Initial Environmental Examination

September 2011

PNG: Rural Primary Health Services Delivery Project

CURRENCY EQUIVALENTS
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ABBREVIATIONS

ADB – Asian Development Bank
CEMP – contractor environmental monitoring plan
CHP – community health post
DEC – Department of Environment and Conservation
EIA – environmental impact assessment
EMP – environmental management plan
IEE – initial environmental examination
NDOH – National Department of Health
NHP – national health plan
PHC – primary health care
PNG – Papua New Guinea
PSU – project support unit

NOTE

(i) In this report, "$" refers to US dollars unless otherwise stated.

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I. EXECUTIVE SUMMARY

1. An Initial Environmental Examination (IEE) of the Rural Primary Health Services Delivery Project was carried out which was based on secondary data and research in flora, fauna, land use and sociology. The project’s objective is to improve the health of rural populations in rural areas via the provision of (i) equitable access to quality primary healthcare services, and (ii) effective delivery of rural primary healthcare services. The project outputs at the national level include support for the development and implementation of policies, standards and strategies for community health posts (CHP) and health human resources. At the sub-national level, the project will improve service delivery, strengthen the health system, improve local capacity for health care, and provide effective project management. Within the sub-national components, the project will build new health facilities and upgrade existing facilities (output 4). It is within the remit of these buildings that the project could potentially have an environmental impact, and that environmental protection measures need to be considered.

2. The IEE has reviewed the environmental impacts associated with the project. Overall, there are few impacts associated with the development of health facilities. There are however a variety of issues relating to wastewater treatment that require consideration.

3. Construction activities will only occur in small areas – probably no more than 0.25 ha per location. While the actual location of the facilities will be determined within the early stages of the project, it is certain that they will be located within populated areas, in proximity to existing roads and infrastructure. For this reason, their construction will not require the clearance of any forest, or ecologically important vegetation. No significant vegetation, primary forest or conservation areas will be affected by the development. There will be no impacts on any flora or fauna.

4. The IEE concludes that the project has few adverse impacts and all can be satisfactorily managed and that an environmental impact assessment is not required.

II. INTRODUCTION

5. The project will strengthen Papua New Guinea’s (PNG) rural health system in selected areas by increasing the coverage and quality of primary health care (PHC) in partnership with both state and non-state service providers. It will build on Asian Development Bank’s (ADB) experience in strengthening health service delivery in rural areas of PNG.¹ The project will cover two districts in each of the following eight provinces: Eastern Highlands, East Sepik, Enga, Milne Bay, Western Highlands, West New Britain, Morobe provinces, and the Autonomous Region of Bougainville.²

6. The fourth output of the project relates to sub-national support to improve service delivery via the rehabilitation or construction of primary health care facilities, provision of medical equipment, strengthening management and supervision, and health promotion in communities. This output will support sub-national governments to build an enabling environment for rural health service delivery. It will include the construction of new CHPs, refurbishment of existing rural health facilities where they are justified by service need. This

¹ The Asian Development Bank (ADB) provided project preparatory technical assistance. ADB. 2009. Project Preparatory Technical Assistance to the Papua New Guinea (PNG) “Strengthening Rural Primary Health Services Delivery”, Manila.

² The provincial selection was made by the Government of PNG. ADB PPTA provided advice on health needs, service capacity in provinces, and the Department of Health embarked on a process of self-nomination by provinces. Subsequently, DOH selected these eight provinces for phase 1. Further expansion of the project will be considered at the project’s mid-term review. Project sites within each province will be determined by the Government of Papua New Guinea in accordance with the agreed selection criteria for outputs 2, 3, 4, and 5.
will include staff housing, water supply, renewable energy sources, and sanitation. It is proposed that all health facilities in the district will be supported with medical equipment to meet national standards and supervision. The executing agency for the project is the National Department of Health (NDOH) while the implementing agencies responsible for output 4 are provincial governments, or in the case of Western Highlands, Eastern Highlands and Milne Bay Provinces, the provincial health authorities.

7. This IEE presents a general assessment of the project’s environmental impacts, proposed mitigations, monitoring, consultation disclosure, and grievance redress mechanism, institutional responsibilities, and reporting. The IEE has been carried out in compliance with the *Asian Development Bank Safeguard Policy Statement, June 2009*. The main purpose of this IEE is to provide a practical example for implementing agencies to follow when preparing IEEs during implementation.

8. The IEE has been undertaken within the parameters of the PPTA7400 work program.

A. Overview

9. The government’s long-term Vision 2050, its Development Strategic Plan 2010–2030, and Medium Term Development Plan 2011-2015 aim to transform PNG’s health system, to achieve the health Millennium Development Goals and to improve PNG’s ranking on the Human Development Index. In support of the government’s approach and in line with the ADB’s Operational Plan of Health,³ ADB’s Country Partnership Strategy for PNG 2011-2015 includes health as one of the priority areas.

10. The project will support the Government of Papua New Guinea in the implementation of its National Health Plan (NHP) 2011-2020 as it relates to rural health. The project aims to increase the coverage and quality of PHC services for the rural population by strengthening the rural health system at the provincial and district levels.

11. The people of PNG have experienced an overall deterioration in their health status over the last two decades. Much of the decline is attributed to the neglect of the health system, especially in rural areas. Hundreds of rural health facilities have either closed or are not fully functioning. Limited resources, deteriorating infrastructure, inadequate and declining accessibility to basic health services are among core issues which undermine the health status of the PNG population. To strengthen the existing rural PHC system in PNG, the project will, by working through envisioned partnerships, build human resource capacity in the health sector; improve health information and monitoring systems; and revitalize rural health facilities.

B. Objectives and Scope of the IEE

12. The objectives of the IEE are to:

   (i) Assess the existing environmental conditions in the project area including the identification of environmentally sensitive areas;
   (ii) Provide guidance as to the assessment of suitability for construction locations;
   (iii) To review any legislative and approval requirements under which construction activities can occur; and
   (iv) To prepare an environmental management and monitoring plan (EMP) incorporating mitigation and monitoring measures that will guide environmental management during project construction and operation.

C. Report Structure

13. The report structure follows the format outlined in the Annex to Appendix 1 of the Asian Development Bank Safeguard Policy Statement, June 2009. The IEE consists of 11 sections: (i) Executive Summary; (ii) Introduction; (iii) Policy, Legal and Administrative Framework; (iv) Description of the Project; (v) Description of the Environment; (vi) Anticipated Environmental Impacts and Mitigation Measures; (vii) Analysis of Alternatives; (viii) Information Disclosure, Consultation, and Participation; (ix) Grievance Redress Mechanism; (x) Environmental Management Plan; and (xi) Conclusions and Recommendations.

III. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Policies

14. The IEE has been carried out to ensure that potential adverse environmental impacts are addressed according to the Asian Development Bank Safeguard Policy Statement, June 2009.

15. The ADB’s Safeguard Policy Statement, June 2009 has been used to classify the project as a Category B project which requires an IEE.

B. PNG Requirements

16. There are two pieces of legislation that have bearing on the construction of new health facilities in rural areas. These are the Public Health Act (1973) and potentially the Environment Act of 2000. Given that all facilities will be built outside of major towns, they do not require approval from the local town authorities and fall outside the jurisdiction of the Physical Planning Act (1989).

17. The Public Health Act (1973) makes provision with respect to matters of public health in PNG including the handling of food and the supply of potable water. The 141 sections of this act are divided into 10 parts: Preliminary (I); Administration (II); Various diseases and disorders affecting human beings (III-VIII); Procedural and evidentiary provisions relating to certain regulations (IX); Regulations (X). In addition to any other powers conferred on him by this act, the Minister has, throughout the country, the powers conferred by this act on a local medical authority or on an inspector, and addition to any powers conferred on him by this act, a local medical authority has all the powers conferred by this act on an inspector. The Minister may appoint health inspectors for purposes of this act under section 8. The Head of State may make regulations to prescribe matters for purposes of this act including rules for the prevention of animal diseases, the prevention of the pollution of natural watercourses; the maintenance of the purity of water supply; and the licensing, control and inspection of food premises and premises where animals used for food are kept.

18. The Public Health Act (1973) has six regulations that will apply to the design of new facilities and in the renovation of old facilities:

(i) Public Health (Drinking Water) Regulation 1984;
(ii) Public Health (Sanitation and General) Regulation 1973;
(iii) Public Health (Septic Tank) Regulation;
(iv) Public Health (Sewerage) Regulation;
(v) Public Health (Underground Water Tank) Regulation; and
(vi) Public Health (Paint Regulation).
19. Where matters relating to the design of facilities fall outside of these regulations the default guidelines used in PNG are ‘The Australasian Health Facility Guidelines’. The Australasian Health Facility Guidelines provides guidance to designers on the special needs of typical health care facilities considering safety, privacy and dignity of patients, staff and visitors. It is a resource to assist in the planning, design and construction of Health Care facilities. The guidelines are aimed at promoting public confidence in standards of health care facilities, providing affordable solutions to planning and design of health care facilities, removing design features that result in unacceptable practices, minimizing recurrent costs while encouraging operational efficiencies. They are attached to this document in Appendix 4.

20. Part E of the Australasian Health Facility Guidelines provides performance benchmarks with the following objectives:

   (i) flexibility and innovation in design;
   (ii) improvements in the delivery of engineering services and sustainable outcomes by addressing advances in technology;
   (iii) cost efficiency;
   (iv) integration of relevant design disciplines; and
   (v) principles of quality management.

21. The Department of Environment and Conservation (DEC) is responsible for the administration and enforcement of the Environment Act 2000 and its regulations. As the government’s environmental management agency, the mission statement of DEC is: “To ensure PNG’s natural resources are managed to sustain environmental quality, human well-being and support improved standards of living.” The department consists of three divisions: (i) Environment Protection which is responsible for environmental approvals, (ii) Sustainable Environment Management; and (iii) Policy Coordination and Evaluation. The current organization structure consists of about 200 positions and about 170 are currently occupied. The DEC operates at the national level from its office based in Port Moresby. It does not have offices and personnel in the provinces. As part of the national government’s decentralization policy, DEC has to work in close consultation with the various provincial governments through the respective provincial administrations to ensure implementation of environmental legislation at the provincial level. Certain environmental management and monitoring functions are delegated to provincial administrations if and when they have the resources and capacity to conduct these activities.


23. The Environment Regulation 2002 categorizes projects as “Prescribed Activities” in two schedules according to the anticipated potential environmental impact. Projects that are likely to have significant adverse environmental impact (level 2 and level 3) are required to obtain an environmental permit from DEC following environmental assessment.

24. The upgrading and rehabilitation of existing health facilities is not listed as either level 2 and level 3 of the “Prescribed Activities”. However, certain associated project activities commonly associated with upgrading and improvement works such as earthworks, minor civil works and discharge of wastewater are level 2 activities that may require an environmental permit depending on the duration and scale of those activities.
25. A sub-category of the regulations that may be of potential relevance to this project is Item 11 that addresses Waste Treatment. Item 11.2 in this sub-category includes “Septic tank sludge disposal systems intended to serve an equivalent population of greater than 500 people.” Should the health facility serve greater than 500 people at any one time, a permit from DEC will be required. However the current design of the CHPs will only cater for less than 100 individuals (staff and patients), so it is envisaged that construction will follow the standard NDOH practice of utilizing a sewerage pond. Item 11.4 of the regulations addresses “incineration, reprocessing, treatment or disposal of industrial or biomedical waste of a capacity greater than 10 tonnes per year.” Should the health facilities require an incinerator to dispose of medical wastes of a mass greater than 10 tonnes per year, a permit will be required from DEC. However, once again it is not envisaged that any of the CHPs will be of the size that would require such a disposal facility.

26. To ensure compliance with the government’s environmental assessment requirements, NDOH will disclose the scale and scope of the subprojects to DEC so that DEC can decide whether any specific environmental requirements will be needed for the proposed upgrading and rehabilitation of health facilities. Considering the government’s environmental requirements and ADB’s Safeguard Policy Statement, 2009, an IEE will be prepared.

27. Pollution standards are described for the protection of marine and aquatic life in fresh and marine waters in the Environment (Water Quality Criteria) Regulation 2002. These standards will be referred to for water quality monitoring during the environmental management of the subprojects. The PNG Water Quality Standards are attached in Appendix 3.

