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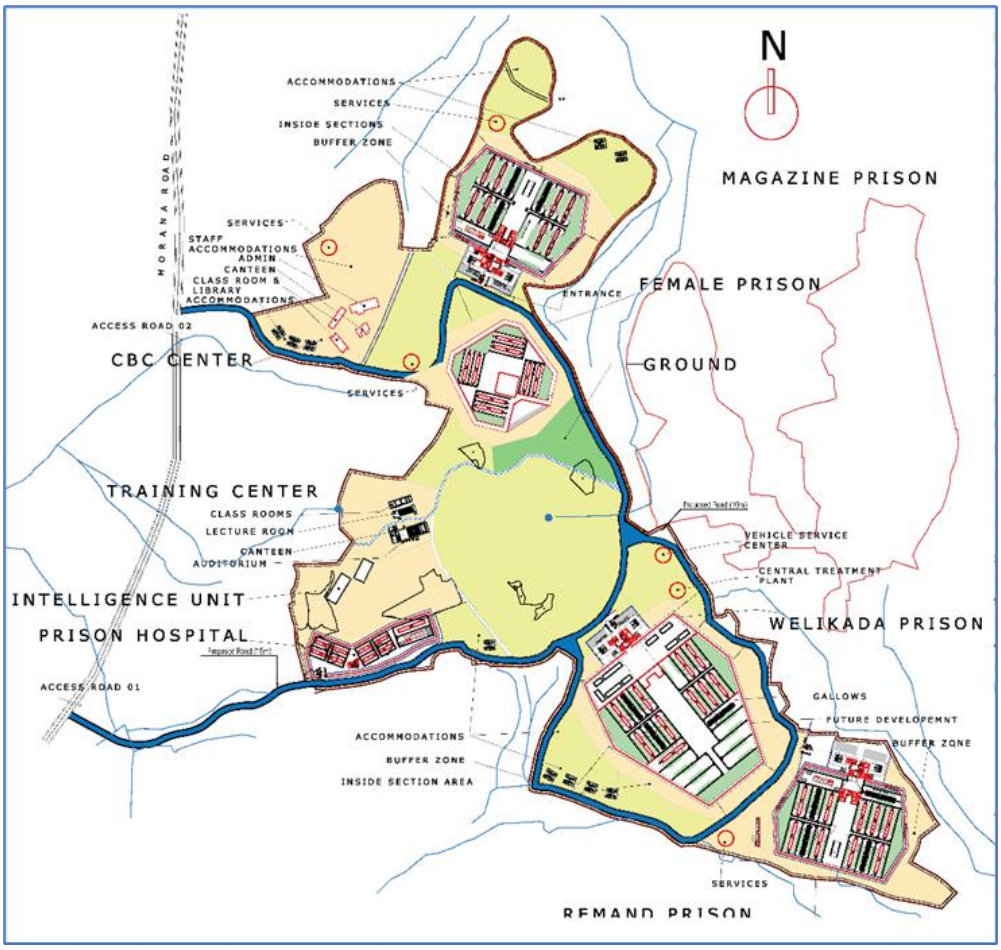
Urban Development Authority

Environmental Impact Assessment (EIA) Report
of Proposed
Prison Relocation Project at Millewa, Horana



Volume 1 – Main Report

Submitted to
Central Environmental Authority of Sri Lanka

EIA by
Consortium of Consultants for Sustainable Development (CCSD)

August 2021

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Environmental Impact Assessment (EIA) Report of Proposed Prison Relocation Project at Millewa, Horana

Submitted to:
Central Environmental Authority (CEA)
104, Denzil Kobbekaduwa Mawatha, Sri Jayawardenepura Kotte

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ABBREVIATIONS

A/L	Advance Level
ANSI	American National Standards Institute
AI	Artificial Intelligent
ASME	American Society of Mechanical Engineers
BLEVE	Boiling Liquid Expanding Vapour Explosion
BOD	Biochemical Oxygen Demand
BOI	Board of Investments
CAS	Chemical Abstracts Service
CBO	Community Base Organizations
CCSD	Consortium of Consultants for Sustainable Development
CD	Compact Disk
CD Waste	Construction and Demolition Waste
CEA	Central Environmental Authority
CEB	Ceylon Electricity Board
CFL	Compact Fluorescent Lamp
CHH	Considered Households
CIDA	Construction Industry Development Authority
CMC	Colombo Municipal Council
COD	Chemical Oxygen Demand
CWWTP	Common Wastewater Treatment Plant
DC	District Court
DS	Divisional Secretaries
DWLC	Department of Wildlife Conservations
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
EMoP	Environmental Monitoring Plan
EMP	Environment Management Plan
EMP	Environmental Management Plan
EPF	Employee Provident Found
EPL	Environmental Protection Licensing
EPZ	Export Processing Zone
ESH	Employee Health & Safety
ETF	Employee Trust Found
ETL	Electro Technology Laboratory
ETP	Effluent Treatment Plant
GCE O/L	General Certificate of Education - Ordinary Level
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GN	Grama Niladhari
GND	Grama Niladhari Division
GoSL	Government of Sri Lanka
ha	Hectares
HC	High Court
HH	Households

HMIS	Hazardous Materials Information System
ICTAD	Institute of Constructions Training and Development
ITI	Industrial Technology Institute
LPG	Liquid Petroleum Gas
m	Meters
MC	Magistrate Court
MOH	Ministry of Health
MOU	Memorandum of Understanding
MPC	Millawa Prison Complex
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
MSL	Mean Sea Level
NBRO	National Building Research Organization
NCC	National Colour Coding
NEA	National Environmental Act
NERD	National Engineering Research and Development Canter
NGO	Non-Government Organization
NIOSH	National Institute of Occupational Health & Safety
NWSDB	National Water Supply and Drainage Board
OHS	Occupational Health & Safety
OPD	Outdoor Patient Department
PAA	Project Approving Agencies
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
PS	Pradesheeya Saba
RCRA	Resource Conservation and Recovery Act
RoW	Right of Way
SDS	Safety Data Sheet
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
SLLRDC	Sri Lanka Land Reclamation and Development Corporation
SLS	Sri Lanka Standards Institute
SLMC	Sri Lanka Medical Council
SLLDC	Sri Lanka Land Development Corporation
SME	Small Medium Enterprises
SS	Safety Standards
STP	Sewage Treatment Plant
SWML	Scheduled Waste Management License
TEC	Technical Evaluation Committee
TOR	Terms of Reference
TSS	Total suspended Solids
TVOC	Total Volatile Organic Compounds
UC	Urban Council
UDA	Urban Development Authority
UN	United Nations
USEPA	United States Environmental Protection Agency

VOC	Volatile Organic Compounds
WGR	Waste Generation Rate
WHO	World Health Organization
WWTS	Wastewater Treatment System

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EXECUTIVE SUMMARY

The Welikada prison had been developed during the British Colonial period in 1841 based on "Colonial Standards" that prevailed at that time. Currently, it is overcrowded and non-inhabitable. The modern prison standards are developed to make conducive built and natural environments to give the convicted people a kind of psychological therapy in their social transformation. Hence the Government of Sri Lanka has decided to shift the entire Welikada Prison complex to a site at Millewa Horana. Thus, relocation of the Welikada prison has two objectives: (i) converting the presently underutilized prison premises to productive urban uses, and (ii) developing a new prison complex based on modern standards. The proposed site in Millewa for relocation of the prison has many advantages. Firstly, it is easily accessible due to the expressway network, and highways. Secondly, the topography, of the site and adjacent areas particularly paddy fields and marshes provide an attractive aesthetic environment to creating a habitable built environment, for a prison of modern standards.

The project site could be accessed through either Horana Galagedera Road through Nagas Handiya and then through MillewaWatta Road or Gurugoda Malagala Padukka Road and Millewa Watta Road. Approximately 250 Acres have been set apart for the proposed development as the Project Site.

Topography of the area is hill tops with low to moderately steep denudational slopes. Due to presence of shallow rock beds, with the geological structural features, typically can form scarp slopes having higher gradient slopes, but in this site area, that was not observed, except some escarpments in bed rocks. The site area consists of Granitic gneiss, Calc gneiss, Undifferentiated Charnockitic gneiss and Charnockite. All these rock beds extend from Southeast to Northwest with many geological structures. Structurally, the study area has a very complex geological setting. According to the agricultural classification of soil in regional scale, the site area having a Red, yellow podzolic soil with Laterite. These soils are in-situ formation from rock beds due to weathering. According to the regional scale this area is less susceptible for soil erosion due to the nature of soil type, slope gradient, land use and lack of thick overburden.

The project area lies in Kaluthara District Horana DS Division. Except for a negligible portion, the entire project land falls mainly within 628C Pahala Millewa Watta North GN division (GND).

Two site alternatives have been considered. One site is at SoranaWatta, Horana and the other site is at Kaluthara, Millaniya but these sites were not selected as there are many housing clusters around the considered sites and the site area are insufficient to house the Magazine Prison, Remand Prison, Female Prison and Welikada Prison and the Prison Hospital. The site selected close to Kaluthara Mileniya is far from Colombo to routinely produce inmates to courts.

Various building components of the prison along with all necessary facilities and amenities will be established within this premises. Some of the existing prison components will be re-established in the new project premises along with additional components. These components are: Prison Buildings (Magazine Prison, Female Prison, Welikada Prison, Remand Prison), Prison Hospital (Clinical waste management system, wastewater and solid waste management system), staff quarters (Single housing units, apartments), training center, intelligence unit, community-based correction center, wastewater treatment plants, treated wastewater conveying pipeline, vehicle service areas , parking areas, Landscaped areas, sentry points and fencing/ parapet for protection. Due to security reasons the project will not consist of any high-rise structures. It has

accommodated only single and two storied buildings. The height of the tallest structure is 8.5 meters from the existing ground level.

The principal land use is rubber even in the vicinity of project footprint. The vicinity studied by the sociologist is defined as 500m wide land belt around the proposed project footprint. The second significant area (22.5%) is used for paddy cultivation. Some patches of land have been used for residential activities

Within this project site there are two officer quarters, managers bungalow, a non-functioning factory building and six-line houses with occupants as estate workers. There are about 5 dug wells one tube well (non-functioning) and two water springs within the project site. One of these springs are perennial and across the other non-perineal spring water path a small pond has been constructed but at present there is no use of water from these springs.

Water supply to the project will be provided by NWSDB and the electricity will be provided by CEB. A wastewater plant is designed by NWSDB, and the treated effluents will be discharged to Mawak Oya which is a branch of Kalu Ganga which is at about 7 km from the project site along the existing roads. Biodegradable solid waste will be handed over to Horana Pradesheeys Sabha for composting as there will be an augmentation to the existing composting plant by the Western Province Solid Waste Management Authority. Non-biodegradable operational stage wastes will be given for recycling.

Water for concrete construction will not be needed as most of the concrete will be ready-mix concrete. For the site uses water will be obtained from NWSDB through a temporary connection.

According to the water quality reports, Phosphate, oil & grease and NH_3-N were undetected in all water bodies and BOD_5 levels were less than 4 mg/L which is the upper limit for Category C waters. Therefore, it could be concluded that the waterways in the Project Site and the immediate vicinity are relatively unpolluted considering the tested physicochemical parameters (except for one canal, which is moderately polluted), though faecal pollution was evident including the Mawak Oya. As treated wastewater will be released to Mawak Oya water quality of Mawak Oya were checked. pH of the Mawak Oya is slightly below the required pH ranges, NO_3-N levels were 10 mg/L. However, all other parameters are meeting with the ambient inland water quality standards considering Category A, B and C standards.

The measured ambient noise levels within the site were low and are in the range of 37-46 db. The measured vibration levels were also low and for Type 3 structures the maximum peak velocities were in the range of 0.09 mm/sec to 0.31 mm/sec

Traffic generation to the prison complex will be significant due to the visitors and staff arriving at the complex. In addition, the transport of prisoners to courts also generate traffic during specific periods.

Although the site area is mostly a flat terrain, there are some slopes, those may be vulnerable for slope failures or landslides according to the published hazard zonation map of Kaluthara district by National building Research Organization at a scale of 1:50,000. The site area lies to category named “landslides can be expected” and “modest level of landslide hazard” in that zonation map.

The land is a sloping land where there is an existing rubber plantation as a part of the larger Millewa Rubber Estate. The rubber trees must be uprooted, and the site should be prepared to get different elevations to suit the architectural and the engineering design. The tree uprooting will loosen the topsoil layers and depending on the site conditions, the weak topsoil layers will have to be removed. It is proposed to clear only 50% of the land and the rest of the rubber plantation will remain.

As for flora, a total of 227 plant species belonging to 65 families were recorded in the range of habitats within and around the project site. Among these were 27 endemic species and 74 exotic species. As for fauna, a total of 291 faunal species belonging to seven taxa (amphibians, reptiles, birds, mammals, butterflies and dragonflies and freshwater fish) have been recorded within the project site and its surrounding habitats. These include as many as 54 endemics and 17 exotic/migrant species. The area considered for prison-re-location could be considered as being moderately sensitive habitat. In semi-urban or urban landscapes. In this respect, the two locations that would be impacted by project activities –the Mawak Oya, located about 7 km away from the project site deemed to receive sewage and effluent emanating from the prison facility, and the two springs, associated pool, and abandoned rubber within the project site, could be considered sensitive.

About the Mawak Oya, the importance is particularly relevant to aquatic/semi-aquatic fauna – fish, amphibians, dragonflies, and other aquatic insect assemblages that will be adversely impacted. Overall, a total of 37 fish species would likely occur here. Fifteen species of fish, including the Sri Lanka Stone sucker and the Sri Lanka Black ruby barb, which are both endemic and threatened, were observed during the survey at the proposed outfall locations. Eight species of fish including the threatened and endemic Sri Lanka Cherry barb, were observed at the spring and associated pool. The streamlet near the entrance of the proposed land supports many fish species and is reported to have relatively clean water. The riparian vegetation in these aquatic/semi-aquatic habitats serve as a refuge for the dragonflies and hence, the Mawak Oya, the spring location and streamlets also supported a relatively large community of dragonflies. Collectively, around 20 species which included some threatened and endemic species were recorded during the rapid assessment survey. Apart from these species, there was evidence that many other terrestrial faunal species (e.g., fishing cat, otter) use these water sources. A total of 42 endemic species of fauna (3 amphibians, 2 reptiles, 12 birds, 2 mammals and 23 freshwater fish) as well as 35 nationally threatened species have been recorded in the project site and the surrounding areas as well as in the vicinity of the Mawak Oya. The threatened species included 5 Critically Endangered species, 17 Endangered species and 13 Vulnerable species. A further 27 species are Near Threatened.

There are not any historically, archeologically, culturally, or religiously significant places located within project footprint, except small cemetery. The workers residing in Millewa Watta are mostly Tamil and therefore, they have one Hindu Kovil established outside of the project footprint but within Millewa Watta. A temple also is located between boundary of Millewa Watta and B123, Horana -Galagederamain road. However, the SIA team observed some religious places located within 2 km radius from the boundary of project footprint

Detail survey was confined to households located in the project land. The number of households in project land is 6. The socio-economic and its sub-culture related context of the community studied in detail are like the rest of the households planned to be resettled by UDA from Millewe Watta. The SIA team provides basic information on 49 other households to be resettled. The information presented on 6 households is representative to the total households to be resettled.

All the community members in these households are workers of Watta as labourers and most of them are Tamils and mainly limited their social interactions to their relatives living in Watta. In this context, the information presented on 6 households is regarded as representative in this report.

Apart from paddy and mixed crops the communities outside the Millewa estate are also involved in tea and rubber plantation at small scale. Most of the land outside of the estate are freehold belongs to the farmers. The workers living and working in Millewa Watta for the last several decades have no ownership to any property. They are just living in line houses with unsatisfactory facilities.

The most significant construction impacts identified were site clearing and loss of vegetation, likely disturbance to the springs and the boundary streams, earth stability issues, soil erosion and deposition in streams, safety threats to surrounding housing clusters through conventional blasting, loss of floral and floral habitats, loss of employment and livelihood of estate workers. Loss of dwellings of six families in the line houses to be relocated, worker health and safety impairment, aesthetic degradation, lifestyle cultural pattern changes, landscape degradation, public health and safety impairment, public inconvenience caused by construction equipment, material transporting vehicles, noise and vibrations caused by construction equipment and blasting, disturbance to internal drainage paths, loss of paddy filled by the fillings for permanent access roads and traffic congestion in the main road due to material transportation equipment. There also could be hindrances to the traveling students of Millewa Maha Vidyalaya as the dedicated access road is crossed by the narrow access road to Millewa Maha Vidyalaya during the school time also there could be some temporary noise disturbance to it.

The most critical operational impacts are water quality degradation of Mawak Oya on effluent disposal and the resulting impacts on the downstream water users of Mawak Oya and the Kandana Water supply intake at Kalu Ganga, odor and other impacts from biodegradable solid waste disposal, health hazardous from clinical waste disposal, surface and groundwater pollution through vehicle servicing , social dissidence , flood aggravation caused by paddy field filling for access roads, impacts caused by the failure of the wastewater treatment plant, fire hazards, safety issues caused by inmates, traffic congestion in the Horana Galagedera Road by the incoming human (visitor) traffic and vehicular traffic etc. There also will be safety issues on the prison inmates. There also could be contingency impacts such as shock loads from the wastewater treatment plant, fire etc.

Standard mitigation measures have been proposed for the construction impacts. Non-conventional control type or chemical blasting will be considered under the GSMB guidelines. The two springs will be preserved, and the layout plans has been adjusted to avoid building construction on springs. It will be difficult to reverse the impact caused on land use and vegetation removal. However, these impacts will be mitigated through a contribution to a forest planting program and planting trees as far as possible within the prison complex maintaining green areas. The removed trees will be sold to the prospective buyers through a tendering process. There will be dust, noise, pedestrian and traffic impacts when laying pipeline. However, most of the roads except for 640 m of Gurugoda Malagala Road are rural Pradesheeya Sabha Roads. Impacts will be mitigated through standard Environmental Health and Safety Precautions such as traffic control, signage, water sprinkling and temporary followed by permanent road reinstatement.

To mitigate the wastewater impacts NWSDB has been entrusted to design and operate a wastewater treatment plant (Capacity 2000 m^3/day) which will include Anoxic/Anerobic/Oxic treatment, constructed wetland and a bioassay pond for water quality monitoring. The wastewater

will be treated to inland water standards and if a further requirement arises the treatment will be elevated to a higher level.

Water quality of Mawak Oya will be monitored periodically. The shock loads will be disposed to a stock tank. Standard fire protection equipment will be installed to fight fire. There will be a sophisticated security system for the safety of the inmates. It is also proposed to reuse about 20% of the treated wastewater for land irrigation during non-rainy dry periods.

The proposed prison hospital services and functions will be similar to that of the existing prison hospital but with more beds. It will consist of a lab, a dental unit, wards etc. All scheduled solid and liquid wastes generating from the hospital will be segregated and disposed. A detailed account on the waste types and disposal are presented from pages 1-9 to 1-14.

Number of housing structures located in the project footprint is 5. But 6 families are living because one housing structure is occupied by 2 families. We recommend resettle all 6 families in 6 new housing structures constructed in alternative land already planned for resettlement. These are the project affected households due to the implementation of the proposed project. Fifty-one 51 families are reported living within the land plot proposed for the resettlement site. These 51 families are living in low-income housing structures and therefore, the UDA has proposed to provide new houses for these 51 families also even though they are living outside of the project footprint, which is socially justifiable.

The UDA has planned to construct alternative houses in a land block identified from outside of proposed project footprint but still within Millawe Watta. The workers residing in line houses established in Millawe Watta will be offered these new houses. The productivity of the Millawe estate has gone down significantly and therefore, UDA has prepared Compulsory Resettlement Scheme (CRS) for the workers. Apart from providing alternative houses compensation for workers will be paid due to loss of their employments. UDA has identified portion of land within Millewa Watta to be used as resettlement site. Payment of a compensation package for each worker based on the age categories, period of employment etc.

Resettlement of 51 families also can be interpreted as an indirect positive impact of the proposed project and the decision to provide them with good houses similar to the families brought to the resettlement site from the project footprint can be also defined as strategic social mitigation suggested by the project developer.

An Environmental Management Plan (EMP) and an Environmental Monitoring Plan (EMoP) has been prepared and included into the EIA to manage and monitor the critical environmental impacts. The environmental monitoring and management will be carried out by the UDA in collaboration with the other line agencies such as CEA, NBRO, GSMB, DS, RDA and the Pradesheeya Sabha. The EMP and the EMoP will be made a part of the contract documents and the EMP will be further updated to suit the construction requirements.

There are few positive impacts of the project in the form of creation of additional employments and better facilities to the prison inmates. There also could be an increase of land value and some businesses in the area because of the new infrastructure and the influx of the outside crowd.

Accordingly, the project is recommended for execution on mitigating the environmental impacts subjected to the mitigation measures, EMP and the EMoP proposed in full.

Furthermore, a Resettlement Action Plan (RAP) needs to be prepared on this project. This is a legal requirement according to the National Involuntary Resettlement Policy (NIRP 2001) of the country. The RAP should be a comprehensive report since there are more than 20 households to be resettled. Separate funds should be allocated for the monitoring and environmental management items not included in the Engineering Cost.

Google Map of the Project Area, Important Entities and Project Components is presented in **Figure A**.

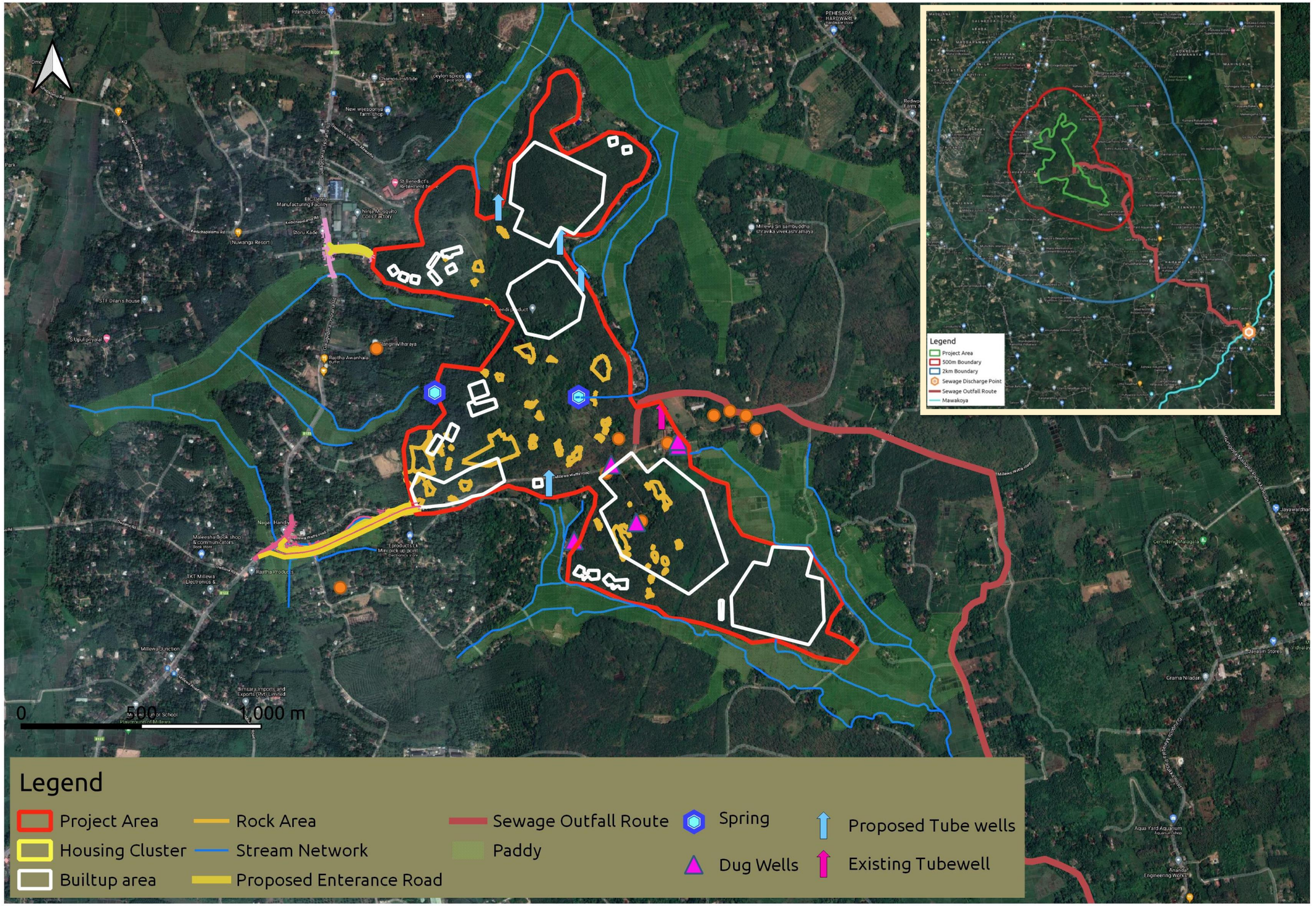


Figure A – Google Map of the Project Area, Important Entities and Project Components

SUMMARY FOR WASTEWATER AND SOLID WASTE MANAGEMENT DURING OPERATION

WW: WASTEWATER MANAGEMENT
WW1: PRISON (WITHOUT THE HOSPITAL and SERVICE AREA)

1. Waste sources: Administration units, training centres, kitchen, canteens/meal rooms, STP and toilets, etc.

2. Waste types: Solid and liquid waste (excluding wastewaters)

Non-Hazardous Wastes

Biodegradables: food wastes, garden wastes, screenings retrieved from the screening chambers of the sewage treatment plant (STP) and kitchen effluent pre-treatment and wasted sludge from the STP

Recyclables: paper, polythene, and glass

Hazardous Wastes

1. e-wastes
2. waste oil and other flammable liquid wastes
3. Janitorial chemical wastes/containers
4. Pesticide cans
5. VOC or flammable liquid rich aerosol cans / pressurized cans
6. Contaminated material (example, cloth contaminated with oil)
7. Empty
8. cylinders of flammable gases such as LPG

3. Wastewater types (Profile) - Greywater from canteens, toilets, and kitchens
Blackwater from toilets

4. Approximate quantities of solid waste

Expected quantities of non-hazardous wastes during fullest operation considering the hospital and service area too

Waste Type	Quantity (kg/day)
Biodegradable food wastes	3328.3 kg/day
Total Recyclables	2821.2kg/day
Paper	1072.1 Kg/day
Plastic and polythene	677.1 kg/day

Garden wastes will contribute to another 75% to the total non-hazardous waste stream

Expected quantities of hazardous wastes during fullest operation

Waste Type	Quantity (kg/day)
e-wastes	Quantities variable
waste oil & other flammable liquids	
Janitorial chemical wastes	
Pesticide cans	
VOC or flammable liquid rich aerosol cans / pressurized cans	
Contaminated material (example, cloth contaminated with oil)	
Empty cylinders of flammable gases	

5. Method of solid waste disposal

Non-hazardous wastes
Recyclables to Horana PS for subsequent recycling through handing over to CEA approved recycling parties contracted by the Horana PS.

Food wastes and other biodegradables to Horana PS for composting (except for wasted sludge from the STP which may be given to Insee Ecocycle for co-processing or Horana PS for incineration in their dual-chambered high-temperature incinerator, after sufficient drying only)

Hazardous Wastes
E-wastes and other hazardous wastes (except empty cylinders of gases) – CEA approved parties that will transport and correctly dispose hazardous wastes as per the National Environmental Act No. 47 of 1980 (as amended) and international conventions and protocols ratified by Sri Lanka.

Empty cylinders of gases – to be handed over to suppliers for re-filling.

6. Wastewater flow output rate- ~1800 m^3/day

7. Quality of the combined wastewater
BOD_5, COD, TSS, oil and grease and total coliform will be around 45-54 g/capita day, 1.6-1.9 g x BOD_5/ capita day, 70-145 g/capita per day, 10-30 g/per capita day and 10^9-10^{10} g per capita per day respectively without stormwater input. Input characteristics to the STP will be 240 BOD_5 mg/L, 600 COD mg/L, 500 TSS mg/L and < 10 oil and grease mg/L.

8. Method of domestic wastewater treatment – A_2O process with a tertiary treatment system.

The EIAR recommends to screen kitchen and canteen effluents and skim off oil prior to diversion to the CWWTP/STP.

9. Quality of the treated effluent and standard - Tolerance Limits for the Discharge of Industrial waste into Inland Surface Waters (National Environmental (Protection and Quality) Regulations, No. 1 of 2008 of the National Environmental Act No. 47 of 1980 and its amendments (Gazette No. 1534/18 – 01.02.2008. pH, BOD_5, COD, oil and grease, NH3-N and TSS levels are 6.0-8.5, < 30 mg/L, < 250 mg/L, < 10 mg/L, < 50 mg/L and < 50 mg/L, respectively.

9. Disposal method for the treated effluent - Direct discharge to Mawak Oya through a 6.8 km long pumping main.

10. Dilution conditions at Mawak Oya - 8 times dilution condition is satisfied even for the 25-year annual minimum flow

WW2- PRISON HOSPITAL
1. Hospital Components
   a. Wards
   b. Digital X-ray
   c. Hematological Lab with a Hematological Analyzer and a Biochemical Analyzer

d. Dental Unit
e. Dispensary
f. Oxygen cylinders area
g. Kitchen
h. Canteen

2. Wastewater Generating Hospital Components

a. Wards
b. Hematological Lab with a Hematological Analyzer and a Biochemical Analyzer
c. Dental Unit
d. Dispensary
e. Kitchen
f. Canteen

3. Possible Wastewater Profile / possible components of the wastewater stream

A: Domestic effluents

a. Domestic wastewater: blackwater and greywater from the toilets (wards and other components) with some laundry effluents mixed
b. Domestic wastewater from kitchen and meal room/ canteen

Domestic effluent quantity from the hospital during fullest occupancy 264 m^3/day. Computed domestic wastewater characteristics – combined stream without stormwater (for a total staff of 114 and 610 inmates hospitalized at 100% bed occupancy)

Parameter	Concentration
BOD_5at 20°C (mg/L)	222-267
COD (mg/L)	355-506
TSS (mg/L)	346-716
Oil and grease (mg/L)	49-148

Note that fresh sewage is alkaline (6.5- 8.5) but becomes acidic under septic conditions.

B: Biodegradable Liquid Wastes

a. Blood, serum, and urine samples disposed of by the laboratory
b. relatively mild liquid or semi-liquid pharmaceuticals, such as solutions containing vitamins, cough syrups, intravenous solutions (amino acids, lipids, glucose, etc.), eye drops

C: Chemical Liquid Wastes that will contribute to COD and heavy metals

c. Outdated, unused, contaminated, or excess liquid pharmaceuticals / medicinal solutions
d. Mouth washed water from the dental unit - amalgam mixed water
e. spent chemical wastes from the lab such as diluents and reagents used in testing and processing during biochemical and hematological analysis and disinfecting chemicals

4. Solid and liquid Waste profile (wastewaters excluded)

Non-Hazardous Wastes

- Biodegradables: food wastes, garden wastes, screenings retrieved from the screening chambers of the kitchen effluent pre-treatment
- Food wastes quantity from the hospital is 366 kg/day during 100% bed occupancy
- Recyclables: paper, polythene, and glass

Hazardous Wastes

- E-wastes

- janitorial chemicals
- pesticide cans
- Empty cylinders of flammable gases such as LPG
- Biomedical wastes
  - infectious wastes
  - waste sharps
  - pathological wastes (blood and serum)
  - heavy metal rich wastes
  - chemical wastes
  - pharmaceutical / medicinal wastes
  - pressurized containers of liquid O_2

Expected quantities of hazardous wastes during fullest operation

Waste Type	Quantity (kg/day)
Infectious wastes and sharps	5.73 kg/day
Other biomedical wastes	Quantities variable
e-wastes	
Janitorial chemical wastes	
Pesticide cans	
Empty cylinders of flammable gases such as LPG	

5. Proposed Wastewater Treatment Method

Only domestic wastewaters to be directly diverted to the CWWTP/STP. The EIAR recommends to screen kitchen and canteen effluents and skim off oil prior to diversion to the STP. In addition, only the following liquids are allowed for disposal to the sewer system / STP

- Blood and serum samples after pre-treatment as per SLMC recommendations
- Urine samples
- Solutions of reducing agents - Dilution (water) or appropriate reduction with care in accordance with the MSDS (updated ones every 3 years as per GHS criteria)
- Solutions of oxidizing agents - Dilution (water) or appropriate oxidation with care in accordance with the MSDS (updated ones every 3 years as per GHS criteria)

The following liquid, semi-liquid and solid residues are not disposed to the sewer system (except for mouth washings from the dental clinic)

- Chemical wastes
- Expired/outdated pharmaceuticals and medicinal items
- Heavy metal rich wastes such as ayurvedic solutions, drugs and dental amalgams (example, expired, sub-standard or contaminated amalgams)

6. Proposed solid and liquid waste disposal methods

Non-hazardous wastes

- Recyclables to Horana PS for subsequent recycling through handing over to CEA approved recycling parties contracted by the Horana PS.
- Food wastes and other biodegradables to Horana PS for composting

Hazardous Wastes

E-wastes and other hazardous wastes (except empty cylinders of gases) – CEA approved parties that will transport and correctly dispose hazardous wastes as per the National Environmental Act No. 47 of 1980 (as amended) and international conventions and protocols ratified by Sri Lanka. Empty cylinders of flammable gases and liquid O_2 – handing over to suppliers for re-filling

Biomedical wastes

Blood and serum, dental mouthwash - Pretreatment and feeding to common WWTP.
Pharmaceutical liquid for incineration (Sicily Encare or Insee Ecocycle)

The waste management plan for the hospital will be further improved during the EPL issuing process.

WW3: SERVICE AREA

1. Waste Types (Hazardous component)

- Oil and grease mixed water
- Service station ETP sludge
- Cans of ETP chemicals and other chemicals such as glues and paints
- e-wastes
- waste oil and other flammable liquid wastes
- Janitorial chemical wastes
- Corrosives
- Pesticide cans
- cylinders of liquid O_2
- VOC or flammable liquid rich aerosol cans / pressurized cans
- Oil or chemical contaminated material (example, cloth contaminated with oil)
- Empty cylinders of flammable gases
- Empty

Expected quantities of hazardous wastes during fullest operation

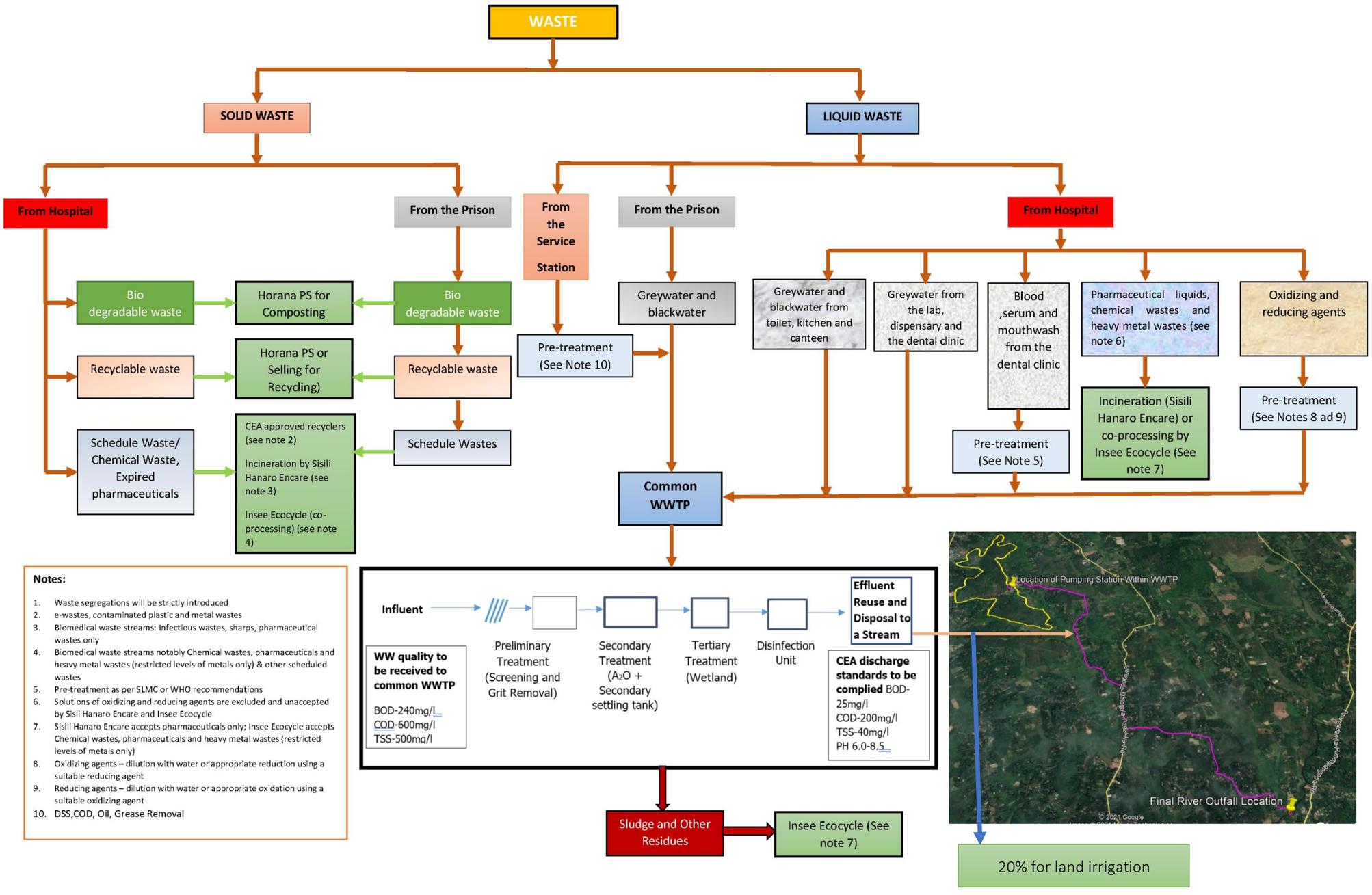
Waste Type	Quantity (kg/day)
▪ e-wastes ▪ Janitorial chemical wastes ▪ Corrosives ▪ Pesticide cans ▪ Oil or chemical contaminated material (example, cloth contaminated with oil) ▪ VOC or flammable liquid rich aerosol cans / pressurized cans ▪ Empty cylinders of flammable gases ▪ Empty cylinders of liquid O_2	Quantities variable
Service station ETP sludge	To be determined after further study (evaluation of raw effluent composite samples, jar test works)
Waste oil and other flammable liquid wastes	Variable 420 L per month with buses contributing to 79% of the waste oil – vehicle servicing yard

2. Treatment Method

The EIAR recommends pre-treatment of service station effluents through oil and grease removal and physico-chemical treatment such that quality of treated effluent (before diversion to the STP) to meet with the Tolerance Limits for the Discharge of Industrial waste into Inland Surface Waters

E-wastes and other hazardous wastes (except empty cylinders of gases) – CEA approved parties that will transport and correctly dispose hazardous wastes as per the National Environmental Act No. 47 of 1980 (as amended) and international conventions and protocols ratified by Sri Lanka.
Empty cylinders of flammable gases (acetylene) and liquid O_2 to the suppliers for re-filling.

PROCESS DIAGRAM FOR TOTAL WASTE MANAGEMENT



Notes:

1. Waste segregations will be strictly introduced
2. e-wastes, contaminated plastic and metal wastes
3. Biomedical waste streams: Infectious wastes, sharps, pharmaceutical wastes only
4. Biomedical waste streams notably Chemical wastes, pharmaceuticals and heavy metal wastes (restricted levels of metals only) & other scheduled wastes
5. Pre-treatment as per SLMC or WHO recommendations
6. Solutions of oxidizing and reducing agents are excluded and unaccepted by Sisili Hanaro Encare and Insee Ecocycle
7. Sisili Hanaro Encare accepts pharmaceuticals only; Insee Ecocycle accepts Chemical wastes, pharmaceuticals and heavy metal wastes (restricted levels of metals only)
8. Oxidizing agents – dilution with water or appropriate reduction using a suitable reducing agent
9. Reducing agents – dilution with water or appropriate oxidation using a suitable oxidizing agent
10. DSS,COD, Oil, Grease Removal

Figure B- Process Diagram for Waste

1 CHAPTER 1: INTRODUCTION

1.1 Background of the proposed project

Colombo city, being the primate city of Sri Lanka, experiences a high rate of urban growth. However, most parts of the City of Colombo are subjected to floods due to the low-level nature of such areas. Further, the inadequacy of highland is a key issue of development that the City of Colombo faces. One of the effective development instruments that the Urban Development Authority has been practicing in overcoming the land issue, and urban financing issue is "Urban Regeneration". Welikada Prison Site has been zoned for such an urban regeneration project in UDA plans. Due to the location of the Welikada Prison at a high elevation, its' large extent, and strategic location on Baseline Road near Borella Junction makes it an ideal site for a comprehensive urban regeneration project.

1.2 Objectives and justification of the proposed project

1.2.1 Project Objectives

The Welikada prison had been developed during the British Colonial period in 1841 based on "Colonial Standards" that prevailed at that time. Currently, it is overcrowded and non-inhabitable. The modern prison standards are developed to make conducive built and natural environments to give the convicted people a kind of psychological therapy in their social transformation.

1.2.2 Project Justification

1.2.2.1 General

Thus, relocation of the Welikada prison has two objectives: (i) converting the presently underutilized prison premises to productive urban uses, and (ii) developing a new prison complex based on modern standards.

The proposed site in Millewa for relocation of the prison has many advantages. Firstly, it is easily accessible due to the expressway network, and highways. Secondly, the topography, of the site and adjacent areas particularly paddy fields and marshes provide an attractive aesthetic environment to creating a habitable built environment, for a prison of modern standards. Thirdly, Horana has become an industrial area due to the BOI industrial estate and continuous public and private investments in new industrial developments. Thus, Horana provides a conducive environment for training the inmates in industrial employment.

1.2.2.2 Justification of the proposed project from the perspectives of Local stakeholders

The proposed project has been justified by the UDA as the project developer and the Prison Department as principal project beneficiary. The sociologist attempted at documenting the views of the local level stakeholders including public agencies, community leaders of the justification of the project from their perspectives. This information is useful for project developer and operator to address any concerns of these stakeholders who are going to be neighbours of the project operation in the long run. The views expressed by them are summarized below:

Table 1.1 - Stakeholder Views on the Project

Local stakeholder	Views on Justification on the Project
Horana DS	I have some conceptual understanding of the UDA's proposal to shift Welikada prison from Borella to Horana. The land to be used for the proposed project is in Horana DSD. The community members living within this Division will come to me through respective GNs or even directly if they are faced with any problem due to the interventions under the project. Therefore, my involvement throughout the project construction and even after construction will be critically significant. In this context, I as a public servant need to aware of the significant activities of the project during construction and operation phases. I have full confidence on the participatory approach of the UDA as project developer in consultation of relevant stakeholders and getting them involved in every significant project activity especially with regard to community and their resources.
GNs relevant	The GN also holds the view that they are prepared to provide any support to the public sector implemented projects but, he suggests that he should be provided with project relevant information and create opportunity for him and other officials to get involved in the project related planning and implementation activities
Other community leaders	The community leaders did not express direct objections to the project but, they are of the view that this rubber land can be used for enhancing its performance or it can be used for other light industries that will generate significant number of employments to the local community

Source: SIA team of the EIA

1.3 Objectives of the EIA study

1.3.1 Main Objectives

The main objectives of the EIA study are as follows.

1. **Prepare an EIA report, which should properly address all the requirements specified in the TOR issued by the Project Approving Agency (PAA) – the Central Environmental Authority**, which should be substantial and adequate to qualify for the environmental approval from the CEA. Meticulous attention will be paid to all items of the ToR.
2. **Assimilate baseline data and information relating to physical physiochemical ecological and social environments** in and around the project site. All technically related baseline information will be obtained from the UDA feasibility reports, resource profiles available with the Divisional Secretary, and the details available in other research publications and reports if available.
3. **Liaising with the line agencies**, Divisional Secretary, Grama Niladari, the Central Environmental Authority (the Project Approving Agency) local communities and households in and around the project site, to deepen the understandings of the project and its surroundings.
4. **Assess the potential impacts** that might be generated during the construction as well as operational phases of the project. The most critical impacts such as the social impacts, destruction of flora and fauna, waste-related impacts, domestic black and greywater management, solid waste management and disposal, will be prioritized.
5. **Formulation of Mitigation Measures-** For the identified impacts mitigation measures should be formulated. Some mitigation measures are taken in advance through the design

itself e.g., avoidance of wastewater impacts by the design of the wastewater treatment plant.

6. **Social Consultation and Participation** – All related project stakeholders such as, villagers who live close to the project were formally consulted using various social consultative methods, such as focus group discussions, key informant interviews, meetings, etc. The general project activities (construction and operation) which are expected to take place, were disclosed to them during this consultative process.
7. **Formulate necessary mitigation measures against the potential adverse impacts** to minimize the possible negative impacts due to project implementation based on the study outcomes.
8. **Prepare environmental management and monitoring plans** (EMP and EMoP) so that the UDA can proactively take necessary action before the impacts become irreversible during the project execution and ensure the prevention of environmentally negative effects.

1.3.2 Objectives of the Social Impact Assessment

1.3.2.1 Objectives

The social impact study focused on analyses of the potential impact, positive and negative due to implementation of proposed project to relocate Welikada Prison in Millewe, Horana. The SIA also suggested measures to mitigate negative impacts and enhance positive impacts. Further the study proposed mechanism for monitoring the social impact mitigatory process during construction and operation phases of the project.

1.3.2.2 Methods of data collection

The study covered the total land area falling within the project footprint and its adjacent land belt (500m) and the land area up to 2 km radius from the boundary of the project site. Profile including all the features related to land use and socio-economic conditions was prepared for the land block demarcated for the project. Primary data also from project impacted area (500m) was collected to document the socio-economic profile on the project impacted area. The 2km radius from the project footprint is defined as project's macro-environment and secondary data was collected from this geographical unit for the study. The table below summarizes the criteria and indicators used for the field study under the SIA of the study.

Table 1.2 - Data Collection Methods

Criteria	Indicators	Data	Methods
Demography	Population within proposed project land	Number of persons available in the project site	Interview with all the persons presently available through household questionnaire,
	Population in the vicinity of the project land (500m radius)	Number of families living in the vicinity of the project land (500m radius from the boundary of project site)	Secondary and primary sources
	Population in project relevant Grama	Population and families	GN office

Criteria	Indicators	Data	Methods
	Niladhari division/s and its different villages (project influence area -2Km radius		
	Population in project relevant DS office as larger area of the project corridor	Population and families	DS office
Social differences of the population	Percentage of ethnic, religious, gender, family size etc.- all Geographical units studied	Families under each category	Data from DS and GN offices and household surveys
Land use	Extent under each category of land use in project land, its immediate vicinity and GN area	Land use categories and extent	Observations, and secondary sources
Livelihood	Number of livelihood activities performed in project land, its immediate vicinity and its GN and DS area	Families and percentage under each livelihood category	Interview, Questionnaire survey and secondary sources
Archaeological, historical, cultural and religious places	Number and name of places	List of places located in the site and its immediate vicinity with distance to each place from the boundary of land (places marked on the map)	Observations
Other Sensitive institutions	Schools, hospitals, Community institutions etc.	List of such institutions Marked on the Map	Observations
Infrastructure facilities	Roads, power, communication, water etc.	Prepare Map indicating the available infrastructure within and outside of the project land	Observations
Views of stakeholders	Views of users of project land, people living in the immediate vicinity of the project land and other stakeholders relevant to the project area	Views of each category of stakeholders	In person interviews and group discussions and also from Questionnaire survey

The data related to Households, livelihood activities and their related infrastructure, land and whatever other properties affected due to intended use of the land for the proposed project was extracted from the data collected through the methods mentioned in above table. This data was used to address the ToR items mentioned under resettlement issues. The project developer has already identified a land to resettle the project affected people the consultant carried out a reconnaissance survey in the area demarcated for alternative housing. This study is to analyze the socioeconomic characteristics of the host communities in the new settlement for the proposed project affected communities.

1.4 Applicable laws, regulations standards, and requirements covering the proposed project.

The following laws and regulations are applicable.

1.4.1 National Environmental Act, No. 47 of 1980 and attendant regulations

The proposed project is a Prescribed Project since it involves land clearing s exceeding an area of 10 hectares" (in this case 250 acres or 101 ha) and the project. Hence it requires an EIA study to receive the Environmental Approval from the CEA as the PAA.

Furthermore, according to the National Environmental (Protection and Quality) Regulations, No. 1 of 2008 under Section 32 of the National Environmental Act, No. 47 of 1980, published by Extraordinary Gazette No. 1534/18 dated 01st February 2008, to operate this prison (especially the prison hospital and the wastewater treatment plants requires obtaining Environmental Protection License (EPL) and Scheduled Waste Management License (SWML).

- National Environmental (Noise Control) Regulations No. 1 of 1996 published by Gazette notification No. 924/12 dated 21st May 1996.
- Interim vibration control standards published by Pollution Control Division of the CEA on 04th December 2008 under the provisions of NEA

1.4.2 Pradesheeya Sabha Act No 15 of 1987

The project area is under the jurisdiction of the Horana Pradesheeya Sabha. Hence this applicable in terms of drainage, waste disposal (especially solid waste) etc.

1. Ceylon Electricity Board Act No. 17 of 1969 and subsequent amendments

The project requires three-phase electricity for its operation. In this regard, consent from the CEB (established under the Ceylon Electricity Board Act No. 17 of 1969) needs to be obtained. The power required to be supplied by the CEB.

2. National Water Supply and Drainage Board Law, No. 2 of 1974 and subsequent amendments

Since the water supply to the project will be obtained by the National Water Supply and Drainage Board (NWSDB) the act cited above is applicable.

3. Flora and Fauna Protection Ordinance No. 44 of 1964 and subsequent amendments

The project area is a rubber estate with birds, animals, etc. Since this rubber estate must be half cleared for the proposed project, approval from the Department of Wildlife Conservation is necessary under the Flora and Fauna Protection Ordinance No. 44 of 1964 and subsequent amendments.

4. Felling of Trees (Control) Act 9 of 1951 and subsequent amendments

Since the proposed prison development involves large number of rubber tree felling this act is applicable.

5. Road Development Authority Act No. 73 of 1981

The proposed prison premises during construction and operation will be mainly accessed through Horana -Galagedera Road which is an A Class Road operated and maintained under the Road Development Authority.

6. Sri Lanka Land Reclamation and Development Corporation Act No. 15 of 1968 and subsequent amendments

There will be a new access road to the proposed prison complex. This access road will have to be built across a paddy area and reclamation of a low-lying land will be entailed. Hence the SLLRDC Act is applicable.

1.5 Extent and the scope of the study.

The extent of the study is determined by the Project Site and its influential areas based on various environmental domains i.e., the physical, physiochemical, ecological, and social environments. The Project Area is the project site of which the outline has been provided by the UDA. To decide the Project influential Area the following criteria were used.

1. A 500 m boundary from the site boundary for noise and vibration and immediate social environment and ecological environment. - Boundary1
2. A 1 km boundary for air quality studies. - Boundary 2
3. A 2 km boundary for distant social environment -Boundary 3
4. A 100 m corridor for the proposed treated wastewater (treated sewage) disposal line - Boundary 4
5. The catchment areas for stormwater management and the catchment area of Mawak Oya at the treated wastewater discharge point. However, the sub catchment areas of the stormwater management lie within the site. -Boundary 5.
6. Downstream of Mawak Oya up to the Kalu Ganga confluence and the up to the location of the Kandana water supply intake. -Boundary 6

The project site and its influential area is in **Figure 1-1.**

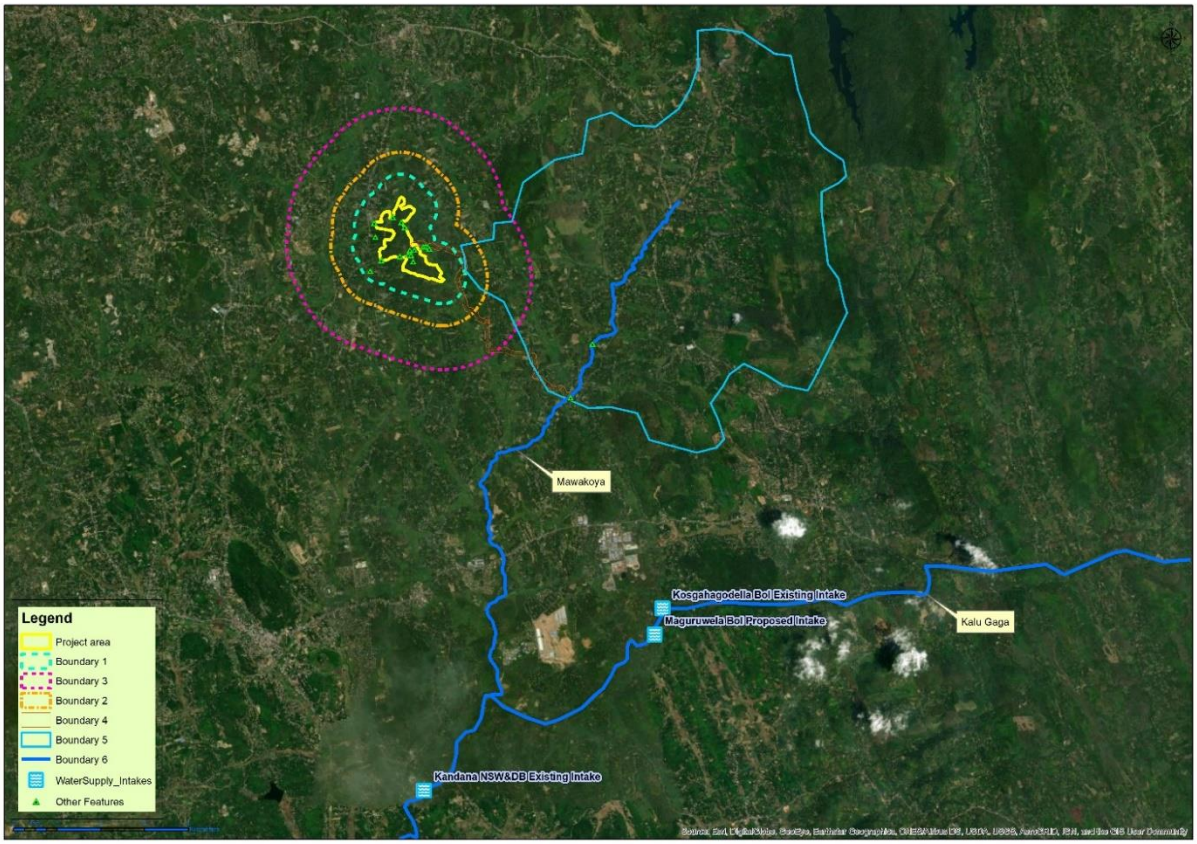


Figure 1.1- "Project Area" and "Project Influential Area"

1.6 Approvals Needed for proposed development from state agencies.

The required approvals will be determined based on the applicable laws and regulations and identifying the line agencies with jurisdiction.

- Central Environmental Authority
- Pradesheeya Sabha
- Divisional Secretary and Grama Niladhari
- Ceylon Electricity Board
- National Water Supply and Drainage Board
- Road development authority – for the traffic impact on Horana-Galagedera Road
- Sri Lanka Land Development Corporation- for the construction of an access road on a paddy field
- National Water Supply and Drainage Board – for the water supply.
- National Building Research Organization (NBRO)- for site geo-stability issues.

1.7 Any conditions laid down by state agencies in granting preliminary clearance for the project.

The details in the form of letters issued by the relevant line agencies to the UDA is given in Annex 2. A summary of the main conditions set out are given below. Refer Annex 2 for further details and the relevant letters issued by the line agencies.

The Department of Agrarian Development in their letter of 31/03/2021 has imposed the following conditions.

1. The proposed access roads traverse the paddy fields. The consent from the paddy owner farmers should be obtained or land acquisition should be done according to the enactments.
2. To provide permission for the access roads across the paddy fields a survey plan from the Department of Survey for the affected area should be submitted.
3. According to the circulars the approval from the Commissioner of Agrarian Services should be obtained to use the paddy fields for other purposes.

The Land Development Corporation in its letter of 04/06/2021 has stated the following conditions.

1. A hydrological study should be conducted to especially cover the access road areas across the paddy fields.
2. Based on the hydrological study, details of the ground levels, locations of the existing and proposed culverts and the stormwater system should be submitted to the Planning Committee approval.

Further in their letter dated 29/09/2021 SLLDC has agreed to obtain construction debris to the Kerewalapitiya Waste Management Facility.

Ceylon Electricity Board has indicated the following in their letter dated 16 September 2021.

CEB has agreed to provide two types of power supply i.e., Type 1- Construction supply and Type 2 -Permanent Supply. Type 1 power will be supplied by existing 33kv network connected to Kosgama 132kV Grid Station and Type 2 power will be supplied by the proposed 33kV tower line connected to the proposed Homagama Grid Station.

National Building Research Organization (NBRO) in their letter of 7/9/2021 has stated as follows:

NBRO has conducted a filed investigation and conducted the land stability survey. Recommendations are given in their report NBRO/LRRMD/KT/HOP/LD21/0009. Since the layout of the Remand Prison was changed NBRO has recommended UDA to obtain a revised report through their letter of 7/9/2021. NBRO site investigation report is given in Annex 19.

Water Resource Board through their Letter of 27/09/2021 has indicated the following.

A monitoring system to identify any groundwater quality deterioration due to the sewerage treatment plant. The locations of shallow monitoring tube wells should be decided considering the hydrology and hydrogeology of the site.

Water Resources Board has provided a site investigation report indicting 4 tube wells locations to obtain water. Please see Annex 06 for details. However, yield tests have not been done for those four tube wells as using of ground water is not envisaged at this stage.

Road Development Authority (RDA) in their letter dated 20/09/2021 states as follows:

1. Approval should be obtained from the UDA Traffic Impact Assessment Committee for the Traffic Impact Assessment (TIA).
2. It is needed to carry out a comprehensive TIA for the entire industrial zone of 735 Acres, in future

Irrigation Department

Following comments were made by their letter dated 22/10/2021

1. Discharge velocity at the release location should be analyzed. If the discharge velocity causes bank erosion mitigation measures such as Energy Dispersion System, Reiver Bank Protection, etc. must be introduced by the PP, subject to approval of Director of Irrigation (Colombo).
2. 15 m reservation of the Marwak Oya should be maintained without any permanent or temporary structures.

Horana Pradesheeya Sabha following conditions have been set out in the following letters.

Letter Dated 02/02/2021

1. Has expressed agreement to accept solid waste when the PS solid waste management system is upgraded

Letter 13/10/2021

1. The EIA Approval should be obtained from the CEA.
2. Treated wastewater discharge to Mawak Oya should comply with the CEA standards.
3. Approval from the Horana Divisional Coordinating Committee and the approvals from other relevant authorities should be obtained.

Letter Dated 03/10/2021

1. PS Needs two Garbage Compactors to cater to the enhanced garbage input from the proposed prison. The garbage facility has to be upgraded.
2. PS needs to employ prisoners in the solid waste management work.
3. The project should avoid any impact to Mawak Oya as it has various public uses in a beautiful setting.
4. The project should minimize any social or environmental issue.
5. Action will be taken to sign an MoU for the acceptance of garbage in future.

National Water Supply and Drainage Board in its letter of 15/10/2021 has granted the certificate of Clearance (For Development Stage) which assures the following:

1. It is feasible to provide 8"bulk service connection as a permanent service connection to cater to the water requirement for Prison Relocation Development which includes the relocation of Welikada Prison, Magazine Prison, Female Prison, Remand Prison, Prison Hospital, Intelligent Unit, Training Centre, CBC Centre, Administration Building only after completion of the proposed headworks improvements. The said improvements are covered under the proposed water supply project of KGWSEP – Stage 1.

2. It is feasible to provide 3"water connection as a temporary service connection to cater the demand of 100 m^3/day up to year 2023. This temporary connection can be provided by extending the existing pipeline to your premises along access road No. 1 as depicted in your submitted architectural drawing. The development cost should be borne by you.

3. The other stipulated conditions can be found in Annex. 2

1.8 Conformity with the existing policies and development plans in the area

Western Region Megapolis Master Plan prepared in 2016 by the former Ministry of Megapolis and Western Region Development, can be considered as an extension to the previous regional plans, which places a major focus on the Western Region in achieving the country's national economic development goals. One of the plans' strategic focuses was the concentration of urban developments based on spatially demarcated five themes, namely Aero City, Industrial townships, Plantation City, Science and Technology City and Forest City. Horana, and Mirigama were selected for development of industrial townships. Reasons for consideration of Horana for an industrial township were:

- Location on the border of Colombo and Kalutara districts,
- 7.5 km to Southern Express Way having access from two interchanges
- 45 km to Colombo Port on the Southern Expressway, Outer Circular Expressway and CKE Expressway and then connecting to Port Access Road.
- 60 km to the Colombo International Airport on the Highway. (On Southern Express Way, Outer Circular Expressway and Katunayake Expressway)
- Located on Panadura – Rathnapura A Class Road, having access to both Southern Express Way and the Proposed Colombo – Ratnapura Express Way (Ruwanpura Expressway)
- WRMPP planned the Horana Industrial City development based on five industrial clusters (**Figure 1.2)** as listed in **Table 1.3.** The project site proposed for the prison relocation and its adjacent rubber plantations totalling to 1013 acres in Millewa were zoned for Biotechnology, Pharmaceuticals and Modernized Ayurvedic Cluster. A part of Millewa Rubber Plantation has been considered for establishment of pharmaceutical industries.

Table 1.3 Industrial Clusters, Planned by WRMPP in Horana

Location	Cluster Theme	Extent (Acres)
Millaniya	Rubber Based Cluster	526
Ballapitiya	SME Development Cluster	160
Poruwadanda	Value Added Textile and Apparel Cluster	1236
Millewa	Biotechnology, Pharmaceuticals and Modernized Ayurvedic Cluster	1013
Thalagala	Electrical and Electronic Industries Development Cluster	410

Figure 1.2 - Western Region Megapolis Plan, development themes (Source: WRMMP)

2 CHAPTER 2-DESCRIPTION OF THE PROJECT AND REASONABLE ALTERNATIVES

2.1 Description of the Project

2.1.1 Location of the Project

The project site could be accessed through either Horana Galagedera Road through Nagas Handiya and then through Millewa Watta Road or Gurugoda Malagala Padukka Road and Millewa Watta Road. The Location map of the project is presented in **Figure.2.1.** The proposed Access Road Layout is given in **Annex 03**.

Except for a negligible portion, the entire project land falls mainly within 628C Pahala Millewa Watta North GN division (GND). The negligible portions are observed in Malagala, Pahala Millewa South and Kotigangala GNGs. Therefore, the project influential area is defined as 628 C Pahala Millewa North GND in this assessment to describe the socio-economic condition in project influence area.

Table 2.1- Administrative Areas of Millewa Prison

Administrative Unit	Name
Province	Western
District	Kalutara
DSD	Horana
GND	628C Pahala Millewa North
Villages	Halbarawe, Pinnakanatta, Pansalgodalla, Millewa Watta, Kanatthagammadda, Araliyawe

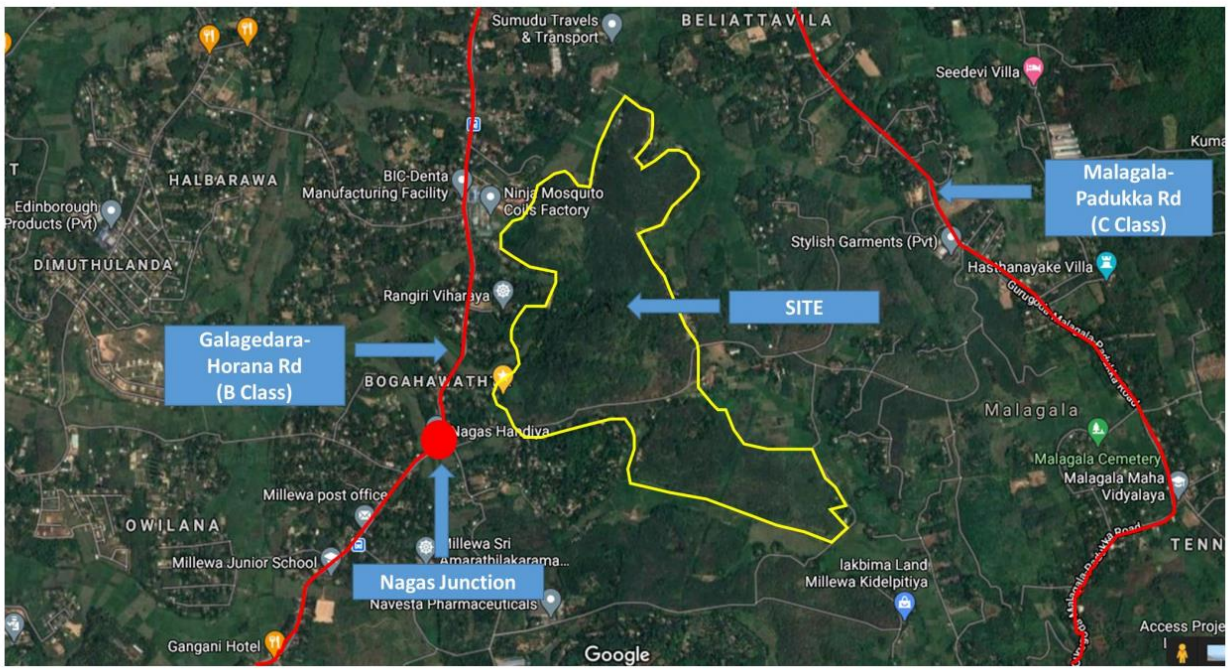


Figure 2.1 - Project Location Map

Plate 2-1- Millewa Watta Road leading to the Project Area from Horana Galagedera Road

Plate 2-2- Millewa Watta Road leading to the Project Area from Malagala Padukka Road

2.1.2 Extent of the Project Area

The project area is 255 Ac 01 R 75 P an approximately 103.6 Ha (i.e., ~256 Ac) A copy of the survey plan is given in **Annex 04**.

2.1.3 Present Ownership of the Project

The site is an abandoned rubber estate with some rubber tapping still ongoing now owned by UDA.

2.1.4 Project Layout Plan

The project layout plan is presented in **Figure 2.2.**

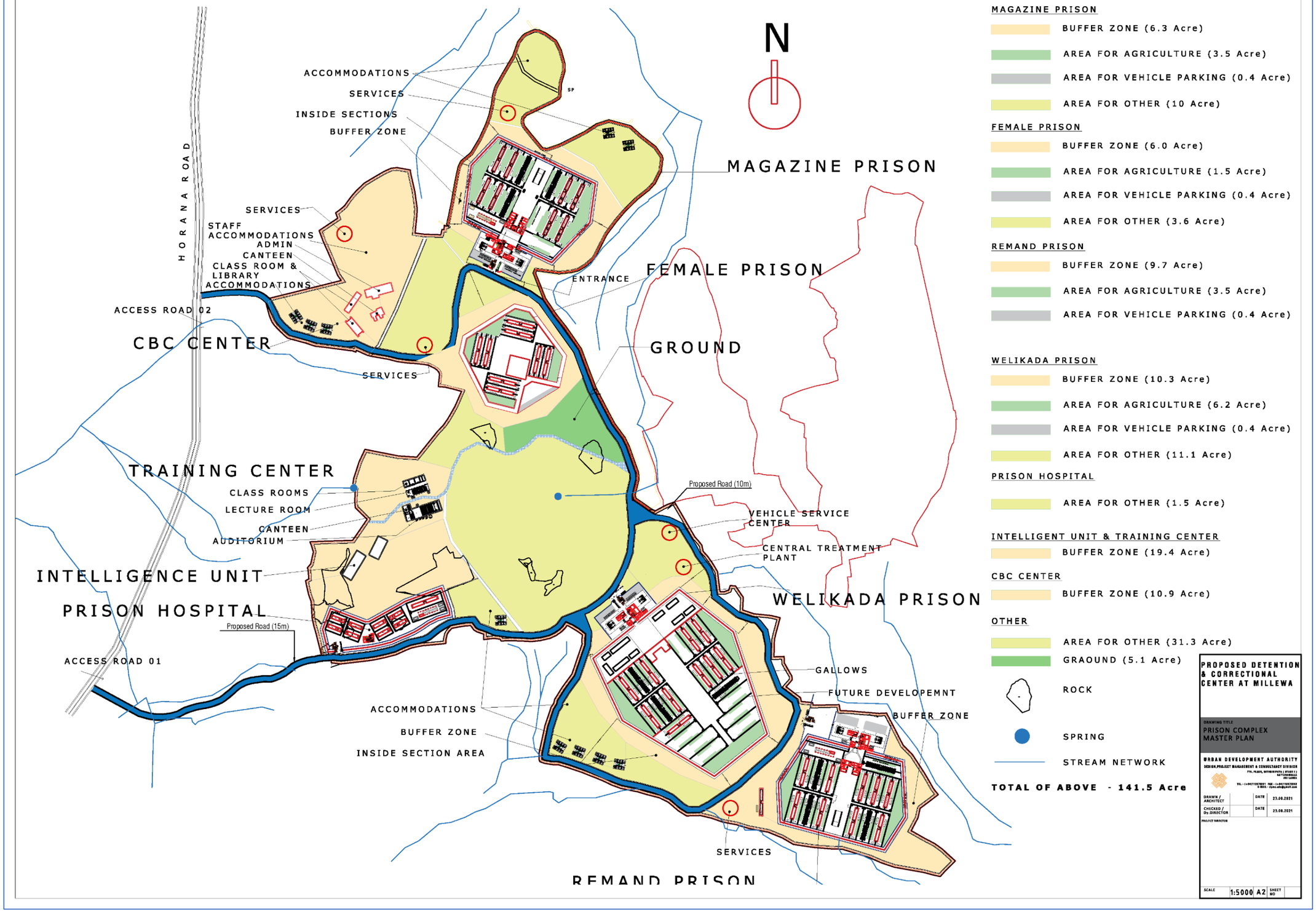


Figure 2.2 - Proposed Layout Plan

2.1.5 Major Components of the Project

2.1.5.1 Buildings and Structures to be Constructed.

Building Types

Various components of the prison along with all necessary facilities and amenities will be established within this premises. Some of the existing prison components will be reestablished in the new project premises along with additional components.

- Prison Buildings (Magazine prison, Female prison, Welikada prison, Remand prison)
- Prison Hospital (Clinical waste management system, Wastewater & solid waste management system)
- Staff Quarters (Single housing units, Apartments)
- Training centre
- Intelligent unit
- Community based correction centre
- Wastewater treatment plant
- Treated wastewater/sewage conveying pipeline to Mawak Oya and the outfall structure
- Treated wastewater conveying pipeline.
- Vehicle service areas
- Parking areas
- Landscaped areas
- Sentry points
- Fencing/ parapet for protection

Population in the Buildings and Building Areas

Population in the building areas of the existing Welikada Prison and the proposed Millewa Prison is given in Table 2.2.

Table 2.2 - Building Occupancy

PRISON	SITE EXTENT (ACRE)		INMATES			BUIDING AREA(m2)		OFFICERS		BUIDING NO	
	EXISTING	PROPOSED	EXISTING	PROPOSED	FUTURE	EXISTING	PROPOSED	EXISTING	PROPOSED	SINGLE STORY	TWO STORY
MAGAZINE	-	36.5	1834	2000	500	2446.1	21 300	214	601	5	19
REMAND	-	41.04	1622	2250	-	3280.7	22 000	271	601	5	19
FEMALE	-	36.05	670	1000	200	1569.1	15 200		337	5	12
WELIKADA	-	59.20	3363	2500	1000	14 651.5	31 500	442	834	13	24
PRISON HOSPITAL	-	9.83	199	525	85	3377.3	12 000		114	-	2

PRISON	SITE EXTENT (ACRE)		INMATES			BUIDING AREA(m2)		OFFICERS		BUIDING NO	
	EXISTING	PROPOSED	EXISTING	PROPOSED	FUTURE	EXISTING	PROPOSED	EXISTING	PROPOSED	SINGLE STORY	TWO STORY
TRAINING CENTER	-	17.07	-	-	-	743.3	10 879	26	560	-	4
INTELLIGENCE UNIT	-	4.95	-	-	-	-	6 000		615	-	2
CBC-CENTER	-	12.23	-	200	-	-	-		50	1	2
OPEN GROUND	-	3.5	-			-	-				
TOTAL	**38**	**219.92**	**7688**	**8475**	**1785**	**26,000**	**118 879**	**953**	**3712**	**29**	**84**

2.1.5.2 Relocation / resettlement

Number of families to be resettled

Number of housing structures located in the project footprint is 5. But 6 families are living because one housing structure is occupied by 2 families. It is recommended resettling all 6 families in 6 new housing structures constructed in alternative land already planned for resettlement. These are the project affected households due to the implementation of the proposed project.

In addition, fifty-one (51) families are reported living within the land plot proposed for the resettlement site. These 51 families are living in low-income housing structures and therefore, the UDA has proposed to provide new houses for these 51 families also even though they are living outside of the project footprint, which is socially justifiable.
in **Table 2.3.**

Table 2.3 - No of families to be resettled

No of housing structures within the land, to be relocated	Number of families to be resettled from within the project site	No. of families living outside the project site needing concurrent resettlement	Total number of families needing resettlement	Sinhala	Tamil
5	6 *(There are two families in one of the housing units)*	51	51+6=57	10	47

Socio economic status of the affected population

The SIA team interviewed 5 housing units located in the project footprint with detail household questionnaire. The basic data available in the profile of all the households identified by UDA in most recent time was revalidated by the SIA team visiting all the project affected households and found no deviation occurred in the profile of UDA prepared list. Therefore, the data in UDA prepared profile of affected households is used in this EIA report.

It was observed that basic socio-economic and cultural information of the project affected 57 population are uniform mainly because they have been living in the line houses within Millewa Estate and performing same types of income generation activities for long period of time. The detail information collected from 6 households located in project footprint is observed as representative information depicting the socio-cultural nature of the affected households. Further details of the 6 housing units interviewed are shown in chapter 3 of this report. Few salient information related to project affected 57 households is shown below and other details of these 57 households are presented in **Annex 05.**

- Number of households to be resettled - (6 in project footprint and 49 in proposed resettlement site)
- The name of the original occupants of 10 households are changed at present.
- Except one occupant all the others have provided with their National Identity card numbers
- 19 of 57 households are managed by women as chief householders
- Electricity supply has not been obtained for 5 houses
- Pipe water facilities are available only in 14 houses
- Average floor area of affected 57 houses range from 100sqft to 957sqft

Compensation packages

The UDA has planned to construct alternative houses in a land block identified from outside of proposed project footprint but within Millawe Watta. The workers residing in line houses established in Millawe Watta will be offered these new houses.

The productivity of the Millawe estate has gone down significantly and therefore, UDA has prepared Compulsory Resettlement Scheme (CRS) for the workers. Apart from providing alternative houses compensation for workers will be paid due to loss of their employments. The details of the compensation package for employees are described below:

Payment of a compensation package for each worker based on the age categories, period of employment as per the table mentioned below.

Table 2.4 - Details of Compensation Payment

Age Groups of workers (Years)	Compensation for period of		Amount of compensation for one month period
	employed	To be employed up to age of 65 years	
Less than 50	02 months (44 days) slalary for each 12 months	01 month (22 days) salary for each 12 months	Minimum daily salary per day as per the gazette No 2217/37 dated 05.03.2021.

