***Employer:***

**PE “Regionalni vodovod Crnogorsko primorje” Budva**

**IDA credit No: 3823YF / IBRD loan No: 8002-ME**

***Contractor:***

 **“Integral Inženjering” Plc, Laktaši**

CONSTRUCTION OF SANITARY LANDFILL AT LOCATION MOŽURA, MUNICIPALITY OF BAR, MONTENEGRO,

CONTRACT NO A-SLF-003

**ENVIRONMENTAL MANAGEMENT PLAN**

**DURING THE CONSTRUCTION AND OPERATION OF THE SANITARY LANDFILL**

**(EMP 2)**

 PROJECT MANAGER

 Dragan Jevtović, B. Sc. C.E.

## August, 2011

##### A. MITIGATION PLAN

| Phase | Issue | Mitigating measure | Cost | Institutional responsibility | Comments(e.g. secondary impacts) |
| --- | --- | --- | --- | --- | --- |
| Install  | Operate |
| **Construction** | * **Material supply**
 |  |  |  |  |  |  |
|  | 1. *Borrow pit of stone fractions and clay*

Disturbance of  | 1. using existing borrow pits or buying material from licensed companies for production of stone fractions and clay
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 |  |
|  | * **Material transport**
 |  |  |  |  |  |  |
|  | 1. *Stone, sand and gravel*

dust | 1. wet or cover truck load
 | 1. minimal
 | 1. minimal
 |  | 1. Construction Contractor
 | Specifications for realization of works |
|  | 1. *Clay*

waste | 1. cover truck load
 | 1. minimal
 | 1. minimal
 |  | 1. Construction Contractor
 |  |
|  | 1. *Traffic management*

noise, vehicle exhaust, the obstruction of local traffic (possible road blockages due to the great deal of vehicles needed for construction) | 1. Transportation through urban areas during rush hours should be avoided or directed to the roads with lighter traffic. In road, those passing through inhabited areas, particularly near schools and hospitals, should be avoided. When construction activities must disrupt traffic, i.e. conveyor road crossings, proper signs must be put up, as well as alternative route signs. The construction activities that significantly affect traffic should be scheduled for light traffic periods, i.e. during the night for the silent ones.
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 |  |
|  | * **Construction site**
 |  |  |  |  |  |  |
|  | 1. *Noise disturbance to human and fauna of the sanitary landfill Možura*
 | 1. limit activities to daylight working hours (not between 8 p.m. and 7 a.m. or as agreed with public and local authorities of the Municipalities Bar and Ulcinj); equipment operating with noise mufflers; notification of work to local residents; appropriate equipment maintenance
 | 1. NA; minimal.
 | 1. NA; minimal.
 |  | 1. Construction Contractor
 | a)-k) it has to be specified in bid documents-Technical Specifications for realization of worksSigned contract with supervisory institution on controlling planned measures and monitoring the implementation of these measures – Contractor supervision |
|  | 1. *Dust*
 | 1. water construction site of the sanitary landfill Možura and building material storage as appropriate
 | 1. minimal
 | 1. minimal
 |  | 1. Construction Contractor
 |  |
|  | 1. *Vibrations resulting from equipment work*
 | 1. limit work activities to daylight working hours (not between 8 p.m. and 7 a.m. or as agreed with public and local authorities of the Municipalities Bar and Ulcinj)
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 |  |
|  | 1. *Traffic disruption during construction of the sanitary landfill Možura*
 | 1. traffic management plan with appropriate measures to redirect traffic that are easily seen or easy to follow; include inspection; construction can be carried out also in the period of tourist season because the landfill is far enough from the main road
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 |  |
|  |  |  |  |  |  |  |  |
|  | 1. *Vehicle and pedestrian safety when there is no construction activity*
 | 1. appropriate lighting and well defined safety signs on the site of sanitary landfill Možura
 | 1. minimal
 | 1. minimal
 |  | 1. Construction Contractor
 |  |
|  | 1. *Water and soil pollution from improper material storage, management and usage of building and other material*
 | 1. organize and cover material storage areas; isolate concrete and other works from the surface water by using sealed formwork; isolate wash down areas of concrete trucks and other equipment from permeable soil and surface water by selecting areas for washing that are not free draining directly or indirectly into groundwater and surface water; eventually treat/discharge water to remove solids
 | 1. Minimal.
 | 1. Minimal.
 |  | 1. Construction Contractor
 |  |
|  | 1. *Water and soil pollution from improper disposal of utility, inert and dangerous waste*
 | 1. Produced and municipal solid waste collected in containers;

