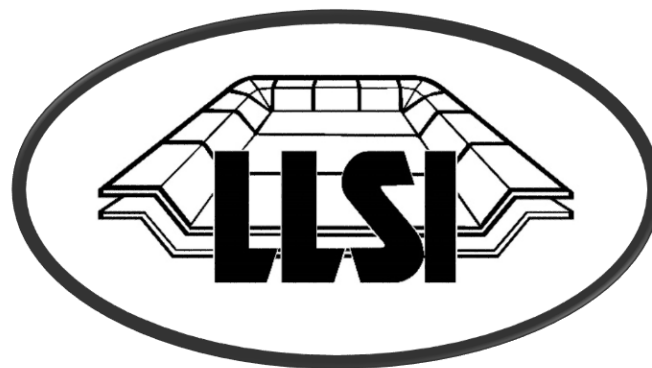


Matthew Kemnitz Leak Location Services, Inc.



- Wastewater
- Power Plants
- Landfills
- Mining
- Oil – Frac Ponds

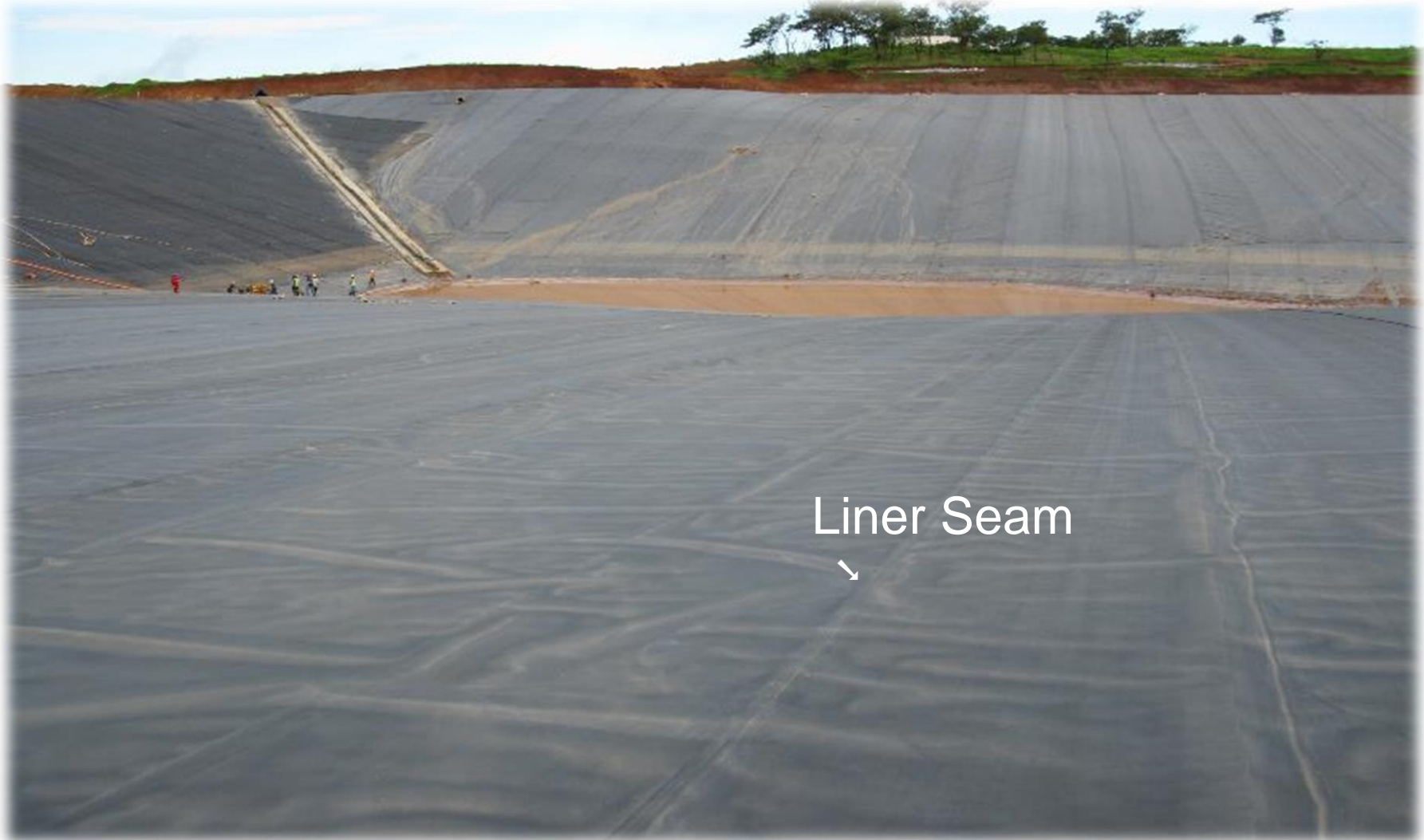
What is the Function of a Geomembrane?



To prevent liquids from flowing into the environment:

- 1) Improper or poor seam welds
- 2) Holes in the geomembrane

Installed Geomembrane



Installed Geomembrane



Standard Methods for Testing Seams

<u>Test Type</u>	<u>% of Area Tested</u>
Destructive	0.001
Vacuum	0.1
Air Pressure	1.0

<u>Test Type</u>	<u>% Area Tested</u>
Bare Liner Method	100%
Water Survey Method	100%
Soil Survey Method	100%
Leak Monitoring System	100%

Standard Guide for Selection of Techniques for Electrical Detection of Potential Leak Paths in Geomembrane

This standard guide is intended to assist individuals or groups in assessing different options available for locating leaks in installed geomembranes through the use of electrical methods.

Isolation Factors for Surveys

Potential Issues with Preparation

- Lack of bare geomembrane border around survey area
- Sediment
- Large grounding sources – aerators, etc.
- Pumphouses
- Steel piping
- Water filled PVC or HDPE risers or pipes
- Concrete pads perforating the geomembrane
- Electrified leachate pumps in landfills

