Waste Management and Point Source Pollution Plan

Person Responsible	**HEC HSE Manager**

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ACRONYMS

Name	Description
BOOT	Build, Own, Operate and Transfer
CESMP	Construction Environmental and Social Management Plan
DIA	Direct Impact Area
EPC	Engineering, Procurement and Construction
E&S	Environmental and Social
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GRM	Grievance Redress Mechanism
HCC	Honiara City Council
HEC	Hyundai Engineering Corporation Limited
HSE	Health, Safety and Environment
IA	Implementation Agreement
K-water	Korea Water Resources Corporation
LTA	Lenders Technical Adviser
masl	Meters above sea level
MMERE	Ministry of Mines, Energy and Rural Electrification
MSDS	Material Safety Data Sheet
MW	Mega Watt
OE	Owner's Engineer (Stantec New Zealand)
PO	Project Office
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PS	Performance Standard
SIEA	Solomon Islands Electricity Authority
SIG	Solomon Islands Government
SIWA	Solomon Islands Water Authority
THL	Tina Hydropower Limited
TRHDP	Tina River Hydropower Development Project (the Project)
WMPSPP	Waste Management and Point Source Pollution Plan

1 INTRODUCTION

The Tina River Hydropower Development Project (TRHDP or "Project") is a hydropower development located in Central Guadalcanal, Solomon Islands, managed by a dedicated Project Office (PO) under the national Ministry of Mines, Energy and Rural Electrification (MMERE).

Tina Hydropower Limited (THL) was established by Korea Water Resources Corporation (K-water) and Hyundai Engineering Corporation Limited (HEC). THL will Build, Own, Operate and Transfer (BOOT) the Project under an Implementation Agreement (IA) and a Power Purchase Agreement (PPA) with the Solomon Islands Government (SIG) and Solomon Islands Electricity Authority, respectively. The BOOT concession is expected to last for a 30-year period, following commissioning.

HEC will be responsible for the Engineering, Procurement and Construction (EPC) of the Project, while THL will be responsible for the Operation and Maintenance contract. THL will sell electricity to the Solomon Islands Electricity Authority (SIEA) trading as Solomon Power, the state-owned power utility, for the duration of the concession. At the end of the concession, the hydropower infrastructure will be transferred to the SIG or SIEA.

1.1 PROJECT OVERVIEW

The Project consists of a 53-meter-high Roller Compacted Concrete dam (from riverbed to dam crest) in an uninhabited area of Malango Ward of Central Guadalcanal, located 20 km southeast of Honiara, at an elevation of approximately 122 meters above sea level (masl) and roughly 30 river km from the sea. It also incorporates a 3.3 km tunnel to a powerhouse and a tailrace at elevation 73 masl. The reservoir formed by the dam will extend upstream approximately 2.6 km and will have a surface area of about 0.31 km^2 at an elevation of 175 masl. The powerhouse will be located 5.4 km downstream from the dam on the left bank of the Tina River, and water will be diverted to the powerhouse from the reservoir through the underground tunnel. Initially, the powerhouse will have 3 turbine/generator units, each with a capacity of 5 MW, allowing a maximum discharge of about 18 m^3/s and a minimum discharge of 2.4 m^3/s. An environmental flow of 1 m^3/s will be maintained between the dam and the powerhouse tailrace, a distance of 5.7 km.

1.2 PURPOSE AND SCOPE

The purpose of this Waste Management Plan and Point Source Pollution Plan (WMPSPP) is to provide guidance on waste management in relation to construction activities. The plan defines the excess materials likely to be generated and addresses how to reduce or avoid its production.

This WMPSPP is one of a series of environmental and social management plans (ESMPs) that have been developed to address key environmental and social aspects of the Project. It regulates the generation of waste and management of point source pollution within the Project Direct Impact Area (DIA) (Figure 1-1 and Figure 1-2).

The scope of this WMPSPP is limited to the management of waste generated by the construction activities and is applicable to all Project employees including subcontractors.

The HEC HSE Manager is ultimately responsible for the implementation of this WMPSPP. Should the Project change or new regulations, guidelines or standards apply, HEC will review and amend this WMPSPP. Any changes will be subject to review by THL, and potentially require the approval of the Project Office (PO) and Lenders (according to the management of change procedure outlined in the Construction ESMP (CESMP); P1).

Figure 1-1:Designated waste disposal locations

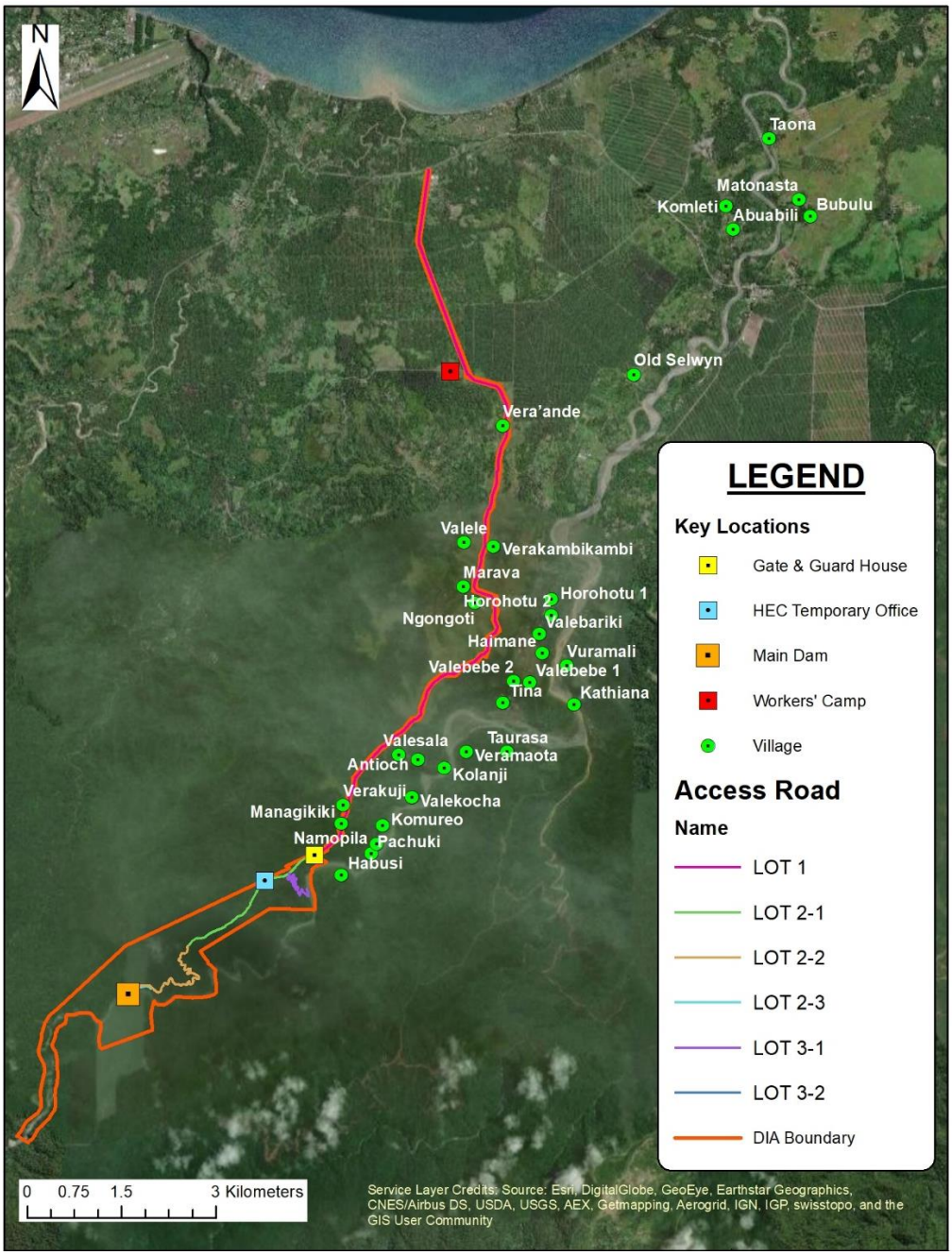

Figure 1-2 Project Overview: DIA, Camp and Temporary office locations

1.3 DEFINITIONS

EPC Contractor	The engineering, procurement and construction contractor for the TRHDP; Hyundai Engineering Corporation Limited (HEC)
Employer / Owner	Tina Hydropower Limited (THL); the Project Owner, which will take over operation of the hydropower facility once it is constructed.
Employee(s)	Tina Hydropower Limited (THL); the Project Owner, which will take over operation of the hydropower facility once it is constructed.
Hazardous waste	Hazardous waste shares the properties of a hazardous materials (e.g., ignitability, corrosivity, reactivity or toxicity), and other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Waste may also be defined as "hazardous" by local regulations or international conventions based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics (IFC General Environmental Health and Safety [EHS] Guidelines, 2007).
Non-hazardous waste	Non-hazardous waste generated at the Project site will consist of domestic trash and garbage, inert construction/demolition materials, and residual waste from construction operations that previously did not contain hazardous materials.
Point source pollution	Pollution generated by a single identifiable source, such as an oil spill, concrete wash water, suspended solids from earthworks, stack emissions from diesel generators and sanitary wastewater drainage.

1.4 WASTE FACILITIES FOR DOMESTIC WASTE IN HONIARA

The Honiara City Council (HCC) Environmental Health Division is responsible for collecting household waste within Honiara City and transporting it to the Ranadi dump site. However, less than half of Honiara City's population is provided with waste collection services. Since only a small proportion of solid waste is collected, much of the Honiara urban area's waste is improperly disposed of through open burning and illegal dumping.

The HCC Environmental Health Division is also responsible for managing the Ranadi dumpsite, which is located 6 kilometres from the city, on what was once a wetland, sited behind the sand berm that formed the nearby beach in a light industrial area.

The active part of the dumpsite covers about 1.5 hectares, but the total area is likely double that since beach erosion to the northwest reveals a thick layer of rubbish, and waste has also spread to adjacent properties. It is estimated that 20 to 30 tons of solid waste is disposed of daily at the dumpsite. Access to the site is unrestricted, and all wastes are accepted. Scavenging at the dumpsite provides a source of income for several dozens of nearby residents.