Between 50 - 65	01 ½ months (33 days) salary for each 12 months	01 month (22 days) salary for each 12 months	(Rs. 900/- per day x 22 days = 19800/-)
More than 65	01 month (22 days) salary for each 12 months	No	

i. To pay all statutory payments such as EPF, ETF and gratuity earned by workers up to the date of retirement as per the labour law.

ii. To determine the maximum age of retirement as 65 years.

iii. To pay the compensation package only to the workers who have maintained an average daily attendance per month (excluding public holidays, Saturdays and Sundays) 50% of above during the last two years period from the proposed date of retirement

(Avg. attendance Per month = Operated days of Planation during last 2years /24 months)

iv. To consider the date of new appointment for the workers who had retired and recruited subsequently to calculate the amount of compensation.

v. To recover all outstanding dues from respective workers from the compensation

vi. To pay the comensation to the workers from the UDA budget 2021 under the Prison Relocation programme as approve by the Cabinet of Ministers.

vii. To fix the date of compulsory retimrement as 31.08.2021

viii. Maximum amount of the compensation package for each employee is limt to Rs. 1.00 million.

Relocation sites

UDA has identified portion of land within Millewa watta to be used as resettlement site for the project affected 57 households to be resettled. The details of the proposed resettlement site are shown in **Table 2.5.**

Table 2.5 Relocation sites

Features	Information
Address of the relocation site	Millewa watta, Millewa, Horana.
Distance from the HHs to be resettled Meters	600 m (for 6 households but others are very close to the site)
Number of houses in the vicinity of relocation site	49
The employments of host community (main employments)	Most of the persons within employable age in these 48 houses are working in Millewa Watta, but some are also working in outside areas.
Types of houses of the host community (types of majorities of houses)	Semi-permanent line houses.

Features	Information
Nature of settlement of the host community (line houses, scatted houses, large houses etc.)	Low-income community
Facilities available in the houses of the host community (water, electricity, telecommunication, access roads)	Drinking water is from a common well, they all have access to electricity, and they have better access to reach their present houses, even though they do not have land phone facilities SIA observed most of household community members use mobile phones.

The relocation site details are given in **Figure 2.3** and **Figure 2.4.**

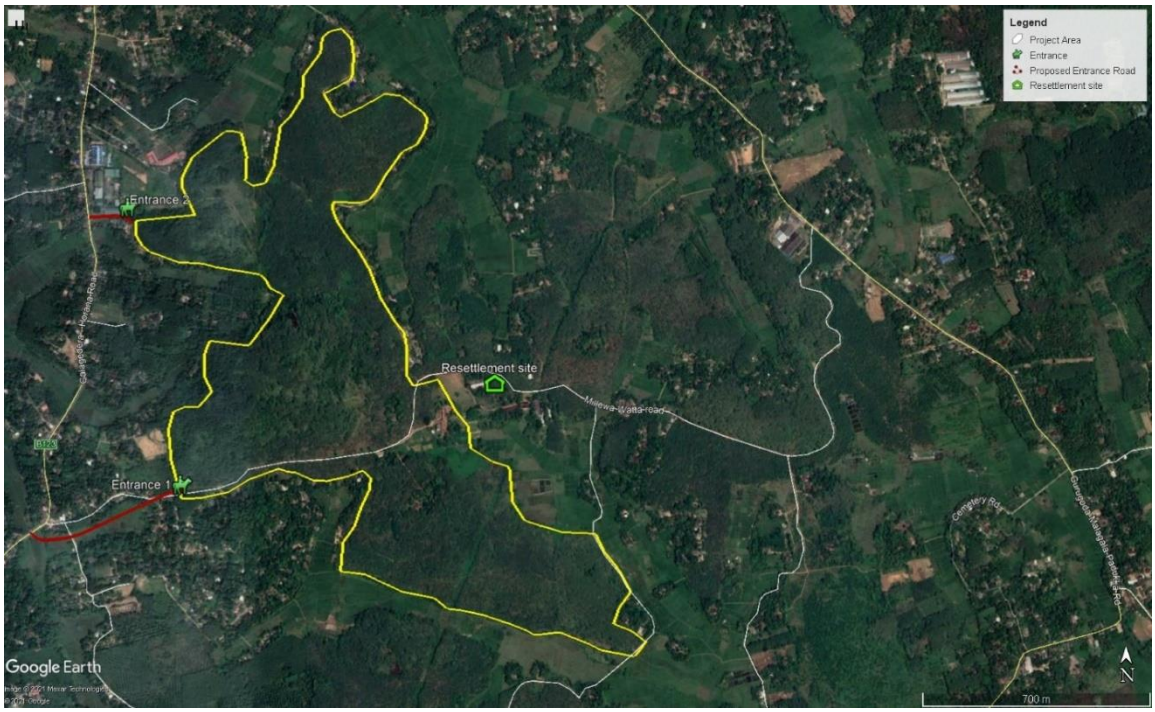


Figure 2.3 - Location of the Resettlement Site

Figure 2.4- Layout Plan of the Proposed Resettlement Site

Other facilities to be provided

The community members living in affected 6 households within project footprint expressed their views on the expected other facility in the newly resettled site. The views they expressed on expectation of other facilities are mentioned in Table 2.6.

Table 2.6 - Other facilities Expected by affected 6 households

Other Facilities for the HHs resettled	No of households	%
Access road to be improved	6	100
Pipe Water facilities are expected	6	100
Electricity	Even now it is available and same facilities in the new houses are expected	100
Assistance for alternative livelihoods	6	100
Assistance to get children admitted to schools	3 school children are available in these families,	50
Small piece of land for cultivation	6	100
Other Basic equipment for the household	6	600

2.1.5.3 Internal road layout and parking

All internal roads are 2 lane roads (10 m carriageway width). Separate pedestrian walkways are also provided. Therefore, internal roads are sufficient for internal circulation.

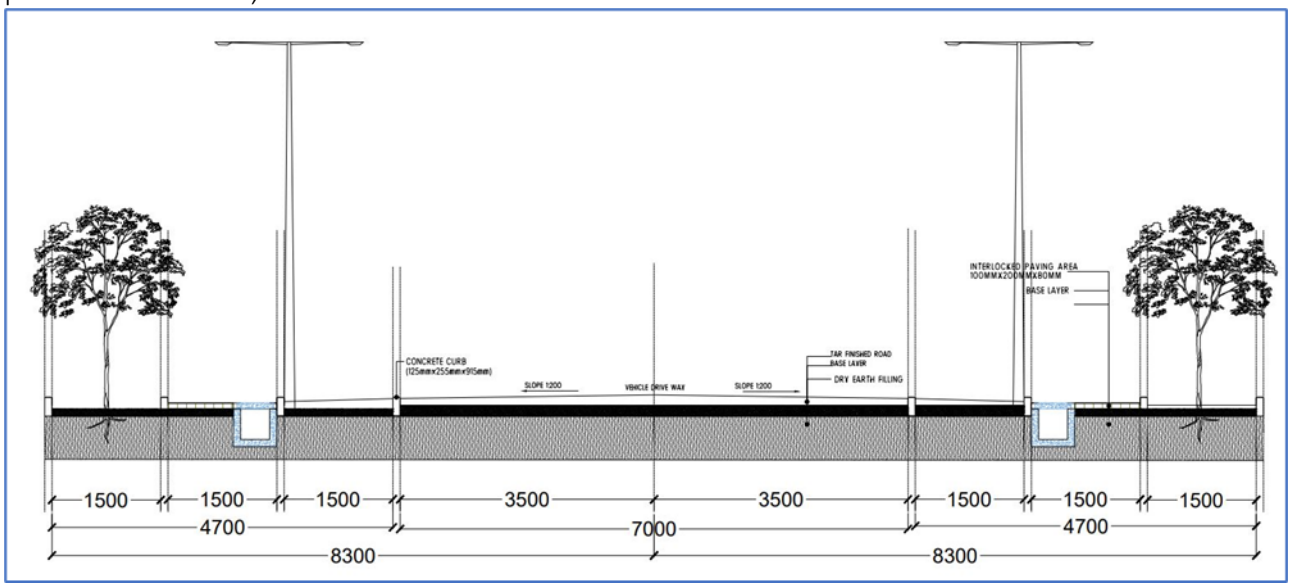


Figure 2.5 – Typical Road Cross Section

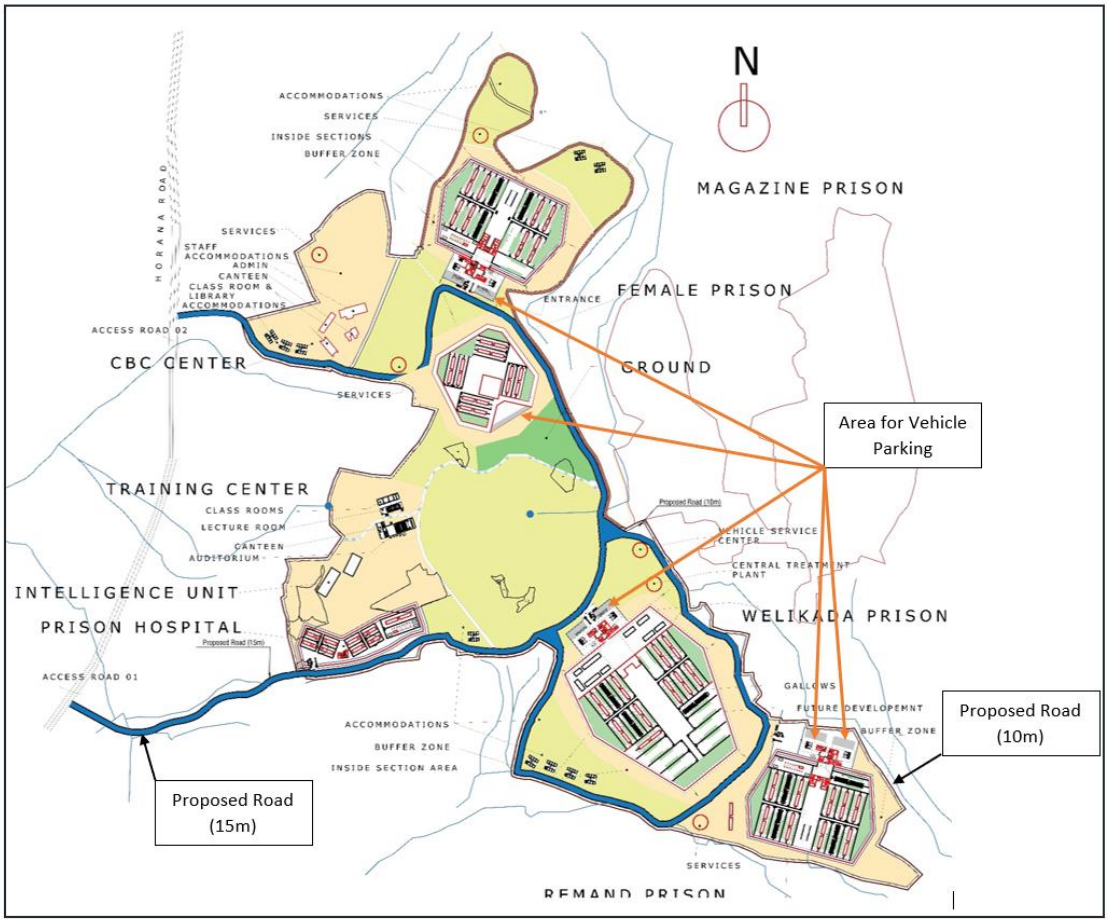


Figure 2.6 - Internal Road Network & Parking Areas

Parking area includes 200 standard parking lots and 60 bus parking lots. These are distributed across Magazine, Remand, Female, and Welikada Prison premises.

Parking requirement for unique developments such as these is to be determined based on the functionality of the development. Most of the staff are given accommodation within premises. If we consider the non-prison type developments, the total floor area is 28,879 sq.m. The parking requirement for developments that cannot be categorized into typical building types defined by UDA would be 1 parking lot per 100 sq.m floor area. Therefore, an estimate of around 288 standard parking lots and 58 commercial parking lots for the premises would be required. However, as explained earlier the estimation of parking requirement should be based on the functions of the proposed development. Therefore, the proposed parking area is deemed adequate to subject to providing provisions for an area that can accommodate around 50 car parking lots.

2.1.6 Constructional activities

2.1.6.1 Site preparation activities

Extent of land to be cleared for different project components.

According to the building layouts the land to be cleared for the four major prison entities i.e., Welikada Prison, Magazine Prison, Remand Prison and Female Prison plus Prison Hospital, Training Centre, CBC centre, Accommodation, Ground/Service Areas, etc. Except for the building footprint the other areas to be cleared are marked in **Figure 2.7.**

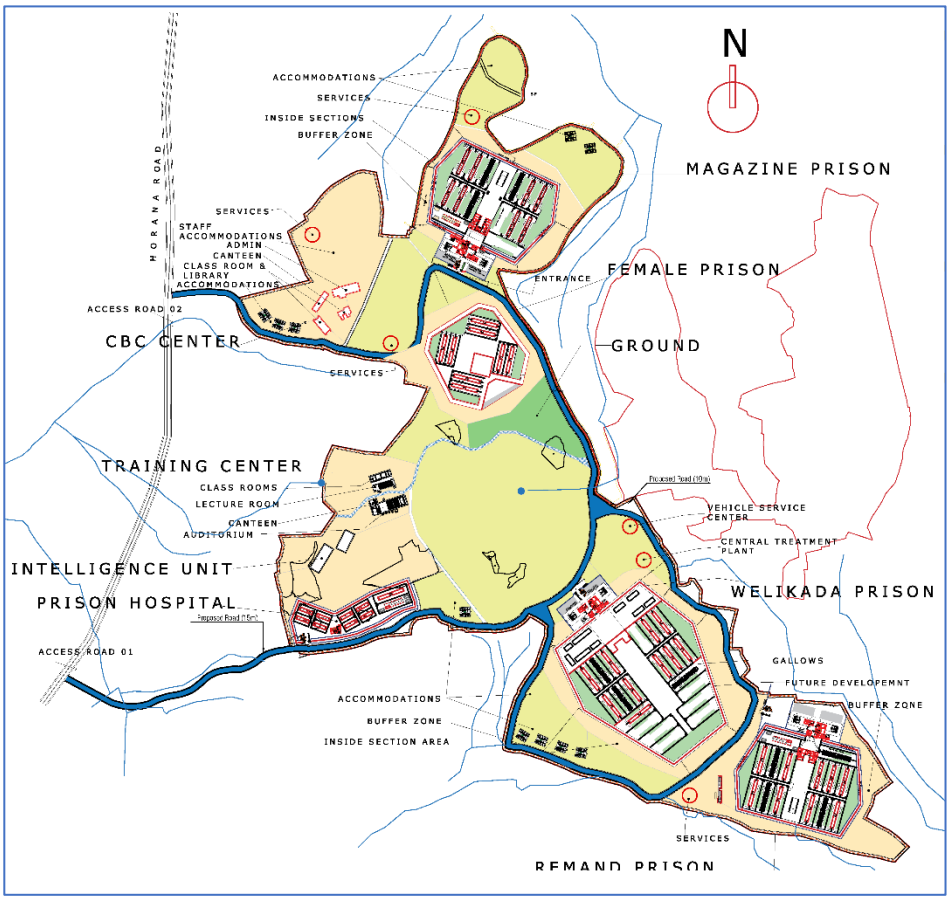


Figure 2.7 -Areas to be cleared

Other land preparation activities envisaged/soil conservation measures.

The land is a sloping land where there is an existing rubber plantation. The rubber trees must be uprooted, and the site should be prepared to get different elevations to suit the architectural and the engineering design. The tree uprooting will loosen the topsoil layers and depending on the site conditions, the weak topsoil layers will have to be removed. Temporary soil conservation measures with contoured hard soil mounds, sandbag mounds will be used for erosion control and soil conservation. The removed topsoil could be used for the open landscaped areas. There are existing drainage paths identified and these drainage paths will be preserved or suitably deviated.

Details of the demolishing, land filling / levelling and excavation (extent and level of filling/excavation)

Only few buildings (six-line houses, isolated manager's bungalow, staff quarters and the existing factory etc.) will have to be demolished. Land filling and levelling will be required to make the ground to put up buildings. Land excavation is also needed to get a level land for buildings and to make foundation trenches. However, the amounts of land clearing will vary based on the site configuration needed and the nature of the structural design.

Type, quantity, and sources of filled material

After soil investigations the cut earth will be used for fill earth as far as possible. If excess earth is required earth will be brought from a licensed burrow pit. The details of the licenced burrow pits will be obtained from the Geological Survey and Mines Bureau. At this stage the quantities of fill material required cannot be estimated. Since the fill material could be obtained from the cut soil and foundation trenches the extra quantities of fill material will not be extremely high.

Disposal sites

The debris will be accepted by SLLDC for their Kerawalapitiya Waste Park. Please see Annex 2 for the letter of authorization.

2.1.6.2 Description of tree felling /clearing of any natural vegetation

The trees to be removed will be assessed through a tree survey. As the extent of the site is very large an individual rubber tree count will not be possible. Those trees to be fell will be identified on "area to be cleared" basis. If there are other valuable trees those will be individually identified. Felled rubber trees will be sold through tendering. According to the design only 50% of the rubber plantation is envisaged to be cleared.

2.1.6.3 Reservation areas to be maintained.

From the site investigations it was understood that the reservations will be needed for the following:

The peripheral streams abutting the project boundary on the paddy fields.
The internal springs and the connecting streams
Other streamlets valleys

It is proposed to use the reservations indicated in the reservation guidelines of the Survey Department. According to the Survey Department guidelines, for streams of which the width is less than 3m then 5m reservation will have to be maintained on both banks.

2.1.7 Water supply

Water supply will be from NWSDB.

For the groundwater availability the water Resources Board has conducted preliminary investigations and suggested 4 places for groundwater extraction. There is also an existing tube well close to the factory which is now abandoned. The locations of the existing tube well and the proposed tube wells are presented in **Figure 2.8**. However, groundwater will not be used either for construction or for the operation. Should there be an acute need groundwater can be extracted subject to necessary yield tests and the necessary approvals obtained from CEA and WRB.

The Water Resources Board report is given in **Annex 06**. The water requirement details are presented in **Table 2.7.**

Table 2.7 -Water Requirements for Construction and Operation

Stage	Water Requirement m^3/day	Supply from Groundwater m^3/day	Source for Groundwater	Supply from Surface Water m^3/day	Source for Surface Water
Construction Stage and Operational Stage up to 2023	100	No groundwater will be used during construction/ operation	4 tube wells	100	NWSDB Mains (3" temporary connection till 2023)
Operational Stage beyond 2023	2250	No groundwater will be used during the operation	4 tube wells	2250	NWSDB Mains (8" bulk supply after 2023)

Amount of water required during construction (m^3/d) will be decided based on the final drawings where the quantities of brick and cement work is available through which the exact water requirement could be computed. However, it will not exceed 100 m^3/d as estimated in the succeeding sections.

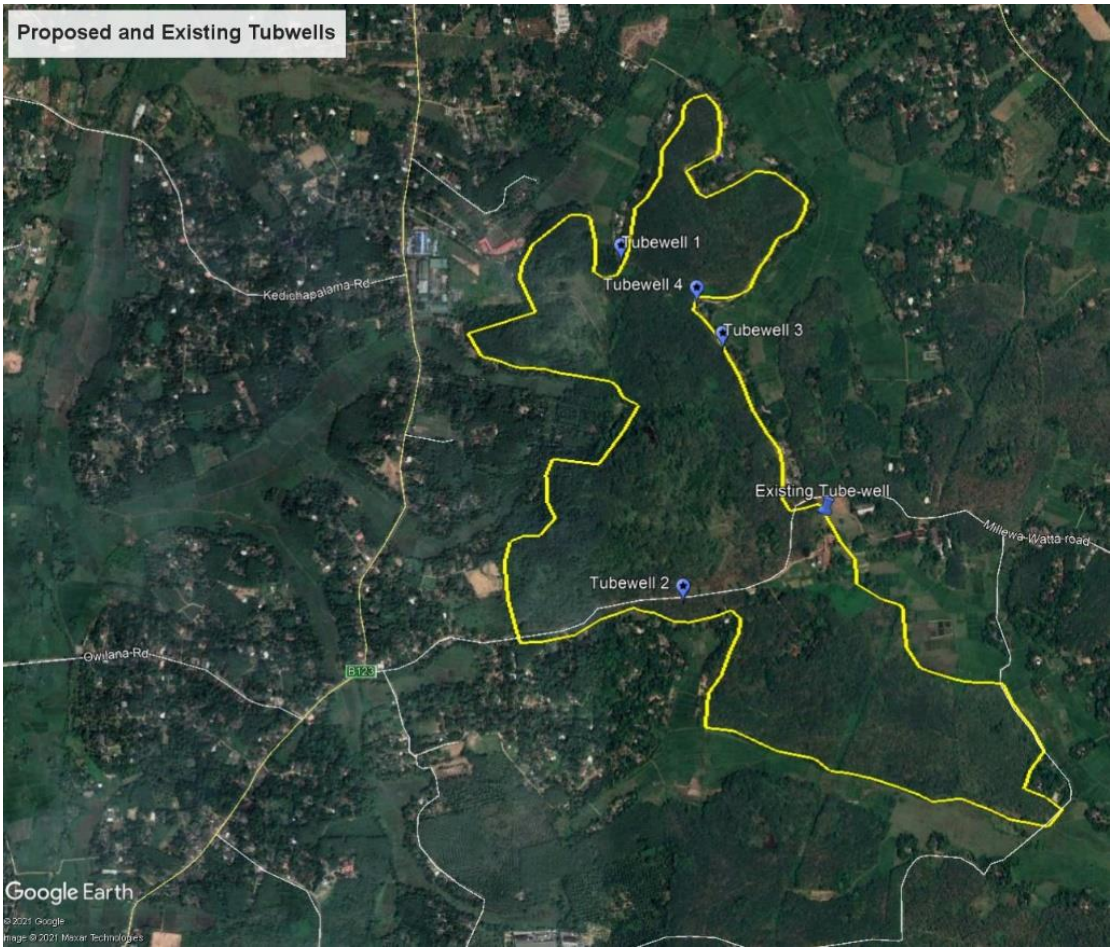


Figure 2.8 – The locations of the existing tube well and the proposed tube wells

2.1.7.1 Water Sources and supply locations:

Surface water will be supplied from NSWDB mains.

2.1.7.2 If extraction of ground water is envisaged, provide a report from the Water Resources Board indicating the availability of ground water and safe extraction limits, etc.

Extraction of ground water is not envisaged. However, Water Resource Board has conducted investigations on availability of ground water and the report is given in Annex 06.

2.1.7.3 If extraction of surface water is envisaged, consent letters from the relevant agencies should be obtained and attached to the report.

Consent letters obtained from NWSDB is given in Annex 02.

2.1.7.4 Rainwater harvesting systems (if any)

It is expected to do rainwater harvesting according to the UDA rainwater harvesting regulations and guidelines.

2.1.8 Other infrastructure facilities required/provided.

2.1.8.1 Energy requirement during construction and operation stages separately (source, availability, and alternative sources)

Electricity supply will be provided by the Ceylon Electricity Board. A temporary electricity supply will be obtained during the construction stage. CEB letter of consent for the Construction Supply is given in Annex 2.

2.1.8.2 Details of any access road to be built/improved.

The available access road is Millewa Estate Road to which dual access is available from Horana - Galagedera Road and Gurugoda-Malagala Road. This access road will be fully examined for its future use, width, traffic condition, surfacing, side drains, culverts, etc. If any details of the access road development have been provided in the feasibility studies and planning, those details also will be used. If the feasibility report has indicated any other access road the development of that too will be examined on the possible impacts.

2.1.9 Wastewater

2.1.9.1 Quantity and quality of wastewater to be generated daily both during construction and operation.

Following four main wastewater generation points have been identified in the proposed Millewa Prisons Complex (MPC).

1. Welikada Prison
2. Remand Prison
3. Female Prison
4. Magazine Prison

In addition, wastewater is also generated at the following units.

5. Training centre
6. Prison hospital
7. Intelligence unit
8. CBC Centre
9. Staff accommodation
10. Vehicle service area

These locations are indicated in the proposed layout plan. Furthermore, the MPC includes numerous other units which could generate wastewater. The total quantity of wastewater is estimated as 1781 m^3/day (~1800 m^3/day) during the operation phase as detailed below.

Wastewater Quantity and Quality Generated During Construction

It is assumed that the labourers and technical staff will not exceed 350 at any given time during the stagewise construction phase. Per capita consumption per day is 120 lpcd. Total wastewater amount = 85% of 350x120/1000 m^3/day = 35.7 m^3/day.

Wastewater quality will be BOD_5, COD, TSS, oil and grease and total coliform will be around 45-54 g/capita day, 1.6-1.9 g x BOD_5/ capita day, 70-145 g/capita per day, 10-30 g/per capita day and 10^9-10^{10} g per capita per day, respectively without stormwater input.

Wastewater Quantity and Quality Generated During Operation

Wastewater quantities for the entire prison complex during full operation is presented in Table 2.8

Table 2.8- Wastewater Quantity Calculation

WASTEWATER GENERATION FORECAST - WELIKADA PRISON RELOCATION PROJECT

Water consumption(Domestic)	=	120 lpcd
Water consumption(Office Staff)	=	50 lpcd
Water consumption(Hospital Bed)	=	400 lpcd
WW generation(Domestic)	=	85% of water consumption
WW Infiltration	=	20% of domestic ww generation

S/N	PRISON NAME	PRISONERS			TOTAL STAFF	QUARTERS			WASTEWATER GENERATION(m3/day)			
		PROPOSED	FUTURE	TOTAL		STAFF MEMBERS	FAMILY MEMBERS	TOTAL	PRISONS	QUARTERS	INFILTRATION	TOTAL
1	MAGAZINE	2,000	500	2,500	601	192	192	384	281	31	62	**374**
2	REMAND	2,250	0	2,250	601	192	192	384	255	31	57	**343**
3	FEMALE	1,000	200	1,200	337	120	96	216	137	17	31	**184**
4	WELIKADA	2,500	1,000	3,500	834	244	208	452	392	36	86	**514**
5	PRISON HOSPITAL	525	85	610	114	58	40	98	212	8	44	**264**
6	TRAINING CENTRE	0	0	0	560	180	16	196	24	12	7	**43**
7	INTELLIGENCE UNIT	0	0	0	615	0	0	0	26	0	5	**31**
8	CBC CENTRE	0	200	200	50	0	0	0	23	0	5	**27**
	TOTAL	8,275	1,985	10,260	3,712	986	744	1,730	1,349	135	297	**1,781**

Source: National Water Supply and Drainage Board (NWSDB)

Entire Prison Complex

The estimated quantity of daily wastewater inflow is 1781 m^3/day including 297 m^3/day stormwater infiltrations (source: NWSDB) during the peak operation period. This will include a combination of blackwater and greywater with kitchen effluents. There are no specific laundries, but it will get mixed with this quantity as in households). BOD_5, COD, TSS, oil and grease and total coliform will be around 45-54 g/capita day, 1.6-1.9 g x BOD_5/ capita day, 70-145 g/capita per day, 10-30 g/per capita day and 10^9-10^{10} g per capita per day, respectively without stormwater input (Arceivala and Asolekar, 2012).

The wastewater quantity estimate represents approximately **14,106 pax** in the complex at peak operation.

Service Station

The service station effluent quantity (4000 litres/day = 4m^3/day minimum) is a separate effluent stream which is not a part of the wastewater quantity of 1781 m^3/day. This will be high oil and grease with TSS (especially mud) laden wastewater that needs pre-treatment (otherwise mud settlement will occur in

the common STP with oil and grease blocking of pipes, valves, and pumps in the STP as well as clogging of the microbial growth of the A_2O process).

Total effluent quantity due to service station effluents and sewage from the entire prison complex will be 1785 m^3/day (~1800 m3/day).

Hospital Complex

The hospital complex will also generate sewage (blackwater, greywater with kitchen effluents) and it will become part of the sewage (domestic wastewater) component generated by the entire prison complex.

The quantity of sewage from the hospital during the fullest capacity is simulated as follows (114 officers serving the prison hospital in 2 shifts per day out of which 58 are staying in staff quarters)

Officers 56 x 50 litres/day (85% of total water demand ending up in the sewer network) x 0.85 x 10^{-3} = 2.4 m^3/day
Resident Officers 58 x 120 litres/ day (85% of total water demand ending up in the sewer network) x 0.85 x 10^{-3} = 6.0 m^3/day
Prisoners at 100% occupancy = 610 x 400 litres/day (water demand) x 0.85 x 10^{-3} = 207.4 m^3/day
Thus, the total wastewater generation from the Hospital would be around 216 m^3/day

Sewage quality (blackwater and greywater, etc.) will be 1.5 times the afore-mentioned quality of sewage (Arceivala and Asolekar, 2012) and the computed values are given in **Table 2.9**

Table 2.9: Computed domestic wastewater characteristics – combined stream without stormwater (for a total of 724 persons

Parameter	Concentration
BOD_5at 20°C (mg/l)	222-267-
COD (mg/l)	355-506
TSS (mg/l)	346-716
Oil and grease (mg/l)	49-148

Note that fresh sewage is alkaline (6.5- 8.5) but becomes acidic under septic conditions.

However, there will be some antibiotics and pain killer molecules or their metabolites that will contribute to the COD component (present in the urine of patients administered with these drug) along with oxidized and disinfected blood and urine samples. The mouth wash waters from the dental clinics may contribute to Hg from amalgam residues. But, these constituents will get diluted by the balance 1517 m^3/day of the effluent (with stormwater intrusion) from the entire prison complex when reaching the STP; antibiotics and pain killer molecules or their metabolites will often end up in the wasted sludge due to adsorption. Other components that will contribute to COD will include the following If disposed to the sewer lines:

- Formulations/preparation of any medicine/medicinal solutions, etc that are no longer required, etc
- spilt, and contaminated pharmaceutical products, medicines, drugs, vaccines, and sera
- relatively mild liquid or semi-liquid pharmaceuticals, such as solutions containing vitamins, cough syrups, intravenous solutions (salts, amino acids, lipids, glucose, etc.), eye drop solutions (compounds like glucose, lipids and amino acids are biodegradable)

When medicines / pharmaceuticals are administered to patients, it is expected that they will often get metabolized (except any heavy metals present in certain drugs especially ayurvedic medicine). However, any direct and regular disposal of antibiotic solutions depending on the chemical properties (excess, unused or expired) in the long run can be injurious to the STP[1]; if ones with low biodegradability (e.g., quinolones / fluoroquinolones, nitroimidazoles and sulphonamides) are disposed on and off.

2.1.9.2 Types of wastewaters generated (kitchen, laundry, hospital, etc.)

The type of wastewater generated at the MPC can be termed "domestic wastewater" except the vehicle service station and a small quantity of hazardous wastewater from the hospital. All domestic wastewaters will be collected using a wastewater collection network under gravity and conveyed to the WWTS. However, considering the topography, there will be small pumping units and force mains in the proposed network. The network arrangement is not yet determined. The network will include pipes laid in trenches, manholes, pump houses, and such other associated items as ventilation shafts, brake pressure chambers, etc.

2.1.9.3 Arrangements for treatment and disposal of all wastewaters including Sewage Both During Construction and Operation

Arrangement for Wastewater Treatment During Construction

There will be no specific arrangement for the wastewater treatment during construction except for collecting to the temporary septic tanks and soakage pits within the site.

Arrangements for Wastewater Disposal During Construction

Sewage collected to temporary septic tanks will be emptied either by use of gully bowsers of Horana Pradesheeya Sabha or of Private Parties and disposed e.g., to Moratuwa Rathmalana Sewage Treatment Plant.

Arrangements for Wastewater Treatment During Operation

General

The responsibility of planning and designing the Wastewater Treatment and Disposal System for the MPC is entrusted to the National Water Supply and Drainage Board (NWSDB). They have proposed a centralized wastewater treatment system (WWTS) with the possibility of treated wastewater reuse.

As explained to the Consultants, the developer will abide by the recommendations of the NWSDB regarding wastewater management. The NWSDB proposed reuse of wastewater and recommended applications in green areas and agricultural activities. However, reuse of wastewater is optional, and in

[1] antibiotics are regarded to have a pronounced bacterial toxicity and most antibiotics tested to date have not been biodegradable under aerobic conditions (Kümmerer, 2001)

any case, does not expect to exceed more than 20% of the treated effluent. Thus, the main disposal arrangement is river outfall to Mawak Oya. The NWSDB advises the developer to consider the total wastewater generation (16,000 m^3/day) of the Millewa Estate Development Project in designing and constructing the treated effluent disposal pipeline.

Three acres have been assigned for the WWTS, and the location of the WWTS is shown in Figure 2.10.

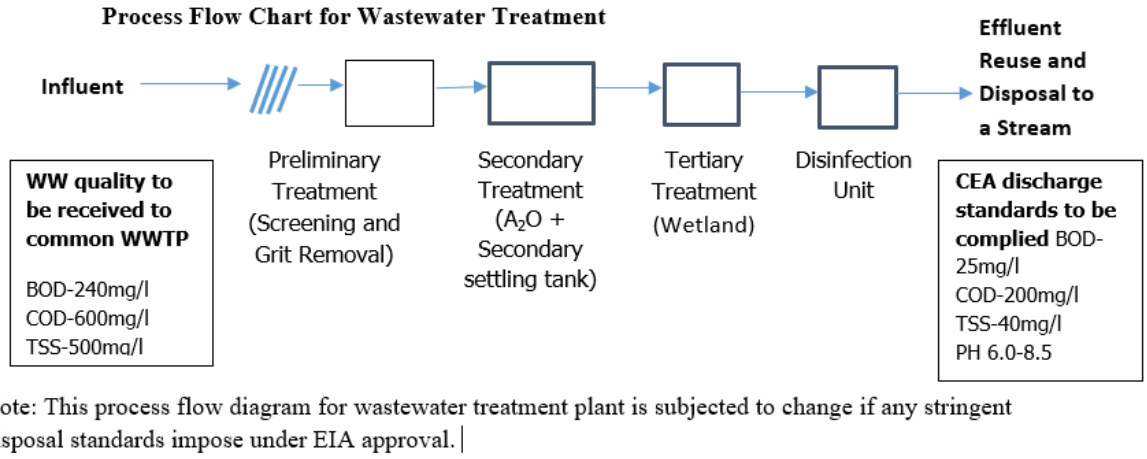
Figure 2.9 illustrates the proposed centralized treatment process. The treatment system includes primary, secondary, and tertiary treatment units. The tertiary treatment is by a wetland that provides further polishing after secondary treatment. The influent characteristics represent the medium strength domestic wastewater, and the treated effluent meets the disposal standard for disposal of treated effluent to inland waters.

Wastewater Collection

It is proposed to collect domestic wastewater (Black water + Grey Water) from all the premises (Magazine Prison, Welikada Prison, Remand Prison, Female Prison, Training Centre, Prison Hospital, Intelligence Unit, CBC Center and Playground area) of the prison site under gravity through a pipe network and through force mains to where necessary utilizing few pump houses.

Wastewater Treatment [Schematic Process Diagram]

The wastewater will be collected to a centralized wastewater treatment plant (WWTP). The WWTP will be constructed in a technically suitable location within the proposed site as marked (Tentative location) in the Figure 2.10. A wetland can be provided for further polishing (Tertiary Treatment) of effluent depending on land availability and will be done in the design stage.



Note: This process flow diagram for wastewater treatment plant is subjected to change if any stringent disposal standards impose under EIA approval.

Figure 2.9 Process Flow Chart for Wastewater Treatment

Effluent Reuse System

Treated effluent reuse in the green areas, agricultural activities, etc. is always encouraged. Therefore, the effluent reuse systems will be planned considering the above options in the design stage. It is envisaged to use around 20% of the wastewater for Irrigation. More details are presented in Section 5.1.

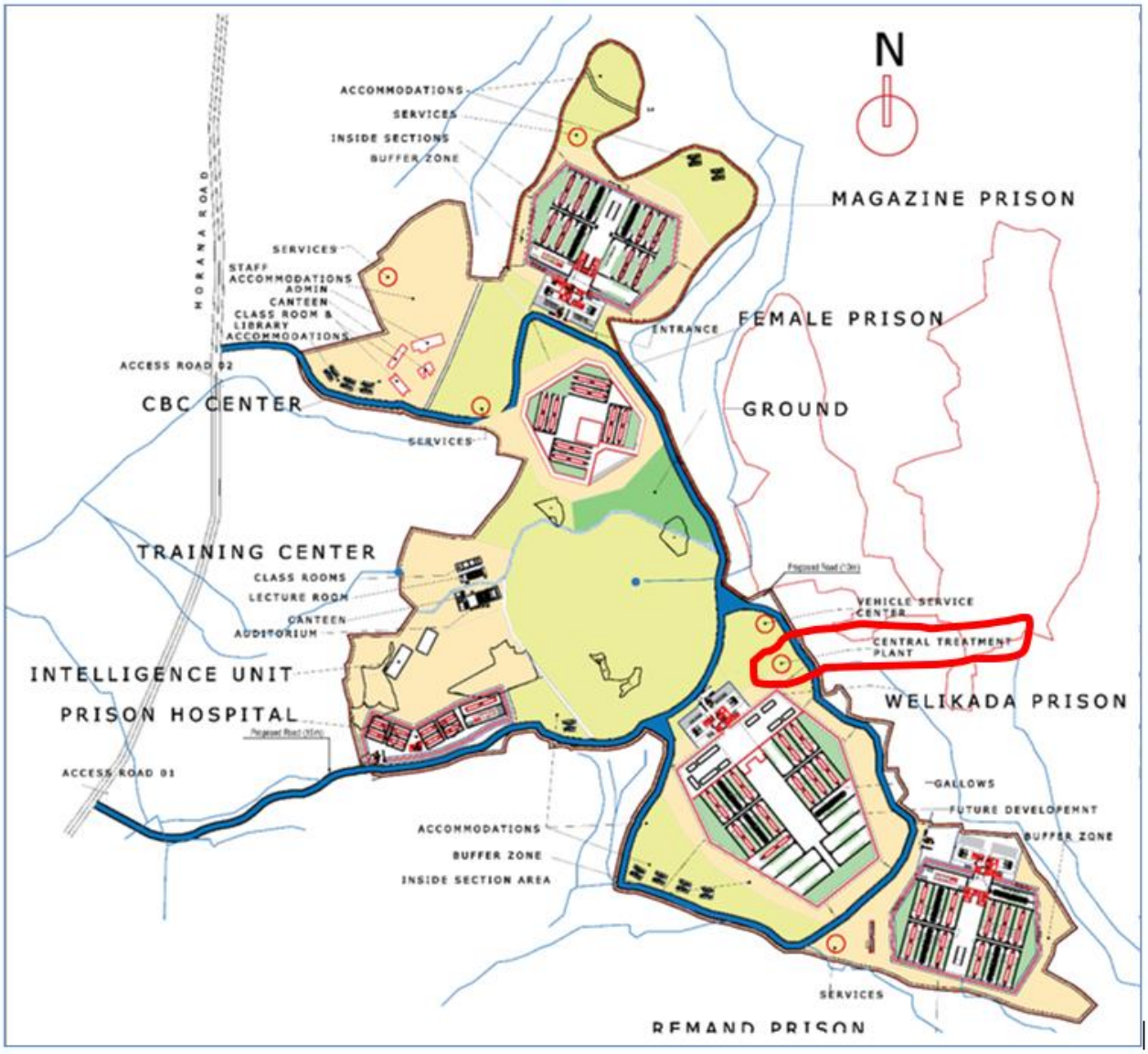


Figure 2.10 - Location of the Proposed Wastewater Treatment Plant

Arrangement for Wastewater Disposal During Operation

Treated wastewater will be discharged to Mawak Oya using a 7 km long pipeline following existing roads. The treated effluent disposal location was identified in Mawak Oya, which connects to Kalu Ganga at its downstream.

Since the treated wastewater quantity will be about 1800 m^3/day, a final disposal point/s to be found even after reusing of around 20% for irrigation. Two possible discharge points to Mawak Oya have been studied and the final disposal point has been identified around 7 km away from the tentative location of the WWTP. The effluent will be carried through a high-density polyethylene (HDPE) pipeline route to the discharge location as shown **Figure 2.11**. An enhanced map for the outfall location is given in **Figure 2.12**. The Cross Section Details of the Treated Wastewater/Sewage Discharge is given in **Figure 2.13 and 2.14**. The details of the outfall structure are given in **Figure 2.15.**

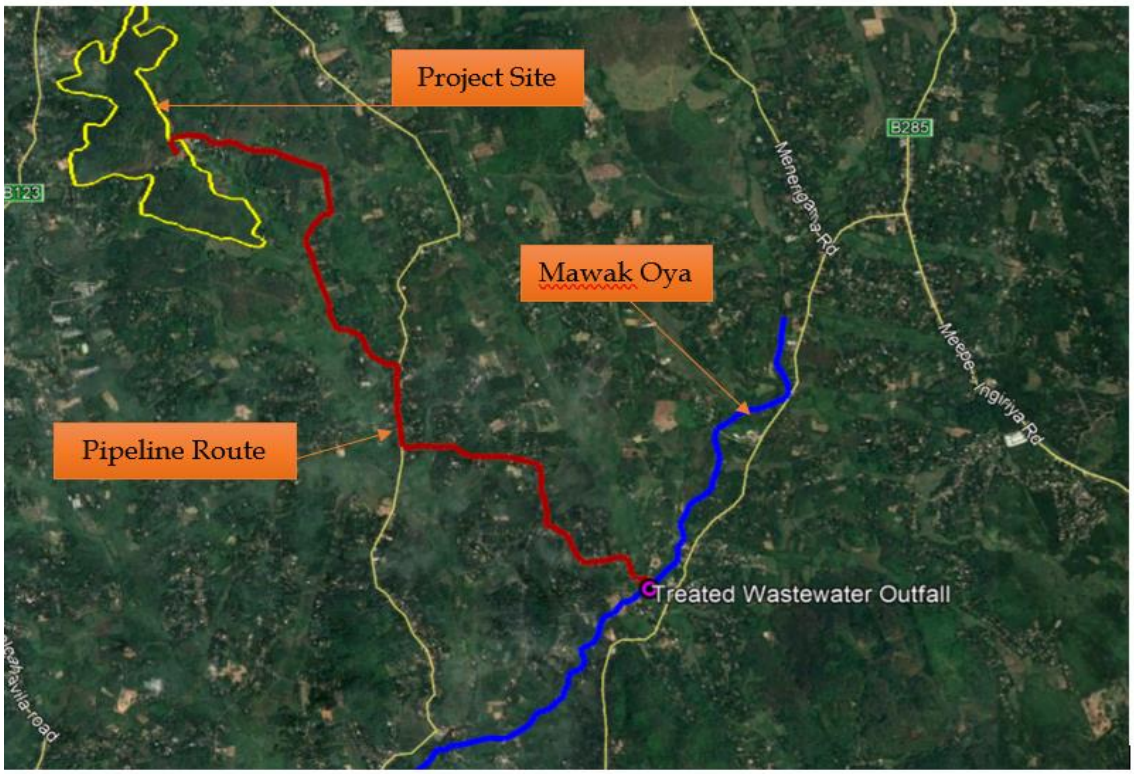


Figure 2.11- Pipeline Route and outfall in Google Map

Figure 2.12- A closeup view near the outfall -Mawak Oya

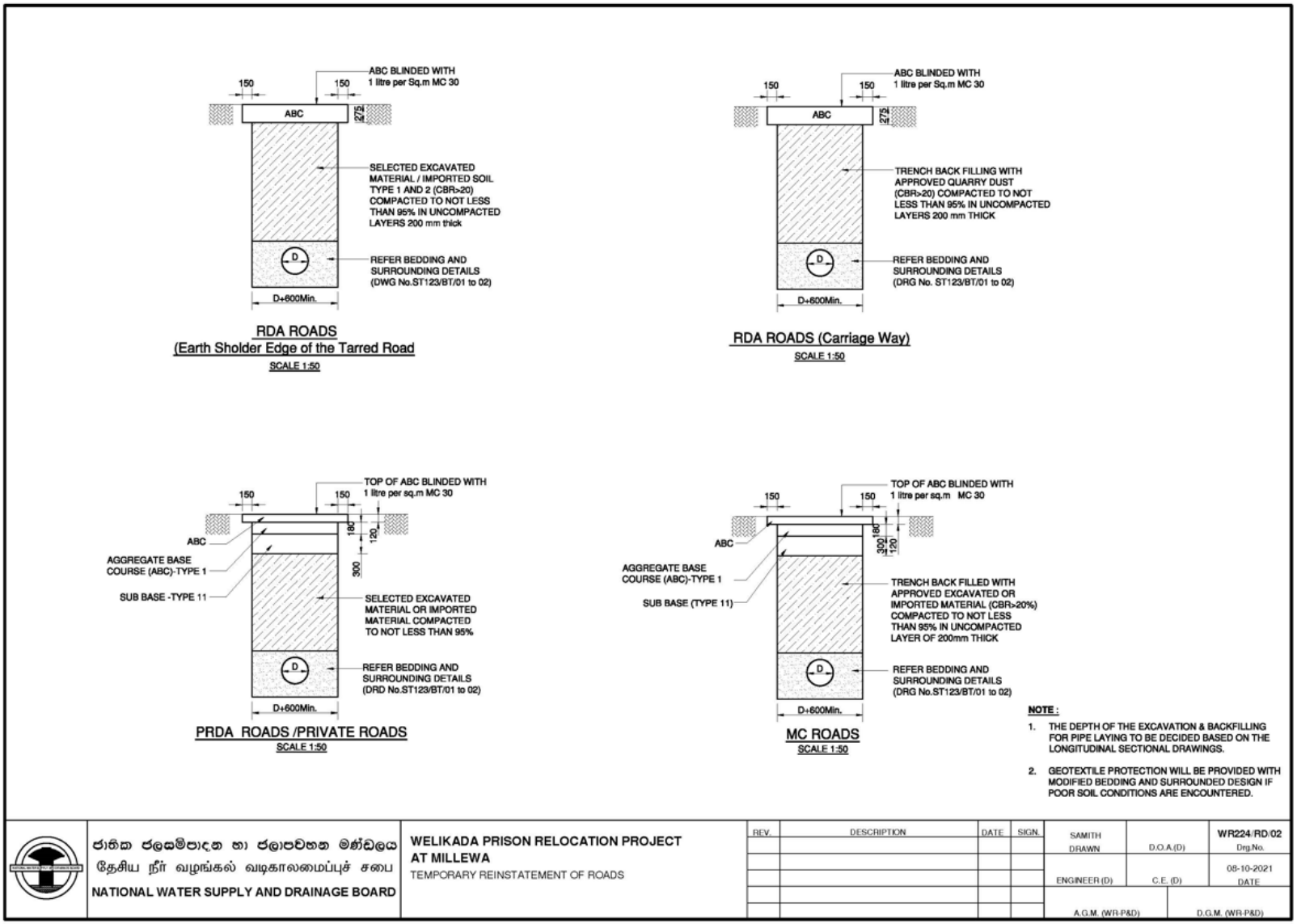


Figure 2.13- Cross Section of the Treated Effluent Discharge Pipeline

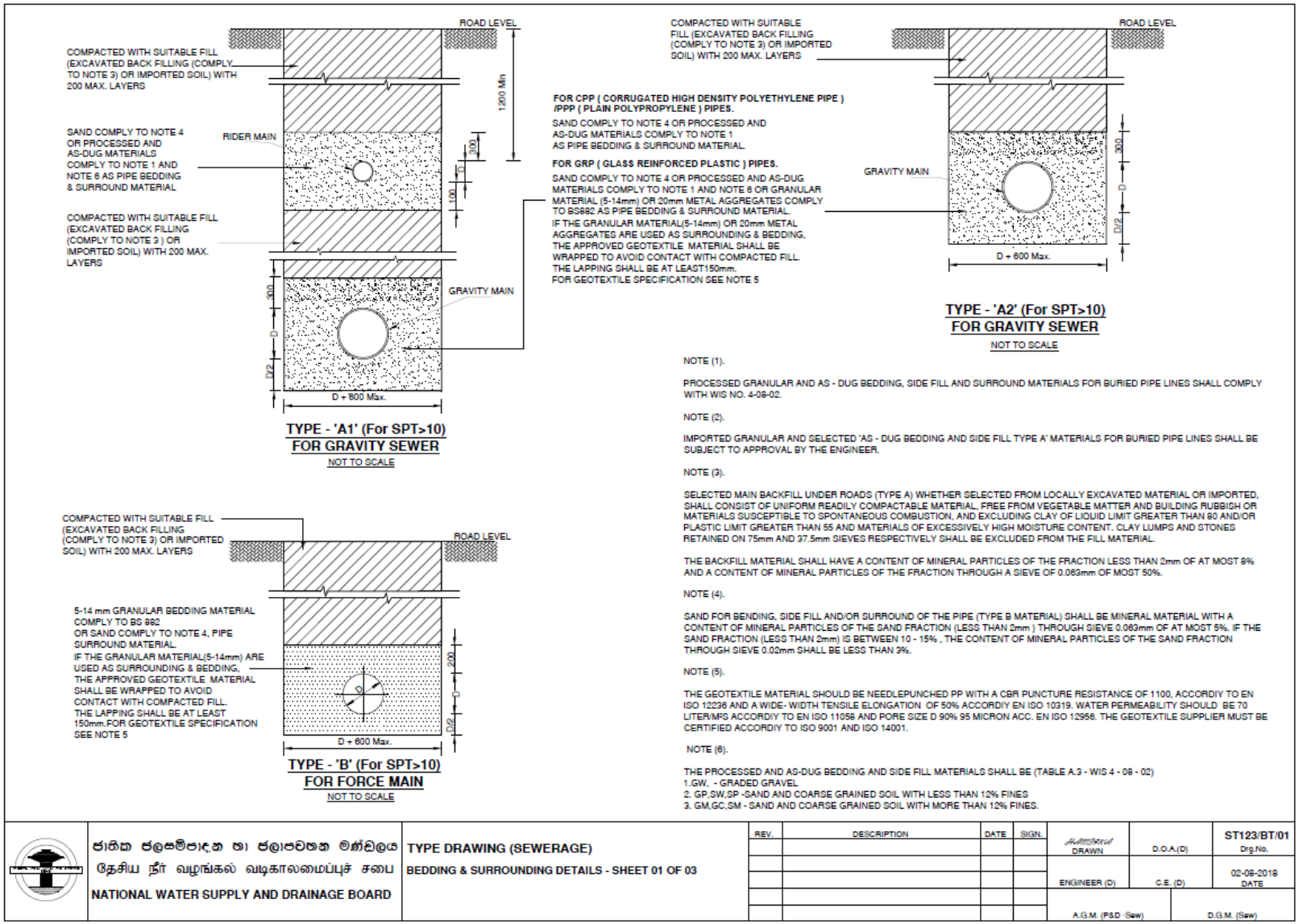


Figure 2.14- The Cross Section of the Sewage Discharge Pipeline

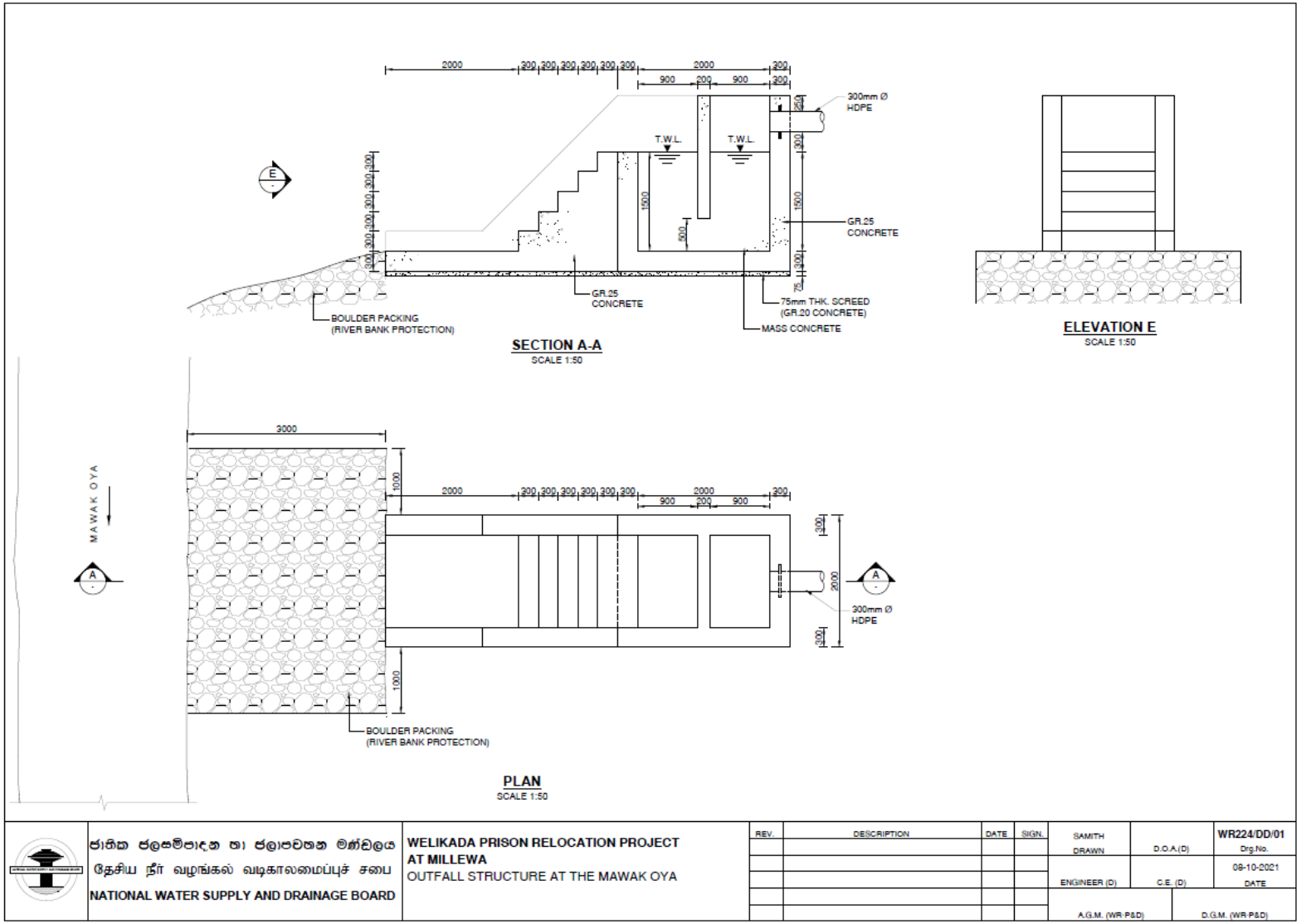


Figure 2.15- Details of the Outfall Structure

Land Use and Ownership of the Pipeline Route

The pipeline route follows the existing estate roads and other public roads. Most of the roads along which the pipeline traverses are internal Pradeesheeya Shabha roads with very low traffic. These roads are internal roads of Millewa Estate, Nakandala Road, Kahawala Yatawathura Road, Kajuwetiya Road and Panangalawatte Muthugala Road. Only Gurugoda Malagala Padukka Road is a B Class RDA Road and about 0.64 km of this road will be intercepted.

The pipeline will be laid along the road shoulder. The typical land use of the pipeline route is given in the photos below.

Photo-Typical Land Use of the Pipeline Route

Photo-Typical Land Use of the Pipeline Route

Photo-Typical Land Use of the Pipeline Route

Photo-Typical Land Use of the Pipeline Route

2.1.9.4 The final point of discharge of treated wastewater.

The disposal location is approximately seven kilometres (7 km) from the proposed MPC, and the disposal location is shown in **Figure 2.16**. Disposal pipes will be laid in trenches with other associated items as air valves—pipe material High-Density Polyethylene (HDPE).

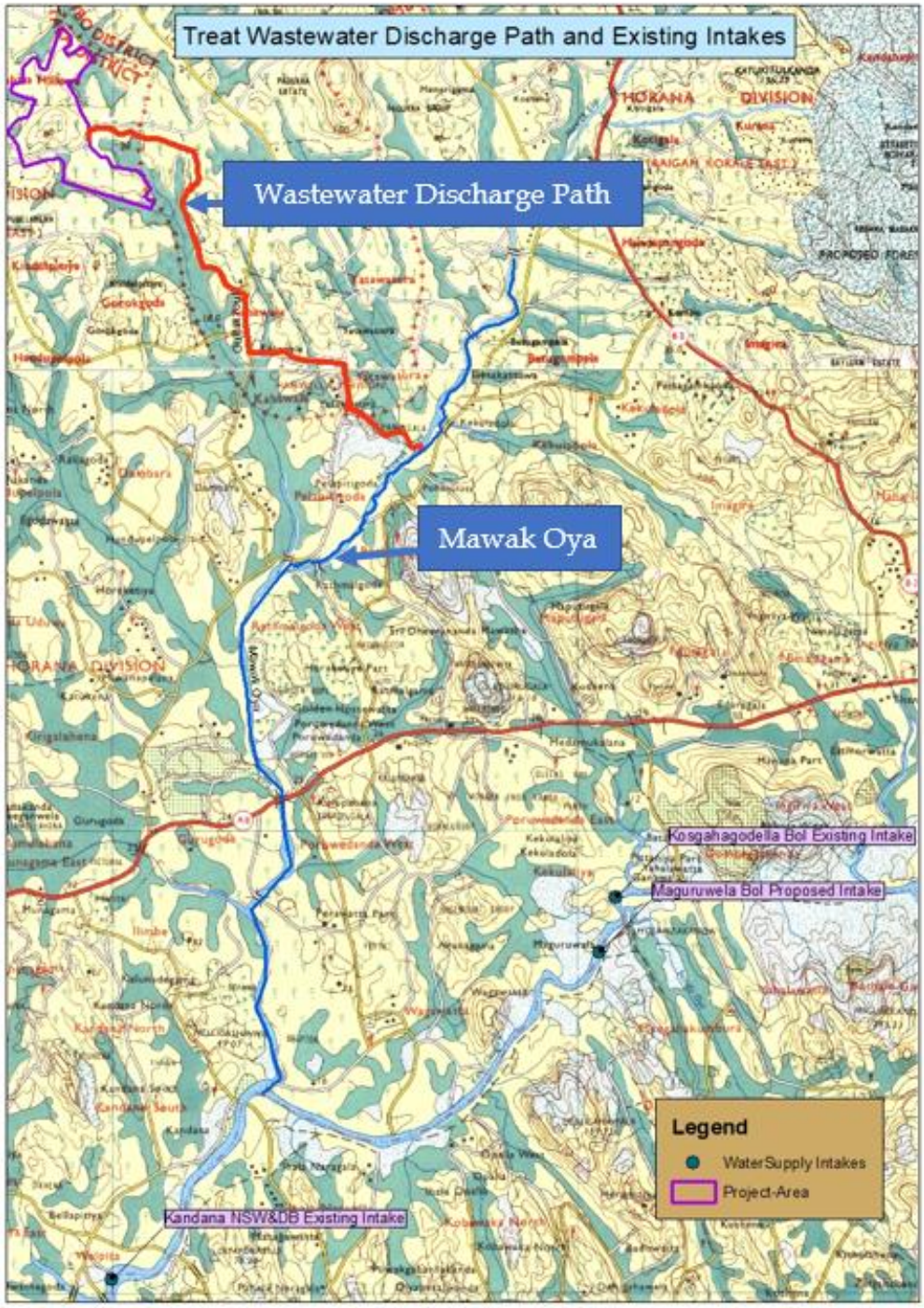


Figure 2.16 - Proposed Treated Effluent Disposal Pipeline Route and Disposal Location

2.1.9.5 Operational and maintenance procedure of the proposed treatment and disposal system

The operational and maintenance procedure are standard operational and maintenance procedures for similar plants. Preventive maintenance is the main type of maintenance.

a) The following are considered the main environmental and social risks associated with the operation of WWTS, including collection network and disposal system. Hence the preventive maintenance procedures will be followed to avoid such risks.

b) Failure of WWTS – Failure of WWTS, particularly the biological system, can happen. In such a situation, discharge through pressure-main will be released untreated or partially treated to the receiving waters causing severe pollution and public health issue. The common reasons for WWTS failure include the following.

i. Operator failure in the proper operation of the plant (due to lack of knowledge and skills)
ii. Poor maintenance of the plant
iii. Equipment failures
iv. Wastewater toxicity (release of toxic waste that interferes with biological processes
v. Wastewater not complying with design loads or characteristics

c) Failure of Pressure-main – Pressure-mains fails due to surge conditions and pipe corrosion. These can be avoided by design (surge protection system) and selection of pipe material. However, if the pressure-main failure occurs, the discharge of treated wastewater to Mawak Oya will be interrupted. Also, the release of treated effluent to the natural environment could happen in an unplanned manner. Therefore, measures are necessary to minimize the risk of pressure-main failure and/or manage the release of wastewater during such a failure.

d) Opposition to Effluent Discharge to Mawak Oya– Social opposition to discharge treated effluent to Mawak Oya could happen at any stage. Such opposition can result from the instigation of the public by interested parties, lack of awareness among the public on legal requirements and assimilation capacity of receiving waters, environmental concerns and opposition to pollution and based on the perception of risk.

2.1.9.6 Alternative ways of disposal of wastewater

The alternative way of operational wastewater disposal considered is emergency storage sumps located at the major prison units emptying them through gully bowsers.

2.1.10 Solid Waste Generation (both during construction and operation stages)

2.1.10.1 Types and quantities of solid wastes generated.

Non-hazardous wastes

Municipal solid wastes (MSW): A major component involves the biodegradable material generated from the kitchens and bakeries including excess or left-over food.

According to the Prison Department, daily quantities of biodegradables given to piggeries from the current prison at Borella are as follows (i.e., for 7688 prisoners and 953 officers) and the records are approximate.

- Welikada - 450 kg
- Colombo Remand Prison (CRP) - 250 kg
- Magazine - 200 kg

Furthermore, the Colombo Municipal Council (CMC) takes away the following quantities of biodegradables.

- Welikada – approx. ½ tractor / per day

- Female Ward -approx. 02 Big Bins /per day (each is 240 l)
- Prison Hospital – approx. 02 sacks /per day
- Colombo Remand -approx. 200Kg /per day
- New Magazine – approx.500 Kg /per week

Additionally, glass, plastic / polythene waste (as packaging material of food items delivered by the contracted suppliers and mineral water bottles, etc) and metal cans (example, canned fish) are generated from the kitchens.

Wastepaper / cardboard material with plastic wastes are generated from the administration units, intelligence unit, staff quarters, kitchens, training centre and other services providing sections and the hospital (wards, office blocks and labs).

Scrap iron and other removed metal wastes are generated from the Prison Vehicle servicing and repairing yard.

Hazardous Wastes

The following categories of hazardous waste are generated from the prison complex.

Hospital

- Biomedical wastes from the hospital (as discussed below)

Prison vehicle repairing and servicing yards

Largely flammable liquid wastes

- Waste oil
- Oil contaminated material (such as filters and cotton / fabric used for spill cleaning, etc)
- empty flammable liquid cans including paint cans, oil cans and pressure cans (example, WD-40 used to lubricate corroded or hard nuts and bolts)

Emergency generator rooms

- Waste oil
- Oil contaminated material (such as filters and cotton / fabric material used for spill cleaning, etc)
- Oil cans

All complexes

- e-wastes such as CFL lamps – cells and other units of the prison complex
- computer parts, CDs, etc from the prison complex (except from the cell blocks)

Quantities of waste oil (containing gear oil, break oil, etc) generated from the prison bus and other prison vehicle serving yards is around 420 litre per month (2 barrels each of 210 litre capacity) for the servicing and repairing of the vehicle fleet shown in **Table 2.10.** Normally, one bus will be serviced per day using 4000 litres of water.

Table 2.10 - Fleet of prison vehicles available for servicing per month

Type of vehicle	Number of vehicles		
	Welikada Prison	New Magazine	Remand Prison
Buses	2	2	22
Double cabs	1	1	1
Van	1	1	1
Ambulance	1		

2.1.10.2 Onsite waste management system including waste separation and storage

Non-hazardous wastes

It is planned to segregate non-hazardous wastes in accordance with the CEA's "Technical Guidelines on Solid Waste Management in Sri Lanka" prepared in 2005. The following colour coded, labelled bins will be used for the following waste categories (where necessary) and will be kept in major waste generating areas like the kitchens, bakeries and offices and staff quarter units.

- Biodegradable material – Green
- Metal wastes (example, tins/cans of food material from the kitchens and scrap iron and metal parts removed from prison vehicles in the vehicle servicing yards) and coconut shells– brown
- Glass – red
- Plastic & Polythene-Orange
- Paper – Blue

Final collection / Storage facilities are allocated as follows.

- Floor area of 1636.2 m^2 – Magazine Prison
- Floor area of 2154.4 m^2 – Welikada Prison
- Floor area of 1137.3m^2 – female prison
- Floor area of 1800.9 m^2 – Remand Prison

Tentative locations for the storage facilities are given in Figure 2.17

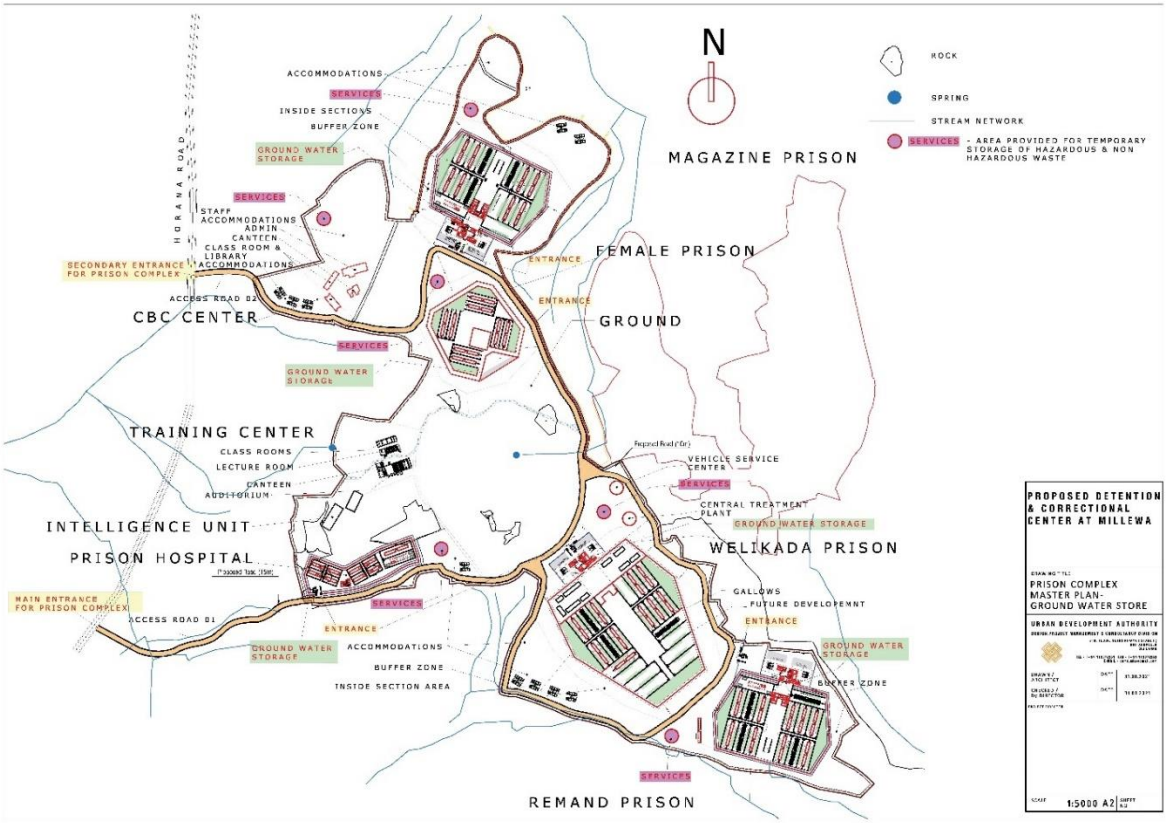


Figure 2.17 – Location for Storage Facilities

Hazardous wastes

At current location of the prison there's no detailed plan for hazardous wastes segregation except for clinical wastes (discussed below). However, this EIAR has developed a detailed plan for hazardous was segregation and is given in Chapter 5.

The waste oil (collected to 210 litre capacity drums) and other wastes generated from the vehicle servicing and repairing yards are kept within the premises itself (inside the office building) until handed to approved parties selected through Government Tendering Procedures.

2.1.10.3 Solid Waste Management Plan approved by the relevant local authority.

It is planned to handover the biodegradables to the Horana PS for their composting activities. It is also planned to hand over the recyclables to the Horana PS. Relevant letter is given in Annex 02.

2.1.10.4 Method of final disposal of solid waste (both during construction and operation)

Disposal Practices – Construction Phase

The construction and demolition (CD) wastes including debris arising from land clearing and excavation works will be dumped at Kerawalapitiya Waste Park of SLLDC (see authorization letter in Annex. 2). It will be the responsibility of the contractor.

Project Proponent will mediate to handover the cut rubber trees to sawmills/carpentry units and for furniture manufacturing enterprises such as the State Timber Corporation of Sri Lanka.

Disposal Practices – Operation Phase

MSW: It is planned to compost the segregated biodegradable wastes for landscaping works and to handover all recyclables to the Horana Pradesheeya Sabah.

Hazardous Wastes

(a) **Flammable liquids and solids:** The following wastes will be disposed as follows (this is also the current practice at the Welikada Prison, Borella, where the authorities are dealing with the CMC in many cases).

- Metal cans containing flammable liquids and pressure cans – handing over to Horana Pradesheeya Sabah
- Plastic cans of flammable liquids, detergents and other chemicals used in vehicle servicing works – handing over to Horana Pradesheeya Sabah
- Cotton / fabric material used in spill clean ups and for other cleaning works – handing over to Horana Pradesheeya Sabah
- Paper and plastic contaminated with oil – handing over to Horana Pradesheeya Sabah
- Waste oil and oil filters – handing over to approved parties selected through Government Tendering procedures

(b) **e-wastes** such as CFL bulbs: handing over to Horana Pradesheeya Sabah

(c) **Clinical Wastes (Biomedical Wastes):** Discussed below.

2.1.10.5 Clinical waste/ hospital waste management

The new hospital will comprise the following units as in the current prison complex at Welikada, Borella.

- Dental clinic
- Digital X-ray room
- Wet laboratory that will undertake blood sample and urine collection for biochemical tests such as glucose levels, sputum collection and analysis, PCR tests for COVID-19 and formulation of medicine. It will comprise a biochemical analyser and a haematological analyser.
- Pharmacy / dispensary (which are also available in each prison cluster)
- Wards
- OPD clinic

There are no chemotherapy and cancer treatment work, operation theatres and labour rooms (i.e., within the female prison complex). It is planned to send the prisoners to the nearest hospitals if there is a necessity for surgery or deliveries.

Sisili Hanaro Encare will be entrusted to collect and destroy infectious wastes, sharps and removed teeth from the dental clinics (see **Table 2.11**), while this firm will be entrusted to supply separate puncture proof boxes and yellow coloured leak/puncture proof plastic bins with bags for the source segregation of infectious wastes and waste sharps, respectively. The said labelled containers for the segregation and collection of waste sharps and infectious wastes will be provided in key areas of waste generation such as wards, OPD clinics, dental clinics, and the wet labs. The said bins will be removed / emptied when 3/4 full and transported using trolleys (as in the Katunayake International airport)[2] to a central collection point to be taken over by Sisili Hanaro Encare (which will be contacted when required).

Table 2.11 summarises the planned disposal system of the different biomedical waste streams.

[2] Same trolleys available at the current prison complex at Welikada, Borella would be used for the new premises

Table 2.11 - Treatment and disposal methods of different types of biomedical wastes

Waste category	Areas of generation	Method of Treatment	Final disposal	Remarks
Waste sharps	Labs, Wards, OPD clinics, dental clinics	-	High temperature incineration by Sisili Hanaro Encare in their facility at the Kerawalapitiya Industrial Estate	-
Infectious wastes		About 8 drops of 5% phenol solution is added to the Sputum cups which are then sealed with the lid for subsequent disposal to a designated Infectious Waste receiving bin		Spills will be cleaned with 1% NaOCl and disposed as infectious wastes
Pathological wastes: blood	Labs	About 20-30 mL of freshly prepared 1% NaOCl solution is added to blood samples in the tubes and kept for 1 hr. Then the oxidized and disinfected blood sample is poured to a container of 5% Lysol (containing quaternary ammonium compounds) and kept for 20 minutes. Thereafter, the Lysol container and the tubes are washed with tap water (with the washings disposed to the sewer) and tubes are reused after drying. Blood and serum samples from the haematological analyser and the biochemical analyser, respectively are washed with 5% Lysol and disposed to the sewer	-	
Pathological wastes: teeth	Dental clinic	Mouth washings are directed to the sewer	High temperature incineration by Sisili Hanaro Encare in their facility at the Kerawalapitiya Industrial Estate	-
Sanitary pads	Female prison	-	Handed over to Pradeshiya Sabah for subsequent disposal	At the present prison complexes, it is given to the CMC

Waste category	Areas of generation	Method of Treatment	Final disposal	Remarks
Expired/outdated pharmaceuticals and medicinal items	Dispensary	-	Handed over to MOH (Gabada Sameekshana Unit) for later disposal	Generally, required quantities are ordered and hardly any expired material gets generated. However, low quality/sub-standard drugs, etc are kept at premises and are not accepted by the MOH
Pressurized containers such as liquid O2	Wards	-	Empty containers will be handed over to the Welikada Stores for subsequent handover to the supplier/s	-

Table 2.12 shows the quantities of infectious wastes and waste sharps handed over to Sisili Hanaro Encare from the current prison complexes in early 2021. It is expected that similar quantities are expected from the hospital of the proposed project.

Table 2.12 - Quantities of infectious wastes and sharps handed over to Sisili Hanaro Encare

Period	Quantity (kg)	Remarks
January 2021	49	180 beds at 100% occupancy with bed capacity > 180 at present
February 2021	38	
March 2021	65	

2.1.10.6 Debris disposal method

The debris will be disposed to the Kerewalapitiya waste site managed by SLLDC. The consent letter by SLLDC is given in Annex 2. The appointed Contractor is expected to manage construction and demolition (CD) wastes including debris arising from land clearing and excavation works.

2.1.10.7 Management of Sludge generated from the WWTP

Although it is the usual practice to use the wasted sludge (after sufficient drying) for landscaping works as a fertilizer cum soil conditioner in this case the sludge will be given to Insee Ecocycle for incineration in the furnace.

2.1.11 Air Emission control

2.1.11.1 Use of generator/boilers or any other machinery

If boiler or generator emissions exist, the main selection criteria should be low emission and high energy efficiency. Depend on the fuel specific factors and technology applied, type of air pollution control systems to be installed to the exhaust stream can be vary. For boilers, fly ash can be collected through mechanical devices such as cyclone separators, fabric filters etc. Depend on the fuel requirement the gaseous emissions can be controlled by the dispersion of pollutants through properly designed stack. Discharge of air pollutants through stack of stationary boiler is regulated by the National Environmental (Stationary Sources Emission Control) Regulations, No. 01 of 2019. Determination of the minimum stack height had been denoted under regulation 11 and the stack height shall not be less than 20m except for the combustion sources with gross heat input less than 0.620 MW. Proper tuning of boiler by adjusting air to fuel ratio can control the pollution load emitted to the environment.

Emissions generated from cook stoves/furnaces should be discharged through a properly designed stack. According to the National Environmental (Stationary Sources Emission Control) Regulations, No. 01 of 2019, (Regulations 3 and Regulation 15) SCHEDULE III, Pollutant Based Standards, PART I, stipulated under Section 32 of National Environment Act, No. 47 of 1980; the emission limit for Total Volatile Organic Compounds (TVOCs) from any non-combustion sources is 10 ppm.