Perimeter Isolation



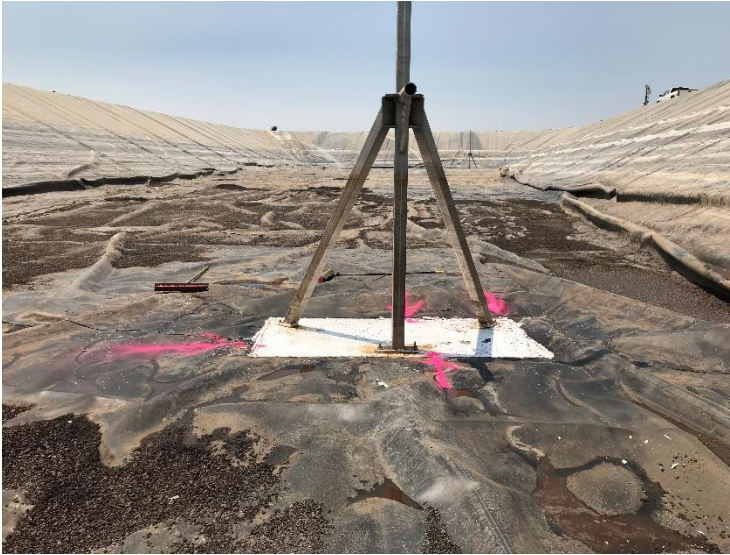
Perimeter Isolation After Construction



No Isolation – No Bare Liner



Grounding Examples



Grounding – Corrugated Pipe



Grounding – Pump in Cell



Too Much Stuff



Bare Liner Survey Method



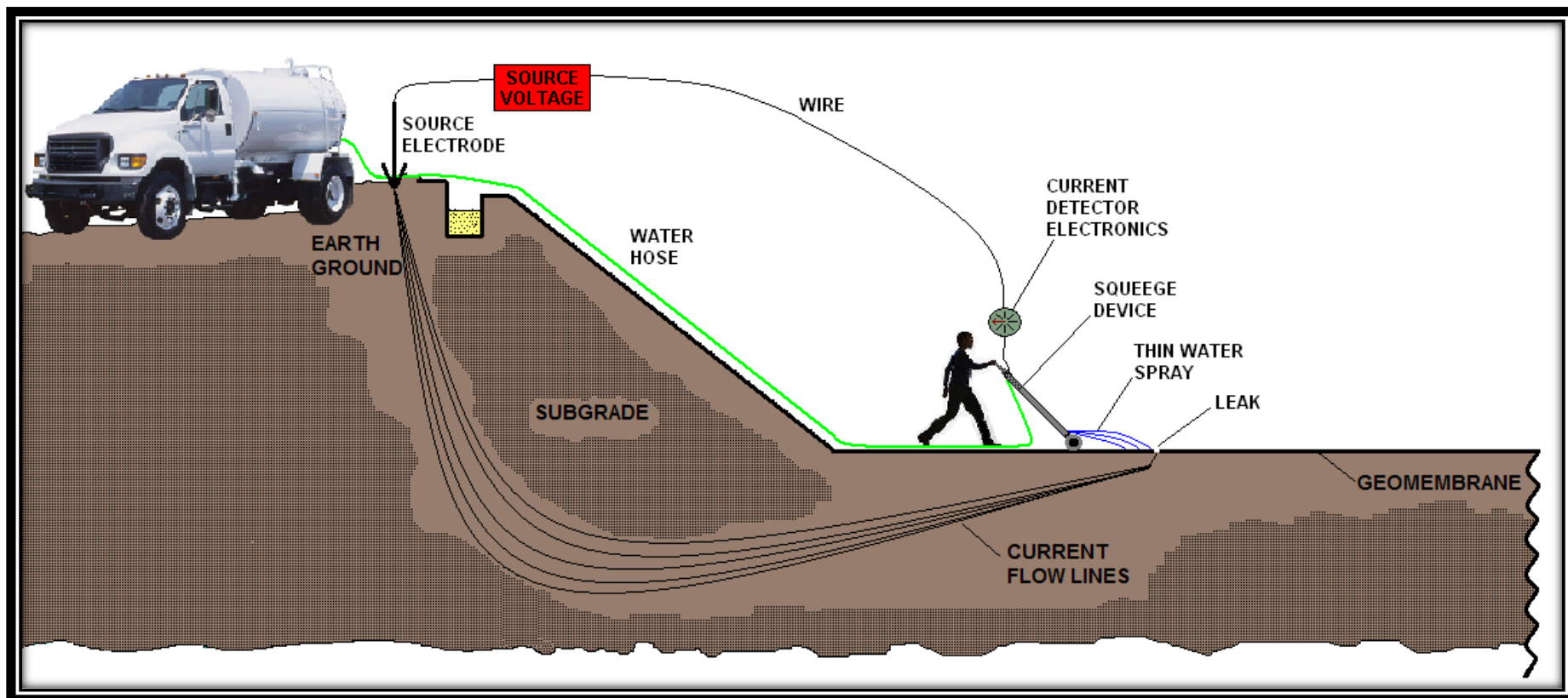
Bare Liner Survey Method

Types of Surveys

- New pond construction
- Single or double lined* (with limitations)
- Tanks
- Standard HDPE, LLDPE, XR-5 etc. as well as properly welded conductive liners

Bare Liner Survey Method

(ASTM D7002)





Leak Located by Bare Liner Method



Bare Liner Method

Advantages

- Does not require flooding the geomembrane with water
- Can be done as construction progresses
- Fast (175,000 sq. ft./man/day)
- Can be performed on non-conductive/conductive
- Can be done on double lined systems with proper layering

Limitations

- Does not have the benefit of hydrostatic load
- Leaks on wrinkles may not be detected – surveys best conducted at night during warmer months