Uncontrolled burning was commonly used to reduce the volume of wastes at the site, with no leachate treatment or control. Records on the number of vehicles and quantity of wastes entering the dump site are not kept.

In 2013, upgrading works on the dumpsite began with assistance provided by the Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management funded by the Japan International Cooperation Agency. As part of the assistance, new cells have been created where waste is now being compacted. Large bulky wastes, such as vehicle bodies and white goods, have been removed to create more space; and a simple drainage system to capture leachate and a small settling and digestion pond have been installed. An office is also being established to improve administrative management of the dumpsite.

The HCC provides guidelines for the disposal of waste at Ranadi landfill (honiaracitycouncil.com), which are summarised in Table 1-1.

Table 1-1: Guidelines for the disposal of waste at Ranadi Landfill.

Type of waste	Guidelines
General Waste	Plastic/Glass bottles and metal-cans should be recycled by a business or the supplier if possible. Otherwise they are to be disposed in the general waste area. Plastics, glass, construction waste material and all other solid waste materials are to be disposed in a general disposal cell area. For expired food goods, please contact the Environmental Health Division at 28295 for instruction.
Organic Waste	Compostable organic waste should not be taken to the dumpsite. Animal meat or bones, or the manure of a meat-eating animal are not to be composted. Copra waste is not accepted in the Landfill since it is flammable.
Hazardous Materials	Asbestos is to be wrapped properly in plastic and buried in the allocated area. Contact the Landfill Supervisor for disposal instructions at Phone: 27545. Sewage is to be disposed at the designated site. Follow the instructions of the Landfill Officers or call the Landfill Supervisor at Phone: 27545.
Healthcare Waste	Healthcare waste is to be burned in the Healthcare waste pit. The landfill does not have an incinerator for medical waste. Currently, an open pit has been designated for the disposal of hazardous waste, e.g. medical waste.

Type of waste	Guidelines
	The procedure to follow states: *"You must put a tyre in the pit and then put your medical waste on top, and then light the waste on fire in the open pit. It is better to bring waste tyres if they have them or look round the dumpsite. It is the responsibility of the person disposing the rubbish to monitor the fire until it has completely died and water is poured on the ashes."* General waste (non-medical) from the hospital or a clinic should not be burned in the Healthcare waste pit. However, burning waste on a tyre can cause environmental, safety and health issues, so the following controls will be implemented by HEC to minimise any risks associated with this burning activity: • Ensure the personnel wear appropriate PPE (safety goggles, face mask with appropriate rating and disposable nitrile gloves) • Equip firefighting equipment such as water and/or extinguishers within quick and easy reach while burning waste • No personnel should complete this task while working alone.
Bulky Waste	Disposal of bulky waste should be directed by the Landfill Supervisor, who can be reached at Phone: 27545. Bulky waste can include: end of life vehicle bodies, waste tyres, saw dust and soil.

1.5 Overview of Project (Construction) Waste Management Practices

Reusable and recyclable construction wastes generated during construction activities (such as access road development, reservoir & dam construction, office & workers camp construction, and etc) will be collected and temporarily stored at the construction waste disposal site adjacent to maintenance shop in worker's camp area and batching plant area.

The location of construction waste disposal sites was selected using the below criteria for waste disposal facilities.

- Accessibility;
- Concrete truck washing post, treatment pond and drainage;
- Sensitive receptors - communities
- Flooding risk area;
- Wet land;
- Fault critical area;
- Seismic impact zone;
- Aesthetic area; and
- Unstable area – destabilizing event

Once the daily operation has completed, the construction waste shall be collected and treated in the nearest waste disposal sites (see Figure 1.1) everyday.

Construction wastes will be segregated based on waste characteristics for reuse or recycling. Waste concrete, most of the construction wastes, will be crushed and reused on site as non-structural aggregate for road ballasting or surfacing works yards.

HEC is preparing a Public Environment Report (PER) including facilities layout, showing the waste disposal site, which will be submitted to the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) for their approval for the waste disposal sites. After obtaining of the approval (and after review by THL and the OE, and approval by Lenders), waste disposal sites will be constructed.

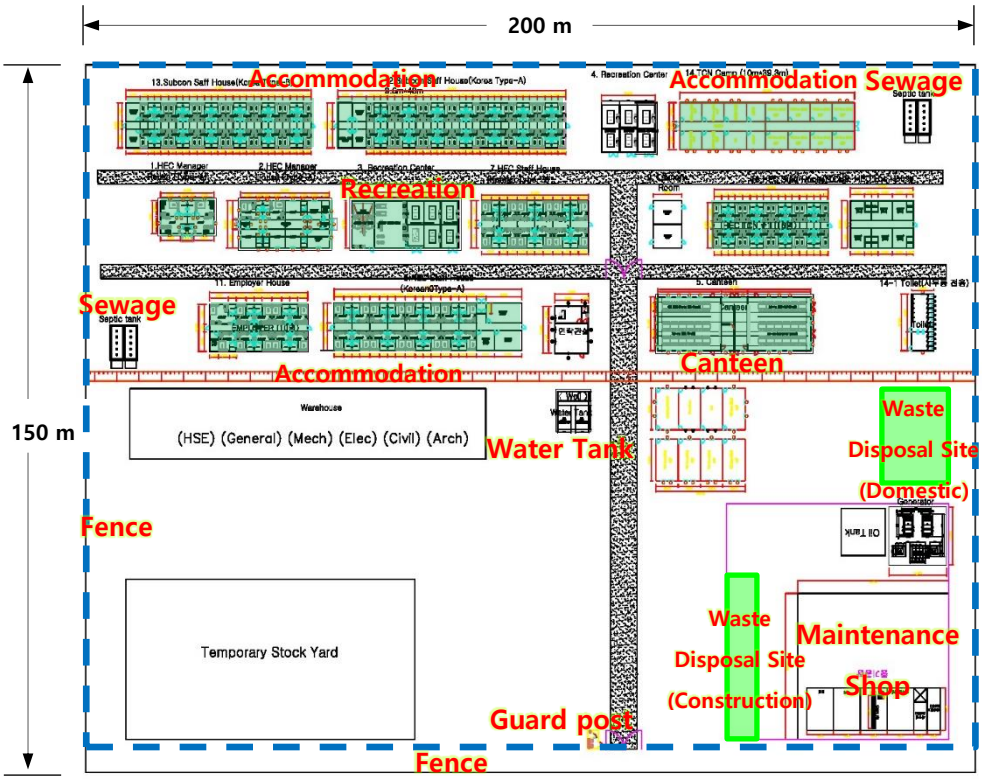

Figure 1-3 Waste disposal locations in the Workers' Camp (green areas)

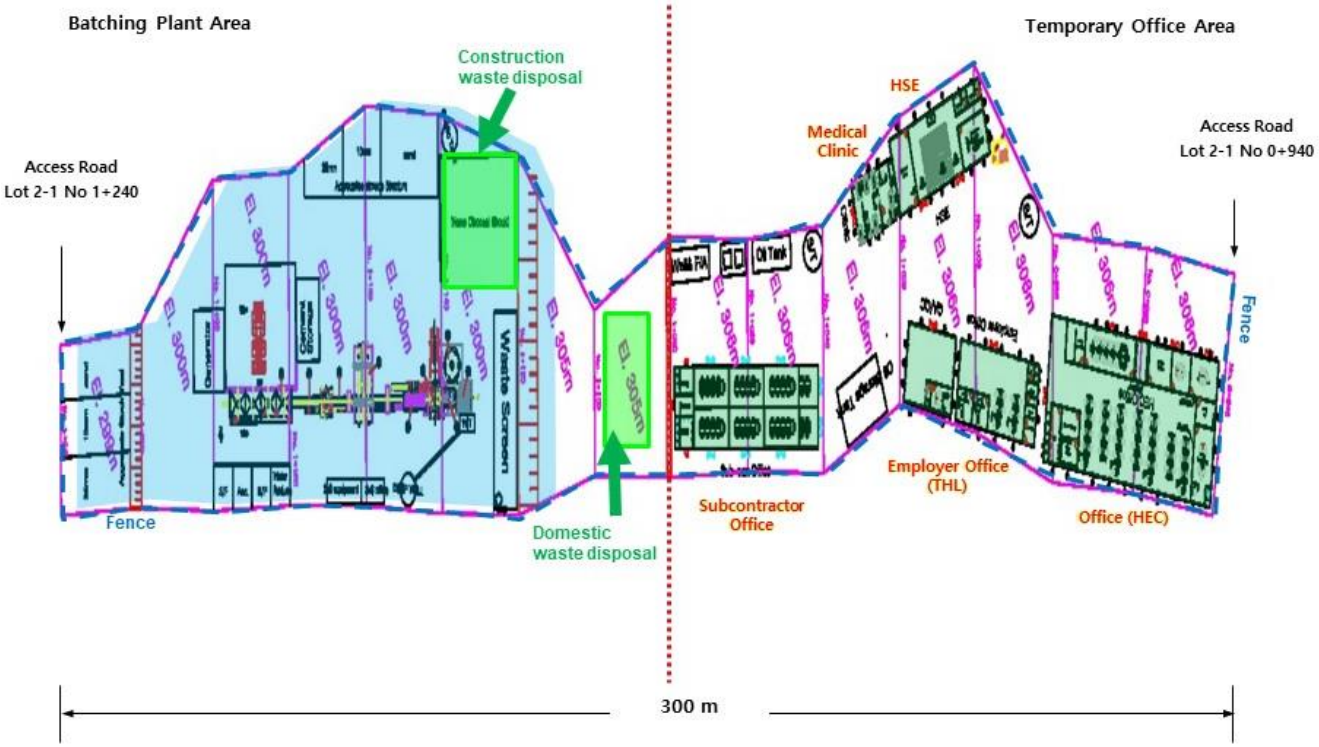

Figure 1.4: Waste Disposal Locations in the Temporary Office/Batch Plant site (within DIA)

1.6 APPLICABLE STANDARDS

This WMPSPP has been developed with due regard to relevant legal requirements, National and International Standards. The framework refers to legislation and standards to which all relevant parties must adhere from the commencement of the Project through the completion of the construction works. The construction practices to be implemented during this project have been designed based on relevant regulations, guidelines and standards at the time of the last version of ESIA (August 2017) and EIS (updated on July 2019) and is needed to be reviewed annually during construction phase, and if there is a change in any of legislations listed below. The construction practices will be modified accordingly. The Applicable Standards for this WMPSPP are as follows:

Applicable Legislation

- Solomon Islands Environmental Health Act 1980;
- Solomon Islands Environmental Act 1998;
- Solomon Islands Environment Regulations 2008;
- Solomon Islands Provincial Government Act 1997;
- Solomon Islands Water Authority Act 1992 (SIWA);
- Solomon Islands Roads Act 1996;
- Honiara City Act 1999; and
- Honiara Litter By-Law 1995.

