

ENVIRONMENTAL GEOTECHNICS

MKAJ 1083

**TOPIC 1: GUIDELINES & REGULATIONS ON
WASTE DISPOSAL**

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WASTE



SOLID WASTE



SEWAGE
(WASTEWATER)



HAZARDOUS
WASTE



ELECTRONIC
WASTE



METHODS OF SOLID WASTE DISPOSAL

- OPEN BURNING
- DUMPING INTO THE SEA
- **SANITARY LANDFILLS**
- INCINERATION
- COMPOSTING
- PLOUGHING IN THE FIELDS
- HOG FEEDING
- GRINDING AND DISCHARGING INTO SEWERS
- SALVAGING
- FERMENTATION AND BIOLOGICAL DIGESTION

LAWS & REGULATIONS

- Local Govt. Act 1974; Town and Country Planning Act, 1976
- Street, Drainage and Building Act, 1974
- Environmental Quality Act, 1974
- Land Conservation Act, 1960
- The Water Enactment Act
- The National Land Code, 1965;
- Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979
- Environmental Quality (prescribed Activities)(Environmental Impact assessment), October 1987
- Environmental Quality (Prescribed Premises)(Scheduled Waste Treatment and Disposal Facilities) Regulations, 1989
- Uniform Building By-Laws; Earthworks By-Law
- Public Cleansing By-Laws; Anti Litter By-Laws
- Refuse Collection, Removal and Disposal By-Laws



