

**WELCOME!**

**Welcome to DES**

**&**

**to Today's Workshop**

**“Landfills: Things You Never  
Knew You Needed To Know”**

# WHY THIS WORKSHOP?

## Landfills

- Tie together the concepts you learned in Basic Training and other CPD
- Create an understanding of how landfills function and why monitoring and maintenance is so important



# TODAY'S AGENDA

- **Introduction: History and Design of Landfills**
- **Activity**
  - Building a Landfill
  - Debrief
- **Post-Closure Monitoring & Maintenance**
- **Take Away**

# LANDFILLS: HISTORY & DESIGN



JAIME COLBY, PE  
PERMIT ENGINEER

NHDES – WASTE MANAGEMENT DIVISION

# HISTORY: PRE-1960s



*Prior to 1960s:*

- *Open dumps*
- *Burn dumps*

# HISTORY: EARLY LEGISLATION

*Federal legislation in 1960s-70s*

- *Clean Air Act*
- *Solid Waste Act*

*New Hampshire changes*

- *1969-1972 NH Solid Waste Laws & Regulations*
- *1981 Solid Waste Management Act*  
*(currently RSA 149-M)*



# HISTORY: THE RULES

*1982 – SW Rules Adopted*

*1987 – NHDES established*

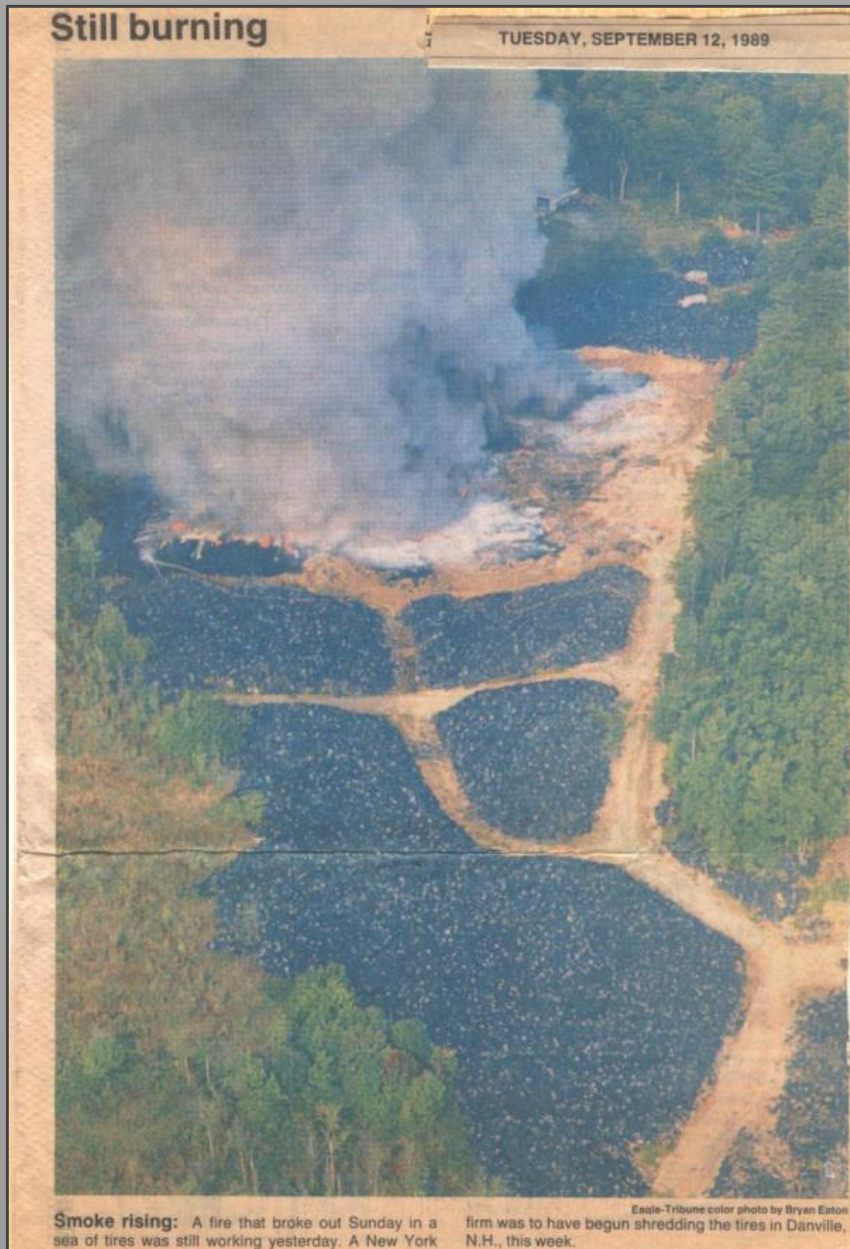
*1991 – Major updates relative to  
Landfills, SWOT added*

