## Appendix 1 – Preliminary Green Port Concept

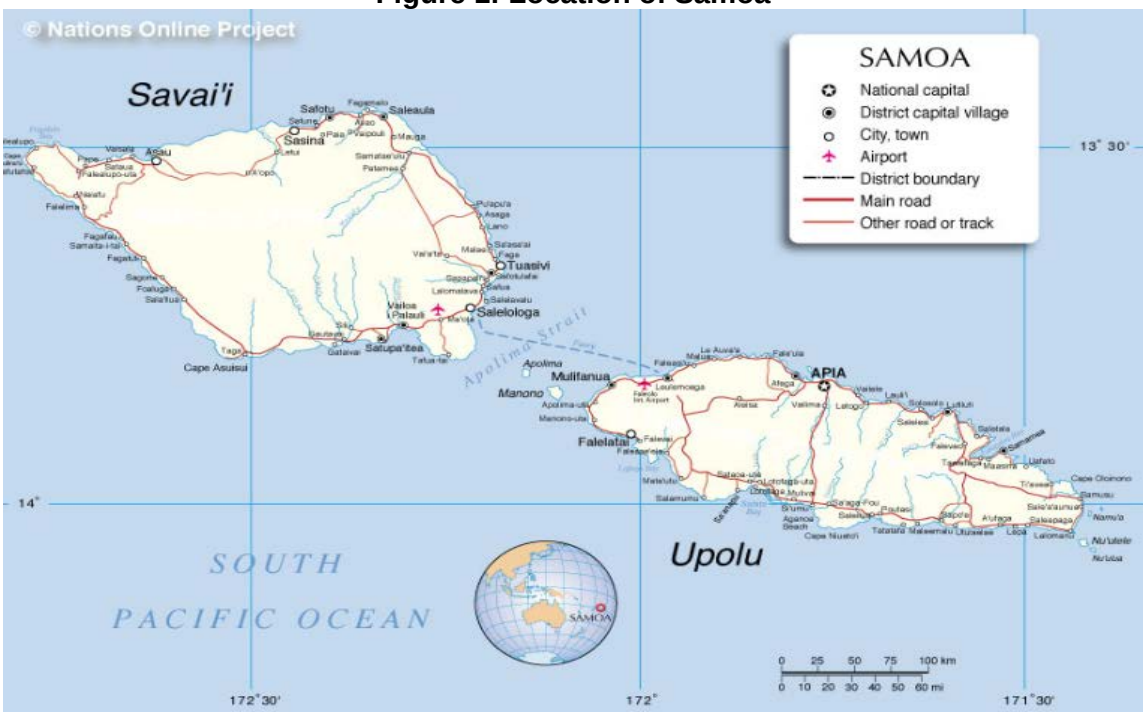
### I. Project Location

1. Samoa is an island state located in Polynesia in the South Pacific, about halfway between Hawaii and New Zealand (Figure 1). The country comprises two main islands—Upolu and Savai'i—and eight smaller islands, composed of narrow coastal plains where most of the population live, surrounding ancient volcanic mountain interiors. Together they total 2,831 square kilometers in area, which makes Samoa a small country even by South Pacific standards. With a population of 195,843 (according to the latest census in 2016, Samoa Bureau of Statistics), it is one of the smaller countries in the Pacific.

2. Upolu is the home to more than 75% of the total population; Apia, located on the north coast of Upolu, is the capital city of Samoa. It serves as the economic, political, and educational centre and also provides the international air and sea transport gateways. Its urban area of 51.8 square kilometers accommodates 37,391 people out of Upolu's total population of 152,419 according to the latest census by Bureau of Statistics. The Port of Apia functions as the main transport hub of the country, and international sea freight cargoes are predominantly handled here.

3. Like most of the national gateway seaports in the South Pacific, trade is dominated by full container imports and empty container exports and by 20-foot containers rather than 40-foot containers, the latter being mainly reefer containers used for exports of frozen tuna. Imports are fuel, manufactured goods and foodstuffs. Exports are nonu juice, taro, coconut, and beer shipped in dry containers and frozen fish which are landed on the wharf and loaded directly into 40-foot reefer containers for export. Other export trade has suffered from the closure of the Yazaki EDS, which prepared wiring harnesses for the Australian motor industry until its recent closure.

**Figure 1: Location of Samoa**



4. Apia Port, located on a peninsula in the Matautu village (in Vaimauga West district) at the mouth of Apia Bay has served as Samoa's main port of call for foreign vessels since the early 1900s. Apia Port is a natural deep water port, sheltered within the inner reaches of the Apia Harbour, and the port accounts for nearly 100% of physical freight movements in and out of the country, the remainder being high value and time critical imports which are carried as cargo in passenger aircraft.

## II. Description of Port Development

5. Upon Samoa's independence in 1962, a modern port with concrete pile wharves was established on the current location. Since its establishment, Apia Port has undergone various infrastructure upgrades and rehabilitation. Expansion and refurbishment of Apia Port took place in various stages to cater for the evolving trade growth, business needs and the nature of consignments over time.

6. In 1966, a reinforced concrete deck wharf of 185 meter in length was constructed by Government of New Zealand (Old International Wharf) to handle general cargo in nets and on pallets moved round the port by trailer and fork lift, but the load capacity of the wharf apron was below acceptable axle loading to accommodate the emerging needs for container loading and stacking and associated heavy handling equipment adequately.