SOLID WASTE AND
PUBLIC CLEANSING
MANAGEMENT

ACT 2007

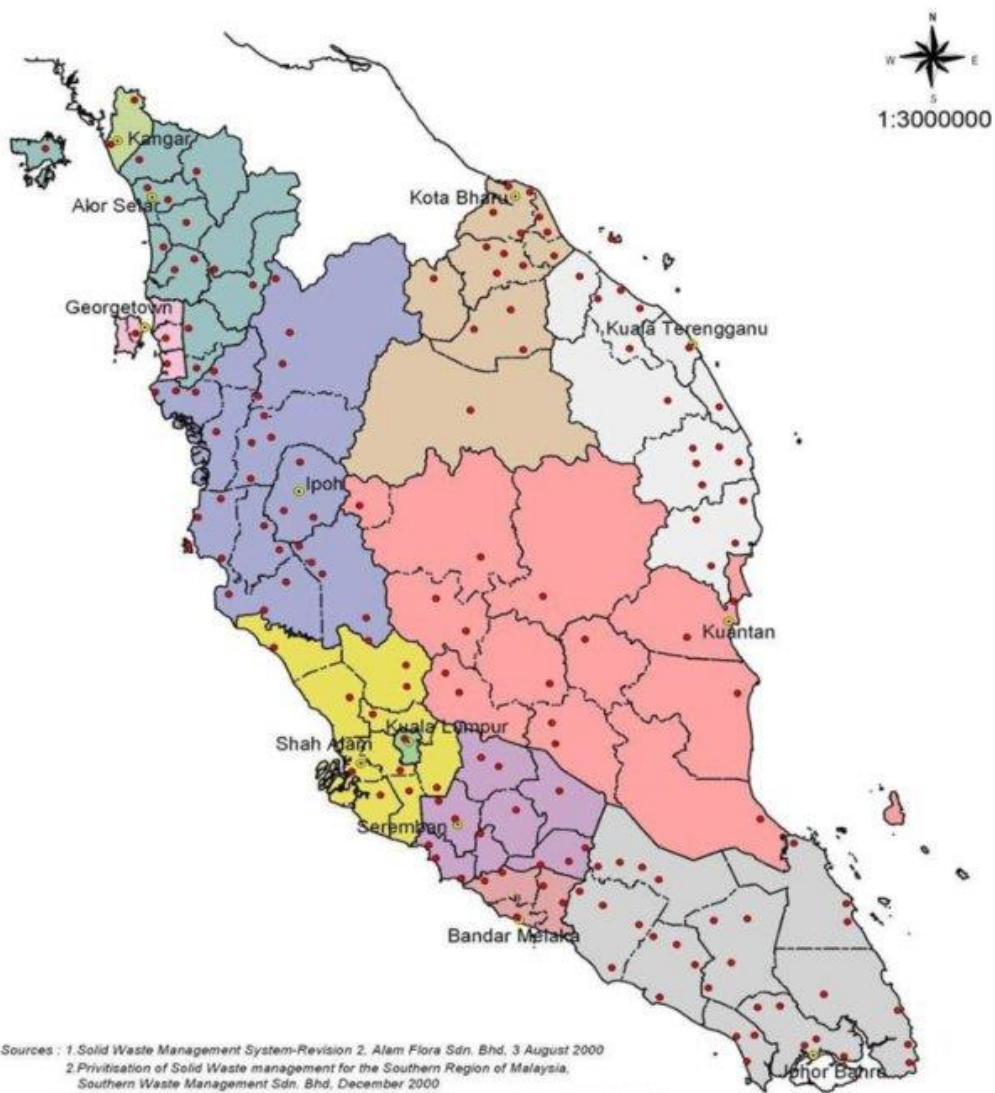


FUNCTIONS OF LANDFILL

- Storage and Treatment
- Environmental Protection
- Land Development



- a) store and safely contain waste and retaining leachate from polluting the environment.
- b) minimize and prevent harmful effects to human health and to protect the environment.



LEGEND :

	State Capitals		KELANTAN		PERLIS
	Existing Landfill Sites		KUALA LUMPUR		PULAU PINANG
	District Boundary		MELAKA		SELANGOR
	JOHOR		NEGERI SEMBILAN		TERENGGANU
	KEDAH		PAHANG		PERAK

States	Landfills In Operation	Landfills Have Been Closed
Johor	15	21
Kedah	10	5
Kelantan	13	4
Melaka	2	5
Negeri Sembilan	8	10
Pahang	19	13
Perak	18	11
Perlis	1	1
Pulau Pinang	2	1
Sabah	21	1
Sarawak	49	12
Selangor	8	12
Terengganu	9	11
