

# RAIN, TRASH, AND TROUBLE: UNDERSTANDING LANDFILL LIQUIDS AND WHY IT MATTERS



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**SO THEN THEY STARTED DRIVING  
A DIFFERENT ROUTE TO AVOID US**



**SO WE STARTED  
WORK ON THAT ROAD TOO.**

**MASTER  
ELECTRIC**

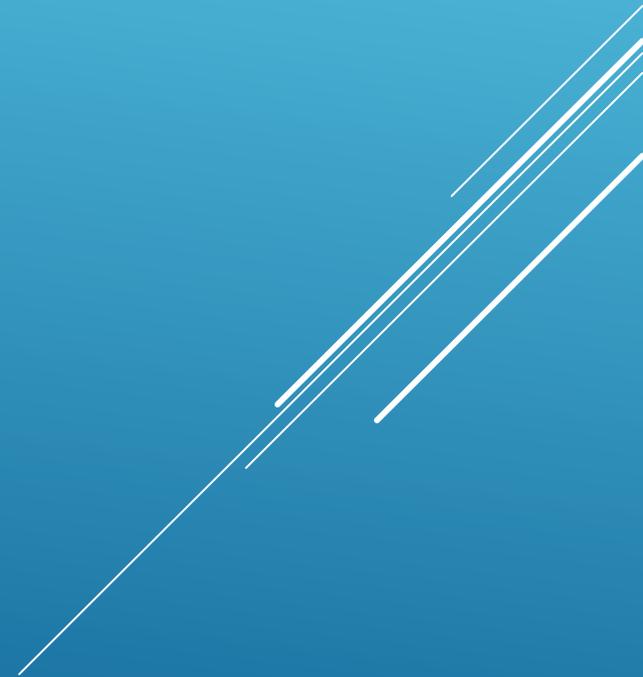
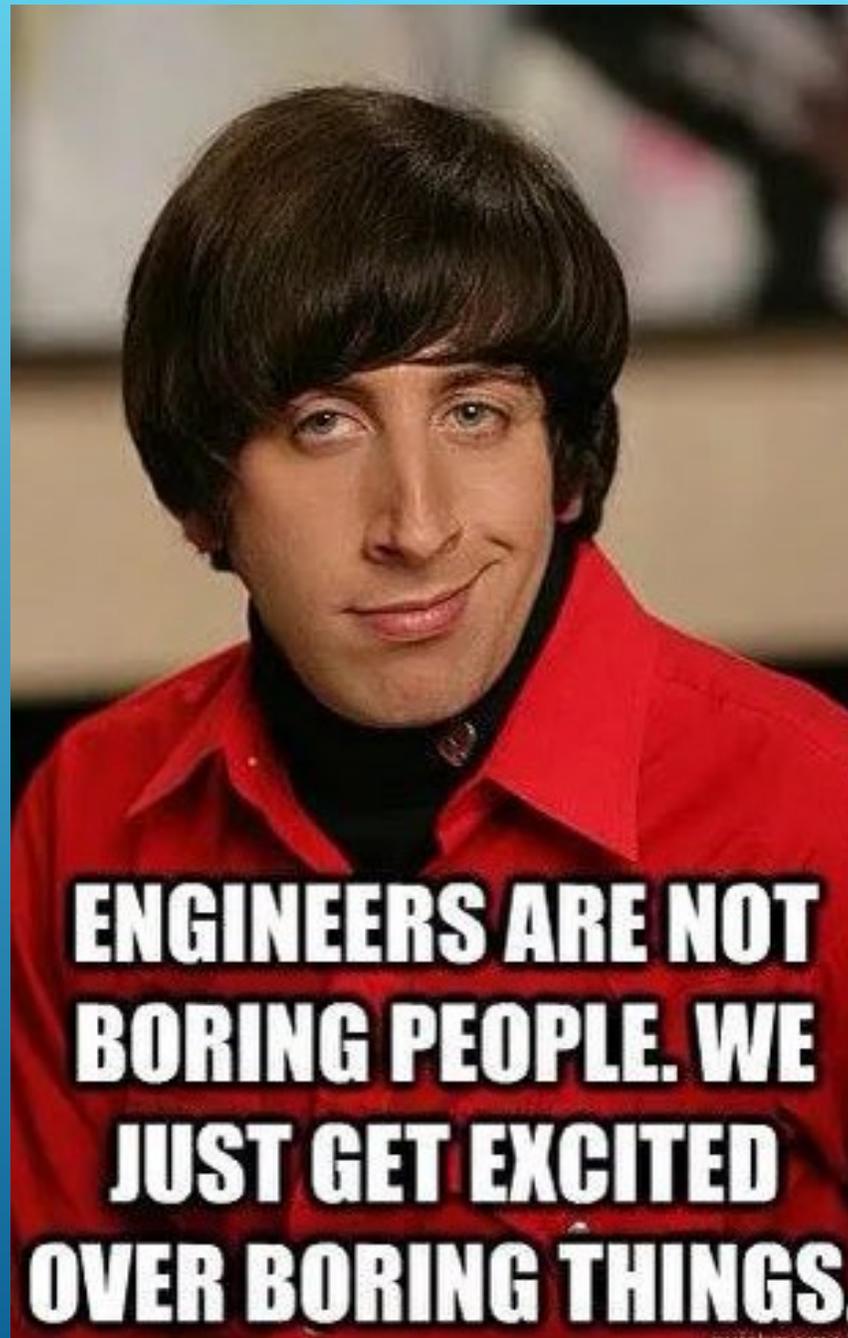
imgflip.com

