

# **The Natural End of Landfill Leachate**

*Peter Garrett, PhD*

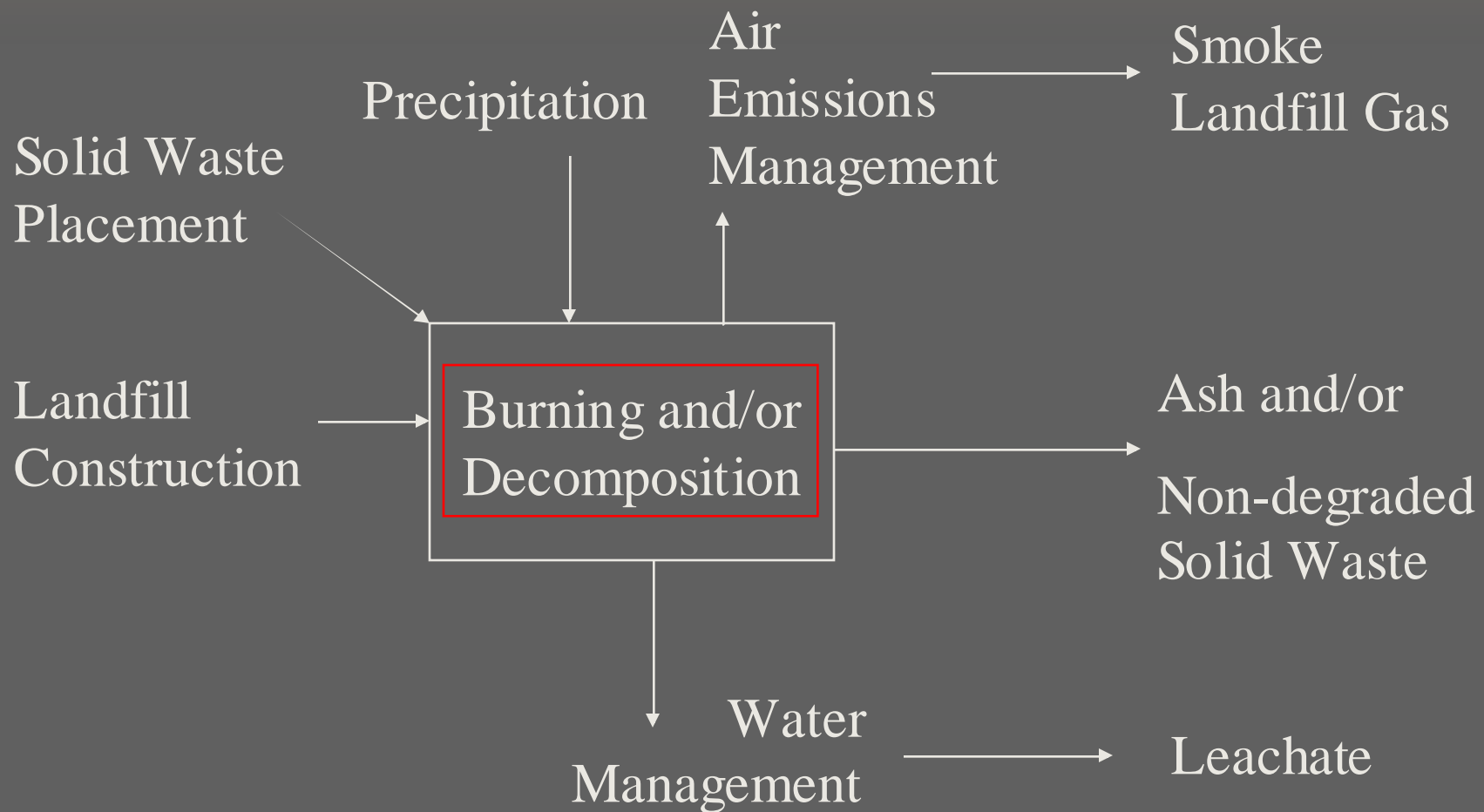
*Emery & Garrett Groundwater, Inc.*

*Waterville, Maine*

# Summary

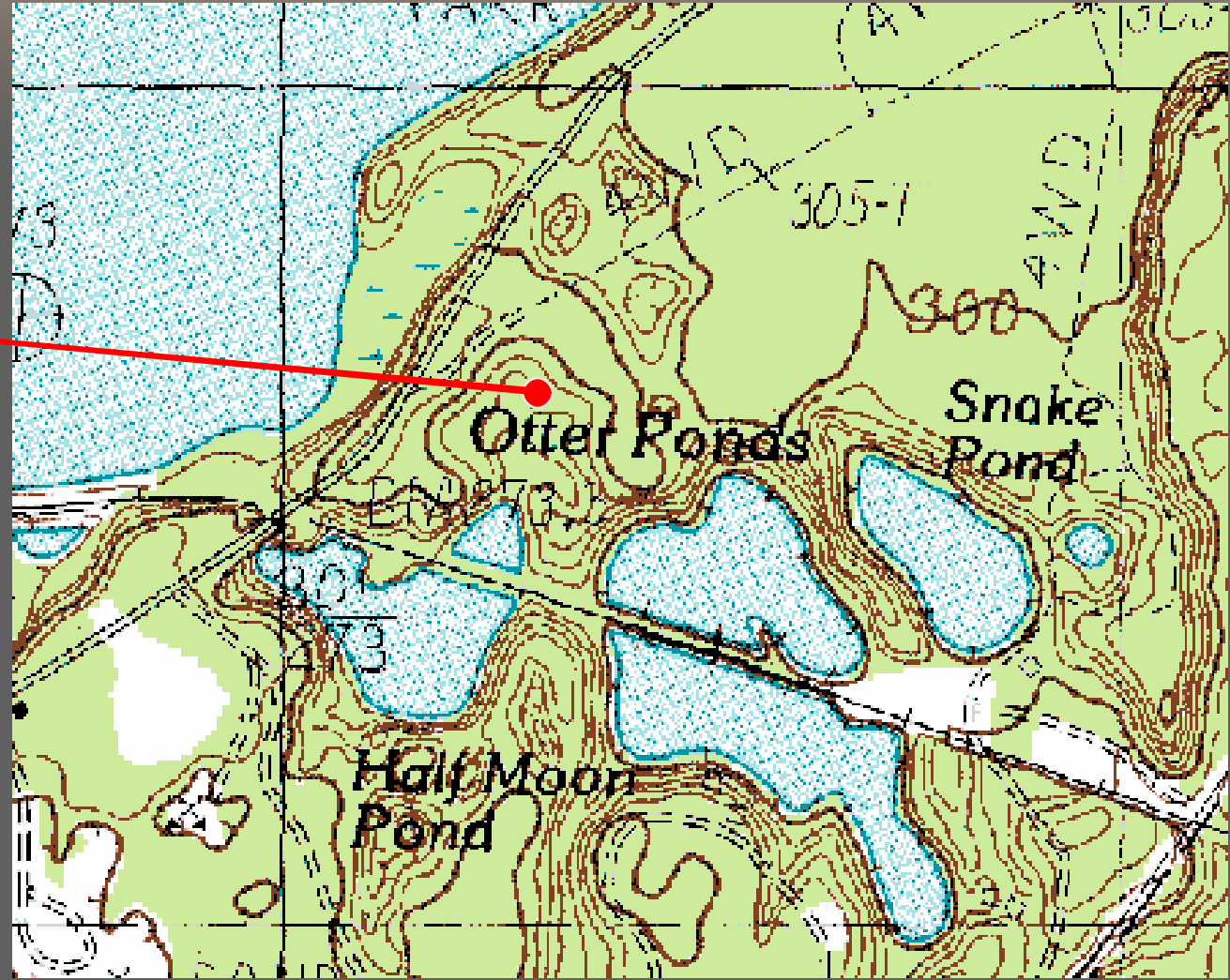
- ⇒ Landfill leachate generation is limited in time
- ⇒ Soluble materials are dissolved out
- ⇒ Organic materials decompose
  
