

Sanitary Landfill Design

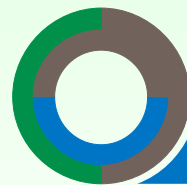
Municipal Solid Waste (MSW)

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The Dump



From Dump to Sanitary Landfill

Definitions (from World bank technical paper no.426.)

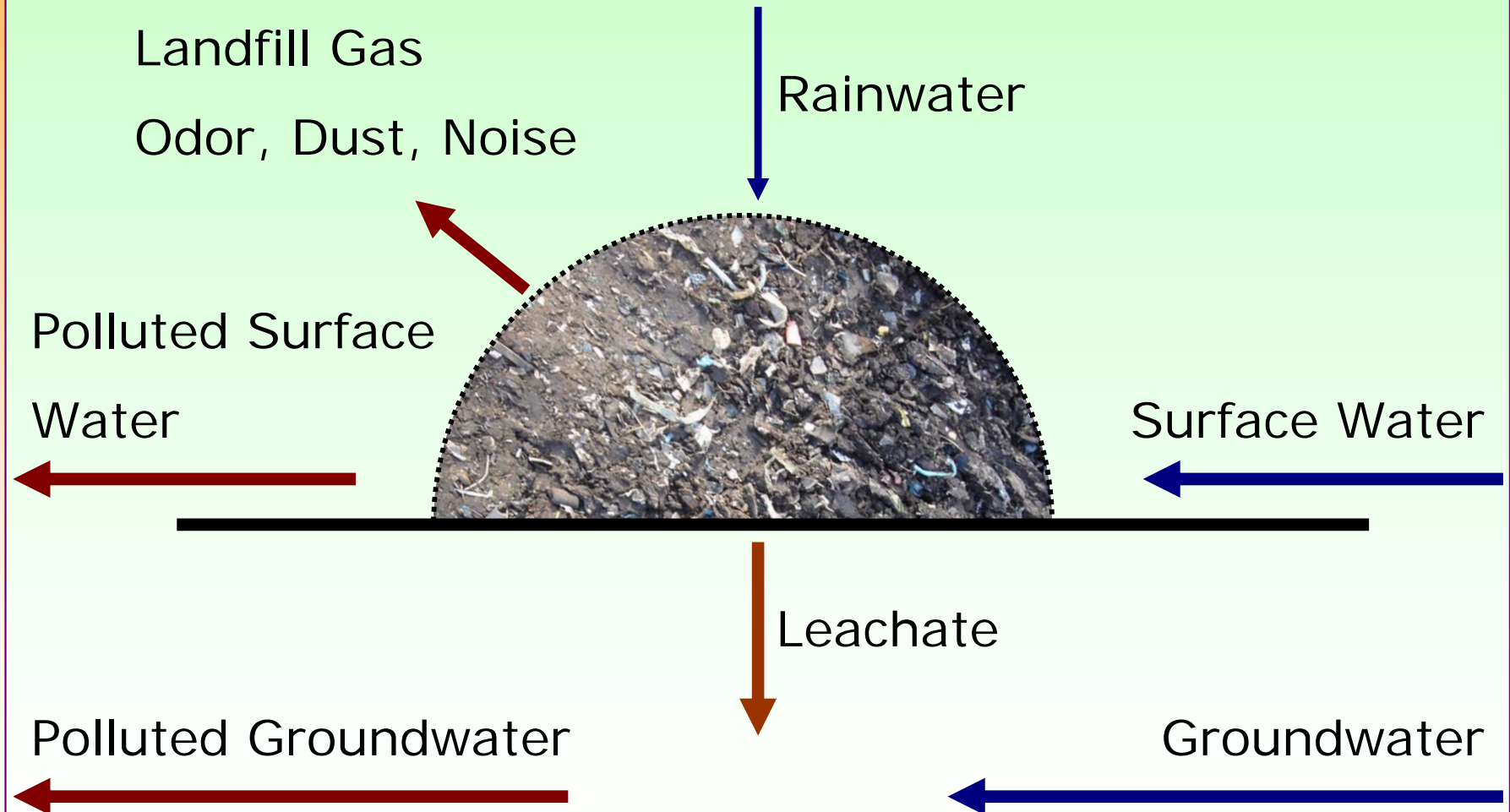
- Dump = uncontrolled dump causing hazards to human and environment
- Controlled Landfill = dump with covering of waste
- Engineered Landfill = controlled landfill + engineered measures to limit impact
- Sanitary Landfill = engineered landfill + landfill gas extraction + groundwater monitoring + highly trained staff + water treatment facility + ...