# ENGINEER

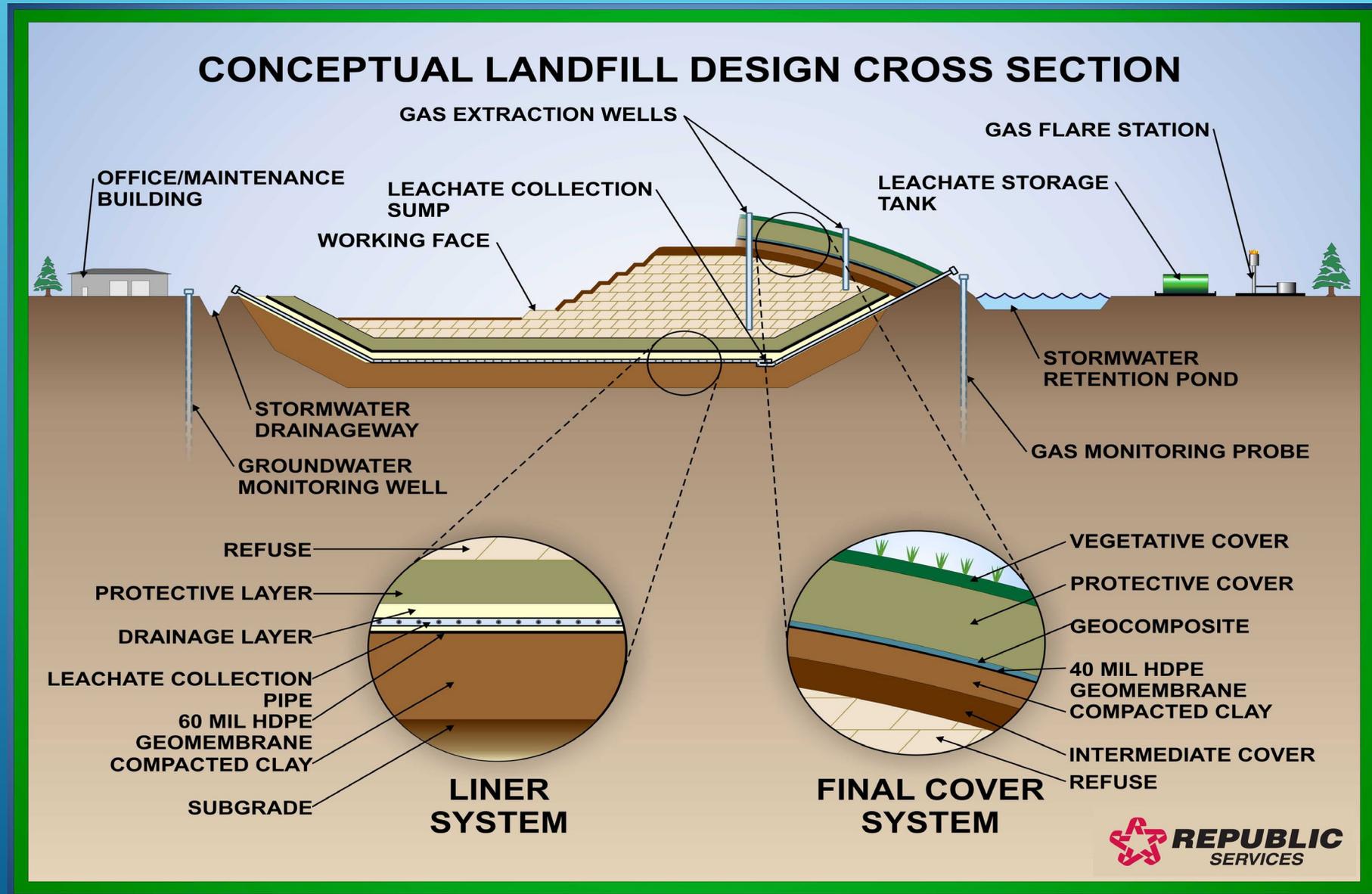
SOLVING PROBLEMS YOU DIDN'T  
KNOW YOU HAD IN WAYS YOU DON'T  
UNDERSTAND



FunnyBeing.com



# ANATOMY OF A LANDFILL



# DEFINITION AND IMPORTANCE OF LIQUID MANAGEMENT

## Water Interaction with Waste

Liquid management at landfills involves controlling and treating water that comes into contact with waste materials.

## Protection of Groundwater

Effective liquid management is crucial for safeguarding groundwater resources from contamination caused by landfill activities.

## Public Health Safety

Proper management of liquid at landfills is essential to ensure public health and prevent potential health risks associated with contaminated water.



# OVERVIEW OF LANDFILL OPERATIONS



## **Engineered Waste Disposal Sites**

Landfills are specially designed sites meant for the safe disposal of waste, ensuring environmental safety.



## **Water Management Importance**

Effective water management is crucial in landfills to prevent contamination of local water sources and surrounding ecosystems.



## **Regulatory Compliance**

Landfill operations must adhere to regulations to ensure environmental protection and proper waste management practices.



KOLKATA, INDIA

NEW DELHI, INDIA





Bogota, Columbia

St. Petersburg, Russia



# INTRODUCTION TO LANDFILL LIQUID MANAGEMENT



# REGULATORY AND ENVIRONMENTAL CONSIDERATIONS



## Regulations on Water Management

Landfill operations must adhere to strict regulations aimed at effective water management to prevent contamination.

## Importance of Compliance

Understanding and complying with regulations is essential for operational success and environmental protection.

## Minimizing Environmental Impact

Effective water management practices at landfills help to minimize the overall environmental impact of operations.

# STORMWATER MANAGEMENT AT LANDFILLS



# ENGINEERED CONCRETE BLOCK MATS



# LETDOWN STRUCTURES



# TERRACES



# STORM WATER DIVERSION





# CONTACT WATER MANAGEMENT AT LANDFILLS

# DEFINITION AND SOURCES OF CONTACT WATER

## What is Contact Water?

Contact water refers to water that comes into contact with waste materials, forming a potential pollutant.