C. Other PNG Legislation

28. There are no other legislative instruments that apply to the project.

D. International Agreements

29. PNG is a signatory to the following international agreements with environment and conservation implications, however, none of them have bearing on the implementation of the project:

(i) International Plant Protection Convention, Rome 1951
(iii) Plant Protection Agreement for the South East Asia and Pacific Region, Rome 1956
(iv) International Convention on Civil Liability for Oil Pollution Damage, Brussels 1969
(xi) International Convention for the Protection of the Natural Resources and Environment of the South Pacific, 1986 (SPREP Convention)
(xii) International Convention on Biological Diversity, Rio de Janeiro 1992

IV. DESCRIPTION OF THE PROJECT

A. Background

30. The project will contribute to improved health of the rural population in the project areas. The project will address improvement of supply and demand sides, and strengthening policy and legal framework for health services at all levels. The outcome will be that the selected provinces in partnership with non-state service providers, efficiently deliver quality PHC for the rural population (particularly to women and children). The project is composed of six integrated outputs. These are:

31. **Output 1 - National policies and standards.** The project will assist the Department of Health (DOH) to develop and implement policies, standards, and strategies for CHPs and human resource strengthening in the health sector within the framework of the NHP. It will assist the DOH in its provincial planning and coordination functions, including facility and asset management, human resource audits, staff retention, and the planning of health services. The project will provide improved health information systems, through application of information and communication technology (ICT) and geographic information system technology. This support will (i) increase the availability of relevant information for all levels of the health sector, (ii) enable provincial and district level local governments to monitor performance in the health sector, and (iii) improve logistics for the supply of drugs at the local level.

32. **Output 2 - Sustainable partnerships between provincial governments and non-state actors.** The project will help the provincial and district governments to develop and formalize existing or new partnerships with non-state providers of health services. This will facilitate greater coordination and efficiency among the diverse providers as well as increased consistency and accountability of such providers. In particular, it will assist provincial governments to formalize partnerships and negotiate and implement agreements (including monitoring and evaluation tools and targets) with non-state actors. The project will assist participating provinces to set up facility base funding in selected districts to enable them to better use funds provided by the government.

33. **Output 3 - Human resource development in the health sector.** The project will strengthen the skills of health personnel in rural communities. It will provide upskilling and capacity training for existing health workers and training for district and provincial managers on facilities management and clinical supervision in all participating districts. The project will address performance and retention issues of the health workers.

34. **Output 4 - Community health facility upgrading.** The project will build/upgrading two CHPs, and upgrading and refurbishing of eight rural health facilities in each of the 16 participating districts. It will provide medical equipment and small vehicles (cars, boats or motorbikes). It will upgrade staff housing; install or upgrade sanitation facilities; provide waste management facilities; and establish renewable energy supplies for the selected

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4 Facility-based funding in the health sector has been introduced in the Autonomous Region of Bougainville. This funding arrangement has been used initially for operational costs including outreach. The project will facilitate the introduction of the funding arrangement in the participating provinces. Output-based funding using project funds will be considered after the mid-term review of the project.
health facilities. The design of these facilities will be climate proof such as a rise in sea level for facilities on small islands.\footnote{The adaptation and mitigation measures should be guided by the opportunities and challenges for climate change and health in PNG: http://www.thecommonwealth.org/files/191129/FileName/PapuaNewGuinea_2009.pdf}

35. **Output 5 - Health promotion in local communities.** The project will increase women’s involvement in all aspects of delivering health services at the community level. Through health promotion programs, it will support existing and new initiatives by civil society organizations to increase knowledge on sanitation, primary health, i.e., maternal and child health and HIV, and gender in local communities.

36. **Output 6 – Project monitoring, evaluation and management.** The project will support project planning, reporting, coordination with development partners, and monitoring and evaluation. It will establish a project support unit (PSU) in the DOH. A formative evaluation\footnote{A formative evaluation focuses on improving or enhancing a project while it is ongoing.} every 6 months will inform stakeholders of project progress, impact and experiences, including cross-cutting aspects such as gender and climate change.

37. It is the fourth of these components, “community health facility upgrading,” that includes provision for the renovation of existing facilities and the construction of new facilities, that has the potential to have a minimal environmental impact.

B. **Technical Description**

38. The final layout and design for CHPs is yet to be fully resolved by NDOH. One concept is displayed in Figure 1. It is understood that after project inception NDOH will commission architectural and design works, leading to the finalization of CHP design, with variations in the design based on local needs. The current concept incorporates a basic structure of approximately 20x20 meters enclosing about 12 individual rooms/wards. They will be constructed predominantly of steel (color bond), wood and fireboard with galvanized iron roofing and will have a concrete foundation. CHP design will also make provision for a small incinerator. Guidelines covering the construction and use of incinerators are provided in Appendix 5.

39. The NDOH considers that the rollout of CHPs is an excellent opportunity to consider design approaches that incorporate opportunities for sustainable power generation. In the early stages of the project, options for solar power and/or micro-hydro generation will be examined.

40. A maximum of two CHPs will be constructed in each of the 16 recipient districts within eight provinces – totaling a maximum of 32 CHPs. The eight provinces are Western Highlands, Eastern Highlands, Enga, West New Britain, Morobe, East Sepik, Milne Bay and the Autonomous Region of Bougainville. These provinces and districts have been identified by NDOH in conjunction with ADB on the basis of their needs relative to other provinces and districts in the country. Districts may have the option of not having new facilities, but having 2-4 existing facilities renovated instead. These final decisions will be made by the NDOH in consultation with provincial and district staff. A map showing the location of these districts is presented in Figure 2.

41. It is envisaged that in the majority of circumstances CHPs will be constructed upon sites currently occupied by existing aid posts. In some cases, this will involve the renovation of existing facilities – in others their removal of the old facilities and replacement with a new construction. Most aid posts are currently located within the environs of existing villages.
This means that the surrounding sites have been cleared of natural vegetation a considerable time in the past and the surrounding environment can be described as subject to human use.

42. For the above reasons, it is not envisaged that the construction of any CHP will have any negative ramifications for any natural habitats, native species or ecologically sensitive species.

43. The majority of extant aid posts are constructed from wood and plasterboard with corrugated iron roofs. Where construction activities require the demolition of these existing facilities, the waste materials will either be reutilized, or disposed of in a manner compatible with standard provincial government modalities.

44. It is unknown whether or not asbestos will be encountered in the demolition of existing facilities. During site assessment in the early phase of project implementation, facilities marked for replacement will be assessed for asbestos materials. Should they be identified, the project management will put in place a standard asbestos management plan. In PNG, best practice removal involves ensuring appropriate safety equipment is worn by workers (gloves, masks, and goggles), the continual wetting of the materials during their removal, before their disposal via burial. Asbestos is not currently sold in PNG – so there is no opportunity or need for it to be used in any future constructions.

45. A map showing all the locations of the ≈2,700 aid post locations is presented in Figure 3. Central to the National Health Plan (NHP) is the upgrading of some of these facilities to the status of CHPs.

V. DESCRIPTION OF THE ENVIRONMENT

46. PNG occupies the eastern half of the island of New Guinea and extends across the Bismarck Archipelago, the island of Bougainville and more than 600 outlying islands and atolls. It lies between 1°–11° south of the equator, with Australia to the south, Indonesia to the West and the Solomon Islands to the east. PNG has a total land area of 462,840 km², mostly on the mainland (Commonwealth of Australia, 2006). The country is divided into 20 administrative regions known as provinces, with the capital at Port Moresby.

A. Physical Environment

47. Much of the terrain of PNG is rugged and mountainous with a surrounding fringe of coastal lowlands, swamps and rolling foothills (Sekhran and Miller, 1994). The highest mountain in PNG is Mount Wilhelm (4,509 m), and several peaks exceed 4000 m. Almost one quarter of the country is over 1,000 meters above sea level. The mountains are the sources for fast-flowing rivers that descend to the coastal plains and form some of the largest river systems in the world. The Fly River extends for 1,200 km and both the Fly and Sepik are navigable for 800 km.

B. Biological Environment

48. Biogeographically, PNG forms part of the broader Australasian region with Australia, the portion of Indonesia east of Wallace’s Line, New Zealand, and some of the Pacific Island groups, including the Solomon Islands and Vanuatu (Beehler, 1992). At greater resolution, the various tectonic boundaries and mountain ranges subdivide the country. New Guinea has a broad range of natural ecosystems from mountain glaciers (in Indonesian West Papua) and alpine herb fields to humid tropical rainforest, savannah, grasslands, freshwater wetlands, mangroves, littoral vegetation and coral reefs. The extent and integrity of PNG’s
Figure 1: A Sample Schematic Architectural Design of Community Health Posts Undertaken by the National Department of Health

Note: It is important to note that this is an indicative design, and that it is likely each facility will vary in design based on local government needs.
Figure 2: Location of Recipient Districts and Provinces
Figure 3: Location of Aid Posts Throughout PNG Marked with White Diamond Crosses
forests are of note. While none of PNG can be considered completely uninhabited, there are areas where human intervention is at very low levels. Population density, which averages a low 9.5 km\(^2\) nationally, can be below 1 km\(^2\) in remote forested areas such as the TransFly or the lower montane belt. Dubbed 'frontier forests' (Bryant et al., 1997), sparsely populated, contiguous blocks of forest provide the greatest opportunity for the maintenance of forest-based ecological processes and for the conservation of wide ranging animals that are threatened in more dissected habitats.

49. PNG probably harbours more than 5% of the world's biodiversity within some of the world's most biologically diverse ecosystems (Davis et al., 1995). The forests of PNG are some of the biologically richest on earth and are of international significance for their biodiversity and endemism (PNG National Assessment Report, 2006; Paijmans, 1976). They contain the world's greatest diversity of orchids (over 2,000 species) and a comparable number of fern species. These forests also provide the habitat for the majority of PNG's birds (733 species), mammals (304 species) and herpetofauna (371 species) (Sekhran and Miller, 1994; Allison, 2007). The International Union for the Conservation of Nature list of most threatened animals includes 38 species of mammals, 22 species of birds, eight species of reptiles and 26 species of invertebrates from PNG (IUCN, 2006).

50. The lowland tropical and subtropical moist forests of New Guinea have been ranked among the world's ten most ecologically distinctive forest regions (Olsen and Dinerstein, 1998). Its mangrove forests are recognized as the most extensive and species rich in the world; the tropical savannah woodlands are considered globally important because of their many endemic and restricted species; its riverine ecosystems are recognized for their high fish endemism and other distinctive species that depend in one way or another on the surrounding forests.

51. In particular, PNG’s forests are a vital natural resource for the human population that they sustain, the wide biological diversity they contain, the ecological services they provide and their global role in securing climatic stability (Hunt, 2006). These forests provide subsistence food and building materials for a large proportion of PNG’s 6 million people. They also provide an important safety net when crops fail, in times of economic crisis or conflict and when natural disasters strike. They provide a range of both local and global environmental benefits that are often overlooked and remain economically undervalued. These services include carbon sequestration, watershed protection, water filtration, coastal and reef protection, preservation of fish stocks, soil stability and fertility and aesthetic landscape benefits. They also provide commercial timber.

52. The natural environment is coming under a variety of damaging pressures (European Union, 2006). Terrestrial ecosystems, especially forests are subject to depletion through commercial forestry operations, or are being cleared to make way for subsistence agriculture, plantation and mining projects. Freshwater ecosystems in some parts of the country are being polluted through the disposal of mining, agricultural and to a lesser extent, urban wastes. This pollution ultimately impacts upon marine systems, which are also affected by additional pressures from fisheries. Threats and pressures on PNG’s biological diversity include not only the more conspicuous, outside-driven activities – industrial logging, large-scale mining, and commercial exploitation of marine resources – but also the more traditional, but high impact processes of human population growth with associated gardening and burning.

53. All CHPs will be constructed in areas that have been cleared of natural vegetation and used by people for considerable periods of time. They will either be located within the built environs of district centers, currently dominated by roads, buildings or vacant urban land, or in a village environment where the land is maintained for rotational garden use or is
devoid of vegetation as a consequence of repeated burnings. In most if not all cases, CHPs will be constructed on land already occupied by existing aid post facilities.

C. Climate and Climate Change

54. PNG has tropical climates characterized by slight seasonal temperature variations. Temperatures range between about 23°C and 35°C in coastal areas and between 0°C and 8°C at treeline in the mountains (3,900 m above sea level) where there are frequent frosts and occasional snow. There is a northwestern monsoon from December to March and southeastern trade winds from May to October (McAlpine et al., 1983). Rainfall ranges from around 1,000 mm yr\(^{-1}\) with a pronounced dry season in May-October, in lowland southern areas to more than 8000 mm yr\(^{-1}\), spread year-round, in the wettest upland areas. Over much of the country’s annual rainfall exceeds 2,000 mm and there is sufficient rain for plant growth year-round.

55. It is now recognized that climate change brought about by the unregulated release of carbon into the atmosphere through human activity poses an enormous threat to the maintenance of the biosphere. After the burning of fossil fuels, the most important sources of greenhouse gas emissions are activities related to land use change and within this, primarily tropical deforestation and forest fires that release carbon to the atmosphere (CIDA, 2001).

56. As carbon dioxide emissions are responsible for about 60% of human-induced global warming and as tropical forests are carbon-rich reservoirs, these forests are important in mitigating further climate destabilization (Hunt, 2006). While it is likely that intact tropical forests have been a net CO\(_2\) sink through increased sequestration in the last century, this role is likely to reduce as forests reach physiological boundaries to further increases in biomass (Lewis, 2006; Saatchi et al., 2007). However their loss, through a variety of deforestation processes now accounts for 18% of annual global greenhouse gas emissions (Stern, 2007).

