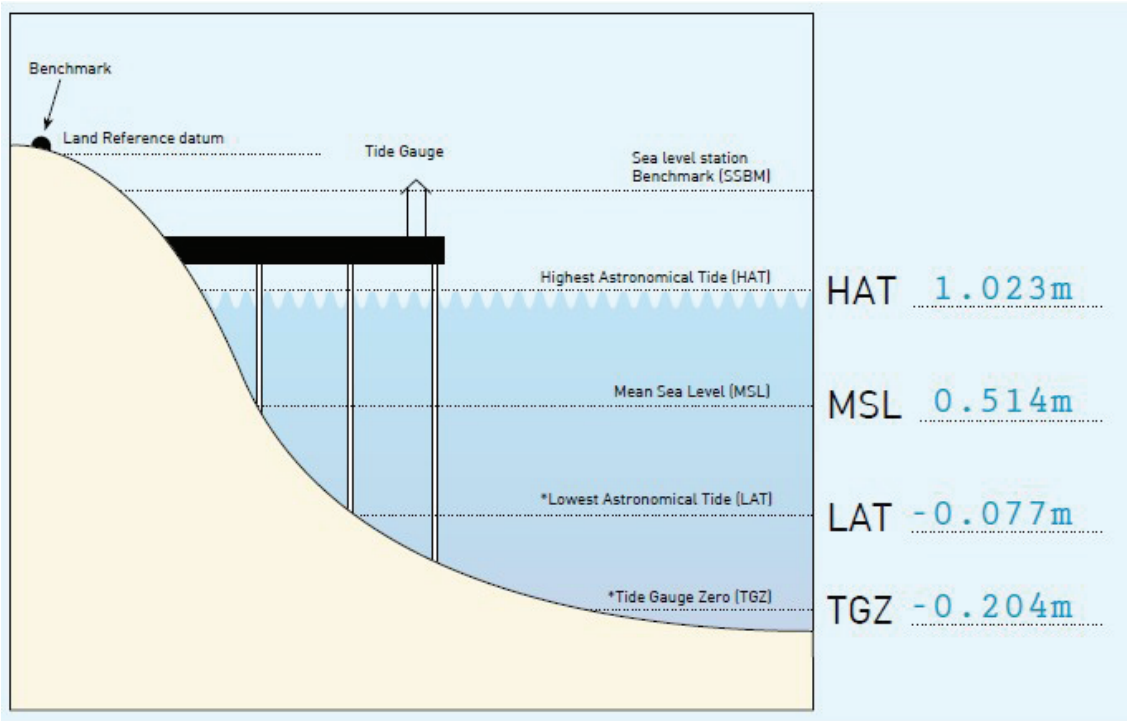


Figure 8: Honiara tidal chart showing highest astronomical tide, mean sea level lowest astronomical tide and tide gauge zero

4. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, one can confidently confirm that the surface wind stress has a direct influence on the behavior of surface current around the globe. For the Solomon Islands, there are two seasons, dry and wet season. During the wet season from November to April, the westerlies strengthen and enhance the flow of current from east to west of the eastern Solomon Islands waters. During the dry season, the wind and the flow of current from east to west weakens resulting in the reversing of the surface current flow. Iron Bottom Sound has a flatter and wider continental shelf on the eastern end and narrower and stiffer continental shelf on the western seafloor. The eastern end of Honiara coastline has higher percentage of risk to coastal erosion and inundation than west Honiara coastline. However, the more coastal barriers and protection mechanisms are in place, the slower the rate of erosion along the coast. Tidal ranges of Honiara are experienced in the middle of the year and in the end. This is where the influences of tide along the coast will be seen in effect the most.

The report recommends: -

i. Support for ongoing monitoring and updating current state of bathymetry and hydrography of the Honiara coastal/ marine area

ii. Support for further research and modelling of the movement of coastal sedimentation and plume; an important part of the study when considering the distribution of pollution along the coast

iii. Supporting other relevant studies that is and will be taking place along the same areas of study and fill the gaps of the missing information needed to make proper decisions on any development along the same line of study

5. LESSONS LEARNED

The Solomon Islands, like other Pacific Island countries, is experiencing the effects of rising sea levels due to global warming and other environmental phenomena that cause changes in our ocean. In some areas of Honiara's coastal areas, depletion has occurred, while in others, barriers and coastal defenses have been erected as adaptation measures.