Water-Covered Geomembrane



Deep Water Method – Over 30" Deep



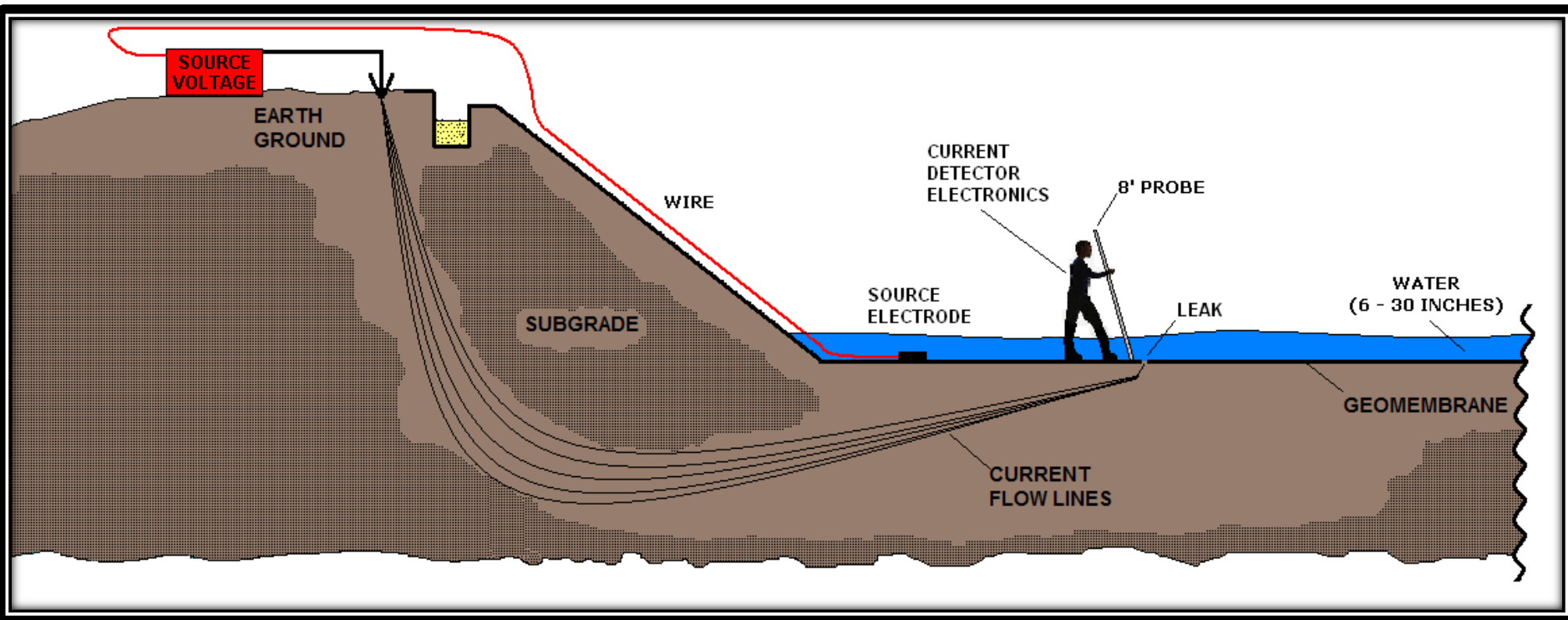
Shallow Water Method 30" Deep or Less



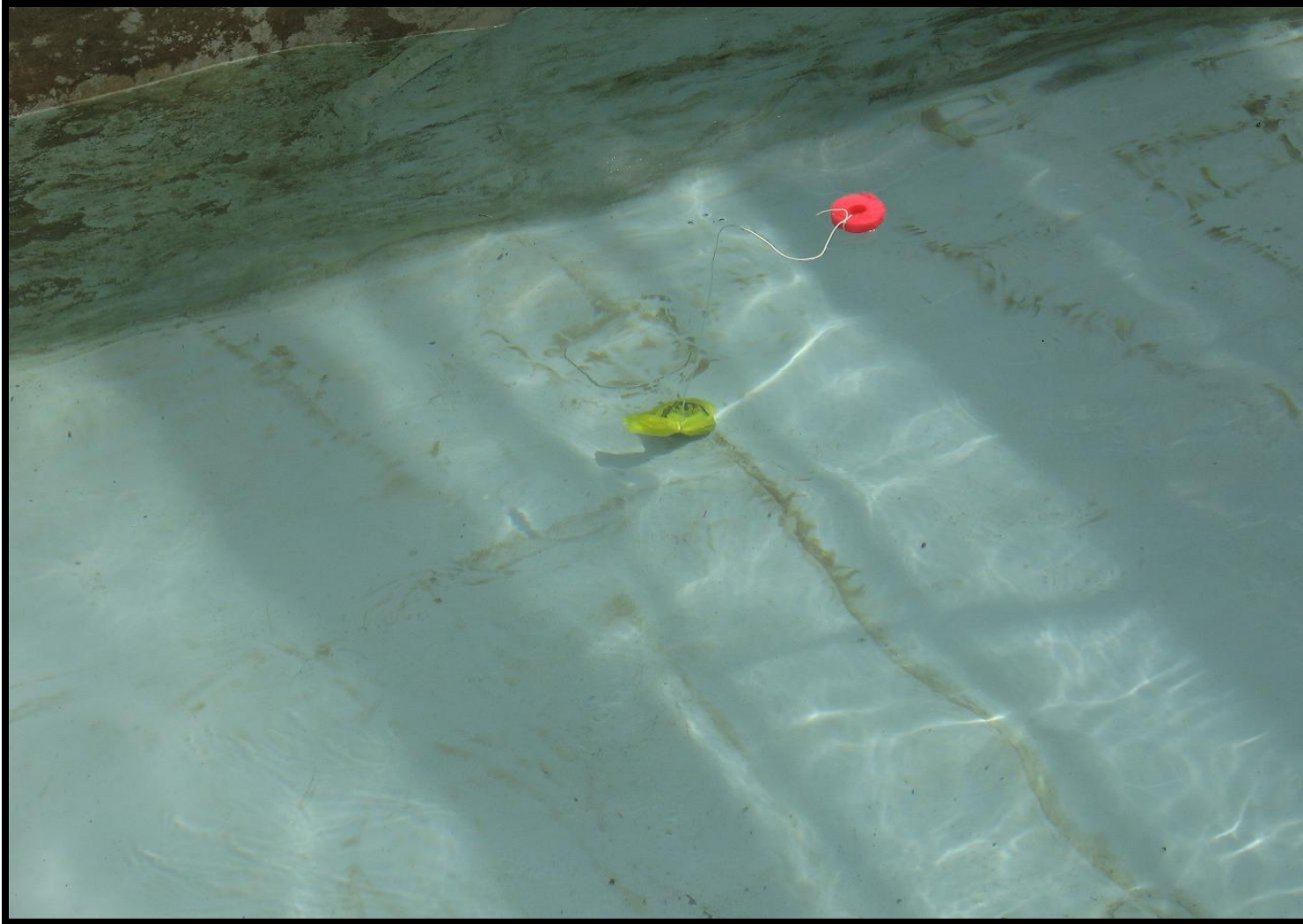
Types of Surveys

- Wading or Shallow Water Survey
- Deep Water Survey
- Survey of vertical walls
- Survey of sumps and vaults

Water Survey Method



Water-Covered Geomembrane



Water Covered Geomembrane

Advantages

- Performed under hydrostatic load
- Locates tortuous leak paths in seams and patches
- Most sensitive method for locating smallest leaks
- Can be used for in-service impoundments

Limitations

- Only the portion of the geomembrane that is underwater can be tested.