Federal Territories	1	7
Total	176	114
	290	



SEELONG SANITARY LANDFILL

LANDFILL

On the basis of type of waste disposed

Municipal Solid Waste Landfills (MSWLFs)

For, household nonhazardous waste.
Eg. Bioreactor landfill

Industrial Waste Landfill

For, commercial & institutional waste. Eg. C&D landfill, Coal combustion residual(CCR) landfill

Hazardous Waste Landfill

For, toxic & hazardous waste. Eg. Polychlorinated biphenyl (PCB) landfill

On the basis of engineering facilities

Open Dump Landfill

Represent worst case reference, common in developing countries.

Conventional Semi-controlled landfill

Dump waste is compacted and top cover is provided

Engineered Sanitary Landfill

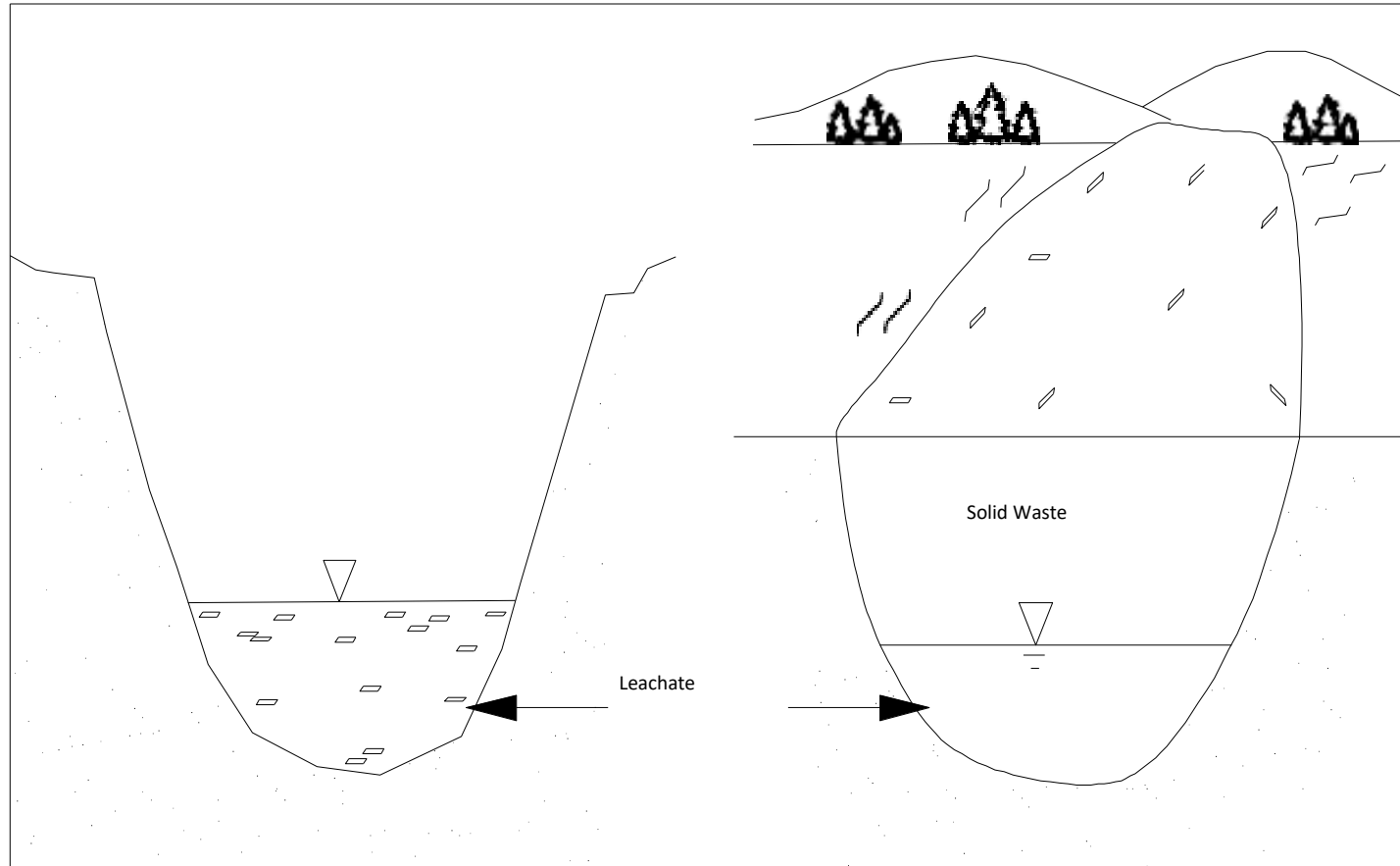
Leachate management and gas collection and utilisation is carried out