After completing the assessment, there are so many lessons to learn from and to take away from this assessment. Data is limited and for some certain aspects of study such as bathymetry, ocean and hydrography, it is very difficult to acquire information, as there are no available sources. Ocean data is scarce, if at all available, and requires technical skills to extract them. The reason for the unavailability of data is the lack of instrumentation to collect data, and; if instruments are available, the cost of hiring these instruments to collect the required data is too expensive.

There needs to be an organized group work from every ocean expert in the Solomon Islands to try to work together using the current available instruments and collect all sorts of ocean data for present and future use. In addition, there needs to be some mechanism set in place that would allow sharing of ocean data between private entities, government and institutions to provide necessary data for such studies in the future.

REFERENCES

Hristova, H. G., and William S. K. “Surface circulation in the Solomon Sea derived from Lagrangian drifter observations.” *Journal of physical oceanography* 42.3 (2012): 448-458.

Kessler, W. S., and Sophie, C. “Mean circulation of the Coral Sea.” *Journal of Geophysical Research: Oceans* 118.12 (2013): 6385-6410.

Ministry of Environment, Climate Change, Disaster Management and Meteorology. The National Biodiversity Strategic Action Plan 2016 – 2020. Honiara.

Pacific Horizon Consultancy Group (2008). Solomon Islands Sate of the Environment Report. Ministry of Environment Conservation and Meteorology.

Solomon Islands Ecosystem and Socio-Economic Resilience Analysis and Mapping (ESRAM), Volume 3: Honiara. Apia, Samoa: SPREP, 2018.

Solomon Islands Government-Ocean 12 (2018). Solomon Islands National Ocean Policy. *Ministry of Environment, Climate Change, Disaster Management and Meteorology*.

Qi-wei, H. A. N. “Some rules of sediment transportation and deposition-scouring in the lower Yellow River [J].” *Journal of sediment Research* 3 (2004): 1-13.

Solomon Islands: waste management and pollution control strategy 2017 – 2026. Apia, Samoa: Secretariat of the Pacific Regional Environment Programme (SPREP) (2017). 106p.

Son, Kwang-Ik. “Modelling of Sediment Transportation and Deposition in GIS.” *Journal of Korea water resources association* 38.3 (2005): 223-233.

The Environment Bill 1998. no. 8. (Sol. Is.). Retrieved from: https://www.parliament.gov.sb/files/legislation/Acts/1998/The%20Environment%20Act%201998.pdf

UN-Habitat (2016a) Honiara Urban Resilience & Climate Action Plan. A joint strategy for the Honiara City Council and the Solomon Islands Government. Prepared for United Nations Human Settlements Programme (UN-Habitat) Cities and Climate Change Initiative (CCCI). Lead authors: Alexei Trundle and Darryn McEvoy, RMIT University Climate Change Adaptation Program, Melbourne.

ANNEX 1.

a) Environment Act 1998

The Environment Act covers all the environmental issues in the Solomon Islands, make provisions for the conservation and protection of the environment, and establishes the Environment and Conservation Division (ECD) within the Ministry of Environment, Climate Change, Disaster Management and Meteorology whose function is to administer the environment legislation. The Act provides for an integrated system of development control, EIA and pollution control. The Environment Act has considerable power by virtue of article 4 (1) which states that in the event of conflict between the Act and other Acts, the provisions of the Environment Act shall prevail.

As required under Part III of the Act, all developers must make an application for development consent together with the relevant EIA report and any other relevant information as may be required by the Director of ECD. The Director with responsible staff and government agency then reviews the application with the relevant EIA report and make decisions whether to grant or not to grant development consent.

b) National Waste Management and Pollution Control Strategy

The formulation of the National Waste Management and Pollution Control Strategy (NWMPCS) 2016-2024 is part of the ongoing efforts in the country to address the issue of waste and pollution as the country enters a period of rapid social and economic change. The objectives are:

1. The development of our natural resources does not compromise the wellbeing of natural environment, ecosystems and wellbeing.
2. Ensure that existing legislations, strategies and guidelines on waste management and pollution control are effectively implemented and enforced.
3. Support, encourage 4Rs and where relevant, regulate waste minimization for solid wastes noting that organic waste forms a large component of wastes produced in the country.
4. Develop institutional capacity and train waste and pollution experts for the country.
5. The government through the Ministry of Environment, Climate Change and Disaster Management and Meteorology (MECDM), provincial government and Ministry of Infrastructure Development (MID) are to ensure that all provincial centers have in place proper landfills or waste disposal sites and a functioning waste collection system.
6. All Solomon Islanders are aware of the issue of waste and pollution and are taking appropriate actions to address it.
7. Waste management and pollution control activities are undertaken based on accurate data and research, updated information, innovation and technology.
8. Encourage public-private partnership and investment in waste management and pollution control.
9. There is in place a long financial mechanism in place at the national level to manage waste and address pollution issues.
10. International guests and tourists are able enjoy the natural beauty and aesthetic value of the country.
11. Waste management and pollution control is fully addressed in responding to climate change and natural disasters.