Standard kitchen canopies with grease traps should be installed to remove oil and grease entrained with the cooking fumes. Air pollution control systems such as settling chambers, cyclone separators should be installed depend on the fuel utilized. Proper fresh air supply should be maintained at kitchen area by designing proper system for fresh air distribution.

Proper design, construction, and operation of the sewers, sewage pumping station, equalization tank and sewage treatment plant can do much to reduce and sometimes even eliminate odour annoyance. The introduction of new systems not generating any favourable conditions for gaseous emissions is also possible. Effective emission abatement can mostly be achieved if sanitary and general engineering rules are adhered to strictly.

Managing food waste onsite as per recommended in EIA study should be strictly followed to eliminate or reduce the odorous emissions. Composting the biodegradable part of the food waste is a means of managing the malodour as well as can beneficially use as a bio fertilizer.

More details are Presented in the air quality report prepared by the Industrial Technology Institute ITI. Please see Annex 07.

2.1.11.2 Emission management /control facilities

Emissions generated through the activities of workshop can be managed by developing specific controls. The areas to be separated for wood working, repairing, recycling and general workshop activities. Particulate emissions from specific operations should be controlled by installing proper air pollution control systems such as cyclone separators, fabric filters etc. emission of solvents should be minimized by practising proper handling practices such as closing the containers at every time, storing at separate enclosed area, etc. Emissions caused by spraying chemicals should be controlled through installing specific booth systems and proper ventilation systems. Activities discharging heavy metals with gaseous pollutants should be avoided.

2.1.12 Work Force

Availability of skilled labour

The project developer can find persons from the group presently under employed from 628C Pahala Millewa North GN divisions for employments if they need during construction and operation phases of the project. Since the project intends to shift its operations from Welikada to the new site there will be no significant need for new employment. But construction phase will require persons to be employed from the local area. There are about 204 GCE (O/L) failed and 83 (A/L) failed persons in 628C Pahala Millewa North GN divisions area who can be employed as unskilled labourers in the construction sites. At the same time according to the data in GND there are about 16 graduates expecting employment in the GN area. They may also be available for suitable employment if needed in the project during its construction and operation phases. It was also reported that 13 youths with acquired skills such as masonry, carpentry, and motor mechanism are available in the GND. They also may be willing to work in the project. However, the project developer will make purposive attempts to motivate construction contractors to give priority for the unemployed community members in 628C Pahala Millewa North GN divisions for employment.

2.1.13 Aesthetic and Visual environment

Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site.

The Client has not prepared a landscape plan for the project yet. However, the following factors are being considered for the proposed landscape plan:

- Within prison area up to the inner fence no tall trees will be planted, due to security reasons.
- From the outer fence up to the road which is a buffer zone medium to tall trees will be planted.
- Rubber trees will be replaced with indigenous plants of economic and aesthetic value.
- Priority will be placed on agriculture output of which would be used for inhouse consumption.

(ii) The height of the proposed tallest structures

Due to security reasons the project will not consist of any high-rise structures. It has accommodated only single and two storied buildings. The height of the tallest structure is 8.5 meters from the existing ground level.

(iii) Whether the view in the immediate vicinity would be altered, impaired, or obstructed because of the proposed structures.

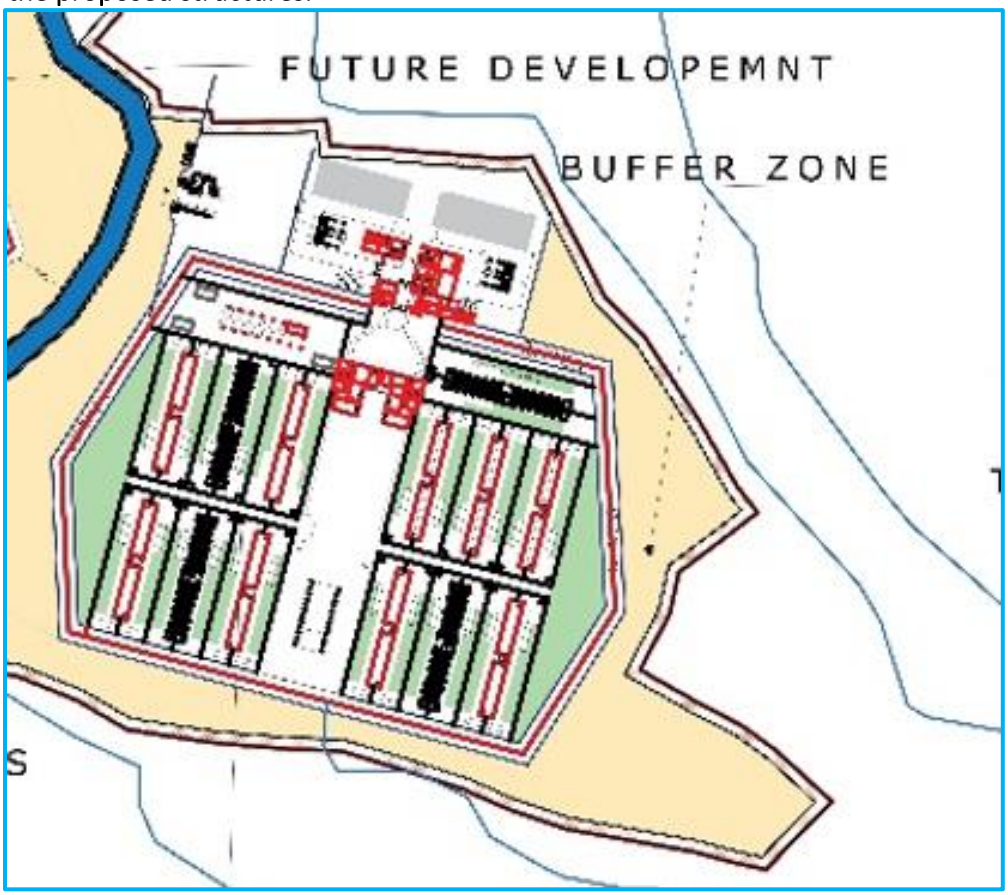


Figure 2.18- Magazine Prison Section - Buffer Zone

The buildings of the proposed project, due to its low-rise nature will not have a significant visual impact on the built and natural environment in the study area. Further, the hard surface areas in the project site consisting of buildings, and tarmac areas will be limited to approximately 25%. The balance 75% will consist of green areas. 6-meter-high security wall around the prisons will create negative impacts. However, such negative impacts could be mitigated by planting medium and large size trees in the buffer zone. The average width of the buffer zone is 25 meters and therefore is wide enough to maintain an effective green zone to mitigate such potential impacts.

2.1.14 Drainage Management

2.1.14.1 The approved Drainage Management Plan in and around the site.

The drainage management plan has been prepared by Sri Lanka Land Reclamation and development corporation which is presented in **Figure 2.19.**

2.1.15 Future maintenance and management procedures

2.1.15.1 General

Future maintenance and management procedures are necessary for the.

1. Wastewater water treatment plant for liquid waste
2. Solid waste (i.e., domestic solid waste, recyclable waste, and clinical waste from the prison hospital)
3. Safety systems such as firefighting equipment
4. Proposed composting plant.
5. Vehicle service centres
6. Stormwater drainage system

Solid waste management (i.e., domestic solid waste, recyclable waste, and clinical waste from the prison hospital).

Prisoners will be employed to remove and transfer the bins/containers and bags of infectious wastes to the storages after in-situ segregation by the hospital staff.

Prisoners will also be employed to transfer the segregated biodegradables and recyclables to the storage areas for subsequent collection by the Horana PS and maintain the storages. They will also be used to wash the garbage bins (biodegradables and recyclables).

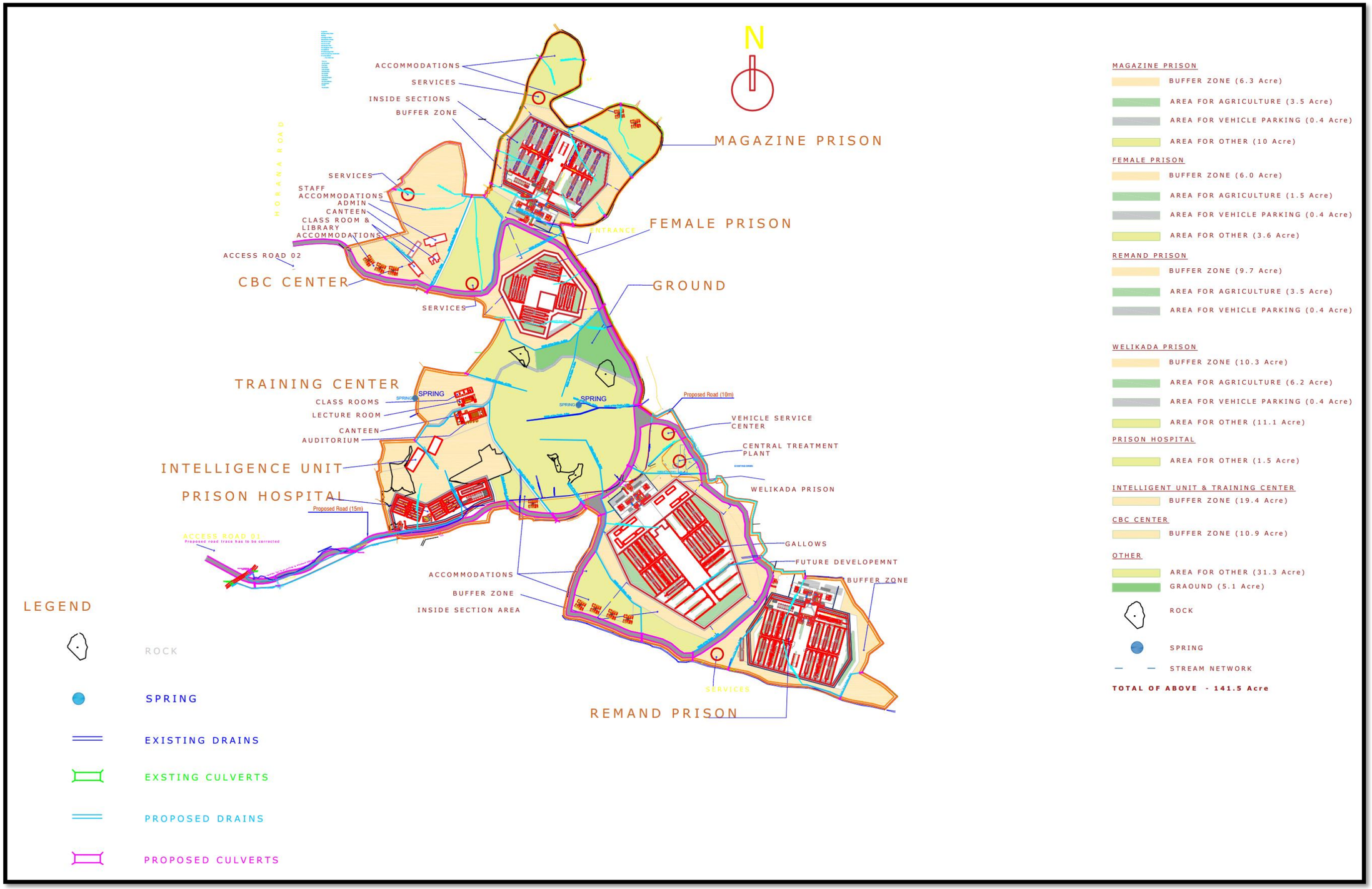


Figure 2.19 - Drainage Management Plan by SLLDC

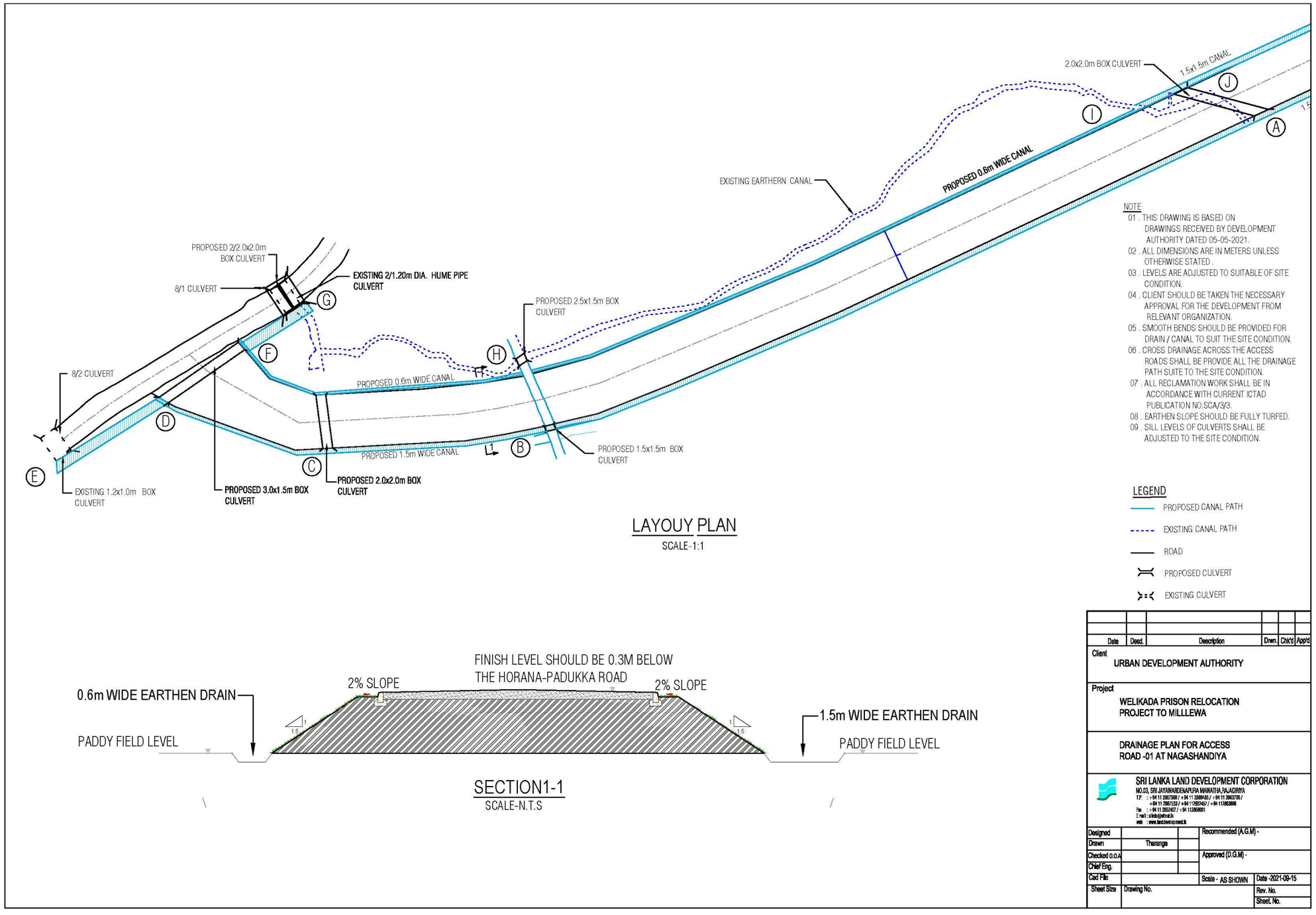


Figure 2.20- Detailed Drainage Plan for the Proposed Access Road

2.1.15.2 Stormwater Drainage System

The stormwater drainage system consists of drains and culverts. These drains will consist of silt traps. These drains a, silt traps culverts will be periodically cleared and desilted.

2.1.16 Future expansions

The site has been planned to occupy everything needed for the Remand Prison, Magazine Prison, Female Prison, Welikada Prison etc. along with other appurtenant infrastructure such as the service areas, prison hospitals etc. Hence there will not be any future expansions.

2.1.17 Evaluation of Alternatives

2.1.17.1 No action alternative (to demonstrate environmental conditions without project)

The no action alternative has two parts:

1. Removal of the Welikada Prison from the Present Site
2. Reestablishment of the prison at the new site at Millewa with enhanced facilities

Removal of the Welikada Prison from the Present Site

Part 1 of the "No action Alternative" will not be a viable alternative as the present Welikada Prison is very old and cannot occupy a facilitate many prisoners. Also, the present Welikada prison is placed in a commercially high value land which could have been used for an economically beneficial purpose.

Reestablishment of the prison at the new site at Millewa with enhanced facilities

If the proposed prison is not established at Millewa site, the site will remain as a semi productive rubber plantation, and it will not have a prison with enhanced facilities. Since the site has been acquired by the UDA for the establishment of different ventures the site cannot stay anyway under the present state. Hence the establishment of the prison with enhanced facilities not totally unjustifiable. Also, this construction will be done as a national project according to a policy decision by the Government.

Because of the reasons given above the no action alternative is not the best alternative.

2.1.17.2 Site alternatives

Two site alternatives have been considered. One site is at SoranaWatta Horana, and the other site is at Kaluthara Millaniya . The alternative sites with the selected alternative are presented in **Figure 2.21 to Figure 2.23.**

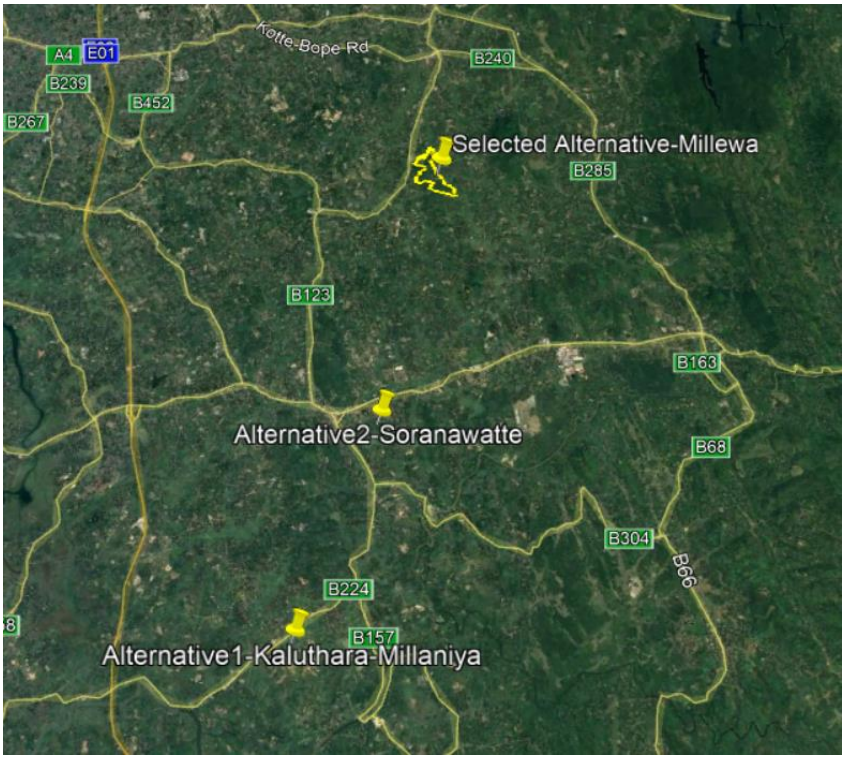


Figure 2.21 – Alternative sites and the selected alternative

Figure 2.22 -Alternative Site 1 -Kaluthara Milleniya

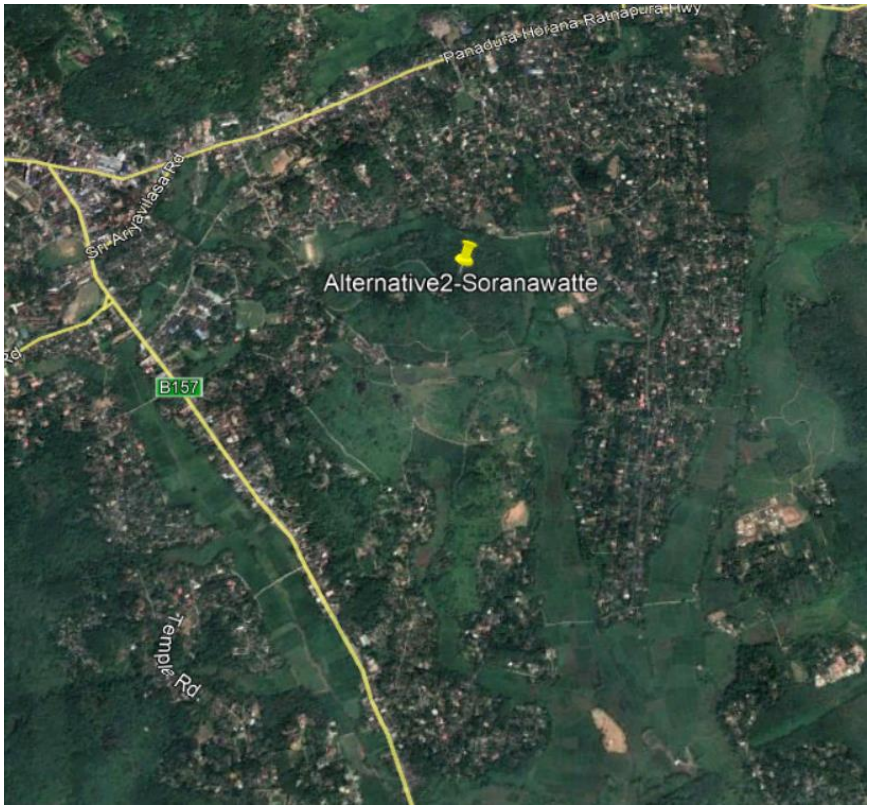


Figure 2.23 - Alternative Site 2 -SoranaWatta Horana

2.1.17.3 Design and technology section

Layout plans have been decided to best suit the site conditions and the layouts will be further adjusted according to the findings of the EIA. The alternative of making the site flat for each major prison was considered but that alternative is not viable as the site consists of rock and the terrain is sloping. Hence the best design alternative is to adjust the layout and the building elevations to suit the terrain.

2.1.17.4 Construction techniques and phasing

Various construction technologies will be considered once the layout drawings are finalized. The construction will be carried out by the contractors and such contractors are allowed to follow the best construction technique based on the site conditions, time availability and the possession of special construction equipment. Work phasing alternatives also be decided through project management activities considering the nature of work.

2.1.17.5 Reasons for selecting the present site

The Alternative 1 - Milleniya Site and a access are is subjected to flooding and there are populated villages around. Also, this site does not have the required area to house the necessary infrastructure and other services. This site is too far from Colombo to timely transport of prisoners to produce to the courts in Colombo.

In case of the alternative 2-SoranaWatta site too there were populated villages around the site. It is also difficult to provide dedicated short access road without disturbing the houses and the environment.

The present site has a medium distance to Colombo. It has adequate areas to place all necessary infrastructure and services. More importantly the site could be accessed through a very short, dedicated access road and since the site is a portion of the UDA acquired land the impact on the surrounding community is relatively less.

Figure 2.24 - The Selected Alternative Site

2.1.17.6 Alternative Blasting Methods

Conventional method using explosive and detonators.

Rock excavation is an essential phase in mining and civil engineering projects; it can be defined as the process of removing hard rock by using conventional or alternative blasting method

The conventional blasting rock excavation method is the main means of rock breakage because of its high productivity, and it is relatively inexpensive compared to other methods. However, it raises safety concerns and can negatively impact the environment. The major disturbances that may be induced by this method include fly-rock, gas emissions, and vibrations.

Non-explosive alternative methods to conventional rock blasting

There are some nonexplosive rock breakage methods, particularly the hydraulic splitter and expansive chemical agents, that can be employed instead of the conventional blasting method. Hard rock breaking can be executed effectively and safely using alternative methods, which have a wide range of advantages, including safe operation, ease of use, and environmental friendliness, over conventional explosive methods. Despite the accelerating progress in the mining industry as well as other related industries, conventional drilling and blasting remain the preferred options for rock breakage. Compared to other methods, conventional drilling and blasting provide more realistic solutions to the two most important mining issues, i.e., mining cost and production efficiency. However, there are certain direct negative impacts that can arise when using these conventional methods for rock breakage.

Expansive chemical agents' method

Expansive chemical agents are nonexplosive agents that offer many advantages when used in mining and civil projects for rock breakage. Compared to conventional explosives, they are much safer, producing lower levels of noise, vibrations, and fly-rock. Furthermore, expansive chemical agents can be applied without any restrictions, unlike explosives that are subject to strict regulations. Additional information on blasting methods is presented in Annex 16.

3 CHAPTER 3: DESCRIPTION OF THE EXISTING ENVIRONMENT OF THE STUDY AREA

3.1 Topography

Topography of the area is hill tops with low to moderately steep denudational slopes. Due to presence of shallow rock beds, with the geological structural features, typically can form scarp slopes having higher gradient slopes, but in this site area, that was not observed, except some escarpments in bed rocks. Majority of slopes are from 0-20 degrees and that occupy about 72 % of total land area. Table 1 shows the distribution of slopes in the site area (**Figure 3.1, Plate 3-1 and Table 3.1**). Slopes, over 30 degrees are generally susceptible for landslides if other factors are fulfilled. In this site slopes over 30 degrees area 0.53 % of total land areas (0.5 ha). Area of rock exposures 3.3 ha or 3.24 % of total area was not considered for slope calculation due to lack of elevation data (Contours are not continuing through the rock exposures).

Topographical ground profiles in **Figure 3.2** and section locations in Figure 5 indicate feasibility of construction of proposed buildings / structures with minimum disturbances to the natural slopes. Although, there may face to some difficulty to construct building in Section AB, as that is too close to a rock escarpment.

The area is having a dendritic stream network, that controlled by geological structures and ground water level of site area varies from surface level to 1-1.5m below the surface. There are two springs located within the site area (Plate 3-2). Remand prison building is proposed to be constructed covering the spring 1 and that will be problematic. In one hand that will be adversely affect to the slope stability and on the other hand that will be environmentally affect to the dry up the stream and pond associated with this spring. Therefore, the shifting of this structure to another place is more worthwhile.

Table 3.1 - Distribution of slope classes in the study area

slope class	Area (sq.m)	Area %
0-10 deg	758986.4	72.71
11-20 deg	179029.3	17.15
21-30 deg	66010.31	6.32
31-40 deg	5529.53	0.53
above 40 deg	243.28	0.02
Rock Exp.	33780.41	3.24

Plate 3-1 Rock exposures and general slope of the site

Plate 3-2 Spring 1 and small tank in the proposed Remand Prison area (left). Spring 2 at the west of site (Right)

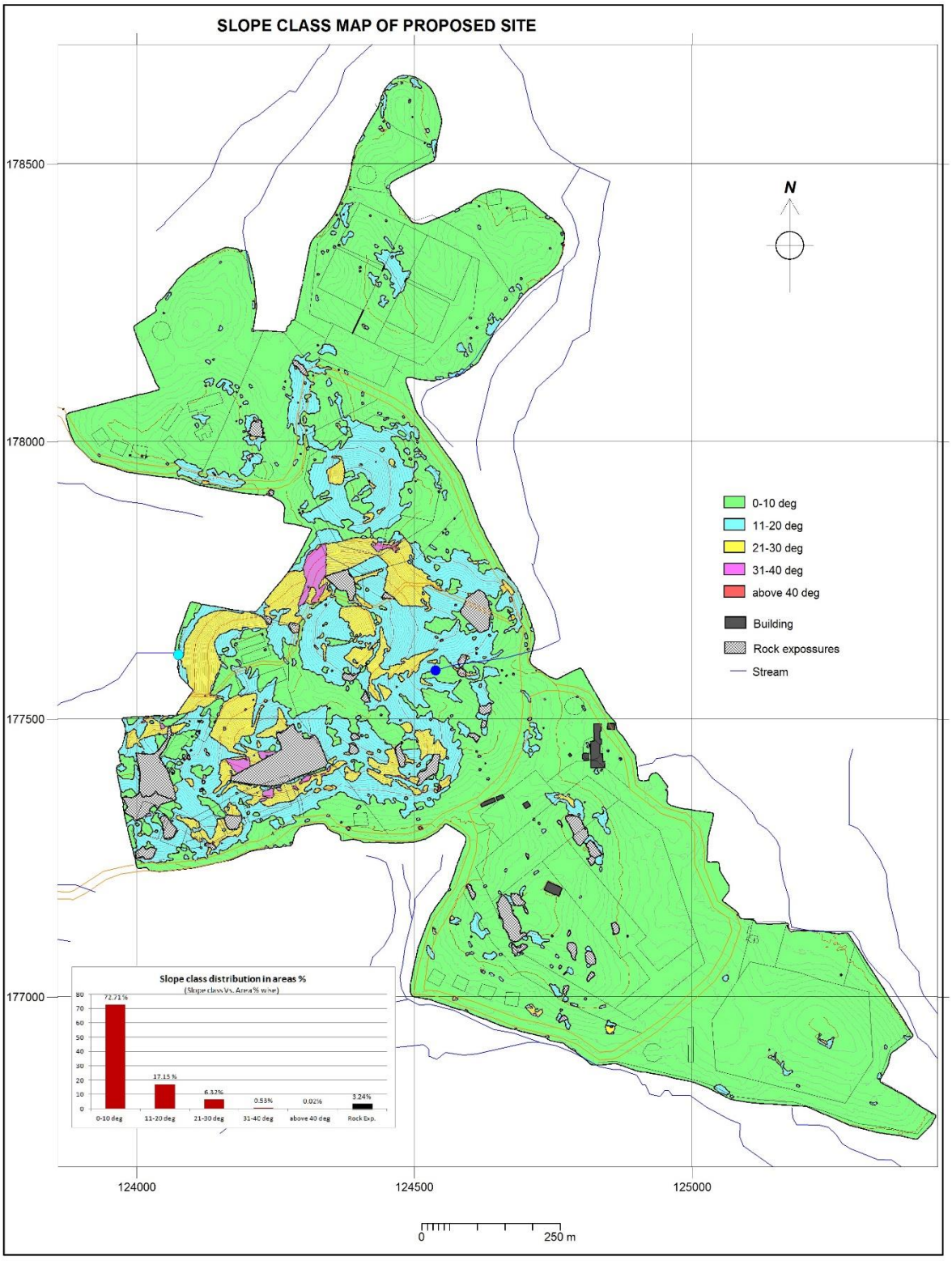


Figure 3.1 - Slope category map of proposed site area

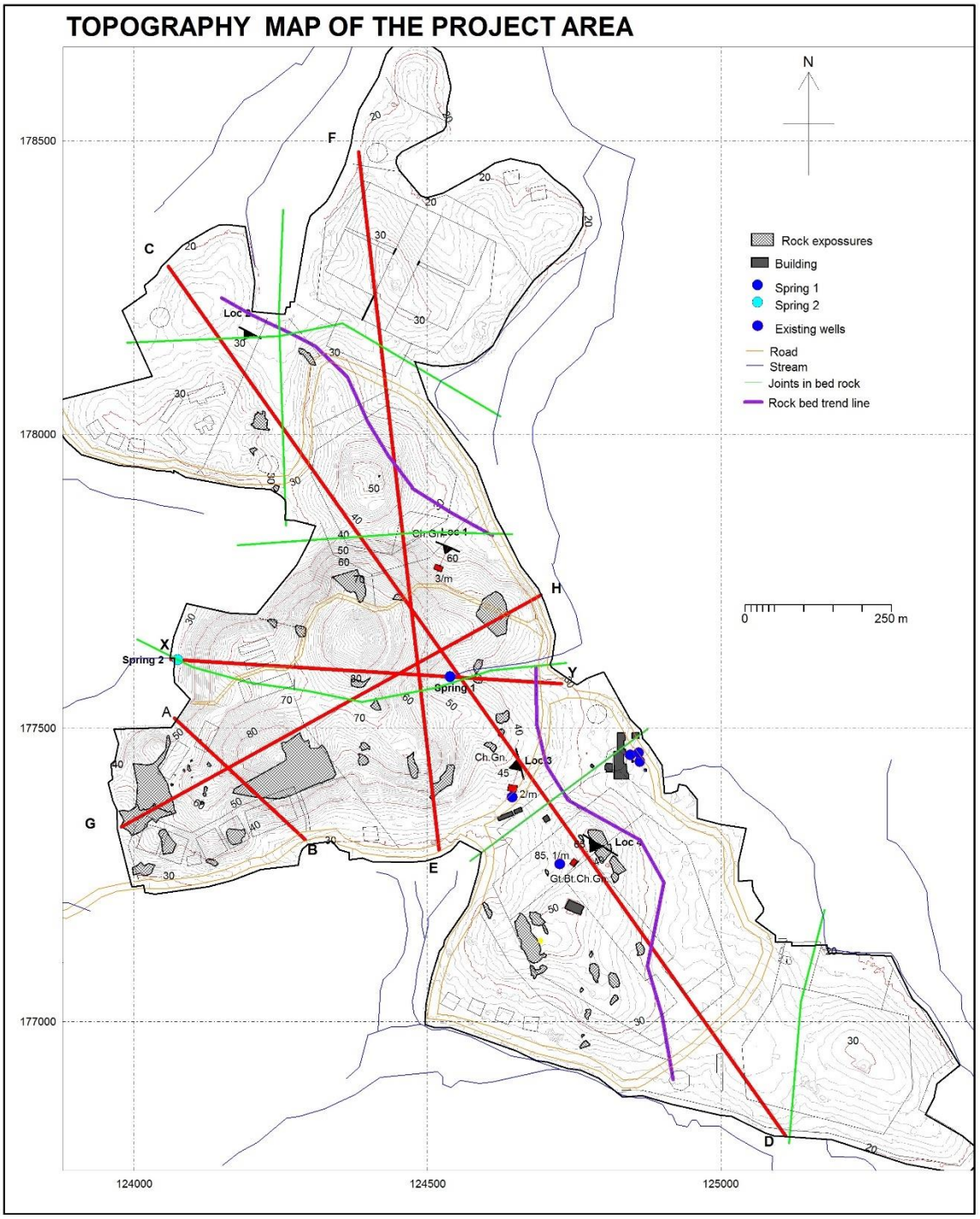


Figure 3.2 Topography, Local geology, topographic sections, waterways, wells and springs of site area

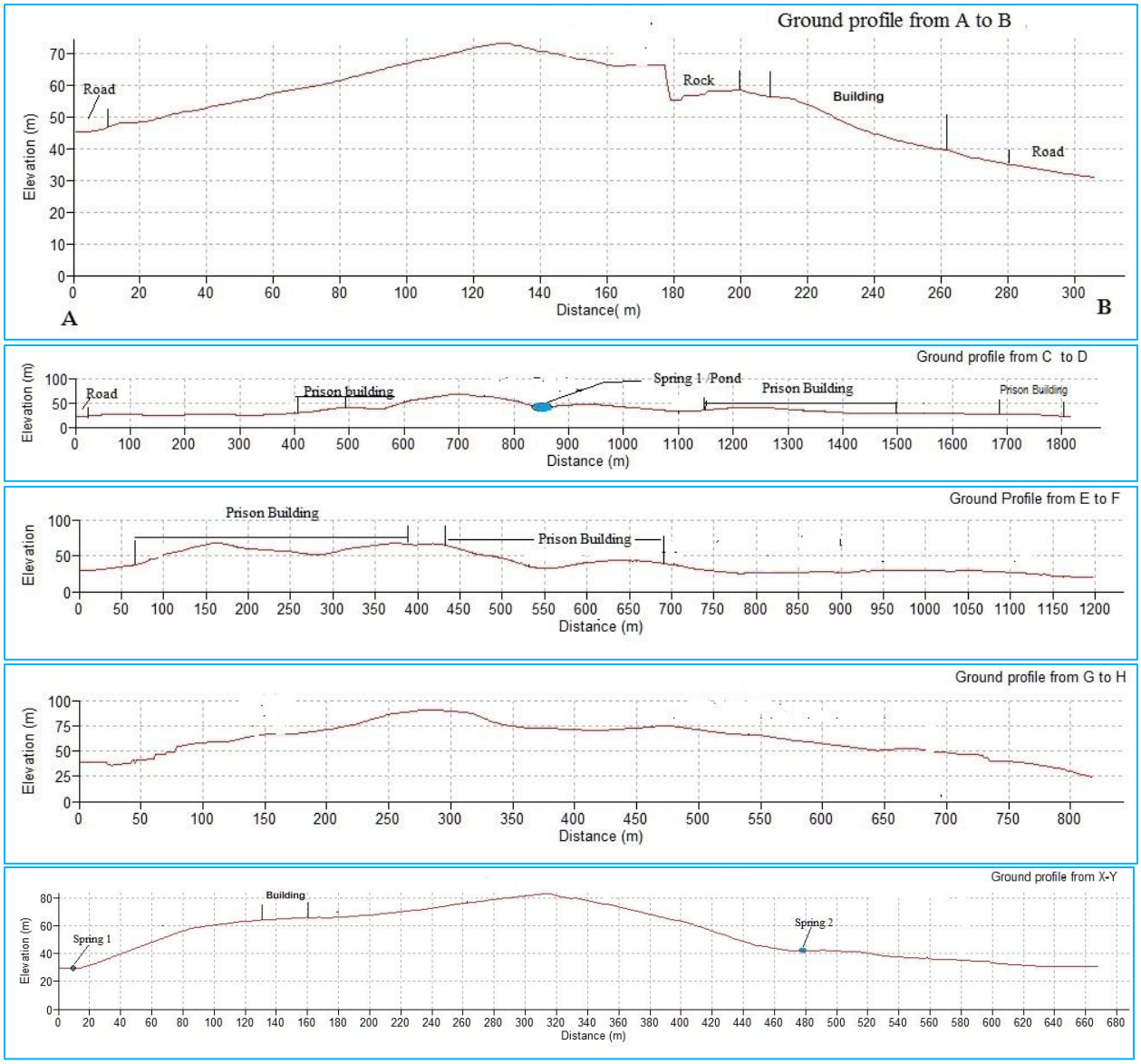


Figure 3.3 - Topographic ground profiles of site area with proposed building boundaries and springs

3.2 Geology and soil characteristics

3.2.1 Geologic characteristics of the project site and the study area

3.2.1.1 Regional Geology

Geologically, the study area lies on the Highland series of Sri Lanka and high-grade metamorphic rocks exist in this geological formation. Figure 3.4 shows the regional geology around the site and the study area. The site area consists of Granitic gneiss, Calc gneiss, Undifferentiated Charnockitic gneiss and Charnockite. All these rock beds extend from Southeast to Northwest with many geological structures. Generally rock beds dip towards Southwest with around 60 degrees. Structurally, the study area has a very complex geological setting. An antiform axis that runs from Southeast to Northwest is present at the West of study area. Another antiform axis exist East to the site, which is not running through the study area. A thrust zone is located East to the study area and a graphite deposit is in this thrust

zone in the Southeast. Apart from those, some faults also can be seen at the East (**Figure 3.4 and Figure 3.5**) Major lineaments are running from Southwest to Northeast direction.

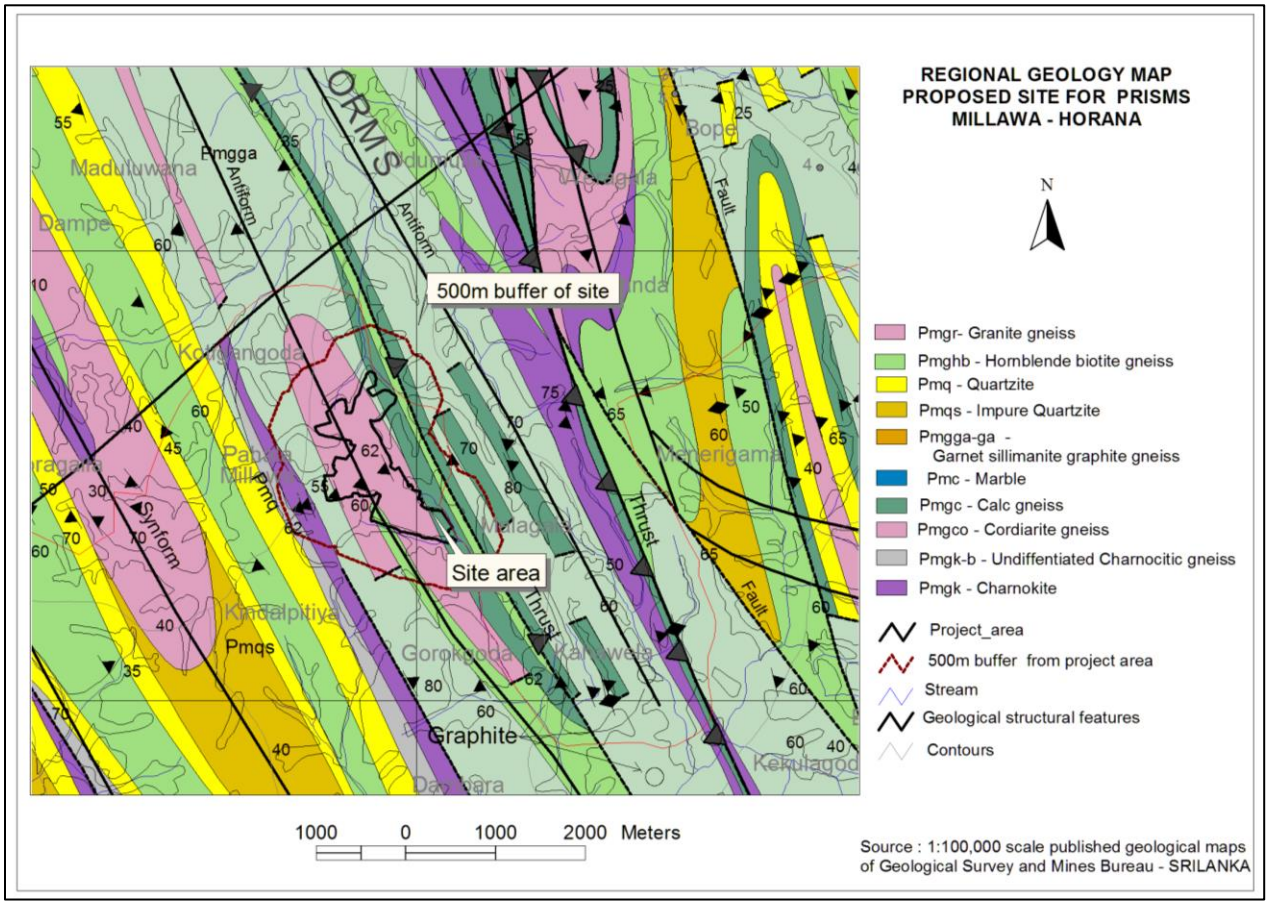


Figure 3.4 - Regional geology around proposed site

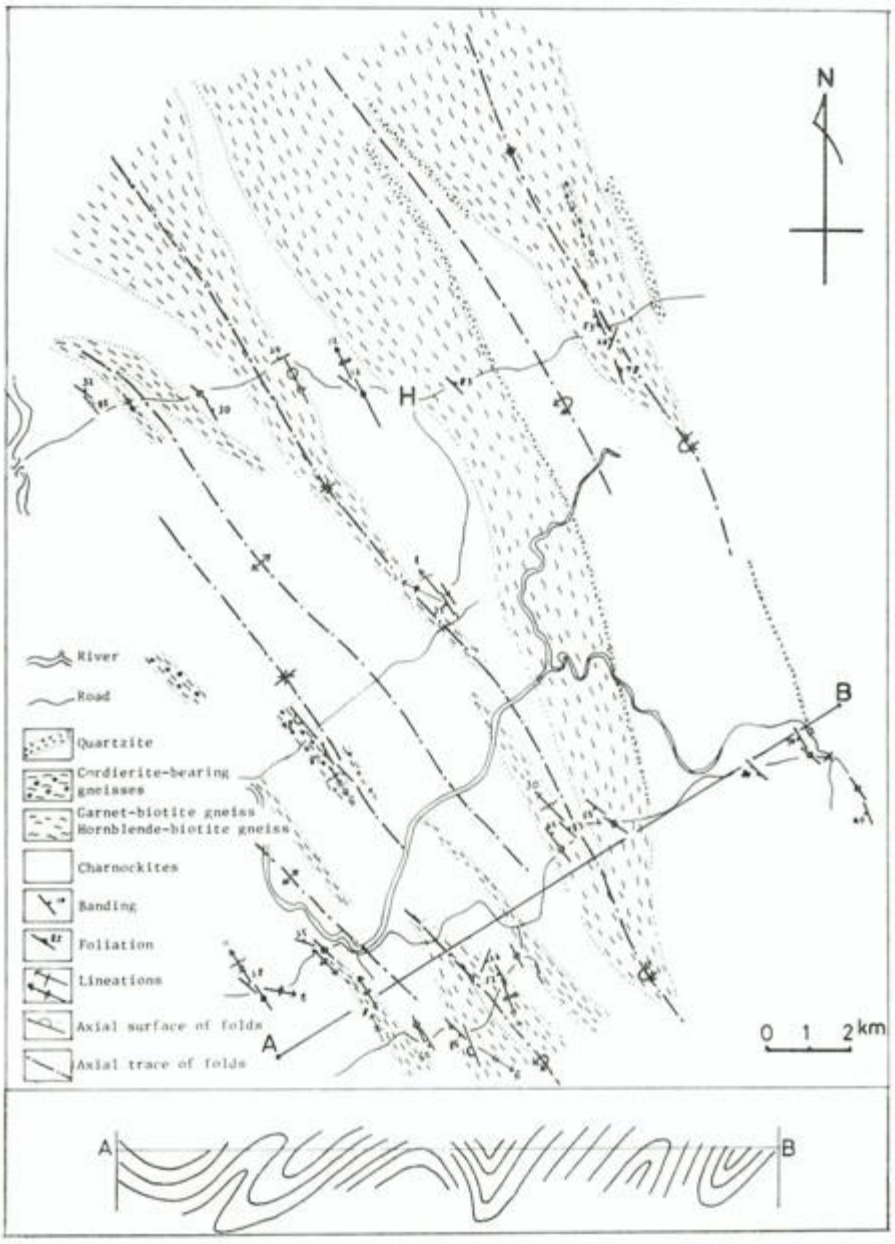


Figure 3.5 - Generalized geology map and geological section from Southwest to Northeast of Horana area

(*Masary Yoshida, K.V. Wilbert Kehelpannala, Yoshikuni Hiroi and Pidasa W. Witanage; Sequence of Deformation and Metamorphism of Granulites of Srilanka, Journal of Geosciences, Osaka City University, Vol.33, Art 3,p 69-107, March, 1990.)*

3.2.1.2 Geology of the Project Site

As stated earlier, the site area consists of Granitic gneiss with some amount of Garnet minerals. Number of rock exposures observed within the site area (**Figure 3.5**), shows a thin overburden around 1 - 1.5 m (**Plate 3.3**). Strike and dip of rock beds observed are generally to Northwest – Southeast and Southwest respectively. Due to the presence of a number of folds, faults and other structural features, those strike and dip directions are changing. Strike of rock beds vary from 290 - 430 degrees from

North and the dipping angle vary from 45-65 degrees and directed towards the Southwest direction. (see Figure 3.5).

Plate 3-3 Granitic gneiss rock exposures at the site area

A common joint system is observed, and that is almost perpendicular to the strike direction with intensity of 1-2/m. Almost all the cross valleys have been developed along this joint system. Other prominent valleys from Southeast to Northwest are strike valleys and those may form along weak rock beds or contact zones. There are two significant springs which were observed along a prominent joint system, and those joints continue to a long distance and they are open. All those valleys are structurally controlled due to the high level of folding, fault, antiforms, synforms, trust etc. With these structural phenomena, there is a possibility of the existence mineral deposits in the area.

3.2.2 Type of soil and its main characteristics

According to the agricultural classification of soil in regional scale, the site area having a red, yellow podzolic soil with laterite. These soils are in-situ formation from rock beds due to weathering. Surrounding area, especially along valleys, Alluvium stiff, brown organic matters rich paddy clays exist (Figure 3.6). The site area has lateritic soil up to a depth of 1-1.5 m in most of low gradient slopes. According to the engineering classification these are yellowish brown, Silty sand and less susceptible for erosion also less problematic for construction of buildings and structures due to having a good bearing capacity. In most of the road cuts it was observed that, soil is located on top of laterite which derived from the parent rocks. The formation of laterite is basically due to the fluctuation of ground water level for a long period of time (Plate 3-4)

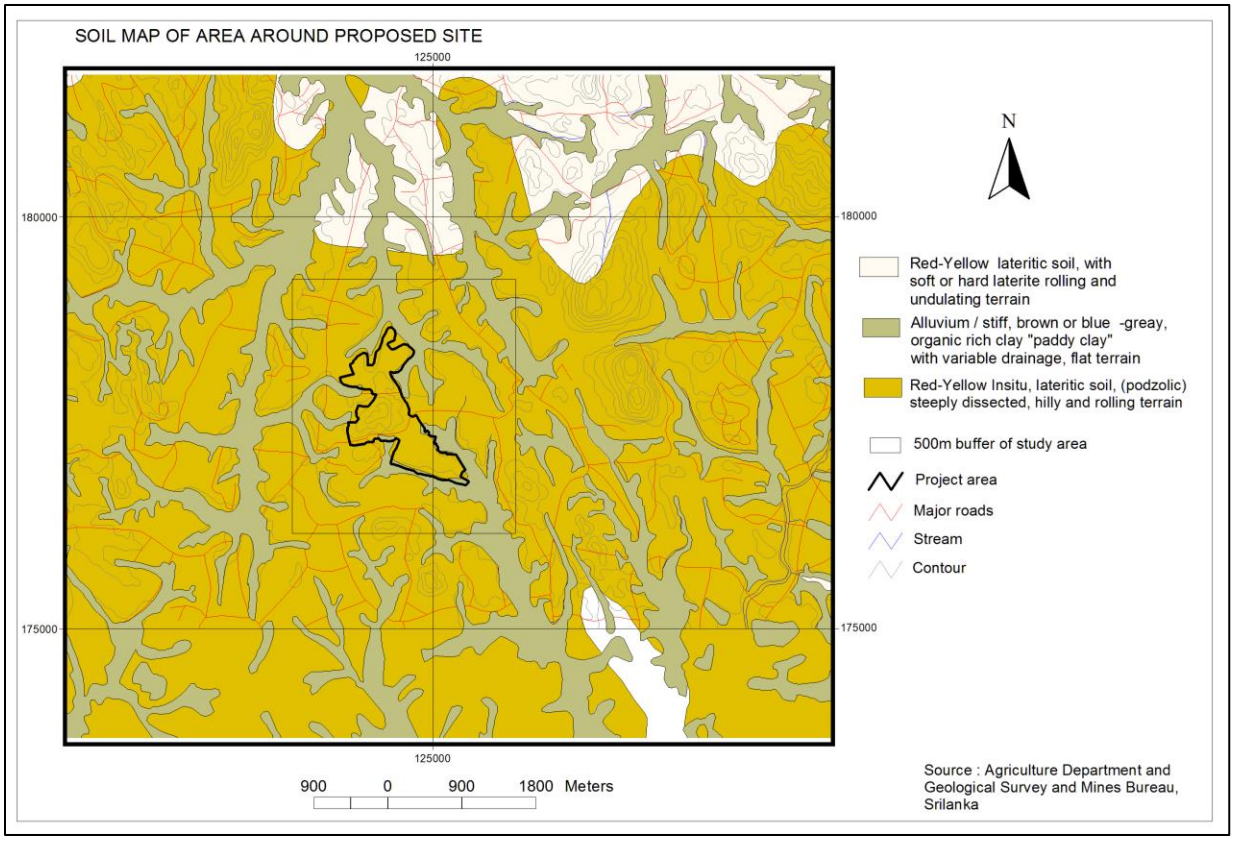


Figure 3.6 - Regional soil distribution of study area

Plate 3-4 Residual Lateritic soil in the area

3.2.3 Susceptibility to Erosion

According to the regional scale this area is less susceptible for soil erosion due to the nature of soil type, slope gradient, land use and lack of thick overburden. Soil erosion hazard is presented in **Figure 3.7** and the levels of hazards is quantitatively illustrated in **Table 3.2**, according to that, the site area and its surrounding are at a level of low to moderate class. Main factors / data layers used to evaluate the erosion hazard levels are, (a) Digital elevation model, (b). Rainfall, (c) Soil types, (d) Land use and

land cover, (e) Watershed and (f) *C –crop-* and P-*management- factors* (*M.J.P.T.M. Jayasekara, H.K. Kadupitiya and U.W.A. Vitharana , Mapping of Soil Erosion Hazard Zones of Sri Lanka, Tropical Agricultural Research Vol. 29 (2): 135 – 146 (2018*).

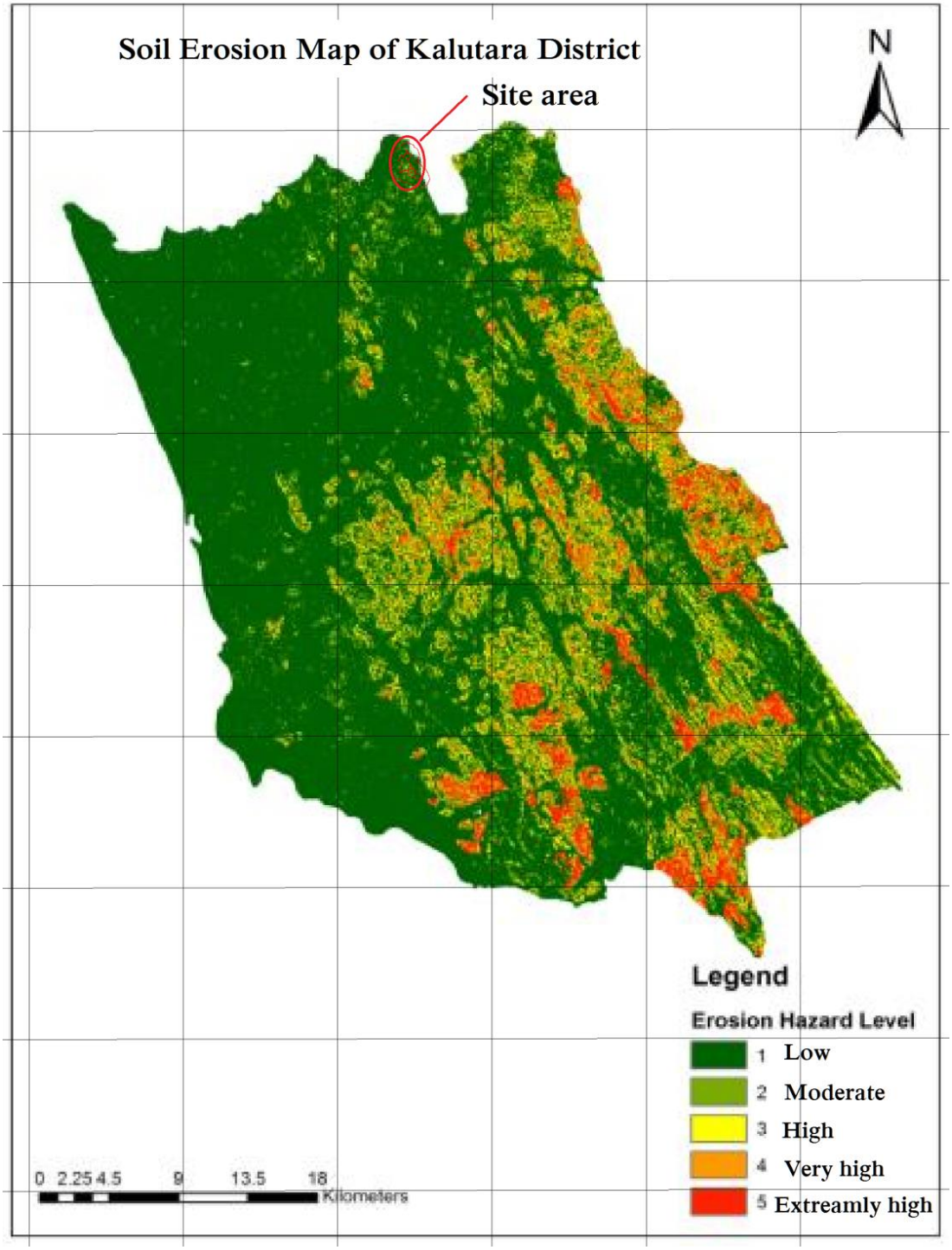


Figure 3.7 - Soil erosion susceptibility of study area in Kalutara district

Table 3.2 - Erosion Hazard levels (Senanayake et al, 2013)

Erosion Hazard level	Average annual soil loss (t/ha/yr)
Low	0-5
Moderate	5-12
high	12-25
Very high	25-60
Extremely high	>60

The hazard level of soil erosion can be changed with the changing of land use practices, especially disturbing of soil by uprooting of trees, construction of roads, blocking or changing of natural waterways etc. Therefore, up to some extent soil erosion can be expected with the proposed construction activities. Therefore, appropriate measures need to be adopting to minimize the soil erosion with construction.

3.2.4 Geohazards of the Project Area and Stability Issues

Although the site area is mostly a flat terrain (**Figure 3.7**), there are some slopes, those may be vulnerable for slope failures or landslides according to the published (1:50,000 scale) landslide hazard zonation map of Kaluthara district by National Building Research Organization at a scale of 1:50,000. The site area lies to category named "landslides can be expected" and "modest level of landslide hazard" in that zonation map (**Figure 3.8**).

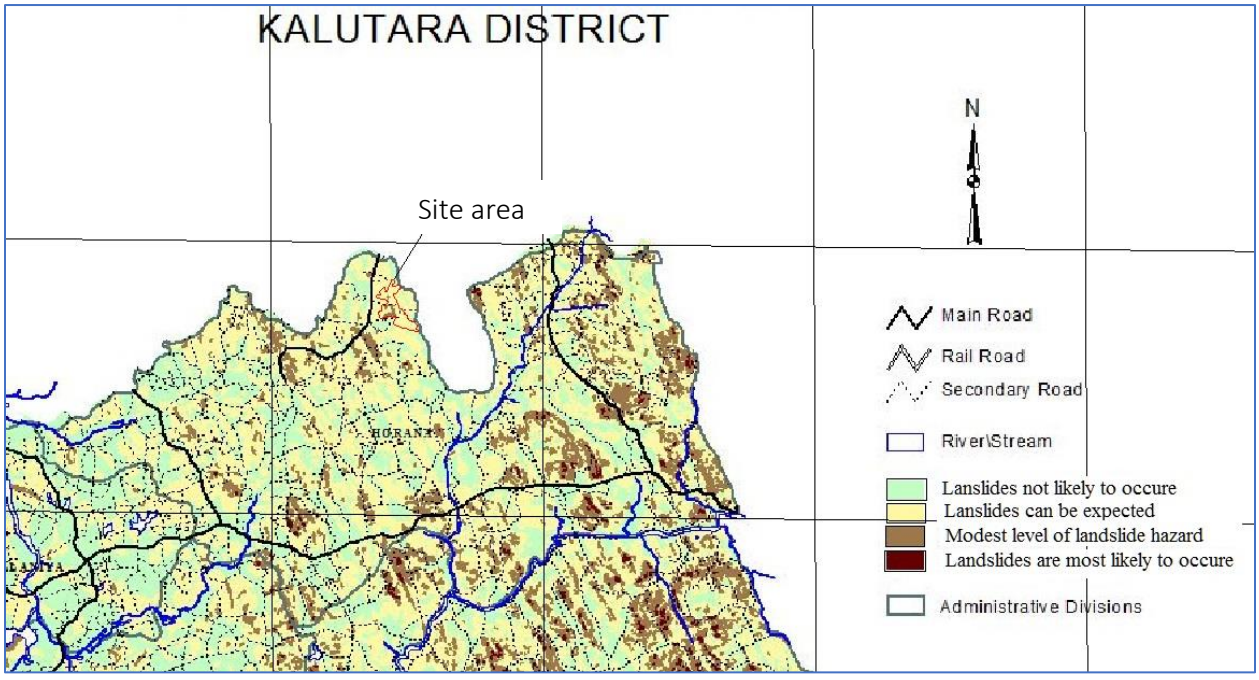


Figure 3.8 - Part of Landside Hazard Zonation map of Kaluthara district – 1:50,000 scale (www.nbro.gov.lk)

During the field visit it was observed that, slopes greater than 30 deg. especially on dip slopes (slopes located in western slopes of hillocks) can be transferred to a landslide potential slope with inappropriate land use practices (i.e., heavy blasting of rocks, making steep and deep cuts etc.). This

situation can be assessed properly, and mitigation measures could be given only through a proper geotechnical assessment. This investigation is a must especially for the slopes which can be affected by constructions. This will be done by National Building Research Organization (NBRO) and will guide the construction for minimal effect to the initiation of landslide hazard for both to the building structures and to the surrounding environment.

Anyhow, in general, blocking of natural springs and change of land use practices can adversely affect the stability of slopes. Therefore, it is recommended to avoid blocking or changing of existing springs and waterways and use the best practices in changing land use in the site with proposed constructions.

3.3 Rainfall pattern

Rainfall patterns was obtained from the data of the Department of Meteorology. The closest rainfall station is the Millewa Estate as depicted in **Figure 3.9.** Only a limited amount of data are available for the years 2017 and 2018.

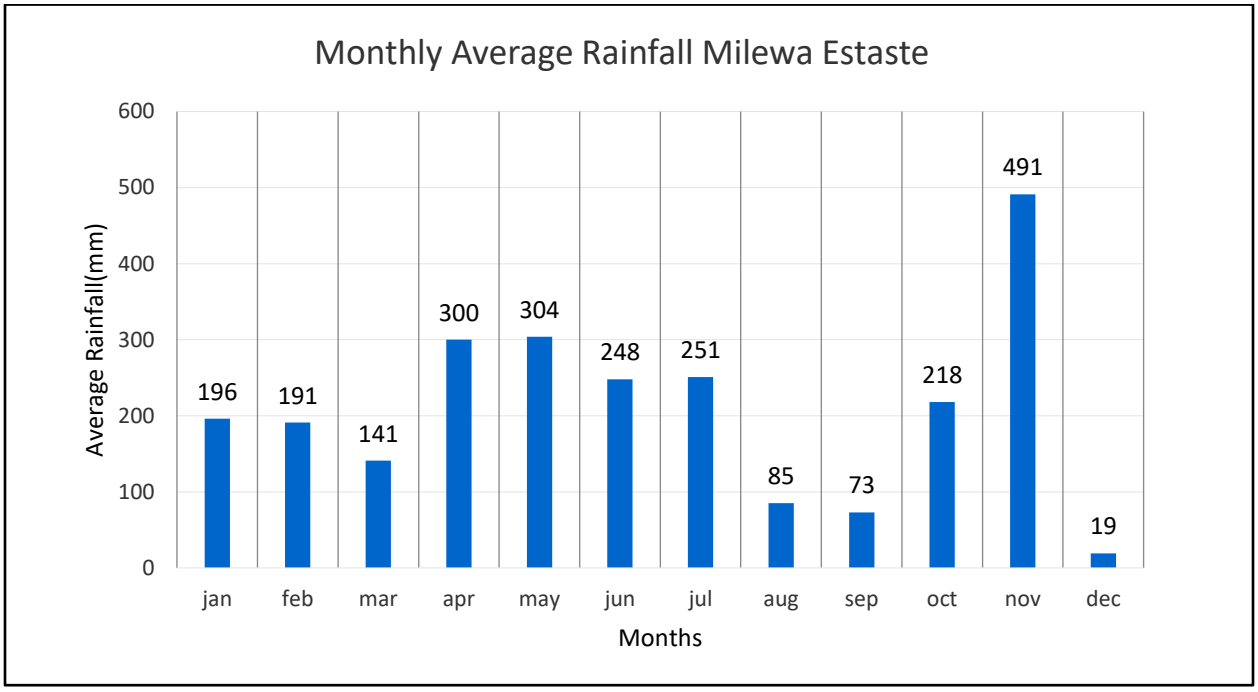


Figure 3.9 - Monthly Rainfall of Milewa

Figure 3.10 - Daily Rainfall Stations Close to the Project Site

3.4 Hydrology & Drainage

3.4.1 Surface water bodies in the study area

3.4.1.1 General

Apart from the dry ditches the only surface waterbody within the project site is the spring and the small water pond. There are paddy field drainage canals in some parts of the project periphery. These waterbodies are given in **Figure 3.11** This spring is not perineal, and it goes dry during the dry season.

Plate 3-5 Photos of the spring and the pond

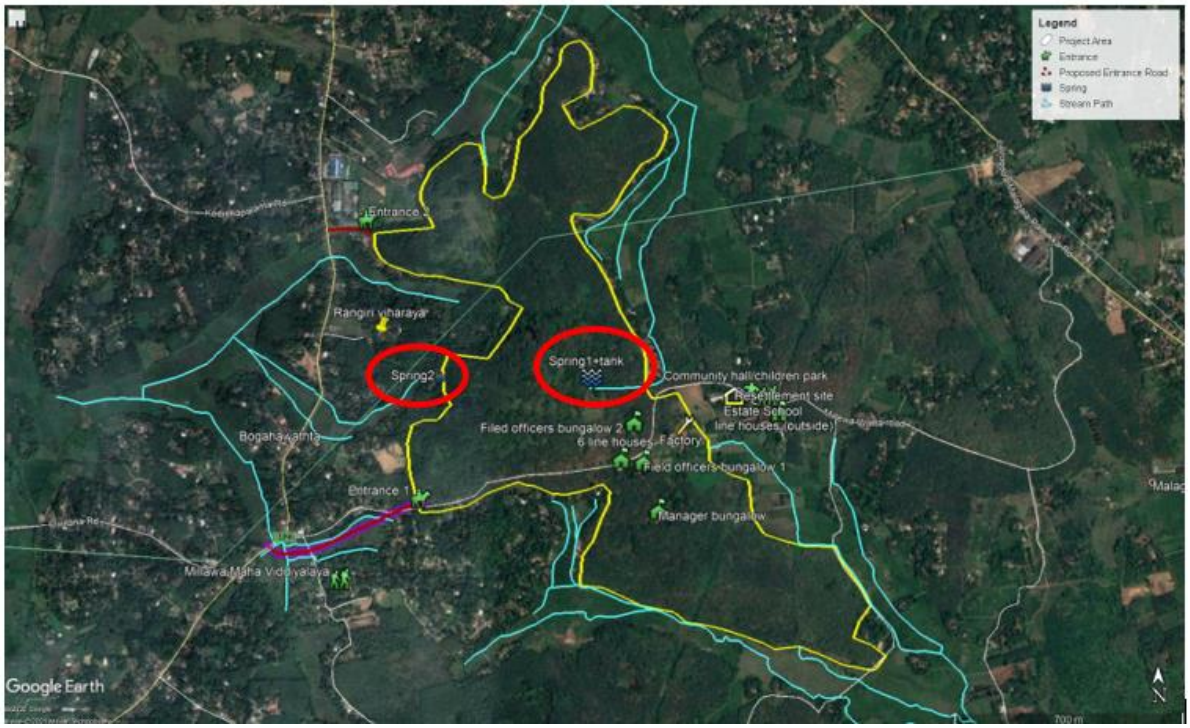


Figure 3.11 - Existing Surface Waterbodies

There is another spring on the site boundary, but it is located slightly outside the site. However, the catchment for the spring is within the site.

3.4.1.2 Drainage Pattern of the Area

The site is a slightly hilly undulating where the drainage paths are directed towards downstream paddy areas. There are only two internal visible streams with waterflow as they originate from springs. Other drainage paths are dry and those are mostly ditches. The drainage pattern is presented in **Figure 3.12.**

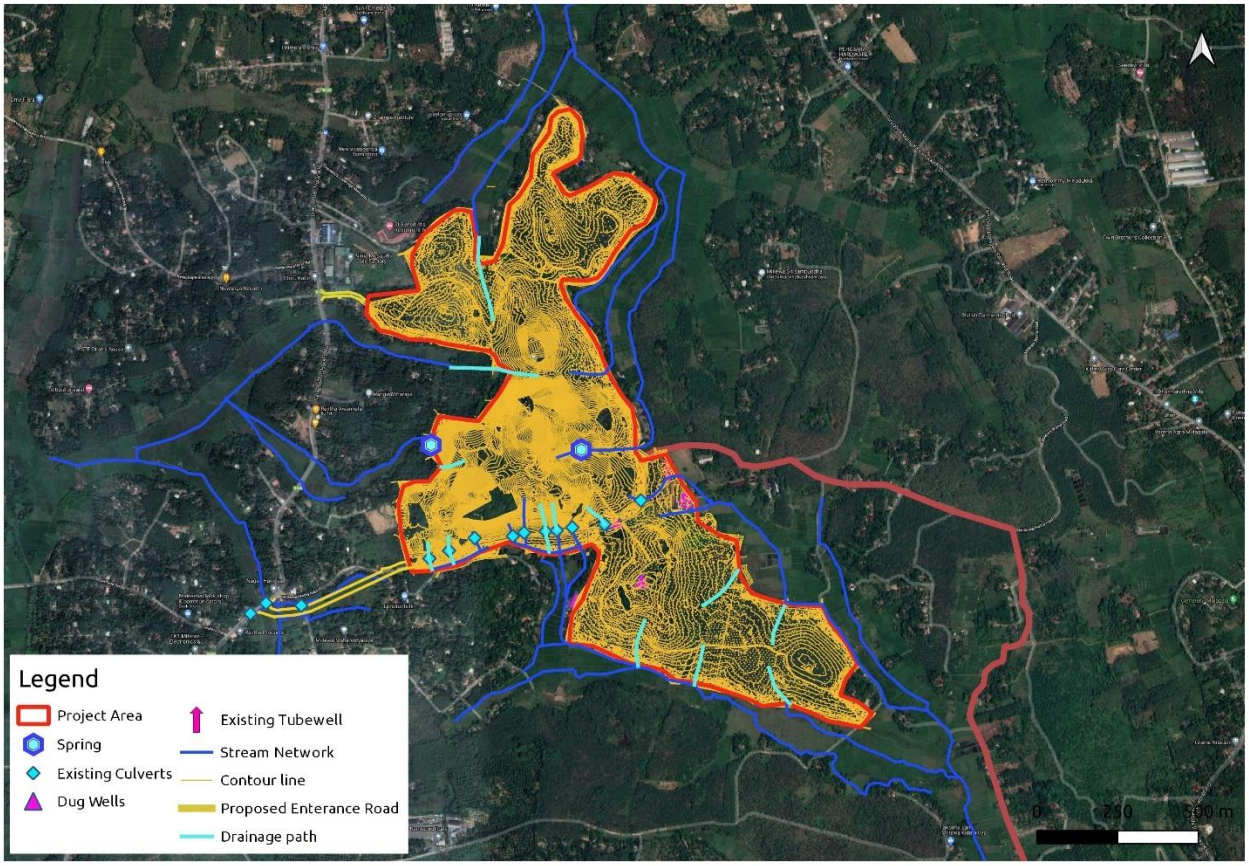


Figure 3.12 – Drainage Pattern of the Site

3.4.1.3 Hydrology of Mawak Oya

As it is planned to convey the treated wastewater of the proposed prison to Mawak Oya, which is located about 7 km away from the site, the outfall of the treated wastewater conveying pipeline is a part of the project area.

Location of the proposed Mawak Oya wastewater outfall along with the proposed pipeline route is presented in **Figure 3.13**. Mawak Oya annual minimum low flows based on the Ellagawa gauging station flows for the period 1981-2020 (water year basis) are given in **Figure 3.14.**

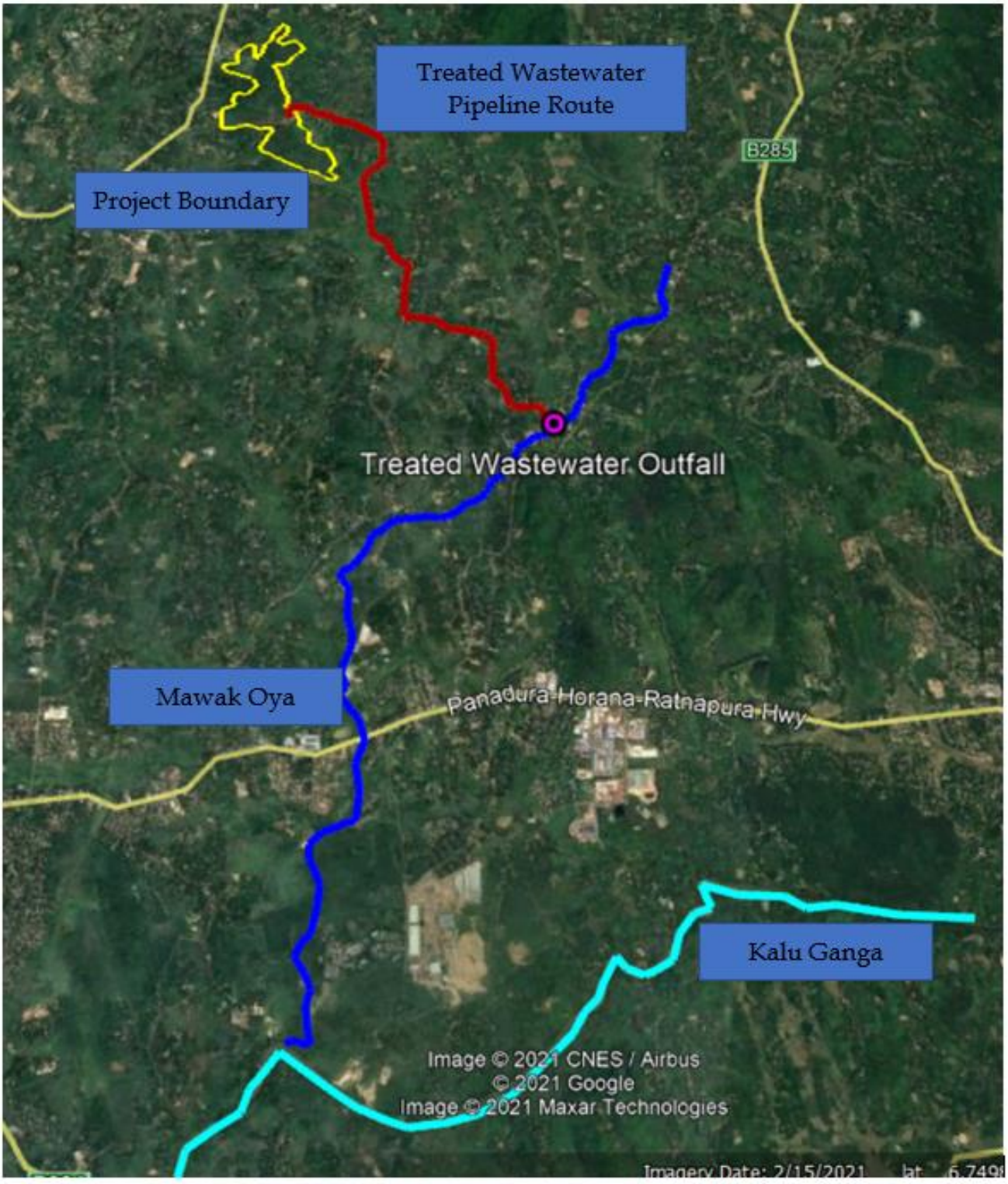


Figure 3.13- Treated Wastewater Conveyance Pipeline Route and Mawak Oya

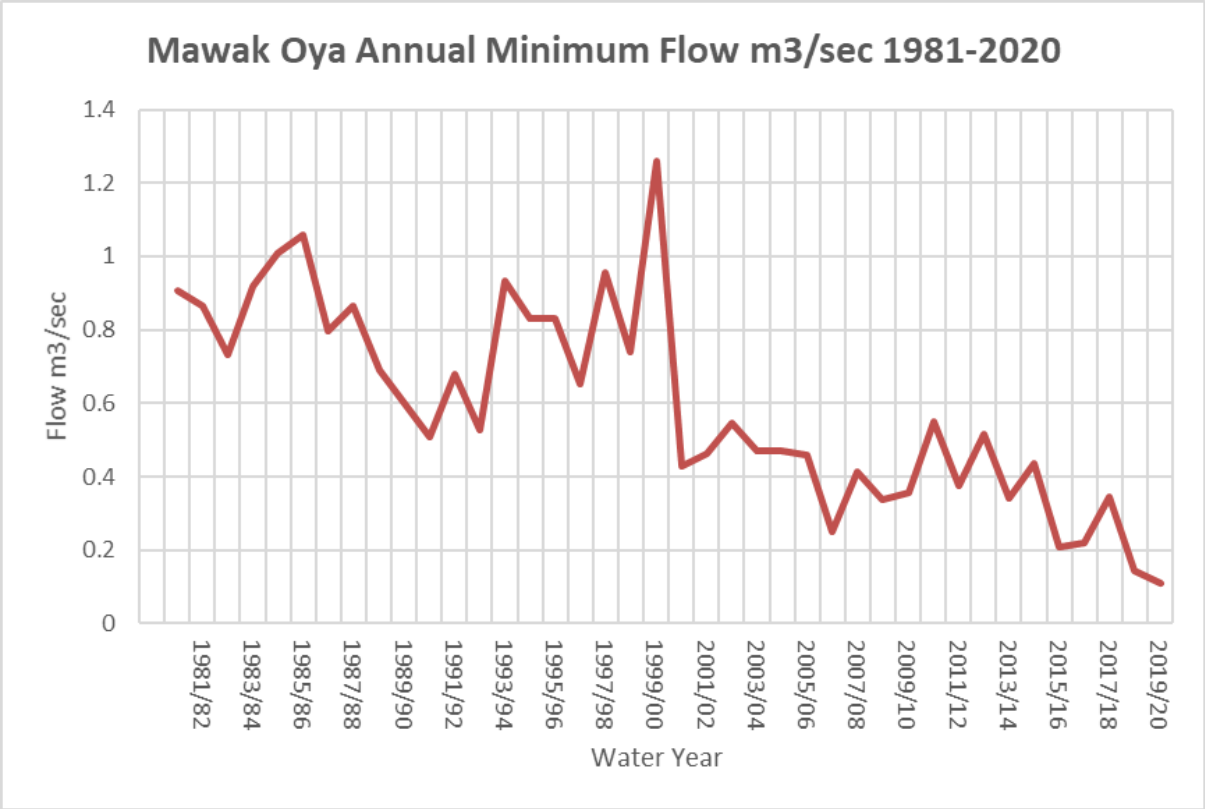


Figure 3.14- Mawak Oya Annual Minimum Flows Based on Ellagawa Flows

Table 3.3 – Low Flow Frequency Analysis for Mawak Oya

Return Period	Probability P(x)	Probability P(x)%	Discharge (Q)-1980-2020-m3/s	Discharge (Q)-1980-2015-m3/day-Ellagawa	Discharge (Q)-1980-2015-m3/day-Mawak Oya Outfall
2	0.5	50	15.70	1,356,887	49,229.05
5	0.2	20	9.19	794,057	28,809.50
10	0.1	10	6.45	558,928	20,206.13
25	0.04	4	4.12	355,753	12,907.21
50	0.02	2	2.95	255,122	9,256.18
100	0.01	1	2.12	183,405	6,654.19
1000	0.001	0.1	0.71	61,629	2,235.98

3.4.2 Surface water quality and present uses of surface water.

3.4.2.1 Surface Water Quality

Surface Water Quality

Mawak Oya (Location 6)

pH of the Mawak Oya is slightly below the required pH ranges stipulated by the CEA for ambient inland waters (National Environmental (Ambient Water Quality) Regulations, No. 01 of 2019 – Gazette No. 2148/20 – dated November 5th, 2019) in terms of Category A (water that requires simple treatment, for drinking), B (bathing and contact recreational water) and C (aquatic life protection). Furthermore, NO_3-N levels were 10 mg/L in terms of Category A, B and C limits. However, all other parameters are meeting with the ambient inland water quality standards considering Category A, B and C standards.