Impacts from Dumps

A dump will impact its surrounding environment by:

- Its presence (area need, visual impact, social and economical impact)
- Transport of waste (noise and air)
- Waste attracts animals (vermins, insects)
- Waste emits landfill gas (odor, fires, global warming)
- Waste emits dust and other materials (plastic)
- Waste emits pollutant water impacting soil, surface water and groundwater (drinking water problems, food)

Impacts from Dumps



Landfilling

Waste disposal on land – disadvantages:

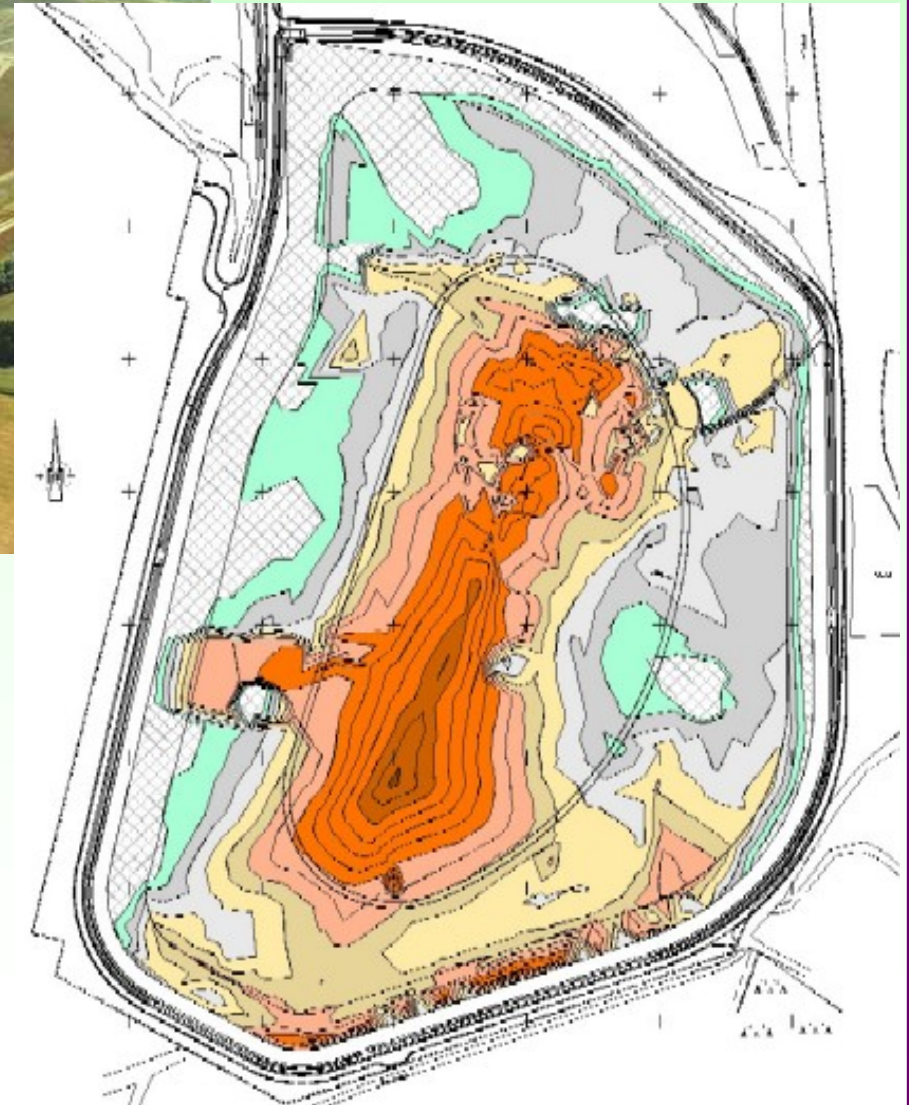
- Can endanger public health + lives (people were killed during accidents at landfill slope instability)
- Can harm environmental quality
- Needs space
- Society doesn't want to accept a landfill (NIMBY)

