# *Leachate Mounding, Collection Systems*

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# *Leachate Collection System (LCS)*

- Unlike the traditional landfill - entire premise is that leachate quantities in bioreactors are significantly increased
- Higher enzyme level for utilization of preferential substrate e.g. carbohydrates
- LCS has to deal with substantial quantities
- Cleanout/refurbishment of LCS is a critical feature

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## *LCS must accommodate*

- Larger volumes of water moving through the refuse
  - Larger diameter
  - Pumping capacity
  - More permeable drainage layer

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## *Elements of LCS System*

- Drainage layer
- Collection piping network
- Leachate removal system
  - Containment system

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## *Example of an LCS System*

- 2 ft of drainage material
- Geotextile
- Geocomposite drainage layer
- Geosynthetic clay liner
- Secondary 60 mil HDPE
- 2 ft of compacted clay
- 0.5 ft of compacted earth fill
- 40 mil HDPE vapor barrier

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## *Example*

- Trenches 12 feet deep & 6 ft. wide
- 4 inch diameter HDPE pipe
- Backfilled with tire chips
- 100 foot spacing
- (Mandeville et al., 2003, “Then Add Water”, Waste Age, June)

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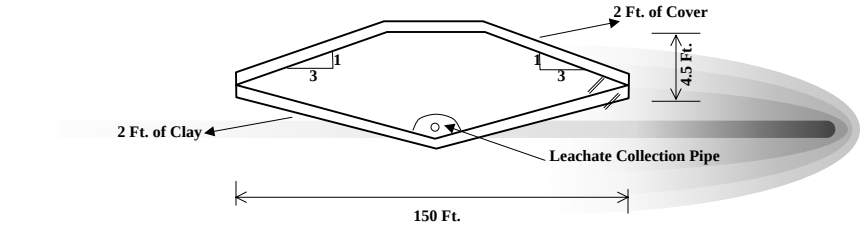
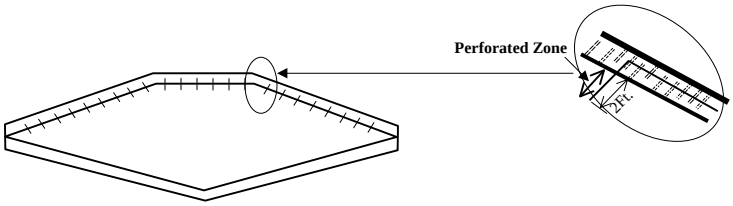



**Cross-section of Bioreactor, Latvia**




**Mechanism of Leachate Injection, Latvia**

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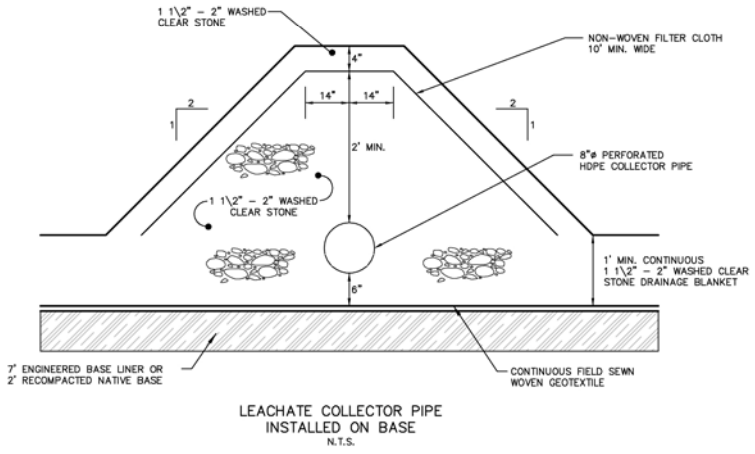


LEACHATE COLLECTOR PIPE
INSTALLED ON BASE
N.T.S.

LEACHATE COLLECTION SYSTEM DETAILS
SOLID WASTE LANDFILL
*Indiana Department of Environmental Management*

**CRA**

9425 (PR) JAN 24/97(W) REV.0 (OH12)

# *LCS Needs Periodic Maintenance*

- Need periodic maintenance
- Bacterial populations can develop very rapidly on granular materials
- Accelerated decomposition occurs early in life when liner systems are most effective

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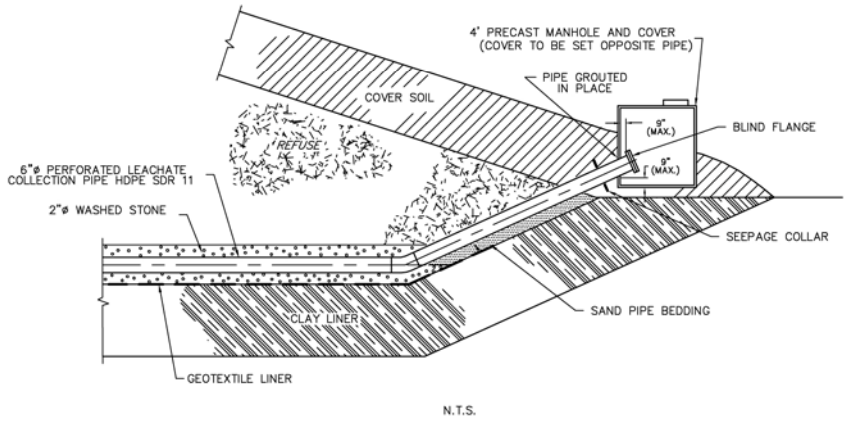