57. The current global focus on the mitigation of the impacts of human-induced global warming means that the carbon stored in forests now has potential commercial value. The value of the carbon stored in PNG’s forests has been estimated by Hunt (2006) to average ≈US$5,000 per hectare. Ongoing international discussions will determine whether or not this value will ever be realized.

58. The impacts of climate change for PNG are potentially serious given the fact that the majority of the population is in subsistence and therefore has a low adaptive capacity. The major likely direct impacts of global warming and sea level rise for PNG are: increased humidity and decrease in human comfort, coastal inundation, coastal flooding by storm surges, salt water intrusion of coastal groundwater systems, water table elevation, and changes to coastal landforms (Bualia and Sullivan, 1990).

59. Global warming is linked to increased severity El Niño weather patterns and it is suggested that seasonal variability will increase, causing increased flooding, mudslides and more regular and severe droughts. There is concern about the spread of endemic malaria from coastal areas of PNG to the densely populated highlands. In the past, the highland populations have been protected by altitude - both insect vector and parasite have been deterred by the low temperatures on the central plateau (approximately 1,500 m above sea level). This barrier will be diminished with global warming: it has been estimated that isotherms will rise by 300 m with a doubling of effective CO\(_2\) (McGregor, 1990). There is also uncertainty about the impacts that climate change will have on PNG’s biodiversity. A shift to novel climate regimes is likely to be disruptive since it forces ecosystems into climatic ranges outside of that to which they evolved (IPCC, 2001; IPCC, 2007).
60. A central problem in the identification of climate change related issues at a local, or even provincial level is the paucity of basic climatic data. Since the mid-1970s, the number of actively-monitored weather stations has declined from about 80 to only two. This means that while there is much discussion and conjecture about the impacts of climate change, there is an unfortunate dearth of data that can be used to determine its veracity. This is also the case in terms of the reported spread of malaria into the highlands. While NDOH statistics do show that the incidence of malaria has increased in these provinces over the last decade, this could also be result of greater numbers of people (with malaria) traveling up to the highlands from lowland areas where malaria is far more prevalent. While climate change could also be a factor, it is probably not necessary to explain this trend. Nevertheless, regardless of the interplay of these potential factors, malaria incidence in the highlands is increasing, suggesting that further investments in the health sector at this time are warranted.

D. Human Population

61. PNG’s geographical variety and the complex pattern of different landscapes are paralleled by its ethnic and cultural diversity (European Union, 2006). There are 850 separate local language groups with many spoken by fewer than 10,000 people, each with their own unique customs. English and Pidgin English have become the main languages for national communication.

62. Prior to the 1980 census an accurate assessment of PNG’s population is not available (Hayes, 1993), but estimates suggest that in 1970, at the beginning of the study period, PNG had a population of approximately 2.5 million (FAOSTAT, 2005). By 1980 PNG’s population had grown to 2,978,057, representing a growth rate of 2.3% per annum (see Figure 4). Twenty years later, 5,172,000 people were recorded in the 2000 Census (NSS, 2000). The more than exponential increase in PNG’s population is displayed in Figure 2. With a growth rate of 3.2% per year, the estimated population by 2006 was 6,248,000. This is expected to grow to just under 9 million people by 2020 (NSS, 2000). It can be conservatively concluded that over the last 30 years, the population of the country has more than doubled. FAO estimates that PNG has a 2010 population of 6.88 million (FAOSTAT, 2010).

Figure 4: Estimates of PNG population (in thousands) over the period of 1961-2003

(FAOSTSAT, 2005)
63. The most densely populated area is the Highlands Region of the mainland where almost 2 million people were recorded in 2000. In contrast, the Islands Region had a population of less than 750,000 people. As can be seen in Figure 5, rural population density peaks at approximately 48 km$^2$ at 1,700 m asl. The low population density below 1,200 m elevation is historically partly due to endemic malaria in the lowlands.

**Figure 5: Population Density by altitude derived from the 2000 Census figures (NSS, 2000) and the SRTM Digital Elevation model of PNG (Farr, et al, 2007)**

64. The southern and north-western coastal regions have low population densities (4 km$^2$ and 7 km$^2$, respectively) while the Islands and Highlands regions are more densely populated (10 km$^2$ and 22 km$^2$ respectively) (NSS, 2000). The Western, Gulf and Sepik Provinces remain sparsely populated. Over one-third of PNG’s population is concentrated in the 13.5% of the total land area of the Highlands region. Although 22 km$^2$ is the average density in the Highlands region, it has been reported that in some highland valleys densities exceed 200 km$^2$ (Allen, 2001).

65. The 2000 Census found more than 85% of the total population was living in rural areas and the total urban population was less than 700,000 people (NSS, 2000). The median age was just below 20 years. In 2000, the life expectancy for the average Papua New Guinean was 54 years and infant mortality was 64 per 1,000 live births. PNG has the lowest life expectancy and highest infant mortality amongst neighboring countries in Southeast Asia and the Pacific (Taylor et al, 2005). The literacy rate in 2000 was 56% and only 5% of the population over the age of 15 years had Grade 10 school-leaving qualifications.

**E. Socio-Economic and Socio-Cultural Conditions and Human Health**

66. For their everyday food and material needs, 85% of the population rely on subsistence agriculture, fishing, forest harvesting, and hunting. A component of natural resource management in PNG is the close linkage between the majority of the population and their land of which 97% is customary land privately owned by owned by individuals and communities rather than by the government. The result of this model of ownership is that very little land is easily available for development and it ensures that the owners have the opportunity to benefit from the resources on their land.
Development has not been uniform across the country and the resulting migration to urban areas has created landless people who live in squatter settlements in and around urban areas with accompanying high crime rates. With 85% of the population reliant on subsistence activities poverty is widespread, with an estimated 39% of the population currently living below the international poverty line of $1 per day. PNG also has the worst human poverty and human development indices (52.2 and 0.314, respectively) in the Pacific region (average of 21.19 and 0.560, respectively), (ADB, 2004). However, with so little of the population directly involved in the cash economy of the country poverty should not be viewed simply in financial terms. Fulfillment of basic human needs, improved quality of life, access to services (e.g., health, education, transport), and reduction in vulnerability would be more meaningful measures of poverty to the vast majority of the population (ADB, 2005c).

The rugged and swampy terrain has seriously limited the development of road infrastructure, most notably the absence of a road connecting the capital in the south to the majority of the population in the highlands. There are 19,600 km of road of which less than 700 km is paved. In contrast, there are about 500 airstrips suitable for light aircraft associated with Government and Mission outposts or mines, and 21 with paved runways suitable for larger, aircraft. Many of these airstrips are in a poor condition. Coastal shipping is a major means of transport around the mainland and to the islands.

While major roads exist within provinces, there are few major inter-province connections. The main arterial road in the country is the Highlands Highway which links Lae with the populous Highlands provinces. It is used to transport goods to and from Lae and the surrounding provinces and services Porgera Mine while a branch provides road access for the new Highlands Kainantu Ltd. mine at Bilimoia, the Ramu Sugar Complex and Madang. A third highway connects West and East Sepik with Wewak. No road connection exists between Port Moresby and the Highland, Western or Milne Bay Provinces.

Locally, there are roads and tracks linking centers of population. The majority of these roads are in a poor state of repair and often become impassable for months at a time whilst they await repair by the provincial authorities. Where external donors have upgraded roads problems still exist in a country where rainfall is measured in metres and little financial or practical resources are available to provincial authorities for the maintenance of the new roads.

Passenger travel is predominantly by boat in the coastal and island regions and by air throughout the country. Air Niugini has regular service to most provincial capitals and other airlines service smaller airports. Trade and passenger boats ply the main routes and smaller craft ferry passengers and goods throughout the country. Many of these smaller boats ply from beaches or local jetties as there are few landing docks outside main centers.

The difficulties posed by transportation and transport facility in PNG are a major disincentive to development, a major health issue as well as making the transport of goods to market or to ports for export very difficult. In many cases, mines and agricultural estates build and maintain the infrastructure they require out of their annual operating budgets.

F. Waste Disposal Issues

PNG has an annual population growth rate of around 2.5% nationally and up to 3% in some provinces such as Morobe. Additionally, mining and forestry activities provide isolated communities with financial resources that they cannot spend in their traditional areas. This exacerbates urban migration and a move towards a more consumer based society. The move from rural to urban areas and from a subsistence type lifestyle to a consumer-based one has led to a rapid increase in the quantities of waste that require disposal.
74. Solid waste disposal is a major concern in the urban areas of PNG with most wastes being collected and transported to local (unsanitary) landfills where they are buried or burned. There are inadequate sites for the proper disposal of solid waste and there is little waste management undertaken, resulting in quantities of unprocessed rubbish that are a source of disease and pollution either in the form of leachate or from ending up in the rivers as the only perceived method of disposal.

75. The city and town authorities in each of the 19 provinces and the National Capital District, manage and operate their own waste disposal. Disposal sites are often poorly located and have inadequate capacity to handle the growing volumes of waste. Contractors collect municipal solid waste on a routine basis, the frequency of collections being dictated by population size and the amount of waste being generated. Little is done to encourage waste reduction, reuse, recovery or recycling. The NDOH administers the Public Health Act that provides the mechanism for regulating and controlling domestic refuse and the establishment of refuse points. It covers health, sanitation, cleaning, scavenging, and disposal of wastes.

76. Despite having frameworks in place that should ensure proper waste disposal, waste management programs have generally been ineffective. This is reflected by the fact that waste collectors and operators are not adequately trained to achieve improved standards or performance, and there is no proper engineering design of waste disposal sites. No controls are in place on waste generation at the source to minimize waste, and rapid development of towns and industries result in increased waste generation, creating added pressure and making further planning difficult. Finally, customary land tenure arrangements severely limit the availability of lands to be used as waste disposal sites.

77. Provision for the disposal and treatment of both domestic and industrial wastewater is rudimentary at best and often completely lacking in PNG. Dumping of a variety of wastes (domestic waste, sewage, industrial, and hazardous wastes) directly into water bodies contributes to water pollution. Sanitation facilities in PNG are not well developed; approximately 96% of rural households use traditional toilet facilities (long drops, or disposal into water bodies), and more than half the households in urban areas also lack flush toilets.

78. Water pollution caused by unregulated runoff from industrial activities and the direct dumping of wastes including domestic waste, and sewage into river systems is widespread in PNG. The effect of water pollution, particularly for the 71% of the rural population who have no access to an improved water supply, usually manifests itself as diarrhoea which is a major contributor to childhood morbidity and mortality accounting for 9% of admissions to health facilities amongst children aged 1-4 years and 6% of child deaths in health facilities (World Bank 2005). In addition, in areas where there is extensive small scale gold mining, there are raised levels of mercury pollution in the rivers which has serious health consequences.

79. Although PNG’s waste disposal infrastructure is not an associated facility of the project, it is recommended that ADB include waste management as a discussion topic during planning phases of project implementation. As previously stated, the project has retained the identification of final construction localities as a key project task. The aim of this is to treat this process as a capacity building exercise within NDOH, such that consideration is given to planning an entire district health system, and in addition, how such a system can function within and with the wider provincial system. Within such a planning framework, waste disposal needs be considered as a key issue that needs to be managed on a district and provincial basis. Indeed, it is far more likely to be adequately considered in such a planning environment, than if it was only to be examined on a facility-by-facility basis.
VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

80. The project will have very limited impact on the natural environment since each facility will either be constructed within already disturbed/cleared areas, or simply and usually entail the renovation of an existing facility. Construction is expected to generate a range of minor impacts in terms of noise, dust, employment opportunities, and waste disposal. Construction will create some short term employment opportunities that wherever possible should benefit the local communities. Construction impacts are of a general nature and as these are applicable to most projects these will be discussed in the EMP section.

81. The impacts are first presented in terms of the timeframe in which they are likely to occur in relation to construction – either during the construction period or during operation of the facilities. These impacts are then summarized in terms of their impacts on the physical, biological and socio-economic environments. For each of these categories, the impacts are discussed in terms of their decreasing order of magnitude.

A. Impacts During Construction

82. This section provides an assessment of the positive and negative impacts on the physical environment in the immediate vicinity of the construction area resulting from the development of the project, and the corresponding mitigation and enhancement measures to negate such negative impacts. The environmental quality of the project site could be affected from project activities during each phase of project development if environmental management measures are not properly followed.

83. The project will rehabilitate/construct health facilities that include water systems and sewage tanks/treatment ponds. It is current practice in the case of health centers to build a series of septic tanks that discharge their waste water into a settling pond. The rehabilitation/construction activities would create environmental disturbances normally associated with major construction works, such as dust, noise, and exhaust emissions from construction equipment and vehicles and waste generation. As rehabilitation/construction works will be confined within the current footprint, the impacts of such environmental disturbances will be insignificant. The project and its contractors will comply with applicable government environmental legislative requirements.