TYPES OF LANDFILL



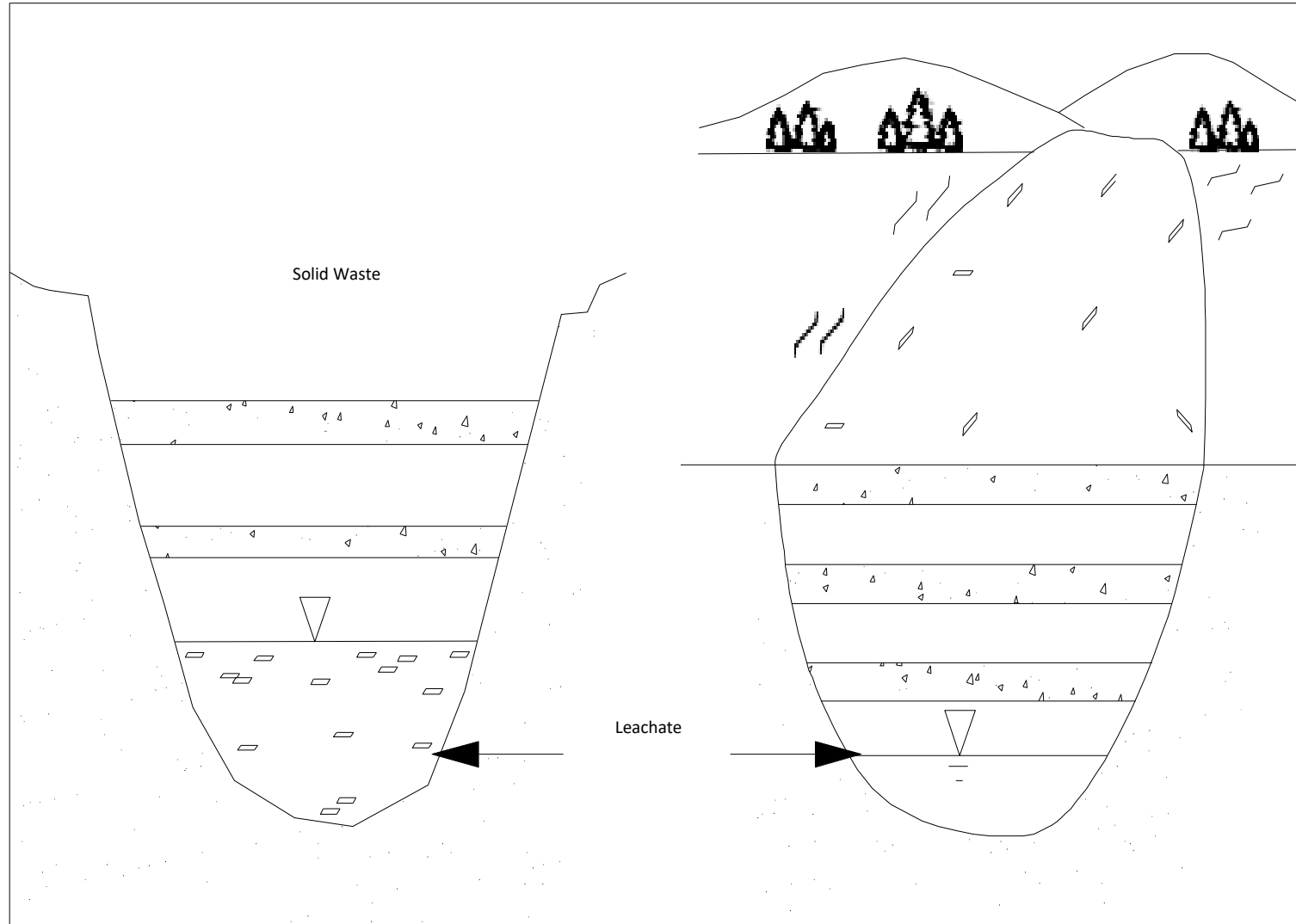
1. **Anaerobic landfill**
2. **Anaerobic sanitary landfill with daily cover**
3. **Improved anaerobic sanitary landfill with buried leachate collection pipes**
4. **Semi-aerobic landfill with natural ventilation and leachate collection facilities**
5. **Aerobic landfill**