7. A new wharf was constructed in 2003, funded by the Government of Japan (New International Wharf). This modern construction of 166 meter in length comprises a reinforced concrete deck supported by fill, which in turn is retained by a segmental pipe pile wall offering sufficient deck strength for modern container handling equipment.

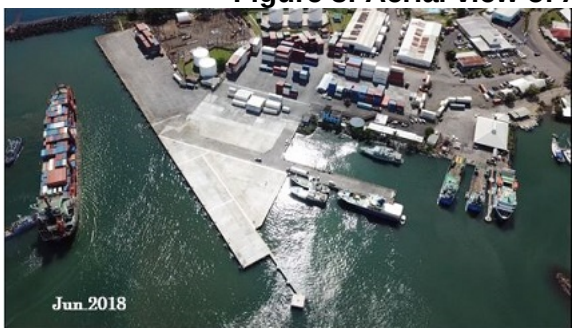
8. The Japan International Cooperation Agency (JICA) funded project-*Study on the Development of the Ports in Western Samoa* in 1987 led to the construction of a 100-meter-long breakwater at the eastern lead entrance to the Apia Harbour (see Figure 3.1).

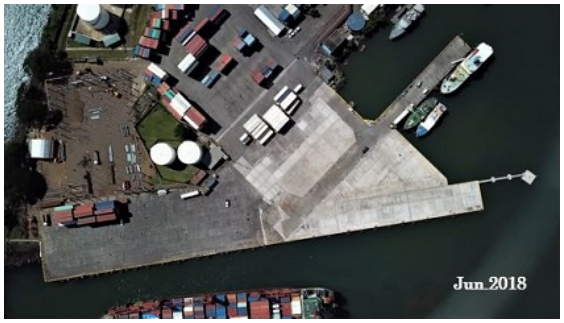
**Figure 2: Aerial View of Apia Port before JICA extension**


Source: Samoa Ports Development Masterplan (2016)

9. The latest development at the port started in 2015, when the Government of Japan announced the *Enhancement of Safety of Apia Port Project*, a US$D 30 million grant for an extension to the New International Wharf towards the Old International Wharf, creating an uninterrupted wharf alignment. This wharf extension was completed in 2018 and a combined wharf structure of 302m is now in operation (Figure 3).

**Figure 3: Aerial view of Apia Port after JICA extension**




Source: Samoa Ports Authority.

10. SPA which was established under the Port Authority Act (1998, No. 34) is responsible for the planning, promotion, development, construction, operation, and maintenance of Apia Port. SPA operates as a public trading body (state-owned enterprise) in accordance with the Public Bodies (Performance and Accountability) Act 2001. SPA reports to the Minister of Works, Transport and Infrastructure (MWTI), and the Ministry of Public Enterprises which was established in 2015 to act as the government 'watchdog' over the performance and financial results of state-owned enterprises including SPA. The MWTI is the government agency responsible for preventing and managing marine pollution and oils spills.

## III. Identifying and Classifying Green Port Issues

11. There are a number of ways of classifying Green Port Issues. One is to classify the issues and impacts by type, indicating the most common effects and identifying stakeholders. The second is to follow the flows through the port, using a logistics process map or a fishbone chart and classifying the environmental impacts of each step in the process by nature and source. The first has been adopted for this high-level report, although for the later detailed planning of individual initiatives through process mapping may be more suitable. Gender analysis will be carried out under each heading.

12. Table 1 below sets out the recommended items to be taken into consideration under the green port study. The table identifies key activities, environmental impacts, and stakeholders whose activities impact on Apia Port and its authority or are impacted by Apia Port operations.

**Table 1: Initially Identified Matters for a Green Port at Matatu-Apia**

| **Green Port activity** | **Environmental impacts and considerations** | **Primary Stakeholders** |
|---|---|---|
| Port operational efficiency | Port Type<br>(Bulk, general cargo, container, fishing, recreational)<br>Throughput(s)<br>Size and layout<br>Choice of operational method and machinery<br>Operational, customs and other agencies IT<br>management and data capture systems<br>Choice of commercial structure (Vertically integrated, private franchisee, private stevedores, private tug operators, pilots, etc.) | SPA<br>Terminal Operators<br>MWTI,<br>SSC<br>Stevedores<br>Freight forwarders<br>Shipping Lines<br>Road transport operators<br>MFR - Customs<br>Immigration<br>Biosecurity (Samoa Quarantine Service)<br>Ministry of Health |
| Energy efficiency and sources of power | Selection of port equipment requiring substantial energy inputs<br>Cranes, handling equipment, freight transport within the port, refrigeration, lighting)<br>Opportunities for emissions reduction at point of use (e.g. electrification)<br>Opportunities for the use of hybrid equipment allowing energy recovery<br>Sources of electrical energy and the use of renewable sources (hydro, wind, solar) | SPA<br><br>Terminal Operators<br>Stevedores<br>Shipping Lines<br>MNRE – Renewable Energy<br>Electric Power Company<br>(e.g. regulations for off – grid power generation by the Port Authority or franchisees) |

