



BATTELLE

LANDFILL CONSTRUCTION AND OPERATIONS WORKSHOP

LANDFILL CONSTRUCTION AND OPERATIONS WORKSHOP

No.	Module	Presenter
1	Importance of Proper Landfill Management	P. Ruesch
2	Landfill Construction Part I	M. Elizondo
3	Landfill Construction Part II	J. Davila
4	Landfill Operations Part I	M. Elizondo
5	Landfill Operations Part II	M. Elizondo
6	LFG Basics and GCCS	J. Davila
7	LFG Utilization Technologies	J. Davila
8	Open Dump Closure	P. Ruesch

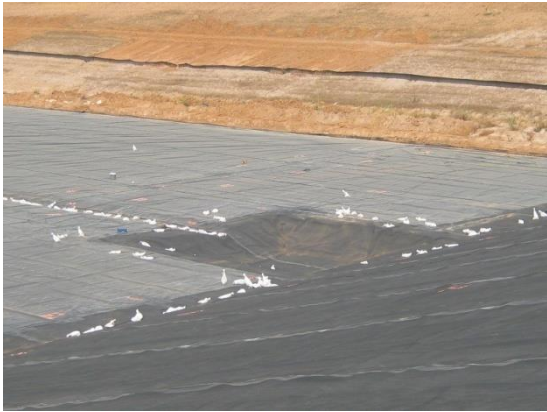


Module No. 3 Landfill Construction Part II

Jose Luis Davila, Consultant



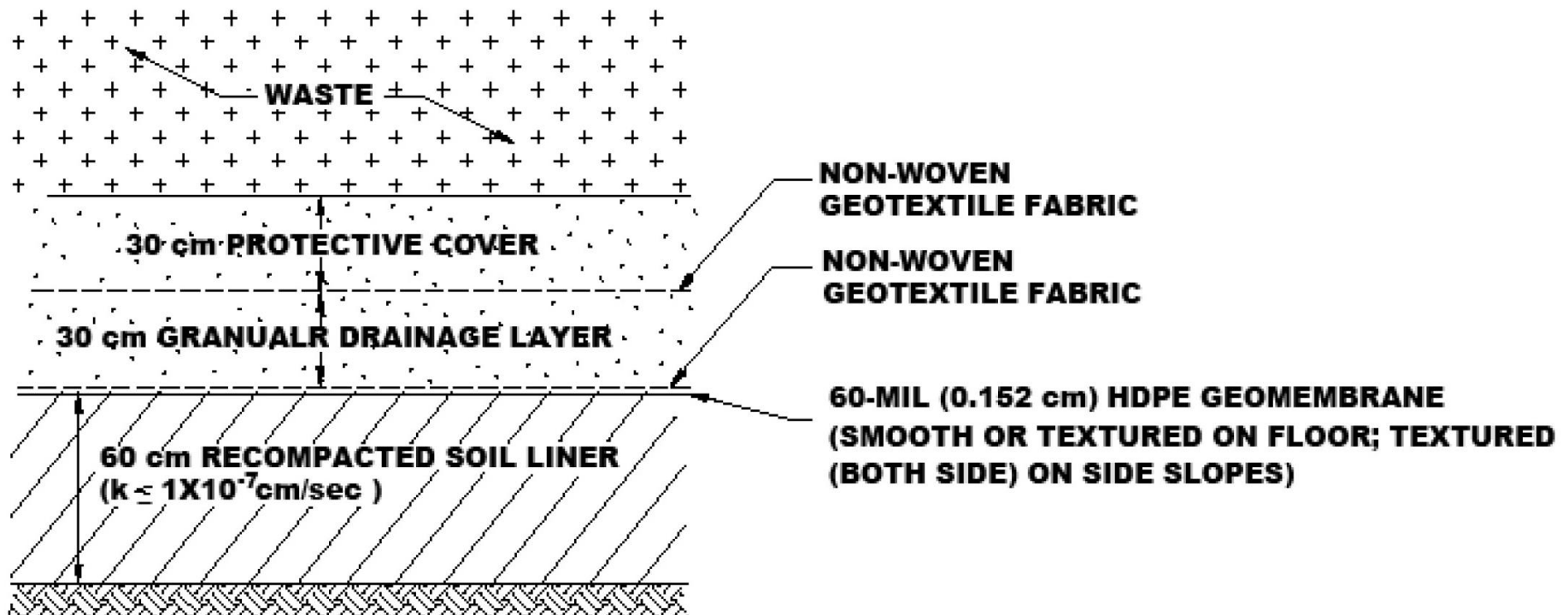
Leachate Collection System



Leachate Collection System

- Purpose is to drain and control the level of leachate in the waste and on top of liner system
- Components:
 - Drainage layer
 - Collection pipes
 - Sumps or low collection points
 - Pump system and risers
 - Collected leachate management

Bottom Liner Components



Drainage Layer

- Installed on top of liner to provide flow by gravity to collection trenches and pipes
- Materials:
 - Granular (30 cm thickness)
 - Gravel/rock
 - Sand
 - Geonet and geotextile
- Design for a leachate maximum height of 30 cm (1 ft)

Granular Drainage Layer

- Clean soil
- Permeability $\geq 1 \times 10^{-2}$ cm/sec
- $< 5\%$ passing 0.075 mm sieve
- Maximum particle size = 1 cm (3 cm if a geotextile is used over geomembrane)
- Place on top of geomembrane without compaction
- Verify thickness every 500 m²

Granular Drainage Layer



Geonet Drainage Layer

- Tridimensional Polyethylene net
- Provides liquid flow plane
- High conductivity
- Geotextile goes on top of geonet to avoid fine soils clogging geonet
- Must be placed on top of geomembrane
- Ties must be installed every 1.5 m
- Geotextile is sewed

Geonet Drainage Layer



Geonet Sewing



Collection Pipes

- Materials
 - PVC
 - High Density Polyethylene (HDPE)
- Maximum size = 15 cm
- Perforated or slotted
- Must slope towards sump or low point