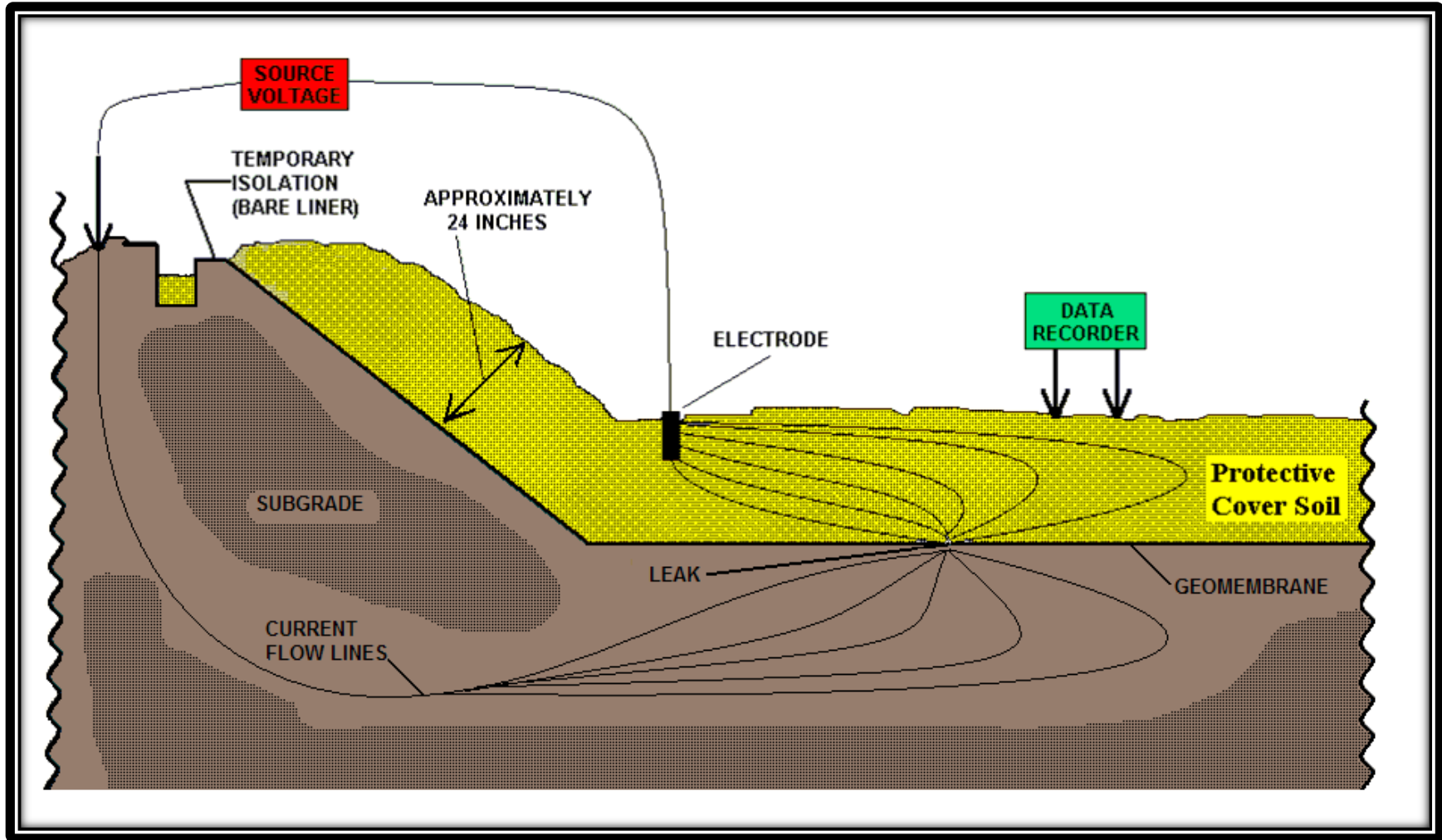
Soil Survey Method



Potential Surveys

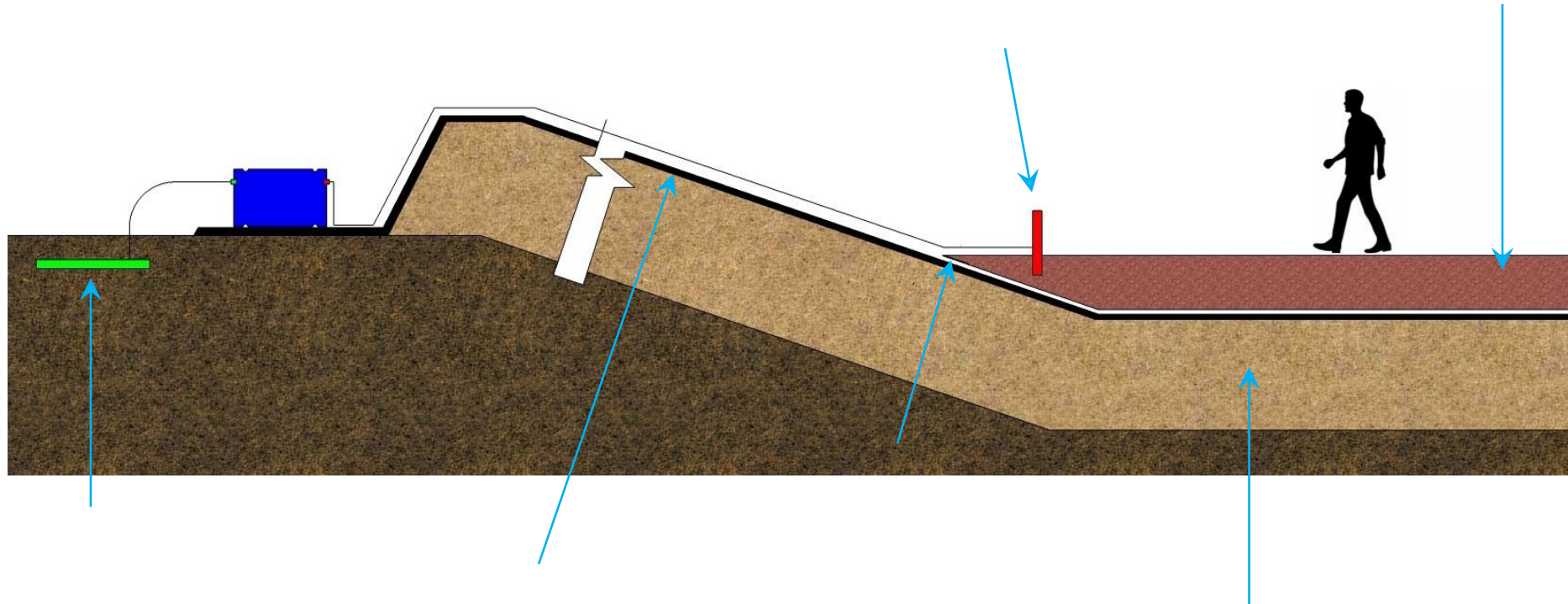
- New Landfill Cells - Single or Double Lined* (with limitations)
- Mining Heap Leach Pads
- Landfill Caps

