Lao People's Democratic Republic

Peace Independence Democracy Unity Prosperity

****

Ministry of Natural Resources and Environment

Lao Pollution and Waste Management Project (P175996)

Preliminary Environmental and Social Impact Assessment (Pre-ESIA)
(Draft 26 January 2024)

Prepared by:

Environment Protection Fund

26 January 2024

Table of Contents

ABBREVIATIONS AND ACRONYMS IX
EXECUTIVE SUMMARY 11
PROJECT LOCATION 11
PROJECT CONCEPTUAL DESIGN AND FACILITIES 13
ANALYSIS OF DESIGN AND LOCATION ALTERNATIVES 15
ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS OF THE PROPOSED SITE 18
METEOROLOGY 18
TOPOGRAPHY AND LAND USE 18
HYDROGEOLOGY AND WATER QUALITY 18
AIR QUALITY AND NOISE 20
FLORA AND FAUNA 21
SOCIAL PROFILE 21
PREVAILING ENVIRONMENTAL AND SOCIAL ISSUES 22
POSITIVE ENVIRONMENTAL AND SOCIAL IMPACTS 23
ADVERSE ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS 24
CONSTRUCTION PHASE 24
OPERATIONAL PHASE 25
POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS ASSOCIATED WITH THE LEGACY WASTE AT THE VCOMS SITE 26
CLOSURE PHASE 28
MITIGATION MEASURES 28
PRE-CONSTRUCTION PHASE 28
CONSTRUCTION PHASE 29
OPERATIONS PHASE 30
LEGACY WASTE MITIGATION MEASURES 31
CLOSURE PHASE 32
CUMULATIVE ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS ASSOCIATED WITH THE LEGACY WASTE AT THE VWMC SITE AND VWMC'S ACTIVITIES AND RECOMMENDED MITIGATION MEASURES 33
ENVIRONMENTAL AND SOCIAL MONITORING 35
1 PROJECT BACKGROUND 37
2 PRE-ESIA SCOPE AND OBJECTIVE 40
3 DESCRIPTION OF COMPONENT 2 WASTE AND PLASTIC MANAGEMENT INFRASTRUCTURE INVESTMENTS 42

3.1 THE POLLUTION AND WASTE MANAGEMENT PROJECT OR "PWMP" 42
3.2 OVERVIEW OF COMPONENT 2 INVESTMENTS 43
3.2.1 Subcomponent 2A Capacity building for waste management planning, operation, monitoring, waste service delivery, and cost recovery at the local level 43
3.2.2 Subcomponent 2B Waste and Plastics Management Infrastructure Investment 43
3.3 KM 32 LANDFILL HISTORY AND CURRENT OPERATIONS 44
3.3.1 Background 44
3.3.2 Landfill Legacy Waste History 45
3.3.3 Current Operations and Activities 51
4 KM 32 LANDFILL PROJECT DESIGN 55
4.1 DESIGN DEVELOPMENT 55
4.2 WASTE FLOWS 55
4.3 LANDFILL DESIGN, ACTIVITIES AND FACILITIES 58
4.4 IMPLEMENTATION SCHEDULE 65
4.5 ANALYSIS OF ALTERNATIVES 65
5 LEGAL AND INSTITUTIONAL FRAMEWORK 73
5.1 NATIONAL LEGAL FRAMEWORK 73
5.2 APPLICABLE WORLD BANK ENVIRONMENTAL AND SOCIAL STANDARDS (ESSS) 76
6 EXISTING CONDITIONS 78
6.1 METEOROLOGY, CLIMATE AND NATURAL HAZARDS 78
6.1.1 80
6.1.2 Wind 80
6.1.3 Climate Change Projections 82
6.1.4 Climate Change Design Considerations 84
6.1.5 Earthquake Hazard 84
6.1.6 Cyclone/Typhoon Hazard 85
6.1.7 Flood Hazard 85
6.2 ENVIRONMENTAL BASELINE PROFILE FOR THE LANDFILL SITE 87
6.2.1 Topography and Hydrogeology 87
6.2.2 Hydrology 93
6.2.3 Surface Water Quality 96
6.2.4 Wastewater / Leachate Quality 98
6.2.5 Groundwater Quality 100
6.2.6 Soil Quality 103

6.2.7 Air Quality and Noise 105
6.2.8 Biological and Ecological Environment 107
6.3 Social Baseline 108
6.3.1 Population and Demography 109
6.3.2 Waste Pickers and Waste Collectors 114
7 POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS 123
7.1 Methodology 123
7.2 Benefits 125
7.3 Landfill Siting 126
7.4 Environmental and Social Risks and Impacts Assessment 129
7.4.1 Construction Phase Environmental and Social Risks and Impacts 129
7.4.2 Operational Phase Environmental and Social Risks and Impacts 130
7.4.3 Potential Environmental and Social Risks and Impacts associated with the Legacy Waste 132
7.4.4 Closure Phase Environmental and Social Risks and Impacts 134
7.5 Overview of Mitigation Measures 134
7.5.1 Recommended Design Considerations 134
7.5.2 Construction Phase Mitigation Measures 136
7.5.3 Operations Phase Mitigation Measures 137
7.5.4 Legacy Waste Mitigation Measures 138
7.5.5 Closure Phase Mitigation Measures 140
7.6 Environmental and Social Risk Matrix 140
7.7 Indirect Impacts 165
7.8 Cumulative Impacts 165
8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) 179
8.1 About the ESMP 179
8.2 Contractor's Environmental and Social Management Plan 216
8.2.1 CESMP Subplans 216
8.2.2 Borrow Pit and Spoil Disposal Site Selection 216
8.3 Management of incoming Waste and onsite Relocation of Waste in the Construction Phase 217
8.4 Monitoring 220
8.5 Capacity Development and Training 240
8.6 Implementation Arrangements 242
9 CONSULTATION AND STAKEHOLDER ENGAGEMENT 250
9.1 Stakeholder Engagement Plan 250

9.2 CONSULTATIONS DURING PROJECT PREPARATION 250
9.3 STAKEHOLDER ENGAGEMENT DURING PROJECT IMPLEMENTATION 252
10 REFERENCES 252
ANNEX 1 PHOTO DOCUMENTATION 255
ANNEX 2 NATIONAL STAKEHOLDER WORKSHOP 262
ANNEX 3 RISK SCORING METHODOLOGY 268

List of Tables

Table 3-1 Outline of key provisions in the amendments to the concession agreement between GOL and VWMC 52
Table 4-3 Evaluation of the Do Nothing Alternative 67
Table 4-4 Evaluation of Alternative Landfill Siting 68
Table 4-5 Evaluation of Alternative Landfill Liner Systems 69
Table 4-6 Evaluation of Final Cap on the New Landfill Cells 71
Table 4-7 Evaluation of Final Cap on the Legacy Waste 72
Table 4-8 Evaluation of Alternative location of recycling facilities 73
Table 5-1 National Policies and Legislations 73
Table 6-1 Potential Impacts from Climate Change on Landfill Operations 84
Table 6-2 Surface Water Quality Results 97
Table 6-3 Wastewater/Leachate Quality Results 99
Table 6-4 Groundwater Quality Results 102
Table 6-5 Results of metal analyses on Soil Samples 104
Table 6-6 Results of Air Quality Measurements carried out under the Pre-Feasibility Study, Feb-2022 106
Table 6-7 Results of Noise Measurements carried out under the Pre-Feasibility Study, Feb-2022 107
Table 6-8 Population Surrounding KM 32 Landfill Site 109
Table 6-9 Occupations of Villagers 110
Table 6-10 Basic Service Infrastructure 111
Table 6-11 Education Information in Surrounding Villages 111
Table 7-1 Assessment Criteria 123
Table 7-2 Zones of Impacts 124
Table 7-3 Evaluation of the Km 32 Landfill Project against Siting Criteria 127
Table 7-4 Recommended Design Improvements 135
Table 7-5 Overview of the anticipated Environmental Risks and Impacts associated with the Km 32 Landfill Project 142

Table 7-6 Overview of the anticipated Social Risks and Impacts associated with the Km 32 Landfill Project 155
Table 7-7 Overview of Preliminary Cumulative Impact Assessment 167
Table 8-1: Proposed Pre-Construction Phase Environmental Mitigation Measures for the Km 32 Landfill Project 180
Table 8-2 Proposed Construction Phase Environmental Mitigation Measures for the Km 32 Landfill Project 182
Table 8-3: Proposed Operational Phase Mitigation Measures for the Km 32 Landfill Project 196
Table 8-4: Proposed Closure Phase Mitigation Measures for the Km 32 Landfill Project 205
Table 8-5 Proposed Social Mitigation Measures for the Km 32 Landfill project 208
Table 8-6: Site Selection Criteria for Borrow Pits and Spoil Disposal Sites 216
Table 8-7 Pre-Construction Phase Environmental Monitoring 221
Table 8-8 Pre-Construction Phase Social Monitoring 225
Table 8-9 Construction Phase Environmental Monitoring 226
Table 8-10 Construction Phase Social Monitoring 230
Table 8-11 Operational Phase Environmental Monitoring 232
Table 8-12 Operational Phase Social Monitoring 237
Table 8-13 Closure Phase Monitoring 239
Table 8-14 Outline of Training Programmes on Environmental, Social and Health and Safety Matters 241
Table 8-15 Overview of Proposed Arrangements for the Implementation of the Km 32 Landfill Project 243

List of Figures

Figure 0-1 Location of the Km 32 Landfill Project 11
Figure 0-2 the Km 32 Landfill Site 12
Figure 0-3 Pre-Feasibility Study Conceptual Layout Design of the Km 32 Landfill Project 15
Figure 0-4 Liner System Alternative (a) on the left and Alternative (b) on the right 17
Figure 0-5 Local Hydrology 19
Figure 0-6 Leachate drainage from the Km 32 Landfill 19
Figure 0-7 The Waste Pickers' camp 22
Figure 2-1 Location of Naxaythong, Xaythany and Xaysetha Districts, Vientiane Capital 41
Figure 2-2 Overview Map with the Location of the Km 32 Landfill Project and the Km 16 Transfer Station ... 42
Figure 3-1 Surroundings of the Km 32 Landfill Project Site 45
Figure 3-2 Google Earth Image January 2008 indicating early construction works 46

Figure 3-3 Google Earth Image January 2010 46
Figure 3-4 Google Earth Image January 2014 47
Figure 3-5 Google Earth Image January 2020 47
Figure 3-6 Google Earth Image January 2023 48
Figure 3-7 Area used for waste dumping on the VCOMS Site 2009-2023 49
Figure 3-8 Area used for waste dumping on the VWMC Site 2009-2023 50
Figure 3-9 Area used for waste dumping on the entire Landfill Site 2009-2023 51
Figure 3-10 Diagram of the waste processing at VWMC as contemplated in the EMMP 53
Figure 4-1 Waste flow diagram, 2030 56
Figure 4-2 Results of Waste Composition Survey for waste collected in Naxaythong District (Pre-Feasibility Study, Task 3 Report) 58
Figure 4-3 Conceptual Layout Design of the Km 32 Landfill Project 61
Figure 4-4 Cross-sections of the Conceptual Landfill Design 62
Figure 4-5 Conceptual design of the Landfill Liner 62
Figure 4-6 Conceptual design of final cap 63
Figure 4-7 The Conceptual Landfill Design superimposed on a Google Earth Image, 2023 63
Figure 4-8 Proposed Leachate Treatment System 64
Figure 4-9 Drone Photo (July 2022) of Cell 10 and Cell 11 where the new cells will be constructed 64
Figure 6-1 Monthly mean, minimum and maximum Temperatures and mean monthly precipitation for Vientiane Capital 1991-2020 79
Figure 6-2 Trend in mean annual temperature and mean annual precipitation 80
Figure 6-3 Vientiane Average Hourly Wind Speeds 81
Figure 6-4 Vientiane Wind Directions 81
Figure 6-5 Climate Change Projections for Vientiane Capital, 2020-2039 82
Figure 6-6 Peak Ground Acceleration for a 1:475-year Earthquake 85
Figure 6-7 Baseline 1:100-year Flood Hazard 86
Figure 6-8 Predicted 1:100-year Flood Hazard in 2030 with a business as usual/pessimistic scenario 86
Figure 6-9 Terrain profile of the Km 32 Landfill across the VCOMS site 88
Figure 6-10 Terrain profile of the Km 32 Landfill across the VCOMS and Khouanmouang Company sites 89
Figure 6-11 Main Aquifers in Lao PDR[17] 90
Figure 6-12 Borehole location map 91
Figure 6-13 Soil Profiles 92
Figure 6-14 Local Hydrology 93
Figure 6-15 Ponds on the Km 32 Landfill, 06 September 2022 94

Figure 6-16 Leachate drainage from the Km 32 Landfill **95**
Figure 6-17 Leachate drainage from the northern part of the Km 32 Landfill **95**
Figure 6-18 Surface Water Quality Monitoring Stations **96**
Figure 6-19 Location of Wastewater/Leachate sampling **99**
Figure 6-20 Groundwater wells monitored under the Pre-Feasibility Study **100**
Figure 6-21 Location of Soil Samples **104**
Figure 6-22 Air Quality Monitoring Stations under the Pre-Feasibility Study **106**
Figure 6-23 Protected Areas **108**
Figure 6-24 Location of Villages in the proximity of the Km 32 Landfill **109**
Figure 6-25 Photo of Temple in Ban Nakhoa **112**
Figure 6-26 Photo of the Waste Pickers' camp **114**
Figure 6-27 Education Levels of Interviewees **115**
Figure 6-28 Household income of Waste Pickers and Collectors per month **116**
Figure 6-29 Household Expenditure of Waste Pickers and Collectors Per Month **117**
Figure 6-30 Other Sources of Household Income of Respondents **117**
Figure 6-31 Average Collected Recyclable Waste Kg/HH/Week **118**
Figure 6-32 Necessities for Improving Work Environment for Waste Pickers **119**
Figure 7-1 Drone photo with view from the Landfill looking south (July 2022) **129**

ABBREVIATIONS AND ACRONYMS

CERC	Contingency Emergency Response Component
CHSP	Community Health and Safety Plan
COVID19	Corona Virus 19
DCC	Department of Climate Change
DHUP	Department of Housing and Urban Planning
DINE	Department of Inspection on Natural Resources
DOE	Department of Environment
DOP	Department of Planning
DPWT	Department of Public Works and Transport
ECC	Environmental Compliance Certificate
EDPD	Environmental Research and Disaster Prevention Division
EGEF	Ethnic Group Engagement Framework
EGEP	Ethnic Group Engagement Plan
EHSG	Environmental, Health and Safety Guidelines
EPF	Environmental Protection Fun
E&S	Environmental and Social
ESCOP	Environmental and Social Code of Practice
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
ESIA	Environment and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environment and Social Management Plan
ESS	Environmental and Social Standards
EXRI	EX Research Institute Ltd
FGD	Focused Group Discussion
FPIC	Free Prior and Informed Consent
GBV	Gender Based Violence
GDP	Gross Domestic Product
GGGI	Global Green Growth Institute
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome
IEE	Initial Environmental Examination
IFC	International Finance Corporation
LFND	Lao Front for National Development
LMP	Labour Management Procedures
LOD	Limit of Detection
LOQ	Limit of Quantification
LWU	Lao Women's Union
MAF	Ministry of Agriculture and Forestry

MOIC	Ministry of Industry and Commerce
MONRE	Ministry of Natural Resource and Environment
MPWT	Ministry of Public Works and Transport
NGO	Non Government Organization
PAD	Project Appraisal Document
PAP	Project Affected People
PONRE	Provincial Offices of Natural Resource and Environment
PPE	Personal Protective Equipment
Pre-FS	Pre-Feasibility Study
Pre-ESIA	Preliminary Environmental and Social Impact Assessment
PTI	Public Works and Transport Institute
PWMP	Pollution and Waste Management Project
RAP	Resettlement Action Plan
RDF	Refuse-Derives Fuel
RPF	Resettlement Policy Framework
SEA/SH	Sexual Exploitation and Abuse and Sexual Harassment
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SMEs	Small and Medium-sized Enterprises
SMP	Social Management Plan
UDAAs	Urban Development Administrative Authorities
US$	United States dollar
UXO	Unexploded Ordnance
VAC	Violence Against Children
VCOMS	Vientiane City Office for Management and Service
VUDAA	Vientiane Urban Development and Administration Authority
WB	The World Bank

EXECUTIVE SUMMARY

1. The Rehabilitation and Development of an Engineered Landfill at the Existing Km 32 Landfill Site is among the activities being considered for funding under Component 2B of the proposed Pollution and Waste Management Project (PWMP), a project being developed for World Bank financing. The preliminary ESIA study is part of the environmental and social framework instruments being prepared for the Project as agreed with World Bank. The main objective of the preliminary ESIA is to conduct a preliminary identification and assessment of the potential environmental and social risks and impacts of the initial project design and to carry out an initial analysis of possible design alternatives, and based on the results, to recommend the preferred design and the associated environmental and social management, mitigation and monitoring measures.

PROJECT LOCATION

2. The Km 32 Landfill Project is proposed to be developed at Vientiane Capital's existing Km 32 landfill located in Ban Naphasouk, Xaythany District, Vientiane Capital (see *Error! Reference source not found.Error! Reference source not found.*). The landfill is connected to Road No. 13 South by a 2.8 km two-lanes unpaved access road.

FIGURE 0-1 LOCATION OF THE KM 32 LANDFILL PROJECT



3. The total area of the landfill site is 100 hectares, and the area is divided into two main sites (see ***Figure 0-2***):

- A 70 ha large area covering the 50 ha southern half of the entire site and 20 ha on the north-western part of the site. This site is managed by Vientiane City Office for Management and Service (VCOMS) and includes the active landfill disposal area, waste sorting operations and previous landfill cells. This site is hereafter called the VCOMS site, and it constitutes the **Km 32 Landfill Project** under PWMP.
- A 30 ha large are on the north-eastern part of the 100 ha site. This site is leased to Vientiane Waste Management Company (VWMC) under a concession agreement. The concession agreement dates back to 2011 and originally covered the 50 ha northern part of the 100 ha landfill site. The agreement was amended in 2019 and further amendments negotiated in 2023 are expected to be signed in early 2024. With these amendments, the land lease will be reduced to the said 30 ha.

FIGURE 0-2 THE KM 32 LANDFILL SITE



4. VCOMS has a contractual arrangement with a private company, Small B, under which the company implements waste management-related administrations, fee collection, data collection, waste collection, and landfill operation and management.

5. The facility currently handles about 400 tons of unsorted waste per day. The landfill started operating in 2009 and based on an analysis of historical Google Earth images, the total area used for waste dumping on both the VCOMS site and the VWMC site over the course of the landfill history is roughly 56.6 ha. The total estimated amount of legacy waste is 628,000 m3.

6. The VCOMS landfill compound includes a controlled entrance and fence, administration office, weighbridge, waste incineration plant for medical waste, two sludge ponds, wheel-washing, storm-water ponds, recyclable plant (one active, and one disabled), and a garage, truck parking, and recyclable waste storage. The landfill has a simple barbed-wire perimeter fence, but the fence is broken in many places.

7. The VCOMS landfill has an estimated life expectancy of 5-7 years if the rate of waste deposited at the landfill is maintained.

8. VCOMS has currently registered 264 waste pickers at the Km 32 landfill. A total of about 10-15 t/day recyclables (plastic, metal cans, scrap metal, paper, cardboard, glass) are being collected and sold to Thai and Vietnamese middle-companies for export and further processing.

9. The landfill is operated as an unsanitary open dump without leachate collection and treatment systems and at least until recently without daily cover of the waste. Thus, contaminated untreated wastewater is directly discharged to the surrounding area. Fires have occurred twice at the Km 32 landfill in the past. As reported by VCOMS, measures currently implemented to prevent occurrence of landfill fire include watering of the landfill 2 times/day during the dry season, and establishment of 6-7 m buffer zone around the landfill.

10. The Km 32 site access road used by waste collection trucks is unsealed and in poor condition. Maintenance is the responsibility of VCOMS, but their budget is quite limited. According to information from VCOMS, the access road has been rehabilitated and maintained in late December 2022. In addition, a guideline for waste transportation which will require waste trucks to be registered is under preparation by VCOMS.

11. The municipal waste received at the Km 32 Landfill is composed of about 58% organic (kitchen, vegetation) waste, 18% plastic, 5% paper and cardboard, 4% glass, 2% textile, rubber and leather, 1% metals, stone and ceramics and 12% of unclassified waste types.

PROJECT CONCEPTUAL DESIGN AND FACILITIES

12. The “Integrated Solid Waste Management (ISWM)” concept which attempts to address the whole waste value chain is applied for the technical design of the PWMP. The project will overall help to reduce waste to the Km 32 landfill in Vientiane Capital through interventions at different nodes along the waste value chain. However, the project’s interventions and investments are not expected to have a significant effect on the recyclable waste that is available for wastepicking at the Km32 landfill. Two waste transfer stations (one at Km16 and one in

Naxaythong District) will be part of PWMP ISWM, and each will be equipped with facilities to sort and compost the organic waste which will minimize the amount of residual waste. Non-organic waste including recyclable waste will be brought to the Km 32 landfill.

13. The rehabilitation and development works will involve:

(a) Construction of two new engineered landfill cells (Cell 10 and Cell 11 in ***Figure 0-3***) with a total capacity of 1.15 million m^3 over a design life of 10 years, covering an area of 11.45 ha.

(b) The preferred cell design includes a composite liner consisting of a bottom low permeable clay liner, a 1.5 mm HDPE geomembrane, a geotextile to protect the geomembrane against puncture and a drainage layer with leachate collection system.

(c) The cells will be equipped with landfill gas collection and ventilation systems.

(d) Excavation of about 156,000 m^3 of waste from Cell 10 and Cell 11 and onsite relocation and capping of the waste at a 4.12 ha large area to make space for the new landfill cells.

(e) Capping of legacy waste in cells 1-4, legacy waste on the north-western part of the VCOMS site and legacy waste on the VWMC site including installation of gas ventilation. Hospital waste dumped near the pond on the north-western corner of the landfill site to be segregated and incinerated in the existing medical waste incinerator on the VCOMS site.

(f) Remediation of the leachate ponds / wastewater ponds on the VCOMS and VWMC sites (three on VCOMS site and two on VWMC site).

(g) Construction of a 900 m^2 floor area hazardous waste storage facility for temporary storage of small amount of residue hazardous waste in incoming municipal waste.

(h) Construction of a leachate treatment facility comprising a combination of an Up-flow Anaerobic Sludge Blanket Reactor (UASB) and an aerobic rotary disc system and including a HDPE lined regulating pond with a surface area of 38,000 m^2 and a volume of 140,000 m^3 for the leachate coming from the new landfill cells.

(i) Installation of stormwater drains system throughout the entire site to divert stormwater away from roads, landfill cells, buildings, and facilities, and to avoid mixing with leachate. This will prevent contamination of stormwater with leachate.

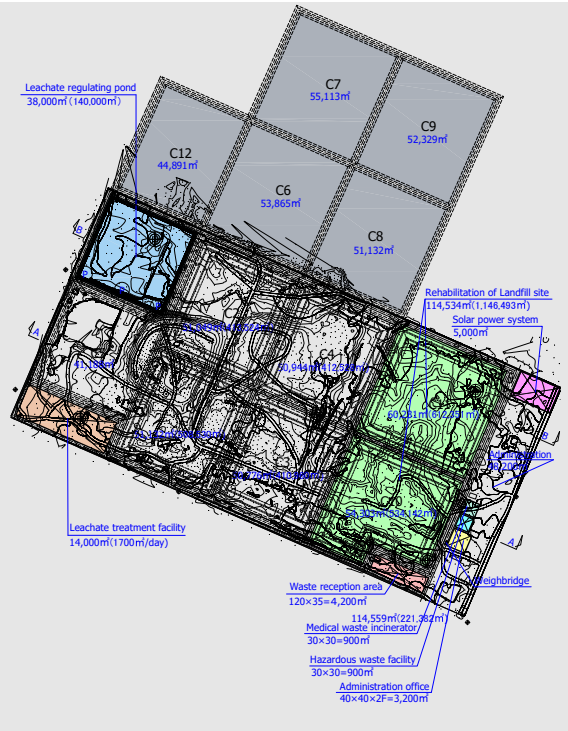
(j) Construction of waste reception area where waste picker can access waste and a 3,200 m^2 floor area administration building with a weighbridge, a solar power system, and one kilometre, 7 m wide internal concrete roads.

(k) Upgrading of the existing waste recycling facilities to improve the working conditions and increase the value of recyclables.

(l) Recycling equipment for the waste management community centre in the Km 32 landfill.

(m) Construction of groundwater monitoring wells.

FIGURE 0-3 PRE-FEASIBILITY STUDY CONCEPTUAL LAYOUT DESIGN OF THE KM 32 LANDFILL PROJECT



ANALYSIS OF DESIGN AND LOCATION ALTERNATIVES

14. The Pre-ESIA has undertaken an analysis of key project design and location alternatives and determined the preferred options. The analyses of alternatives are based on the initially proposed design elements contemplated in the Pre-feasibility study (see ***Figure 0-3***).

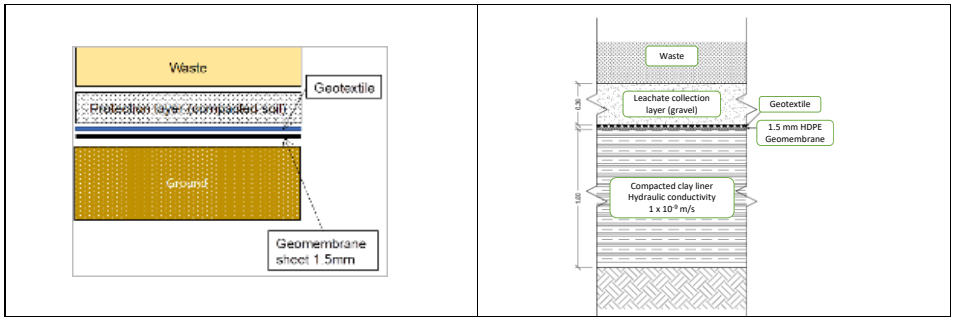
15. ***The "do nothing alternative"***. Doing nothing will continue to expose landfill workers, waste pickers and residents to a range of health and safety risks and will continue to constitute a high risk of groundwater and surface water contamination with significant adverse effects on

the environment and public health. **The preferred option** is to develop and implement the proposed Km 32 Landfill Project.

16. ***Landfill siting***. Alternative (a): Construct the proposed new landfill facilities on a 50 ha large area bordering the existing Km 32 Landfill. This alternative would involve acquisition of land from farmers and would require resettlement, compensation and livelihood assistance. This would be a costly option but would on the other hand not necessitate relocation of waste. Alternative (b): Construct the proposed new landfill facilities within the existing VCOMS site. This alternative would not require any land acquisition, but waste would have to be relocated to make space for the proposed landfill cells. **The preferred option** is Alternative (b) as this option avoids land acquisition. Furthermore, with the proposed mitigation measures addressing the legacy waste and with improved health and safety conditions for the waste pickers, Alternative (b) also provides important environmental and health and safety benefits as compared with Alternative (a). It should also be noted that when compared to the siting criteria of the World Bank and the Lao PDR guideline siting criteria, for both options (the sites are next to each other), the siting does not fully meet the recommended siting criteria and distances to sensitive receptors. However, this does not necessarily mean that the location is unacceptable or incompatible, in fact it may very well be difficult to find a place within reasonable distance of Vientiane Capital that would satisfy all criteria – but it does point towards the need for high quality landfill design and consistent and proper execution of landfill operations and maintenance.

17. ***Landfill liner systems***. Alternative (a) see ***Figure 0-4***: A single liner composed of (from top to bottom): A drainage layer with leachate collection, protective geotextile, and 1.5 mm HDPE geomembrane on top of the intact soil. Alternative (b) – see ***Figure 0-4***: A composite liner composed of (from top to bottom) to be installed at the new landfill cells, the cell for the relocated waste and under the leachate regulating pond: A drainage layer with leachate collection, protective geotextile, 1.5 mm HDPE geomembrane, and 1 m compacted clay on top of the intact soil. **The preferred option** is alternative (b) a composite liner system as this provides a double layered high level of protection against groundwater pollution superior to the single liner alternative. It is also standard engineering design for municipal solid waste disposal and recommended by the World Bank EHS Guidelines and has been applied by recent ADB funded landfill projects in Laos and Cambodia.

FIGURE 0-4 LINER SYSTEM ALTERNATIVE (A) ON THE LEFT AND ALTERNATIVE (B) ON THE RIGHT



18. ***Final Waste Cell Cap***. Alternative (a): A 2 m thick soil layer and landfill gas collection. Alternative (b): A topsoil layer (150 mm), intermediate layer (150 to 300 mm), barrier layer (600 mm) and a gas collection layer (150 to 300 mm) with landfill gas ventilation wells. **The preferred option** is alternative (b) as this is standard landfill engineering design and in accordance with World Bank EHS Guidelines, it will provide long term environmental protection by preventing direct or indirect contact of living organisms with the waste materials, minimize infiltration of rainwater into the waste and the subsequent generation of leachate, control landfill gas migration, and minimize long term maintenance needs.

19. ***Final Cap on Legacy Waste***. Alternative (a): Do nothing and leave the legacy waste as it is. Alternative (b): Full rehabilitation of legacy waste according to EHS guidelines of the World Bank and international conventional technical standards for landfills. **The preferred option** is alternative (b) as this is a relatively low-cost method that will provide a significant protection against groundwater and surface water pollution and prevent direct or indirect contact of living organisms with the waste materials and effectively prevent landfill fires, and emission of malodour from decomposing waste.

20. ***Location of Recycling Facilities*** (see ***Table 4-6***). Alternative (a): At the Km 32 Landfill site (VCOMS) and maintaining direct delivery of waste from part of the entire service area. Alternative (b): At the transfer stations (in Naxaythong District and Km16) redirecting the majority of the waste through the transfer stations where recyclable materials will be segregated. The preferred option is a combination of the two alternatives with support to recycling facilities at the transfer stations to reduce the cost of transporting waste to the Km 32 Landfill while also implementing proper recycling facilities at Km 32 Landfill recognizing that a reasonable amount of recyclable materials will likely still go to the landfill. This together with the other support to the waste pickers that the project is proposing, will also help to alleviate the concerns that the waste pickers have expressed over the risk of loss of income. It should be noted that the option (b) to invest in

recycling facilities at the transfer stations has subsequently been taken out of the project, however, the project proposes to invest in composting facilities for composting of organic waste.

ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS OF THE PROPOSED SITE

METEOROLOGY

21. The ***climate*** in Vientiane Capital is classified as tropical wet and dry climate with dry winter (*Aw*) in the Köppen and Geiger Climate Classification System. Meteorological data shows a trend towards increasing annual mean temperatures in Vientiane Capital from around 25°C in the 1950'ies to about 26.5°C in 2020. The mean annual rainfall, on the other hand, shows a decreasing trend with annual mean rainfall decreasing with about 200 mm over the same period. The city in located in the region of low seismic hazards. The prevailing wind speed is moderate at 2.0 to 2.7 m/s. Vientiane Capital is located in a region with low cyclone/typhoon hazards. The landfill is likely located within the 1:100-year riverine flood line.

TOPOGRAPHY AND LAND USE

22. The landfill site is surrounded by paddy fields and other agricultural land (paddy field and garden) with patches of secondary low forest vegetation. Three waste recycling businesses are located along the access road to the landfill and the wider area can be generally characterized as rice cultivation farmland with urbanized strips with small and medium size industries along the road network.

HYDROGEOLOGY AND WATER QUALITY

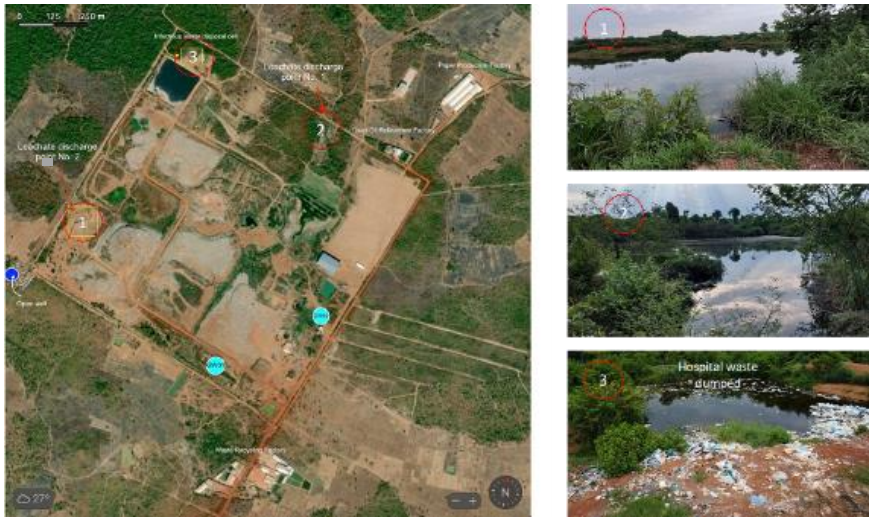
23. The site sits on sedimentary sandstone which is a good aquifer which is an important source of domestic water supply. Information on the groundwater level indicate an unsaturated zone of 5-7 m based on drillings near the site. Groundwater is widely used as the main source of water supply in the area. There are two groundwater wells on the site, and two private wells within about 500 m of the site.

24. Surface water from the site drains into the Nam Ngum River about 7.5 km from the landfill site. There are several ponds inside and near the sites, some of these serve as primary treatment ponds for leachate (see ***Figure 0-5*** and ***Figure 0-6***).

FIGURE 0-5 LOCAL HYDROLOGY



FIGURE 0-6 LEACHATE DRAINAGE FROM THE KM 32 LANDFILL



25. **Soil samples** collected near the large leachate pond on the north-western part of the VCOMS site stand out with very high concentrations of arsenic (123 mg/kg) and cadmium (27.3

mg/kg), which corroborates with the high concentrations of cadmium detected in the wastewater sample from the outlet of the pond.

26. **The surface water samples** taken within the site have high COD and BOD concentrations, indicating impact of leachate from the waste dump. Coliform bacterial counts are also high especially inside the landfill where chloride concentration is also high. A sample collected from a small pond 500 m southwest of the landfill indicated that both BOD and COD are unusually high for surface water (COD exceeds standard), and in particular the high COD would not normally be caused by agricultural activities; however, clear evidence that these high concentrations are caused by landfill activities have not been established. The level of coliform bacteria is also high (exceeding the standard) but not unusually high and may be caused by domestic animal faeces. It should also be noted that as reported by the Pre-Feasibility Study a community complaint from Nakao Village (located about 2.8 km to the north of the landfill) to VCOMS claimed that black water from the km 32 landfill had caused a reduction in their rainfed rice yield, and that farmers had experienced skin rashes when getting in contact with the water. However, clear evidence that these incidents were caused by the landfill have not been established.

27. **Groundwater** samples taken from the wells on and near the landfill also showed high total dissolved solids, high bacterial counts, and unusually high concentrations of faecal coliform. Lead concentration in one well inside the landfill is also exceed standard threshold indicating contamination from landfill. However, bacteria concentration in two wells outside the landfill showed considerable higher results than those of the inside wells. This could imply that the landfill may not be the only source of bacterial contamination in the groundwater.

28. One of the groundwater samples from inside the landfill contained 0.017 mg/L lead which exceeds the groundwater quality standard of 0.01 mg/L. The source of the lead is unknown and may include legacy waste, natural geologic background levels (although this is not supported by the other groundwater samples where lead was not detected), and corrosion of well construction materials, pumps and piping.

29. It is recommended that the full ESIA should undertake a comprehensive hydrogeological investigation.

30. The groundwater from the monitored wells inside and outside Km 32 landfill is used mainly for washing purposes. However, one household use a well as the main water supply for washing, cooking, and livestock raising.

AIR QUALITY AND NOISE

31. The air quality measurements taken from monitoring stations indicate compliance with the relevant Lao ambient air quality standards for all the monitored parameters. However, PM10 concentrations were two times higher than the WHO recommended air quality guidelines. Noise

measurements carried out in the same stations are all within government and IFC EHS guideline values.

FLORA AND FAUNA

32. The landfill site is not within or near any biodiversity conservation area. It is surrounded by rice paddies, grazing lands and patches of secondary growth forests. Domestic animals including cows, buffalos and goats roam around and inside the landfills due to broken fences in many sections. The field survey did not identify any sensitive flora, fauna, or habitats and no threatened species on the landfill site and its vicinities.

SOCIAL PROFILE

33. The landfill is situated in an area dominated by agriculture and small and medium size businesses along the access road and Road No. 13 South. The nearest village is about 2.5 km south of the landfill. A new residential area is being established about 1.4 km southwest of the landfill consisting of about 20 units, but these appear to be still unoccupied. More than 90% of the people in the villages are engaged in farming, particularly paddy rice, vegetables, livestock, and fisheries. Other income sources include small businesses, wage labour, and employment in the government.

34. The people directly affected by the project are the waste pickers and waste collectors. VCOMS has registered 264 waste pickers. They have established their camp on leased land immediately outside the landfill where they temporarily store collected recyclables (see Figure 0-7). A few of them also live in the camp. Waste collectors numbering about 113, are employees of waste collection companies as members of the collection truck crews.

FIGURE 0-7 THE WASTE PICKERS' CAMP



35. The population in the Xaythany District is composed of four main ethnic groups: LaoTai-Lao, Mon-Khmer, Sino-Tibetan, and Hmong-Iumien. Of the population in the district, 90.6%, 7.2%, and 2.2% are Buddhist, animist, or Christian, respectively. All households in the three villages near to KM32 identified themselves as Lao, which falls under the Tai-Kadai family, also being referred to as Lao-Loum. The vast majority (90%) of the population in the three villages are Buddhist, the remaining few are Animists (7.2%) and Christians (2.2%). Most of the waste pickers are Lao Tai.

PREVAILING ENVIRONMENTAL AND SOCIAL ISSUES

36. Based on interviews and dialogues with the villagers and waste pickers, the prevailing issues associated with the existing landfill operation include: (a) exposure of villagers from air pollution coming from burning waste at the landfill, causing respiratory problems especially for the elderly; (b) broken and poorly maintained fences enable farm animals to enter and feed on the waste making them sick; (d) contamination of rice fields from leachate-laden runoff during the rainy season affecting the rice crop and causing skin rashes to farmers; (e) collection trucks causing litters along the hauling routes because of overloading and absence of cover; (e) waste pickers working conditions, particularly the lack of water and sanitation facilities at the site and lack of training in handling hazardous waste; and, (f) presence of child labour among waste pickers.

POSITIVE ENVIRONMENTAL AND SOCIAL IMPACTS

37. The potential benefits of the Project will be enhanced by:

- Offering waste pickers skills and vocational training on literacy, numeracy, entrepreneurship among others to improve their livelihoods and prevent job loss.
- Implementing additional support for children and women including additional child protection measures and tangible support such as setting up social protection schemes.
- Offering opportunities for waste pickers to move into safer roles in the informal sector, into formal employment in the waste sector, and/or to access skills and vocational training for employment outside of the sector.
- Implementing interventions for improving female workers' access to jobs in the waste sector
- ensuring that Social Security (health and life insurance) is provided to all workers according to the Labour Law and the Law on Social Security before the commencement of project activities.
- improving the working conditions by upgrading the recycling facilities, providing training in waste handling, hazardous waste and by providing PPE.
- Pegging unit rates paid to waste pickers for recyclables to current market prices with deduction of a reasonable margin to ensure profitability for the appointed on-site buyer.

38. The proposed preferred design of the new landfill cells and capping of the legacy waste combined with proper implementation of the operational mitigation measures will minimise the risk to groundwater and significantly reduce the risk of pollution of surface water bodies draining the landfill site and thus prevent future adverse impacts on surface water and agricultural fields.

39. The occupational and community health and safety conditions will be improved through proper landfill operations including a complete stop for open burning of waste, daily cover of incoming waste, and reduced littering. Furthermore, the Project will contribute to reducing emission of landfill gas into the atmosphere and thereby contribute to mitigation of climate change.

40. Upon closure, the design of the final capping of the engineered landfill cells will allow a range of recreational or productive land uses such as sports, cultivation of crops and grazing for cattle, goats or other domestic animals.

ADVERSE ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS

CONSTRUCTION PHASE

41. The environmental and social impacts and risks associated with the construction works are overall assessed to be moderate, temporary, and localized; however, occupational health and safety risks are considered substantial. In any case, these risks will be effectively mitigated by conventional construction methods and standard mitigation measures.

42. The potential environmental and social risks to be addressed and mitigated include:

a) Risks related to labour management and working conditions, including (i) employment discrimination, (ii) denial of basic labour rights; (iii) unresolved labour disputes, (iv) sexual exploitation and abuse and sexual harassment, (v) child labour; (vi) accidents and injuries involving heavy equipment; and (vii) injuries and illnesses due to exposure to waste which may contain toxic agents, sharp objects, and pathogens as well as exposure to contaminated soils and dusts at construction site.

b) Community health and safety related to construction site hazards such as the movement of heavy equipment, construction dust and noise and malodour from excavating and relocating waste. Nearby residents and farmers working downwind could potentially be exposed to dust and malodour while those along the construction routes may be impacted by the construction traffic. The temporary influx of construction workers could affect nearby villages, potentially increasing incidence of substance abuse and gender-based violence and spread of communicable diseases. Although the landfill areas are outside the UXO danger zone, there may be risk of encountering UXOs at borrow pits.

c) Dusts and noise generated by construction works and project related traffic, and malodour from excavating and relocating legacy waste can affect construction workers, landfill workers, waste pickers and collectors and nearby residents.

d) Earthmoving activities may generate sediment-laden runoff at the construction site and at borrow pits potentially affecting nearby surface water bodies.

e) Impacts on flora and fauna from construction activities are considered negligible because the landfill site is already a disturbed area with waste dumped on most part to the site and there are no flora or fauna of conservation value at or near the site. However, establishing new borrow pits or spoil disposal sites may generate impacts on flora and fauna. These risks can be avoided through proper siting of borrow pits and disposal areas.

f) Sourcing of construction materials from borrow pits may involve loss of private or communal land including agriculture land and products.

g) Disruption or restrictions on recycling activities with risk of causing reduction in income of the waste collectors and waste-pickers and other groups who rely on income from the waste stream

h) Risk of spreading COVID-19, HIV and other communicable diseases to local communities.

i) Community health and safety risks and road damages due to the increased heavy traffic, including garbage trucks and construction vehicles going back-and-forth to the landfill.

j) Risk of accidents involving children and vendors working close to the access road.

k) Risk of impacts on potential heritage assets or values including discovery of artifacts or relics during operation of borrow pits.

OPERATIONAL PHASE

43. The environmental and social impacts and risks associated with the operations of the proposed project activities at Km 32 landfill are assessed to be substantial; however, the risks are increased to high when taking into account (i) weak legal and institutional capacity on waste management; and (ii) the existing waste at the Km 32 Site and associated legacy risks and impacts. The potential operational phase environmental and social risks to be addressed and mitigated include:

a) Risks related to labour management and working conditions, including risk of (i) employment discrimination, (ii) denial of basic labour rights; (iii) unresolved labour disputes, (iv) sexual exploitation and abuse and sexual harassment, (v) accidents involving fire and explosion of landfill gas and accidental spills of hazardous waste and leachate; (vi) health risks from exposure to flies and other vermin attracted by the future incoming waste.

b) Risk of groundwater pollution from leachate leaking through liner systems in the new landfills cells, the cell for relocated waste or the leachate regulation pond.

c) Pollution of surface water by uncontrolled discharge of leachate or seepage from waste piles due to improper landfill operations impacting on agricultural production, aquatic flora and fauna, and human health.

d) Pollution of the ambient air due to burning of waste, dust from handling of waste and daily traffic, malodour from decomposing waste, and emission of landfill gas including greenhouse gasses.

e) Community health and safety risks due to exposure of the waste pickers including children among the waste pickers to flies and other vermin attracted by the future incoming waste and to sharps and other hazardous items in the waste.

f) Health and safety risks for communities along the hauling route due to accidents involving daily waste truck traffic.

g) Impacts to property values and aesthetics of nearby areas.

h) Risks of impacts on the waste pickers' livelihoods will likely be insignificant as the waste pickers will have access to segregating the recyclables from the incoming waste at the waste reception area. The previously proposed investments in recycling facilities at the Km 16 and Naxaythong transfer stations have subsequently been dropped and the earlier concern that these investments would cause a reduction in recyclables arriving at the Km 32 landfill site and thus potentially cause a reduction in the income of waste collectors and waste pickers, is therefore no longer expected to materialise. However, the waste pickers have noted a reduction in recyclables due to unsorted waste collected by VCOMS/Small B is being directed to the VWMC RDF plant, whereas pre-sorted waste containing less recyclables is delivered to the VCOMS site by private companies. During the consultations, VCOMS responded that they will address this concern so that at least 50% of VCOMS' and Small B's waste trucks are directed to the VCOMS site.

POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS ASSOCIATED WITH THE LEGACY WASTE AT THE VCOMS SITE

44. It is estimated that the area where waste has been dumped on the VCOMS site is about 47.8 ha roughly corresponding to about 533,000 m^3 of legacy waste of which about 156,000 m^3 is proposed to be relocated onsite in Cell 5 to make space for the proposed two new landfill cells. On the VWMC site, it is estimated that waste has been dumped on about 8.8 ha corresponding to roughly 95,000 m3 of legacy waste. Waste continuing to arrive at the landfill until the new landfill cells come into operation will increase the legacy waste with about 100,000 to 200,000 m^3/year. It should be noted that these estimates are associated with considerable uncertainties, and it is recommended that the full ESIA should include detailed field survey to draw-up a reasonably accurate map of the lateral and vertical extent of legacy waste on the entire landfill site.

45. The legacy waste includes hospital waste (mostly COVID-19 related waste) dumped around the pond on the north-western part of the site. According to information from VCOMS this amounts to about 432 tons of hospital waste.

46. There are four ponds on the landfill site (two on VCOMS site and two on VWMC site that likely contain polluted water and possibly polluted sediments.

47. The key potential environmental and social risks and impacts associated with the legacy waste and legacy wastewater include:

a) Historic and ongoing infiltration of polluted leachate from the legacy waste at both the VCOMS site and the VWMC site pose and will, if not mitigated, continue to pose significant long-term risks to the regional groundwater resources that are currently or may in the future be used for domestic water supply, and which is therefore an important resource for long-term water supply.

b) Significant long-term risk of contamination of surface water in streams and ditches receiving drainage from the landfill site and its ponds potentially polluted by seepage from the legacy waste. In the area where hospital waste has been dumped at the leachate pond in the north-western part of the VCOMS site, high concentrations of cadmium and arsenic were detected in a soil sample and a water sample from the pond outlet contained elevated levels of cadmium.

c) Surface water contamination may affect the productivity and quality of rice production and other agricultural production in the surrounding fields; and may also pose a risk to the health of farmers, domestic animals and wildlife in the area nearby Km 32 landfill; and may in general render the water resources in the affected streams unusable. As reported in the Pre-Feasibility Study, residents in Nakao Village (located about 2.8 km north of the landfill) have complained that black water from the km 32 landfill had caused a reduction in their rainfed rice yield, and farmers have experienced skin rashes when getting in contact with the water. However, clear evidence that these incidents were caused by the landfill have not been established.

d) Pollution of the ambient air due to burning of legacy waste, malodour from decomposing legacy waste, and emission of landfill gas including greenhouse gasses. Smoke and bad smells from frequent burning from the current landfill operation has also been reported as concern from nearby residents. These risks would likely be long-term, moderate in magnitude and occurring within a radius of 2-3 km from the Km 32 landfill and thus possibly affecting nearby villages.

e) Potential fire hazards due to inadequate measures to capture landfill gas.

f) Health and safety risks of waste pickers and landfill workers from exposure to polluted leachate, and flies and other vermin attracted by the legacy waste.

g) Impacts on the livelihoods of the waste pickers due to the proposed capping of the legacy waste is likely insignificant as recyclable items in the legacy waste currently on the landfill site most likely already have been removed by the waste pickers, and during the construction phase, the waste pickers will be provided with access to the incoming waste at the waste reception area.

h) Contribution to climate change by fugitive emission of greenhouse gases (methane and carbon dioxide) in landfill gas generated by decomposing organic waste.

CLOSURE PHASE

48. The most relevant closure phase risks and impacts to be addressed and mitigated include:

a) Exposure to waste by people or animals.

b) Spread of diseases by vectors and vermin.

c) Odour nuisances, windblow litter and risk of fire.

d) Breach of capping and ponding in depressions leading to increased infiltration and increased generation of leachate, erosion and crop death.

e) Uncontrolled use of the land incompatible with the design of the caps or the integrity and stability of the cells.

f) Risk of pollution of surface water by leachate or seepage from waste impacting on agricultural production, aquatic flora and fauna, and human health.

g) Risk of groundwater contamination due to failure of the liner and the leachate collection and treatment system. The likelihood of liner failure may increase over time as the liner weakens but over time, the strength of the leachate will likely decrease.

MITIGATION MEASURES

PRE-CONSTRUCTION PHASE

49. Recommended **Design Element** In addition to the analyses of the key alternative landfill design elements and the identification of the preferred options, it is further recommended to take the following design recommendations into account when developing the final detailed design of the project:

- Adoption of a simple pond and wetland system to treat leachate instead of the proposed UASB and rotating disc technology which requires power and could easily breakdown.
- Inclusion of a leachate recirculation system to minimize discharge of treated leachate to the environment and to accelerate waste decomposition and reach the stabilization phase earlier.
- To minimize the volume of leachate that goes into the leachate treatment system, the leachate collection system should be designed such that rainwater from the inactive parts of a cell are collected and discharged separately as clean stormwater and only waste-leachate are conveyed into the leachate treatment unit. Each section of a cell should be

equipped with an interchangeable pipe system that can switch between discharge to stormwater and the leachate transport system.

- Assurance that operator's errors/non-compliance with operating protocol cannot result in switching leachate into the proposed "clean stormwater" discharge and discharging it untreated.

50. The Project will commission a full scale ESIA study in conjunction with the detailed engineering design of the project. The ESIA report shall be reviewed and approved by the MPWT, World Bank and finally by MONRE for issuance of an Environmental Compliance Certificate. The final ESIA shall also cover the PWMP investments in the Km 16 and Naxaythong sites. The local communities and other stakeholders shall be informed and consulted regarding the findings of ESIA study. It is also likely that a Health Impact Assessment will have to be carried out in conjunction with the ESIA studies.

CONSTRUCTION PHASE

51. The contractor will be required to prepare a Contractor's Environmental and Social Management Plan (CESMP) based on the recommended measures in the final ESIA. The CESMP shall address environmental impacts of construction activities such as localized erosion and sedimentation, generation of noise and vibration, generation of dusts, generation of construction wastes, and domestic wastes at labour camps. The CESMP shall also include the contractors' plan for sourcing of borrow material, and acquisition of sites and easements and the required government clearances (including UXO clearance) for its temporary facilities such as labour camp, workshop and laydown areas, borrow pits, and spoil disposal sites (if any). The PMU will review and approve the CESMP with support from the supervision firm to ensure consistency with the ESF instruments.

