



## WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

### Siting of sanitary landfill and faecal treatment plant



Robert R Bannerman

#### Introduction

Long term planning for improvement in solid waste and night soil disposal of Accra, the capital city of Ghana, called for assessment of the suitability of different locations within the Greater Accra Metropolitan Area and the adjoining Ga District, to serve as sanitary landfill and faecal treatment plant sites.

Methodology adopted for the study comprised the search for technical information and its review; interviews with Government authorities, chiefs, stool elders, land owners and users; and reconnaissance surveys.

The proposed sites were identified through interpretation of aerial photographs; and the study of large scale geological and topographical maps. As much as possible field observations and measurements were made to establish the ground truth. The sites were then plotted on large scale maps, marking the coordinates of prominent edge points.

#### The survey

Details of the survey included the description of the following:

- location and accessibility of proposed sites, not only in terms of distance from the generation points but also taking into consideration the class and inter-connection of road and rail network.
- topographical characteristics: indicating the elevations of natural valleys (lowlands), their trends and gradients; and any modifications of these that have resulted from man-made activities.
- the lithology and structure of soil and overburden materials and their thickness; and structural features of the bedrock or any outcrops; and also of any made-up ground.
- geohydrologic conditions: such as estimation of the permeability of the different soil and rock types; and the presence of permanent or ephemeral streams, rivers and ponds and their discharges; and ascertain whether the sites are prone to flooding.
- groundwater occurrence and its utilization and measurement of groundwater levels and flow directions.
- current and future land use.

Other aspects of the survey included: determination of:

- distances to nearby developed communities.
- the ownership of the said lands.
- the size of the areas (in hectares).
- prospective fill volumes (in cubic meters) for the landfill.
- As some of the sites are near the Accra International Airport, to assess potential restrictions by air traffic regulations.
- For faecal treatment sites, assess among others the volume of water in streams and lagoons to take in the effluent.

#### Assessment

##### Landfill

Accessibility to all 4 sites studied are generally adequate; as they are approachable by tarred and second class laterite roads. But they fall within increasing distances, varying between 7 to 16km from the waste generation centres.

##### Topographical characteristics

All the proposed sites are in valleys with gentle slopes which are closed on one side, with the other side opening into adjoining larger valleys.

In 3 cases ridges mark the rim of the valleys making them "contained".

The bottoms of these valleys have been extensively modified through excavations for sand and gravel; and this activity has more or less created additional fill volume.

The sites have topographical characteristics which allow rainwater and surface water to drain off; hence have "high" suitability for land-filling purposes.

##### Geohydrologic conditions

All the sites are underlain by Precambrian metamorphic rocks comprising gneisses, schists, quartzites and quartz schists.

The bedrock is overlain by shallow weathered and decomposed materials consisting mainly of sands and sandy clays, and in some cases, transported alluvial deposits. The

thickness of the overburden varies between 0 and 30m, averaging 10m over most of the areas.

Special regard was given to the permeability of the sub-soil as this determines the amount of water which can trickle through these layers and potentially contaminate the groundwater.

Generally geohydrological conditions are favourable as none of the areas has good groundwater sources and potential that could be impaired.

### Surface water discharge

3 of the valleys are occupied by ephemeral streams and are prone to flash flooding. In one case, there is a perennial pond at the lower end of the valley.

### Distance to nearby developed communities

Only one proposed site is within 800m from a human settlement; the rest, located more than 1000m away from are regarded as averagely suitable.

### Ownership of land

Three of the four sites are owned by Chiefs and Stool Elders. This would not make land use negotiation easy. However for landfill operations, even over a longer period, it does not seem to be necessary to own the land. A contract only for the utilization of the land will make negotiations easier. In the case of the one site owned by Government negotiations could be much easier.

### Official land use plan

The kinds of land use which have been officially allocated to the area by the Government Planning Authorities were reviewed. Also considered was the time distance from now till when these plans should be realised. 3 sites were assessed as of "high suitability" as there are no specific plans for immediate residential or industrial use.

### Distance from airport/flight path

The distance of the proposed sites from the airport and the flight path was a crucial argument for assessment. 3 of the sites were found to be near aircrafts flightpath, thus birds, like vultures could become a serious safety problem for flight operations.

### Area fill volume

This concerns the life span and the initial investment costs to start a new landfill. A large site with options of a deep fill or a high build up of refuse are highly desirable. An average suitability was given to 3 sites, of anticipated life span of 5 years.

In addition the possibility of future expansion was assessed. 2 sites which offer such opportunity were assessed as having "high" suitability; and 2 other sites with rather unknown future land use plans were shown as "average".

One site with very limited future expansion plans showed "low" suitability with regard to this factor.

### Availability of suitable cover material within the vicinity

Fill-and-cover should be a standard for the operation of a sanitary landfill site. Daily covering removes stretch, minimizes fly nuisance and discourages birds on the landfill.

Easy availability of cover materials like sand, gravel, laterite rubble or even saw dust, is highly appreciated for landfill operations. At 3 sites such materials are easily available within the vicinity and hence these sites were assessed as of "high" suitability.

### Assessment

#### Faecal treatment sites

3 proposed sites were assessed, with regards to their location, accessibility, prevailing wind direction and especially, nearness to a large volume of water in a stream, lagoon or pond to ensure dilution and drainage away of the effluent.

All the sites are accessible by tarred road. 2 of them, considered suitable, are located on hill slopes with sufficient gradient to allow flow of effluent into a large perennial volume and flow of water.

Airflow both in the valleys and on the hill sides is quite adequate for removal of odour. The sites are not near any developed neighbourhood and there is no new development planned in their immediate vicinity.

### Conclusion

The attributes of each of the 4 proposed landfill and 3 faecal treatment plants sites were compared and contrasted. This exercise was based on criteria and ratings developed from arguments, factors and issues under the different conditions.

Grades of assessment were thus established, following rules for assessing qualitatively measurable characteristics. The assessment result of (low, average or high) suitability was then linked to a numeric system.

In this manner, all the prospective sites were screened and sites that met most of the criteria and thus most appreciated were chosen.

The result of the study highlighting the principled arguments, would be presented to the Waste Management Division of Accra Metropolitan Authorities to help them decide on the final choice and approval of the sites.