84. Dust generated during construction is expected to have some impacts on air quality. However, this will be mitigated as necessary by regular spraying on paths of heavy vehicles with water, and controlling the speed and limiting movement of construction equipment and vehicles. All equipment and vehicles will undergo routine maintenance to reduce engine emissions.

85. Noise will be generated during rehabilitation/construction works. Civil works will be planned to avoid noisy operations. Powered mechanical equipment like back-hoes, air compressors, concrete mixers, etc., will only be used with low sound power whenever possible.

86. Personal protective equipment will be provided to workers to minimize the effects of high noise levels. Specific mitigation measures and appropriate techniques for the control of noise will be implemented such as: (i) siting of “fixed” pieces of equipment, such as generators, in locations away from settlements; (ii) fitting of pneumatic tools to be operated near settlements with an effective air exhaust port; (iii) affixing noise labels to all air compressors; (iv) maintaining noise suppression devices on construction vehicles and equipment; (v) notifying landowners of intended work and duration where noise from construction activities may impact; and (vi) considering construction works schedules to mitigate noise emission impacts during the day and night time.
87. During the peak of rehabilitation/construction phase, laborers would be employed locally. Sewage and wastewater from contractor’s workshop and equipment washing yard will be generated. Sewer drains will lead to an on-site disposal area for treatment or holding in septic tanks with ponds/leach fields.

B. Impacts During Operations

1. Air and Noise Quality

88. The only source of likely air pollution will be the operation of diesel generator sets. To reduce pollution, the fuel to be used for the generator sets will be of low sulfur content (less than 0.05%) and generator sets will be used during emergencies and power shortages only. Expected emission of \( \text{SO}_2 \) and particulate matters will be mitigated by installing an exhaust chimney with requisite height to be prescribed by the regulations of the DEC.

89. The noise impact on the surrounding areas due to the commissioning of the health facility will be insignificant. There will be no major noise generating sources except the operations of the diesel generator sets. Adequate precaution will be taken to prevent noise and vibration at the source by proper acoustic treatment, anti-vibration mountings, acoustic enclosure, etc., to keep the noise levels within the stipulated limits.

2. Water and Wastewater Quality

90. Potable water requirement will be sourced from local water companies as well as from existing bore wells within the site. The water requirement will not have significant adverse impact on groundwater resource.

91. The wastewater to be generated including domestic, e.g., kitchen, toilets, and other liquid wastes from the clinic, will be combined and treated in an on-site sewage treatment facility or septic tank system depending on the size of the facility. It is envisaged that for the majority of facilities a standard septic tank will suffice.

3. Terrestrial Environment

92. There are no major impacts anticipated on the terrestrial environment. A green belt along the periphery of the facilities will be implemented to enhance the aesthetics and reduce air and noise pollution. The species used in the planting of a greenbelt should be those commonly grown in the vicinity. Coconuts should not be used.

4. Biomedical and Domestic Waste Management

93. Proper management of biomedical waste during the operational phase of the project will be strictly enforced. Guidelines will include requiring all health care establishments to undertake the proper method of segregation, storage, treatment, and disposal. Containers will be color coded and properly labeled for segregation and storage. The sources of hospital wastes include the emergency room, pharmacy, laboratory, day care, and operation theater. Infectious and non-infectious wastes must be segregated and placed in color coded bags with proper labels and stored in the waste holding room prior to collection, treatment and disposal to a common treatment facility or incinerator. The waste holding room must have proper storage and temperature control facilities. Ideally, these wastes are prescribed to be stored at 4°C in case the wastes have to be stored for more than 48 hours before collection for final treatment and disposal by incineration. It is standard practice for the construction of health centers to include the construction of a small incinerator. Suggested design specifications are listed in Appendix 5.
The domestic waste generated by the clinic staff and patients will be collected separately from the biomedical waste. The domestic waste will be collected by municipal waste operators/corporations for further treatment and final disposal.

C. **Summary of Impacts on the Biological Environment**

There are no expected significant impacts on the biological environment from construction activities. The constructions themselves are small – easily able to be located with a standard 0.25 ha house block. All potential sites will be within already cleared regions, usually within the boundaries of District or Local Level Government Stations. Such areas were cleared of native vegetation decades ago and now are usually covered by grass or are bare ground. In the infrequent cases where construction occurs on unalienated land, a construction site will only be deemed suitable if it was already cleared at some time predating the project. It is not envisaged that local people would attempt to clear forest to enable the construction of health facilities as generally the forest exists a large distance from the villages themselves, so would then substantially reduce the amenity of the facility.

In regard to waste water and sewerage management, all ADB constructed facilities will be designed in full compliance with the Australasian Health Facility Guidelines and the Public Health (Septic Tank) Regulation of the Public Health Act (1973). There will be no discharge of untreated water to the environment. These guidelines are attached to this document in Appendix 4.

D. **Summary Impacts on the Socioeconomic Environment-Acquisition of Land**

In the majority of cases, land will be designated by the provincial or local level government from titled land owned by the government. In these cases, there will be no negative impacts arising from the use of this land by the project. Nor will there be any necessity for any form of compensation.

In a minority of cases where construction will take place on unalienated village land, the project will work in consultation with the local government authorities and local communities, to assist those communities identify the land that they wish to be used for these purposes. Preference will be given to those sites where communities that are able to provide land, and caveat-free agreements over that land. It is envisaged that preference will be given to church-owned land existing within village areas.

**VII. ANALYSIS OF ALTERNATIVES**

A. **Alternatives to Location**

There are no restrictions to the physical siting on CHPs, other than the land should be as flat as possible, well drained, and free of major impediments. The two main criteria relevant to CHP locations are that these sites address health needs and that the site is free of legal encumbrances, preferably has legal title, and is within a secure environment. This means that within the vicinity of a district headquarters, the CHP could be located at many different actual locations.

B. **Alternatives to Design**

The design of CHPs will be based totally on health considerations. Given that the actual facilities will have no environmental impact, it is not relevant to consider alternatives to design in this IEE.
VIII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

101. Following approval of the IEE by ADB, this document will be posted in the NDOH and ADB website.

102. In this document, the term ‘consultation’ includes meetings with government organizations and landowners.

103. Consultations to date with the national government include numerous meetings with NDOH and related departments, both at staff and management level. These consultations have occurred within the auspices of the PPTA7400 works and are ongoing and fully documented in the project administration manual.

104. Consultations with provincial and district government staff as well as with local people have been undertaken. A total of 55 consultations were conducted across nine provinces. The visited provinces were: Sandaun, East Sepik, Madang, Morobe (Momase Region), Western Highlands, Enga (Highlands Region), Bougainville, West New Britain (Islands Region), and Oro (Southern Region). Following this process, NDOH has decided that the project will focus on delivery in five of these provinces: Enga, Morobe, East Sepik, West New Britain, and Western Highlands. The selection of provinces was based on need, perceived management capacity, and potential for private sector and church partnerships. The initial selection included at least one province in each of PNG’s four regions.

105. The consultations adopted a participatory rapid assessment approach utilizing analysis of secondary data, semi-structured interviews and focus group discussions with key informants, stakeholder groups and potential project beneficiaries. Consultation with communities in potential CHP sites was considered an important part of the social analysis because it provided the opportunity to learn about project specific issues that are important to communities and incorporate existing community knowledge and experience into the project design. The groups and the locations where interviews were conducted are outlined in Table 1. A total of 46 consultations were conducted across the five provinces. In addition to those shown in Table 1, representatives from Care International Bougainville Office were interviewed and a focus group discussion was held in Tamane Village in Madang that is implementing a Healthy Islands Project. A full discussion of these interviews in methodology and results, is presented in the linked document, “Summary Poverty Reduction and Social Strategy”.

106. In all rural consultations, the reoccurring theme was the poor level of service delivery being received. People are generally of the view that the level and quality of health service provision has declined over the last decade – and in this view they are supported by empirical evidence. Local people were consistent in their support and enthusiasm regarding receiving improved health service delivery. In all of these consultations, no concerns were raised about the potential environmental impacts (real or otherwise) of the construction of new facilities. In a rural environment where health services are poor or non-existent, the nuisance from dust or noise from the construction of a health facility is essentially immaterial to the beneficiaries of the facility.

107. Visits to provinces revealed that all provinces have already heard about and most have embraced the concept of CHPs as described by NDOH in the NHP. All provinces visited had identified and prioritized sites where they wished to establish community health posts. Although some provinces questioned how the introduction of this new type of service would alleviate existing problems and improve health indicators, all were willing to support the concept. Some provinces have progressed plans and allocated funds within 2011 budgets for establishing community health posts.
108. As the preliminary site selection is crystallized in the early stages of the project implementation, similar processes of district and local consultations will be undertaken.

### Table 1: Stakeholder Groups and Location of Interviews/Discussions

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Sandaun</th>
<th>Madang</th>
<th>Autonomous Region of Bougainville</th>
<th>Western Highlands</th>
<th>Oro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial Administrator and Provincial Officials</td>
<td>Provincial Administration Office, Vanimo</td>
<td></td>
<td>ARB Administration Office</td>
<td>Mt Hagen General Hospital</td>
<td>Provincial Administration Office</td>
</tr>
<tr>
<td>Provincial Health Office and Church Health Services</td>
<td>Provincial Health Office, Vanimo Hospital</td>
<td>Provincial Health Office, PAC Office</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District Administrator, District and LLG Officers</td>
<td>Vanimo Green LLG Office</td>
<td>Bogia District Office</td>
<td>Buka District Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Centre Staff</td>
<td>Vanimo-Green Urban Clinic, Bewani Health Centre</td>
<td>Bunabun Health Centre</td>
<td>Hanahan Health Sub Centre</td>
<td>Bukapena Health Centre, Kuruk Health Centre</td>
<td></td>
</tr>
<tr>
<td>Aid Post Staff</td>
<td>Waramo</td>
<td>Tohatsi</td>
<td></td>
<td></td>
<td>Kiorota</td>
</tr>
<tr>
<td>Community Leaders</td>
<td>Maewark &amp; Karok</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Female Community Members</td>
<td>Waramo, Itoli</td>
<td>Maewark</td>
<td>Tohatsi, Nengil, Waknam</td>
<td></td>
<td>Harange</td>
</tr>
<tr>
<td>Adult Male Community Members</td>
<td>Yako, Itoli</td>
<td>Maewark &amp; Karok</td>
<td>Tohatsi, Ketz Ketz</td>
<td></td>
<td>Ario, Harange</td>
</tr>
</tbody>
</table>

### IX. GRIEVANCE REDRESS MECHANISM

109. This procedure is for addressing environmental issues. Any grievances dealing with land and compensation issues are to be directed to NDOH and the Provincial Lands Officers who have established procedures for dealing with these issues.

110. During the course of the project, it is possible that people may have concerns with the project’s environmental performance including the implementation of the EMP. Issues may occur during construction and again during operation. Any concerns will need to be addressed quickly and transparently, and without retribution to the affected persons.

111. The following process is to be used and commences with an attempt to sort out the problem directly at sub-project level. If this cannot be resolved, then the grievance moves to the resolution process outlined in Section 87 of the Environment Act 2000. The process is also shown as a flow chart in Figure 5.

#### A. During Construction

112. During construction the contractor will be initially responsible for monitoring and supervising compliance with the EMP. The project environmental civil engineer will be assisted by the safeguards specialist to supervise the contractor while the safeguards specialist will monitor the work and report any defects to the project civil engineer as
required. The local community will be encouraged to seek work on the project sites and will be advised of opportunities by a series of planned awareness meetings which will commence during pre-construction.

113. Most complaints arising during construction are expected to be minor complaints concerning dust or noise that should be resolved quite easily and acted upon immediately at the sub-project level by the project civil engineer. Where the complaint is of a more serious nature the project civil engineer will have up to 2 weeks to resolve the complaint.

114. All complaints arriving at the site office are to be entered in a register that is kept at site by: date, name, contact address, and reason for the complaint. A duplicate copy of the entry is given to the affected persons for their record at the time of registering the complaint. The register will show who has been directed to deal with the complaint and the date when this was made together with the date when the affected person was informed of the decision and how the decision was conveyed to the affected person. The register is then signed off by the person who is responsible for the decision and dated. The register is to be kept at the front desk of the site office and is a public document. The duplicate copy given to the affected persons will also show the procedure that will be followed in assessing the complaint, together with a statement affirming the rights of the affected person to make a complaint. For anybody making a complaint, no cost will be charged to the affected persons.

115. The project civil engineer will consider the complaint and within a maximum of 2 weeks convey a decision to the affected persons. The affected persons or the ward councilor may if so desired discuss the complaint directly with the project civil engineer or his representative. Prior to the dismissal of a complaint, the project civil engineer will present the case to the project manager at the PSU for review. Should the PSU concur that the complaint be dismissed the affected persons will be informed of their rights in taking it to the next step. A copy of this decision is to be sent to the project manager at the project support unit.

116. Should the affected persons not be satisfied, the affected persons may take the complaint to the Secretary of DEC and continue the grievance in accordance with Section 87 of the Environment Act 2000 (Procedure for dealing with compensation claims for environmental impacts). The procedure is shown in the following steps. Given that the only aspect of CHP construction that may require an environmental permit is an incinerator, this process is highly unlikely to be actioned.