International Guidelines, Standards and Treaties

- World Bank Performance Standard (PS) 3: Resource Efficiency and Pollution Prevention, 2012;
- World Bank Group Environmental, Health, and Safety (EHS) General Guidelines, 2007;
- World Bank Group EHS Guidelines for Waste Management, 2007;
- London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972);
- Noumea Convention, Protocol for the prevention of pollution of the South Pacific region by dumping, 1986; and
- Economic Development Cooperation Fund (EDCF) Safeguard Policy (2016)

Where both national and international standards are applicable, the Project will aim to apply the most stringent standard.

1.7 LINKS TO OTHER MANAGEMENT PLANS

Table 1-2: Links to other management plans.

Management Plan	Relevance
Construction Environmental Social Management Plan (CESMP ; P1)	Refer to this plan for presentation of organizational charts, detailed description of the audit process, description of process to amend the management plans.
Grievance Redress Mechanism (GRM; P6)	Refer to this plan for management of grievances raised during the construction period.
Hazardous Materials Management Plan (HMMP; P13)	Refer to this plan for handling of hazardous materials and hazardous waste.
Spill Prevention and Emergency Response Plan (SPERP; P14)	Refer to this plan for mitigation measures for point pollution sources to water.
Air Quality Management and Dust Control Plan (AQMDCP; P15)	Refer to this plan for mitigation measures for diffuse and point source air pollution and odour control associated with waste generation/storage.
Quarry Management Plan (QMP; C5)	Refer to this plan for mitigation measures for reduction of waste generated in borrow pits/construction material extraction sites.
Spoil and Topsoil Management Plan (STMP; C9)	Refer to this plan for reduction of waste generated during excavation works.
Drainage, Erosion and Sediment Control Plan (DESCP; C10)	Refer to this plan for the mitigation measures to reduce pollution from diffuse pollution sources, through site drainage (e.g. from waste storage/disposal areas).
Suspended Sediment Monitoring Plan (SSMP; M1)	Refer to this plan for the monitoring of suspended sediment in watercourses, from diffuse pollution sources (e.g. erosion of exposed soils across the Project DIA).
Water Quality Monitoring Plan (WQMP; M2)	Refer to this plan for the monitoring of water quality in the Tina River catchment, to detect and manage diffuse pollution.
Air Quality and Noise Monitoring Plan (AQNMP; M7)	Refer to this plan for the monitoring of air pollution and noise generation (e.g. odour at waste disposal sites, noise generated by waste collection/transport).

2 ROLES AND RESPONSIBILITIES

2.1 INTRODUCTION

Having an appropriate organizational structure in place, with all persons having defined roles and responsibilities, is essential to ensuring the overall success of this WMPSPP.

HEC has the overall responsibility for waste management during the Project construction phase and mitigation of pollution generated from point sources.

HEC will hire a subcontractor for the collection and disposal of domestic waste generated within the Project DIA and the Temporary Workers' Camp.

2.2 SUBCONTRACTOR

HEC is currently negotiating a contract agreement with Faith Holding (waste contractor) for the collection and disposal of domestic waste. The contract agreement (with Faith Holding, or an alternative) will be finalized before completion of workers camp and project office construction.

Faith Holding is a sanitation and waste service company existing under the laws of Solomon Islands having its principal office at Ranadi, East Honiara. The company was registered in Honiara and has been duly registered under number:BN20201013.

The subcontractor will be a registered company with the Solomon Islands Government and the office for Registry of Companies (Company Haus). The subcontractor will be trained in domestic waste handling and obtain chain of custody documentation for wastes transferred to the final destination. It will be a requirement for the subcontractor to demonstrate to HEC as part of the tendering process the way their role in the plan will be implemented. Such actions will then become a contractual commitment between the subcontractor and HEC. The subcontractor will be in possession of licenses or approval from HCC Environmental Health Division. The subcontractor will be required to comply with and assist in implementing this WMPSPP.

2.3 DESCRIPTION OF POSITION AND RESPONSIBILITIES

A description of the key position and their responsibilities are provided in Table 2-1.

Table 2-1: Key Roles and Responsibilities.

Position	Responsibilities
HEC Project Manager (Mr. Eu Man Moon)	• Ensure that adequate resources are provided to successfully implement this WMPSPP • Ensure that all HEC project managers and subcontractors understand and fulfil their CESMP responsibilities. • Ensure there is an effective company policy for health and safety and that all employees, subcontractors and temporary workers are made aware of their individual responsibility. • Ensure that the management plans are maintained and are fit for their purpose. • Ensure that the mitigation activities are sufficiently resourced with competent and trained personnel to comply with the requirements of the management plans. • Ensure that all supervisors and Project personnel understand and fulfil their responsibilities with regard to HSSE.
HEC Construction Manager (Mr. Yoo Jae Bong)	• Ensure that the HEC HQ Design Team integrates E&S mitigation measures into the final project design. • Participate in site inspections to plan and confirm the detailed design of E&S site measures. • Review and approve detailed site plans and method statements incorporating E&S measures. • Ensure that all personnel involved in construction activities, including subcontractors and vendors, are adequately trained and informed on the requirements of the WMPSPP • Participate in site inspections in the early stages of works at each site with the HEC HSE Manager, subcontractors and THL. • Review and approve HSE reports. • Audit subcontractor performance.
HEC H&S Discipline Supervisor	• Ensure the day-to-day implementation of the Worker's Health and Safety Plan. • Ensure that all employees receive appropriate induction and training on the general and site risks and inform them of the means for prevention placed at their disposal. • Ensure that HSE team report HSE performance, identify and implement corrective actions. • Inspect the Worksite and reporting and correcting unsafe acts and conditions.
HEC HSE Manager (*Mr. Dae Yong Kim*)	• Maintain this WMPSPP. • Ensure that all personnel including subcontractors and vendors are adequately trained and informed on the requirements of this WMPSPP.

Position	Responsibilities
	• Lead site inspections with the HEC Construction Manager to plan and confirm the detailed design of E&S site measures. • Prepare detailed site plans integrating E&S measures into final design drawings and method statements and submit these to the HEC Construction Manager. • Lead weekly site inspections with subcontractors and THL during construction. • Prepare weekly and incident HSE Performance Reports. • Audit subcontractor E&S performance. • Lead internal HSE audits and inspections, committees, and incident investigations and development and implementation of corrective and preventive actions. • Ensure that notification and reporting procedures to THL, PO and the relevant statutory authorities are carried out. • Oversees the activities of staff responsible for training, safety, security, emergency and environment. • Maintain safety and protection against accidents. Act as the site's accident prevention officer.
HEC E&S Supervisor (Ernest Kolly)	• Undertake field inspections to monitor implementation waste management and pollution prevention controls, reporting any issues directly to the HEC HSE Manager on a daily basis. • Contribute to weekly and incident HSE reports prepared by the HEC HSE Manager. • Ensure the HEC E&S team conducts all monitoring and reporting as set out in the ESMPs. • Provide support to HEC HSE Manager in updating this WMPSPP as necessary. • Assist in worker training on [insert aspect, e.g. air quality] protection.
HEC Training Supervisor (*Mr. Patrick Kekete*)	• Provide appropriate training and assessment for all parties involved in waste management operations, with the assistance of the HEC HSE Manager. • Provide appropriate training to project personnel for the use of disposal facilities • Provide appropriate training in hazardous materials handling
THL E&S Manager (*to be confirmed; currently Mr Jihun Lee, CFO is primary contact*)	• Review WMPSPP compliance with the E&S Standards and GIIP. • Participate in daily site inspections in the early stages of works at each site with HEC and subcontractors. • Participate in weekly site inspections with HEC and subcontractors during construction (following early works). • Prepare monthly E&S performance reports, advising HEC of any non-conformances and required corrective actions. • Audit HEC compliance with the WMPSPP.
THL Owner's Engineer (OE) - Stantec	• Review WMPSPP for compliance with the E&S Standards and Good International Industry Practice (GIIP) • Monitor and audit project delivery and HEC activities in accordance with the detailed project design, method statements, ECSMP, related MPs, and detailed site plans. • OE Site Engineer (*Vilive Anise and/or William Waddell*) will undertake regular site supervision, and report any E&S non-compliances to the HEC

Position	Responsibilities
	HSE Manager, THL E&S Manager and OE Environmental & Social Safeguards (ESS) Lead (*Jessica Grinter – Off Shore*). • Audit HEC performance with respect to the requirements of the EPC Contract, and health, safety, environmental and social obligations (including but not limited to the E&S Standards, and Schedule 7 of the EPC Contract). Auditing will include a site visit conducted every six months from commencement of construction, for the duration of the construction phase, by the OE ESS Lead at minimum.