*1995 – NH becomes an approved  
state under RCRA Subtitle D*



*Danville, NH Tire Fire of 1984*

# HISTORY: THE RULES



*1997 – Pre-1981 Landfills and Interim Closure Status*

*2003 – “Brady Bill” passed, becomes law  
RSA 149-M:9(XIII)*

*2014 – Readopted w/amendments*

*Danville, NH Tire Fire of 1989*



# HISTORY: THE RULES

*WHY DOES IT MATTER?*



*Concord Municipal Landfill (then)*



*Concord Municipal Landfill (now)*

# LANDFILL DESIGN: THE BASICS

Landfill Gas

Cap

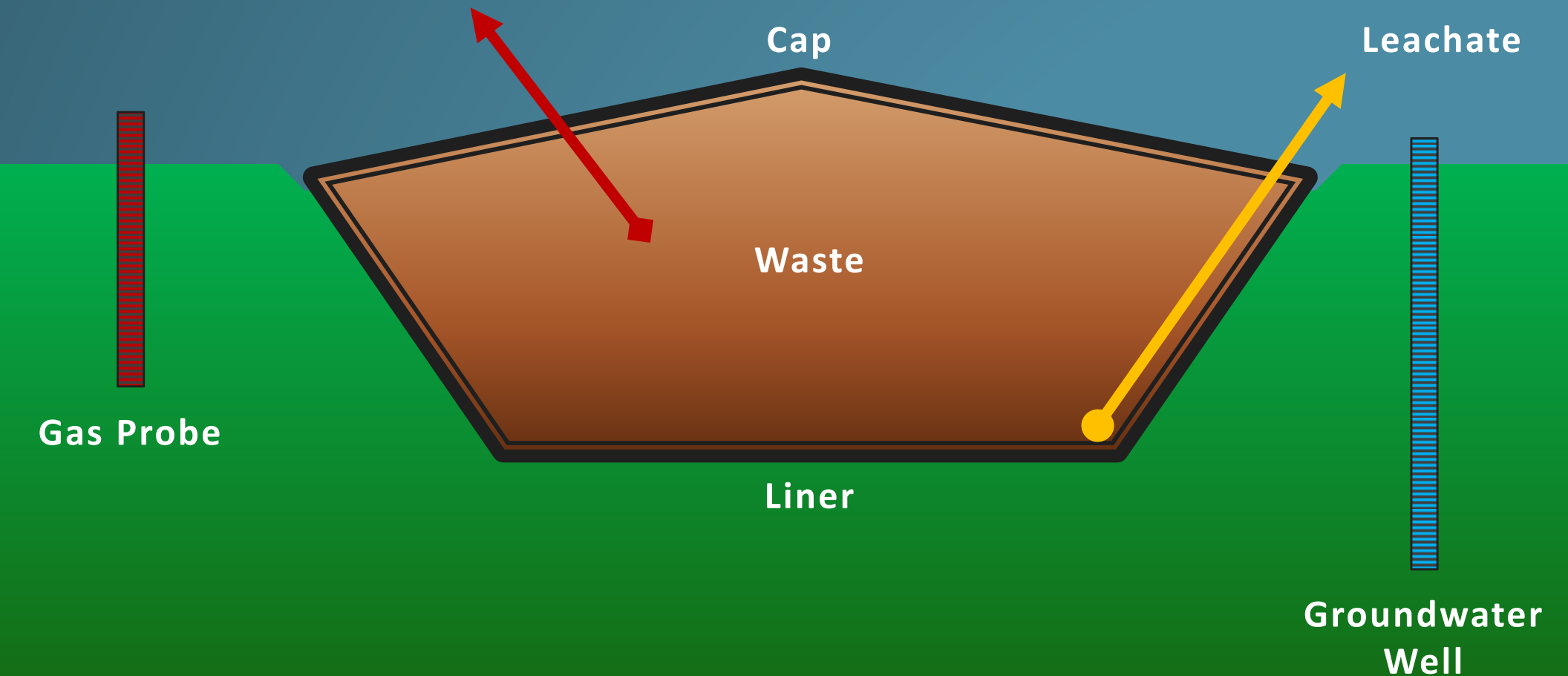
Leachate

Waste

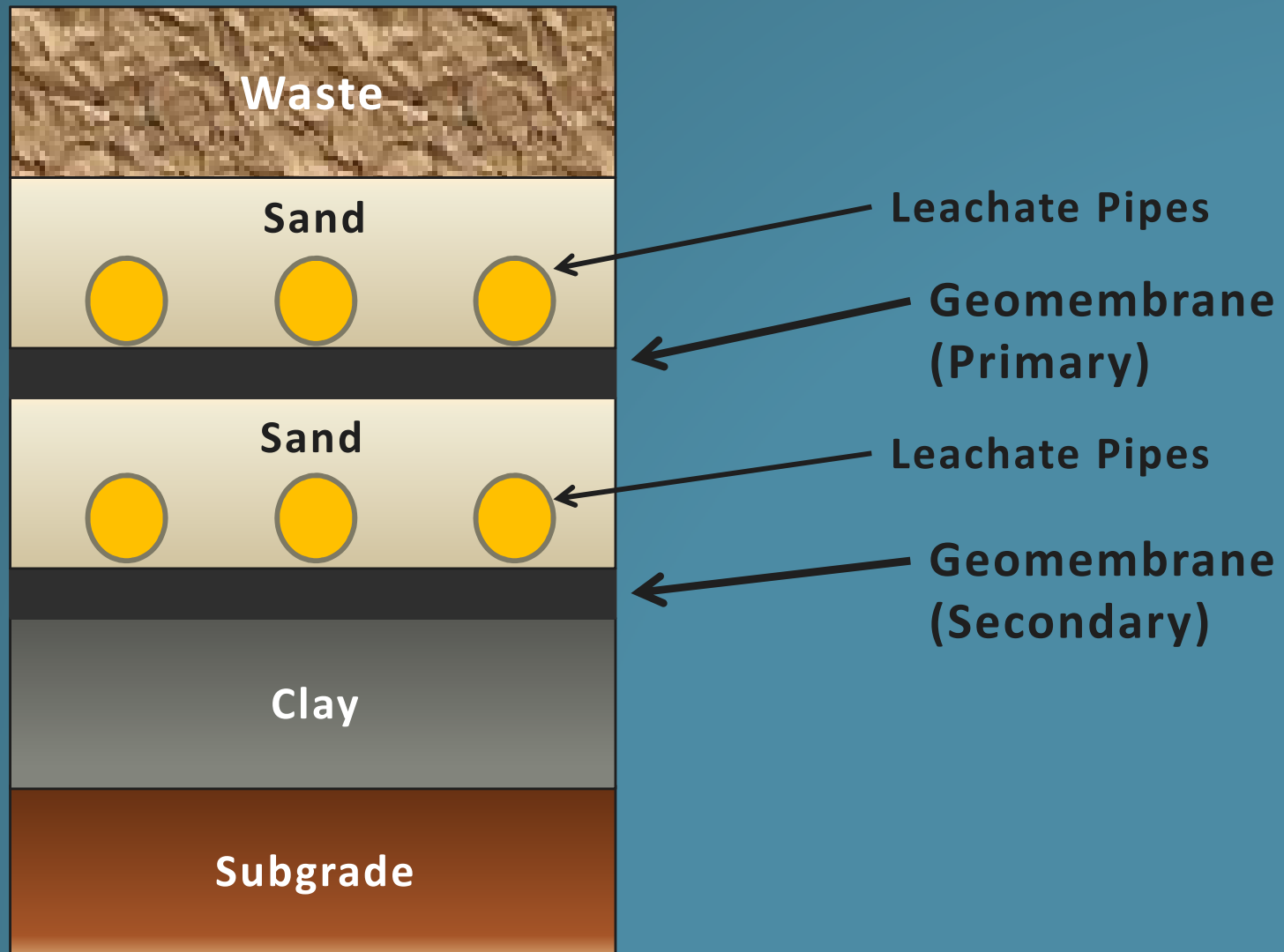
Liner

Gas Probe

Groundwater  
Well



# LINED LANDFILLS



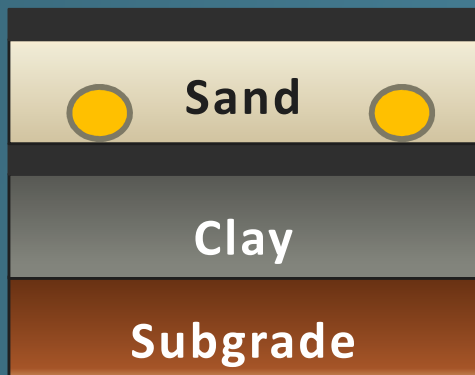
# SUBGRADE THROUGH SECONDARY GEOMEMBRANE