 inert waste excavated material disposed at the site protected from erosion;Fractions of dangerous waste (depleted waste oil, oiled packaging, the remains of the bitumen, resources, etc.) collected in containers and the same in cooperation with the person who is authorized to maintain the dangerous waste transported to a place of treatment, i.e. the disposition  | 1. depends on location
 | 1. depends on quantity of waste
 |  | 1. Construction Contractor and company authorised to maintain with dangerous waste
 |  |
|  | 1. *Potential contamination of soil and water from improper maintenance and fuelling of equipment*
 | 1. proper handling of lubricants for degreasing, liquid fuel and solvents by secured storage; ensure proper loading of fuel and maintenance of equipment during the construction of sanitary landfill Možura
 | 1. minimal
 | 1. minimal
 |  | 1. Construction Contractor
 |  |
|  | 1. *Destruction of surfaces covered with low and shrub vegetation*
 | 1. ensure control of working zone and land acquisition; compensate damage; forming of green area (high vegetation) on the border of planned landfill; practice to minimize erosion of soil; minimizing of work and manipulative areas during the construction of sanitary landfill Možura
 | 1. NA
 | 1. depends on quantity of damage
 |  | 1. Construction Contractor
 |  |
|  | 1. *Safety at work*
 | 1. adoption and compliance with internal Regulation book of safety at work, using the protective equipment and protective means during the construction of sanitary landfill Možura
 |  |  |  |  |  |
| **Operation** | * **Maintenance**
 |  |  |  |  |  |  |
|  | 1. *Noise disturbance to human and animal population*
 | 1. The impact is only limited on the plant and equipment which is needed on the landfill (bulldozer, waste compactor, vehicles for waste transport); the landfill is located in an in uninhabited area. Limiting operation hours of landfill, suggestion: 07 – 20 h.
 | 1. NA; minimal.
 | 1. NA; minimal.
 |  | 1. RWSS Company
 | a)-d) it has to be specified in procurement and installation contract documents for the equipment -Technical Specifications for procurement, installation and maintenance works e  |
|  | 1. *Possible air pollution*

Dust, vehicle exhaust, landfill gas, unpleasant odours | 1. Installation of the system for degasification of landfill gas from the landfill body; conduct periodic inspections and examinations of work, provide sufficient cover material "covers" in order to neutralize unpleasant odours and delivery of waste, form a "green belt" out of vegetation around the landfill, construction of the internal infrastructure on the landfill Možura
 | 1. minimal
 | 1. minimal
 |  | 1. RWSS Company
 |  |
|  | 1. *Possible water pollution*

Production of seepage water, liquid fuel leakage or uncontrolled spillage of lubricants, production of sanitary waste water, pollution of rain water  | 1. storage of lubricants and liquid fuels;provide the installation of systems for the detection and continuous monitoring of landfill gas;for the evacuation of rainwater from the area of the landfill to build perimeter channel,build adequate waterproofing multi-chamber pit for disposal of sanitary sewage and water,transportation and handling areas overlaid with impermeable layer (concrete or asphalt) the base of sanitary tub protected with appropriate permeability clay, HDPE film, geo-grids and layers of stone fractions,derived system for removal of seepage waters,predict the construction of a seepage water treatment plant (phase II),predict recirculation of seepage water
 |  |  |  |  | Compliance with the rules set by the Law on Waste Management of Montenegro 80/05 and EU directives) 99/31/EC, Directive 94/62/EEC |
|  | 1. *Possible soil pollution*