## Sources of Contact Water

The primary sources of contact water include precipitation and surface water interacting with various waste materials.

## Importance of Identification

Identifying the sources of contact water is crucial for effective environmental management and pollution prevention.



# DAILY COVER

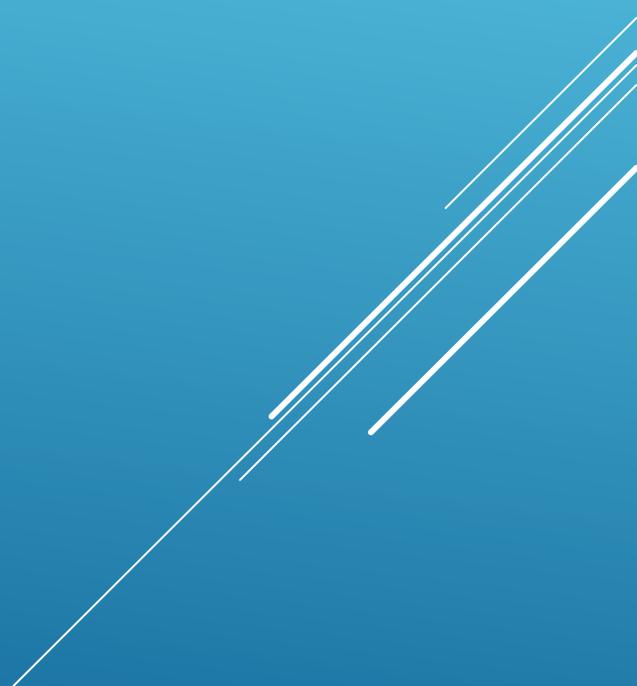


# WIND FENCE

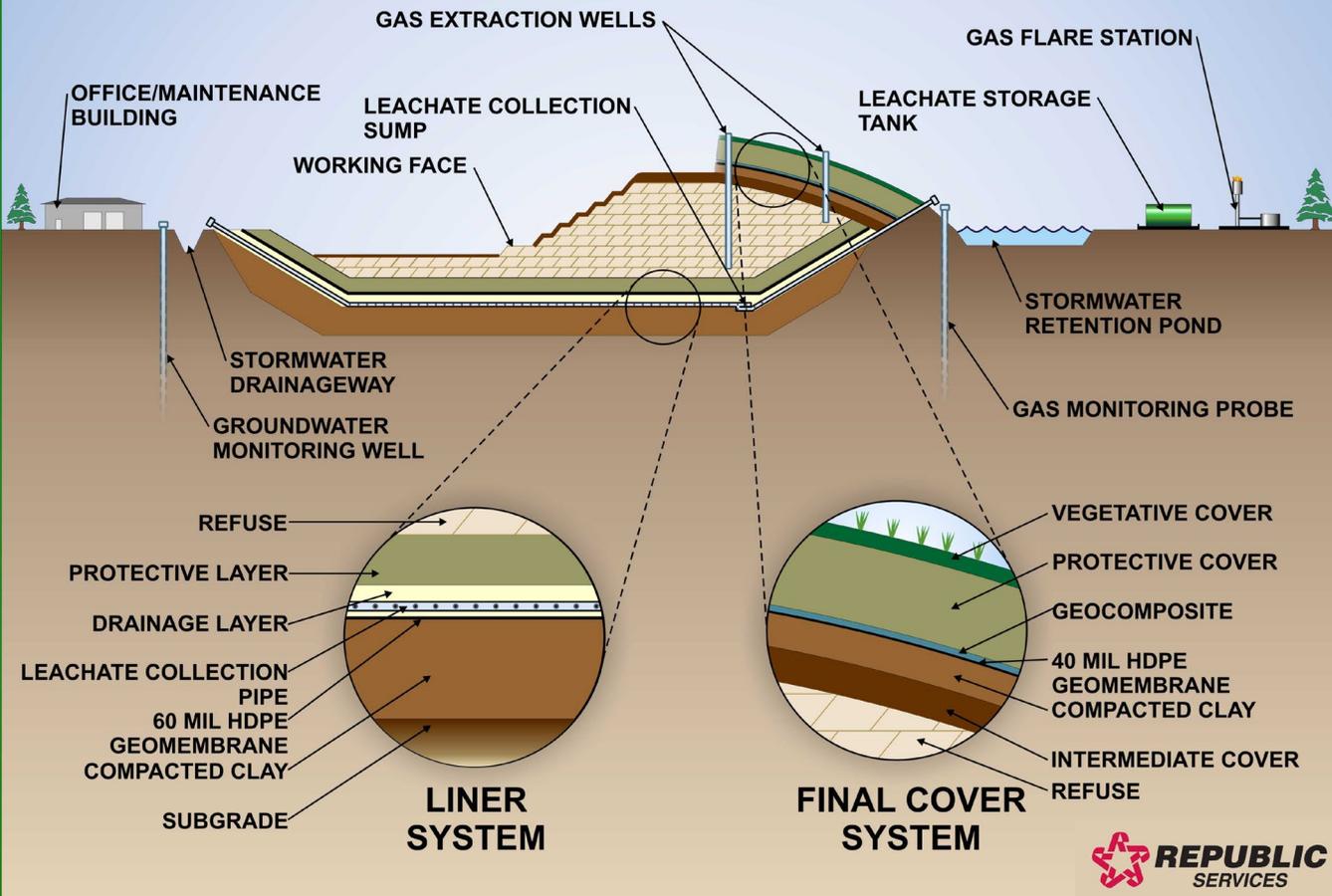




# LEACHATE MANAGEMENT AT LANDFILLS



## CONCEPTUAL LANDFILL DESIGN CROSS SECTION



# FORMATION AND COMPOSITION OF LEACHATE

## Leachate Formation Process

Leachate is generated when water seeps through waste, leading to the dissolution of harmful substances found in the waste material.

It is also created from moisture/liquid within the waste mass. As it is compacted and heated up, liquids are "squeezed" out.

## Variability in Composition

The composition of leachate can vary widely depending on the types of waste materials it interacts with during formation.



# LEACHATE COLLECTION AND CONTAINMENT SYSTEMS

## **Purpose of Leachate Systems**

Leachate collection systems aim to capture and contain leachate, protecting the environment from contamination.

## **Design Importance**

Effective design is essential for leachate systems to function properly and ensure environmental safety.

## **Maintenance Practices**

Regular maintenance of leachate systems is crucial for their effectiveness and longevity in preventing contamination.

# LEACHATE BLOWOUT





LEACHATE BLOWOUT

# LEACHATE TREATMENT AND DISPOSAL METHODS

## Evaporation Methods

Evaporation methods utilize heat to separate water from contaminants in leachate, reducing volume and facilitating disposal. This can include evaporation towers.

## Sanitary Sewer

Tie into local POTW. Biological processes use microorganisms to break down organic matter in leachate, offering an environmentally friendly treatment option. PFAS is a big driver away from this practice!