- ⇒ However...
- ⇒ Chlorinated and non-chlorinated hydrocarbons can persist.

# Mass Balance for Landfills



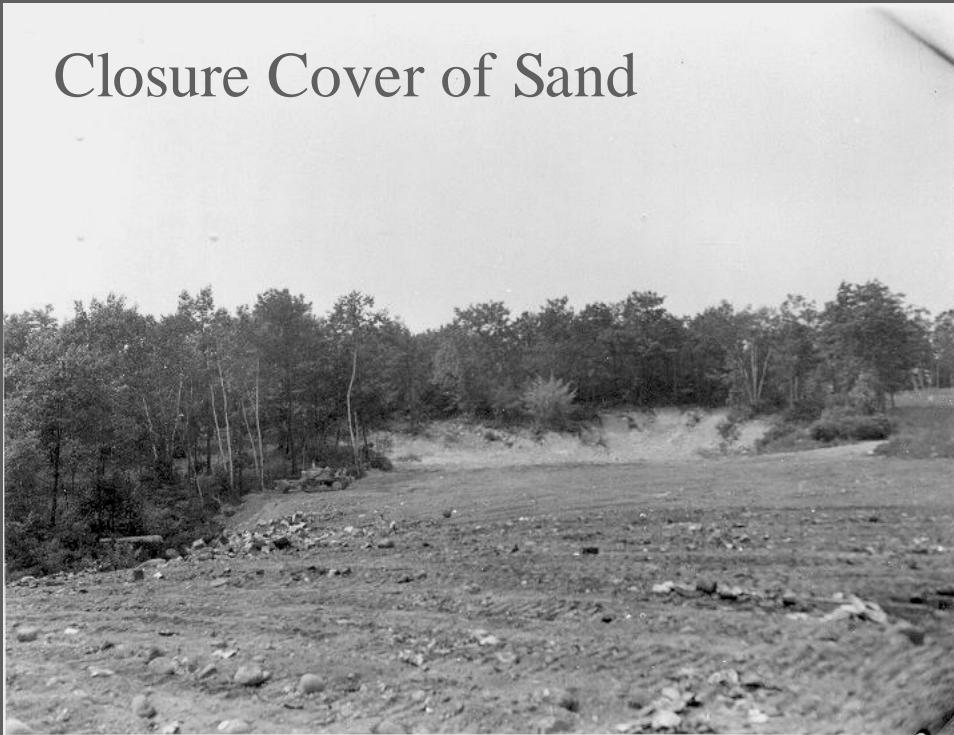
# Case #1

The Site

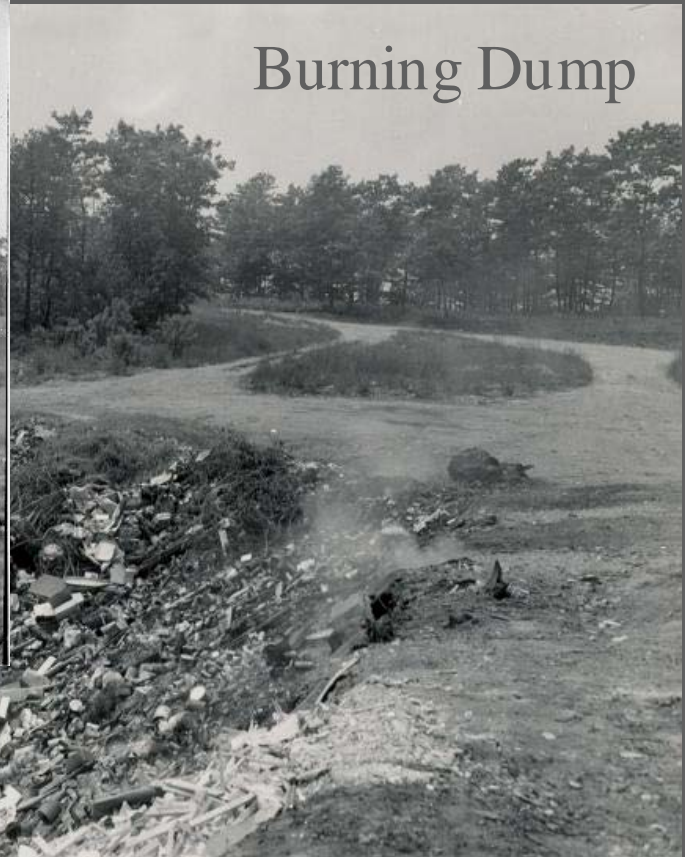


# The Dump

Closure Cover of Sand



Burning Dump



Dump closed 1961

# Aerial, 2003

Dump Site



# Underground

2-3 feet of Sandy Cover Material

A layer 3-9 feet thick of:

- Ash,
- Bottles,
- Cans and metal fragments,
- Brick, concrete and ceramic

Native fine to coarse sand and cobbles



# Water Quality Results

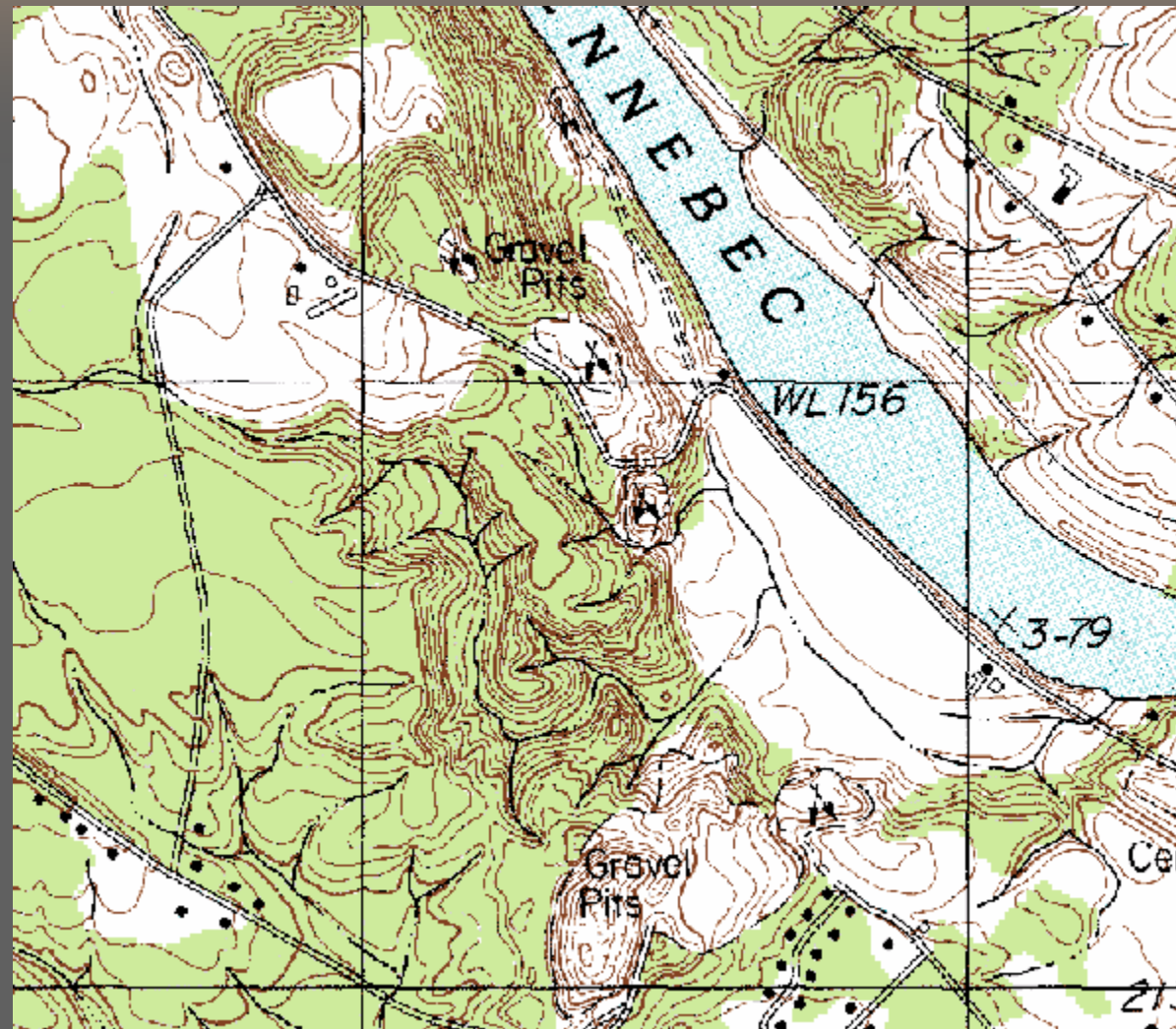
Water Quality in Downgradient Monitoring Wells is Indistinguishable from Upgradient Well.

- COD, BOD, TOC are below detection
- TDS 32-50 mg/L
- No volatile Organics
- No Photo-ionization Detections
- No odor

# Case #2, Topo- graphic

Note:

- Esker
- Outwash
- Till/bedrock
- Floodplain



# Case #2, Aerial View



# On the ground



Dump was closed 1975



# Underground

Grey-pink Colored  
Ash, with  
Bottles,  
Cans,  
Leather Scraps  
and  
Bricks  
in Sand  
and Gravel



# Water Quality Results

Monitoring Wells through the dump site show:

- No parameters above MCL or MEG
- COD, BOD and TOC at or below detection
- Total Dissolved Solids <150 mg/L
- Chloride about <10 mg/L
- No Volatile Organics
- No odor