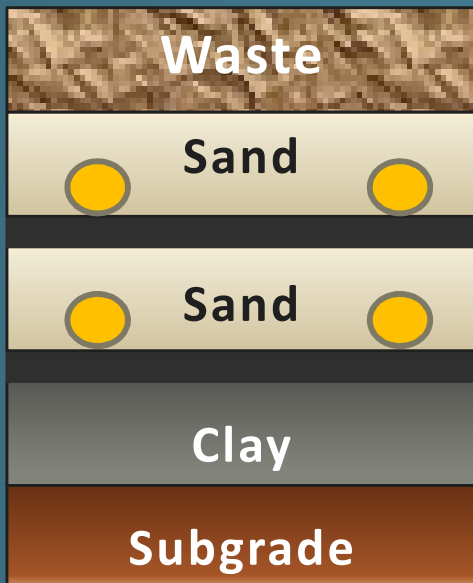
Clay

Subgrade

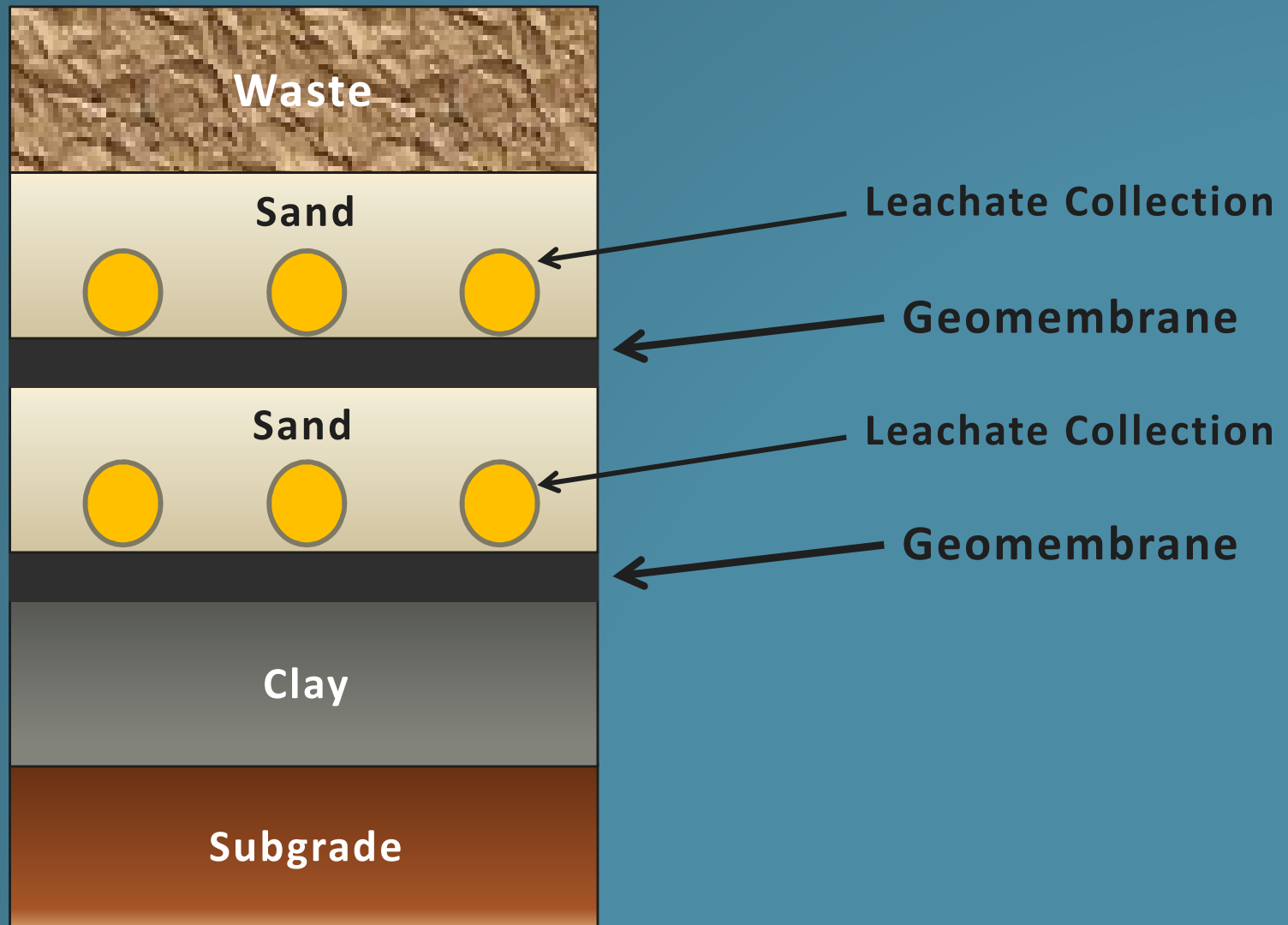
# SAND & PRIMARY GEOMEMBRANE



# SAND & WASTE



# LINED LANDFILLS



# UNLINED LANDFILLS





# LANDFILL DESIGN: THE BASICS

Landfill Gas