52. To address labour management-related risks, the contractor will be required to prepare a labour management plan and an Occupational Health and Safety Plan. These plans shall address potential issues of employment discrimination, ensures access to a grievance redress mechanism, minimises the risks of sexual exploitation and abuse and sexual harassment in the workplace, prevents child labour, ensures occupational health and safety and other requirements in compliance with the World Bank ESS 2, the Lao Labour Law and ILO conventions ratified by the Lao PDR.

53. To manage potential social impacts related to labour influx such as increase in substance abuse, increasing incidences of sexual harassment, gender-based violence, and spread of diseases, the Project will promote local recruitment of workforce and require the contractor to adopt a Workers' Code of Conduct. The Project will also provide awareness training through third party service providers, on sexual exploitation and abuse and sexual harassment, substance abuse, gender-based violence, and prevention of disease transmission.

54. The Project will enforce speed limits on all project vehicles especially in populated sections of the construction routes. Throughout the construction period, the contractor will be required to undertake regular repair and maintenance works on roads it frequently uses.

55. To minimize the risk of damage to ecologically sensitive areas and damage to cultural properties and chance finds of artifacts at borrow pits, the contractor will be required to apply the Negative List, undertake ES Screening on prospective sites based on the ESMF and develop and monitor the implementation of site-specific management plans as part of the CSEMP. The contractor shall also adopt a chance find procedure for archaeological artifacts.

56. To mitigate possible disruption or restrictions on recycling activities of waste pickers due to construction work, the Project will encourage contractors to hire the waste pickers as laborers in the construction, and the construction work will be scheduled to ensure that the waste reception area is made ready for use as early as possible.

OPERATIONS PHASE

57. ***Operations and Maintenance Manual***. An Operations and Maintenance Manual to be support under Sub-component 2A should also contain the following guidelines and procedures: (a) Procedures for compacting waste; (b) Controlling and minimizing windblown waste (c) procedures for handling of non-hazardous waste; (d) Procedures for controlling and recording waste disposed of at the landfill, including origin, quantity, type of waste, collector; (e) Operational procedures for leachate management (f) Procedures for handling of hazardous waste including determining if the waste is acceptable for temporary storage in the hazardous waste storage facility, transportation, labelling, temporary storage, separation according to their type and risks, and permanent disposal - in line with local and international regulations; (g) Pest management procedures (h) Occupational health and safety measures and use of PPEs; (i) Community relations and health and safety plan; and (j) Emergency response plan.

58. ***The*** PMU and the landfill operator should conduct on-the-job training on the Operations and Maintenance Manual.

59. ***Groundwater pollution.*** The risks of groundwater pollution from leachate leaking through the bottom of the new waste cells will be minimised through installation of composite liner systems combined with leachate collection and treatment systems.

60. ***Surface water pollution.*** The risks of surface water pollution from leachate-laden runoff or discharge of untreated or poorly treated leachate will be minimised through leachate collection and treatment systems, stormwater site drainage, and implementation of proper landfill operations including regular inspection, maintenance and repair of structures and leachate treatment facilities, and separation and safe isolation of hazardous waste.

61. ***Air pollution.*** The risks of air pollution from open burning of waste, malodour emissions by decaying organic waste and dust from handling of waste will be effectively minimised through implementation of proper landfill operations including regular soil cover of waste, landfill gas capture, and construction and maintenance of a perimeter fence.

62. Livelihood ***impacts***. To mitigate any impacts of the operation of the new engineered landfill cells to the livelihood of waste-pickers and seasonal recyclers whose access to the recyclable waste may be reduced, the project will: (a) provide opportunities to waste pickers to work at the new waste management facilities at km 32, and at km 16 and Naxaythong sites; (b) offer waste pickers skills and vocational training on literacy, numeracy, entrepreneurship among others to improve their livelihoods and prevent job loss; (c) improve their working conditions by upgrading of the existing recycling facility and the waste reception area, providing training in waste handling, hazardous waste and providing PPE.

63. In addition, to address the concern raised by waste pickers that unsorted waste collected by VCOMS/Small B is being directed to the VWMC RDF plant next to the VCOMS site, whereas pre-sorted waste containing less recyclables is delivered to the VCOMS site by private companies, VCOMS has arranged that at least 50% of VCOMS' and Small B's waste trucks be directed to the VCOMS site. The risk of impacts on the livelihoods of waste pickers and waste collectors is therefore considered minor but it is something that needs to be closely monitored during project implementation.

64. Community ***health and safety***. Community health and safety risks include risk of accidents involving vendors and children close to the access roads, and community exposure to dusts, noise, smells, litters, water pollution and road safety issues. VCOMS has rehabilitated the access road in December 2022. To further improve road safety, it is recommended to enforce a speed limit of 20 km/hour and provide adequate sidewalks and road signs.

LEGACY WASTE MITIGATION MEASURES

65. The Project design includes full rehabilitation of the legacy waste on both the VCOMS site and the VWMC site. Legacy waste on VWMC will be relocated and treated at the VCOMS site. This will be further explored during the detailed design.Key environmental and social mitigation measures to deal with the legacy waste include the following:

66. ***Health and safety***. The risks to waste pickers' and landfill workers' health and safety due to exposure to landfill leachate from the legacy waste and infectious diseases from vectors attracted by the legacy waste are proposed mitigated through the following measures: (i) Capping of the current legacy waste early in the construction phase, (ii) early construction of the waste reception area to ensure that sorting of incoming waste during the construction phase can take place under proper and safe conditions, (iii) physical zoning and access control to tipping

areas, (iv) regular compaction and soil cover of waste after the waste pickers have segregated recyclables at the waste reception area.

67. ***Groundwater pollution.*** The risk of future groundwater pollution from leachate seeping into the subsoil underneath the legacy waste will be minimised through installation of a final cap based on the preferred design option on the legacy waste dumps on both the VCOMS site and the VWMC site. The cap is designed to minimise infiltration of rainwater and thus generation of leachate.

68. ***Surface water pollution.*** The risks of surface water pollution from leachate-laden runoff or seepage from the legacy waste will be minimised through installation of the preferred final cap and by regular inspection and aftercare of the cap. The cap is designed with a drainage layer between the topsoil and the infiltration barrier which will drain clean water to the surrounding stormwater systems. In addition, subject to further detailed investigations and analyses during the full ESIA studies, it is proposed that the ponds on both the VCOMS site and the VWMC site that likely contains polluted water and possibly polluted sediments should be remediated. It is proposed that these ponds be dewatered, and depending on water quality test results, the water may either be reused e.g. for dust suppression or conveyed for treatment in the new leachate treatment facility. Any polluted sediment to be deposited in the new landfill cells or depending on the nature and severity of the contamination, be built in under the legacy waste caps.

69. ***Air pollution.*** The risks of air pollution from open burning of waste, and malodour emissions by decaying organic waste will be effectively minimised through the installation of the preferred final cap on the legacy waste. In the interim period until the proposed new landfill cells come into operation, incoming waste will be compacted, build into regular cells and provide with regular soil cover.

CLOSURE PHASE

70. Operational and Maintenance Manuals to be prepared under the PWMP project TA will include closure plan for Km32. The preparation of the closure plan shall include consultations with landfill staff, waste pickers, local authorities and MONRE.

71. The key closure phase mitigation measures include:

(a) Access control to ensure that waste is not received for disposal at the site/cell after landfill operations cease

(b) Inspection and aftercare of the leachate collection and treatment systems, stormwater drainage systems and gas ventilation system.

(c) Inspection and aftercare of the final cap and vegetation cover including repairing effects of erosion, slumping and settlements.

(d) Inspection and monitoring of landfill gas generation/migration, odour, dust and litter.

CUMULATIVE ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS ASSOCIATED WITH THE LEGACY WASTE AT THE VWMC SITE AND VWMC'S ACTIVITIES AND RECOMMENDED MITIGATION MEASURES

72. Over the years since the start of operations at the Km 32 landfill, waste has also been dumped on the 30 ha large area on the north-eastern part of the landfill. This area was leased to the VWMC in 2011 under a concession agreement.

73. The preliminary assessment of cumulative environmental impacts has been undertaken with respect to the following resources/receptors:

- Regional groundwater resources.
- Surface water in streams and creeks draining the landfill into paddy fields, other agricultural land and fishponds surrounding the landfill.
- Residential environments within a radius of 2-3 km of the landfill.
- Landfill workers including VCOMS and a landfill operator company employees and waste pickers.
- Commercial and business enterprises within a radius of 2-3 km of the landfill.

The results of the preliminary assessment of cumulative environmental impacts are summarized below:

Cumulative Risks and Impacts	Cumulative Impact Assessment
Regional groundwater resources: • Risk of leakage from the Km 32 Landfill Project waste cells into groundwater. • Risk of leachate leaking through the bottom liner placed in Cell 5 and the leachate pond. • Past infiltration of landfill leachate from existing waste dumps and leachate ponds. • Future infiltration of leachate from capped legacy waste on the VCOMS	• Considering the implementation of the Km 32 Landfill Project with the preferred design including capping of all legacy waste and remediation of the ponds on both the VCOMS site and the VWMC site; and the proposed mitigation of groundwater risks from VWMC's activities, the cumulative risks are assessed to be reduced to an acceptable level. • In addition, Component 1 under PWMP will establish a coordination mechanism among VCOMS, VWMC, MPWT, MONRE

site and the VWMC site contaminating the groundwater • Risk of groundwater pollution from VWMC's waste storage areas or wastewater ponds.	and PONRE to address environmental, social and health and safety issues. There remains a risk that the legacy waste may already have contaminated the groundwater. The significance of this risk should be investigated and assessed under the full ESIA study
Surface water in streams and creeks draining the landfill: • Risk of occasional discharge of non-compliant effluents (leachate) from the Km 32 Landfill Project to channels that are used for irrigation or flow into fishponds. • Discharge of contaminated surface water from the Km 32 Landfill Project • Historical and ongoing discharge of leachate from leachate ponds and contaminated surface runoff from legacy waste dumps and leachate ponds on the VCOMS Site and the VWMC site into channels that are used for irrigation and into fishponds. • Risk of surface water pollution from VWMC's waste storage areas or wastewater ponds. • Potential discharge of untreated wastewater from factories along the access road (no information)	• Considering the implementation of the Km 32 Landfill Project with the preferred design including capping of all legacy waste and remediation of the ponds on both the VCOMS site and the VWMC site; and the proposed mitigation of surface water pollution risks from VWMC's activities, the cumulative risks are assessed to be reduced to an acceptable level. • In addition, Component 1 under PWMP will establish a coordination mechanism among VCOMS, VWMC, MPWT, MONRE and PONRE to address environmental, social and health and safety issues.
Landfill workers, waste pickers, residential environments and businesses within a radius of 2-3 km of the landfill: • Risk of emission of odours and air pollution form landfill fires at the Km 32 Landfill Project.	• Considering the implementation of the Km 32 Landfill Project with the preferred design including capping of all legacy waste on both the VCOMS site and the VWMC site, and proper implementation of landfill operation and maintenance; and

• Risk of spread of infectious diseases from vectors at the Km 32 Landfill Project. • Littering along the access road. • Ongoing emission of malodours and air pollution from landfill fires due to legacy waste and leachate ponds on the VCOMS Site and VWMC site. • Ongoing risk of spread of infectious diseases from vectors from legacy waste and leachate ponds on the VCOMS Site and the VWMC site. • risk of air pollution from VWMC's activities • Risk of accidents, road damage, dust, waste spillage from VCOMS and VWMC related transport.	the proposed mitigation of air pollution risks and risks of accidents on the access road from VWMC's activities, the cumulative risks are assessed to be reduced to an acceptable level. • In addition, Component 1 under PWMP will establish a coordination mechanism among VCOMS, VWMC, MPWT, MONRE and PONRE to address environmental, social and health and safety issues.

ENVIRONMENTAL AND SOCIAL MONITORING

74. The Project will implement comprehensive environmental quality and social monitoring programmes over the course of the project development and implementation phases from pre-construction, through construction, operation and closure of the landfill cells. The environmental quality monitoring at the site and its immediate surroundings aims at obtaining reliable data to determine and assess project related impacts and the need for any corrective actions.

75. During the pre-construction phase the environmental monitoring will be carried out under the full ESIA study to establish a robust baseline and will include air and noise monitoring, surface water quality monitoring of water bodies receiving drainage from the landfill, analyses of soil samples inside the landfill and from agricultural fields next to the landfill, monitoring of aquatic life in the receiving water bodies, indications of impacts on crops in nearly fields, monitoring of leachate and monitoring of groundwater in existing groundwater wells near the landfill. The social monitoring will comprise a baseline census and socioeconomic survey, monitoring of grievances and recording of results of consultations with potentially affected people and beneficiaries.

76. During the construction phase the environmental quality monitoring will include monitoring of noise and air quality, surface water quality monitoring, monitoring of aquatic life

in the receiving water bodies, indications of impacts on crops in nearly fields and monitoring of groundwater quality and groundwater table from newly constructed monitoring wells.

77. The social monitoring during the construction phase will comprise complaints from workers and local authorities and surrounding communities, compliance of workers' welfare facilities with World Bank standards, workers or waste pickers (with gender, age and ethnic groups segregated data) hired for construction activities at the worksite, safe working conditions and use of PPE and occupational health and safety statistics for construction workers and waste pickers, and child labour, and compliance with the Lao Labour Law and ESS2 including gender and worker discrimination, and unfair wage or salary.

78. During the operational phase the environmental quality monitoring will include monitoring of untreated and treated leachate, surface water quality in the water body receiving treated leachate, monitoring of aquatic life in the receiving water bodies, indications of impacts on crops in nearly fields and monitoring of groundwater quality and groundwater table, and monitoring of landfill gas and odour. In addition, the integrity and maintenance status of the landfill facilities and infrastructure will be inspected.

79. The social monitoring during the operational phase will comprise complaints from workers and local authorities and local residents associated with the operation of the landfill, number of workers or waste pickers (with gender, age and ethnic groups segregated data) hired for operations at the landfill and its facilities, safe working conditions and use of PPE, occupational health and safety statistics for landfill workers and waste pickers, child labour, gender and worker discrimination, and unfair wage or salary, social conflicts between the labour and waste pickers, SEA/SH and VAC and use of weapon/violence related to drug and alcohol consumption of the waste pickers, amounts and types of recyclables collected and sold, demography, and welfare and socioeconomic status of the waste pickers and waste collectors.

80. During the closure phase the monitoring will include leachate quality, groundwater and methane gas, and the land use, integrity of the landfill cell caps, vegetation cover, and drainage lines will be inspected. A full E&S monitoring program will be further developed in a full ESIA that will be prepared during the detailed design phase.

1 PROJECT BACKGROUND

81. The Lao People's Democratic Republic achieved rapid growth and significant poverty reduction between 2005 and 2020, though inequality widened. COVID-19 is placing an added economic burden on the country. Economic growth declined to 0.4 percent in 2020, the lowest level in three decades.

82. Due to the increasing urbanization in Vientiane and secondary cities and despite improvements, cities and districts suffer from lack of infrastructure and municipal services. City limits have been expanded but often in the absence of spatial planning and urban development planning. The continued growth of the cities will require higher levels of infrastructure and municipal service levels, which are currently facing underinvestment together with weak institutional capacity in policy, planning implementation and enforcement.

83. Lao PDR has been shifting its development trajectory to a green growth path that is more resilient, inclusive and sustainable. Key policies have been put in place that aim to reduce pollution and the high cost it places on human health and economic growth. The National Green Growth Strategy 2030 prioritizes policy and investment action on renewable natural resources; pollution and waste management; environmental fiscal instruments; and others that can drive the circular economy. The proposed project would build upon these achievements and support the GOL by increasing its implementation capacity to address a range of environmental issues, including pollution and waste management.

84. Solid waste generation has increased substantially over the years. Sound waste data is missing in the country and is often inconsistent and unverifiable. Waste generation is rapidly increasing in cities and towns due to urbanization, economic growth and changing lifestyles, as well as in tourism hotspots which have seen rapidly increasing numbers over the last decade. During the last decade, household waste generation is estimated to have almost doubled in Vientiane (around 0.80 kg per person per day), same as in the previous decade. As in many other developing countries, the major portion of municipal waste generated in Lao PDR is composed of organic materials. Food, garden, wood and green waste makes up 57 percent of the waste while dry recyclables such as glass, plastics, metal, paper and cardboard account for 22 percent of the waste.

85. Solid waste collection and disposal are inadequate. Waste collection in the country is largely limited to the urban centres but remains at low levels. While no accurate figures exist, it is estimated that in Vientiane city only around 30-50% of the waste generated, and only about 25% of household waste, is collected and transported to the landfill sites. Similar figures are estimated for secondary cities such as Savannakhet, Luang Prabang and Champassak. Due to the lack of appropriate collection systems, open burning, household burying, littering along roadsides and rivers, and dumping in vacant lands are widely spread practices in both urban and rural areas. Illegal dumpsites are also common in urban areas. Open waste burning contributes to respiratory infections for urban residents resulting in significant health damages and lost working days, and further aggravates the severe air pollution in the country. Poor and

vulnerable populations are the most likely to suffer from inadequate sanitation due to uncollected waste, which can be a heavy financial burden through health-related expenditures and lost productivity.

86. Even when solid waste is collected, disposal at open waste dumpsites cause severe environmental pollution. While the amount of solid waste generation has substantially increased, the infrastructure for collection and sanitary disposal has not kept up with the demand, causing significant environmental problems. Landfills in Lao PDR are usually operated as open dumpsites without proper waste and leachate treatment, with the landfills of Vientiane or secondary cities such as Luang Prabang or Savannakhet being no exception. Waste dumping is done without compaction and disposal planning. Toxic waste components are contaminating surface and groundwater, including of adjacent farmland. Uncollected methane significantly contributes to national greenhouse gas emissions and results in a high risk of landfill fires.

87. Women and children in the informal waste sector face multiple disadvantages and are exposed to health and social threats posed by inadequate solid waste management. Their contributions to recovery and recycling of valuable plastics in the face of underdeveloped formal waste management systems are largely overlooked and unsupported. Improving the management of waste collection systems must consider the informal sector, where substantial amount of waste pickers are women, and work in hazardous and unsanitary environments without adequate protection and safety.

88. Plastics pollution is an increasing concern in the country. The amount of plastic waste is continuously increasing particularly in urban areas and often remains uncollected. In Vientiane, plastics constitute around 12 percent of the total waste stream. In a series of studies, the priority plastic items ending up in the environment and waterways were identified as: drinking bottles; caps and lids; bags; cups; food containers; and straws. In major cities such as Vientiane, Savannakhet, and Pakse, plastic waste is a key factor in blockage of drainage systems causing sudden flooding during rains. In key tourism hotspots such as Luang Prabang or Vang Vieng, widespread plastics littering poses a substantial threat to the touristic value. Fishers throughout the country report catching plastics almost every single time they are out fishing, and a study at the largest marshland of Vientiane found high amounts of microplastics in fish, surface water, and sediments. In addition, burning of plastics is widespread, contributing to air pollution and causing respiratory health issues. Lao PDR has seen an almost 10-fold increase in plastic waste imports from 2018 to 2019 due to the recent import regulations by China and other countries in the region. The quality and recyclability of the waste imports are unknown, and the capacity to cope with the large amounts of plastic waste in Lao PDR is not present.

89. Improved environmental, pollution and solid waste management is emerging as a priority for the GOL, as pollution deriving from inadequate waste management and other sectors becomes increasingly apparent and costly. These efforts are reflected by the adoption of the Green Growth Strategy 2030 which puts environmentally sustainable development at its core, as well as by the 9th National Socio-Economic Development Plan 2021-2025 currently under development, which promotes circular economy to reduce dependence on natural resources and reduce waste amounts. In 2019, the GOL signed the Bangkok Declaration on

Combating Marine Debris jointly with ASEAN members which was a signal of the GOL's commitment to supporting regional efforts to reduce marine plastics pollution.

90. However, a clear institutional and specific regulatory framework for solid waste management is missing. At the national level, two main bodies are responsible for issues related to solid waste management: The Ministry of Public Works and Transport (MPWT), mainly responsible for construction of infrastructures, and the Ministry of Natural Resources and Environment (MONRE), tasked with a regulatory, supervisory and supporting role. The specific responsibilities of different central governmental agencies are however not clearly defined. MONRE's main tasks and responsibilities include the preparation of environmental laws and regulations, however few of these specifically target the solid waste sector. Urban Development Administrative Authorities (UDAAs), at provincial level are the main bodies tasked with solid waste management issues but undefined responsibility at the national level affects solid waste management at the local level in policy implementation, budget allocation, and provision of services.

91. In addition, regulatory oversight of solid waste management is limited, and local governments (LGs) lack capacities for solid waste operations. Solid waste services are often outsourced to the private sector with limited financial sustainability of operations. While the responsibility for solid waste management lies with the province, UDAAs are not equipped with sufficient budget and staffing to provide the regulatory oversight and services required. UDAA's do not receive public funding from the government for solid waste management and generate revenue through waste collection and landfill tipping fees which are spent for O&M. Many UDAAs outsource (part of their) waste collection and disposal to private companies while sometimes also running direct operations in selected service areas. For example, in Vientiane around 10 collection companies currently operate in addition to UDAA's own collection services. Services are however hampered by the general (i) lack of performance benchmarks and key performance indicators in the contracts and lack of regulation, monitoring and reporting; and (ii) a lack of financial sustainability to extend services. Typically, waste fee collection is the responsibility of the provincial governments, who use the revenues for payment of services. In Lao PDR, waste collection companies collect fees directly from households typically upon collection of waste. There is no enforcement mechanism for households to pay for waste services, thus resulting in low waste fee collection rates. Consequently, the collection companies limit their services to more profitable urban centers and areas with ability and willingness to pay as well as to public institutions, and the commercial sector in order to achieve cost recovery.

92. The priority challenges within the solid waste sector can be summarized as follows. (a) lack of a clear legal framework for solid waste and pollution management and policies and regulations on pollution and solid waste management; (b) lack of capacities at national level to provide regulatory oversight; (c) lack of monitoring and enforcement capacities for environmental pollution (d) local governments are in charge of solid waste management but lack of capacities for operations, monitoring and regulations; (e) lack of financial sustainability due to limited fee collection leading to partial services; (f) lack of proper treatment, recycling

and disposal infrastructure causing environmental pollution and severe health and economic impacts; (g) strong increase of single-use plastic items and widespread plastics pollution. The project will be designed to address these key challenges and priorities at both national and local levels.

2 PRE-ESIA SCOPE AND OBJECTIVE

93. The Pre-ESIA has assessed potential environmental and social risks and impacts associated with the rehabilitation and development of an engineered landfill and other waste management facilities at the existing Km 32 landfill site, Xaythany District, Vientiane Capital (hereafter called the **Km 32 Landfill Project**) proposed to be financed under Component 2B of the PWMP. The Pre-ESIA includes an Environmental and Social Management Plan (ESMP) based on the identified impacts.

94. The Pre-ESIA has been prepared by the following team of environmental and social consultants contracted by the Environmental Protection Fund of the Lao PDR:

- Mr. Peter Gammelgaard Jensen, Team leader, International Environmental Consultant
- Mr. Victoriano Macasaquit, International Social Consultant
- Ms. Khamsy Chansamai, National Social Consultant
- Mr. Khamsone Xaysomphou, National Environmental Consultant

95. As of writing this report, the conceptual design of the Km 32 Landfill Project is still preliminary and is likely to undergo changes during the final detailed design phase.

96. The Km 32 Landfill Project is part of a wider integrated waste management system proposed implemented under Component 2. This system includes establishing a new transfer station and Integrated Waste Management Facilities in Naxaythong District and upgrading the existing Km 16 Transfer Station in Xaysetha District with similar Integrated Waste Management Facilities. The location of the involved districts is indicated in ***Figure 2-1***.

FIGURE 2-1 LOCATION OF NAXAYTHONG, XAYTHANY AND XAYSETHA DISTRICTS, VIENTIANE CAPITAL



The location of the Km 32 Landfill Project and the Km 16 Transfer Station are displayed in ***Figure 2-2***.

FIGURE 2-2 OVERVIEW MAP WITH THE LOCATION OF THE KM 32 LANDFILL PROJECT AND THE KM 16 TRANSFER STATION



3 DESCRIPTION OF COMPONENT 2 WASTE AND PLASTIC MANAGEMENT INFRASTRUCTURE INVESTMENTS

3.1 THE POLLUTION AND WASTE MANAGEMENT PROJECT OR "PWMP"

97. The Government of Lao PDR through the Ministry of Public Works and Transport (MPWT), the Ministry of Natural Resources and Environment (MONRE), and the Environment Protection Fund (EPF) is working with the World Bank on preparation of a comprehensive and long-term project to support and strengthen environmental and waste management in Lao PDR.

98. The Project Development Objective is to strengthen Laos' capacity for waste and pollution management, improve municipal solid waste services in targeted areas in Lao PDR, and provide immediate and effective response in case of an Eligible Crisis or Emergency.

99. The proposed project titled "Pollution and Waste Management Project or "PWMP" comprises three interrelated components and a fourth contingent emergency response component:

- Component 1: Supporting National Policy Implementation and Capacity Enhancement
- Component 2: Waste and plastics management operations and investments
- Component 3: Project Coordination and Reporting
- Component 4: Contingency Emergency Response Component

100. Details of all PWMP Project components are presented in PWMP Project ESMF.

3.2 Overview of Component 2 Investments

101. Component 2 is divided into Subcomponent 2A and Subcomponent 2B.

3.2.1 Subcomponent 2A Capacity building for waste management planning, operation, monitoring, waste service delivery, and cost recovery at the local level

102. The sub-component will support enhancement of the waste management system in VC using an Integrated Solid Waste Management (ISWM) approach and build capacity for waste management planning, operation, monitoring, waste service delivery, and cost recovery in the Vientiane Capital. Finance will be provided under this subcomponent for:

a. Developing local regulations and strengthening capacity for waste management planning; financial and revenue management including tariff and tipping fee setting, contract management and supervision of private waste operators; and waste recycling at KM32 landfill, transfer stations and landfill operations and management.

b. Developing a waste management plan for VC that includes waste collection zones; waste collection schedules; resources management; fee structures (tariff, tipping fee); contract management; approaches for enhancing collection of tariffs and tipping fees; awareness raising and engagement with waste service users; waste facilities management; and waste data collection and regular environmental monitoring.

c. Developing operational manuals for equipment maintenance, transfer stations, composting facilities, and landfill management including site selection, standard landfill design, standard operational procedures for construction, day-to-day operation, risk management, pollution monitoring, environmental and social safeguards, and landfill closure process. The operational manual for landfill will include the long-term plan for KM32 landfill upgrading and operation.

d. Establishing a registration system of informal waste pickers at KM32 landfill and providing support for improving waste pickers' working conditions through:

   i. Vocational skills building and training, provision of protective equipment and health and safety training.

   ii. Interventions for improving female workers' access to jobs in the SWM sector described in the Gender assessment section (Annex 5) of this PAD.

   iii. Support measures for children engaged in waste picking described in Annex 3 of this PAD.

   iv. Allowing informal waste pickers to safely access incoming waste at the KM32 landfill.

e. Investment preparation for solid and plastic waste infrastructure and equipment. This will include preparation of a feasibility study and detailed design, site-specific Environmental and Social Framework (ESF) instruments, an action plan for environmental and social legacy issues, and bidding documents.

3.2.2 Subcomponent 2B Waste and Plastics Management Infrastructure Investment

103. Subcomponent 2B will finance solid waste infrastructure including, two transfer stations and composting facilities, KM32 landfill rehabilitation, necessary equipment for waste infrastructure and waste collection-related equipment such as collection vehicles for VC. This component will generate regional benefits on reduced plastics pollution due to improved collection, recovery, and disposal of

plastics waste. Investments in integrated waste management facilities and landfill rehabilitation are key project activities contributing to reduced plastics pollution (and GHG emissions) by increasing collection, sorting, treatment, recovery and recycling, and sanitary disposal ensuring no burning of plastics or subsequent plastic leakage into the environment and waterways.

104. The actual technical design and infrastructure at each project site will be determined during the detailed design in the project implementation stage. Activities under this subcomponent will:

a. Rehabilitate the KM32 landfill to extend its lifetime by at least 10 years with financing for:
   i. Civil works – capping and closing waste cells, relocation (and compacting) of existing waste, construction of new sanitary landfill cells to accept incoming waste, rehabilitating the existing leachate pond, constructing an internal access road in the landfill and regulation pond and leachate treatment facility, installing methane gas capturing pipes and leachate collection piping system, developing a waste reception area, clean-up of legacy waste in concession area, and building bathroom facilities for waste workers and upgrading of the administration office.
   ii. Equipment – a weighbridge and washing, crushing, and pelletizing equipment at the waste management community centre for informal waste workers (IWWs), a solar plant for on-site electricity generation, trucks and other equipment for landfill operation.
b. Establish the Naxaythong transfer station and composting facility (north-west of VC) with financing for:
   i. Civil works – build a waste transfer facility that will segregate organic waste, aggregate and compact regular waste for transfer to bigger waste transportation vehicles. The transfer station will also have a composting plant, administration office building, vehicle maintenance workshop and bathroom facilities for waste workers.
   ii. Equipment - weighbridge; transportation truck, wheel loader, forklift and other equipment for transfer station operation.
c. Upgrade the KM16 transfer station in Xaysettha District with financing for:
   i. Civil works - waste transfer facility for segregating organic fraction of waste, aggregate and compact regular waste for transfer to bigger waste transportation vehicles; upgrading the existing composting plant; and vehicle maintenance workshop, and bathroom facilities for waste workers.
   ii. Equipment - a weighbridge; transportation truck, wheel loader, forklift, and other equipment for transfer station operation.
d. Increase the waste collection equipment in sub-urban districts with financing for:
   i. Equipment including various size of waste collection vehicles from tricycles, waste-carts, collection bins, community collection point set-up, and waste containers.

3.3 KM 32 LANDFILL HISTORY AND CURRENT OPERATIONS

3.3.1 Background

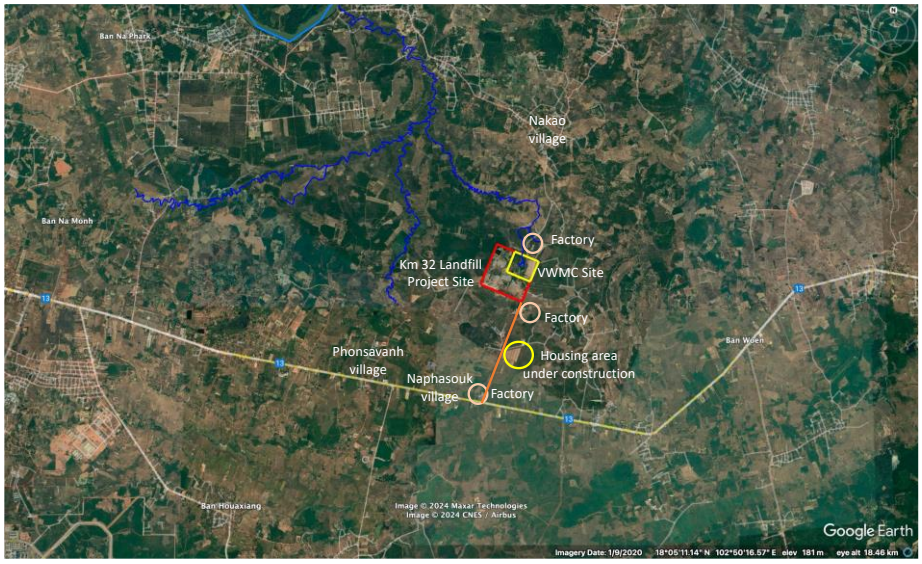
105. The rehabilitation of the KM 32 landfill, hereafter called the **Km 32 Landfill Project** is proposed to be implemented at Vientiane Capital's existing Km 32 landfill located in Ban Naphasouk, Xaythany

District, Vientiane Capital. The landfill is connected to Road No. 13 South by a 2.8 km two-lanes unpaved access road (see ***Figure 3-1***). The site is a square with 1 km long sides covering a total area of 100 ha.

106. The 100 ha landfill site is divided into two main sites:

- A 70 ha large area covering the 50 ha southern half of the entire site and 20 ha on the north-western part of the site. This site is managed by Vientiane City Office for Management and Service (VCOMS) and includes the active landfill disposal area, waste sorting operations and previous landfill cells. This site is hereafter called the VCOMS site, and it constitutes the **Km 32 Landfill Project** under PWMP.
- A 30 ha large are on the north-eastern part of the 100 ha site. This site is leased to Vientiane Waste Management Company (VWMC) under a concession agreement. The concession agreement dates back to 2011 and originally covered the 50 ha northern part of the 100 ha landfill site. The agreement was amended in 2019 and further amendments negotiated in 2023 are expected to be signed in early 2024 (see Section 3.3.3). With these amendments, the land lease will be reduced to the said 30 ha.

FIGURE 3-1 SURROUNDINGS OF THE KM 32 LANDFILL PROJECT SITE



Source: Google Earth image of 09/2020

3.3.2 Landfill Legacy Waste History

107. The gradual development of the landfill and the extent of waste dumping over the course of the landfill history from its start in 2009 until 2023 are illustrated in the historical Google Earth images displayed in ***Figure 3-2, Figure 3-3,*** *Error! Reference source not found.****Figure 3-4****,* ***Figure 3-5*** and ***Figure 3-6***.

FIGURE 3-2 GOOGLE EARTH IMAGE JANUARY 2008 INDICATING EARLY CONSTRUCTION WORKS

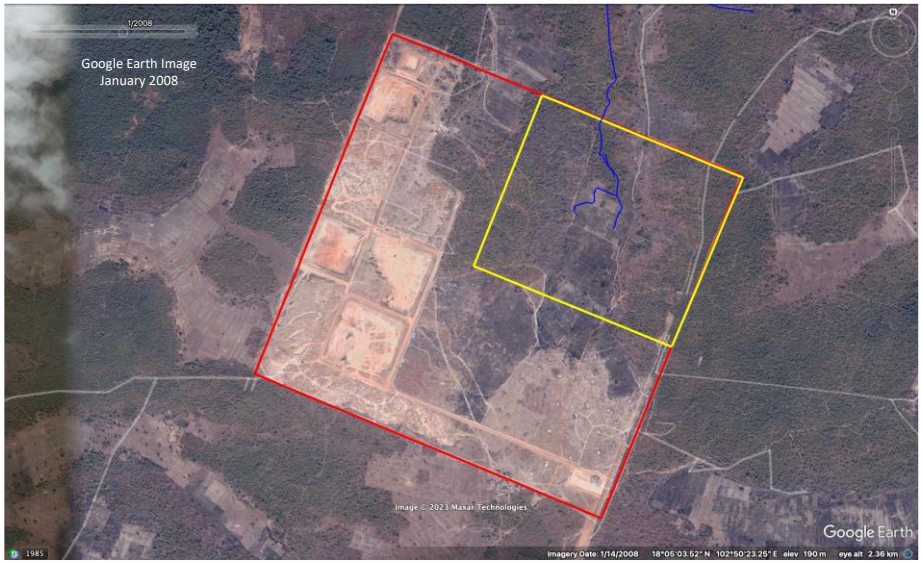


FIGURE 3-3 GOOGLE EARTH IMAGE JANUARY 2010

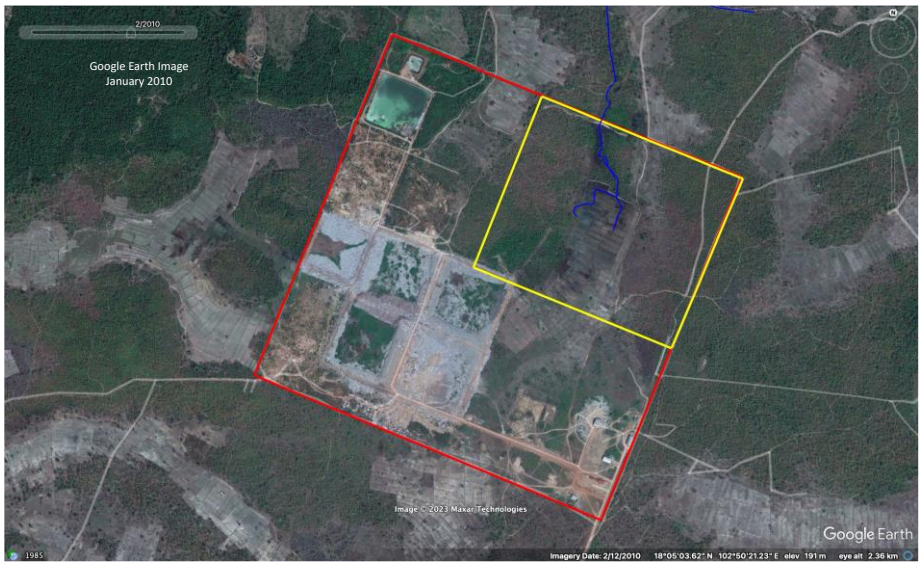


FIGURE 3-4 GOOGLE EARTH IMAGE JANUARY 2014

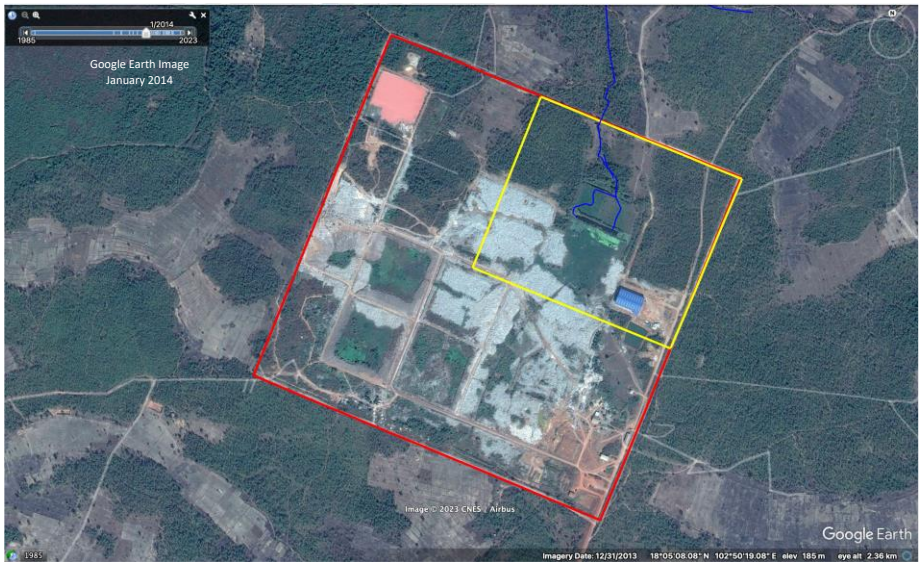


FIGURE 3-5 GOOGLE EARTH IMAGE JANUARY 2020



FIGURE 3-6 GOOGLE EARTH IMAGE JANUARY 2023



108. As indicated in the historical satellite images, waste has been dumped on both the VWMC site and on the VCOMS site. On the original 50 ha VCOMS site (the southern half of the entire area), historical satellite images indicate that waste has been dumped on roughly 35 ha. This is in the same range as estimated in the Pre-Feasibility Study (Pre-FS dated June 2022) according to which the amount of existing waste at the VCOMS site (the southern 50 ha) is 390,000 m^3 covering roughly 30 ha. On the north-western part of the VCOMS site, satellite images suggest that the area where waste has been dumped is about 12.8 ha. The total area on the VCOMS site where waste has been dumped is thus estimated to 47.8 ha (35 ha + 12.8 ha) - see ***Figure 3-7***. Assuming the same ratio of waste per ha as estimated in the Pre-FS, the amount of waste on the north-western part would be about (390,000 m^3/35ha * 12.8 ha) 143,000 m^3 and the total amount of legacy waste on the VCOMS site would be 533,000 m^3.

109. The area on the VWMC site where waste has been dumped is estimated to a total of 8.8 ha as shown in ***Figure 3-8***. This includes a 6.55 ha large area where waste was dumped up until about 2014. A large landfill fire broke out on this area some years later and according to information from VCOMS[1], the waste has been covered with soil and is currently at least partly overgrown with shrub and other low vegetation. In 2021, VWMC constructed a waste recycling facility within this area and as noted by VWMC[2], in the area where the recycling facility has been built, legacy waste is present at depths of 0.5 m to 1 m. The VWMC site also includes a 0.34 ha waste dump filled between 2018 and 2020 and a separate roughly 1.93 ha area with waste dumped by VCOMS as an emergency measure during a major landfill fire on the VCOMS

[1] Verbal information from VCOMS on 15-Jan-2024

[2] Verbal information from VWMC on 15-Jan-2024

site in early 2022. VCOMS has estimated the amount of waste to about 9,000 tons. This waste is still present on the site and has not been compacted or covered with soil. Assuming the same waste per ha ratio as for the VCOMS site and a waste density of 0.5 t/m3 for the 9,000 tons of waste dumped in 2022, the total amount of legacy waste on the VWMC site would be about (6.89 ha * 11,143 m^3/ha + 9,000 t/0.5 t/m^3) = 95,000 m^3.

110. The total area where waste has been dumped on the entire 100 ha site from 2009-2023 is estimated 56.6 ha as shown in ***Figure 3-9***.

FIGURE 3-7 AREA USED FOR WASTE DUMPING ON THE VCOMS SITE 2009-2023



FIGURE 3-8 AREA USED FOR WASTE DUMPING ON THE VWMC SITE 2009-2023



FIGURE 3-9 AREA USED FOR WASTE DUMPING ON THE ENTIRE LANDFILL SITE 2009-2023



111. The amount of legacy waste at the area where the Km 32 Landfill Project intends to construct two new cells is estimated to 156,000 m3 covering 11.45 ha.

3.3.3 Current Operations and Activities

112. The Km 32 landfill is managed by Vientiane City Office for Management and Service (VCOMS) and VCOMS has a contractual arrangement with a private company, Small B, under which the company implements waste management-related administrations, fee collection, data collection, waste collection, and landfill operation and management.

113. In 2011, the GOL signed a concession agreement with a group of investors comprising the Khonemeuang Group Sole Co., Ltd, UAC Energy Co., Ltd, and SBANG Sustainable Energies Ltd., to establish and operate waste management facilities on the 50 ha large northern half of the landfill site. The concession agreement was amended in April 2019 and further amendments negotiated in 2023 are expected to be signed within April 2024. The concessionaires have established the Vientiane Waste Management Company (VWMC) to manage and operate their activities on the site, however, besides small-scale testing of waste recycling over the course of the period since 2011, VWMC first started larger scale waste management operations after construction of a refuse derived fuel production (RDF) plant in 2023.

114. The amendments and key provisions in the concession agreement that are relevant to the **Km 32 Landfill Project** under PWMP are outlined in ***Table 3-1***.

TABLE 3-1 OUTLINE OF KEY PROVISIONS IN THE AMENDMENTS TO THE CONCESSION AGREEMENT BETWEEN GOL AND VWMC

Issue	2019 Amendment	2023 Amendment (expected to be signed in 2024)
Concession Period	• 45 years (2019-2064)	• 45 years (2019-2064)
Concession area	• 50 ha covering the northern part of the landfill site	• 30 ha covering the north-eastern part of the landfill site
Activities	Construct and operate: • Waste sorting plant • Waste to energy plant • Refuse derived fuel plant • Bio-chemical fertilizer plant • Plastic recycling plant • Water reservoirs and wastewater ponds for use in the project	• No changes
Waste sources	• Extract legacy waste at the VCOMS site for 10 years (2019-2029) • Use waste from nearby districts delivered by waste management companies contracted by VWMC	• Use waste delivered by VCOMS (140 t/day)
Waste types	• Household waste (specifically excludes industrial waste and medical hazardous waste)	• No changes

Source: Draft amended concession agreement between GOL and VWMC, 01-Dec-2023

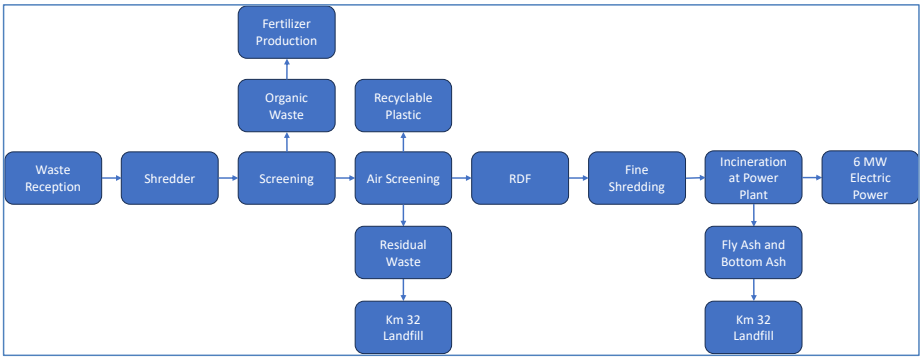
115. With the amendments to the concession agreement expected to take effect by April 2024, the VCOMS site, which constitutes the **Km 32 Landfill Project** under PWMP, includes the 50 ha southern part of the entire site and the 20 ha north-western part – in total 70 ha. The VWMC site covers the 30 ha on the north-eastern part of the site are.

116. The VWMC facilities does not fall into the definition of Associated Facilities defined in the ESF which requires that Associated Facilities are necessary for the project to be viable and would not have been constructed, expanded or conducted if the project did not exist.

117. VWMC commissioned an EIA and EMMP in 2018[3] covering the waste management facilities and activities outlined in the 2019 amended concession agreement. MONRE approved the EIA and EMMP and issued an Environmental Compliance Certificate in 2019. The EMMP was updated in 2023 and according to the updated plan, the intention is to establish waste processing facilities consisting of separation of the waste into three main types: 1) organic waste for composting and production of fertiliser, 2) plastic waste for recycling, and 3) refuse derived fuel for generation of electric power in a 6 MW waste-to-energy power plant. The process is illustrated in the simplified diagram in ***Figure 3-10***.

118. The refuse derived fuel production (RDF) plant was established in 2023, and VWMC is currently receiving about 200 t/day unsorted household waste from VCOMS for production of RDF to be sold to cement production plants.

FIGURE 3-10 DIAGRAM OF THE WASTE PROCESSING AT VWMC AS CONTEMPLATED IN THE EMMP



Source: Prepared by the Consultant based on the EMMP, VWMC Waste to Energy Project, EnviPro Consulting Co. May 2023

119. At a consultation meeting with VCOMS, VWMC and the Consultant held on 08-Jan-2024, VWMC informed that they are currently contemplating establishing a 13 MW waste-to-energy power plant based on an input of 700 t/day of unsorted household waste. 4This would replace the earlier intended waste separation and RDF production processes summarized above. A decision on this alternative is awaiting the completion of a power purchase agreement between VWMC and Electricite du laos (Edl).

[3] Environmental and Social Impact Assessment, Project on Investment to Establish the Waste Processing Plant to Generate Renewable Energy, Khouanemeuang Group Sole Co. Ltd. November 2018. Environmental Management and Monitoring Plan, Vientiane Waste Management Company Ltd, May 2023

[4] According to the feasibility study (2018), EIA (2018) and updated EMMP (2023), VWMC planned to establish a 6 MW waste-to-energy power plant based on an unput of 400 t/day of unsorted household waste.

120. The concession agreement requires VWMC to fully implement the EIA/EMMP including ensuring that the power plant will be designed and operated for continuous combustion at high temperatures to eliminate or minimise generation of toxic air pollutants (dioxins and furans) and be equipped with flue gas air emission controls which as described in the EIA/EMMP include scrubbers and bag filters to remove sulphur dioxide and particulate matter. Other environmental obligations include to establish surface runoff drainage systems, a wastewater collection treatment system, to conduct air quality and water quality monitoring and report the results to MONRE on a monthly basis.

121. According to VWMC EIA and EMMP, the waste to energy plant would generate about 15.6 t/day of ashes for disposal at the Km 32 Landfill.

122. The VCOMS landfill compound includes a controlled entrance and fence, administration office, weighbridge, waste incineration plant for medical waste, two sludge ponds, wheel-washing, storm-water ponds, recyclable plant (one active, and one disabled), and a garage, truck parking, and recyclable waste storage. The landfill has a simple barbed-wire perimeter fence but there is a lack of site security personnel to prevent incursions. VCOMS has agreed to install fencing around the landfill site. This will be important for controlling access and for preventing animals from entering the landfill.

123. The VCOMS landfill has an estimated life expectancy of 5-7 years if the rate of waste deposited at the landfill is maintained. Currently 400 tonnes of waste per day is deposited at the landfill. The VCOMs site receives about 100 dump trucks per day.

124. VCOMS has currently registered 264 waste pickers at the Km 32 landfill. A total of about 10-15 t/day recyclables (plastic, metal cans, scrap metal, paper, cardboard, glass) are being collected and sold to Thai and Vietnamese middle-companies for export and further processing.

125. The landfill is operated as an unsanitary open dump without leachate collection and treatment systems and at least until recently without regular soil covering of the waste (at a site visit on 22 December 2022, the EPF Consultant observed ongoing soil cover operations at the landfill – see Photo Documentation in Annex 1). Contaminated untreated wastewater is directly discharged to the surrounding area. Fires have occurred twice at the Km 32 landfill in the past. The most recent one occurred in March 2022 due to self-ignition from spray cans and batteries. As reported by VCOMS, measures currently implemented to prevent occurrence of landfill fire include provision of two water trucks at the site, watering of landfill 2 times/day during the dry season, establishment of 6-7 m buffer zone around the landfill to prevent fire from nearby rice fields, and smoking is prohibited (but enforcement is weak). An annual budget has also been allocated for fire prevention. The design of the Km 32 Landfill Project will also include activities to monitor site temperature at the two new waste cells by the installation of cameras (thermal/CCTV/drones) for fire protection of the site. The two nearest fire stations are located 18 km and 32 km away respectively.

126. On the north-western corner of the VCOMS site there is a large wastewater pond and as observed by the EPF Consultant during site visits, hospital waste has been dumped along the dirt road that surrounds the pond (see Photo Documentation in Annex 1).

127. The access road between National Road No. 13 South and the Km 32 landfill used by waste collection trucks is an unsealed dirt road in poor condition. Maintenance is the responsibility of VCOMS and VCOMS has also agreed to improve the access road. Good quality roads will help to reduce the wear and tear on the waste trucks, as well as reducing noise and dust. VCOMS completed rehabilitation of the access road in December 2022 and has also confirmed that annual road maintenance will be undertaken with funds from the provincial budget.

4 KM 32 LANDFILL PROJECT DESIGN

128. The description of the proposed project design is based on the Pre-Feasibility Study, subsequent revisions described in various internal workshop documents[5] and incorporating the preferred design options based on the analyses of alternatives carried out as part of this Pre-ESIA (see ***Section 4.5***). The final technical design and infrastructure at the Km 32 Landfill site will be determined during the detailed design and full ESIA in the project implementation stage.

4.1 DESIGN DEVELOPMENT

129. The early preliminary design concepts for the **Km 32 Landfill Project** were developed within certain budget constraints which also put certain limitations on the initially proposed design and the scope of landfill rehabilitation efforts with respect to the legacy waste issues. In addition, the early design concepts also took into consideration that the concessionaire of the northern part of the landfill area, VWMC, through its concession agreement with the GOL had acquired the right to the waste on the VCOMS site. Over the course of preparing this Pre-ESIA, the concession agreement has been renegotiated and VWMC's right to extract legacy waste from the VCOMS site has been removed (see ***Table 3-1***). Instead, VWMC will receive "fresh" unsorted household waste delivered by VCOMS (or waste companies contracted by VCOMS). The other main revision to the concession agreement includes the handover of the 20 ha western part of the original 50 ha concession area. The 20 ha will be part of the Km 32 Landfill Project under PWMP.