Other Waterways

Waterway W1 is slightly acidic not meeting the required range of 6.0-8.5 in terms of aquatic life protection (Category C limits under Gazette No. 2148/20 – dated November 5th, 2019), though BOD_5 levels are low in terms of Category C standards. Furthermore, the DO levels in W1 is < 5 mg/L, which is the minimum DO levels needed in terms of aquatic life protection.

According to Illeperuma (2000), the relationship between water quality and DO levels is 8.0-9.0 mg/L – Excellent, 6.7-8.0 – Slightly polluted, 4.5-6.7 – moderately polluted and < 4.5 mg/L – Highly Polluted. Therefore, W1 is moderately polluted in terms of this relationship. However, P, oil and grease and NH_3-N were undetected in all water bodies. BOD_5 levels were less than 4 mg/L, which is the maximum limit for Category C waters. Therefore, it could be concluded that the waterways in the Project Site and the immediate vicinity are relatively unpolluted considering the tested physicochemical parameters (except for W1 waterway), except that faecal pollution is evident, which may be due to excreta from birds and mammals.

3.4.2.2 Present uses of surface water.

There is no present use of surface water of the spring inside the project site. The small pond is used to for buffalo wallowing. The drainage canal in the project periphery is used for paddy field drainage.

3.4.3 Ground water availability, quality, and present uses of ground water.

Groundwater is available in several dug wells within the site. Altogether there are six dug wells where 3 dug wells exist behind the factory premises, one dug well exist in the premises of the present line houses, one dug well exists near the Manager's bungalow and there is also a private dug well within the project site which used by an outside house. The dug wells behind the factory and near the Manager's bungalow are not being used at present whereas the dug well in the line house premises and the well, used by a private party are used for taking water for drinking. There is also one tube well near the factory which is not used at present.

The locations of these dug wells and the tube well are presented in **Figure 3.15.**

Groundwater quality

Groundwater quality in the vicinity of the project site appears to be relatively potable considering the SLS 614: 2013 drinking water standards, except that pH is slightly acidic (not meeting the range of 6.5-8.5) and total coliform and faecal coliform are present.

The occurrence of total coliform (rod shaped Gram-negative bacterial species belonging to 4 genera of the Enterobacteriaceae family namely *Klebisella, Citrobacter, Escherichia* and *Enterobacte*r) and faecal coliform[3] may be due to animal droppings (birds and mammals) and / or long-term cesspit effluents contaminating the dug well water

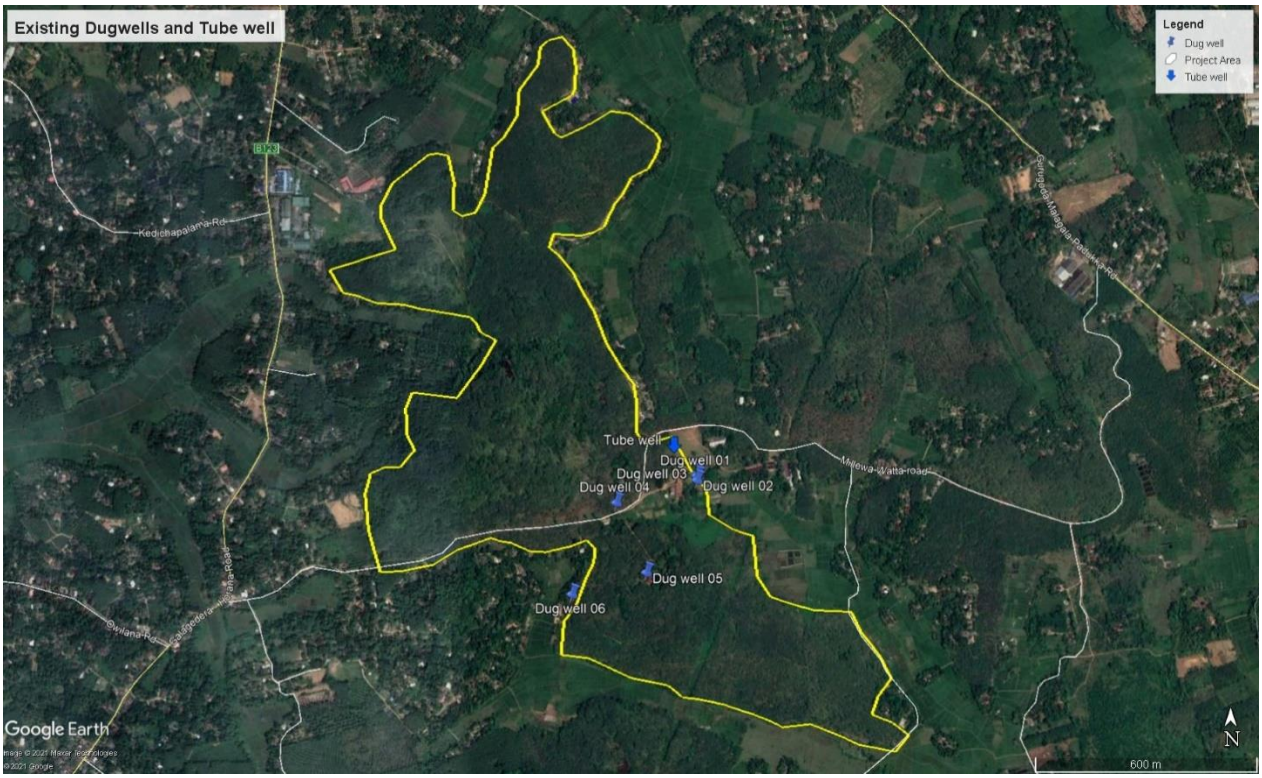


Figure 3.15 - Existing Groundwater bodies

Annex 08 shows the results of the groundwater and surface water quality studied by the National Building Research Organization (NBRO).

3.4.4 Depth to ground water levels and seasonal changes in the level

The groundwater level is almost at the water level in the close by paddy fields. According to the existing ground level near the wells and the seasonal rainfall fluctuations, the level of groundwater varies. For example, the groundwater depth of the wells behind the factory is about 5' at the time of inspection during the month of July. The seasonal levels changes in groundwater has a bimodal pattern similar to that of the rainfall.

[3] Fecal coliform bacteria are *Escherichia* such as *E. coli* and are part of the Total Coliform. They are more representative of faecal contamination

3.5 Land Use

3.5.1 Land Use-Socio Economic and Administrative Perspective

3.5.1.1 Present Land Use of the Project Site

The land demarcated for the proposed project is about 256 acres. It is mainly used for rubber cultivation. Therefore, the main land use can be classified as rubber plantation. Some of the rubber trees have been neglected but remaining trees are used for tapping. About 5 acres of 256 acres has been used for residential facilities of workers. The data on present land use within project footprint is shown in **Table 3.4** and **Figure 3.16.**

Table 3.4 - Land use pattern within 256 acres project footprint

Land use pattern	Extent- acres	%
Rubber	246	96
Houses	5	2
roads	4	1.6
Water bodies & other facilities such as sports ground and cemetery	1	0.4
Total	256	100

Source: Arc GIS Map Extractions

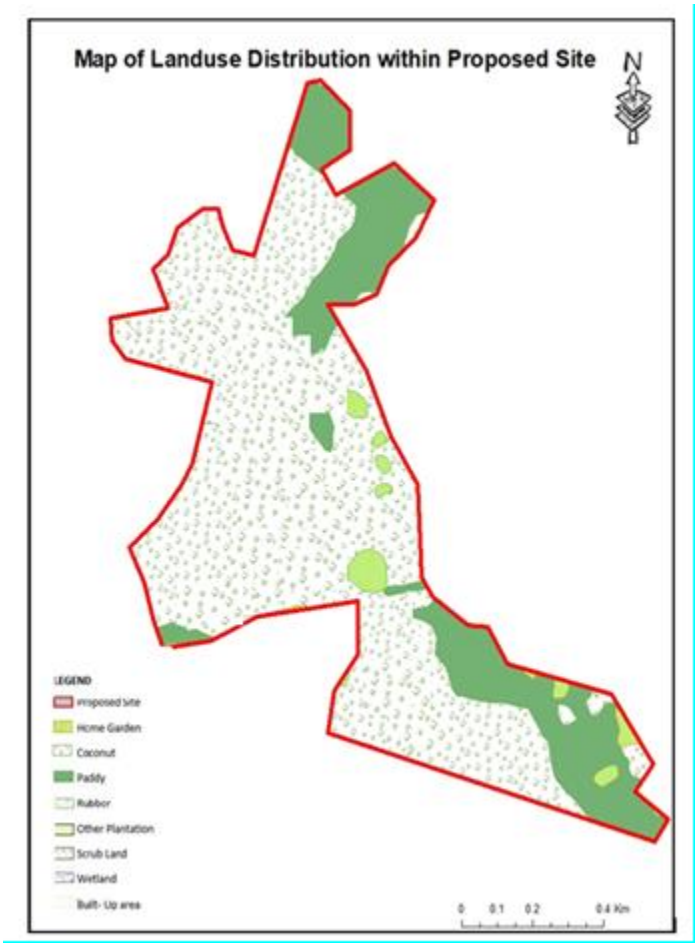


Figure 3.16 Land use pattern within project footprint

3.5.1.2 Land use pattern of 500 m Land belt adjacent to the project footprint

The principal land use is rubber even in the vicinity of project footprint. The vicinity studied by the sociologist is defined as 500 m wide land belt around the proposed project footprint. The second significant area (22.5%) is used for paddy cultivation. Some patches of land have been used for residential activities. The data on land use pattern observed in the 500 m wide land belt adjacent to the project footprint is shown in **Table 3.5** and **Figure 3.17.**

Table 3.5 - Land use Pattern relevant to 500 m buffer

Land use pattern	Extent- Ha	%
Paddy	88.96	22.56
Coconut	4.03	1.02
Rubber	221.45	56.16
Other Plantation	0.50	0.13
Residential	74.70	18.95
Scrub land	0.23	0.06
Commercial	2.32	0.59
Transportation	2.11	0.53
Total	394.28	100.00

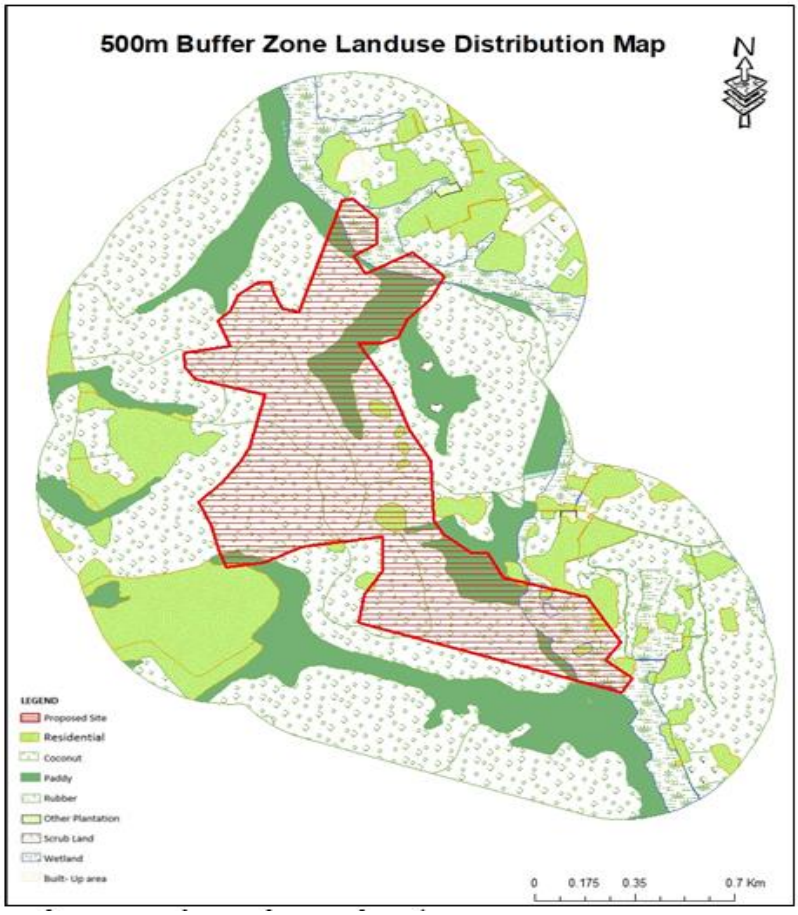


Figure 3.17 - Land use pattern within 500 m buffer zone adjacent to the project

3.5.1.3 Land use pattern of GND relevant to the project

The project footprint is in 628C Pahala Millewa North GN division. The total land area used for different activities in Pahala Millewa North is 375ha. The major land use pattern is rubber that has occupied about 58% of total land. Paddy is the second significant land use (27%). The other land use patterns observed include residential, coconut and commercial activities etc. The data on land use observed in GN division is shown in Table 3.6 and Figure 3.18.

Table 3.6 - Land use pattern in project relevant GND

Land use pattern in Pahala Millewa North GND	Extent-Ha	%
Paddy	100.77	26.89
Coconut	0.29	0.08
Rubber	219.12	58.47
Residential	53.50	14.28
Scrub land	0.94	0.25
Commercial	0.13	0.04
Total	374.76	100.00

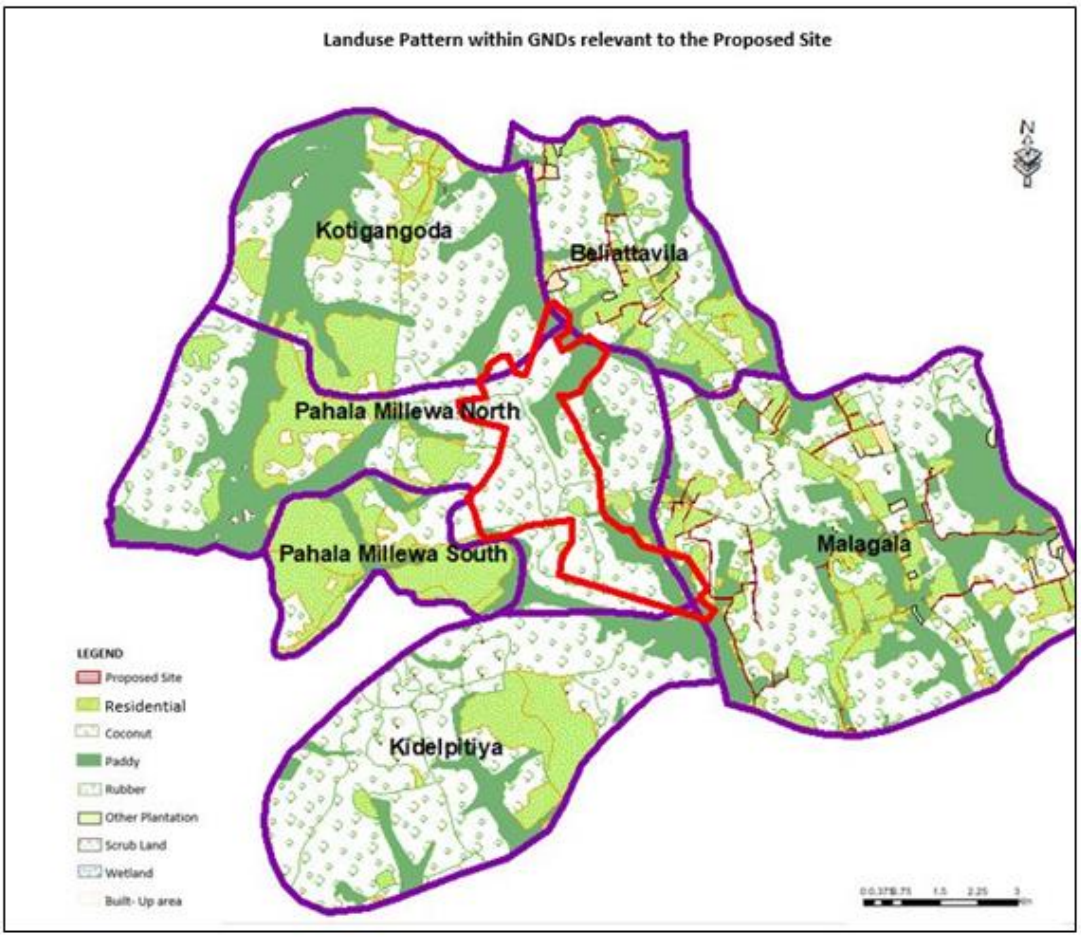


Figure 3.18 - Land use pattern in project used GNDs

3.5.1.4 Land use pattern of Horana DSD

Horana DSD is regarded as project relevant macro environment. About 11273ha in Horana DSD has been used for different economic and social infrastructure activities. The most significant land use pattern even in Horana DSD is rubber which is about 39% of the total land. The second highest land used is human settlements. The remaining area of DSD has been used for other various activities such as agriculture, infrastructure, and other natural resources. The data on land use of DSD extracted from Horana resource profile is shown in **Table 3.7** and **Figure 3.19.**

Table 3.7 - Land Use Types of the Project Area

Land use pattern	Extent-Acres	%
Agriculture	163.64	1.45
Built up	128.14	1.13
Coconut	0.31	0.002
Commercial	38.01	0.33
Forest	25.23	0.22
Industrial	2.78	0.02
Institutional	29.82	0.26
Paddy	2363.40	20.96
Park and Playground	19.44	0.17
Religious	2.53	0.02
Residential	3711.25	32.92
Rock	20.66	0.18
Rubber	4450.50	39.47
Scrub Land	202.53	1.79
Tea	4.45	0.03
Transportation	23.87	0.21
Utilities	13.076	0.12
Water	35.55	0.32
Wetland	38.13	0.34
Total	11273.29	100

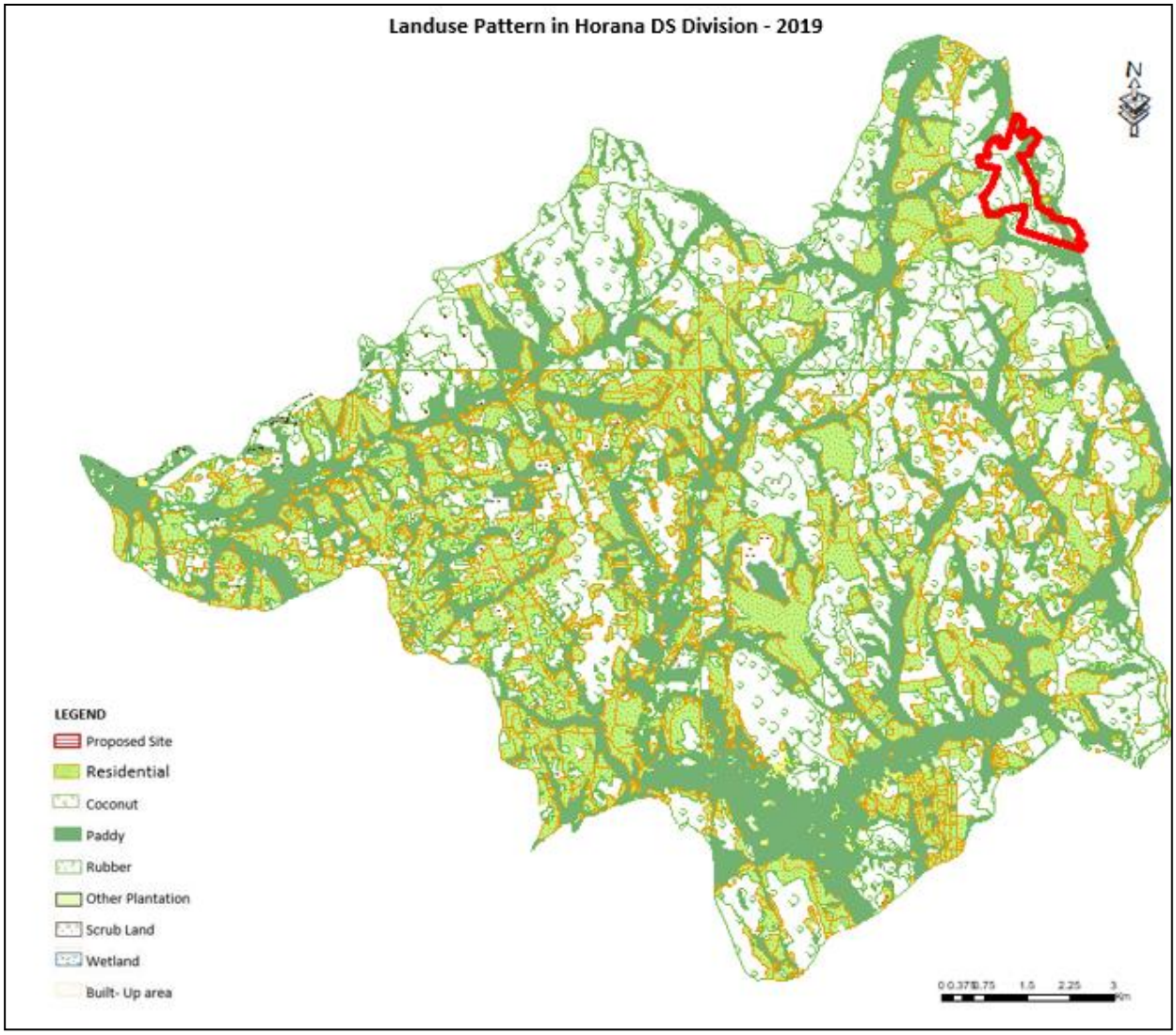


Figure 3.19 - Land used pattern in Horana DSD

3.5.1.5 Predominant land use of the area and the period of existence of such land use

As described above predominant land use is rubber plantation. The rubber plantation has been in existence for more than 90 years according to the elderly community members in the area. The line houses have also been there for the same period in this estate.

3.5.1.6 Land use potential of the site

Views expressed by stakeholders on potential alternative land use of the project footprint

The SIA team inquired about alternative possibilities of the project footprint from agency and community stakeholders. Most of them are of the view that proposed project is a misfit to the traditional rural environment. The estate as a plantation has been there for more than 90 years. Therefore, they are of the view that alternative use such as light industries which would generate employment for the rural community would be better for the local economy. The specific views expressed by stakeholders are summarized below.

Table 3.8 – Stakeholder Views

Stakeholder	Views on potential land use of the project footprint
DS (Horana)	I have some conceptual understanding of the UDA's proposal to shift Welikada prison from Boralla to Horana. The land to be used for the proposed project is located in Horana DSD. The community members living within this Division will come to me through respective GNs or even directly if they are faced with any problem due to the interventions under the project. Therefore, my involvement throughout the project construction and even after construction will be critically significant. In this context, I as a public servant need to aware of the significant activities of the project during construction and operation phases. I have full confidence on the participatory approach of the UDA as project developer in consultation of relevant stakeholders and getting them involved in every significant project activity especially with regard to community and their resources.
GN (Millewa)	GN is also holds the same opinion. Both DS and GN are of the strong view that they are obliged to provide any support required for this project to plan and implement.
Community leaders in the area	We heard in reason past that this Watta would be used to established light industries, but we do not know what has happened to that proposal. Most of the community members and community leaders were much happy about previous proposal to use this Watta for industrial for light industry which would be generated significant number of employments for local youths
Householders in the project footprint	The government could have planned to use this land for an activity grating jobs for the local people
Data collectors of the study	The area in general is agriculture and rural economy. Some alternative interventions such as improving rubber plantation or light industries feasible to the existing cultural context and to generate jobs for the local community members would have been one of the alternative land uses

3.5.2 Land Use of the Project Site-Aesthetic Perspective

3.5.2.1 General

The project site is a Rubber Plantation, a state land formally managed by "Kotagala Plantation". After the acquisition of the project site by the Urban Development Authority (UDA), Kotagala Plantation withdrew its management. Although, UDA field staff by engaging the same labours taps rubber milk and sells to a nearby factory, it is an abandoned rubber plantation. Thus, its present land use remains as a rubber plantation.

There exist some other activities such as residential (labour quarters, managers bungalows), rubber factory, playground etc. all are related to the rubber plantation infrastructure.

The project site does not consist of any sensitive area (as listed by the Central Environmental Authority), and it represents monoculture due to the rubber plantation.

3.5.2.2 Photographic Survey of Land Use

A photographic survey was carried out to understand the aesthetic perspective of the land use and details are presented below. Photo locations are presented in **Figure 3.20.**

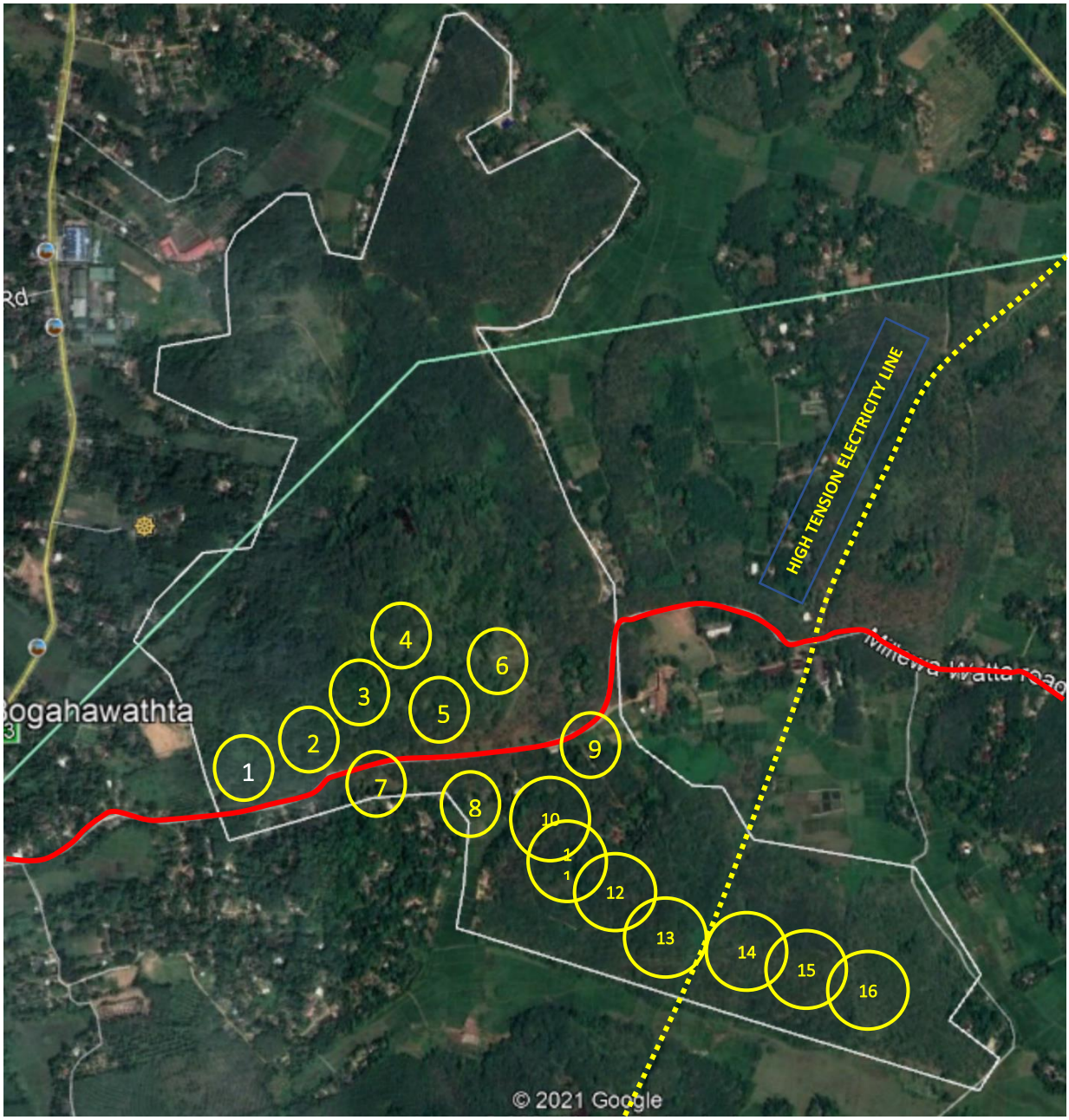


Figure 3.20 – Photographic Survey of Existing Land Use – Project Site

The section from the entrance through the project site up to the turn to Managers' Bungalow consists of a mix of rubber plantation (**Figure 3.21 and 3.22**). The plantation to the left of the road consists of

old rubber trees requiring removal and replantation, and a part of the plantation on to the left of the access road consists of young productive plantation. An interesting feature in this section is a rock outcrop on the left of the access road at a higher elevation (Photograph 5). The land slopes from North to South.

Figure 3.21 - Photographic Survey of the Land Use of the Project Site - From Entrance to the Tern to Managers' Bungalow

Figure 3.22 - Residential character near the rubber factory

Near the former rubber factory (which is now abandoned), at the turn to the Managers Bungalow access, a residential character is visible due to the location of two quarters of field officers, six units of labour quarters, and the workers at the former factory site (Figure 3.22).

Figure 3.23 - Photographic Survey, from entrance to the Managers' Bungalow towards south-eastern direction

The section from entrance to the Managers' Bungalow Road towards south-eastern direction consists of productive rubber plantation (**Figure 3.24, Figure 3.25 and Figure 3.26**). Compared to the first section of the project site shown in **Figure 3.23**., the second section is more productive. The site slopes

towards southern direction that carries storm water towards the paddy field located at the end of the high ground on the southern end. The rest of the area towards southeast and south has a similar characteristic of productive rubber plantation (**Figure 3.24**).

Figure 3.24 - Towards South-East, productive rubber plantation

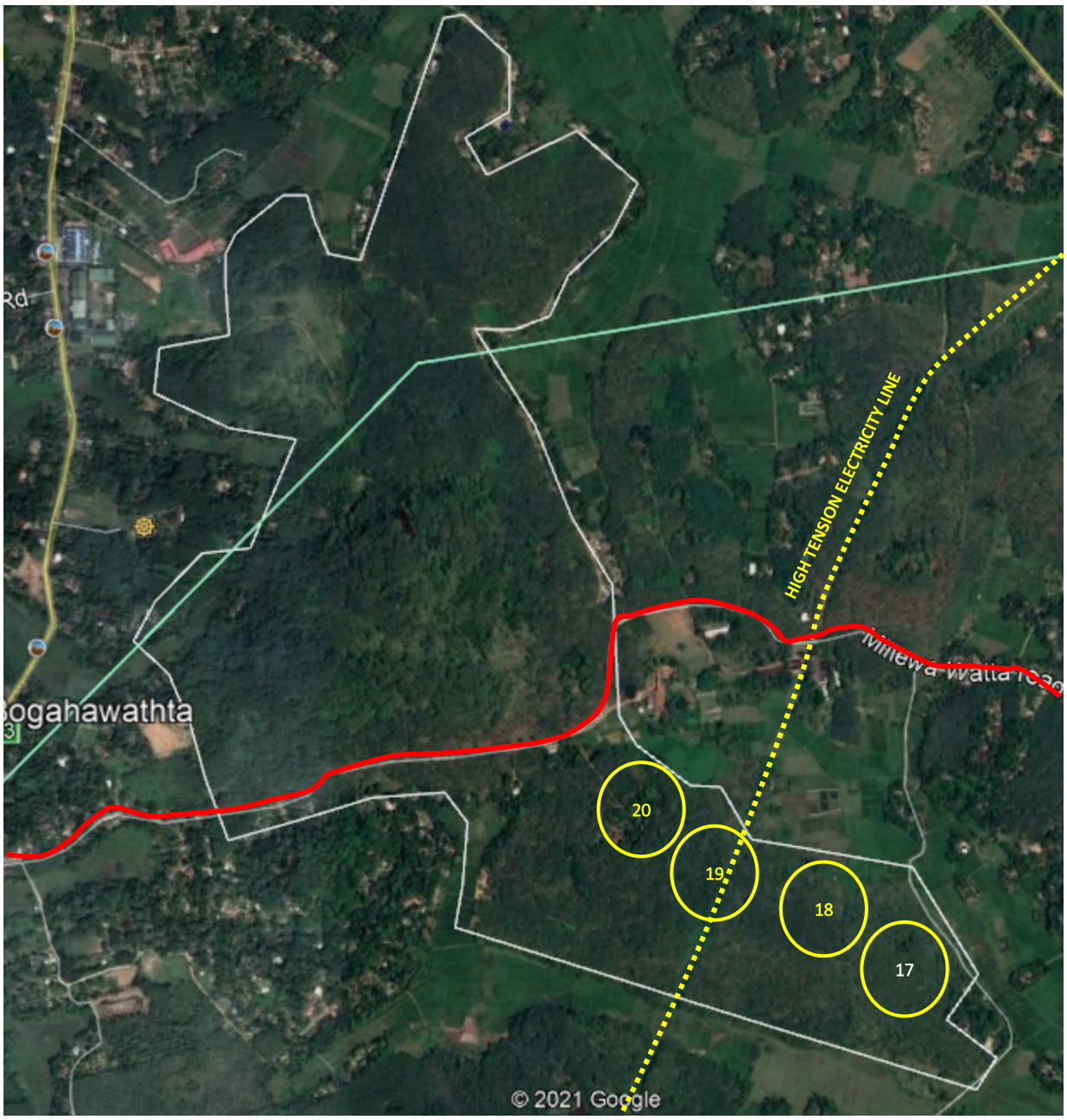


Figure 3.25 - Photographic Survey of land use - Southern Boundary, lower section of the project site

Figure 3.25 and Figure 3.26 illustrates the land use system in the lower southern section of the project site, up to the southern boundary. A few locations (i.e., Photograph Number 18) illustrates natural growth of wet zone floral species due to the abandoning of the rubber plantation. Such sites indicate acquisition of its natural habitats with diverse species. A Hindu cemetery is located opposite the site shown in Photograph Number 18. The areas close to the eastern boundary (i.e., Photograph Number 17) has comparatively high scenic value due to its location overlooking the paddy field. The other areas represent similar rubber plantation characteristics in the project site.

Figure 3.26 - Land use towards the end of the southern boundary of the project site

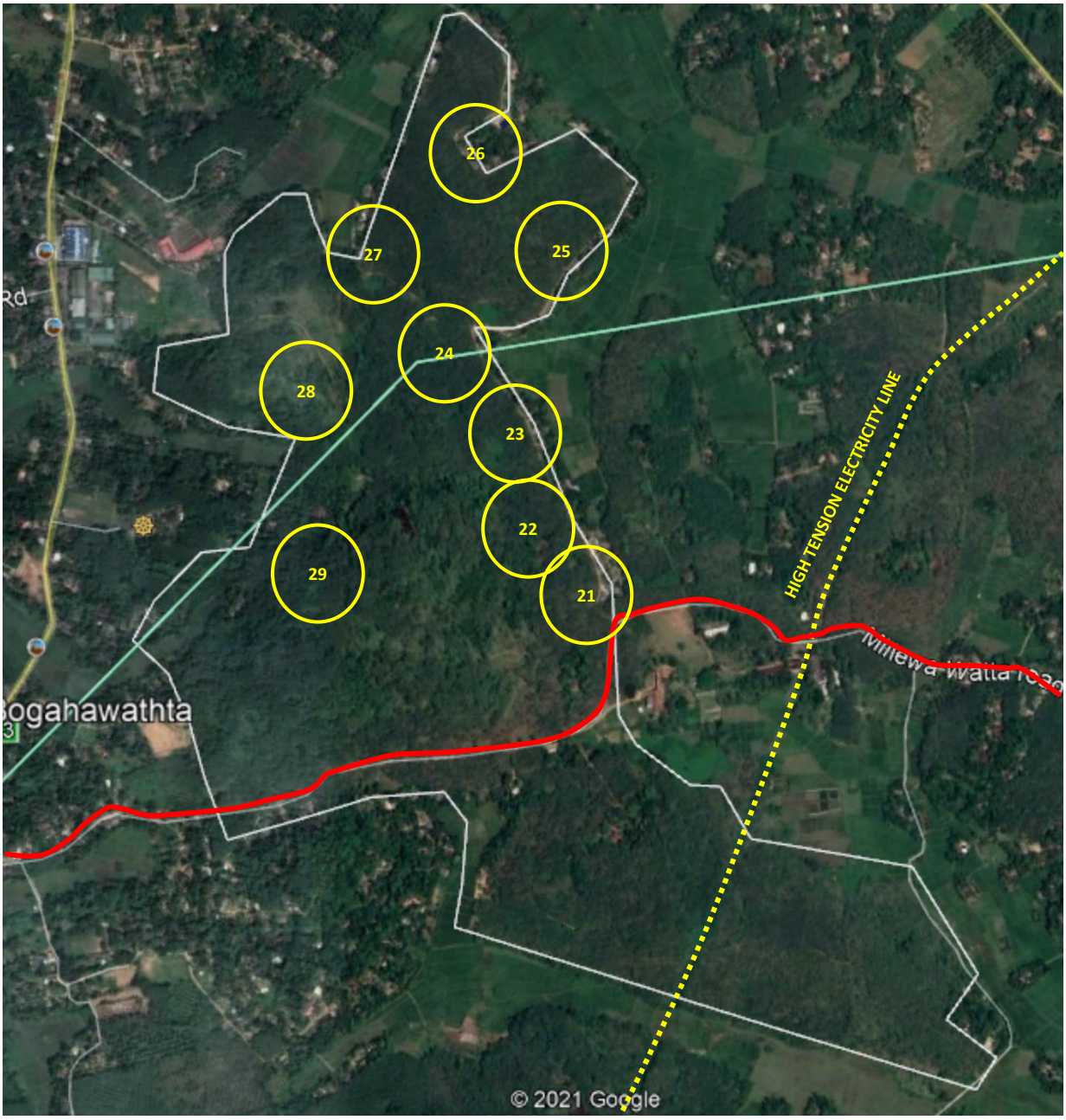


Figure 3.27 - Pictorial illustration of the land use system in the Northern section of the project Area

The Northern part of the project site has similar land use characteristics of the southern part – rubber plantations of various status, such as productive rubber, and abandoned unproductive rubber plantation. A strip of land at the edge of the rubber plantation, maintained as a reservation for paddy fields appears to have been encroached and currently has become a residential strip (Figure 3.27 Figure 3.29). A concentration of rock outcrops is in the Northern Section adjacent to the access road, which is an interesting natural landscape that requires integrating into the proposed build environment (Figure 3.28).

Figure 3.28 - Some sections of the Northern part of the project area

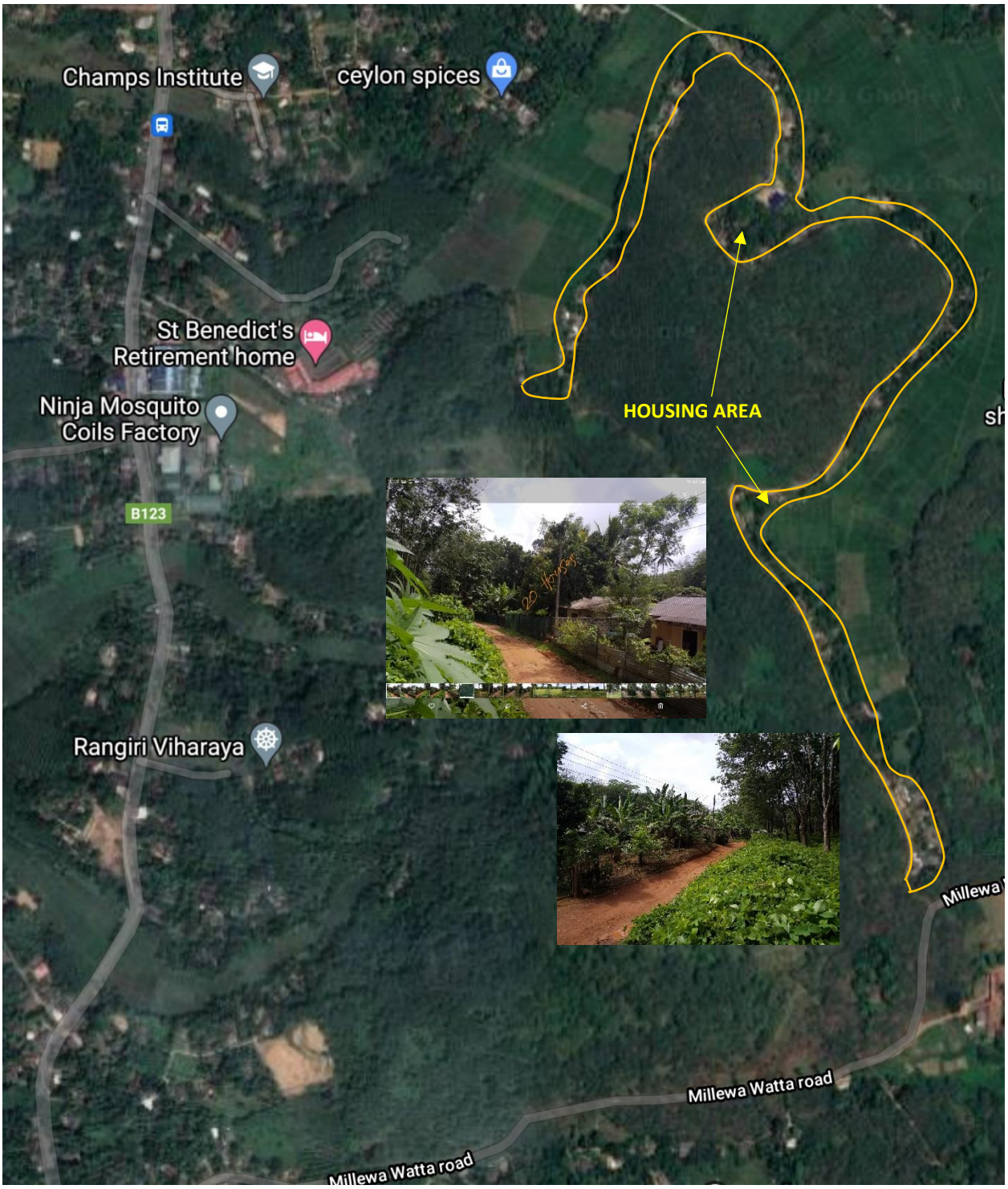


Figure 3.29: Housing in the reservation between the rubber plantation and the paddy field

Figure 3.30 - Rock outcrops in the Northern part of the project site, needing incorporation to the proposed built environment

3.5.1.2 Land Use of the Study Area

The project study area was considered as one km from the boundary of the project site, which covers an areas of 1200 hectares after leaving the extent of the project site which is 105 hectares. The predominant land use characteristics in the project study area in the past had been rubber plantations and paddy fields. All the high lands had been used for rubber plantations while the low-lying areas had been under paddy cultivation. Presently the same land use pattern exists, with significant changes of conversion of rubber plantations into residential use. Residential developments in the study area have three characteristics:

(i) Original settlements areas that developed together with the rubber plantation industry during the British Colonial period,

(ii) Encroachments on reservations between rubber plantations and paddy fields, and

(iii) More recent residential developments particularly due to the impact of improved accessibility. Horana – Meepe road plays a significant role in this connection.

The existence of large land parcels, and easy accessibility to the City of Colombo have made Horana and its surrounding area attractive for industrial uses. Thus, the study area too has attracted several industrial establishments towards the northern boundary of the project site.

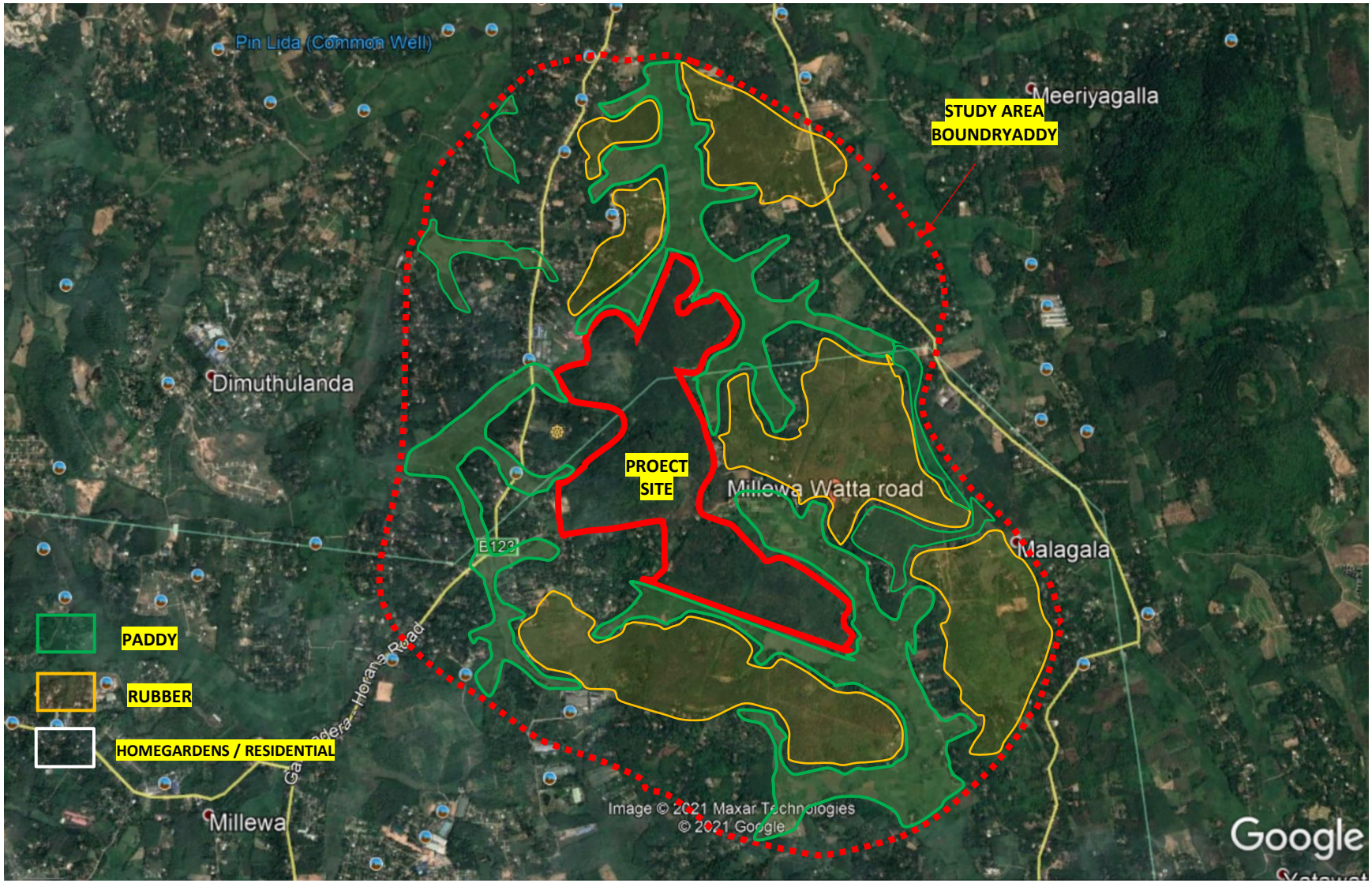


Figure 3.31 - Generalized Land Use Zones in the Study Area

Figure 3.31, and Table 3.9 illustrates generalised land use system of the study area.

Table 3.9 - Generalized Land Use, 2001 - Study Area

No	Land Use	Extent (ha)	%
1	Paddy	250	22.83
2	Rubber	310	28.31
3	Other (Home gardens, Commercial, Industrial)	535	48.86
	Total extent excluding the project site	1095	100.00

The land use along Horana-Meepe road is mixed consisting of residential, commercial (particularly retail), and industrial.

Figure 3.32 - Retail Activities along Horana-Meepe Road

Large scale industrial establishments (i.e., Ninja Mosquito Coil Manufacturing Plant), educational institutions, and social welfare institutions (i.e., St. Benedict's Retirement Home), are located towards North-Western part of the study area on Horana-Galagedera Road Figure 3.33.

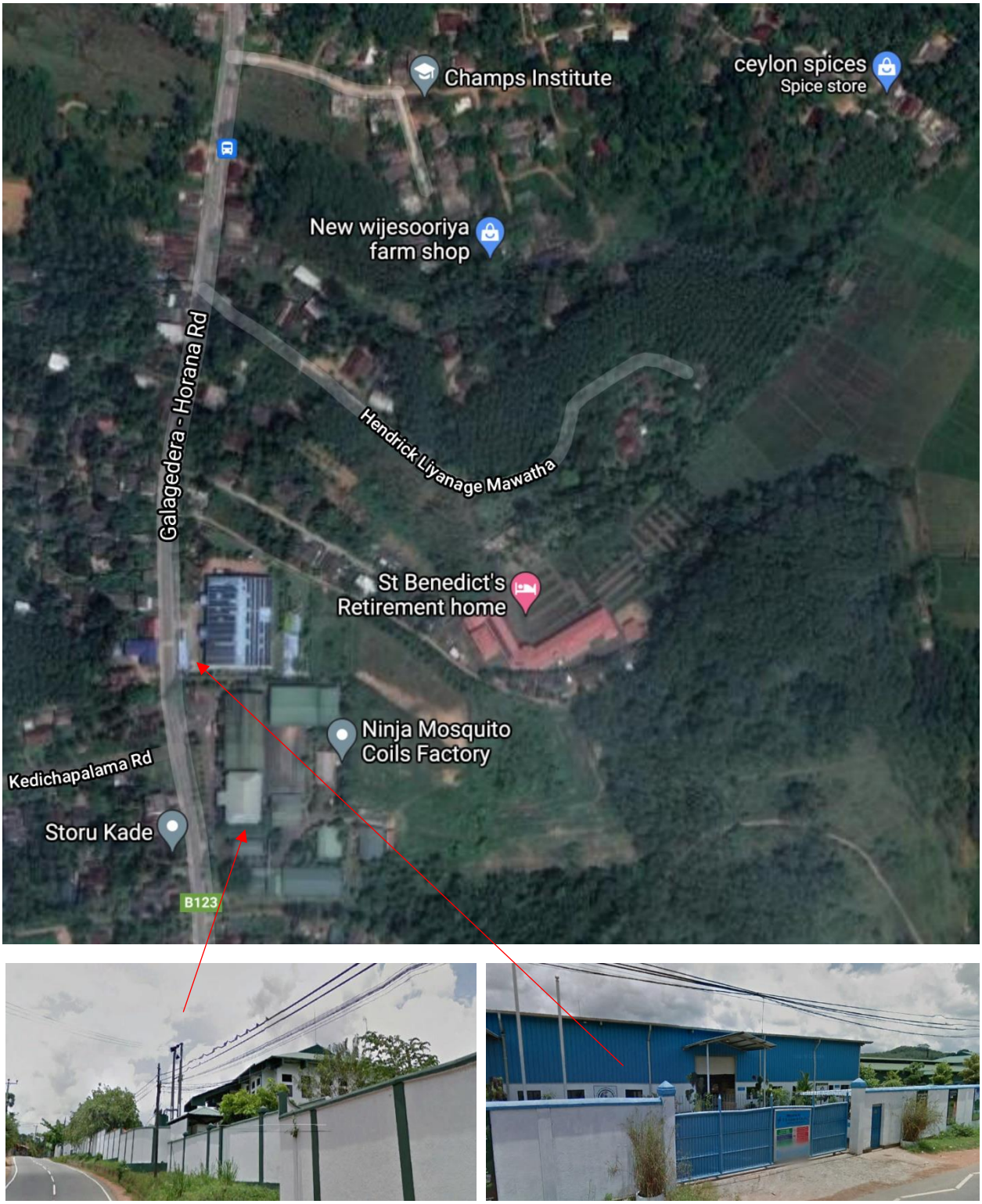


Figure 3.33 - Concentration of Large-Scale Industrial, and Social Institutions

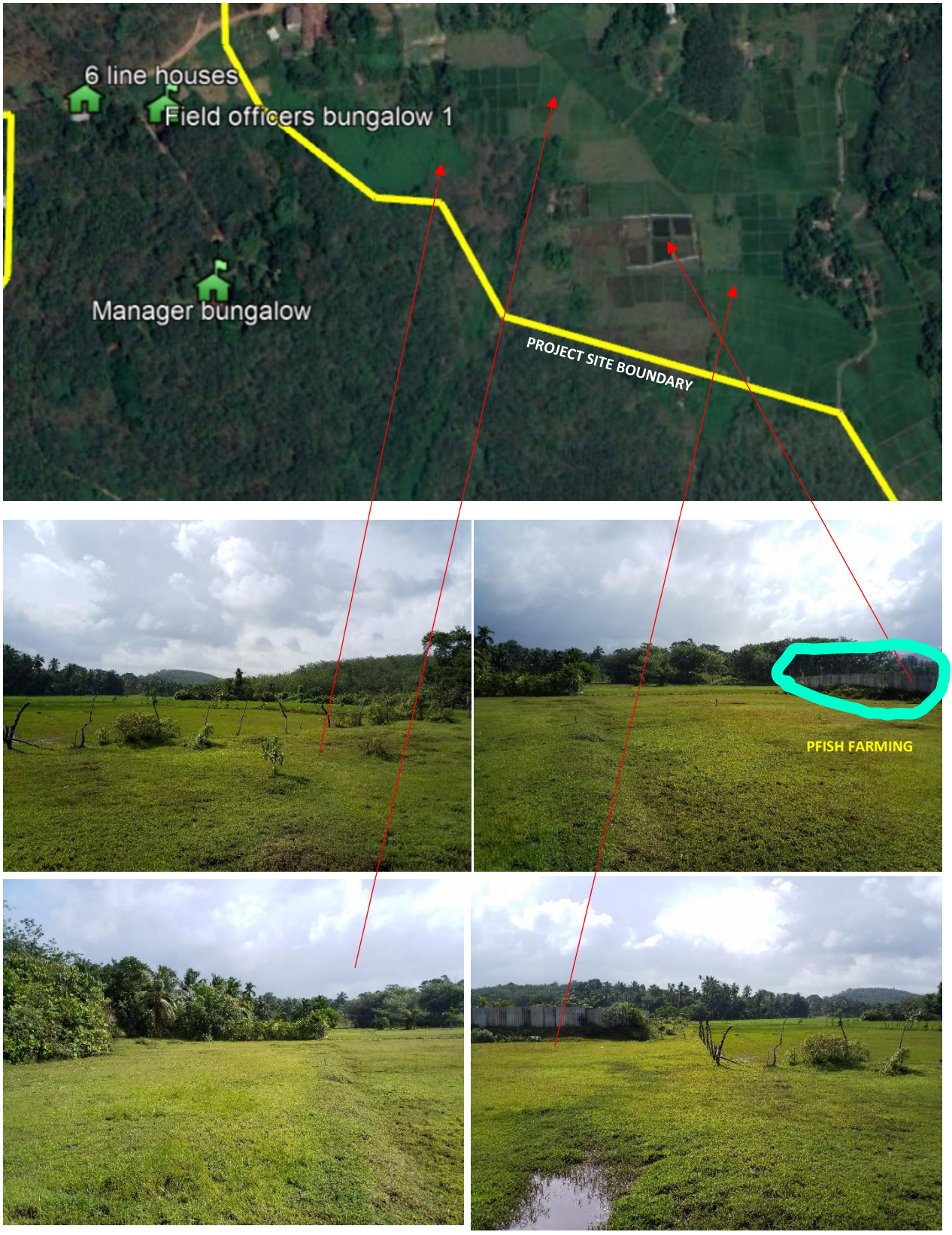


Figure 3.34 - Paddy Fields Along Eastern Boundary of the Project Site

Paddy fields in the Eastern Boundary have high aesthetic value due to the mountains in the backdrop. Some parts of the paddy field have been converted to some related highland agricultural and fish farming projects **(Figure 3.34)**

Figure 3.35 - Typical Residential Land Uses in the Eastern Part of the Project Site

Residential neighbourhoods in the study mostly consists of large plot sizes with pleasing natural environments. In many places they relate to paddy fields (**Figure 3.35**)

Protected Areas, Sensitive Habitats

The study area does not contain any protected or sensitive areas as declared by the Central Environmental Authority. Wetlands – a key feature in the study area can be considered as a sensitive land use particularly due to their role as flood retention areas. Most of the wetlands are paddy fields and therefore, their biological diversity is not equivalent to that of marshes.

3.5.2.3 Predominant Land use of the area and the period of existence of such land use

The three predominant land uses in the study area – (i) Wetlands, mostly paddy fields (22.83%), Rubber (28.31%), and (iii) Mixed use (particularly home gardens) – 48.86%.

3.5.2.4 Land Use Potential of the Project Site

The project site is in the wet zone, which is known for areas for high biological diversity. However, currently it represents monoculture due to the removal of its native vegetation during the colonial period for rubber plantation. The climate and the soil condition of the area makes the project site high productive for agricultural uses. Thus, the site has a high potential for wet zone agriculture, particularly for high value export oriented, and import substitutional agricultural products.

Due to the scenic value of the project site listed below, the project site is also having a comparatively high potential for development of a tourist accommodation facility:

(i) Undulating landscape with rock outcrops located in interesting places,
(ii) Location of wetlands around the project site with high scenic value,
(iii) Easy accessibility to the project site, particularly due to the proposed "Ruwanpura Expressway",
(iv) Potential of restoring the old rubber factory as a place of tourist interest, and
(v) Availability of a large extent of land (over 250 acres) to develop an eco-friendly high end tourist destination.

3.5.3 Zoning

The project study area falls under Horana Pradesheeya Sabha, for which UDA has not prepared a development plan. Therefore, no zoning plan is available.

3.6 Ecological Resources (both terrestrial and aquatic)

3.6.1 Existing natural habitats within the area and their importance (Proximity to wetlands, water bodies)

Habitat types in the proposed project area and its buffer

The area which has been identified for the proposed re-location of the Welikada prison is a state land – a rubber estate under the Urban Development Authority (UDA). The estate is in Horana, falling within the Colombo district. Hence, biogeographically the site lies in the lowland wet zone where the biodiversity is recorded as being the highest in the country. The estate within which the proposed project site is located covers and extent of 735 Acres of which a large proportion (over 95 %) comprises a rubber plantation.

The proposed project will spread across an extent of 256 Acres, much of it being under rubber, but also containing six-line houses, a factory and rice paddies along the boundary. The rubber plantation within the project site is of two types, those that are abandoned (**Plate 3.6**) and those that are currently managed (**Plate 3.7**). These two habitats should be distinguished because each supports a mix of different plants and holds different habitat qualities in terms of supporting biodiversity and ecosystem services. The abandoned rubber areas at present are seen to have become naturalized to some extent, attaining a multi-storied structure resembling a patch of

immature forest. In comparison, the managed rubber has a scanty undergrowth and is much less diverse.

With respect to aquatic and semi-aquatic habitats, the site holds a spring which has given rise to a small water pool which is surrounded by a patch of riparian and terrestrial vegetation. This is a permanent water source for the animals in the area. Two streamlets, one within the project site near a homestead, and the other at the boundary are also found here. These have a moderate flow during the monsoons but reduce to a trickle in the drier months. These two streams support fish and other faunal species. A small marshy area was also observed near the factory which is important for semiaquatic species. Figure 3.36 gives an indication of the locations of the different habitat types, and Plates 3.6 to 3.9 show the habitats.

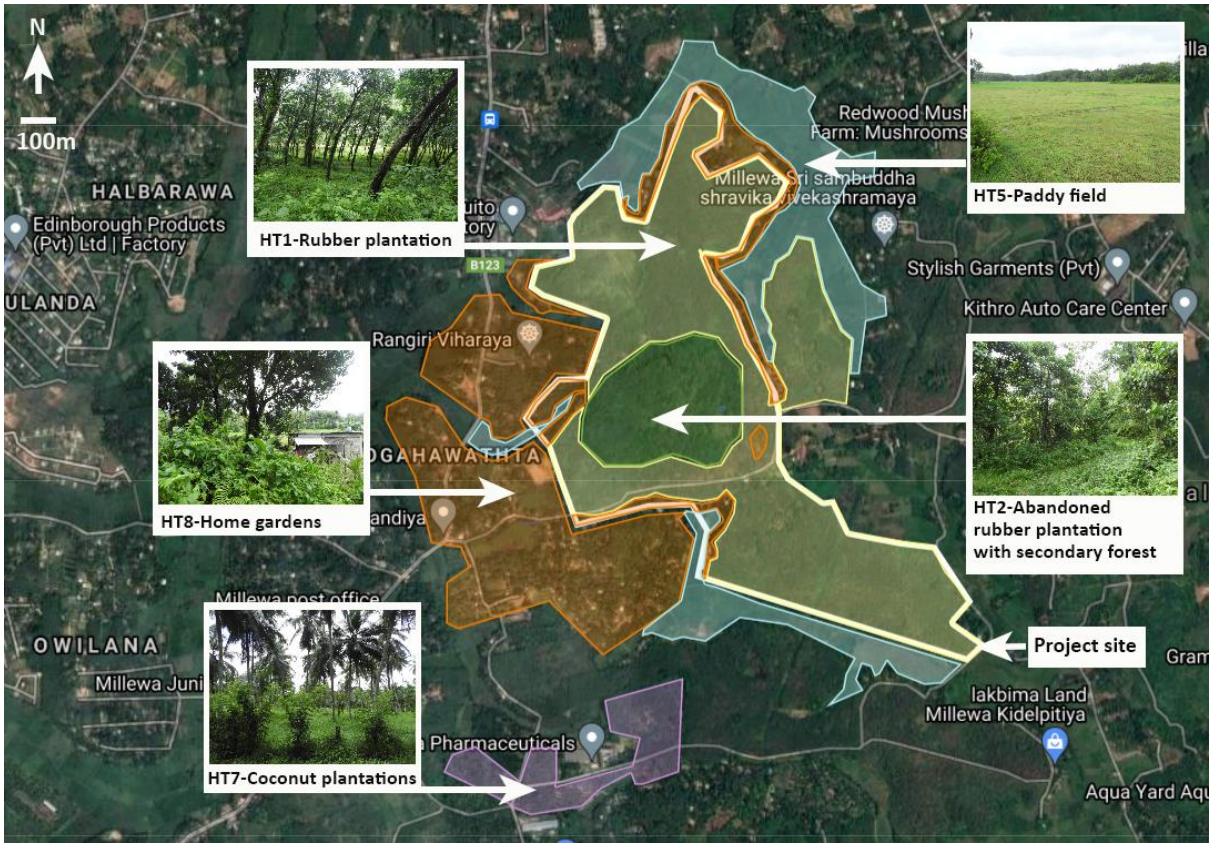


Figure 3.36 - The proposed Welikada prison re-location site and the habitats within and around it.

Plate 3-6 Abandoned rubber plantation showing colonization by native / non-native plants within the site

Plate 3-7 Managed rubber plantation within the site with scanty understory vegetation

3.6.2 The existing aquatic ecosystem in the study area

A description of the existing aquatic habitats of the study area is given below. The aquatic ecosystems are the surrounding paddy field areas, the existing springs (two springs) and Mawak Oya into which the treated wastewater will be discharged.

Plate 3-8 Water spring (top), marsh (middle) and the streamlets (below) within the project site.

Plate 3-9 A home garden, coconut plantations and rice paddies in the buffer zone of the proposed project site

Another location of particular interest is the Mawak Oya where the waste is proposed to be discharged. The Mawak Oya which is a tributary of the Kalu river is located approximately 7 km away from the project site. The most significant natural vegetation found here is the riverine strip bordering the stream. Although much of the vegetation is disturbed due to the anthropogenic habitats along the stream bank, it supports many species of fauna. The habitats at the two possible locations of discharge are shown in Plates 3-10 and 3-11. The pipeline transporting sewage will traverse primarily through areas of paddy and rubber and some interspersed home gardens (Figure 3.37).

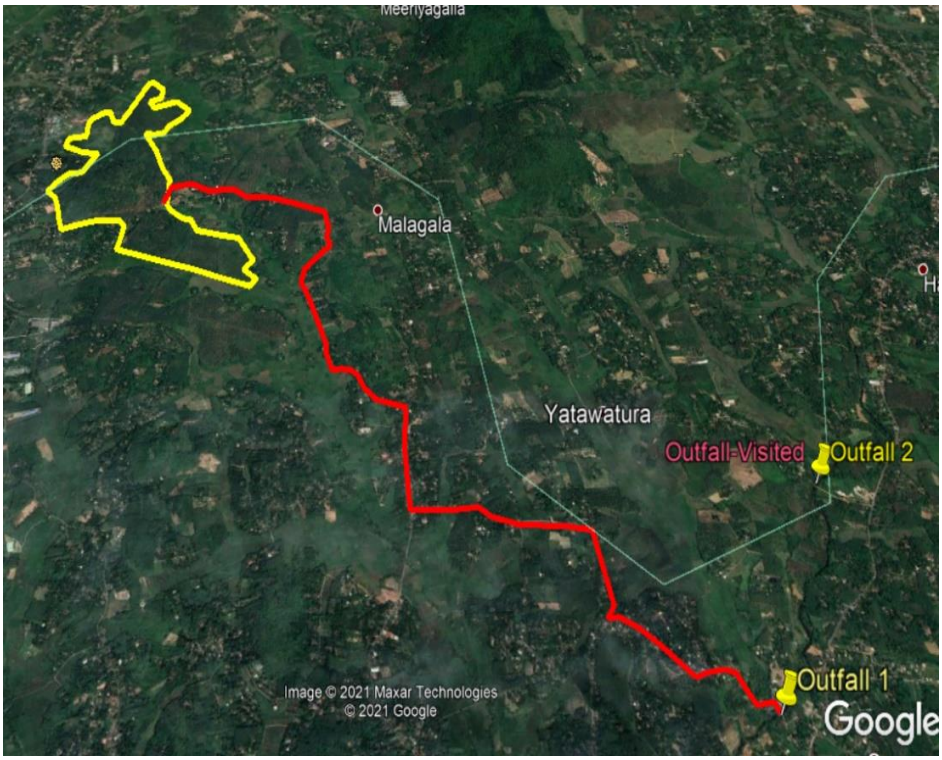


Figure 3.37 - The path of the sewage disposal pipeline to the Mawak Oya.

Plate 3-10 - Riparian vegetation surrounding Outfall 1 (6.777180 N, 80.129875 E).

Plate 3-11 Habitats surrounding Outfall 2 (6.766342 N, 80.125362 E).

3.6.3 Present status of fauna and flora in the study area

Floral and Faunal community

Flora: The project area falls within the low country wet zone of Sri Lanka. This fact and being some distance away from the Colombo city, would explain the relatively moderate diversity in the rubber estate, which is the site selected for the present project, and its environs. A total of 227 plant species belonging to 65 families were recorded in the range of habitats within and around the project site. Among these were 27 endemic species and 74 exotic species. The endemics recorded were *Litsea longifolia, Scyphostachys coffeoides, Uvaria semecarpifolia, Tabernaemontana dichotoma, Lagenandra praetermissa, Garcinia quaesita, Argyreia thwaitesii, Mallotus fuscescens, Osbeckia octandra, Artocarpus nobilis, Aporosa lanceolata, Bridelia moonii, Ochlandra stridula, Xanthophyllum zeylanicum, Gaertnera vaginans, Petchia ceylanica, Dipterocarpus zeylanicus, Isonandra zeylanica, Strobilanthes Adenophora, Wrightia antidysenterica, Calophyllum acidus, Bhesa nitidissima, Entada zeylanica, Cinnamomum verum, Memecylon urceolatum, Horsfieldia iryaghedhi* and *Pandanus ceylanicus.* Some of the recorded species are shown in **Plates 3-12 to 3-14**. The detailed list of plants is provided in **Annex 9.1** with an indication of the habitats in which they were observed.

Argyreia thwaitesii

Ficus arnottiana

Tetracera sarmentosa

Ochlandra stridula

A fern species

Symplocos cochinchinensis

Plate 3-12 Some plant species in the study site and surrounding areas.

Lagenandra ovata

Barringtonia racemosa

Asplenium nidus

Alstonia scholaris

Ficus hispida

Alstonia macrophylla

Plate 3-13 Some plant species in the study site and surrounding areas.

Ficus tinctoria

Hemidesmus indicus

Lagerstroemia speciosa

Monochoria vaginalis

Plate 3-14 Some plant species in the study site and surrounding areas.

3.6.4 Presence of natural habitats and rare, threatened, endemic, fauna and flora (if any) within such habitats.

Fauna: A total of 291 faunal species belonging to seven taxa (amphibians, reptiles, birds, mammals, butterflies and dragonflies and freshwater fish) have been recorded within the project site and its surrounding habitats. These include as many as 54 endemics and 17 exotic/migrant species. The summary of the species observed is shown in Table 1. With respect to the faunal community, it must be reiterated that the provided lists are based on a rapid faunal assessment and on other documented information for this area. One must keep in mind that animals are mobile and hence not all faunal taxa present in a location could be detected at a given time. Further, no nocturnal sampling was conducted. The detailed lists of species of the different faunal groups are provided in Annex 9.2 to 9.8, with an indication of the habitats where the species were observed.

A summary of the faunal species recorded in the project site and its vicinity, based on a rapid assessment survey and reported information. CrEN – Critically Endangered; EN – Endangered; VU – n Vulnerable; NT – Near Threatened

Table 3.10 - A summary of the faunal species recorded in the project site and its vicinity

Taxon	Families	Total species	Endemics	Exotics/ Migrants	Threatened			
					CrEN	EN	VU	NT
Freshwater fish	17	50	23	1	2	10	3	5
Amphibians	4	8	3	-	-	-	-	2
Reptiles	7	12	2	-	-	-	-	1
Birds	49	126	12	15	1	1	2	11
Mammals	15	18	2	-	-	2	1	2
Butterflies	5	40	-	-	-	-	-	-
Dragonflies	10	37	11	1	2	4	7	6

Taking individual taxa, seven native amphibian species belonging to four families were recorded during the study. Among these were three endemics – *Indosylvirana temporalis* (Bronzed Frog), *Pseudophilautus popularis* (Common Shrub Frog) and *Polypedates cruciger* (Common Hourglass Tree-frog). See Annex 9.1.

The reptiles recorded during the present survey comprised 12 species representing seven families. This included two lizards, one skink, the two monitors, one gecko, five snakes and a freshwater turtle. Two of these *Lankascincus fallax* (Common Lankaskink) and *Xenochrophis asperrimus* (Sri Lanka Keelback) are endemic. See Annex 9.3.

A total of 126 bird species in 49 families were recorded in the area. These include 12 endemics – *Treron pompadora* (Sri Lanka Green-pigeon), *Ocyceros gingalensis* (Sri Lanka Grey Hornbill), *Psilopogon rubricapillus* (Sri Lanka Crimson Fronted Barbet), *Psilopogon flavifrons* (Sri Lanka Yellow-fronted Barbet), *Chrysocolaptes stricklandi* (Greater Sri Lanka Flameback), *Dinopium psarodes* (Lesser Sri Lanka Flameback), *Loriculus beryllinus* (Sri Lanka Hanging-parrot), *Psittacula calthropae* (Sri Lanka Emerald-collared Parakeet), *Tephrodornis affinis* (Sri Lanka Wood-shrike), *Cecropis hyperythra* (Sri Lanka Swallow), *Pycnonotus melanicterus* (Sri Lanka Black-capped Bulbul) and *Pellorneum fuscocapillus* (Sri Lanka Brown-capped Babbler). Although this is not the migratory season, we have included 15 migrants that have been recorded previously in the broader area. See Annexure 4.

With respect to the mammals, a total of 18 species were recorded either during the survey or based on the information provided by the villagers. Of these two – *Semnopithecus vetulus* (Sri Lanka Purple-faced Langur) and the *Macaca sinica* (Macaque monkey) are endemic. The mammals comprised a single bat species, two monkeys, pangolin, jackal, otter, fishing cat, a mongoose, two civets, mouse deer, wildboar, porcupine, a squirrel, hare, and rats. The presence of one Sambur (*Rusa unicolor*) was reported by a villager, but this was not included in the list as we could not verify this. See Annex 9.5.

The two invertebrate taxa surveyed included the butterflies and dragonflies. Five families of butterflies with 40 species were recorded during the survey. No endemic species were recorded. The dragonflies included 37 species from 10 families. Eleven endemics – *Vestalis nigrescens* (Black-tipped Flashwing), *Euphaea splendens* (Shinning Gossamerwing), *Libellago greeni* (Green's Gem), *Libellago adami* (Adam's Gem), *Elattoneura centralis* (Sri Lanka Dark-glittering Threadtail), *Prodasineura sita* (Sri Lanka Stripe-headed Threadtail), *Ceylonosticta brincki* (Brinck's

Shadowdamsel), *Paragomphus henryi* (Brook Hooktail), *Megalogomphus ceylonicus* (Sri Lanka Sabretail) and *Macromia zeylanica* (Sri Lanka Cruisera) were among them. See Annex 9.6 and 9.7.