Cap

Leachate

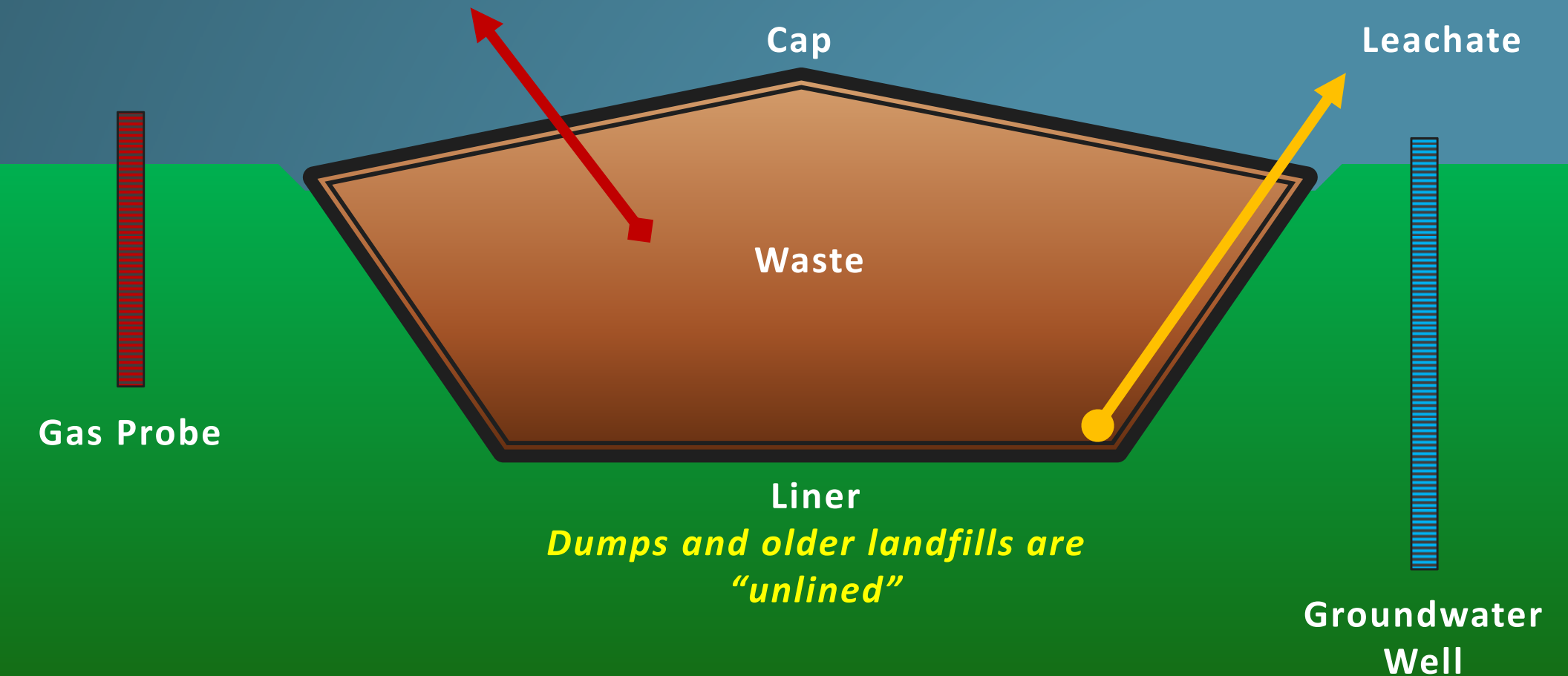
Waste

Liner

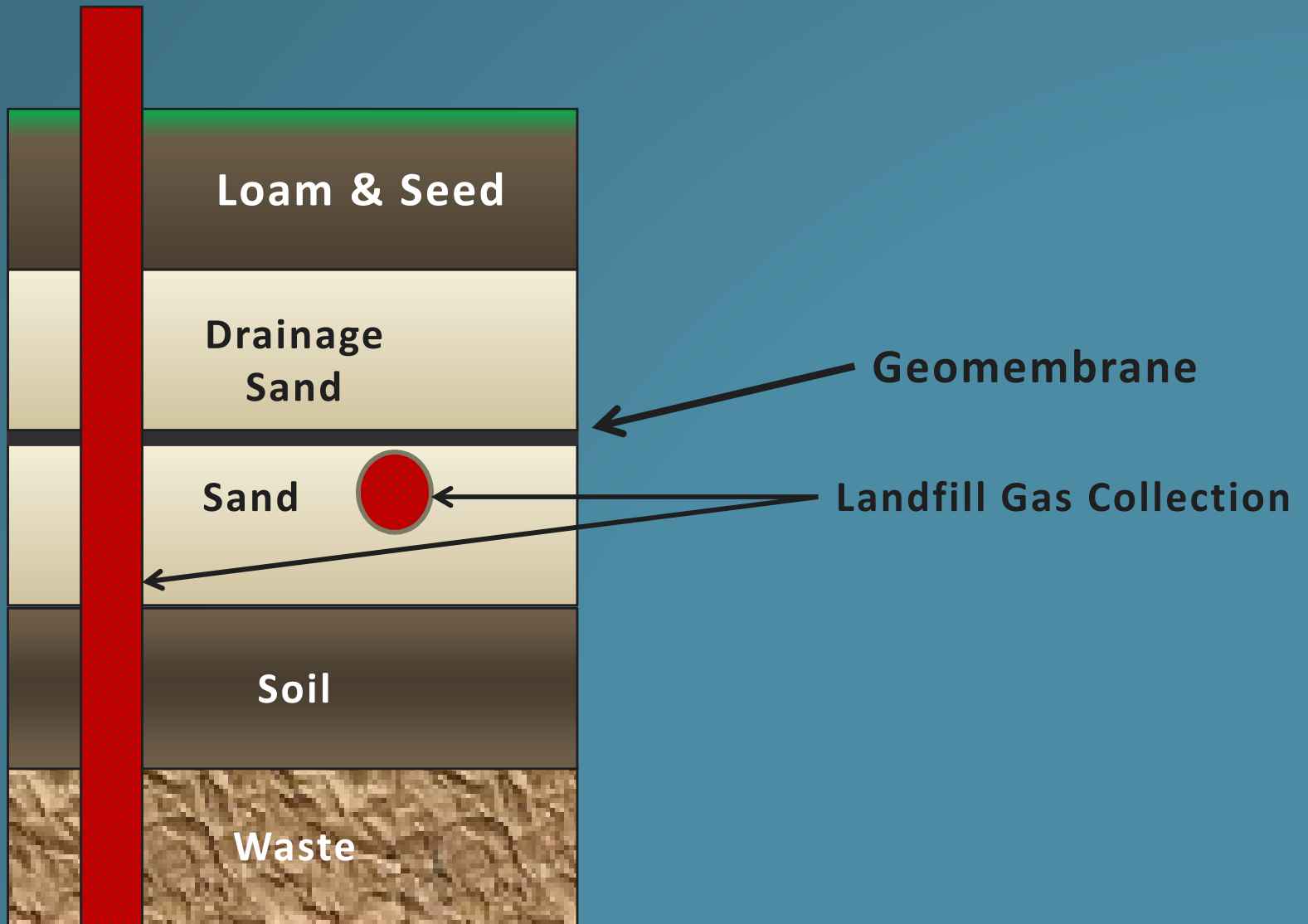
*Dumps and older landfills are  
"unlined"*

Gas Probe

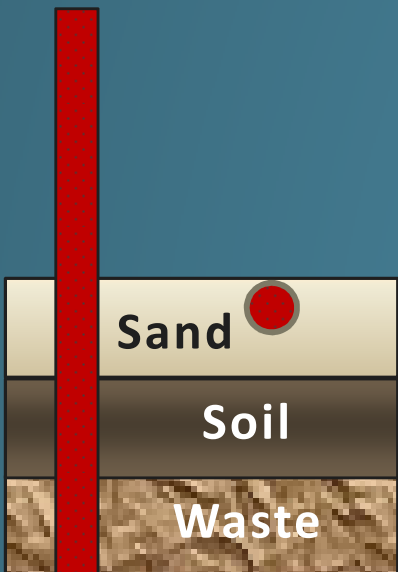