Landfilling

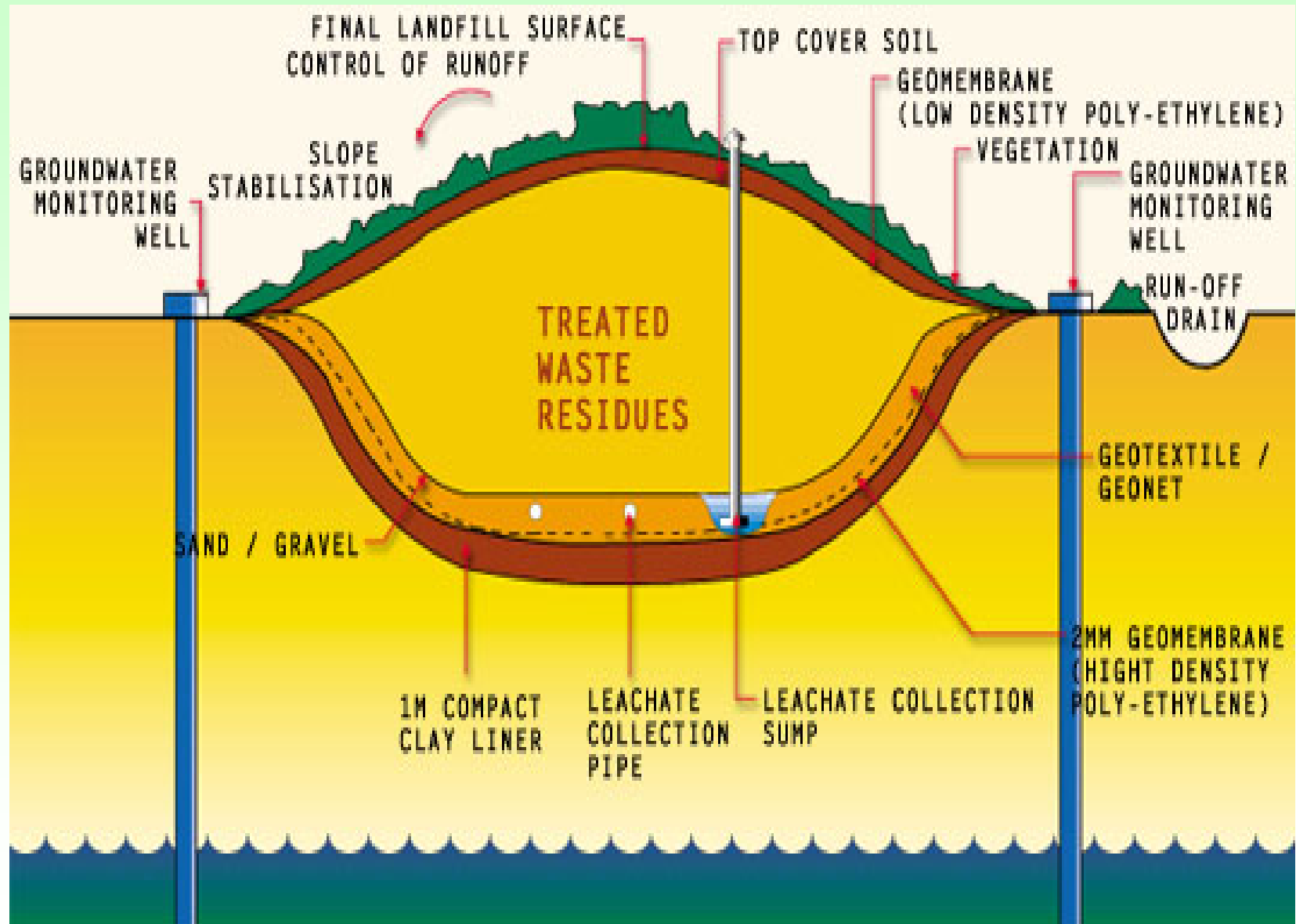
Waste disposal on land – advantages

- It is the final option when other options fail (reuse, recycling, composting)
- Not all waste can be treated otherwise
- Landfills can be environmental safe
- Relatively cheap