117. The affected persons meet with the environment permit holder to formally register concern over impact and seek redress. A copy of the alleged impact is submitted to the DEC Secretary.

118. The environment permit holder has to determine whether the impact has occurred due to its activities.

119. If the environment permit holder accepts responsibility for the impact, it can negotiate a mutually acceptable settlement with the AP within 90 days.

120. If the environment permit holder rejects responsibility for the impact, the affected persons can request DEC to carry out a verification investigation.

121. If DEC confirms that the impact has occurred, he/she will advise the environment permit holder and affected persons to negotiate a settlement within 90 days.
122. If a negotiated settlement is not reached under either step 3 or 5, the environment permit holder or affected persons can request the DEC Secretary to formulate a determination. Once this request is made, DEC will have 90 days to reach a determination.

123. If either party is dissatisfied with the determination, it can appeal to the National Court.

124. The DEC Secretary will have 4 weeks to consider the complaint. The Secretary will arrange for any complaint to be dealt with under the same procedure i.e., there will be no charge made to the affected persons for making a complaint.

125. Should the affected persons not be satisfied with the ruling of the DEC Secretary, the affected persons may at their discretion make a complaint to the PNG judicial system. If the court shows that the Secretary, or the administration have been negligent in making their determination the affected persons will be able to seek costs.

B. During Operation

126. The same procedure is followed except that the complaint is now directed to the CHP Manager/Director to rectify. During operation, the same conditions apply i.e., there are no fees attached to the affected persons for making a complaint. The complainant is free to make the complaint which will be treated in a transparent manner and the affected persons will not be subject to retribution for making the complaint.

X. ENVIRONMENTAL MANAGEMENT PLAN

127. This section identifies mitigation and management measures to avoid, reduce, mitigate or compensate adverse environmental impacts that have already been identified in the previous sections. The EMP is a management tool and the issues are accordingly addressed with regard to the sequence of operations, i.e., those activities that apply to pre-construction, construction, and operation. These issues are summarized in Appendix 1. In Appendix 2, report templates for ‘Site Environmental Compliance Inspection and Monitoring’ as well as ‘Environmental Progress and Monitoring’ are provided.

A. Environmental Impacts and Mitigation Measures Needed During the Design/Pre-Construction Phase

128. The design and pre-construction phase will address the environmental mitigation measures that are outlined in this section. The majority of the measures are already established within Best Engineering Design Practices. The pre-construction work concludes with the integration of the EMP conditions into the bid and contract documents and the evaluation and selection of the contractor. The responsibility for carrying out this work is shared by the project civil engineer and the safeguards specialist. No additional costs have been identified for this work and all work required at this time will be covered by the budget for the pre-construction or design phase for the PSU. The following items are to be addressed during pre-construction.

(i) Acquisition of land;
(ii) Provision of climate change requirements in design;
(iii) Siting of sub-project facilities - avoiding vegetation losses;
(iv) Review EMP, extract construction section of the EMP and attach to the bid and contract;
(v) documents; and
(vi) Evaluation and selection of contractor.
Figure 5: Flow Chart Outlining Grievance Review Mechanism

Complaint to be actioned in:

Person making complaint

On-site Project Engineer (PE)

Complaint approved

Yes

PE arranges to rectify complaint

No

Secretary DEC

Complaint approved

Yes

No

Judicial system

Complaint approved

Yes

Directs PPL to instruct PE to rectify complaint

No

90 days

2 weeks

as required
1. **Acquisition of Land**

129. There is a clear division in the type of documentation that can and should be obtained if the works are to occur on government land than if they are to occur in a village environment.

130. In the case of development within the boundaries of a government station, development should only be commenced after the provincial authorities are able to demonstrate clear ownership via title deeds. Secondly, the implementing agency should have written permission from the provincial and district governments for the land to be used for a health facility. Provincial governments should either have land title documentation in their possession, or be required to obtain it from the Surveyor General's Office. The provision of this documentation must be a prerequisite for ADB to commit to building a new facility. Further, it should stipulate that there will be no rental charged, levies raised, etc., and that any land claims/compensation demands be the responsibility of the provincial government.

131. In the village environment, constructing CHPs on church land will be seen as a priority. Churches have often established that certain portions of a village environment are for the use by the church, perhaps for accommodation for church workers. Accessing land through the local church is seen as an easier route than working with the community directly.

2. **Provision of Climate Change Requirements in Design**

132. There is evidence that climate change is occurring in PNG and modeling predicts that by 2050 there will be increased rainfall and increased frequency of extreme rainfall events. Stream flows will be more variable with greater extremes which will be manifested in lower minimum flows and higher maximum flows. Siting of CHPs should take into account the likelihood of increased flooding, both in periodicity and extent to ensure that construction occurs beyond areas that may be potentially inundated in the future. The project civil engineer will be responsible for including this as a specification within the Bid and Contract Documents.

133. The project civil engineer should develop some basic rules of thumb for considering the siting of facilities in relation to water bodies, considering their potential for future flooding above levels previously experienced.

134. Geoscience Australia, in conjunction with the Department of Mineral Policy and Geohazards Management (with assistance from the UPNG Remote Sensing Centre) are developing a series of risk models for PNG. One of these assessments will relate to modifications to previously experienced hydrologic events - flood modeling. Over the course of 2011 a series of maps will be generated that will allow infrastructure developers to take into account changes in rainfall and flooding susceptibility. The civil engineer should consult these authorities for the provision of these maps and incorporate them into siting considerations.

3. **Siting of Project Infrastructure - Avoiding Vegetation Losses**

135. While the siting of CHPs will be constrained by technical requirements and the availability of land, there should be no reason for any forest to be cleared.
4. **Review EMP, Extract Construction Section of the EMP, and Attach to the Bid and Contract Document**

136. Experience shows that inadequate application of the EMP by the contractor may occur due to weak linkages of the EMP with the contract document. The EMP is part of the work program and as such, it must be addressed by the contractor and carried out as required. If the EMP is not satisfactorily addressed, then the environmental safeguards and project sustainability will be compromised.

137. In the bid and contract section, “Special Conditions of Contract” list, the safeguards specialist will arrange the following: (i) prior to the tender being called, the safeguards specialist will revise and update the EMP and (ii) extract the construction section of the EMP and together with the project manager will attach this to the bid and contract documents in section; Part II - Requirements; Section 6 - Employer’s Requirements. In the bid and contract section “Special Conditions of Contract” list the construction section of the EMP as forming part of the bid and contract document. The contractor will use this document to cost his compliance with the EMP. This will be the responsibility of the safeguards specialist and project manager as shown above.

5. **Bid Evaluation and Selection of Contractor**

138. The contractor will be required to provide a short statement that confirms the following three points. The statement is to be attached to the bid in the section, “Special Conditions of Contract”.

   (i) The construction section of the EMP conditions have been cost into the bid price;
   (ii) The contractor is to provide prior experience of working with an EMP; and
   (iii) The contractor is required to provide the name, details of qualifications, and experience of the person on the contractor’s team who will be responsible for the environmental compliance requirements of the EMP.

139. During bid evaluation these strengths will be evaluated in the selection of the contractor. Should the contractor not provide these details, the bid will be judged to be non-compliant and the bid rejected.

140. The project manager will be responsible for ensuring that these conditions are included as conditions in the bid and contract document.

141. Both the project manager and safeguards specialist are to be members of the bid evaluation panel. The safeguards specialist will evaluate the contractor’s environmental capability to the evaluation panel.

B. **Environmental Impacts and Mitigation Measures Needed During Construction**

142. Environmental impacts identified during construction are limited in size, are site specific, and temporary. The activities would normally be recognized as Best Construction Practices. While the scale of the works for the construction of a CHP are relatively minor, the project will still require the normal range of contractor’s facilities such as site offices, workshops, storage areas, and construction camp. The following activities have been identified during construction:

   (i) Contractor prepares the Contractor Environmental Monitoring Plan (CEMP);
   (ii) Induction of contractor to site;
   (iii) Preparation of site and establishment of contractor's facilities, concrete batching areas, etc.;
(iv) Excavation of construction (or other) sites (if any);
(v) Prevention of soil erosion on construction site;
(vi) Removal and disposal of excavated waste material, if any;
(vii) Prevention of soil erosion on finished work areas;
(viii) Storage and handling of construction materials, fuel, and lubricants;
(ix) Noise and vibration;
(x) Dust management;
(xi) Public access to site;
(xii) Community safety from increased vehicle movements;
(xiii) Use of hazardous materials and Appendix 6 - Prohibited Activities;
(xiv) Workplace health and safety;
 xv) Worker issues - hiring of workers;
(xvi) Worker issues - use of fuel wood;
(xvii) Worker issues - hunting and sale of wildlife;
(xviii) Worker issues - clearing of forest for gardens;
(xix) Disposal of waste materials;
(xx) Chance discovery of archaeological and cultural sites; and
(xxi) Clearance and rehabilitation of construction sites, and removal of contractor's facilities.

143. During construction, the contractor will work according to the requirements of the CEMP which has been prepared by the contractor. Supervision and monitoring of the CEMP activities will be undertaken as follows:

(i) The contractor has the initial responsibility for supervising and monitoring of the CEMP as already provided for in supervision of the works contract;
(ii) The project civil engineer located within the project management unit will direct the contractor with regard to compliance with the CEMP. The project civil engineer will be supported by the safeguards specialist:
(iii) The safeguards specialist will carry out independent monitoring of the work and can issue defect notices to the project civil engineer who will transmit these to the contractor; and
(iv) The contractor will have his own representative on site – the site engineer who will be responsible for implementing the contract and complying with the CEMP.

144. Contractor prepares CEMP. Following the award of the contract and before commencing work, the contractor will be required to prepare a CEMP that addresses the conditions of the construction EMP that has been attached to the bid and contract documents. The CEMP will amplify how the contractor will address the activities in the construction section of the EMP. An outline of the CEMP will be provided by the safeguards specialist. The contractor will submit the CEMP to the safeguards specialist for approval. The contractor has 10 days to prepare the CEMP and the safeguards specialist has 5 days to review the CEMP.

145. Induction of contractor to site. Following the selection of the contractor and the approval of the CEMP, the contractor together with the person on the contractor’s staff who will be responsible for supervising the CEMP will meet the safeguards specialist on-site where the CEMP conditions will be confirmed with the contractor. When the safeguards specialist is confident that the contractor understands and can comply with the CEMP, the safeguards specialist will advise the project civil engineer that the contractor can now commence work.

146. Preparation of site and establishment of contractor's facilities. This applies to all of the contractor's facilities: storage areas, workshops, labor camps, concrete batching areas, etc.
147. The sites are to be selected so that:

(i) Sites do not interfere with the welfare of surrounding communities in terms of noise dust and vibration from construction activities and their social well being from their proximity to contractor’s labor camps;
(ii) Size of contractor’s facilities are limited to reduce unnecessary clearing of vegetation;
(iii) Sanitary waste and grey water is not to be released untreated into surface water systems;
(iv) Sites are to be properly drained. Paved areas, including vehicle parking areas, workshops and fuel storage areas are to drain to an oil and water separator;
(v) Fuel storage areas are not to be located within 20m of a water course; and
(vi) Contractor’s facilities are to be contained within an adequate security fence.

148. The location and development of contractor’s facilities are to be approved by the project civil engineer and safeguards specialist.

149. **Excavation of construction sites.** This applies to all cleared sites where excavation will be undertaken. The contractor is to arrange the following.

150. Limit the areas to be excavated to those that can be effectively managed and protected.

151. Topsoil is removed and stored in separate heaps that are located in stable areas for later reuse for site rehabilitation.

152. Excavated material is sorted and stored as either competent (able to be reused) and incompetent (to be disposed of) materials. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will responsible for the supervision and monitoring of the contractor.

153. **Prevention of soil erosion on construction site.** This applies to all excavated sites. The contractor will be responsible for ensuring that the site is stable and that erosion is contained by appropriate soil conservation protection methods, including:

(i) Limiting the extent of excavation to reduce soil erosion potential;
(ii) Soil conservation protection methodology is to be applied to susceptible areas to avoid storm water runoff carrying eroded materials either, off-site to susceptible areas or, else onto already finished work areas;
(iii) Where excessive areas are to be opened up, soil protection is unlikely to be effective or storm water drainage is likely to discharge sediment into neighboring water courses sediment traps are to be used to settle eroded particles; and
(iv) Avoid excavating areas and operating machinery in wet ground conditions.

154. Excavated areas are to be revegetated as soon as possible at the completion of the site work. This will be the responsibility of the contractor. The project civil engineer and the safeguards specialist will be responsible for the supervision and monitoring of the contractor.