Freshwater fishes should be a central focus of this EIA report primary because one of the activities of the proposed project, namely the release of sewage and effluent during the operational phase, involves the Mawak Oya a major tributary of the Kalu river. This river / stream is relatively rich in Ichthyofaunal diversity. A total of 50 species of freshwater fish belonging to 17 families have the likelihood of being found here. This is based on the rapid assessment conducted as part of the present survey and those that have been conducted in tributaries around this site in the recent past. Of the species, as many as 23 of these are endemic to Sri Lanka – *Laubuca varuna* (Sri Lanka Varuna Laubuca), *Amblypharyngodon grandisquamis* (Sri Lanka Large Silver Carplet), *Pethia cumingii* (Sri Lanka Cuming's Barb), *Pethia nigrofasciata* (Sri Lanka Black Ruby Barb), *Puntius kamalika* (Sri Lanka Kamalica's Barb), *Puntius titteya* (Sri Lanka Cherry Barb), *Systomus pleurotaenia* (Sri Lanka Black-Lined Barb), *Paracanthocobitis urophthalma* (Sri Lanka Tiger Loach), *Sicyopus jonklaasi* (Sri Lanka Lipstick Goby), *Channa ara* (Sri Lanka Giant Snakehead), *Aplocheilus dayi* (Sri Lanka Day's Killifish), *Labeo heladiva* (Sri Lanka Heladiva Labeo), *Puntius thermalis* (Swamp Barb), *Mystus nanus* (Striped Dwarf Catfish), *Mystus zeylanicus* (Yellow Catfish), *Mystus ankutta* (Sri Lanka Dwarf Catfish), *Schistura notostigma* (Sri Lanka Banded Mountain Loach), *Clarias brachysoma* (Sri Lanka Walking Catfish), *Belontia signata* (Sri Lanka Combtail), *Garra ceylonensis* (Sri Lanka Stone Sucker), *Horadandia atukorali* (Horadandia), *Channa orientalis* (Smooth-Breasted Snakehead) and *Ompok argestes.* One exotic species was also recorded. (See Annex 9.8).

Critical/Sensitive Areas around the proposed project site at Millewa

Protected areas would fall under the definition of critical areas. With respect to this criterion, the proposed re-location site or its buffer of 1 km does not support any protected areas. The Meeriyagolla forest lies immediately outside the 2 km buffer zone and would hence not be impacted by the project. See Figure 3.38.

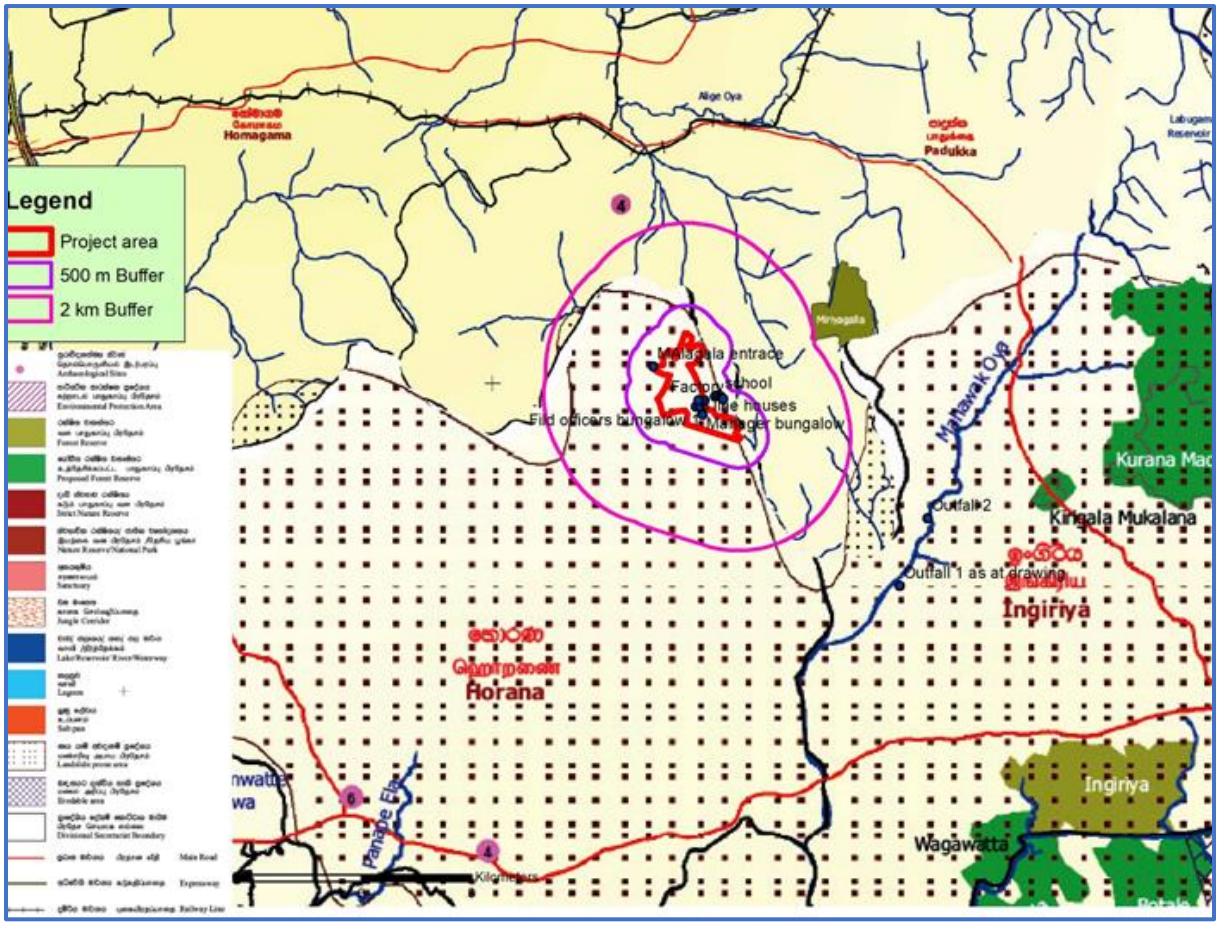


Figure 3.38 - The map of the project area where the proposed project site

(Indicated in a redline) and the two buffer zone boundaries (pink/purple lines). Note Meeriyagolla lies immediately outside the 2 km buffer.

A critical habitat is also defined as a habitat required for the survival of critically endangered or endangered species and areas with special significance for endemic or restricted-range species. Based on these criteria, the area considered for prison-re-location could be considered as being moderately sensitive. In semi-urban or urban landscapes every effort must be made to protect biodiversity. Even in the absence of legally designated protected areas, other habitats that support moderate numbers of species, endemics, and threatened species, must be protected to the extent possible. In this respect, the two locations that would be impacted by project activities – the Mawak Oya, located about 7 km away from the project site deemed to receive sewage and effluent emanating from the prison facility, and the spring, associated pool, and abandoned rubber within the project site, could be considered sensitive.

With regards to the Mawak Oya, the importance is particularly relevant to aquatic/semi-aquatic fauna – fish, amphibians, dragonflies, and other aquatic insect assemblages that will be adversely impacted. It must be noted here that since both outfalls are located along the same stream, although they are separated by a small distance, we would expect both areas to hold a similar faunal / floral community. Overall, a total of 37 fish species would likely occur here. Fifteen species of fish, including the Sri Lanka Stone sucker and the Sri Lanka Black ruby barb, which are both endemic and threatened, were observed during the survey at the proposed outfall locations. Eight species of fish including the threatened and endemic Sri Lanka Cherry barb, were observed at the spring and associated pool, during the rapid assessment survey. The streamlet near the entrance

of the proposed land supports many fish species and is reported to have relatively clean water. The riparian vegetation in these aquatic/semi-aquatic habitats serve as a refuge for the dragonflies and hence, the Mawak Oya, the spring location and streamlets also supported a relatively large community of dragonflies. Collectively, around 20 species which included some threatened and endemic species were recorded during the rapid assessment survey. Apart from these species, there was evidence that many other terrestrial faunal species (e.g., fishing cat, otter) use these water sources.

Sensitive species within and around the proposed prison re-location site

Endemic and threatened species could be regarded as sensitive species. Accordingly, 27 endemic plant species were recorded in the proposed project site. As many as 19 are Nationally threatened – 2 Endangered and 17 Vulnerable, and a further 12 species are Near Threatened. No point endemics were recorded within the site. The list is given in **Table 3.11.**

Table 3.11 - Threatened plant species list within the proposed project site and the buffer.

Species	Sinhalese name	Distribution Status	Threatened Status
Scyphostachys coffeoides	වල් කෝපි	Endemic	EN
Combretum acuminatum		Native	EN
Strobilanthes adenophora	නෙළු	Endemic	VU
Wrightia antidysenterica	ඉද්ද, කැළෑ ඉද්ද, සුදු ඉද්ද, වල් ඉද්ද	Endemic	VU
Calophyllum acidus	කීන, දෙහි කීන, බටු කීන	Endemic	VU
Bhesa nitidissima		Endemic	VU
Entada zeylanica	හීන් පුස් වැල්	Endemic	VU
Cinnamomum verum	කුරුඳු, පත් කුරුඳු	Endemic	VU
Memecylon urceolatum		Endemic	VU
Horsfieldia iryaghedhi	රුක්, රුක් ගෙඩි, තලන්, මළබොඩ	Endemic	VU
Pandanus ceylanicus	ඕ කෙයියා	Endemic	VU
Cyathula prostrata	බිම් කරල් හැබ	Native	VU
Anodendron parviflorum	අස්වැල්, දුල්, ගැරඩි දුල්	Native	VU
Gymnema sylvestre	මස් බැද්ද, බිම් නුග	Native	VU
Murdannia loriformis		Native	VU
Trichopus zeylanicus	බිම් පොල්	Native	VU
Grona heterocarpa var. *heterocarpa*		Native	VU
Pericopsis mooniana	නැදුන්	Native	VU
Phyllanthus emblica	නෙල්ලි	Native	VU
Petchia ceylanica	වල් කදුරු, වස කදුරු, කුකුල් කදුරු	Endemic	NT
Dipterocarpus zeylanicus	හොර, සරල	Endemic	NT
Isonandra zeylanica		Endemic	NT
Hunteria zeylanica	මැදිය, වල් මැදිය, වල් වරල	Native	NT
Combretum latifolium	ගැට කහ	Native	NT
Artocarpus gomezianus subsp. *zeylanicus*	කන ගෝන, කවුඩු ගෝන, කොස් ගෝන	Native	NT
Ziziphus rugosa	මහ එරමිණියා	Native	NT

Species	Sinhalese name	Distribution Status	Threatened Status
Neolamarckia cadamba	ඇඹුල් බක් මී, එළ බක් මී, කලඹ, නිප, නාවත	Native	NT
Cardiospermum microcarpum	පෙනෙල වැල්, වැල් පෙනෙල	Native	NT
Mimusops elengi	මූණමල්, මුගුණ, මුකුරු, සිංහ කේසර	Native	NT
Quassia indica	සමදරා, තිත්ත සමදරා	Native	NT
Smilax zeylanica	කබරස, හීන් කබරස	Native	NT

A total of 42 endemic species of fauna (3 amphibians, 2 reptiles, 12 birds, 2 mammals and 23 freshwater fish) as well as 35 nationally threatened species have been recorded in the project site and the surrounding areas as well as in the vicinity of the Mawak Oya. The threatened species included 5 Critically Endangered species, 17 Endangered species and 13 Vulnerable species. A further 27 species are Near Threatened.

Among the amphibians only two Near Threatened species were recorded, although one of these *Pseudophilautus popularis* is a globally Endangered species. No threatened or Near Threatened reptile species were recorded during the survey. Among the birds there were two Critically Endangered species, one Endangered species, two Vulnerable species and 11 Near Threatened species. With respect to *Columba livia* (Rock Dove), although the feral population of this species is classified as Critically Endangered, since the rubber estate under consideration does not include area of natural forests, this would not be applicable. With respect to the mammals, three threatened species, two Endangered and one Vulnerable species were recorded along with a further two Near Threatened species. No threatened butterflies were recorded at the site. Among the dragonflies were 13 nationally threatened species – 2 Critically Endangered, 4 Endangered and seven Vulnerable, and a further 6 Near Threatened species. The entire list of Nationally Threatened and Near Threatened species are shown in **Table 3.12.**

Table 3.12Nationally Threatened and Near Threatened faunal species recorded in the project site and its buffer.

Species	Name	Distribution Status	Threatened Status
Amphibians			
Indosylvirana temporalis	Bronzed Frog	Endemic	NT
Pseudophilautus popularis	Common Shrub Frog	Endemic	NT
Birds			
Merops philippinus	Blue-tailed Bee-eater	Resident	CR
Columba livia	Rock Dove	Resident	CR
Hierococcyx varius	Common Hawk-cuckoo	Resident	EN
Gallirallus striatus	Slaty-breasted Rail	Resident	VU
Falco peregrinus	Peregrine Falcon	Resident	VU

Species	Name	Distribution Status	Threatened Status
Psittacula calthropae	Sri Lanka Emerald-collared Parakeet	Endemic	NT
Cacomantis sonneratii	Banded Bay Cuckoo	Resident	NT
Surniculus dicruroides	Fork-tailed Drongo Cuckoo	Resident	NT
Ixobrychus sinensis	Yellow Bittern	Resident	NT
Ixobrychus cinnamomeus	Cinnamon Bittern	Resident	NT
Strix leptogrammica	Brown Wood-owl	Resident	NT
Bubo nipalensis	Spot-bellied Eagle-owl	Resident	NT
Pernis ptilorhyncus	Oriental Honey-buzzard	Resident	NT
Ictinaetus malaiensis	Black Eagle	Resident	NT
Ceyx erithaca	Oriental Dwarf-kingfisher	Resident	NT
Picus chlorolophus	Lesser Yellownape	Resident	NT
Mammals			
Semnopithecus vetulus	Sri Lanka Purple-faced Langur	Endemic	EN
Prionailurus viverrinus	Fishing Cat	Native	EN
Lutra lutra	Eurasian Otter	Native	VU
Muntiacus muntjak	Barking deer	Native	NT
Manis crassicaudata	Pangolin	Native	NT
Dragonflies			
Ceylonosticta brincki	Brinck's Shadowdamsel	Endemic	CR
Macromia zeylanica	Sri Lanka Cruiser	Endemic	CR
Libellago greeni	Green's Gem	Endemic	EN
Paragomphus henryi	Brook Hooktail	Endemic	EN
Megalogomphus ceylonicus	Sri Lanka Sabretail	Endemic	EN
Tetrathemys yerburyii	Yerbury's Elf	Endemic	EN
Vestalis nigrescens	Black-tipped Flashwing	Endemic	VU
Libellago adami	Adam's Gem	Endemic	VU
Elattoneura centralis	Sri Lanka Dark-glittering Threadtail	Endemic	VU
Ceriagrion cerinorubellum	Painted Waxtail	Native	VU
Onychargia atrocyana	Marsh Dancer	Native	VU
Orthetrum Chrysis	Spine-tufted Skimmer	Native	VU
Trithemis festiva	Indigo Dropwing	Native	VU
Euphaea splendens	Shinning Gossamerwing	Endemic	NT
Gynacantha dravida	Indian Duskhawker	Native	NT
Orthetrum luzonicum	Marsh Skimmer	Native	NT
Orthetrum pruinosum	Pink Skimmer	Native	NT
Neurothemis intermedia	Paddyfield Parasol	Native	NT
Zyxomma petiolatum	Dingy Duskflier	Native	NT
Fish			

Species	Name	Distribution Status	Threatened Status
Laubuca varuna	Sri Lanka Varuna Laubuca	Endemic	CR
Sicyopterus griseus	Stone Goby	Native	CR
Amblypharyngodon grandisquamis	Sri Lanka Large Silver Carplet	Endemic	EN
Pethia cumingii	Sri Lanka Cuming's Barb	Endemic	EN
Pethia nigrofasciata	Sri Lanka Black Ruby Barb	Endemic	EN
Puntius kamalika	Sri Lanka Kamalica's Barb	Endemic	EN
Puntius titteya	Sri Lanka Cherry Barb	Endemic	EN
Systomus pleurotaenia	Sri Lanka Black-Lined Barb	Endemic	EN
Paracanthocobitis urophthalma	Sri Lanka Tiger Loach	Endemic	EN
Sicyopus jonklaasi	Sri Lanka Lipstick Goby	Endemic	EN
Channa ara	Sri Lanka Giant Snakehead	Endemic	EN
Aplocheilus dayi	Sri Lanka Day's Killifish	Endemic	EN
Horadandia atukorali	Horadandia	Endemic	VU
Channa orientalis	Smooth-Breasted Snakehead	Endemic	VU
Garra ceylonensis	Sri Lanka Stone Sucker	Endemic	VU
Schistura notostigma	Sri Lanka Banded Mountain Loach	Endemic	NT
Clarias brachysoma	Sri Lanka Walking Catfish	Endemic	NT
Belontia signata	Sri Lanka Combtail	Endemic	NT
Tor khudree	Masheer	Native	NT
Xenentodon cancila	Freshwater Gar Fish	Native	NT

3.7 Historical and Archaeological Importance

3.7.1 Places located within project footprint and its vicinity

There are no historically, archeologically, culturally or religiously significant places, located within project footprint, except small cemetery. The workers residing in Millewa Watta are mostly Tamil and therefore, they have one Hindu Kovil established outside of the project footprint but within Millewa Watta. A temple also is located between boundary of Millewa Watta and B123 Meepe, Horana main road. However, the SIA team observed some religious places located within 2km radius from the boundary of project footprint. The details of religious places are shown in **Table 3.13 and Figure 3.39.**

Table 3.13 - Religious places located within 2km radius

Names of Religious places	Distance-Km from the boundary of the project land
Amaratilakaramaya	0.78
Rangiri Viharaya	0.19
Purana Gallen Viharaya	1.34
Siri Vijayawardanaramaya	1.01
Paramadhammakithyaramaya	1.51
Galge Viharaya	1.07

Names of Religious places	Distance-Km from the boundary of the project land
Vijaya Visuddharamaya	1.56

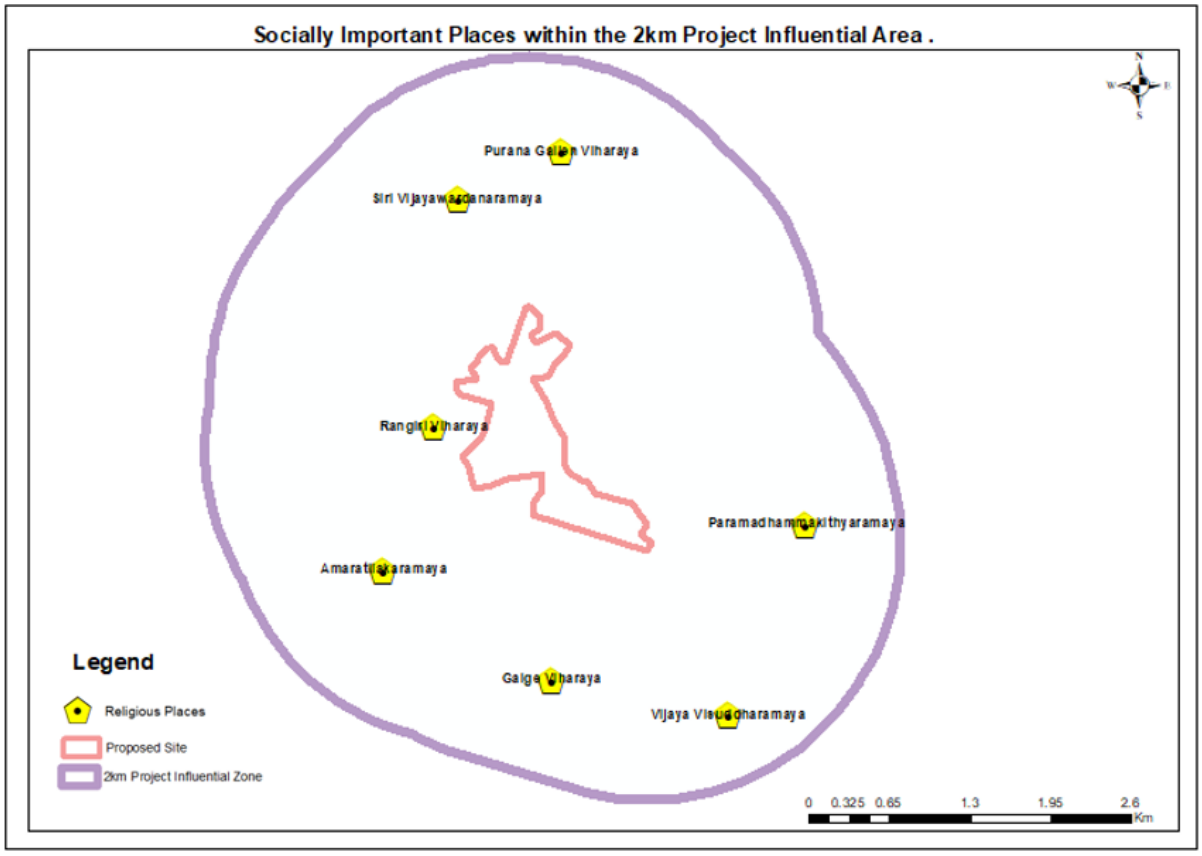


Figure 3.39 - Culturally Important Places in the Project Influential Area

3.8 Socio-Economic Environment

General Introduction

Significant land area in 628C Pahala Millewa North GN division falls within Millewa Watta rubber plantation. Millewa Watta has a long history as a plantation. It had been initiated as a private company. Most of the workers in this company were Tamil with south Indian origin. The plantation management had provided with accommodation within the estate in line houses. Due to significant performance deterioration of the estate in from the recent time some workers had become redundant and therefore, they had gone out to seek employment. Even now the workers attempt at seeking employments in outside areas. The people living outside of the Millewa Watta are mainly farmers involved in paddy cultivation and cultivation of minor export crops, such as pepper, cinnamon etc.

Apart from paddy and mixed crops the communities outside the Millewa estate are also involved in tea and rubber plantation at small scale. Most of the land outside of the estate are freehold belongs to the farmers. The workers living and working in Millewa Watta for the last several decades have no ownership to any property. They are just living in line houses with unsatisfactory facilities.

3.8.1 Presence of agricultural lands

The site too is an existing agricultural land where there is a rubber plantation. At some places beyond the site boundary there are paddy lands. There are also home gardens too beyond the site boundary.

3.8.2 No. of families living within the study area and their socio-economic status/ livelihoods.

3.8.2.1 Population in Horana DSD and Millewa GND

The proposed project land is in 628 C Pahala Millewa North GND and Horana DSD and therefore, these administrate units are considered ass project relevant geographic areas, GND as project influential area and DSD as macro geographical unit. Horana DSD is large administrative units with 60 GN divisions. Its population is 132856 reporting from 35030 families. 628 C Pahala Millewa North GND is a moderately large administrative unit with 2249 population and 612 families. The data on population is shown in Table 3.14.

Table 3.14 - Population in Horana DSD and Millewa GND

Administrative Unit	No of Families	Population	Male	Female
Horana DSD	35030	132,856	62,666	70,190
Pahala Millewa North GND	612	2249	1114	1135

Source: Resource Profile Horana DSD- 2019

Majority of population in 628 C Pahala Millewa North GND are Sinhala 525 (86%) except 67 (14%) families belongs to Tamil.

3.8.2.2 Socio-economic condition of project affected households

Detail survey was confined to households located in the project land. The number of households in project land is 6. The socio-economic and its sub-culture related context of the community studied in detail are like the rest of the households planned to be resettled by UDA from Millewe Watta. The SIA team provides basic information on 49 other households to be resettled. The information presented on 6 households is representative to the total households to be resettled. All the community members in these households are workers of Watta as labourers and most of them are Tamils and mainly limited their social interactions to their relatives living in Watta. In this context, the information presented on 6 households is regarded as representative in this report.

3.8.2.3 Socio economic condition of households living within project footprint

Number of Households

The number of households to be relocated is 6 but 2 households have two sub families. The population in these households is 18 including 8 female and 10 males. The age group of the chief householders of 6 households are shown in Table 3.15.

Table 3.15 Age of the chief householders of affected households

Age	No	%
26 – 50 years	3	50
51 – 60 years	1	17
More than 60	2	33
	6	100

Age Difference

The age differences of the population affected in these 6 families is also a significant information required for resettlement activities. The details of their age are mentioned in the **Table 3.16.**

Table 3.16 - Age of project affected population

Age	No	%
Less than 5	1	5.5
6 – 18 years	3	17
19 – 25 years	3	17
26 – 50 years	6	33
51 – 60 years	1	5.5
More than 60 years	4	22
Total	18	100

Education levels of CHHs in HHs to be resettled

The education levels of households to be resettled is comparatively poor. This is indicated by the fact that 17% of CHH is persons with no formal education, another 50% is persons having education only up to grade 5. There are no persons among CHHs who have studied beyond grade 10 as shown in **Table 3.17.**

Table 3.17 - Education levels of CHHs in HHs to be resettled

Education levels	No	%
No formal education	1	17
Less than grade 5	3	50
Grade 6-10	2	33
GCE (O/L)	0	0
GCE (A/L)	0	0
University	0	0
Other technical/professional	0	0
Total	6	100

Education levels of total population in HHs to be resettled

The education levels of the rest of the members of the households are also poor. There are no persons even among other members who have studied beyond grade 10. The data on education levels among other members of the households is shown in **Table 3.18.**

Table 3.18 - Education levels of other members of the households

Education levels	No	%
No formal education	2	12
Less than grade 5	7	38
Grade 6-10	7	38
GCE (O/L)	0	0
GCE (A/L)	0	0
University	0	0
Other technical/professional	0	0
Students' population	2	12
Total	18	100

Economic activities of population

The most significant economic activity of people in 628 C, Pahala Millewa North GND and Horana DSD is private sector employment. The private sector employments are mainly agricultural workers in plantations and informal sector workers in nearby townships. The second most significant employment is reported as agriculture sector, but these are mainly paddy farmers and persons growing minor export crops in highlands. The data on main income generation activities of people in GND 628 C, Pahala Millewa North & Horana DSD is shown in Table 3.19.

Table 3.19 - Employment of people in 628C, Pahala Millewa North GNDs & Horana DSD

Employment category	Horana DSD		Pahala Millewa North GND	
-	No	%	No	%
Government Sector	7579	10.98	57	6.36
Semi- Government Sector	3401	4.93	0	0.00
Private Sector	35116	50.87	644	71.88
Self-Employment	6250	9.05	38	4.24
Migrated	1691	2.45	12	1.34
Other	5530	8.01	0	0.00
Technical sector	2967	4.30	15	1.67
Agriculture Sector	4068	5.89	125	13.95
Commercial sector	2430	3.52	5	0.56
Total	69032	100.00	896	100.00

3.8.2.4 Information on socio economic vulnerability of people in project relevant GND and DSD

The families receiving benefits under Samurdhi program are considered as economically and socially vulnerable households. In project relevant GND & DSD about 16% households are receiving benefits under Samurdhi program.

The persons in some families receiving subsidies are also recognized as socially and economically vulnerable persons. About 9% of such persons in GND, 628 C, Pahala Millewa North and 18% in Horana DSD are reported as persons receiving subsidies from government welfare schemes.

According to the definition of Sri Lankan social welfare programs families headed by women are defined as socially vulnerable households. About 2% of such households in GND, 628 C, Pahala Millewa North and 5% in Horana DSD are vulnerable under this category. The data on Samurdhi and other welfare receiving persons and families is shown in Table 3.20.

Table 3.20 - Samurdhi households and other social welfare receiving persons

Admin Unit	Old age	Public	Samurdhi	Other subsidy	Families entitled but not receiving subsidy	Total range subsidies
GN	0	147	98	59	0	304
DS	347	2765	5919	3559	553	12665

3.8.2.5 Economic activities of CHHs in HHs to be resettled

One of the 6 householders residing in project footprint is working in Millewa Watta. Another 3 although they are residing in Millewa Watta work in outside places due to lack of income generation activities within the rubber plantation. The chief householders in two households are retired labourers from the employment of Millewa Watta.

Only three other members of affected population in six households are working in Millewa Watta but, all other household members within employable age work outside of Millewa rubber plantation.

3.8.2.6 Income of the CHH

One of the chief householders in affected 6 households is drawing about Rs. 5000/- per month according to their details. Other 3 chief householders draw Rs. 10000 to 20000/- per month. The data on monthly income of chief householders is shown in **Table 3.21.**

Table 3.21 - Income of the CHH

Monthly income-Rs	No.	%
Less than 5000	1	16.5
10000 -20000	3	50
20000-30000	1	16.75
30000 -40000	1	16.75
Total	6	100

3.8.2.7 Total Income of the Household

The total household income of the affected 6 households ranges from 10000 to 60000 according to the information they provided. The data on total household income provided by chief householders is shown in **Table 3.22.**

Table 3.22 - Total Income of the Household

Monthly income-Rs	No	%
6000-10000		
10000 -20000	1	17
20000-30000	1	17
30000 -40000	1	17
40000-50000	2	32
More than 60000	1	17
Total	**6**	**100**

3.8.2.8 Indicators of Social/economic vulnerability

Any of the Chief Households in 6 affected Household is not socially or economically vulnerable. There is one person disable in one of the 6 Household studied. The per capita income of all 6 Households is far beyond monthly poverty line and therefore, they are not economically vulnerable.

3.8.2.9 The description of social and cultural values

The proposed project land is in traditional rural environment in 628 C, Pahala Millewa North. Scattered located rubber plantations can be observed in the vicinity of project land. Significant number of families are growing paddy under rain fed condition. They also grow minor export crops in their residential lands. The community in the area are not much exposed to urban environment and therefore they maintain traditional value system established for long period of time. Strong social capital is observed due to relationships among community members. The SIA team observed the agricultural activities in the project footprint, 500m and 2km wide land belts adjacent to the

project footprint. The data on agricultural activities perform in 3 geographical area studied is shown in **Table 3.23.**

Table 3.23 - Presence of agricultural lands

Type of agriculture land in project foot print	Extent ha	% Of total land area	Type of agriculture land in 500m land belt- ha	% Of 500m land belt	Type of agriculture land in 2 Km wide land belt- ha	% Of total land area
Paddy	0	0	88.96	28.25	341.06	21.47
Coconut	0	0	4.03	1.28	81.02	5.10
Rubber	79	100	221.45	70.31	1135.45	71.48
Other Plantation	0	0	0.5	0.16	30.98	1.95
Total	79	100.00	314.94	100.00	1588.51	100.00

Source: observation of SIA team and ARC GIS extraction data

3.8.2.10 Facilities in the households to be resettled

General

The facilities available in line houses are same with all 57 housing units expected to be resettled. The SIA team obtain data on all the facilities available in 6 housing units which is representative to the entire project affected households. The data is shown in **Table 3.24.**

Table 3.24 - Facilities in the households within project footprint to be resettled

Facility	No of households said yes	%
Pipe water	none	0
Water from well	6	100
Use firewood for cooking	2	33
Use gas for cooking	4	67
Water sealed latrines	5	85
Pit latrine	0	0
Common latrine	1	16
Share with larine in neighbouring house	0	0
Electricity	6	100
Telephones	Land phone 0	0
	Mobile phone - 4	67
Access roads to the house-Yes	6	100

Schools for children

Three children presently schooling is available in project affected households. The school they attend are mentioned below.

Table 3.25 - Schools Attended by Millewa Estate Children

Name of the school	No of children attend	Distance km
Galagedara Muslim schoo1	1	5km
Millewa estate Tamil school	1	0.5
Ingiriya Tamil school	1	20km

3.8.2.11 Data from workers in the planation

General

About 120 persons presently wok in the Millewa estate, although they do not have continuous engagement. The details of this persons working in the Millewa estate are shown below.

Table 3.26 - Data from workers in the planation

Details	No	%
Work in the Millawe Planation and stay in a house in Millewa Land	41	34
Work in Millewa Planation but stay outside	79	66

Sources observation of SIA team

Note: about 108 workers of total 120 workers work as rubber tappers

Number of years working

These persons have been working for considerable period in the estate. The specific data were not revealed by this group to the SIA team.

Present Remuneration

The daily paid remuneration to a worker range from Rs. 800/- to 1000/-.

Compensation expected by the employees

Some of the employee's loose employment as well as their residences. The SIA team observed their significant reservations to propose types of compensation they expect. Most of them categorically mentioned that UDA will implement reasonable program on compensation, few ideas on compensation they express to the SIA team are mentioned below:

Table 3.27 - Compensation expected by the employees

Solutions for loss of residence	Solutions for loss of employment
• An alternative house provided by UDA from its proposed housing scheme • Legal Ownership to the house and land	• Reasonable compensation for the loss of employment • We do not have clear idea of the proposed project and its impacts and solutions planned to address their impacts • We may be able to find daily paid labour work in other plantations and townships in the area.

3.8.3 Availability of infrastructure facilities (e.g., roads, power, and water supply, etc. and other resources)

Power is available through existing 33kV network connected to the 132KV Grid Substation atKosgama for construction and that will be available from the proposed 33kV tower line to the proposed Homagama Grid Substation. All the people in studied areas have access to electricity facilities.

Pipe water supply is available for most of the GN area in Horana DSD, but households located in Millewa estate do not have access to pipe water.

Improved access facilities are available through main roads available in Horana DSD area. Galagedara –Horana road and Malagala - Padukka road are the main roads that are connected to proposed project land through sub roads such as Millewa Watta road. The Millewa Watta sub roads are connected to both main roads.

The existing sub roads are not wide enough to reach the proposed project land during its construction and operation phases. Therefore, a new road has been proposed under the project to construct from Horana Galagedera main road. This proposed road has been designed mainly through a paddy land. SIA team observed about 4 houses are in the vicinity of right of way of proposed access roads. There will be no need arises to evacuate these houses due to the construction of the road. A road network available to access proposed project site is shown in Figure 3.40.

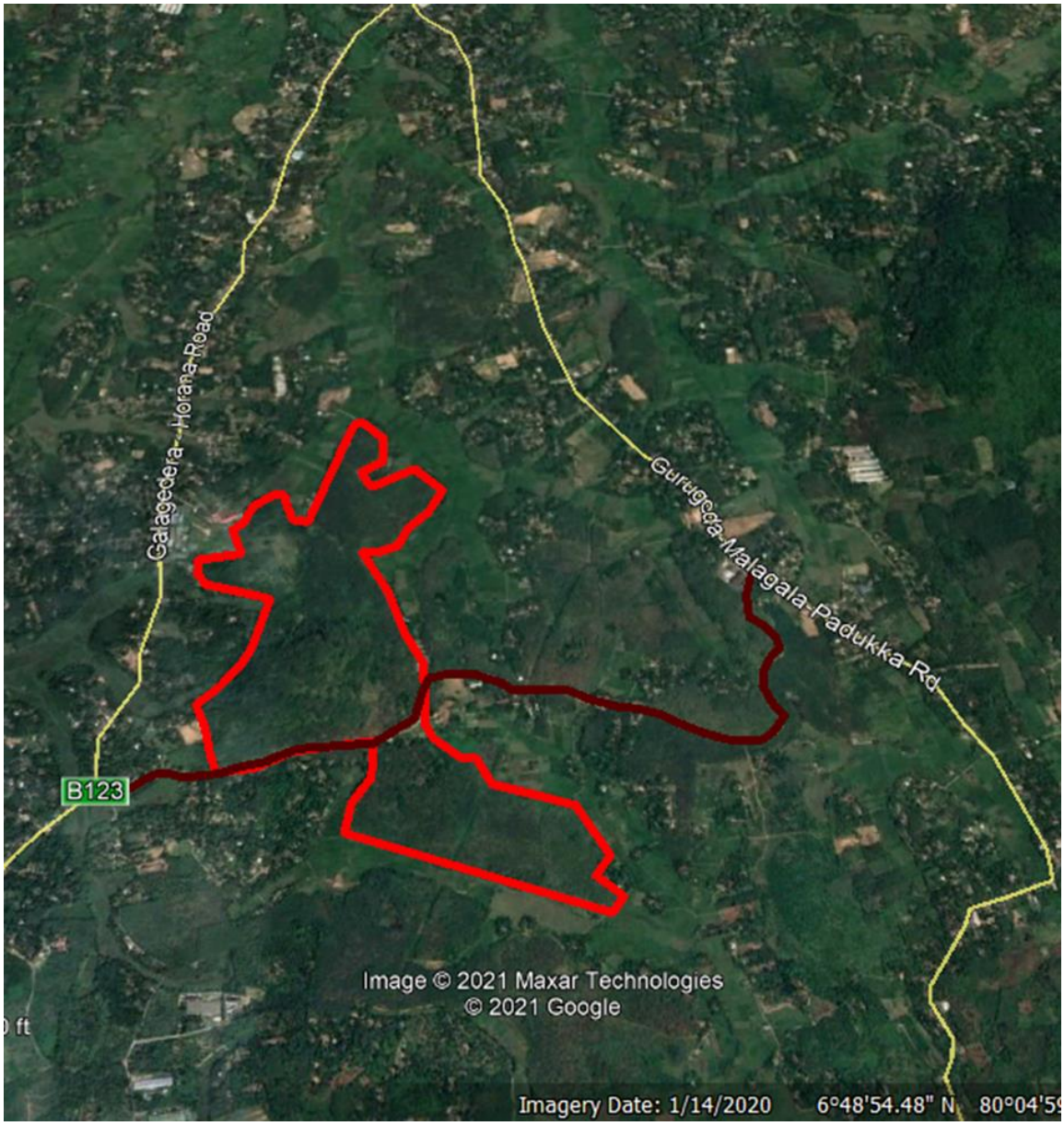


Figure 3.40 - Road layout to the Proposed Site

Urban centres available for the operators of the proposed project sites:

The proposed project site is in interior area of Horana DSD. Nevertheless, it has access to several improved urban centres in western Province through the improved road network and transport system. The details of urban centres available for the proposed project operators when need arises are shown below in Table 3.41 and Figure 3.42.

Table 3.28 - Urban centers available for the proposed project.

Urban Centres	Distance from the Site – Km
Horana	8
Ingiriya	9.2
Avissawella	20
Malabe	17
Colombo	30

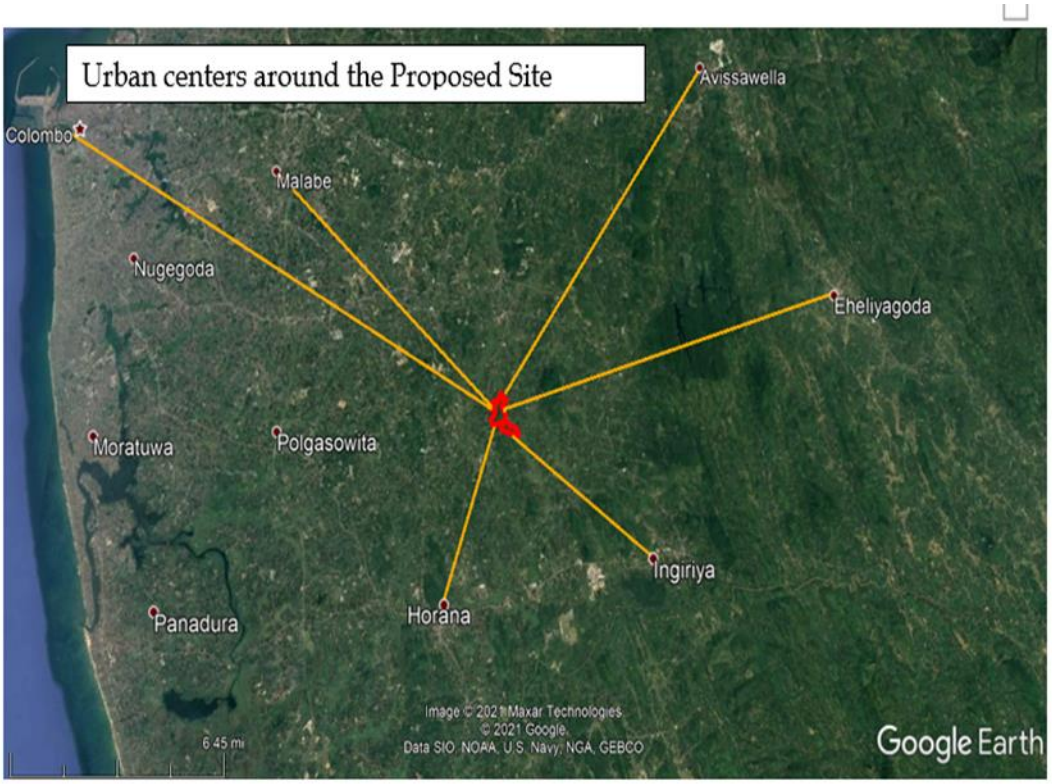


Figure 3.41 - Urban Centres around Project Site

In the 2km radius project influential area there are 5 schools located in the same land belt (2Km radius). The details of these schools are shown in Table 3.29 and Figure 3.42

.

Table 3.29 - Schools located in the project vicinity

Names of School	Distance-Km from the boundary of the project land
M.D.H. Jayawardena Vidyalaya	1.03
Millewa Kanishta Vidyalaya	1.1
Millewa Maha Vidyalaya	0.28
Malagala Maha Vidyalaya	1.61
Malagala Kanishta Vidyalaya	1.69

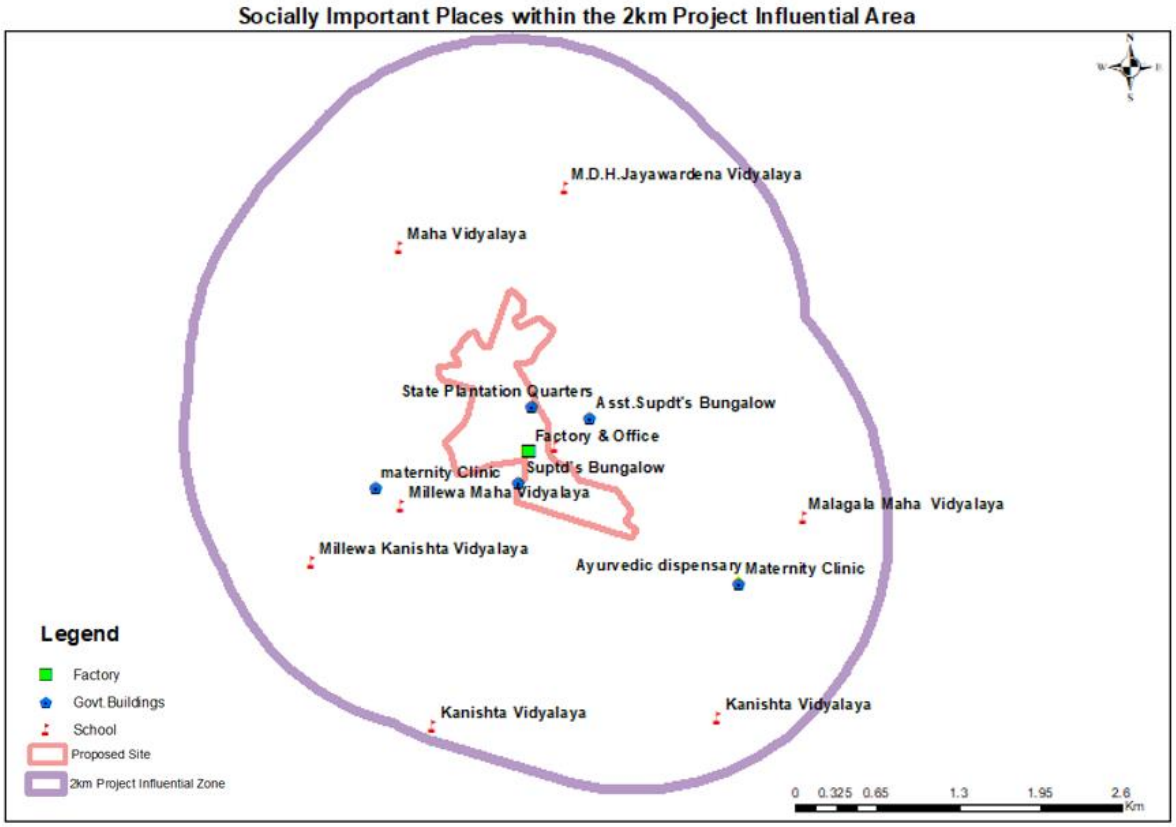


Figure 3.42 - Socially Important Places within the Project Influential Area

3.8.4 Existing infrastructure facilities which are being facilitated through the project site such as roads, power, water supply accessibility to agricultural farms/ lands, etc.

The access roads constructed from main road up to boundary of the project land may also be available for the use of local community. The local community will not be allowed to use the road exclusively constructed around the footprint. Power transmission line will be established for the use of project land but there will be no need for the local communities to tap power line established for the proposed project. This is because the local community has access to the power.

The project developer will make arrangement to have water for the project site. The main water transmission line constructed for the project may be available for distributing pipe water to the local community in future. The project construction activities will not disturb the access facilities to the agricultural area in the vicinity of project land.

3.8.5 Other facilities affected by the project

As described above the activities implemented by the project will not disturb existing infrastructure facilities enjoyed by the local community. Instead, local community also will have opportunities to enjoy infrastructure facilities such as roads, water, established by the project. The SIA team observed following facilities presently enjoyed by local community will be disturbed due to the project.

- Natural pond located in the middle of project footprint – this pond is presently used by local community for their buffalo wallowing and feeding them with water.
- Small cemetery located in one side of project footprint – this cemetery is mostly used by Tamil community to perform their specific rituals according to their culture. This activity will be disturbed due to the project.

Socio-economic features of the RoW demarcated for wastewater pipeline

The project has planned to discharge it generated wastewater to the Mawak Oya after proper treatment. The out fall of the wastewater system runs for about 7Km from project land up to the out fall at Mawak Oya. The main features located about 5 m land belt on both sides of the pipeline up to outfall was approximately counted and the details observed within 10 M RoW of pipeline are shown below in the Table 3.30 and Figure 3.43

Table 3.30 - Existing Infrastructure in the Buffer Zone

Infrastructure Type	Within 10 m Buffer either side	
	Left (Approx.)	Right (Approx.)
Residential	63	74
Commercial	4	7
Religious	1	0

* Religious place is Sri Vijaya Sunandaramaya

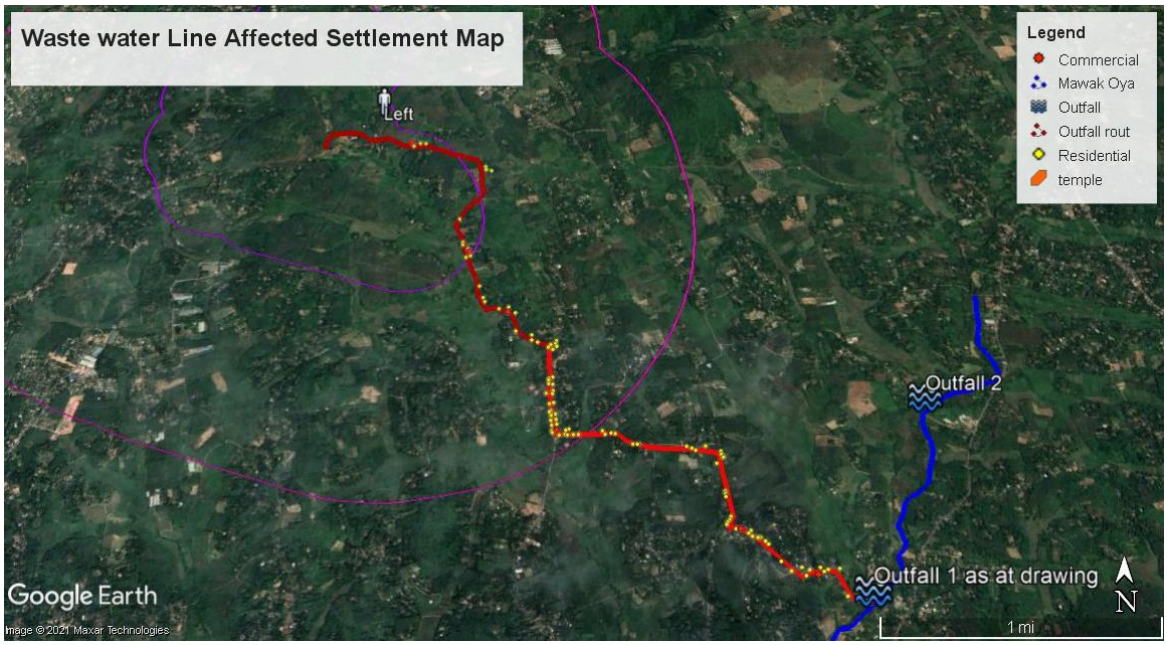


Figure 3.43 - Features observed within 10 m RoW of the wastewater pipe line

The water uses in the downstream of Mawak Oya

The information on water uses in in the downstream of Mawak Oya up to about 2 km from the out-fall point was observed with assistance from knowledgeable local community members living in the areas close to Mawak Oya. The Mawak Oya in this section runs from Handapangoda, Panangala, Koshena, Ratmalgoda and Maputugala GNDs. The main water use is local community using the river water for bathing and bathing their Buffaloes (about 16 community bathing spots and 2 Buffalo washing spots were observed- Annex 11)

3.8.6 Existing transportation infrastructure

3.8.6.1 Main Access Routes

The main access road to the site is the B123 Horana-Galagedara Road. At present the site is accessible via 2 local roads.

- Millewa Watta Road
- Local road around 925m North from Na-gas junction on B123 (near Ninja factory premises)

B123 is a national road (B class) managed by the Road Development Authority. It is a 2-lane road linking Padukka and Horana towns. The road has buses in operation with Bus route No. 315 operating on the road. The nearest bus stop and the pedestrian crossing is within 200m from the Na-gas junction which is the junction at Millewa-Watta Road and B123. The local roads have limited width 4-5m on most segments. Millewa Watta Road is concrete road, and the condition of the road is partially deteriorated.

The pedestrian facilities along B123 near Na-gas junction are limited also there is roadside space available.
Traffic speeds remain at moderate level throughout the day around 30-40 km/h.

3.8.6.2 Details of baseline noise/vibration measurement

Assessment Period

Three-hour background and existing noise level measurements

Background and existing noise measurements were carried out at four locations. The period is given below.

Day	- Two hour at each location between 0700h to 1800h
Evening/Night	- One hour at each location between 1800h to 2400h

3.8.6.3 Existing vibration level measurements

The two-measurement location were selected for vibration level measurements
Day- one hour at each location (0600h to 1800h)

Instrumentation Details

The following instruments and software used to determine the baseline noise levels

Noise data logger	: Modular Precision Sound Level Analyser, Bruel and Keajer Type 2250 and 2250L and Enhanced sound analysis software
Field calibrator	: The above meter was calibrated before the measurements against an acoustic calibrator B & K Type 4230,
Vibration data logger	: PULSE Multi Channel noise/vibration analyser Bruel and Kjaer (B&K) Type 3160-A-042, Model LAN-XI
Field calibrator	: The above meter was calibrated before the measurements against vibration exciter Brüle & Kjaer type 4294,

Result of baseline noise/vibration measurement

Summary of noise level data

Summary of noise level measurement data for four measurement locations are presented in **Table 3.31**. (Day - 2 hour and evening/night – 1hour)

Table 3.31 - Results of the baseline noise level measurement.

Date	Measurement Location		Assessment time period			
			ENL dB(A)		RBL dB(A)	
			Day	Evening/ Night	Day	Evening/Night
7th July 2021	L1	6°47'57.91"N 80° 5'8.63"E	43	46	40	43
7th July 2021	L2	6°47'33.28"N 80° 5'3.41"E	44	46	40	44
7th July 2021	L3	6°48'25.94"N 80° 5'27.35"E	41	46	37	44
7th July 2021	L4	6°47'49.42"N 80° 5'44.99"E	46	45	40	43

ENL - Existing noise level ($L_{Aeq,h}$) h-hour RBL - Rating background level ($L_{A90,15min}$)

3.8.7 Noise and Vibration

3.8.7.1 Summary of vibration level data

Summary of vibration level measurement data for two measurement locations are presented in **Table 3.32 and Table 3.33** (daytime – one hour).

Vibration Level Results - One hour Summary of measurement data for vibration Max. Peak value in velocity mode (mm/sec.) *

Table 3.32 - Measurement Location – L1

Description	Assessment period – Day – 1 hour			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure Results – Vibration	Type 3	Type 3	Type 3	Type 3
Max. Peak value in velocity mode (mm/sec.)	0.31	0.18	0.09	0.29
Frequency range (Hz) Predominant Frequency (Hz)	10 – 50 11.75	10 – 50 11.0	0 – 10 9.5	0 – 10 9.5

Table 3.33 - Measurement Location – L4

Description	Assessment period – Day – 1 hour			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure Results – Vibration	Type 3	Type 3	Type 3	Type 3
Max. Peak value in velocity mode (mm/sec.)	0.13	0.09	0.10	0.12
Frequency range (Hz) Predominant Frequency (Hz)	0 – 10 9.0	10 – 50 12.5	10 – 50 13.5	0 – 10 9.75

3.8.7.2 Evaluation of baseline noise and vibration levels

Noise surveys were carried out at four sensitive receptor locations during day and night-time. Background noise was low and typical of a suburban location and noise was dominated by local and distant traffic noise. Background noise level is marginally high during night-time due to noise created by the insects. No significant vibration was observed.

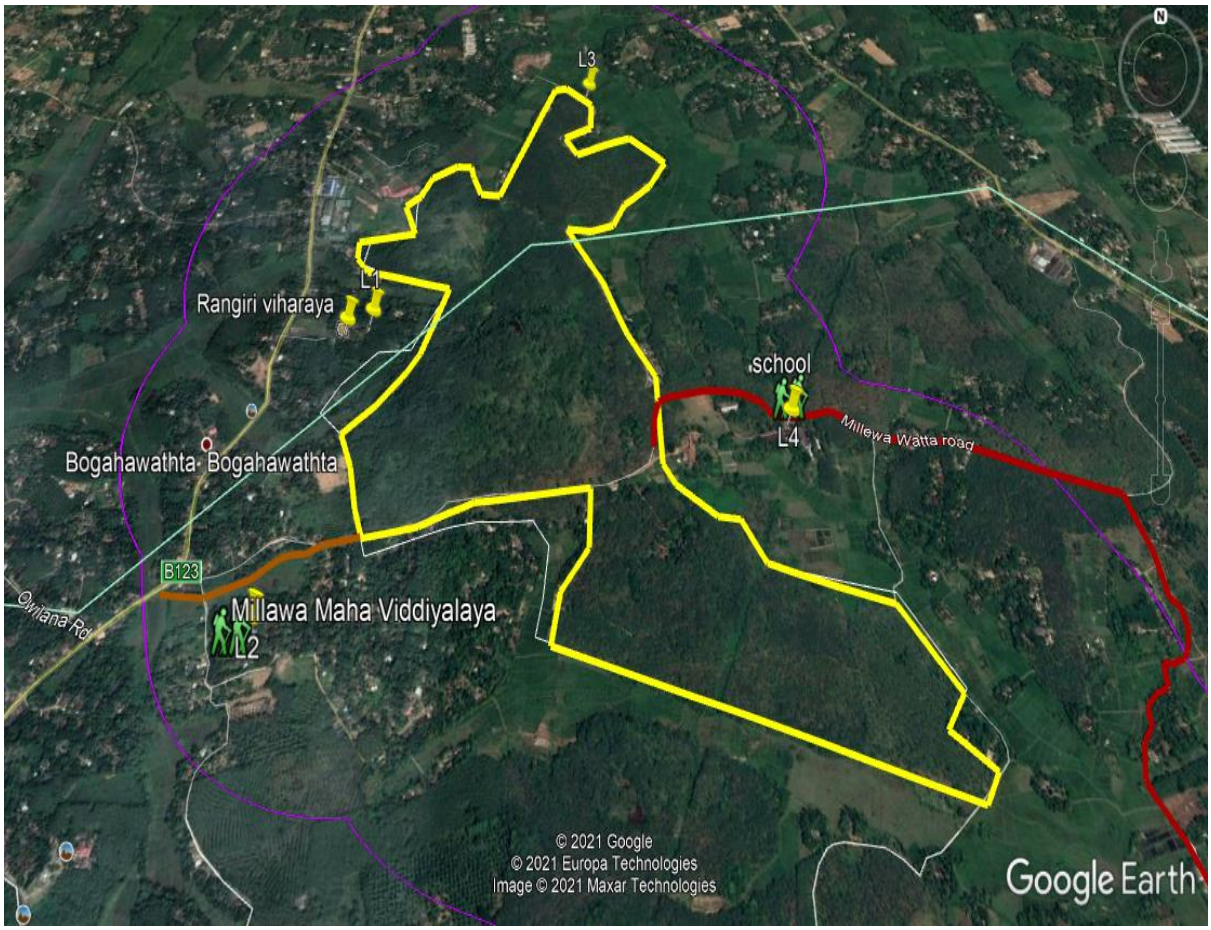


Figure 3.44 - Locations of measurement of baseline noise and vibration level

Baseline noise and vibration level report is in **Annex 12.**

3.8.8 Air Quality

3.8.8.1 Summary of Air Quality Measurements

Baseline air quality measurements were done by the Industrial Technology Institute (ITI). Summary details are given below. Report is given in Annex 07.

Table 3.34 -Comparison of AAQ measurement results with applicable local standard

Parameter/unit	Averaging time	Units	Concentration	Maximum Permissible level*
Suspended Particulate Matter Aerodynamic Diameter less than 10 µm (PM10)	24-hour Average	µg/m3	28	100
	1 hour Average	µg/m3	55	Not Available
Suspended Particulate Matter Aerodynamic Diameter less than 2.5	24-hour Average	µg/m3	8	50
	1 hour Average	µg/m3	12	Not Available
Sulphur Dioxide (SO_2)	24-hour Average	ppb	1.2	30
	1 hour average	ppb	1.9	80
Nitrogen Dioxide (NO_2)	24-hour Average	ppb	1.3	50
	1 hour average	ppb	3.3	130
Carbon Monoxide (CO)	24-hour Average	ppb	624.2	Not Available
	1 hour average	ppb	768.4	26000
Ozone(O_3)	24-hour Average	ppb	21.0	Not Available
	1 hour average	ppb	31.9	100

**National Environmental (Ambient Air Quality) Regulations, 1994 published in Gazette Extraordinary, No. 850/4 dated 20th December 1994 and amended by Gazette Extraordinary No 1562/22 dated 15th August 2008.*

4 CHAPTER 4: ANTICIPATED ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

4.0 Significant Impact Identification through Leopold Matrix

4.0.1 Leopold Matrix

The Leopold matrix is a standard tool for finding the magnitude and the significance of the environmental impacts, which will help screen and prioritise the impacts to propose mitigation methods for the most significant impacts. A Leopold Matrix was prepared considering the impact types listed in the following sections.

To assign the scores to each impact, project activities during various stages of the project i.e., Pre-Construction Stage, Construction Stage, and Operational Stage were evaluated against various impact themes of the Physical, Physiochemical, Social, and Ecological Environments. Positive scores will be assigned for positive impacts while negative scores were assigned on negative impacts. The impact scores were assigned on two major themes i.e., the Magnitude [M] and the Significance[S]. The scores will be assigned based on the criteria outlined in the following table.

Table 4.1 - Scoring Method for the Environmental Impacts

SCORING METHOD	
+ Positive	- Negative
Magnitude[M]/Significance[S]	
"Blank"	Not relevant
1-3	Insignificant
4-6	Significant
7-9	Very significant

Cumulative Effect of the Impact Magnitude and Significance

The cumulative effect of the Magnitude[M] and the Significance[S] of impacts will be assessed on taking the multiplication of S and M. Negative values were used for negative impacts and positive values were used for positive impacts. These cumulative effects will be illustrated using a colour code within the Leopold Matrix as indicated in the table below.

Table 4.2 - Colour Coding Method for the Environmental Impacts

Magnitude[M] X Significance[S]			
-	(-1) to (-27)	+	1 to 27
-	(-28) to (-55)	+	28 to 55
-	(-56) to (-81)	+	56 to 81
Negative		**Positive**	

The degree of positivity and negativity is illustrated for each impact through the colour coding process. Hence the significant negative impact items could be readily spotted in the Leopold Matrix.

Impact Threshold Scores

The typical impact threshold scores with the colour coding are given in the table below.

Table 4.3 - The typical impact threshold scores with the colour coding

Note: Figures given in the table are fictitious

	Magnitude [M]								
Signinificance [S]	POSITIVE IMPACTS								
	Significance	1	2	3	4	5	6	7	8	9
	1	1	2	3	4	5	6	7	8	9
	2	2	4	6	8	10	12	14	16	18
	3	3	6	9	12	15	18	21	24	27
	4	4	8	12	16	20	24	28	32	36
	5	5	10	15	20	25	30	35	40	45
	6	6	12	18	24	30	36	42	48	54
	7	7	14	21	28	35	42	49	56	63
	8	8	16	24	32	40	48	56	64	72
	9	9	18	27	36	45	54	63	72	81
	NEGATIVE IMPACTS								
	Significance	-1	-2	-3	-4	-5	-6	-7	-8	-9
	1	-1	-2	-3	-4	-5	-6	-7	-8	-9
	2	-2	-4	-6	-8	-10	-12	-14	-16	-18
	3	-3	-6	-9	-12	-15	-18	-21	-24	-27
	4	-4	-8	-12	-16	-20	-24	-28	-32	-36
	5	-5	-10	-15	-20	-25	-30	-35	-40	-45
	6	-6	-12	-18	-24	-30	-36	-42	-48	-54
	7	-7	-14	-21	-28	-35	-42	-49	-56	-63
	8	-8	-16	-24	-32	-40	-48	-56	-64	-72
	9	-9	-18	-27	-36	-45	-54	-63	-72	-81

The Leopold matrix for different environmental sub domains and for the different stages of the project is presented in **Figure 4.4** and the sorted matrix on the total score is presented in **Figure 4.5.** The significant negative impacts identified through the Leopold matrix in the order of priority are presented in **Table 4.6.**

Table 4.4 - Leopold Matrix for Different Environmental Sub Domains

No.	Project Stage(Pre Construction, Construction , Operation)	Sub Environment	ENVIRONMENTAL IMPACTS / PROJECT ACTIVITIES	Construction Phase												Operational Phase										Total Score
				Site clearing (trees and ground cover, demolision of houses)	Cuting, Land filling, & excavation	Rock blasting, excavation and flyrock	Heavy vehicle movement & transportation of material/ equipment	Temporary labour camp construction including latrines	Internal roads, new drainage system, sewage network, water distribution	Construction of buildings/ structures	Construction of Wastewater Treatment Plant (Wastewater and sewage)	Construction and demolition waste disposal	Overland pipe laying for sewage outfall construction	Construction of prison infrastructure	Essential Landscaping	Disposal of treated domestic wastewater	Disposal of Scheduled (Hazardous) waste	Disposal of solid waste(Domestic/Municipal)	Operation of the service stations	Disposal of bio medical waste in hospital	O & M of the wastewater tratment plants and the sewerage network	O&M of the treated sewage discharge outfall and pipeline	O&M of the water supply network	O&M of the stormwater network	Activities of prisnors and workers	
1	CON	PHY	Landuse/Landscape changes	-64	-42	-81	-15	-24	-36	-42	-16	-36	-16	-16	36	4	25	49	49	-4	-64	-64	-25	-16	-3	-401
2	CON	PHY	Land stability degradation due to construction activities	-64	-64	-75	-40	-12	-30	-25	-12	-36	-25	-25	49	0	0	0	0	0	0	0	0	0	0	-359
3	CON	PHY	Potential for soil erosion	-64	-64	-64	-25	-12	-30	-25	-12	-36	-25	-25	49	0	0	0	0	0	0	0	0	0	0	-333
4	CON/OPNL	PHY	Groundwater Impacts, depletion due to extraction	-49	-49	-49	-4	-4	-4	-4	-4	-4	-4	-4	-2	-4	-16	-16	-16	-20	0	0	0	0	0	-253
5	CON	PHY	Blasting hazards	-64	-25	-81	-64	-64	-64	-64	-64	-64	-64	-64	-64	0	0	0	0	0	0	0	0	0	0	-746
6	CON	PHY	Visual image/ open space quality/ greenary degradation	-64	-64	-81	-36	-25	-25	-49	-4	-25	-25	-36	81	0	-49	-49	-25	-25	-25	-25	-25	-25	-25	-626
7	CON	PHY	Natural drainage pattern and hydrology	-36	-64	-81	-4	-2	-4	-16	-1	-25	-1	-36	4	-64	-81	-25	-16	-4	-25	-1	-49	-49	-1	-581
8	CON	PHY	Waterbody/spring destruction	-81	-64	-81	-4	-16	-4	-25	-25	-16	-2	-25	-4	0	-25	-25	-25	-16	-36	-25	-25	-25	-16	-565
9	CON	PHY	Air Quality Impacts (Odour, dust, opacity)	-49	-36	-81	-36	-9	-16	-16	-2	-49	-16	-49	64	-36	-64	-16	-36	-25	-36	-4	-4	-4	-9	-529
10	CON	PHY	Surface Water Quality Impacts (Odour,taste, colour and appearance)	-36	-36	-81	-36	-49	-25	-4	-25	-25	-4	-36	25	-49	-64	-25	-16	-25	-25	-25	-3	-3	-16	-583
11	CON	PHY-CHE	Ground water quality degradation by conventional pollutants (COD/BOD/SS alterations to undesired level)	-25	-49	-81	-4	-16	-4	-4	-4	-49	-9	-9	9	-81	-81	-25	-25	-25	-64	-1	-16	-16	-49	-628
12	CON	PHY-CHE	Land contamination by oil in service areas	-16	-16	-81	-16	-2	-4	-16	-2	-25	-2	-36	-2	-64	-81	-25	-49	-36	-25	-1	0	0	-1	-500
13	OPNL	PHY-CHE	Water quality and ecological degradation of Mawak Oya by untreated effluent from the treatment plant (during breakdown)	0	0	0	0	0	0	0	0	0	0	0	0	-81	0	0	-64	-81	-81	-64	-16	-16	-25	-428
14	CON	PHY-CHE	Noise and Vibration (Inconvenience to sensitive receptors such as religious places, schools, hospitals)	-36	-64	-81	-64	-16	-25	-25	-4	-4	-25	-16	-1	-4	0	0	0	0	-4	0	0	0	-16	-385
15	OPNL	PHY-CHE	Health hazards from disposal of biomedical and scheduled wastes	0	0	0	0	0	0	0	0	0	0	0	0	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-640
16	CON	PHY-CHE	Dust/ PM_{10}, $PM_{2.5}$ levels increase (Air Quality)	-81	-64	-81	-42	-24	-16	-36	-4	-30	-9	0	25	0	0	0	0	0	0	0	0	0	0	-362
17	CON	PHY-CHE	Groundwater quality degradation by sewage and clinical waste	0	0	0	0	0	0	0	0	0	0	0	0	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-250
18	CON	ECO	Loss and alteration of Habitats of flora and fauna	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	25	-64	-81	-16	0	0	0	0	0	0	-4	-878
19	CON	ECO	Destruction (death and displacement) of Terrestrial Flora at the site	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	25	-64	-81	-16	0	0	0	0	0	0	-4	-878
20	CON	ECO	Destruction (death and displacement) of Terrestrial Fauna at the site	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	25	-64	-81	-16	0	0	0	0	0	0	-4	-878
21	CON	ECO	Death and destruction of flora(threatened, endangered or endemic floral species)	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	81	-64	-81	-36	-64	0	-36	-36	-36	-36	-25	-671
22	CON	ECO	Destruction of threatened, endangered or endemic faunal species	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	4	-64	-81	-36	-64	0	-64	-64	-64	-64	-25	-860
23	CON	ECO	Death and destruction of Aquatic Flora	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	81	-64	-81	-36	-64	0	-36	-36	-36	-36	-25	-671
24	CON	ECO	Death and destruction of Aquatic Fauna	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	81	-64	-81	-36	-64	0	-36	-36	-36	-36	-25	-671
25	CON	SOCIO	Loss of employment of estate workers	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-1408
26	CON/OPNL	SOCIO	Worker health and safety impairment	-64	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	-64	-40	-63	-36	-49	-81	-72	-72	-36	-36	-64	-1334
27	CON/OPNL	SOCIO	Loss of houses for 6 families	-64	-64	-64	-25	-49	-36	-36	-36	-36	-16	-16	-16	-49	-49	-49	-49	-36	-36	-36	-36	-36	-49	-883
28	CON/OPNL	SOCIO	Change of Cultural Values/social unrest in sorrounding villages	-64	-64	-64	-25	-49	-36	-36	-36	-36	-16	-16	-16	-49	-49	-49	-49	-36	-36	-36	-36	-36	-49	-883
29	CON	SOCIO	Economic loss from the destruction of rubber plantation	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	-64	0	0	0	0	0	0	0	0	0	0	-802
30	CON/OPNL	SOCIO	Public health, safety and convenience degradation	-16	-16	-64	-25	-25	-16	-4	-25	-49	-25	-25	-25	-64	-64	-16	-25	-25	-16	-64	-81	-49	-25	-744
31	CON/OPNL	SOCIO	Fire hazards	-16	-16	-16	-36	-36	-36	-36	-36	-36	-36	-36	0	-64	-64	-64	-81	-49	-49	-49	-49	-49	-64	-918
32	OPNL	SOCIO	Livelihood/Life style/ cultural changes	-4	-4	-4	-4	-4	-4	-4	-4	-4	-16	-49	-4	-4	-25	-25	-25	-25	-16	-64	-49	-49	-64	-451
33	CON/OPNL	SOCIO	Traffic Flow and other road users / access difficulties	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-25	-25	-25	-25	-25	-25	-25	-25	-25	-9	-282
34	CON/OPNL	SOCIO	Property value fluctuations	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-25	-175
35	CON	SOCIO	Natural drainage congestion, natural drainage system degradation	-64	-49	-64	-16	-8	-25	-25	-9	-30	-20	-20	49	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-341
36	CON/OPNL	SOCIO	Employment creation	25	30	30	30	30	30	30	30	30	30	30	30	25	25	25	25	25	25	25	25	25	25	605
37	CON/OPNL	SOCIO	Increase of social infrastucture (transport/communication/ business /commercial activities)	25	25	25	36	25	64	81	81	25	49	81	16	64	64	64	64	64	64	64	64	64	64	1173

Table 4.5 - Leopold Matrix for Different Environmental Sub Domains-Sorted According to the Scores [Negative to positive]

No.	Project Stage(Pre Construction, Construction, Operation)	Sub Environment	ENVIRONMENTAL IMPACTS / PROJECT ACTIVITIES	Construction Phase												Operational Phase										Total Score
				Site clearing (trees and ground cover, demolision of houses)	Cuting, Land filling, & excavation	Rock blasting, excavation and flyrock	Heavy vehide movement & transportation of material/ equipment	Temporary labour camp construction including latrines	Internal roads, new drainage system, sewage network, water distribution	Construction of buildings/ structures	Construction of Wastewater Treatment Plant (Wastewater and sewage)	Construction and demolition waste disposal	Overland pipe laying for sewage outfall construction	Construction of prison infrastructure	Essential Landscaping	Disposal of treated domestic wastewater	Disposal of Scheduled (Hazardous) waste	Disposal of solid waste(Domestic/Municipal)	Operation of the service stations	Disposal of bio medical waste in hospital	O & M of wastewater tratment plants and the sewerage network	O&M the treated sewage discharge outfall and pipeline	O&M of the water supply network	O&M of the stormwater network	Activities of prisnors and workers	
25	CON	SOCIO	Loss of employment of estate workers	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-1408
26	CON/OPNL	SOCIO	Worker health and safety impairment	-64	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	-64	-40	-63	-36	-49	-81	-72	-72	-36	-36	-64	-1334
31	CON/OPNL	SOCIO	Fire hazards	-16	-16	-16	-36	-36	-36	-36	-36	-36	-36	-36	0	-64	-64	-64	-81	-49	-49	-49	-49	-49	-64	-918
27	CON/OPNL	SOCIO	Loss of houses for 6 families	-64	-64	-64	-25	-49	-36	-36	-36	-36	-16	-16	-16	-49	-49	-49	-49	-36	-36	-36	-36	-36	-49	-883
28	CON/OPNL	SOCIO	Change of Cultural Values/social unrest in sorrounding villages	-64	-64	-64	-25	-49	-36	-36	-36	-36	-16	-16	-16	-49	-49	-49	-49	-36	-36	-36	-36	-36	-49	-883
18	CON	ECO	Loss and alteration of Habitats of flora and fauna	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	25	-64	-81	-16	0	0	0	0	0	0	-4	-878
19	CON	ECO	Destruction (death and displacement) of Terrestrial Flora at the site	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	25	-64	-81	-16	0	0	0	0	0	0	-4	-878
20	CON	ECO	Destruction (death and displacement) of Terrestrial Fauna at the site	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	25	-64	-81	-16	0	0	0	0	0	0	-4	-878
22	CON	ECO	Destruction of threatened, endangered or endemic faunal species	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	4	-64	-81	-36	-64	0	-64	-64	-64	-64	-25	-860
29	CON	SOCIO	Economic loss from the destruction of rubber plantation	-81	-64	-81	-64	-64	-64	-64	-64	-64	-64	-64	-64	0	0	0	0	0	0	0	0	0	0	-802
5	CON	PHY	Blasting hazards	-64	-25	-81	-64	-64	-64	-64	-64	-64	-64	-64	-64	0	0	0	0	0	0	0	0	0	0	-746
30	CON/OPNL	SOCIO	Public health, safety and convenience degradation	-16	-16	-64	-25	-25	-16	-4	-25	-49	-25	-25	-25	-64	-64	-16	-25	-25	-16	-64	-81	-49	-25	-744
23	CON	ECO	Death and destruction of Aquatic Flora	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	81	-64	-81	-36	-64	0	-36	-36	-36	-36	-25	-671
24	CON	ECO	Death and destruction of Aquatic Fauna	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	81	-64	-81	-36	-64	0	-36	-36	-36	-36	-25	-671
21	CON	ECO	Death and destruction of flora(threatened, endangered or endemic floral species)	-81	-64	-81	-9	-25	-25	-1	0	-36	-16	0	81	-64	-81	-36	-64	0	-36	-36	-36	-36	-25	-671
15	OPNL	PHY-CHE	Health hazards from disposal of biomedical and scheduled wastes	0	0	0	0	0	0	0	0	0	0	0	0	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-640
11	CON	PHY-CHE	Ground water quality degradation by conventional pollutants (COD/BOD/SS alterations to undesired level)	-25	-49	-81	-4	-16	-4	-4	-4	-49	-9	-9	9	-81	-81	-25	-25	-25	-64	-1	-16	-16	-49	-628
8	CON	PHY	Visual image/ open space quality/ greenary degradation	-64	-64	-81	-36	-25	-25	-49	-4	-25	-25	-36	81	0	-49	-49	-25	-25	-25	-25	-25	-25	-25	-626
10	CON	PHY	Surface Water Quality Impacts (Odour,taste, colour and appearance)	-36	-36	-81	-36	-49	-25	-4	-25	-25	-4	-36	25	-49	-64	-25	-16	-25	-25	-25	-3	-3	-16	-583
7	CON	PHY	Natural drainage pattern and hydrology	-36	-64	-81	-4	-2	-4	-16	-1	-25	-1	-36	4	-64	-81	-25	-16	-4	-25	-1	-49	-49	-1	-581
8	CON	PHY	Waterbody/spring destruction	-81	-64	-81	-4	-16	-4	-25	-25	-16	-2	-25	-4	0	-25	-25	-25	-16	-36	-25	-25	-25	-16	-565
9	CON	PHY	Air Quality Impacts (Odour, dust, opacity)	-49	-36	-81	-36	-9	-16	-16	-2	-49	-16	-49	64	-36	-64	-16	-36	-25	-36	-4	-4	-4	-9	-529
12	CON	PHY-CHE	Land contamination by oil in service areas	-16	-16	-81	-16	-2	-4	-16	-2	-25	-2	-36	-2	-64	-81	-25	-49	-36	-25	-1	0	0	-1	-500
32	OPNL	SOCIO	Livelihood/Life style/ cultural changes	-4	-4	-4	-4	-4	-4	-4	-4	-4	-16	-49	-4	-4	-25	-25	-25	-25	-16	-64	-49	-49	-64	-451
13	OPNL	PHY-CHE	Water quality and ecological degradation of Mawak Oya by untreated effluent from the treatment plant (during breakdown)	0	0	0	0	0	0	0	0	0	0	0	0	-81	0	0	-64	-81	-81	-64	-16	-16	-25	-428
14	CON	PHY-CHE	Noise and Vibration (Inconvenience to sensitive receptors such as religious places, schools, hospitals)	-36	-64	-81	-64	-16	-25	-25	-4	-4	-25	-16	-1	-4	0	0	0	0	-4	0	0	0	-16	-385
1	CON	PHY	Landuse/Landscape changes	-64	-42	-81	-15	-24	-36	-42	-16	-36	-16	-16	36	4	25	49	49	-4	-64	-64	-25	-16	16	-382
16	CON	PHY-CHE	Dust/ PM_{10}, $PM_{2.5}$ levels increase (Air Quality)	-81	-64	-81	-42	-24	-16	-36	-4	-30	-9	0	25	0	0	0	0	0	0	0	0	0	0	-362
2	CON	PHY	Land stability degradation due to construction activities	-64	-64	-75	-40	-12	-30	-25	-12	-36	-25	-25	49	0	0	0	0	0	0	0	0	0	0	-359
35	CON	SOCIO	Natural drainage congestion, natural drainage system degradation	-64	-49	-64	-16	-8	-25	-25	-9	-30	-20	-20	49	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-341
3	CON	PHY	Potential for soil erosion	-64	-64	-64	-25	-12	-30	-25	-12	-36	-25	-25	49	0	0	0	0	0	0	0	0	0	0	-333
33	CON/OPNL	SOCIO	Traffic Flow and other road users / access difficulties	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-25	-25	-25	-25	-25	-25	-25	-25	-25	-9	-282
4	CON/OPNL	PHY	Groundwater Impacts, depletion due to extraction	-49	-49	-49	-4	-4	-4	-4	-4	-4	-4	-4	-2	-4	-16	-16	-16	-20	0	0	0	0	0	-253
17	CON	PHY-CHE	Groundwater quality degradation by sewage and clinical waste	0	0	0	0	0	0	0	0	0	0	0	0	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-250
34	CON/OPNL	SOCIO	Property value fluctuations	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-25	-175
36	CON/OPNL	SOCIO	Employment creation	25	30	30	30	30	30	30	30	30	30	30	30	25	25	25	25	25	25	25	25	25	25	605
37	CON/OPNL	SOCIO	Increase of social infrastucture (transport/communication/ business /commercial activities)	25	25	25	36	25	64	81	81	25	49	81	16	64	64	64	64	64	64	64	64	64	64	1173

Table 4.6 – List of Identified Significant Negative Environmental Impacts

Project Cycle Stage	Sub Environment	Project Induced Significant Impacts
CON	SOCIO	Loss of employment of estate workers
CON/OPNL	SOCIO	Worker health and safety impairment
CON/OPNL	SOCIO	Fire hazards
CON/OPNL	SOCIO	Loss of houses for 6 families
CON/OPNL	SOCIO	Change of Cultural Values/social unrest in surrounding villages
CON	ECO	Loss and alteration of Habitats of flora and fauna
CON	ECO	Destruction (death and displacement) of Terrestrial Flora at the site
CON	ECO	Destruction (death and displacement) of Terrestrial Fauna at the site
CON	ECO	Destruction of threatened endangered or endemic faunal species
CON	SOCIO	Economic loss from the destruction of rubber plantation
CON	PHY	Blasting hazards
CON/OPNL	SOCIO	Public health, safety and convenience degradation
CON	ECO	Death and destruction of Aquatic Flora
CON	ECO	Death and destruction of Aquatic Fauna
CON	ECO	Death and destruction of flora (threatened, endangered or endemic floral species)
OPNL	PHY-CHE	Health hazards from disposal of biomedical and scheduled wastes
CON	PHY-CHE	Ground water quality degradation by conventional pollutants (COD/BOD/SS alterations to undesired level)
CON	PHY	Visual image/ open space quality/ greenary degradation
CON	PHY	Surface Water Quality Impacts (Odor, taste, colour and appearance)
CON	PHY	Natural drainage pattern and hydrology
CON	PHY	Waterbody/spring destruction
CON	PHY	Air Quality Impacts (Odor, dust, opacity)
CON	PHY-CHE	Land contamination by oil in service areas
OPNL	SOCIO	Livelihood/Lifestyle/ cultural changes

Project Cycle Stage	Sub Environment	Project Induced Significant Impacts
OPNL	PHY-CHE	Water quality and ecological degradation of Mawak Oya by untreated effluent from the treatment plant (during breakdown)
CON	PHY-CHE	Noise and Vibration (Inconvenience to sensitive receptors such as religious places, schools, hospitals)
CON	PHY	Land use/Landscape changes
CON	PHY-CHE	Dust/ PM_{10}, $PM_{2.5}$ levels increase (Air Quality)
CON	PHY	Land stability degradation due to construction activities
CON	SOCIO	Natural drainage congestion, natural drainage system degradation
CON	PHY	Potential for soil erosion
CON/OPNL	SOCIO	Traffic Flow and other road users / access difficulties
CON/OPNL	PHY	Groundwater Impacts, depletion due to extraction
CON	PHY-CHE	Groundwater quality degradation by sewage and clinical waste

CON=Construction OPNL= Operational

The following sections give the details of the impacts according to the Item order of the ToR. The mitigation measures proposed for the impacts found are presented in Chapter 5.