PO E&S Monitoring team (with Lenders Technical Advisor, LTA)	• Monitor that HEC and THL have:
	  ○ complied with all requirements, guidelines, procedures, timetables and other specifications set forth in the WMPSPP at all times
	  ○ obtained, maintained and complied with all applicable laws, regulations, permits, licences and consents.
	• Audit HEC and THL E&S performance

Subcontractor-Waste Management – *Proposed – Faith Holding*	• Collection and transportation of project's wastes • Ensure adequate vehicle selection and maintenance • Ensure adequate drivers training • Maintain waste collection, transport and disposal records for all movement of waste materials relating to the Project (for which the subcontractor is responsible).Implement all controls measures set out in the WMPSPP. • Maintain E&S control measures in good working order, and modify these controls as needed. • Notify HEC of any E&S incidents and proposed corrective actions, and record these in an incident log. • Undertake the agreed corrective actions in a timely manner.

2.4 SUBCONTRACTOR ORGANIZATION AND CONTACTS

Contact details for the waste management contractor will be provided here once a contract is finalised, along with number of available staff (and the training they have received / proven skills to fulfil the contract obligation and comply with ESMPs).

3 RISK ASSESSMENT AND MANAGEMENT

A risk assessment was conducted to identify the project activities which might present a hazard or risk relating to waste management and pollution prevention and assess the potential impacts which may arise. A range of mitigation measures and management approaches were then identified, to achieve a reduction in the initial perceived risk. The objective in implementing these measures and approaches is to reduce the level of residual risk to a lower (and acceptable) level.

The following tasks were undertaken to analyse and evaluate risks and identify potential impacts:

- Identify all activities and sub-activities associated with construction of the Project;
- Assess the likely impact of the activity on the environment, safety and security of workers and the public, and social/cultural aspects of the Project setting;
- Determine the possible consequences if each impact were to occur;
- Assess the likelihood of each impact occurring in the absence of any controls;
- Consider the severity of impact/s;
- Determine a risk level based on a 5 X 5 risk assessment matrix.
- Document current and future mitigation measures that need to be implemented to bring the level of risk down to an acceptable level (including consideration of the findings of the Environmental and Social Impact Assessments (ESIAs) dated August 2017 and July 2019); and
- Re-evaluate to determine the residual risks once the mitigation measures have been implemented.

HEC and THL applied a modified version of the Risk Ranking Table from the IFC EHS Guidelines (Table 2.1.1) to assess the environmental, health and safety, security and social risks which could be encountered due to construction activities. The matrix applied is presented in Table 3-1 below.

The initial risks identified for each activity; associated impacts, and residual risks (after implementation of mitigation measures) have been captured in a 'live' risk register, which is maintained on ProjectSpace, the online document management system administered by HEC for the Project. The activities and impacts presented in ESMPs are consistent with those listed in the register. The register will be used by HEC, THL and the OE as a tool to monitor the effectiveness of mitigation measures in reducing risk across the Project, and will be regularly reviewed and updated as the Project progresses.

Table 3-1 5 X 5 Risk Assessment Matrix

Likelihood	Consequences				
	Insignificant Negligible impacts to a minimal area of low environmental or social significance, managed by internal control procedures	**Minor** Minor or minimal short-term impacts to the environment and social areas	**Moderate** Significant impacts to the wider environment or social areas, where short-term restoration works are needed	**Major** Major, persistent and/or extensive impacts to the environment or social areas where longer term remediation is required (> 6 months)	**Catastrophic** Catastrophic and irreversible environmental damage to social areas or environment
A. Almost certain Very high likelihood the risk will occur (>75%)	Moderate	High	Extreme	Extreme	Extreme
B. Likely High likelihood the risk will occur (51 - 75%)	Moderate	High	High	Extreme	Extreme
C. Possible Medium likelihood the risk will occur (21 - 50%)	Low	Moderate	High	High	Extreme
D. Unlikely Low likelihood the risk will occur (5 - 20%)	Low	Moderate	Moderate	High	High
E. Rare Very low likelihood the risk will occur (<5%)	Low	Low	Low	Moderate	Moderate

Mitigation measures were selected to achieve the following:

- In the cases where risk level was assessed as a Moderate or High – reduce risk to Low;
- In the cases where risk level was assessed as Low – ensure risk level does not increase; and
- In the cases where risk level was assessed as Extreme – modify the project to avoid critical risk activities.

The impacts associated with construction of the Project, and particularly in relation to the scope of this Plan, are included in Table 3-2, along with assigned mitigation measures / management approaches. The table also outlines the monitoring actions that will be applied to continually evaluate the effectiveness of these measures and approaches for the duration of construction. HEC is committed to implementing the identified management measures to avoid and mitigate project impacts on the environment and local communities in accordance with applicable standards, guidelines and good international industry practice.

As noted in Section 1.7, this WMPSPP has links to several other plans. In particular, Table 3-2 below cross-references measures from (and should be read and implemented in conjunction with):

- Hazardous Materials Management Plan (HMMP; P13)
- Spill Prevention and Emergency Response Plan (SPERP; P14)

Table 3-2 Mitigation / Management and Monitoring Procedures

#	Project Issue / Activity / Facility	Mitigation / Management		Monitoring & Reporting	
		Management Measure	Responsibility and Timing	Monitoring & Reporting Activity	Responsibility / Timing
1.	Preparation of a detailed Waste Management Plan	• A detailed Waste Management Plan shall be prepared covering all types of waste and disposal sites (on site and off site) (*and incorporated into Section 4 of this WMPSPP*). • Waste types, estimated volumes, frequency of collection, reuse/recycling/disposal, and disposal sites (on site and off site) shall be confirmed, including the wastes accepted at the Ranadi landfill.	Construction Manager and HEC HSE Manager – pre-waste generation	• Sign-off of detailed Waste Management Plan	THL and OE ESS Lead – within two weeks following plan submission

2.	General requirements	• Appropriate waste collection / storage areas (on site and camps) shall be identified, ensuring that sufficient space is allocated and included in project and camp site layouts.
		• A full-time dedicated waste management team shall be appointed to support the implementation of mitigation measures. HEC has engaged a subcontractor for waste management; Faith Holdings Limited.
		• Project waste will be minimized by applying the waste minimization hierarchy principles (as per IFC EHS Guidelines for Waste Management): prevention, reduction, reuse, recovery, recycling, removal, and finally disposal of wastes.
		• Waste shall be segregated at source by waste type, as described in Table 4.2.
		• The construction site will be provided with separate bins for:
		  • general domestic waste (i.e. general litter and rubbish, paper, glass, cardboard, light bulbs);
		  • recyclable plastic (i.e. plastic bottles and plastic containers);
		  • recyclable metal (i.e. cans, scrap metal, hydraulic hoses);
		  • different types of hazardous waste (i.e. used oil, oil contaminated waste, fluorescent, colour spray, etc.);
		  • exhausted batteries; and
		  • construction waste (i.e. concrete, debris, etc.)
		• Safety equipment and/or systems will be installed, incorporating:
		  • waste labelling;
		  • concrete floor;
		  • sunshade;
		  • lids on bins to prevent rainfall entering and the wind-blown spread of waste;
		  • impervious bunding of hazardous waste storage areas.
		• The dumping of any wastes in unauthorised locations such as watercourses, agricultural land and surrounding areas is prohibited.
		• Any necessary agreement or permit for the disposal of different waste streams in the Ranadi landfill will be obtained from the relevant authority prior to the commencement of project waste generation.
		• On-site waste management and disposal sites will be surveyed, pegged and clearly marked prior to the commencement of project waste generation.
		• All waste storage and waste facilities will be installed prior to related waste generation.
		• Each waste storage and disposal site will be reviewed by THL prior to use, with a Notice to Proceed issued for each facility where it meets the required measures.
		• Complaints about waste management shall be investigated promptly and appropriate action initiated to reduce impacts and improve management.
		• All site workers will receive training in waste handling, segregation, storage and disposal for each different waste stream prior to the commencement of project waste generation.
			HEC Project Manager and HEC HSE Manager
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			HEC HSE Manager
			
			Subcontractors
			Subcontractors
			THL
			
			HEC HSE Manager
			HEC HSE Manager and HEC Training Supervisor
				• Waste facilities sign-off
				
				• Joint weekly site inspections
					HEC HSE Manager and HEC Construction Manager
					
					HEC HSE Manager, Subcontractors, THL (and HEC Construction Manager during initial waste management activities)

3.	Workers Accommodation Camp waste	• Separate bins will be provided for:
		  • compostable waste (i.e. food residues, kitchen waste, paper, cardboard etc.)
		  • kitchen oil;
		  • general domestic waste (i.e. general litter and rubbish);
		  • recyclable plastic (i.e. plastic bottles and plastic containers);
		  • recyclable metal (i.e. cans, scrap metal, electronics without batteries);
		  • hazardous waste (i.e. used oil, batteries, printer cartridges and toner, thinners, etc.); and
		  • sanitary waste.
		• Bins for food waste will be fitted with secure lids to prevent scavenging by birds and animals.
		• Sewage will be drained into septic tanks with sufficient capacity for 300 employees.
		• Grease traps will be installed to limit the flow of grease to the kitchen greywater collection tank.
		• Waste clean-up at camps will be undertaken fortnightly to collect any waste or disused materials.
		• All collected waste will be managed and disposed of in accordance with the applicable regulations and good practice.
			Subcontractors - construction
			
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			Subcontractors
			
			Waste subcontractor – camp operation
				• Workers Camp waste facility sign-off	HEC HSE Manager and HEC Construction Manager