TYPICAL LEACHATE COLLECTION PIPE CLEANOUT
COVER SYSTEMS
LANDFILL DESIGN SEMINARS
*Indiana Department of Environmental Management*

**CRA**

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## *Failure Mechanisms for Leachate Collection System*

- Physical buildup of material in the pipe or drainage layer
- Differential settlement
- Loss of capacity of the drainage pipe

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## *Fouling Mechanisms*

- Biological growth
- Precipitation of calcium carbonate and magnesium carbonate
- Biochemical processes such as Fe(OH)3 and FeS

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## *Incrustation Processes*

- Microorganism colonizations first become attached to a surface and occur in aggregates
- Precipitation of inorganic materials occur on the microorganisms. The inorganic deposits are rich in nutrients and substrate, providing a suitable environment for multiplication of microorganisms
- Development of precipitates into macroscopically recognizable incrustations occurs over a short period (days)
- Once isolated microorganisms become connected, forming a continuous layer ("bio-rock")

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## *Biological Slime Buildup*

- Nutrient limitation is unlikely
- Microorganisms
- Organics
- Acidic environment

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- Channeling through the refuse may be caused by the presence of the instrumentation and/or via gas collection wells
- Different spacings for large bioreactors

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## *LCS*

- Need redundancy in collection in case of failure
- Design for cleanouts
- Compactive effort influences vertical migration of leachate and potential for leachate breakout
- May be possible to reduce capital costs for landfill since cap doesn't have to minimize entry of moisture through the cap

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# *Spacing of Leachate Collection Tiles*

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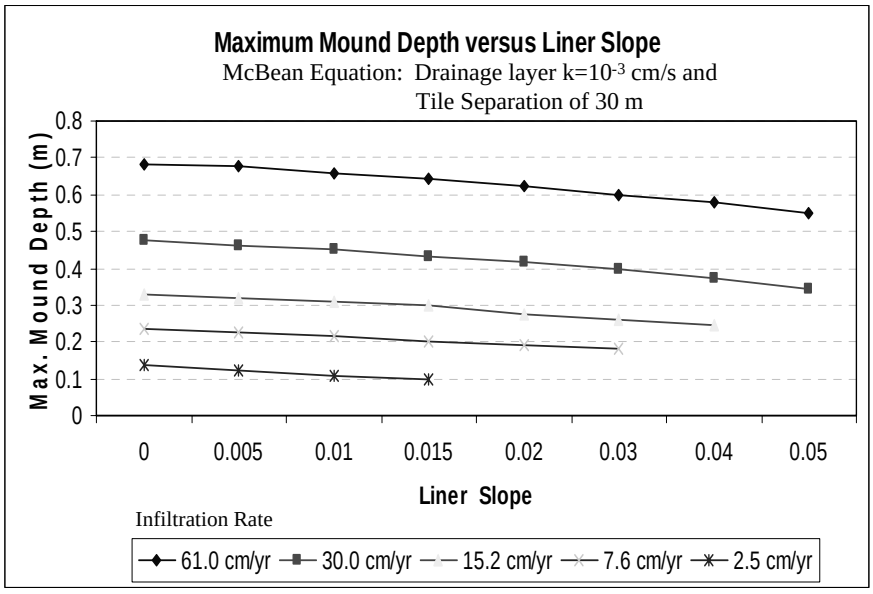


Tile separation 30 m

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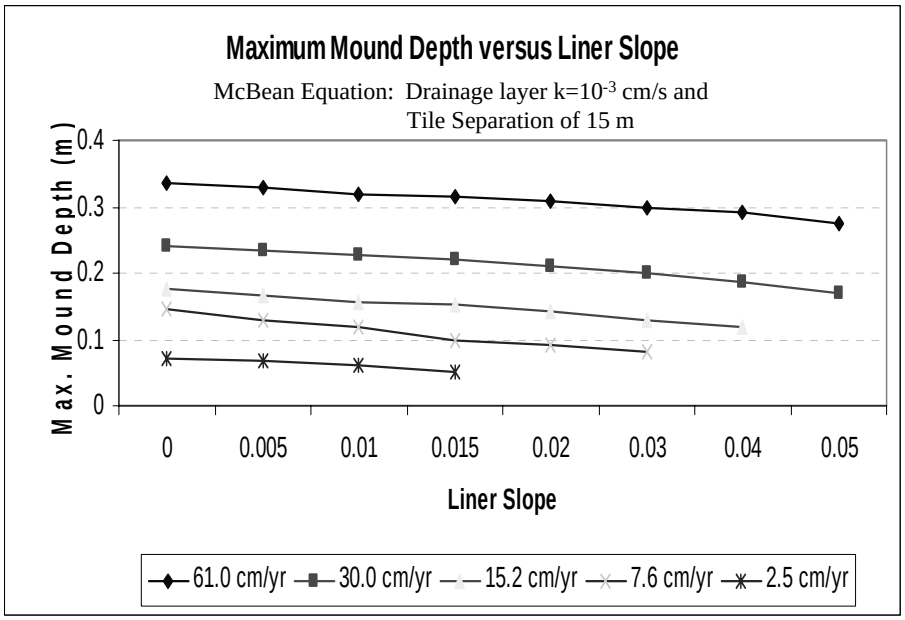