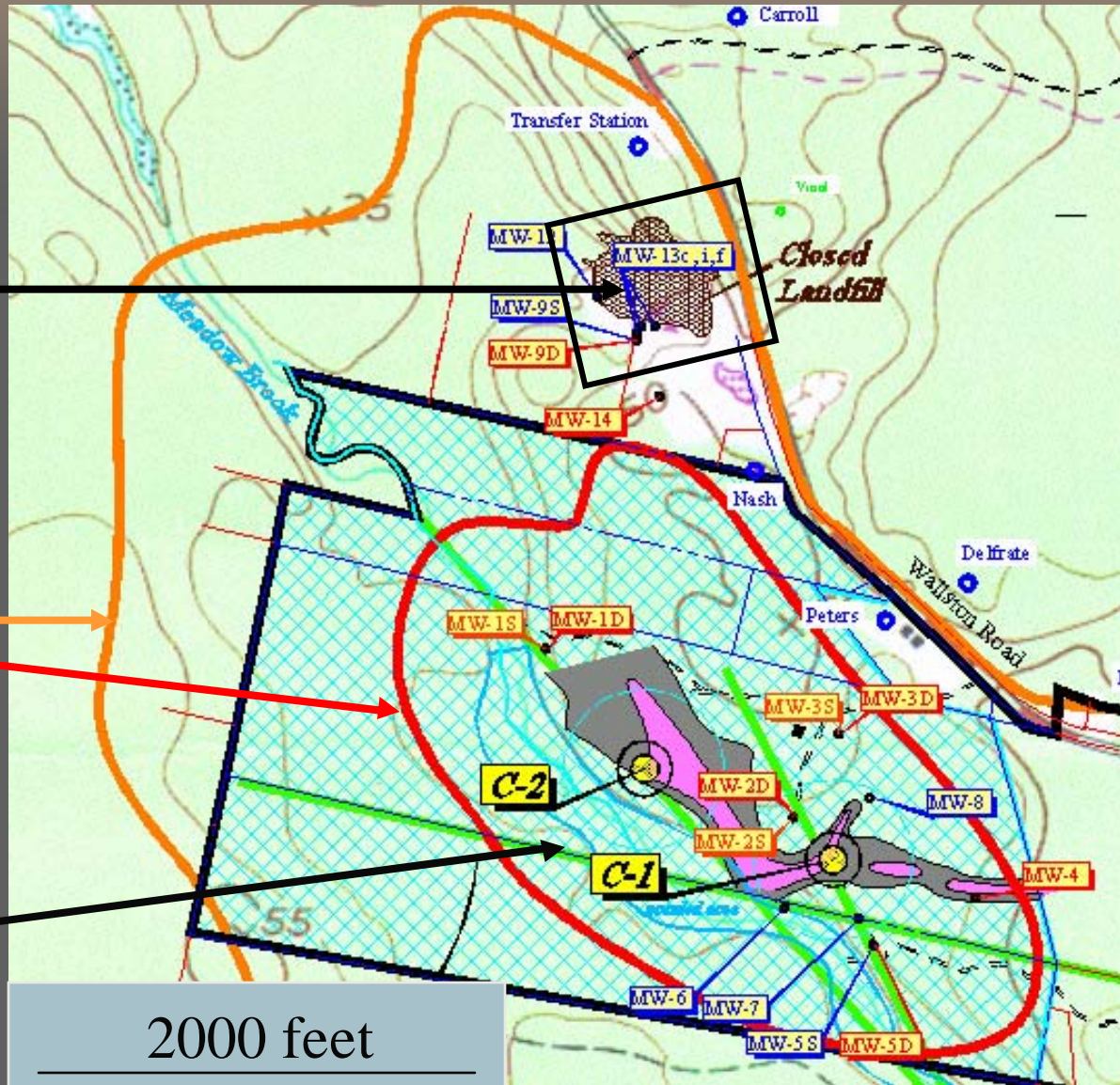
No reported problems with  
Water Supply Production Well

# Case #3

Landfill  
(Closed 1990)