#	Project Issue / Activity / Facility	Mitigation / Management Management Measure	Responsibility and Timing	Monitoring & Reporting Monitoring & Reporting Activity	Responsibility / Timing
		• Sewage sludge will be removed from septic tanks biyearly (or more often if required) and disposed by Faith Holdings Ltd at an approved facility. • Grease traps will be regularly emptied and the waste disposed of according to the Management of Hazardous Waste described in this table.	Waste subcontractor Waste subcontractor	• Joint weekly site inspections	HEC HSE Manager, Subcontractors, THL (and HEC Construction manager during initial waste management activities)
4.	General construction waste	• All waste transportation arrangements during construction, including provision, maintenance, dismantling and clearing debris, will be approved and directed by the HEC Construction Manager. • Daily site clean-up procedures shall be established and enforced, including maintenance of disposal facilities for construction debris, prior to the commencement of project waste generation. • A sufficient number of waste containers will be made available at construction site. • Waste disposal facilities will be sited and signposted on site, and waste containers (or similar disposal receptacles) will be clearly marked "Hazardous Waste" or "Non-Hazardous Waste" for waste separation. • All workers shall receive training in project waste management to avoid, reduce and reuse wastes. • The operation of all waste disposal sites utilised by Subcontractors and HEC shall be assessed against the required environmental standards.	HEC Construction Manager Subcontractors Subcontractors Subcontractors HEC HSE Manager HEC Construction Manager and HEC HSE Manager	• Waste facility and activity sign-off • Joint weekly site inspections	HEC Construction Manager and HEC HSE Manager HEC HSE Manager, Subcontractors, THL (and HEC Construction manager during initial waste management activities)
5.	Temporary Waste Storage Areas	• Temporary waste storage areas will be located at least 100 m from any natural sensitive area. If this setback distance cannot be achieved given the proximity of receptors to the work sites, then an alternative solution will be identified and approved by the HEC HSE Manager prior to installation. • Temporary storage areas will be protected from moving machinery and vehicles, but shall have machinery access for regular collection, and be located on a flat impervious surface to prevent infiltration. • Stored wastes and containers will be covered to protect from rainfall and adverse weather conditions. • Non-hazardous waste will be stored separately from hazardous waste. • Temporary hazardous waste storage facilities shall be managed to prevent accidental discharge to the environment. • Ensure a sufficient number of spill kits will be provided at all times.	Subcontractors (HEC HSE Manager if needed) Subcontractors Subcontractors Subcontractors Subcontractors Subcontractors	• Waste facility sign-off • Joint weekly site inspections	HEC HSE Manager and Construction Manager HEC HSE Manager, Subcontractors, THL (and HEC Construction manager during initial waste management activities)
6.	Management of Hazardous Waste	The registration and labelling of hazardous waste will be in accordance with the guidelines described in the HEC standard "Control of Substance Hazardous to Health" (HEC-AH-H04-H34), including: • Hazardous waste register - all potentially hazardous waste registered and tracked (waste types, quantities generated and stored). • Movement of hazardous waste register - the transport of hazardous waste to disposal sites. • Register of fuel delivers/dispensed - to reconcile fuel use. • Registers maintained and available in each hazardous waste storage area.	Subcontractors	• Joint monthly site inspections	HEC HSE Manager, HEC Construction Manager, Subcontractors, THL
		Handling Safety Procedures and Personal Protective Equipment: • Safety procedures applicable to the handling and use of hazardous waste will be established and included in the training program conducted prior to the commencement of project waste generation. • Safety rules will be provided in English. • Safety rules in Pidgin will be printed on posters and displayed at hazardous waste storage areas. • Personal protective equipment (PPE), i.e. face masks, heavy duty gloves, plastic aprons, clothes that cover the body, heavy duty boots, will be provided to workers and the use of this equipment will be enforced. • Material Safety Data Sheets (MSDS) will be available at readily accessible locations in the construction area.	Subcontractors	• Joint weekly site inspections	HEC HSE Manager, Construction Manager, Subcontractors, THL
		Refuelling procedures: • All refuelling shall occur in dedicated refuelling areas, on a hardstand that drains into an oil trap. • Stationary equipment can be refuelled by a service vehicle, with adequate measures taken to avoid spills including drip trays, bowsers with automated shut off, etc. • Safety procedures regarding fire and accidental spill management shall be posted on-site. • "No Smoking" labels and posters shall be placed wherever fuel is handled or stored. • Refuelling shall not take place within 50 m of the Tina River, streams or drainage lines. • Fuel storage areas will be sealed and bunded, with at least 120% of the total fuel storage volume provided.	Subcontractors	• Joint monthly site inspections	HEC HSE Manager, HEC Construction Manager, Subcontractors, THL

#	Project Issue / Activity / Facility	Mitigation / Management Management Measure	Responsibility and Timing	Monitoring & Reporting Monitoring & Reporting Activity	Responsibility / Timing
		Storage of Hazardous Waste: • HEC shall design and approve hazardous waste storage facilities.		• Facility sign-off	HEC HSE Manager and HEC Construction Manager
		Repairs and Maintenance: • All vehicle, machinery and equipment repairs and maintenance shall be undertaken in a covered workshop area with a hardstand that drains into an oil sump. • Containers used to temporarily store and transport liquid hazardous wastes shall be bunded with a suitable containment capacity given the volume of the storage container. Liquid wastes storage will be equipped with secondary retention with a volume at least equal to the volume of the waste contained in the containers as per HEC standard "Control of Substance Hazardous to Health" (HEC-AH-H04-H34).	HEC Construction Manager and HEC HSE Manager Subcontractors Subcontractors	• Joint monthly site inspections	HEC HSE Manager, HEC Construction Manager, Subcontractors, THL

7.	Sewage	• Toilets shall be installed for all workers, including pit latrines installed at isolated construction sites.
		• Workers will be instructed to use the designated toilets.
		• Sewage will be drained into septic tanks with sufficient capacity for 300 employees.
		• Septic tanks will be located more than 50 m away from streams, rivers and drainage lines.
		• If septic tanks are underground, they will be placed in a concrete lined chamber to avoid infiltration into the ground.
		• Septic tanks will be inspected each week by the HEC Environmental and Social Team to assess function and capacity.
		• Sewage sludge will be removed from on-site wastewater treatment systems biyearly (or more often if required – to be confirmed in final design of systems) and disposed by Faith Holdings Ltd at an approved facility.
		• Sewage effluent will be treated on-site at either the Camp or the temporary Office, to a standard which is agreed with THL and the OE, and approved by lenders. No treated wastewater or other by-products of treatment will be discharged to surface war bodies. Any are of land used for disposal of sewage sludge and/or treated effluent will need to be assessed regarding capacity to receive the discharge, and potential impacts on the receiving environment and sensitive receptors (e.g. public health risk). HEC will submit designs to THL and the OE for review prior to construction/installing any septic systems. Such systems will only be constructed once design has been reviewed and approved by Lenders, and any required permits are applied for (by HEC) and granted by SIG.
		• Design of the septic system shall consider measures to mitigate odour and implement as many as are appropriate, including:
		  ◦ Locate the septic system downwind of camp occupants and other sensitive receptors (such as neighbours, public roads/tracks), based on known prevailing winds in the area
		  ◦ Include an activated carbon filter within any treatment systems (final polishing prior to disposal)
		  ◦ Where there is sufficient space within the site footprint, consider installing a biofilter (appropriately sized to the size of the septic tank/treatment facility)
		  ◦ Include a contained system to capture foul air and treat it prior to release into the outside ai
			Subcontractors
			Subcontractors
			Subcontractors
			Subcontractors
			Subcontractors
			HEC E&S Team
			Waste subcontractor
			
			HEC Engineering Design team (review by THL and OE) prior to procurement, installation and commissioning of any septic, treatment and disposal systems.
				• Joint monthly site inspections
				
				Design review
					HEC HSE Manager, HEC Construction Manager, Subcontractors, THL
					
					HEC Construction Manager
					THL E&S Manager, OE – prior to installation of any system

8.	Hazardous waste and concrete washwater	• Spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances will be provided where potential leaks and spills may occur and entered into an inventory.
		• Any leaks or spills will be immediately cleaned up.
		• Spill response kits will be located at workshops, service areas, chemical and waste storage areas, and refuelling points.
		• All personnel involved with the refuelling and servicing of equipment will be trained in the use of spill response kits and emergency procedures as described in the Spill Prevention and Emergency Response Plan (HEC-CDSB-CESMP-PPP-014).
		• Concrete wash waters must not be released to water bodies or wetlands. All concrete truck wash out will take place in a dedicated hard stand area, with drainage and subsequent treatment in ponds and drying beds. The capacity of each pond will be greater than a full day supply of wash water and will consider that the area often receives considerable rain. The following good practice measures will be implemented to ensure proper management of the concrete wastewater:
		  • Collect and recycle concrete wash water on site using a combination of settling ponds[1].
		  • Coagulants or flocculants will need to be added before discharging the water into the first or primary pond.
		  • Water must flow over small weirs from one basin to the next until the quality is good enough to be reused as plant water. The first pond will require periodic cleaning.
		  • Concrete washout area should be inspected daily and after heavy rains to check for leaks to identify if any plastic linings and sidewalls have been damaged by construction activities and determine whether they have been filled to over 75 percent capacity
			Subcontractors
			
			Subcontractor
			Subcontractor
			
			Subcontractor
			Subcontractor
			Subcontractor
			Subcontractor
			Subcontractor
			Subcontractor
			
			Subcontractor
			
			Subcontractor
				• Joint monthly site inspections
				
				Monitoring of treated wash water as per the WQMP (M2).
					HEC HSE Manager, HEC Construction Manager, Subcontractors, THL
					
					HEC E&S Supervisor, as per WQMP

[1] https://www3.epa.gov/npdes/pubs/concretewashout.pdf

#	Project Issue / Activity / Facility	Mitigation / Management		Monitoring & Reporting	
		Management Measure	Responsibility and Timing	Monitoring & Reporting Activity	Responsibility / Timing
		• The hardened concrete that is removed will be crushed and reused on site as non-structural aggregate for road ballasting or surfacing works yards. • Damages to the pond structure should be repaired promptly. Before heavy rains, the washout pond's liquid level should be lowered, or the pond should be covered to avoid an overflow during the storm.			

4 WASTE MANAGEMENT PLAN

4.1 PURPOSE

This section of the WMPSPP provides further detail on how HECC and all Project employees (including subcontractors) will reduce the volume of residual waste which requires disposal, at each stage of the waste cycle. The waste management hierarchy as defined by the IFC EHS guidelines for waste management will be adopted by the Project (Table 4-1).