Groundwater  
Well



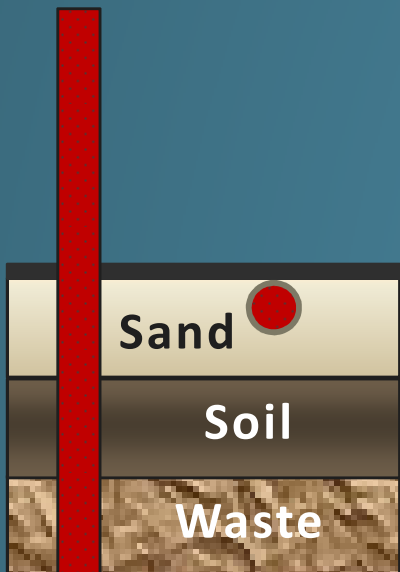
# LANDFILL CAP



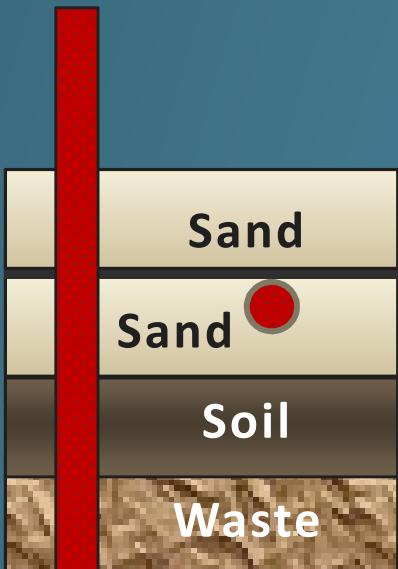
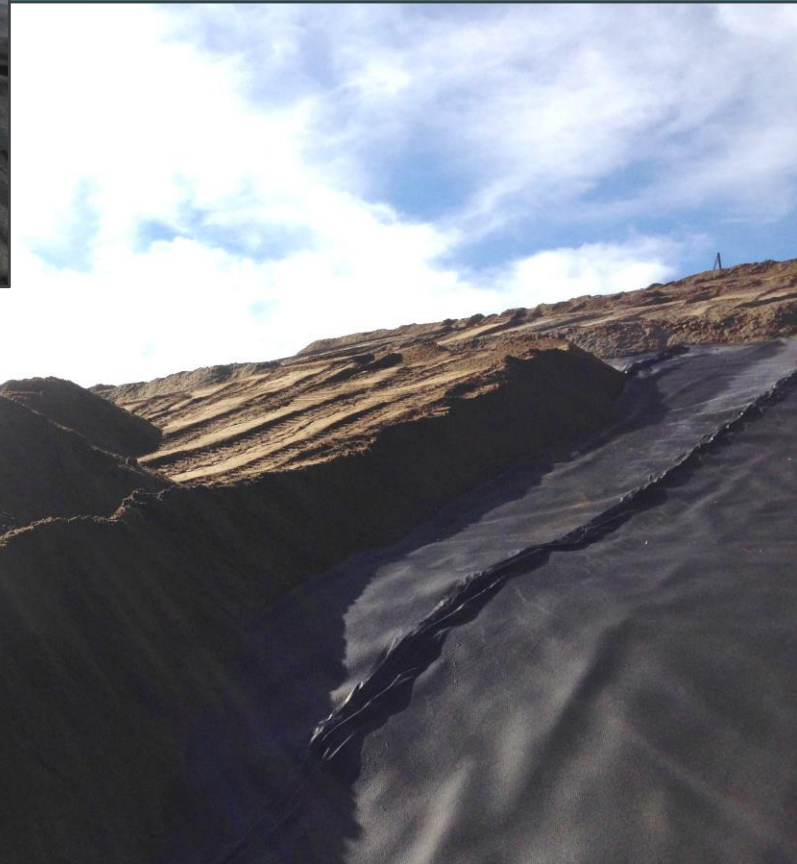
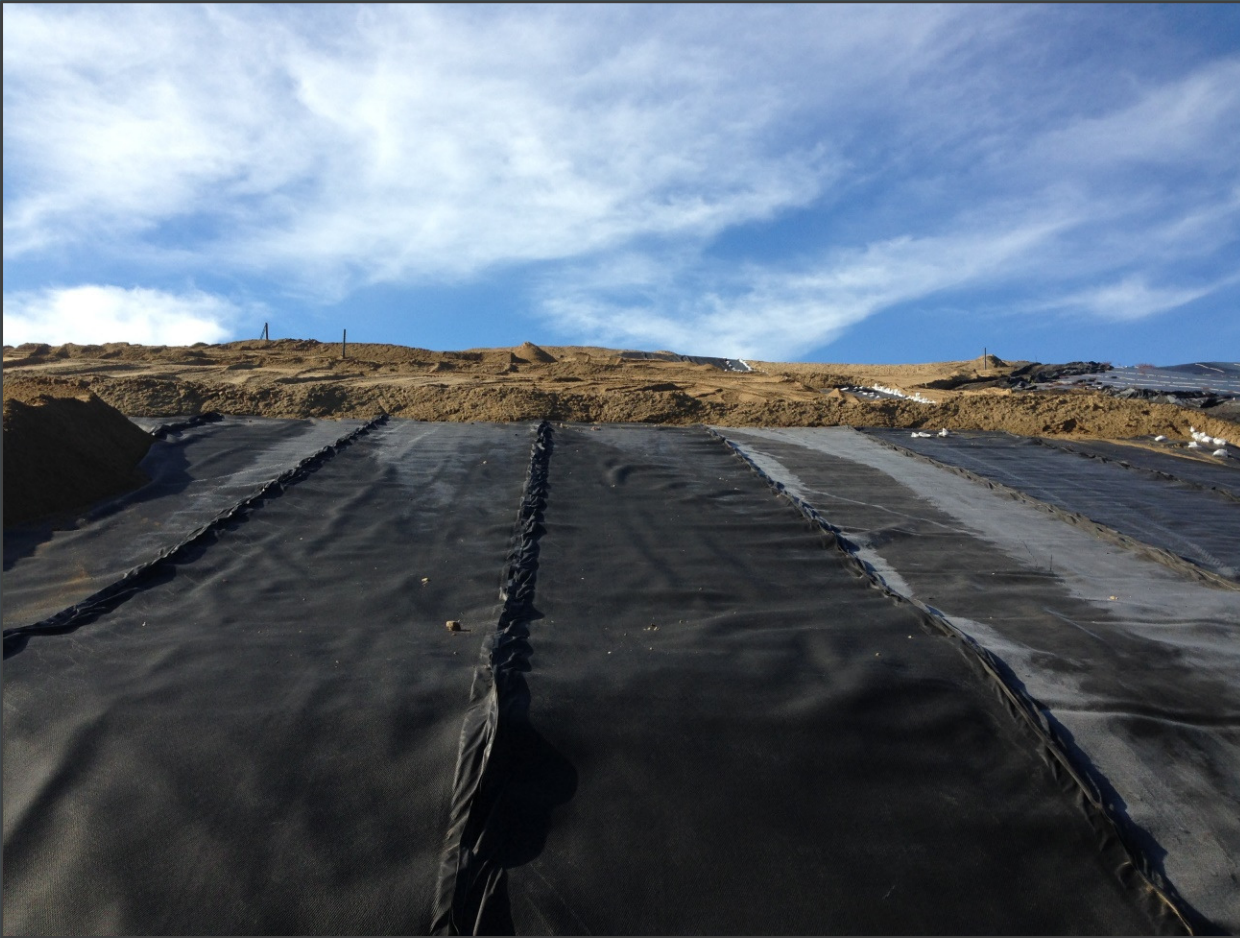
# SAND