Anaerobic landfill

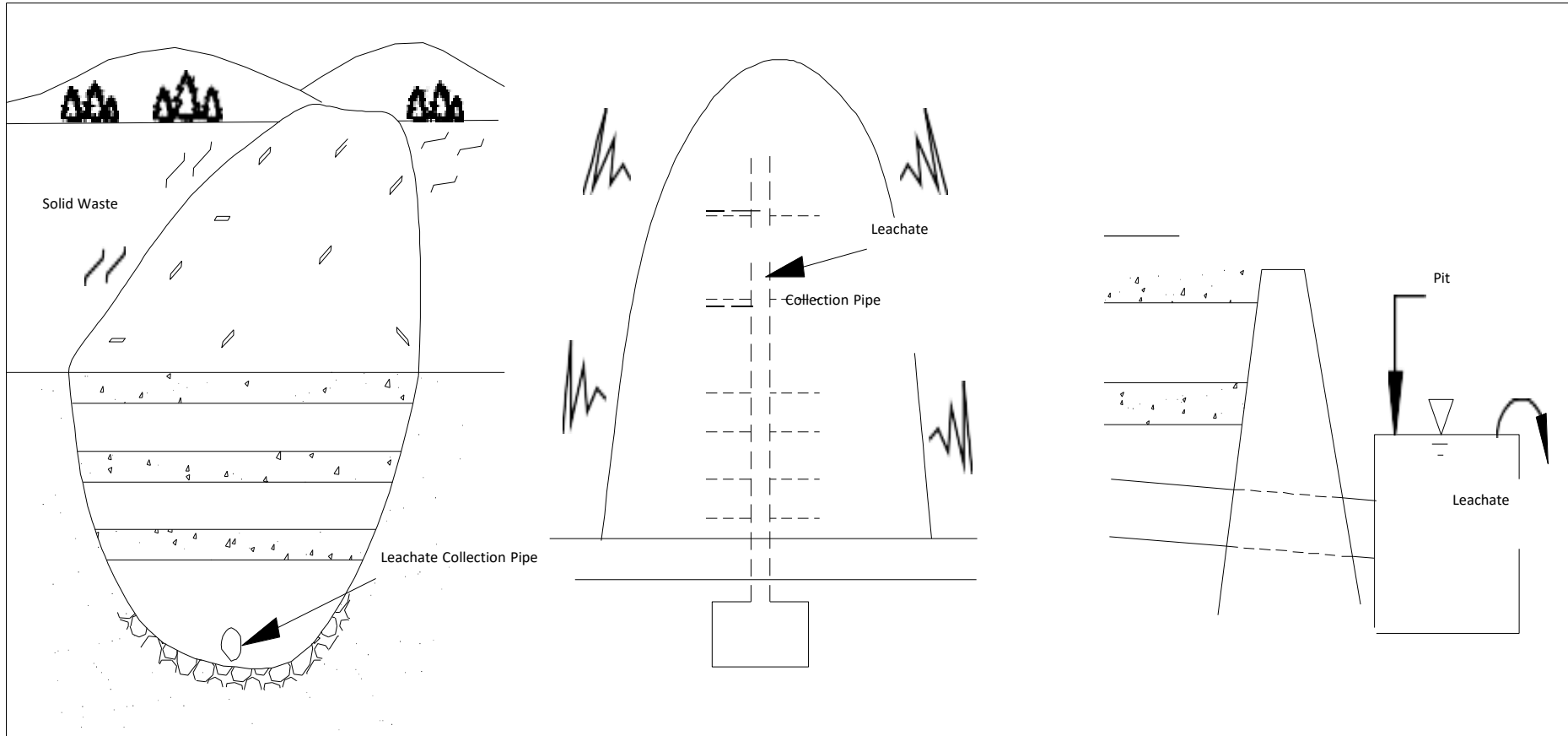


- Liquids are added to help bacteria break down the waste
- Biodegradation occurs in the absence of oxygen (anaerobically) and produces landfill gas

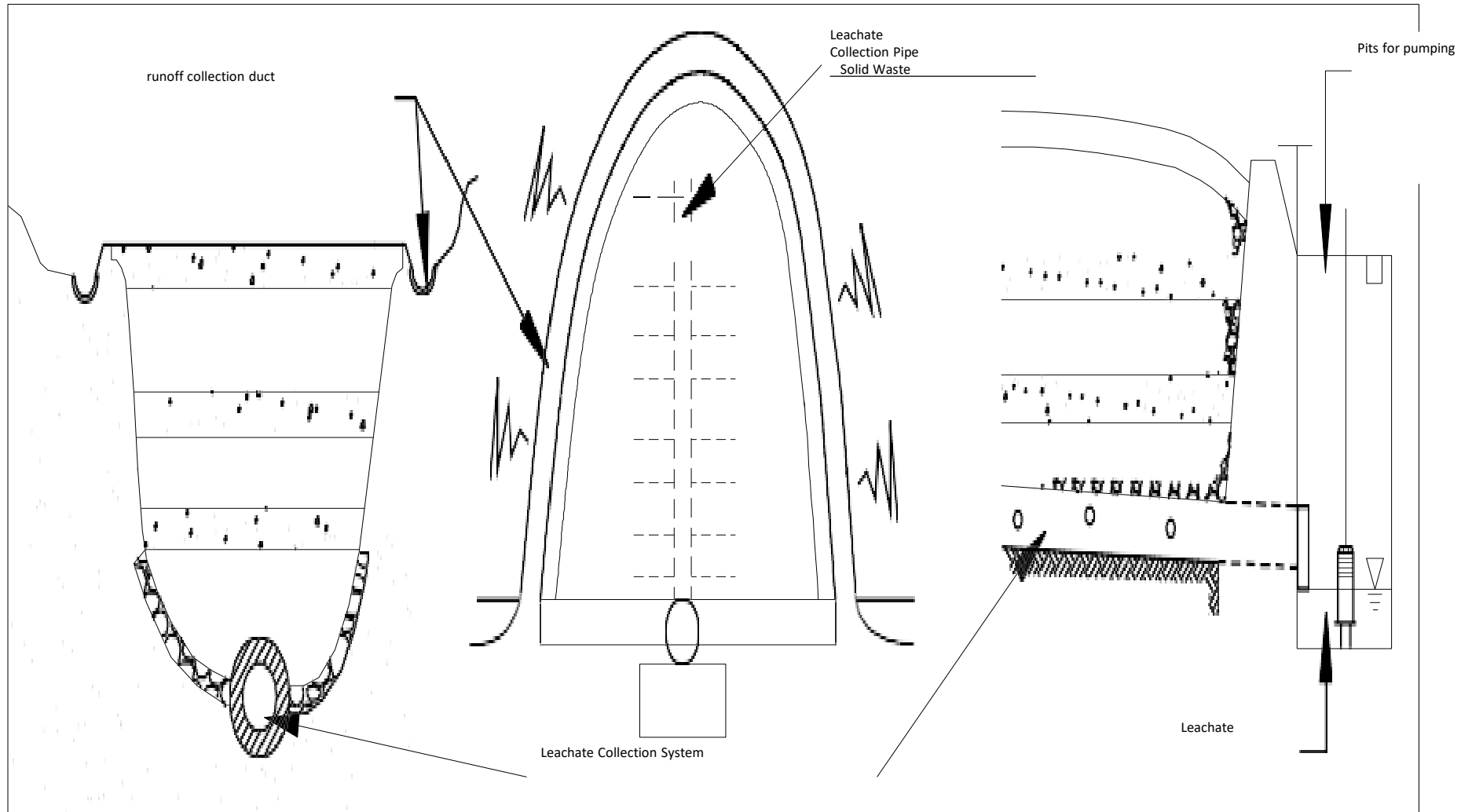
Anaerobic sanitary landfill with daily cover