Soil Survey Method

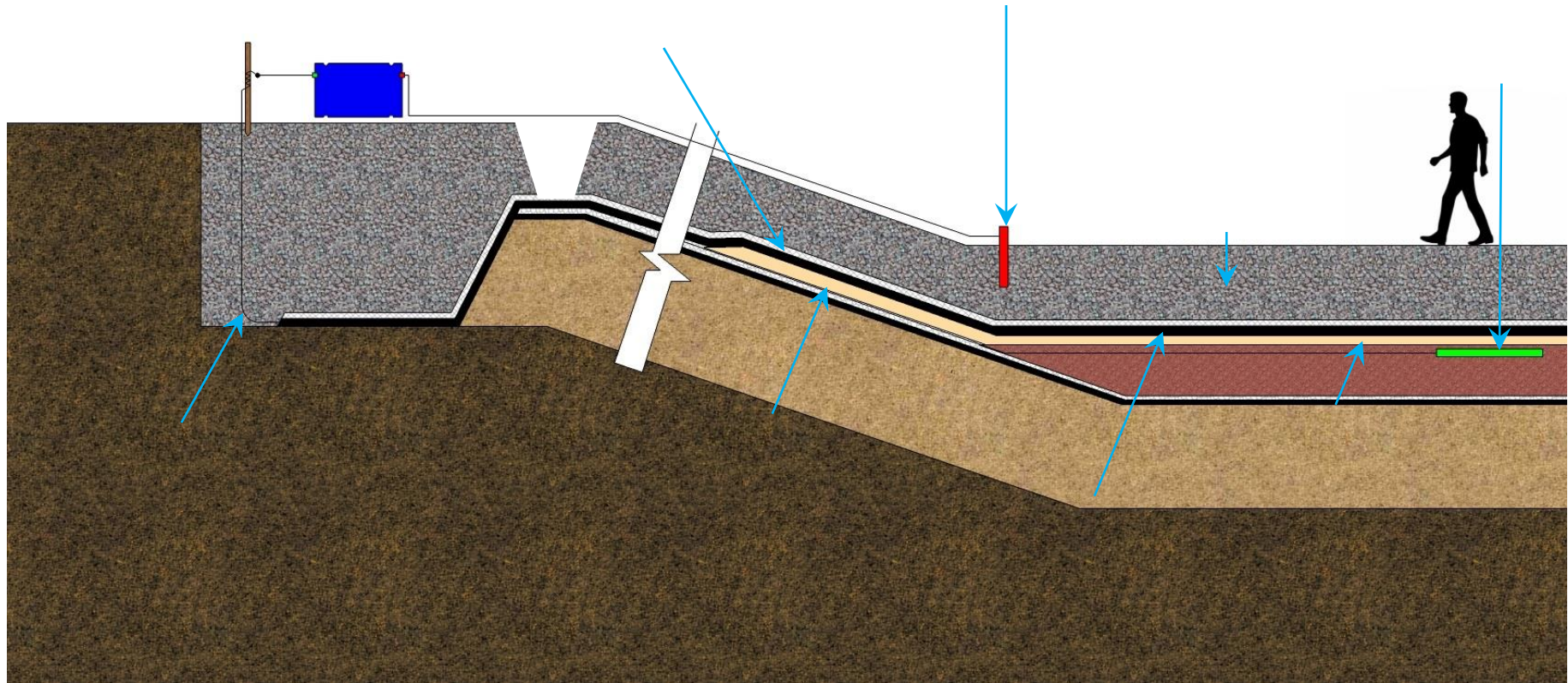


(Ref: ASTM D7007)