c) Solomon Islands National Ocean Policy

The Solomon Islands Government in its inaugural, National Ocean Summit in 2015 saw the importance of ocean towards the people of the Solomon Islands and "recognized the need to have an integrated, cross-ministerial approach to ocean management and that no overreaching legislative or policy framework existed to facilitate such an approach." (Solomon Islands National Ocean Policy [SINOP], 2018). The formation of Ocean12 in April 2016 highlights just how important the ocean is to Solomon Islanders. SINOP mission 'aims to define and strengthen integrated ocean governance at various levels, and across sectors, to achieve national, regional and global ocean-related sustainable development goals on socio-economic development, food security, climate change resilience and adaptation, environment protection and conservation of biodiversity, protection from natural disasters, and national security." ((SINOP, 2018).

d) International Environmental and Social Treaties

Solomon Islands is a party to some of the international treaties and conventions. See table below:

Table 1: International Treaties and Conventions that the Solomon Islands is part of.

Multi-lateral Agreements that the Solomon Islands is a party to Convention or Treaty	Status	Purpose/Aim	Agency Responsible
Regional MEAs			
i. Pollution Protocol for Dumping	Ratified 10/9/98	Prevention of pollution of the South Pacific region by dumping	Marine Division/ECD
ii. Pollution Protocol for Emergencies	Ratified 10/9/98	Cooperation in combating pollution emergencies in the South Pacific region.	Marine Division/ECD Project: National Pollution Prevention Plan
iii. Natural Resources & Environment of South Pacific Region (Secretariat of the Pacific Regional Environment Programme [SPREP] Convention)	Ratified 10/9/98	Protection of natural resources and environment of the South Pacific Region in terms of management and development of the marine and coastal environment in the South Pacific Region.	ECD
iv. Waigani Convention on Hazardous & Radioactive Wastes 1995	Ratified 7/10/1998	Bans the importation of hazardous and radioactive wastes into Forum Island countries	ECD
		and to control the trans- boundary movement and management of hazardous wastes within the South Pacific region.	
Chemicals, Wastes and Pollution			
i. Liability for Oil Pollution Damage	Ratified	Strict liability of ship owner for pollution damage to a coastal state within a certain amount.	Marine Division

Multi-lateral Agreements that the Solomon Islands is a party to Convention or Treaty	Status	Purpose/Aim	Agency Responsible
ii. Marine Pollution Convention (London)	Ratified	Prevention of marine pollution by dumping of wastes and other matter.	ECD/Foreign Affairs
iii. Desertification (United Nations Convention to Combat Desertification [UNCCD])	Acceded 16/4/1999	Agreement to combat desertification and mitigate the effects of drought in countries experiencing drought or desertification.	Agriculture Division/ECD Project: National Action Plan on Land Degradation and Drought; National Capacity Self-Assessment (NCSA)
iv. POPs (Persistent Organic Pollutants) Convention (Stockholm)	Acceded 28.7/2004	Protection of human health and environment from persistent organic pollutants.	ECD/Environmental Health Div. Project: National Implementation Plan
Biodiversity			
i. CITES (Convention on International Trade in Endangered Species)	Instrument of ratification being prepared	Regulations and restriction of trade in wild animals and plants through a certification system of imports and exports.	ECD
ii. World Heritage Convention	Acceded 10/6/1992	Protection of sites of Outstanding Universal Values. Solomon Islands currently has East Rennell Island as a World Heritage site.	Museum/ECD
iii. Convention on Biological Diversity (United Nations Convention on Biological Diversity [UNCBD])	Ratified 3/10/1995	Conserve biological diversity through the sustainable use of its components and the fair and equitable sharing of the benefits arising out of utilizing genetic resources.	ECD Project: NCSA; National Biodiversity Strategy and Action Plan; International Waters Program; 3rd National Report
iv. Cartagena Protocol	Acceded	Protection of human health and the	ECD