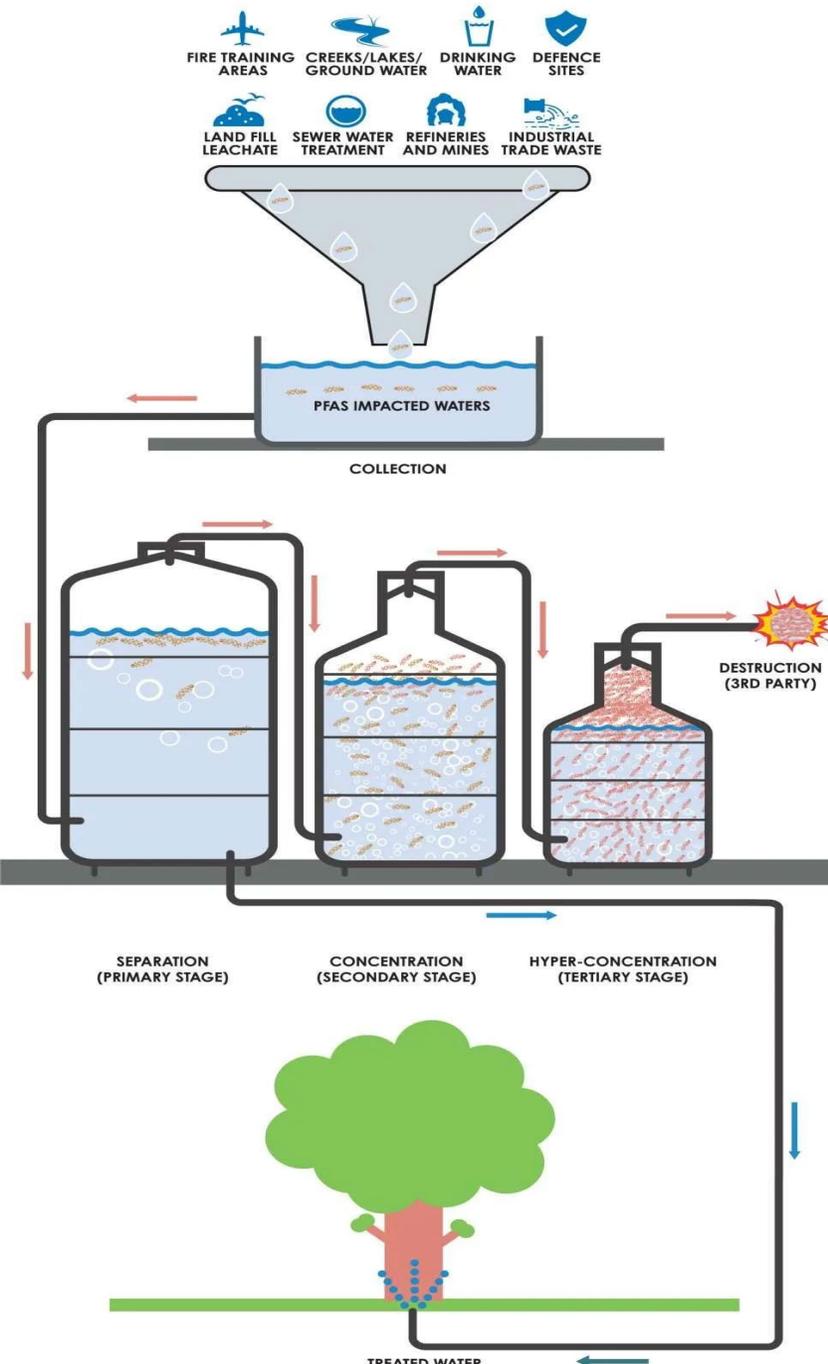
## Deep Well Injection

This involves injecting liquids deep underground into porous geologic formations. Deep well injection is usually combined with pretreatment technology.

## Chemical Treatments

Chemical treatments involve adding chemicals to leachate to neutralize pollutants, making it safer for disposal or further treatment.





# TREATMENT AND REGULATORY COMPLIANCE

## Importance of Water Treatment

Proper water treatment is critical to prevent environmental damage and protect natural resources. It ensures safe water for communities.

## Understanding Regulations

Awareness of specific regulations helps organizations comply with standards and avoid penalties. This includes local, national, and international guidelines.

## Implementation Measures

Implementing necessary measures involves adopting technologies and practices that align with regulatory requirements for effective water treatment.