- Design to prevent collapse or deformation
- Place in trench surrounded by gravel

Collection Pipes



Sumps or Low Collection Points

- Leachate is transported through drainage layer and collection pipes to sumps or low collection points
- Filled with gravel
- Covered with extra layer of geotextile
- Typical size = 3m x 3m x 1m in depth (square with the bottom) or in “V”
- Leachate is extracted from the sump using electric or pneumatic pumps using a riser

Sumps or Low Collection Points



Leachate Collection System

- Leachate must be pumped from the sump to:
 - Leachate storage or evaporation ponds
 - Leachate storage tanks
 - Leachate treatment plant
 - Transported to off-site treatment
 - Recirculation system
- LFG condensate can be combined with leachate

Pump System and Riser



Leachate Storage or Evaporation Ponds



Leachate Storage Tanks



Leachate Treatment Ponds



Cell Construction and Monitoring Well Documentation

Cell Construction Documentation

- Quality assurance test must be documented in construction report
- Final report documents full construction process
 - Liner evaluation report

Groundwater Monitoring Wells

- Groundwater monitoring wells provide samples of groundwater at location of well
- Samples are analyzed for environmental impact indicators
- Groundwater wells typically are located at site perimeter
 - Downstream – every 250 m
 - Upstream - every 500 m

Groundwater Monitoring Wells

- 4Need samples to establish a baseline
 - 1 sample quarterly
- Detection monitoring
 - 1 sample every 6 months
- Evaluation monitoring start when results of a detection monitoring indicate impact
 - Triggers collection of samples and lab analysis for list of expanded constituents
- For more information see:
 - <https://www.epa.gov/landfills/requirements-municipal-solid-waste-landfills-mswlfs#groundwater>
 - <https://www.ecfr.gov/cgi-bin/text-idx?SID=601815df286127bc71fa686dfff13bc4&mc=true&node=sp40.25.258.e&rgn=div6>