4.1 Constructional Impacts

4.1.1 Impacts due to land preparation and removing of rubber plantation/ vegetation/ ground cover.

4.1.1.1 General

During land preparation and the removal of the vegetation cover there will be dust stir, noise and the topsoil layers will become lose and the vulnerability to erosion will increase.

Significant negative ecological impacts would arise due to two main activities related to the proposed prison relocation project, as given below.

A. Clearance of vegetation and land preparation within the project site

Clearance of rubber trees (*Hevea braziliensis*) which is the dominant plant species at the project site, and the clearance of understorey and riparian vegetation at the site and other ancillary locations, would occur as the land is prepared for the construction of the prison facility and this would have a considerable negative impact on the biodiversity and ecology of the local area. It should be noted that the rubber trees are old (aged) and that only 50 % are proposed to be removed. A new road is proposed to be constructed bordering the project site, which will result in some filling of a paddy field. All these activities will permanently modify the surrounding landscape with negative impacts on biodiversity / ecology.

4.1.1.2 Loss and alteration of habitats of flora and fauna

- One of the terrestrial habitats that would be lost because of prison re-location project is the rubber plantation. The rubber plantation is aged and only 50 % of the rubber trees are due to be removed. Rubber plantations although much lower in ecological benefits in comparison to natural forests, provide a range of ecological services. These functions include providing habitats for biota, carbon sequestration and storage, water-regulation, erosion control, flood mitigation, mitigating pests and vectors and therefore controlling vector-borne diseases, maintaining soil quality, and facilitating soil formation. These services become crucial in urban/semi-urban landscapes such as those found in the Colombo district, because the extent of natural forests is extremely low.

- Total clearance of rubber from a relatively large extent of the land would result in the loss or displacement of plant and animal species. The surveys conducted showed that the rubber plantation concerned supports over 50 species of native plants which include at least 13 endemics. Some of these are also nationally threatened. Among the mammals, of particular importance is the Purple-faced leaf monkey. This species requires habitats with a reasonable canopy cover to survive and hence abandoned rubber plantations would be an alternative in the absence of natural forests. The shady habitat and the litter layers would be congenial habitats for herpetofauna and arthropods. There were many threatened species – those that are currently suffering from severe range and population declines. In the long term many of them would likely become locally extinct and suffer considerable regional declines in their population due to the proposed project and other projects that have been planned for, soon.

- The spring habitat is also relatively rich in flora and fauna. This is a permanent water source that is currently used for bathing buffaloes. The pool that has been created below the spring has led to the establishment of some riparian vegetation. Otter scat was recorded at this site,

and it could be expected that many terrestrial species would also use this as a source of drinking water. Therefore, the loss of this site would be detrimental to these species.

- The leakage of effluent, sewage might occur if the treatment facility is located near the spring site, near the streamlets or paddy fields.

- A small marshland is also found close to the present factory which was seen to be important for fauna. Construction operations might require that this area be filled prior to levelling and building. Removal of rock outcrops and the surrounding vegetation would also result in the loss of many faunal species, particularly small mammals and herpetofauna.

- Clearing might also occur due to the construction of the road as well as for pipelines taking sewage and sludge from the prison establishment to the Mawak Oya. The vegetation on the banks of the Mawak Oya at the point of discharge may have to be cleared to some extent.

Overall, species would be adversely affected given that the surrounding habitats are also heavily disturbed. It has been notified that clearance for the present project is restricted to 250 Acres from the total extent of around 735 Acres. However, the fact the rest of the land is also earmarked for other development projects also requiring clearance soon, one cannot ignore the long-term and permanent damage that such clearances would entail. The impacts on flora and fauna would be negative, being moderate and permanent.

4.1.1.3 Death and displacement of fauna

- The biodiversity survey conducted in the area recorded the presence of many important species. Clearance of vegetation would result in the displacement of small mammals and herpetofauna which may not be able to move to other suitable locations in a timely manner. Many of the species might also be active at night (or dawn or dusk) and may be less active during the day when clearance operations would be done and so these activities might be detrimental to them. The more mobile species such as birds, would be able to move away from the site at the slight hint of disturbance.

- Getting trapped within the site of disturbance would stress out these animals and might result in their death. Some may be run over by construction vehicles when escaping. The impacts will be mainly during site preparation and would be high and permanent.

- The displacement of some animals would result in these species inhabiting home gardens and becoming a menace to the area residents. Attacks by jackals and visits by fishing cats have been noted recently in villagers in the Horana area. Such encounters would threaten both the animals and humans particularly if the animals are rabid. Such dangers might also arise due to the movement of poisonous snakes. These animals are generally killed by residents.

- Blasting of rock outcrops which are home to many species of reptiles and small mammals would occur at the site. This would be detrimental to the fauna both in these areas and around.

4.1.1.4 Accumulation of debris due to clearance

- The removal of the rubber trees and clearance of other vegetation in the re-location site will result in a large quantity of debris and wood. The dumping of this debris near water ways or abandoned lands might cause adverse impacts such as:

- obstruction of water ways (if they are dumped near streams)
- spreading of invasives into natural habitats
- decline in the aesthetics

These impacts will be moderate and temporary.

- Proposed waste management strategies are imperative during land preparation and construction phases. Debris may also contain cement and construction material from the demolishing of the existing buildings or from the remainder of construction material. These should not be dumped in an *ad hoc* location particularly near waterbodies or in this case close to the spring or abandoned rubber areas, that are recommended to be conserved.

4.1.2 Impacts of transportation of construction material.

The transportation of construction material will be done from various places and during such transportation noise and vibration, dust stir, traffic connection and inconvenience to the public will cause.

4.1.3 Impacts due to land filling, excavation.

During excavations, the soils become loose, and the soil stability will drop. Since the project area is a sloping high ground soil filling will be minimal. Foundations of the buildings will have to be filled and compacted. Such activities will cause noise and vibration during the construction stage. There will be rock boulders at different places and these rock boulders will have to be removed either through regular blasting or chemical blasting. Blasting will cause temporary noise, vibration, and safety issues to the houses in the border village.

4.1.4 Impacts on natural drainage pattern and hydrology of the study area.

The soil excavation, removal of the trees filling will disturb the vegetal cover and the drainage pattern. The existing drainage paths and the existing spring and the stream could get disturbed. The runoff coefficient will change, and haphazard drainage flow and erosion will take place. The excavated soil during the rain could erode and flow along the slopes and could get deposited in the peripheral streams.

The paddy area abutting the Horana Galagedera road will have to be filled to construct the dedicated access road to the site. This could cause a flood lift which could impact the access road to the Millewa Maha Vidyalaya and some surrounding premises. The access road to Millewa Maha Vidyalaya is a narrow concrete road which crosses the proposed access road. Details are presented in Figure 4.1.

Figure 4.1 - Details of the Dedicated Access Road through Paddy Fields

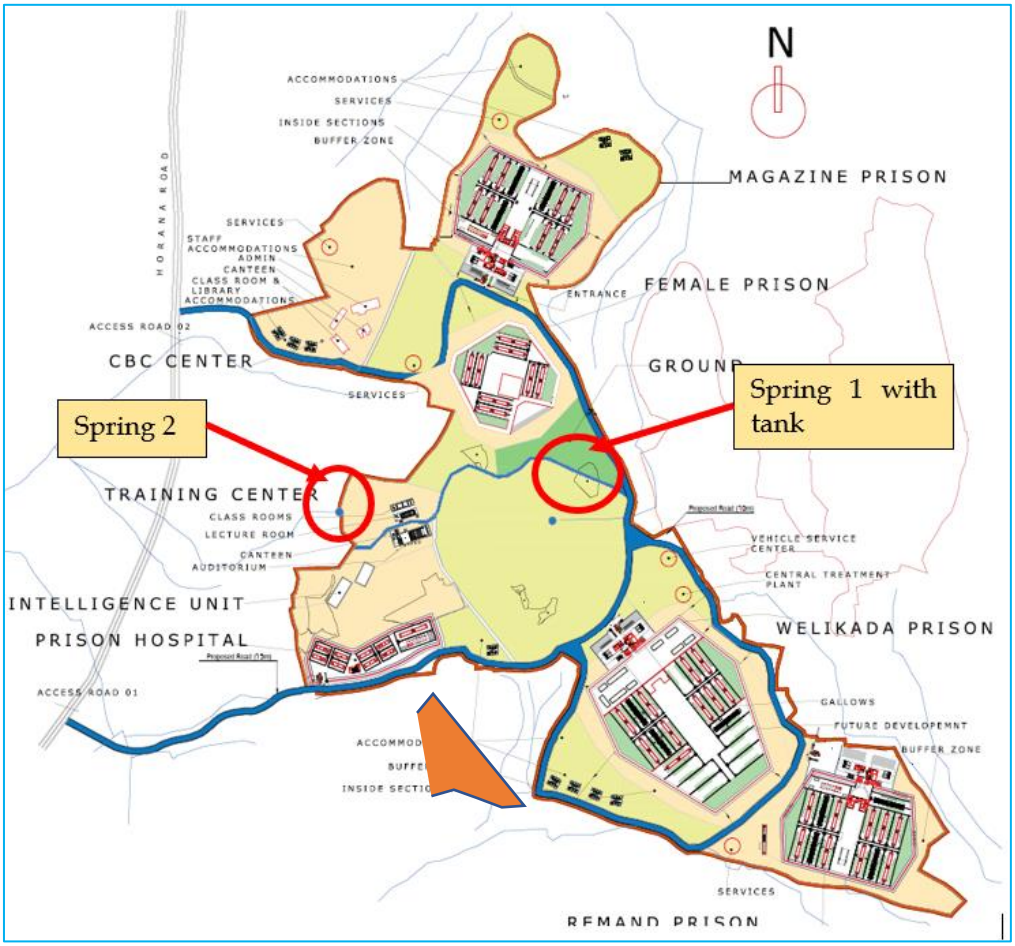


Figure 4.2 - Locations of Existing Water Springs

4.1.5 Impacts of land stability, especially, due to heavy constructional activities

Details on geo hazards are presented in Section 3.2.4. UDA has requested NBRO to provide a stability report and the report is given in Annex 19.

4.1.6 Noise, vibration, dust, and air quality impacts

4.1.6.1 General

The construction activities such as earth cutting, rock blasting, pile driving (only if required in exceptional circumstances) will cause dust stir, noise and vibration which will cause disturbance and inconvenience to the surrounding houses which are close to the site boundary.

4.1.6.2 Sensitive Receptors

Rangiri Viharaya and Millewa Maha Vidyalaya could become sensitive receptors as those are located close to the project boundary. Also, the school within Millewa Watta , community center and the line houses could become the sensitive receptors as these are located close to the project site . These entities are outside the project site. The locations of these noise sensitive receptors are presented in **Figure 4.3.**

Plate 4-1 - Rangiri Viharaya Temple -Millewa

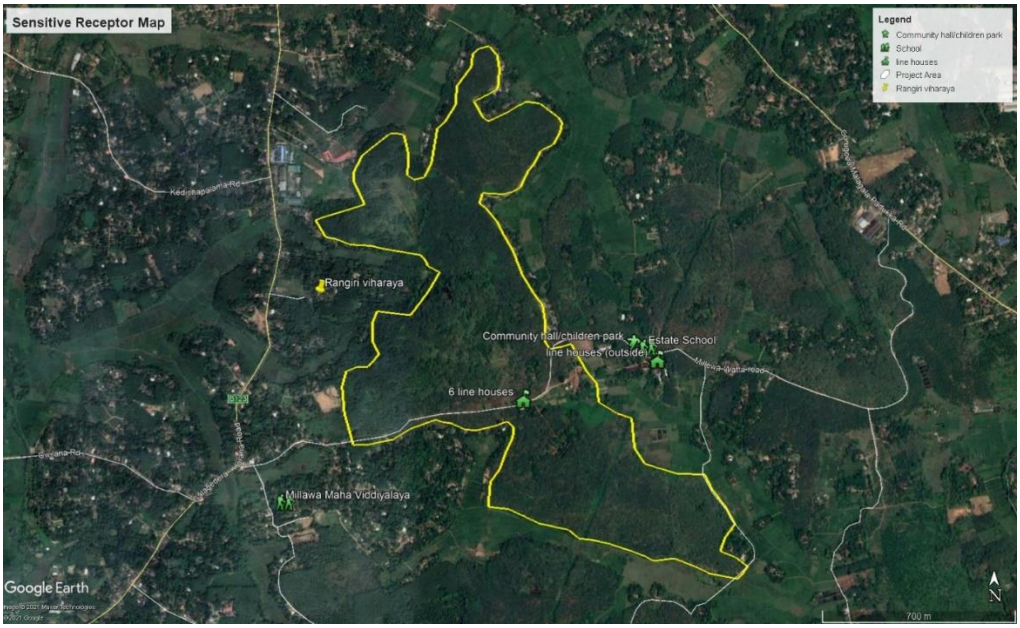


Figure 4.3- Locations of Sensitive Receptors

4.1.6.3 Construction Impacts due to machinery use

Noise and vibration sources

Following primary construction activities can be considered as the main noise and vibration sources that may have impacts on the natural environment in and around the project area during construction.

- Transportation of construction material (heavy vehicle movement)
- Unloading and loading operations
- Land preparation and earthwork
- Open excavation
- Piling
- Foundations
- Erection of prefabricated buildings
- Construction of internal roads
- Construction of boundary wall of the prison.

4.1.6.4 Anticipated noise and vibration levels

Noise

Even though, exact construction methods are not known at this stage, dozers, excavators, mechanical/ electrical tools, heavy machinery, and other manual activities could generate high noise level during construction phase. Noise levels of these sources are expected to be less than 85 dB(A) at a 1 m distance from each source.

Maximum permissible noise levels at boundaries of the land in which the source of noise is located in $La_{eq'}$,T for construction activities as stipulated by the National Environmental (Noise Control) Regulations No. 1 of 1996 published by Gazette notification No. 924/12 dated 21st May 1996, Schedule III (Regulation 4) is, 75 dB(A) during day time and 50 dB(A) during night time.

The measured existing noise level during daytime was well below 75 dB(A). Hence, the estimated noise level at boundary would not exceed the respective permissible level for construction activities, thus significant noise impacts are not anticipated during daytime construction activities. However, construction works during night-time have high potential to cause annoyance on sensitive receptors who are located closer to the project boundary. Therefore, construction activities with low noise generation will be allowed (if necessary). during night-time.

Vibration

Considerable vibration related impacts due to construction activities will not expected at the nearby building structures and would not exceed the permissible level stipulated in the "Interim Standards for Vibration of the Operation of Machinery, Construction Activities and Vehicle Movements "

4.1.6.5 Rock excavation for land preparation.

It was observed that some part of the project land consists of higher elevation due to rock. In addition to this main rock area isolated boulders also observed. As per the contour map of this area, this rock area is in the range of 80- 90-meter height. Details plan of the proposed buildings are not available up to now. Therefore, it is not clear the level of excavation required for this rock area. However, as per our estimate, medium scale rock excavation is required to prepare the land. It indicates blasting activity requirement to excavate this rocky area and isolated boulders. Vibration

Environmental problems related to the blasting process can affect residents. Vibration induced by blasting in mining and construction projects is a major environmental concern; it can cause damage to the neighbouring structures and buildings. For example, ground vibrations affect the surrounding houses through basements and foundations, while airwaves enter buildings over walls and roofs. Humans feel and react to vibrations whose intensities are lower than that considered as the threshold for structural damage. Vibration-induced damage is evaluated based on the frequency, magnitude, and duration of the vibration as well as the exposed building type

4.1.6.6 Air overpressure

In the open pit mine, air overpressure (air blast) induced by blasting operations is a major concern. It poses a risk to the surrounding buildings and structures. Air overpressure is creating due to the released energy from explosion.

4.1.6.7 Negative impact of conventional blasting in open-pit mining

General

Conventional blasting in open-pit mining and civil engineering projects has negative impacts on safety and the environment. The accelerated exploitation of mineral resources in recent years has led to an increase in the demand for explosive materials, and consequently, safety concerns and environmental accidents have increased.

Fly-rock

Fly-rock, which can be defined as fragmented rocks that are unexpectedly pushed out of the blasting area or moved by the force of the explosion, is considered the biggest concern during conventional blasting. Fly-rock can damage nearby buildings and can make injury to human and animals. The main factors that can cause the generation of fly-rock include geological structure discontinuity, poor layout and loading of the blast hole, insufficient burden, and inappropriate stemming and delay time.

4.1.6.8 Air Quality Impacts

Air Quality Impacts during Construction

Potential Air Emissions during Construction Stage

Main air polluting activities during construction include site clearance, excavation, land levelling, landscaping, construction material transportation, loading and unloading, and storage activities. Since road traffic congestion will increase during the construction phase due to heavy vehicle movement to and from the construction site, vehicular emissions including road kick-off dust would increase correspondingly.

Other than from roads, fugitive dust also generates from cleared areas and raw materials stored onsite (open piles). Accordingly, dust or particulate matter (PM) can be considered as the major air pollutant during the construction stage. Construction consists of a series of different operations mentioned above, each with its duration and potential for dust/PM generation, which often vary substantially depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions results from equipment traffic over temporary roads at the construction site. The temporary nature of construction differentiates it from other fugitive dust sources in the case of estimation and emission control. Diesel engines are frequently used in construction vehicles and machinery such as earth moving vehicles, generators, and compressors, etc. Diesel exhaust contains particle pollution, ozone-forming nitrogen oxides and toxic air pollutants. Combustion of gasoline and diesel fuel by internal combustion engines, vehicles, generators, construction equipment, etc. would generate local emissions of PM, NOX, CO, VOCs, and SO2 throughout the site preparation and construction period. Moreover, during construction and fixing of building structures and development of access roads (both internal and external); the activities such as welding, painting, asphalt processing/paving, will generate fumes and non-methane Volatile Organic Compounds (NMVOCs). Besides, open burning of solid waste generated during site clearance and construction will generate air emissions including CO, NOX, SOX, VOC, dust/PM with un-burnt carbon, dioxins, furans, etc.

Anticipated Air Quality Impacts during Construction Stage

The potential air emissions during construction activities would attribute to the rise in all ambient air quality parameters. Particle pollution by various construction activities can make a significant contribution to local air pollution posing public health problems. Mainly there can be temporary impacts on existing ambient air quality due to an increase of dust/PM concentration, which will cause health impacts (such as respiratory, eye, and dermatological diseases) on construction workers and neighbouring people, a nuisance for the sensitive receptors (i.e., people in the vicinity) due to local settling and reduced visibility as well as direct/indirect environmental impacts on existing biota as elevated dust concentrations in ambient air will decline photosynthesis process due to deposition of dust on the foliage, while affecting the paddy fields in numerous ways.

In terms of vehicular emissions and resultant pollutant concentrations, emissions from surface road vehicular density are released at the ground level which would affect the immediate vicinity of the project site.

The total amount of combustion emissions from diesel engines and internal combustion engines would be less and that would result in minimal off-site impacts. Any open burning of solid waste including polythene, plastic, and other synthetic materials might result in toxic air emissions leading to adverse impacts on the exposed human and biota.

Air quality impacts from construction activities would be temporary and mainly dependent on man-made factors such as the intensity of activity and control measures. Other than that, natural factors such as wind speed, wind direction, soil moisture will also lead to air quality impacts. However, even under unusually adverse conditions, the predicted air emissions would have, at most, a minor, transient impact on off-site air quality that would not expect to exceed or violate any applicable ambient air quality standard. Overall, the air quality impact of construction-related activities of the proposed project would be temporary and not be significant.

4.1.6.9 Impacts from Construction and Demolition (CD) Wastes

The project involves a clearing of more than 100 rubber trees of varying heights (total and bole) and DBH.

During the construction of the prison complex and demolition of 6-line houses (see **Figure 4.4**, there will be a significant quantity of construction and demolition (CD) wastes. This is a mixture of soft inert material (e.g., spoil), hard inert material (e.g., broken concrete and rocks/rubble) and non-inert material (e.g., metals, timber, plastic, and packaging wastes) as the non-hazardous waste component. Additionally, there will be some hazardous wastes too.

Figure 4.4 - Some close views of the building material of the line houses that will end up as CD wastes during demolition works

Non-hazardous wastes

Non-inert material

- Plastic wastes: Example, packaging material which is significant in terms of quantity (e.g., polythene bags and rigifoam made of polystyrene foam) and polyvinyl chloride (PVC) items such as cut pieces of pipes and the water tanks of the existing line houses.
- Wood wastes: example Plywood timber used as formworks, cut pieces of timber / wood and roof timber material (example rafters and reapers), doors and window panels that will get generated from the 6-line houses that will get demolished
- Metal wastes items such as metal roofing sheets from the line houses and cut pieces of electrical wires, reinforcements, rivet nails and nails
- Cardboard and paper (example, from Contractor Site offices and packaging wastes)
- Defective or damaged PPE (this will include rubber gloves, dust masks and goggles)

Hard inert material

- Pump car wash water (excess concrete) and waste / rejected concrete
- Concrete blocks of the toilet pits of the line houses
- Porcelain (example, cut pieces of tiles)
- Glass items such as thinner bottles
- Cement blocks, Bricks and plaster wastes from the 6-line houses that will get demolished

Hazardous wastes

- E-wastes (e.g., computer/photocopy toners, CDs and Hg rich CFL bulbs from the Contractor /Site Office complex)
- Contaminated plastic wastes (e.g., contaminated plastic wastes such as empty cans of chemicals that were used for termite treatment[4] and tubings left from chemical anchoring works[5], empty paint cans and adhesive tubings[6])
- Waste oil generated from repairing and maintenance of construction equipment and machinery (this will also include oil contaminated material such as cloth used for spill curtailment / wiping and filters removed from machinery)
- Metal that contained flammable liquids and VOCs (e.g., Paint and adhesive cans)
- Contaminated PPE
- Asbestos roofs from the 6-line houses

[4] Termite treatment chemicals often contains chlorpyrifos ($C_9H_{11}Cl_3NO_3PS$, an organophosphate insecticide) or fipronil ($C_{12}H_4Cl_2F_6N_4OS$, a broad-spectrum insecticide)

[5] HILTI chemicals (e.g., Hilti HIT-RE 500 and HIT-RE 500 V3) do contain corrosive agents and Bisphenol-A (an EDC and a severe toxicant to aquatic life)

[6] They contain flammable material and VOCs

The CD wastes from the line houses will involve asbestos roof material (to be considered as hazardous wastes) with plaster material, bricks and wooden material, etc (Fig. 4.4). Each line house has a total floor area of 378 ft^2 (total will be 2268 ft^2 / 210.7 m^2).

The following equation approved by the USEPA was used to estimate the CD waste generation amounts (Lu et al., 2017).

$W_t=W_c+W_d+W_r=AC\times WGR_c+AD\times WGR_d+AR\times WGR_r$

Where W_t is the estimated total amount of building-related CD waste generation, W_c is the waste generated from new construction of buildings, W_d is the waste generated from demolition of buildings, and W_r is the waste generated from renovation of buildings, AC is total floor area of building under construction (m^2), and WGRc is waste generation rate (ton/m^2) in building construction; AD is the total floor area of demolished building (m^2), and WGR_d is waste generation rate (ton/m^2) in building demolition; AR is total floor area of building under renovation (m^2), and WGR_r is waste generation rate (ton/m^2) in building renovation.

The present project involves only demolition and construction of new buildings, and the total CD waste quantity (non-hazardous quantity) can be estimated as follows:[7]
= (Magazine Prison 23,636.3 m^2 + Welikada Prison 31,119.4 m^2 + Female Prison 16,428 m^2 + Remand Prison 26,013 m^2 + Training Centre 10,879 m^2 + Intelligence Unit 6000 m^2 + hospital 12, 000 m^2) x 60 kg + (210.7 m^2 x 1196.57 kg)
= 7,564, 542 kg + 252,117.30
= 7,816,659.3 kg (7816.7 tons)

One of the key causes of construction waste generation would be excess or over-ordering of material due to procurement issues (such as ordering errors, supply errors and /or over-allowances). Example, Left over bricks, rubble, sand, tiles and other construction material such as timber, etc. Also design concept changes such as last minute design changes (resulting in reworks of already done works), designer's lack of experience in evaluating construction methods and the sequence of construction operation (leading to detailing errors that may require alteration or abortion of completed works), increasing design complexity (producing off-cuts), lack of enough design information (leading to assumptions made by the Contractor and sub-contractor or leading to procurement errors such as ordering items not in compliance with specifications) are key drivers to result in construction waste generation during this building construction.

Improper CD waste management planning works could lead to indiscriminate dumping of CD wastes to nearby areas especially the debris that will get generated due to the demolition of the line houses.

[7] WGR_c is around 50-60 kg waste by constructing every m^2 of Construction floor area. 1196.57 kg/m^2 is the WGR_d in this study and is about 29 times WGR_c. According to the USEPA, on a per building basis, demolition waste quantities are often 20 to 30 times as much as C&D material generated during construction (Lu et al., 2017).

Additionally, Sri Lankan workforce has the habit of practicing indiscriminate dumping of municipal wastes including paper, left over lunch packets, etc. polythene material presents in lunch packets resulting in visual pollution of the sites. Moreover, smell attracting vermin will be evident because of indiscriminate dumping of perishables. Proposed to provide space to reuse CD waste until given away.

4.1.6.10 Impact from the Pipeline Route

The pipeline mostly traverses Pradesheeya Sabha (PS) Roads, except for a 640m of Gurugoda Malagala Road which is a B Class Road. There is no heavy traffic in PS Roads. The pipe will be laid in the road shoulder and the tarred road surface will not be damaged. The impacts caused are mostly the following usual impacts.

1. Dust emanation in cutting the trenches and related public inconvenience.
2. Erosion and deposition of loose soils near streams.
3. Impacts on walking the pedestrians.
4. Traffic congestion in the B Class Road -Padukka Malagala Road
5. People/vehicles clashing against the trenches or falling to trenches at night.
6. Noise from excavating equipment and compactors.

4.1.7 Impacts on the proposed or planed government / private sector development activities in the vicinity.

The entire land is a rubber estate belongs to UDA and there are no planned activities in the vicinity. A dedicated access road will be constructed along the paddy fields from Horana Galagedera Road so that construction and operational activities will be carried out using this dedicated access road. According to the information collected from the local informants including DS, GN and other public agencies there are no existing or proposed development projects in the area except some local roads to be improved under the road rehabilitation program of the government. The road improvement projects in the local area will contribute for the community required social and economic related mobility. The proposed project will not have any conflicts due to the local level road improvement activities.

4.1.8 Impacts due to Change of Land Use / Land Use Incompatibilities

4.1.8.1 Impacts on Land Use Changes

The existing land use of the project site is rubber plantation and associated infrastructure, primarily staff and labour residential facilities. Thus, the extent of the existing built environment of the project site is minimal – 874 m^2 (Table 4.1), which is 0.1 % of the total land extent (256 acres – 103.6 ha) reserved for the proposed project.

Table 4.7: Floor area of the existing built environment

No	Built Environment (Structures)	Extent (m2)	% Of the total land
1	Mangers' Bungalow	406	
1	Staff Quarters	228	
3	Labour Quarters	240	
	Total Floor Area of the Built Environment	874	0.1

Source: Measured on Google Map

The total floor area of the proposed project is 118,879 m^2 *(Source: Project brief provided by the UDA)* which is 11.5% of the total extent of the project site, which is a significant increase. When considering other tarmac areas such as roadways, parking areas, foundations for boundary walls etc. the total impermeable extent would become around 50% of the total land extent and only 50% of the land will be cleared. Thus, the impact due to the land use change on the environment in terms of increase in the impermeable area, and removal of vegetation is significant.

4.2 Operational Impacts

4.2.1 Water and wastewater disposal

4.2.1.1 Changes in water quality and its impact on fish and other aquatic fauna in Mawak Oya

- During the operational phase the sewage and effluent from the prison establishment is due to be released to the Mawak Oya which is located approximately 7 km away from the site. The release of sewage will result in increased levels of organic matter and turbidity, changes in pH levels and reduced oxygen at the site of the outfall and immediately below it. The water would also be contaminated with faecal coliform. The grey water generated from the facility would also contain many other impurities such as detergents, grease, and food particles. Therefore, adverse changes in water quality would occur at the site of the outfall and below it.

- The rapid assessment conducted revealed the presence of 15 species of fish in the proposed outfall locations, and several others have been recorded in the area previously. Some of these species are endemic and threatened. The stream is also home to freshwater crabs and prawns, whist the banks support many species of amphibians and dragonflies. Many of the smaller fish species and fingerlings use the shallow, well oxygenated areas of the river close to its banks. The predicted changes in water quality would result in these species moving out of this stretch of the stream. The rock pools at or below the point of discharge would tend to accumulate sewage and would have poor levels of oxygen and would also become obnoxious to the stream and bank dwelling fauna. Low levels of oxygen might result in the death of stream fauna (e.g., fish kills), particularly during the dry season when the flow is sluggish.

- Other species that are tolerant such as flies, mosquitoes might start breeding in these areas during the dry spell further adversely affecting the natural faunal assemblage here.

The contamination of this waterway would have a detrimental long-term impact on the faunal assemblage at the point of discharge and in downstream areas.

4.2.1.2 Impacts on Wastewater Discharge to Mawak Oya

Increase in Turbidity in Mawak Oya

During outfall construction, turbidity will increase in the river. Presently the turbidity level in the river is very low. Until the outfall design is finalized, and the construction method is determined, the extent of the rise in turbidity in the river during construction cannot be ascertained. In the ambient water quality standard, the permissible turbidity level for bathing is not specified. However, local rivers in Sri Lanka show that people bathe even in water with high turbidity, such as NTU 30 (Kelani River). However, considering very low turbidity levels in Mawak Oya, experienced by present users, it is recommended that turbidity control measures be taken during outfall construction.

Impacts on the Downstream Water Users of Mawak Oya

Wastewater discharge to Mawak Oya may create negative issues on social and cultural environment if the recommended quality standards of wastewater treatment are not maintained by the operators of the established prison. The community members (in about 16 bathing locations within 2 km section of Mawak Oya in its downstream) bathing in Mawak Oya in its downstream area of wastewater discharge outfall will have negative impacts. Even though this impact is heavily dependent on the project operators' systemic program implemented on wastewater treatment this is regarded by sociologist as one possible negative impact that will need mitigatory actions.

4.2.1.3 Impacts on surface/ground water due to water extraction for project activities (if any)

The Water Resource Board (WRB) has investigated the site and submitted a report on the availability of groundwater. WRB has recommended 4 locations within the project site closer to the paddy areas. The Project Developer shall be mindful that excessive groundwater draw off will deplete the groundwater levels. It could affect the nearby dug wells in the village close to the site boarder and other tube wells. However, since the project area is in a high rainfall receiving wet zone, this impact is expected to be minimal. As groundwater use is not envisaged at this stage no mitigation action is required. If such a need arises separate approvals will be sought from CEA and WRB.

4.2.1.4 Methods of wastewater disposal (Discharge location should be indicated) and its impacts.

Treated wastewater will be discharged to Mawak Oya through a dedicated pipeline. The discharge location is presented in Figure 3.13. Wastewater will be treated to Inland Water Standards stipulated by the CEA when there is 8 times dilution discharge at Mawak Oya. It is not expected to discharge treated wastewater to Mawak Oya if the flow is very low. In such a case there will be water quality degradation and uncongenial conditions to the fish and other aquatic species will be created.

There will be possible contingency scenarios such as.

1. Overcrowding the prison
2. Failure of the treatment facility
3. Mawak Oya falling below the threshold dilution level (A low probability event as dilution has been check against annual minimum flows)

increasing the pollution load on Mawak Oya causing the impacts citing above.

4.2.1.5 Pollution of surface /groundwater due to oil and grease spillages from parking areas

Consultants also agree that wastewater is considered "domestic". However, the wastewater generated from the vehicle service station and the kitchens contains a significant quantity of oil and grease.

A minimum of 4 m^3/day of washwaters (having high loads of oil and grease with TSS especially mud), will be generated from the prison vehicle servicing and washing activities. In the long run the servicing yard premises and the surrounding soil will get polluted with oil and grease. Any diversion to the STP without pre-treatment will lead to siltation of the reactors in the A_2O process, while inhibiting biological growth, clog the valves and pipes and even oily material floating in the secondary settlement tank. STP failures will cause pollution of the Mawak Oya. Therefore, pre-

treatment unit is added for wastewater from the kitchens and service stations before discharging to the common sewer network (see **Figure 2.9** Process Flow Chart for Wastewater Treatment).

The bulk of the wastewater generated in the hospital would be domestic type too. However, various hazardous materials are generated within the hospitals. There will be some antibiotics and pain killer molecules or their metabolites that will contribute to the COD component (present in the urine of patients administered with these drug) along with oxidized and disinfected blood and urine samples. The mouth wash waters from the dental clinics may contribute to Hg, Pt and Pd. But these constituents will get diluted by the balance of 1517 m^3/day of effluent from the entire prison complex (inclusive of stormwater intrusion) when reaching the STP; antibiotics and pain killer molecules or their metabolites will often end up in the wasted sludge due to adsorption. Other components that will contribute to COD will include the following If disposed to the sewer lines.

- formulations/preparation of any medicine/medicinal solutions, etc that are no longer required, etc
- spilt, and contaminated pharmaceutical products, medicines, drugs, vaccines, and sera
- relatively mild liquid or semi-liquid pharmaceuticals, such as solutions containing vitamins, cough syrups, intravenous solutions (amino acids, lipids, glucose, etc.), eye drop solutions (compounds like glucose, lipids and amino acids are biodegradable)

When medicines / pharmaceuticals are administered to patients, it is expected that they will often get metabolized (except any heavy metals present in certain drugs especially ayurvedic medicine). However, any direct and regular disposal of antibiotic solutions depending on the chemical properties (excess, unused or expired) in the long run can be injurious to the STP[8]; if ones with low biodegradability (e.g. quinolones / fluoroquinolones, nitroimidazoles and sulphonamides) are disposed on and off.

The inflow to the treatment plant used in the design shows the characteristics of medium-strength domestic wastewater as per MetCalf and Eddy (2003). However, the wastewater characterization indicated much weaker strength in Colombo City. Since wastewater character has considerable influence on the design and sizing of the treatment plant, further scrutiny of the wastewater strength at the detailed design stage is recommended.

The proposed plant is a biological wastewater treatment system of anaerobic/anoxic/oxic (A_2O) configuration with secondary settling unit. Therefore, the plant is intended for nutrient removal. In addition, tertiary treatment is provided through a constructed wetland, which acts as a polishing unit. The disinfection system proposed by the NWSDB is not detailed at this stage, but the exact method will be decided during the detailed design. The proposed treatment process is sensitive and needs careful attention in operation. It is certainly not a system that can be operated without proper knowledge and experience. Constructed wetland is desirable. However, there can be issues such as mosquito breeding if a free-water surface (FWS) wetland is proposed. Waste sludge is septic (with some adsorbed antibiotics or their metabolites) and requires proper disposal arrangement; many of the antibiotics such as quinolones / fluoroquinolones (e.g. ciprofloxacin & norfloxacin), nitroimidazoles and sulphonamides such as sulphadimethoxine, sulphanilamides, sulphasalazine sulfamethoxazole & sulfamethazine (which all have low biodegradability),

[8] antibiotics have been regarded to have a pronounced bacterial toxicity and most antibiotics tested to date have not been biodegradable under aerobic conditions (Kemmerer, 2001)

tetracyclines such as tetracycline, chlortetracycline, oxytetracycline, demeclocycline and doxycycline (which have half-lives up to several 100 days) and β-lactams (such as ampicillin, amoxicillin, penicillins, cephalosprins, carbapenems, monobactams and ß-lactamase inhibitors) are removed through adsorption to sewage sludge (Kümmerer, 2001). However, antibiotics such as ampicillin, doxycycline, oxytetracycline, and thiamphenicol are biodegradable (gets mineralized to simple assimilable material). Some tetracyclines gets hydrolyzed and ß-lactams are rapidly hydrolysed; The ß-lactam ring of ß-lactam antibiotics such as penicillins can be opened / cleaved by ß lactamase, an enzyme present in bacteria (Kümmerer, 2009).

In addition, placement of screens before the grit chambers may cause siltation of the screening chambers with both organics and grit material entangled together resulting in septicity and hence bad odor.

There can be issues regarding the construction of the network, as the site includes rocky areas. Thus trenching (for pipe laying) will be difficult and require rock removal by blasting or other methods.

The plant is designed to meet the regulations for the disposal of treated effluent to inland waters. Once released to the river, the effluent will get mixed with the receiving waterbody's flow and further diluted. Although the treated effluent disposal to Mawak Oya meets the regulatory/legal requirements, a review of water users downstream of the disposal point and social concerns should be considered in the plan. The disposal pipeline is 6.8 kilometres and is very long. Therefore, the construction cost of this pipeline is high, and during operation will result in a high energy cost. Nevertheless, the proposal to discharge the treated effluent to Mawak Oya seems the only realistic option. The WWTS designers propose recycling wastewater, but it will not eliminate the need for the proposed discharge arrangement to Mawak Oya.

All open areas except playground and gathering areas will be used to gardening & agriculture during non-rainy relative dry times.

4.2.2 Solid waste disposal

4.2.2.1 Impacts Due to Clinical Waste Disposal

Types and Quantities of generation

Considering the WHO classification of biomedical wastes, the following could be concluded. There are no generation of radioactive wastes, genotoxic / cytotoxic wastes, and human anatomical parts.

Since digital x-rays are used, there will be no photographic fixing (usually contains 5-10% hydroquinone, 1-5% potassium hydroxide, and < 1% silver) and developing solutions (45% glutaraldehyde) as well as x-ray films. But some chemical wastes (many as liquids) are still generated (quantities may be variable depending on usage frequency and subsequent disposal as spent chemical wastes and empty original containers). These are discarded solid and liquid, chemicals, for example from diagnostic and experimental work and from cleaning, housekeeping, and disinfecting procedures. It will include chemicals (diluents and reagents)[9] used in testing and processing during biochemical and haematological analysis and disinfecting chemicals (notably

[9] This will include organic and inorganic chemicals. Examples of diluent for the hematology analyzer comprises sodium chloride, sodium sulfate, a phosphate buffer agent, ethylene diamine tetraacetic acid, 1-pyridone-2-sulphur and formaldehyde.

NaOCl and phenol). Key generation area is the laboratory. Many are hazardous having at least one of the following characteristics in the context of this hospital.

- toxic
- corrosive (e.g., acids of pH < 2 and bases of pH > 12)
- flammable
- reactive (due to oxidizing or reducing nature)

A few chemical wastes are non-hazardous; examples are sugars, amino acids, and certain organic and inorganic salts

Infectious wastes and sharps will constitute the highest quantities of biomedical waste stream largely generated from the OPD clinic, wards, and the dental clinic. Also, the wet lab will produce some infectious wastes. Quantity of infectious wastes with waste sharps generation seems to be highly variable in the prison hospital considering the generation and disposal records presented in Chapter 2. However, as an average this will be around 1.69 kg/day or 0.0094 kg/bed/day, which is well below the ranges reported from other government hospitals in Sri Lanka (Kularatne, 2021) and 0.2–3.0 kg/bed/day reported in developing countries such as India and Egypt (Gupta and Boojh, 2006; El-Salam, 2010; Kularatne, 2021). If 610 beds are used, the quantities expected per day would be around 5.73 kg.

Expired and outdated and sub-standard medicinal items are expected largely from the dispensary. The labs will also generate some. The quantities may be variable depending on usage/ demand or small if the required quantities are ordered only. This category will include

- formulations/preparation of any medicine/medicinal solutions, etc that are no longer required:
    - spilt and contaminated pharmaceutical products, medicines, drugs, vaccines, and sera
    - expired tablets with their casings/foils, creams, or lotions, etc
    - relatively mild liquid or semi-liquid pharmaceuticals, such as solutions containing vitamins, cough syrups, intravenous solutions (salts, amino acids, lipids, glucose, etc.), eye drops, glass ampoules, etc.
    - discarded items used in the handling of pharmaceuticals, such as bottles or boxes with residues, gloves, masks, connecting tubing, and drug vials.

Wastes with high content of heavy metals:

Wastes with a high heavy-metal content represent a subcategory of hazardous chemical waste and are usually highly toxic. This will include outdated, contaminated dental amalgams (rich in Hg in general, some also contain Pt and Pd) and their packaging material or containers (which are regarded as contaminated material). Hg wastes are typically generated by spillage from broken clinical thermometers, and this is expected (likelihood of conventional thermometers getting damaged due to careless handling are generally high compared with blood-pressure gauges) unless substituted with solid-state electronic sensing instruments. Some drugs may contain heavy metals especially ayurvedic drugs (example, As, Hg, Pb, Sn, Ag and Tl) but these are considered as pharmaceutical waste.

Pressurized containers will include liquid oxygen cylinders (empty ones).

Segregation and final disposal systems

Since point source segregation will be done using the labelled bins and bags provided for the infectious wastes and specific puncture proof boxes for waste sharps, all provided by Sisili Hanaro Encare, and Sisili Hanaro Encare will be entrusted to destroy these wastes, no adverse environmental and OHS impacts are expected. Also, the methods of disposal of other biomedical wastes discussed in Chapter 2 is acceptable as per WHO guidelines, except for expired / outdated pharmaceuticals and medicinal items.

Current practice of returning expired / outdated pharmaceuticals and medicinal items back to the Ministry of Health (MoH) is not encouraged as pharmaceuticals outsourced to suppliers or manufacturers for possible disposal in dumping sites leading to localized pollution and the possibility of reaching scavengers. This practice is unacceptable as per the WHO guidelines (Prüss et al., 1999; Chanpika et al., 2015; Karunasena et al., 2015; Kularatne, 2021). Such pharmaceuticals might reach scavengers and end up subsequent reselling in pharmacies resulting in health problems to buyers.

Internal Transportation

The trolleys presently used in the current complex do not have proper railings to prevent the infectious waste bins and sharp boxes from falling (not as per WHO guidelines). If such small trolleys without railings are used, then spills may occur during internal transportation when the containers fall (especially if the infectious waste bags or sharp boxes are not well closed and stacked on one another). Those who are transporting the wastes will be at risk of exposure to infections especially when cleaning or collecting the spilled material (especially from AIDS/HIV and hepatitis B and C through injuries caused by the waste sharps). New technological methods will be used for internal transportation.

Storage

It was also noted that the current Welikada Complex has designated an open area very close to the mortuary to store infectious waste bins (with bags also stacked on one another over the lids of the bins) and sharp boxes and bags. If such practices continue at the proposed project, serious OHS concerns could arise (persons from Sisili Hanaro Encare would be at risk from exposure to spills, etc). Leaks (collected blood) may drain out to nearby areas from torn out bags and damaged containers. Odors (from anaerobic decomposition of blood and other organic material such as saliva, sputum samples) may also get generated attracting vermin such as flies especially when the material is stored for more than 24 hours.

Improper handling of liquid oxygen[10] cylinders could lead to cold contact burns and frostbites. Improper storage of filled and empty cylinders in storages devoid of ample ventilation may pose a fire and explosion hazard (when leaks are there). Cryogenic liquids evaporate into large volumes of gases relative to their volumes as liquids (especially if spilt on water), creating excessive pressure in adequately ventilated storages (even a small spill or leak is enough to yield more gaseous volumes). Although O_2 is not combustible, it can cause spontaneous fires in contact with combustible (including metal, wood) when exposed to a heat source.

[10] This is a cryogenic fluid with a boiling point < -150°C at 1 atm pressure

4.2.2.2 Impacts due to solid waste disposal on surface/ground water, land and air

(A) Other Hazardous Wastes

Other hazardous waste generated from the prison complex will have any one or all of the following properties:

- Flammable gases (UN Hazard Class 2.1)[11], Hazard Class 2.2 gases[12] and flammable liquids (UN Hazard Class 3)[13] - generated largely from the vehicle servicing yard, maintenance workshops and emergency generator rooms
- Corrosive (acid and alkalis) – major areas of generation are maintenance workshops, service station ETP and vehicle servicing yard
- Toxic / poisonous

e-wastes: Horana PS has no capacity to accept e-wastes and what comes with the MSW are either dumped or very often buried close to the existing compost yard area (Figure 4.5) Therefore, it is not advisable to burden the UC to take over any e-wastes.

Figure 4.5 - e-wastes within the received plastic and polythene wastes

It is proposed to handover e-waste to CEA registered e-waste collectors

[11] Gases at 20°C and 101.3 kPa and ignitable when in a mixture of 13% or less by volume with air or have a flammable range with air at least 12% regardless of the lower explosive limit

[12] These are empty cylinders of non-flammable and non-toxic gases (gases at a pressure of not less than 280 kPa at 20°C or as refrigerants: liquid O_2 as a cryogenic liquid comes from welding workshops and the hospital).

[13] These are empty cans / containers of liquids having a flash point < 100°F (38°C) as defined by the National Fire Protection Association (USA), US Department of Transportation, US Environmental Protection Agency and the US Occupational Safety and Health Administration

Waste oil (UN Hazard Class 3): No adverse impacts since Government Tendering Procedures will be used to select parties that will reuse or recycle it.

Oil chemical contaminated paper and other material: Paper and cardboard recyclers in Sri Lanka initially screen out the collected material for good quality material which is then baled for subsequent exporting to the overseas for recycling. They do not collect or export soiled material as the pulp become weak if soiled. Therefore, soiled paper and cardboard material is often disposed by the local recyclers cum collectors and hence it is not suitable to hand over such wastes to paper and cardboard recyclers.

Sanitary pads: being contaminated with blood, are infectious wastes (though CEA does not classify it as scheduled wastes) as per the WHO (Průss et al., 1999). Municipal workers handling such material without gloves or wearing damaged gloves and scavengers at the dump site coming into contact with such material, may get exposed to blood-borne disease.

Storage of Waste oil at the Vehicle Servicing Yards

Quantities expected is 420 litres per month with buses contributing to 79% of the waste oil. It is noted that in the current prison complex, there were no proper secondary containment of barrels with the availability of labelled spill kits. If such practices continue, in the long run there will be visual pollution due to localized pollution of the premises and the surrounding soils (coupled with disposal of oil and grease and TSS laden service station effluents) with oil spills and leaks. Oily / slippery conditions can pose OHS hazards (accidents) and even fire when exposed to an ignition source.

Other OHS Concerns

In areas like the vehicle service stations and service station ETP, the following wastes can be expected.

Vehicle Service station

- Spent acids / vehicle batteries containing H_2SO_4 acid
- Waste oil (UN Hazardous Class 3)
- Cans and pressurized containers of various Solvents, paints, etc (as totally or empty containers) that may contain flammable liquids, acids, or bases, etc.

Service Station ETP

- Empty cans of pH corrections (HCl, NaOH – all corrosives)

Welding workshops

- Empty cylinders of acetylene (UN Hazard 2.1 gas)
- Empty cylinders of liquid O_2

Storage of incompatible waste residues / containers and cylinders (whether totally or partially empty) will lead to OHS concerns through fire hazards, etc. For example, the following storage of following waste streams are not acceptable.

- Acid with bases (all UN Hazard Class 8 corrosives), flammable solids (UN Hazard Class 4), flammable liquids (UN Hazard Class 3), flammable gases (UN Hazard Class 2.1) and oxidizing agents; UN Hazard Class 5 (example, H_2O_2 and NaOCl)
- Bases with acids, flammable solids, gases and liquids and oxidizing agents

- Oxidizing agents with acids, flammable solids, gases and liquids and reducing agents
-

(B) Non-hazardous Wastes

Quantities of Biodegradable wastes and disposal

According to the Prison Department, daily quantities of biodegradables given to piggeries from the current prison at Borella are as follows (i.e., for 7688 prisoners and 953 officers) and the records are approximate.

Welikada	450 kg
CRP	250 kg
Magazine	200 kg

Furthermore, the Colombo Municipal Council (CMC) takes away the following quantities of biodegradables.

- Welikada – approx. ½ tractor / per day (500 kg/day)
- Female Ward -approx. 02 Big Bins /per day (each is 240 litre) = 150 kg/day (a 240 litre capacity bin can hold a capacity of 50 kg of loose uncompressed waste and 75 kg of manually compressed waste)
- Prison Hospital – approx. 02 sacks /per day (each 50 kg means 100 kg/day or 0.6 kg/bed/day with 180 beds at present)
- Colombo Remand -approx. 200Kg /per day
- New Magazine – approx.500 Kg /per week (71.4 kg/day)

Total quantities are 1821.4 kg/day (without the hospital complex)

This means the quantity is around 0.21 kg / person / day. From a total of 14,106 persons (9650 inmates + 3712 staff and 744 family members in quarters) during the fullest capacity of the prison complex, this will be around 2962.3 /day. With the hospital complex (with 610 beds and 100% occupancy) the total can be:

= 2962.3 kg/day + (610 x 0.6) = 3328.3 kg/day (~3.3 tons/day)

Acceptance by Horana PS

No adverse impacts are expected since biodegradables will be handed over to the Horana PS.

For a present population of 132,856 in the Horana area (both PS and Urban Council areas) as per the Resource Profile (2019), the expected quantity of biodegradable component can estimate to be:[14]

= 132,856 x 0.6 kg x 66 / 100 = 52,611 kg /day which is 0.4 kg/person/day.

[14] 62-66% of the MSW in Sri Lanka contains biodegradable material by wet weight and per capita generation of waste in an Urban Council area is 0.6 kg/person/day (Vidanaarachchi et al., 2006; Kularatne, 2015)

The Horana PS currently receives 12-15 tons of biodegradable wastes (capacity of the manual windrow system is 10 tons/day)[15] by means of collection from the main roads / town areas only of the UC and PS areas largely due to the availability of a low fleet of collection vehicles[16]. Therefore, considering that the food waste quantities will be around 3.3 tons/day from the proposed prison complex current handing of wastes to the composting plant of the Horana PS is not feasible.

However, in the long run, the PS expects to commission and operate a 50 ton/day capacity "Kawashima" screw type composting plant within a space of 100 x 50 m and according to the Horana Pradesheeya Sabah, they could collect the biodegradables from the prison too. When this is under operation equipped with a sieving machine and multi-chopper, the capacity will not exceed since the total contribution (maximum) from the current collection (but assuming that population growth is not occurring considerably) and prison complex will be 18.3 tons per day.

The construction phase of the prison will last at least 2 years and after 2 years it will be feasible to hand over the entire load of biodegradables (this is considering the fullest load generated when the prison has reached its maximum capacity) provided the PS has constructed and commissioned their compost plant by this time.

However, if the balance 37.6 tons/day of biodegradables are collected from the rest of Horana PS and if the UC areas are also covered by the PS, then the daily collected amounts (maximum) will be around 55.9 tons (exceeding the composing capacity of the "Kawashima" screw type composting plant).

Quantities of recyclables and disposal

Currently, Horana PS takes only a maximum of 29% of MSW (both biodegradables and recyclables) from the main towns of the PS and UC areas. Expected generation rate of recyclables is estimated to be:

= 132,856 x 0.6 kg x 34 / 100 x = 27,102.6 kg /day which is 0.2 kg/person/day.
29% of the above amount will be 7859.8 kg/day.

During the period of maximum capacity, the prison complex will contribute to
14,106 x 0.2 = 2821.2 kg/day of recyclables and they are largely contributed from the officers' quarters, administration units and intelligence units (as prisoners' contribution to the generation of recyclables is very less).

Sri Lankan MSW in general having a high moisture content of 70–80 % (on a wet mass basis) with a low calorific value (around 600–1,000 kcal/kg) contains 6.5–13 % of paper, 5–8 % of plastics, 2 % of glass, and a high content of biodegradable organic matter (62–66 %) (Vidanaarachchi et al., 2006; Kularatne, 2015). This means as a maximum, 79,713.6 kg /day of MSW (both biodegradables and recyclables from the entire Horana UC and PS areas) contains around 10,362.8 kg/day and 6377.1 kg/day of paper / cardboard and plastic/polythene, respectively (which means the total recyclable component will contain around 38% of paper material and 24% of plastic / polythene material).

[15] This means only 29% of the biodegradables is collected per day from both UC and PS areas as a maximum

[16] Two numbers of 1 ton tractors with one 6 ton capacity compactor operated from the Ingiriya and Poruwadanda sub-offices and 2 numbers of 1 ton tractors with one 6 ton capacity compactor operated from the Kanamvila (Millewa is located in the Kanamvila area) and Pokunuwita sub-offices

Majority of the recyclables (total is 2821.2 kg/day) from the prison complex will be around 1072.1 kg/day of paper and 677.1 kg/day of polythene / plastic during the fullest capacity.

Total recyclable loads that will be received by the PS (considering the recyclable loads received from the prison when the prison is at its fullest capacity and the currently served towns in the PS and UC areas) will be ~10.7 tons / day (7859.8 kg/day + 2821.2 kg/day kg/day); this will include

- ~4.07 tons of paper / day (i.e., 3 tons from the PS and UC areas and 1.07 tons from the prison)
- ~2.6 tons of polythene material (i.e., 1.9 tons from the PS and UC areas and 0.7 tons from the prison)

However, there is no indiscriminate disposal and a burden on the PS since the Pradeshiya has already contracted the following CEA approved parties for recycling or acceptable disposal practices (Fig. 4.6).

- Paper and cardboard – Nithya Papers Pvt Ltd for recycling (located within Horana EPZ of the BOI)
- PET (Polyethylene terephthalate) Bottles – Eco Spindles for recycling /manufacturing of yarn (located within Horana EPZ of the BOI)
- Polythene and other plastic – Ace Power / Waste-to-Energy Plant at Kerawalapitiya Industrial Park for co-processing
- Glass – Piramal Glass Ceylon Ltd (for recycling)

Figure 4.6 - Sorted out glass wastes (brown, transparent and green colored material) (left photograph) and PET material (right photograph) for handing over to relevant recyclers

In addition, there is a 1-ton capacity double chambered incinerator (operation temperature of the secondary chamber is 900-1200^{o}C) with a 25 m high chimney at site to burn material that cannot

be recycled or given to Ace Power Ltd. This has been designed and constructed by NERD and Premadasa and Sons, respectively, but not yet commissioned (**Figure 4.7).**

Figure 4.7 - Some views of the 1-ton capacity incinerator

4.2.2.3 - Odor from temporary storage areas

Municipal Solid Waste

The PS takes away both biodegradables and recyclables twice a week from the Kanamvita area (where Millewa is located) using 1 compactor (6 tons) and 2 tractors (1 ton each).

However, if biodegradables (food wastes) get stored for more than 3 days in case if the PS is unable to collect the wastes due to reasons like breakdown in their collection vehicles, then odor problems[17] are likely to emanate because of anaerobic decay (unless the storages are adequately ventilated).

Infectious wastes and sharps

Open storage of infectious wastes and sharps (as described earlier) would lead to serious OHS concerns (waste handlers from the prison and persons from Sisili Hanaro Encare would be at risk from exposure to spills, etc). Leaks (collected blood) may drain out to nearby areas from torn out bags and damaged containers. Odours may also get generated attracting vermin such as flies especially when the material is stored for more than 24 hours.

[17] This occurs due to formation of volatile fatty acids (VFAs) generated from acidogenesis following hydrolysis.

4.2.3 Air quality Noise and Vibration

4.2.3.1 Noise vibration and dust due to constructional activities

Noise air blast overpressure from blasting activities and vibration could cause inconvenience to the residents and damages to the housing clusters close to the project boundary. Likely housing clusters and rock outcrop locations are presented in **Figure 4.8.**

Dust clouds also could get drifted outside the site and get deposited in the gardens and houses of nearby residents causing inconvenience and respiratory issues.

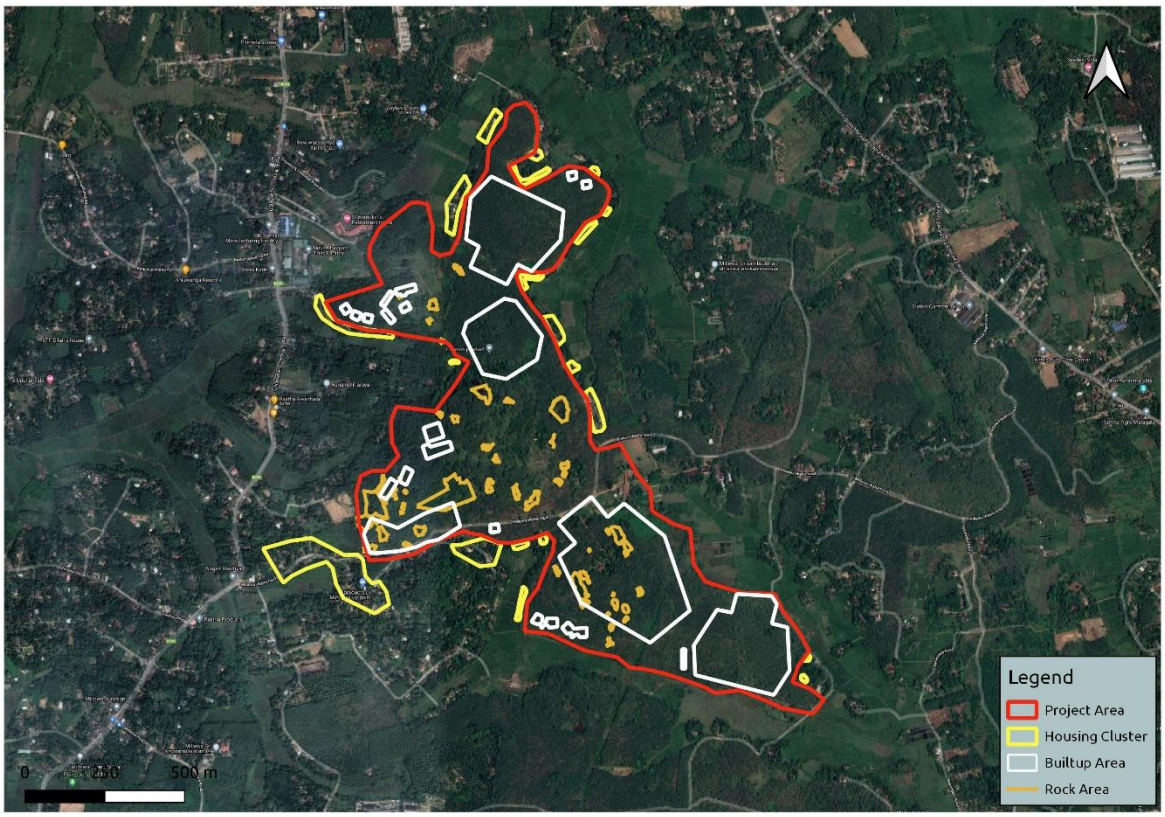


Figure 4.8 - Locations of rocks within the site and surrounding housing clusters

Air Quality Impacts during Operation

Air pollutants would be generated by different sources, including exhaust gases from driving tracks, operation of boilers and generators and exhaust emissions from chimney outlet of kitchen.

Generally, steam will be utilized in prisons for laundry operations, hot water and heating purposes, workshop activities etc. Depend on the amount of fuel, its type and quality have a direct influence on the boiler operation, efficiency, combustion process and consequently the type and number of pollutants emitted to the atmosphere. Depend on the requirement, boiler may not operate continuously. During the operation of Boiler with conventional fuels such as biomass or oil contributes to emit criteria air pollutants (PM10, PM2.5, SOx, NOx), CO, CO_2, VOCs.

The primary purpose of backup generator is to preserve essential facility functions in the event of a loss of grid power or for situations that threaten the facility. Depend on the type of fuel used and the capacity of the generator, the major air pollutants include Particulate Matter (PM), NOx, $SO_2$and CO.

Meal preparation for the prisoners and staff will be carried out at the kitchen premises. Furnace/stoves might be utilized to prepare baked products for a large group of people. Besides stove/furnace and fuel source characteristics, type of food, method of cooking and cooking temperature can also impact the air pollutants and concentration generate from cooking. Thus, the air pollutants of concern would be PM, SOx, NOx, CO and CO_2. In addition high-heat cooking activities such as frying can produce acrolein [Acrolein (systematic name: propenal)] is the simplest unsaturated aldehyde. It is a colourless liquid with an acrid smell. The smell of burnt fat (as when cooking oil is heated to its smoke point) is caused by glycerol in the burning fat breaking down into acrolein).

polycyclic aromatic hydrocarbons (PAHs), and particulates. In addition, cooking processes can generate large number of volatile organic compounds (VOCs) including carbonyl compounds during frying, stir-frying, par-cooking, full cooking, parboiling, and boiling.

Cooking emissions are one of the main sources of indoor air pollution as they can get accumulated indoors without adequate ventilation to exhaust them, resulting in concentrations higher than outdoors. Depending on the concentration levels, these pollutants can cause nuisance due to unpleasant odour and/or characteristic food smell on sensitive receptors as well as health and environmental impacts.

Emission concentration of the above stated air pollutants depend mainly on combustion characteristics influenced by firing configuration, operating conditions and fuel specifications, equipment age, operational practices, conditions of air pollution control equipment used, raw material quality, meteorological condition etc.

Since kitchen is used to prepare meals for a large group of people, food waste accumulation would be possible. If large amount of food waste is accumulated without discharging daily, it may lead to difficulty in waste management and leads to release odorous gases as air pollutants. The odorous gases are generated because of the stacking and decomposition of food wastes. The gases emitted mainly consist of organic gases because the food wastes are mainly organic materials. The other odours that comprise 1% of the gases are S-compounds, aromatics, esters, alkanes, and limonene, which result in unpleasant odours that are harmful to the health.

Malodorous compounds can be arising at stages of wastewater management, starting from the sewer network, via the technological sewage-treatment system, through to the sludge-management stage. The formation of hydrogen sulphide is a significant problem even while sewage remains in sewers, as anaerobic conditions prevalent in the network are conducive to wastewater putrefaction, and therefore contribute to increased malodorous emissions. The development of such anaerobic conditions is favoured by the over sizing of conduits or designs that feature inadequate gradients, causing wastewater in the network to stagnate. Where emissions to the air from wastewater occur, they are found to constitute a complex mixture of perhaps even 1000 different substances, produced under varying process conditions. Among those present are compounds of sulphur and nitrogen, chlorinated compounds, and other organics.

Workshops having different kind of activities such as woodwork, metal work, concrete and electric work can be established within the premises to provide hands on practice of technical work for inmates. Activities carried out in workshop may load the air environment with particulate matter and obnoxious gases such as SO_2, NO_x, O_3, CO, and hydrocarbon etc. Other than these gases use of solvents for repairing activities may generate VOCs. Processing methods used in workshops such as heating, grinding, sawing, crushing, etc generate Particulate matter (PM).

4.2.4 Traffic and Transport

4.2.4.1 Traffic Generation

Traffic generation to the prison complex is largely due to the visitors and staff arriving at the complex. In addition, the transport of prisoners to courts also generate traffic during specific periods.

During days when prisoners are required to appear before court proceedings, the buses leave premises -7.30AM -9.30AM and return during 4.00PM- 5.30 PM. Buses depart to courts located in Colombo Fort MC, Colombo HC /MC Homagama HC/MC/DC, Kaduwela MC, Gangodawila MC/DC, Mt Lavinia MC,Moratuwa MC/DC,KesbewaMC ,MaligakandaMC, Appeal Courts, Supreme Courts and Hospital, Clinics as well.

Some of the staff will also travel via staff transport services. It is expected that the total bus movements will be less than 25 during this period[18] (equivalent to 50 pcu/h)
In addition, there will be visitor trips to the prison complex which is distributed as follows[19],

- Welikada - 40-50 per day
- Female Ward - 70-80 per day
- Prison Hospital – 20 per day
- Colombo Remand -100-150 per day
- New Magazine -200 per day

The traffic composition for the visitors to the prisoners are assumed as follows, 30% three-wheelers, 10% private vehicles (cars/vans), 10% motorcycles and 50% public transport. Therefore, total trips generated which is around 500 passenger trips per day would generate, around 250 vehicle trips per day. The peak generation would be around 25% of the daily attraction, which is 62.5 (approx. 60) veh/h. This is equivalent to 33 pcu/h.

4.2.4.2 Impact of increased traffic on existing habitats and other land-use practices

As the necessary places within the site will be cleared before there will not be any impact on the habitats and land use in the construction areas. There will be a temporary impact on the construction land in the form of soil compaction or creation of potholes during construction. However, this impact is temporary.

4.2.4.3 Traffic movements along roads during construction and operation stages

Impact on traffic flow and other road users

1. Impacts on accessibility and mobility

Impact on accessibility is mostly relevant to local roads when the heavy construction vehicles volumes increase on these roads. Therefore, during the construction period the accessibility of the residents will be affected since the roads are narrow and may not allow passage of vehicles from the opposite direction when heavy vehicle movement is present. Also, the damages to the road will further deteriorate the road condition reducing the travel speeds along the road.

[18] Information provided by Prison Department
[19] ibid

The upgrading of local road (near Ninja factory premises) will result in some accessibility issues during the construction period.

Impacts on mobility on the B123 road would be due to the increased turning movements at the Na-gas junction during construction period. Similarly, after the Prison complex starts functioning there will be increase in turning movements at the junction with the new access road. Especially during times when Prison buses are departing to courts.

Also, there will be increased traffic flow on the B123 road due to visitors and staff members to the Prison Complex. Although this net increment is negligible considering the road capacity. Capacity of a 2-lane road like B123 road is 25,000 passenger car units per day (2500 pcu/h in the peak hour[20]). The generated traffic would be less than 2% (approximately 50 pcu/h or 500 pcu/day), which negligible when considering the impact on the road capacity.

Majority of the visitors to the prison complex and staff (non-officer) are likely to use public transport. Therefore, it is expected that the pedestrian movement and pedestrian crossing movement at the locations are likely to increase. Therefore, this will cause some delays to the through traffic after opening of the Prison Complex.

The dedicated access road to the site will be first constructed before the commencement of the construction.

2. Impact on road user safety

The following safety issues are anticipated due to the project

1. Safety of pedestrians and motorists due to the movement of heavy vehicles along the road transporting excavated materials, machinery to/from the site during construction period.
2. The new intersection created with the new access road and the local road towards Millewa Madya Maha Vidyalaya. Since this is a local road used mostly by road users in the vulnerable road user category (i.e., pedestrians, motorcyclist, cyclist) and likely to be used by school children, special attention needs to be put in to install traffic calming measures near the intersection
3. The access point of the new road is near a horizontal curve on a downward gradient on the B123 road. The junction geometry may create safety issues if not designed properly especially considering there will be number of bus movements.
4. Due to the high pedestrian movements at the B123 road from the nearest bus stop to the access point road, the pedestrian related conflicts may increase due to lack of sufficient pedestrian facilities.

[20] Peak hour flow is approximately 10% of the daily traffic flow

Figure 4.9 - Local Road towards the school and the probable location of the junction with the new access road

Figure 4.10 - New access point on B123

4.2.4.4 Usage of vehicles and their loading during the construction period

Since a dedicated access road to the site will be constructed to transport material to the site there will not be any impact on unloading construction material, as there will be ample space within the cleared site for vehicle access and material unloading.

4.2.4.5 Impact on road infrastructure

1. Impact on pavement/road structure

There will be a new road constructed over the paddy field for access when the Prison Complex is operation. Therefore, there will not be major issues to the existing local roads that is linked to the

land plot in the long term. Moreover, the local road near Ninja factory premises will be upgraded under the project, therefore no long-term issues are relevant for the road.

However, during construction, the movement of heavy vehicles will damage the pavement structure of the local roads as they are not designed for the heavy vehicle movement which will be significant during the construction period.

The following local road is likely to be affected in addition to the local roads used to access the site.

- Local road leading to Millewa Maha Vidyalaya

The access point of the proposed road is located on B123 Galagedara-Horana Road. This will have an impact the existing main road near the junction due to the construction work. Furthermore, the new access road will intersect with another local road which will have an impact at the junction.

4.2.4.6 Impact on utilities

There are no major impacts on utilities are foreseen, in local roads that are not widened. For the local road that is widened the utility lines would need to be shifted. The power lines on B123 are on the opposite side of the road where the new is road is intersecting, therefore minimum likelihood of any issues occurring.