155. **Removal and disposal of spoil.** This applies to all sites where incompetent excavated materials have been produced that need to be disposed of off-site. This includes excavation waste (spoil) from the construction site. The contractor will be responsible for selecting sites and disposing of excavated waste at the sites. Sites for spoil dumps will not be approved where there is significant vegetation and at the completion of dumping the sites will need to be reshaped and rehabilitated back to a stable vegetated state. When the sites
are opened, these areas will require that vegetation be cleared and topsoil removed prior to being used. Once they are being used, they must be maintained in a stable manner and soil conservation technology applied as required. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for approving the site selected by the contractor and supervising and monitoring the contractor.

156. **Prevention of soil erosion on finished work areas.** This applies to all finished sites that have been disturbed by construction activities. The contractor will ensure at the completion of work that all excavated areas are properly stabilized. This includes the rehabilitation of all disturbed areas by the most appropriate and effective method. Re-vegetation requirements are to be discussed with the project manager’s representative who will advise on the re-vegetation conditions as required for the areas. This will be the responsibility of the contractor. The project civil engineer and the safeguards specialist will be responsible for the supervision and monitoring of the contractor.

157. **Storage and handling of construction materials.** Fuel and lubricants: only small amounts of construction materials are likely to be brought to site. These will include sand, gravel and cement for concrete manufacture, reinforcing rods and steel mesh, wood and other construction materials, paint and thinners, fuel and lubricants. Areas will need to be prepared for storing these materials. Fuel and oil will need to be stored in dedicated areas at least 20 m away from a watercourse. The contractor must have trained personnel who are competent in fuel handling procedures and for cleaning up accidental spills. All waste oil, oil and fuel filters are to be collected and disposed of in secure landfill areas. At the closure of the site all contaminated soil is to be excavated, removed, and replaced with fresh topsoil. This will be the responsibility of the contractor. The project civil engineer and the safeguards specialist will be responsible for the supervision and monitoring of the contractor.

158. **Noise and vibration.** This applies to all machinery, vehicles and construction sites where noise and vibration may affect local people. The contractor will be responsible for ensuring that noise and vibration does not affect the surrounding communities. While it is unlikely that noise and vibration will be an issue due to the distance between the activities and the communities the contractor must be prepared to curtail work to daylight hours (7:00 a.m. to 7:00 p.m.) should the community find that any night time operations become a nuisance. Noise is not to exceed 45 dBA at the boundary of residential areas. This will be the responsibility of the contractor. The project civil engineer and the safeguards specialist will be responsible for the supervision and monitoring of the contractor.

159. **Dust management.** This applies to all of the construction sites, haul roads, quarries, and topsoil and spoil dumps. If possible work that is carried out during the drier time of the year and especially when wind speeds increase may create localized dusty conditions. During construction when dust may be generated, the contractor is to monitor the worksite conditions and apply dust control measures which includes reducing traffic movements and spraying water on exposed areas. Use of oil for dust control is not allowed. The contractor is to maintain a dust control record that shows where and when dust control practices were carried out. This is to be made available as required when requested by the project civil engineer and/or the safeguards specialist. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

160. **Public access to the site.** This applies to the contractor’s site and work areas. Access will be controlled to the contractor’s facilities since this will be surrounded by a security fence. All visitors will be required to report to a check point before being allowed to enter the site. Other work areas will be demarcated by barrier tape and signs erected as required to warn people that there is no right of entry to these areas. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will responsible for the supervision and monitoring of the contractor.
161. **Community safety from increased vehicle movements.** This applies to all vehicles and in particular haul trucks that have to pass through villages. The contractor is to ensure that all vehicles that may be required to pass through villages are operated and transport equipment and materials safely without endangering these communities. The contractor is to ensure that:

- (i) trucks and other vehicles are maintained in safe operating condition;
- (ii) all drivers and machinery operators act responsibly;
- (iii) all loads are to be secured and all loads with fugitive materials (e.g., excavated soil and sand) are to be covered with tarpaulins; and
- (iv) the contractor is to immediately remove any drivers that ignore any of the community safety requirements.

162. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

1. **Use of Hazardous Materials and Prohibited Activities:**

163. **Hazardous materials.** Care will need to be taken should any hazardous materials be required during construction. It is recommended that the contractor uses the Hazchem system which is based on the UN classification system. Details of the classification of dangerous materials can be found on the site [http://www.minerals.csiro.au/safety/dangood.htm](http://www.minerals.csiro.au/safety/dangood.htm). The contractor will be required to prepare a list of all materials that are proposed to be brought to site together with their Hazchem rating. The safeguards specialist is to verify the Hazchem rating and approve the use of any Hazchem rated chemicals. The contractor will also be required to display Material Safety Data Sheets in all work areas and to train workers in the safe use of these materials, including the provision of protective equipment for handling these substances.

164. **Prohibited activities.** The contractor is to be aware of the activities shown in Appendix 5 of the ADB's *Safeguard Policy Statement, Prohibited Investment Activities List* that became effective in January 2010. Any listed Appendix 5 activities are prohibited. The project civil engineer and safeguard specialist are to verify that the contractor is aware of the Appendix 5 requirements and that none of these activities will be sanctioned during construction. This will be the responsibility of the contractor. The project civil engineer and the safeguards specialist will be responsible for the supervision and monitoring of the contractor.

2. **Workplace Health and Safety**

165. Workplace health and safety is covered by the Employment Act (1978). The contractor may employ up to 100 people at any one time of which all will have to be housed on site. The main workplace safety issues include:

- (i) Hazards from operating and using machinery. Direct hazards to the machine operators and to workers working in the vicinity of the machine;
- (ii) Hazards from working in the pipeline trench where sides may collapse;
- (iii) Hazards to workers exposed from heavy materials being lifted by cranes;
- (iv) Refueling hazards;
- (v) Exposure to Hazchem materials; and
- (vi) Traffic accident hazards.

166. Before commencing work in any of these activities (and in any other areas that the contractor identifies), the contractor will be required to prepare a brief work statement that
identifies hazards that apply at a particular site together with an outline of the approved work procedure and details of protective safety equipment to be used by any person entering the specified work area. The work statement is also to include an emergency response plan to address serious accidents and nominate a person who is to be immediately contacted should an accident occur. A copy of the work statement is to be posted at the site and before commencing work the contractor is required to discuss the work statement requirements with the workers. The work statement plan is to be submitted to the project civil engineer and SS for approval one week prior to starting work in any of these areas.

(i) The contractor will be required to keep the site free of drugs and alcohol;
(ii) The contractor will be required to appoint a person on his staff who will evaluate workplace safety issues and instruct all workers on workplace hazards and health and safety issues;
(iii) The contractor will be required to provide a safe work environment and provide safety measures and protective equipment for all workers including hand, head, eye and ear protection and safety footwear;
(iv) The contractor is also to provide first aid facilities on-site and employ a competent person trained in first aid;
(v) Noise and dust are to be controlled at the workplace;
(vi) Supplies of potable water, toilets and washing water are to be provided for workers;
(vii) A record of accidents and time lost from accidents will be required to be kept by the contractor which will be forwarded each month to the project manager’s representative for the attention of the ES; and
(viii) The project civil engineer or safeguards specialist will inspect and approve the adequacy of these arrangements.

167. **Worker camp establishment/incoming workers.**

a. Location of camps with regard to social conflicts.

(i) A construction site such as this may employ upwards of 10-15 persons who will be housed and located on-site. There is a potential for conflict to develop with local communities should they be marginalized by the introduction of outside workers who then enjoy an enhanced economic status in comparison to the local communities.

(ii) Camps to be located and managed so that social harmony is maintained between workers and local communities.

(iii) Local people should be given priority in labour recruitment.

(iv) This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

(v) Provision of adequate living conditions:

(vi) Workers will need adequate housing, sanitation and recreational facilities.

(vii) The contractor will provide acceptable camp facilities with potable water, adequate food rations and recreational facilities to either meet requirements of the Employment Act (1978) or an acceptable international standard whichever is the higher;

(viii) This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

b. **Camp water heating and cooking.** To avoid sudden and unsustainable loss of any resources to the detriment of surrounding communities, the contractor
will be required to address these issues as follows. This will be the responsibility of the contractor. The PE and the SS will be responsible for the supervision and monitoring of the contractor.

(i) Locate camp outside significant forest areas;
(ii) Limit collection and use of fuel-wood; and
(iii) Contractor provides gas and kerosene for water heating and cooking.

c. **Hunting and sale of wildlife.** To avoid sudden and unsustainable loss of any wildlife resources, the contractor will be required to address these issues as follows. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

(i) Labor employment agreement enforced by contractor that bans hunting and trading in wildlife; and
(ii) Provision of adequate camp rations.

d. **Clearing of forest for gardens.**

(i) Workers may want to clear areas for gardens. This will be driven by tradition rather than necessity as the contractor will be required to provide all workers with an adequate ration. Clearing for gardens, or gardening activity per se will not be permitted. The contractor is to provide adequate and nutritionally balanced rations for all workers under his control that also incorporates traditional food items that would normally be sourced from markets;

(ii) This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

168. **Disposal of waste materials.** All construction waste materials including steel and timber off-cuts, sand and gravel, cement bags, etc., are to be suitably disposed of. If these cannot be recovered for scrap value, these materials are to be taken to an approved landfill sites and dumped there. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

169. **Chance discovery of archaeological and cultural sites.** Archaeological sites are protected under the National Cultural Property (Preservation) Act (1965). While it is highly unlikely that there will be archaeological or cultural sites within the boundaries of CHP sites, it is possible that “chance discoveries” may be made during development of the site. The contractor will be responsible for these finds and is to immediately stop work where the discovery has been made and advise the project civil engineer and safeguards specialist of the discovery. The safeguards specialist will arrange to have the site evaluated. Depending on the evaluation of the discovery the contractor will be advised whether or not it is possible to resume work on the site. This will be the responsibility of the contractor. The project civil engineer and safeguards specialist will be responsible for the supervision and monitoring of the contractor.

170. **Clearance and rehabilitation of construction sites and removal of contractor’s facilities.** It is the contractor’s responsibility to address site clean up. This includes the removal of all waste materials, machinery and any contaminated soil. All construction sites and work areas are to be rehabilitated so that these can be returned as close as possible to their previous use. This includes the stabilization and landscaping of all of the construction
sites. Any contaminated soil must be removed from fuel and oil storage areas and the site revegetated. No waste is to remain behind after work is completed that will not naturally and safely decompose. Should waste not be removed, the safeguards specialist is entitled to withhold payment, and arrange the clean-up, and deduct the cost of the clean-up from the final payment amount less an additional 10% for arranging the task. The project civil engineer is to ensure that all waste is removed and the site restored. The safeguards specialist will also inspect and approve the clean-up of the site.

C. Environmental Impacts and Mitigation Measures Needed During Operation

171. During operation the main issues are:

   (i) Ensuring that there is no discharge of any untreated wastewaters into the environment; and
   (ii) Ensuring that all medical wastes are disposed of correctly.

172. Both these issues are the full responsibility of NDOH staff who are managing the facilities.

D. Monitoring

173. A matrix summarizing the monitoring that is required for the EMP is attached as Annex 2, which shows the monitoring measures required together with the frequency of measurement, the means of verification, and who is responsible for monitoring the activity. Monitoring is carried out as follows:

   (i) **Pre-construction.** During preconstruction the safeguards specialist will monitor the tasks identified within the EMP.

   (ii) **Construction.** During construction, monitoring of construction activities is carried out to ensure that construction work complies with the requirements of the EMP. Monitoring responsibilities are arranged as follows.

      a. The contractor has the initial responsibility for monitoring compliance with the CEMP which is identical to the contractor’s responsibilities for monitoring the construction works.

      b. The project engineer is responsible for monitoring the contractor’s compliance with the CEMP and the project engineer will be assisted in this role by the safeguards specialist. A monitoring checklist is attached as Annex 2.

      c. The safeguards specialist also monitors the work but in more of an auditing role. The safeguards specialist can issue defect notices for non-compliant work and depending on the seriousness of the work may instruct the contractor that this is to be completed by a certain date. The defect notice is given to the project civil engineer who directs the contractor to undertake the work as shown in the defect notice. If the work is not completed by the due date then the project civil engineer can arrange for the work to be completed by another contractor and the cost deducted from the contract plus 10% as a management charge.

      (iii) Monitoring may also be carried out by a third party e.g., DEC who may make spot checks on the work being undertaken.

      (iv) During operation, monitoring will be undertaken by NDOH as part of their ongoing national monitoring programs.
E. IMPLEMENTATION ARRANGEMENTS

1. Implementation Schedule

174. The project will be provided as a loan which allows the borrower to draw the loan down as required.

2. Institutional Arrangements

175. The NDOH will have overall responsibility for implementing the EMP. Other organizations and individuals involved in implementing the EMP include:

(i) Government agencies such as DEC who will be responsible for environmental approval. DEC is responsible for the administration and enforcement of the Environment Act 2000 and its regulations.

(ii) The contractor who will be responsible for mitigating and reporting on environmental activities during construction.

(iii) The project manager will be responsible for ensuring that the environmental safeguards are implemented so as to meet their intended requirements. This includes ensuring that the construction section and tendering conditions for the EMP is attached to the bid and contract documents.