Secondary Geomembrane



Primary Geomembrane



Landfill Construction



Survey Over Coarse Drainage Gravel

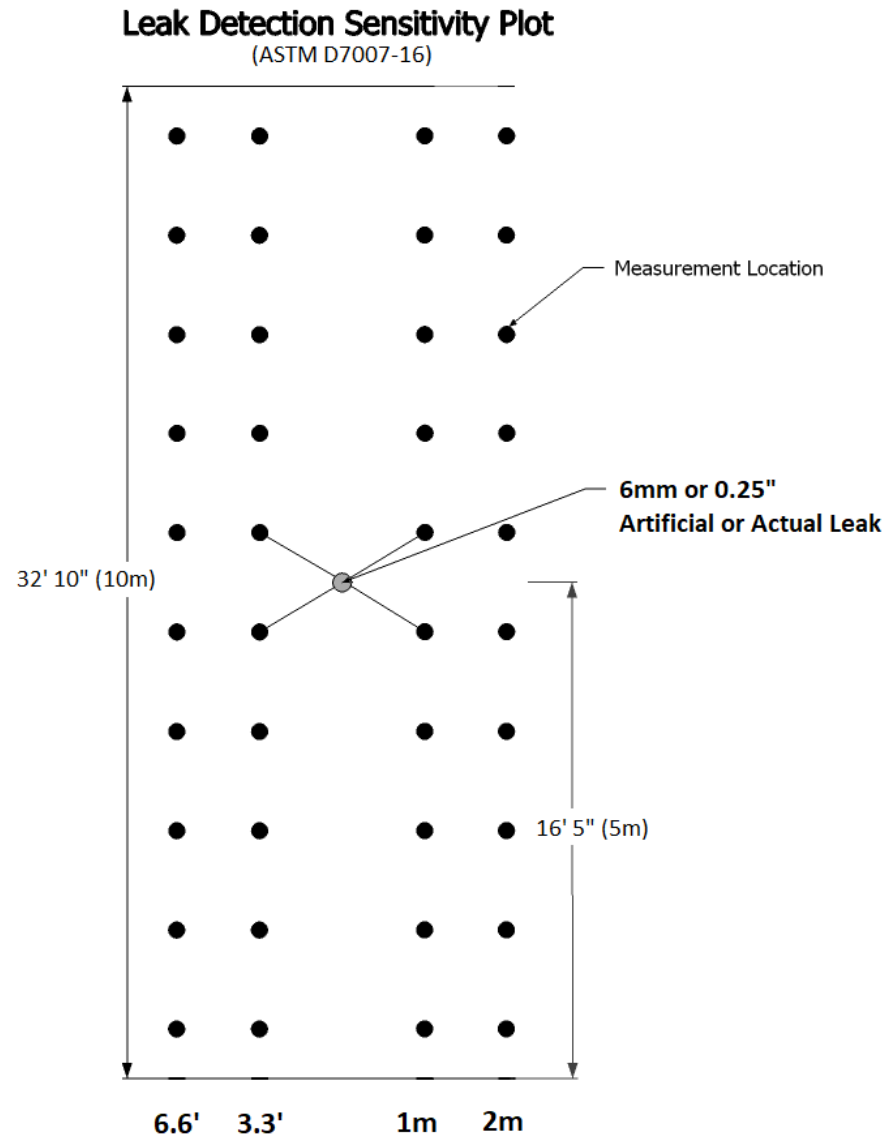


Typical Survey Grid

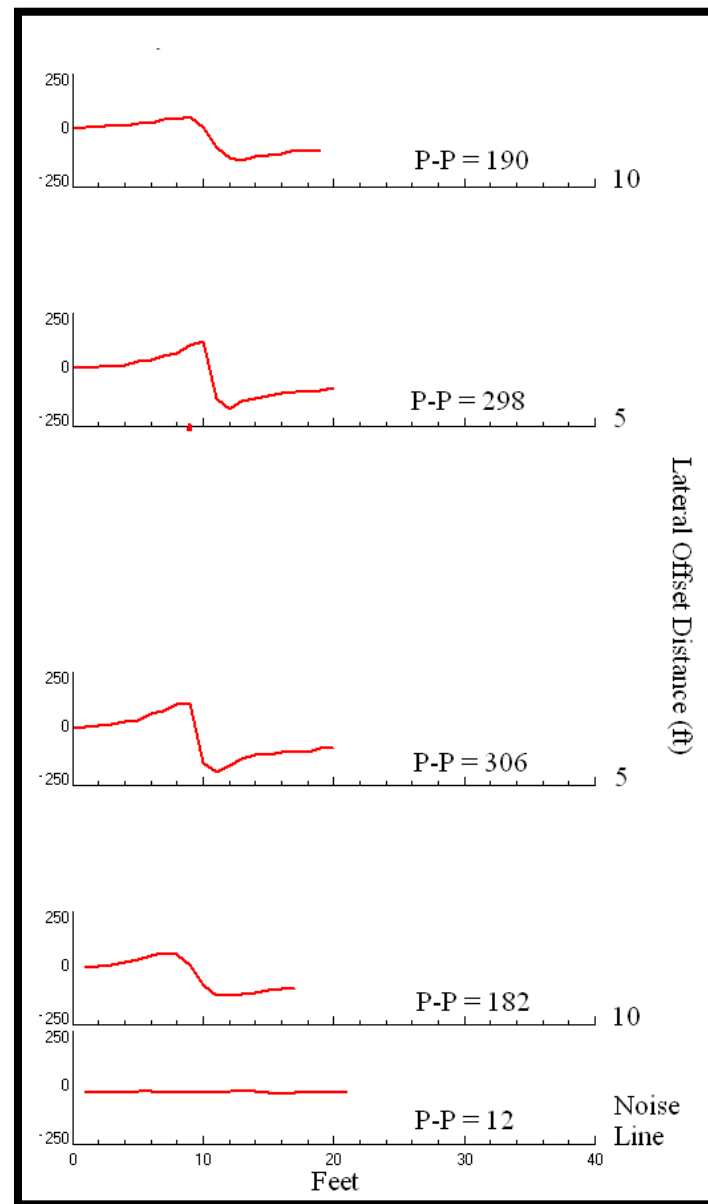
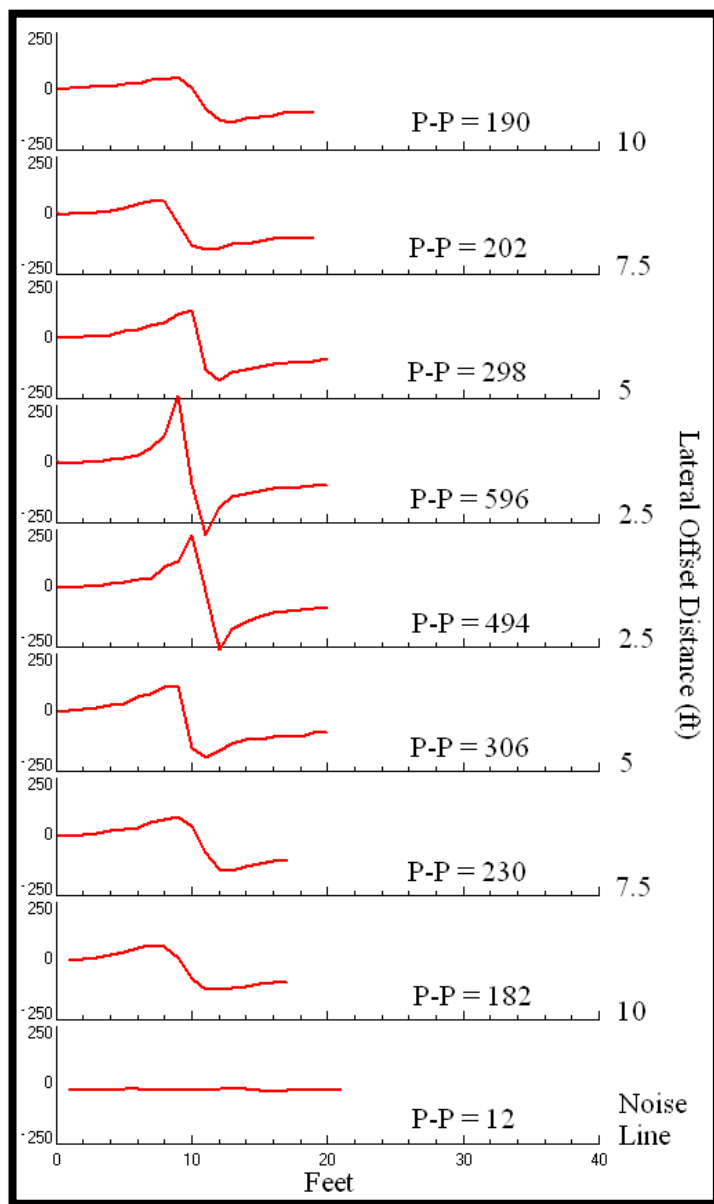


Sensitivity Test - Updated

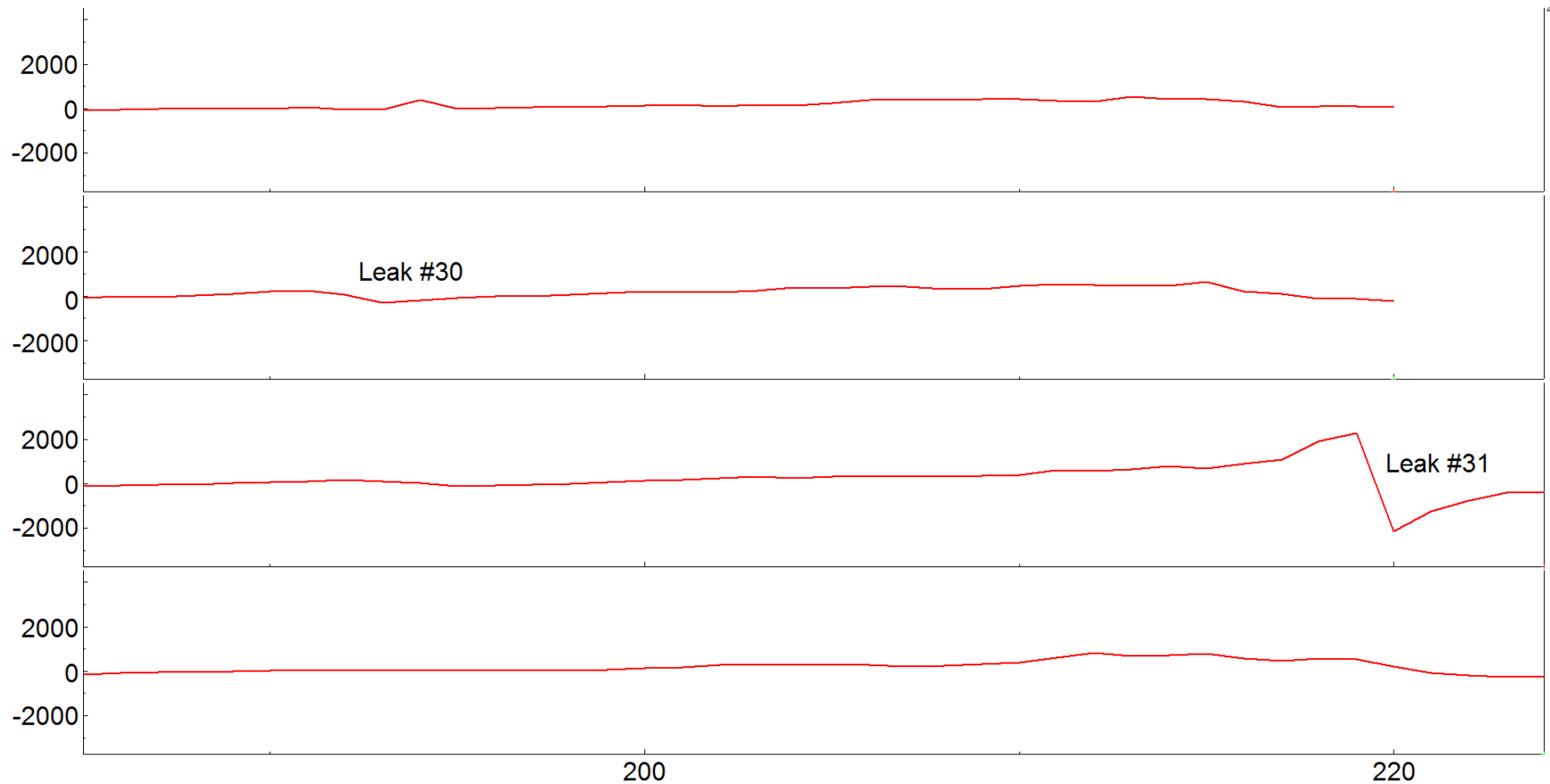
Survey Grid Geometry for Leak Sensitivity Test