4.2 WASTE FLOWS

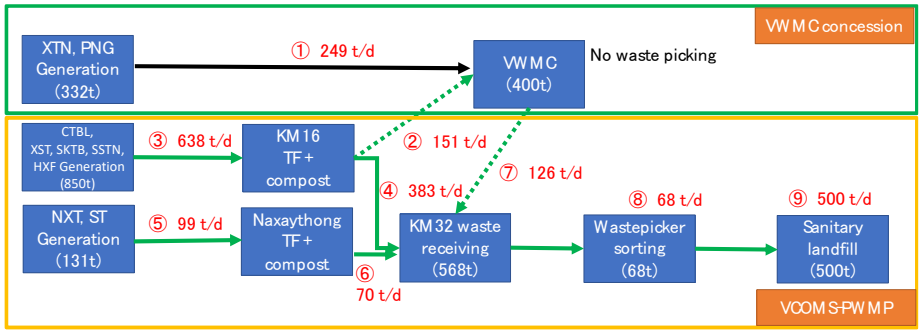
130. The service area for the Km 32 Landfill Project includes all districts in Vientiane Capital. The official collection coverage rate in Vientiane Capital is 31 percent, and according to VCOMS waste collection covers 353 villages out of a total of 481 villages in the Capital. The Vientiane Capital Administration would like to increase the coverage rate to 100 percent by 2030.

[5] The Pre-Feasibility Study on Solid and Plastic Waste Management System and Infrastructure in Lao PDR: Task 3, Review and Recommendation of conceptual design options of identified suitable investment for 3 short-listed provinces, Annex 02, Further consideration in Task 3, Chapter 2 "10-year rehabilitation of KM32 in Xaythany District";
Revisions presented in "Layout of disposal cells at KM32_21August2022.pdf"
Revisions presented in "Cross section of disposal cells at KM32_21August2022.pdf"
Revisions presented in "220831 Xaythany district (KM32)_ESF discussion.ppt"
World Bank Aide Memoire, Third Preparation Mission 04 to 18 July 2022.
World Bank draft Project Appraisal Document of 29 August 2022.

131. The investments in the Km 32 Landfill Project will be designed to ensure a design life of minimum 10 years.

132. The waste flows and amounts estimated under the Pre-Feasibility Study have been updated based on subsequent design changes for the Naxaythong transfer station and the KM16 transfer station under Component 2B of PWMP. The updated waste flows are presented in the flow diagram in ***Figure 4-1***. This diagram assumes delivery of 400 t/d of waste to VWMC. If VWMC implements the 13 MW waste-to-energy power plant, that amount would be increased to 700 t/d and the amount of residual waste (ashes) from VWMC for landfilling would be reduced to about 14 t/d.

FIGURE 4-1 WASTE FLOW DIAGRAM, 2030



Legend: XTN-Xaythany, PNG-Pak Ngam, CTBL-Chanthabuly, XST-Xaythany, SKTB-Sikhottabong, SSTN-Sissatanak, HXF-Hadxaifong, NXT-Naxaythong, ST-Santhong

Notes to *Figure 4-1:*

1. 249 t/d of waste collected from XTN and PNG districts provided for VWMC waste offtake. Waste transport approximately 30 km.
2. 151 t/d of waste provided from KM16 transfer station to VWMC for waste offtake.
3. 638 t/d of waste collected from CTBL, XSY, SKTB, SSTN and HXF is sent to KM16 transfer station. Waste transport approximately 30 km.
4. 383 t/d of compacted sorted waste is transported from KM16 transfer station to KM32 landfill. Waste transport approximately 16 km.
5. 99 t/d of waste collected from Naxaythong and Santhong is sent to Naxaythong transfer station. Waste transport approximately 30 km.
6. 70 t/d of compacted sorted waste is transported from Naxaythong transfer station to KM32 landfill. Waste transport is approximately 55 km.
7. 126 t/d of residual waste from VWMC disposed at Km 32 landfill.
8. 68 t/d of waste is sorted and recycled by waste pickers.

9. 500 t/d remaining waste to be landfilled at the Km 32 landfill.

133. According to the preliminary design contemplated in the Pre-Feasibility Study, the proposed two new landfill cells will have a capacity of 1.15 million m^3 of waste (see ***Section 4.3***), which suggests that the cells will be full after about 5 – 6 years of operation. To ensure a design life of 10 years as originally contemplated, the detailed design of the waste cells will consider and re-examine this issue and develop the necessary design changes.

134. In the Pre-ESIA it is assumed that incoming waste during the 5-year construction period from 2025 to 2029 will have to be disposed of at the Km 32 Landfill and that the disposal activities will have to be coordinated with the construction works.

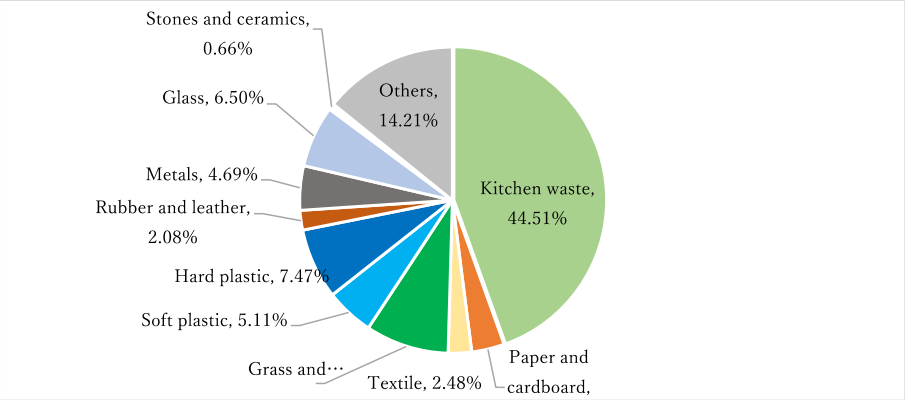
135. The Pre-Feasibility Study undertook a waste composition survey for waste collected in Naxaythong District. In summary, the survey found that the waste is composed of about 58% organic (kitchen, vegetation) waste, 18% plastic, 5% paper and cardboard, 4% glass, 2% textile, rubber and leather, 1% metals, stone and ceramics and 12% of unclassified waste types. See also the diagram in ***Figure 4-2.***

136. The Pre-Feasibility Study applies a waste reduction rate of 58% but the study does not describe the composition of the remaining 42%; however, the study includes expected recovery rates for various waste fractions at the integrated waste management facilities and based on these recovery rates it appears that the study expects that for the waste that is processed in the integrated waste management facilities, the remaining waste for landfill disposal will be composed of soft plastic, textiles, leather and rubber and other unspecified waste.

137. Although, a certain reduction in waste amounts including organic waste should be expected, it is recommended to re-examine the waste reduction rates during the detailed design due to changes in the proposed investments since the Pre-Feasibility study was prepared.

138. According to information obtained by the EPF Consultant from Small B (waste management company working for VCOMS), from October 2021 to September 2022 about 171 tons of general infectious waste and about 261 tons of COVID-19 related infectious waste were delivered to the landfill to be incinerated in the infectious waste incinerator on the VCOMS site.

FIGURE 4-2 RESULTS OF WASTE COMPOSITION SURVEY FOR WASTE COLLECTED IN NAXAYTHONG DISTRICT (PRE-FEASIBILITY STUDY, TASK 3 REPORT)



4.3 LANDFILL DESIGN, ACTIVITIES AND FACILITIES

139. The proposed preferred preliminary design of the **Km 32 Landfill Project** includes the following main activities and facilities:

1) Construction of two new engineered landfill cells covering a total area of 114,534 m^2 and with a total capacity of 1.15 million m^3 of waste. The two new cells will be constructed on the eastern part of the VCOMS site where currently Cell 10 and Cell 11 are located.
2) The preliminary conceptual layout of the landfill project is displayed in ***Figure 4-3*** and cross-sections are presented in ***Figure 4-4.***
3) The preferred design of the cells includes a composite liner consisting of a bottom low permeable clay liner (hydraulic conductivity $\leq$ 1 x 10^{-9} m/sec), a 1.5 mm HDPE geomembrane, a geotextile to protect the geomembrane against puncture and a drainage layer with leachate collection system. The conceptual design of the preferred liner system is displayed in ***Figure 4-5.***
4) The cells will be equipped with landfill gas collection and ventilation systems.
5) The cells are designated for incoming waste over a design life of 10 years. The final height of the cells will be about 16 m at El. 193 m asl.
6) When filled-up, the cells will be capped. The preferred design of the final cap consists of a topsoil (150 mm) layer, an intermediate layer (150-300 mm), a barrier layer (600 mm), and a gas collection layer (150 – 300 mm). The cap will Include gas ventilation (see ***Figure 4-6***).
7) The conceptual design superimposed on a Google Earth image is shown in ***Figure 4-7.***

8) Excavation and relocation of the existing waste in Cell 10 and Cell 11. The waste will be deposited at the existing Cell 5. Before relocating the waste in Cell 10 and Cell 11, the waste in Cell 5 will be temporarily relocated to place a composite liner with the same design as the liner for Cell 10 and Cell 11 at the bottom of Cell 5 and then redeposited together with the waste from Cell 10 and Cell 11. A final cap with the same design as the cap for Cell 10 and Cell 11 will then be installed on Cell 5. The total amount of waste to be relocated from Cell 10 and Cell 11 is estimated to 156,000 m^3. A drone photo taken in July 2022 of the current conditions at Cell 10 and Cell 11 is shown in ***Figure 4-9.***

9) Construction of a hazardous waste storage facility (900 m^2) for temporary storage. Small amounts of hazardous solid waste in the incoming municipal waste will be segregated and put in drums and the drums will be stored in a structure with roof, walls and a leak-proof bunded floor with chemical resistant pavement.

10) Construction of a leachate treatment facility (see ***Figure 4-8***). The proposed treatment system consists of a combination of an Up-flow Anaerobic Sludge Blanket Reactor (UASB) and an aerobic rotary disc system and including a regulating pond lined equipped with a composite liner of the same design as the preferred waste cell liner. The pond will have a surface area of 38,000 m^2 and a volume of 140,000 m^3. Leachate from the new landfill cells and any other leachate/seepage from the capped legacy waste will be treated in the leachate treatment facility. Sludge generated in the leachate treatment facility will be removed from time to time and deposited at the landfill[6].

11) Capping of legacy waste in cells 1-4, legacy waste on the north-western part of the VCOMS site and legacy waste on the VWMC site. The waste dumps to be regrouped and graded to ensure slope stability, proper drainage preventing ponding of water and so as not to cause erosion. Any seepage of polluted leachate on side slopes to be collected and treated in the leachate treatment facility. Provision of a final cap to be composed of: Topsoil (150 mm), intermediate layer (150-300 mm), barrier layer (600 mm), and a gas collection layer (150 – 300 mm). Installation of landfill gas vents connected to the gas collection layer. The hospital waste dumped near the pond on the north-western corner of the landfill site to be segregated and incinerated in the existing medical waste incinerator on the VCOMS site.

12) Remediation of the leachate ponds on the VCOMS and VWMC sites (three on VCOMS site and two on VWMC site). Subject to further studies under the full ESIA, the remediation will include dewatering and treatment of the water, excavation of contaminated sediment and safe disposal, possibly in one of the new cells.

[6] Based on a typical concentration of 500 mg/L suspended solids in leachate (Integrated Solid Waste Management for Local Governments, a Practical Guide, Asian Development Bank, 2017) and a leachate volume of 1,700 m3/day, this would theoretically generate 850 kg/day of sludge. However, it should be noted that it is almost impossible to predict the composition of leachate, so this needs to be studied further during the detailed design phase

13) Installation of stormwater drains system throughout the entire site to divert stormwater away from roads, landfill cells, buildings, and facilities, and to avoid mixing with leachate. This will prevent contamination of stormwater with leachate.
14) Construction of a solar power system (5,000 m^2).
15) Construction of administration building (3,200 m^2).
16) Construction of a weighbridge.
17) Construction of concrete paved internal roads (width 7 m, length 950 m).
18) Upgrading of the existing recycling facility, provision of recycling equipment and installation of a waste reception area to improve the working conditions and increase the value of recyclables.
19) Provision of separate bathroom facilities for males and females.
20) Support for waste pickers to avoid livelihood impacts and to improve working conditions including by: offering work at the new waste management facilities at the km 16 and Naxaythong; offering skills and vocational training on literacy, numeracy, entrepreneurship among others; provision of personal protective equipment (PPE); ensuring access to water and sanitation, and training on health and safety.
21) Provision of equipment for operation of the landfill including a bulldozer, an excavator, a backhoe, a dump truck and a water sprinkler truck to control dust.
22) Construction of groundwater monitoring wells.

FIGURE 4-3 CONCEPTUAL LAYOUT DESIGN OF THE KM 32 LANDFILL PROJECT

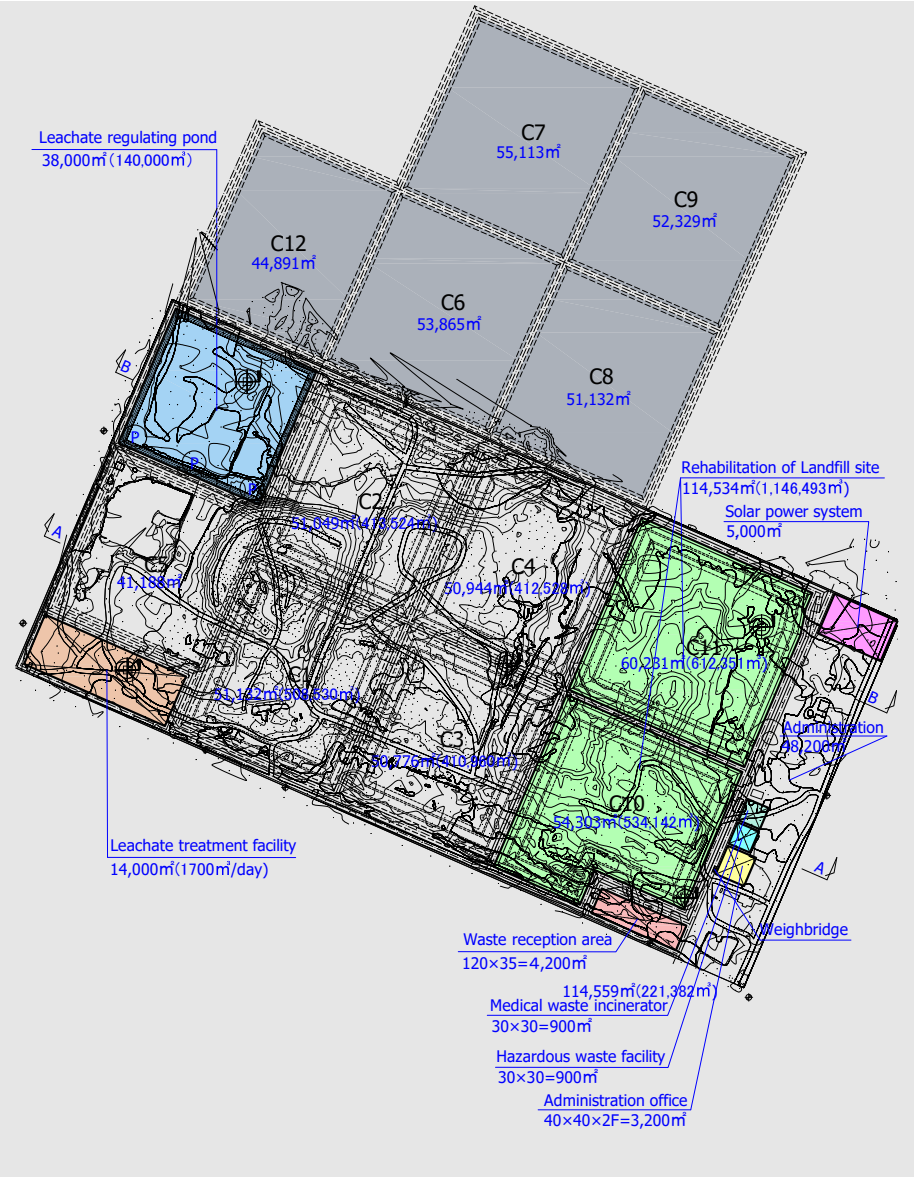


FIGURE 4-4 CROSS-SECTIONS OF THE CONCEPTUAL LANDFILL DESIGN

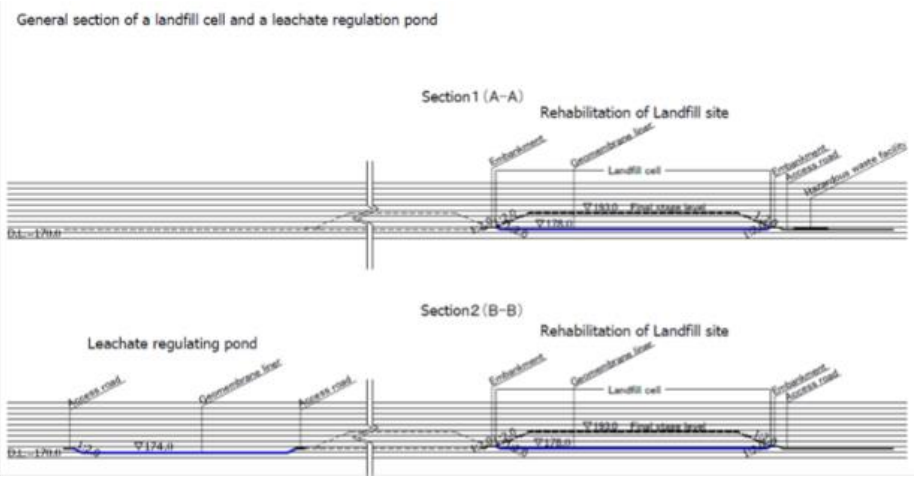


FIGURE 4-5 CONCEPTUAL DESIGN OF THE LANDFILL LINER

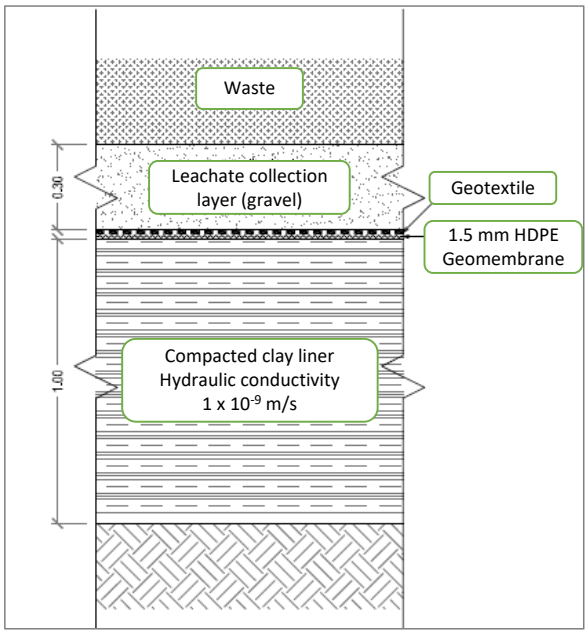


FIGURE 4-6 CONCEPTUAL DESIGN OF FINAL CAP

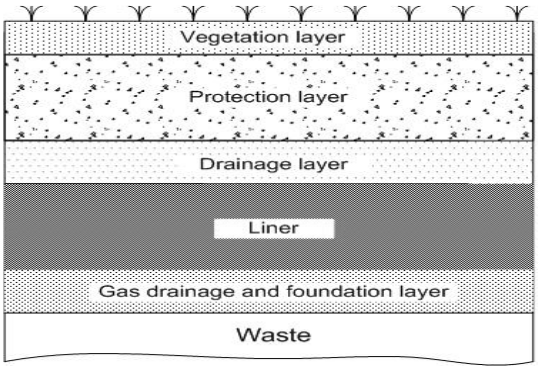


FIGURE 4-7 THE CONCEPTUAL LANDFILL DESIGN SUPERIMPOSED ON A GOOGLE EARTH IMAGE, 2023

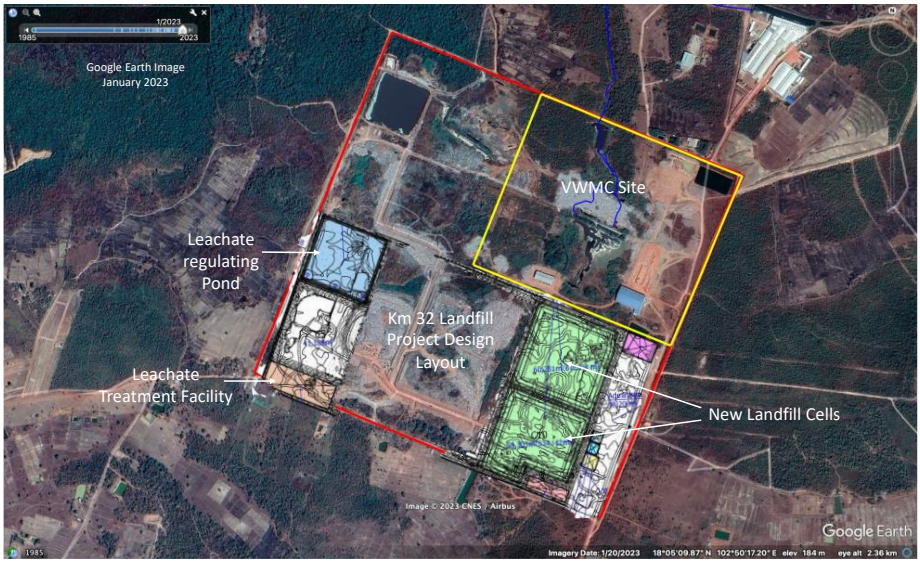


FIGURE 4-8 PROPOSED LEACHATE TREATMENT SYSTEM

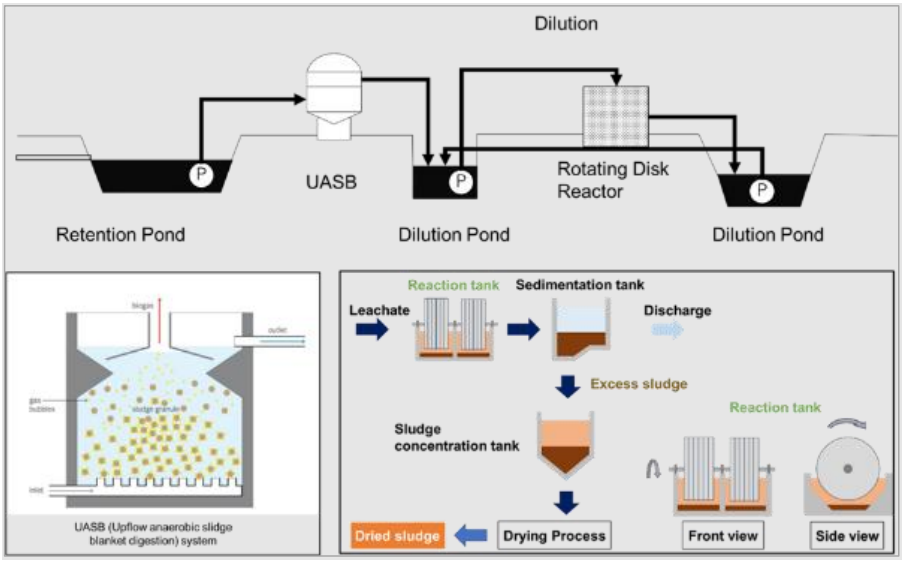


FIGURE 4-9 DRONE PHOTO (JULY 2022) OF CELL 10 AND CELL 11 WHERE THE NEW CELLS WILL BE CONSTRUCTED



4.4 IMPLEMENTATION SCHEDULE

140. Based on the recent discussions between the World Bank and GOL, the PWMP will be implemented over 6 years, from mid-2025 to 2031. Detailed design and preparation of bid documents are expected to start immediately at the beginning of Project implementation period and take approximately 8 -10 months. Consulting services including construction supervision and some technical assistance programs are planned to be completed approximately 6 months before project closing date. Civil works will be followed by a one-year defects liability period.

141. After the civil works have been completed, equipment for the waste management facilities procured, and training of VCOMS staff on operation and maintenance of the landfill and waste facilities undertaken, the facilities will be handed over to the Vientiane Mayor's Office, with a legal document confirming transfer of the assets. Even after the facilities are handed over Mayor's Office, the MPWT and DPWT will continue to provide capacity support and training for operation and maintenance of the facilities.

142. In terms of landfill operations, it is worth noting that the PWMP Component 1 will support development of a National Waste Management Decree and subordinate regulations, and Subcomponent 2A will support development of standard operational procedures for waste management and training. The National Waste Management Decree will clarify roles and responsibilities of line ministries, provincial and district authorities in waste management; provide guidance on waste management planning and appropriate treatment measures for different types of wastes; and provide guidance on the management of waste management facilities, recycling and import/export of solid waste.

4.5 ANALYSIS OF ALTERNATIVES

143. The Pre-ESIA has undertaken an analysis of key project design and location alternatives and determined the preferred options. The analyses of alternatives include the initially proposed design elements contemplated in the Pre-feasibility study. These and other reasonably feasible alternatives have been evaluated as presented in ***Table 4-1*** to ***Table 4-6.***

144. ***The "do nothing alternative"*** (see ***Table 4-1***). Doing nothing will continue to expose landfill workers, waste pickers and residents to a range of health and safety risks and will continue to constitute a high risk of groundwater and surface water contamination with significant adverse effects on the environment and public health. **The preferred option** is Alternative (b) to develop and implement the proposed Km 32 Landfill Project.

145. ***Landfill siting*** (see ***Table 4-2***). Alternative (a): Construct the proposed new landfill facilities on a 50 ha large area bordering the existing Km 32 Landfill. This alternative would involve acquisition of land from farmers and would require resettlement, compensation and livelihood assistance. This would be a costly option but would on the other hand not necessitate relocation of waste. Alternative (b): Construct the proposed new landfill facilities within the existing VCOMS site. This alternative would not require any land acquisition, but waste would have to be relocated to make space for the proposed landfill cells. **The preferred option** is

Alternative (b) as this option avoids land acquisition. Furthermore, with the proposed mitigation measures addressing the legacy waste and with improved health and safety conditions for the waste pickers, Alternative (b) also provides important environmental and health and safety benefits as compared with Alternative (a). It should also be noted that when compared to the siting criteria of the World Bank and the Lao PDR guideline siting criteria, for both options (the sites are next to each other), the siting does not fully meet the recommended siting criteria and distances to sensitive receptors. However, this does not necessarily mean that the location is unacceptable or incompatible, in fact it may very well be difficult to find a place within reasonable distance of Vientiane Capital that would satisfy all criteria – but it does point towards the need for high quality landfill design and consistent and proper execution of landfill operations and maintenance.

146. ***Landfill liner systems*** (see ***Table 4-3***). Alternative (a): A single liner composed of (from top to bottom): A drainage layer with leachate collection, protective geotextile, and 1.5 mm HDPE geomembrane on top of the intact soil. Alternative (b): A composite liner composed of (from top to bottom) to be installed at the new landfill cells, the cell for the relocated waste and under the leachate regulating pond: A drainage layer with leachate collection, protective geotextile, 1.5 mm HDPE geomembrane, and 1 m compacted clay on top of the intact soil. **The preferred option** is alternative (b) a composite liner system as this provides a double layered high level of protection against groundwater pollution superior to the single liner alternative. It is also standard engineering design for municipal solid waste disposal and recommended by the World Bank EHS Guidelines and has been applied by recent ADB funded landfill projects in Laos and Cambodia.

147. ***Final Waste Cell Cap*** (see ***Table 4-4***). Alternative (a): A 2 m thick soil layer and landfill gas collection. Alternative (b): A topsoil layer (150 mm), intermediate layer (150 to 300 mm), barrier layer (600 mm) and a gas collection layer (150 to 300 mm) with landfill gas ventilation wells. **The preferred option** is alternative (b) as this is standard landfill engineering design and in accordance with World Bank EHS Guidelines, it will provide long term environmental protection by preventing direct or indirect contact of living organisms with the waste materials, minimize infiltration of rainwater into the waste and the subsequent generation of leachate, control landfill gas migration, and minimize long term maintenance needs.

148. ***Final Cap on Legacy Waste*** (see ***Table 4-5***). Alternative (a): Do nothing and leave the legacy waste as it is. Alternative (b): Full rehabilitation of legacy waste according to EHS guidelines of the World Bank and international conventional technical standards for landfills. **The preferred option** is alternative (b) as this is a relatively low-cost method that will provide a significant protection against groundwater and surface water pollution and prevent direct or indirect contact of living organisms with the waste materials and effectively prevent landfill fires, and emission of malodour from decomposing waste.

149. ***Location of Recycling Facilities*** (see ***Table 4-6***). Alternative (a): At the Km 32 Landfill site (VCOMS) and maintaining direct delivery of waste from part of the entire service area. Alternative (b): At the transfer stations (in Naxaythong District and Km16) redirecting the majority of the waste through the transfer stations where recyclable materials will be

segregated. The preferred option is a combination of the two alternatives with support to recycling facilities at the transfer stations to reduce the cost of transporting waste to the Km 32 Landfill while also implementing proper recycling facilities at Km 32 Landfill recognizing that a reasonable amount of recyclable materials will likely still go to the landfill. This together with the other support to the waste pickers that the project is proposing, will also help to alleviate the concerns that the waste pickers have expressed over the risk of loss of income.

TABLE 4-1 EVALUATION OF THE DO NOTHING ALTERNATIVE

Alternative	Pros	Cons
(a) Do nothing and continue the existing waste disposal practices on the existing Km 32 Landfill	- Relative low costs - Continue business as usual	- No mitigation of ongoing contamination of streams and paddy fields - No mitigation of high risks of groundwater pollution - No mitigation against air pollution from landfill fire/open burning of waste - No mitigation against spread of infectious diseases from vectors - No mitigation against bad smell from decomposing waste - No mitigation against risk of injuries
(b) Develop and implement the proposed Km 32 Landfill Project	- Provides adequate protection against groundwater pollution - Minimises risk of surface water pollution and pollution of nearby farmland - Provides treatment of leachate from the new landfill cells minimising the risk of contamination of streams and paddy fields	- High investment costs - Risk of impacts on waste pickers due to less recyclables arriving at the Km 32 landfill

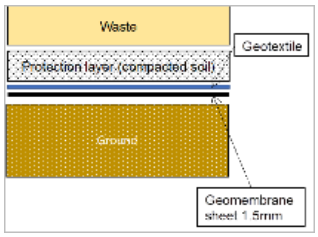
Alternative	Pros	Cons
	- Minimises the risk of landfill fires, emission of malodour and spread of infectious diseases by vectors - Provides improved occupational health and safety for landfill workers and waste pickers - Supports increased recycling - Provides capacity building and technical support to improve Km 32 planning, operation and closure, - Supports mitigation of impacts from legacy waste	

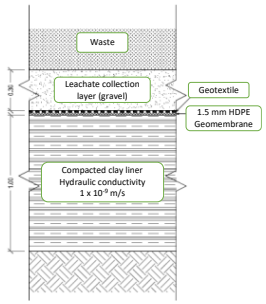
TABLE 4-2 EVALUATION OF ALTERNATIVE LANDFILL SITING

Alternative	Pros	Cons
(a) At a 50 ha large area bordering the existing Km 32 Landfill	- No need to relocate waste - Close to existing recycling facilities - Close to existing landfill and existing waste transport routes	- Requires acquisition of private farmland - High cost of land acquisition - Requires resettlement and livelihood assistance to affected households - Will convert farmland and dry forest vegetation to landfill - Does not address legacy waste impacts and unhealthy working conditions for the waste pickers at the VCOMS site
(b) At the existing Km 32 Landfill site (VCOMS)	- No land acquisition necessary - Some landfill infrastructure exists	- Need to relocate existing waste for the new landfill cells and other facilities

Alternative	Pros	Cons
	- Some existing recycling facilities on site - Addresses environmental impacts from legacy waste - Improves the working conditions for waste pickers	

TABLE 4-3 EVALUATION OF ALTERNATIVE LANDFILL LINER SYSTEMS

Alternative	Pros	Cons
(a) Single liner (from top to bottom): - Drainage layer with leachate collection - Protective geotextile - 1.5 mm HDPE geomembrane - Intact soil - 	- Lower construction costs - Very low hydraulic conductivity - Provides basic protection against groundwater pollution	- Risk of failure or puncture of the geomembrane - Leachate will be directed to any hole in the liner, concentrating leakage at that point, rather than diffusing it as with clay liners or Geosynthetic Clay Liner
(b) Composite liner (from top to bottom) at new landfill cells, Cell 5 for the relocated waste and under the leachate regulating pond: - Drainage layer with leachate collection - Protective geotextile - 1.5 mm HDPE geomembrane - 1 m compacted clay - Intact soil	- Hydraulic conductivity very low - Standard engineering design for municipal solid waste disposal - Recommended by internationally recognized standards including WBG EHS Guidelines. - Double layered high level of protection	- Higher construction costs than the single liner option (a)

Alternative	Pros	Cons
- The clay liner may be substituted with a Geosynthetic Clay Liner (GCL)[7] if suitable clay is not commercially available  -	against groundwater pollution - Research and modelling of leakage through a single HDPE geomembrane compared with leakage through a composite liner comprising a HPDP geomembrane on top of a compacted clay liner, indicate that the leakage through a single HDPE geomembrane is orders of magnitude higher than leakage through a composite liner system[8]. - Applied by recent ADB funded landfill projects in Laos and Cambodia	

[7] A GCL is a relatively thin layer of processed clay (typically bentonite) either bonded to a geomembrane or fixed between two sheets of geotextile

[8] T. Katsumia, C.H. Bensonb, G.J. Foosec, M. Kamond, Performance-based design of landfill liners, Engineering Geology 60 (2001) 139±148

TABLE 4-4 EVALUATION OF FINAL CAP ON THE NEW LANDFILL CELLS

Alternative	Pros	Cons
(a) Final cap on C10 and C11 to be composed of 2 m soil and gas ventilation	- Can enable future land use for recreation, sport, agriculture, grazing - Prevents direct contact with waste by animals and humans - Minimises risk of spread of infectious diseases, foul odour, dust and windblown litter - Minimises risk of landfill fires	- Risk of migration of landfill gas to surrounding area and confined spaces - Risk of excess infiltration and generation and build-up of leachate, and therefore increased risk of groundwater pollution or seepage through embankments
(b) Final cap[9] to be composed of: Topsoil (150 mm), intermediate layer (150-300 mm), barrier layer (600 mm), and a gas collection layer (150 – 300 mm). Includes gas ventilation	- Can enable future land use for recreation, sport, agriculture, grazing - Minimizes risk of infiltration and generation of leachate - Minimises risk of uncontrolled migration of landfill gas - Complies with internationally recognized standards including WBG EHS Guidelines.	- Higher cost than the 2 m soil cap option (a)

[9] The USEPA recommends that the permeability of the final cover shall be less than the underlying liner system, but no greater than 1.0 x 10^{-7} m/sec. This design requirement was established to minimize the "bathtub effect", which occurs when the landfill fills with liquid because the cover system is more permeable than the bottom liner system. This "bathtub effect" greatly increases the potential for generation of leachate

TABLE 4-5 EVALUATION OF FINAL CAP ON THE LEGACY WASTE

Alternative	Pros	Cons
(a) No cap	- No direct investment costs	- Risk of migration of landfill gas to surrounding area and confined spaces - Risk of infiltration and generation and build-up of leachate, and therefore risk of groundwater pollution - risk of spread of infectious diseases, foul odour, dust and windblown litter - Risk of landfill fires
(b) Final cap on legacy waste dumps to be composed of: Topsoil (150 mm), intermediate layer (150-300 mm), barrier layer (600 mm), and a gas collection layer (150 – 300 mm). Includes gas ventilation	- Enables future land use for recreation, sport, agriculture, grazing - Minimizes risk of infiltration and generation of leachate - Minimises risk of uncontrolled migration of landfill gas - Complies with World Bank EHS Guidelines - Minimises risk of spread of infectious diseases, foul odour, dust and windblown litter - Minimises risk of landfill fires	- Higher cost than the “no cap” option (a)

TABLE 4-6 EVALUATION OF ALTERNATIVE LOCATION OF RECYCLING FACILITIES

Alternative	Pros	Cons
(a) At the Km 32 Landfill site (VCOMS) - Maintaining direct delivery of waste from part of the entire service area	- Provides a reasonable amount of recyclable materials to ensure a steady income to the informal recyclers - Recycling facilities already included in the design	- Increases the cost of waste transport to the landfill - Not enough area available at Km 32
(b) At transfer stations - Redirecting the majority of waste through transfer stations where recyclable materials will be segregated	- Reduces the transport cost of waste to the landfill	- Reduces the amount of recyclable materials at the Km 32 Landfill and therefore the income of the informal recyclers - Opposed by the villagers collecting recyclables at the Km 32 Landfill

5 LEGAL AND INSTITUTIONAL FRAMEWORK

5.1 NATIONAL LEGAL FRAMEWORK

150. The Lao PDR has many laws and regulations that govern environmental and social impacts and risks assessment and management applicable for all development projects financed by both public and private sectors. The key Lao laws and regulations relevant to the PWMP Project are listed in ***Table 5-1,*** while details are provided in ***Annex 2 of the PWMP Project ESMF.***

TABLE 5-1 NATIONAL POLICIES AND LEGISLATIONS

Subjects	Related national policies, strategies, laws, regulations
Natural Environment	• Constitution of the Lao PDR People's Democratic Republic (amended) No. 63/NA, 08/12/2015 • Law on Environment Protection, No. 29/NA, dated 18/12/2012 • Law on Land, No. 70/NA, dated 21/06/2019 • The Law on National Heritage (Amended), No. 11/NA, 16 November 2021

Subjects	Related national policies, strategies, laws, regulations
	• Law on Forestry, No. 08/NA, dated 13/06/2019 • Law on Disaster Management, No. 15/NA, dated 24/06/2019 • Law on Water and Water Resources, No. 23/NA, dated 11/05/2017 • The Law on Aquatic and Wildlife Animals No. 07/NA (2007) • Decree on Environmental Impact Assessment, No. 21/GoL, dated 31/01/2019 • Decree on Protected Forest Management (No.134/Gov, dated 13 May 2015) • Decree on the Promulgation and Enforcement of National Environmental Standards, No. 81/PMO, dated 21 February 2017 • Decree on Occupational Health and Safety, No. 22/GoL, dated 05/02/2019
Waste management	• Ministerial Decision on landfill management No. 521/MPWT, 23 February 2007 • Ministerial Instructions on Hazardous Waste Management, No. 0744/MONRE, 11-Feb-2015
Labour: OHS, child labour non-discrimination, freedom of association, worker grievance; labour code	• The Law on Labour Protection, No. 43/NA, dated 24/12/2013; • The Law on Grievance Redress, No. 023/NA, dated 09/11/2016; • The Law on Hygiene, Prevention and Health Promotion, No. 73/NA, dated 22/11/2019; • The Law on Prevention of HIV Disease, dated 01/NA, dated 29/6/2010; • The Law on Lao Union, No. 3-/NA, dated 15/11/2017; • The Law on Anti-Human Trafficking, No. 73/NA, dated 17 December 2015; • The Law on the Protection of Children Rights and Benefits, No. 05/NA, dated 27/12/2006; • The Law on Road Traffic, No. 021/NA, dated 08/11/2016; • Health Impact Assessment No. 365, MOPH, 01 March 2006 • Health Impact Assessment Guidelines, Ministry of Public Health, 2010. • The Decree on Occupational Health and Safety, No. 22/GoL, dated 05/02/2019;

Subjects	Related national policies, strategies, laws, regulations
	• Decree on the Promulgation and Enforcement of National Environmental Standards, No. 81/PMO, dated 21 February 2017 • The Decision on Occupational Health and Safety at Construction Sites, No. 3006/MLSW, dated 21/08/2013; • The Decision on Occupational Health and Safety at Construction Sites, No. 3006/MLSW, dated 21/08/2013; • Other applicable laws and regulations.
Ethnic Groups including engagement	• The Constitution of the Lao PDR People's Democratic Republic (1991, amended, No. 63/NA, 08/12/2015; • The Law on Land, No. 70/NA, dated 21/06/2019; • The Law on Forestry, No. 08/NA, dated 13/06/2019; • The Law on Resettlement and Occupation, No. 086/NA, dated 15/06/2018; • The Law on Compensation and Resettlement of People Affected by Development Projects, No. 84/GoL, dated 05/04/2016; • The 9th National Socioeconomic Development Plan (NSEDP); • The Public Involvement Guidelines in ESIA Process, No. 707/MONRE, dated 05/02/2013; • Other applicable laws and regulations.
Land acquisition including involuntary resettlement	• The Law on Environment Protection, No. 29/NA, dated 18/12/2012 • The Law on Land, No. 70/NA, dated 21/06/2019 • The Law on National Heritage, No. 44/NA, dated, 24/12/2013 • The Law on Forestry, No. 08/NA, dated 13/06/2019 • The Law on Resettlement and Occupation, No. 086/NA, dated 15/06/2018 • The Decree on Compensation and Resettlement of People Affected by Development Projects, No. 84/GoL, dated 05/04/2016 • The Decree on Environmental Impact Assessment, No. 21/GoL, dated 31/01/2019 • The Public Involvement Guidelines in ESIA Process, No. 707/MONRE, dated 05/02/2013 • Other applicable laws and regulations

Subjects	Related national policies, strategies, laws, regulations
Sexual Exploitation and Abuse/ Harassment (SEA/SH)	• The Law on Preventing and Combating Violence against Women and Children, Law No. 56/NA, 23/12/2014; • The Law on Anti-Human Trafficking, No. 73/NA, dated 17 December 2015; • The Law on the Development and Protection of Women, No.08/NA, dated 22/10/2004; • The Law on Prevention of HIV Disease, dated 01/NA, dated 29/6/2010; • The Family Law, No. 05/NA, dated 26/9/2008; • The Law on the Protection of Children Rights and Benefits, No. 05/NA, dated 27/12/2006; • The National Plan of Action for the Prevention and Elimination of Violence against Women and Violence against Children 2014-2020; • Other applicable laws and regulations.

5.2 APPLICABLE WORLD BANK ENVIRONMENTAL AND SOCIAL STANDARDS (ESSS)

151. The World Bank Environmental and Social Standards (ESSs) that are relevant to the **Km 32 Landfill Project** are:

- ESS 1 – Assessment and Management of Environmental and Social Risks and Impacts. Relevant. ESS1 is mandatory.
- ESS 2 – Labour and Working Conditions. Relevant as the design, supervision, construction and monitoring of the project involves different categories of Project Workers (people employed to work directly for the project and people employed or engaged through third parties to work for the project.
- ESS 3 – Resource Efficiency and Pollution Prevention and Management. Relevant as the project aims at reducing waste being landfilled and the project will reduce potential impacts associated with disposal of waste at the Km 32 landfill
- ESS 4 – Community Health and Safety. Relevant because the project aims at improving the health and safety of waste pickers and residents living near the Km 32 landfill
- ESS 5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement. Relevant. The project has been designed to avoid land acquisition impacts, but there are risks of socio-economic impacts which need to be mitigated.

- ESS 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources. Relevant as part of identification and assessment of potential impacts of biodiversity.
- ESS 10 – Stakeholder Engagement and Information Disclosure.

The following ESSs are considered not relevant to the **Km 32 Landfill Project**:

- ESS 7 – Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities
- ESS 8 – Cultural Heritage and
- ESS9 – Financial Intermediaries.

6 EXISTING CONDITIONS

6.1 METEOROLOGY, CLIMATE AND NATURAL HAZARDS

152. The climate for Vientiane Capital is classified as tropical wet and dry climate with dry winter (*Aw*) in the Köppen and Geiger Climate Classification System[10]. The climate is dominated by the monsoon where the northeast monsoon brings drier and cooler air from November to February, hotter air prevails in March, April and May, and the southwest monsoon brings the rainy season from May to October.

153. The monthly mean rainfall and temperature for Vientiane Capital from 1991 to 2020 are displayed in ***Figure 6-1***, and the trends in annual mean temperatures and rainfall from 1951 to 2020 are presented on the graphs in ***Figure 6-2***.

154. As displayed in ***Figure 6-2,*** there is a trend towards increasing annual mean temperatures in Vientiane Capital from around 25°C in the 1950'ies to about 26.5°C in 2020. The mean annual rainfall, on the other hand, shows a decreasing trend with annual mean rainfall decreasing with about 200 mm over the same period.

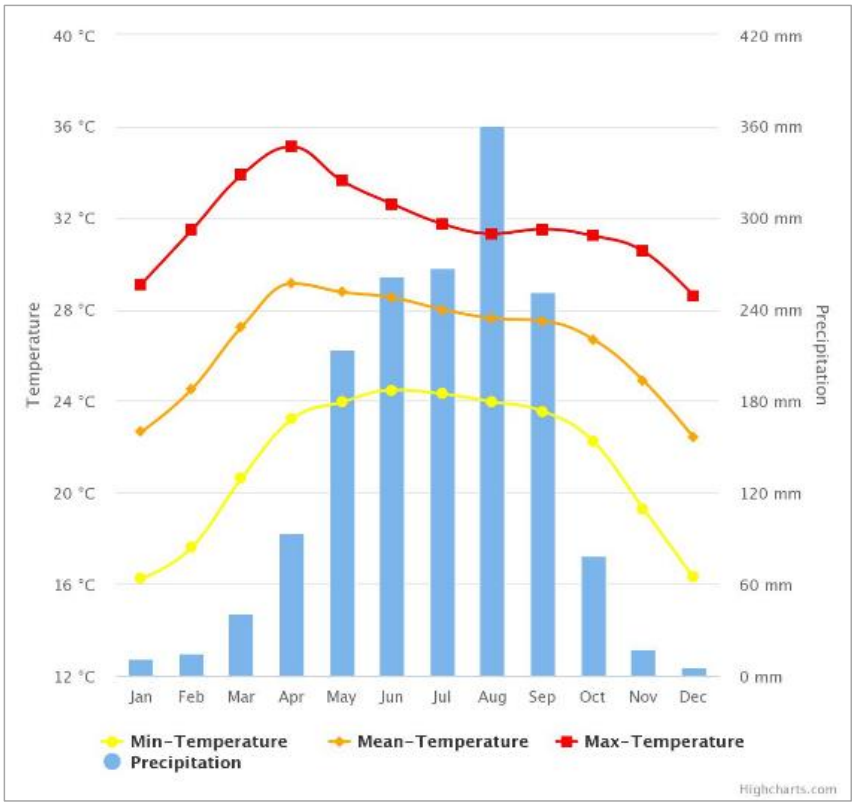
155. The hottest months in Vientiane Capital are April and May with mean temperatures around 29°C and the coolest months are December and January with mean temperatures of about 22.5°C.

156. The rainy season is from May to the end of October and the dry season is from November to the end of April. The month with the most wet days is August, with an average of 20.5 days with at least 1.00 mm of precipitation[11]. The month with the fewest wet days in Vientiane is December, with an average of 0.6 days with at least 1.00 mm of precipitation[11].

[10] The Köppen-and Geiger climate classification is one of the most widely used climate classification systems. The classification system divides climates into five main climate groups, with each group being divided based on seasonal precipitation and temperature patterns. https://en.wikipedia.org

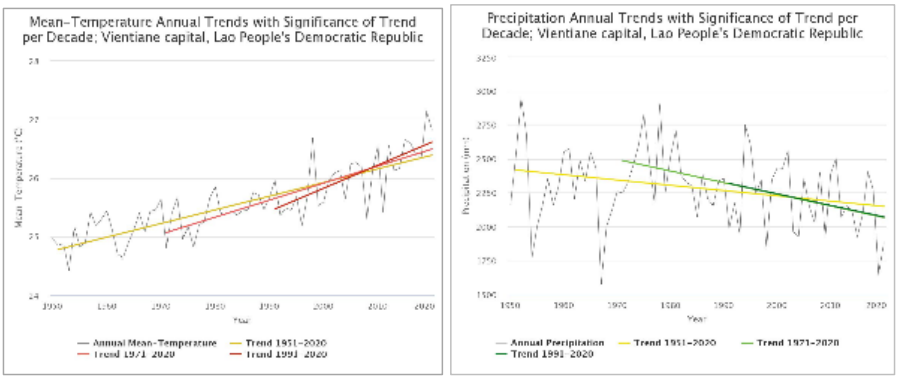
[11] https://weatherspark.com/y/114314/Average-Weather-in-Vientiane-Laos-Year-Round Accessed on 24-Sep-2022

FIGURE 6-1 MONTHLY MEAN, MINIMUM AND MAXIMUM TEMPERATURES AND MEAN MONTHLY PRECIPITATION FOR VIENTIANE CAPITAL 1991-2020



Source: https://climateknowledgeportal.worldbank.org/country/lao-pdr Accessed on 24-Sep-2022

FIGURE 6-2 TREND IN MEAN ANNUAL TEMPERATURE AND MEAN ANNUAL PRECIPITATION



6.1.1

Source: https://climateknowledgeportal.worldbank.org/country/lao-pdr Accessed on 24-Sep-2022

6.1.2 Wind

157. The average hourly wind speed in Vientiane is displayed in ***Figure 6-3***[12]. The chart indicates that there are minor seasonal variations.

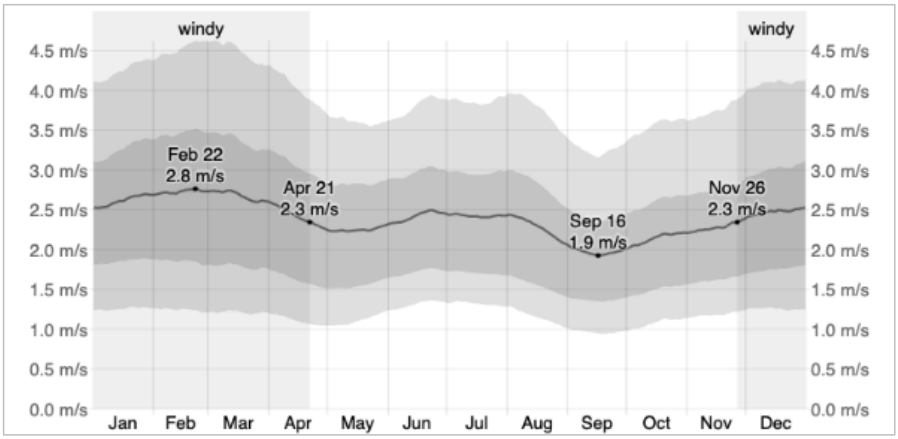
158. The windier part of the year lasts for roughly 5 months, from end of November 26 to the middle of April, with average wind speeds between 2.5 m/s and 2.7 m/s. The windiest month of the year is February, with an average hourly wind speed of 2.7 meters per second.

159. The calmer time of year lasts for about 7 months, from the middle of April to the end of November. The calmest month of the year in Vientiane is September, with an average hourly wind speed of 2.0 meters per second.