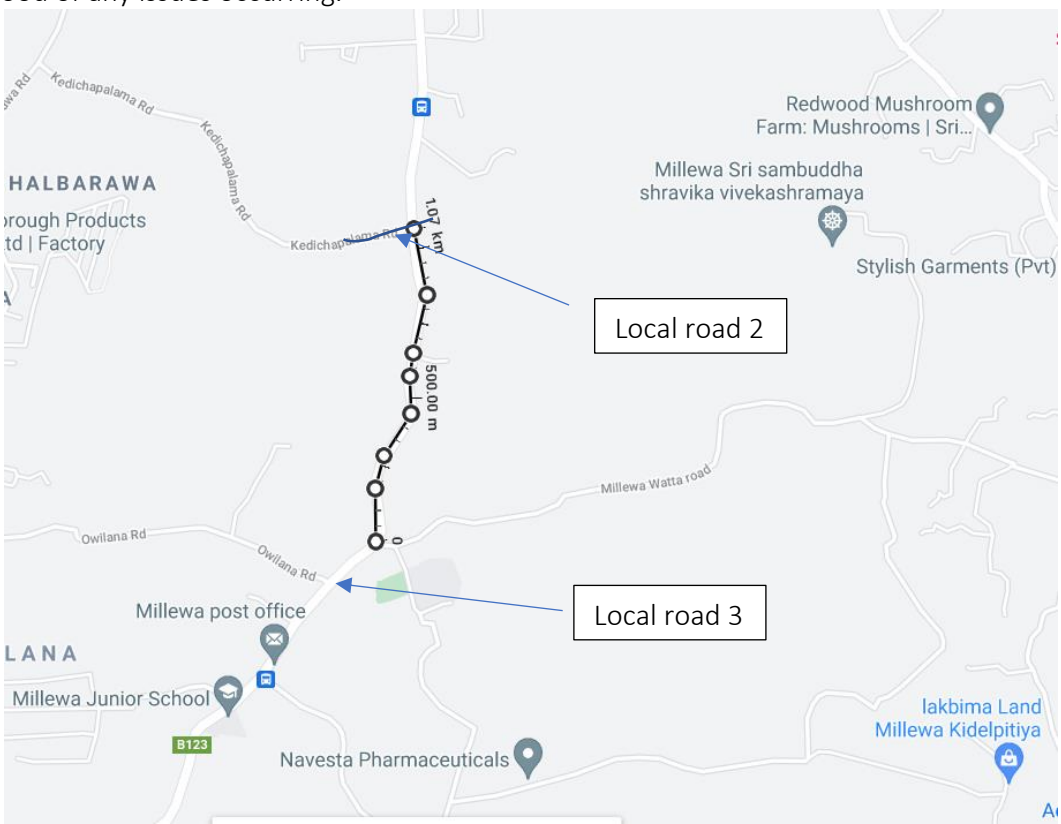


Figure 4.11 - Road Network in the study area

Figure 4.12 - B123 Road and probable access point of the new road to the prison complex on the RHS of the image

Figure 4.13 - Millewa watta road (near B123 junction)

Figure 4.14 - Local access road to the site

4.2.5 Ecological Resources

4.2.5.1 Impacts of project activities on fauna and flora of the surrounding area, water bodies, paddy lands (direct impact and indirect impacts)

- Blasting operations would generate noise levels that would be hazardous for wildlife. Noise levels would also be high during the construction operations.
- Dust levels would temporarily increase during blasting and when bare land is cleared and exposed prior to construction. Blasting and crushing rocks and the demolishing of the existing structures would result in fine cement/stone dust which would settle on the surrounding vegetation.
- Dust emission would also occur due to the transport of quarry material by trucks especially when loading and unloading, levelling and transport. Heavy machinery plying along the newly constructed access road would also increase dust emissions. This might cause a temporary reduction in the efficiency of primary production owing to the blocking of exposure to sunlight. The dust/debris might also be washed into the nearby streams/marshes/rice paddies increasing turbidity and sedimentation affecting the biotic community and the productivity of the plantations. Impacts would be moderate and temporary.

4.2.5.2 Loss/disturbance to habitat

Since the site will be 50% cleared there will not be any significantly remaining habitats except for the habitats near the springs and streams and the sporadic trees. Rock blasting and other construction activities could disturb these habitats.

4.2.5.3 Ecological Impacts of the release of treated sewage and effluent to Mawak Oya

During the operational stage the prison establishment is due to release treated sewage and other effluent to Mawak Oya which will result in a long-term significant negative impact in terms of permanent alterations in water quality at the site of discharge and in downstream areas which will affect the aquatic fauna and flora, if untreated or partially treated effluent is released. Although located 7 km away from the prison location, the rationale for the selection of this stream is that it is the closest perennial water way which also has a relatively high flow. However, there will not be any significant ecological impact if the effluent is treated conforming to the CEA inland water standards as indicated.

4.2.6 Human and socio economic/cultural impacts

4.2.6.1 Impacts due to land use incompatibilities

The construction activities of the prosed project will be confined to demarcated land block from Millewa Watta. The project will not require acquiring of other lands with different lad use pattern from the area. The project will need to remove rubber trees and evacuation of residential structures. The impacts on resettlement issue is discussed in a separate section exclusively dealing with resettlement issues.

The impacts are assessed based on the information collected from the existing socio-economic and cultural environment. The possible changes due to proposed project designs to be implemented in the demarcated land blocks will be assessed. The views expressed by local stakeholders including community and the knowledge and experience of the SIA team are used in identification of the impacts. The impacts are identified in terms of their magnitudes on possible positive and negative implications.

Impact will not be expected due to land use incompatibilities between proposed project's land use and the uses of other land blocks in the project area and its vicinity. The type of proposed project's interventions and the land use of the project footprint and its vicinity are not compatible. The proposed project activities will be confined to separate land blocks. Therefore, there will not be conflicts due to incompatible land use to be established in the project during its operation phase.

4.2.6.2 Impacts on land value of this area

The present value of planation land ranges from Rs. 100,000 to 150,000 a perch that can be used for residential purposes. The productivity of most of the rubber lands have gone down and there will be decreasing trend to use the land in the vicinity of prison for residential purposes. Therefore, this value may go down to Rs 50,000 to 10,000 per perch for residential plots according to the social perception. The value of paddy land will not change due to the proposed project as perceived by the local community members. The present value, Rs.30,000/perch will remain as it is. The residents presently living in the 50 m land belt adjacent to the boundary of the prison land are in dilemma according to them. They perceive that their peaceful living may get significantly disturbed and there may be a trend emerge among some community members to sell their properties and leave the area. This opinion is held only by some community members, but some others look at the project as opportunity for them to get into some income generation activities.

4.2.6.3 Impacts on livelihood /lifestyle of the people within this area/ accessibility to cultivable lands e.g., paddy lands

Some impacts both negative and positive are expected taking place on the lifestyles of local people during operation period of the proposed project. The possible impacts expected/perceived, their magnitude and the specific details of impacts are mentioned below:

Table 4.8 - Positive and Negative Social Impacts

Impact area	Magnitudes	Positive impacts	Negative impacts
Loss of income generation of HHs to be resettled	Significant due to impacts on 57 households to be resettled	This group will receive alternative houses as new property with legal ownership. A piece of land and a house owned by the householders. Very significant impact in terms of the residential facilities	The income generation activities in the plantation will not be possible. Even at present planation activities are very limited and there are no opportunities for all the workers to involve in work. They tend to go out of the Planation to find daily earnings.
Employees in the Millewa planation losing their Jobs	Significant, 120 employees lose their jobs	The households of all the present employees in the planation will receive new houses (57 households) and monitory compensation. This is positive impacts	Losing employments is a significant negative impact. As mentioned above a trend of losing income generation opportunities in the planation has already taken place/started.

Impact area	Magnitudes	Positive impacts	Negative impacts
		for the entire household/family	
Access difficulties to residential area	No impacts expected	Opportunities available for the local communities to use some of the new roads or rehabilitated roads in the vicinity of the project land.	No impacts are expected
Access difficulties to agricultural areas	There will not be disturbances to the current access to the agricultural lands, but a new road has been designed to construct through paddy land. Therefore, this will be a significant negative impact on the present operators of the paddy land	No positive impacts are expected	The present agricultural activities of the paddy land may have various difficulties due to access road proposed. There can be physical fragmentation of some land plots, The natural water flow within the paddy land may get disturbed (this land area is rain fed), Significant land extent will also acquire for the road,
Other changes expected on the routine lifestyles of local communities	Sign	Some community members expect positive impacts on their routine lifestyles, they expect there may be income generation opportunities during construction of the project.	Negative impacts are expected on the routine lives of the community in the area close to the prison. They perceive prison as incompatible element to the rural environment.

4.2.6.4 Potentials for social unrest

The SIA team did not observe serious objections of the local stakeholders including community for the proposed project. Nevertheless, some of the community leaders and grass root level agency officials indicated the unhappiness of some community members about the project. Most of the community members and even local level agency officers are not fully aware of the proposed project, its components, and possible impacts. This may be the main reason for neutral situation of the area. The householders living in the land belt within about 50 m are much concerned of the proposed project. The SIA team observed some social desatisfaction among this group. In future it can be assumed that some resistance may emerge if not the proper information about the project is received by the stakeholders such as NGOs and CBOs.

4.2.6.5 Potentials for illegal actions/ activities

Some representatives of local stakeholders including religious leaders and other community leaders perceive some illegal actions likely to take place due to relocation of the Prison to this land. This is mainly because of the information about illegal activities frequently reported from prisons in Sri Lanka. This is the concern specifically expressed by the householders living in the land adjacent to the project footprint.

4.2.6.6 Impacts due to changes of land use

The type of information needed on this has been discussed in item 4.2.6.1. The land use changes of the project footprint will generate impacts to the employees presently depending on the rubber plantation. This impact has been discussed in separate sections assigned for discussing resettlement issues. Apart from displacements of livelihood activities of present workers changes of land use in project footprint will not generate other positive or negative impacts

4.2.6.7 Employment to be provided to the local people during construction and operation.

The local level stakeholders especially community members expect some income generation opportunities in the project during construction and operation phases. Availability of employment will be obvious during construction but the same cannot be expected during operation. This is mainly because the Welikada prison will be shifted to this location with its present employees. Therefore, there will be hardly any significant opportunities for employment during operation phase.

4.2.6.8 Socio economic benefits (other than employments) to be provided to the local people

There can be significant indirect income generating activities for the local people living close to the new project land. They will have opportunities to start business activities to serve for the visitors and employees of the prison. The opportunities such as providing meals and accommodation for the visitors and employees may be significantly available.

The community members living close to project land are traditional rural farmers. The second generation in these families may get motivated to start some business activities. There also can be possibilities for this local community members to sell their land to outside persons and leave the sensitive area close to the new prison. The businesspersons who are aware of the high potential for business in the vicinity of prison may tend to purchase land from the local community members.

4.2.6.9 Impacts on cultural values

General

The SIA team observed unique subculture existing among rural community living in the vicinity of the project land. These community members have strong social capital due to relations living in the same cluster and other social relations developed and established during long period of time. This culture may have conflicts with the new culture potential to emerge around new prison. There can be illegal activities to be taken place between prisoners/visitors and local youths living in the vicinity of the prison. The traditional farmers may not be happy to tolerate the new culture emerge due to the new prison established.

Specific impacts on existing culturally sensitive locations

There aren't any archeologically, culturally, or religiously sensitive places within the project footprint except small cemetery located in one end of the project land.

A temple between B123 road and the project footprint is located but there will be no disturbances to this religious place.

Possible impacts on existing cultural practices of the local community

The cultural practices of the community members such as farmers will not have negative impacts due to the prison to be established in a separate land block covered with huge boundary walls.

4.2.6.10 Incompatibilities between project and settlers of the area

There are significant incompatibilities between project operators, prisoners, and the local settlers. This incompatibility will not lead to generate serious positive or negative impacts.

4.2.6.11 Impacts due to relocation (if any)

The relocation will be a significant impact of the proposed project. About 57 households including 120 employees will be relocated to clear the land for intended project implementation. The community to be resettled is unique in terms of their subculture. Almost all the project affected householders are Tamil except few Sinhala families. Even the few Sinhala families are culturally integrated to the sub-Tamil culture. The UDA has identified large land block from Millewa plantation itself to construct housing scheme for the affected 57 households. This resettlement site is about couple of 100m away from the present residences. About 49 households located in the site chosen for resettlements will also be given new residences from the housing scheme. Therefore, there will not be possibility to emerge any conflict between new settlers and host community. The UDA has planned to construct required common facilities such as Kovil, Sport grounds etc. for the resettles. Each resettle will be given about 10 perches land with a house constructed. At present these affected householders are in line houses with extremely unsatisfactory facilities. The new houses will be moderately adequate and resettles can enjoy their privacy. In this context, resettlement will not create negative impacts or unnecessary unrest among affected households.

Displacement of employment may also not a significant negative impact even though it is serious livelihood related aspect. This is mainly because of the present agriculture activities taking place in rubber plantation. The rubber plantation is becoming neglected. And as a result, present workers do not have opportunity to work in all the days of a month. They have occasional opportunity to engage in work in the plantation. The daily remuneration for the workers is also not much attractive because they receive only about Rs 1000 a day. Even at present majority of the workers tent to go out of the plantation to find employment. The UDA has workout compensation package which may be attractive to the underutilized labours in the plantation. All the workers will also be beneficiaries of the new alternative houses and therefore it can be considered as benefit to them even though they are going to lose their highly unproductive employment in the plantation.

4.2.6.12 Other socio-economic impacts/benefits (if any)

Some community members use a natural pond available in the middle of the project footprint to feed their buffalos. They will lose this opportunity due to the proposed project.

The SIA team also observed one common shallow well-constructed within the project footprint. Water in this well is being used by significant number of households in the vicinity. Since this well is also getting to the project land the present users will have some issues.

4.2.7 Aesthetic and Visual Environment

4.2.7.1 Impacts on visual environment due to proposed building and its operational activities

The present land scape is viewed as much environmentally friendly feature by majority of local stakeholders. Converting about 200 rubber plantations into a complex of large buildings to be used as prison will change the existing aesthetic and visual environment significantly. Some people perceive this as a negative impact.

Impacts on visual environment due to proposed building and its operational activities

The existing spatial development pattern of the project site and the adjacent area has clear three layers: (i) the rubber plantation on high ground having undulating landscape, (ii) residential development on the boundary of the rubber plantation adjacent to paddy fields, and (iii) low lying areas, mostly paddy fields (

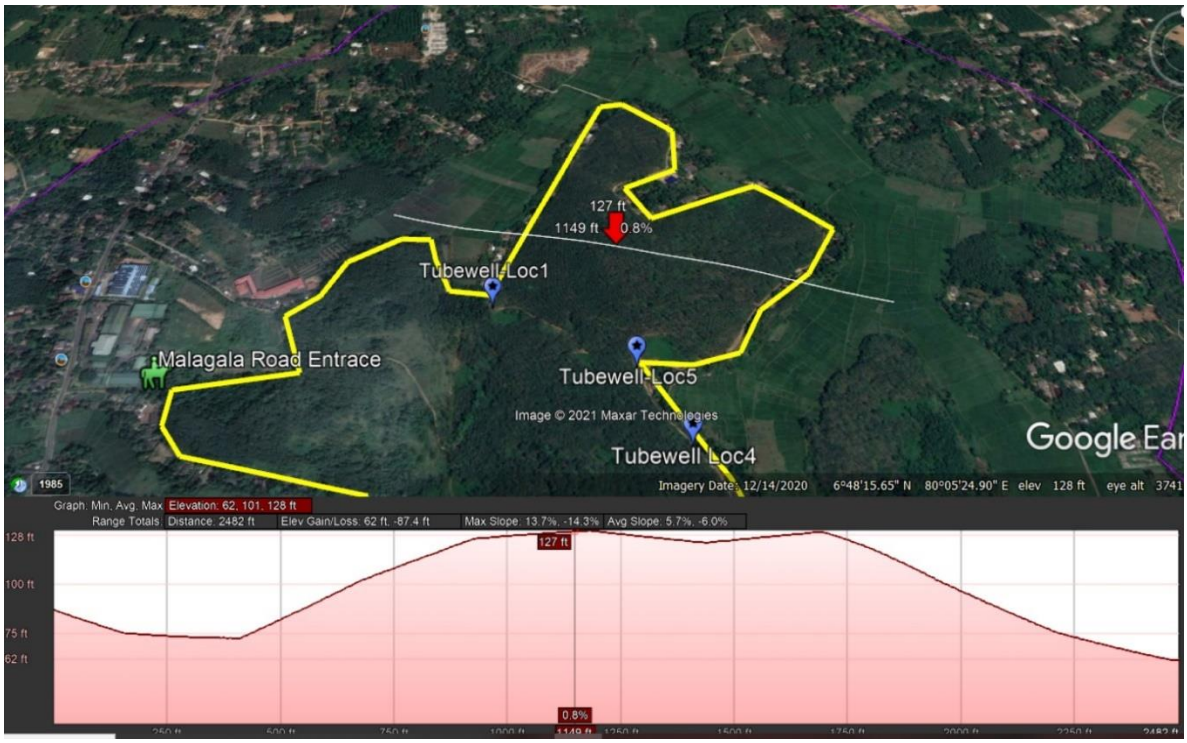


Figure 4.15). Thus, the residential areas in the immediate surrounding of the project site has view to paddy fields and high grounds, creating a pleasing natural environment.

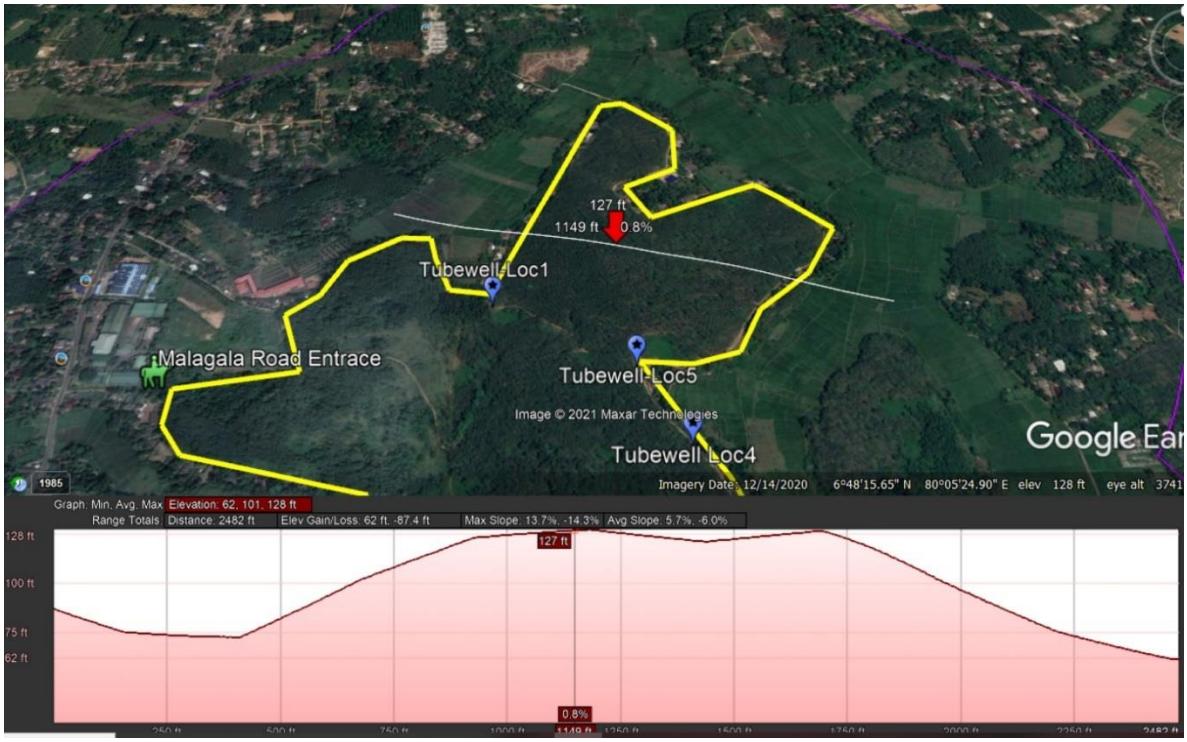


Figure 4.15 - Elevation Profile - Northern End of the Project Site

Figure 4.16 - Borella Prison - Void of Trees

The total impermeable surface area of the project site due to the location of buildings and infrastructure (50%) will result in the removal of that amount of existing vegetation. However, the proposed buildings will not be high rise structures, and will consists of single to two storied structures. Hight of such structures will not exceed medium sized trees. Maintaining adequate vegetation cover of medium size trees in the open spaces could minimize the negative visual impact.

However, due to security reasons, if the vegetation cover is removed similar to the existing prison premises in Borella (**Figure 4.16**) visual environment of the project site will be deteriorated. A

significant negative impact can be expected due to the 6-meter-high boundary wall, around the project site.

4.2.8 Any other impacts

4.2.8.1 Environment Health and Safety Impacts

Impacts During Construction

Anticipated impacts on fire emergencies to be addressed during planning and design

The closest fire brigade available is Fire and Rescue Unit in Horana Urban Council, located appx. 12kms away from the proposed Millewa prison relocation project site. Discussion with Section Officer -Mr. A.M. Prasanna (Fire & Rescue Unit, Horana-UC), revealed that, during fire emergencies, it will take minimum 15mts for the fire brigade to reach Millewa site location during the daytime and sometimes might further delayed in case of any unforeseen circumstances.

Anticipated Impacts in establishing conventional security systems:

Around the entrance and perimeter areas usage of conventional cameras and other manual safety may lead to human errors resulting in safety and security concerns.

Anticipated impacts due to conventional rock excavation methods

It is evident that the Rocky strata and boulders need to be cleared during construction, during the excavation process blasting operations, rock handling and transportation of rocks and boulders including handling of explosive materials. This will create significant impacts to the surrounding environment and health and safety hazards to the workmen and others in the closest proximity of the project area.

Anticipated Health and Safety impacts for skilled and unskilled workers during construction

During the construction phase of the project, the skilled and unskilled workmen are exposed to construction hazards resulting in First Aid Cases, Loss Time Injuries (LTI), Major Accidents and loss of life.

Impacts During the Operational Phase

Impact on establishing active and passive fire protection equipment:

It was identified that conventional active and passive fire protection equipments such as fire extinguishers, fire sprinklers etc. could not be used due to securty concerns inside the proposed prison complex.

Anticipated impacts during hot works in Workshop and during Kitchen activities.

During the hotworks such as cutting, welding etc conducted in workshop, and food preparation activities in undertaken in kitchen, most of the time the inmates and workers are expected to get exposed to fire hazards, which may lead to injuries and accidents.

4.2.8.1 Geological Impacts

With considering all proposed activities, geologically impacts can be summarized as bellow,

(a) Impacts for natural mineral deposits

As there are not any economically valuable mineral deposits encountered within the site, there is not any impacts related to this.

(b). Impacts to natural slopes by initiation of slope failures / landslides

The site area having majority of low gradient slopes, initiation of slope failures and landslides are minimal. Although, the possibility of initiation of minor scale slope failures exists with the disturbance of natural slopes by cuts, especially in slope gradient greater than 20 degrees (More details will be presented in the report submitted by NBRO). Heavy Rock blasting can be an adversely affect to the slope stability in steep slopes. Excessive infiltration of wastewater and rainwater to the ground by changing land uses (uprooting of trees etc.), can accelerate the slope failure impacts in the area.

(c). Increase of soil erosion

This is one of the main impacts to the environment with the proposed construction activities by changing land use pattern of the area. Uprooting of existing trees (Rubber), ground preparation for roads and buildings can accelerate the soil erosion in the site area. Ultimately this can lead to form gully erosion and initiation of minor scale landslides in steel sl0pe areas.

5 CHAPTER 5: PROPOSED MITIGATORY MEASURES

5.1 Waste management techniques (liquid and solid) including Solid Waste Management Plan

5.1.1 Wastewater Management

Wastewater (domestic wastewater and sewage) will be treated to the Inland water Standard and disposed to Mawak Oya through a pipeline. If any special treatment arises the treatment standard will be elevated to a higher level. More details of NWSDB concerns are presented in **Annex 18**.

The prisoners will not be housed in the Millewa Prison until the STP is established tested and operated.

The following safeguards are useful in addition to suggestions given by the NWSDB with reference to the treated effluent discharge location **(Annex 18).**

- Kitchen effluents require pre-treatment through screening and skimming of oil material using oil and grease traps
- Service station effluents also require pre-treatment (see Section 5.1.3.2.)
- Screens should be placed after the grit chamber to avoid siltation of screening chambers and angled at 30-60^0 to the flow direction to reduce flow velocity
- Provide 2 grit chambers in parallel so that one unit is available for wastewater flow when the other is shut down for cleaning and vice versa. A Parshall flume shall be provided at the lower/effluent end of the grit channel to prevent scouring of settled grit due to large increase in flow velocity expected during peak hours.
- The STP should be designed for at least 2000 m^3/day capacity.
- The proposed wetland should be operated as a horizontal sub-surface flow (SSF) constructed wetland system as per SLS 745 (2009) and Arceivala and Asolekar (2007) criteria to remove any particulates (dissolved as well as particulate components of organic matter) that may escape from the sedimentation tank and any nutrients effectively due to plant assimilation, denitrification, and sorption in the case of NH^{4+} and TP.
- Plants to be used shall be a combination of native aquatic emergent plant species in a zig-zag manner (to minimize short-circuiting) and to increase the possibilities of interspecific competition for nutrients. The other advantage is that such wetlands do not provide mosquito breeding receptacles.

The Quantity of Wastewater Used for Irrigation

It is recommended to use at least 20% of the treated sewage (~360 m^3/day during the fullest operation) for agriculture & gardening during non-rainy seasons.

Land Area to be Irrigated

The irrigable area is the area set forth for agriculture and landscaping given in the lay out plan (Figure 2.2). For landscape irrigation, the area requirement would be in the range of 1.6 - 2.1 ha (3.95 -5.2 acres) if the entire 360 m^3/day would be used and taking into consideration of the following:

- The site and project area having a red, yellow podzolic soil with laterite has a sandy loam texture.
- Dosage of settled industrial effluents recommended by the CEA as per the NEA (Gazette No. No. 1534/18 – February 1st, 2008) for sandy loam soils is 170-225 m^3/ha/day.
- There is enough land area within the prison complex (more than 5.2 acres); the playground (5.1 acres) and all the areas set for agriculture can be used for irrigation (refer to the layout plan – Fig. 2.2).

Following areas are available for irrigation:

Magazine Prison-	3.5 Ac
Female Prison –	1.5 Ac
Remand Prison-	3.5 Ac
Welikada Prison-	6.2 Ac
Playground-	5.1 Ac
Total-	19.8 Ac (8 Ha approximately)

Method of Irrigation

Irrigation needs separate identifiable plumbing and further polishing using a multi-media filter (comprising chemically treated sand and activated carbon) or a pressure sand filter and an activated carbon filter. Before implementation of any gardening irrigation system (which can be done using movable sprinklers), the in-situ infiltration rate of the land to which the effluents be discharged will be measured in accordance with the conditions stated in the "Proposed tolerance limits for the discharge of wastewater or effluents on land for agriculture purposes" of the proposed amendment to the National Environmental (Protection and Quality) Regulations (this service should be obtained from an accredited testing laboratory).

Based on ANSI/ ASME A13.1 international pipe colour code standard (Fig. 5.1), following colour codes are proposed for the different effluent pipelines.

Gray for raw sewage (blackwater, kitchen waters and greywater)

Orange for raw service station effluents

White for treated service station effluents

Black for treated sewage from the common STP with "NOT for Drinking" signage

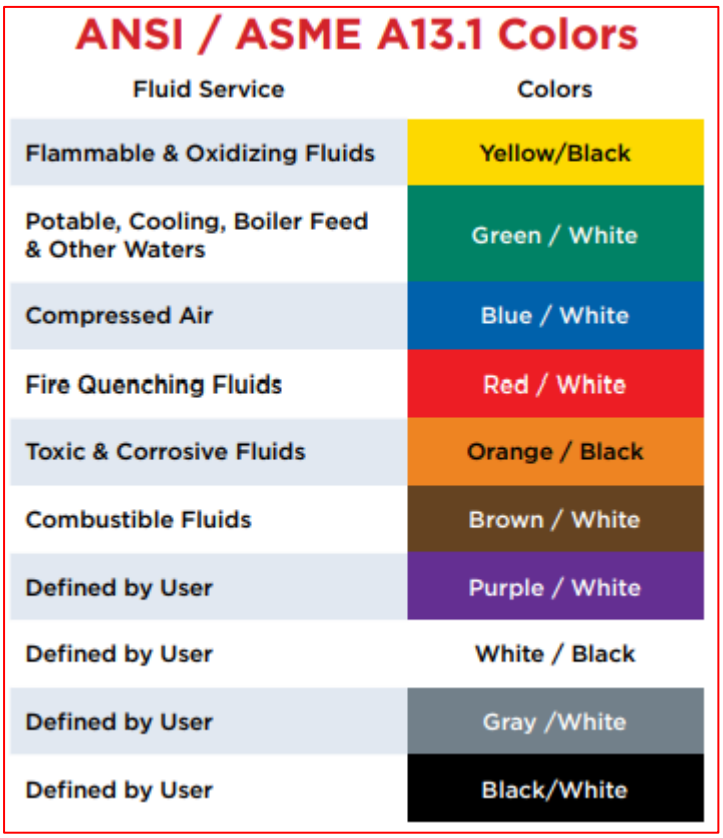


Figure 5.1 ANSI/ASME A 13.1 International pipe colour

Alternative Methods of Discharging Wastewater

To prevent any breakdown in the STP, the following pro-active strategies are recommended:

- There should be a septic tank as the stock tank cum equalization (EQ) tank to collect all effluents and to avoid shock loads during peak hours to the STP as well as to make the composition of the influent more uniform before pumping to the STP. It must have sufficient capacity (at least 1.5-2.0 times the total daily volume) to collect the wastewaters in case the STP is malfunctioning and until it is rectified or when the Mawak Oya has less flow.
- The common STP should have standby pumps in the EQ tank so that they can be alternately operated, and one will be available in case of a failure.
- Prison Department should seek the services of the NWSDB or a suitable wastewater treatment/management engineering firm that will have qualified and experienced STP operators to undertake operation and maintenance of the STP. Prison Department must discuss and agree with the party that will operate the common STP to ensure all electro-mechanical equipment including spare parts of them are readily available in case of malfunctioning of the installed equipment.
- Horana PS has only 1 gully sucker (6000 litre capacity) and the septage is handed over to the NWSDB's STP at Ratmalana-Moratuwa. Prison Department should seek their services to remove septic tank effluents until the STP is rectified or in case the flow of the Mawak Oya reduces drastically or stagnates, etc. They should be supplied with at least 3-4 numbers of 6000 litre capacity gully suckers to maintain them and assist the prison complex during

an emergency. However only a limited quantity of untreated sewage wastewater could be removed by this method.

- The treatment plant will be designed as two lines to prevent overall breakdown. The standard preventive maintenance methods will be implemented to prevent frequent failure (the normal practices adopted)

Handling Project Phase Wise Minimum Wastewater Load

If the project is to be implemented phase-wise, the minimum wastewater load required for working the wastewater treatment plant and the wastewater collecting procedure to the wastewater treatment plant with the implementation of the phases of the project:

- There are few parameters available for the operators to handle this type of situation such as a change to aeration duration, increase or decrease of sludge recirculation rates, etc. However, there are limits to which these options could be used. Therefore, the first step is to go for a robust design. This means having several parallel treatment chains. Let's say the prisons can have three parallel chains of 600 m^3/d each for example. This approach addresses the situation related to hydraulic loading variations reasonably but does not address the organic loading variations totally. The organic loading can be addressed to some extent by having flexibility in the sludge recirculation rate. Therefore, the designers must carefully consider wastewater inflow (quantity and quality) development over time and achieve a rational decision to design a robust plant.

- In case of the initial low loading, organic matter is very unlikely to be a problem as the aeration system stabilize the organic matter, it can be over stabilized causing difficulties in the settlement of sludge thus causing colour, turbidity and increased suspended solids. Nutrient removal also will be affected as anaerobic conditions may not be achievable.

- It would be difficult even for the designers to calculate *"what if"* for all these considerations. Generally, only predictions are based on published literature based on long terms studies of plants.

- However, if the designer could use software such as GPS-X to simulate their designed plant for underloading and overloading and lean wastewater load scenarios.

5.1.2 Waste Management Construction Phase

Construction Demolition (CD) Waste Management

Role of the UDA as the Project Planners: CD waste reduction is essential to prevent the creation of any disposal sites or haphazard dumping and this need to be achieved through carefully reviewing the design concepts and through material selection and construction method selections. These aspects will be considered by the Architects of the UDA and make it clear for the Contractor/s too on a regular basis. Architects will liaise with the Contractor/s very closely.

Design measures and concepts that could be used to reduce CD wastes are:

- Dimensional coordination and standardization; consideration shall be given at the design stage so that dimensions will match with the material size standards, hence cutting wastes could be minimized. Furthermore, use of prefabricated material such as pre-cast concrete

slabs for concrete structures or wherever possible containerized structures (for example, for the office buildings, intelligence units) and even recycled material would reduce waste generation at the site.

- Minimizing the use of temporary works; example use of system metal formworks will minimize the use of plywood timber
- Avoiding late designing modifications (which will avoid any demolitions of already done structures and redoing of works)
- Provision of more detailed designs (which will avoid abortive works and excessive redoing of works). But design complexity should not be substantially high.

Role of the Contractor: Prior to commencement of works, the Contractor shall prepare a specific Construction Waste Management Plan covering the entire project (to be handed over to the UDA, Horana Pradesheeya Sabah, and the CEA for approval) which shall detail the following (but not limited to):

- An inventory of hazardous wastes and non-hazardous wastes that are to be generated (with the sources and activities of wastes generation)
- Methods of minimization and segregation of different wastes (both non-hazardous including spoil and hazardous wastes)
- Areas designated for the storage of hazardous and non-hazardous wastes including storage procedures and proactive safety precautions to be adopted
- in-situ reuse, in-situ recycling and / or environmentally safe disposal strategies
- OHS management strategies that will be taken when dealing with hazardous wastes including removal of asbestos sheets from the line houses

The Contractor shall also maintain a Logbook with documentary evidence (i.e., a system to document the disposal of construction waste types and quantities, copies of the Environmental Protection Licenses of recyclers the Contractor is dealing with, etc).

Special attention shall also be placed to segregate and safely dispose hazardous wastes and make appropriate arrangements to deal with parties that have a valid EPL and a scheduled waste management license issued by the CEA and also an approval from the CEA (as the Competent Authority responsible for implementing the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal) for those parties involved in exporting hazardous wastes for reuse, recycling, co-processing and /or destruction. Explore the option to deal with Elephant Masonite Ltd that might be able to recycle (closed-loop recycling) the asbestos sheets from the line houses. Another option might be to give the asbestos sheets to those households that will get relocated or reuse for the prison complex, provided they are not damaged or abrased.

UDA will mediate to handover the cut rubber trees to plywood manufacturers, nearby sawmills/carpentry units (Figure 5.2) as much as possible as a CSR project and for furniture manufacturing enterprises such as the State Timber Corporation of Sri Lanka.

Figure 5.2 - One of the nearby sawmills close to the Millewa Estate

5.1.3 Waste Management During the Operation Phase

5.1.3.1 Waste management techniques (liquid and solid) including Solid Waste Management Plan

Domestic biodegradable waste will be handed over to Horana PS for composting. It is expected to expand the composting plant of the Horana PS. If the composting plant is not upgraded in parallel with the project biodegradable food waste will be given to piggeries and biodegradable non-food waste will be used for inhouse composting, using composting bins. If there is a delay in funding UDA will provide funds to PS under this project and the upgrading of the composting plant of the Horana PS will be done as a part of the project.

It is not expected to establish any biogas facility immediately. However, during the detailed planning stage such options may be considered.

Source Segregation (SS) Practices

The prison complex will promote an integrated solid waste management strategy prioritizing on RECP (resource efficient and cleaner production) concepts (i.e., waste generation prevention and waste -minimization or reduction) to the extent possible, to reduce unnecessary loads of wastes. One strategy would be to avoid the use of single use plastics.

Source Segregation (SS) as a good housekeeping practice should be prioritized to prevent any contamination of non-hazardous recyclables such as paper by hazardous wastes due to cross-contamination (for example potential contamination of cardboard and paper with oily material in service station areas) and to avoid the generation of unnecessary loads of hazardous wastes that require specific costly disposal methods (to be discussed later). Therefore, providing thorough awareness to prison officers regarding the identification of different waste types (especially hazardous wastes) and importance of proper SS practices of both hazardous and non-hazardous waste streams (along with necessary instructions/information disseminated through posters, etc.) is necessary in relevant areas like the service stations and workshops, etc.

Necessary bins / containers (puncture or leak proof with well closing lids) will be placed within all the areas wherever waste is generated (to exclude access to vermin and to prevent wind-blown

litter). All bins will be labelled in all 3 languages / colour coded as per the "Technical Guidelines on Solid Waste Management in Sri Lanka" prepared by the CEA (**Table 5.1**).

Table 5.1 - Recommended SS practices as a good housekeeping strategy

Type of waste	Colour	Remarks
Non-hazardous wastes		
Bio-degradable wastes / food wastes	Green	Important areas for consideration are the kitchens, bakeries, canteens/lunchrooms of the training centre, administration units and the intelligence unit and residential units of prison officers Glass, paper, and plastic wastes (such as PVC) can also arise from renovation works. Glass and plastic waste are also generated from the vehicle servicing yards
Paper & Cardboard	Blue	
Plastic & Polythene	Orange	
Glass	Red	
Metal	Brown	Important areas for consideration are the kitchens, bakeries (e.g., Tins / cans of food items) and the vehicle servicing yards (example, removed metal scrap from vehicles)
Ceramic	Marked bins	Need to be separately collected. This will include broken cups and plates from kitchens, cut tiles from constructions/renovations
Rubber	Marked bins	Need to be separately collected. This will include broker slippers of inmates and officers and shoes/boots of officers
Mixed wastes	Marked bins	Plastic and paper fused waste (single-use plastics will also come under this category) and rubber-plastic mixed wastes
Wood wastes	Marked bins	They need to be separately collected. This will include material from workshops, material from constructions/renovations
Coconut shells	Brown*	These wastes are generated from kitchens
Hazardous wastes		
e-wastes	Yellow	E-wastes including toners and cartridges from administration officers and CFL bulbs (which are also scheduled wastes) may be separately collected but in marked / labelled bins (under the supervision of the ESH Department).

Type of waste	Colour	Remarks
Hazardous wastes (excluding biomedical wastes)	Yellow	Key areas of generation will include machinery workshops, emergency generator rooms, service station ETP and vehicle servicing yard. This will include oil contaminated material (e.g., filters, fabric material used for spill clean-up, paper and cardboard, etc), aerosol cans/pressurized containers, pesticide cans, paint cans and adhesives, spent acids/car batteries, etc. Due consideration shall be given to containment of such wastes / containers (whether totally or partially empty) in terms of incompatibility as per the Storage and Handling guidelines given in the Safety Data Sheets (MSDS) of the chemicals (example, acid with alkaline residues, spent acids with flammable liquid traces and bases with flammable liquid traces shall not be kept together)
Biomedical wastes	Discussed below	Discussed below

In-house storage of Hazardous wastes

Where hazardous wastes are to be generated and then stored until given to a contracted party (e.g., workshops, vehicle servicing yards, emergency generator rooms and vehicle servicing station ETP), separate water and weatherproof and lockable storages[21] shall be provided that shall be also be devoid of ignition sources and equipped with the following active firefighting systems in pairs as a precautionary measure especially if one cylinder would be under replenishment. There should be unobstructed access to the extinguishers.

- Class B fires (flammable liquids) – 25 kg CO_2 extinguishers, dry chemical powder or 9L foam cylinders
- Class C fires (flammable gases) – 25 kg CO_2 extinguishers or dry chemical powder
- Class E (electrical fires) – 25 kg CO_2 extinguishers or dry chemical powder

Where hazardous liquid wastes are stored (example, waste oil generated from the vehicle servicing yards), secondary containment (capacity should be 10% more of the total storage capacity) is necessary with provision of spill kits[22]. Note that collected contaminated / spilled material shall be disposed as a hazardous waste (discussed below).

[21] Placement of appropriate warning signage at the entrance (example, "WARNING - CONTAINS WASTE DANGEROUS TO HUMAN HEALTH AND THE ENVIRONMENT") along with other warning labels such as "NO FOOD" and "NO SMOKING" signs in all 3 languages is essential

[22] Spill kits shall include the following:

Suitable absorbent material such as saw dust or fabric (not sand, since it is unacceptable for Insee Ecocycle). Note that spills involving alkaline chemicals may require neutralization with EXTREME CARE.

The following waste streams (empty cans, containers, etc) shall not be stored together and the updated MSDS of the suppliers[23] shall be consulted for the familiarisation with the storage of empty containers, etc.

- Acids with bases (all UN Hazard Class 8 corrosives), flammable solids (UN Hazard Class 4), gases (UN Hazard Class 2.1) and liquids (UN Hazard Class 3) and oxidizing agents; UN Hazard Class 5
- Bases with acids, flammable gases, solids and liquids and oxidizing agents
- Oxidizing agents with acids, flammable solids, gases, and liquids and reducing agents

Empty cylinders of liquid O_2 and acetylene generated from the workshops with HMIS, or GHS labels must be stored separately in designated areas with the following conditions.

- protected against weather and inundation,
- devoid of ignition sources and not located close to hot working environments,
- The entrances to be placed with the pictograms with appropriate signages like "No Smoking", "Flammable" and "Explosion Hazard"

Suitable pictograms for any flammable gas cylinder storage areas (whether empty or filled)

- equipped with unobstructed active fire suppression systems (to address Class C and E fires) and mechanisms placed to prevent BLEVE (Boiling Liquid Expansion Vapor Explosion)
- have adequate ventilation (natural or dilution ventilation systems).

(using a weak acid) prior to usage of any absorbent. Water is not suitable for acids other than using weak bases such as Na_2CO_3 or $NaHCO_3$ prior to usage of absorbents.

Coir brush or broom, dust pan

Empty container or tough bag (to store the contaminated absorbent)

Relevant & clean PPE. PPE as a minimum should be cartridge type respirators having activated carbon or full-face respirators with N95/N99 certification, eye goggles (conforming to ANSI Z87.1 or EN 166 Standards), chemically resistant gloves (conforming to ANSI 105 or EN 374; 2003 standards) and chemical resistant boots (conforming to ANSI Z41 or EN345 Standards).

[23] MSDS provided should not more than 3 years old and updated as per the GHS (Globally Harmonized System of Classification and Labelling of Chemicals) criteria

- Any empty gas cylinders shall be chained or strapped to wall / bench (multiple cylinders shall be stored by nesting) with their safety valves and protective caps intact and kept on flat / levelled areas. Keep non-compatible gases separate (no storage of empty acetylene and liquid O_2 cylinders together; procedures to store empty cylinders of liquid O_2 are further discussed below under clinical waste management).

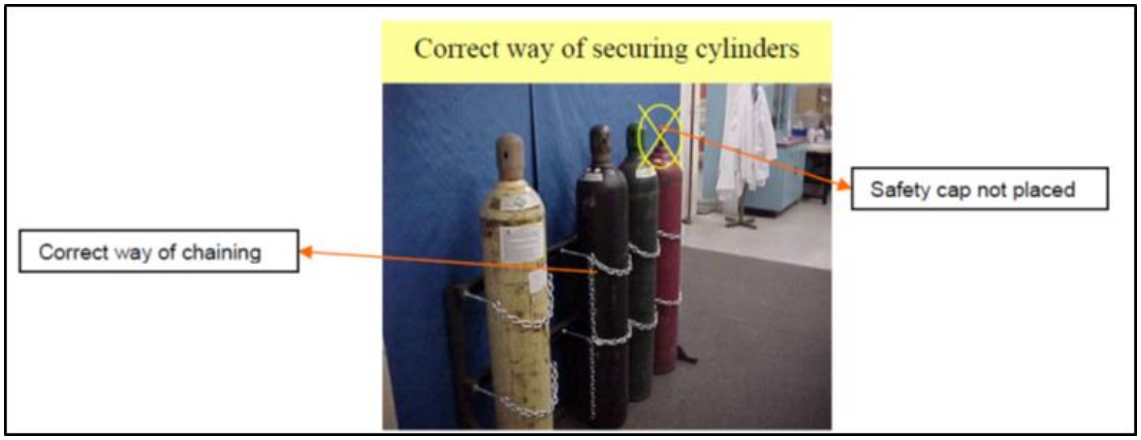


Figure 5.3 - An example of stacking empty gas cylinders

Additionally, in the immediate vicinity of hazardous wastes storages (especially where there are flammable and corrosive liquid material are stored; example, workshops, vehicle service stations and service station ETP) provide an emergency eye washing unit coupled with an emergency shower (this needs to be always unobstructed) (**Figure 5.3**)[24].

Figure 5.4 – Examples of spill kits

[24] Posters shall be erected in all 3 languages near these units and the waste storage areas indicating the actions to be taken event that persons have been contaminated

Figure 5.5 – An example of an emergency shower with an eye washing unit

In the relevant hazardous waste storages, allocate a small space to collect / store e-wastes also from the various departments/sections of the complex until handed over to the contracted recycling party.

In-house storage of MSW

The MSW storages (where the biodegradables are stored) should be operated as cold rooms (temperature should be < 10^{o}C) with ample side windows to provide ventilation. The walls and floors should be tiled (smooth tiles) and provided with a gully to facilitate washing or mopping and disinfection. The gullies (equipped with mechanisms to prevent the entry of vermin including rodents) / wash waters should be directed to the sewage treatment plant.

Having considered the unexpected breakdown of the collected vehicles and collection frequency will be confined to at least once a week at worst, the total quantity of wheely bins (240 L) required for the collection and storage of biodegradables is computed below.

- Maximum quantity of biodegradables per day during the fullest capacity = 3248.31 kg/day
- Bulk density of loose uncompacted waste is around 200 kg/m^3, but after in-house storage it will be around 300-400 kg/m^3 (Kularatne, 2015).
- Therefore, volume of food wastes after 7 days of storage will be around = 3248.31 kg x 7/400 = 56.8 m^3.
- Total number of biodegradable wheely bins needed at the common storage = 56.8 / 0.24 = 237 bins
- Maximum quantity of biodegradables per day during the fullest capacity = 5085.8 kg/day kg
- Bulk density of loose uncompacted waste is around 200 kg/m^3, but after in-house storage it will be around 300-400 kg/m^3 (Kularatne, 2015).
- Therefore, volume of food wastes after 7 days of storage will be around = 4862.8 kg x 7/400 = 85.1 m^3.
- Total number of biodegradable wheely bins needed = 85.1 / 0.24 = 355 bins

Final Disposal

Tables 5.2 and 5.3 present the disposal options for the different types of non-hazardous wastes and hazardous wastes (except for biomedical wastes), respectively.

Table 5.2 - Disposal options for non-hazardous wastes

Waste Category		Disposal option	Remarks/alternative options
Biodegradables	Food wastes	Until the "Kawashima" screw type composting plant is commissioned by the Horana PS, compost the food wastes with garden wastes (to supply C-rich browns and N-rich green material) at site (for subsequent landscaping works) using various methods like compost bins, bio cages and Takakura Handing over to CEA/PS approved piggeries (having a valid EPL) is an alternative	Handing over to CEA/PS approved piggeries (having a valid EPL) and in-situ composting is encouraged in case the PS is unable to handle the already collected areas (due to any increase in population size with time). Handing over to piggeries is an option if there is a phase-wise development of the complex. Excess food (not left-overs from plates, etc) can be given to nearby religious places, home for the elders, etc as a CSR / charity activity
	Garden wastes	Compost at site, handover to Horana PS or handover to nearby horticulture units that may need it for composting	-
	Oil and grease skimmings and sludge from oil and grease interceptors / traps (receiving kitchen effluents)	In the case of oil and grease traps receiving kitchen / canteen effluents, the sludge and oil skimmings may be given to CEA licensed piggeries (having a valid EPL)	STP's O&M staff may dose solutions containing special enzymes to break down fats, oils and greases. Enzymes can be effective (where properly used), but keeping fat, oil and grease out of drains in the first place should make them necessary wherever possible
	Screenings from the screen chambers (receiving kitchen effluents)	This may be given to Horana PS along with the food wastes for composting purposes since this contains more biodegradable organics	Handing over to CEA/PS approved piggeries (having a valid EPL)
	Screenings from the screen	Since the screenings will be coated with some organic material (contains more organics than grit), it can be	screenings will include some putrescible organic matter (including pathogenic faecal matter)

Waste Category		Disposal option	Remarks/alternative options
	chambers of the common STP	given to the Horana PS along with food wastes for composting	
	Waste sludge from the STP	Handover to Horana Pradesheeya Sabah for incineration in their high-temperature incinerator or to Insee Ecocycle co-processing after sufficient drying to 70% moisture (due to possibilities of some adsorbed antibiotics or their metabolites)	Normally, wasted sludge from STPs could be used as a fertilizer cum soil conditioner. But in the context of this project, due to the prison hospital complex, this material needs to be disposed as a hazardous waste
Paper & Cardboard Plastic & Polythene Glass Metal Mixed wastes Coconut shells Wood wastes Rubber		Handover to Horana Pradesheeya Sabah after proper SS for subsequent handing over to appropriate recyclers	Horana PS has a high-temperature incinerator to burn any wastes that cannot be reused or given to recyclers such as single-use plastics
Ceramic		-	Collect the pieces. Once enough is available, they could be used as a bedding material for future construction / renovation works. Rough ceramic material pieces could be used as alternatives for aggregates in concrete

Table 5.3 - Recommended disposal options for hazardous wastes

Waste Category	Disposal strategy	Best Environmental Practices (BEPs)
e-wastes (UN Hazard Class 6)		
Fluorescent bulbs and tube lights	Through Government Tendering Procedures, handover any remaining items to Government approved firm (having a valid EPL and a SWML) for the recovery of white P and Hg and salvaging of metal items and glass, etc	Prioritize to replace such bulbs with LED bulbs which are Hg free and more energy efficient wherever possible
Toner and ink jet cartridges	Through Government Tendering Procedures Handover to government approved / licensed e-waste collectors cum recyclers having a valid EPL and a SWML	Prioritize to use refillable material so that they could be sent back to the supplier (for re-filling)

Waste Category	Disposal strategy	Best Environmental Practices (BEPs)
Other e-wastes	Handover to government approved / licensed e-waste collectors cum recyclers (valid EPL and SWML)	-
Capacitors from air-conditioners in office complexes	Handover to government approved / licensed e-waste collectors cum recyclers (valid EPL and SWML)	Suppliers / persons coming for maintenance works shall be requested to take back such wastes
Flammable liquids (UN Hazard Class 3), Corrosives (UN Hazard Class 8) and other wastes from vehicle service stations, service station ETP, workshops and emergency generator rooms		
ETP Sludge – Chemical sludge[25]	After sufficient dewatering, hand over to Insee Ecocycle for co-processing in their cement kilns in Puttalam	-
Used Oil / waste oil (except transformer oil and oils from capacitors and welding plants in the workshops known or suspected to contain PCBs)	Hand over to Insee Ecocycle for co-processing in their cement kilns in Puttalam	Through Government Tendering Procedures, prioritized to handover to a government approved waste oil recycling firm having a valid EPL and SWM (as has been done at present)
Oil sludge in fuel storage tanks	Hand over to Insee Ecocycle for co-processing in their cement kilns in Puttalam	-
Used or waste oil removed from welding plants (known or suspected to contain PCBs)	Carefully remove the oil and contaminated material, store in a leak proof drum / container which shall be sealed and labelled as “Caution: Contains PCB” and then handover to Insee Ecocycle (do not reuse / recycle due to possible occurrence of PCBs)[26]	Use PCB free welding plants
Oil and/or other chemical contaminated wastes (example, oil filters and spill kit material)	Hand over to Insee Ecocycle for co-processing in their cement kilns in Puttalam	-

[25] Effluents / washwaters from the prison vehicle repairing and servicing yards require pre-treatment (commencing with oil and grease removal in grease traps followed by TSS removal using coagulants and flocculants) prior to diversion to the STP

[26] Persons who are required to carry out any work exposing them to materials either proven or suspected to contain PCB, must use the appropriate PPE. This includes impermeable long gloves, coveralls or aprons, overshoes, chemical type safety goggles and respiratory protective equipment. Clothing manufactured from absorbent materials should be avoided

Waste Category	Disposal strategy	Best Environmental Practices (BEPs)
Used Pb Acid Batteries	Handover to a government licensed recycling facility (Valid EPL and SWML)	-
Spent acids	2 options: Hand over to Insee Ecocycle for pre-processing and subsequent disposal Careful neutralization with a weak base (e.g., baking powder/$NaHCO_3$) until pH reaches 6.5-8.0 and subsequent disposal to the sewer	-
Cans and tubes of adhesives and glues	The following options can be considered. Through Government Tendering procedures, handover to a licensed facility (having a valid EPL or SWML) having an arc furnace to make steel Hand over to Insee Ecocycle for co-processing in their cement kilns in Puttalam	-
Metal cans of chemicals such as paints, oil, etc		-
Pesticide cans		-
Aerosol cans / pressurized containers		-
Paint and other chemical cans (plastic)	The following options can be considered: Through Government Tendering procedures, handover to responsible recyclers having a suitable washing plant with an ETP (recycler should have a valid EPL and a scheduled waste management license). The recycler should be making material that are of non-food grade material (not for toys, water storage tanks, tables and chairs and for any food-grade usages) or not sending pellets to such industries. Hand over to Insee Ecocycle for co-processing in their cement kilns in Puttalam	-
Janitorial chemicals and other chemicals used for maintenance		
Empty plastic cans	Handover to Horana PS	Send back to the supplier for refilling / reuse (evidence of proper reuse is needed)
Empty Gas Cylinders		
LPG cylinders	-	Send back to the supplier for refilling / reuse

Waste Category	Disposal strategy	Best Environmental Practices (BEPs)
Refrigerants (e.g., R 22, R134)[27]	-	
Cylinders due to oxyacetylene works (oxygen and acetylene gas cylinders)[28] used in workshops	-	

EPL and SWML refers to Environmental Protection License and Scheduled Waste Management License, respectively

UDA and the Prison Department is advised to make a contractual arrangement with the Horana PS to collect biodegradables and recyclables.

[27] R22 (HCFC-22) is chlorodifluoromethane or difluoromonochloromethane (CHClF2), a hydrochlorofluorocarbon (HCFC) that is phased out in USA and EU since it is an O_3 depleting chemical

[28] Liquid oxygen is a cryogenic fluid, but acetylene is a flammable gas (UN Class Hazard 2.1)

5.1.3.2 Effluents from vehicle service stations

The effluents (vehicle washwaters) from the prison vehicle servicing yards needs to be treated and then disposed to the sewer or recycled for further washing of vehicles. The final effluent quality shall conform to the "Tolerance Limits for the Discharge of Industrial waste into Inland Surface Waters (National Environmental (Protection and Quality) Regulations, No. 1 of 2008 of the National Environmental Act No. 47 of 1980 and its amendments; Gazette No. 1534/18 – 01.02.2008).

There needs to be a physio-chemical treatment plant encompassing an oil and grease trap and a coagulation-flocculation unit with a sedimentation tank (to remove TSS). A dead space may be kept in the oil and grease trap to remove sand and mud as much as possible.

The floor area of the ETP should be made impervious with mechanisms to prevent runoff entry. The reactors such as the coagulation-flocculation units and the settling tanks must have ample free-board space (0.5-1.0 m) to prevent spills.

Oil to be removed from the vehicles and any oil contaminated material should be separately collected, stored, and disposed as suggested in this report (i.e., co-processing, reuse or recycling where appropriate) instead of disposal to the wash water stream.

A holding tank (needs to be made waterproof with mechanisms to prevent surface runoff and rainwater entry) should be provided prior to recycling or diverting to the sewer for treated effluent quality sampling and monitoring in accordance to the conditions of the EPL that will be issued by the CEA.

5.2 Clinical waste management

5.2.1 General

Prior to commencement of the hospital operations, an audit of biomedical waste is required to understand the type and quantity of waste generated and hence to formulate a more specific plan for segregation, waste handling and management (in terms of storage and final disposal). However, the following sections deal with the safeguards.

5.2.2 Categorization and Source Segregation (SS) of Biomedical Wastes

The national colour coding (NCC) system recommended by the MOH in 2006 shall be continuously implemented for infectious wastes and sharps (considering the hazardous component) as well as for general healthcare wastes, biodegradables, paper, plastics and glass (Table 5.4). Bins receiving infectious wastes and sharps shall be placed at appropriate generating locations (dental clinic, wards, OPD clinic and wet labs) and Sisili Hanaro Encare[29] should be advised to strictly adhere to the guidelines given in Table 5.4.

[29] Visits to the current prison hospital complex revealed that the yellow-colored infectious waste containers did not have the biohazard symbol and waste sharp containers were not well labelled too without the biohazard symbol with red stripes

Table 5.4 - Colour coding of biomedical wastes and relevant guidelines currently adopted in Sri Lankan government and private healthcare facilities

Colour	Waste category / labelling requirement	MOH and SLMC guidelines	Remarks
Hazardous biomedical wastes			
Yellow	Infectious wastes	Usage of yellow polythene bags of minimum 300 µm gauge (having the international biohazard symbol). Bags should be sealed with appropriate adhesive tape and removed from the bins when ¾ full	MOH/SLMC recommendation matches the WHO guidelines
Yellow with red stripes	Sharp wastes	Usage of specific puncture / leak-proof cardboard or plastic boxes designed with a small opening (so that items can be dropped in but no item can be removed). Boxes should have the international biohazard symbol and should be closed when ¾ full.	This recommendation closely matches the WHO guidelines. This requirement is also recommended by SLMC
Non-hazardous biomedical wastes			
Black	general wastes	Should be placed in black polythene bags of minimum 200 µm gauge	MOH/SLMC recommendation matches the WHO guidelines; general healthcare waste should join the stream of domestic refuse or municipal waste for disposal
Green	biodegradable wastes	-	These colour coding systems are in accordance to the guidelines on solid waste management developed by the CEA
Red	glass wastes		
Blue	paper wastes		
Orange	plastics		

All containers (irrespective of the type of biomedical wastes to be collected) need to be strong leak-proof containers having a well closing lid (Prüss et al., 1999; Kularatne, 2021).

Additionally, separate brown coloured bins (labelled with suitable pictograms that may be in accordance with the Globally Harmonized System) are recommended to contain chemical wastes[30] in the lab and pharmaceutical wastes generated from the dispensaries, etc – WHO recommendations, (Prüss et al., 1999; Kularatne, 2021).

[30] Due consideration shall be given to the incompatibilities by referencing to the MSDS / SDS of the relevant chemicals to avoid fire and violent chemical reaction hazards, etc.

Pharmaceutical wastes

Expired / outdated material must be kept within their original packages or containers, well-sealed and kept within a brown coloured bin marked as "Pharmaceutical/Medicinal wastes" with the suitable GHS pictograms for ultimate removal / collection by the contracted party.

Chemical wastes

For chemical wastes, use the original containers for containment with chemical labels as per GHS criteria and sealed for ultimate removal/collection by the contracted parties.

Otherwise, a common bin / container (as per WHO it should be brown in colour) may be used for chemical wastes. But it should be sealed, the material of the container should be suitable for the constituents to be stored (as per the instructions given in the MSDS of the relevant chemicals) and marked as "Waste Chemicals" with indication of suitable GHS pictograms, constituents, and their CAS Numbers. However, ensure the different chemical wastes to be contained within the container are compatible to one another by consulting the GHS updated (i.e., within the last 3 years) MSDS/SDS of the relevant chemical wastes. Similarly, storage of such chemical waste containers with other chemical waste containers should be done by considering the instructions given in the MSDS/SDS of the relevant chemicals. For example, no mixing and storage of oxidizing agents and reducing agents together and no mixing and storage of acids and alkaline material together.

5.2.3 In-situ transportation and OHS practices

Biomedical wastes should be transported to the respective storages avoiding the mealtimes (Prüss et al., 1999; Kularatne, 2021).

The existing trolleys at the current complex are not recommended to be used, unless modified with a railing or some means to prevent bins, etc from falling, sliding during internal transportation (see Additionally, the following WHO criteria must be met (Prüss et al., 1999; Chanpika et al., 2015; Kularatne, 2021): easy to load and unload, no sharp edges that could damage waste bags or containers during loading and unloading and easy to clean (transporting carts or trolleys should be cleaned and disinfected daily with an appropriate disinfectant).

No stacking of containers, bags, and sharp boxes on top of one another during transportation to avoid spillage and / or damage to each other by sharps for example. Each bag and container will be kept with the filling side upward.

As per the WHO recommendations, all waste collectors or handlers should wear personal protective equipment (PPE) such as plastic overalls, industrial aprons, helmets (with or without visors depending on the operation), boots, gloves (disposal gloves for medical staff and heavy-duty gloves for waste handlers) and face masks with safety goggles (Prüss et al., 1999; Chanpika et al., 2015; Kularatne, 2021)[31].

[31] protective clothing / plastic overalls, protective respiratory equipment for which the protection characteristics are made known to the users, industrial aprons, boots complying to ANSI Z41 or EN 345 standards, disposal gloves complying to ANSI 105 or EN 374 standards and face masks with safety goggles

Figure 5.6 - Typical trolley systems to take away the wheely bins to the common waste storage area

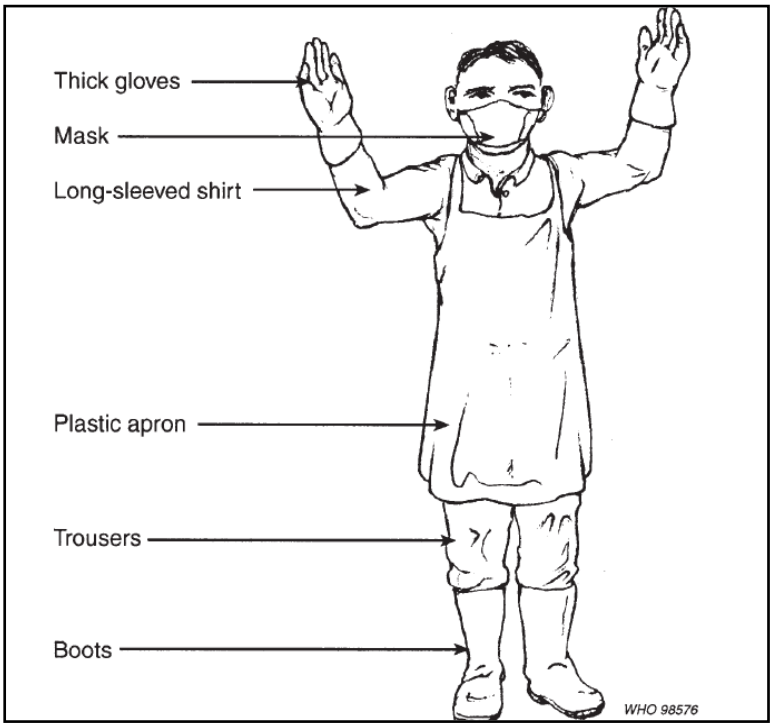


Figure 5.7 - Example of recommended protective clothing for biomedical waste management personnel

(Source: Prüss et al., 1999)

Only nursing and hospital appointed staff (trained staff) shall collect from the generating points and store in their waste storages. Prisoners are not recommended to be deployed for the SS,

container and bag removal and internal transfer arrangement matters as well for maintenance of storages.

There is also a WHO recommendation to immunise all hospital staff (permanent and contract) against hepatitis B and tetanus (Prüss et al., 1999; Kularatne, 2021).

5.2.4 Storage of biomedical wastes

5.2.4.1 General

As WHO recommends, there needs to be a permanent storage for the different biomedical wastes (except liquid oxygen cylinders) and the following criteria are to be met (Prüss et al., 1999; Chanpika et al., 2015; Kularatne, 2021).

- The floor should be impermeable and hard standing with good drainage; it should be easy to clean and to disinfect. There should be a water supply for cleaning purposes. The gullies (equipped with mechanisms to prevent the entry of vermin including rodents) / wash waters should be directed to the sewage treatment plant.

- A supply of cleaning equipment (spill kits – Figure 5-6)[32], protective clothing (as PPE) and waste bags or containers should be conveniently located nearby.

- The storage area should provide easy access for waste handlers (it should be totally lockable to prevent access by unauthorised persons) with easy access for waste collection vehicles.

- It should be protected from the sun and rain and inaccessible to vermin.

- There should be good lighting and adequate ventilation (i.e., free of odour). Note that storage times (i.e., the delay between production and treatment) shall not exceed 24 hours (Otherwise, refrigeration / air-conditioning is required).

- It should not be situated near fresh food stores, kitchens and bakeries, wards, and other areas where patients are congregating.

Additionally, the storage must provide the following.

- It shall have the following statement displayed (in all 3 languages) along with the biohazard symbol: "WARNING: CONTAINS WASTE DANGEROUS TO HUMAN HEALTH AND THE ENVIRONMENT"
- Active firefighting systems in the immediate vicinity (2 numbers of CO_2 fire extinguisher or a foam extinguisher to address Class A and B fires, 2 numbers of 9L capacity water fire extinguisher for Class A fires and two 2 numbers of 25 kg dry powder extinguisher to address all types of fires)[33]

[32] This will include a suitable adsorbent material such as cloth (not sand) and a disinfecting agent with disposal gloves, dust pan, bag and bin. Collected contaminated / spilled material shall not be disposed elsewhere, other to a bin labelled to infectious wastes only

[33] Any extinguishers provided should be available in pairs as a precautionary measure especially if one cylinder would be under replenishment.

- Suitable disinfectants / hand sanitizer (in case any person gets into contact with the infectious wastes) with a washbasin and an emergency eye wash and an emergency shower unit (Figure 5-4) within easy reach of the storage. Posters shall be erected in all 3 languages near these units and the waste storage areas indicating the actions to be taken event that persons have been contaminated.

A 20-foot container can accommodate 7 tons / per day (EML Consultants, 2020). Therefore, if a 20 ft container is used, then total storage capacity for a week assuming once a week collection by Sisili Hanaro Encare will be 7 x 1.69 = 11.83 kg / week which is more than sufficient. It is recommended to decide with Sisili Hanaro Encare to remove the wastes at least once or twice a week and to provide new disinfected bins with sharp boxes and bags when taking away the wastes.

5.2.4.2 Pressurized Containers – Empty Cylinders of Liquid O_2

General

A separate adequately ventilated and clean, weatherproof storage area (with its floor made crack proof/impermeable) should be provided exclusively for such cylinders (one section partitioned fully to store empty cylinders and the other section for new cylinders) and devoid of ignition sources (including naked lamps, but spark proof lamps acceptable). The empty cylinders should be well secured to the wall; chained or strapped to wall / bench (multiple cylinders shall be stored by netting) with their safety valves and protective caps intact.

The said storage should be always lockable and have ample clothing material or rags that should be soaked with fine water spray in case to form massive ice caps by covering any leaks/spills (provided no fires are there).

There shall be a fire hose mounted on a special trolley such that to aim water sprays for small spills only (spills up to 300 cm^3 - for quick evaporation) and to aim on adjacent cylinders (in case of fire involving liquid O_2) at a considerable distance. Provide 2 numbers of 25 kg dry powder cylinders.

The storage entrance shall be placed with the pictograms with appropriate signages like “No Smoking”, “Oxidizer” and “Explosion Hazard” and “Health Hazard”.

Suitable pictograms for the storage of liquid O_2 gas cylinders

5.2.5 (D) Final Disposal

Table 5.5 presents the recommended disposal options

Table 5.5 - Recommended treatment and disposal methods of different types of biomedical wastes

Waste category	Areas of generation	Method of Treatment	Final disposal	Remarks
Waste sharps	Labs, Wards, OPD clinics, dental clinics	-	High temperature incineration by Sisili Hanaro Encare	-
Infectious wastes		About 8 drops of 5% phenol solution is added to the Sputum cups which are then sealed with the lid for subsequent disposal to a designated Infectious Waste receiving bin		Spills will be cleaned with 1% NaOCl (freshly prepared) and disposed as infectious wastes.
Pathological wastes: blood	Labs	About 20-30 mL of freshly prepared 1% NaOCl solution is added to blood samples in the tubes and kept overnight as recommended by the SLMC. Then the oxidized and disinfected blood sample is poured to a container of 5% Lysol (containing quaternary ammonium compounds) and kept for 20 minutes. Thereafter, the Lysol container and the tubes are washed with tap water (with the washings disposed to the sewer) and tubes are reused after drying. Blood and serum samples from the haematological analyser and the biochemical analyser, respectively are mixed with freshly prepared 1% NaOCl, kept overnight in a container and then disposed to the sewer (as recommended by the SLMC)	Sewer system after pre-treatment	Note that blood bags must be considered as infectious wastes

Waste category	Areas of generation	Method of Treatment	Final disposal	Remarks
Pathological wastes: teeth	Dental clinic	Mouth washings are directed to the sewer	Removed teeth: High temperature incineration by Sicili Hanaro Encare	-
Sanitary pads	Female prison	-	Handover to Sicili Hanaro Encare for incineration or contract a reputed service provider who will remove the waste sanitary pads and replace with new bins that are chemically charged with sterilizing chemicals (whenever taking away the sanitary pads)	These are infectious wastes as per the WHO criteria
Chemical wastes	Labs, wards	Solutions of reducing agents – Considerable Dilution (water) or appropriate oxidation with care and disposal to the sewer line: Check the MSDS (updated ones every 3 years as per GHS criteria) to find out the best oxidizing agent Solutions of oxidizing agents – Consideration dilution (water) or appropriate reduction with care and disposal to the STP line: Check the MSDS (updated ones every 3 years as per GHS criteria) to find out the best reducing agent. Example, unused or excess NaOCl solutions should be reduced with sodium bisulfite or sodium thiosulfate and neutralized with acids before discharge into sewers (Prüss et al., 1999)	Except for oxidizing and reducing agents, handover to Insee Ecocycle for co-processing in their cement kilns in Puttalam or to a nearby hospital having a high temperature incinerator (the hospital or facility should have a valid EPL & Scheduled Waste Management License)	Most are liquids. Disposal to sewer not recommended. Disposal of raw or concentrated oxidizing agents and reducing agents to the sewer is also not recommended, unless reduced and oxidized, respectively or considerably diluted with tap water and then disposed – this is as per RCRA of the USEPA Prior to commencement of the hospital operations, an audit of this stream is required to understand the type and quantity of waste generated and hence to formulate specific treatment (if required) and disposal procedures Note that Insee Ecocycle does not accept oxidizing agents and with reference to heavy metals, Insee Ecocycle accepts only restricted levels in ppm; Pb, Hg, Cd, Cu, As and Se (all volatile and semi-volatile metals) are acceptable up to levels < 5 ppm

Waste category	Areas of generation	Method of Treatment	Final disposal	Remarks
Expired/outdated pharmaceuticals and medicinal items (solids and liquids)	Dispensary and labs	-	Expired medicinal / pharmaceutical items (example, tablets and casings/foils, creams, or lotions, etc) may be given to Sisili Hanaro Encare for high temperature incineration or Insee Ecocycle for co-processing in their cement kilns or to a nearby hospital having a high temperature incinerator (the hospital or facility should have a valid EPL & Scheduled Waste Management License)	Disposal to sewer not recommended. Note that Insee Ecocycle accepts only restricted metal levels in ppm; Pb, Hg, Cd, Cu, As and Se (all volatile and semi-volatile metals) are acceptable up to levels < 5 ppm
Heavy metal rich wastes	Labs, dental clinic	-	Handover to Insee Ecocycle for co-processing in their cement kilns or to a nearby hospital having a high temperature incinerator (the hospital or facility should have a valid EPL & Scheduled Waste Management License)	Disposal to sewer not recommended. Note that Insee Ecocycle accepts only restricted metal levels in ppm; Pb, Hg, Cd, Cu, As and Se (all volatile and semi-volatile metals) are acceptable up to levels < 5 ppm Refer to the Cleaner Production Strategies discussed below
Pressurized containers such as liquid O_2	Wards	-	Empty containers will be handed to the supplier/s for re-filling	Damaged cylinders shall be sent back to the suppliers immediately or rejected upon delivery

5.2.6 Some cleaner production strategies

The following strategies of waste generation reduction are recommended for the hospital complex (Prüss et al., 1999; Chitnis et al., 2005; Kularatne, 2021).

- Usage of reusable items made of glass, plastic, and metals to the extent possible that can be easily disinfected (except for catheters, hypodermic needles and syringes). For example, certain types of containers could be reused once carefully washed and disinfected or autoclaved. The vacutainers containing blood can be disinfected with hypochlorite. The blood smear slides covered with immersion oil can be boiled with detergent and washed and reused.
- Usage of steam sterilization methods (exposure to saturated steam at 121°C for 30 minutes in an autoclave)[34] or dry sterilization methods (exposure to 160°C for 120 minutes or 170°C for 60 minutes in a 'Poupinel' oven) for reusable items in preference to chemical disinfection to avoid the generation of hazardous chemical wastes.
- Usage of Infrared thermometers or digital thermometers and Hg free, digital sphygmomanometers.
- Avoiding the usage of heavy metal rich chemicals (e.g., Hg rich preservatives, skin and diuretic agents and ayurvedic medicines), cleaning chemicals, pharmaceuticals and Pd, Pt and Hg-bearing dental amalgam.
- Proper stock management of medicinal and pharmaceutical items (to avoid expiration and subsequent unnecessary disposal). This will include frequent ordering of relatively small quantities rather than large amounts at one time (applicable to unstable products), use of the oldest batch of a product first, use of all the contents of each container and checking of the expiry date of all products at the time of delivery.

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5.3 Mawak Oya Water Quality and Dilution

Reduce Total Coliform level of fewer than 1x 104 MPN/100ml. Fecal Coliform less than 500 MPN/100ml (recommended level for ambient water quality for bathing)

Mawak Oya Flow Analysis

Annual minimum flows (low flows) from 1980-2020 for the hydrometric station Ellagalwa was selected for the dilution analysis as it is the closest hydrometric station to the wastewater discharge point to Mawak Oya. Flow data were obtained from the Irrigation Department. Annual minimum flow frequency was analysed using the Log Gumble distribution (See **Figure 5.8**). Annual minimum flow at Ellagawa were converted to Mawak Oya outlet on the catchment area basis.

[34] The melted media and liquids in the containers (after autoclaving) can be emptied in stainless steel buckets and subsequent disposal to the sewer. The condensed steam (containing volatile substances, but biologically inert) can be directed to the sewer

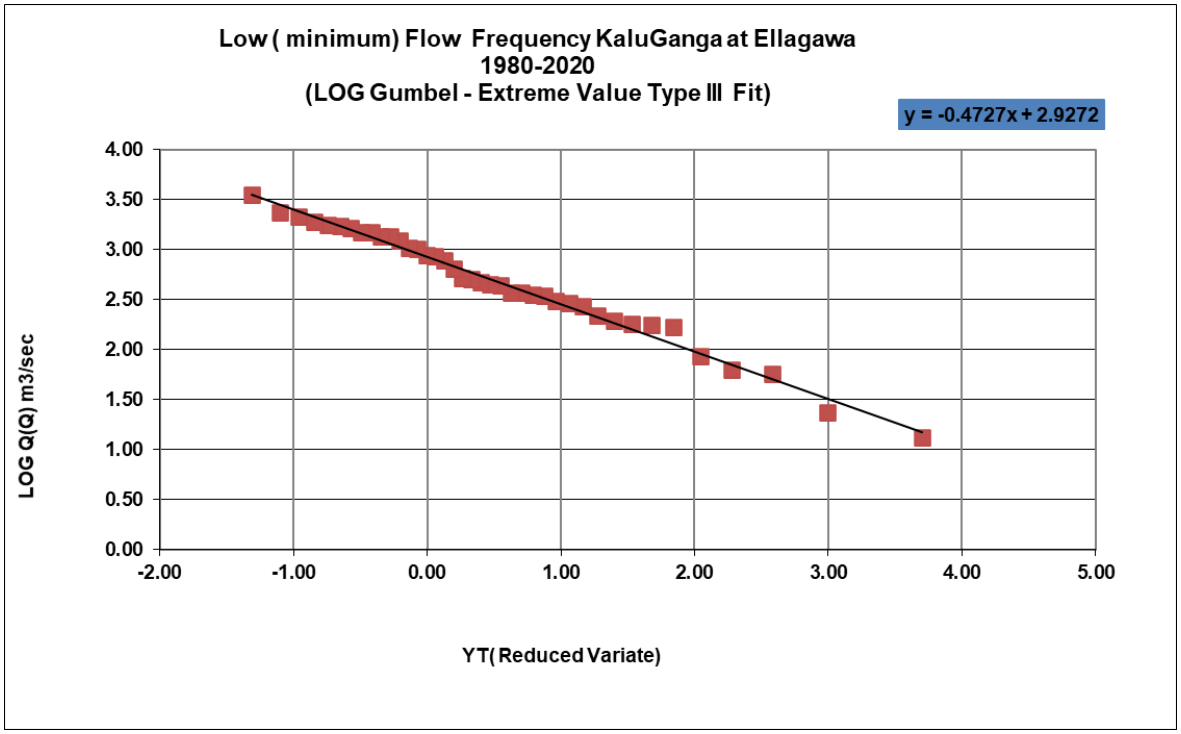

Figure 5.8 - Mawak Oya Annual Minimum Flow Frequency Distribution

Table 5.6 - Mawak Oya Flow and Wastewater Flow Dilution Calculation

Return Period	Probability P(x)	Probability P(x)%	Discharge (Q)-1980-2020-m3/s	Discharge (Q)-1980-2015-m3/day-Ellagawa	Discharge (Q)-1980-2015-m3/day-Mawak Oya Outfall	Required 8 times dilution flow m3/day	Excess Flow at Mawak Oya Outfall Site m3/day	Meeting 8 times dilution
2	0.5	50	15.70	1,356,867	49,229.05	14400	34,829.05	Ok
5	0.2	20	9.19	794,057	28,809.50	14400	14,409.50	Ok
10	0.1	10	6.45	556,928	20,206.13	14400	5,806.13	Ok
25	0.04	4	4.12	355,753	12,907.21	14400	(1,492.79)	Not Ok
50	0.02	2	2.95	255,122	9,256.18	14400	(5,143.82)	Not Ok
100	0.01	1	2.12	183,405	6,654.19	14400	(7,745.81)	Not Ok
1000	0.001	0.1	0.71	61,629	2,235.98	14400	(12,164.02)	Not Ok

CASE 1- 100 Year Annual Minimum Flow		
Estimated discharge of effluent	1800	m3/day
100 Year Low flow Ellagawa	183,405	m3/day
Catchment area Ellagawa	1393	km2
Catchment area at Mawak Oya sewage	50.54	km2

Note: The flow conversion was done only using the catchment area ratio only as the catchment properties are somewhat similar and the flows analysed were annual minimum flows which are essentially dry weather flows which generate without the precipitation influence. Hence precipitation ratios were not used for the conversion.