| **Green Port activity** | **Environmental impacts and considerations** | **Primary Stakeholders** |
|---|---|---|
| Efficient use of water | Sources of water for ships' bunkers and port use (high quality mains water, rainwater, recycled water)<br><br>Classification of water requirements (drinking, bunker, cleaning, container washing, watering, site planting, etc. | Port Authority<br>Terminal Operators<br>Stevedores<br>Shipping lines<br>Samoa Water Authority |
| Marine water quality<br>(port-related discharges and emissions) | Liquid and solid wastes and runoff from Port Area<br>Liquid wastes and runoff from agricultural, residential, commercial and industrial development in the catchment area of the harbour<br>Wastewater from vessels, including ballast water<br>Port sanitary facilities and treatment | SPA<br><br>MWTI,<br>MNRE: PUMA, DEC, Water Resources Division (and Board)<br>Terminal Operators<br>MAF – Fisheries Division<br>Communities and villages adjacent to Apia Port<br>Vaisigano and Matatu River-side communities and villages<br>Samoa Water Authority<br>Major industrial developers |
| Air Quality<br>(Port Component of emissions) | Emissions of global warming gases, noxious gases and particulates from both port operations and equipment<br>Emissions from vessels within the harbour waters<br>Emissions from port related industrial development<br>Generation of dust from materials handling within the port and port related industrial developments | SPA<br>MWTI<br>MNRE<br>Terminal Operators<br>Stevedores<br>Shipping Lines<br>International Maritime Organisation (IMO)<br>Port related industry managers<br>Communities and villages adjacent to Apia Port |
| Solid Waste Management | Waste from vessels<br>Waste from port operations<br>Construction Waste<br>Dredged materials<br>Clearance of contaminated land | SPA<br>Terminal Operators<br>Shipping Lines<br>Port Construction Contractors<br>MNRE – PUMA, Solid Waste Division, Chemical and Hazardous Waste Section |
| Noise Reduction | Noise reduction at point of use (e.g. electrification, use of ear protection)<br>Noise from loading operations<br>Use of buildings as noise barriers<br>Noise from vessels in port (engine noise) | Port Authority<br>Terminal Operators<br>Stevedores<br>Shipping Lines<br>MNRE – PUMA<br>Communities and villages adjacent to Apia Port<br>Ministry of Health |
| Light Spillage | Light from night-time port operations affecting neighbouring developments | Port Authority<br>Terminal Operators<br>Stevedores<br>Shipping Lines<br>Port Related Industries<br>MNRE – PUMA<br>Communities and villages adjacent to Apia Port |

| Green Port activity | Environmental impacts and considerations | Primary Stakeholders |
|---|---|---|
| Biosecurity | Vermin from vessels<br>Pests in and on containers<br>Control of foreign species<br>Ballast Water<br>Introduction of invasive/alien species | Port Authority<br>Terminal Operators<br>MNRE – DEC - Terrestrial Biodiversity Section, Marine Biodiversity Section<br>Samoa Quarantine Services |
| Impact of Port Traffic | Gate design<br>Access road system<br>Volume of port traffic vs local traffic<br>Proportion of transshipment | Port Authority<br>Terminal Operators<br>Shipping Agents<br>Freight Forwarders<br>Land Transport Authority<br>MNRE – PUMA<br>Communities and villages adjacent to Apia Port |
| Emergency environmental response and protection | Port Safety<br>Port Fire Control<br>Spillage from land and vessels | SPA<br>MWTI<br>MNRE – Meteorology and Climate Change Division, DEC - Terrestrial Biodiversity Section, Marine Biodiversity Section, Chemical and Hazardous Waste Section<br>Ambulance Service<br>Fire Service<br>Coastguard |

## IV. Port Types and their Influence

13. Ports differ according to their size and the functions they perform. Larger ports are usually divided into separate terminal areas handling different types of traffic and vessels, whereas small ports may provide for more than one function at a common facility. Similarly, large ports will usually have separate specialized terminal franchisees to operate each type of terminal, whereas small ports will often have a single vertically integrated port authority to run the port. They will also have specialist facilities to handle toxic wastes and pollutants.

14. Types of terminals include:

- Liquid and dry bulk terminals
- Container terminals
- General cargo terminals
- Cruise terminals
- Ferry (usually ro-ro) terminals
- Fishing harbours
- Recreational marinas

15. In terms of environmental impact and green port policies, bulk terminals and in particular large dry bulk terminals for minerals etc. and large liquid bulk terminals serving refineries or tank farms have specific problems of dust, noise, fire control and heavy road or rail traffic and are best segregated from other terminals and residential and commercial development.

16. Container ports and terminals are in principle usually “greener” than bulk materials ports, but large terminals produce significant noise and light spillage as they operate day and night and require careful building layout and design to create barriers between the port and neighbouring development. They also create greater channel dredging problems, as they require access at all states of the tide, whereas bulk vessels can enter and leave at high tide, using deeper pocket dredged berths during their stay.

17. Container ports which are primarily transshipment hubs have a limited impact on the road system, but large national and continental entry and exit container ports can produce heavy flows requiring dedicated road and rail links separated from the local traffic circulation. Rotterdam, for example, has a major freeway system to feed the hundreds of terminals located over a distance of 25 kilometer down the Maas River from the city.

18. Container ports and terminals may also be under additional pressure to reduce costs where one or more ports compete for the same business. Examples include Western Europe where ports in Germany, the Netherlands and Belgium compete as gateway ports for the Western European market, or in the Malacca Straits where Singapore and Malaysian ports and terminals compete for transshipment business. This can lead to poorer environmental standards unless suitable regulations are imposed and uniformly enforced. This may require either international agreement to achieve common standards and a “level playing field” or trans-national regulation such as that in the European Union.