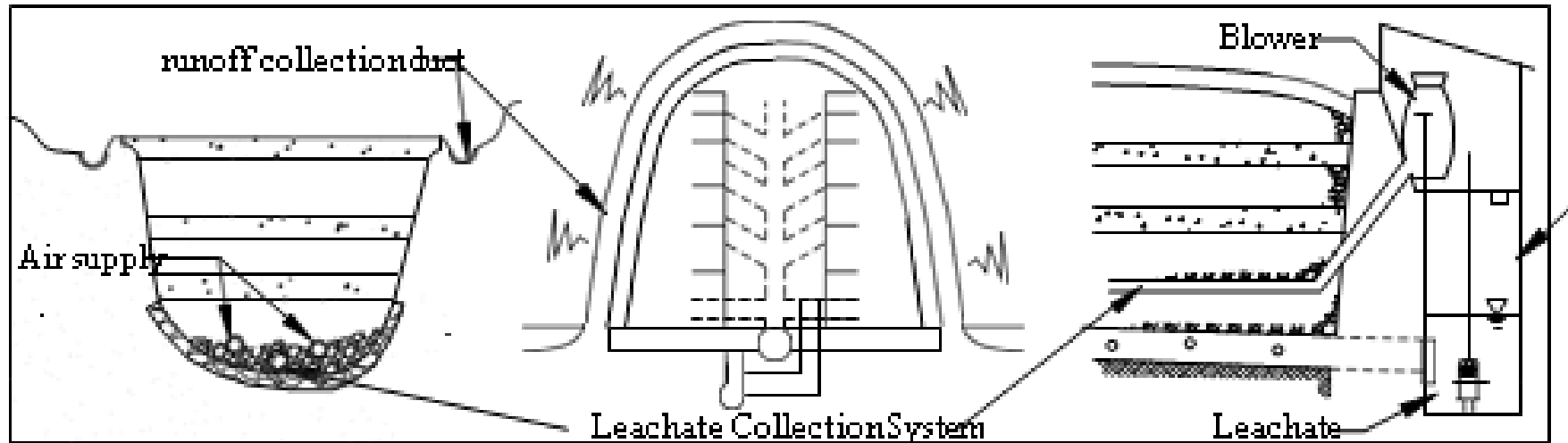
Improved anaerobic sanitary landfill with buried leachate collection pipes

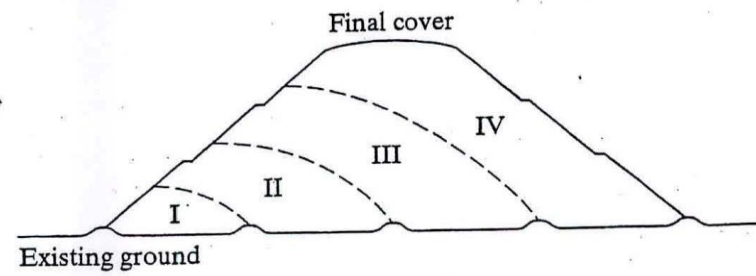


Semi-aerobic landfill with natural ventilation and leachate collection facilities

