

# **BELIZE SOLID WASTE MANAGEMENT PROJECT ENVIRONMENTAL IMPACT ASSESSMENT REVISED**

## **7.0 ENVIRONMENTAL MONITORING**

### **7.1 INTRODUCTION**

This section proposes environmental monitoring requirements for the proposed new landfill facility at Mile 22 of the Western Highway and supporting transfer / recycling facilities in Belize City, San Pedro and Caye Caulker. Monitoring is intended to provide the environmental information necessary to ensure that pollution or related problems are discovered in time to prevent or repair adverse effects, and to evaluate the success of mitigative or preventive measures set out in the design.

### **7.2 SURFACE WATER QUALITY**

Regular monitoring of surface water quality at key locations (see below) shall be conducted throughout the construction and operational life of the Mile 22 Sanitary Landfill and transfer stations in Belize City, San Pedro and Caye Caulker. Samples shall be collected and analyzed at bi-monthly intervals during the construction of the landfill and for the first year of its operation to develop base line data. Following the first year of operation, surface water samples may be collected at less frequent intervals, to be decided on the basis of the results to that time, and in consultation with the Department of Environment and the Community Advisory Committee. Substances of potential health/environmental concern should be included in the analyses, including at a minimum: conductivity, pH, total dissolved solids, total suspended solids, total and faecal coliformes, nitrates, phosphorus, and selected heavy metals such as lead, zinc and mercury. Sampling and analysis of surface water as defined above should begin as soon as possible, so that pre-construction baseline data may be obtained. Sampling and analysis of surface water should continue for at least five years after facility closure and reclamation. If the results are satisfactory during this post closure period, the monitoring program may be terminated. The following sampling points for the regional sanitary landfill should be included in the water quality monitoring program:

- Water in the leachate retention pond;
- A designated surface water location in the Cox lagoon system; and
- Belize River at a point directly north east of the Mile 22 Landfill facility
- where the Cox Lagoon system drains into the River

The following sampling point will also be included in the water quality monitoring program as they relate to the transfer sites in Belize City, San Pedro and Caye Caulker:

- Upstream, downstream and at the Belize City mile Three site in the instance of Belize City's Transfer Station Site.

# **BELIZE SOLID WASTE MANAGEMENT PROJECT ENVIRONMENTAL IMPACT ASSESSMENT REVISED**

The same points and protocol should be used each time samples are taken.

## **7.3 LEACHATE MANAGEMENT AND GROUNDWATER QUALITY**

Liquid in the leachate lagoons shall be sampled at 6-month intervals and analyzed for the parameters listed in Appendix G. This sampling and analysis should continue until such time as the range of concentrations is sufficiently established or the parameter is established to be negligible. A series of nested observation wells (piezometers) shall be installed at the outside boundaries of the landfill, for the long-term monitoring of ground water. This program shall include at least one observation wells upgradient and at least two down gradient of the waste disposal site. Water samples shall be taken at least annually from these wells for the first year after their construction and analyzed for the parameters listed in Appendix G. After the first year of operation, the analyses may be reduced to a smaller number of indicator parameters. These indicator parameters will include, as a minimum, conductance, pH, and major ions (e.g., sodium, chlorides, sulphates, nitrates). Each well shall consist of a 51-mm ID PVC pipe extending at least 20 m (70 feet) below the surface or to at least 1 m (3 feet) below the water table. A second well at each site shall be constructed into the surface layer of clay. In order to detect any seepage of leachate from the leachate retention ponds, at least one of the nested observation wells shall be placed down gradient of them, and any collected water monitored as outlined above. Sampling and analysis of water collected in the observation wells should begin as soon as possible, so that pre- operation and construction baseline data may be obtained.

## **7.4 LANDFILL GAS**

1. The presence and levels of landfill gas (LFG) shall be monitored during the first year of landfill operation, and thereafter twice per year or as shown to be necessary based on site soil conditions, proximity of structures, etc., using the ground water monitoring wells or surface gas detection probes.
2. On-site buildings and other enclosed structures shall be monitored regularly to determine whether LFG is seeping into them and introducing the risk of explosion.

## **7.5 ODOR AND OTHER PUBLIC NUISANCES**

The presence of odors and dust downwind from the landfill shall be assessed by site staff at least weekly. Complaints from future neighbouring areas about machinery noise and animal pests including birds, rodents and insects, shall be documented in the site diary by landfill site staff. Any complaints from the public or nearby future commercial, institutional or residential facilities shall be recorded and maintained at

# **BELIZE SOLID WASTE MANAGEMENT PROJECT ENVIRONMENTAL IMPACT ASSESSMENT REVISED**

the landfill site, noting the identity and location of the complainant if offered, the date and time, and the nature of the complaint. This information will be shared with the Community Advisory Committee, which will also serve as an additional route for learning of public concerns.

## **7.6 HISTORICAL RESOURCES**

The construction supervisor shall be aware of the possibility of encountering artefacts of historic interest, including “mounds” of artefacts such as pottery and pottery shards. In the event that such items are encountered, the Institute of Archaeology shall be informed immediately (Tel: 501-822-2106; Fax: 501-822-3345), and the work in the immediate area shall halt temporarily, to allow an opportunity to briefly survey and collect remaining material.

## **7.7 TRAFFIC**

It is recommended that traffic densities be monitored at intervals to ascertain that waste management vehicles travelling to and from the Mile 22 Sanitary Landfill facility are not posing a safety or traffic flow problem on the Western Highway.

## **7.8 POST-OPERATIONAL LIFE**

Ongoing monitoring and maintenance of the cap, the surface soil, and the vegetation shall be performed for a period of ten years or until such time as the landfill has stabilized and this proves to be no longer necessary. Landfill gas monitoring (and control if needed) shall continue until LFG production levels indicate that no further control or monitoring is necessary. Monitoring of leachate and surface water should continue throughout the post operation period.

## **7.9 REPORTING**

The landfill facility operator shall submit annual written reports to the Department of Environment, both during the operation and post operation periods. These reports shall contain the following information:

- Volume (i.e. mass) of material received, by type and period;
- Ground water monitoring/analyses results;
- Leachate monitoring/analyses results;
- Landfill gas monitoring/analyses results;
- Documentation of any spills, emergencies, fires, or waste releases from the site;
- Details of extraordinary discharges (e.g., leachate);
- Records of daily, intermediate and final cover applied;
- Documentation of stabilization and vegetation of final cover, with indication of success or problems;

## **BELIZE SOLID WASTE MANAGEMENT PROJECT ENVIRONMENTAL IMPACT ASSESSMENT REVISED**

- Documentation of landfill space occupied and amount remaining in current phase;
- Odor, litter, dust, noise monitoring records;
- Records of complaints from neighbouring public or businesses, and action taken to address them;
- Minutes of Community Advisory Committee meetings; and
- A summary of any operating problems and the proposed means of addressing them.