Table 4-1 Waste management hierarchy

Waste Management Hierarchy (as per IFC EHS Guidelines for Waste Management)	
Avoid (i.e. prevention)	- Encourage cleaner production
Reduce	- Encourage designs that cause less waste to be created - Use standard sizes and quantities of materials, and plan ahead to reduce off cuts - Avoid over-ordering - Arrange deliveries to match work stages to avoid materials being stored on site longer than necessary - Ensure storage areas are safe, secure and weatherproof - Minimise rework from errors and poor workmanship
Reuse	- Collect off cuts and use first instead of new materials - Encourage the temporary materials (e.g. form, scaffold) so they can be dismantled and reused many times.
Recovery	- Evaluate the possibilities of utilising the waste in any activities involved in this project.
Recycle	- Identify the waste that waste contractor can recycle. - Sort different waste materials on site - Keep materials for recycling clean, dry and separate from other materials or waste.
Removal	-Remove any hazardous content from the waste from appropriate treatment
Dispose	- Obtain any necessary agreement /confirm acceptance of different waste streams to be disposed of at the landfill with the relevant authority

The principles of reduction, reuse, recycle, and recover shall, as far as practicable, be applied to that majority of waste streams. HEC follows the concept of "Duty of Care" whereby

generators of waste should be able to demonstrate that all reasonable steps were taken to ensure that waste products were efficiently handled and disposed of.

4.2 WASTE IDENTIFICATION AND CLASSIFICATION

Waste generated during construction activities shall be identified, quantified and characterize, and waste management practices shall be selected for each waste category. A form to be used by each Waste Generator for recording waste produced in site (both Hazardous and Non-Hazardous waste). Please refer to Annex B (contains waste log form template for hazardous and non-hazardous waste consignments).

Non-Hazardous Industrial Waste

These wastes include solid, liquid, semi liquid, liquid or contained gaseous material or wastes resulting from industrial and construction operations, sludge from waste water treatment plant considered as non-hazardous. Main Non-Hazardous Industrial Waste expected to be generated in site during construction phase:

- Domestic waste from camp, site and catering facilities
- Concrete debris & building material
- Wood
- Steel and steel scrap
- Aluminum sheets
- All Types of plastic
- Rubber tires
- Sewage water
- Glass
- Empty Lead acid batteries with weak electrolyte
- Empty Steel drums if not contained any traces of hazardous materials
- Electric cables and Wiring materials, Fuses & contactors
- Welding electrodes.
- Grinding and cutting wheels
- Filters
- All types of packaging boxes
- Insulation materials (mineral wool, polystyrene etc.)

Hazardous Industrial Waste

Hazardous wastes are classified as those wastes which by the virtue of their quantity, concentration of constituents and characteristics (such as ignitibility, corrosively, reactivity, toxicity, radioactivity, etc.) pose a hazard to human or environmental health if improperly managed, or controlled by legal requirements.

Examples of Hazardous waste on Site are:

- Spent/Used oil or diesel

- Used/spent/expired solvents, resins and painting materials
- Medical Waste
- Wastewater from equipment/concrete washing bay.
- Acid batteries
- Rubber tires
- Filters containing Hazardous chemicals/oil
- Fluorescent light tubes and light bulbs
- Wastewater with inhibitors (if any) used for commissioning/hydro testing
- Bottles with refrigerant gas use for AC refilling
- Radioactive source used for welding inspection (if any)
- Batteries containing mercury/lead.

4.3 WASTE MANAGEMENT

The following waste management processes will be implemented at the project.

Compliance with Regulatory Requirements

HEC shall comply with all relevant legislative statutes and regulations applicable to Local law & regulations and legal requirements regarding waste management. A register of applicable environmental laws and other legal requirements shall be filed and kept up to date in site for reference. Legal environmental compliance on waste management shall be periodically evaluated.

Waste Segregation and Storage

Wastes shall be segregated for more efficient handling before treatment or disposal. Wastes shall be collected as they accumulate, and in any case at the end of each working day and shall be put in adequate and correctly color-coded skips/containers. Foremen and Supervisors shall ensure that good housekeeping is always maintained in their work areas, and that waste segregation and colour coding is maintained at collection areas on site.

Colour Coding of Skips

Color coded skips shall be for waste segregation as follows:

GREEN SKIP: Domestic Waste
YELLOW SKIP : Medical Infectious waste
BLUE SKIP: Industrial Non-Hazardous Waste
BLACK SKIP: Hazardous Waste

Hazardous Waste Storage

All waste and their storage areas shall be clearly marked, adequately labeled and secured to prevent unauthorized access. Hazardous waste will be stored with secondary containment. HEC will provide sufficient numbers of appropriate types of containers at its camp/construction

sites to ensure the adequate collection, segregation, and storage of domestic, nonhazardous from hazardous waste.

Hazardous waste storage shall meet the following criteria:

- Shall have concrete Impermeable base with four-sided bund walls.
- Shall have spill control kit.
- Shall have Fire extinguisher of appropriate type
- Shall have secured fence with closed roof for sun protection.
- Shall have proper ventilation.
- Shall have MSDS for each hazardous waste.
- Any other additional requirements stated in the MSDS.

Hazardous Waste Containers

Hazardous waste containers are portable devices used to store, transport and in other ways handle materials that are harmful to people and/or the environment. As a method of spill containment, hazardous wastes containers should enable the correct handling of waste. A wide range of containers such as 55-gallon drums are the most common type of hazardous waste container. The following practices will be adhered to, for hazardous waste:

- Containers have been cleaned out first or the containers are new without any history of storage of materials.
- Hazardous waste must be protected from sources of ignition or reaction including but not limited to open flames, smoking, cutting and welding torches/equipment, hot surfaces, frictional heat, sparks (static, electrical or mechanical), spontaneous ignition (from heat-producing chemical reactions) and radiant heat.
- Containers for hazardous waste will be compatible with the material in question (i.e. waste must not react with the container and/or impair its ability to contain the waste).
- Hazardous waste must be stored in containers that are in good condition (i.e., no severe rusting or apparent structural defects), and will provide complete waste containment.
- Hazardous waste bearing containers must be kept closed or covered (e.g. bungs or sealable lids on drums etc.) at all times unless waste is being added to or removed from a container.
- Hazardous waste-bearing containers will be stored in single layers (not stacked).
- Hazardous waste-bearing containers will be stored on pallets to provide protection from contact with any spilled liquid.
- Void spaces in containers holding small liquid-containing items (e.g. Lab Packs) will be filled with an absorbent material to absorb without reacting with liquids, if released from their primary containers.
- Mixing different types of hazardous waste in the same container will be avoided at all times especially if such mixing involves incompatible materials and/or has the potential to make it more difficult to properly recycle/dispose of the resulting waste mixture.

Please also refer to the HMMP (P13) which specifically addresses management of hazardous materials.

Management of Non-Hazardous Waste

- Collection bins for domestic waste shall be provided near all the offices, rest areas, mess halls, kitchens (if any) and Near workshops, warehouses and working areas collection bins and/or skips (depending on the amounts and the sizes of waste expected to be produced) for Non-hazardous Industrial Waste shall be provided.
- The number of these bins/skips shall be adequate to the quantities of waste generated in the relevant areas.
- A removal service shall be arranged on daily basis.
- Clear pictures/signboards shall be inserted on the skips/bins in all the collection points, in order to help identifying appropriate waste type and promote segregation.
- Construction debris shall not be allowed to accumulate causing safety or environmental hazards. This material shall be removed on a daily basis.
- HEC shall arrange a site main collection lot of adequate size and capacity to accommodate a number of containers matching the generated domestic and Non-hazardous as well as hazardous waste.
- The same segregation and collection principles described in this section shall be applied in the Workers' Camp, Temporary Office and any other occupied facility.
- Timber and other scrap material with a commercial value shall be separated and stored in segregated areas for recovered materials prior to removal.

Management of Hazardous Waste

HEC and its Subcontractors will take all necessary measures to prevent any discharge of any substances, which may result in pollution or be deleterious to life or the surrounding environment. These measures are outlined in detail in the HMMP (P13) but are summarised here.

- Hazardous waste from the camps and accommodation will be stored in predetermined collection points prior to their removal and disposal.
- Sharps containers will be provided in the medical facilities (for syringes, suturing kits and needles) and also clearly identified bagging for infectious or contaminated items.
- Adequate drainage and sewerage facilities designed and installed in accordance with local laws and regulation.
- The general waste collection on site (e.g. Temporary Office, and active construction sites) and Workers'Camp will be conducted at minimum once a week and adjusted according to the workforce allocated on site. The collection of hazardous waste will occur on request, when a minimum of five drums/bins are accumulated. Sewage water will be collected on request in a volume maximum of 4,000 L per load.
- The estimation of waste volume was assumed as per the reference data from USA showing the unit volume and composition of construction waste as in Table 4-2 and Table 4-3.