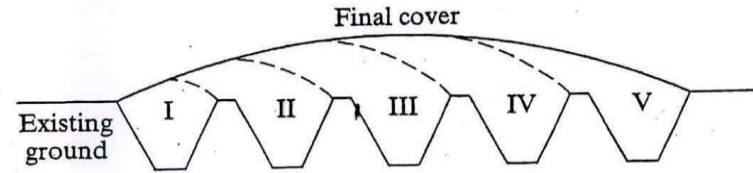


Aerobic landfill

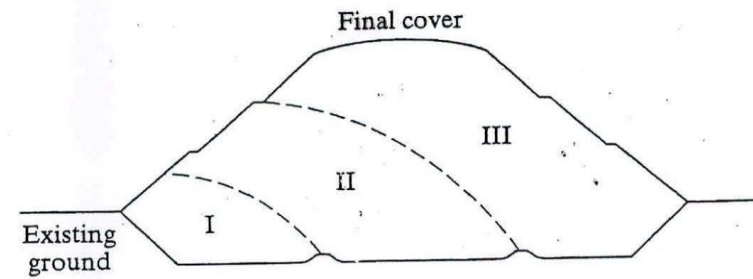




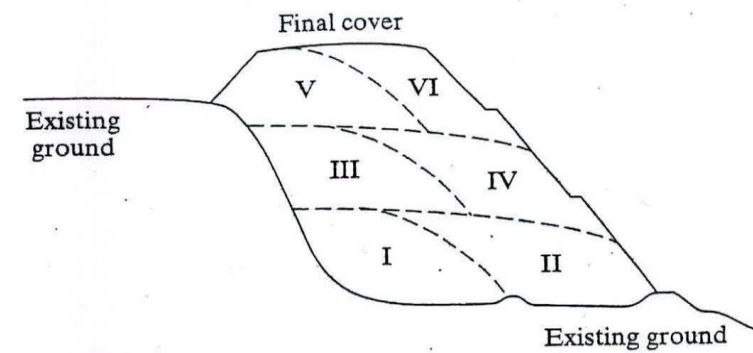
(a) Area fill



(b) Trench fill



(c) Above and below ground fill



(d) Valley fill

FIGURE 1.5 Four Types of Solid Waste Landfill Geometry

BASIC DESIGN CONSIDERATION

- The target lifespan shall be set at approximately 10 to 15 years of operation.
- Provide some reserve margin
- The projected solid waste amount should be estimated up to the target lifespan with increments of 5-year intervals
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- The unit generation rate per capita is estimated to be 1.15 kg/capita/day by 2020
- The waste generation will increase to 3.6% per year by 2020 (11, 500, 000 ton/yr)

BASIC DESIGN PARAMETERS

- Design Landfill Capacity (DLC):

$$DLC = (ADLV + CMV) \times Years$$

$$ADLV = \frac{ADLW}{SWW}$$

$$CMV = \frac{ADCMW}{SWCM}$$

ADLV = annual designed landfill volume

CMV = cover material volume

ADLW = annual designed landfill weight

SWW = specific weight of waste (compacted and landfilled)

ADCMW = annual designed cover material weight

SWCM = specific weight of cover material (landfilled and compacted)

ENVIRONMENTAL GEOTECHNICS

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**TOPIC 2: SITE INVESTIGATION AND SELECTION
FOR LANDFILL**

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SITE SELECTION CRITERIA



Available area



Surrounding
environment and
conditions



Topography and
geological
conditions



Transport
infrastructure and
access



Services & Security



Availability of
supplies

p/s: please refer to the site assessment & selection's NOTE for detail information

Available Area

1. Land Use

- Local authority should be referred to in relation to land use zoning (residential, agricultural, industrial or high amenity)
- Sites in areas of lower population density are generally preferable

2. Land Area Requirements/Availability

- Area of land needed for a landfill influenced by:
- land to act as a buffer zone and to screen off residential or other developments
- availability of cover material

3. Local Community

- Landfill operations are a source of concern ~ water pollution, litter, vermin, flies, dust, odour, fire, traffic and noise
- Local community involvement ~ in site selection and might be maintained during landfill operation



Surrounding environment & conditions

1. Buffer Zones for Sensitive Receptors

- To providing space between an activity and a sensitive receptor to mitigate environmental problems
- Type of receptor
- The nature of the waste (inert, municipal, etc);
- The design of the landfill (scale of operation, landfilling sequence, environment control, etc);
- Direction of prevailing wind, groundwater, surface water flow

2. Site Visibility /Natural Screening

- Areas with natural screening, isolated settings, or existing natural depressions would be preferable.
- Screening around landfill sites can also be accomplished through construction of berms, fences, planting, or enhancement of existing vegetation.
- Siting at remote locations ~ consider longer distances for transporting waste.

3. Ecology

- Any adverse impacts on ecology must be balanced against the advantages.
- Consider:
 - any relevant designations (e.g. Special Areas of Conservation, Special Protection Areas, Natural Heritage Area);
 - any rare or protected species of plants and/or animals;
 - any particular features of habitats (terrestrial and aquatic)

4. Archaeological Heritage

- Potential landfill sites should be assessed in relation to potential impacts on archaeological heritage.
- Landfill siting should also have regard to Development Plan objectives and policies for the protection of archaeological and architectural heritage.

5. Areas of High Amenity

- Areas of special amenity ~ outstanding natural beauty or its special recreational value.
- Local Development Plans must be consulted for the landscape and amenity objectives and designations.

Topography and geological conditions

1. Geology And Hydrogeology

- Geological setting of the sites to evaluate the suitability ~ *type of rock, the state of weathering, structural features (faults, joints and bedding planes)*.
- Subsoils ~ composition, lateral and vertical continuity of the strata, permeability, stress deformation behavior.
- Hydrogeological investigations ~ type and distribution of aquifers.