The water quality of Mawak Oya (River) is extremely good and meet the requirement for ambient water quality for drinking after simple treatment. The water uses along Mawak Oya downstream of the proposed discharge point up to 2 km is mainly bathing and washing. Sixteen public bathing points and two bathing spots maintained by tourist hotels were identified along this stretch. In addition, there were two locations exclusively used for bathing Buffaloes. The most important water use is extraction for drinking water supply. Kadana, water supply intake, is located about 14 km downstream of the effluent discharge location. Mawak Oya has a significant flow. There is no

problem meeting the specified dilution of eight (8 times) at the discharge point even in 10-year low flow conditions.

5.3.1 Mitigation Measures for the Increase in Turbidity in Mawak Oya

- Work affecting river quality (such as in-stream construction activities) should be carried out only during the dry season
- Provide necessary arrangements such as isolation of the construction area to prevent the free flow of sediments and turbidity, causing the material to the river flow
- Adopt construction methodology that minimizes the loss of sediments/soil to the river.

5.3.2 Mitigation Measures for the Impacts Created by the Pipeline Route

All the mitigation measures are standards Environmental, and Health Safety related measures as given below.

1. Dust emanation in cutting the trenches and related public inconvenience – Continual water sprinkling
2. Erosion and deposition of loose soils near streams- Open loose soil will not be left. The trenches will be closed, and the soils should be compacted as soon as the pipes are laid. Excess soils will be removed from the site.
3. Impacts on walking the pedestrians – Protective fencing will be used at specific places along with a pedestrian walkway. Traffic control men will be employed. Warning signs will be displayed at the specific places.
4. Traffic congestion in the B Class Road - Padukka Malagala Road – Traffic control men will be deployed during the daytime for traffic control. Assistance from the local police will be sought if necessary.
5. People/vehicles clashing against the trenches or falling to trenches at night- Reflector foils, night lights, illuminated warning signs will be displayed. No night work will be done.
6. Noise from excavating equipment and compactors- Impact temporary. Well serviced baby backhoes and hand tampers will be used for compaction.
7. Roads will be first temporarily reinstated and later they will be permanently reinstated. Details are presented in **Figures 5.9 and 5.10.**

5.3.3 Mitigation Measures for Mawak Oya Flow Falling below 10 Year Return Period Value

The emergency tank will be used which has the capacity to store the wastewater without discharging to Mawak Oya for about two days. Wastewater will be temporarily taken away through gully bowsers for disposal to a suitable place i.e., Moratuwa Rathmalana Sewerage Treatment Plant. Some prisoners will be taken to other prisons temporarily. The amount of land irrigation will be increased as according to the available land area up to 50% of the treated wastewater discharge i.e., 900 m^3/day could be taken for land irrigation. As Mawak Oya flow falling below the threshold is an extremely rare dry spell event the increase of land irrigation should be possible. All the mitigation measures are standards Environmental, and Health Safety related measures as given below.

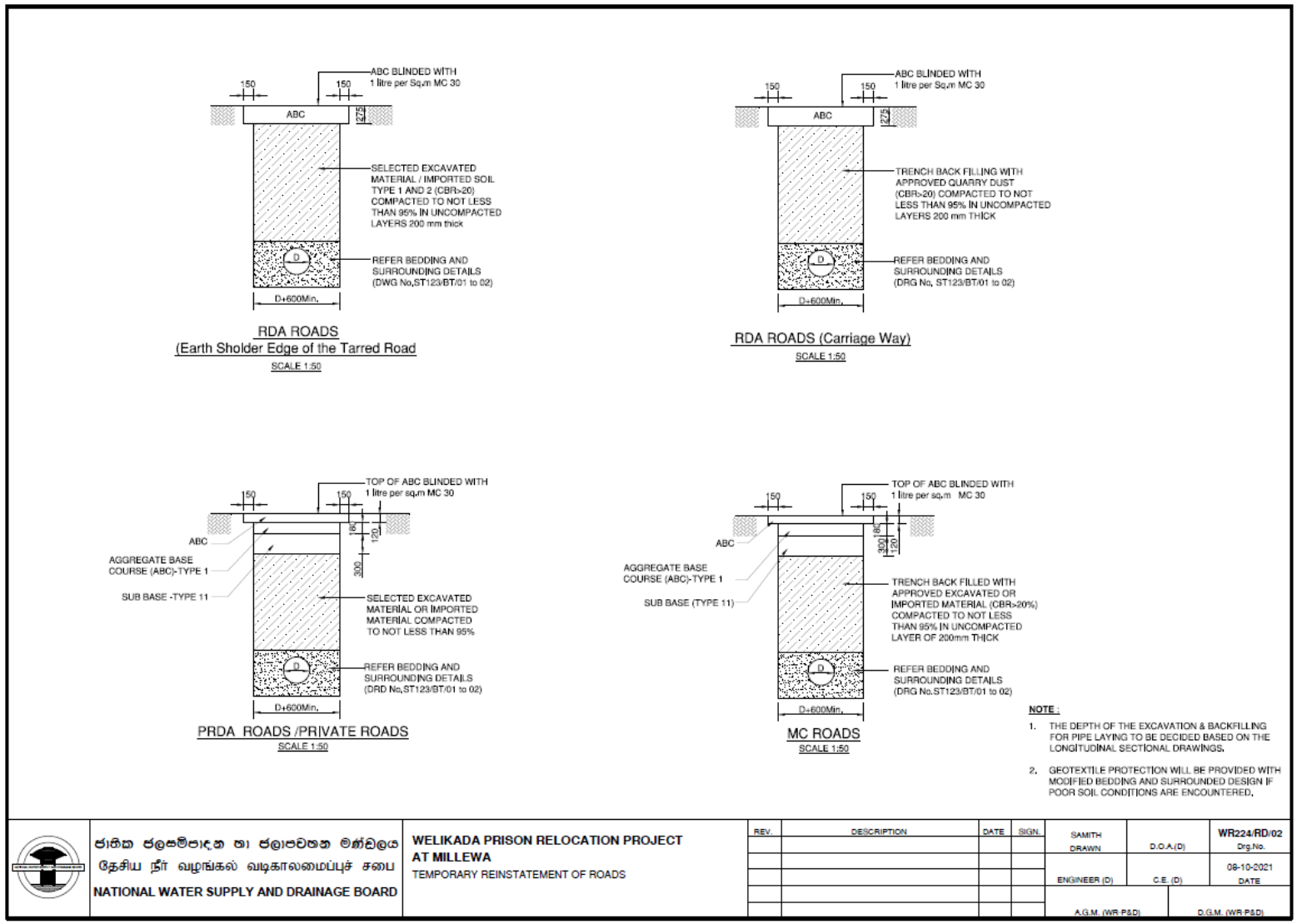

Figure 5.9- Temporary Reinstatement of Roads Damages by the Pipeline Construction

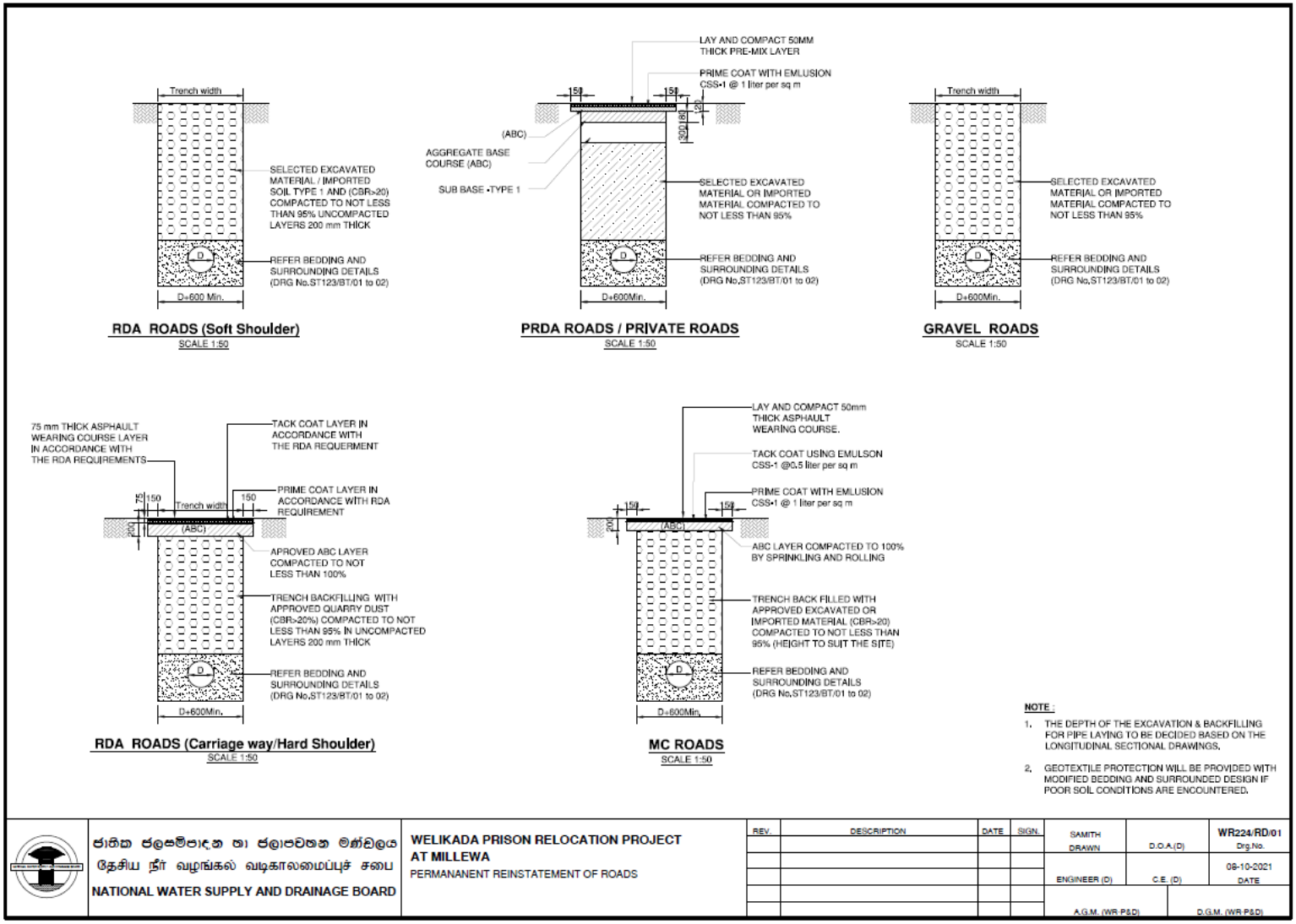

Figure 5.10- Permanent Reinstatement of Roads Damages by the Pipeline Construction

5.4 Proposed measures to address problems due to increased traffic, dust, noise, vibration, and air pollution.

5.4.1 Mitigation Measures for Traffic Impacts

Mitigatory measures to avoid negative impacts for pavement damage, traffic flow and road user safety during the construction stage.

1. The drivers of construction material transport vehicles and other project related heavy vehicles should be advised to follow safe practices (during turning movements, travel speeds etc.) to minimize safety risks to other road users and that should be monitored during the construction work.
2. It is recommended that the contractor submits a work-zone management plan when carrying out road works near the main road. Proper work zone management practices should be always followed in compliance with Manual on Traffic Control Devices Part II – Road Work Areas[35].
3. For major road corridors, movement of heavy vehicles should be restricted during the peak hours especially if the material transport vehicles are travelling through congested town areas such as Padukka and Horana.
4. Pre-construction Road audits should be conducted on all local roads used and those roads will be reinstated after the construction work is completed, subject to the satisfaction of the local road authority.
5. During upgrading works of the local road near Ninja factory premises, adequate notice to be given to residents and road users. Since it's a local road, temporary passage can be provided for vehicles during construction period to mitigate any adverse impacts on accessibility.
6. The utility line shifting on the local roads should be done giving adequate notice to the residents along the road to minimize the inconvenience caused.

Mitigatory measures to avoid negative impacts for traffic flow and road user safety during the operational stage.

1. The design of the new access point **(Figure 5.11)** should take into consideration the safety of the road users an easy manoeuvrability of heavy vehicles such as buses. Therefore, the position of the access point is vital to ensure there is sufficient sight distance from vehicles approaching the junction from the Padukka direction. Also, the vehicles approaching from the opposite direction are coming from a straight road stretch, thus the speeds are generally high. Also, the junction geometry should facilitate the turning radius required by the heavy vehicles. **Figure 5.12** gives the layout of the proposed new road, the location of the pedestrian crossing would need to be shifted considering the high concentration of activities between Nagas-junction and the new access point junction.
2. The junction with the local road towards the schools also should be designed providing sufficient traffic calming measures, warning signs to drivers, clear pedestrian paths at the junction approach. Pedestrian crossings should also be provided, ideally a raised pedestrian crossing can be provided to encourage motorists to reduce speed. If there are VIP or high-

[35] Published by the Road Development Authority (2004)

security convoys are moving which require them to travel at recommended speed, conflicting movements must be stopped by posting Police officers during those instances.

Figure 5.11 - New access road (probable trace)

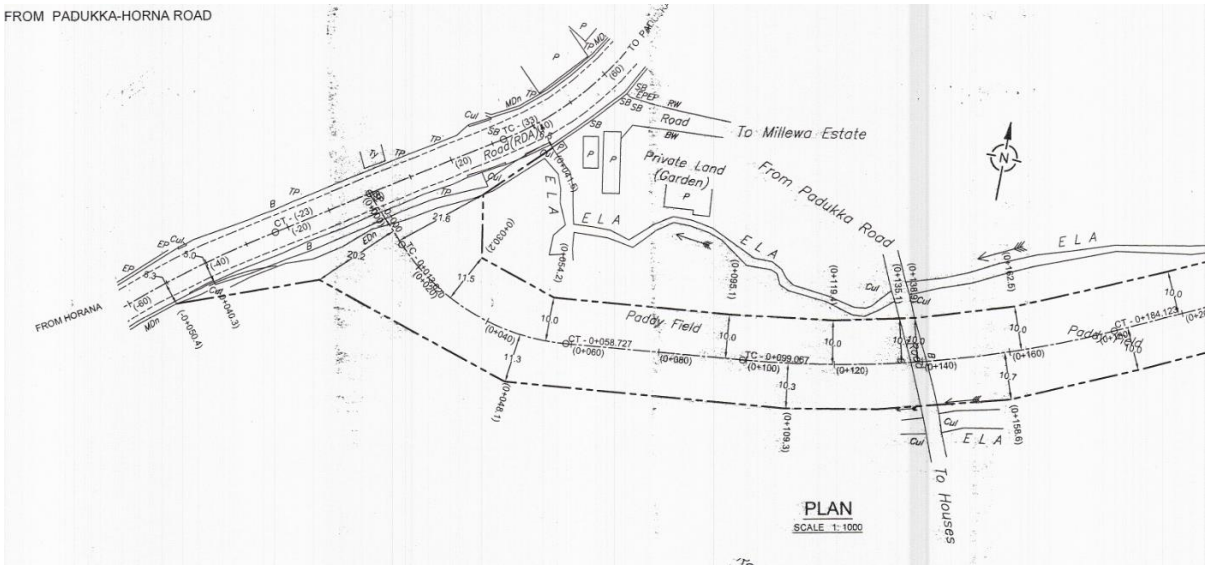

Figure 5.12. New access point and the B123 road segment

3. The pedestrian facilities from the new access points to the nearest bus stops on either direction should be improved to accommodate the additional pedestrian movements. The roadside should be widened a raised pedestrian walkways should be constructed. Guard rails should be installed to ensure pedestrian crossing take place only at designated crossings.

4. New bus bays should be provided, and a bus shelter should be constructed in either direction near the Na-gas junction. The existing bus bay is only indicated via a pavement marking on the lane, which is would not suffice after the Prison complex is in operation. The location of bus bay, pedestrian crossing to be determined after the junction with the new access road is designed.

5. It is likely majority of the visitors to prison will use public transport modes. Therefore, the availability buses during the scheduled visiting hours must be investigated and frequency of the bus operations improved. This will discourage people from hiring three-wheelers etc which will further increase the traffic flow. Also, consider having a shuttle service from the main road to the prison complex, since there is around 500m distance from the main road to the entrance of the complex.

6. There would also be a reasonable number of visitors using private vehicles, taxis to the prison complex, and external parking area should be identified for such visitors.

5.4.2 Mitigation Measures to Minimise Dust and Resulting Air Quality Degradation

- All precautionary measures must be taken to avoid dust emissions. Precautions taken include wetting of gravel road and the covering of the trucks carrying excavated material to reduce the amount of dust release. The construction operations must be done according to the air quality standards stipulated by the Central Environmental Authority.
- Suitable coverage of the exposed areas of the land must be ensured prior to the monsoons.

Dust Control Measures

- Project proponent will be advised to adhere to the following mitigation measures for dust suppression by several means, including wetting, covering of exposed surfaces, and minimization of mechanical disturbance during construction.
- Avoid unnecessary removal of trees and vegetation during site clearing activities. Tree plantations at the site around the project boundary could be protected as much as possible. Plantation of high-dense trees (with brad leaves) will be initiated at the early stages by planting 2 to 3 years old saplings, for which regular watering will be done.
- Dispose of any solid wastes generated during the construction activities including trees, bushes, and other plants removed during site clearance with the concurrence of the Local Authority and shall not be allowed to burn in an open environment.
- Limit the size of the active working area as far as practical.
- Enclose areas where dust generation activities are carried out or the entire construction site with temporary dust barriers of sufficient height (3 m). If required, a temporary dust barrier of at least 2-3 m height will be installed in front of the sensitive receiver where dust-generating

construction works are done close by. The use of rigid and reusable hoarding materials with the acceptable standard is recommended.

- Dust suppression by water sprinkling. Twice-daily watering of exposed working surfaces can reduce dust emissions by about 50%, while watering of stockpiles and their access areas can reduce dust emissions by up to 25%.
- Restrict the maximum speed of all vehicles on the site to 8-10 km/h and confine haulage and delivery vehicles to designated roadways inside the site.
- Cover the construction materials such as soil and crushed metal (quarry dust) with tarpaulin during transportation and take precautions such as spraying of water to avoid dust emissions during loading, transportation, and unloading.
- Any vehicle with an open load-carrying area used for moving construction materials, and having the potential to create dust, required to be provided with proper fittings and tailboards. Materials having the potential to create dust, required to be loaded to a level below the side and tailboards, and be covered by a clean tarpaulin. The tarpaulin sheet is required to be properly secured and extends at least 300 mm over the edges of the side and tail boards.
- Enclose stockpiles of construction aggregate or fill material greater than 20 m3 by three sides, with walls extending above the pile and 2m beyond the front of the pile.
- Limit or slow down main dust-generating activities such as excavation, heavy vehicle movement, etc. (if required).
- Clean all vehicles leaving the site to ensure earth, mud, debris, dust, and the like are not allowed to deposit on access roads to minimize the fugitive dust emissions (road kick-off dust).
- Following the completion of construction works, those areas required to be progressively restored and surface water drainage systems to be constructed on exposed slopes to control dust generation and surface water runoff.

Control of Exhaust Emissions from Vehicles, Machinery, and Equipment

Project proponent will be advised to practice the following measures in this regard.

- Use vehicles conformed to vehicular exhaust emission standards stipulated by the National Environmental (Air, Fuel and Vehicle Importation Standards) Regulations No. 01, 2003 for the construction works, to ensure that all machinery and equipment to be used in the construction site are properly maintained in good operating condition with acceptable vehicular emission level.
- Request, inspect, evaluate, and approve work methods and machinery/equipment intended to be used on the construction site to ensure their suitability.

Mitigation Measures to minimize Air Quality Impacts during Operation

- If boiler or generator emissions exist, the main selection criteria should be low emission and high energy efficiency. Depend on the fuel specific factors and technology applied, type of air pollution control systems to be installed to the exhaust stream can be vary. For boilers, fly ash can be collected through mechanical devices such as cyclone separators, fabric filters etc. Depend on the fuel requirement the gaseous emissions can be controlled by the dispersion of pollutants through properly designed stack. Discharge of air pollutants through stack of stationary boiler is regulated by the National Environmental (Stationary Sources Emission Control) Regulations, No. 01 of 2019. Determination of the minimum stack height had been denoted under regulation 11 and the stack height shall not be less than 20m except for the combustion sources with gross heat input less than 0.620 MW. Proper tuning of boiler by adjusting air to fuel ratio can control the pollution load emitted to the environment.

- Emissions generated from cook stoves/furnaces should be discharged through a properly designed stack. According to the National Environmental (Stationary Sources Emission Control) Regulations, No. 01 of 2019, (Regulations 3 and Regulation 15) SCHEDULE III, Pollutant Based Standards, PART I, stipulated under Section 32 of National Environment Act, No. 47 of 1980; the emission limit for Total Volatile Organic Compounds (TVOCs) from any non-combustion sources is 10 ppm.

- Standard kitchen canopies with grease traps should be installed to remove oil and grease entrained with the cooking fumes. Air pollution control systems such as settling chambers, cyclone separators should be installed depend on the fuel utilized. Proper fresh air supply should be maintained at kitchen area by designing proper system for fresh air distribution.

- Proper design, construction, and operation of the sewers, sewage pumping station, equalization tank and sewage treatment plant can do much to reduce and sometimes even eliminate odour annoyance. The introduction of new systems not generating any favourable conditions for gaseous emissions is also possible. Effective emission abatement can mostly be achieved if sanitary and general engineering rules are adhered to strictly.
- Managing food waste onsite as per recommended in EIA study should be strictly followed to eliminate or reduce the odorous emissions. Composting the biodegradable part of the food waste is a means of managing the malodour as well as can beneficially use as a bio fertilizer.

- Emissions generated through the activities of workshop can be managed by developing specific controls. The areas to be separated for wood working, repairing, recycling and general workshop activities. Particulate emissions from specific operations should be controlled by installing proper air pollution control systems such as cyclone separators, fabric filters etc.

emission of solvents should be minimized by practising proper handling practices such as closing the containers at every time, storing at separate enclosed area etc. Emissions caused by spraying chemicals should be controlled through installing specific booth systems and proper ventilation systems. Activities discharging heavy metals with gaseous pollutants should be avoided.

5.4.3 Mitigation Measures to Minimize Noise and Vibration

5.4.3.1 During Construction

- The area does not contain any protected forests and would typically fall into the category of 'rural residential areas' where the permitted noise levels are 55 dB and 45 dB, during day and night, respectively, as specified by the National Environment Act, No. 47 OF 1980. Therefore, care must be taken not to exceed these limits both during construction and operation phases.

- No construction or clearance operations should be permitted at night.

5.4.3.2 During Operation

- Standby generators are the only sources available in the prison which generate high noise levels. All generator houses will be soundproof to achieve 85 dB(A) at one-meter distance from generator house. No vibration generating equipment are in operation inside the prison.
- Therefore, no environmental impact of noise and vibration at the nearest residences due to operation of the prison
- There are no noise and vibration generating equipment used in the prison other than the standby generators. All generator houses will be soundproof to achieve 85 dB(A) at one meter distance from generator house.

  Therefore, no requirement of mitigation work in noise and vibration control.

5.5 Proposed measures to avoid/minimize negative social and cultural issues.

To minimize the socio-cultural issues before construction an awareness meeting will be held with the line agencies and the affected stakeholders. During construction a complaint mechanism will be established to redress the social grievances. Workers and the contractors will be advised to maintain good social rapport with the village.

5.6 Mitigation of land use incompatibility

According to the premiminary design brief provided by the UDA, the impermeable area of the proposed project site will be approximately 50% of the total land extent, leaving 50% of the site open. Thus, 1/2 of the proejct site is available for landscaping, to mitigate the land use incompatible issues. The prison authority has plans to use the open space primarily for agricultural purposes, the output of which sould be used for inhouse consumption. While the prison areas inside the inner fence will not have large trees, the buffer zone (between the outer fence and the site boundary) which is approximateloy 25 meters wide, will accommodate medium and large size trees – all wetzone species.

The deveopment of a green belt with medium, and large size trees of indiginious species in the "No Man Zone" and the "Buffer Zone" can mitigate the negative impact of the 6.0 meter high security wall.

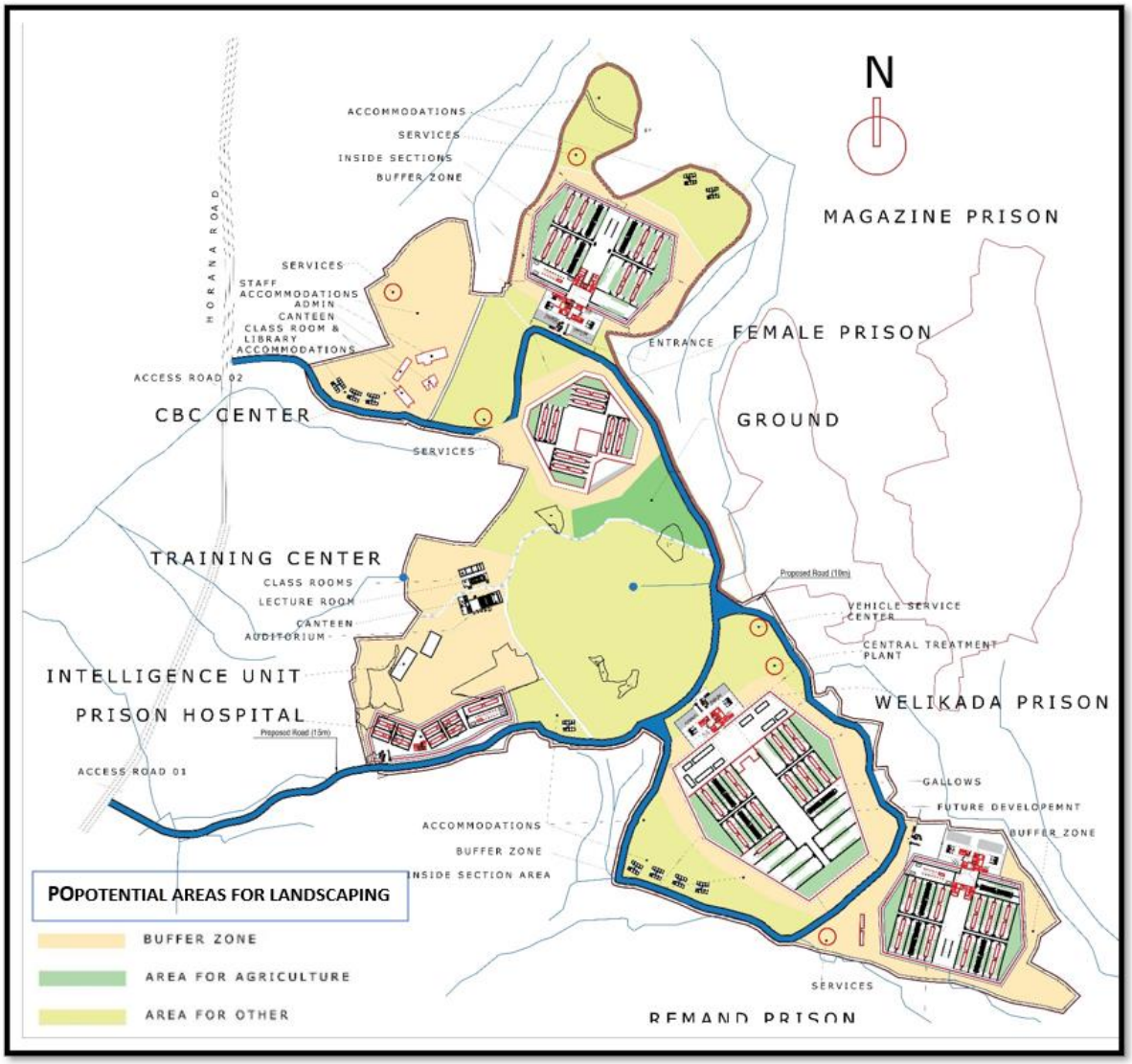

Figure 5.13 - Potential open spaces for planting (Source of the Layout – UDA)

5.7 Management of resettlements/ relocation of families/ social unrest

- All the possible impacts are identified in social impact section in Chapter 4. The sociologist categorizes impacts as "no impact, low impact, moderate impact and high impact "in terms of their degree of significance. In this analysis categories of no impact and low impact will not require mitigatory measures but, mitigatory measures are suggested for moderate and high impact issues. Some impacts are positively significant but, they are considered in this analysis to recommend measures to further enhance of the positive aspects. Negative impacts are considered to recommend measures to mitigate their negative implications on the socio-economic and cultural environment. The details of this categorization are shown below:

Table 5.7 - Level of significance of the identified impacts

Impact	Significance	Mitigatory measures required- Yes/No
Impacts on existing and proposed development projects in the area	Low impacts	No
Impacts due to land use incompatibility during construction period	Low impacts	No
Wastewater discharge from the established prison complex	Highly significant	Yes
Land use incompatibility during operation phase	Low	No
Changes of Land value	Moderate	Yes
Changes on routine lifestyles of local community	Highly significant	Yes
Impact on planation workers	Highly significant	Yes
Access to residences	Low	No
Access to Agriculture	Moderately Significant	Yes
Social unrest	Highly significant	Yes
Sensitive locations	Moderately significant	Yes
Resettlement issues	Highly significant	Yes
Problems with using natural pond and drinking water in a well	Moderately significant	Yes

Proposed mitigation measures

As mentioned above the mitigatory measures are suggested for the moderately significant and highly significant impacts. The mitigatory measures possible for implementations are mentioned below:

Table 5.8 - Social Impacts and Mitigation Measures

Impact	Mitigation measures
Wastewater discharge from the established prison complex	The project developer has planned to introduce and operate proper system of treatment for wastewater before releasing to the Mawak Oya through a 7 km long pipeline. There are housing structures located within 10 m ROW of pipeline. The pipeline will be established without creating negative impacts to these housing structures. There are significantly large number of bathing places in Mawak Oya in its downstream of wastewater discharge point. In this case wastewater treatment standard will be maintained throughout operation period of wastewater system. Reliable monitoring

Impact	Mitigation measures
	system will be carried out by responsible agency such as NWSDB to ensure proper implementation of recommended action for wastewater discharge.
Changes of Land value	A program will be implemented with the involvement of grassroots level agency officers such as GN, Samurdhi Niyamaka and community leaders to make householders living in the vicinity of the prison to convey the potential increase of land values after establishment of the prison. They may be motivated to keep their land without disposing to the outside businessmen.
Changes on routine life styles of local community	The management of prison will take all possible actions to prevent unnecessary attempt at developing illegal relationships with prisoners/visitors. Since the activities of the prison will be mainly confined to its premises covered with huge boundary walls there will be no possibilities to expose prison related activities to the outside community. However, prison Department may make proper arrangement to monitor the possible disturbances to the outside community due to routine operation of the prison.
Impact on plantation workers	About 120 plantation workers will lose their jobs due to the proposed project. The UDA has already developed a compensation package to be paid to the affected plantation workers. This package will be implemented covering all the plantation workers presently working in the affected project footprint. The implementation of this compensation package will be carried out with good practices such as transparency and inclusion of affected persons into the compensation package planning and implementation program. The compensation will be completed prior to commencement of construction work of the project.
Access to Agriculture	There will be negative impact due to construction of proposed access road through paddy land. The impacts on farmers will be mitigated through compensations to the loss of land and standing crops if any at the time of construction. Action will be taken to avoid disturbances to the water flows within the paddy land due to the construction of road across agricultural area. However, mitigation program for farmers will be implemented with the active involvement of affected famers
Social unrest	Serious disturbances to the lifestyle of community in the vicinity is a perception of the local people. They expect disturbances due to visitors and other security arrangement of the prison. This perception should be cleared through developing relationships with neighborhood by the prison management. It can be assumed that community's routing activities will not be interfered by the prison management, and therefore, proper public awareness program will be implemented with the involvement of Horana DS, Pahala Millewa GN and other representative of local agencies and

Impact	Mitigation measures
	community leaders to address the perception of local community on possible disturbances due to prison operations.
Sensitive locations	Even though there are no sensitive locations within project footprint the operation activities of the project including traffic in access roads will be managed without creating disturbances to the temple, school, sports ground and Kovil located in the vicinity of the prison premises
Resettlement issues	The UDA has already developed arrangement to resettle project affected households in a separate land located within Millewa Watta. Each affected household will be given a new house constructed in 10 perch land block. This will be a significant positive impact. The UDA will ensure providing houses for all the project affected families. Resettlement activities will be planned and implemented with active involvement of Horana DS, Pahala Millewa GN and all the affected households. As UDA planned other required livelihood facilities such as sports ground, religious center, school etc. will be provided to the affected community resettled in new housing scheme.
Problems with using drinking water in a well	The project developer will allow householders presently depending on drinking water well located in the footprint to obtain pipe water facilities from the distribution lines constructed to the project. If this is not feasible the present users of the well will be provided with assistance to construct an alternative well in one of their land plots.

5.8 Provisions/ accessibility measures to facilitate to agricultural lands

There will be dedicated access roads to the proposed prison complex also, there will be access roads to access the houses near the site boundary. Paddy lands are the main agricultural lands which are outside the project site which could be accessed through the access roads located around the site. There are other rubber plantations belonging to Millewa Estate under UDA and there will not be any restrictions of access to agricultural lands.

5.9 Mitigating impacts of habitat loss/disturbance and displacement of fauna

5.9.1 General

Habitat loss and disturbance was identified as one of the major long-term impacts that the proposed prison re-location project would bring about. The loss of vegetation and its impacts on overall biodiversity at the site and in the local region cannot be totally circumvented by any means. Nevertheless, clearance of vegetation cannot be prevented given the fact that the site does not include any legally designated protected areas.

Looking at it from the perspective of the loss of biodiversity and provisional services, and the lack of natural forests in the district, however, one must strive to mitigate harm that actions might impose on the ecology of the proposed site and its environs, to the extent possible. The following are some recommended mitigatory measures.

(i) It was noted that a part of the rubber plantation has been abandoned and since then it has been colonized by many native flora and faunal species. **It is recommended that a small extent of this area surrounding the spring be preserved.** The maximum area that could be left untouched could be determined depending on the feasibility.

(ii) It is also highly recommended that the **spring location and the associated pool be protected.** With the clearance of much of the rubber plantation, many of the displaced faunal species would move towards this area and therefore it is critical that sufficient space be left for these species, which would require that a strip of the surrounding vegetation be also preserved. It is advisable to link a section of the abandoned rubber plantation and the spring location by a habitat strip. This strip should be left open to the exterior so that the broader landscape could be used by species. The spring should not be bounded on all sites by buildings and a strip of vegetation must be retained around this site. The spring is located where the remand prison building was due to be constructed. Hence, shifting of the Remand Prison was done to preserve the spring. The treatment facility should not be near the spring location.

(iii) If possible, the small marshy area behind the present factory must be protected with no landfilling. This would be an ideal site for amphibians and dragonflies. These areas could be used to improve hydrology and aesthetics within the location.

(iv) The two streamlets alongside the paddy field at the boundary of the proposed location and near the homestead must be protected. No cement or debris must be thrown into them, and the water flow should not be blocked. Sides of these streams must not be lined with concrete and the natural margins (vegetated or rocky) must be left intact. A culvert might have to be placed at the crossing point of the stream bordering the paddy fields (where the proposed road is to be constructed) to facilitate flow. Felling of trees for the construction of the road must be avoided as much as possible. If at all, the sides of these streams can be enriched with native vegetation.

A map showing the locations which require to be protected are shown in **Figure 5. 14.**

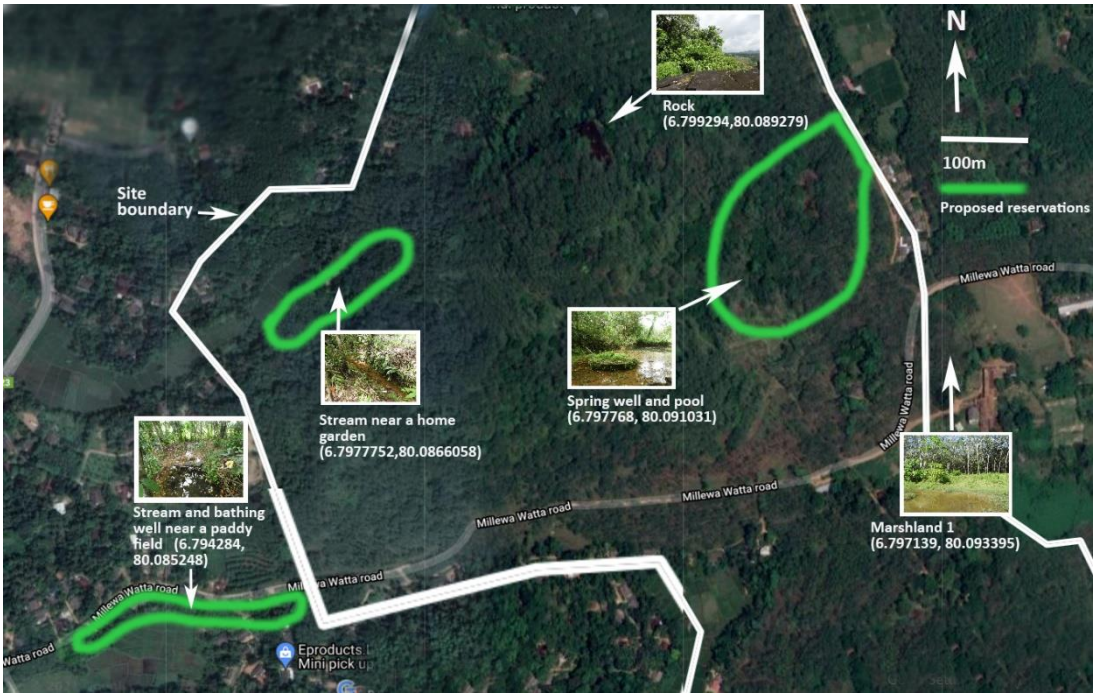

Figure 5.14 - The areas that are recommended for preservation (shown in green) within the project site.

Whilst protecting the biodiversity to some degree, these measures would improve the aesthetics of the environment.

(iv) Another recommendation is to contribute towards establishing a forest patch in the vicinity of the site or in another area within the Colombo District. Suitable sites should be selected in consultation with the Forest Department. The extent of this area should be equivalent to at least 50 % of the lost plantation area. Several native / endemic / threatened plants that have been reported in the present report, could be used for replanting/enrichment planting. Plants removed from the site (root-balled), can be used for this purpose.

(vi) Many butterfly species were recorded from the site. Therefore, an additional measure that could be easily taken is the creation of a butterfly garden in spaces between the buildings. Small native shrubs and flowering plants with low maintenance and which are known to attract butterflies could be planted.

5.9.2 Mitigating animal displacement and death of fauna

- Capture and relocation should happen as a mandatory measure. Animals that can be captured would include the less mobile species such as geckoes, skinks, snakes, lizards, porcupines, and small mammals such as mongooses and civets. The captured animals should not be relocated within other areas in the site but elsewhere in the lowland wet zone in a protected habitat. They should not be released in the abandoned rubber site or spring site that is proposed to be protected as there might be over population of these species which would again result in them moving out to residential areas/home gardens. Potential release locations are the Labugama - Kalatuwawa or Meethirigala forest reserves, the former would be more suitable as it is larger in extent. Financial provisions must be set aside for this purpose. Transportation of the captured animals must be done under the supervision of wildlife officials. Proper catching and trapping devices, and holding facilities (cages), must be at hand.

- The sites must be disturbed prior to felling and bulldozing to allow mobile species to move out. The personnel must be informed, and some experts must be at hand to assist in the capturing process and for proper identification of species, particularly snakes and mammals.

- Vehicles driving around, particularly at night must be cautioned. Any death (roadkill) must be reported to the authorities, and any injured animals must be taken care of, and handed over to the Department of Wildlife Conservation or another veterinary facility.

- As recommended above, leaving the spring site and a section of the abandoned rubber plantation around it would allow some species to move there, reducing animal kills.

5.9.3 Mitigating impacts to the Mawak Oya biotic community

- Disposal of any effluent or sewage from the prison facility must be considered seriously as it can lead to severe adverse environment impacts particularly in the vicinity of the Mawak Oya. It is mandatory that all sewage and effluent is treated within the site to ensure that levels of all pollutants have been brought down to acceptable limits stipulated by the CEA regulations. The release of the treated water must also ensure a minimum of 8 times dilution in the receiving waters. Although Mawak Oya is a perennial stream its flow is considerably variable – high during the monsoons and very low during the driest period of the year (generally – January – February). Hence, this EIA has calculated the safety levels based on the minimum weather flow of the tributary.
- It is essential that water quality is regularly and systematically monitored. The important physico-chemical parameters for monitoring include BOD, DO, nitrates, phosphates, temperature, pH, turbidity, and conductivity. Additional parameters could be considered as necessary.
- The area used for the treatment facility must be carefully selected. The treatment facility must not be located near the water spring, streamlets or near paddy fields. The leakage of effluent and sewage (leaching or surface flow) must be prevented at all costs through various engineering options.

5.9.4 Reducing impacts due to the accumulation of debris

- Arrangements should be made to remove the felled rubber trees almost immediately to a nearby factory as rubber wood is used for the manufacture of furniture and other products. This would avoid having to store the wood/stems within the site or in any other location.

- The other vegetation must not be dumped near the spring location, near a waterway or within the abandoned rubber area which is proposed to be protected. The removal of vegetation to a composting facility should be considered.

5.10 Mitigation Measures for Land Stability and Geological Impacts

Mitigation measures can be introduced to the impacts in the point of geological aspects as follows,

(a) Impacts of initiation of slope failures and landslides can be minimized by

1. Disturbing of natural slopes should be minimized and required to be adopt proper retaining structures (engineered) to all cut slopes or altered slopes.

2. Effect of rock blasting can be minimized by using chemical and /or control blasting

3. Effect of excessive infiltration can be minimized by adopting a proper impermeable drainage system to divert all excessive water to natural streams nearby and cover the altered slopes by a suitable vegetation to minimize the infiltration by rainfall.

4. Prior to the constructions of heavy structures, a detailed geo-technical investigation is a must, and that will minimize the loading of unstable slopes by identifying appropriate depths to transfer the loads.

5.11 Any other Impacts

5.11.1 Environment Health and Safety Impacts

5.11.1.1 Mitigation measures to address the fire emergencies during planning and design

As fire can spread very quickly, during emergencies minimizing the response time is extremely inevitable. Therefore, it is suggested to establish a common (minimum capacity) fire brigade facility for entire Millewa relocation zone (as similar ones maintained in BOI zones). In case, this option is not workable. It is recommended to construct fire storage water tank for each zone, to manage fire temporarily until the fire brigade team reaches the site location during the emergencies. As per CIDA Fire regulations (CIDA Publication No. CIDA/DEV/14 – June 2018 3rd edition), Reg. 5(31, 47, 48) guidelines, minimum tank capacity could be 67,500litres and should deliver 1500litres of water per minute at 4 bar pressures to manage the fire up to 40mts maximum (this storage capacity may be revised to account for additional flow requirement where multiple risers are anticipated as per the requirements).

5.11.1.2 Mitigation measures for impacts on establishing conventional security systems:

Combination of modern technologies with human integrity could bring foul proof security systems that contains inclusive latest technologies and Software Solutions, this may include Artificial Intelligence, IoT and Machine Learning based solutions, and could provide:

- **Total perimeter security system:** empowered with out-door engagements, advanced detection and notifications (intruder detection even during pitch darkness, heat, smoke, fire detection using thermal sensors alongside the optical sensors) plus video surveillance up to 20 km.
- **Access Control System:** could undertake, intelligent visitor screening, out-door events with face detection (for black-listed persons) and facial expression, distress identification (for suspicious persons), identification of authorized persons and tagging with arrival departure times, body temperature, etc., including recording of all visitors and ability to retrieve and analyses data (people search, etc.) using AI tools
- **Complete Smart Zone Solutions:** Detects commotion, people unrest monitoring, advanced notifications on suspicious activities, traffic offences, robbery etc.
- **Central Command & Control System:** Command and control all the above systems either by stationary computer or mobile systems, or by both the systems based on the requirement.

Further details of similar AI systems with advanced security applications are provided in **Annex. 13** for reference.

5.11.1.3 Mitigation Measures During Construction

Mitigation measures for impacts due to rock excavation

As rock excavation involves removing of rocks and boulders, this should be undertaken with proactive approach, as its significance of the impact and health hazards vary with methods used

for rock excavation, among the available and workable methods are analyzed and three of the non-blasting methods such as Rock splitter method, Chemical expansion method and diamond wheel cutting methods were recommended on case-by-case basis, depending upon the sensitivity of the immediate environment and health hazards to personnel involved, pls refer **Annex 14** for recommended methods of rock excavation during construction at Millewa relocation area.

Mitigation measures for Health and Safety Impacts of skilled and unskilled workers during construction

Prior to construction, the plans and methods should be prepared and implemented in such a way, it will reduce all detrimental health and safety hazards during construction and evade: First Aid Cases, Loss Time Injuries (LTI) and Fatal cases, by ensuring maximum Safe Man-hours. To achieve this objective, a EHS Plan will be developed by the contractor prior to the construction, by incorporating the guidelines from all applicable stakeholders such as NIOSH, CIDA, CEA, ICTAD and Department of Labour etc. Further, this EHS plan could be implemented during construction by including the following:

a. administrative control, b. work methods and operational controls, c. Hazards and Risk Assessments, d. implementing Emergency Response Plans, e. adhering to Electrical Hazards and Safety guidelines, f. following proper g. Working at height procedures, h. following excavation and blasting guidelines, i. implementing work permit system, j. conducting tool-box sessions, k. safe material handling and lifting activities, etc. Also, necessary Audit systems, monitoring methods, management participation and review should be established to ensure continual improvement and to ensure the sustainable implementation of Environmental Health and Safety Systems during construction. Please refer Annex- 18 D Brief Health and Safety Guidelines to be followed during Construction.

5.11.1.4 Mitigation Measures During Operation

Mitigation measures to address the gaps for using active and passive fire protection equipment:

Usage of fire storage water tank facility to alternate the fire safety equipement, in combination with AI based passive fire protection method using advanced cameras as an alternative. In AI the neurolitic algorithms allows the system to trigger alarms, whenever a fire or smoke is detected by any one of the cameras. By utilizing this AI based systems fires can be prevented and any potential danger from smoke and fire could be resolved in advance.

Mitigation measures due to impacts during hot work activities in Workshop and Kitchen.

It is suggested use AI cameras for fire watching, usage of fire blankets, trolley and block chain arrangement for gas cylinders, usage of flash back arrestors and usage of necessary hot work permit systems etc. could be implemented based on site requirements and workability.

Mitigation measures for the impact on the treatment plant by overcrowding

The proposed Millewa Prison is a spacious one and the Prison Department will avoid overcrowding. The peak wastewater discharge is 1800 m^3/day. However, the WWTP has been designed for 2000 m^3/day. Hence some allowance is already available for overcrowding, if any. As such, the WWTP will not be overloaded beyond its capacity.

6 CHAPTER 6: ENVIRONMENTAL MANAGEMENT PLAN

6.1 General

This chapter describes the Environmental Management Plan (EMP) and the Environmental Monitoring Plans (EMoP) for the proposed project. The Environmental Management and Monitoring Plan summarize the potential major impacts of the project, suggested mitigation measure/s and identifies the party responsible for implementation of each mitigation measure proposed as well as the party responsible for monitoring the implementation of mitigation measures.

6.2 Transfer of EMP and EMoP Requirements to Contractors, Sub Contractors or Other Parties

The EMP and the EMoP should necessarily form part of the Bid documents and will be taken into consideration along with the specifications. The mitigation measures indicated in the EMP will be made contractually binding on the main contractors while sub-contractors will also be made aware of the contents of the EMP and the EMoP.

It is important to ensure that the actions specified by the Environmental Management Plan are given some form of legal standing through integration of the EMP and the EMoP into the tender documents for the project as a set of environmental specifications. Only those aspects of the EMP/EMoP that are directly relevant to the contractors' activities will be contained within the environmental specifications. The environmental obligations required will be clearly communicated to the contractors and the submitted tenders require to have considered and budgeted for the environmental requirements specified in the EMP and the EMoP.

Separate funds will be allocated to implement the EMP and EMoP items where costs for such items have not been included in the Engineering Cost.

A committee headed by Horana DS with the membership of GN Pahala Millewa North, representatives of the UDA, the Contractor, Agrarian Development Department and Horana Police will be established for taking overall responsibility to ensure proper mitigatory measures are implemented. This committee will meet monthly during construction period and bi- annually during operation phase. However, if needs arise committee can meet at any time to address the urgent issues. The information about this institutional arrangement will be disseminated to the local stakeholders in the area. The possible issues that may need monitoring and attendance if problems emerge are mentioned in the table below.

The EMP is given in **Table 6.1** and the EMoP is given in **Table 6.2.**

Table 6.1 - Environmental Management Plan

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
Construction Stage				
Physical Environment				
Land preparation	Dust emanation	Water sprinkling regularly. Establishing dust barriers close to recipient locations in the village area.	UDA through the Contractor	UDA/CEA
	Noise	No noise generation activities during night work. No noise causing activities at sensitive locations and during the days of religious significance. Temporary noise barriers near houses if a need arise.	UDA through the Contractor	UDA/CEA
	Vibration	Crack surveys for the properties in closest proximity, especially vulnerable houses in the site boarder and close to the access road, could be determined based on the sensitivity of location and site conditions on the need basis.	UDA through the Contractor	UDA/CEA
	Soil erosion	Provide temporary soil mounds, establish perimeter drains, use silt fence, etc. to protect streams and drains.	UDA through the Contractor	UDA/Local Authority
Transport of vehicles during construction	Damage to the existing pavement	Re-instate the road pavement after the project and ensure road is maintained at reasonable state (motorable) during the project construction period as well.	UDA through the Contractor	UDA/CEA/ Local authority
	Delays at the junction	Avoid or reduce movement during peak hours.	UDA through the Contractor	UDA/CEA
Land clearing and preparation	CD waste haphazard dumping	Formulation and implementation of CD Waste Management Plan encompassing the following as minimum	UDA through the Contractor	UDA/CEA
Demolition of existing structures				

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
Construction of new buildings		- An inventory of expected hazardous and non-hazardous wastes (with description of sources or generation activities). - Methods of minimization and segregation of different wastes - Areas designated for the storage of hazardous and non-hazardous wastes including storage procedures and proactive handling safety precautions to be adopted - in-situ reuse, in-situ recycling and / or environmentally safe disposal strategies - OHS management strategies that will be taken during waste handling Maintenance of a Logbook with documentary evidence of proper accountable disposal.		
Transport of vehicles during construction	Damage to the existing pavement	Re-instate the road pavement after the project and ensure road is maintained at reasonable state (motorable) during the project construction period as well.	UDA through the Contractor	UDA/CEA/ Local authority
	Delays at the junction	Reduce movement during peak hours	UDA through the Contractor	UDA/CEA
Access road construction	Flood aggravation	Provide cross culverts. Monitor flood pattern.	UDA through the Contractor	UDA/SLLDC
Infrastructure construction	Destruction or disturbance to springs	Adjust building layouts. Provide reservation and protect springs.	UDA through the Contractor	UDA/WRB

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
Groundwater extraction for construction	Groundwater level depletion	Carry out pumping test and ensure the safe extraction limits	UDA through WRB	UDA/WRB
Infrastructure construction	Worker health and safety impairment	Adopt standard construction health and safety methods	UDA through the Contractor	UDA/Factory Engineer Labour Department
Physicochemical Environment				
Earthwork /Concrete work	Water quality degradation of streams	Examine Surface water quality deterioration visually (turbidity, colour)	UDA through the Contractor	Local authority
Emission from all stationary and mobile construction machineries	Degradation of Air Quality	Monitor Air Quality parameters from stationary sources and mobile sources during construction at locations where baselines established and at additional locations as required	UDA through the Contractor	Local authority
Piling and other earthworks	Ground Water quality degradation	Examine ground water quality deterioration using appropriate sampling	UDA through the Contractor	Local authority
Ecological Environment				
Vegetation clearance	Loss of habitats for plants / animals Loss of ecological services	Conserve and Protec the following locations * Spring and pool with abandoned rubber stretch * Streamlet near homestead/boundary Contribute to the establishment of forest area, establish butterfly garden, Prevent felling around Mawak Oya basin	UDA UDA UDA/FD UDA	UDA/CEA UDA/CEA UDA/FD/CEA UDA/CEA

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
Blasting/removal of vegetation	Death & Displacement of fauna	Disturbance of vegetation prior to clearance to facilitate prior faunal movement away from the site area. Capture & relocate and conserve, if necessary, based on the site conditions.	UDA/DWLC/YZA/Experts	UDA/CEA
Disposal of debris	Blocking waterways/filling lowlying areas /spread of invasive species	Removing logged rubber /vegetation /construction debris immediately/Selecting a suitable site and method for disposal	UDA	UDA/CEA
Social Environment				
Construction activities within project footprint	Loss of residences	Resettlement of the occupants in new housing scheme	UDA	DS Horana, GN 628C Pahala Millewa North and UDA
Construction activities within project footprint	Loss of employment of plantation workers	Implementation of UDA proposed compensation package.	UDA	DS Horana, GN 628C Pahala Millewa North and UDA
Construction activities within project footprint	Possible conflict with local community	Providing employment opportunities in construction site for local community members, actions to establish friendly environment with neighbouring communities.	UDA, contractor	DS Horana, GN 628C Pahala Millewa North and UDA
Construction activities within project footprint	Negative impact on houses located in the immediate	Monitoring the negative impacts created on housing structures in the vicinity	UDA, contractor	DS Horana, GN 628C, Pahala Millewa North and UDA, Contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
	vicinity of project land			
Construction of access road	Loss of paddy lands, disturbances to the water flow in the paddy lands and land fragmentation	Compensation for the loss of land, engineering intervention for solving disturbances to the water flows and compensation for the existing crops if any.	UDA, contractor,	UDA, contractor, agriculture research and production assistant in Pahala Millewa North, Agrarian Development Department
Installation of wastewater discharge outfall pipeline	Possibility for disturbing houses in the ROW of the pipeline	Take all possible actions to avoid disturbances to houses located close to the ROW	UDA, contractor	UDA, contractor, NWSDB, DS Horana, GN 628C, Pahala Millewa North
Transport of vehicles during construction	Road user accessibility and safety	Provide guidance to heavy vehicle drivers on road user safety, monitor complaints against project construction vehicles Reduce peak hour travelling	UDA, Contractor	CEA/ Local Authority
Increase pedestrian activity	Road user safety	Provision of pedestrian facilities and public transport infrastructure on B123 road and the access roads.	UDA, Contractor	RDA
Rock blasting	Damage to houses and public inconvenience	Adopt less destructive blasting methods to minimise or stop fly rock	UDA, Contractor	GSMB
Transport of vehicles during construction	Road user accessibility and safety	Provide guidance to heavy vehicle drivers on road user safety, monitor complaints against project construction vehicles	UDA, Contractor	CEA/ Local Authority

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
		Reduce peak hour travelling		
Infrastructure construction	Geohazards	Carry out geotechnical investigations and adopt suitable design and protection methods	UDA, Contractor	NBRO
Operational Stage				
Physical Environment				
General operations	Public and inmate safety impairment	Adopt security systems, warning systems	Prison Department	Prison Department
General operations	Fire destruction	Adopt fire protection measures according to the CIDA guidelines	Prison Department	Prison Department/External firefighting unit of Horana UC
Physicochemical Environment				
Operation of the prison vehicle service yard	Long-term soil pollution with oil and grease and metals due to disposal of wash waters	Operation and maintenance of a physico-chemical treatment plant encompassing an oil and grease trap and a coagulation-flocculation tank coupled to a sedimentation unit Proper retrieval/collection, storage and acceptable disposal of waste oil and oil contaminated material such as brushers and filters, etc (example, co-processing, reuse or recycling where appropriate) instead of disposal to the wash water stream	Prison Department. Prison Department through the party that operates and maintain the ETP. But Prison Department has the overall responsibility	Local Authority/CEA

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
		The ETP sludge requires disposal through Insee Ecocycle or a suitable contractor having a valid EPL and a SWML Treated effluent quality monitoring as a part of environmental compliance monitoring (as the frequency prescribed in the EPL conditions)		
Operation of the prison complex	OHS concerns and contamination of recyclables due to improper SS (both hazardous and non-hazardous wastes)	Regular monitoring of the SS practices within the major areas of waste generation (both hazardous and non-hazardous wastes) Provision of awareness on SS and proper storage practices particularly hazardous wastes to officers/ waste handlers through displaying of necessary instructions (key areas should be the hazardous waste generation areas and the dedicated waste storages)	Prison Department	Local Authority / CEA
Operation of the prison hospital	OHS concerns from biomedical waste handling	Proper categorization and SS of infectious wastes and sharps (as per the NCC of the MOH) and other hazardous biomedical wastes Officials shall ensure that the waste bags and containers (for sharps and infectious waste collection) given by Sisili Hanaro Encare have the appropriate colors and biohazard symbol Officials shall ensure that the waste bags and containers (for sharps and infectious waste collection) given by Sisili	Prison Department	Prison Department / CEA and MOH

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
		Hanaro Encare are not damaged; only fresh intact ones are accepted Only trained dedicated staff will be deployed to handle biomedical wastes (including the maintenance of the waste storages and removal and internal transportation to the biomedical wastes to the storages) Trolleys used for internal transportation shall be in accordance to WHO guidelines Operate and maintain a separate vermin-proof, weatherproof, lockable store for biomedical wastes (except for empty cylinders of liquid O_2 and other cryogenic fluids) Operate and maintain a separate weatherproof, lockable store exclusively for empty cylinders of liquid O_2 and other cryogenic fluids with ample ventilation, active fire-fighting systems, and spill kits Regular monitoring of the SS practices and condition of the storages Conduct a biomedical waste audit (focussing on the hazardous waste component) prior to commencement of operations and formulate a specific biomedical waste		

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
		management plan for implementation and continual improvement Maintain records of hazardous biomedical wastes given to Sisili Hanaro Encare or any other contracted party (including copies of their EPLs and SWMLs and hazardous waste declaration forms)		
wastewater treatment plant operation	Environmental pollution by shock loads	Use the stock tank. If there is an overflow to paddy areas pay compensation to affected parties.	Prison Department through the party that operates and maintain the STP. But Prison Department has the overall responsibility	NWSDB/Local Authority
	Water quality degradation of Mawak Oya and water user health degradation	Be flexible to stakeholder complaints and monitor water quality in case of a complaint	Prison Department	NWSDB
Ecological Environment				
Release of untreated/treated sewage to Mawak Oya	Alteration of water quality / Death & displacement of stream fauna	Ensure at least x 8 dilution as determined by dry weather flow Systematic / regular monitoring of water quality	UDA	NWSDB/Local Authority

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Implementation Responsibility	Supervision/ Monitoring
Social Environment				
Operations of wastewater discharge system	Possible concerns of downstream water users on treated water discharged to Mawakoya	Continuous monitoring and keeping water quality related data for dissemination if needs arise	Department of Prison and NWSDB	NWSDB, DS Horana, GN Millewa North
Influx of visitors	Possible conflicts with local community	Proper management system of visitors introduced and implemented by the Department of prison	Department of Prison	Department of Prison and DS Horana, GN Millewa North
Routine operation activities of prison	Social unrest, conflicts between prison operators and the local communities, possible illegal activities among prisoners, prison operators and local community	Continuous and proper monitoring system introduced and implemented and keeping records for learning	Department of Prison	Department of Prison, DS Horana, GN Millewa North
Increase pedestrian activity	Road user safety	Provision of pedestrian facilities and public transport infrastructure on B123 road and the access roads.	Department of Prison	RDA

Table 6.2 - Monitoring Plan

Proposed Mitigation Measure-Activity	Parameters to be monitored	Location	Frequency of Measurement	Monitoring Responsibilities
Traffic monitoring and road congestion abatement	Traffic Flow/traffic volume/traffic count	Entrances to the site from main road	Start from one month prior to construction	Contractor/UDA
Crack Monitoring and survey households closer to construction site.	And extent of existing cracks	In buildings Upstream and downstream of the salinity barrier	Monthly (weekly basis during heavy rainfall)	Contractor/UDA
Quality of the treated sewage	pH, BOD_5, COD, Oil and grease, TSS, NH3-N, TP, faecal conform, and detergents/surfactants as per Tolerance Limits for the Discharge of Industrial waste into Inland Surface Waters (National Environmental (Protection and Quality) Regulations, No. 1 of 2008 of the National Environmental Act No. 47 of 1980 and its amendments; Gazette No. 1534/18 – 01.02.2008)	Holding tank for composite sample collection	As per the conditions stipulated in the EPL and based on serious complaints	Prison Department through the party that operates and maintain the ETP. However, Prison Department has the overall responsibility An accredited lab should be selected for sampling and analysis
Ambient water quality in Mawak oya Treated wastewater outfall	Water quality parameters including COD, BOD, DO, TSS, Ammonia, Nitrate, Conductivity, pH, Temperature, TDS, Total Alkalinity, Total Hardness, Chloride, Ca Hardness, Phosphate, Iron, Total Coliform, E. Coli, Free Residual Chlorine, Oil & grease.	Upstream and downstream of the treated sewage outfall	Monthly or in case of a complaint	Prison Department through the party that operates and maintain the STP. But Prison Department has the overall responsibility An accredited lab should be selected for sampling and analysis

Proposed Mitigation Measure-Activity	Parameters to be monitored	Location	Frequency of Measurement	Monitoring Responsibilities
Ambient water quality in the spring within the site	Water quality parameters including COD, BOD, DO, SS, Conductivity, pH, Temperature, TDS, Total Alkalinity, Total Hardness, Nitrate, Ammonia, Chloride, Phosphate, Iron, Total Coliform, E. Coli, Free Residual Chlorine, Oil & Grease.	At the origin of the spring	Monthly or in case of a complaint	Contractor/UDA Through an accredited laboratory
Water Quality - Groundwater	Salinity, pH, EC, Na, F, K, Ca, SO_4,^{2} Cl, Al, Mg, Fe, NO_3^-, total coliform, and faecal coliform as per SLS 614:2013 Also, BOD_5, COD, TDS and oil and grease levels	In the existing tube well or any dug well which will be kept undisturbed (ideally from the ground water source where baseline sampling conducted). Additionally, 4 monitoring wells have been proposed. Please see Figure 6.1 for they locations.	Monthly	Contractor/UDA (pre-construction and construction phase). Through an accredited laboratory Prison Department (operation phase). Through an accredited laboratory Separate tubewells/monitoring wells may be established by considering the geological and hydrogeological set up of the site
Monitoring of discharge to conserve freshwater fauna (fishes)	Flow rate, Fish species and abundance.	500 m up upstream and down stream	Rainy season and dry season (biannually)	Prison Department (Through a university or research organization)

Proposed Mitigation Measure-Activity	Parameters to be monitored	Location	Frequency of Measurement	Monitoring Responsibilities
Measures to minimize/avoid disturbance to fish at the treated sewage outfall				
Monitoring of noise abatement measures	Construction Noise measurement (Day 55dB and night 45dB) in dB	At all identified the boundary of construction site and identified sensitive locations.	In situ Daily by contractor. and if there are complaints, need to be validated by the independent party (e.g.: NBRO /ITI /etc.)	Contractor is responsible for monitoring with UDA and CEA supervision To be carried out by a CEA registered laboratory using Noise Level meter
Monitoring of vibration and reduction measures	Vibration Levels	At all preidentified baseline locations such as (construction site and identified sensitive locations, etc.)	Biweekly during rock excavation, and more frequently if there are complaints.	Contractor is responsible for monitoring with UDA and CEA supervision To be carried out by a CEA registered laboratory using vibration measurement meter
Dust emission control measures	Dust emissions	Entire site and in the vicinity within 250m distance from the site boundary	Based on complaints	Contractor is responsible for monitoring with UDA and CEA supervision To be carried out by a CEA registered laboratory using particulate matter measurement equipment
Disposal of wash waters from the vehicle repairing yards/service stations	At least the following parameters:	As per the conditions mentioned in the EPL issued by the CEA	Holding tanks for grab or composite sample collections (to be sited in the vicinity of the	Prison Department to the CEA Prison Department through the party that operates and

Proposed Mitigation Measure-Activity	Parameters to be monitored	Location	Frequency of Measurement	Monitoring Responsibilities
	BOD_5, COD, pH, oil and grease and TSS levels		premises before recycling or diversion to the sewer network/STP)	maintain the ETP. But Prison Department has the overall responsibility (An accredited lab should be selected for sampling and analysis)
Monitor Air Quality from stationary and mobile sources during construction at locations where baselines established and at additional locations as required.	SO2, NO2 and O3 (1-hr average) PM10 and PM2.5 (24-hr average) Flue gas analysis: SO_2, NOX, TSP, O_2, CO, CO_2, velocity/ flow rate, temperature.	Preferably baseline monitoring locations and additional locations as per the site activities and site conditions.	Once in 3 months for stationary sources e. g: Incinerator, once in 6 months for other construction activities	Prison Department to CEA
SS Practices for wastes and Operation of the Waste storages – Prison Complex	SS practices – as a checklist Cleanliness and condition monitoring of the waste storages as a checklist Odor from the MSW/Food waste storages, presence of vermin	Weekly	For SS practices - All areas where waste generation occurs (especially the kitchens, bakeries, vehicle repairing yards, workshops, administration, and intelligence units, etc) All non-hazardous waste storages All hazardous waste storages	Prison Department to the CEA

Proposed Mitigation Measure-Activity	Parameters to be monitored	Location	Frequency of Measurement	Monitoring Responsibilities
SS Practices for biomedical wastes and Operation of the Waste storages – Prison Complex	SS practices – as a checklist Cleanliness and condition monitoring of the waste storages as checklist Health and Safety hazards and accidents including near misses Condition of the trolleys and bags/bins for the collection of clinical wastes Odor from the clinical waste storages, presence of vermin	Weekly	Wards, laboratories, dispensaries, dental room, X-ray room, OPD clinic for SS practices Biomedical waste storages	Prison Department to the CEA and MOH
Conservation of natural surface water sources	Demarcate spring / streamlet and abandoned rubber strip to be protected. Re-forestation Create a butterfly garden	Extent preserved of the named habitat Extent re-forested Number of shrubs (flowering) grown	Select and demarcate area Instruct construction personnel of this Liaise with Forest Department / Select suitable site /Take	One time

Proposed Mitigation Measure-Activity	Parameters to be monitored	Location	Frequency of Measurement	Monitoring Responsibilities
			steps for replantation & maintenance	
Conservation of Fauna prior to land clearance	Capture and release of fauna	Number of animals captured and relocated	Liaise with experts and DWLC to facilitate this	Throughout clearance operations
Discharge and monitoring of treated water in Mawak Oya.	Monitoring water quality in the Mawak Oya	Main physicochemical characters of water quality	Take water samples and outsource testing at certified lab	Multiple times during the operational stage

As the Central treatment plant is located in an area where the ground water level is low in depth, 4 Number of monitoring wells (shallow tube wells) need to be establish for the long-term monitoring. These monitoring wells are located based on the local geology of the area, considering possible weak rock beds and prominent weak zones developed along joint systems (Figure 6.1).

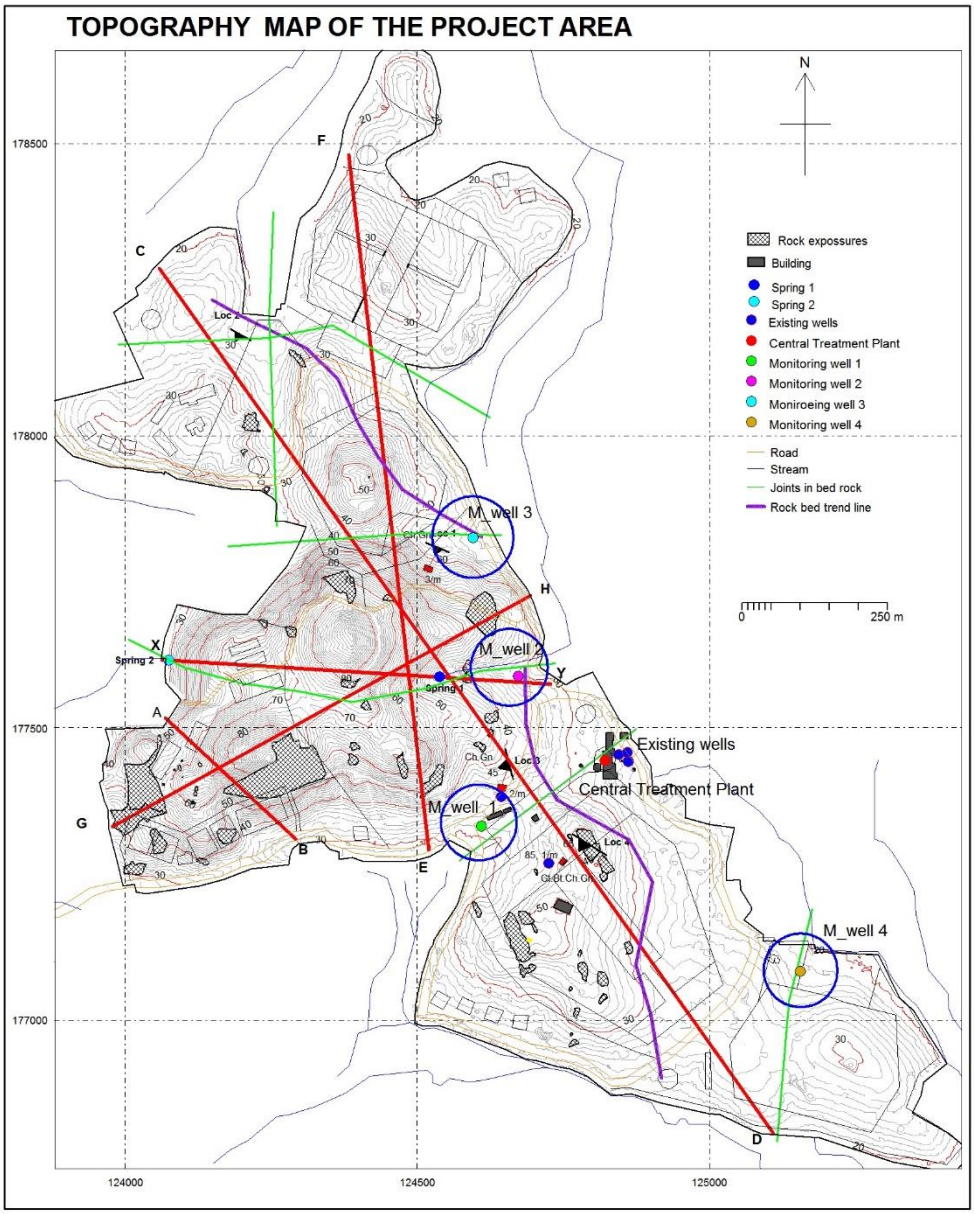

Figure 6.1 – Location of Groundwater Monitoring Wells

7 CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

1) It could be concluded that the proposed project could be carried out subjected to the proposed mitigation measures and Environmental Monitoring and Management plans.
2) A Resettlement Action Plan (RAP) needs to be prepared on this project. This is a legal requirement according to the National Involuntary Resettlement Policy (NIRP 2001) of the country. The RAP should be a comprehensive report since there are more than 20 households to be resettled.
3) Project developer needs to take prudent action to make local stakeholders aware about the proposed project, it's components and the progress.
4) It is recommended to develop and implement participatory approach in implementing some of the sensitive components of the project to establish conducive and friendly environment in the area. The project developer should make all the possible strategies to develop sustainable friendly neighbourhood in the vicinity of the project.
5) Monitoring should be used as an effective tool to observe behaviour of routing activities to make necessary arrangements to bring harmony, if needs arise
6) Considering the elevation, sensitivity of the biological and social environment, and considering other Health and Safety hazards involved during operation, the rock blasting activities are not recommended during the excavation activities.
7) Absence of Health & Safety implementation plan may lead to ad hoc, or no health and safety guidelines implemented or practiced during construction.
8) In case of fire emergencies, timely response is necessary, considering the distance of fire brigade from the project location, it is concluded to arrange contingencies in addition to conventional fire brigade system.
9) Using conventional security systems may lead to delayed response and human errors. Therefore, it is concluded to utilize latest technologies based on Artificial Intelligence along with human interface as a solution.
10) In case of any emergency, in-situ response team is necessary, and they should possess knowledge and training to address initial emergency measures.

7.2 Recommendations

7.3 General Recommendations

1) All the mitigation measures proposed in this EIA should be considered as recommendations.
2) The provided EMP and the EMoP should be improved further to suit the final construction method to be adopted.
3) EMP/EMoP should be made a part and parcel of the bidding documents and subsequently the contract documents.
4) Separate funds should be allocated for the monitoring and environmental management items not included in the Engineering Cost.

7.4 Specific Recommendations

1) The only surface water source existing within the site is the spring and its stream which should be preserved undisturbed. The building layouts have been adjusted accordingly.

2) A contribution should be made to the afforestation funds to grow trees elsewhere to make good the loss of tree felling, and the loss ecosystem services from trees.
3) Social harmony should be maintained with the surrounding villages during the operational phase for the smooth functioning of the prison.
4) After completion of construction activities, it is suggested to register the project in closest fire brigade, i.e., Horana Urban Council, to ensure immediate assistance required during emergencies.
5) Instead of rock blasting activities, an alternate non-blasting methods such as Rock splitting, chemical expansion and diamond wheel cutting methods are recommended based on site conditions.
6) Health and Safety implementation plan should be prepared, approved and implemented by the contractor during construction.
7) Conventional security systems could be upgraded by AI-based security systems along with human interface.
8) In case of fire emergencies, establishing separate fire brigade is recommended, which could be alternated by fire storage water tank and hydrants
9) Fire department clearance for the building, plans should be obtained, after commissioning of each zone, a Risk Assessment Report, Certificate of Clearance, etc. should be obtained from Fire department as per the CIDA fire regulation guidelines. Please refer Annex 15 CMC guidelines (in conjunction with CIDA guidelines) for mandatory structural fire protection and access requirements to be included in proposed building plans.
10) After occupancy at each prison zone, a combined in situ emergency response team will be established to address fire emergencies, first aid, etc. Also, necessary awareness and training (fire department could facilitate the training) to be provided for team to handle the emergencies, periodic fire mock drills will be conducted along with other departments, ambulance services, police department, etc.

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