Land degradation due to the movement of machines, leakage or uncontrolled spillage of lubricants, production of foul water and seepage water from the landfill body, etc. | 1. Disposal of waste in the sanitary cells on the landfill Možura, constructed system of bottom sealing of the landfill according to the EU standards CD 1999/31/EC, proper storage and safe handling of fuel derivates, deposited waste proper covering according to the modern technology of waste depositing (on the 3 m of compacted waste, internal layer of cover from 30 cm), pavement of internal roads and manipulative plateaus building the fence around the landfill, control of the entry and exist at the entrance gate, composition of separated organic waste, recycling of waste, building channel for washing of the wheels of vehicles that transport waste to the landfill Možura
 |  |  |  |  |  |
|  | 1. *fire at the landfill, waste dispersal in the adjacent plots (wind, animals), access of unauthorized persons to landfill*
 | 1. Provide a sufficient quantity of water against fire and other fire extinguishing agents, the landfill is to be fully enclosed by a fence height 2.20 m, the entrance to the landfill to be ensured by a checkpoint with scales, perform exterior lighting within the administrative buildings and ancillary facilities
 | 1. depends on the length of the system
 | 1. minimal
 |  | 1. RWSS Company
 |  |
|  | 1. *Workers safety*
 | 1. provide workers with safety instructions and protective equipment (gloves, boots, working suits, masks, individual detectors of explosive gas)
 | 1. Minimal.
 | 1. minimal
 |  | 1. RWSS Company
 |  |

# B. MONITORING PLAN

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Phase | **What** *parameter is to be monitored?* | **Where** *is the parameter to be monitored?* | **How** *is the parameter to be monitored?/ type of monitoring equipment* | **When** *is the parameter to be monitored? (frequency of measurement or continuous)* | **Why** is the parameter to be monitored? (optional) | **Cost** | Institutional responsibility |  |
| Install | Operate | Monitoring oversight |
| **Construction** |  |  |  |  |  |  |  |  |  |  |
| * **Material supply**
 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 1. *Stone, sand, gravel and clay borrow pit*
 | 1. possession of official approval or valid operating license
 | 1. stone, gravel and clay borrow pit
 | 1. Inspection
 | 1. before work begins
 |  | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |
| * **Material transport**
 |  |  |  |  |  |  |  |  |  |  |
| 1. *Crushed stone*
 | 1. truck load covered or wetted
 | 1. Main and local road; job site
 | 1. Inspection
 | 1. unannounced inspections during work
 | a)-c) safety requirements and enable as little disruption to traffic as it is possible | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |
| 1. *Sand, gravel, clay*
 | 1. truck load covered or wetted
 | 1. Main and local road; job site
 | 1. Inspection
 | 1. unannounced inspections during work
 | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |
| 1. *Traffic management*
 | 1. routes selected; following a traffic management plan
 | 1. Main and local road; job site
 | 1. Inspection
 | 1. unannounced inspections during work
 |  | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Phase | **What** *parameter is to be monitored?* | **Where** *is the parameter to be monitored?* | **How** *is the parameter to be monitored?/ type of monitoring equipment* | **When** *is the parameter to be monitored? (frequency of measurement or continuous)* | **Why** is the parameter to be monitored? (optional) | Cost | Institutional responsibility |  |
| Install | Operate | Monitoring oversight |
| * **Construction site**
 |  |  |  |  |  |  |  |  |  |  |
| 1. *Noise disturbance to human and animal population*
 | 1. Overall level of noise that is transmitted in the immediate environment
 | 1. job site; nearest homes
 | 1. sound level detector
 | 1. At the beginning of works, on complain
 | a)-j) assure compliance of performance with environment,health and safety requirements and enable as little disruption to traffic as it is possible | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Environmental Inspector |
| 1. *Pollutants and flying particles in the air (dust)*
 | 1. air pollution (flying particles, pollutants in the air and oxides of C, S, N, ozone and similar. )
 | 1. at and near job site
 | 1. laboratory with necessary equipment of the licensed organization
 | 1. during material delivery and construction; on complain
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Environmental Inspector |
| 1. *Vibrations resulting from equipment work*
 | 1. limited time of activities
 | 1. job site
 | 1. observation
 | 1. unannounced inspections during work and on complain
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Environmental Inspector |
| 1. *Traffic disruption during construction activity*
 | 1. existence of traffic management plan; traffic patterns
 | 1. main and local road; job site
 | 1. traffic police
 | 1. unannounced inspections during work and on complain
 | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |

| Phase | **What** *parameter is to be monitored?* | **Where** *is the parameter to be monitored?* | **How** *is the parameter to be monitored?/ type of monitoring equipment* | **When** *is the parameter to be monitored? (frequency of measurement or continuous)* | **Why** is the parameter to be monitored? (optional) | Cost | Institutional responsibility |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Install | Operate | Monitoring oversight |
| 1. *Reduced access to roadside activities*
 | 1. Provided alternative access
 | 1. Job site
 | 1. Observation
 | 1. During construction
 |  | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |
| 1. *Vehicle and pedestrian safety when there is no construction activity*
 | 1. Visibility and appropriateness
 | 1. At and near job site
 | 1. Observation
 | 1. During construction
 |  | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Construction Supervising Engineer |
| 1. *Water and soil pollution from improper material storage , management and usage building and auxiliary*

*materials* | 1. water and soil quality (suspended solids, oils, organic solids, heavy metals, pH value, conductivity, constant physical and chemical parameters)
 | 1. runoff from site, material storage areas; wash down areas of equipment
 | 1. observation; laboratory with necessary equipment of the licensed organization
 | 1. On complain
 |  | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Environmental Inspector |
| 1. *Potential contamination of soil and water from improper maintenance and fuelling of equipment*
 | 1. Water and soil quality (suspended solids, oils, fuel, lubricants, organic compounds, heavy metals, pH value, conductivity); procedures of work
 | 1. Job site; equipment maintenance facilities
 | 1. Observation; laboratory with necessary equipment of the licensed organization
 | 1. On complain or in case of accident situation
 |  | 1. NA
 | 1. NA
 |  | 1. Construction Contractor
 | Environmental Inspector |
|  |  |  |  |  |  |  |  |  |  |
| 1. *Destruction of crops, trees, meadows, etc.*
 | 1. land acquisition
 | 1. Job site
 | 1. Observation
 | 1. During material delivery and construction
 |  | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Environmental Inspector |
| 1. *Workers safety*
 | 1. protective equipment (glasses, masks, helmets, boots, etc); organization of bypassing traffic
 | 1. Job site
 | 1. Observation
 | 1. Unannounced inspections during work
 |  | 1. NA
 | 1. minimal
 |  | 1. Construction Contractor
 | Inspector of safety at work |
| **Operation**  |  |  |  |  |  |  |  |  |  |  |
| * **Maintenance**
 |  |  |  |  |  |  |  |  |  |  |
| 1. *Noise disturbance to human and animal population*
 | 1. Total equivalent noise level for referential time intervals „day“and „night“.
 | 1. Nearest homes, at min. 4 locations outside the landfill
 | 1. sound level detector
 | 1. Annually or unannounced inspections during maintenance activities and on complaint
 | a)-d) assure compliance of performance with environment, health and safety requirements | 1. NA
 | 1. NA
 |  | 1. RWSS Company
 | Environmental Inspector |
| 1. *Possible air pollution*
2. *Biogas monitoring*
 | 1. polluting solids in the air (SO2, CO, NOx, LČ10)
2. concentration of methane, H2S, CO
 | 1. Sampling of waste water exiting the system for collecting seepage water and sampling of water in the nearest drinking water intakes and surface flow;