Tile Spacing 15 m

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# *Need for Redundancy in LCS*

- Failure implications are huge
- Secondary leachate collection system (e.g. in event of failure of pipe through clogging, via the drainage matrix)

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- One of the objectives is to treat the leachate (achieve reductions in contaminant concentrations)

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# Chemical Inhibitors of Methanogens

| | Inhibition Concentration (mg/L) | |
|---|---|---|
| | Moderate | Strong |
| Metals | | |
| Ca | 2500 | 8000 |
| Mg | 1000 | 3000 |
| Na | 3500 | 8000 |
| K | 2500 | 12000 |
| Fe | - | NTSL |
| Al | - | NTSL |
| Cu | - | 2 |
| Zn | - | 2 |
| Ni | - | 2 |
| Cr iv | - | NTSL |
| | | |
| Ammonia | 2000 | 3000 |
| Sufude | - | 200 |
| VFA (acetate) | - | 9000 |
| | | |
| | NTSL = Nontoxic to solubility limit | |

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- Leachate collection systems also have the capability to collect significant quantities of biogas
- Potential for fires in bioreactors
- May significantly increase the practicality of gas to energy utilization

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*Questions?*

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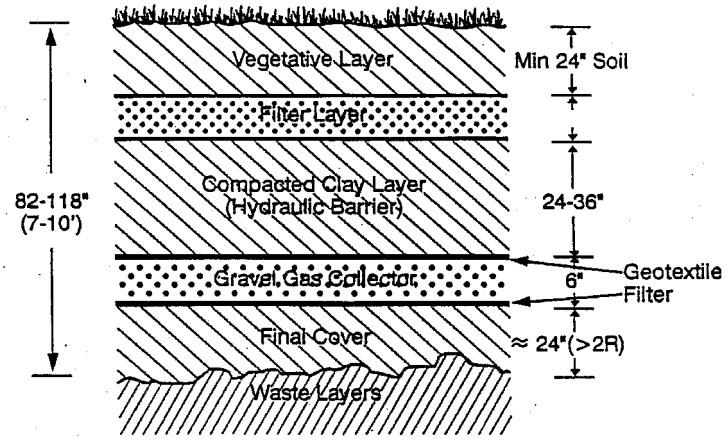
Vegetative Layer
Min 24" Soil
Filter Layer
Compacted Clay Layer
(Hydraulic Barrier)
82-118"
(7-10')
24-36"
Gravel Gas Collector
6"
Geotextile
Filter
Final Cover
≈ 24"(>2R)
Waste Layers

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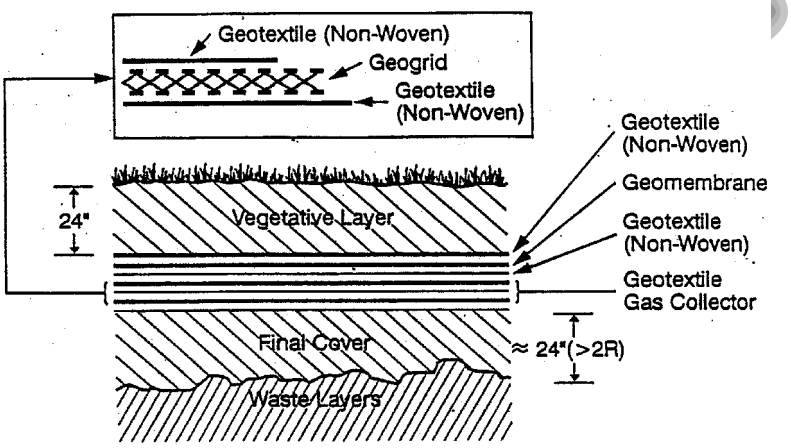
Geotextile (Non-Woven)
Geogrid
Geotextile
(Non-Woven)
Geotextile
(Non-Woven)
Geomembrane
24"
Vegetative Layer
Geotextile
(Non-Woven)
Geotextile
Gas Collector
Final Cover
≈ 24"(>2R)
Waste Layers

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