19. If calling numbers are high, cruise liners usually call at separate terminals which are increasingly designed to high environmental standards as they form a tourist gateway and destinations are keen to encourage second visits with longer stays and hence a higher benefit through hotel and restaurant use. The small scale of yachting marinas makes it easier to integrate them into the urban landscape and they can become a tourist attraction in themselves where older port areas are redeveloped as marinas, as in the Old Port of Marseilles. They require specific controls, in particular over refuse and sanitary waste disposal from small vessels.

20. In summary, the main distinction is between small ports, with common facilities for one or more of these port functions and in most cases a vertically integrated management structure, and large ports with specialized terminals, often under separate management or ownership, catering for larger vessels up to 400 meter LOA and DWT up to 200,000 tonnes for container vessels and 300,000 tonnes or more for bulk carriers.

21. This preliminary report concentrates attention on small ports without significant bulk materials handling and where (as in Apia) joint use is made of the primary yard and wharf facilities, although separate facilities are provided for domestic, fishing, ferry and recreational yachting vessels.

## V. Stakeholders

22. The third column in Table 1 indicates the wide range of stakeholders with responsibilities for, or an interest in, environmental quality. These include regulators, both international regulators and national regulation under international treaties and agreements, and under country systems. As noted above, the scope of a gender sensitive Green Port Policy must be aligned with the administrative, regulatory and management responsibilities of the government ministries.

23. An important international regulator is the International Maritime Organisation (IMO) which sets standards under its Marine Pollution (“Marpol”) Regulations which individual countries have

treaty obligations to enforce. These are set to introduce new controls on fuels for maritime use and hence smokestack emissions in 2020.

24. Other stakeholders include public, private and community organisations whose actions directly affect the port and maritime waters environment or are affected by port operations. chiefly the port authority itself, franchisees and subcontractors such as terminal operators and stevedores, shipping lines whose vessels call at the port and logistics managers such as shipping agents and freight forwarders who provide logistics management. Land-side warehousing and land transport to and from the port.

25. There are also stakeholders by virtue of being businesses and individuals whose actions impinge on the port and in particular, the water quality and operational safety of the port waters for which the Port Authority has responsibility. Whilst the actions of these parties may fall outside the control of the Port Authority, they must not be forgotten.

## VI. Apia and Small South Pacific Port Green Port Policies

### A. Apia as an Exemplar of a Small South Pacific Port

26. In this section, Apia is discussed both as an exemplar of a small South Pacific Port and as the focus of the proposed detailed study of existing problems and initiatives in Apia. In common with almost all small ports, it is located close to the heart of the city, as Figure 1 below shows clearly, and the two interact. In this section, the issues set out in Table 1 are discussed in the context of Apia and the current problems and constraints for each are examined.

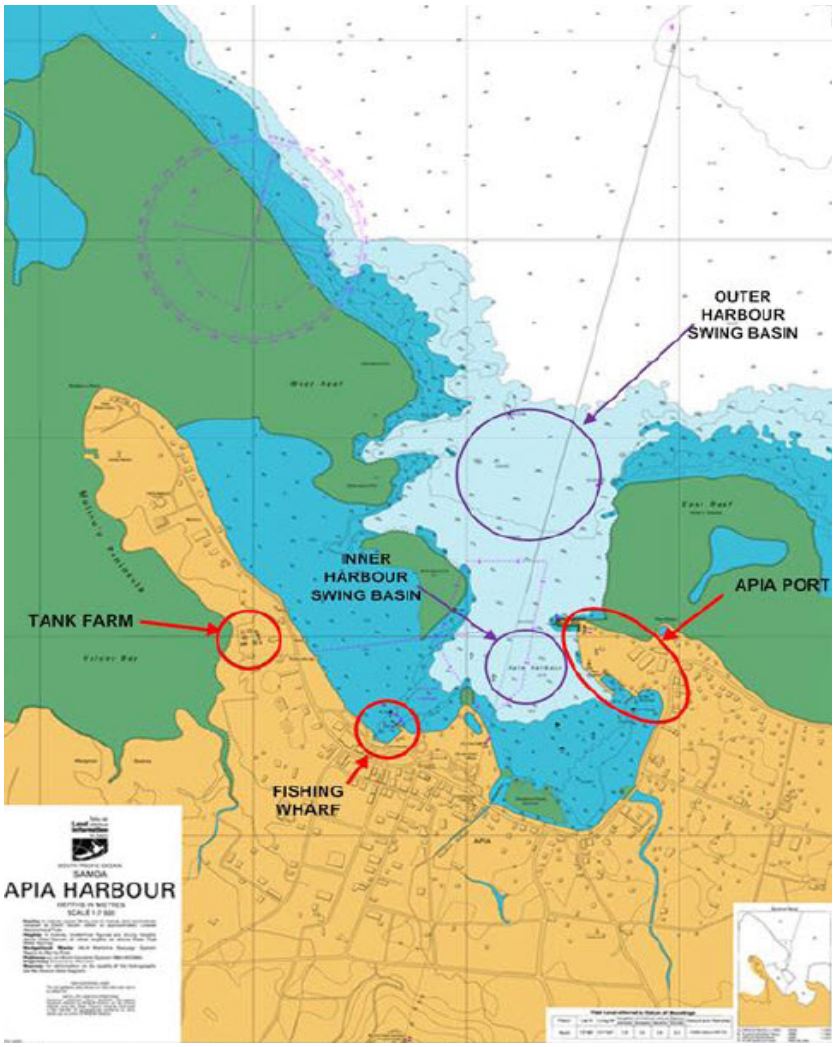
27. The port is operated by the Samoa Ports Authority which is headed by a Chief Executive Officer. He reports to the Minister of Works, Transport & Infrastructure and the Ministry of Public Enterprises which was established in 2015 to act as a government ‘watchdog’ over the performance and financial results of certain State-Owned Enterprises, including SPA.