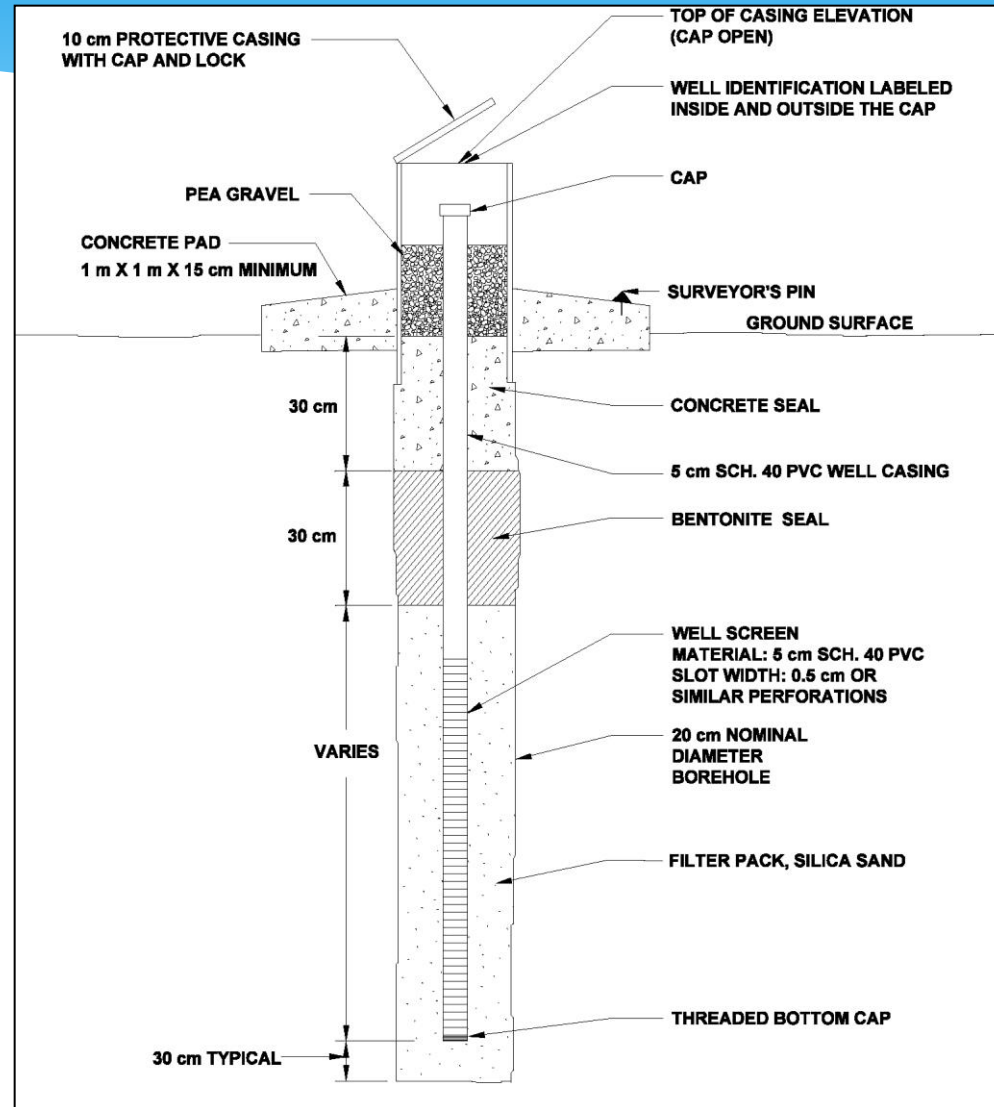
Groundwater Monitoring Well Construction

- Safety is a priority
- Drilling wells can be dangerous
- Using clean procedures is key
 - Contamination introduced during construction can have adverse long-term effects on water quality
 - Materials must be shipped with protected packaging including
 - Sand, bentonite, and PVC

Groundwater Monitoring Well Construction

- Use threaded PVC pipe (no glue or solvents)
- Lower end of pipe perforated/slotted to permit flow of water
- Length of perforated/slotted pipe typically ~ 3m but can vary
- Well base must be at elevation of landfill bottom
- Below water table
- Space between casing and drilling wall must be filled with sand
- Bentonite installed on top of sand to seal well from surface water
- Concrete base must be placed above bentonite

Groundwater Monitoring Wells



Groundwater Monitoring Wells



LFG Monitoring Probes

- Take atmospheric sample to detect presence of LFG
- Helps assure that methane concentration at site perimeter does not exceed explosivity limits
 - Lower explosivity limit = 5% by volume
 - Upper explosivity limit = 15% by volume
- Typically located around site perimeter every 100 m
- Installation similar to groundwater wells