160. These are wide area hourly wind speeds at 10 m above ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

[12] https://weatherspark.com/y/114314/Average-Weather-in-Vientiane-Laos-Year-Round

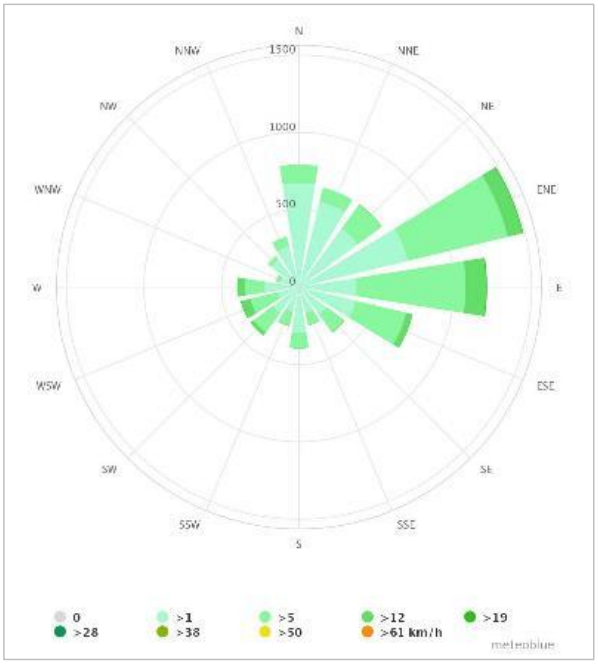
FIGURE 6-3 VIENTIANE AVERAGE HOURLY WIND SPEEDS



The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands

161. The wind rose for Vientiane displayed in ***Figure 6-4*** shows how many hours per year the wind blows from the indicated direction. Winds from the east-northeast and from the east dominate over the year.

FIGURE 6-4 VIENTIANE WIND DIRECTIONS



https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/vientiane_laos_1651944

6.1.3 Climate Change Projections

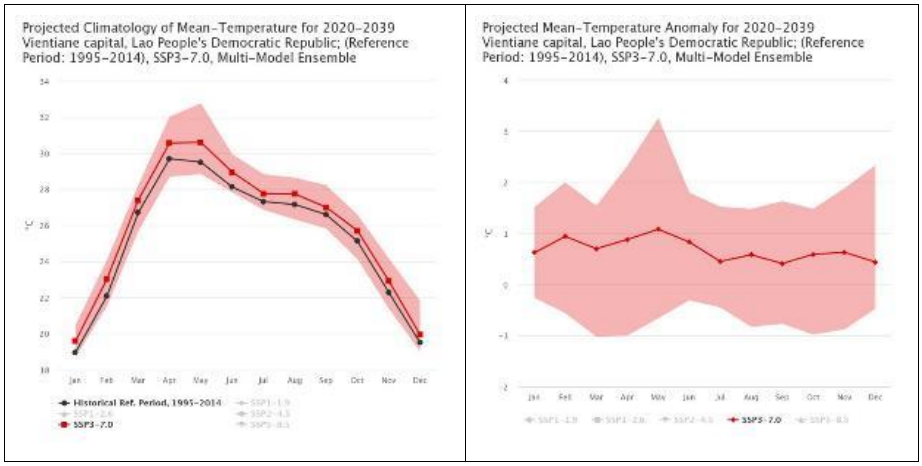
162. Selected climate change projections with respect to temperature and precipitation for Vientiane Capital are displayed in ***Figure 6-5***[13].

163. The projections represent a certain possible societal development and policy pathway or Shared Socioeconomic Pathway (SSP) and greenhouse gas emission level. The chosen scenario is SSP3-7.0 for the period 2020-2039. SSP3-7.0 is a scenario with high GHG emissions and high challenges to mitigation and adaptation[14].

164. The mean temperature projections suggest that the climate will become hotter with increases in mean monthly temperatures of about 0.5°C to 1°C. The projected mean monthly precipitation hovers around the historical record. The same is the case for the largest 5-day cumulative precipitation event, however with considerable variation. The rainfall anomaly for September has a median of 14.5 mm increase, and a span from the 10th to the 90th percentile from -63 mm to +201 mm. For August, the median anomaly is -18 mm with a span from the 10th to the 90th percentile from -87 mm to +172 mm.

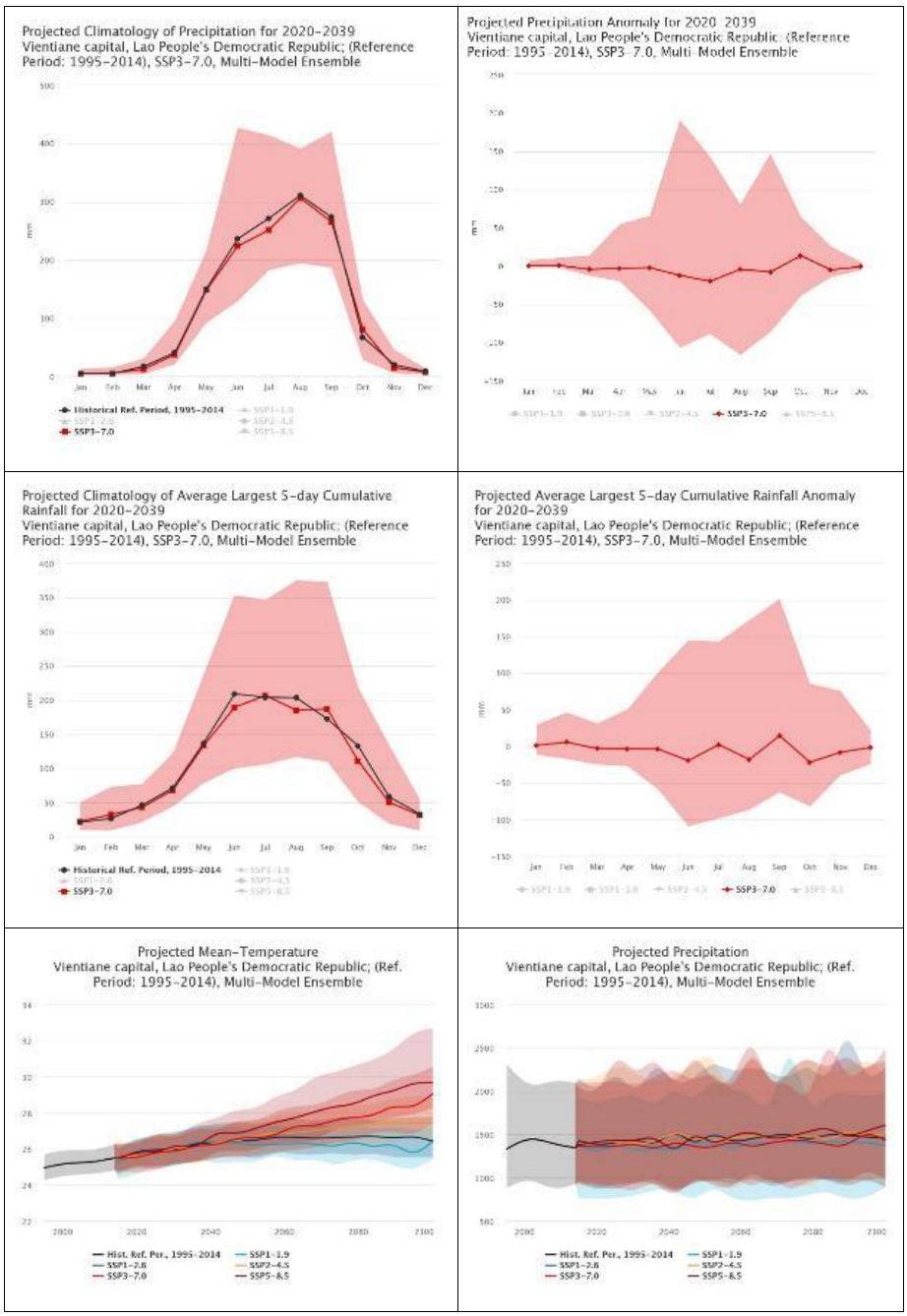
165. The difference in mean temperature/rainfall projections among the various SSPs are illustrated in the figures at the bottom of the table.

FIGURE 6-5 CLIMATE CHANGE PROJECTIONS FOR VIENTIANE CAPITAL, 2020-2039



[13] The World Bank's Climate Change Knowledge Portal, https://climateknowledgeportal.worldbank.org/ Accessed on 25-Sep-2022

[14] https://climateknowledgeportal.worldbank.org/overview Accessed on 25-Sep-2022



Source: https://climateknowledgeportal.worldbank.org/country/lao-pdr Accessed on 25-Sep-2022

6.1.4 Climate Change Design Considerations

166. Potential impacts from Climate Change on Landfill Operations are summarized in ***Table 6-1***.

TABLE 6-1 POTENTIAL IMPACTS FROM CLIMATE CHANGE ON LANDFILL OPERATIONS

Climate Change Factor	Impacts
Warmer Temperatures	• Changes in biological and chemical processes at the leachate treatment facilities. • Greater exposure of workers to flies, which are a major cause of infectious diseases (flies breed more quickly in warm temperatures and are attracted to organic waste) • Increased odour and pest activity
More Frequent and/or Intense Extreme Weather Events	• Increased risk of direct flood damage to the landfill site. • Increased risk of untreated leakage overflowing and contaminating water bodies.

167. It is recommended that the landfill design considers the following climate change related design components, which not only addresses climate change adaptation but also contributes to reduction in greenhouse gas emissions:

- Landfill gas collection systems should be made ready for retrofitting with flaring of gas, including methane, a powerful greenhouse gas.
- The finished ground level of all the construction should be above the flood level.
- Install surface water drainage systems for the entire site to protect against storm events.
- Leachate collection and treatment lagoons should be designed to manage high volumes of wastewater in case of extreme events.
- Construct one or more earthen structures (such as vegetated berms, or stormwater ponds) or install fabricated drainage structures (such as culverts or French drains) at vulnerable locations to prevent stormwater from reaching landfill cells.

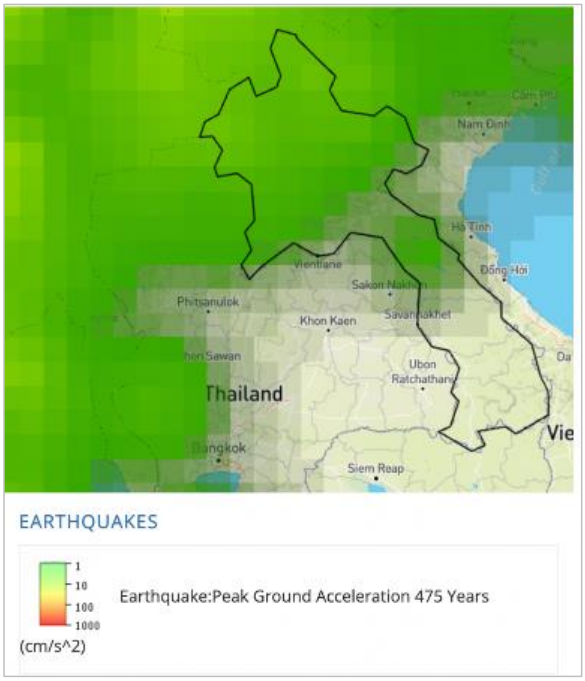
6.1.5 Earthquake Hazard

168. Vientiane Capital is located in a region with low seismic hazards. As indicated on the map in ***Figure 6-6***, the 1:475-year Peak Ground Acceleration is estimated to between 1 cm/s^2 and 10 cm/s^2, which corresponds to a weak/light perceived shaking of the ground with no structural damages [15] (see also https://maps.openquake.org/map/global-seismic-hazard-map/#7/17.429/101.158).

[15] https://en.wikipedia.org/wiki/Peak_ground_acceleration

169. Nevertheless, the detailed engineering design of the **Km 32 Landfill Project** should undertake a specific assessment of the earthquake hazard to ensure that the structures are sufficiently robust.

FIGURE 6-6 PEAK GROUND ACCELERATION FOR A 1:475-YEAR EARTHQUAKE



Source: https://climateknowledgeportal.worldbank.org/country/lao-pdr/vulnerability

6.1.6 Cyclone/Typhoon Hazard

170. Vientiane Capital is located in a region with low cyclone/typhoon hazards. This means that the there is a 1% chance of potentially damaging wind speeds in the next 10 years[16]. It is recommended that the detailed design of the **Km 32 Landfill Project** takes cyclone hazards into account.

6.1.7 Flood Hazard

171. The flood hazard for the area where the landfill is located is assessed using the World Resources Institute's Aqueduct Floods Tool[17]. The flood hazards are modelled for riverine flood hazards and ***Figure 6-7*** shows the baseline flood hazards, and ***Figure 6-8*** shows flood hazard forecast for 2030 with a business as usual/pessimistic scenario. The landfill is surrounded by inundated areas in the baseline riverine flood hazard scenario, but not itself inundated. The

[16] https://www.thinkhazard.org/en/

[17] https://www.wri.org/applications/aqueduct/floods/

spatial extent of the 2030 flood forecast is reduced compared with the baseline, and the landfill site is not surrounded by inundated land.

172. In terms of historical information about flooding at the landfill, the Deputy Head of DHUP has informed that the landfill has never been flooded (this is understood to mean during its current lifetime).

173. Taking into consideration uncertainties in the global flood hazard modelling and the relative short period of historical information, and that the baseline scenario indicates that the landfill may be within the 100-year flood line, it is recommended that the detailed design of the project should undertake a specific analysis of flood hazards and incorporate the results into the design.

FIGURE 6-7 BASELINE 1:100-YEAR FLOOD HAZARD

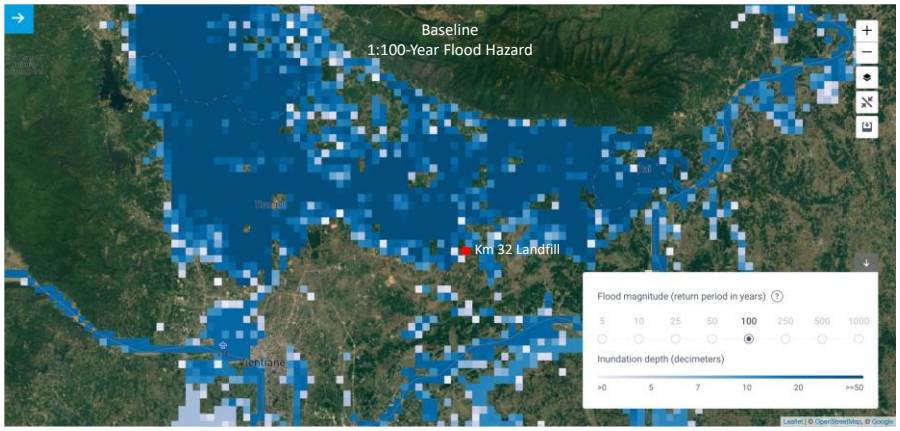
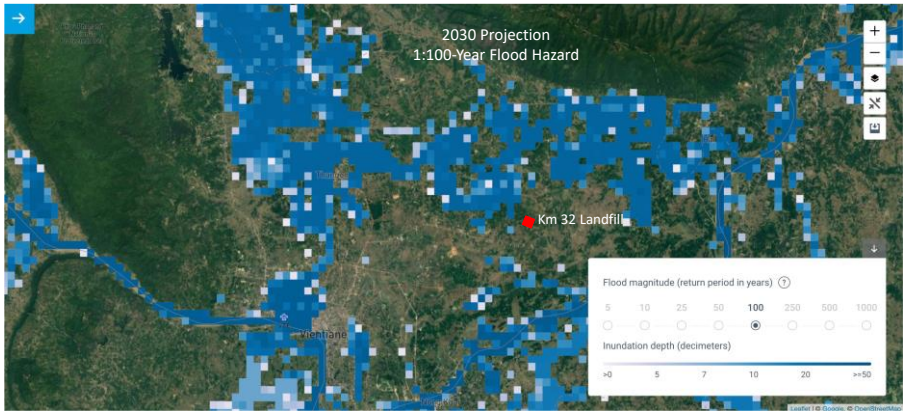


FIGURE 6-8 PREDICTED 1:100-YEAR FLOOD HAZARD IN 2030 WITH A BUSINESS AS USUAL/PESSIMISTIC SCENARIO



6.2 ENVIRONMENTAL BASELINE PROFILE FOR THE LANDFILL SITE

174. The environmental baseline information presented here is based on primary data obtained from field missions in July and September 2022 that included meeting and discussion with VCOMS and landfill operator company on the overall operation of solid waste management in Vientiane and challenges related the operation of Km 32 landfill. Secondary data was obtained through desk research of the Pre-Feasibility Study Report, Task 5 of June 2022[18], various scientific publications, Lao Government publications and from analyses of Google Earth images.

175. Under the Pre-Feasibility Study, environmental quality monitoring was carried out by Phanthamit Analytical Lab, Co., Ltd in February 2022. The monitoring included two wastewater (leachate) samples, four groundwater samples, four surface water samples, four soil samples, two ambient air samples and two ambient noise samples at the landfill and its immediate surroundings.

6.2.1 Topography and Hydrogeology

176. The landfill site is surrounded by paddy fields and other agricultural land (paddy field and garden) with patches of secondary low forest vegetation. Three waste recycling businesses are located along the access road to the landfill and the wider area can be generally characterised as rice cultivation farmland with urbanized strips with small and medium size industries along the road network.

177. Terrain profiles generated from Google Earth are displayed in ***Figure 6-9*** (VCOMS site) and in ***Figure 6-10*** (across the VCOMS and VWMC sites). The terrain on the VCOMS site is generally at El 180 m asl. with top of waste piles reaching El. 182-184 m asl. At the western edge of the waste dumps, the terrain drops to about El. 178 m asl. Across the entire landfill site, the terrain gently slopes from the VCOMS site towards the northern border of the gently slopes Khouanmouang Company site.

[18] Pre-Feasibility Study on Solid and Plastic Waste Management System and Infrastructure in Lao PDR: Task 5, EX Research Institute Ltd., CTI Engineering International Co. Ltd. and National University of Laos for the World Bank, June 2022

FIGURE 6-9 TERRAIN PROFILE OF THE KM 32 LANDFILL ACROSS THE VCOMS SITE



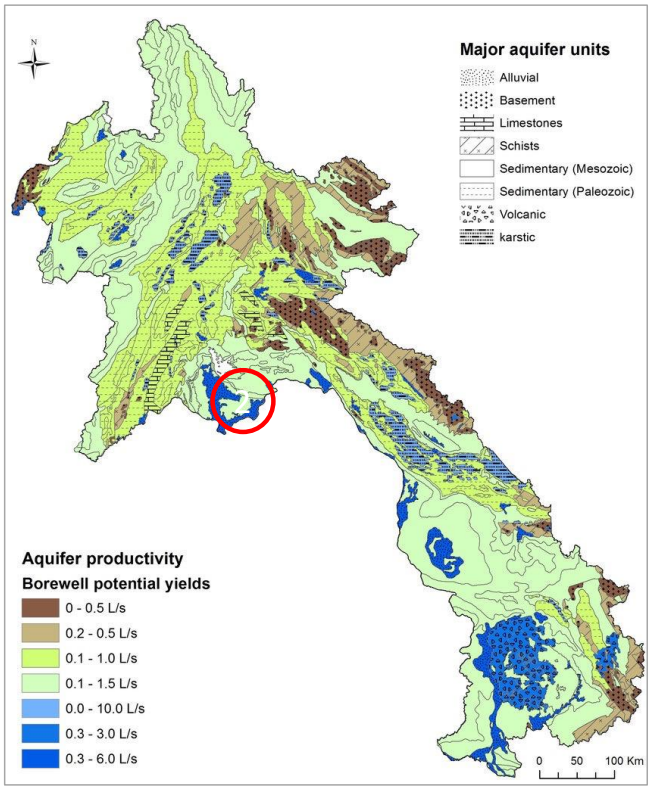
FIGURE 6-10 TERRAIN PROFILE OF THE KM 32 LANDFILL ACROSS THE VCOMS AND KHOUANMOUANG COMPANY SITES



178. The km 32 landfill is located in the Vientiane Plain within the Nam Ngum catchment area about 7 km southeast of Nam Ngum River and 11.5 km north of the Mekong River. The regional geology is dominated by thick Mesozoic sedimentary sandstone deposits which form an important aquifer for domestic water supply. Groundwater is widely used as the main source of water supply in the area. The expected range of yields for the Mesozoic sandstones aquifer group is estimated at 0.1–1.5 L/s[19] - see ***Figure 6-11***.

[19] Guillaume Lacombe, Lisa-Maria Rebelo, Touleelor Sotoukee, Regional Mapping of Groundwater Resources in Data-Scarce Regions: The Case of Laos, Hydrology 5(2):1-24 March 2018

FIGURE 6-11 MAIN AQUIFERS IN LAO PDR[19]



179. The local topography is relatively flat with ground elevation at the landfill site of about 180 m asl.

180. The Pre-feasibility Study drilled five boreholes in the area immediately west of the landfill site. The drillings were 5-7 m deep, and the soil profiles consisted of 1-3 m of clayey sand followed by mudstone. Groundwater was not detected in any of the drillings. The location of the drillings is shown in ***Figure 6-12*** and the soil profiles are presented in ***Figure 6-13.***

181. The Pre-feasibility Study identified four groundwater tube-wells located at or near the landfill (GW01, GW02, GW03, and GW04). GW01 and GW02 are located inside the landfill on the eastern side. They are equipped with submersible pumps and the water is used by landfill workers for washing purposes. GW03 is located northwest of the landfill. It is used as the main water supply for washing, cooking, and livestock raising by one household living there. It is a closed well with a submersible pump. GW04 is located inside the waste recycling factory along the access road close to the landfill. The well is the main source of water for washing purposes by staff and workers. The Pre-feasibility study does not provide data on the depth to groundwater in these wells. The location of these wells is displayed in ***Figure 6-20***.

FIGURE 6-12 BOREHOLE LOCATION MAP

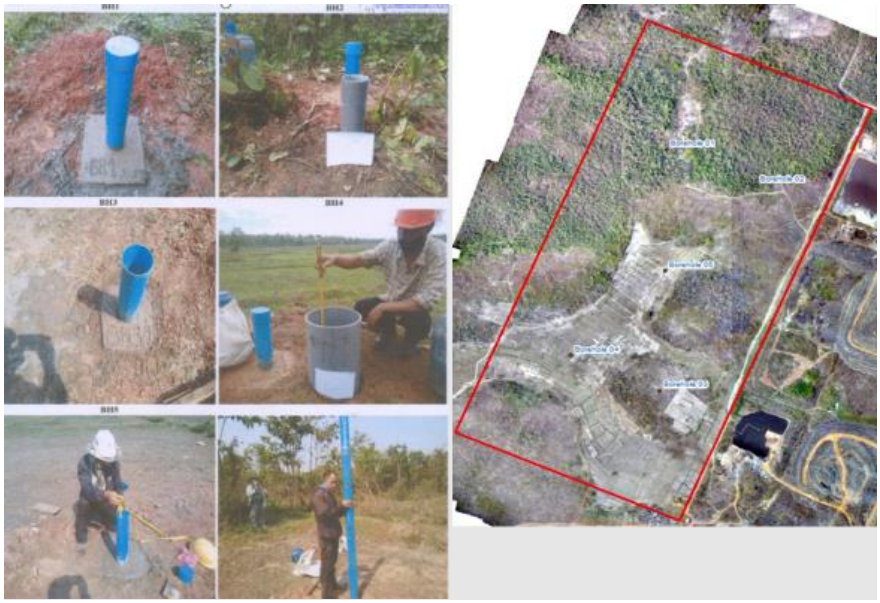
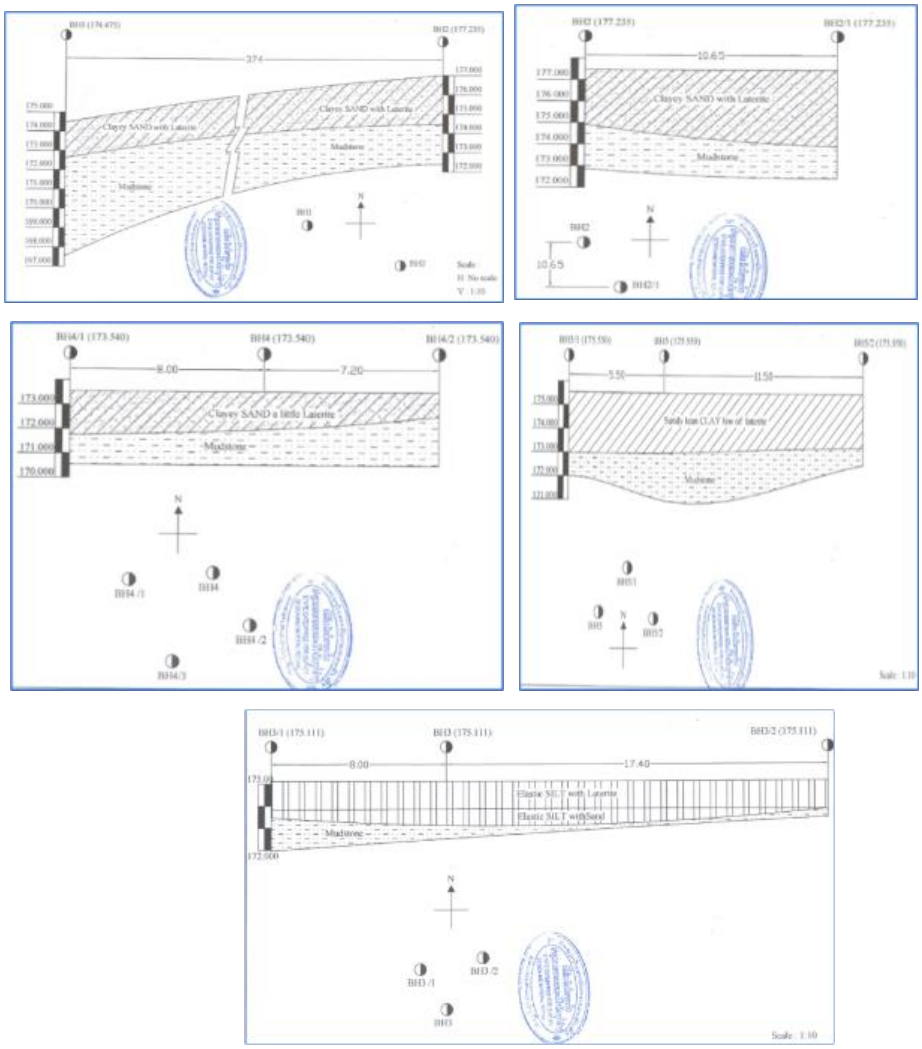


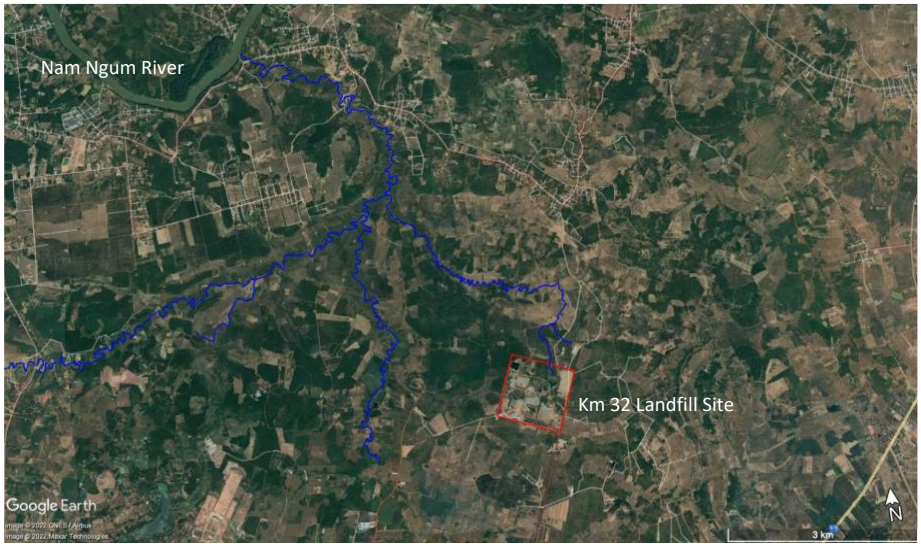
FIGURE 6-13 SOIL PROFILES



6.2.2 Hydrology

182. Based on an analysis of historical Google Earth images, the overall local hydrology has been interpreted as indicated in ***Figure 6-14***. Surface water from the landfill area either evaporates, infiltrates into the soil or is channelled via seasonal ditches and streams – some of which are used for irrigation of paddy fields – to the north and northwest and finally empties into Nam Ngum River about 7 km from the landfill. This interpretation also matches well with the field survey carried out by the Pre-Feasibility Study team, according to which the overall flow path of surface water at the landfill site is to the north and northwest. However, local flow paths inside the landfill and its immediate surroundings may be different.

FIGURE 6-14 LOCAL HYDROLOGY



183. On the VWMC site, there are currently three ponds including a large pond with an area of about 1.3 ha (pond 4 in ***Figure 6-15*** and in ***Figure 6-16***), a recently constructed 0.5 ha pond (pond 6 in ***Figure 6-15***) and a smaller pond and discharge point shown as pond No. 2 in ***Figure 6-15*** and in ***Figure 6-16.*** The likely drainage pattern from pond No. 4 is illustrated in ***Figure 6-17***. Pond No. 4 also likely drains a large part of the legacy waste on Cell 10 and Cell 11 on the VCOMS site.

184. On the VCOMS site there are two large ponds, a seasonal pond with an area of about 1.5 ha shown as pond No. 1 in ***Figure 6-15*** located immediately west of the waste dumps, a 1.99 ha permanent pond (No. 3 in ***Figure 6-15***) in the north-western part of the site, and a smaller pond located along the southern border of the site (pond No. 5 in ***Figure 6-15***).

FIGURE 6-15 PONDS ON THE KM 32 LANDFILL, 06 SEPTEMBER 2022



FIGURE 6-16 LEACHATE DRAINAGE FROM THE KM 32 LANDFILL

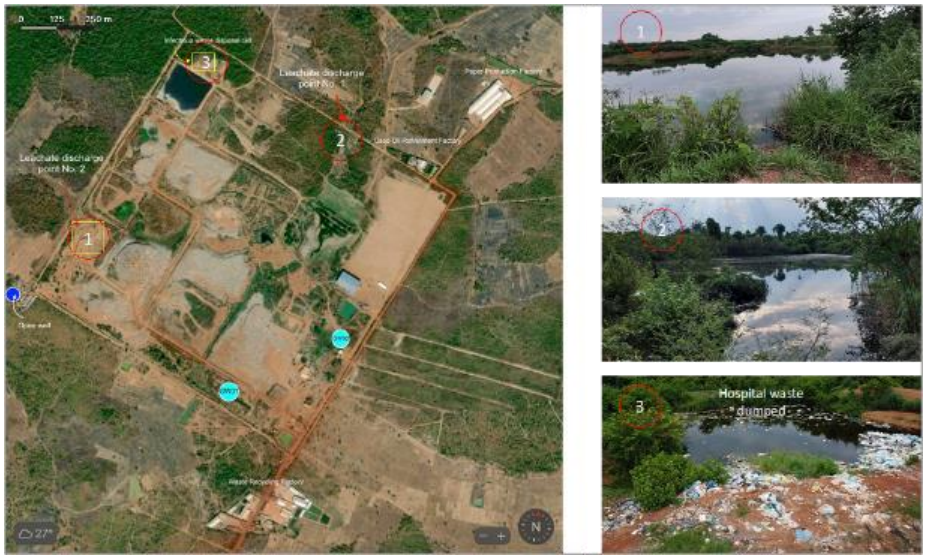


FIGURE 6-17 LEACHATE DRAINAGE FROM THE NORTHERN PART OF THE KM 32 LANDFILL



6.2.3 Surface Water Quality

185. The Pre-Feasibility Study analysed surface water samples from four stations. The location of the stations is shown in ***Figure 6-18*** and the results of the analyses are summarized in ***Table 6-2***.

186. The water quality of sample SW01 collected in the north-eastern corner of the landfill site is within normal ranges for surface water except for COD which exceeds the standard and is unusually high indicating impacts from wastewater/leachate.

187. SW02 was taken from a small pond about 500 m southwest of the landfill. Both BOD and COD are unusually high for surface water (COD exceeds that standard), and in particular the high COD would not normally be caused by agricultural activities; however, clear evidence that these high concentrations are caused by landfill activities have not been established. The level of coliform bacteria is also high (exceeding the standard) but not unusually high and may be caused by domestic animal faeces.

188. SW03 taken inside the landfill has even higher concentrations of BOD, COD and coliform bacteria than SW02 (COD and coliform bacteria exceed the standard). In addition, SW03 also has a high content of chloride. The contamination is considered attributed to impacts from landfill leachate.

FIGURE 6-18 SURFACE WATER QUALITY MONITORING STATIONS



189. SW04 taken from a pond just outside the southern border of the landfill has a high COD concentration and a high content of coliform bacteria (both exceeding the relevant standard). There are ponds of water inside the landfill next to the pond where SW04 was collected, and it seems likely that the contamination in SW04 is caused by contaminated landfill runoff/leachate.

190. Google Earth image from May 2017 shows red discolouring of the large pond in the north-western corner of the landfill (see *Error! Reference source not found.*). This may have been caused by algae bloom.

191. It should also be noted that as reported by the Pre-Feasibility Study a community complaint from Nakao Village (located about 2.8 km to the north of the landfill) to VCOMS claimed that black water from the km 32 landfill had caused a reduction in their rainfed rice yield, and that farmers had experienced skin rashes when getting in contact with the water. However, clear evidence that these incidents were caused by the landfill have not been established.

192. Interviews by the Pre-Feasibility Study team with 45 waste pickers at the landfill, document that over 73% of the interviewees had observed of leachate run-off to the surrounding area, 62% had observed landfill fire, and 64% had experienced flooding; however, no detailed information on specific flooding locations and types of flooding were given.

TABLE 6-2 SURFACE WATER QUALITY RESULTS

Parameter	Unit	Standard [20]	LOD	LOQ	SW01	SW02	SW03	SW04
Ammonia (NH_3-N)	mg/L as N	<0.5	0.07	0.13	ND	ND	ND	ND
Ammonium (NH_4)	mg/L as NH_4^+	<1.5	0.07	0.13	ND	ND	0.49	ND
Biochemical Oxygen Demand	mg/L	-	0.30	1.00	2.20	**37.20**	**94.50**	5.00
Chemical Oxygen Demand	mg/L	5-7	1.00	4.00	**35.30**	**62.00**	**154**	**90.00**
Chloride	mg/L as Cl^-	-	1.00	3.00	ND	18.50	**568**	24.80
Colour	Pt.Co	-	0.50	1.00	24.20	158	178	58.00
Dissolved Oxygen	mg/L	>6	0.30	1.00	5.45	8.95	13.40	7.60
Hardness	mg/L as $CaCO_3$	-	3.00	10.0	40.20	90.60	399	109.00

[20] The Decree on National Environmental Standards, No. 81/GOL, 21 February 2017: Article 10 Surface Water Quality, Class 2 (Class 2 water that is suitable for aquatic life, fisheries and recreation). The Lao surface water quality standards include 5 classes. Class 2 has been chosen as the class that best represents the water quality that would be expected for surface water in a similar environmental setting without the landfill. Water bodies in an area with paddy fields, other agricultural land use and patches of forest normally have a quality able to sustain aquatic life. Fishing in paddy fields, ponds and other water bodies on agricultural land is normal practice for Lao farmers

Parameter	Unit	Standard [20]	LOD	LOQ	SW01	SW02	SW03	SW04
Hydrogen Sulphide	mg/L as H_2S	-	0.14	0.50	ND	ND	0.75	ND
Iron	mg/L	-	0.01	0.10	<0.10	0.67	ND	<0.10
Oil and Grease	mg/L	-	0.70	2.00	ND	ND	ND	ND
pH		6-8	-	-	7.30	7.30	7.80	6.90
Temperature	℃		-	-	24.10	24.60	25.70	23.90
Total Dissolved Solids	mg/L	500[21]	10	25	352	80	173	171
Total Suspended Solids	mg/L	<25	1.00	2.50	17.70	**132**	19.90	21.50
Turbidity	NTU	-	-	1.00	17.10	138	16.00	53.40
Arsenic (As)	mg/L	<0.01	0.05	0.10	ND	ND	ND	ND
Cadmium (Cd)	mg/L	<0.003	0.002	0.003	ND	ND	ND	ND
Coliform Bacteria	MPN/100 mL	<5,000	-	-	4,900	**92,000**	**160,000**	**14,000**
Lead (Pb)	mg/L	<0.01	0.005	0.010	ND	ND	ND	ND
Mercury	mg/L	<0.001	0.00005	0.00010	ND	ND	ND	ND
Phosphate	mg/L	<0.5	0.03	0.46	<0.46	0.46	2.40	<0.46

Note: Yellow highlight indicates non-compliance with the water quality standard. Bold font indicates elevated level for parameters without a standard

6.2.4 Wastewater / Leachate Quality

193. The Pre-Feasibility Study analysed two wastewater/leachate samples (WW01 and WW02). The location of the sampling is indicated in ***Figure 6-19*** and the results of the analyses are summarized in ***Table 6-3***. The samples were not analysed for content of bacteria.

[21] The standard is 1000 uS/cm which roughly corresponds to 500 mg/L TDS

194. WW01 was taken from the pond in the north-western corner of the landfill site within the VCOMS site. WW02 was collected in the outlet channel of the pond.

195. WW01 has high concentrations of both BOD and COD in a range typical for landfill leachate. The pH is also very high which could be caused by photosynthetic activity by algae. WW02 has elevated concentration of cadmium but is otherwise similar in water quality to the surface water quality of SW03 with elevated levels of BOD and COD.

FIGURE 6-19 LOCATION OF WASTEWATER/LEACHATE SAMPLING

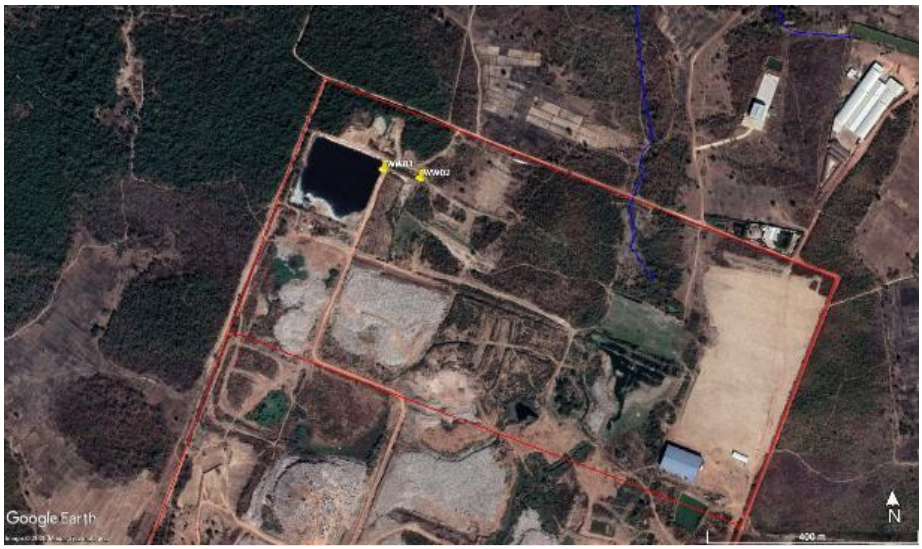


TABLE 6-3 WASTEWATER/LEACHATE QUALITY RESULTS

Parameter	Unit	Standard[22]	LOD	LOQ	WW01	WW02
Ammonium (NH_4)	mg/L as NH_4^+	-	0.07	0.13	0.14	0.47
Biochemical Oxygen Demand	mg/L	60	0.30	1.00	**3,600**	60.00
Chemical Oxygen Demand	mg/L	120	1.00	4.00	**5,107**	112.00
Iron	mg/L	-	0.01	0.10	2.18	1.49
Oil and Grease	mg/L	15.0	0.70	2.00	ND	<2.00
pH		6-8.5	-	-	**11.00**	7.00

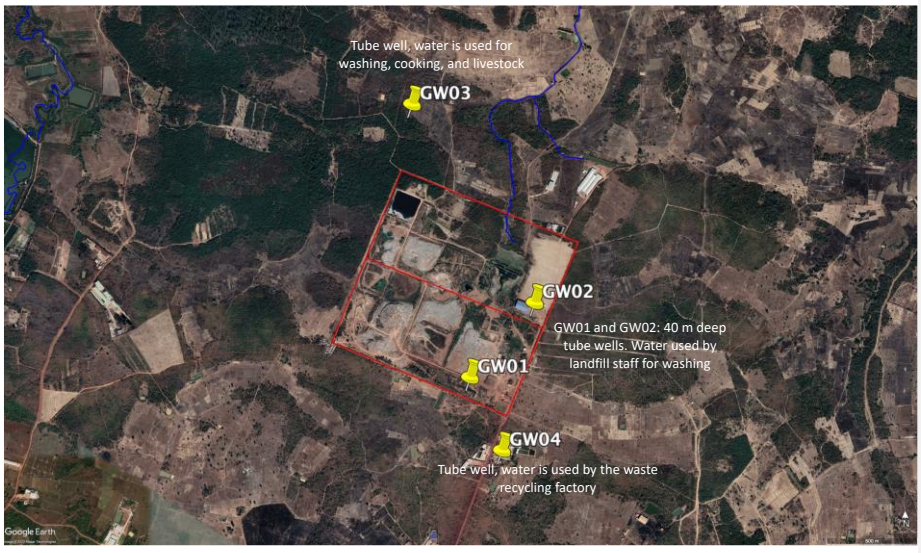
[22] The Decree on National Environmental Standards, No. 81/GOL, 21 February 2017: Article 14 Effluent limit values for general industry

Parameter	Unit	Standard[22]	LOD	LOQ	WW01	WW02
Turbidity	NTU	-	-	1.00	**179.00**	32.30
Cadmium	mg/L	0.03	0.02	0.03	<0.03	**0.23**
Chromium	mg/L	-	0.05	0.10	<0.10	ND
Copper	mg/L	2.0	0.05	0.10	0.14	ND
Lead	mg/L	0.20	0.050	0.10	<0.10	<0.10
Mercury	mg/L	0.005	0.0005	0.0010	ND	ND
Nickel (Ni)	mg/L	1.00	0.05	0.10	<0.10	ND
Phosphate	mg/L	-	0.03	0.46	393.00	2.71

6.2.5 Groundwater Quality

196. The Pre-Feasibility Study analysed groundwater samples from four groundwater wells. The location of the wells is indicated in ***Figure 6-20*** and the results of the analyses are summarized in ***Table 6-4***. The groundwater flow direction has not been determined and it is therefore not possible to determine which, if any, of the monitored wells that are located downstream the landfill waste dumps and leachate ponds.

FIGURE 6-20 GROUNDWATER WELLS MONITORED UNDER THE PRE-FEASIBILITY STUDY



197. All samples have a rather high concentration of Total Dissolved Solids, but this may be the natural background level in the aquifer.

198. All samples have a high content of bacteria, and the concentrations of faecal coliform bacteria are unusually high in GW03 and GW04 both located outside the landfill. Considering that the groundwater flow direction is unknown (*the Pre-feasibility Study asserts that the flow direction it southwestern, but the report does not contain any evidence and does not explain how they have reached this conclusion – if correct, this would mean that none of the wells are located downstream the landfill waste dumps*), it is not possible to determine if any of the wells are affected by the landfill waste and they cannot all be downstream the landfill waste, which implies that the landfill may not be the only source of bacterial contamination in the groundwater. The impact from infiltration of bacteria contaminated leachate into groundwater underneath the landfill and the transport and fate of the contamination would depend on several factors including the thickness of the unsaturated zone, the type of aquifer, the gradient of the groundwater table and the hydraulic conductivity[23]. None of these data are available for this case; however, considering the extremely high concentrations of bacteria in the groundwater samples (particularly in GW02, GW03 and GW04), sources of contamination very close to the wells are likely to contribute significantly to the contamination – perhaps combined with poorly constructed wells.

199. The groundwater sample from GW02 located inside the Km 32 Landfill contained 0.017 mg/L lead[24] which exceeds the groundwater quality standard of 0.01 mg/L. The source of the lead is unknown and may include legacy waste, natural geologic background levels (although this is not supported by the other groundwater samples where lead was not detected), and corrosion of well construction materials, pumps and piping[25]. This needs to be further investigated under the full ESIA studies.

200. One of the groundwater samples from inside the landfill contained 0.017 mg/L lead which exceeds the groundwater quality standard of 0.01 mg/L. The source of the lead is unknown and may include legacy waste, natural geologic background levels (although this is not supported by the other groundwater samples where lead was not detected), and corrosion of well construction materials, pumps and piping.

[23] Xiang, R., Xu, Y., Liu, YQ. et al. Isolation distance between municipal solid waste landfills and drinking water wells for bacteria attenuation and safe drinking. Sci Rep 9, 17881 (2019). https://doi.org/10.1038/s41598-019-54506-2 https://www.nature.com/articles/s41598-019-54506-2

[24] Lead is a highly toxic metal. Multiple uses of lead increase the potential for human exposure and harm to human health. No safe levels of lead exposure for children have been identified. Even at low exposure levels, children can show neurodevelopmental deficits https://www.cdc.gov/nceh/ehs/water/private-wells/corrosive-groundwater.html

[25] https://www.waterboards.ca.gov/gama/docs/coc_lead.pdf

TABLE 6-4 GROUNDWATER QUALITY RESULTS

Parameter	Unit	Standard[26]	LOD	LOQ	GW01	GW02	GW03	GW04
Ammonia (NH_3-N)	mg/L as N	-	0.07	0.13	ND	ND	ND	ND
Ammonium (NH_4)	mg/L as NH_4^+	-	0.07	0.13	ND	ND	ND	ND
BOD	mg/L	-	0.30	1.00	<1.00	1.70	ND	1.00
COD	mg/L	-	1.00	4.00	ND	ND	ND	ND
Dissolved Oxygen	mg/L	-	0.3	1	2.75	8.00	1.95	2.60
Hardness	mg/L as $CaCO_3$	500	3.00	10.0	103.00	116.00	222.00	75.20
Hydrogen Sulphide	mg/L as H_2S	-	0.14	0.50	ND	ND	ND	ND
pH		6.5-9.0	-	-	7.10	6.80	6.40	6.40
Temperature	℃	-	-	-	25.10	17.70	27.40	28.10
Total Dissolved Solids	mg/L	-	10	25	**360**	**278**	**287**	**366**
Total Suspended Solids	mg/L	1,200	1.00	2.50	ND	ND	23.50	3.70
Turbidity	NTU	20	-	1.00	1.09	1.20	**56.20**	2.99
Arsenic (As)	mg/L	0.01	0.05	0.10	ND	ND	ND	ND
Cadmium (Cd)	mg/L	0.003	0.002	0.003	ND	ND	ND	ND
Lead (Pb)	mg/L	0.01	0.005	0.010	ND	**0.017**	ND	ND
Phosphate	mg/L	-	0.03	0.46	<0.46	<0.46	<0.46	0.62
Total Bacteria	colonies/cm^3	500	-	-	**8,100**	**290,000**	**>300,000**	**>300,000**

[26] The Decree on National Environmental Standards, No. 81/GOL, 21 February 2017: Article 11.1 Groundwater for use

Parameter	Unit	Standard[26]	LOD	LOQ	GW01	GW02	GW03	GW04
Faecal Coliform Bacteria	MPN/100mL	2.2	-	-	**17.00**	**13.00**	**92,000**	**24,000**
Total Nitrogen	mg/L as N	-	1	5	ND	<5	<5	<5
Surfactants	mg/L as MBAS	-	0.35	0.40	ND	ND	ND	ND

201. The EIA commissioned by VWMC in 2018[27] for their planned waste management project collected groundwater samples from five wells, three newly constructed 5-7 m deep boreholes at the VWMC site and two from existing groundwater wells which appear to be the same as GW02 and GW04. The results are similar to the results reported by the Pre-Feasibility study (summarized above) indicating high content of bacteria in all wells. However, the VWMC EIA analysed fewer parameters including no heavy metal analyses.

6.2.6 Soil Quality

202. The Pre-Feasibility Study analysed soil samples for heavy metals from three locations inside the landfill and one location from farmland outside the landfill. The sampling locations are indicated in ***Figure 6-21*** and the results of the analyses are summarized in ***Table 6-5***.

[27] Environmental and Social Impact Assessment, Project on Investment to Establish the Waste Processing Plant to Generate Renewable Energy, Khouanemeuang Group Sole Co. Ltd. November 2018. Environmental Management and Monitoring Plan, Vientiane Waste Management Company Ltd, May 2023

FIGURE 6-21 LOCATION OF SOIL SAMPLES



203. The results of the soil analyses are compared with soil quality standards from Lao PDR and Vietnam where the Lao standards apply to other land use than residential and agricultural, and the Vietnamese standards apply to industrial land use. Compared with soil quality standards from other countries, the Lao standards in particular, are in the high end[28].

204. Soil 02 collected near the pond on the north-western corner of the landfill stands out with very high concentrations of arsenic and cadmium. High concentrations of cadmium were also detected in the wastewater sample (WW02) from the outlet of the pond. These data clearly indicate significant impacts on soil and water from waste dumped at the landfill.

TABLE 6-5 RESULTS OF METAL ANALYSES ON SOIL SAMPLES

Parameter	Unit	Standard[29]	Standard[30]	Soil01	Soil02	Soil03	Soil04
Arsenic (As)	mg/kg	27	25	<5.00	**123**	5.01	<5.00
Cadmium (Cd)	mg/kg	810	10	1.81	**27.3**	2.22	1.14
Chromium (Cr)	mg/kg	640	250	8.10	61.2	22.8	30.0
Lead (Pb)	mg/kg	750	300	10.40	39.7	24.1	5.82

[28] https://www.nature.com/articles/s41598-020-65359-5/tables/2

[29] The Decree on National Environmental Standards, No. 81/GOL, 21 February 2017: Article 8.1 Soil quality standards for residential areas and areas for agricultural production

[30] Vietnam, Circular No. 64/2015/TT-BTNMT Technical Standards on Soil, Industrial land use

Parameter	Unit	Standard[29]	Standard[30]	Soil01	Soil02	Soil03	Soil04
Manganese (Mn)	mg/kg	32,000	-	769	766	4,043	275
Mercury (Hg)	mg/kg	610	-	ND	ND	ND	ND
Nickel (Ni)	mg/kg	41,000	-	14.10	11.60	34.20	6.35

6.2.7 Air Quality and Noise

205. Air quality measurements were carried out under the Pre-feasibility Study at two stations in February 2022. The location of the stations is displayed in ***Figure 6-22***. The monitoring covered the following nine parameters: Total Suspended Particulate (TSP), particulate matter with a diameter of 10 micrometre or smaller (PM10), particulate matter with a diameter of 2.5 micrometre or smaller (PM2.5), sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2) ozone (O_3), lead (Pb), and mercury (Hg). The results of the monitoring are summarized in ***Table 6-6***.

206. The air quality monitoring data indicate compliance with the relevant Lao ambient air quality standards for all the monitored parameters. However, as noted in the Pre-feasibility Study Task 5 Report, the monitoring stations were located upwind from where open burning of waste was taken place during the measurements and the results therefore do not adequately reflect the impact of open waste burning on the ambient air quality.

207. Nevertheless, the PM10 measurements show levels 2 times higher than the WHO recommended air quality guidelines and based on the Consultant's experience from other projects in Laos[31], the PM10 levels measured at the landfill are higher than typical average levels in rural villages for this time of year.