Sanitary MSW Landfill



Sanitary MSW Landfill



Sanitary MSW Landfill Site selection

- Large enough to accommodate the SW needs of the area it serves (lifetime, 10 yrs, ...)
- Compatible with the local SW management programs
- Site must protect public health, safety, welfare, & environment
- Minimize adverse impacts on surrounding area

Sanitary MSW Landfill Site selection

- Minimize adverse impacts on property value
- Minimize impacts on traffic flow
- Minimize potential for fire, spill, accidents
- e.g. outside the 100 year flood plain
- Far from airports (birds) - jet airports, other airports
- Provide emergency response plan including notification, evacuation, & containment procedures

Sanitary MSW Landfill Site selection

- Land availability
- Haul distance
- Impact on SW management program
- Soil conditions and topography
- Geological conditions - unstable areas, seismic activity
- Hydrologic conditions (surface and ground water)
- Climatic conditions (rainfall and wind)
- Environmental and ecological conditions
- Public input and concerns
- Potential use after closure

Sanitary MSW Landfill Volume Requirements

- Development of legal regulations
- Changes in per capita generation
- Waste diversion
- Incineration rates, recycling rates, waste separation
- Different cover options

Sanitary MSW Landfill Area Requirements

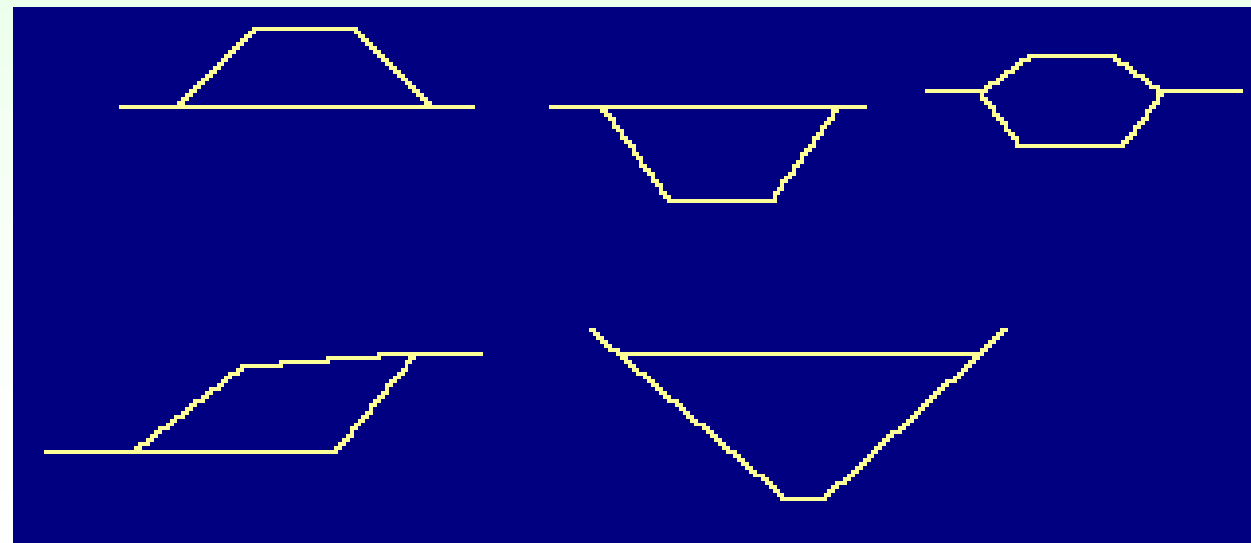
- Leachate treatment plant
- Gas management and treatment
- Access requirements (streets, railroads, ...)
- Economics (height vs. Area of landfill)
- Co-located waste processing (recyclables processing (MRF), special wastes, household, hazardous wastes....)
- Composting of Biowaste
- Administration of the Landfill (Buildings, ...)
- Scalehouse (located at the Entrance)
- Stormwater control (ponds, rainwater infiltration, ...)
- C&D debris recycling and disposal