# LANDFILLS IN OR NEAR FLOODPLAINS





# RISKS AND CHALLENGES ASSOCIATED WITH FLOODPLAIN LOCATIONS

## **Leachate Risks**

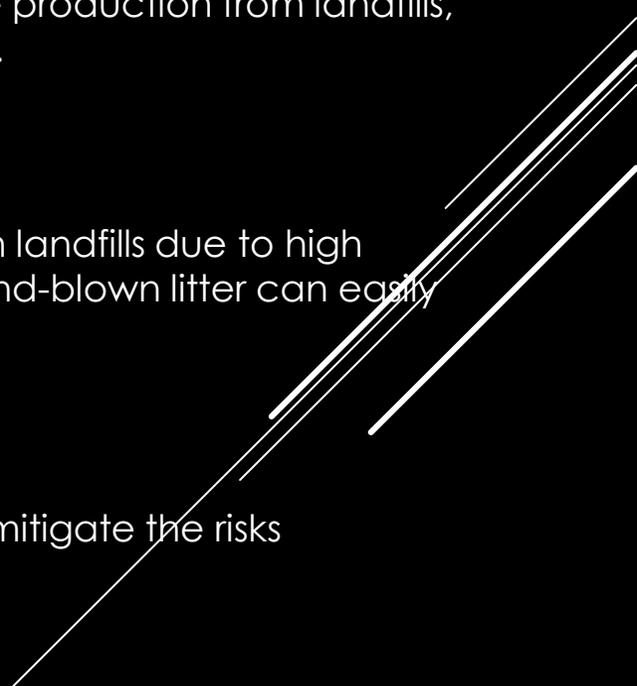
Floodplain locations increase the risk of leachate production from landfills, which can lead to soil and water contamination.

## **Contaminant Migration**

Contaminants can easily migrate from floodplain landfills due to high water levels, posing risks to local ecosystems. Wind-blown litter can easily enter adjacent waterways.

## **Management Strategies**

Effective management strategies are crucial to mitigate the risks associated with landfill locations in floodplains.





GRANADA VILLAGE

Google Earth

Image © 2025 Airbus

35°26'40.58" N 97°37'56.62" W elev 1304 ft eye alt 9593 ft

1985





Image Landsat / Copernicus  
Image © 2025 Airbus



DELANO TOWNSHIP

Image © 2025 Airbus

SHERWOOD GLEN

Google Earth





# FLOOD PROTECTION AND MITIGATION MEASURES



## Importance of Levees

Levees play a vital role in flood protection by controlling water flow and preventing overflow into vulnerable areas.



## Drainage Systems

Effective drainage systems are essential for managing excess water and reducing flood risk in urban and rural areas.



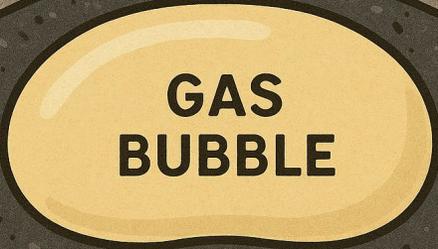
## Environmental Protection

Implementing flood mitigation measures helps protect the surrounding environment and maintain ecological balance. Oklahoma Regulation (252-515-5-32) does not allow new cells to be located within the 100-yr flood plain.