208. There is no standard for lead in the Lao ambient air quality standards. Instead, the USEPA standard is listed in ***Table 6-6.*** This standard is for a three-months averaging period and therefore not directly comparable but does indicate that the detection limit is much higher than what may be considered reasonably safe air quality levels. In any case, the risk of lead contamination to human health is probably better assessed by measuring the concentration of lead in blood. The WHO proposes 100 µg/L as a critical concentration of lead in blood[32].

209. **Noise measurements** were carried out at the same stations as the air quality measurements. The results are presented in ***Table 6-7***. The noise was measured close to the landfill boundary, and it is therefore appropriate to compare with the standard for industrial

[31] Air quality measurements during construction of the Nam Ngiep 1 Hydropower Project in Bolikhamxay Province

[32] WHO Air Quality Guidelines for Europe, 2000, https://www.euro.who.int/__data/assets/pdf_file/0020/123077/AQG2ndEd_6_7Lead.pdf

areas which both in the Lao Standard and in the IFC General EHS guideline[33] is set at maximum 70 dB(A). The results indicate compliance with the noise standard.

210. A basic noise calculation[34] assuming full-time operation of one bulldozer, one large excavator, one roller and four trucks would generate a noise level of 67 dB(A) at façade level 200 m from the noise sources.

FIGURE 6-22 AIR QUALITY MONITORING STATIONS UNDER THE PRE-FEASIBILITY STUDY



TABLE 6-6 RESULTS OF AIR QUALITY MEASUREMENTS CARRIED OUT UNDER THE PRE-FEASIBILITY STUDY, FEB-2022

Parameter	Unit	Standard	AQ01	AQ02
TSP	mg/m^3	0.33	0.244	0.172
PM10 (24-hour)	mg/m^3	0.12 (0.045)[35]	0.096	0.090
PM2.5 (24-hour)	mg/m^3	0.05 (0.015)[35]	ND	ND
Lead (quarterly average)	mg/m^3	0.00015[36]	<0.01	<0.01

[33] IFC Environmental, Health and Safety Guidelines, General Guidelines, Environmental Noise Management, 30 April 2007

[34] https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/tools/construction-noise-calculator/

[35] WHO Global Air Quality Guidelines, 2021

[36] USEPA air quality standard https://www.epa.gov/criteria-air-pollutants/naaqs-table

Parameter	Unit	Standard	AQ01	AQ02
Mercury	mg/m^3	-	<0.0005	<0.0005
CO (1-hour)	ppm	30.0	2.019	0.716
CO (8-hour)	ppm	9.0	1.091	0.615
SO_2 (1-hour)	ppm	0.05	0.0004	0.0008
SO_2 (24-hour)	ppm	0.13 (0.015 ppm, 0.040 mg/m^3)[35]	0.0005	0.0006
NO_2 (1-hour)	ppm	0.11	0.0182	0.00856
NO_2 (24-hour)	ppm	0.11	0.01	0.00
O_3 (1-hour)	mg/m^3	0.20	0.0090	0.0012
O_3 (8-hour)	mg/m^3	0.140	0.0071	0.00

TABLE 6-7 RESULTS OF NOISE MEASUREMENTS CARRIED OUT UNDER THE PRE-FEASIBILITY STUDY, FEB-2022

Parameters	Unit	Standard	AQ01	AQ02
Leq24hr	dB(A)	70	52.9	63.4
Maximum	dB(A)	115	65.8	65.8

211. The EIA commissioned by VWMC for their planned waste management project in 2018 included air quality measurements at two stations. The wind direction was from the southwest meaning from across the Km 32 landfill. The measurements were carried out in November 2018. The results for TSP and PM10 were 2-3 times lower than the results reported by the Pre-Feasibility Study summarised above. In March 2020, VWMC commissioned three ambient air quality measurements. The results for PM10 were about 50% higher than the Lao standard for ambient air quality for two of the measurements and just below the standard for the third measurement. The TSP results were slightly above the standard for one measurement, just below the standard for the second measurement and about half the standard value for the third measurement (wind direction not mentioned). Another round of air quality measurements was carried out in July 2020 and the results showed TSP and PM10 levels 5-10 times lower than the respective standard (wind direction western/southwestern).

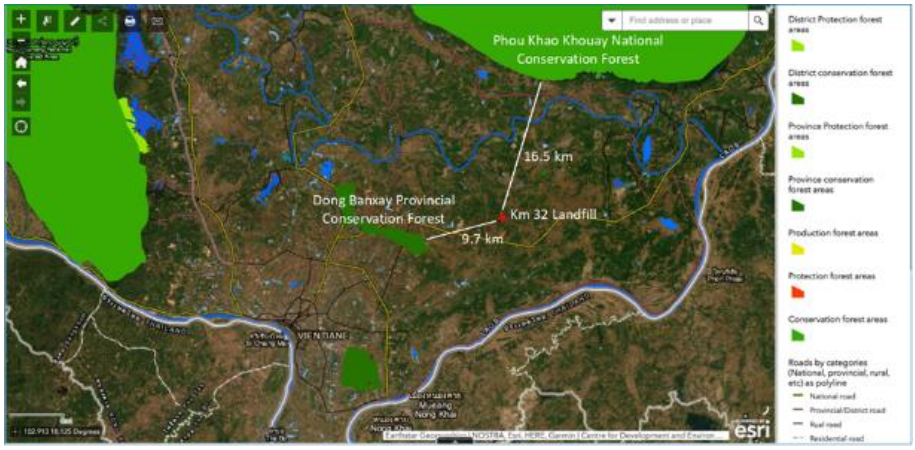
6.2.8 Biological and Ecological Environment

212. The site is surrounded by agricultural land and livestock farmland. Domestic animals including cows, buffalos and goats are roaming around in the site due to broken fences in many

sections. The Pre-Feasibility field survey did not identify any sensitive flora, fauna, or habitats and no threatened species. At the site and its surroundings, the following common tree species were found *Shorea obtusa* Wall.ex Blume, *Shorea siamensis* Mig, *Terminalia alata* Heyne ex Roth, *Dipterocarpus tuberculatus* Roxb., and *Lepisanthes fruticosa* Leenh. A bird survey in the early morning identified the sound of more than 10 bird species in the mixed deciduous forest north and northwest of the landfill site. In interviews with surrounding villagers and waste pickers at the landfill, the interviewees identified the following animal species include bird species *Cypsiurus balasiensis, Acridotheres, Orthotomus sutorius, Glaucidium cuculoides, Centorpus sinensis,* and *Gallus gallus,* while other amphibians including reptiles such as *Hopplobrachus rugulosus, Duttaphrynus melanostictus, Duttaphrynus melanostictus*, tree lizards, and snakes, while *Gastropoda* were also found such as *Molluska,* and *Cryptozona siamensis*.

213. The nearest protected areas are indicated in ***Figure 6-23***. The map shows that the nearest protected area is the 1,282 ha large Dong Banxay Provincial Conservation Forest about 9.7 km southwest of the Km 32 Landfill Project. The map also shows that the Phou Khao Khouay National Conservation Forest is located about 16.5 km north of the Km 32 Landfill Project.

FIGURE 6-23 PROTECTED AREAS



Source: The Knowledge for Development (K4D) Project, the Ministry of Agriculture and Forestry, https://www.k4d.la/

6.3 SOCIAL BASELINE

214. The information provided in this section is based on the Pre-Feasibility Study Task 5 Report[37] and site visits in July 2022 including consultations with waste pickers, representatives of residents in the surrounding villages and meetings with VCOMS and Small B. This section is a summary of the social baseline included in the PWMP Social Impact Assessment.

[37] Pre-Feasibility Study on Solid and Plastic Waste Management System and Infrastructure in Lao PDR: Task 5, EX Research Institute Ltd., CTI Engineering International Co. Ltd. and National University of Laos for the World Bank, June 2022Task 5 Report prepared by the Pre-FS consultant

6.3.1 Population and Demography

215. Xaythany District, like other districts in Vientiane Capital has a full range of facilities such as schools, factories, and other facilities that attract people from provinces to settle in the district for education, business, and employment. As a result, the population is growing rapidly.

216. Xaythany District has a total of 104 villages with a population of 220,661 people (in 2019), of whom 110,838 are women, in 45,750 households, and the population density was 256 persons per km2 (Vientiane Capital Statistics book, 2020). The details of the population in the villages adjacent to the KM 32 landfill are presented in ***Table 6-8***.

217. There are three villages near the KM 32 landfill site: Naphasouk Village located 2.5 km south of the landfill; Phonsavanh Village around 2.8 km southwest of the landfill; and Nakhao Village around 3 km north of the landfill. A new residential area 1.4 km southwest of the landfill along the access road has recently been established, comprising approximately 20 units that appear currently to be unoccupied (see ***Figure 6-24***). This area was visited but was not included in this social economic survey.

FIGURE 6-24 LOCATION OF VILLAGES IN THE PROXIMITY OF THE KM 32 LANDFILL

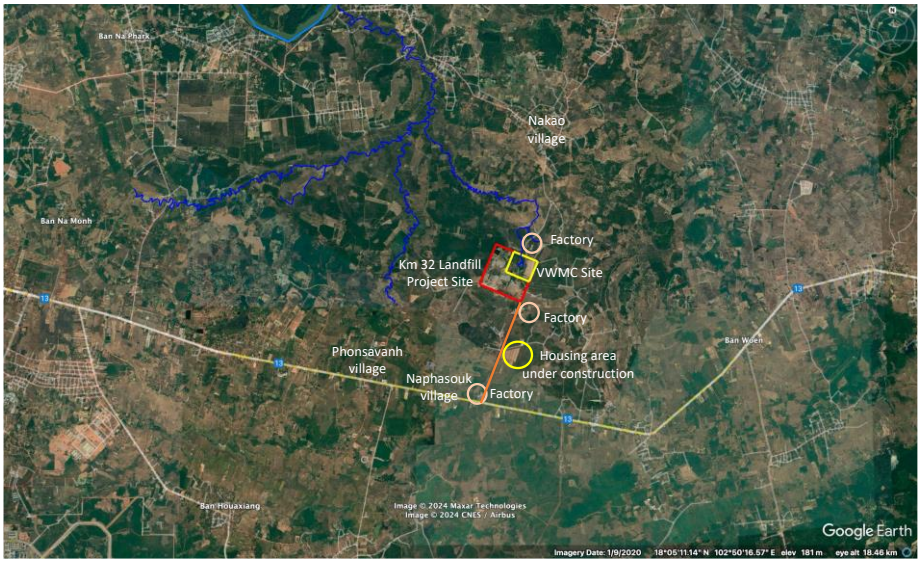


TABLE 6-8 POPULATION SURROUNDING KM 32 LANDFILL SITE

No.	Village Name	Number of Households	Total Population	Number of Females
1	Naphasouk	252	1,483	561
2	Nakhao	365	2,478	984
3	Phonsavanh	132	665	329
	Total	749	4,626	1,874

Source: EXRI Task 5 Report, June 2022

6.3.1.1 Land Use and Land Tenure

218. The existing Km 32 landfill is owned by VCOMS and thus by the government of Lao PDR. The surrounding areas are privately-owned. The site was developed by VCOMS in 2009. There are no known grievances or disputes concerning land tenure.

219. To the north, there are two factories; one is active, and the other one has been closed due to the impact of COVID-19. Worker accommodations located near the landfill are on the north side, across the access road. Two houses and a grocery shop are located along the access road east of the landfill site, and two recycling factories are located along the access road. The landfill is surrounded by agricultural land including paddy fields, fishponds, pig farms, grazing land and patches of dry forest. The waste pickers have established their camp on leased land immediately outside the southwestern corner of the landfill. They temporarily store the collected recyclables at their camp. The access road to the Km 32 landfill is a 2.8 km long unpaved road.

220. One family with a few huts lives inside the mixed deciduous forest area immediately west of the landfill. They raise livestock, produce charcoal and have small agricultural plots.

6.3.1.2 Ethnicity and Religion

221. The population in Xaythany District is composed of four main ethnic groups: LaoTai-Lao, Mon-Khmer, Sino-Tibetan, and Hmong-Iumien. In Xaythany District, there are 132 temples, 12 churches, 539 monks, 698 novices, and 38 nuns. Of the population in the district, 90.6%, 7.2%, and 2.2% are Buddhist, animist, or Christian, respectively. All households in the three villages near the Km 32 landfill identified themselves as Lao, which falls under the Tai-Kadai family, also referred to as Lao-Loum. A vast majority of the population in the three villages are Buddhist. Every village has a temple.

6.3.1.3 Economy and Livelihood

222. More than 90% of the population is engaged in farming using a diversity of cultivation activities such as paddy rice, vegetable cultivation, livestock raising, and fishing. Therefore, the main source of income is from agriculture production. Other income sources include small businesses/services and employment in the government or from daywork. There are 10 (poor) households with insufficient income for their livelihoods in Nakhao and Phonsavanh villages as shown in the table below.

TABLE 6-9 OCCUPATIONS OF VILLAGERS

No	Village	Number of Households	Occupation			Sufficient	Insufficient	Remark
			Farmer (%)	Officer (%)	Worker/labor force (%)			
1	Naphasouk	252	90	3	7	252	0	
2	Nakhao	365	98		2	357	8	There are unstable occupations
3	Phonsavanh	132	85	5	10	130	2	Unemployed and childless elderly

223. Naphasouk and Phonsavanh villages are located along National Road 13 South, while Nakhao village is located away from the road. The discussion with concerned villages revealed that all villagers have access to water supply and electricity as well as proper sanitation facilities.

TABLE 6-10 BASIC SERVICE INFRASTRUCTURE

Village Name	Type				
	Market	Company	Small Shop	Hotel & Guesthouse	Waste Recycle Collection Shop
Naphasouk	0	12	24	2	4
Nakhao	0	0	14	0	1
Phonsavanh	0	8	15	2	1

6.3.1.4 Education and Literacy

224. Xaythany District has 74 kindergartens, including 24 public and 50 private kindergartens with 278 classes, and 63 nursery rooms with 9,842 nursery students with enrolment rates of 51% for males and 49% for females. There are 128 primary schools with a total of 19,792 students of which 52% are males and 48% are females. There are 9 lower secondary schools with 331 classrooms and 13,270 students, consisting of 51.8% males and 48.2% females. At the upper secondary level, there are 25 schools with 206 classrooms and 8,196 students, with an enrolment rate of 50.8% for males and 49.2% for females.[38] The table below shows the number of educational institutions and the number of students in the three villages near the Km 32 landfill.

TABLE 6-11 EDUCATION INFORMATION IN SURROUNDING VILLAGES

Village Name	Type	Students	No. Classes	No. Teachers
Naphasouk	Kindergarten	60	3	8
	Primary School	100	5	5
	High School	-	-	-
Nakhao	Kindergarten			
	Primary School	237	6	7
	High School			
Phonsavanh	Kindergaten			
	Primary School	100	5	5
	High School			

6.3.1.5 Public Health

225. In Xaythany District there is one community hospital, 11 small hospitals, 119 pharmacies, 56 private clinics, nine village medicine clinics, five traditional medicine clinics, and 128 general practitioners providing health care services.

[38] Source: Five-Year (2015-2020) socio-economic implementation report, Vientiane Capital Administration

226. In Naphasouk village no significant health issues were reported. Interviewees from Nakhao and Phonsavanh village mentioned health problems allegedly related to landfill operations such as skin rashes and respiratory diseases.

227. When seeking health care, the villagers usually go to nearby health care centers (Souksala) – in the Paksap cluster for Nakao, the Khok Sivilai cluster for Phonsavanh, and the Xieng cluster for Naphasouk, which is almost 7 km away. The Xaythany District hospital is about 16-20 km from the villages, while hospitals in central Vientiane Capital are about 25-35 km away.

6.3.1.6 Cultural Heritage

228. There are temples at the villages near the Km 32 landfill site. There are no known cultural sites immediately adjacent to the landfill site.

FIGURE 6-25 PHOTO OF TEMPLE IN BAN NAKHOA



6.3.1.7 UXO

229. According to the US Airforce historical records 1963-1975[39], the Km 32 landfill is not located in an area at risk of UXO or landmines. This shall be further studied during the full ESIA study.

6.3.1.8 Community Feedback on the Existing Km 32 Landfill

230. All three studied villages report having experienced air pollution and bad smells generated by waste burning at the Km 32 landfill.

231. All three villages claimed that their health was affected by the landfill fires in 2022. They also confirmed that smoke and bad smells from frequent burning at the landfill causing

[39] Based on analysis of UXO maps available on https://www.k4d.la/ Geographic Information for Development Planning of the Government of Lao PDR hosted by the Ministry of Agriculture and Forestry

respiratory problems, particular during night-time. Many elderly people could not sleep and found it difficult to breath.

232. Phasouk and Phonsavanh villagers also mentioned that previously their cattle were affected because of eating garbage at the landfill. Some cattle died, and they also would not eat the meat due to concerns about chemical contamination. Villagers had to prevent animals from entering the landfill by themselves, because many parts of the landfill fencing were broken.

233. In addition, Ban Nakhao villagers claimed that they used to be affected from dark water (leachate runoff) during the rainy season. It caused skin rashes of villagers who touched the water contaminated with the leachate. In rice fields to which the contaminated leachate flowed, the rice plants were beautiful, but produced no yield (no production, no harvesting). Villagers were also concerned about water quality and would not fish or eat the fish from creeks or streams that were contaminated with landfill leachate.

234. Naphasouk and Phonsavanh villagers reported that sometimes waste falls from waste collection trucks due to overloading without cover, and the trucks are also damaging the access road.

235. From the results of interviews and village observation, it was found that not all the solid waste generated in Nakhao and Naphasouk villages is collected. Improper disposal is common including open burning, burying, and illicit dumping and littering along roads, in roadside drains, streams, and on vacant land.

6.3.1.9 Community Feedback on the Proposed Project

236. A Focus Group Discussion (FGD) was carried out on 11 August 2022 by the EPF consultants together with technical staffs from EPFO, NRERI and PTI in Naphasouk Village, the Km 32 landfill with a total of 22 participants including 19 females. All of them are Lao Tai. Based on the information provided by the Naphasouk Village Chief, there is about 195 households with 1800 people including 482 females (all are Lao Tai) in the village and 90% of 195 households have at least 1-2 members work as informal or seasonal waste pickers to collect and sell waste for their livelihoods.

237. The main objectives of the FGD were to:

- Present the main objective of the PWMP and give a brief description of the project
- Seek their opinions on the project development and implementation.

238. While participants acknowledged the value of the proposed project in improving waste management for Vientiane Capital, most of the discussion concentrated on the implications of reduced volumes of recyclable waste being delivered to Km 32 due to increased materials recovery at other waste management 'feeder' facilities (Km 16 and Naxaythong). Villagers engaged in waste picking emphasized its significance as a source of income, and concern if earnings reduced or waste picking ceased entirely due to the project. Local unskilled employment is limited, with factory work offering low salaries (~LAK 1.5 million per month) and

few opportunities for women due to long and fixed hours that are not compatible with family responsibilities. By contrast, waste picking provides a reasonable income with flexible working hours. Possible new employment opportunities at the Km 16 waste facility were discussed, however cost of travel was a concern.

239. The participants expressed doubts about building toilets or a shelter at the landfill because they foresee that the facilities will not be cleaned and maintained, and the shelter could create social issues such as a place for drug and alcohol consumption which can lead to violence and sexual harassment and abuse. They also mentioned that the toilet built previously by a NGO was not well utilized.

6.3.2 Waste Pickers and Waste Collectors

6.3.2.1 Basic Information on Waste Pickers and Waste Collectors

240. According to VCOMS' records there are 264 registered waste pickers (124 females and 140 males) with ages ranging from 14 to 63 years old. Most of them belong to Lao Tai, ethnic groups while 3 are Khmu. Nineteen are under 18 years old. Five live in non-permanent settlement area nearby (See ***Figure 6-26***). Most of the waste pickers are local residents living in the nearby villages or in other villages in Xaythany District and other districts in Vientiane Capital and the remainders are from other provinces including Champasak, Khamuane, Luang Prabang, Oudomxay.

FIGURE 6-26 PHOTO OF THE WASTE PICKERS' CAMP



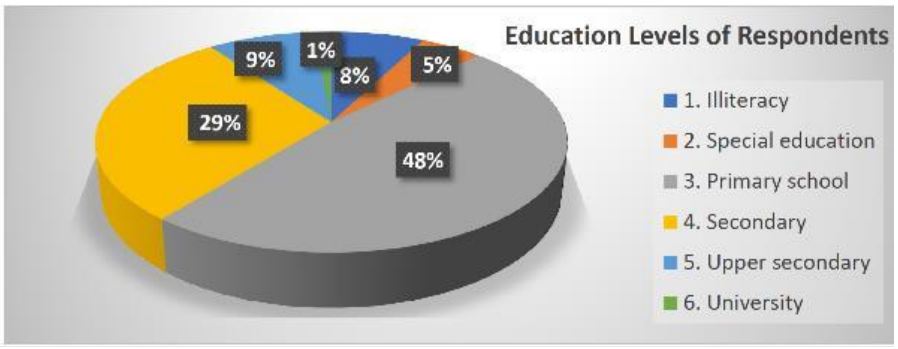
241. A total of 113 waste collectors are employed as members of waste collection truck crews by seven waste collection/transportation companies. The number of employees excludes

those employed by 5 other small waste collection/transportation companies who did not report the number of employees.

242. This assessment interviewed 158 persons (69 women). The interviewees included 102 waste pickers, 44 waste collectors and 12 workers that work both as waste pickers and as waste collectors. About 30% of the registered waste pickers were interviewed.

243. The average age of the interviewees was 37 years of age, the median was 35, the youngest was 15, and the oldest was70. Six interviewees were under 18 years old. The interviewees' marital status included 76.58% who are married, 19% who are single, 3% who are divorced, and a small fraction that were widowers/widows. 89% of interviewees said that the household head is their husband or a man, while the remainder was composed of wives or women. The largest household had 18 members, the smallest had 2 members and the median was 5 members. The level of education was quite low, illiteracy, special education, primary, secondary, upper secondary, and higher education was 8%, 5%, 48%, 29%, 9% and 1%, respectively. 99% of interviewees said that they are Buddhist, and the remainder were animists.

FIGURE 6-27 EDUCATION LEVELS OF INTERVIEWEES



244. The demography of the interviewees' family members shows that 30% of families are of a young age, 68% are in the labour force and 2% are elderly.

Residence and Livelihoods

245. 89% of the waste pickers and waste collectors are local residents, while 11% are from other provinces such as Vientiane, Xiengkouang, Houaphan, Louang Pra Bang, Xaysomboun, Bolikhamxay, Savannakhet, Attapheu, and Oudomxay. One person was from Thailand. 78.48% of the waste pickers are local residents who live in their own accommodation and the remainder rent accommodation or stay near the landfill site. Of the 78% who are local residents, 36.71% of respondents live in Ban Naphasouk, where the Km 32 landfill is located. 16.13% of them live in Ban Xaysomboun, 6.33% live in Ban Nakhao, 5.70% live in Ban Khoknoy and the remainder live in 10 villages located in Xaythany District.

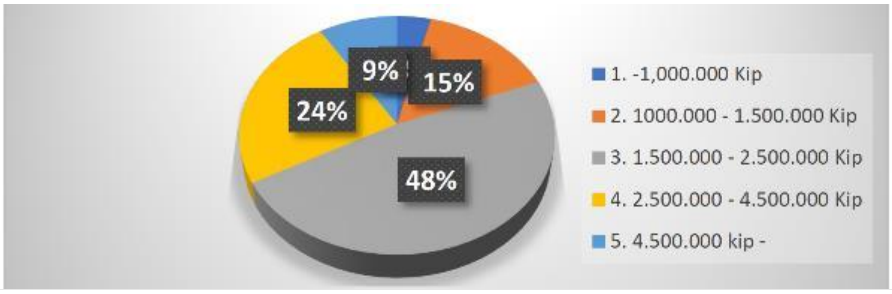
246. 94% of the interviewees claimed that they are working full-time, the remainder claimed that they work irregularly, mostly during the dry seasons. 12% of interviewees has worked less

than 1 year, 38% had worked 1-5 years, 18% had worked 5-10 years, 28% 10-20 years and 4% for over 20 years. 27% work 7 days a week, 48% 6 days a week, 23% work 4-5 days a week, and the remainder less than 4 days a week. This survey also found that 10% of interviewees work around 15 hours per day, 37% work 10 to 14 hours per day, 50 % of them work 6-9 hours per day and the remainder work less than 6 hours per day.

247. 73% of the interviewees go to work by motorbike, 7% by walking, 7% via company vehicles, 6% by bike and the remainder use other means of transport. 33% of interviewees said that they get food from near landfill sites. 50% said that they bought prepared food from markets, only 3% said that food was provided by their employer, and the remainder got food from elsewhere. 78% of the interviewees get water from groundwater, 16% use a water tap, and the remainder get water from wells and river channels.

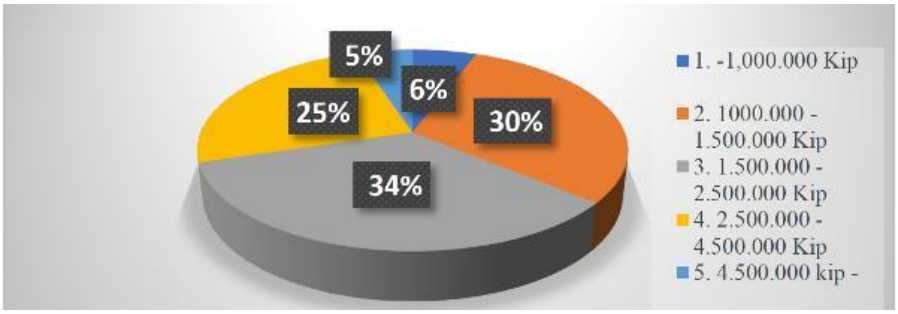
248. 64% of the interviewees said that they only get income from selling recyclable waste and they earn an average of 1.51 million LAK per month (Max=4, median=1.5 and Min=0.1 million LAK/month), and 28% receive a company salary only with an average salary being 1.85 million LAK/Month (Max=3.4, median=1.7, and min=1 million LAK/Month). 8% of interviewees said they have two sources of income, both a salary and selling waste.

Figure 6-28 Household income of Waste Pickers and Collectors per month



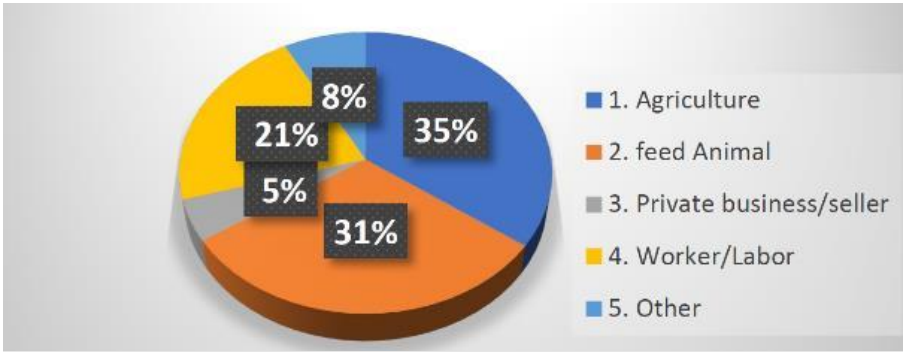
249. The monthly household income of the waste pickers and waste collectors indicates that 4%, 15%, 48%, 24%, and 9% of the interviewees earn less than 1 million LAK, 1-1.5 million LAK, 1.5-2.5 million LAK, 2.5-4.5 million LAK and over 4.5 million LAK per month, respectively. 6%, 30%, 34%, 24% and 5% of the interviewees said that their monthly household expenditure is less than 1 million LAK, 1-1.5 million LAK, 1.5-2.5 million LAK, 2.5-4.5 million LAK and over 4.5 million LAK, respectively. 54% said they have enough money for expenditures but no savings, 28% said that they have enough money for expenditures and have savings, and 18% said they didn't have enough money for expenditures and so they borrow money.

FIGURE 6-29 HOUSEHOLD EXPENDITURE OF WASTE PICKERS AND COLLECTORS PER MONTH



250. The households represented by the interviewees do not rely just on income from selling recyclable waste or their salaries, they also have other sources of income including agriculture, livestock, commerce, other labour jobs and other miscellaneous income. The details are shown in the figure below.

FIGURE 6-30 OTHER SOURCES OF HOUSEHOLD INCOME OF RESPONDENTS

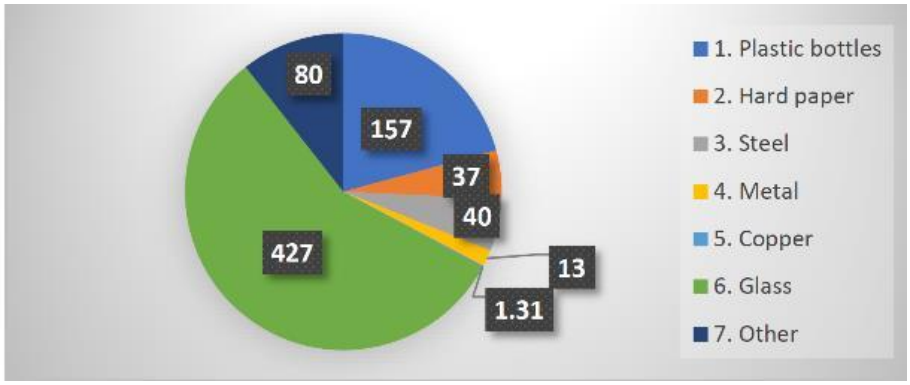


6.3.2.2 Waste Segregation and Occupational Health and Safety

251. Recyclable waste includes plastic bottles, paper, metals, steel, copper, glass, and etc. The average amounts of the recyclable waste collected per HH per week are shown below.

252. As indicated in ***Figure 6-31***, the average amount of recyclables collected by the waste pickers per week includes: 157 kg of plastic bottles, 37 kg of paper, 40 kg of steel, 13 kg of other metals, 1.31 kg of copper, 427 kg of glass, and 80 kg of other materials. The waste pickers collect the recyclable waste categories are differently, but majority concentrated on plastic bottles: 98 HHs, steel=90 HHs, hard paper=62 HHs, coper=48 HHs, metal=34 HHs, glass=27 HHs and other=3 HHs.

FIGURE 6-31 AVERAGE COLLECTED RECYCLABLE WASTE KG/HH/WEEK

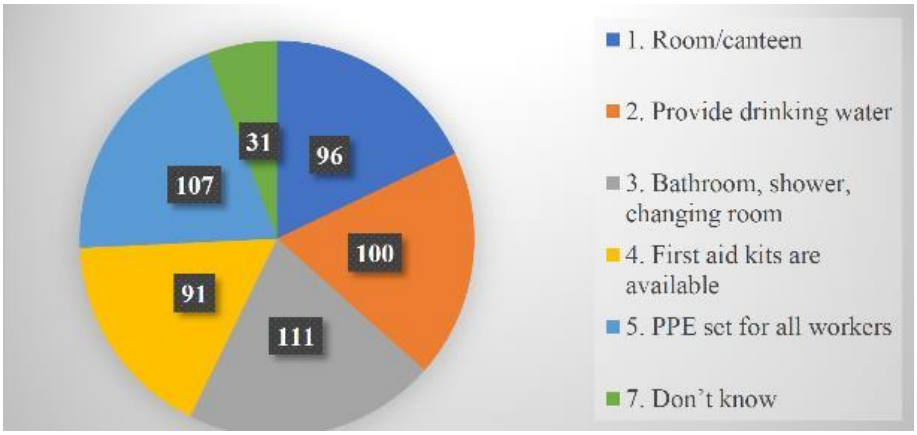


253. The top three common obstacles for waste segregation raised by the waste pickers include (1) waste being mixed together from several waste trucks, (2) food waste, and bad odours, and (3) there being no designated waste segregation areas in final disposal areas.

254. Both waste pickers and waste collectors think about hazardous waste based on the state of the waste, 88% consider glass, broken glass, sharp materials, and bad odours, 84% consider computers, batteries, and engine oil, and 46% consider plastics, masks, waste medicine, and medicine bottles. Only 7% of the interviewees reported that they don't know anything at all about hazardous waste.

255. For waste collectors at the KM32 landfill site, 71% said they were not trained on health, hygiene, and safety, and similarly 74% said they were not trained on waste segregation, waste type or waste management. 41% of the interviewees confirmed that they had not received personal protective equipment, while 50% had received safety shoes, 31% had received hard hats, and another 12% received safety vests. 65% of interviewees reported that they haven't been affected by any health issues during work, 16% had sore eyes, 11% had skin allergies, 21% had insomnia and respiratory diseases, and 12% had other illnesses. 36% of interviewees have been in accidents, while 64% have not. Finally, when unwell, 37% of interviewees prefer going to a district-province hospital, 34% prefer private clinics, 23% prefer village health centres and 29% prefer buying medicine from a pharmacy.

FIGURE 6-32 NECESSITIES FOR IMPROVING WORK ENVIRONMENT FOR WASTE PICKERS



6.3.2.3 Gender Issues, Human Trafficking, Sexual Exploitation and Abuse, Sexual Harassment and Violence Against Children

256. Gender**:** No gender issues were raised during the FGD. Men and women share opinions, respect each other and make decisions together on important topics. Money or income is kept and managed by women or wives as they are use money more wisely than men.

257. **Human trafficking:** This was not raised as a concern during the FGD.

258. **SEA/SH and VAC:** Two SH cases were reported to VCOMS about 4 years ago. Both cases occurred at the non-permanent settlement area and were related to drug and alcohol consumption and have been solved.

6.3.2.4 Labour Division

259. During the FGD conducted on 11 August 2022, the villagers stated that both husband and wife go and pick waste at the landfill. Income is kept and managed by women or wives as they use money more wisely than men.

6.3.2.5 Potential for Increased Accidents

260. During the FGD conducted on 11 August 2022, the waste pickers said that there are minor accidents and injuries from excavator movements without signalling or warning.

6.3.2.6 Vulnerable and Poor Groups

261. A female headed household (56 years old) with one daughter and two nephews age about 4 and 5 years old playing in the landfill without wearing shoes. Mother and daughter are both working at the landfill and live in a house on land owned by relatives nearby the landfill. Additionally, the waste picker income data collected by the pre-feasibility study shows some are below the poverty line. All waste pickers are considered vulnerable due to the unregulated and precarious nature of their work, social marginalization and low income. Information about

vulnerable and poor groups or individuals needs to be collected and analysed during the full ESIA stage.

6.3.2.7 Concerns and Opinions of the Registered Waste Pickers

262. The Focus Group Discussion (FGD) with registered waste pickers (staying in the camp next to the southwestern corner of the landfill) was carried out on 11 August 2022 by the EPF consultants together with technical staffs from EPFO, NRERI and PTI at the KM32 landfill with a total of 60 participants including 33 females. Most of them are Lao Tai with only 3 participants (waste pickers) are Khmu. The main objectives of the FGD were to:

- Present the main objective of the PWMP and give a brief description of the project
- Seek their opinions on the project development and implementation
- Collect their opinions on the potential positive and negative impacts of the PWMP as well as their suggestions and recommendations.

263. During the FGD, all participants supported the project development, but they do not support to move the waste to other places. However, some of them said that if the waste is moved to other places, they will move to the new place. All agreed that the PWMP will create positive impacts to their occupational health and safety and will improve their livelihoods as long as they can continue to have access to the waste for collection and selling.

264. The key results of the FGD are summarized below:

- Their Income from selling waste is 500,000-1,500,000 kip per household per week (300 kip/kg); some of them work both at daytime and night-time at the landfill. They often find valuable materials (gold, jewellery, clothes) and money with values ranging from 100,000 kip to 10 million kip. If they don't have waste to pick and sell, it will significantly affect their income and livelihoods.
- At least one household have picked waste since 2009. Before 2009, the area was mainly used for agriculture (paddy field) and one lady said that her paddy was acquired by the landfill, and they had received compensation for their land.
- They use PPE but those who came to the consultation said that they had not received any training on health and safety.
- Surprisingly, they said they did not have health issues (only normal cold and fever) and they did not experience bad smells from the landfill which was different from information given by the village authorities.
- The participants requested the Project to construct more toilets and shelter at the landfill with clean water and basic facilities. They are willing to pay a fee for these services.
- The participants requested the Project to provide PPE and health checks at least once per year and provide first aid kits at the landfill.

- There should be more excavators to move/push the waste so they can easily sort the waste.
- Fire trucks should be available for emergency cases.
- The participants requested the Project a large space for sorting the waste and a safe space to park motorbikes and motorbike with extended trailer.
- The excavator drivers should give signal or warning (horn).
- The access road to the landfill should be paved.
- The participants requested VCOMS to increase the price of recyclables.
- The participants requested the Project to provide assistance to one poor and vulnerable household – if possible, land and house with basic facilities.

6.3.2.8 Follow-up Consultations

265. On 8 January 2024, the ESF consultants conducted additional consultation on the latest PWMP with VCOMs, VWMC and waste pickers with a total of 46 participants of which 27 of them are female. The consultation results are summarised below:

- VCOMs and VWMC reported on the status of the updated concession agreement Vientiane Capital Administration and noted that all government agencies have signed and are waiting for the company to sign.
- VCOMs and VWMC confirmed that the updated concession agreement excludes the right to use the existing waste on the VCOMS site and that VWMC has agreed to return 20 ha back to VCOMS.
- The demarcation of the 20 ha has been identified and agreed with VWMC. After signing of the concession agreement, PONRE will update the land title.
- VCOMs proposed to the Project: (i) to move the planned leachate treatment facility and leachate regulating pond to the 20 ha area, which would give more space for future landfill cells; (ii) there should be cell space for depositing healthcare waste that has been autoclaved by the hospitals. These points will be further discussed and investigated during the detailed design and full ESIA study.
- The waste pickers expressed their strong support to the Project, acknowledging the Project will provide them with safer working conditions, improved sanitation facilities and access to vocational skills and training.
- The waste pickers noted that recyclable waste is now reduced due to VCOMS/Small B trucks are directed to the VWMC RDF plant. Only private trucks are dumping waste at the landfill. The private trucks have less recyclable waste as their waste collection crews sort the waste before reaching the landfill. They requested to allocate some of the VCOMS/Small B trucks to the VCOMS site at least 50%. VCOMS responded to the waste

picker that they will help out as requested.

- The waste pickers requested that they should be allowed to sell the recyclables to at least two buyers (used glass bottles) as now they are only allowed to sell to one particular buyer who pays a lower price than the previous buyer, and sometimes does not buy all. VCOMs responded that they will consider and get back to the waste pickers.
- In addition to the proposed facility improvements under PWMP, the waste pickers requested the project to improve the community waste facility/center and provide equipment such as compactor, washing machine and a building with roof, fence and gate with a security guard for their motorbikes. They are happy to pay for a fee to a security guard. This will be addressed under Component 2B.

266. The SEP includes full details of the consultations carried out during project preparation, including concerns/comments.

6.3.2.9 Training Needs and Other Comments

267. Waste pickers and waste collectors need training and support for health and safety on different topics.

268. Landfill workers said that to improve their working environment they need, (i) bathrooms, showers and changing areas, (ii) safety equipment (PPE), (iii) drinking water, (iv) canteen or room for lunch breaks, and (v) easily accessible first aid kits.

7 POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

7.1 METHODOLOGY

269. Based on the characteristics of the Project, baseline conditions and receptor sensitivity, a preliminary prediction of potential significant social and environmental impacts and risks that the proposed Project is likely to generate have been carried out. This includes the environmental and social risks and impacts specifically identified in ESS2–6, including the risks and impacts identified in ESS1, paragraph 28.

270. For this Preliminary Environmental and Social Impact Assessment (Pre-ESIA), a simple impact identification and assessment methodology has been applied building on well-known and typical risks and impacts associated with landfill siting, design, construction, operation and closure and taking into account the site-specific conditions and the preferred landfill design proposed in this Pre-ESIA (see ***Sections 4.3 and 4.5***).

271. Anticipated impacts have been characterized in terms of type (direct/indirect, cumulative, positive or negative); duration (temporary, short-term, long-term/permanent); geographical extent (local, provincial or national); intensity or magnitude (low, medium, high), probability (unlikely, possible or likely) leading to a significance score (low, moderate, substantial or high). These criteria are explained in ***Table 7-1*** and a detailed explanation of the scoring system is presented in ***Annex 3***.

272. It should be noted that for the purpose of this preliminary assessment of impacts, a sharp distinction and separation of direct and indirect impacts have not been applied. Dividing impacts in direct and indirect impacts is often a somewhat arbitrary exercise – however, the important aspect of the assessment is to have a reasonable clear understanding of the impact pathway and the sequence of causes and effects.

273. The impact assessment has been divided by project phase (pre-construction, construction, operation and closure).

TABLE 7-1 ASSESSMENT CRITERIA

Criteria	Definition	
Spatial Extent	National	Impacts extending beyond the provincial boundaries
	Provincial	Impacts extending within district and provincial boundaries
	Local	Impacts occurring mainly within or close proximity to the proposed project area

Criteria	Definition	
Duration	Long-term/Permanent	Impacts occurring over a period of 5 years or longer
	Short-term	Impacts occurring over a period of 1 year up to 5 years
	Temporary	Impacts occurring over a period of less than 1 year
Magnitude/Intensity	High	Impacts assessed to exceed established thresholds, or causing loss of livelihood or inflicting harm or damages to life or property
	Medium	Impacts predicted to be considerably above background levels but within established thresholds, or to cause detectable but non-life or livelihood deterioration of environmental or social conditions
	Low	Impacts predicted to be somewhat above typical background conditions but well within established thresholds, or within normal socio-economic fluctuations
Probability	Likely	Long history of occurring in similar environments/conditions. The impact is expected to occur in most circumstances
	Possible	The impact could occur based on reasonably foreseeable actions
	Unlikely	The impact could occur but is not expected as it would be a rare event
Significance	High	Unacceptable and critical
	Substantial	Unacceptable
	Moderate	Acceptable
	Minor	Acceptable

274. The zones of impacts that have been taken into consideration under the impact assessment are summarized in ***Table 7-2***.

TABLE 7-2 ZONES OF IMPACTS

Risk or Impact	Zone of Impact	Potential Receptors
Noise emissions from construction or landfill operations	250 m radius from the landfill	Landfill workers, construction workers, waste pickers, nearby residents
Odour emissions from waste handling	500 m radius from the landfill	Landfill workers, construction workers, waste pickers, nearby residents
Air emissions from landfill fire	3-4 km radius from the landfill	Landfill workers, construction workers, waste pickers, residents incl. children in nearly villages
Pollution of surface water from discharge of wastewater	5 km radius from the landfill	Streams, aquatic life, irrigation water, agricultural production, farmers, water users incl. children
Groundwater pollution by leachate infiltrating into groundwater	10-15 km radius from the landfill	Groundwater resource, existing and future users incl. children
Loss of biodiversity	500 m radius from the landfill	Habitats and/or wildlife of conservation value
Spread of infectious diseases from vectors	500 m radius from the landfill	Landfill workers, construction workers, waste pickers, nearby residents incl. children
Landfill work related injuries or illnesses	Landfill site and the access road	Landfill workers, construction workers, waste pickers, nearby residents incl. children

7.2 BENEFITS

275. The proposed preferred design of the new landfill cells and capping of the legacy waste combined with proper implementation of the operational mitigation measures will minimise the risk to groundwater and substantially reduce the risk of pollution of surface water bodies draining from the VCOMS landfill site and prevent future adverse impacts on surface water and agricultural fields from the site and reduce the risks to human health due to consumption of water from receiving water bodies.

276. The occupational and community health and safety conditions will be improved through proper landfill operations including a complete stop for open burning of waste, daily cover of

incoming waste, and reduced littering. Furthermore, the Project will contribute to reducing emission of landfill gas into the atmosphere and thereby contribute to mitigation of climate change.

277. Upon closure, the design of the final capping of the engineered landfill cells will allow a range of recreational or productive land uses such as sports, cultivation of crops and grazing for cattle, goats or other domestic animals.

278. Compared with a "do nothing" scenario, the proposed improvements to waste disposal, leachate collection and treatment and waste disposal operations including a complete stop for open burning of waste, daily cover of incoming waste, reduced littering, establishment of a waste reception area and capping of the legacy waste on the VCOMS site are assessed to minimise odour nuisances, air and water pollution and improve health and safety for landfill workers and waste pickers. Furthermore, the Project will contribute to reducing emission of landfill gas into the atmosphere and thereby contribute to mitigation of climate change.

279. The project will benefit many residents who live in towns as waste collection coverage will be extended, and the quality of waste collection will be improved. These improvements will make urban areas cleaner, reduce odours from waste, reduce the amount of waste illegally dumped along roads or on vacant land, and reduce the risk of landfill fires.

280. The project will create job opportunities for the waste pickers and waste collectors at the landfill both during construction and operation of the landfill and the potential benefits of the Project will be enhanced by:

- Offering waste pickers skills and vocational training on literacy, numeracy, entrepreneurship among others to improve their livelihoods and prevent job loss.
- Implementing additional support for children and women including additional child protection measures and tangible support such as setting up social protection schemes.
- Offering opportunities for waste pickers to move into safer roles in the informal sector, into formal employment in the waste sector, and/or to access skills and vocational training for employment outside of the sector.
- Implementing interventions for improving female workers' access to jobs in the waste sector
- ensuring that Social Security (health and life insurance) is provided to all workers according to the Labour Law and the Law on Social Security before the commencement of project activities.
- improving the working conditions by upgrading the recycling facilities, providing training in waste handling, hazardous waste and by providing PPE.
- Pegging unit rates paid to waste pickers for recyclables to current market prices with deduction of a reasonable margin to ensure profitability for the appointed on-site buyer.

7.3 LANDFILL SITING

281. ***Table 7-3*** provides a preliminary evaluation of the proposed siting of the landfill project against World Bank and Lao PDR guideline siting criteria. The evaluation indicates that the siting of the landfill project does not fully comply with the recommended siting criteria and distances

to sensitive receptors. However, this does not necessarily mean that the location is unacceptable or incompatible, in fact it may very well be difficult to find a place within reasonable distance of Vientiane Capital that would satisfy all criteria – but it does point towards the need for high quality landfill design and consistent and proper execution of landfill operations and maintenance.

TABLE 7-3 EVALUATION OF THE KM 32 LANDFILL PROJECT AGAINST SITING CRITERIA

	World Bank / IFC EHS Guidelines[40]	Lao PDR Guideline[41]	Km 32 Landfill Project
Residential Receptors	No residential development within 250 meters from the perimeter of the proposed landfill cell development. No visibility of the proposed landfill cell development area from residential neighbourhoods within 1 km.	At least 300 m away from households At least 7 km away from urban areas (for lowland) and 5 km from urban areas (for upland) The Urban Planning Manual issued by the Ministry of Public Works and Transport, 27 June 2008 recommends locating a new landfill site more than one kilometre from an existing or proposed residential zone	Waste pickers' camp next to the landfill Single farmhouses within 200 m Residential area under development but currently uninhabited is 1.4 km from the site along the access road Nakao Village 3 km north of the landfill Naphasouk Village 2.4 km south of the landfill
Groundwater	Groundwater's seasonally high table level (i.e., 10-year high) should be at least 1.5 m below the cell bottom No private or public drinking, irrigation, or livestock water supply wells within 500 meters downgradient of the landfill boundaries	The bottom/base of a potential landfill shall be at least 2 m above the groundwater table	Information on groundwater in the Pre-FS, Task 5 report is unclear, but indicate an unsaturated zone of 5-7 m based on drillings west of the site. There are two groundwater wells on the site, and two private wells within

[40] IFC Environmental, Health and Safety Guidelines, Waste Management Facilities, 10 December 2007

[41] Ministerial Decision on landfill management No. 521/MPWT, 23 February 2007

	World Bank / IFC EHS Guidelines[40]	Lao PDR Guideline[41]	Km 32 Landfill Project
	Landfill boundaries should be located outside of the 10-year groundwater recharge area for existing or pending water supply development.		about 500 m of the site The site is in an area with important regional aquifers
Surface water	No perennial stream within 300 meters downgradient of the proposed landfill cell, unless diversion, culverting or channelling is economically and environmentally feasible to protect the stream from potential contamination. No environmentally significant wetlands of important biodiversity or reproductive value are present within the potential area of the landfill cell development.	At least 300 m away from creeks, streams, lakes, reservoirs, wetlands, rivers, wells, irrigations unless otherwise installation of diversion and culverts	Information is sketchy. There are ponds and ditches in the surrounding area likely used for irrigation Seasonal streams likely drain the landfill to the north-northwest and finally into Nam Ngum River 7 km from the landfill
Biodiversity	No known environmentally rare or endangered species breeding areas or protected living areas are present within the site boundaries. No significant protected forests are within 500 meters of the landfill cell development area.	Not inside Protected Area or Protection Forest	Not inside or near any area of biodiversity conservation importance
Other Sensitive Receptors	Further than 3 km of a turbojet airport and 1.6 km of a piston-type airport	At least 3 km away from any airport At least 1 km from historical or heritage sites	No airport near the site No heritage sites identified near the landfill

FIGURE 7-1 DRONE PHOTO WITH VIEW FROM THE LANDFILL LOOKING SOUTH (JULY 2022)

View looking south:
- 2.8 km of unpaved access road to Road No. 13 South
- 1.4 km to residential area
- Houses and fishponds at the landfill boundary
- Paddy fields and other agricultural land
- The perimeter fence was broken in many places



7.4 ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS ASSESSMENT

282. Environmental and Social (E&S) risks of the project are rated as High.

7.4.1 Construction Phase Environmental and Social Risks and Impacts

283. The environmental and social impacts and risks associated with the construction works are overall assessed to be moderate, temporary, and localized; however, occupational health and safety risks are generally substantial. In any case, these risks will be effectively mitigated by conventional construction methods and standard mitigation measures.

284. The potential environmental and social risks to be addressed and mitigated include:

a) Risks related to labour management and working conditions, including (i) employment discrimination, (ii) denial of basic labour rights; (iii) unresolved labour disputes, (iv) sexual exploitation and abuse and sexual harassment, (v) child labour; (vi) accidents and injuries involving heavy equipment; and (vii) injuries and illnesses due to exposure to waste which may contain toxic agents, sharp objects, and pathogens as well as exposure to contaminated soils and dusts at construction site.

b) Community health and safety related to construction site hazards such as malodour from excavating and relocating waste, dust and noise from movement of heavy equipment and project related traffic to and from the site may adversely affect the health and safety of waste pickers, landfill workers, and construction workers, and nearby residents and farmers working downwind could potentially also be exposed to dust and malodour while those along the construction routes may be impacted by the construction traffic.

c) The number of vehicles and heavy equipment operating at the landfill site and travelling on the access road will increase substantially during the construction phase. Construction activities will take place in or close to areas normally frequented by landfill workers and waste pickers including their children. This will increase the risk that waste pickers and their children, landfill workers, construction workers and vendors working close to the access road may be injured from getting struck by moving vehicles or heavy equipment at the landfill site or the access road.

d) The wear and tear on the landfill access road will increase due to increased traffic and this is likely to further damage the access road which again may increase the risk of road accidents possibly involving other road users including local residents and workers, waste pickers and children.

e) The temporary influx of construction workers could affect nearby villages, increasing the risk of spreading COVID-19, HIV and other communicable diseases to local communities and potentially increasing incidence of substance abuse and gender-based violence.

f) Earthmoving activities may generate sediment-laden runoff at the construction site and at borrow pits potentially affecting nearby surface water bodies.

g) Impacts on flora and fauna from construction activities are considered negligible because the landfill site is already a disturbed area with waste dumped on most part to the site and there are no flora or fauna of conservation value at or near the site. However, establishing new borrow pits or spoil disposal sites may generate impacts on flora and fauna. These risks can be avoided through proper siting of borrow pits and disposal areas.

h) Sourcing of construction materials from borrow pits may involve loss of private or communal land including agriculture land and products.

i) Disruption or restrictions on recycling activities with risk of causing reduction in income of the waste collectors and waste-pickers and other groups who rely on income from the waste stream.

j) Risk of impacts on potential heritage assets or values including discovery of artifacts or relics during operation of borrow pits.

k) Although the landfill areas are outside the UXO danger zone, there may be risks of encountering UXOs at borrow pits.