Wellhead  
Protection  
Areas

Public Supply  
Wells



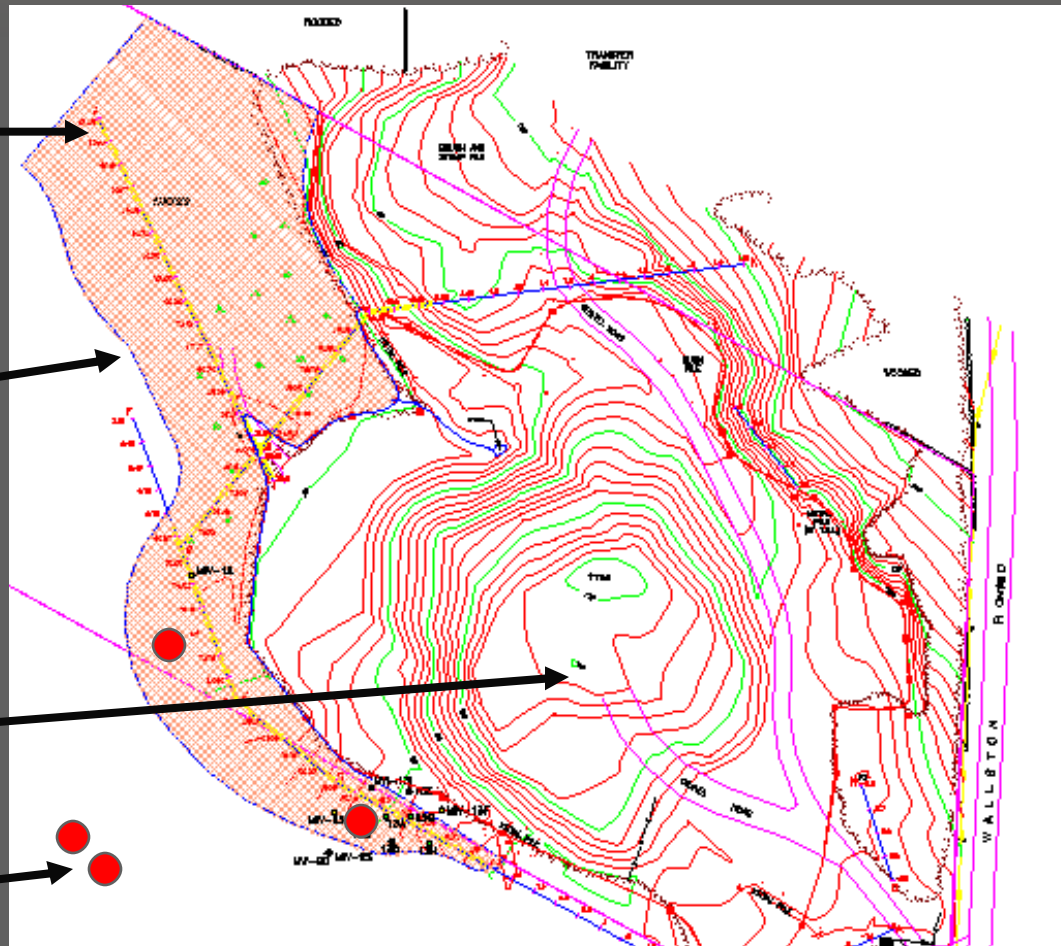
# 1994 Landfill Resistivity Survey

Resistivity Lines

Resistivity-Defined Plume