(iv) The PSU will be responsible for supervising the implementation of the EMP during construction. The project civil engineer will be assisted by the safeguards specialist. The project civil engineer will be responsible for conveying any instructions from the safeguards specialist to the contractor.

(v) During pre-construction, the safeguards specialist will ensure that issues that need to be addressed by the project civil engineer are considered in the design. The safeguards specialist will prepare a design brief containing these requirements for action by the PSU technical design team. The safeguards specialist will also review and revise the EMP as required and extract the construction section from the EMP so that these may be attached to the bid and contract documents. The safeguards specialist will arrange public consultation to advise affected communities of the scope and scheduling of the project to raise awareness within the communities of the likely phasing of events that will occur within their social boundaries.

(vi) Prior to construction commencing, the safeguards specialist will also evaluate and approve the CEMP that will be prepared by the contractor as a condition of the contract. Following approval of the CEMP the safeguards specialist will arrange to induct the contractor to the construction site whereby details of the CEMP are confirmed with the contractor. When the safeguards specialist considers that the contractor is competent to undertake compliance with the CEMP the safeguards specialist advises the project civil engineer that the contractor may now commence work.

(vii) While the contractor's SE will undertake day-to-day supervision of the CEMP, the project civil engineer who will be assisted by the safeguards specialist will have overall site supervision responsibilities for ensuring that the Contractor is meeting the CEMP requirements.

(viii) During operation, the safeguards specialist will also undertake regular monitoring as required by the EMP. The safeguards specialist may issue defect notices concerning non-compliant work which are channeled to the contractor via the project civil engineer.

(ix) The safeguards specialist will prepare IEEs and notification of preparatory Works for other projects as required to meet the requirements of the sector loan.
(x) The safeguards specialist will work with and train contractors to assist them in proactively understanding their contractual requirements. The safeguards specialist is to be familiar with contract preparation, evaluation and supervision so as to across the environmental safeguards across to the bid and contract documents, the evaluation of bids, selection of the contractor and the monitoring of the contractor’s work. The safeguards specialist will need to be recruited prior to tendering so as to ensure that the environmental safeguards are integrated into the contractual documents.

176. **The contractor.** The contractor’s responsibilities include:

(i) Prior to construction commencing, the contractor will address the construction section of the EMP which has been attached to the bid and contract documents and develop this into a detailed CEMP that amplifies the conditions established in the EMP. The CEMP also identifies persons who will be responsible for undertaking the work within the contractor’s team. It will include a basic monitoring plan and a reporting program.

(ii) The CEMP will be submitted to the safeguards specialist who will approve it and forward a copy to DEC for their information.

(iii) Following approval of the CEMP, the contractor is required to attend a site induction meeting where the CEMP is further discussed directly with the contractor to ensure that all compliance conditions are understood.

(iv) Following this, the safeguards specialist advises the project civil engineer that the contractor is now cleared to commence work.

(v) The contractor will prepare a quarterly compliance report that will be submitted to the PSU. The report will also contain the monthly accident report. The safeguards specialist will submit the report to DEC and include a copy for ADB in the project’s quarterly progress report prepared to meet the ADB loan requirements.

3. **Budget**

177. The total cost of the project will be $70 million, comprising an ADB loan and donor partner and PNG government contributions. These contributions are detailed in Table 2.

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<tr>
<th>Source</th>
<th>Type</th>
<th>Amount US$ (million)</th>
<th>Share of Total (%)</th>
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<td>ADF Loan</td>
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<tr>
<td>Australian Agency for International Development</td>
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<td>Japan International Cooperation Agency</td>
<td>Yen Loan</td>
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<td>JICA JOCV Volunteers</td>
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<td><strong>Total</strong></td>
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<td><strong>100.00%</strong></td>
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**XI. CONCLUSIONS AND RECOMMENDATIONS**

178. The project will develop or renovate 32 CHPs. A further 178 will be created by NDOH, distributed in the 89 districts of PNG.

179. These CHPs will occupy no more than 0.25 ha each. They will mostly be located on church and government owned land at district stations.
180. It is not envisaged that their construction will require the clearance of any forest or intact native vegetation.

181. The CHPs will be constructed according to the regulations of the Public Health Act (1973) and The Australasian Health Facility Guidelines. These guide all matters pertaining to the management of medical wastes and sewerage.

182. The largest potential for environmental impact will occur in the construction phase, in terms of the noise and dust generation. Both these and other possible construction-related impacts will be managed by the PSU and Contractor. During construction, the contractor will be initially responsible for monitoring and supervising compliance with the EMP. The project civil engineer will be assisted by the safeguards specialist to supervise the contractor while the safeguards specialist will monitor the work and report any defects to the project civil engineer as required.

183. All other construction impacts are of a routine nature and can be dealt with by the EMP.

184. Based on the above, it is concluded that the project has few adverse impacts and all impacts can be satisfactorily managed by the application of the EMP. The project is classified as a Category B project that requires an IEE to be completed. The IEE shows that all impacts can be satisfactorily mitigated and an EMP has been prepared that contains practical and realizable mitigation measures.

185. The IEE concludes that adverse environmental impacts arising from the construction of the CHPs can be minimized to insignificant levels. Therefore, a full Environmental Impact Assessment is not warranted.
REFERENCES


## ENVIRONMENTAL MITIGATION AND MONITORING PLAN

### IMPACT MITIGATION

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Potential Environmental Impact</th>
<th>Proposed Mitigation Measure</th>
<th>Implementing Responsibility</th>
<th>Mitigation Cost</th>
<th>Parameter to be Monitored</th>
<th>Frequency and Means of Verification</th>
<th>Monitoring Responsibility</th>
<th>Monitoring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRE-CONSTRUCTION ACTIVITIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquisition of land</td>
<td>2 x 0.25 ha areas of land required in 89 districts. Potential for use disputes</td>
<td>NDOH and Provincial Authorities identify suitable lands with titles; or Church land in village areas used.</td>
<td>NDOH, Provincial Lands Officers</td>
<td>Nil. Free provision of land for construction is a prerequisite for CHP construction</td>
<td>Availability of Title, or agreement with village councils.</td>
<td>Once</td>
<td>PSU</td>
<td>To be determined</td>
</tr>
<tr>
<td>Provision of climate change requirements in design</td>
<td>Siting of CHPs needs to reflect future flooding potentialities</td>
<td>Clear site designation above potentially inundated sites</td>
<td>PSU, SS, PE</td>
<td>Nil</td>
<td>Design Plans</td>
<td>Once</td>
<td>PSU</td>
<td>Nil</td>
</tr>
<tr>
<td>Siting of project facilities - avoiding vegetation losses</td>
<td>Loss of habitat/environmental amenity</td>
<td>CHP sites only suitable if they are devoid of intact vegetation</td>
<td>SS, PSU</td>
<td>Nil</td>
<td>Site condition</td>
<td>Once</td>
<td>PSU</td>
<td>Nil</td>
</tr>
</tbody>
</table>

### CONSTRUCTION ACTIVITIES

| Preparation of site and establishment of contractor’s facilities | Maintains integrity of site | i) Site is limited to reduce unnecessary clearing of vegetation. ii) Sanitary soakage areas to be sited so that they do not discharge to surface water systems. iii) Vehicle parking areas and workshops to be provided with oil and water | Contractor | Costed by contractor and cost carried into contract. | Site developed according to EMP specifications. | Weekly or as required until site has been established. Verify that contractor’s facilities meet EMP requirements. | Contractor, PE and SS | Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU. |
## IMPACT MITIGATION

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Potential Environmental Impact</th>
<th>Proposed Mitigation Measure</th>
<th>Implementing Responsibility</th>
<th>Mitigation Cost</th>
<th>Parameter to be Monitored</th>
<th>Frequency and Means of Verification</th>
<th>Monitoring Responsibility</th>
<th>Monitoring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation of construction (other) sites (if any)</td>
<td>Loss of topsoil</td>
<td>i. Limit excavation area. ii. Remove and store topsoil. iii. Sort and store other excavated materials as required</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract.</td>
<td>Topsoil recovered</td>
<td>Monthly and then as required. Topsoil recovered and stored and available for later re-use.</td>
<td>Contractor, PE and SS</td>
<td>Contractor's monitoring costs met by contractor. SS and PE costs met by PSU.</td>
</tr>
<tr>
<td>Prevention of soil erosion on construction site</td>
<td>a. Soil erosion from excavation b. Eroded soil interfering with construction activities.</td>
<td>i. Limit excavation area. ii. Apply soil conservation and erosion protection technologies. iii. Use sediment basins. iv. Avoid operating machinery in adverse ground conditions. v. Protect and revegetation as soon as possible.</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract.</td>
<td>Soil erosion and sediment supply to water courses controlled</td>
<td>Monthly and then as required.</td>
<td>Contractor, PE and SS</td>
<td>Contractor's monitoring costs met by contractor. SS and PE costs met by PSU.</td>
</tr>
<tr>
<td>Removal and disposal of excavated waste material if any</td>
<td>a. Loss of significant vegetation from poor siting of spoil dumps. b. Lowered water quality from eroded material. c. Loss of visual amenity from poorly located dumpsites</td>
<td>i. Excavated material to be disposed of outside and away from the work area where it can be re-used if required. ii. Material which cannot be re-used is to be landscaped so as not to erode back into canal and revegetated. iii. All disposal</td>
<td>a. Contractor to arranges location of dumping sites with PE. b. PE and SS</td>
<td>Costed by contractor and cost carried into contract.</td>
<td>Sites properly prepared and maintained.</td>
<td>Monthly and then as required.</td>
<td>Contractor, PE and SS</td>
<td>Contractor's monitoring costs met by contractor. SS and PE costs met by PSU.</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Environmental Impact</td>
<td>Proposed Mitigation Measure</td>
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</tr>
<tr>
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</tr>
<tr>
<td>Prevention of soil erosion on finished work areas</td>
<td>a. Loss of soil resources. b. Water quality affected.</td>
<td>Rehabilitation of all excavated sites including replacement of topsoil and revegetation of disturbed areas.</td>
<td>Contractor and SS will advise on revegetation requirements</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Completed work areas are stable (non-eroding).</td>
<td>Monthly and then as required.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Storage and handling of construction materials, fuel and lubricants.</td>
<td>Pollution of soil and water resources i. Storage areas to be prepared to avoid deterioration of materials. ii. Fuel should be stored in properly sealed containers. iii. All fuel storage areas to be security fenced and provided with oil and water separators. Fuel hoses to be locked and provided with a shut off valve at the tank. iv. All refueling to be done at least 20 m away from waterways by trained personnel. v. All waste oil and oil filters to be collected and if possible recycled, otherwise to be</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Storage areas prepared. Fuel and oil storage and handling procedures practiced and well understood.</td>
<td>Initially once to approve storage and handling procedures then as required. Verify that storage and handling of construction materials, fuel and lubricants meet these requirements.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
<td></td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Environmental Impact</td>
<td>Proposed Mitigation Measure</td>
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<td>----------------</td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>Noise and vibration nuisance to surrounding communities</td>
<td>i. If particularly noisy activities are required work may need to be limited to daylight hours. ii. Noise not to exceed 45dBA at boundary of workplace.</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>i. Noise complaints from surrounding communities. ii. Noise measurement</td>
<td>At start of noisy activities then as required. Community complaints. 45 dBA measured at workplace boundary.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Dust management</td>
<td>Dust may be generated from activities. Will affect air quality of workplaces and surrounding areas</td>
<td>When dust is carried towards residential areas or becomes problematic on-site, the contractor is to apply dust control measures.</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Work areas are acceptable with regards to generation of dust.</td>
<td>i. As determined by wind and site conditions. ii. Complaints from communities.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Public access to site</td>
<td>Accidents to surrounding communities</td>
<td>Erect warning signs and barriers around work areas. Site can only be accessed with permission of contractor</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Warning signs and barriers erected around work places. Access to work areas controlled.</td>
<td>Weekly. Accident reports involving community.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Community safety from increased vehicle movements</td>
<td>Accidents to surrounding communities from vehicles transiting villages.</td>
<td>i. All vehicles to be properly maintained and operated in accordance with road laws. ii. All loads to be properly secured and fugitive loads</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Trucks and vehicles operated safely</td>
<td>Weekly. Accident reports involving community.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
</tbody>
</table>
## IMPACT MITIGATION