Sanitary MSW Landfill Design concepts

- Disperse and dilute
 - Pollution accepted to a certain level
- Dry tomb (in most legislation)
 - Isolation of waste inside the landfill body
- Bioreactor
 - Isolation
 - Recirculation of leachate/gas to promote biodegradation and stabilisation
 - Research

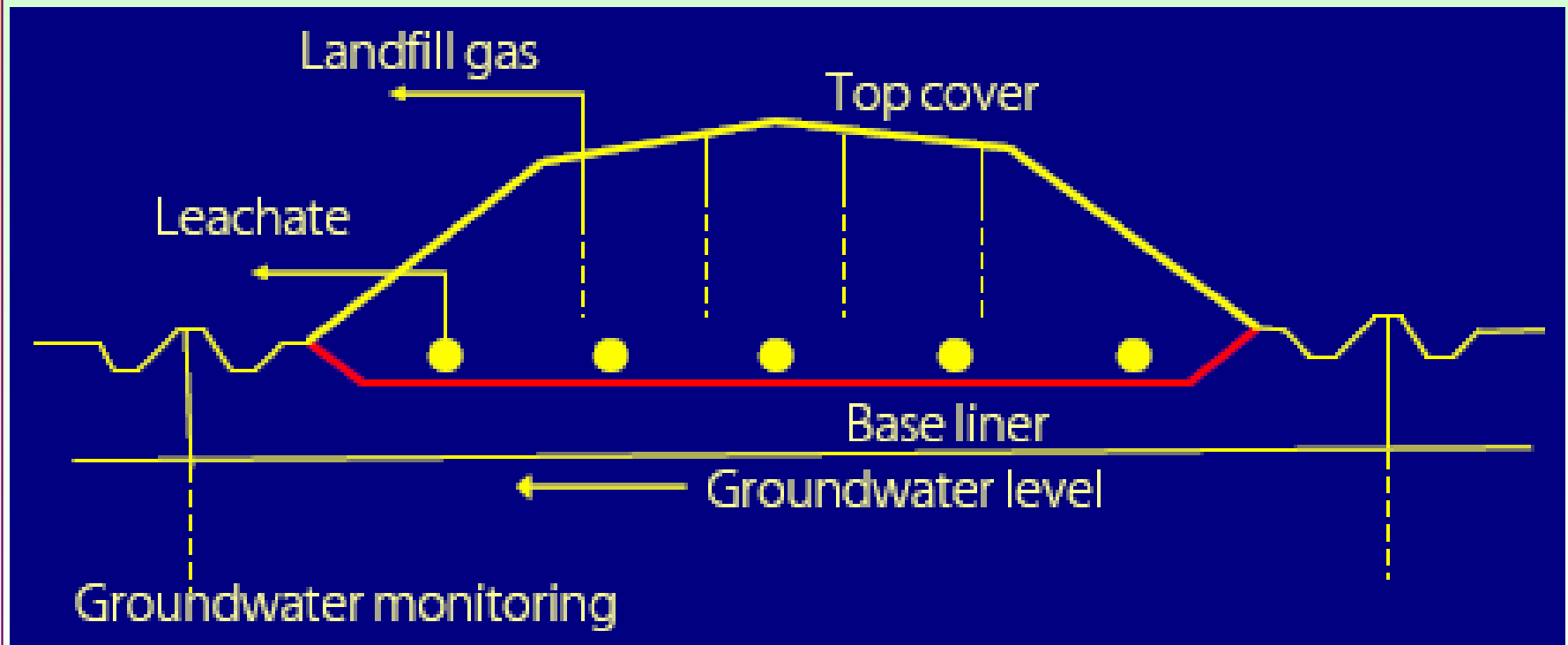
Sanitary MSW Landfill Design concepts

- Design a shape for the landfill that is acceptable to the public (hide/keep distance)
- Limit impact by limiting transport of pollutants (construct liners/cover waste)
- Think of future use after closure (recreation?)
- The shape of the area has major impact on the design of the landfill



Sanitary MSW Landfill Design concepts

Dry tomb (schematic cross section)



Sanitary MSW Landfill Design process

- Environmental impact statement
- Permitting procedure
- Detailed design and tender documents
- Construction
- Landfilling plan
- (Optional) extensions of the landfill
- Design of final cap
- After-care of the landfill