28. SPA is responsible for management of the port itself and marine waters within a radius of two nautical miles (approximately 4km) radius from the port, covering all the bay of Apia at the mouths of the Vaisigano and Togafu’afu’a Rivers, which drain residential, commercial and agricultural land, the adjacent coastline and the approach channels out to deep water.

29. It also covers the reefs adjacent to the approach channel, which are the most likely locations for marine accidents which could lead to spillage when vessels are attempting to enter in summer swell conditions with a following quartering wind.

30. The chart of Apia Port in Figure 4 below depicts an area about 4 kilometer in width, so the port jurisdiction extends slightly beyond this area, although in practice, the bay and the approach channels are of greatest importance.

**Figure 4: Chart of Apia Harbour**




Sources: SAM Ports Masterplan, 2016, Ref 6, and Admiralty Chart.

31. On the land side, the demarcation of the Port Authority's legal and regulatory duties appears to be based primarily on land ownership, but its responsibilities are not entirely clear. It does, for example, use an area outside the gated and controlled area which at present is of low visual and operational quality as a parking and waiting area for trucks carrying goods and containers to and from the port.

### B. Apia International Port Facilities

32. The Apia port facilities are described in more detail in the SAM Ports Masterplan, Final Report, Ref.6 and comprise five separate components, the first three being located close together on the Eastern shore of the harbour:

- The international yard and wharf
- Domestic wharves including the ro-ro berth for the Apia – Pago Pago ferry
- The yacht marina
- Separate swinging moorings for gas tankers on the West side of the harbour connected to an onshore tank farm by undersea pipelines
- A separate wharf for small local fishing vessels on the South West shore of the harbour.

33. The International Wharf has recently been extended by 137m under a JICA project which included the provision of strengthened fenders on the existing wharf and the extension, together with the construction of an additional 1970m2 of container yard. Further improvements to the yard and proposals for the repair of the damaged breakwater is currently being prepared. The proposed additional improvements to the International Yard include:

- Improved Traffic Circulation between the wharf and the stacking areas
- Construction of new reefer container facilities for exports of frozen tuna
- Rationalisation of the container yard layout to improve circulation. Since the AMSTEC Report was published in 2016, the northern section of the existing yard immediately behind the breakwater has been allocated to a cable store and cable vessel loading facility. The extra yard area provided under the JICA Aid Project has partly compensated for the reduction in yard space.
- Improved lighting and new low voltage electricity supply network
- Reconstruction of weak areas of yard originally built about 50 years ago for general cargo movement using forklifts rather than for laden 40ft containers
- Provision of facilities for a customs x-ray scanner to improve the efficiency and effectiveness of customs inspection
- Provision of new water mains
- Repairs to cable covers and areas of wharf subject to flooding

34. **Legislative and Regulatory Responsibilities for Environmental Matters.** MWTI is responsible for marine pollution and oil spills. Responsibility for regulation of almost all the environmental matters listed in Table 1 falls under the Ministry of Natural Resources and Environment, which is responsible for:

- Renewable energy
- Water resources
- Disaster management
- Terrestrial and marine environment and conservation
- Land management
- Planning and urban management (and issue of development consents)
- Solid waste management
- Chemical and hazardous waste management
- Climate change and GEF services, and
- Forest management

35. The main exception is electricity generation and distribution, and renewable power initiatives which are the responsibility of the Electric Power Corporation (EPC) and water supply and sanitation which is the responsibility of Samoa Water Authority (SWA). Both agencies report to the Ministry of Public Enterprises.

36. These agencies have a major stake in the development of the proposed green port initiatives to be taken forward, since it is important that the Green Port initiatives support rather than overlap or duplicate with the functions and responsibilities of the MWTI, divisions of MNRE, SWA, EPC within the.

37. In particular, greater administrative clarity can be achieved if the studies and initiatives developed under the Green Ports Policy are restricted to:

- The impact which port operations and navigation within the landside port areas and the marine waters which are under the SPA jurisdiction have on the environment, leaving the impacts of other developments on (for example) air and water quality to the initiatives of the MNRE. These include (for example) the Apia Waterfront Development Project
- The impact of international vessels calling at the port on the environment
- A checklist of other matters which are the responsibility of other Ministries and are not covered directly by initiatives under the Policy, but which need to be covered within initiatives by other Ministries. These include (for example) impacts on marine water quality within the designated harbour area which do not result from port operations, visiting vessels or navigation.

38. **Suggested Content of the Green Port Studies.** The following sets out the type of information and assessment to be included in the pre-feasibility level assessments and studies to inform the development of a gender sensitive Green Port Policy for Apia and a set of defined initiatives which can be taken forward by SPA.