Landfill Mound

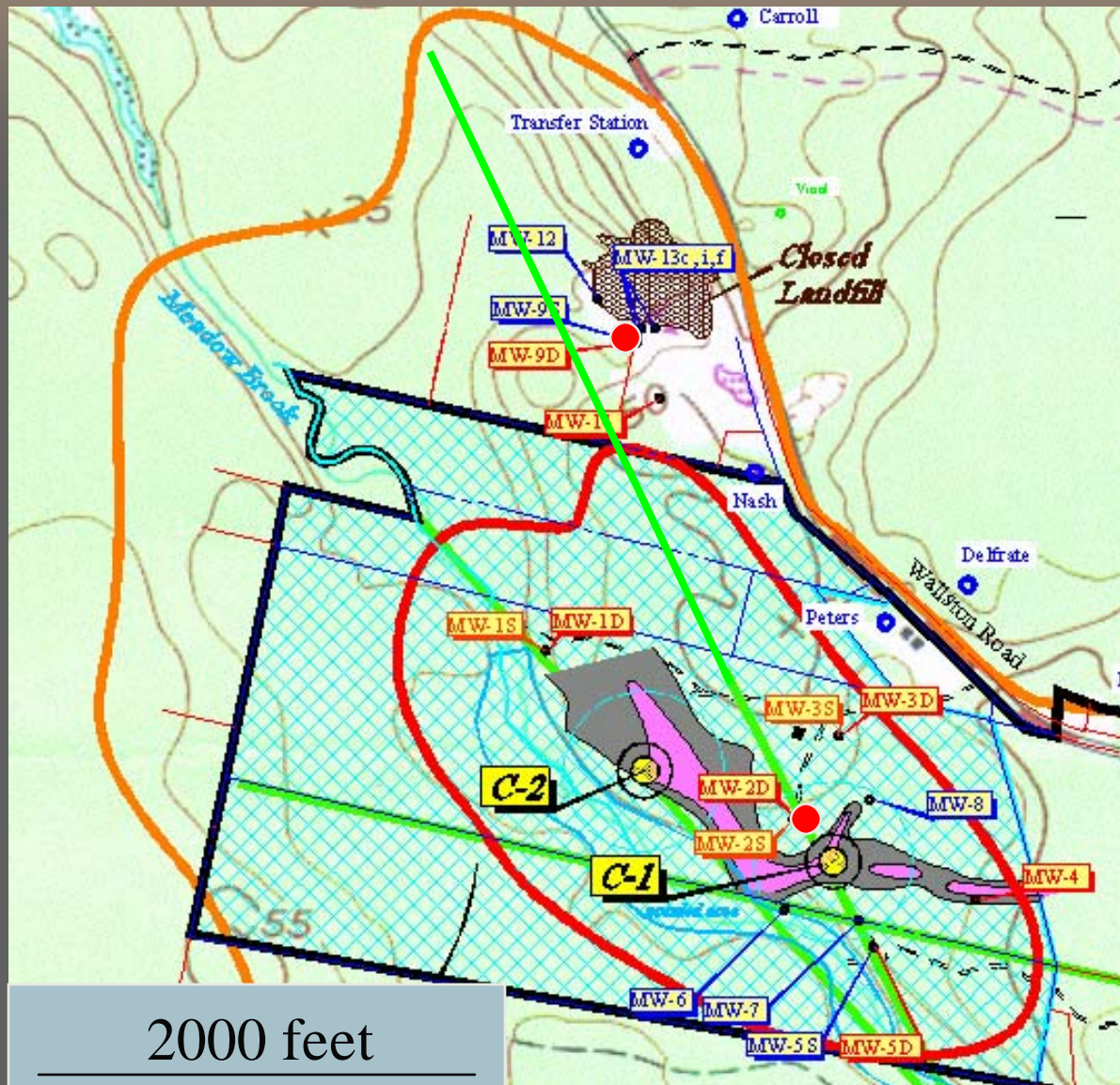
Monitoring Wells



# Toe of Landfill, 2006



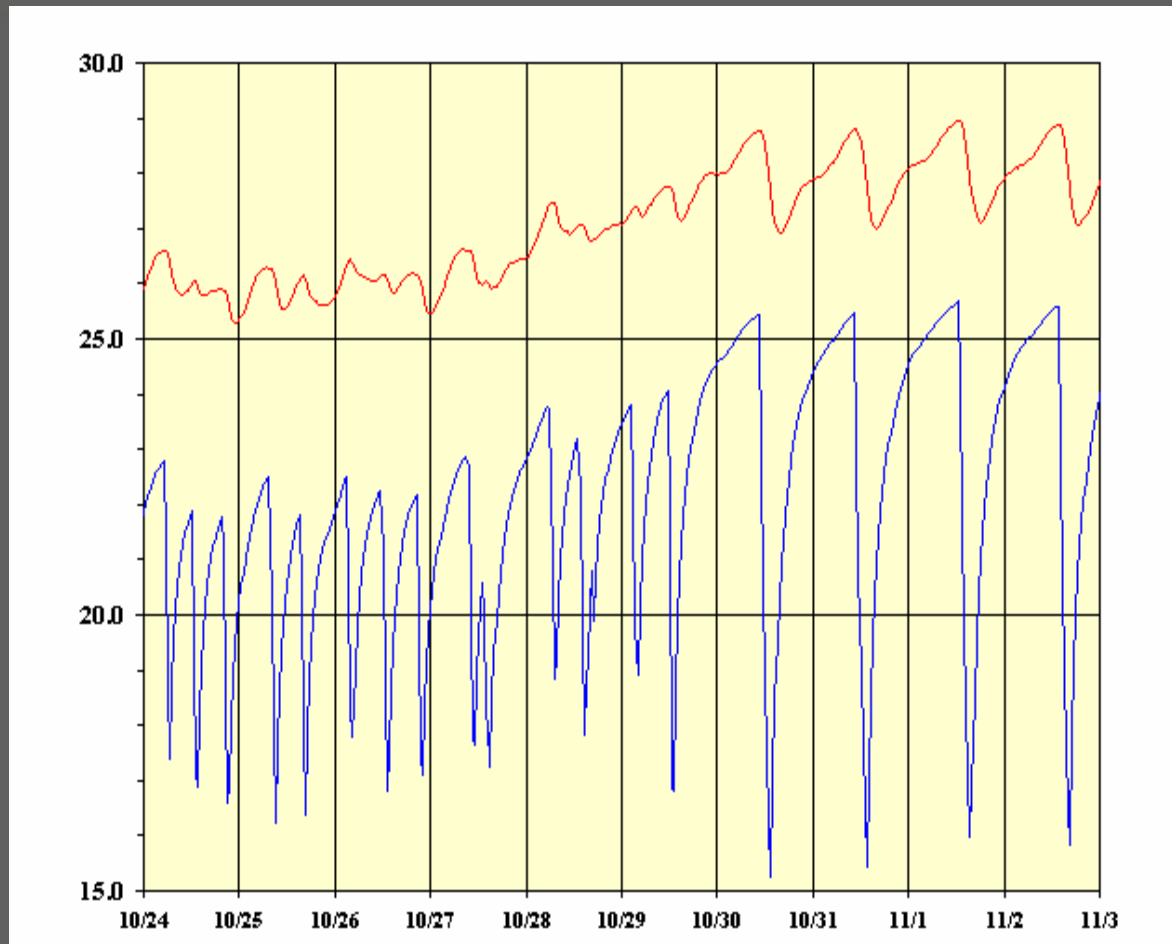
Could  
there  
be a  
Problem ?