<table>
<thead>
<tr>
<th>Project Activity</th>
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<th>Frequency and Means of Verification</th>
<th>Monitoring Responsibility</th>
<th>Monitoring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of hazardous materials and Appendix 6 Prohibited Activities</td>
<td>Health dangers to workers and the environment. Loss of water quality</td>
<td>i. Contractor to provide list of all HAZCHEM products to be used on site ii. List verified against HAZCHEM. iii. Contractor to display MSDS sheets in work areas. iv. Contractor to abide by Appendix 5 Prohibited Activities (SPS, June 2009)</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>a. List of chemical compounds and their hazard ratings. b. Appendix 5 activities</td>
<td>At start of work and whenever any hazardous compounds are to be brought to site. b. No Appendix 5 activities initiated</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Worker issues - use of fuel wood</td>
<td>Causes social friction</td>
<td>Collection banned by contractor and all meals provided to workers</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Staff behaviour</td>
<td>Continuously</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Worker issues - hunting and sale of wildlife</td>
<td>Causes social friction</td>
<td>Hunting banned by contractor</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Staff behaviour</td>
<td>Continuously</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Worker issues - clearing of forest for gardens</td>
<td>Causes social friction</td>
<td>Clearing/gardenin g banned by contractor. Contractor to</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Staff behaviour</td>
<td>Continuously</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Environmental Impact</td>
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<td>Frequency and Means of Verification</td>
<td>Monitoring Responsibility</td>
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<td>-----------------</td>
</tr>
<tr>
<td>Disposal of waste materials</td>
<td>Soil and water pollution.</td>
<td>All waste materials to be collected and sorted; (i) those that can be recycled and (ii) those that need to go to an approved landfill site for disposal.</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Sites cleaned of materials. Materials dumped in approved sites</td>
<td>Spot checks and weekly inspections. Waste being collected and disposed of to meet requirements.</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
<tr>
<td>Chance discovery of archaeologica l and cultural sites</td>
<td>Loss of cultural values</td>
<td>Chance discoveries are to be notified to the PE who will advise the SS.</td>
<td>Contractor</td>
<td>Costed by contractor and cost carried into contract</td>
<td>Contract document and specification</td>
<td>Yearly. Notification of chance discoveries</td>
<td>Contractor, PE and SS</td>
<td>Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU</td>
</tr>
</tbody>
</table>
| Clearance and rehabilitation of construction sites and removal of contractor’s facilities | Re-establishes environmental values | i. All solid waste to be removed from sites and disposed in approved landfills.  
ii. All contaminated soil to be removed.  
iii. All sites to be rehabilitated and restored to original condition.  
iv. Drainage to be re-established.  
v. To be included as part of Final Inspection before payment made. | Contractor | Costed by contractor and cost carried into contract | Sites cleared, waste removed, sites landscaped and revegetated. | At completion of construction. Site has been cleared of materials, rehabilitated and returned to original state. | Contractor, PE and SS | Contractor’s monitoring costs met by contractor. SS and PE costs met by PSU |
<table>
<thead>
<tr>
<th>OPERATION ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensuring that there is no discharge of any untreated wastewaters into the environment</td>
</tr>
<tr>
<td>Proposed Mitigation Measure: Sewerage systems to be build in accordance with CHP specifications</td>
</tr>
<tr>
<td>Implementing Responsibility: PSU and NDOH</td>
</tr>
<tr>
<td>Mitigation Cost: Costed by contractor and cost carried into contract</td>
</tr>
<tr>
<td>Parameter to be Monitored: Ongoing coliform monitoring</td>
</tr>
<tr>
<td>Frequency and Means of Verification: Quarterly</td>
</tr>
<tr>
<td>Monitoring Responsibility: NDOH</td>
</tr>
<tr>
<td>Monitoring Cost: NDOH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ensuring that all medical wastes are disposed of correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Environmental Impact: Spread of disease.</td>
</tr>
<tr>
<td>Proposed Mitigation Measure: Incinerators to be constructed at CHPs according to CHP specifications</td>
</tr>
<tr>
<td>Implementing Responsibility: PSU and NDOH</td>
</tr>
<tr>
<td>Mitigation Cost: Costed by contractor and cost carried into contract</td>
</tr>
<tr>
<td>Parameter to be Monitored: Site inspections</td>
</tr>
<tr>
<td>Frequency and Means of Verification: Quarterly</td>
</tr>
<tr>
<td>Monitoring Responsibility: NDOH</td>
</tr>
<tr>
<td>Monitoring Cost: NDOH</td>
</tr>
</tbody>
</table>
MONITORING CHECKLIST

I. IEE MONITORING REQUIREMENTS

1. For this project, a table summarizing the monitoring requirements shown in the Environmental Management Plan (EMP) is attached as Appendix 1 for pre-construction and construction. The matrix shown in Appendix 1 shows the mitigation measures, monitoring requirements and responsibilities of the various persons that need to be addressed during design/pre-construction, construction and operation phases. Only the main monitoring requirements are shown in Appendix 1 and will need to be revised as follows.

   (i) At the start of the project and before monitoring begins, the environment officer will review the monitoring activities shown in Appendix A and update the monitoring requirements to conform with any changes that have been made to the project design and activities.

2. Monitoring will be addressed as follows:

   (i) During pre-construction, monitoring of these activities will be carried out by the safeguards specialist. The safeguards specialist in association with the project civil engineer will be responsible for ensuring that the issues that are to be addressed by the technical design team are implemented as required in the EMP.

   (ii) During construction, monitoring will be carried out as follows: the contractor will have the initial responsibility for self-monitoring his work which will be undertaken according to the CEMP. The contractor will appoint a person on his team who will have overall responsibility for ensuring that the CEMP requirements are complied with. The project civil engineer will supervise and monitor the contractor's work and direct the contractor accordingly. The safeguards specialist will support and assist the project civil engineer in monitoring the contractor's work. The safeguards specialist will also independently monitor the construction activities and will issue defect notices for non-complying work to the contractor via the project civil engineer.
# PNG WATER QUALITY STANDARDS

## WATER QUALITY CRITERIA FOR AQUATIC LIFE PROTECTION

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Fresh water</th>
<th>Seawater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia – nitrogen</td>
<td>Dependent on pH and temperature (see Table 2.)</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Barium</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Boron</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.01</td>
<td>0.001</td>
</tr>
<tr>
<td>Chlorine (total residual)</td>
<td>0.005 at pH 6</td>
<td>0.005</td>
</tr>
<tr>
<td>Chromium (as hexavalent form)</td>
<td>0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>Colour</td>
<td>No alteration to natural colouration (for both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td>Limit of delectability (for both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>1.0</td>
<td>0.03</td>
</tr>
<tr>
<td>Cyanide (as HCN)</td>
<td>0.005</td>
<td>0.01</td>
</tr>
<tr>
<td>Faecal Coliform Bacteria</td>
<td>&gt;200 per 100 ml (see Note below)</td>
<td></td>
</tr>
<tr>
<td>Fats</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Fluoride</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Grease</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Insoluble residues</td>
<td>No insoluble residues or sludge formation to occur (both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Iron (in solution)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lead</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>Manganese (in solution)</td>
<td>0.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.0002</td>
<td>0.0002</td>
</tr>
<tr>
<td>Nickel</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Nitrate (as No3+-NO2-)</td>
<td>45.0</td>
<td>45.0</td>
</tr>
<tr>
<td>Odour</td>
<td>No alteration to natural odour (for both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Not less than 6.0</td>
<td>Not less than 5.0</td>
</tr>
<tr>
<td>Pesticides</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>pH</td>
<td>No alteration to natural pH (for both fresh and seawater)</td>
<td></td>
</tr>
</tbody>
</table>
### WATER QUALITY CRITERIA FOR AQUATIC LIFE PROTECTION

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Fresh water</th>
<th>Seawater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenols</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Potassium</td>
<td>5.0</td>
<td>450.0</td>
</tr>
<tr>
<td>Radioactivity</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Silver</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Sulfate (as SS4)</td>
<td>400.0</td>
<td>-</td>
</tr>
<tr>
<td>Sulfide (HS)</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Tars</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Taste</td>
<td>No alteration to natural taste (for both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>No alteration greater than 2°C (for both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Tin</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Toxicants (miscellaneous)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Turbidity</td>
<td>No alteration greater than 25 N.T.U (for both fresh and seawater)</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Notes:**

1. All values are in mg/litre unless otherwise specified.
2. Metal concentrations are for dissolved substances (passing through a normal 0.45µm medium).
3. Criteria for Faecal Coliform Bacteria is based on not fewer than five samples taken over not more than a 30 day period, in which the medium value of the faecal coliform bacteria content of the waters shall not exceed 200 per 100 ml.
4. N.T.U. – Nephelometric Turbidity Unit.

**Source:** Environment Act 2000.
GUIDELINES FOR INCINERATOR USE AND CONSTRUCTION

1. The following requirements should govern incineration of medical waste.

A. Type of waste that shall not be incinerated:

(i) Pressurized gas containers;
(ii) Large amounts of reactive chemical waste;
(iii) Silver salts and photographic or radioactive waste, Halogenated plastics such as polyvinyl chloride (PVC) (blood bags, IV tubing or disposable syringes);
(iv) Waste with high mercury or cadmium content, such as broken thermometers, used batteries and lead-lined wooden panels; and
(v) Wastes chemically treated with any chlorinated disinfectant.

B. Operating standards. All incinerators shall meet the following emission and operating standards.

(i) Combustion efficiency (C.E.) shall be at least 99.0%. The combustion efficiency shall be computed as follows:
(ii) \( C.E = \frac{CO \times 100}{\% CO +\% CO}. \)
(iii) Suitably designed pollution control devices such as scrubbers, filters or electrostatic precipitators, shall be installed/retrofitted with the incinerator to achieve emission limits, if necessary.

C. Feeding

2. Controlled hygienic, mechanical or automatic feeding methods have to be used which will not negatively influence the air supply and temperature in the primary and secondary chambers of the incinerator.

3. No waste is to be fed into the incinerator:

(i) at start up until the minimum combustion temperatures have been reached
(ii) whenever the minimum combustion temperatures are not maintained;
(iii) whenever the previous charge has not been completely combusted in the case of batch loader; or
(iv) until such time as the addition of more waste will not cause the design parameters of the incinerator to be exceeded.

D. Single chamber incinerators

4. The minimum temperature shall not be less than 1100° C.

E. Double chamber incinerators

1. Primary combustion

(i) The primary combustion chamber shall be accepted as the primary combustion zone and shall be equipped with a burner/s burning gas or low sulphur liquid fuel.
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(ii) Primary air supply is to be controlled efficiently.
(iii) The minimum combustion temperature of the primary chamber shall not be less than 800°C.

2. Secondary combustion

(i) The secondary combustion chamber shall be accepted as the secondary combustion zone and shall be fitted with a burner/s burning gas or low sulphur liquid fuel.
(ii) Secondary air supply is to be controlled efficiently.
(iii) Flame contact with all the gases shall be achieved.
(iv) The residence time in the secondary chamber shall not be less than two seconds.
(v) The gas temperature as measured against the inside wall in the secondary chamber, not in the flame zone, shall not be less than 1,100°C;
(vi) The oxygen content of the emitted gases shall not be less than 10%.
Both the primary and the secondary temperatures shall be maintained until all the waste has been completely combusted.

F. Chimney

5. The specifications below cover both single and double chamber incinerators:

(i) The exhaust gas stack (chimney) shall extend above the general terrain in the immediate vicinity of the plant, in order to disperse the combustion gas products adequately.
(ii) The chimney shall have a minimum height of nine (5) meters above ground level and clear the highest point of the building by not less than 6 meters for flat roofs or 3 meters for pitched roofs. The topography and height of adjacent buildings (i.e., closer than 5 meters chimney height) shall be taken into account.
(iii) The minimum exit velocity of the emissions shall not be less than 10 meters/second.
(iv) The stack shall be insulated to maintain the maximum outlet temperature.
(v) The sampling platform and port for measurement of emissions shall be provided.

G. Temperature

6. The temperature shall be determined against the inside wall of the combustion chambers. Care shall be taken not to measure the burner flame temperature.

H. Siting

7. The proposed siting requirements shall address the impact of the facility on ambient air quality, visibility, soils, vegetation, and other factors that may be relevant in determining that the benefits of the proposed facility significantly outweigh the environmental and social costs imposed as a result of its location and construction.

(i) The incinerator shall be sited in accordance with the topography and be compatible with premises in the local area.
(ii) The proposed site shall be approved by NDOH before installation.
(iii) The incinerator shall be housed in a suitably ventilated enclosure.
I. Fuel

(i) The incineration chamber shall be designed to include an auxiliary gas or oil burner to be used as necessary to maintain the prescribed minimum combustion temperatures.
(ii) Some dry solid waste which makes good fuel shall be held back in case of fuel shortage. This is typically cardboard or wooden scraps.
(iii) Where diesel is used, low sulphur diesel shall be used as fuel in the incinerator.

J. Emission limits

(i) Opacity of the smoke shall not exceed 20%.
(ii) All the emissions to air other than steam or water vapor shall be odorless and free from mist, fume and droplets.

K. Ash Processing

(i) The ash processing system shall involve stabilizing the ash product with lime and cement so that it can safely be land filled or used in construction as fill material or construction blocks.
(ii) Ash handling and processing shall be kept under roof and indoors so that it is not offensive to the neighbors and also so that operations may be conducted all year round.
(iii) Incinerator ash and residues shall be disposed of in a special area within an approved landfill unless handled otherwise in accordance with permission from NDOH.