39. **Operational Efficiency and Review of Current Apia Port Layout Proposals.** While a portion of the work for this element is being undertaken through the detailed design of the main project, funded by the project design advance, it will be necessary for the consultant to review of the port layout proposals from a port efficiency perspective, since a key factor in any Green Port Policy must be to reduce the inputs of materials, power and labour required to carry out its functions.

40. The implementation of a Terminal Operating System (TOS) would be particularly necessary as both vessel loading and unloading using ships gear cranes and container movements in the yard itself are (unusually) carried out by independent stevedore companies and not SPA, the terminal operator. Improved locational information which can be transmitted directly to the yard equipment operators by radio link is essential to improve operating efficiency. The proposed systems should be appropriate and cost efficient, taking into consideration of the scale of the port.

41. Other developments and improvements to the existing draft proposals which need consideration include:

- There is a need for a buffer container stack close to the northern end of the wharf where export containers can be placed prior to vessel arrival to speed turn round. The interaction of this stack with the operation of the cable store should be reviewed.
- The proposed reefer yard location is good but it its shape is not ideal, and the area is inadequate as it is restricted by the cable store and the existing pumping station, which is apparently not to be relocated. The layout in this area could be reviewed.
- The current fenders are too large for the long liner tuna fishing vessels and impede fish transfer at the main wharf. An option may be to move the fishing vessels to the old domestic wharves.
- The types of equipment and the method of operation using tugs and trailers to move containers between the wharf face and the stacks appears appropriate for a yard of the size of Apia. However, greater use of lighter empty container equipment could be considered.

Note: The scope of terminal side improvements should be discussed and agreed with SPA at the Inception phase of the Green Port Initiative study. The consultant should also conduct their

analyses based on the final terminal layout design undertaken as part of the “Enhancing Safety Security and Sustainability of Apia Port Project”.

42. **Energy Efficiency and Sources of Power.** Higher efficiency LED yard lighting powered by photovoltaic (PV) solar panels is already being considered for Apia and is already being implemented in other South Pacific ports. This increases efficiency and reduces dependency on imported diesel fuel generation. Samoa has a program of moving to renewable sources (solar, wind and hydro power) by the early 2020s, so the expansion of local generation should be assessed on a cost effectiveness basis taking account of linkage to a grid based on power from renewable sources. Hence any initiatives will need to be developed in close consultation with the EPC and renewable energy division of MNRE.

43. The design of any new buildings should take account of the need for careful design and insulation to reduce air conditioning costs and electricity consumption.

44. The selection of yard equipment should also take account of the possibility of electric power, since this can be supplied in the future from renewable resources from the grid and simultaneously reduce local emissions of $NO_X$, particulates and $CO_2$. This will need coordination between the SPA and the private stevedores who supply their own equipment for yard operations. Where full electrification is not possible hybrid systems with batteries and constant speed clean diesel technology should be considered.

45. There is likely to be a continuing requirement for standby diesel generation as full battery provision (other than for no-break power for control systems, communications and emergency lighting) will probably be too expensive. Any diesel power plants should use clean diesel technology, low Sulphur diesel fuel and emissions control.

To ensure relevance of the consultant’s review of energy requirements, efficiency and sources of power as a component of the Green Policy and the generation of proposals for improvements, the Consultant shall conduct their analyses based on the final terminal layout design undertaken as part of the “Enhancing Safety Security and Sustainability of Apia Port Project”.

46. **Efficient Use of Water.** Water resources management and water supplies, wastewater and sanitation fall respectively under the MNRE water resources Division and SWA. Potable water is needed for human consumption and other purposes including high quality cleaning. But it is expensive to treat and distribute. Many functions within a port do not require such high-quality water and other sources should be considered:

- Rainwater collected from building roofs which can be used for washing and fire
- Recycled water which can be used for more general cleaning and washing down and sanitary purposes
- Recycled water treated in local sanitary facilities which can be used for watering planted areas and hence reduce organic and nitrogenous waste in outfalls.
- Desalinated water is rarely viable used except in areas with low rainfall and very limited potable water supplies. Samoa has adequate annual rainfall, although it is concentrated in the wet season November – January. The policy to be adopted depends on the availability of treated water and its cost, the seasonality of rainfall and the nature of the cleaning operations which do not require potable water.

The Green Policy will need to include an assessment of the opportunities, developed in consultation with the water and sanitation authorities.

47. **Marine Water Quality.** There are several stakeholders to be coordinated and consulted for this element. As discussed earlier, this is perhaps the most difficult area to manage, since harbour water quality (particularly in small ports) is often affected more by the runoff from residential and commercial development to a greater extent than by the port activities themselves. The water quality is also affected by run-off from the port, including outfalls from rainwater drainage, washing areas and sanitary facilities all these require appropriate treatment before being discharged to limit the release of hydrocarbons from diesel fuel and hydraulic fluid leakage as well as detergents and cleaning chemicals from washing areas. The Policy should include requirements for the control of discharges and a set of initiatives to improve currently inadequate practices.

48. The regulatory framework set by the SPA should control the release of all liquid discharges from vessels whilst in port. Ballast water treatment and release should be managed under the Marpol 73/78 International Convention and the IMO recommendations. Following 13 years of negotiations, these were promulgated as in 2017 as the Ballast Water Management Convention 2004, which has now been ratified by over 70 countries. It requires vessels to have appropriate treatment facilities for ballast water, together with a management system which is open to inspection and audit in ports in nations who have ratified the treaty.