7.4.2 Operational Phase Environmental and Social Risks and Impacts

285. The environmental and social impacts and risks associated with the operations of the proposed project activities at Km 32 landfill are assessed to be substantial; however, the risks are increased to high when taking into account legacy waste at the Km 32 Site and associated legacy risks and impacts (see Section 7.4.3) including legacy risks and impacts on the VWMC

site (see section 7.8 – Cumulative impacts) and limited institutional capacity and resources pertaining to waste facility management.

286. The potential operational phase environmental and social risks to be addressed and mitigated include:

a) Risks related to labour management and working conditions, including risk of (i) employment discrimination, (ii) denial of basic labour rights; (iii) unresolved labour disputes, (iv) sexual exploitation and abuse and sexual harassment, (v) accidents involving fire and explosion of landfill gas and accidental spills of hazardous waste and leachate; (vi) health risks from exposure to flies and other vermin attracted by the future incoming waste. These risks are considered moderate with mitigation, but it should be noted that keeping the risks at an acceptable level will necessitate continual, concerted and focused efforts by the involved parties. Supervision, monitoring and consultations are essential to ensure that the mitigation measures remain effective and that they are modified as needed to stay on target.

b) Risk of groundwater pollution from leachate leaking through liner systems in the new landfills cells, the cell for relocated waste or the leachate regulation pond.

c) Pollution of surface water by uncontrolled discharge of leachate or seepage from waste piles due to improper landfill operations impacting on agricultural production, aquatic flora and fauna, and human health.

d) Spread of infectious diseases including water-borne diseases by disease-carrying vectors or by pollution of surface or groundwater with pathogens.

e) Pollution of the ambient air due to open burning of waste, dust from handling of waste and daily traffic, malodour from decomposing waste, waste littered along the access road and from inadequately covered organic waste deposited in the new cells to be constructed by the project and emission of landfill gas including greenhouse gasses.

f) Accidental spills or spill/leaks due to improper management or storage of hazardous waste may affect workers, surface water and/or groundwater resources.

g) Community health and safety risks due to exposure of the waste pickers including children among the waste pickers to flies and other vermin attracted by the future incoming waste and to sharps and other hazardous items in the waste.

h) Health and safety risks for communities along the hauling route due to accidents involving daily waste truck traffic.

i) Impacts to property values and aesthetics of nearby areas.

j) Risks of impacts on the waste pickers' livelihoods will likely be insignificant as the waste pickers will have access to segregating the recyclables from the incoming waste at the waste reception area. At the Naxaythong and Km 16 transfers stations, the investments in recycling facilities discussed during the project feasibility study are not included in

the final design. Therefore, PWMP will not cause a reduction in the amount of recyclable waste being delivered to Km32. However, during consultations in January 2024 (see ***Section 6.3.2.8***), waste pickers reported a reduction in recyclables due to unsorted waste being directed to the VWMC RDF next to the VCOMS site, while waste still being delivered to the VCOMS site by private companies has already been sorted by the collection crews and therefore contains less recyclables. During the consultations, VCOMS responded that they will address this concern so that at least 50% of VCOMS' and Small B's waste trucks are directed to the VCOMS site. Moreover, as PWMP will increase waste collection coverage in Vientiane Capital, the volume of unsorted waste delivered to the Km32 landfill is projected to increase, which will help sustain waste picking activity at the site.

k) In case a sanitary zone is established around waste facilities – to be assessed under the full ESIA – there could be a need for relocation or restrictions on livelihood activities affecting people living or farming on the surrounding land.

7.4.3 Potential Environmental and Social Risks and Impacts associated with the Legacy Waste

287. It is estimated that the area where waste has been dumped on the VCOMS site is about 47.8 ha roughly corresponding to about 533,000 m^3 of legacy waste of which about 156,000 m^3 is proposed to be relocated onsite in Cell 5 to make space for the proposed two new landfill cells. On the VWMC site, it is estimated that waste has been dumped on about 8.8 ha corresponding to roughly 95,000 m3 of legacy waste. Waste continuing to arrive at the landfill until the new landfill cells come into operation will increase the legacy waste with about 100,000 to 200,000 m^3/year. It should be noted that these estimates are associated with considerable uncertainties, and it is recommended that the full ESIA should include detailed field survey to draw-up a reasonably accurate map of the lateral and vertical extent of legacy waste on the entire landfill site.

288. The legacy waste includes hospital waste (mostly COVID-19 related waste) dumped around the pond on the north-western part of the site. According to information from VCOMS this amounts to about 432 tons of hospital waste (see also ***Para 138***).

289. As described in ***Para 109***, about 9,000 tons of waste has been dumped on the VWMC site in 2022 due to a major landfill fire on the VCOMS site. This waste has not been compacted or covered with soil and poses a fire risk, risk of windblown litter and generation of polluted leachate that likely drains into the ponds and ditches on the site which eventually drains into the canals in the surrounding farmland.

290. There are four ponds on the landfill site (two on VCOMS site and two on VWMC site – see ***Sections 6.2.3, 6.2.4*** and ***6.2.6***) that likely contain polluted water and possibly polluted sediments. They pose a risk of continued discharge of polluted water to ditches and canals in the surrounding farmland.

291. The key potential environmental and social risks and impacts associated with the legacy waste and legacy wastewater include:

a) Historic and ongoing infiltration of polluted leachate from the legacy waste at both the VCOMS site and the VWMC site pose and will, if not mitigated, continue to pose significant long-term risks to the regional groundwater resources that are currently or may in the future be used for domestic water supply, and which is therefore an important resource for long-term water supply.

b) Significant long-term risk of contamination of surface water in streams and ditches receiving drainage from the landfill site and its ponds potentially polluted by seepage from the legacy waste. In the area where hospital waste has been dumped at the leachate pond in the north-western part of the VCOMS site, high concentrations of cadmium and arsenic were detected in a soil sample and a water sample from the pond outlet contained elevated levels of cadmium.

c) Surface water contamination may affect the productivity and quality of rice production and other agricultural production in the surrounding fields; and may also pose a risk to the health of farmers, domestic animals and wildlife in the area nearby Km 32 landfill; and may in general render the water resources in the affected streams unusable. As reported in the Pre-Feasibility Study, residents in Nakao Village (located about 2.8 km north of the landfill) have complained that black water from the km 32 landfill had caused a reduction in their rainfed rice yield, and farmers have experienced skin rashes when getting in contact with the water. However, clear evidence that these incidents were caused by the landfill have not been established.

d) Pollution of the ambient air due to open burning of legacy waste, malodour from decomposing legacy waste, and emission of landfill gas including greenhouse gasses. Smoke and bad smells from frequent burning from the current landfill operation has also been reported as concern from nearby residents. These risks would likely be long-term, moderate in magnitude and occurring within a radius of 2-3 km from the Km 32 landfill and thus possibly affecting nearby villages.

e) Potential fire hazards due to inadequate measures to capture landfill gas.

f) Health and safety risks of waste pickers and landfill workers from exposure to polluted leachate, and flies and other vermin attracted by the legacy waste.

g) Impacts on the livelihoods of the waste pickers due to the proposed capping of the legacy waste is likely insignificant as recyclable items in the legacy waste currently on the landfill site most likely already have been removed by the waste pickers, and during the construction phase, the waste pickers will be provided with access to the incoming waste at the waste reception area.

h) Contribution to climate change by fugitive emission of greenhouse gases (methane and carbon dioxide) in landfill gas generated by decomposing organic waste.

7.4.4 Closure Phase Environmental and Social Risks and Impacts

292. The most relevant closure phase risks and impacts to be addressed and mitigated include:

a) Exposure to waste by people or animals.

b) Spread of diseases by vectors and vermin.

c) Odour nuisances, windblow litter and risk of fire.

d) Breach of capping and ponding in depressions leading to increased infiltration and increased generation of leachate, erosion and crop death.

e) Uncontrolled use of the land incompatible with the design of the caps or the integrity and stability of the cells.

f) Risk of pollution of surface water by leachate or seepage from waste impacting on agricultural production, aquatic flora and fauna, and human health.

g) Risk of groundwater contamination due to failure of the liner and the leachate collection and treatment system. The likelihood of liner failure may increase over time as the liner weakens but over time, the strength of the leachate will likely decrease.

7.5 Overview of Mitigation Measures

7.5.1 Recommended Design Considerations

293. In addition to the analyses of the key alternative landfill design elements and the identification of the preferred designs (see ***Section 4.5***), the Pre-ESIA further recommends to take the following recommendations into account when developing the final detailed design of the project (see also ***Table 7-4***):

- Adoption of a simple pond and wetland system to treat leachate instead of the proposed UASB and rotating disc technology which require power, regular maintenance and could easily breakdown.
- Inclusion of a leachate recirculation system to minimize discharge of treated leachate to the environment and to accelerate waste decomposition and reach the stabilization phase earlier.
- To minimize the volume of leachate that goes into the leachate treatment system, the leachate collection system should be designed such that rainwater from the inactive parts of a cell are collected and discharged separately as clean stormwater and only waste-leachate are conveyed into the leachate treatment unit. Each section of a cell should be equipped with an interchangeable pipe system that can switch between discharge to stormwater and the leachate transport system.

- Assurance that operator's errors/non-compliance with operating protocol cannot result in switching leachate into the proposed "clean stormwater" discharge and discharging it untreated.

TABLE 7-4 RECOMMENDED DESIGN IMPROVEMENTS

Risks or Impacts	Current Design	Recommended Design Improvements
Breakdown or malfunction of the leachate treatment system resulting in discharge of contaminated water with risk of soil, surface water and groundwater pollution	Combination of an Up-flow Anaerobic Sludge Blanket Reactor (UASB) and an aerobic rotary disc system and a HDPE lined regulating pond	Consider redesigning the leachate treatment system as a pond and wetland system. This would be a low tech, easy to maintain, biological leachate treatment facility where leachate is moved via gravity through a series of ponds: an anaerobic lagoon, aerobic lagoon, and a maturation lagoon in the form of a constructed wetland, and then to a final treated water lagoon
High leachate volumes to the leachate treatment system	No recirculation	Include a leachate recirculation system to minimise discharge of treated leachate to the environment and to accelerate waste decomposition and reach the stabilization phase earlier
High leachate volumes to the leachate treatment system	No separation of waste-leachate from non-waste leachate	Design the leachate collection system so that only waste-leachate is sent to the leachate treatment facility by separating rainwater from the inactive parts of a cell and discharging it as clean stormwater. Each section of a cell should be equipped with an interchangeable pipe system that can switch between discharge to stormwater and the leachate transport system. Assurance that operator's errors/non-compliance with operating protocol cannot result in switching leachate into the proposed "clean stormwater" discharge and discharging it untreated.

294. The Project will commission a full scale ESIA study in conjunction with the detailed engineering design of the project. The ESIA report shall be reviewed and approved by the MPWT, World Bank and finally by MONRE for issuance of an Environmental Compliance Certificate. The final ESIA shall also cover the PWMP investments in the Km 16 and Naxaythong

sites. The local communities and other stakeholders shall be informed and consulted regarding the findings of ESIA study.

7.5.2 Construction Phase Mitigation Measures

295. The contractor will be required to prepare a Contractor's Environmental and Social Management Plan (CSEMP) based on the recommended measures in the final ESIA/ESMP. The CSEMP shall address environmental impacts of construction activities such as localized erosion and sedimentation, generation of noise and vibration, generation of dusts, generation of construction wastes, and domestic wastes at labour camps. The CSEMP shall also include the contractors plan for sourcing of borrow material, and acquisition of sites and easements and the required government clearances (including UXO clearance) for its temporary facilities such as labour camp, workshop and laydown areas, borrow pits, and spoil disposal sites (if any). The PMU will review and approve the CESMP with support from the supervision firm to ensure consistency with the ESF instruments.

296. To address labour management-related risks, the contractor will be required to prepare a labour management plan and an Occupational Health and Safety Plan. These plans shall address potential issues of employment discrimination, ensures access to a grievance redress mechanism, minimises the risks of sexual exploitation and abuse and sexual harassment in the workplace, prevents child labour, ensures occupational health and safety and other requirements in compliance with the World Bank ESS 2, the Lao Labour Law and ILO conventions ratified by the Lao PDR.

297. To manage potential social impacts related to labour influx such as increase in substance abuse, increasing incidences of sexual harassment, gender-based violence, and spread of diseases, the Project will promote local recruitment of workforce and require the contractor to adopt a Workers' Code of Conduct. The Project will also provide awareness training through third party service providers, on sexual exploitation and abuse and sexual harassment, substance abuse, gender-based violence, and prevention of disease transmission.

298. The Project will enforce speed limits on all project vehicles especially in populated sections of the construction routes. Throughout the construction period, the contractor will be required to undertake regular repair and maintenance works on roads it frequently uses.

299. To minimize the risk of damage to ecologically sensitive areas and damage to cultural properties and chance finds of artifacts at borrow pits, the contractor will be required to apply the Negative List, undertake ES Screening on prospective sites based on the ESMF and develop and monitor the implementation of site-specific management plans as part of the CSEMP. The contractor shall also adopt a chance find procedure for archaeological artifacts.

300. To mitigate possible disruption or restrictions on recycling activities of waste pickers due to construction work, the Project will encourage contractors to hire the waste pickers as laborers in the construction, and the construction work should be scheduled to ensure that the waste reception area is made ready for use as early as possible, where the waste pickers can then segregate recyclables under safe conditions away from the construction activities.

7.5.3 Operations Phase Mitigation Measures

301. ***Operations and Maintenance Manual*.** An Operations and Maintenance Manual to be support under Sub-component 2A should also contain the following guidelines and procedures: (a) Procedures for compacting waste; (b) Controlling and minimizing windblown waste (c) procedures for handling of non-hazardous waste; (d) Procedures for controlling and recording waste disposed of at the landfill, including origin, quantity, type of waste, collector; (e) Operational procedures for leachate management including handling of sludge from the leachate treatment process; (f) Procedures for handling of hazardous waste including determining if the waste is acceptable for temporary storage in the hazardous waste storage facility, transportation, labelling, temporary storage, separation according to their type and risks, and permanent disposal - in line with local and international regulations; (g) Pest management procedures (h) Occupational health and safety measures and use of PPEs; (i) Community relations and health and safety plan; and (j) Emergency response plan.

302. The PMU and the landfill operator should conduct on-the-job training on the Operations and Maintenance Manual.

303. ***Groundwater pollution.*** The risks of groundwater pollution from leachate leaking through the bottom of the new waste cells will be minimised through installation of composite liner systems combined with leachate collection and treatment systems. Research and modelling of leakage through a single HDPE geomembrane compared with leakage through a composite liner comprising a HPDP geomembrane on top of a compacted clay liner, indicate that the leakage through a single HDPE geomembrane is orders of magnitude higher than leakage through a composite liner system [42]. A composite liner system is a standard requirement for non-hazardous waste landfills in many jurisdictions and is also the recommended groundwater protection measure in the World Bank Group's Environmental Health and Safety Guideline for Waste Management Facilities[40]. Cell 5 (for relocated waste from the two new cells - Cell 10 and Cell 11) and the leachate regulation pond will also be provided with a composite liner of the same design as the liner for the new waste cells.

304. ***Surface water pollution.*** The risks of surface water pollution from leachate-laden runoff or discharge of untreated or poorly treated leachate will be minimised through leachate collection and treatment systems, stormwater site drainage, and implementation of proper landfill operations including regular inspection, maintenance and repair of structures and leachate treatment facilities, and separation and safe isolation of hazardous waste.

305. ***Air pollution.*** The risks of air pollution from open burning of waste, malodour emissions by decaying organic waste and dust from handling of waste will be effectively minimised through implementation of proper landfill operations including regular soil cover of waste, landfill gas capture, and construction and maintenance of a perimeter fence.

[42] T. Katsumia, C.H. Bensonb, G.J. Foosec, M. Kamond, Performance-based design of landfill liners, Engineering Geology 60 (2001) 139±148

306. ***Livelihood impacts*.** The risk of disruption or restrictions on recycling activities causing reduction in income of the waste-pickers is considered minor because waste segregation and other recycling activities will continue to take place at the new waste reception area. The previously proposed investments in recycling facilities at the Km 16 and Naxaythong transfer stations have subsequently been dropped and the earlier concern that these investments would cause a reduction in recyclables arriving at the Km 32 landfill site and thus potentially cause a reduction in the income of waste collectors and waste pickers, is therefore no longer expected to materialise. Nonetheless, the project will: (a) provide opportunities to waste pickers to work at the new waste management facilities at km 32, and at km 16 and Naxaythong sites; (b) offer waste pickers skills and vocational training on literacy, numeracy, entrepreneurship among others to improve their livelihoods and prevent job loss; (c) improve their working conditions by upgrading of the existing recycling facility and the waste reception area, providing training in waste handling, hazardous waste and providing PPE. The risk of impacts on the livelihoods of waste pickers and waste collectors is therefore considered minor but is something that needs to be closely monitored during project implementation.

Commented [JS1]: This is not a project-related impact. The issue is discussed in some detail in section 7.4.2

307. ***Community health and safety*.** Community health and safety risks include the risk of accidents involving vendors and children close to the access roads, and community exposure to dusts, noise, smells, litters, water pollution and road safety issues. VCOMS rehabilitated the access road t othe landfill in December 2022.

7.5.4 Legacy Waste Mitigation Measures

308. The Project design includes rehabilitation of legacy waste on both the VCOMS site and the VWMC site. The key environmental and social mitigation measures to deal with the legacy waste on both the VCOMS site and the VWMC site are described in this Section.

309. *Overview of legacy waste mitigation measures*: As noted in ***Para 287*** and displayed in ***Figure 3-7, Figure 3-8*** and ***Figure 3-9***, the estimated area where waste has been dumped on the 100 ha Km 32 landfill site (VCOMS site and VWMC site) is about 56.6 ha roughly corresponding to a total of about 628,000 m^3 of legacy waste of which about 156,000 m^3 is proposed to be relocated onsite in Cell 5 to make space for the proposed two new landfill cells. Subject to further detailed investigations and analyses during the full ESIA studies, the proposed legacy waste mitigation measures will include measures to mitigate: *Health and safety risks, groundwater pollution risks, surface water pollution risks, and air pollution risks*. The essential proposed mitigation measure is encapsulation of the legacy waste under a low permeable cap. The waste dumps will be regrouped and graded to form stable mounts on which the cap will be constructed with stable slopes, proper drainage preventing ponding of water and so as not to cause erosion. Any seepage of polluted leachate on side slopes to be collected and conveyed for treatment in the new leachate treatment facility. The final cap to be composed of: Topsoil (150 mm), intermediate layer (150-300 mm), barrier layer (600 mm), and a gas collection layer (150 – 300 mm). Installation of landfill gas vents connected to the gas collection layer. The hospital waste dumped near the pond on the north-western corner of the landfill site to be segregated and incinerated in the existing medical waste incinerator on the VCOMS site. For the 9,000 tons of waste that VCOMS dumped on the VWMC site in 2022 (see

Para 109 and ***Figure 3-8***), it is recommended to carry out temporary measures early in the construction phase including regrouping and compaction by roll over with a bulldozed, and surrounding the dump with a low berm to prevent polluted runoff from escaping. It is further recommended that this waste is deposited in one of the new cells.

310. ***Health and safety.*** The risks to waste pickers' and landfill workers' health and safety due to exposure to landfill leachate from the legacy waste and infectious diseases from vectors attracted by the legacy waste are proposed to be mitigated through the following measures: (i) Capping of the current legacy waste early in the construction phase, (ii) early construction of the waste reception area to ensure that sorting of incoming waste during the construction phase can take place under proper and safe conditions, (iii) physical zoning and access control to tipping areas, (iv) regular compaction and soil cover of waste after the waste pickers have segregated recyclables at the waste reception area.

311. ***Groundwater pollution.*** The risk of future groundwater pollution from leachate seeping into the subsoil underneath the legacy waste will be minimised through installation of a final cap based on the preferred design option. The cap is designed to minimise vertical infiltration of rainwater into the waste and thus generation of contaminated leachate. The cap cannot prevent a possible horizontal flow of groundwater through the waste, only the vertical entry of water into the waste. The final decision on the closure option for the legacy waste to be made as part of the detailed design and full ESIA study should therefore be based on further investigations of the hydrogeology to make sure that most of the waste is buried above the groundwater table representing the aquifer underneath the landfill. As noted in ***Section 6.2.1***, drillings made by the Pre-Feasibility Study on the site adjacent to the landfill had an unsaturated zone of 5-7 m, which indicates that the legacy waste is likely located above the groundwater table. The cap is designed to prevent the "bathtub" effect. The bathtub effect occurs when a more permeable cover is placed over a less permeable bottom liner or natural subsoil landfill then fills up like a bathtub. A final cover must be designed and constructed to have a permeability less than or equal to the bottom liner system or natural subsoils[9].

312. ***Legacy groundwater pollution.*** There is a risk that the groundwater has already been polluted by contaminated leachate from the legacy waste. There is insufficient information available to assess this risk any closer and it is therefore recommended that the full ESIA should address this issue and undertake a comprehensive hydrogeological investigation.

313. ***Surface water pollution.*** The risks of surface water pollution from leachate-laden runoff or seepage from the legacy waste will be minimised through installation of the preferred final cap and by regular inspection and aftercare of the cap. The cap is designed with a drainage layer between the topsoil and the infiltration barrier which will drain clean water to the surrounding stormwater systems. In addition, the ponds on both the VCOMS site and the VWMC site that over time have received potentially polluted runoff from the waste dumps are likely sources of contamination of ambient waterways and groundwater (see ***Para 291***), and subject to further detailed investigations and analyses during the full ESIA studies, it is proposed that these ponds be dewatered, and depending on water quality test results, the water may either be reused e.g. for dust suppression or conveyed for treatment in the new leachate

treatment facility and any polluted sediment to be deposited in the new landfill cells or depending on the nature and severity of the contamination, be built in under the legacy waste caps.

314. ***Air pollution.*** The risks of air pollution from open burning of waste, and malodour emissions by decaying organic waste will be effectively minimised through the installation of the preferred final cap on the legacy waste. In the interim period until the proposed new landfill cells come into operation, incoming waste will be compacted, build into regular cells and regularly covered with soil.

7.5.5 Closure Phase Mitigation Measures

315. Operational and Maintenance Manuals to be prepared under the PWMP project TA will include a closure plan for the Km 32 Landfill. The preparation of the closure plan shall include consultations with landfill staff, waste pickers, local authorities and MONRE.

316. The proposed final cap would be suitable for open space activities such as grazing, plantations, crop cultivation, sport or recreation and in any case a land use that would not include construction of buildings or other structures.

317. The key closure phase mitigation measures include:

a) Access control to ensure that waste is not received for disposal at the site/cell after landfill operations cease.

b) Inspection and aftercare of the leachate collection and treatment systems, stormwater drainage systems and gas ventilation system.

c) Inspection and aftercare of the final cap and vegetation cover including repairing effects of erosion, slumping and settlements.

d) Inspection and monitoring of landfill gas generation/migration, odour, dust and litter.

e) Control of future land use to ensure that the land use is compatible with the landfill cap and in accordance with the closure plan.

7.6 Environmental and Social Risk Matrix

318. ***Table 7-5*** presents an overview of the potential environmental risks and impacts while ***Table 7-6*** presents an overview of potential social risks/impacts of the Km 32 Landfill Project.

319. The column “Without mitigation” refers to the project **with the preferred design**.

320. For each of the identified impacts, the “With Mitigation” columns in ***Table 7-5*** and ***Table 7-6*** include summary lists of some of the more important mitigation measures based on the Environmental and Social Management Plan detailed in ***Section 8***.

321. In conclusion, this preliminary assessment of environmental and social risks and impacts finds that during the course of the project phases (pre-construction, construction, operation and closure) with the current preliminarily determined preferred landfill design and with implementation of the mitigation measures outlined herein taking into account the extent to

which these measures can reasonably be expected to be effectively implemented considering the current and future technical and managerial capacity and financial resources of the implementing parties, the environmental and social risks and impacts are considered to be at an acceptable and manageable level.

TABLE 7-5 OVERVIEW OF THE ANTICIPATED ENVIRONMENTAL RISKS AND IMPACTS ASSOCIATED WITH THE KM 32 LANDFILL PROJECT

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
Pre-construction Phase							
1. Site selection of sites for installation of groundwater monitoring wells	Loss of habitats, generation of erosion and sediment-laden runoff	Local	Long-term	Low	Possible	Minor	Minor Apply screening tool
2. Conducting ESIA and ESMP to obtain approval from WB and ECC from MONRE	Risks and impacts on the environment and livelihood of affected people due to inadequate integration of environmental and social considerations in project design and design of mitigation measures[43]	Provincial	Long-term	High	Unlikely	Moderate	Minor Close supervision of the studies Expert review of reports Ensure application of the relevant ESF instruments

[43]To avoid unnecessary overlaps, social impacts and risks are included in this item

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
3. FS study and Detailed Design of KM32	Risks and impacts on the environment and livelihood of affected people due to inadequate integration of environmental and social considerations in the engineering design[43]	Provincial	Long-term	High	Unlikely	Moderate	Minor Close supervision of the studies Expert review of reports
Construction Phase							
4. Identification of construction material sources (borrow, sand, quarry sites)	Exposed soil surfaces increasing erosion and sediment-laden runoff Noise and dust emission, and disturbance or loss of habitats of conservation value	Local	Short-term	Medium	Likely	Moderate	Minor Compliance with location criteria
5. Construction of new landfill cells, structures and facilities	Noise, dust, air and water pollution affecting workers, public health and the environment. Accidental spills/leaks of liquid hazardous materials	Local	Short-term	Medium	Likely	Moderate	Moderate Regular dust suppression and cover truckloads Enforce low speed limits

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Use well-maintained equipment Prohibit open burning Limit noisy activities to daytime Hazardous materials on impervious pavement with secondary containment; and use spill trays Daily inspection and supervision
6. Construction of new landfill cells, ponds and structures and	Occupational health and safety risks accidents causing injuries, exposure to pathogens in the waste or from flies and vermin	Local	Short-term	High	Likely	Substantial	Moderate Regular training of supervisors and workers

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
relocation of waste							Work hazard assessment and implementation of hazard mitigation Use of appropriate PPE Daily inspection of work
7. Land clearance for construction works	Fugitive dust from exposed surfaces, clearing and grubbing, loading and unloading affecting workers, public health and the environment	Local	Short-term	Medium	Likely	Moderate	Minor Regular dust suppression and cover truckloads Enforce low speed limits Demarcate the clearing limits Daily inspection and supervision

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
8. Excavation and regrouping and relocation of legacy waste, and capping of the waste including relocated waste in Cell 5 and other legacy waste on the VCOMS site	Noise, air, malodour and water pollution affecting workers, waste pickers, public health and the environment	Local	Temporary	Medium	Likely	Moderate	Minor Regular dust suppression and cover truckloads Enforce low speed limits Install drainage systems to divert clean runoff Continuous inspection and supervision
9. Operation of borrow pits, sand and quarry sites	Exposed soil surfaces increasing erosion and sediment-laden runoff Noise and dust emission	Local	Temporary	Low	Likely	Moderate	Minor Regular dust suppression and cover truckloads Enforce low speed limits

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Demarcate the clearing limits Install drainage systems to divert clean runoff Collect and treat dirty runoff Daily inspection and supervision
10. Operation of worker camps	Discharge of polluted wastewater Waste littering Noise emission	Local	Temporary	Low	Likely	Moderate	Minor Install and maintain septic tanks Collect and dispose of waste Daily inspection and supervision
Operational Phase							

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
11. Landfill Liner System in Cell 10 and Cell 11	Risk of leachate seepage through the liner system into the subsoil and groundwater	Provincial	Long-term	High	Unlikely	Moderate	Moderate Composite bottom liner and leachate collection
12. Management of waste relocated to Cell 5 from Cell 10 and Cell 11 and other legacy waste on the VCOMS site	Risk of leachate seepage into the subsoil and groundwater and/or to surrounding waterways	Provincial	Long-term	High	Unlikely	Moderate	Moderate Composite bottom liner and final cap minimising infiltration
13. Liner for the leachate regulating pond	Risk of leachate seepage into the subsoil and groundwater	Provincial	Long-term	High	Unlikely	Moderate	Moderate Composite bottom liner
14. Operation of leachate collection and treatment facility	Lack of proper operation and maintenance of leachate collection and treatment system may increase the risk of non-compliant discharge of leachate to the environment	Local	Temporary	High	Possible	Moderate	Minor Develop and implement an Operation and Maintenance Plan

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Daily inspection and supervision Maintenance and repair as necessary Regular monitoring of leachate treatment effectiveness
15. Site stormwater management	Risk of stormwater entering landfill cells increasing leachate generation Risk of seepage of leachate into surrounding stormwater drains causing water pollution	Local	Long-term	Medium	Possible	Moderate	Minor Installation of drains and bunds intercepting surface water run-on to the site and internal runoff Daily inspection and supervision Maintenance and repair as necessary

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
16. Waste disposal, compaction and cover	Lack of proper soil cover may increase infiltration, promote vectors and increase the risk of transmission of diseases and increase generation of foul odour. Improper waste disposal practices may increase windblown litter, generation of dust and risk of landfill fire and explosions	Local	Long-term	High	likely	High	Moderate Develop and implement an Operation and Maintenance Plan Installation of drains and bunds intercepting surface water run-on to the site and internal runoff Daily and intermediate cover and waste compaction to reduce infiltration into the waste building waste in pyramidal phases in appropriate daily lifts with limited working face

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Daily inspection and supervision
17. Landfill gas collection and treatment	Lack of proper operation of landfill gas collection and treatment system may increase the risk of landfill fire and explosions and cause emission of landfill gas to the atmosphere thereby contributing to greenhouse gas content in the atmosphere	National	Temporary	Medium	Possible	Substantial	Minor Develop and implement an Operation and Maintenance Plan Installation of landfill gas collection pipes Regular inspection Monitoring of landfill gas
18. Operation and maintenance of hazardous waste facilities	Risk of accidental spills with hazardous waste affecting workers, public health and the environment	Local	Temporary	High	Possible	Moderate	Minor Building designed with impervious pavement and secondary

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							containment, spill trays Daily inspection and supervision Spill absorbent material available
Closure Phase							
19. Control of infiltration and leachate at the (new) landfill cells	Risk of "bathtub effect" where the landfill fills with liquid because the cover system is more permeable than the bottom liner system. This "bathtub effect" greatly increases the potential for generation of leachate, and risk of escape of leachate and increased risk of soil, groundwater and surface water pollution	Provincial	Long-term	High	Unlikely	Moderate	Moderate Ongoing operation of leachate collection and treatment Final cap minimising infiltration Monitoring of cap integrity and aftercare

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
20. Control of the landform of the new landfill cells after capping and the caps on Cell 5 and the caps on the other legacy waste on the VCOMS site	Risk of subsidence or cracks leading to ponding, increased erosion, infiltration and seepage of leachate with increased risk of soil and water pollution	Local	Long-term	Medium	Likely	Substantial	Moderate Develop and implement a closure plan Regular inspection Regular aftercare Fencing the landfill site
21. Management of the new landfill cells to assure that the intended future land use is feasible and safe	Risk of subsidence or cracks in the cap limiting the after-use options, risk of crop death due to landfill gas migration, risk of exposure to waste, risk of uncontrolled incompatible use of the land	Local	Long-term	Medium	Likely	Substantial	Moderate Develop and implement a closure plan Regular inspection Regular aftercare Fencing the landfill site
22. Control of infiltration and leachate at Cell 5	Risk of "bathtub effect" where the landfill fills with liquid because the	Provincial	Long-term	High	Unlikely	Moderate	Moderate

Project Activity	Description of Risks and Impacts	Spatial Extent	Duration	Magnitude / Intensity	Probability	Significance without Mitigation	Significance with Mitigation
containing the relocated waste and the other capped legacy waste on the VCOMS site	cover system is more permeable than the bottom liner system						Composite bottom liner Final cap minimising infiltration Monitoring of cap integrity and aftercare
23. Management of Cell 5 containing the relocated waste and management of the other capped legacy waste on the VCOMS site	Risk of subsidence or cracks leading to ponding, increased erosion, infiltration and seepage of leachate with increased risk of soil and water pollution	Local	Long-term	Medium	Likely	Substantial	Moderate Develop and implement a closure plan Regular inspection Regular aftercare Fencing the landfill site

TABLE 7-6 OVERVIEW OF THE ANTICIPATED SOCIAL RISKS AND IMPACTS ASSOCIATED WITH THE KM 32 LANDFILL PROJECT

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
Pre-construction Phase							
24. Site selection for installation of groundwater monitoring wells	Loss of private and/or communal land including agriculture land and products	Local	Long-term	Low	Possible	Minor	Minor E&S screening to avoid private land Implementation of the Resettlement Policy Framework
Construction Phase							
25. Identification of construction material sources (borrow, sand, quarry sites)	Loss of private and/or communal land including loss of agriculture land and products	Local	Short-term	Medium	Likely	Moderate	Minor E&S screening to avoid private land Compliance with location criteria

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Implementation of the Resettlement Policy Framework
26. Relocation of waste, coordination construction works with management of incoming waste	Disruption or restrictions on recycling activities with risk of causing loss/reduction in income of the waste collectors, waste-pickers and other groups (informal recyclers or small-scale waste buyers) who rely on income from the waste stream	Local	Short-term	Medium	Likely	Moderate	Minor Early establishment of the waste reception area to ensure that waste pickers can safely continue work Encourage the contractor to hire waste pickers as workers
27. Operation of borrow pits, sand and quarry sites	Impacts on heritage assets and values during operation of borrow pits, sand and quarry sites	Local	Short-term	Medium	Possible	Minor	Minor Prior heritage screening Compliance with location criteria Implement chance find procedures

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
28. Project related transportation and transportation of solid waste to the landfill	Community health and safety risks/impacts involving increased traffic, noise and dust	Local	Short-term	Medium	Likely	Moderate	Minor Maintain the access road to the landfill Enforce speed limits for project related traffic Implement traffic management
29. Project related transportation and transportation of solid waste to the landfill	Damages to the local roads due to increased traffic	Local	Short-term	Medium	Likely	Moderate	Minor Maintain the access road to the landfill
30. Design and operation of worker camps	Workers' health and safety risks due to inadequate welfare facilities or provisions for workers	Local	Short-term	Medium	Likely	Moderate	Minor - adequate and separate accommodation and sanitation facilities

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							for male and female workers - adequate supply of safe water, waste and wastewater disposal systems - protection against heat, cold, noise, damp, fire and disease-carrying or poisonous animals
31. Labour influx for construction work	Spread of infectious diseases (COVID-19, HIV-AIDS)	Local	Short-term	Medium	Possible	Minor	Minor Regular training of supervisors and workers Medical check-ups Implement related public health measures
	Labour rights, gender, worker discrimination and unfair wage or salary	Local	Short-term	Medium	Possible	Minor	Minor

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Regular training of supervisors and workers Implementation of code of conduct Implement the Labour Management Plan
	Child labour (construction workers working for landfill construction)	Local	Short-term	Medium	Possible	Minor	Minor As above
	Gender-Based Violence (GBV) and/or Violence against Children (VAC) and/or Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH)	Local	Short-term	Medium	Unlikely	Minor	Minor As above
	Human Trafficking	Local	Short-term	Medium	possible	Minor	Minor As above
32. Management of stakeholder engagement	Inadequate Stakeholder Engagement or inadequate management of the grievances redress mechanism	Local	Short-term	Medium	Possible	Minor	Minor Regular training of supervisors and workers

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
and grievance redress							Regular oversight and monitoring by the project management Implementation of code of conduct Implement the Labour Management Plan, the Stakeholder Engagement Plan and the Grievance Redress Mechanism
Operational Phase							
33. Operation and maintenance of the landfill, waste reception area and recycling facilities	(i) Workplace injuries of waste pickers, collectors and VCOM staffs (ii) Spread of infectious diseases (COVID-19, HIV-AIDS); (iii) SEA/SH and VAC; and	Local	Long-term	High	Likely	High	Moderate Regular training of supervisors and workers Regular oversight and monitoring by the project management

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
	(iv) Labour rights, child labour, gender and worker discrimination, and unfair wage or salary (especially for male and female workers and ethnic groups)						Implement the code of conduct Implement the Labour Management Plan Provide PPE
	CHS risks/impacts involving garbage trucks going back-and-forth to the landfill could lead to increased dust, noise, smells, water pollution, road safety issues spread of sexually transmitted diseases including HIV and other communicable disease including Covid 19, and SEA/SH and VAC.	Local	Long-term	Medium	Likely	Substantial	Minor Regular training of supervisors and workers Regular oversight and monitoring by the project management Implement the code of conduct Implement the Labour Management Plan and the Social Management Plan

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
	Community health and safety risks: Risk of uncontrolled site access leading to injury of people or loss of cattle	Local	Long-term	Medium	Likely	Substantial	Minor Access control and fencing
	Disruption or restrictions on recycling activities with risk of causing loss/reduction in income of the waste collectors, waste-pickers	Local	Long-term	Medium	Possible	Moderate	Minor Provide waste reception area for waste pickers to carry out segregation of recyclables
	Risk of income reduction of waste collectors and waste pickers due to reduced amounts of recyclables arriving at the Km 32 Landfill over time due to unsorted waste being directed to the VWMC waste management facilities	Local	Long-term	Low	Likely	Moderate	Minor Ensure a fair distribution of delivery of unsorted waste between Km 32 landfill and the VWMC site Provide opportunities for vocational training Provide alternative source of income

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							Job opportunities at the landfill and at the Km16 or Naxaythong transfer station Skills and vocational training for waste pickers Implement the Resettlement Policy Framework, Social Management Plan, and the Stakeholder Engagement Plan
34. Changes or development of new waste management policies such as increase in dumping fees at the KM32	Risk of increase in illegal dumping, littering, and open burning exacerbating impacts on public health and the environment	Local	Long-term	Medium	Likely	Substantial	Minor Careful assessment of impacts due to changes in fees or policies through stakeholder consultations Monitoring and strict enforcement of

Project Activity	Description of Risks/Impact	Spatial Extent	Duration	Magnitude/ Intensity	Probability	Significance without Mitigation	Significance with Mitigation
							regulation for waste collection companies awareness raising on environmental impacts of waste dumping and burning issue village-level regulations with penalties for illegal dumping.

7.7 INDIRECT IMPACTS

322. Indirect impacts are normally defined as impacts that are caused by the project and are later in time and farther removed in distance but are still reasonably foreseeable. As noted in ***Section 7.1***, a sharp distinction between indirect and direct impacts have not been made in this preliminary impact assessment. Many of the impacts identified in ***Table 7-5*** and **Table 7-6** could be considered indirect impacts.

323. Where the distinction becomes useful is in situations where an impact is the result of the project combined with other reasonably foreseeable actions, and where the impact would not have occurred but for the project. These types of indirect impacts may include growth-inducing impacts and other impacts related to induced changes in the pattern of land use and related effects on air, water and nature.

324. The Pre-ESIA has considered the likelihood that the **Km 32 Landfill Project** may attract development of small industries, commercial enterprises and residential areas in the surrounding areas. Over the course of the Km 32 landfill history, small and medium size waste-related industries have been established near the landfill, and this trend may continue.

Commented [JS2]: Not relevant in final project design (transfer stations not material recovery at Km16 and Naxaythong)

325. The larger issue related to the future land use and development of the area surrounding the landfill (whether or not induced by the Project) is to prevent incompatible land use / development within a reasonable buffer zone[44] around the landfill. The Ministry of Public Works and Transport is overall responsible for urban planning and by working together with other ministries notably MONRE as responsible for land use planning through the relevant departments in Vientiane Capital, have the authority to determine and enforce such buffer zone.

Commented [JS3]: Not relevant in final project design (transfer stations not material recovery at Km16 and Naxaythong)

7.8 CUMULATIVE IMPACTS

326. The cumulative impacts of the project are the incremental impacts of the project when added to impacts from other relevant past, present and reasonably foreseeable developments as well as unplanned but predictable activities enabled by the project that may occur later or at a different location. Cumulative impacts can result from individually minor but collectively significant activities taking place over a period of time. The Pre-ESIA has considered cumulative impacts that are recognized as important on the basis of scientific concerns and/or reflect the concerns of project-affected parties.

327. The basic methodology applied for the cumulative impact assessment is not fundamentally different from the methodology used to identify and assess direct and indirect impacts; however, to structure and focus the assessment, the following guiding questions have been applied:

[44] See Table 7-2 for details on different buffer zones described in national regulations and guidance, ranging from 300 m to7 km.

- Are there any resources/receptors especially vulnerable to incremental effects?
- Is the **Km 32 Landfill Project** one of several similar actions/projects in the same geographic area?
- Are there any other activities in the area that may have similar effects on the resources/receptors?
- Have these effects been historically significant for the resources/receptors?

328. The preliminary assessment of cumulative environmental impacts has been undertaken with respect to the following resources/receptors (also often called valued environmental and social components):

- Regional groundwater resources
- Surface water in streams and creeks draining the landfill into paddy fields, other agricultural land and fishponds surrounding the landfill.
- Residential environments within a radius of 2-3 km of the landfill.
- Landfill workers including VCOMS and a landfill operator company employees and waste pickers.
- Commercial and business enterprises within a radius of 2-3 km of the landfill.

329. The results of the preliminary cumulative impact assessment are presented in ***Table 7-7***. The preferred design of the project including the capping of the legacy waste (see ***Section 7.5.4***) as proposed by the project are preliminarily assessed to significantly reduce the cumulative risks and impacts on groundwater and surface water resources and agricultural land surrounding the landfill to an acceptable level. However, it is recommended to further investigate this under the full ESIA studies.

TABLE 7-7 OVERVIEW OF PRELIMINARY CUMULATIVE IMPACT ASSESSMENT

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
Regional groundwater resources	**Km 32 Landfill Project:** • Risk of leakage from the **Km 32 Landfill Project** waste cells with infiltration of chemicals and bacteria into groundwater used for domestic water supply. • Risk of leachate leaking through the bottom liner placed in Cell 5 containing relocated waste posing a threat to the groundwater resources	• The preferred composite bottom liner of the new landfill cells, leachate collection and treatment and final capping of the cells provide high level of protection against leakages. • The preferred composite bottom liner design and final capping of Cell 5 for the relocated waste provide high level of protection against leakages. • Inspection and maintenance of leachate collection and treatment facilities. • Inspection and aftercare of final landfill caps. • VCOMS should control delivery of hospital waste and ensure that the waste is incinerated using the incinerator on the VCOMS site.	• Moderate and acceptable risk of leakage contaminating valuable groundwater resources	• Considering the implementation of the **Km 32 Landfill Project** with the preferred design including capping of all legacy waste and remediation of the ponds on both the VCOMS site and the VWMC site; and the proposed mitigation of groundwater risks from VWMC's activities including separate wastewater collection and treatment facilities, lined wastewater ponds, disposal of residual waste at the Km 32 landfill and production facilities under roof and on concrete pavement,

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
	Legacy waste dumps and leachate ponds on the VCOMS Site: • Past infiltration of landfill leachate from existing waste dumps and leachate ponds containing chemicals and bacteria since 2009 over large part of the landfill site possibly already reaching the groundwater underneath the landfill. • Recent hospital waste dumped around the leachate pond on the north-western part of the site. • Future infiltration of leachate contaminating the groundwater	• Regrouping, compacting and grading the waste to form stable mounts on which a low permeable cap will be constructed with stable slopes, proper drainage preventing ponding of water and so as not to cause erosion. • Any seepage of polluted leachate on side slopes to be collected and conveyed for treatment in the new leachate treatment facility. • Final cap designed to minimise future infiltration and generation of contaminated leachate. • Inspection and aftercare of final landfill caps. • Subject to further detailed investigations and analyses during the full ESIA studies, it is proposed that the ponds be dewatered, and depending on water quality test results, the water may either be reused e.g. for dust suppression or	Moderate and acceptable risk of future leakage contaminating valuable groundwater resources. • There is a risk that the legacy waste may already have contaminated the groundwater. The significance of this risk should be investigated and assessed under the full ESIA study	the cumulative risks are assessed to be reduced to an acceptable level. • In addition, Component 1 under PWMP will establish a coordination mechanism among VCOMS, VWMC, MPWT, MONRE and PONRE to address environmental, social and health and safety issues. • There remains a risk that the legacy waste may already have contaminated the groundwater. The significance of this risk should be investigated and assessed under the full ESIA study

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
		conveyed for treatment in the new leachate treatment facility and any polluted sediment to be deposited in the new landfill cells or depending on the nature and severity of the contamination, be built in under the legacy waste caps. • VCOMS should remove and incinerate the hospital waste present around the leachate pond.		
	Legacy waste and wastewater/leachate ponds on the VWMC site: • Infiltration of landfill leachate from existing waste dumps and leachate ponds containing chemicals and bacteria.	• Same as above	• Moderate and acceptable risk of future leakage contaminating valuable groundwater resources. • There is a risk that the legacy waste has already contaminated the groundwater.	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
			The significance of this risk should be investigated and assessed under the full ESIA study	
	VWMC's wastewater reservoir and waste storage • VWMC has conducted an environmental and social impact assessment (ESIA), and an EMMP has been developed and updated and approved by MONRE. • If VWMC is not compliant with their EMMP and their obligations under the concession agreement, there is a risk of groundwater pollution from leachate in waste storage areas or wastewater ponds. • In addition, this pollution may be associated with the Km 32 landfill operations, as it will be difficult to	• According to VWMC's EMMP, a surface water drainage system will be constructed containing all runoff, and a separate wastewater system will convey production wastewater to lined wastewater ponds and wastewater treatment facilities. Most of the treated wastewater will be reused in the production processes. • The current waste production facilities are under roof and on concrete pavement. • Residual waste from sorting activities and fly ash and bottom ash from the waste-to-energy plant	• Once the operation of both the VWMC and Km 32 Landfill is fully implemented, storage of waste that would pose a risk to groundwater is likely to be minimal. • With the proposed mitigation measures and assuming a reasonable level	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
	differentiate the sources of pollution.	will be deposited at the Km 32 (new) landfill. • VCOMS and the construction supervision consultant (PWMP) to ensure that drainage systems for legacy waste is only draining the legacy waste and not draining VWMCs production or storage areas. • VCOMS to undertake weekly inspections of drainage canals and discharge points. • PWMP under Component 1 will provide TA and finance to MONRE to strengthen its capacity for monitoring and enforcing environmental regulations, which will also help MONRE to monitor and enforce VWMC's EMMP. The PWMP will develop standard procedures and systems for compliance monitoring and enforcement including penalty regulations; and provide resources	of compliance by VWMC, it is overall assessed that the risks to groundwater are minor.	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
		for MONRE to undertake regular groundwater monitoring around the landfill.		
Paddy fields, other agricultural land, small streams and fishponds surrounding the landfill	**Km 32 Landfill Project:** • Discharge of treated effluents (leachate) to channels that are used for irrigation or flow into fishponds. • Risk of occasional discharge of non-compliant effluents (leachate). • Discharge of contaminated and untreated surface water.	• Leachate treatment facility provides proper treatment of leachate from new landfill cells and seepage of leachate from capped legacy waste. • Storm water drainage systems will minimise the risk of mixing clean and polluted water.	• Leachate treatment facility likely to provide sufficient mitigation. • Discharge of significant volumes of contaminated site runoff to surrounding water bodies is unlikely	• Considering the implementation of the **Km 32 Landfill Project** with the preferred design including capping of all legacy waste and remediation of the ponds on both the VCOMS site and the VWMC site; and the proposed mitigation of surface water pollution risks from VWMC's activities, the cumulative risks are assessed to be reduced to an acceptable level. • In addition, Component 1 under PWMP will establish a coordination
	Legacy waste dumps and leachate ponds on the VCOMS Site: • Historical and ongoing discharge of leachate from leachate ponds and contaminated surface runoff	• The legacy waste will be capped with a cap designed to minimise rainwater infiltration and seepage of contaminated leachate to the surroundings.	• The cap design and proper maintenance will minimise the risk that significant volumes of contaminated	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
	into channels that are used for irrigation and into fishponds	• The integrity of the cap will be inspected and maintained. • VCOMS should remove and incinerate the hospital waste present around the wastewater pond	leachate and site runoff would be generated and be discharged to surrounding water bodies	mechanism among VCOMS, VWMC, MPWT, MONRE and PONRE to address environmental, social and health and safety issues.
	Legacy waste and wastewater/leachate ponds on the VWMC site: • Historical and ongoing discharge of leachate from wastewater/leachate ponds and contaminated surface runoff into channels that are used for irrigation and into fishponds	• The legacy waste will be capped with a cap designed to minimise rainwater infiltration and seepage of contaminated leachate to the surroundings. • The integrity of the cap will be inspected and maintained.	• The cap design and proper maintenance will minimise the risk that significant volumes of contaminated leachate and site runoff would be generated and be discharged to surrounding water bodies.	
	VWMC's wastewater reservoir and waste storage • VWMC has conducted an environmental and social impact	• According to VWMC's EMMP, a surface water drainage system will be constructed containing all runoff, and the wastewater ponds	• Once the operation of both the VWMC and Km 32	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
	assessment (ESIA), and an EMMP has been developed and updated and approved by MONRE. • If VWMC is not compliant with their EMMP and their obligations under the concession agreement, there is a risk of surface water pollution from leachate in waste storage areas or wastewater ponds. • In addition, this pollution may be associated with the Km 32 landfill operations, as it will be difficult to differentiate the sources of pollution.	will be lined. Most of the treated wastewater will be reused in the production processes. • The current waste production facilities are under roof and on concrete pavement. • VCOMS and the construction supervision consultant (PWMP) to ensure that drainage systems for legacy waste is only draining the legacy waste and not draining VWMCs production or storage areas. • VCOMS to undertake weekly inspections of drainage canals and discharge points. • PWMP under Component 1 will provide TA and finance to MONRE to strengthen its capacity for monitoring and enforcing environmental regulations, which will also help MONRE to monitor and enforce VWMC's EMMP. The PWMP will develop standard	Landfill is fully implemented, storage of waste that would pose a risk to surface water is likely to be minimal. • With the proposed mitigation measures and assuming a reasonable level of compliance by VWMC, it is overall assessed that the risks to surface water bodies are minor.	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
		procedures and systems for compliance monitoring and enforcement including penalty regulations; and provide resources for MONRE to undertake regular surface water monitoring around the landfill.		
	Factories along the access road: • Potential discharge of untreated wastewater	• No information	• No information	
Landfill workers including VCOMS and landfill operator employees and waste pickers **Residential environments**	**Km 32 Landfill Project:** • Risk of emission of odours and air pollution form landfill fire • Risk of spread of infectious diseases from vectors. • Littering along the access road. • Dust generation from transport along the access road • Risk of accidents and road damage related to Km 32 landfill related transport	• Operation of the two new waste cells to include daily soil cover, and collection and treatment of leachate. • Capping of Cell 5 containing relocated waste. • Monitoring to detect signs of fire outbreak. • Firefighting equipment available. • Regular maintenance and clean-up of the access road.	• New landfill cells when operated properly will minimise the risks of odour, fire and vector impacts. • The cap on the relocated waste will prevent emission of offensive odour,	• Considering the implementation of the **Km 32 Landfill Project** with the preferred design including capping of all legacy waste on both the VCOMS site and the VWMC site, and proper implementation of landfill operation and maintenance; and the proposed mitigation of air pollution risks and

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
and commercial and business enterprises within a radius of 2-3 km of the landfill		• VCOMS will implement a Traffic Management Plan for movement of vehicles within the landfill site, and to and from the landfill site. Traffic management must include regular monitoring of traffic safety both within the landfill site and on public road. The Km 32 Landfill contractor is also required to develop and implement a traffic management plan	fire and vector impacts	risks of accidents on the access road from VWMC's activities, the cumulative risks are assessed to be reduced to an acceptable level. • In addition, Component 1 under PWMP will establish a coordination mechanism among VCOMS, VWMC, MPWT, MONRE and PONRE to address environmental, social and health and safety issues.
	Legacy waste and leachate ponds on the VCOMS Site: • Ongoing regular emission of malodours and air pollution from landfill fires • Ongoing risk of spread of infectious diseases from vectors	• The legacy waste will be capped. • The integrity of the cap will be inspected and maintained.	• The cap on the legacy waste will effectively eliminate emission of malodours, exposure to waste by animals and humans and generation of landfill fires	

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
	Legacy waste and wastewater/leachate ponds on the VWMC site: • Ongoing regular emission of malodours. • Ongoing risk of spread of infectious diseases from vectors.	• The legacy waste will be capped. • The integrity of the cap will be inspected and maintained.	• The cap on the legacy waste will effectively eliminate emission of malodours, exposure to waste by animals and humans and generation of landfill fires.	
	Air emissions from VWMC's waste sorting plant, RDF plant, waste-to-energy plant, composting and fertilizer plant; transport of waste and materials to and from VWMC: • VWMC has conducted an environmental and social impact assessment (ESIA), and an EMMP has been developed and updated and approved by MONRE. • If VWMC is not compliant with their EMMP and their obligations	• According to VWMC's EMMP, the energy plant will be equipped with effective air emission controls and automatic air emission monitoring. The ambient air will also be monitored. Truck loads will be covered, the access road sprayed with water, a speed limit will be imposed, and truck drivers will be trained. • VWMC will also establish firefighting system including 2	• With the proposed mitigation measures and assuming a reasonable level of compliance by VWMC, it is overall assessed that the risks of significant air pollution from VWMC's	•

Receptor	Sources / Pathways / Risks	Mitigation Measures	Source Assessment	Cumulative Assessment
	under the concession agreement, there is a risk of air pollution from VWMC's waste sorting plant, RDF plant, waste-to-energy plant, composting and fertilizer plant. • Risk of accidents, road damage, dust, waste spillage from VWMC related transport. • In addition, this pollution may be associated with the Km 32 landfill operations, as it will be difficult to differentiate the sources of pollution.	standby fire trucks, sprinkler system, water pumps and alarms. • PWMP under Component 1 will provide TA and finance to MONRE to strengthen its capacity for monitoring and enforcing environmental regulations, which will also help MONRE to monitor and enforce VWMC's EMMP. The PWMP will develop standard procedures and systems for compliance monitoring and enforcement including penalty regulations; and provide resources for MONRE to undertake regular air quality monitoring around the landfill.	production plants are minor. • The risk of accidents, dust generation and spills from transport on the access road are considered moderate.	