# Hydrological Results

Deep Landfill  
Monitoring  
Well

Deep Wellfield  
Monitoring  
Well

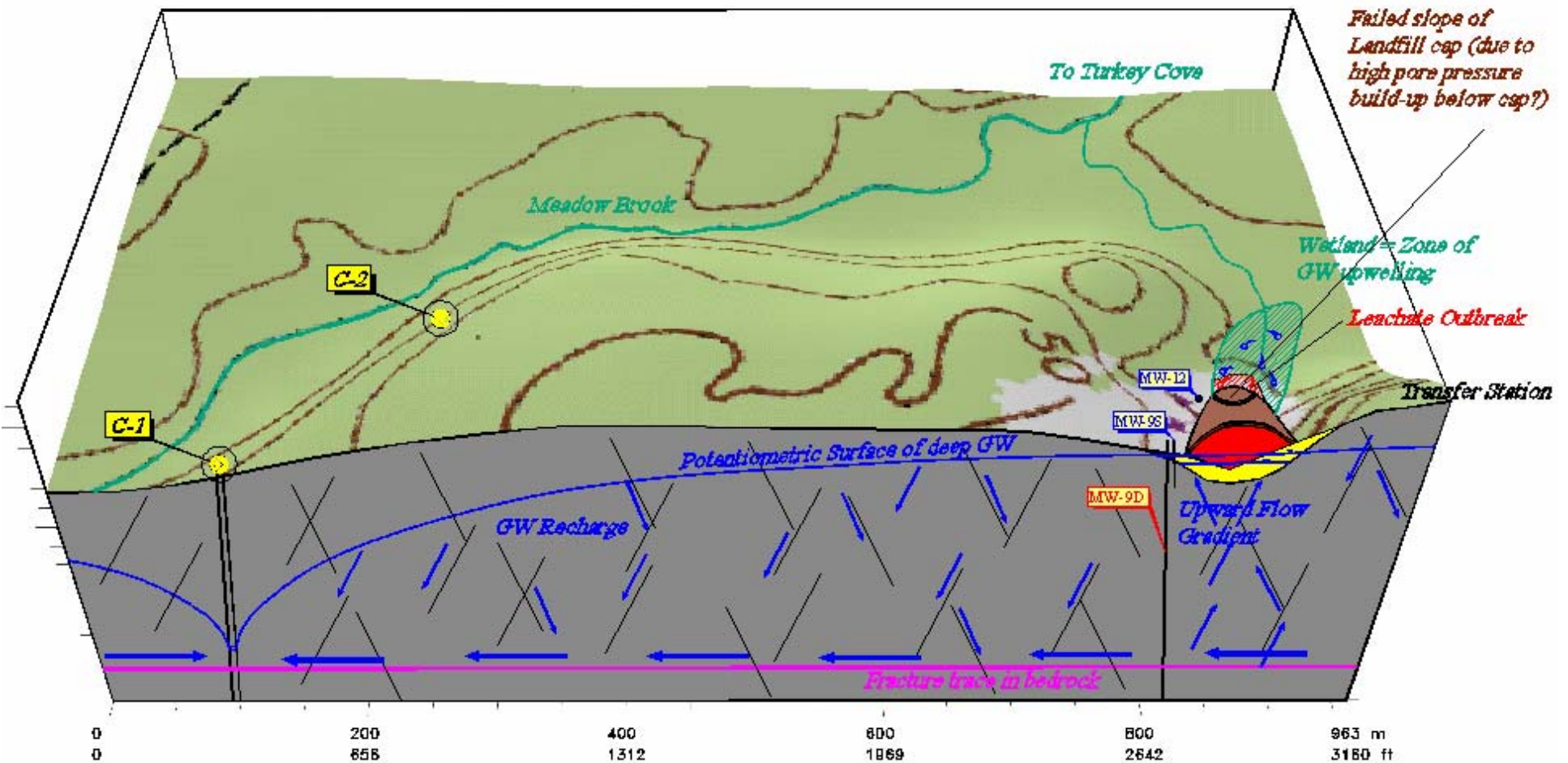


# Water Quality Results

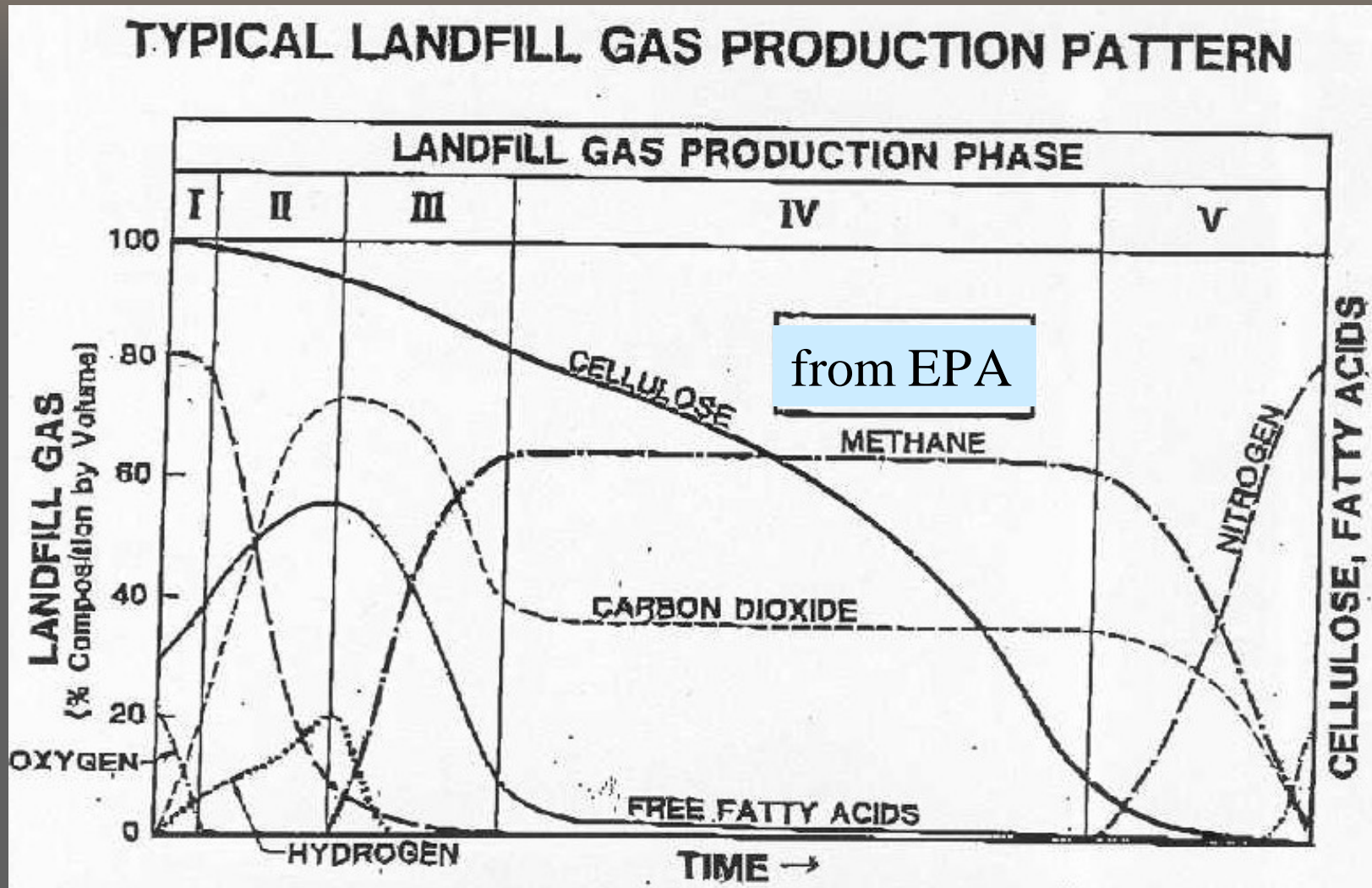
Leachate has:

- No parameters above MCL or MEG, except Fe & Mn
- Iron sheen on water surface
- COD = 16 mg/L, TOC = 3 mg/L
- Total Dissolved Solids 330 mg/L
- Chloride about 34 mg/L
- Dissolved oxygen 3 mg/L
- No Volatile Organics
- No odor