49. general, discharges of ballast water in small ports should be banned and facilities for the treatment of ballast water sediment are unlikely to be available. The primary role of the Port Authority is to ensure staff training leading to ratification of the Treaty and compliance with it and to monitor compliance by shipping lines.

50. A Green Port Policy cannot be reasonably expected to cover the control of non – port and non - vessel liquid waste discharges. However, it is recommended that any study should include an overview of current data on water quality in Apia harbour and the impact of the range of direct and river discharges from residential, commercial and agricultural land uses which affect it to identify any shortfalls requiring study by the MNRE, MWTI and others. The initiatives under the Green Port Policy would however be limited to those which are under the control of the Port Authority.

51. **Port Air Quality.** This item overlaps with energy/sources of power, which includes initiatives to replace diesel generated emissions where possible and control emissions from the remainder. Measures should also be taken to control dust from any dry bulk vessels or dusty cargoes such as cement.

52. The more complex area is that of emissions from international vessels in Samoan waters and Apia Port. In brief the current position is as follows.

53. Historically, all deep-sea vessels have been fueled using residual fuel oil, also known as residual maritime oil (RMO). This is the tar-like heavy oil residue after distillation of lighter grades such as petrol (gasoline) and diesel fuel. It usually retains much of the original Sulphur from the crude oil and in the past sulphur contents as high as 5% were common, leading to high emissions of Sox and particulates at sea and in harbour. The limit was reduced to 3.5% in 2012 but even so, research suggests that the emissions from seagoing vessels may lead to an additional 110,000 premature deaths per year.

54. In 2016, IMO members voted for a change to Marpol limits. (Ref 9) The MARPOL 2020 sulphur limit for maritime bunker fuels will be lowered to 0.5%, the equivalent of low sulphur diesel used in road transport. This is too low to be obtained as a residual fuel oil, so either Sulphur must be extracted from RMO at the refinery to provide a compliant bunker fuel for maritime use, or the Sulphur content of the exhaust must be reduced using an onboard desulphurization plant ("scrubber"), or a switch must be made to very low sulphur gasoil or natural gas. (Refs 9 & 10). The regulations are relaxed for older and smaller vessels (less than 300GRT).

55. This change has created a lively debate about the time needed for transition and the higher cost of fuel which will increase shipping costs. At present, the most likely scenario is expected to be that the majority of smaller vessels will initially use very low Sulphur fuel oil where available or switch to marine gasoil (MGO) where it is not. Ref 11). A significant degree of non-compliance is expected in the shorter term. Over a period of one to two years, as refinery Sulphur extraction capacity increases, there will be a move towards the use of very low Sulphur fuel oils. Large vessels may continue to use high Sulphur fuel oil with onboard scrubbers or later switch to liquid natural gas once a bunker network is set up.

56. majority of future vessels serving Apia, Samoa, are likely to be 50,000 DWT or less, together with a few larger cruise liners. It is expected that the smaller and older vessels will switch to MGO and pass on higher fuel costs to shippers, but larger and newer vessels may retrofit scrubbers. The switch is likely to be rather last minute and the decisions made by major shipping lines, such as Maersk and Swire (who should be consulted in the detailed study), will become clear in 2019. Those by Maersk may be influenced in the longer term by its recently announced program to move to zero net CO2 emissions by 2050.

57. Other means of reducing emissions in port have been proposed, including smokestack capture and "cold ironing" – powering vessels from port electricity supplies whilst in port. Neither appears at present to be economic for small ports such as Apia. Hence the most likely initiative for Apia could be to embrace the Marpol 2020 requirements and as a sovereign state, ensure that all vessels calling in Apia are properly certified and monitored.

58. **Vessel and Port Solid Waste**. The discharge of waste from sea-going vessels is controlled by the IMO Marpol Annex V (1996). Ports have a duty to support this through inspection and verification of on board waste management systems and the provision of port waste reception facilities. These requirements are understood to be in place in Apia, so whilst a check is needed and this requirement must be included in the Policy, there is unlikely to be any need for an additional action plan.

59. Waste within the port is primarily industrial waste associated with port operations, including packaging etc. Solid waste is a further responsibility of the MNRE. It is collected by compactor truck and disposed of in a sanitary land fill. The area with scope for improvement within the port is likely to be recycling practices to reduce land fill volumes.

60. Construction waste is again disposed of in landfill and some may be recyclable. Only an audit as part of a more detailed study can ascertain this. A recurring problem in Samoa has been the disposal of asbestos containing material, which is likely to be incorporated in buildings constructed up to the 1990s. In addition, some from earlier demolition may be buried within the port.

61. There are Samoan branches of companies specializing in the identification and safe disposal of asbestos and this should be covered in a detailed study.

62. Apia is fortunate in that there is little requirement for either channel or pocket dredging and the disposal of dredged materials, except as part of port expansion projects.

63. **Noise Reduction.** All ports have some noisy operations, including pneumatic drilling during construction and repair work and noise from vessels in port and diesel engines and generators. A Green Policy should include recommendations the reduction of noise at source or the use of barriers where this is not possible, together with the compulsory use of ear protectors by staff operating noisy machinery to reduce long term hearing loss.