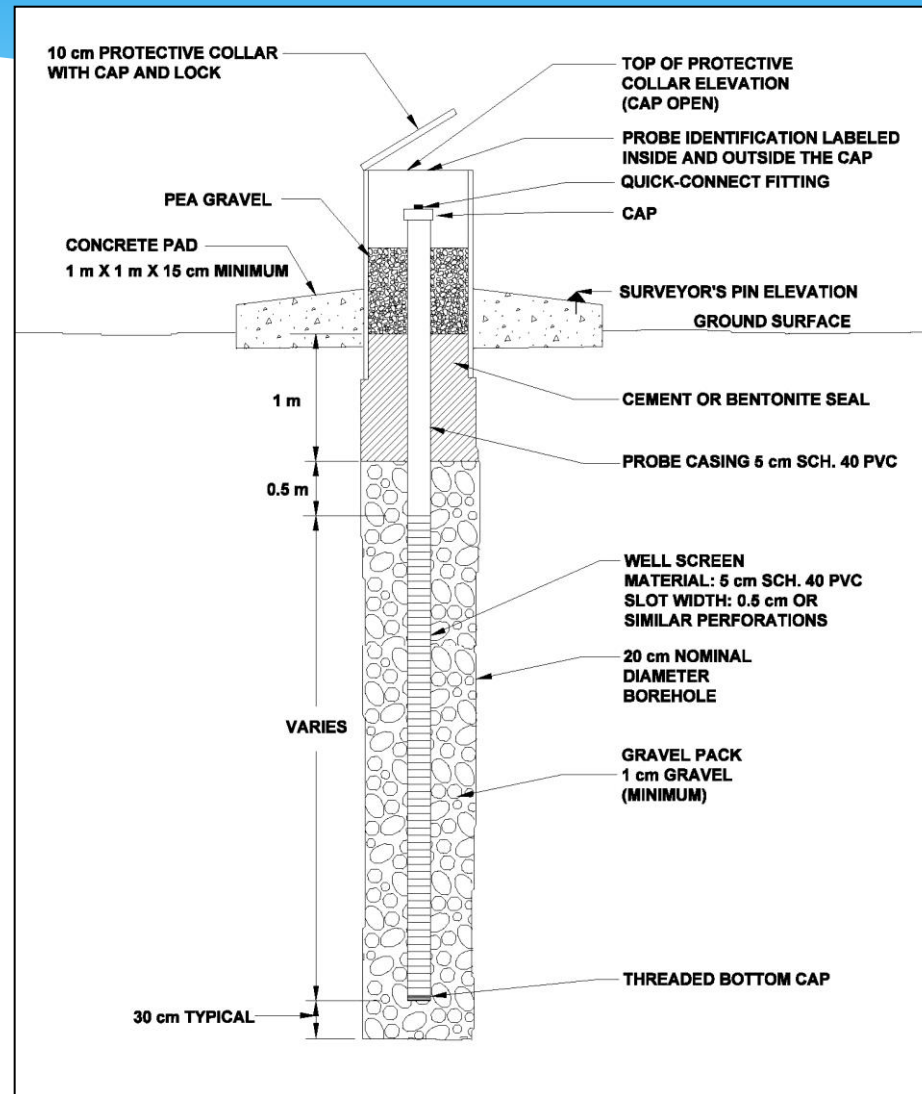
LFG Monitoring Probes Construction

- Safety is a priority
- Drilling wells can be dangerous
- Using clean procedures is key
 - Materials used during construction must be shipped in protected packaging
 - Sand, bentonite, PVC
- Use PVC piping
- Bottom of pipe must be perforated/slotted to permit LFG flow

LFG Monitoring Probes Construction

- Piping consists of 1m of solid pipe above ground surface and 1.5m below ground surface
- Probe base typically 2m below water table or landfill bottom whichever is higher
- Gravel fill between casing and drilling wall
- Bentonite above gravel to seal off the probe and avoid surface water entering well
- Concrete plate above bentonite
- Threaded cap to seal casing w/ quick-connect valve

LFG Monitoring Probes



LFG Monitoring Probes



Thank You

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