# Schematic Hydrogeology



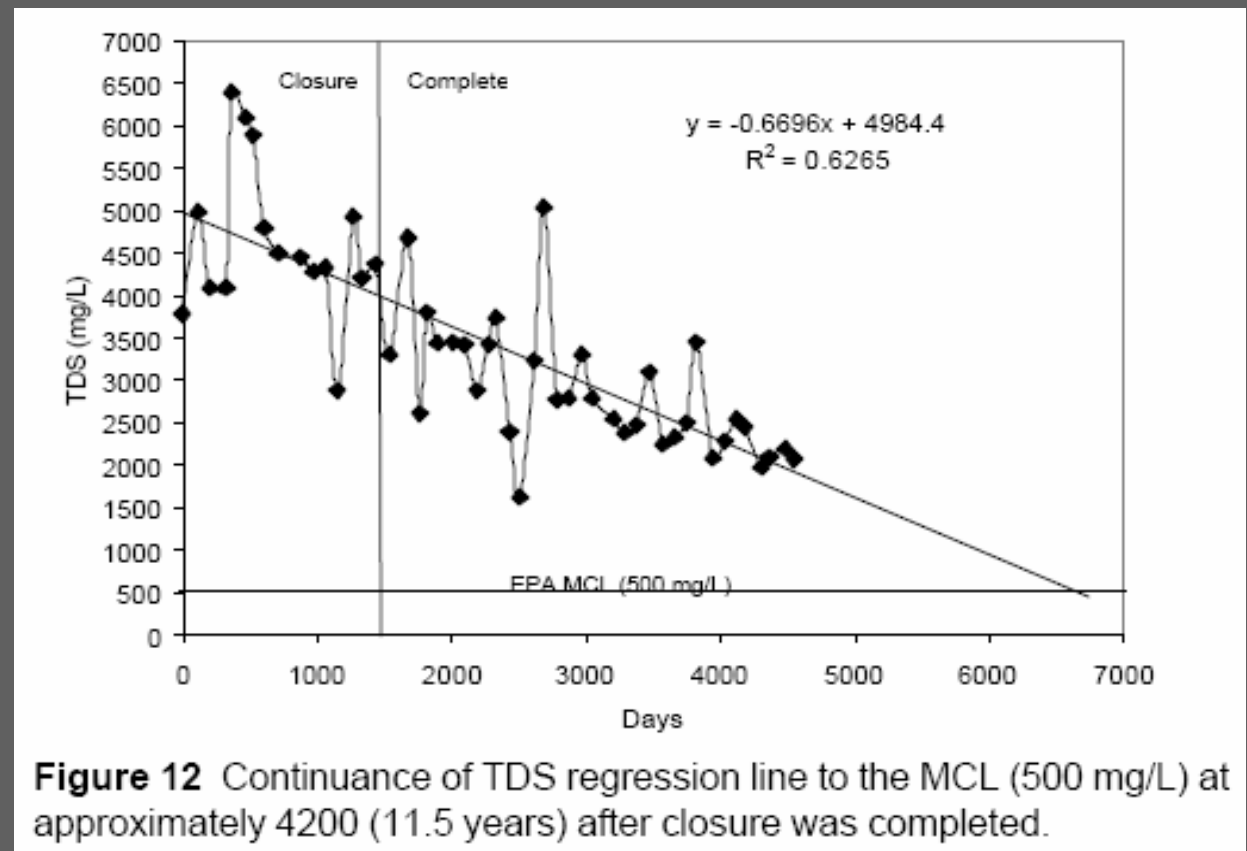
# Evolution of Landfill Gases over Time



# The Natural End of Landfill Leachate

Decrease in  
TDS over  
Time.

Example:  
Lined  
Landfill  
in Florida

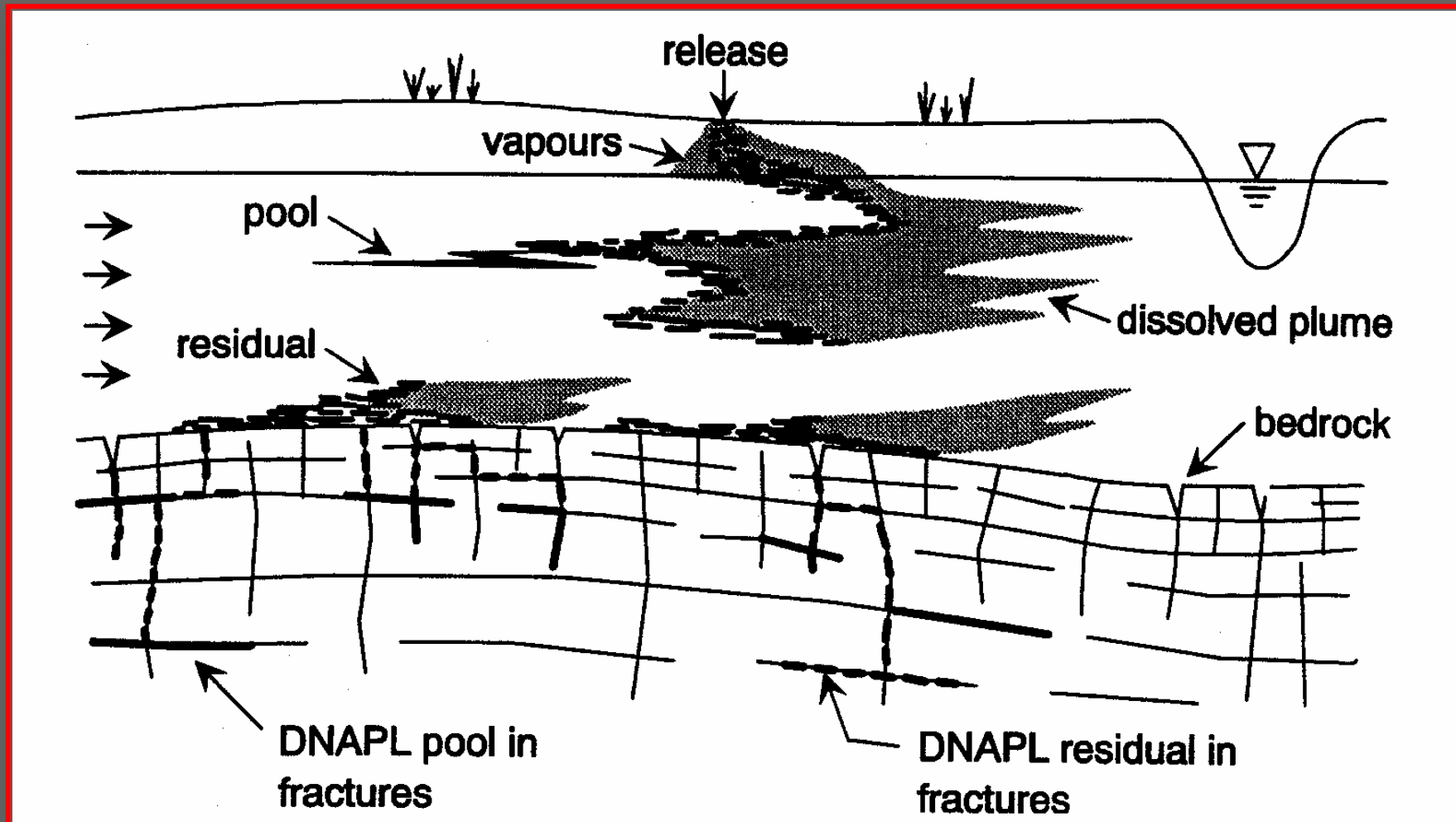


# Beware Chlorinated Solvents

Chlorinated hydrocarbons:

- ⇒ Adsorb to sediment surfaces
- ⇒ Biodegrade slowly, mostly in anoxic conditions
- ⇒ Are slightly soluble, and toxic
- ⇒ Sink through aquifers to lowest level

# Solvents sink to lowest level



# Petroleum Hydrocarbons

Hydrocarbons without chlorine:

- ⇒ Also adsorb onto sediment surfaces
- ⇒ Biodegrade in oxygenated conditions
- ⇒ Can be persistent if buried in landfills in anoxic conditions

# Conclusions

Burning dumps left little but ash.

Landfilled material exposed to water will degrade in a matter of years or a few decades.

At the end of a landfill's life there is:

- ⇒ No more leachate
- ⇒ No more methane
- ⇒ Just solid waste that cannot be degraded.

# Conclusions for Groundwater Exploration

- ⇒ If you find a promising test well site near another site marked "old town dump", don't give up. It might have come to...
- ⇒ the Natural End of Landfill Leachate.