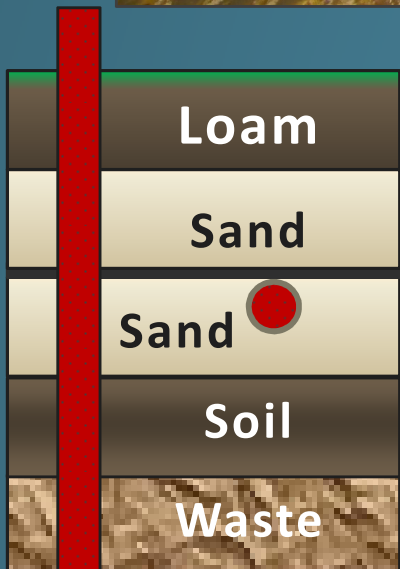
# GEOMEMBRANE



# DRAINAGE SAND



# LOAM & SEED



# LANDFILL GAS: VENTS

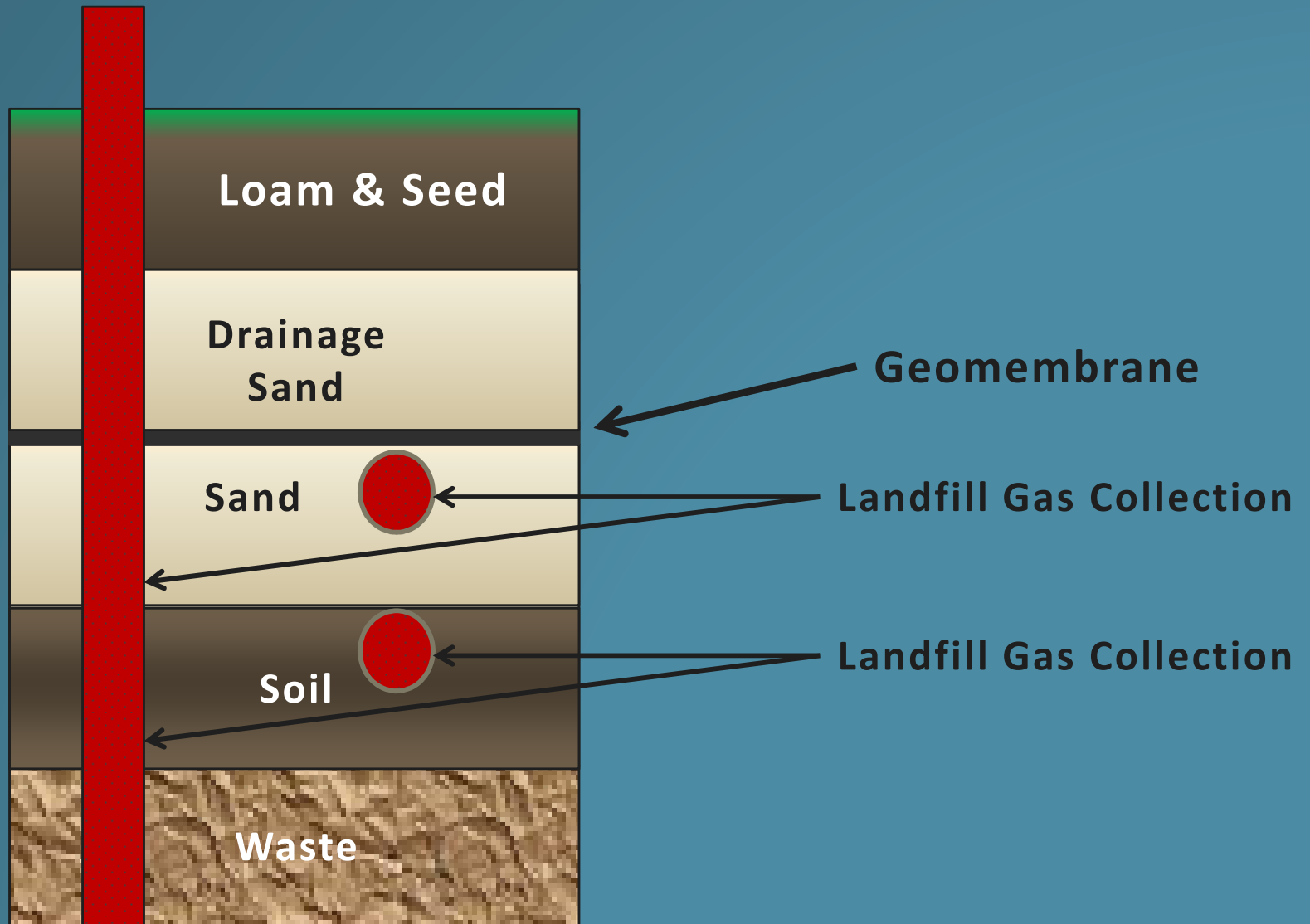


# LANDFILL GAS: EXTRACTION WELLS





# LANDFILL CAP → COVER



# LANDFILL COVER

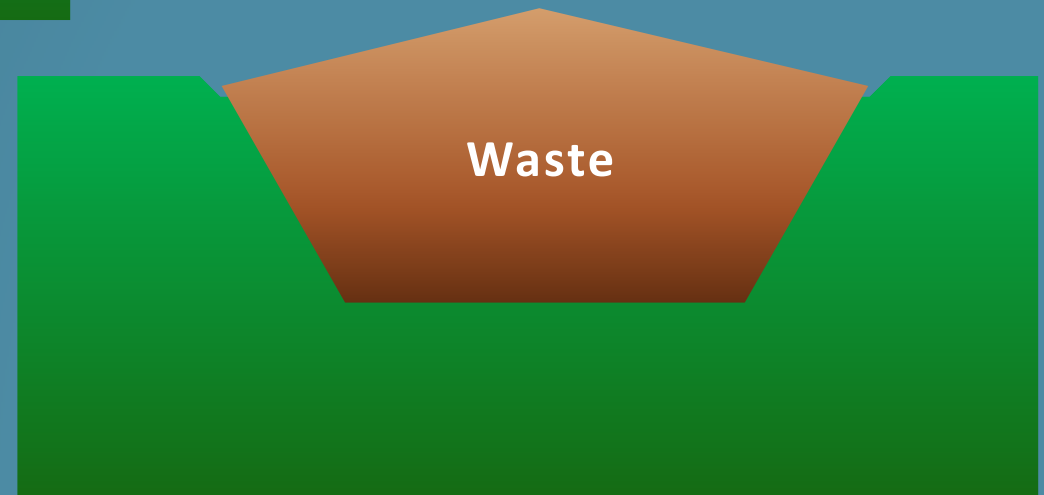
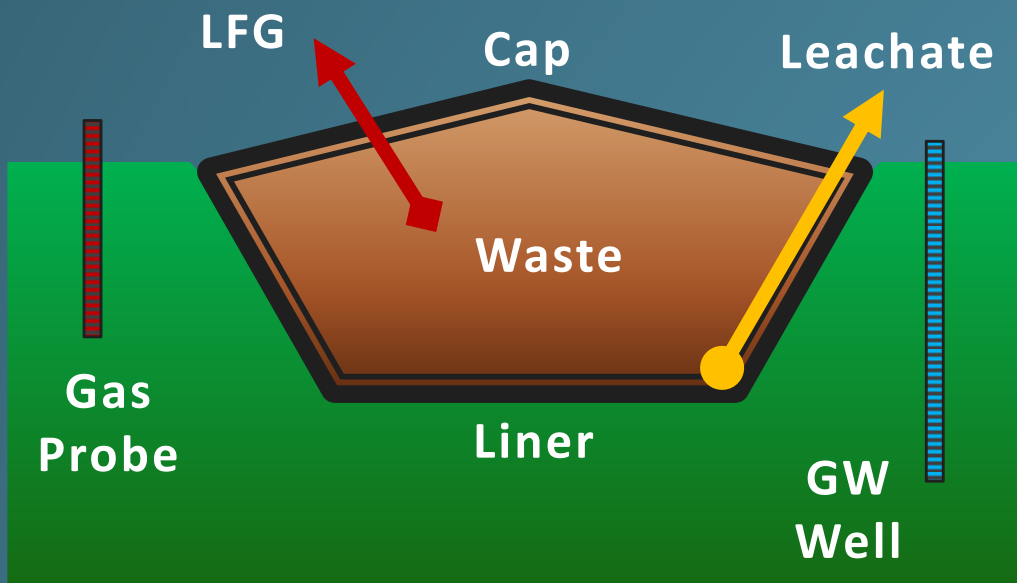


# “BRADY BILL” LANDFILLS

*RSA 149-M:9(XIII)*



# LANDFILL DESIGN: IT'S A CONTAINMENT SYSTEM



# LANDFILLS: HISTORY & DESIGN



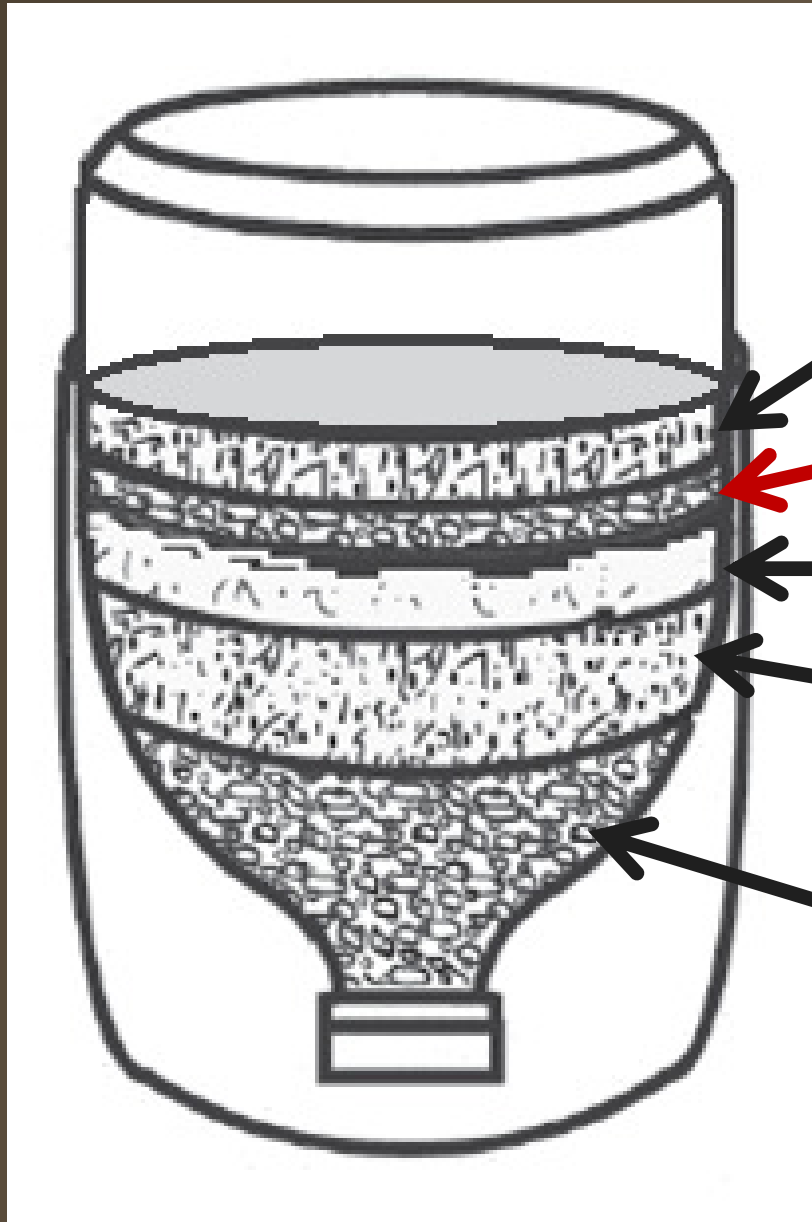
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# ACTIVITY: LANDFILL IN A BOTTLE



5. Add coffee filter and topsoil (about ½")

4. If you have it, add plastic cap or clay layer (about ½")

3. Fill about 1" with sand

2. Fill about 2" sponge pieces (waste)

1. Fill about 2" with gravel

**BREAK!**

# ACTIVITY: LANDFILL IN A BOTTLE

## *DEBRIEF*



U.S. Forest Service sign at Reyes Creek Campground in the Los Padres National Forest, California.