2. Hydrology and Surface Water Protection

- Should include potential effects on water quality (streams, rivers, lakes), quantity and aquatic ecology due to leachate contamination or increased surface runoff.

3. Meteorology

- Information should be obtained from the Meteorological Office on precipitation and evapotranspiration for the areas in question.
- The annual rainfall, wind strength and patterns must also be examined (to avoid blowing or flying debris/litter).

Transport Infrastructure and Access

1. Traffic/ Access

- Distance of potential sites from waste generation areas
- Proximity to the existing national / regional road
- Any required upgrading or new road infrastructure to accommodate additional traffic
- Landfill generated traffic (during construction and operation) ~ noise, vibration, exhaust emissions, dust, dirt and visual intrusion.

2. Airports

- Landfill developers shall follow the recommendations of the International Civil Aviation Authority (ICAO).
- Advice of bird control specialists should be sought and the potential hazard to aircraft due to bird strike should be assessed.



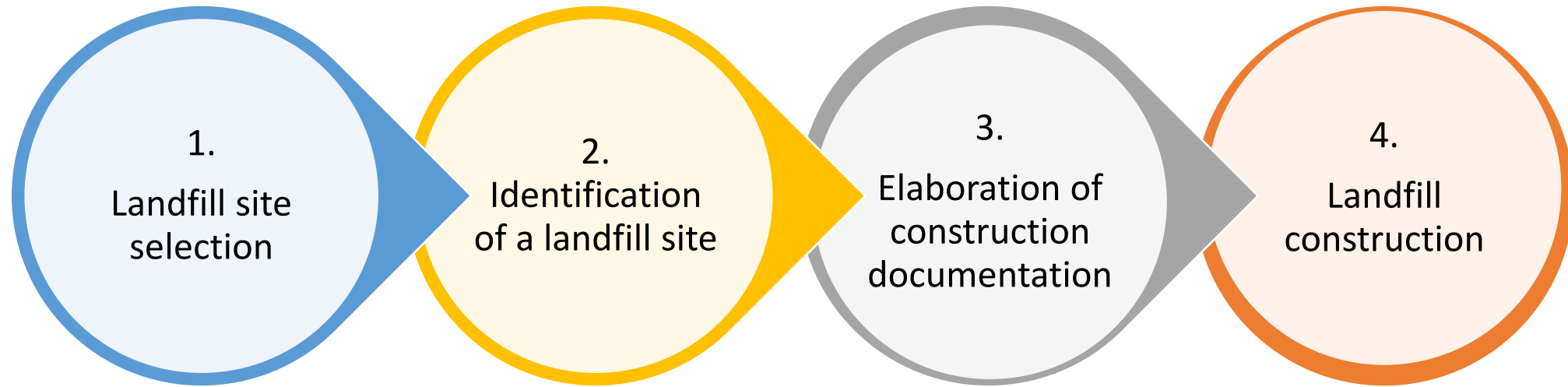
Availability of supplies

- The availability of suitable cover (daily and final restoration) for the duration of the landfilling operation is essential.
- If suitable cover material not available at the site, import and/or alternative cover systems employed.

Services & Security

- water supply, proximity to sewerage system and suitable wastewater treatment, power supply and telephone connections.
- If necessary to transport leachate off-site for treatment, the location of the treatment facilities should be taken into consideration.
- Access to landfill sites must be controlled in order to prevent unauthorised vehicular traffic and illegal dumping of waste.

LANDFILL SITE DEVELOPMENT



- made by a multidisciplinary team of experts
- buildable land
- reconstruction area

- Complete sanitary security for people living in the surrounding residential areas, as well as personnel working at landfills

- Protection of land, air, ground and surface water from pollution

- Rational use of land, as well as save land (increased levels of waste compaction using special machines, as well as a deposition height)

- Implementation of GIS tools in waste management

- Spatial and urban planning requirements
- Spatial and regional requirements
- Landfill site selection
- Required land area
- Transportation distances
- Local site conditions
- Topography
- Climate conditions
- Hydrogeological conditions
- Geological conditions
- Geo-mechanical conditions
- Environmental protection

LANDFILL FACILITIES

Operational

- Retaining structures
- Bund
- Lining system
- Drainage system
- Treatment facilities
- Leachate & gas collection system
- Cover system

Management

- Admin office
- weighbridge

Supporting

- Access road
- Fencing
- Workshop
- Vehicle cleansing facilities
- Fire prevention system



*Thank
You*