FUTURE TRENDS  
AND  
INNOVATIONS IN  
LANDFILL WATER  
MANAGEMENT



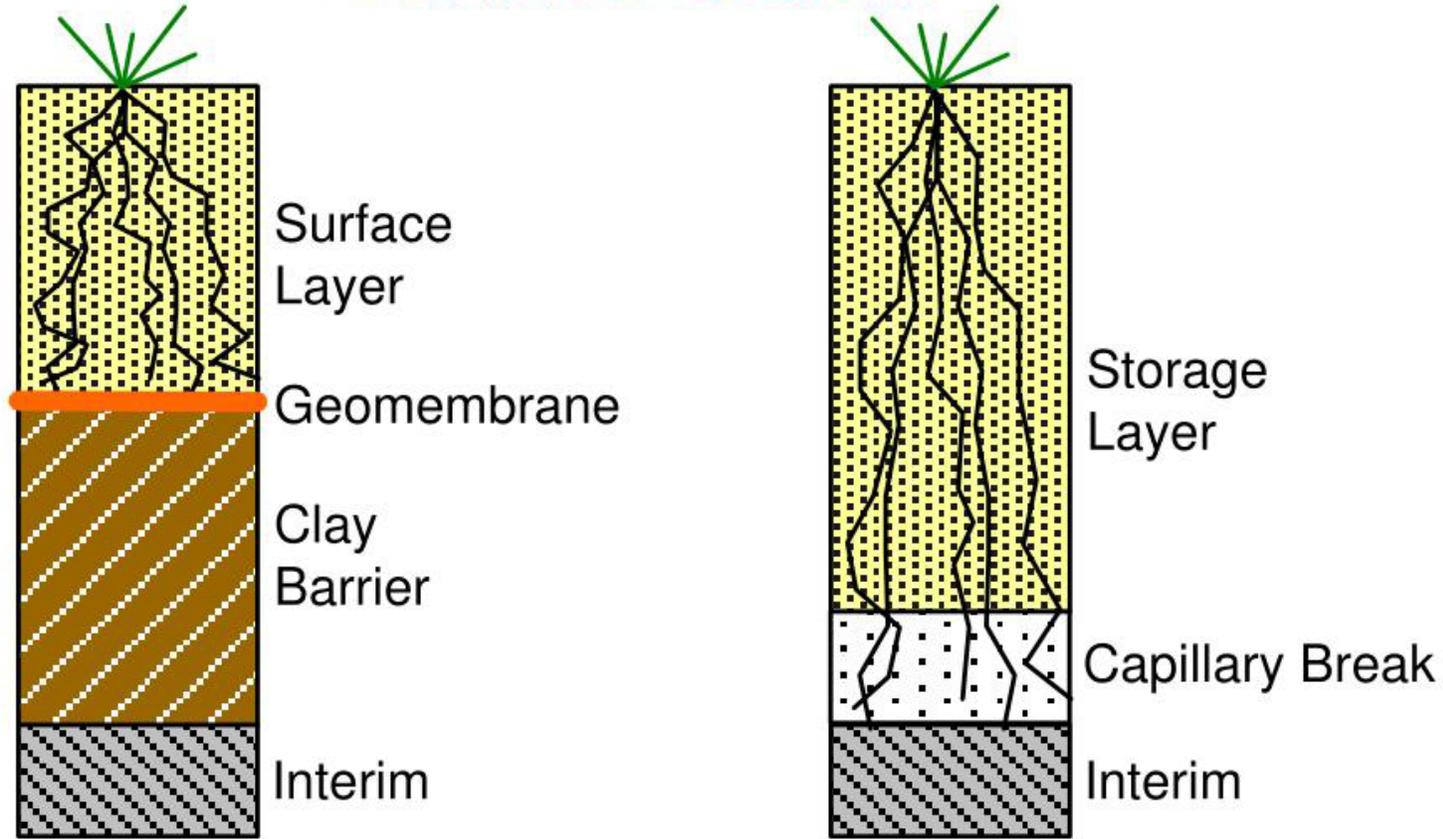
# LANDFILL CAP



# LANDFILL CAP



# Cover Strategy - Conventional vs. Water Balance Covers



**Conventional Cover**

**Water Balance Cover**



# CONCLUSION

## **Environmental Protection**

The United States and the Environmental Protection Agency guide design and operations for landfills which help to protect the environment.

## **Landfill Liquids**

There are four liquids that must be managed at a landfill: stormwater, contact water, leachate, and condensate. Landfill operations need to address each of these.

## **Landfills are Dynamic**

Landfills are not “dumps.” They are engineered systems. Engineering and site operations need to account for the dynamic-ness of the landfill. There’s no single solution.

# THANK YOU

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