# Post-Closure Monitoring & Maintenance



James O'Rourke  
Hydrogeologist  
NHDES - Waste Management Division

*“During the post-closure period, the permittee shall have specific obligations to regularly inspect, monitor and maintain the facility in conformance with the solid waste rules based on the provisions of a post-closure inspection, monitoring and maintenance plan...”*

# Landfill Post-Closure Requirements

- Inspect, monitor, and repair any damage
- Achieve the “performance standards” in the NH Solid Waste Rules:
  - Stop generating leachate,
  - Stop generating decomposition gases like methane,
  - Achieve maximum settlement,
  - Remove harmful impacts to air and water, and
  - Remove threat to human health and the environment.

# Landfill Post-Closure Inspection Report



## Landfill Post-Closure Inspection Report

A. Site Information		B. Contact Information				
Facility Name:		Permittee Name:				
Address:		Address:				
Date Waste Receipt Stopped:		Phone #:				
Closure Date:		Cap Date:		Contact Person:		
Cap Design:						
Soil: <input type="checkbox"/>						
Paper Fiber: <input type="checkbox"/>						
Geomembrane:						
LLDPE: <input type="checkbox"/>						
HDPE: <input type="checkbox"/>						
Other: describe _____						
Permit #:		Inspected by:			Date:	
C. Funding						
Is the Facility owner receiving funding from the State for closure of the landfill [Grant Program, etc.]?						
<input type="checkbox"/> Yes <input type="checkbox"/> No						
If yes, provide the funding source.						
D. Enforcement						
Is the Facility under any enforcement action? <input type="checkbox"/> Yes <input type="checkbox"/> No						
If yes, check the appropriate box:						
Notice of Finding; <input type="checkbox"/> Letter of Deficiency; <input type="checkbox"/> Administrative Order; <input type="checkbox"/> Administrative Fine; <input type="checkbox"/> Other:						
If yes, provide status of enforcement:						
E. Off-Cap Features						
If damage is present, indicate if damage is Minor or Major then use Section H to provide additional information as necessary.						
[Minor damage = no immediate repair needed, but should be repaired or watched during the year]						
[Major damage = requires immediate repair and submittal of a work scope to conduct repair]						
		Yes	No	NA	Minor	Major
(1)	Is there adequate access control [e.g., fencing or natural boundaries]?					
(2)	Are perimeter warning signs present?					
(3)	Is the access road(s) in good condition?					
(4)	Is the retention/infiltration basin(s) in good condition?					
(5)	Is the drainage system in good working order?					
(6)	Are all culverts intact and free of obstructions?					
(7)	Are all under-the-cap drain outlets in good condition?					
(8)	Are all of the soil gas probes in good condition?					
(9)	Were there any landfill odors detected at the property line?					

# Elements of Inspection Reports

- A) Site info
- B) Contact Info
- C) Funding
- D) Enforcement
- E) Off-Cap Features
- F) Cap Features
- G) Reporting Requirements
- H) Comments & Recommendations

**Landfill Post-Closure Inspection Report**

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Address:		Address:				
Date Waste Receipt Stopped:		Phone #:				
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Soil:	<input type="checkbox"/>					
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Geomembrane:						
LLDPE:	<input type="checkbox"/>					
HDPE:	<input type="checkbox"/>					
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Page 1		Revised April 2006				

<http://des.nh.gov/organization/divisions/waste/swmb/css/categories/forms.htm>

# Post-Closure Inspections

- Protect the closure system from damage:
  - Fencing, signage,
  - Landfill slopes,
  - Vegetation,
  - Drainage system,
  - Gas management system, and
  - Groundwater and gas monitoring wells.

# Fencing & Signage



# Slopes





# Vegetation



**Limit of Cap  
RESTRICTED  
ACCESS**

By the New Hampshire Department of  
Environmental Services and  
Town Landfill  
Potential Presence  
of  
Landfill Gases  
603-934-0900



# Gas Management System

Gas  
Vent



Extraction  
System



Flare



Gas  
Probe

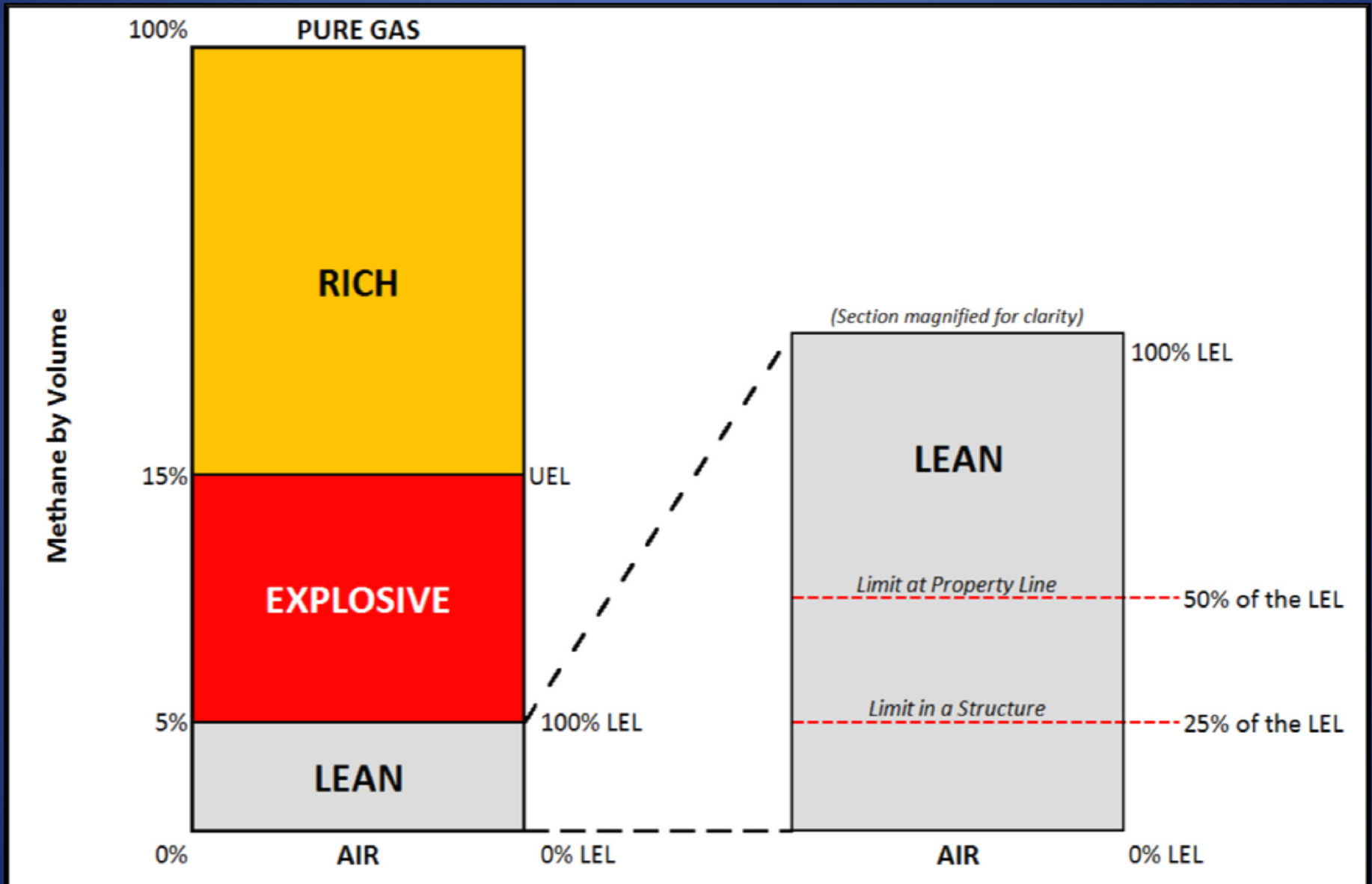


# Landfill Gas Rule Requirements

- As Landfill wastes breakdown they can create decomposition gases. Some of which are harmful and/or dangerous.
- Landfill gases must be controlled to prevent hazards to human health and safety, and the environment.