64. A wider problem affecting neighbouring developments may be noise from night operations, particularly vessel loading and unloading and the use of diesel-powered handling and transport equipment in the yard. Barriers may be needed; warehouses and port buildings sited on the perimeter of the port can provide significant reductions in noise levels in adjacent properties. Guidelines for noise reduction, particularly at night when background noise levels are low, is an important element of a Green Port Policy.

65. **Light Spillage**. Light spillage at night is a significant problem for large container and bulk materials terminals working 24/7 in locations near residential areas. It does not appear to be a major problem in Apia at present, both because night operations are intermittent rather than continuous and the yard itself is not overlooked by residential buildings, although the proposed improvements in lighting levels will need to be considered. Specific problems (for example, close to the boundaries of the port) can be dealt with by the use of directional lighting with cut off shields mounted on the lighting towers.

66. **Biosecurity.** This element will need to be coordinated with Samoa Quarantine Services. Biosecurity is a major concern in the Pacific, since the countries, including Australia and New Zealand, have vulnerable agriculture-based economies as well as endemic flora and fauna. Requirements such as prevention and control measures for introduction of invasive and alien species, vermin barriers on mooring lines are universal and all countries have biosecurity departments charged with limiting the risks of transmission of pests and disease.

67. Important components include phytosanitary cleaning of containers, inside and out, and inspection of ballast water management systems and records.

68. Difficulties have been experienced in some South Pacific countries with coordination between the separate government departments responsible for biosecurity, customs, health and food quarantine. As part of the program of improving port efficiency, proposals for improving coordination of clearance and inspection would be beneficial.

69. **Impact of Port Traffic.** The impact of port traffic is a major issue for large national and regional gateway ports of exit and entry, particularly where the port and its entrance and exit gates are downtown.

70. Apia is a national gateway port, but the relatively low national population (about 200,000) and the low development density of Apia limit its traffic impact. Nevertheless, it is important to ensure that the gate operations do not impede other traffic and heavy trucks do not create accident risks when turning into the traffic stream.

71. This is likely to be a minor concern at Apia, but there is a need for rationalization of the gate area, with greater clarity of routing and landscaping (see below) together with proper pedestrian segregation.

72. **Emergency Environmental Response and Protection.** Almost all South Pacific international ports have good navigations aids. Unfortunately, some suffer from the looting of solar panels required to ensure illumination and safe navigation at night. Several have entrance channels through reef passages which may become difficult to navigate in conditions of heavy following swell and quartering winds. So, there is always the possibility of an accidental grounding giving rise to the release of bunker fuel or diesel fuel carried in small tankers. Hence there is a need for an emergency environmental protection plan for the port and its access channels and adjacent reefs and the provision of floating barriers to contain spills and equipment to remove pollutants from the water and dispose of them.

73. Developing an action plan to minimize the spread of pollutants after incidents ranging from small scale oil and fuel release to major oil and bunker fuel spillage requires a risk assessment to evaluate the nature, scale and risk of incidents followed by the development of a manual, the procurement of suitable equipment and the training of staff drawn from routine activities in the emergency procedures.

74. The Pacific Islands Regional Marine Spill Contingency Plan (PACPLAN, 2013) was developed by the Secretariat of the Pacific Regional Environment Programme (SPREP) to provide a framework for co-operative regional responses.

75. At the nation level, each SPREP member government is to develop and maintain a National Spill Contingency Plan (NATPLAN) and sub – plans for individual ports. It is not clear how much progress has been made to date in individual countries.
Plans in Samoa should also be coordinated with the National Disaster Management Plan, which is updated every three years, the current Plan being for 2017 – 2020.

76. **Green Port Audit and Green Port Initiatives.** The next step in developing green port initiatives should be to carry out a study commencing with the further definition of the components of the gender sensitive Green Port Policy for Apia, based on but not constrained by this initial Report, the preparation of a check list of current performance under each head and an audit of current performance. The checklist and audit will include gender analysis. This would lead to the development of a gender sensitive Green Port Practice Manual suitable for the specific requirements of the Port of Apia for the use of the SPA. It would include examples of best practices appropriate to Apia and a Reporting Framework to assess progress towards the performance targets.

77. Based on the audit, the study consultants will develop a list of current Performance Indicators and Targets and Target Dates for future Port Performance. They will also develop a list of priority initiatives and carry out feasibility studies for each, following which consultants would be engaged for detailed design and implementation work.

78. Based on the initial assessment, the most likely areas for early priority projects appear to be:

- Energy Efficiency and sources of power for fixed and mobile port equipment, including that used by stevedores
- Water supplies, possible rainfall collection and recycling
- Marine water quality impacts of port activities including washing and sanitation. Procedures to ensure ratification of and compliance with IMO Marpol Protocols including BWM 2004 should also be checked. The study should include an initial overview of wider harbour water quality and the effect of emissions from non – port sources, but not a detailed remedial plan, which if needed should fall under the Ministry of Natural Resources and Development
- Review of procedures for regulation of vessel compliance with IMO Marpol procedures including Marpol 2020
- Review of the building maintenance program
- Redesign in association with road authorities and of the gate area and landscaping of truck and passenger vehicle parking areas
- Development of a NATPLAN and local port plans for Emergency Environmental Protection procedures, procurement of equipment and training in accordance with PACPLAN recommendations and the National Disaster Management Plan 2017 - 2020.

79. Further studies may show that in some areas, procedures and existing facilities are already adequate; in others, guidelines have been established but not (or not fully) implemented and in some cases, critical interventions are needed in areas not listed above.

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