Table 4-2 Unit volume of construction waste, USA example

State/Region	Material Included	C&D Waste Disposed	Population	Data Year	**Per capita**
		(tons)			(lbs/day)
California	All C&D Disposed	8,732,074	35,484,453	2003	1.3
Chittenden Cty, VT	Loads Coded As C&D Only	43,379	150,239	2005	1.6
Clark County, WA					1.4
Delaware	All C&D Disposed, including C&D landfills	453,946	853,476	2006	2.9
King County, WA	C&D Recovered and Disposed	774,000	1,750,000	2001	2.4
King County, WA	Disposed C&D Only	264,000	1,750,000	2001	0.8
New Hampshire	C&D Disposed and Recovered (Facility Reports)	388,073	1,314,895	2006	1.6
US EPA	C&D Disposed and Recovered, Estimation			1997	2.8
Vermont	C&D Loads Disposed Only	99,653	623,050	2005	0.9
Wisconsin	Loads Coded as C&D Only	1,116,341	5,364,000	2001	1.1
Wisconsin	All C&D Disposed	1,364,053	5,364,000	2001	1.4
	Average:	**1,960,904**	**6,437,193**		**1.7**

Table 4-3 Composition of construction waste, USA examples

Study:	DSWA	Wisconsin	California	King County, WA	
Year:	(2006 - 07)	(2003)	(2005)	(2002)	Average
	(%)	(%)	(%)	(%)	(%)
Concrete (and mixed rubble)	11.7	12.1	10.8	2.3	**8.7**
Wood	30.1	26.3	20.2	45.3	**30.5**
Drywall		4.1	8.1	7.1	**6.4**
Clean Drywall	*9.8*		*4.5*	*2.6*	***5.6***
Painted/demo drywall	*(1)*		*3.6*	*4.5*	***4.1***
Roofing	15.3	22.1		11	**11.0**
Asphalt roofing	(2)	(2)	*4.4*		***4.4***
Metals	2.9	3.9	4	10.9	**5.4**
Plastics	1.6		0.8	3.1	**1.8**

(1) Painted demo drywall included in residue
(2) Asphalt roofing included in Roofing

Typical waste generation for this construction Project (based on the USA examples, and construction waste analysis completed for Daechung Dam, Korea) is provided in Table 4.6 – 4.9

Table 4-4 Construction waste generated (based on Korea Institute of Construction standard item calculation book)

Description			Concrete Products (Ton/m²)	Metal and Ironware (Ton/m²)	Mixed Waste (Ton/m²)	Total (Ton/m²)
New Project	Public/National Project	Reinforced Concrete structure	0.018	0.0022	0.0088	0.029

Notes:

1. *Concrete products: Concrete waste, brick, mortar, waste aggregate.*
2. *Metal and Ironware: Rebar scrap, wire, H-beam scrap.*
3. *Mixed waste: including residual waste such as wood products, electric, HVAC and building debris generating during construction.*

Table 4-5 Calculation of waste by construction area

Item	Area (m²)		Concrete products (ton)	Metal and Ironware (ton)	Mixed Waste (ton)	Total (ton)
Dam site/ Intake	Dam/Diversion Intake	9226	166.068	20.297	81.189	267.554
Powerhouse / Outlet	P/H, Penstock	2,963	53.334	6.519	26.074	63.549
	Surge tank	420	7.56	0.924	3.696	12.180
	Switchyard	230	4.14	0.506	2.024	6.670
Temporary Facility						
Camp site		4,076	73.368	8.967	35.869	118.204
Office area / BP		2,800	50.4	6.16	24.640	81.200
Total		**19,715**	**354.870**	**43.373**	**173.492**	**571.735**

<u>Waste generated by workforce (Domestic waste)</u>

The maximum occupancy of the workers' camp will be 214 (during peak construction of main plant/dam). As per reference[1], domestic waste generated per person is 1.084kg per day. The total amount of domestic waste is 232 kg/day, based on the rates of generation shown in the table below.

[1] Reference: Daejeon Metropolitan City's daily domestic waste generation as presented in 'Status of total waste generation and treatment, Korea Ministry of Environment, 2004'

Table 4-6 Estimated domestic waste generated by the Project (from Camp occupants only, peak occupancy = 214)

Item		Rate(%)	Unit amount(kg)	Amount per day (kg)
Flammable	Food and vegetable products	23.2	0.25	53.8
	Paper products	20.3	0.22	47.1
	Wood products	3.2	0.03	7.4
	Rubber and leather	0.8	0.01	1.9
	Plastic	10.3	0.11	23.9
	Other	12.0	0.13	27.8
Non Flammable	Soil products	2.2	0.02	5.1
	Metal products	9.8	0.11	22.7
	Glass products (Bottle)	5.7	0.06	13.2
	Other	12.5	0.14	29.0
	Total	**100**	**1.084**	**232**

4.4 TRANSPORTATION AND DISPOSAL (HAZARDOUS AND NON-HAZARDOUS WASTE)

Hazardous Waste

- All Hazardous waste shall be managed in an environmentally responsible manner and in accordance with the Local Environmental Legal Requirements.
- HEC is responsible to ensure that toxic waste are;
    - Sent for incineration when appropriate.
    - Sent for recycling to an approved recycler, or sent back to supplier or given to a user. In any case of the above a "Certificate of Consumption" must be obtained for each shipment, OR
    - Stored on Site (during Construction phase) till an option of the above is achieved.
    - HEC and Subcontractor at the end of Construction phase shall remove all the stored toxic waste.

Non-hazardous waste

- All waste shall be shifted only by authorized waste transporters/subcontractor. Transportation will take place during the day and in acceptable weather/road conditions.
- To ensure a complete tracking of all waste transportation, a Waste Log (Annex B) shall be filled by HEC and Subcontractors to accompany the movement of all waste removed from the working area.
- At the end of each week the waste disposal contractor shall send to the Environmental Supervisor the WMS relevant to all shipments occurred in the previous week. The Environmental Supervisor will check the "Destination Facility" part of the Waste Log fulfilled by the Receiving Facility.
- HEC shall make agreement with specialized services, approved by Local Government and for disposal of different classes of waste.
- HEC shall strongly recommend that all Subcontractors (as Generators of their own waste) to stipulate a similar service agreement with an authorized Third Party. In this case, HEC as well as Subcontractors shall file and keep updated copies of the following documents:
    - Service agreement with the Third Party in charge to transport and dispose the defined waste;
    - Third Party's authorizations by Local Government to operate the required services;
    - Final destination facilities Government authorizations.

A written receipt shall be obtained by the above-mentioned Third Party for each waste shipment. Subcontractors and HSE Department for direct work shall file these receipts and regularly check they are properly completed, and Environmental Supervisor shall check files are properly maintained.

Hazardous and non-hazardous wastes generated by the Project will be segregated, collected and temporarily stored or disposed of in approved/permitted facilities. Table

4-7 shows the potential waste streams generated during the construction phase and the proposed method of disposal. The list will be revised throughout the Project as management of waste materials is improved through adaptive management.

Table 4-7 Summary of waste streams and disposal methods

Waste Stream	Method / Specifications on construction site and workers accommodation camp	Temporary Storage on site	Responsibility for disposal	Disposal site
Hazardous Waste				
Aerosol cans	Segregated	Container	Subcontractor	Landfill
Batteries	Segregated and sealed	Sealed bin	Subcontractor	Batteries will be drained. Acid will be stored at Landfill. Scrap metal segregated at Landfill
Coolant	Segregated and sealed	Sealed tank	Subcontractor	Segregated and disposed at Landfill
Electronics	Segregated after separation of batteries and chemical substances	Container	Subcontractor	Metal scrap collection at Landfill
Hydraulic hoses	Hydraulic hoses will be disassembled by separating metal couplings and the rubber hoses. Metal couplings can be mixed with scrap metals. Rubber hoses mixed with general waste	Container	Subcontractor	Landfill
Hydrocarbon contaminated soils	Segregated	Container	Subcontractor	Transported to Landfill and repurposed as spill kit for soil barrier.
Light bulbs	Segregated	Container	Subcontractor	Landfill
Medical Waste	Segregated and stored at site	Sealed Bin	Subcontractor	Incinerated at Landfill
Oil & lubricants	Waste lubricants from service vehicles and mobile or stationary equipment including generators and pumps	Tank	Subcontractor	Filtered at Landfill and reused
Oily wastes	Oily waste materials such as rags will be disposed off-site by subcontractors	Container	Subcontractor	Incinerated at Landfill
Paints and solvents		Tank	Subcontractor	Repurposed at Landfill

Waste Stream	Method / Specifications on construction site and workers accommodation camp	Temporary Storage on site	Responsibility for disposal	Disposal site
Concrete wash water and washout materials	Collect and reuse [1] such as washing for equipment or an ingredient of concrete after passing through sediment basin and solids removal	Watertight container or Tank or collection pool	Subcontractor	Re-used on site or spread for dust control when possible.
Sewage	Sewage will be stored in septic tanks.	NA	Subcontractor	Transported to Tinghe Ridge Wastewater
Non-Hazardous Solid Waste				
Solid domestic waste	Organics such as food scraps from the kitchen and Workers Accommodation Camps will be segregated	Covered bin	Subcontractor	Shredded and turned into compost material for gardening when possible otherwise to dispose of at Landfill
Glass	Segregated	Bin	Subcontractor	Bottles are collected and reused where possible, otherwise disposed at Landfill
Kitchen oil	Segregated	Tank	Subcontractor	Collected and donated to local organization which uses the oil as fuel. Temporary stored at Landfill
Wood waste	Segregated	Container	HEC	Disposal site within core area
Metals	Steel and other valuable metals will be segregated.	Container	Subcontractor	Collected and stored at scrap metal collection at Landfill
Paper and cardboard	Disposed with organic waste	Covered bin	Subcontractor	Mixed with organic waste and turned into compost
Plastic	Plastics will be segregated	Bin	Subcontractor	Landfill
Tires	Segregated	Container	Subcontractor	Landfill
Unused raw concrete	Any wash residue or clean-up waste will be allowed to settle, harden and reused on site for maintenance works		HEC	On site
Vehicles and heavy equipment	Vehicles and heavy equipment will be kept on-site and used for spare parts. Later, these will be		Subcontractor	Metal items will be disassembled, and scrap metal segregated at Landfill

[1] https://www3.epa.gov/npdes/pubs/concretewashout.pdf

Waste Stream	Method / Specifications on construction site and workers accommodation camp	Temporary Storage on site	Responsibility for disposal	Disposal site
	removed and disposed by the subcontractor.			
Wood	Wooden pallets will be re-used. Disposal strategy for virgin wood will be decided in agreement with PO.	Container	HEC and PO	To be determined
Non-Hazardous Construction Waste				
Concrete	Waste concrete from construction activities will be crushed and reused on site as non-structural aggregate for road ballasting or surfacing works yards		HEC	

Some examples of temporary storage equipment to be used on site are shown in Figure 4-1 Temporary storage containers