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1 ABOUT THE ESMP

330. The ESMP has been developed based on the preliminary identification and assessment of the social and environmental risks and impacts associated with preferred design of the **Km 32 Landfill Project**.

331. The ESMP sets out recommended environmental and social mitigation[45] and monitoring measures to adequately ensure protection of the environment, people's wellbeing, health and livelihoods from impacts associated with the proposed project; and to ensure compliance with applicable environmental and social obligations under the Laws of Lao PDR and the World Bank Environmental and Social Standards. The measures to mitigate the potential Environmental and Social impacts and risks are provided in ***Table 8-1, Table 8-2, Table 8-3, Table 8-4 and Table 8-5***.

[45] Mitigation refers to the elimination, reduction or control of the adverse environmental or social impacts of the project and includes restitution for any damage to the environment caused by such impacts through replacement, restoration, compensation or any other means

TABLE 8-1: PROPOSED PRE-CONSTRUCTION PHASE ENVIRONMENTAL MITIGATION MEASURES FOR THE KM 32 LANDFILL PROJECT

Project Activity	Environmental Risk or Impact	Pre-Construction Period Mitigation Measures	Implemented by	Supervised by
Prepare a full scale ESIA and Health Impact Assessment for the **Km 32 Landfill Project**	All environmental and social risks and impacts of the **Km 32 Landfill Project**	1. Undertake a full scale ESIA and Health Impact Assessment to be approved by MPWT, World Bank and finally by MONRE for issuance of an Environmental Compliance Certificate. Scope of the full ESIA will also cover Km 16 and Naxaythong sites. 2. The Health Impact Assessment shall be certified by the Ministry of Health prior to MONRE's approval. 3. Ensure that necessary baseline surveys are carried out to provide input to the ESIA studies (see ***Table 8-7)***. 4. Regular review of draft findings 5. Regular and frequent coordination and collaboration with the design work 6. Apply the relevant ESF instruments	ESIA Consultants	MPWT/PTI VCOMS
Detailed engineering design of the **Km 32 Landfill Project**	Inadequate design, inconsistent with the ESIA and insufficient to properly prevent or minimise related environmental	7. Regular review of draft design proposals 8. Regular and frequent coordination and collaboration of design studies and surveys with the impact assessment studies. 9. Ensure that necessary baseline surveys are carried out to provide input to the detailed design. This should include field surveys to develop reasonably accurate maps of the vertical and lateral extent of the legacy waste on both the VCOMS site and the VWMC site.	Design consultants and ESIA consultants	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Pre-Construction Period Mitigation Measures	Implemented by	Supervised by
	risks and impacts	10. Adoption of a simple pond and wetland system to treat leachate instead of the proposed UASB and rotating disc technology which require power, regular maintenance and could easily breakdown. 11. Inclusion of a leachate recirculation system to minimize discharge of treated leachate to the environment and to accelerate waste decomposition and reach the stabilization phase earlier. 12. To minimize the volume of leachate that goes into the leachate treatment system, the leachate collection system should be designed such that rainwater from the inactive parts of a cell are collected and discharged separately as clean stormwater and only waste-leachate are conveyed into the leachate treatment unit. Each section of a cell should be equipped with an interchangeable pipe system that can switch between discharge to stormwater and the leachate transport system. 13. Assurance that operators errors/non-compliance with operating protocol cannot result in switching leachate into the proposed “clean stormwater” discharge and discharging it untreated.		
Disclosure and engagement of community through consultation	Any community related risks or impacts	14. Inform and consult with local communities, waste pickers and staff about the final design, mitigation measures and the Grievance Redress Mechanism	PMU	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Pre-Construction Period Mitigation Measures	Implemented by	Supervised by
Unexploded Ordnance (UXO) survey, & removal	Risk of injuries or fatalities among workers or members of the public	15. Request the National Regulatory Authority to determine if a UXO survey is required and if required commission an organization duly accredited by the National Regulatory Authority to undertake the necessary survey and provide the required certificate of UXO survey/clearance to the PMU	PMU through an accredited UXO Survey organization	MPWT/PTI VCOMS
Contractor Environmental and Social Management Plan (CSEMP)	All construction related risks and impacts	16. The contractor shall prepare the CSEMP for review and approval by the PMU prior to starting any work on site	Contractor	MPWT/PTI VCOMS

TABLE 8-2 PROPOSED CONSTRUCTION PHASE ENVIRONMENTAL MITIGATION MEASURES FOR THE KM 32 LANDFILL PROJECT

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
Civil works	Air quality	17. Select Borrow sites located as close as possible to the proposed landfill site to reduce distances. 18. Concrete batching facilities to be located at least 500 m from the nearest dwellings in order to reduce the impact of dust and fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions.	Contractor	MPWT/PTI VCOMS (VCOMS is responsible for management

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		19. Water will be regularly sprayed to suppress fugitive dust at construction sites, material handling areas, access road and borrow pits/spoil disposal sites. 20. Trucks carrying dry construction materials such as earth or waste will be covered with tarpaulins or other suitable cover. 21. Construction vehicles and machinery will be maintained to a high standard to minimize emissions and ensure compliance with the Lao National exhaust emission standards. All mobile equipment should be fitted with catalytic converters. 22. A speed limit of 20 km/h for construction related traffic through inhabited areas and on the access road will be enforced. 23. All open burning of construction and demolition waste material and refuse will be prohibited. 24. Air quality monitoring will be carried out as prescribed in Table 8-9		of the contract with the Operator)
Civil Works	Noise	25. Maintain all exhaust systems in good working order and undertake regular equipment maintenance to ensure compliance with applicable regulations and manufacturers' instructions. 26. Implementation of operating and maintenance practices of equipment and machinery to ensure that they are well-maintained. 27. Ensure that noise control options such as silencers and mufflers are fitted to exhausts, compressors and fans for construction equipment (such as hydraulic excavator, bulldozer, front loader, backhoe and trucks).	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		28. Restrict construction activities using heavy machinery work between 8 am and 6 pm. 29. Provide advance warning to the community on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance and notify the communities about how to raise their concerns (if any) through the Grievance Redress Mechanism. 30. Undertake noise monitoring at the closest residential area and other noise sensitive receptor during times with ongoing construction work to ensure compliance with the relevant noise standards. 31. The contractor shall provide all construction personnel working in the vicinity of noisy construction activities (defined as those activities generating noise levels greater than 80 dB(A)), or any construction personnel who requests hearing protection, with hearing protection equipment. 32. A speed limit of 20 km/h for construction related traffic through inhabited areas and on the access road will be enforced. 33. Noise monitoring will be carried out as prescribed in Table 8-9		
Civil Works	Flora or vegetation	34. Where possible, material from existing licensed borrow and quarry sites will be used. If new sites are needed, they will be subject to due diligence and approval by the PMU and PONRE/DONRE to ensure that sensitive habitats are avoided and that an appropriate restoration plan (recontouring and replanting with native species).	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		35. Provide awareness to construction staffs and follow up strictly monitoring on forest and wildlife resources management. The cutting of timber, and hunting or fishing and trading in wildlife will be prohibited. 36. Burning to clear and control vegetation will be prohibited. 37. The use of herbicides to control vegetation will be prohibited.		
Civil Works	Surface Water and Groundwater	38. Installation of temporary non-erodible ditches or bunds at the construction site to divert clean runoff away from exposed areas and convey potentially dirty runoff to sediment control devises. 39. Pits and ponds shall be dewatered, and any ponded water should be tested and then reused for dust suppression or treated, if necessary, before being discharged to the environment or reused. 40. Stockpiles and materials will be stored at least 50 m from surface waters with drainage directed away from the canals or drainage channels and streams or water sources. 41. No washing or repair of machinery within 50 m of surface waters. 42. Topsoil present on the construction site will be removed and stockpiled in labelled areas for later use in rehabilitation of the construction site. 43. Construction working areas will be clearly demarcated and encroachment onto adjacent areas avoided. 44. A minimum 30 m vegetation buffer shall be maintained between the construction site and the nearest water bodies.	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		45. Portable toilets and small wastewater treatment units will be provided at the construction site and labour camps. All sanitary facilities will be located at least 50 m from surface water bodies. All workers must be instructed to use these facilities, which shall be kept clean at all times. 46. Pit latrines and septic tanks should be placed at least 2 m above the groundwater table must be located at least 50 m from surface water bodies and water wells and in areas of suitable soil profiles. 47. All hazardous materials including hazardous waste will be stored on an impervious surface, under cover, in adequate tanks or containers and within secondary containment. A bund will be provided around any above ground fuel storage tank with capacity of 110% of the largest single tank. Storage of hazardous materials shall be at least 50 m from surface water bodies with no direct drainage to surface water. 48. Areas where spills of fuel or oil may occur will be equipped with easily accessible spill control kits to assist in prompt and effective spill control. 49. Refuelling of machineries by service vehicles will be conducted with measures preventing oil spillage during refuelling including placement of buckets under refuelling nozzles. 50. Stationary equipment such as motors, pumps, generators will be positioned over drip pans. 51. Runoff accumulating at the bottom of (waste free) excavation pits during construction will be pumped out, reused where practicable or otherwise conveyed to appropriate sediment retention pond/devises before being discharged to the environment.		

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		52. Hazardous waste (oil waste) shall be properly collected and stored in closed containers under shelter for recycling or disposal by a duly authorizes enterprise. 53. Water monitoring to be carried out as prescribed in Table 8-9.		
Excavation	Unanticipated finding of artifacts	54. Immediately upon noticing an item that could possibly be an artifact of cultural, archaeological, or historical importance, the finder (Contactor) shall suspend all work and notify the PMU. 55. The PMU shall observe and document (take photo, describe) the finding without physically inspecting it and inform the District Office of Information, Culture and Tourism 56. The PMU shall ensure that the contractor fences off the place of finding and facilitate the officials of the Ministry of Information, Culture and Tourism to access the place of finding and recovering or otherwise protecting the artifact. 57. The construction work may only resume with the permission of the Ministry of Information, Culture and Tourism	Contractor/PMU	MPWT/PTI VCOMS
Spoil and Borrow Site Management	Flora and Fauna Soil and land resources	58. Where possible existing borrow pits or spoil disposal sites shall be used. If new sites are needed, the contractor shall obtain approval from the relevant authorities and from PMU to ensure that sensitive habitats are avoided, and that appropriate mitigation and rehabilitation measures will be implemented. 59. Obtain and document agreement with the landowner.	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		60. Ensure minimisation of vegetation and habitat loss and limit land clearance to only the land required for the borrow pit / spoil disposal. 61. Set out the site boundaries and ensure that the surrounding land is not disturbed. 62. Prohibit the use of burning to clear and control vegetation. 63. Ensure that spoil is disposed of only at the designated disposal sites and that no material is side tipped along roads or down slopes, dumped on private or public land, or dumped in water bodies. 64. Ensure that all necessary disposal site preparation activities are completed prior to the start of the related spoil generation, handling and disposal; 65. The contractor shall install erosion and sediment controls such as sedimentation ponds, non-erodible channels or bunds at each site and progressively adjust the measures as the landform changes, to minimise on-site erosion and prevent off-site sedimentation; 66. Ensure that only inert waste is disposed of at spoil disposal sites; 67. Ensure that roots and stumps and other vegetation debris are separated from the spoil materials prior to disposal and either mulched on-site for reuse in landscaping or ground stabilization works, left to decompose naturally, or otherwise safely disposed; 68. Conduct routine inspections, not less frequently than once a week, of water pollution, erosion and sediment control measures, and promptly undertake necessary maintenance, repair and upgrading works to ensure that the design capacity is maintained;		

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		69. Undertake inspections within 24 hours of a heavy rainfall event; 70. Undertake progressive rehabilitation of disturbed areas taking into consideration what the final land use will be; 71. Conserve topsoil for later site rehabilitation; 72. Recontour the sites, fill depressions and revegetate the sites to create a final surface that is consistent with the original topography of the area; 73. Design the final landforms and slopes to protect groundwater quality, to prevent surface water ponding, to facilitate revegetation, to convey runoff in a non-erosive manner, and to account for long term settlement; 74. Revegetate the sites in such a way as to establish a diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation, soil amendments or fertilizer, and is at least equal in extent of cover to the natural vegetation of the surrounding area; 75. Use appropriate native and non-invasive plant species for re-vegetation and rehabilitation work.		
Solid and Liquid Waste Management	Resource use and natural resource contamination	76. Preparation of a Waste Management Plan as part of the CSEMP before construction which applies the waste hierarchy to ensure efficient use and management of resources with a priority to prevent waste at source followed by recycling, and with disposal as the last resort.	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		77. Recyclables will be separated at source and given/sold to recycler (plastic, metal, card, paper as a minimum). 78. Safe temporary storage of hazardous waste as required under Bullet 47. 79. To the extent possible, a duly authorized waste company will be contracted to recycle hazardous waste. 80. Non-hazardous, non-recyclable solid waste will be temporarily deposited and managed together with the incoming domestic waste and relocated to the new landfill cell once the cell is ready to receive waste. 81. There will be no burning of waste at the site. 82. All vehicles/drivers will be provided with plastic bags for waste collection and prevent any unauthorized waste disposal with particular attention paid to prevention of littering. 83. The Contractor will be required to train the workers in proper waste management.		
Community Health and Safety	Human health and safety	84. Prior to start of construction work, the contractor in cooperation with the PMU will consult with the local authorities and potentially affected residents. Inform them about the upcoming construction work, safety precautions and how to raise concerns or file complaints (GRM); 85. The contractor shall fence off the landfill construction area and control access to the site. 86. A speed limit of 20 km/h for construction related traffic through inhabited areas and on the access road will be enforced.	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		87. The contractor shall suppress generation of dust at the construction site and the access road using a water sprinkler truck. 88. The contractor shall install traffic signage and fluorescent bollards and warning lights to direct traffic and prevent vehicles driving into the lanes with construction activities. 89. The contractor in cooperation with the local authorities shall implement traffic management to ensure a smooth traffic and prevent congestion. 90. Incident/accident reporting including the requirement to notify WB within 48 hrs of become aware of severe accident.		
Occupational Health and Safety and Emergency Response	Human health and safety	91. Prepare a health and safety plan containing site-specific precautions in accordance with relevant occupational health and safety guidelines. 92. Inspect and check the relevant construction equipment to ensure that it meets the applicable mechanical and safety requirements. 93. Inspect the worksite to ensure that the equipment can be safely mobilized and operated, and that there are no unmitigated risks. 94. Install appropriate fencing and control access to the site. 95. Install appropriate safety signage and markings. 96. Where reasonably practicable, install guardrails to prevent falls from worksites, platforms or walkways higher than 2 m 97. Where fall prevention measures are not reasonably practicable, provide fall protection when workers are exposed to unguarded platforms or walkways higher than 2 m.	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		98. Ensure there are safe ways to enter and exit excavations. 99. Provide proper shoring, shielding or sloping of excavations deeper than 1.2 m. 100. Keep excavations dry. 101. provide safety precautions when using high voltage electric power tools; 102. carry out daily toolbox meetings (safety briefings); 103. Maintain an accident record book where all major or minor accidents and incidents are recorded with actions taken; 104. Educate the workers on construction hazards; 105. Train drivers on safe driving skills and traffic regulations; 106. Appoint an Environment, Health and Safety Officer who is a qualified engineer; 107. Make adequate first aid equipment available on site; 108. carry out training and awareness of the workers on HIV-AIDS prevention; 109. implement emergency preparedness and response procedures Response Plan as planned in the CSEMP. 110. Ensure that all workers are equipped with and use Personal Protective Equipment (PPE) 111. Incident/accident reporting including the requirement to notify WB within 48 hrs of become aware of severe accident.		

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
Protection against the COVID-19 disease	Transmission of SARS-CoV-2 virus	112. Plan and execute work in compliance with country-specific COVID-19 risk management regulations and directives. 113. Conduct Risk communication, training, and education. Training of workers in infection prevention and control practices.	Contractor	MPWT/PTI VCOMS
Labour Camp Management	Contamination of water, soil, waste production and social issues	114. If a camp for construction workers is required, the contractor will set out a camp management plan in the CSEMP together with a location map and a site layout map indicating the site facilities and infrastructure. 115. The camp will have adequate and separate accommodation and sanitation facilities for male and female workers, and the facilities will meet good standards of health, hygiene and comfort. 116. There will be adequate supply of clean and safe water, adequate waste and wastewater disposal systems, appropriate protection against heat, cold, noise, damp, fire and disease-carrying or poisonous animals (e.g. insects) 117. Relevant training on camp management will be provided to all staff. 118. Priority will be given to employ local labour and retain evidence of how local labour recruitment efforts were undertaken. 119. At the end of the construction period, all camp facilities, structures, installations and pavements (above ground and below ground, fixed and moveable) will be dismantled or demolished and removed (reused, sold/recycled, disposed of as waste) from the site. 120. All chemicals, waste and pollution will be removed and safely disposed of.	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		121. Septic tanks and other sanitary/waste disposal systems will be emptied, and the content disposed of in accordance with local regulations. The installations will be excavated and removed. 122. The site will be recontoured, depressions backfilled. Topsoil will be applied, and the site will be revegetated		
Emergency Preparedness and Response	Emergencies	123. Preparation of an Emergency Preparedness and Response Plan. 124. The Emergency Preparedness and Response Plan will contain: a. Emergency preparedness and response responsibilities b. Identification of hazards that may lead to an emergency situation c. Identification of people at risk d. Emergency response procedures e. Detection, evaluation and emergency level determination f. Notification and communication g. Emergency action h. Termination and follow-up i. Prevention and preparedness j. Training and exercises k. Emergency contacts	Contractor	MPWT/PTI VCOMS

Project Activity	Environmental Risk or Impact	Construction Period Mitigation Measures	Implemented by	Supervised by
		125. The Emergency Preparedness and Response Plan will address the following emergencies: a. Traffic accident b. Serious injuries c. Fire d. Explosion e. Flooding f. Electrocution g. Chemical spill h. Structural collapse i. Poisoning		

Table 8-3: Proposed Operational Phase Mitigation Measures for the Km 32 Landfill Project

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
Start-up Phase Operation of the landfill	All	126. An operation and maintenance manual shall be developed for approval by the PMU. 127. Conduct on-the-job training of the operator's staff. 128. The operation and maintenance plan shall include an environmental management plan (based on this ESMP) for the operating period. Minimum measures include: • Procedures for compacting and covering waste • Controlling and minimising windblown waste • Procedures for handling of non-hazardous waste • Procedures for controlling and recording waste disposed of at the landfill, including origin, quantity, type of waste, collector. • Operational procedures for leachate management and handling of sludge from the leachate treatment process • Procedures for handling of hazardous waste including determining if the waste is acceptable for temporary storage in the hazardous waste storage facility, transportation, labelling, temporary storage, separation according to their type and risks, and permanent disposal - in line with local and international regulations. • Pests management procedures. • Procedures for inspecting the physical integrity of the capped legacy waste and associated drainage systems.	VCOMS and the Operator assisted by technical and environmental Consultants	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		• Health and safety hazards and use of PPEs • Emergency response plan		
Waste Handling and Disposal	Odour, dust, and fires	129. All fuels or flammable solvents for operational use will be stored on an impervious surface, under cover, in adequate tanks or containers and within secondary containment. A bund will be provided around any above ground fuel storage tank with capacity of 110% of the largest single tank. Storage of such materials will be at least 50 m from surface water bodies with no direct drainage to surface water. 130. Waste deposition in appropriate daily lifts with limited working face. 131. Ensure that the waste is compacted and regularly covered with soil. 132. Highly biodegradable and odorous wastes will be buried immediately with appropriate cover material. 133. Spray water for dust suppression, particularly over exposed waste surfaces. 134. Reduce drop hights where practicable. 135. Set-up nets downwind of operated cell to capture potential windblown litter. 136. Carry out weekly litter collection and removal of any wastes which are not deposited in cells, including waste at the boundary and access roads to the site. 137. All transport of waste will be done with covered trucks. 138. The internal roads will have concrete pavement thereby reducing dust generation.	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		139. Washing wheels of vehicles before they leave site if they are muddy from accessing the landfill cells. 140. Quarterly meetings with residents and / or their representatives to identify odour or nuisance issues. 141. Provide and maintain a vegetation buffer with tree plantings around and in the landfill site to reduce noise, dust and odour nuisances. 142. Gas generated at landfill will be flared. 143. Implement strict control with fire risks at the landfill site including prevention of burning and smoking. 144. A fire response team will be designated and trained to intervene in case of fire at the landfill. 145. A fire water tank or reservoir to be available at the landfill. 146. Odour monitoring will be carried out as prescribed in ***Table 8-11.***		
Hazardous Waste Handling and Disposal	Health and safety, air quality, fire and explosion risk	147. Incoming hazardous waste will be inspected prior to acceptance. 148. The waste acceptance policy for hazardous wastes will be detailed in the Operation and Maintenance manual. It is envisaged that the majority of this waste will be securely and temporarily stored in either HDPE plastic or steel drums, with exact requirements specified in the Operation and Maintenance manual. 149. As a preliminary hazardous waste acceptance guidance, the following waste types are considered acceptable:	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		a. Electronic waste not containing gasses (e.g. chlorofluorocarbons) b. Solid-state batteries c. Residues from incineration of infectious waste and sharps d. Fluorescent lamps e. Empty cans and containers for chemicals (pesticides, paints, hydrocarbons) f. Wiring g. Soil, sweeps, cloth or other solid materials contaminated with hazardous chemicals 150. As a preliminary hazardous waste acceptance guidance, the following waste types are considered unacceptable: h. All types of liquid hazardous waste (hydrocarbons, paint, acids, bases) i. Asbestos containing waste j. Lead batteries k. Untreated infectious waste including sharps (note that medical waste is delivered separately for incineration by the medical waste incinerator at the Km32 landfill) l. Radioactive waste m. Flammable waste		

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		n. Compressed flammable gasses o. Explosives p. Oxidizing agents q. Gas cylinders 151. Inspection and sorting of hazardous waste, temporary storage of recyclable hazardous waste and packaging of hazardous waste for disposal will take place in the Hazardous Waste Storage Facility (such a facility is recommended added to the project design). Medical waste shall be delivered separately directly to the medical waste incinerator at the Km 32 Landfill. 152. The Hazardous Waste Storage Facility will be well ventilated and will have a sealed floor to control any spills.		
Leachate Management	Surface water and Groundwater	153. The landfill design includes a bottom composite liner consisting of a 1.5 mm HDPE geomembrane on top of a compacted low permeable clay liner which provide a high level of protection against groundwater contamination. 154. The landfill design includes a leachate collection and treatment system to ensure that the leachate is collected and treated in compliance with relevant effluent standards. The leachate treatment system proposed in the Pre-Feasibility Study will generate sludge which will be removed from time to time and deposited at the landfill. 155. Ensure proper containment of hazardous waste in designated drums for temporary storage in the Hazardous Waste Storage Facility.	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		156. Leachate production will be minimised by (i) intercepting surface water run-on to the site and internal runoff, (ii) intermediate cover and waste compaction to reduce infiltration into the waste, (iii) building waste in pyramidal phases as opposed to being spread across the whole cell. 157. It is further recommended to consider the design recommendations in ***Table 7-4*** including: a. installing a recirculation system for treated leachate and include specific leachate management procedures in the Operation and Maintenance Manual for strict implementation to ensure zero discharge under most rain events. b. a system where the leachate will be conveyed to a low tech, easy to maintain, biological leachate treatment facility. Leachate is conveyed via gravity through a series of ponds: an anaerobic lagoon, aerobic lagoon, and a maturation lagoon in the form of a constructed wetland, and then to a final treated water lagoon. c. installing a leachate collection system to facilitate that only waste-leachate is sent to the leachate treatment facility by separating rainwater from the inactive parts of a cell and discharging it as clean stormwater. Each section of a cell to be equipped with an interchangeable pipe system, initially set to stormwater, and subsequently turned via a valve to the leachate transport system when waste is deposited in that particular area.		

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		158. Always comply with required operating standards to ensure effective treatment of leachates. 159. In case of discharged effluents, monitor and report the quality of receiving water bodies around the landfill site. 160. Protect the liner throughout lifespan of the landfill and ensure that it is not damaged by the daily waste handling operations. 161. Groundwater and surface water quality monitoring will be carried out as prescribed in in ***Table 8-11***		
Landfill Operation	Pests, and spread of infectious diseases	162. Conduct regular monitoring and recording of key vectors as part of landfill operations and management 163. Provide worker immunization and health monitoring (e.g. for Hepatitis B and tetanus); 164. Maintain good housekeeping in waste processing and storage areas 165. Promptly compact and cover wastes in operated cells, especially for waste with the potential to attract vermin and flies, such as food wastes 166. Grade the area properly to prevent ponding (to minimize insect breeding areas); 167. Use integrated pest-control approaches to control vermin levels, treating infested areas 168. Fully enclose the waste management site with fencing so that no livestock or wildlife is able to come in contact with the waste and thus prevent spread of livestock and zoonotic diseases.	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		169. At the waste reception area, remove all waste at the end of each operating day and frequently clean and wash down the tipping floor.		
Landfill Operation	Occupational Health and Safety	170. Preparation and implementation of a health and safety plan containing: (1) procedures to eliminate or minimize the risk of exposure to biological agents and pests, (2) personal hygiene practices, (3) instructions in proper use of personal protective equipment, (4) emergency procedures. 171. Ensure compliance with the Labour Law and other applicable national legislation including provisions for hazardous working conditions and child labour." 172. The Operator will appoint an Environment, Health and Safety Officer who is a qualified engineer. 173. Worker education and awareness seminars for landfill-related hazards will be given. A site safety program will be developed by the operator and workers shall be trained regularly. 174. The site operator HSE supervisor should conduct daily toolbox meetings (safety briefings) 175. An accident record book will be maintained where all major or minor accidents and incidents are recorded with actions taken. 176. Access to site will be prevented through appropriate fencing, protective barriers, and buffer zones for all non-authorized personnel. All entrances should be recorded. Video cameras should also be put in place around the perimeter of the site.	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Operating Period Mitigation Measures	Implemented by	Supervised by
		177. Sufficient signage giving health and safety warnings and information disclosed at the entrance of all sites. 178. Avoid aerosolizing leachate during recirculation. 179. Avoid direct contact with waste and leachate. 180. Undertake regular health checks of workers/staff. 181. Ensure that all workers and informal recyclers are equipped with and use Personal Protective Equipment. This includes use of appropriate protective clothing at work (coveralls) and hard hat, safety boots, gloves, googles and, where required respiratory protective equipment. 182. Adequate first aid equipment will be made available on site for landfill operators and waste pickers. 183. Firefighting equipment and a trained firefighting team will be present on site. 184. The operator will prepare an Emergency Response Plan.		
Landfill Operation	Community Health and Safety	185. The operator will install a sign board with relevant contact details and operating hours at the entrance to the landfill site. It will state contact details for raising complaints. 186. The operator will record all public complaints and deal with them within a timeframe agreed with MPWT. 187. The operator will develop a Traffic Management Plan for movement of vehicles within the landfill site, and to and from the landfill site. Traffic management must include regular monitoring of traffic safety both within the landfill site and on public road.	VCOMS and the Operator	MPWT/PTI

Table 8-4: Proposed Closure Phase Mitigation Measures for the Km 32 Landfill Project

Sub-Project Activity	Environmental Risk or Impact	Closure Period Mitigation Measures	Implemented by	Supervised by
Closure Plan	All	188. Develop a Closure Plan 6 months before expected closure of the first landfill cell for approval by the PMU. 189. The preparation of the closure plan shall include consultations with landfill staff, waste pickers, local authorities and MONRE 190. The closure plan shall include: • Closure objectives and completion criteria • The detailed design of the final cap including the materials to be used and where these will be sourced. • Construction methods and the timeframe • Post-closure management and monitoring measures (aftercare) for leachate, stormwater, landfill gas, odour, dust, litter and final cap integrity. • Identify feasible future use of the site • Record of consultations with neighbouring residents, businesses and local authorities and MONRE • Measures to ensure that waste is not received for disposal at the site/cell after landfill operations cease.	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Closure Period Mitigation Measures	Implemented by	Supervised by
		• Plan for inspection of the closed cell • Maintenance and aftercare of the landform, vegetation, drainage systems and gas ventilation system • Plan on supporting any staff that may become redundant as a result of the closure • The overall timeframe for the entire closure phase		
Aftercare	Risk of subsidence or cracks leading to ponding, increased erosion, infiltration and seepage of leachate with increased risk of soil and water pollution	191. Over a 5-year period conduct regular inspection of the integrity of the capped cell and the drainage systems, check for any signs of slumping or subsidence and check for signs of seepage 192. Conduct aftercare of the cell landform, vegetation cover and clean-up drainage systems to ensure proper drainage and to minimize erosion	VCOMS and the Operator	MPWT/PTI
Capping	Direct exposure to waste by people or animals	193. Placement of a cap on top of the waste in accordance with the preferred cap design	VCOMS and the Operator	MPWT/PTI

Sub-Project Activity	Environmental Risk or Impact	Closure Period Mitigation Measures	Implemented by	Supervised by
Capping	Disease spread by vectors and vermin odour nuisances, windblow litter and risk of fire	194. Placement of a cap on top of the waste in accordance with the preferred cap design 195. Regular inspection and aftercare	VCOMS and the Operator	MPWT/PTI
Land use management and access control	Uncontrolled use of the land incompatible with the design of the caps or the integrity and stability of the cells	196. Maintain fences around the closed cell 197. Regular inspection of the site 198. Regular consultations with people who may have been allowed to use the land for specific purposes	VCOMS and the Operator	MPWT/PTI
Leachate management	Risk of escape of leachate to surrounding environment	199. Maintain leachate collection and treatment for about 5 years or at least until the composition of the leachate no longer poses a risk to the environment	VCOMS and the Operator	MPWT/PTI

TABLE 8-5 PROPOSED SOCIAL MITIGATION MEASURES FOR THE KM 32 LANDFILL PROJECT

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
Pre-construction Phase			
Conducting site specific ESIAs and ESMPs to obtain approval from WB and ECC from GOL	Lack of inclusive and meaningful consultation with all concerned stakeholders (esp., vulnerable/poor households, women, waste pickers and collectors) could result in the risk is regulatory non-compliance, project delays, reputational harm to project stakeholders.	• Ensuring the compliance with the ESMF, SIA-SMPs (Attachment 1, 2, 3B, 4 and 5- of the SIA-SMP), Pre-ESIA, ESCP and SEP. • Obtain the approval from the WB and ECC from GOL (MONRE).	Implemented by ESIA Firm Monitored by MPWT PTI
Preparation of BD/CD	Lack of understanding and knowledge and risks of exclusion of ESF requirement and instruments in the FS and DD	• Include requirements related to construction phase in the Full ESIA as BD/CD requirements. • Obtain the approval from the WB and from PWMP.	Implemented by FS and DD Teams Monitored by MPWT PTI
Mobilization	OHS and Community health and safety: traffic disruption and road safety (mobilization and transportation of demolished materials)	• Developing, implementing, monitoring and reporting of OHP, CHSP, Dust and Noise Control Plan and Traffic Management Plan as part of C-ESMP in line with the project ESMP and the SIA-SMP Attachment 1 and Attachment 2) and ESCOP (Annex 7B of the ESMF)	Implemented by contractor and monitored by PIU, CSC and MPWT PTI
Construction Phase			

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
Identification of construction material sources (borrow, sand, quarry sites)	Changes involving loss of private and/or communal land: Possibility of private and/or communal land loss including agriculture land and products	• Apply Negative Criteria List (Annex 3B of the ESMF). • Conduct E&S screening and scoping for land acquisition and resettlement (Attachment 4 of the ESMF). • Conduct consultation and obtain agreement with landowner if private land. • Updating, implementing, monitoring and reporting of SEP and GRM. • Completion of resettlement and compensation before commencement of construction activities	Implemented by FS and DD Teams and PIU/DPWT Monitored by MPWT PTI
Relocation of waste, coordination of construction works with management of incoming waste	• Disruption on recycling activities with risk of causing loss/reduction in income of the waste-pickers	• Early construction of the waste reception area to ensure that the waste pickers can continue to work, and in the meantime designate temporary dumping areas where waste pickers can safely work. • Encourage contractors to recruit waste pickers as labours. • Promote local recruitment of workforce	Implemented by VCOMS and monitored by MPWT PTI/DHUP

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
Design and operation of worker camps **Labour recruitment and management for construction work**	• Labour related risks include the risk of: (i) employment discrimination, (ii) labour related disputes, (iv) Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH), (v) child labour (waste pickers); (vi) accidents and injuries, exposure to toxic waste component/ air pollution (dust and bio-aerosols, odours nuisances, and vehicle emissions/noise and vibration/ pathogens and vectors in waste collection, transport and management processes. • Risk of spreading COVID-19, HIV and other communicable diseases to local communities. • Increased the risk of substance abuse such as alcohol and amphetamine. Such substance abuse is often a contributing factor to accidents and incidents. It also is a contributing factor for SEA/SH and VAC.	• Developing, implementing, monitoring and reporting of CHSP as part of CESMP in line with the Annex 2 of the SIA-SMP and the WB Environmental Health and Safety Guidelines (EHSG) and Good International Industrial Practices (GIIP) and taking into account the latest COVID-19guidelines mandated by the government and/or best practice in the country. • Developing, implementing, monitoring and reporting of LMP including OHSP as part of CSEMP in line with Attachment 3B of the SIA-SMP to mitigate OHS issues and ensure that different project teams and workers will be provided with adequate resources, including personal protective equipment (PPE), accommodation, transport, first aid-kits available at working sites, and can be contacted/reached in case of emergency. • Develop and implement no child labour regulation to ensure compliance with the Labour Law and other applicable national legislation including provisions for hazardous working conditions and child labour.	Implemented by contractor and monitored by PIU, CSC and MPWT PTI

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
		• Developing, implementing, monitoring and reporting of (CoCs) on SEA/SH and VAC as part of CESMP in line with Attachment 3B of the SIA-SMP to address the risks and impacts of substance abuse such as alcohol and amphetamine which is a contributing factor for SEA/SH and VAC. • The MPWT PMU will ensure that Social Security (health and life insurance) is provided to all workers according to the Labour Law before the commencement of project activity. • Developing, implementing, monitoring and reporting of a dedicated Worker Grievance Mechanism as part of LMP and SEP, for all groups of workers. • Updating, implementing, monitoring and reporting of SEP.	
Project related transportation and transportation of solid waste to the landfill	• CHS risks and road damages due to the increased heavy traffic, including garbage trucks and construction vehicles going back-and-forth to the landfill	• Rehabilitate/pave the access road to the landfill. This was requested by waste pickers and local communities. • Enforce speed limits.	VCOMS

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
	• Risk of accidents involving children and vendors working close to the access roads.		
Operation of borrow pits, sand and quarry sites	Impacts on the heritage assets or values including discovery of artifacts or relics during operation of borrow pits, sand and quarry sites.	• Apply Negative Criteria List (Annex 3B of the ESMF) • Conduct E&S screening and scoping for land acquisition and resettlement (Annex 4 of the ESMF). • Developing, implementing, monitoring and reporting of borrow pits, sand and quarry management plan as part of C-ESMP in line with the project ESMP and ESCOP (Annex 7B of the ESMF). • Developing, Implementing, monitoring and reporting of "chance finds procedure" as part of C-ESMP in line with ECOP (Annex 7B of the ESMF).	Implemented by contractor and monitored by PIU, CSC and MPWT PMU
Operation Phase			
Operation of new landfill cells and recycling facilities.	• A reduction in recyclables arriving at Km 32 due to unsorted waste being directed to the VWMC waste management facilities may	• Ensure a fair distribution of delivery of unsorted waste between the Km 32 landfill and the VWMC.	Implemented by VCOMS and monitored by

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
	reduce earnings of waste pickers at KM32 and other groups (informal recyclers or small-scale waste buyers) who rely on income from the waste stream at the landfill. • Risk that the villagers who depend on income from recycling at the landfill may disagree with the planned project activities as these may reduce the amount/quality of recyclables arriving at the landfill. • Risk of enhancing impoverishment and economic displacement of waste-pickers (seasonal and registered waste pickers) including vulnerable groups (currently one family working as waste pickers at the KM32 landfill). • Risk that waste-pickers do not receive a fair payment for the recyclables	• Provide opportunities to waste pickers to work at the new waste management facilities at km 32, and at km 16 and Naxaythong sites. • Offer waste pickers skills and vocational training on literacy, numeracy, entrepreneurship among others to improve their livelihoods and prevent job loss. • The MPWT PMU will ensure that Social Security (health and life insurance) is provided to all workers according to the Labour Law and the Law on Social Security before the commencement of project activities. • Peg unit rates paid to waste pickers for recyclables to current market prices with deduction of a reasonable margin to ensure profitability for the appointed on-site buyer. • Updating, implementing, monitoring and reporting of SEP.	MPWT PMU/DHUP
Operation of the landfill and recycling facilities	• Risk of disruption or restrictions on the waste pickers' waste recycling activities	• Establishing a supervised waste reception area where waste segregation can take place under safe conditions	Implemented by VCOMS and monitored by

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
	• OSH of waste pickers, collectors and VCOM staffs: (i) working conditions; (ii) provide and use of PPE; (iii) Spread of infectious diseases (COVID-19, HIV-AIDS); (iv) SEA/SH and VAC; and (v) Labour rights, child labour, gender and worker discrimination, and unfair wage or salary (especially for male and female workers and ethnic groups) • Risk of accidents involving children and vendors working close to the access roads. • CHS risks/impacts involving garbage trucks going back-and-forth to the landfill could lead to increased dust, noise, smells, water pollution, road safety issues and Covid 19 spread including sexual and others transmission sexual (HIV) and others transmission diseases; (iv) SEA/SH and VAC. • Community health and safety risks: Risk of uncontrolled site access leading to injury of people or loss of cattle.	• Developing, implementing, monitoring and reporting of LMP including OHSP as part of C-ESMP in line with Attachment 1, 2, 3B of the SIA-SMP to mitigate OHS issues and ensure that different project teams and workers will be provided with adequate resources, including personal protective equipment (PPE), accommodation, transport, first aid-kits available at working sites, and can be contacted/reached in case of emergency. • Strictly implement safe working practices for waste pickers and collectors (zoning, timing, incompatible activities, handling of various types of waste, use of PPE). • Provision of personal protective equipment (PPE) and training on health and safety. • Developing, implementing, monitoring and reporting of (CoCs) on SEA/SH and VAC (Attachment 3B of the SIA-SMP). • Developing, implementing, monitoring and reporting of a dedicated Worker Grievance	MPWT PMU/DHUP

Project Activity	Description of Risks/Impact	Proposed Mitigation Measures	Responsible Entities
		Mechanism as part of LMP and SEP, for all groups of workers. • Developing, implementing, monitoring and reporting of CHSP (Attachment 2 of the SIA-SMP) and the WB Environmental Health and Safety Guidelines (EHSG) and Good International Industrial Practices (GIIP). • Rehabilitate/pave the access road to the landfill. This was requested by waste pickers and local communities. Recommended to be included as a commitment in the ESCP.	
Changes or development of new policies such as increase in dumping fees at the KM32	• Risk of increase in illegal dumping, littering, and open burning exacerbating impacts on public health and the environment	• Careful assessment of impacts due to changes in fees or policies through stakeholder consultations • Monitoring and strict enforcement of regulation for waste collection companies • awareness raising on environmental impacts of waste dumping and burning • issue village-level regulations with penalties for illegal dumping.	Implemented by VCOMS and monitored by MPWT PMU/DHUP

8.2 CONTRACTOR'S ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

332. The contractor is required to prepare a Contractor's Environmental and Social Management Plan (CESMP) for review and approval by MPWT/PMU. The CESMP shall be prepared in accordance with the final approved ESIA/ESMP and any other requirements as may be stipulated in the bidding documents.

8.2.1 CESMP Subplans

333. It is recommended that the CESMP for the landfill construction works includes the following subplans; however, a final list of subplans should be specified in the final ESIA/ESMP:

- Materials, Spoil and Borrow Site Management
- Solid and liquid waste management
- Air emissions management and monitoring
- Noise and vibrations management and monitoring
- Hazardous materials management
- Erosion and sediment control
- Surface water and groundwater management and monitoring (incl. site surface water management and dewatering of pits and ponds)
- Waste relocation and disposition
- Emergency Preparedness and Response
- Traffic Management
- Labour Camp Management
- Community Health and Safety
- Occupational health and safety subplan.

8.2.2 Borrow Pit and Spoil Disposal Site Selection

8.2.3 The contractor shall include the site selection criteria stipulated in *Table 8-6* when proposing sites for borrow pits and spoil disposal.

TABLE 8-6: SITE SELECTION CRITERIA FOR BORROW PITS AND SPOIL DISPOSAL SITES

Site Selection Criteria	Proposed Site Conditions
Preferably on degraded or lower value land such as grasslands, land devoid of forest or with highly degraded forest cover, or land with poor soil quality	

Site Selection Criteria	Proposed Site Conditions
Not in ecological sensitive area (e.g. Protected Area or Key Biodiversity Area or on land that hosts Threatened (IUCN Red List) plant or animal species	
Not in wetlands, waterways or in riparian zones	
To the extent practicable, not in agricultural productive land	
Not in land with spiritual, cultural, historical or archaeological value	
On lower slope land, so that stable landforms can be created. If possible, land with a slope more than 10% shall generally not be used for spoil disposal, where possible	
Not on unstable slopes, where the added weight could trigger mass movement	
Not where groundwater emerges or a thick organic layer is present	
Above the 0.05 (5%) Annual Exceedance Probability flood line	
Backfilling of excavation voids (for spoil disposal)	

8.3 Management of Incoming Waste and Onsite Relocation of Waste in the Construction Phase

334. During the construction phase, incoming waste will have to be managed while construction activities are taking place including excavation and relocation of waste and regrouping and capping of legacy waste.

335. As described in ***Section 4.3***, the existing waste in Cell 10 and Cell 11 where the two new landfill cells will be constructed, will be excavated and deposited in Cell 5. Existing waste in Cell 5 will have to be excavated and temporarily deposited until it can be redeposited in the constructed Cell 5 together with the waste from Cell 10 and Cell 11.

336. To minimise the environmental, health and safety risks especially with respect to construction workers, landfill workers, waste pickers and local residents, the construction activities and the delivery and management of incoming waste will have to be very well coordinated and controlled.

337. To ensure a safe working environment for the waste pickers during the construction phase, it is recommended to establish the planned waste reception area as early as possible in the construction phase. All waste sorting should then only take place at the waste reception area.

338. In the interim period, until the waste reception is area is operational, waste will be deposited in designated temporary locations, where waste pickers will be permitted to segregate and collect recyclables under the following conditions:

- VCOMs will appoint a supervisor to control and manage the waste picking area.
- The supervisor will designate and mark out zones where waste pickers are permitted to collect recyclables.
- The supervisor will control and signal to the driver of truck or other heavy equipment that the workface is clear with no people in the work zone.
- The supervisor will ensure waste pickers keep a safe distance to trucks and other heavy equipment for example during unloading of waste and removal of waste after sorting.
- Waste pickers will receive training on health and safety procedures, appropriate PPE (including ~~hard~~ hats, reflective safety vests, cut resistant gloves and protective footwear, particle masks, and safety glasses) and access to first aid kits.
- Children shall not be permitted to enter the landfill site.

339. The duly registered waste pickers will be allowed to collect recyclables under strict safe working practices at the waste reception area. These practices are summarised below:

- VCOMS will train the informal recyclers in the health and safety procedures.
- A supervisor will be appointed to control and manage the activities at the waste reception area.
- The supervisor will control and instruct the waste pickers to keep a safe distance to trucks and other heavy equipment for example during unloading of waste and removal of waste after sorting.
- The supervisor will control and signal to the driver of trucks or other heavy equipment that the workface is clear with no people in the work zone.
- The supervisor will control and inform the informal recyclers when and where they are allowed to enter a zone for collection of recyclables. The supervisor shall clearly mark out such zones.
- VCOMS/the Contractor will provide the waste pickers with appropriate PPE including hard hats, reflective safety vests, cut resistant gloves and protective footwear, particle masks, safety glasses and earplugs or earmuffs if the noise level is suspected to exceed 85 dB(A).
- The current practice with children working as waste pickers will not be permitted.
- The Contractor will provide appropriately stocked first aid kits at the site.

340. The following management and mitigation measures should be implemented for disposal of incoming waste and excavation and relocation of waste within the landfill site:

- An area designated for disposal of incoming waste should be physically delineated and marked. Following segregation of recyclables at the waste reception area, the incoming waste should be deposited in the designated area, compacted into waste cells and covered with soil.
- Access to the waste dumps should be strictly controlled and only authorised personnel should be allowed entry. Temporary fences may have to be set up around specific work sites.
- Ponds and pits should be dewatered and any ponded water should be tested and then reused for dust suppression or treated, if necessary, before being discharged to the environment or reused.
- As early as practicable in the construction phase, the legacy waste should be bulldozed and regrouped into low waste cells, increasing compaction and waste density, and then capped in accordance with the preferred cap design.
- Narrow trenches may be excavated to determine the depth of the waste deposits.
- Ditches and bunds should be constructed to control leachate and manage surface runoff.
- Any leachate should be conveyed to a small pond/tank for temporary storage until the leachate treatment system is ready to receive leachate.
- The excavation and relocation of the waste (Cell 5, Cell 10 and Cell 11) should be carried out under constant supervision by trained foremen/supervisors. Only duly authorized personnel should be allowed access to the site where waste is being excavated and redeposited.
- The supervisors should visually inspect the work to identify and remove any hazardous waste. If hazardous waste is discovered, it should be temporarily stored in accordance with the relevant procedures outlined in ***Table 8-3***.
- The supervisors should monitor any signs of emerging fires and immediately alert a fire extinguishing team. The fire extinguishing team should be ready to move in immediately and should be equipped with water trucks and equipment to apply water on the fire. Stockpile with soil cover material and equipment to spread the soil on the fire should be available.
- The sites for waste excavation and re-disposal should be fenced off to prevent unauthorized access and to catch windblown litter. In addition, portable litter screens should be set-up downwind the workfaces and litter should be routinely collected and disposed of.

341. The legacy waste is not expected to contain any significant quantities of recyclables as such materials most likely have already been collected by the waste pickers.

342. After legacy waste from Cell 10 and Cell 11 has been disposed of in Cell 5, the former area of Cell 10 and Cell 11 should be prepared for the construction of the new cells. Voids should be backfilled with clean materials and the site should be shaped in accordance with the detailed engineering design.

8.4 MONITORING

343. The recommended environmental quality monitoring during pre-construction, construction and operation of the **Km 32 Landfill Project** is outlined in ***Table 8-7*** to ***Table 8-12***.

344. The MPWT/PMU is responsible for ensuring that the environmental quality monitoring programs are carried out and that the results are evaluated and that any necessary corrective or preventive actions are developed and implemented.

345. All environmental quality monitoring data should be entered into an electronic online GIS database in accordance with the formats and other technical specifications determined by MONRE.

346. The Ministry of Natural Resources and Environment (MONRE) is the lead ministry responsible for implementation of the Environmental Protection Law and its regulations and/or guidelines and thus the regulatory authority in terms of compliance with environmental requirements including ambient and emission standards. The Department of Environment (DOE) in MONRE is responsible for review of the Environment and Social Impact Assessment (ESIA) report and Environmental and Social Management and Monitoring Plan (ESMMP) including issuance of Environmental Compliance Certificate (ECC) while the Department of Natural Resources and Environment Inspection (DNEI) is responsible for compliance monitoring and inspection of implementation of the ESMMP.