measurement of air quality near the landfill closest to residential buildings;Sampling of land on adjacent parcels | 1. observation/executor; laboratory with necessary equipment of the organization licensed for monitoring of water, air and soil
 | b)-f) unannounced inspections during maintenance activities and on complaint1. automatic metering station which is to measure in continuity air quality installed on the sanitary landfill Možura
2. Biogas monitoring once a month
 |  | 1. NA
 | 1. NA
 |  | 1. RWSS Company
 | Environmental Inspector |
| 1. *Possible water pollution*
2. *Possible groundwater pollution*
 | 1. water quality, (pH of suspended solids, oils, organic compounds, heavy metals, BOD, COB conductivity and other physical and chemical parameters in the effluent
2. groundwater quality pH value, suspended solids, oils, organic compounds, heavy metals, BOD, COB conductivity
 | 1. Sampling of waste water exiting the system for collecting seepage water and sampling of water in the nearest drinking water intakes and surface flow;

measurement of air quality near the landfill closest to residential buildings;Sampling of land on adjacent parcels | 1. Observation/executor; laboratory with necessary equipment of the organization licensed for monitoring of water, air and soil
 | 1. testing of leachate once a year
2. testing of groundwater samples from boreholes, four times a year
 |  | 1. NA
 | 1. NA
 |  | 1. RWSS Company
 | Environmental Inspector |
| 1. *Possible soil pollution*
 | 1. heavy metals in soil (Pb, Cd, Hg, Cr, Fe).
 | 1. Sampling of waste water exiting the system for collecting seepage water and sampling of water in the nearest drinking water intakes and surface flow;

measurement of air quality near the landfill closest to residential buildings;Sampling of land on adjacent parcels | 1. observation/executor; laboratory with necessary equipment of the organization licensed for monitoring of water, air and soil
 | 1. testing of soil once a year
 |  | 1. NA
 | 1. NA
 |  | 1. RWSS Company
 | Environmental Inspector |
| 1. *Vibrations resulting from equipment work*
 | 1. equipment operating with noise mufflers
 | 1. job site
 | 1. observation
 | 1. unannounced inspections during maintenance activities and on workers’ complaint, measuring once per year, constantly
 |  | 1. NA
 | 1. minimal
 |  | 1. RWSS Company
 | Environmental Inspector |
| 1. *Workers safety*
 | 1. protective equipment (glasses, masks, helmets, boots, etc);
 | 1. job site
 | 1. observation; control of the methane (explosive gas) air detector
 | 1. unannounced inspections during maintenance activities and on workers’ complaint
 | Safety and health of workers, prevention of fire and explosion at the landfill | 1. NA
 | 1. Minimal.
 |  | 1. RWSS Company
 | Inspector of safety at work |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

**C. COSTS OF ECOLOGICAL MONITORING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure** | **Cost (EUR)** | **Timing** | **Responsibility** |
| Health checks and vaccinations for employed staff | 2.450 | Every year throughout the landfill operation | Institute for Health and “Možura” d.o.o Management |
| Mitigating the effects of taking soil for daily cover | 21.025/year | Throughout the landfill operating | Možura” d.o.o Management |
| Engineering ditches and settlement ponds to collect the surface runoff water from the landfill site | 7.000 | During the construction | Contractor |
| Testing of groundwater quality | 1.400/year | Throughout the period of landfill operation | Možura” d.o.o Management |
| Leachate monitoring | 4.200/year | Throughout the period of landfill operation | Možura” d.o.o Management |
| Landfill gas related monitoring (quality, quantity...) | 3.500/year | Throughout the period of landfill operation | Možura d.o.o Management |
| Regular monitoring of noise | 1.400/year | During the construction works and landfill operation | Možura d.o.o Management,Contractor and Supervision of works |
| Maintenance of vehicles | 2.100/year | Throughout the period of landfill operation | Možura d.o.o Management |
| Installation of a small automated meteorological station at the site | 3.500 | During the construction phase | Možura d.o.o Management,Contractor and Supervision of works |