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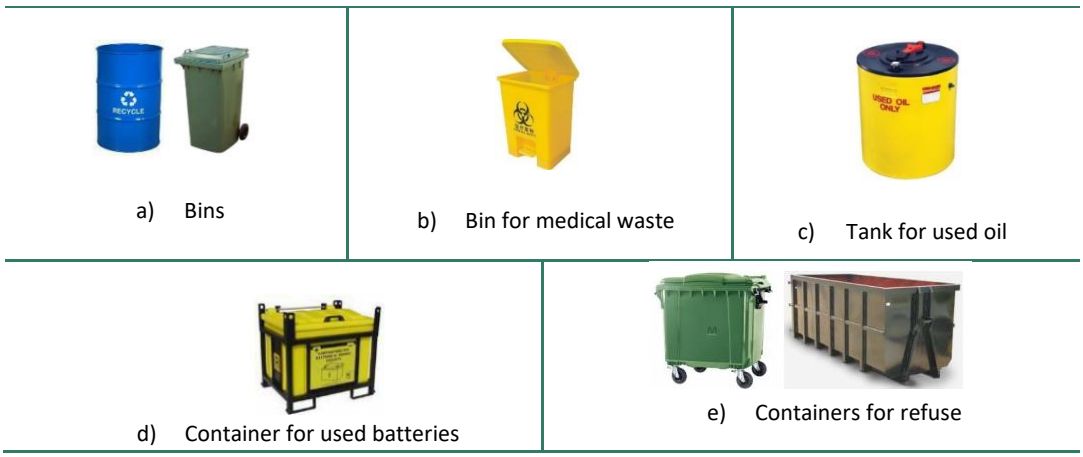

a) Bins

b) Bin for medical waste

c) Tank for used oil

d) Container for used batteries

e) Containers for refuse

Figure 4-1 Temporary storage containers

4.5 RECORD KEEPING

HEC and Subcontractors shall keep records of wastes generated, stored and disposed of, including nature, toxicity, date, quantity, etc. In particular, Environmental Supervisor shall ensure that all necessary authorizations and waste transfer documentation are complete.

Reporting

The Environmental Supervisor is responsible to maintain a monthly record for generated disposed of waste and every month the Environmental Supervisor shall send monthly waste record to the Site HSE Manager and THL HSE Manager together with a Waste Report including description, quantity, conveyor, treatment method and name of disposal subcontractor.

Communication and Training

HEC shall hold a meeting with Subcontractor's representatives to explain and describe the contents and requirements of these guidelines/instructions.

- Each Subcontractor representative, in turn, shall hold a meeting in order to inform and train his employees about the application of this guidelines/instruction and other environmental plans.
- The minutes of these meetings shall send to HEC HSE Department, who will file and record it.
- All workers in site who will be involved in waste handling shall be provided with basic and/or specific information about most significant issues related to waste management.
- Safety awareness in the hazards with the improper handling, storage and transportation of hazardous and non-hazardous shall be given to all workers. Refresher training shall be given as required.
- Training activities reports shall be recorded and filed by Environmental Supervisor.

5 REPORTING AND AUDITING

5.1 REPORTING

This WMPSPP establishes an internal and external reporting structure summarized in Table 5-1.

Internally the reporting hierarchy proceeds as follow:

- the subcontractor reports to the HEC HSE Manager for activities related to domestic waste generation and to the Construction Manager for activities related to construction waste; and
- The HEC HSE and Construction Managers report to HEC Project Manager.

Externally, HEC reports directly to THL (with reviews by the OE) who in turn reports to PO, Lenders and relevant authorities.

The HEC Environmental and Social (E&S) Supervisor is responsible to maintain a monthly record for disposed of waste and distribute it to the HEC HSE Manager, who in turn will distribute to THL.

Monitoring activities will be organized by the HEC E&S Supervisor and include a weekly visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labelled and stored.

A joint monthly inspection of site waste management, disposal facilities and activities will be conducted by the HEC HSE Manager and THL E&S Manger.

The HEC E&S Supervisor will set and monitor the following Key Performance Indicators (but not limited to):

- Annual volume of non-hazardous waste disposed on-site;
- Annual volume of hazardous waste disposed on-site;
- Annual volume of non-hazardous waste disposed off-site; and
- Annual volume of hazardous waste disposed off-site.

The HEC E&S Supervisor will be responsible to prepare and update the:

- MSDS Information quarterly;
- Hazardous Waste Inventory quarterly; and
- Inventory Hazardous Waste Container quarterly.

All accidental events resulting in spillage of waste material will be recorded by the HEC E&S Supervisor in an incident report and provided to the HEC HSE Manager, which will

in turn distributed to THL E&S Manager and Project Office (PO). The WMPSPP will be updated periodically to include measures to minimize the risk of generating the same accident.

The content of the report will include but not be limited to the following:

- Summary of accidents; and
- Review of actions taken and status.

Table 5-1: Reporting structure for the WMPSPP

Preparation	Review	Content	Frequency
Internal			
Subcontractor	HEC Construction Manager	• Quantity of construction waste (topsoil, subsoil, excavated natural material, virgin excavated natural material, concrete, etc.) disposed on site • Quantity of construction waste disposed offsite	Daily
Subcontractor	HEC HSE Manager	• Complete the Hazardous Waste Consignment Note	Daily
HEC E&S Supervisor	HEC HSE Manager	• Maintain the Hazardous and Non-Hazardous waste log • Complete Incident Report Form in the event of an environmental incident • An incident is any accidental release of waste	Daily
HEC Training Supervisor	HEC HSE Manager	• Maintain a training register	Weekly
HEC HSE Manager	HEC Project Manager	• Complete Incident Report Form in the event of an environmental or safety-related incident • An incident is any accidental release of waste • Collection of waste statistics and assess against KPI • Complete the Monthly Waste Record Form	Monthly
External			
HEC HSE Manager	THL E&S Manger and PO	• Collection of Incident Report Form • Monthly Waste Record Form	Monthly

5.2 AUDITING

HEC will be subject to internal and external audits. The internal audit will be conducted by the HEC Headquarters on the onsite team according to HEC's corporate internal HSE Audit Procedure (HEC-AH-H04-H13). The internal examinations performed by the onsite staff are referred to as inspections.

External audits will be conducted by the E&S Manager from THL, E&S Safeguards Manager from the PO, and the Owner's Engineer (OE).

HEC will also conduct audits on the waste management subcontractor to ensure compliance with this management plan and other ESMPs as appropriate.

The detailed structure and content of the auditing process is presented in the Construction Environmental and Social Management Plan (CESMP; P1). The below Table 5-2 summarises the process.

Table 5-2: Summary of auditing process

Auditor	Auditee	Frequency
THL E&S Manger	HEC	Every three months
PO E&S Monitoring team (with LTA)	HEC and THL	Every three months (site visit might be every six months)
HEC Headquarter HSE Team	HEC on-site team	Every six months
HEC HSE Manager	Subcontractor	Every three months
HEC HSE team (with THL)	On-site workers	Every week
THL OE - Stantec	HEC	Every six months

External and Internal auditors shall notify by email the HEC Project Management Team (Project Manager, Construction Manager and HSE Manager) about upcoming audit events. This will provide a mechanism to communicate the schedule, activities and objectives of the audits. If urgent, the Project Site may be notified via phone or fax.

The audit process involves reviewing on-site activities to assess compliance with the management plans and / or HEC internal standards. The auditor will review all records of previous audits and evaluate historic compliance and the use of appropriate corrective actions.

Findings from the audit will be summarised in an audit report. A copy of the resulting audit report is to be made available upon request for reference and, where necessary, implementation of any identified corrective actions.

The key performance indicators to be considered when auditing this management plan are:

- Number and type of non-compliances recorded, and the adverse impact of these non-compliances on the receiving environment and any affected people;
- Number of non-compliances resolved;
- Annual volume of recycled waste;
- Annual volume of non-hazardous waste disposed off-site; and
- Annual volume of hazardous waste disposed off-site.

All reports are to be maintained at the project site for the entire construction period.

ANNEX A. CHECKLIST FOR WASTE MANAGEMENT AUDIT

ANNEX B. WASTE LOG FORMS

WASTE LOG

(Non-Hazardous Waste)

Area : .....

Waste Custodian Tel. .....

Contractor Tel. No .....

Origin of Waste : .....

Name of Waste Stream	Qty. of Waste Unit (No. /Kg.)	Date Dispatched	Time Dispatched	Vehicle Number	Disposal Point	Remarks
AQUEOUS WASTE						
Treated sewage effluent						
SOLID WASTE						
Domestic Refuse						
Industrial Refuse						

GASEOUS WASTE						
Exhaust Stack						
FUGITIVE GASES						
Any other Waste						

Signature : ----------

Name : ----------

Designation : ----------

WASTE LOG

(Hazardous Waste)

Area : .....

Waste Custodian Tel. .....

Contractor Tel. No .....

Origin of Waste : .....

Name of Waste Stream	**Qty. of Waste Unit (No/Kg.)**	**Date Dispatched**	**Time Dispatched**	**Consignment Note No.**	**Vehicle No.**	**Disposal Point**	**Date of Waste Recd.**	**Remarks**
Untreated sewage effluent								
Sewage Sludge (wet)								
Waste Chemicals								
Waste Lubricant								
Oil Sand								
Tank & Other Sludge.								
Batteries								
Tires								
Oil Drums(empty)								

Name of Waste Stream	**Qty. of Waste Unit (No/Kg.)**	**Date Dispatched**	**Time Dispatched**	**Consignment Note No.**	**Vehicle No.**	**Disposal Point**	**Date of Waste Recd.**	**Remarks**
Asbestos (Brake Lining)								
Clinical Waste								
Hydro test Water								
Refrigerant								
Waste fire-fighting agent								

Signature : ----------

Name : ----------

Designation : ----------

Hazardous Waste Consignment Note

Waste Details

Location :_____ Name of waste stream :_____

Quantity of Waste : _____(Pieces) or _____(Tones)

Waste Originator

Name :_____ Reference Indicator : _____

Date Dispatched : _____ Time Dispatched : _____

Name of Disposal Site :_____ Location :_____

Signature :_____

Waste Transporter

Name : _____ Company : _____

Vehicle Number : _____	Date :_____
Time Start : _____	Time Complete: _____
Signature : _____	

Waste Disposal Facility

Site Name : _____	Location : _____
Date Received : _____	Time Received : _____
Name of Guard : _____	Signature : _____

Distribution: Copy Originator Copy: Disposal Site Copy: Return to Originator