347. Component 1 of PWMP will provide technical assistance and finance to MONRE to strengthen its capacity for monitoring and enforcing environmental regulations, which will also help MONRE to monitor and enforce VWMC's EMMP. The PWMP will develop standard procedures and systems for compliance monitoring and enforcement including penalty regulations; and provide resources for MONRE to undertake regular groundwater, surface water and air quality monitoring around the landfill. PWMP will also support an environmental and social coordination committee to manage environmental and social risks around the KM32Landfill and VWMC concession area.

348. During the pre-construction period, environmental quality monitoring and reporting should be assigned to the ESIA consultant as the results will be important for the impact assessment and for development of mitigation measures. The ESIA and the environmental quality monitoring should be carried out in parallel with the detailed engineering design; and the design engineers and the ESIA consultants should work closely together to ensure that the landfill design (in particular the leachate collection and treatment system, landfill cell liner and

landfill gas collection and treatment system) is adequate and sufficiently robust to mitigate the predicted impacts.

349. During the construction phase it is recommended that environmental quality monitoring and reporting is assigned to an environmental consulting firm and chemical laboratory with the necessary competence, equipment and facilities to carry out high quality sampling and testing in accordance with internationally recognized standards.

350. During the initial 2-3 years of the operational phase, it is recommended that environmental quality monitoring and reporting is assigned to an environmental consulting firm and chemical laboratory. The consulting firm should train the operator in simple testing using field equipment such as water testing for pH, EC, temp, and DO.

351. In addition, through the coordination mechanism to be established under PWMP, Component 1 (see ***Para 364***), the PMU will cooperate with VWMC to gain access to their environmental quality monitoring data.

TABLE 8-7 PRE-CONSTRUCTION PHASE ENVIRONMENTAL MONITORING

Environmental Indicators	Location	Method and Frequency	Budget for the Pre-Construction Phase (USD)
Air Quality: Total Suspended Particulate (TSP), Particulate Matter with a diameter of 10 micrometre or smaller (PM10), Particulate Matter with a diameter of 2.5 micrometre or smaller (PM2.5), Sulphur Dioxide (SO2), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Ozone (O3) and odour.	• One station at Km32 landfill • One station at waste picker's camp located southwest of the Km32 landfill • One station at Naphasouk Village • One station at the nearest farmhouses located on the north-west of the Km32 landfill • One station at Ban Don-lan village	Twice prior to or during the detailed design and ESIA preparation, 1 day (24-hr). The sampling period shall cover both dry season and rainy season.	6,300

Environmental Indicators	Location	Method and Frequency	Budget for the Pre-Construction Phase (USD)
	• One station at Ban Nakao Village • One station at residential area along the access road to Km32 landfill		
Ambient Noise: 1. LAeq(1-hour) 2. LAmax 3. LAeq(daytime) 4. LAeq(evening) 5. LAeq(night-time)	• One station at Km32 landfill (same as air quality monitoring station) • One station at waste picker's camp located southwest of the Km32 landfill (same as air quality monitoring station) • One station at residential area along the access road to Km32 landfill (same as air quality monitoring station)	Once prior to or during the detailed design and ESIA preparation, 72 consecutive hours covering workdays	2,430

Environmental Indicators	Location	Method and Frequency	Budget for the Pre-Construction Phase (USD)
Leachate ponds/Ponds in Km32 landfill: • Temp, pH, DO, BOD, COD, EC, TSS, NH3-N, Total nitrogen, Total Phosphorus, Oil and Grease, *E.coli* • major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc)	3 ponds on VCOMS site (No. 1, 3 and 5 on ***Figure 6-15***)	Four times prior to or during the detailed design and ESIA preparation. The sampling period shall cover both dry season and rainy season.	6,900
Ambient Surface Water Quality: • Temp, pH, DO, BOD, COD, EC, TSS, NH3-N, Total nitrogen, Total Phosphorus, Oil and Grease, *E.coli* • Visual observations: water colour, signs of algae growth • Fish kills	• Three stations in a stream draining the landfill site on the **northern boundary outside of Km32 landfill** include: - One station at Km32 landfill leachate discharge point No.1 in ***Figure 6-16 and 6-17;*** - One station in the stream at 500 m	Four times prior to or during the detailed design and ESIA preparation period (corresponding to the leachate sampling and cover both dry and rainy season). Probe for temp, pH, DO and EC. Other parameters by laboratory standard methods.	4,000

Environmental Indicators	Location	Method and Frequency	Budget for the Pre-Construction Phase (USD)
	further downstream; and - One station in the stream at the residential area further downstream (Location 1 in ***Figure 6-17).*** • Two stations at ponds located at southwest and south outside Km32 landfill (station SW02 and SW04 in ***Figure 6-18).***		
Groundwater: Standing water table (depth and elevation in m asl.) Temp, pH, TDS, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, monoaromatic hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead,	• Existing (4) groundwater wells on and next to the landfill site (GW01, GW02, GW03, GW04 in ***Figure 6-20)*** • One water supply well at each of the nearest residential area located southwest,	Four times prior to or during the detailed design and ESIA preparation period (corresponding to surface water sampling and cover both dry and rainy season).	25,600

Environmental Indicators	Location	Method and Frequency	Budget for the Pre-Construction Phase (USD)
manganese, mercury, nickel, zinc), *E.coli*	northeast, and west and east of Km32 landfill (4 stations) representing the same aquifer as under the landfill.		
Biological survey to determine the presence or absence of clean water/polluted water indicator organisms	Same as surface water monitoring stations	Field survey once during dry season and once during rainy season prior to or during a full ESIA study period.	
Soil and sediment samples: arsenic, cadmium, chromium, cobalt, copper, lead, mercury, nickel, zinc	15 samples from the Km 32 Landfill site and 10 samples from agricultural fields receiving drainage from the landfill	Once during dry season and once during rainy season prior to or during a full ESIA study period.	8,000
Agricultural crops, growth, yield,	Agricultural fields receiving drainage from the landfill	Field study by agricultural scientist, once during dry season and once during rainy season	
Technicians: Field work			6,000
Total Budget			**59,230**

TABLE 8-8 PRE-CONSTRUCTION PHASE SOCIAL MONITORING

Social Indicators	Location	Method and Frequency
Complaints or claims	Affected villages and workers' camps	Monthly review of Grievance records

Social Indicators	Location	Method and Frequency
Demography, welfare and socio-economic status of the waste pickers and waste collectors	Waste pickers and waste collectors	Baseline census and socioeconomic survey as part of the full ESIA studies
Record of consultation meetings and trainings with list of participants (with gender-segregated data)	Landfill (waste pickers) and local communities	Consultation and training reports Monthly

TABLE 8-9 CONSTRUCTION PHASE ENVIRONMENTAL MONITORING

Environmental Indicators	Location	Frequency	Budget for the 5-Year Construction Phase (USD)
Air Quality: Total Suspended Particulate (TSP), Particulate Matter with a diameter of 10 micrometre or smaller (PM10), Particulate Matter with a diameter of 2.5 micrometre or smaller (PM2.5), Sulphur Dioxide (SO2), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Ozone (O3), and odour.	• One station at Km32 landfill • One station at waste picker's camp located southwest of the Km32 landfill • One station at Naphasouk Village • One station at the nearest farmhouses located on the north-west of the Km32 landfill • One station at Ban Don-Ian village • One station at Ban Nakao Village	1 day (24-hr) per 3 months during period with earthworks/waste relocation (2 years) More often if standards are exceeded or complaints are filed, or site inspections indicate air pollution	25,200

Environmental Indicators	Location	Frequency	Budget for the 5-Year Construction Phase (USD)
	• One station at residential area along the access road to Km32 landfill		
Ambient Noise: 1. LAeq(1-hour), LAeq (24-hour) 2. LAmax 3. LAeq(daytime) 4. LAeq(evening) 5. LAeq(night-time)	• One station at Km32 landfill (same as air quality monitoring station) • One station at waste picker's camp located southwest of the Km32 landfill (same as air quality monitoring station) • One station at residential area along the access road to Km32 landfill (same as air quality monitoring station	1 day (24 hours) per 6 months during period with earthworks/waste relocation (2 years). More often if standards are exceeded, complaints are filed, or site inspections indicate high noise emissions	3,240
Leachate from legacy waste dumps and capped waste: • Temp, pH, DO, BOD, COD, EC, TSS, NH3-N, Total nitrogen, Total	Ponds or ditches on the landfill site that receive leachate from Cell 5 after relocation of waste (2 locations)	Every 6 months for 2 years. If no significant changes reduce to once per year	4,600

Environmental Indicators	Location	Frequency	Budget for the 5-Year Construction Phase (USD)
Phosphorus, Oil and Grease, *E.coli* • major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc)			
Ambient Surface Water Quality: • Temp, pH, DO, BOD, COD, EC, TSS, NH3-N, Total nitrogen, Total Phosphorus, Oil and Grease, *E.coli* • Visual observations: water colour, signs of algae growth • Fish kills	• Three stations in a stream draining the landfill site on the **northern boundary outside of Km32 landfill** include: - One station at Km32 landfill leachate discharge point No.1 in ***Figure 6-16 and 6-17;*** - One station in the stream at 500 m further downstream;	Every 3 months for 2 years. If no significant changes reduce to once per year More often if standards are exceeded, complaints are filed, or site inspections indicate water pollution Probe for temp, pH, DO and EC. Other parameters by laboratory standard methods	8,000

Environmental Indicators	Location	Frequency	Budget for the 5-Year Construction Phase (USD)
	and - One station in the stream at the residential area further downstream (Location 1 in ***Figure 6-17).*** • Two stations at ponds located at southwest and south outside Km32 landfill (station SW02 and SW04 in ***Figure 6-18).***		
Groundwater: Standing water table (depth and elevation in m asl.) Temp, pH, TDS, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, monoaromatic hydrocarbons, metals	• Existing (4) groundwater wells on and next to the landfill site (GW01, GW02, GW03, GW04 in ***Figure 6-20)*** • One water supply well at each of the nearest residential area located southwest, northeast, and west and east	Every 6 months for 2 years cover rainy season and dry season. Onsite monitoring with probe every 3 months for 2 years The first round of sampling not later than 6 months after start of construction. Probe for dissolved oxygen, temp, pH, and EC. Other parameters by laboratory standard methods	25,600

Environmental Indicators	Location	Frequency	Budget for the 5-Year Construction Phase (USD)
(aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), *E.coli*	of Km32 landfill (4 stations) representing the same aquifer as under the landfill.		
Biological survey to determine the presence or absence of clean water/polluted water indicator organisms	Same as surface water monitoring stations	Field survey twice	
Agricultural crops, growth, yield,	Agricultural fields receiving drainage from the landfill	Field study by agricultural scientist	
Technicians: Field work			10,200
Total			**76,840**

TABLE 8-10 CONSTRUCTION PHASE SOCIAL MONITORING

Social Indicators	Location	Method and Frequency
Number and type of complaints from workers and local authorities and surrounding communities associated with the construction works or worker camps	Work sites and Worker camps	Review of grievance records Minutes of site meetings Minutes of consultations with surrounding communities
Compliance of workers' welfare facilities with World Bank standards	Worker camps	Inspection prior to start of construction work and every 6 months thereafter
Number of workers or waste pickers (with gender, age and ethnic groups segregated	All construction contract	Review of the contractor's monthly progress reports

Social Indicators	Location	Method and Frequency
data) hired for construction activities at the worksite		Review of the contractor's employment register
Safe working conditions and use of PPE by Project workers	All construction sites	Daily site inspections
Construction workers' occupational accidents/diseases including near misses Fatalities, injured persons, type of injuries	All construction sites	Review of the contractor's monthly progress reports
Safe working conditions of waste pickers and use of PPE	Landfill site and waste pickers' camp	Daily site inspections
Waste pickers' occupational accidents/diseases including near misses, fatalities, injured persons, type of injuries	Landfill site and waste pickers' camp	Interviews with waste pickers every 6 month
Child labour	The landfill site	Daily inspection
Workplace discrimination, including unequal contract terms, salary and working conditions (especially for male and female workers and ethnic groups)	The landfill site	Review of grievance records Interview with workers and managers/supervisors
Social conflicts between construction labour and waste pickers	Worker camp and landfill	Daily site inspection Monthly interviews with workers and waste pickers
Encountering archaeological sites during earth works	Construction sites	Review of contractor's monthly progress reports, site meetings, and supervision reports
Unanticipated damages to assets of the surrounding communities	Surrounding communities	Daily site inspection Review of contractor's monthly progress reports, site meetings, and supervision reports Review of grievance records Interview with community leaders

Social Indicators	Location	Method and Frequency
Recommendations, concerns or other issues raised by members of the surrounding communities and waste pickers	Landfill (waste pickers) and surrounding communities	Minutes of consultation meetings Grievance records

TABLE 8-11 OPERATIONAL PHASE ENVIRONMENTAL MONITORING

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
Leachate quality: Inlet and outlet flow rates, Temp, pH, EC, BOD, COD, TSS, NH4-N, Total Nitrogen, Total Phosphorus, Oil and grease, Faecal coliform bacteria	Raw and treated leachate	Quarterly Probe for temp, pH, and EC. Other parameters by laboratory standard methods	1,400
Leachate quality: • Inlet and outlet flow rates, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, BOD5, COD, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), E.coli	Treated leachate	Twice per year Probe for temp, pH, and EC. Other parameters by laboratory standard methods	1,300
Ambient Surface Water Quality: • Temp, DO, pH, Colour, Odour, • TSS, major cations and anions (calcium,	• Three stations in a stream draining the landfill site on the **northern boundary outside of**	Every 6 month and in case of discharge of leachate or if complaints are filed Probe for temp, pH,	2,000

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
magnesium, potassium, sodium, chloride, fluoride and sulphate) • Total Organic Carbon, BOD5, COD • ammonia and nutrients (nitrate, nitrite, and phosphorus) • total petroleum hydrocarbons, • metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), • E.coli • Visual observations: water colour, signs of algae growth • Fish kills • Biological survey to determine the presence or absence of clean water/polluted water organisms	**Km32 landfill** include: - One station at Km32 landfill leachate discharge point No.1 in ***Figure 6-16 and 6-17;*** - One station in the stream at 500 m further downstream; and - One station in the stream at the residential area further downstream (Location 1 in ***Figure 6-17).*** • Two stations at ponds located at southwest and south outside Km32 landfill (station SW02 and SW04 in ***Figure 6-18).***	DO and EC. Other parameters by laboratory standard methods Biological survey annually	

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
Groundwater: Standing water table (depth and elevation in m asl.) Temp, pH, TDS, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, monoaromatic hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), *E.coli*	• Existing (4) groundwater wells on and next to the landfill site (GW01, GW02, GW03, GW04 in ***Figure 6-20)*** • One water supply well at each of the nearest residential area located southwest, northeast, and west and east of Km32 landfill (4 stations) representing the same aquifer as under the landfill.	Every 6 months covering rainy season and the dry season Probe for temp, pH, and EC. Other parameters by laboratory standard methods	12,800
Landfill gas	Methane in landfill gas vents and in any confined spaces at the site	Every 6 month	1,000
Odour	Site boundary (upwind and downwind)	Monthly or more often in case of complaints. Systematic use of the human nose	To be carried out by trained VCOMS and landfill staff
Air Quality: Total Suspended Particulate (TSP), Particulate Matter with a diameter of 10 micrometre	• One station at Km32 landfill • One station at waste picker's	1 day (24-hr) every quarter. More often if standards are exceeded or complaints are filed,	12,600

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
or smaller (PM10), Particulate Matter with a diameter of 2.5 micrometre or smaller (PM2.5), Sulphur Dioxide (SO2), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Ozone (O3), and odour.	camp located southwest of the Km32 landfill • One station at Naphasouk Village • One station at the nearest farmhouses located on the north-west of the Km32 landfill • One station at Ban Don-Ian village • One station at Ban Nakao Village • One station at residential area along the access road to Km32 landfill	or site inspections indicate air pollution	
Ambient Noise: 1. LAeq(1-hour), LAeq (24-hour) 2. LAmax 3. LAeq(daytime) 4. LAeq(evening) 5. LAeq(night-time)	• One station at Km32 landfill (same as air quality monitoring station) • One station at waste picker's camp located southwest of the Km32 landfill (same	1 day (24 hours) twice a year	1,620

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
	as air quality monitoring station) • One station at residential area along the access road to Km32 landfill (same as air quality monitoring station		
Inspection of the site and its facilities • Physical integrity and stability of waste piles, bunds, liners, leachate ponds, drainage canals, pipes, internal roads, fencing and gates • Signs of erosion • Unwanted accumulation of water in the cells • Leachate level in the cells • Accumulation of debris or sediments • Signs of spillage with hazardous substances • Signs of disturbance of vegetation or erosion • Regrowth of vegetation in rehabilitated areas	The Landfill Site, including buffer zone Access Road	Weekly visual inspection and after heavy rain event	To be carried out by trained VCOMS and landfill staff
Biological survey to determine the presence or absence of clean water/polluted water indicator organisms	In streams draining the landfill site, upstream and	Field survey annually	

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
	downstream the site (2 stations)		
Agricultural crops, growth, yield,	Agricultural fields receiving drainage from the landfill	Field study by agricultural scientist annually	
Technicians: Field work			6,000
Total			**36,020**

TABLE 8-12 OPERATIONAL PHASE SOCIAL MONITORING

Social Indicators	Location	Method and Frequency
Number and type of complaints from workers and local authorities and local residents associated with the operation of the landfill	Landfill site and surrounding communities	Review of grievance records Site inspections Minutes of site meetings Minutes of consultations with local communities
Number of workers or waste pickers (with gender, age and ethnic groups segregated data) hired for operations at the landfill and its facilities	Landfill site	Review of the operator's progress reports Review of the operator's employment register Annual survey
Safe working conditions and use of PPE by operator's staff and contractors	Landfill site	Regular site inspections
Operator workers' occupational accidents/diseases including near misses Fatalities, injured persons, type of injuries	Landfill site	Review of the operator's progress reports
Health and safety of waste pickers: Safe working conditions and use of PPE	Landfill site and waste pickers' camp	Regular site inspections

Social Indicators	Location	Method and Frequency
Waste pickers' occupational accidents/diseases including near misses, fatalities, injured persons, type of injuries	Landfill site and waste pickers' camp	Interviews with waste pickers every 6 month
Child labour	The landfill site	Daily inspection
Gender and worker discrimination, and unfair wage or salary (especially for male and female workers and ethnic groups	The landfill site	Review of grievance records Interview with workers and managers/supervisors
Social conflicts between the labour and waste pickers	Landfill site	Regular site inspection Interviews with workers and waste pickers
Unanticipated damages to assets of the surrounding communities	Surrounding communities	Review of operator's progress reports Review of grievance records Interview with community leaders
Recommendations, concerns or other issues raised by members of the surrounding communities and waste pickers	Landfill (waste pickers) and surrounding communities	Minutes of consultation meetings Review of grievance records
Cleanness of toilets and landfill facilities	The landfill site	Regular site inspections
SEA/SH and VAC and use of weapon/violence related to drug and alcohol consumption of the waste pickers	The landfill site	Review of grievance records Interview with community leaders Interview with waste pickers
Number of seasonal and permanent (registered/unregistered) waste pickers	The landfill site	Review of data recorded by VCOMS monthly Annual survey
Amounts, types and value of recyclables collected and sold by waste pickers	The landfill site	Review of data recorded by VCOMS monthly

Social Indicators	Location	Method and Frequency
		Spot checks
Demography, welfare and socioeconomic status of the waste pickers and waste collectors	The landfill site	Socio-economic survey every 2 years
Signs of littering or illegal dumping	Transportation routes	Site inspection Review of grievance records Interview with waste collection companies Interview with local authorities

TABLE 8-13 CLOSURE PHASE MONITORING

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
Leachate quality: Inlet and outlet flow rates, Temp, pH, EC, BOD, COD, TSS, NH4-N, Total Nitrogen, Total Phosphorus, Oil and grease, Faecal coliform bacteria	Raw and treated leachate	Annually Probe for temp, pH, and EC. Other parameters by laboratory standard methods	400
Groundwater: Parameters to be determined based on the results of the monitoring during operations, but may include: Standing water table (depth and elevation in m asl.) Temp, pH, TDS, TSS, chloride, sulphate), ammonia, total petroleum hydrocarbons, metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, zinc), *E.coli*	Minimum seven (4) monitoring wells on or next to the landfill site Upstream and downstream the landfill	Annually interchangeably between the rainy season and the dry season Probe for temp, pH, and EC. Other parameters by laboratory standard methods	3,200

Environmental Indicators	Location	Method and Frequency	Annual Budget (USD)
Landfill gas (to be determined based on landfill gas generation during the operational phase)	Methane in landfill gas vents and on the surface of the caps	Annually	500
• Inspection of the site • Physical integrity and stability of waste caps, leachate ponds, drainage canals, fencing and gates • Signs of erosion • Signs of seepage through caps • Unwanted ponding of water in the cell caps • Accumulation of debris or sediments • Signs of disturbance of vegetation or erosion • Regrowth of vegetation in rehabilitated areas • Signs of incompatible land use	The Landfill Site, including buffer zone	Quarterly inspection and after heavy rain event	To be carried out by trained VCOMS and landfill staff
Technicians: Field work			2,000
Total			**6.100**

8.5 CAPACITY DEVELOPMENT AND TRAINING

352. The implementation of the **Km 32 Landfill Project** will require substantial and continual training on environmental, social, health and safety matters throughout all phases of the project.

353. The training programme envisaged for the project is outlined in ***Table 8-14***.

TABLE 8-14 OUTLINE OF TRAINING PROGRAMMES ON ENVIRONMENTAL, SOCIAL AND HEALTH AND SAFETY MATTERS

Trainees	Training Topics	Trainers	Duration / Frequency
Officers in MPWT/PMU	• World Bank ESS	• Component 3 ESHS Consultants	• Annual workshop
Officers in Vientiane Capital DPWT and VCOMS	• World Bank ESS • ESHS requirements for the landfill project •	• Component 3 ESHS Consultants • Project Management Consultant	• 6-monthly practical and theoretical onsite training workshops
Landfill Construction Contractor (managers, engineers, supervisors)	• ESHS contractual obligations • CESMP and EMP implementation • Health and safety hazards • Code of conduct	• Project Management Consultant • Component 3 ESHS Consultants	• Prior to start of construction works • 6-monthly practical and theoretical onsite training workshops
Landfill Construction Contractor's workers	• Identification, prevention or minimization of health and safety hazards • Code of conduct	• Contractor's ESHS Officer / trained foremen	• Daily tool-box meetings for work teams
Landfill Operator (managers, engineers, supervisors)	• Implementation of the Operation and Maintenance Manual • ESHS contractual obligations • Health and safety hazards • Code of conduct	• Component 3 ESHS Consultants • Landfill operation specialist	• Prior to start of operations • 6-monthly practical and theoretical onsite training workshops

Trainees	Training Topics	Trainers	Duration / Frequency
Landfill Operator's workers	• Identification, prevention or minimization of health and safety hazards • Code of conduct	• Operator's ESHS Officer / trained foremen	• Daily tool-box meetings for work teams

8.6 IMPLEMENTATION ARRANGEMENTS

354. The proposed implementing arrangements for the **Km 32 Landfill Project** are outlined in ***Table 8-15***. The discussion on implementation arrangement will continue and final arrangement will be presented in the full ESIA.

355. Considering the technical challenges of operating a landfill facility in compliance with applicable E&S standards and considering the limited in-country experience in this field, it is strongly recommended to contract a landfill operator (perhaps through some kind of partnership arrangements with the MPWT) with a substantial record of experience with practical landfill operation and maintenance. If this is not possible, the project should engage an individual landfill operation and maintenance specialist to work alongside and assist the operator with practical and effective landfill operations over a period of initially one year followed by annual site visits.

TABLE 8-15 OVERVIEW OF PROPOSED ARRANGEMENTS FOR THE IMPLEMENTATION OF THE KM 32 LANDFILL PROJECT

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
MPWT/PMU	• Strategic guidance and overall supervision • Coordinate with other departments in MPWT and with other ministries • Managing legal/contractual issues • Financial management • Reporting to the National Steering Committee	• Selection of contractors and consultants • Preparation of bidding documents for the construction contract and Terms of References for the Construction Supervision Consultant (CSC) and the EISA Consultant • Review and approval of draft detailed design and draft ESIA Reports • Review and approval of bidding documents for the construction contract	• Overall supervision and oversight of the construction works and environmental and social requirements • Approval of bidding documents for the environmental monitoring consultant • Contract management (construction contracts and consultancy contracts) • Selection of environmental monitoring consultant • Technical support through the Public Transport Institute including regular monitoring of the construction works •	• Overall supervision and oversight of the landfill operations and closure and related environmental and social requirements • Provide capacity support and training •

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
Vientiane Capital DPWT	• Day-to-day management of the CSC and the EISA Consultant • Coordination with other authorities at Provincial and district level • Reporting to MPWT/PMU	• Technical input to bidding documents including detailed design	• Regular monthly monitoring of the construction works • Checking compliance and ensuring that preventive and corrective actions are implemented as needed	• Regular 6-monthly monitoring of landfill operations • Regular monitoring of closure measures • Checking compliance and ensuring that preventive and corrective actions are implemented as needed • Provide capacity support and training
VCOMS	•	• Technical support to preparation of bidding documents and terms of reference for consultants	• Day-to-day management of the contractor • Day-to-day environmental and social monitoring of construction works together with the CSC • Reporting to Vientiane Capital DPWT	• Contract management (Operator) • Day-to-day management of the operator • Day-to-day monitoring of the landfill operations and associated environment, social, health and safety matters • Regular inspection during the closure phase

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
				• Reporting to Vientiane Capital DPWT
Component 2 E&S team including one International E&S Consultant as E&S Team Leader (part-time) and one full time national environmental consultant (with qualifications/expertise in environmental management, ESHS in solid waste management) and one full-time national social consultant (with qualifications/expertise in social/resettlement, livelihood restoration, stakeholder engagement and GRM)	• Technical assistance and training on environmental, social, health and safety matters to the MPWT/PMU, Vientiane Capital DPWT and VCOMS	• Technical assistance to the preparation of bidding documents and Terms of References • Technical assistance on supervision of the EISA studies	• Regular (monthly) monitoring of compliance with environment, social, health and safety requirements • Regular training of Vientiane Capital DPWT, VCOMS and contractors' staff on environment, social, health and safety requirements	• Regular (monthly) monitoring of compliance with environment, social, health and safety requirements • Regular training of Vientiane Capital DPWT, VCOMS and the landfill operator' staff on environment, social, health and safety requirements

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
Construction Supervision Consultant (CSC) with at least one environmental specialist; one social and community specialist; and one OHS specialist	• Technical assistance to Vientiane Capital DPWT	• Preparation of detailed design • Technical preparation of bidding documents • Technical assistance to managing the bidding process and evaluation of bids	• Technical supervision of construction works • Checking compliance with engineering standards and contractual specifications • Daily monitoring of compliance with environmental, social and health and safety requirements • Undertake environmental quality monitoring • Reporting to MPWT/PMU and Vientiane Capital DPWT	• Checking compliance with engineering standards and contractual specifications during a one-year defects liability period
ESIA Consultant	• Ensure that the ESIA Report fulfils the requirements of applicable Lao Laws and regulations and the relevant World	• Undertake ESIA studies • Prepare ESIA Report and any revisions based on comments from MONRE, World Bank or MPWT/PMU		

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
	Bank Environmental and Social Standards	• Coordinate with the CSC on technical design issues • Facilitate consultations, technical workshops • Undertake environmental quality monitoring		
MONRE	MONRE/DOE is responsible for review and approval of the Environment and Social Impact Assessment (ESIA) report and Environmental and Social Management and Monitoring Plan (ESMMP) including issuance of Environmental Compliance Certificate (ECC) while Department of Pollution Control and Monitoring is responsible for compliance monitoring	- MONRE/DOE is responsible for review and approval of the Environment and Social Impact Assessment (ESIA) report and Environmental and Social Management and Monitoring Plan (ESMMP) including issuance of Environmental Compliance Certificate (ECC)	Department of Natural Resources and Environmental Inspection is responsible for compliance monitoring and inspection of implementation of the ESMMP and chair of the Environmental and Social Monitoring Coordination Committee (ESMCC) that coordinates the environmental and social risk monitoring of waste facilities located at KM32 (including the RDF concession).	Department of Natural Resources and Environmental Inspection is responsible for compliance monitoring and inspection of implementation of the ESMMP and chair of the Environmental and Social Monitoring Coordination Committee (ESMCC) that coordinates the environmental and social risk monitoring of waste facilities located at KM32 (including the RDF concession).

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
	and inspection of implementation of the ESMMP.			
Landfill Construction Contractor with At least 1 E&S Manager, 1 environmental specialist; 1 social/community specialist; and 1 OHS specialist	• Compliance with contractual obligations • Reporting to the CSC	• Preparation of CSEMP	• Implementation of construction works • Implementation of ESMP as applicable and the CESMP • Responsible for compliance with environment, social, health and safety requirements associated with the construction works • Day-to-day training of construction workers in environment, social, health and safety measures • Coordinate closely with Landfill operator during construction	-

	General	Pre-Construction Phase	Construction Phase	Operational Phase and Closure Phase
Landfill Operator	• Compliance with contractual obligations • Reporting to VCOMS		• Coordinate closely with Landfill contractor for safe operation	• Responsible for implementation of Operational Manual • Day-to-day training of the landfill operator's staff in environment, social, health and safety measures • Develop and implement a closure plan
Environmental Quality Monitoring Consultant				• Undertake environmental quality monitoring • Reporting to MPWT/PMU and Vientiane Capital DPWT

9 CONSULTATION AND STAKEHOLDER ENGAGEMENT

9.1 STAKEHOLDER ENGAGEMENT PLAN

356. Reference is here made to the standalone Stakeholder Engagement Plan that has been developed as part of the Environmental and Social Framework Instruments for the PWMP. The Stakeholder Engagement Plan presents in detail the objectives, engagement methods and programmes that the project intends to implement for the different project components and thus also with respect to the Km 32 Landfill Project under Subcomponent 2B.

9.2 CONSULTATIONS DURING PROJECT PREPARATION

357. Key Informant Interview was undertaken from 09 to 16 August 2022 with a total of 22 key representatives (9 women) from DOE, DINE, NRERI, PTI, DHUPD, VCOMS, Km32 landfill operator company, and Xaythani district hospital. The PONRE of VTE capital postponed its interview but provided written responses to the consultant team.

358. The Focused Group Discussions (FGD) were carried out on 11 August 2022 by the EPF consultants together with technical staffs from EPFO, NRERI and PTI in Ban Naphasouk village, the KM32 landfill and Nahai village (KM16 Transfer Station) with a total of 82 participants including 52 females. Most of them are Lao Tai with only 3 participants (waste pickers) are Khmu. The team was divided into two groups with group 1 for Naphasouk Village and waste pickers at KM32 Landfill; and group 2 for Nahai Village. The main objective of the FGD was to:

- Present the main objective of the PWMP and its brief project description.
- Seek their opinions on the project development and implementation.
- Collect their opinions on the potential positive and negative impacts of the PWMP as well as their suggestions and recommendations.

359. The results of the above consultations are provided in ***Section 6.3***.

360. A draft executive summary of the Pre-ESIA in both English and Lao language was disclosed on 29 November 2022 on the EPF website https://laoepf.org.la/en/esf-documents-for-ewmp-2/ and stakeholder consultations at national and Vientiane Capital levels were conducted on 20 December 2022 (morning session for national level participants and afternoon session for capital, district and village level participants).

361. A summary of the national stakeholder consultations is attached in ***Annex 2***. The stakeholders expressed their support to the project and key comments from the consultations included the following:

- Important to set clear division of responsibilities among government departments.

- Important to improve waste transportation to avoid spills of waste and leachate from the trucks.
- Recommend to pave the access road to the Km 32 landfill.
- Important that the project interventions stop future landfill fires, discharge of polluted wastewater, and emission of malodour.
- The leachate ponds in the landfill create bad smell.
- Wastewater discharge from the landfill has affected the rice production.
- There are a lot of flies in the villages compared to the time before the landfill.
- VCOMS/Small B are in progress to enhance the waste management services including development of application for online register, payment of waste collection fee through the bank transection system, developing a waste collection schedule covering 190 villages, and annual improvement of the access road to Km 32 landfill.

362. On 8 January 2024, the ESF consultants conducted additional consultations on the latest project design with VCOMs, VWMC and waste pickers with a total of 46 participants (27 female). The consultation results are summarized as follows:

- VCOMs and VWMC reported on the status of the updated VWMC concession agreement. VCOMs and VWMC confirmed that the updated CA excludes the right to use the existing waste and VWMC agreed to return 20ha back to VCOMs and location of 20ha identified and agreed with VWMC. After CA signed, land title of VWMC will be modified.
- VCOMs made several proposals for consideration by Project: (i) to move the planned leachate treatment facility and leachate regulating pond to the 20ha area so they can more space to develop cells in the future; (ii) life of new cells at least 10 years; (iii) new cell for healthcare waste autoclaved by the hospitals (at the 20ha area). This will need further discussion and investigation during the detailed design and full FS and ESIA study.
- Waste pickers strongly support the Project as they recognize the Project will provide them with safe working conditions including personal protective equipment, access to sanitation facilities and training on health and safety, as well as vocational skills and training opportunities.
- The volume of recyclable waste delivered to Km32 has recently reduced because all VCOMS/Small B trucks are delivering waste to the new VWMC RDF plant. Only private trucks are continuing to dump at the KM32 landfill. The private trucks have less recyclable waste as their workers sort and extract the recyclables before reaching the landfill. Waste pickers requested to allocate the VCOMS/Small B trucks to be dumped

at the VCOMS area at least 50:50. VCOMs responded to the waste picker that this issue will be addressed as per request by VCOMs.

- Waste picker requested VCOMS to select at least two buyers for used glass bottles as the new buyer offers a lower price than the old buyer and does not buy all glass. VCOMs responded that they will consider and get back to the waste pickers later.
- Waste pickers requested the project to improve community waste sorting facility and provide equipment such as compactor washing machine and a building with roof, fence and gate with a security guard for their motorbike (they said they are willing to pay a fee security). This request will be addressed under Component 2B.

9.3 Stakeholder Engagement during Project Implementation

363. Stakeholders will be kept informed as the project develops, including reporting on project environmental and social performance and implementation of the stakeholder engagement plan and grievance mechanism. The Project shall report quarterly to the public before and during construction when the public may experience more impacts and annually during operation where impacts will be much larger. Consultations on specific activities shall be undertaken. In addition to written reports submitted to relevant departments/offices, reporting shall be undertaken in the form of meetings/workshops at provincial, district and village levels, involving presentation and discussion. More details are provided in the SEP.

364. Component 1 under PWMP will establish a coordination mechanism among VCOMS, VWMC, MPWT, MONRE and PONRE. The mechanism will facilitate coordination on key issues that may arise related to compliance with regulatory requirements, occupational and community health and safety, waste pickers, and emergency response protocols. MONRE will be the lead and will organize regular meetings (quarterly).

10 REFERENCES

Key reference documents consulted for the preparation of the Pre-ESIA:

- A Roadmap for closing Waste Dumpsites, The World's most Polluted Places, ISWA, 2016
- 40 CFR Part 258 – Criteria for Municipal Solid Waste Landfills, Subpart D - Design Criteria, § 258.40 Design criteria https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-258
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste
- Decree on National Environmental Standards, No. 81/GOL, 21 February 2017: Article 8.1 Soil quality standards for residential areas and areas for agricultural production
- Environmental Guidelines, Solid waste landfills, Second edition, The Environment Protection Authority (EPA) and the State of New South W, 2016

- Guillaume Lacombe, Lisa-Maria Rebelo, Touleelor Sotoukee, Regional Mapping of Groundwater Resources in Data-Scarce Regions: The Case of Laos, Hydrology 5(2):1-24 March 2018
- Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986) Separation Distances between Industrial and Sensitive Land Uses No. 3, Western Australia Environmental Protection Authority, June 2005
- Guidelines for the Closure of Legacy Waste Sites, The Local Government Assocation of the Northern Territory, 2016
- World Bank Group Environmental, Health and Safety Guidelines, General Guidelines, Environmental Noise Management, 30 April 2007
- World Bank Group Environmental, Health and Safety Guidelines, Waste Management Facilities, 10 December 2007
- Integrated Solid Waste Management for Local Governments, a Practical Guide, Asian Development Bank, 2017
- Landfill Manuals, Landfill Monitoring, the Environmental Protection Agency, Ireland, 2003
- Landfill Manuals, Landfill Operational Practices, the Environmental Protection Agency, Ireland, 1997
- Landfill Operational Guidelines 2nd Edition, ISWA Working Group on Landfill, 2010
- Landfill Manuals, Landfill Restoration and Aftercare, the Environmental Protection Agency, Ireland, 1999
- Medical Waste Management, The International Committee of the Red Cross, November 2011
- Ministerial Decision on landfill management No. 521/MPWT, 23 February 2007.
- Pre-Feasibility Study on Solid and Plastic Waste Management System and Infrastructure in Lao PDR: Task 3, Review and Recommendation of conceptual design options of identified suitable investment for 3 short-listed provinces, Annex 02, Further consideration in Task 3, Chapter 2 “10-year rehabilitation of KM32 in Xaythany District
- Pre-Feasibility Study on Solid and Plastic Waste Management System and Infrastructure in Lao PDR: Task 5, EX Research Institute Ltd., CTI Engineering International Co. Ltd. and National University of Laos for the World Bank, June 2022
- T. Katsumia, C.H. Bensonb, G.J. Foosec, M. Kamond, Performance-based design of landfill liners, Engineering Geology 60 (2001) 139±148

- USEPA air quality standard https://www.epa.gov/criteria-air-pollutants/naaqs-table
- Vietnam, Circular No. 64/2015/TT-BTNMT Technical Standards on Soil, Industrial land use
- 2016. "World Bank Environmental and Social Framework." World Bank, Washington, DC
- WHO Air Quality Guidelines for Europe, 2000, https://www.euro.who.int/__data/assets/pdf_file/0020/123077/AQG2ndEd_6_7Lead.pdf
- Xiang, R., Xu, Y., Liu, YQ. et al. Isolation distance between municipal solid waste landfills and drinking water wells for bacteria attenuation and safe drinking. Sci Rep 9, 17881 (2019). https://doi.org/10.1038/s41598-019-54506-2 https://www.nature.com/articles/s41598-019-54506-2

Websites:

- https://www.thinkhazard.org/en/
- https://www.wri.org/applications/aqueduct/floods/
- https://weatherspark.com/y/114314/Average-Weather-in-Vientiane-Laos-Year-Round
- https://www.nature.com/articles/s41598-020-65359-5/tables/2
- https://climateknowledgeportal.worldbank.org/country/lao-pdr Accessed on 24-Sep-2022
- https://www.k4d.la/ Geographic Information for Development Planning of the Government of Lao PDR hosted by the Ministry of Agriculture and Forestry
- https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/tools/construction-noise-calculator/

ANNEX 1 PHOTO DOCUMENTATION





06 September 2022

Km32 Landfill Facilities (Established in 2009)
Eastern side of the VCOMS area comprises:
A. Access Gate
B. Office & parking area
C. Weighing bridge
D. Community recycling facilities
E. Infectious waste incineration
F. Waste C10 & C11





06 September 2022

North-West Perimeter of Km 32 Landfill

- Leachate discharge point at the north perimeter through a seasonal creek draining north-northwest and finally into Nam Ngum River 7 km from the landfill
- Vegetation buffer, but a broken fence found in many placed around the landfill.







06 September 2022

Site visit photo-Km 32 landfill





Waste incineration:

- Operation: 3 shift (small 3)
- Capacity: burn 200 kg of waste /h
- Petrol Consumption: 50 l/h
- Residual (ash) disposed in the waste cell



Waste picking operation at the existing waste cell 10



Mission on 08 July 2022

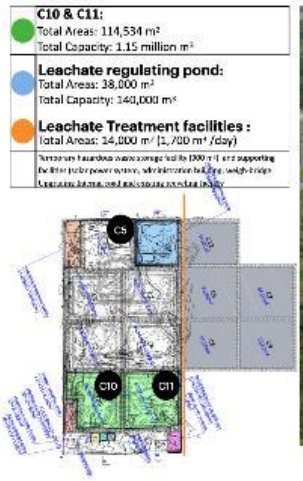
Site visit photos at the Km 32 landfill



Broken fence, herd of domestic animals at site 12 Jan 2022



Infectious waste disposed in the pond located on the northwestern conor of the Km32 landfill 06 Sept 2022





Km32 Landfill, Looking West 06 September 2022

Site Visit on 22 December 2022




















Soil cover operations


Large pond and hospital waste on the Khouanmouang Group Company site


Large pond and hospital waste on the Khouanmouang Group Company site

Large pond and hospital waste on the Khouanmouang Group Company site















ANNEX 2 NATIONAL STAKEHOLDER WORKSHOP

Commented [WU4]: I would suggest to remove individual name from this Consultation record.

National Stakeholder Workshop on the Dissemination of Environmental and Social Framework (ESF) Instruments of the Lao Pollution and Waste Management Project (PWMP)

The national stakeholder consultation workshop on ESF dissemination was held on December 20, 2022, in line with the World Bank's ESF and Environmental and Social Standards (ESS9: Stakeholder engagement). The Environmental Protection Fund (EPF) has prepared detailed meeting minutes and this document summarized comments, concerns, and recommendations of the participants provided during the workshop.

Meeting preparation

- The EPF and its ESF consultants have prepared a draft Environmental and Social Framework of the PWMP Project with technical support from the World Bank's Project Task Team.
- The public disclosure of a draft ESMF via the EPF's website was done on 29 November 2022 as the below link:

(https://laoepf.org.la/en/esf-documents-for-ewmp/)

Workshop implementation

A full-day stakeholder consultation was held on 20 December 2022, in Vientiane capital. The consultation was chaired by Mrs. Phakkhavanh Phissamay, Director General of the Department of Planning and Finance (DPF) with a total of 103 participants (39 females) of different interests and concerns in the PWMP project. The consultation was organized in two modes (face-to-face and remote formats). The morning session was conducted in Lao language for relevant government organizations from all levels (district and provincial offices, and ministries), community representatives, and village chiefs in the project area) and private sector (waste management operator, waste collection companies, national university, and private schools). The afternoon session with presentations in English for international organizations and social organizations (NGOs, CSOs, donors). A list of participants is attached.

The workshop aims to (i) disseminate the ESF instruments of the PWMP relevant to project design, and its potential E&S risks and impacts as well as the recommended mitigation measures, and (ii) receive comments and recommendations from participants that are to be considered in the final design of the project.

Discussion

All presentation materials were accessible to the participants in both Lao and English versions and the following key questions were discussed:

- What do you think about this project?
- What do you think are the positive/negative impacts on Environment and Socials
- What do you think about the ESMF tools? Are they sufficient and suitable for the mitigation and management of potential enviro/social risks and impacts?
- Any suggestions on ESMF tools?

All comments were related to component 2 on the investment in the waste management facility and Km32 landfill project, some are discussions on the current solid waste management operation practices including waste collection and transfer, infectious waste disposal and maintenance work by VCOMS, contracted operator, and waste collection companies. Wastewater discharge, emission, odor, and vectors were also raised by Napahasouk village chef.

Following the consultations, the participants were provided with a communication channel (phone call/WhatsApp/Email) to send their additional comments and recommendations directly to the ESF consultants by 23 December 2022.

Detailed comments and recommendations are shown in the below table:

No	Department/ Organization	Concerns and Recommendations
1.	Mr Siesamouth Sayalath – Nahai village chief (Km16)	**Discussed key concerns and recommendations on the operation of the Km16 waste transfer station:** • Waste spills and leachate leaking from the waste trucks along the road (a 100 m long road connecting the 450 highway and the access road to a waste transfer station); • Irregular waste collection from Nahai village resulted in waste being scavenged by domestic animals. • The waste collection fee is not collected regularly (the fee is collected about every three or four months). Villagers could not afford the accumulated waste collection fee. • Improve waste transportation to avoid waste and leachate spillage. If possible, paving the access road should be considered in this project. • Follow the weekly waste collection. • Collect the waste collection free every month to avoid any conflict relating to payment by the villagers
2.	Mr Phimpha Khamphengsay –	Supported this project intervention with the hope that the landfill fire and wastewater discharging problem will be resolved and

No	Department/ Organization	Concerns and Recommendations
	PONRE of Vientiane capital	raised outstanding landfill operation issues including landfill fire, bad smell, and wastewater from waste dumps that the PWMP needs to take into account: • Full ESIA needs to be carried out for the upgrading of the existing Km16 transfer station to any potential environmental and social impacts; • Improving associated landfill facilities should include the access road pavement work. The PONRE of Vientiane capital continues its environmental campaign and awareness program to support the SW management implementation.
	Mr Chanthanakhone Sayavong –National Committee for Mothers and Children	**Supports the EMWP objectives and aims and shared relevant committee's duty relevant to environmental management:** • The committee has been raising funds from international organizations in Laos for its Environmental management awareness program which is seen as the upstream solutions to the problem. • In general, the implementation of awareness program is discontinuous due to limited funds.
3.	Mr Bouaphan Sievongsay – Deputy head of PONRE of Vientiane province	**Discussed the legacy waste management issues of Vientiane province and provided recommendations for the PWMP:** • Vang Vieng is one of the waste generation hotspots and in general, waste collection service by the contracted companies is inadequate that leads to consequent problem such as waste scavenging and win blowing garbage; This project intervention should take into account the following issues: • The environmental assessment needs to incorporate the assessment of the qualification of the waste collection contractors; basic investment of waste management facilities should come from the contractors (i.e. standard and sufficient waste bins) for public areas; • Define clear roles between the PONRE staff and VOCOMS staff in resolving the public littering (who should take a lead)

No	Department/ Organization	Concerns and Recommendations
		• Investigation of landfill fire with clear conclusion of the root cause, then justify responsibility (if it is because of operation failure, then compensation process needs to be applied).
4.	Mr Koulaiphone Phonsavath – Naphasouk village chief	**Generally, agreed with the PWMP objectives and aims and requested the project to resolve current problems:** • The leachate ponds in the landfill created bad smell especially during the dry season from night-time until about 11 am of the next day. • Wastewater discharge from the landfill has affected the rice production (no yield). • It is noticeably a lot of flies in the village comparing to the time of no landfill. This resulted in difficulty for setting up the village ceremony and wedding party. • Concerns on skin diseases and reparatory problem because the villagers who expose to the waste do not know adequate health care practices during and after handling of waste. • The assess road to Km 32 landfill is very poor and needs improvement. • Used oil refinement factory created bad smell and the village authority already sent complaining letter to MONRE to check and resolve the problem (so far, a waiting for MONRE for field inspection).
5.	Mr Ounhieun Khammiuengmon– waste management operator (Small B)	**Discussed issues relevant to waste collection and transfer by the contracted waste collection companies:** • Clarified that scavenged waste in the community waste drop-off, in many cases, is caused by the mobile waste pickers. They open the waste bags for recyclables and left the bags opened. This attack fries and domestic animals. • The company is in progress to enhance the waste management services including (i) development of application for online register and (ii) payment of waste collection fee through the bank transection system (iii)

No	Department/ Organization	Concerns and Recommendations
		corporate with VCOMS in developing the waste collection calendar covering 190 villages. • Annual improvement of the access road to Km32 landfill will be carried this week.
6.	Mr Siengdala Douangmyxay– MPWT– DHUP	**Clarified the participants' concerns and discussed the next steps:** Comments for improvement of SW management operation: • The DHUP will carry out community consultation to further discuss issues and recommendations. • The improvement of access road for Km 16 and Km32 is included in the annual maintenance plan of DHUP. Comments for the PWMP: • The ESF instruments determine E&S impacts, risks and mitigation measures, we will work together to resolve the problems. • Proposed for the relevant environmental staff to take care of the issue relating community complain about black oil (used oil refinement factory).
7.	Ms Saysamone Phompakdy – Save the children	**Raised question on social impact assessment and feedback on current landfill operation:** • Is there a system to assess the risk related to sexual harassment in the villages surrounding the project areas? (see response in item 11 and 12); • Having followed the presentation and noted that wastewater and landfill operation practices are the challenging issue for the management. However, with hope that investment of proper technology under this project will help solve the problems.
8.	Mr Kingsada Siephanthong – JICA office	**Expressed concerns on the Km32 landfill operation and infectious waste disposal:** • It is very important that waste management practices at Km32 landfill are improved, it is suggested that the project focus on the capacity enhancement for VCOMS and cover other contracted operators (i.e.; setting up adequate policy and strategy);

No	Department/ Organization	Concerns and Recommendations
		• It is good that establishing of the new waste transferring station in Naxaythong district which will reduce the transportation cost and improve the waste sorting process in general; • JICA supported the incinerator for infectious waste management, but photos in the presentation showed inadequate disposal of the infectious waste. It is unclear if this occurred before or after the provision of incinerator.
9.	Ms Thidalath Vongsayalath – GGGI Lao PDR	• The related work that GGGI is carrying out is a waste to energy project. Our organization has engaged with the waste operator (Small B) and VWMC to use the waste at the Km 32 landfill for the waste to energy project. So far, we did not receive any response. (S*ee suggestion in item 13).*
10.	Diane Kim – KOICA	• Supported the project and express thanks for the invitation
11.	Mr Sengdala Douangmyxay – MPWT– DHUP	**Responded to the question by Save the Children regarding social monitoring and feedback by JICA office on the infectious waste disposal:** • Social problem relating sexual harassment should not be a serious issue for the project because we also have the related rules in place with close supervision. • We need to evaluate again the capacity of responsible staff on the issue of the operation of the infectious waste incarnation.
12.	Ms Khamsy Chansamay- ESF consultant	• The SIA-SMP identifies social risks and determine the measure related to sexual harassment and other potential social risks.
13.	Mr Peter Jensen - ESF consultant	• Recommended GGGI to further engage with the World Bank for support in coordinating with relevant agencies regarding the GGGI program on waste to energy.

ANNEX 3 RISK SCORING METHODOLOGY

To determine the significance of the risks/impacts (without mitigation), the level of severity or consequences of the identified risks and impacts have first been rated based on a simple scoring system, the significance has then been determined as the product of consequence and likelihood using a simple matrix.

For each of the criteria that indicate the severity or consequences of the individual risks / impacts (spatial extent, duration and magnitude), a score has been set to each level as shown in the table below:

Criteria	Level	Points
Spatial Extent	National	60
	Provincial	20
	Local	10
Duration	Long-term/Permanent	20
	Short-term	10
	Temporary	5
Magnitude/Intensity	High	60
	Medium	20
	Low	10

The total severity or consequence score of the above criteria is then calculated and categorized as either low, moderate or high based on the scoring intervals shown in the table below:

Severity or Consequence	Total Score
Low	25-40
Moderate	45-85
High	90-140

Finally, the significance of the risk or impact is then determined using the matrix below:

Severity-likelihood	Unlikely	Possible	Likely
Low	Low	Low	Moderate
Moderate	Low	Moderate	Substantial
High	Moderate	Substantial	High