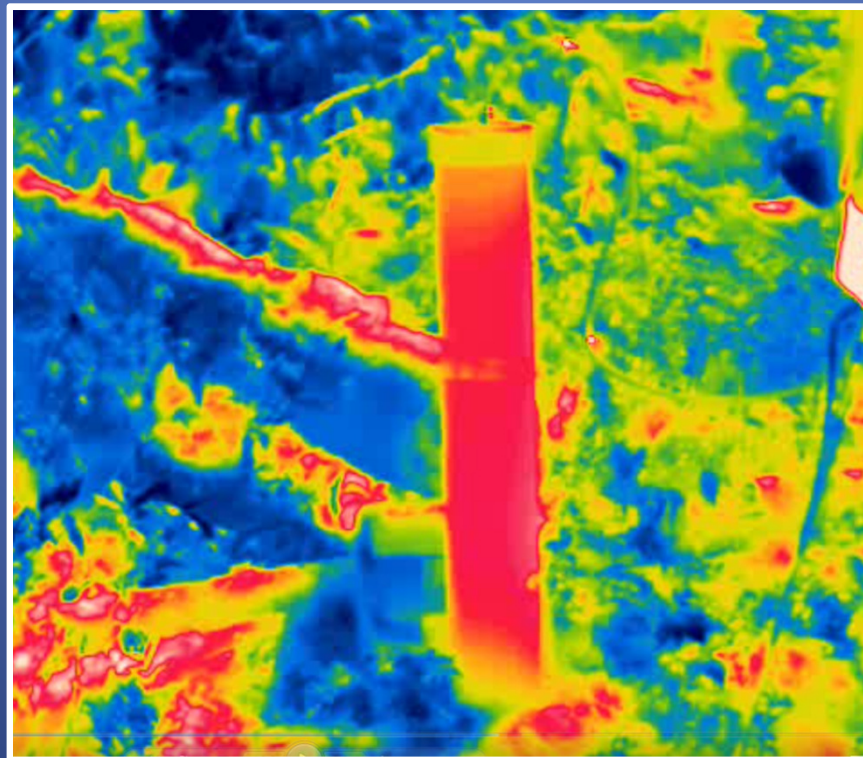


# Gas Monitoring



# Landfill Gas Rule Requirements

- Methane concentrations must not exceed 25% of the LEL in structures on or off-site.
- Methane concentrations must not exceed 50% of the LEL in the soil at the property line.



# Monitoring Wells



# Groundwater Management Permit

Places monitoring requirements on:

- Sampling frequency,
- Number of wells sampled,
- Compounds being analyzed for, and
- Reporting frequency.





# Other Important Features to Monitor

- 
- 
- 



or

# Activities - Landfill Use



# Activities - Landfill Use



# WHAT'S THE ISSUE?



# WHAT'S THE ISSUE?



# WHAT'S THE ISSUE?



# WHAT'S THE ISSUE



Monitoring Date

# Why Does Post-Closure Monitoring Matter?

- Landfills are basically “containment systems” for waste.
- The waste contained in landfills can be a mix of household, business, mining, agricultural, and industrial wastes.
- Without periodic inspections, monitoring, and routine maintenance we can't assume these containment systems will continue to function adequately forever.

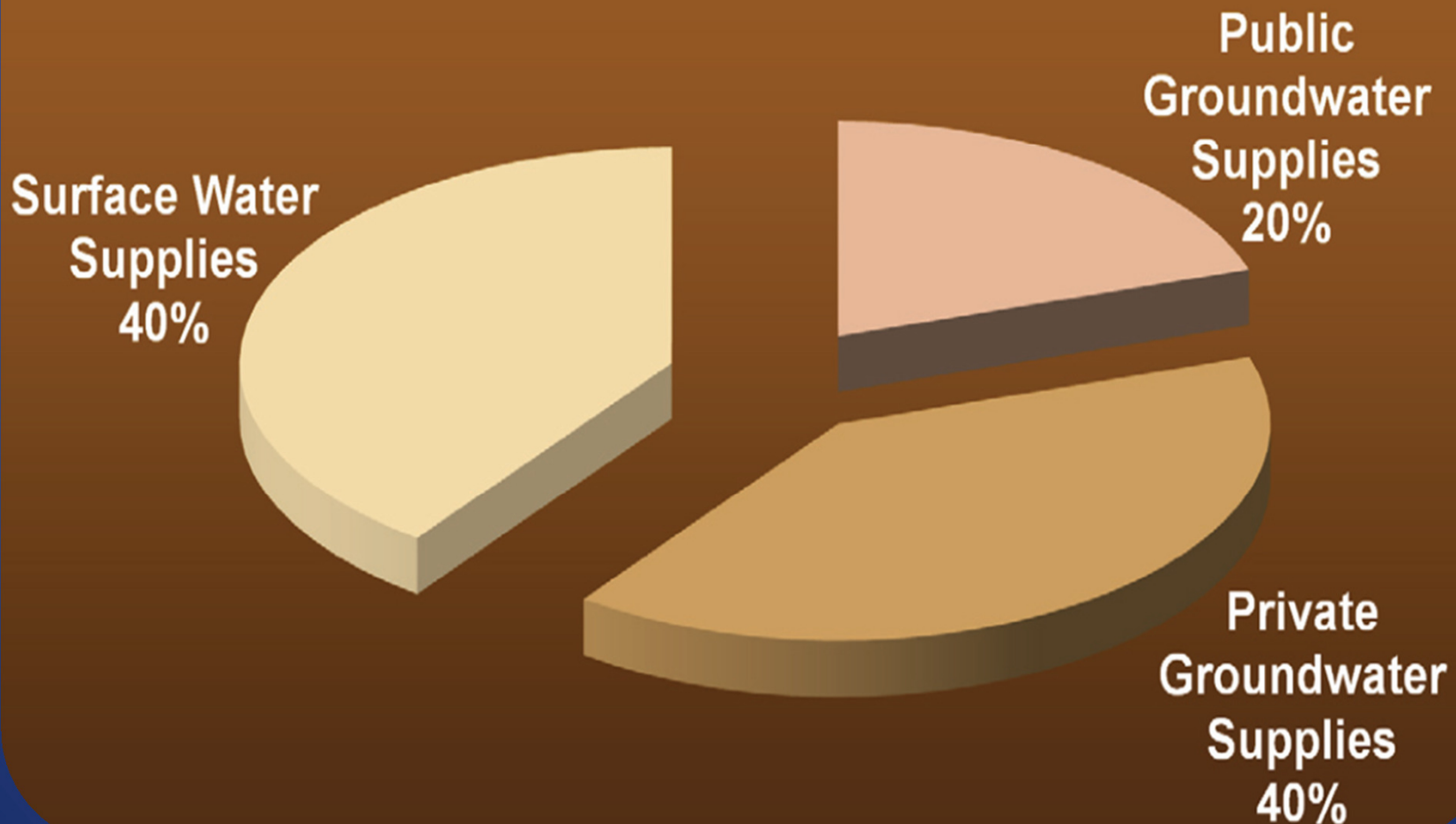


# Why Does Post-Closure Monitoring Matter?



# Why Does Post-Closure Monitoring Matter?

## Sources of Drinking Water in New Hampshire



# Landfill Post-Closure Summary

- Follow your landfill's Post-Closure Plan.
- Include the Landfill Post-Closure Inspection Report as part of your annual reporting.
- Contact DES prior to using the landfill for other purposes.
- Inspect, monitor, repair, and report any damage to the landfill system.

Don't let a small problem become a  
BIG PROBLEM!!!



## Contact Information

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New Hampshire Department of  
Environmental Services

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