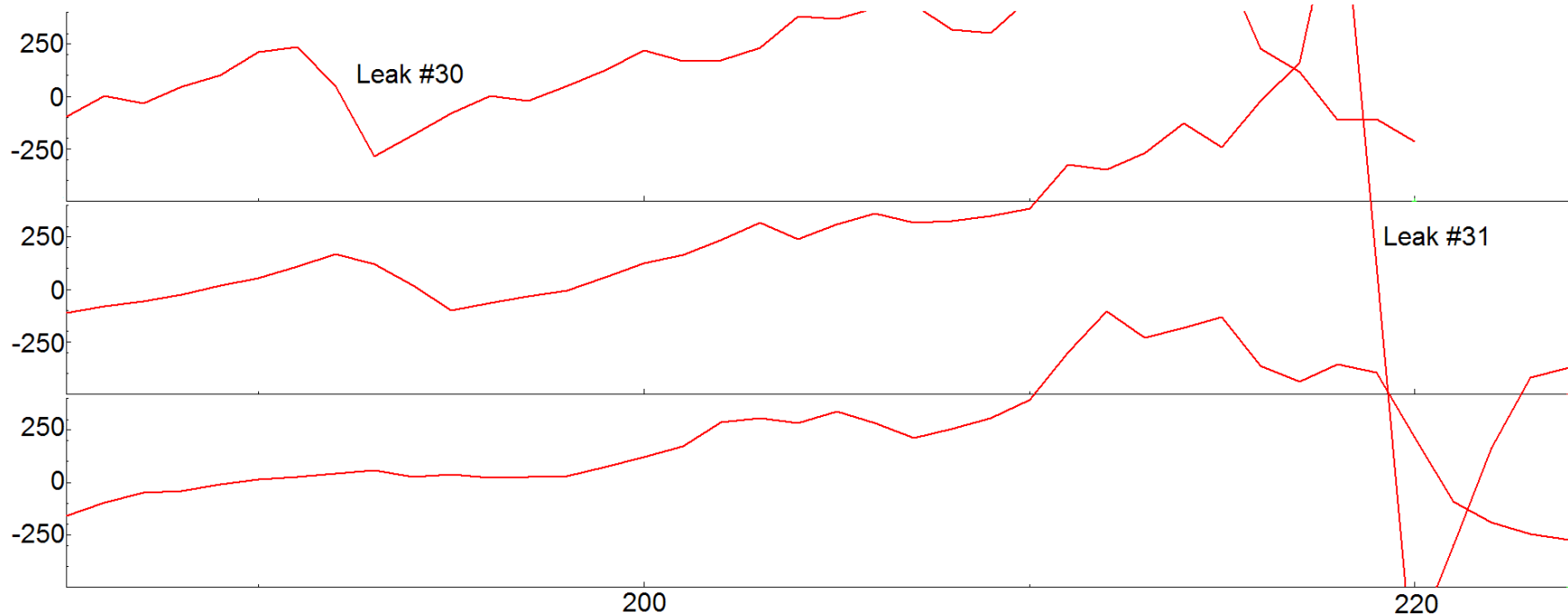
Sensitivity Test Plot



Two Leaks – One Masked



Two Leaks After Adjusting the Scale



The Actual Leaks



Leak # 30



Leak # 31

A Concern in the Industry

Comparison of Two Main Probe Types

**10 foot by 10 foot probe
with readings taken on
survey lines 10 feet apart**

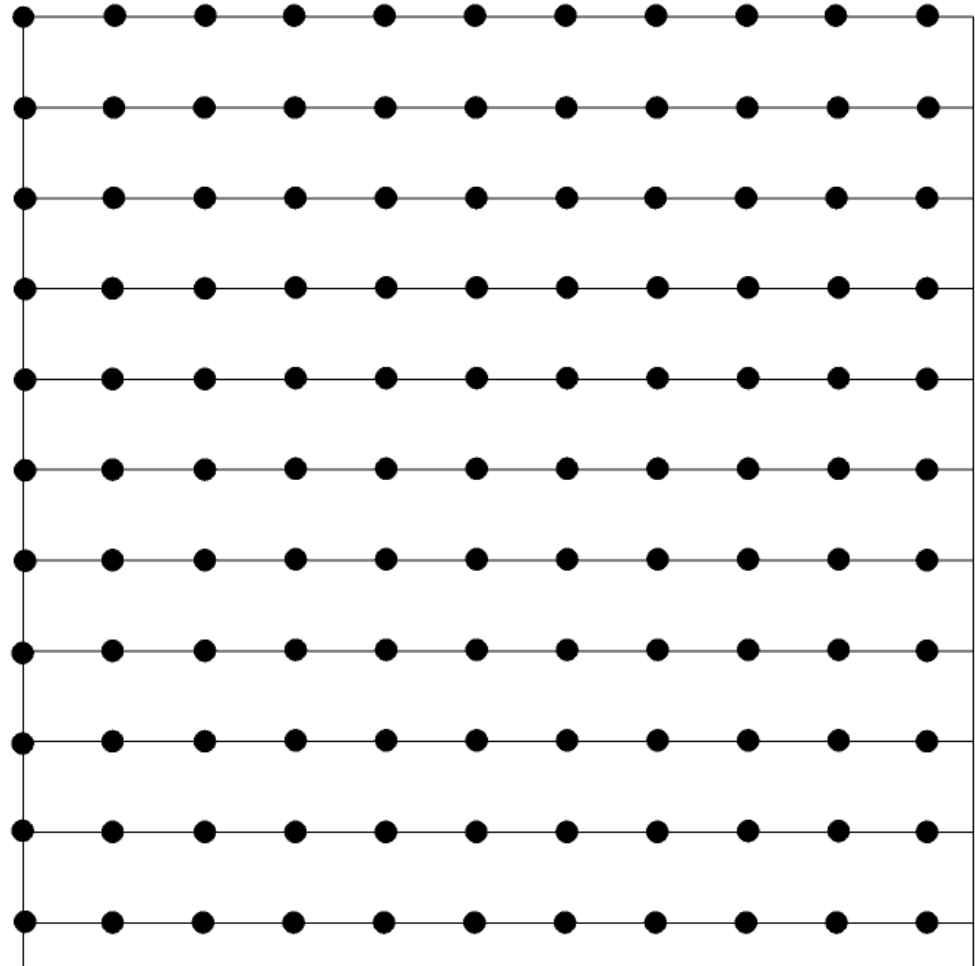
400 data points per acre

+Faster

+More economical

-Large potential for
missed leaks

-Survey must be performed
on 10 ft centers

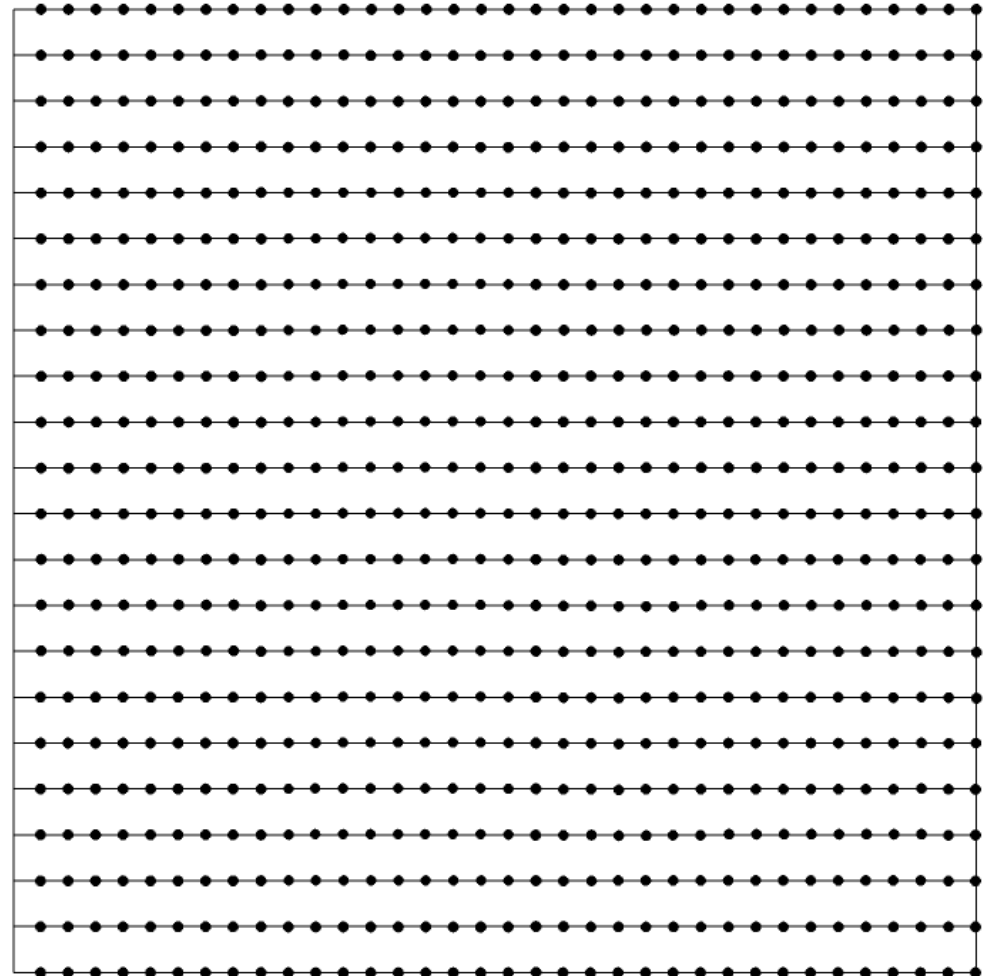


A Concern in the Industry

Benefits and Limitations of Two Main Probe Types

44" LLSI Dipole Probe
With Readings Taken on
Survey Lines 5 feet
Apart

3080 Data Points/Acre

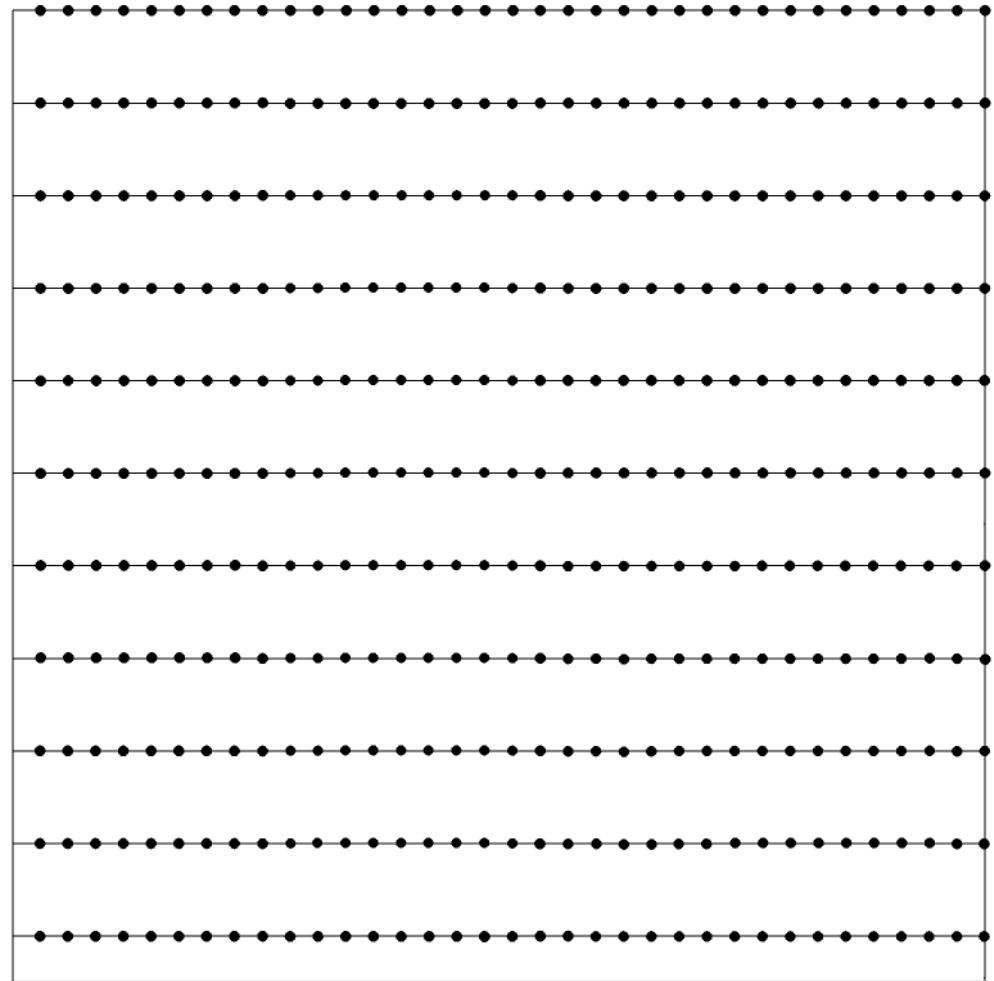


A Concern in the Industry

Benefits and Limitations of Two Main Probe Types

44" LLSI Dipole Probe
With Readings Taken on
Survey Lines 10 feet
Apart

1540 Data Points/Acre



Understanding the Technology



A Concern in the Industry

PROBLEM SPECS – Qualification Satisfied in 4 survey hours

Qualifications and experience of the specialty subcontractor proposed to implement the Electrical Leak Detection Testing Work Plan, including the following:

- a. name of the specialty subcontractor with at least 3 years of experience performing electrical leak detection testing and at least 100,000 square feet of exposed geomembrane tested;
- c. resume of electrical leak detection testing Supervisor proposed for this Project, who shall have at least 200,000 square feet of electrical leak detection testing experience, with at least 50,000 square feet of electrical leak detection testing experience on exposed geomembrane using the means, methods, and techniques proposed in the Electrical Leak Detection Testing Work Plan; and

PROPER SPECS – Excludes All But Most Qualified

1.5 QUALIFICATIONS

A. The leak location contractor shall have qualifications and experience in conducting the proposed survey method including having tested a minimum of 5,000,000 square feet of geomembrane liner within the previous three years. In addition, the leak location surveys must be supervised by a professional or technician with a minimum of three years of liner testing experience using the proposed leak location survey method. The leak location supervisor must be onsite full-time during the performance of the leak location survey.

Construction Damage



Construction Damage



Yes, It's That Good!



GCL, No Problem



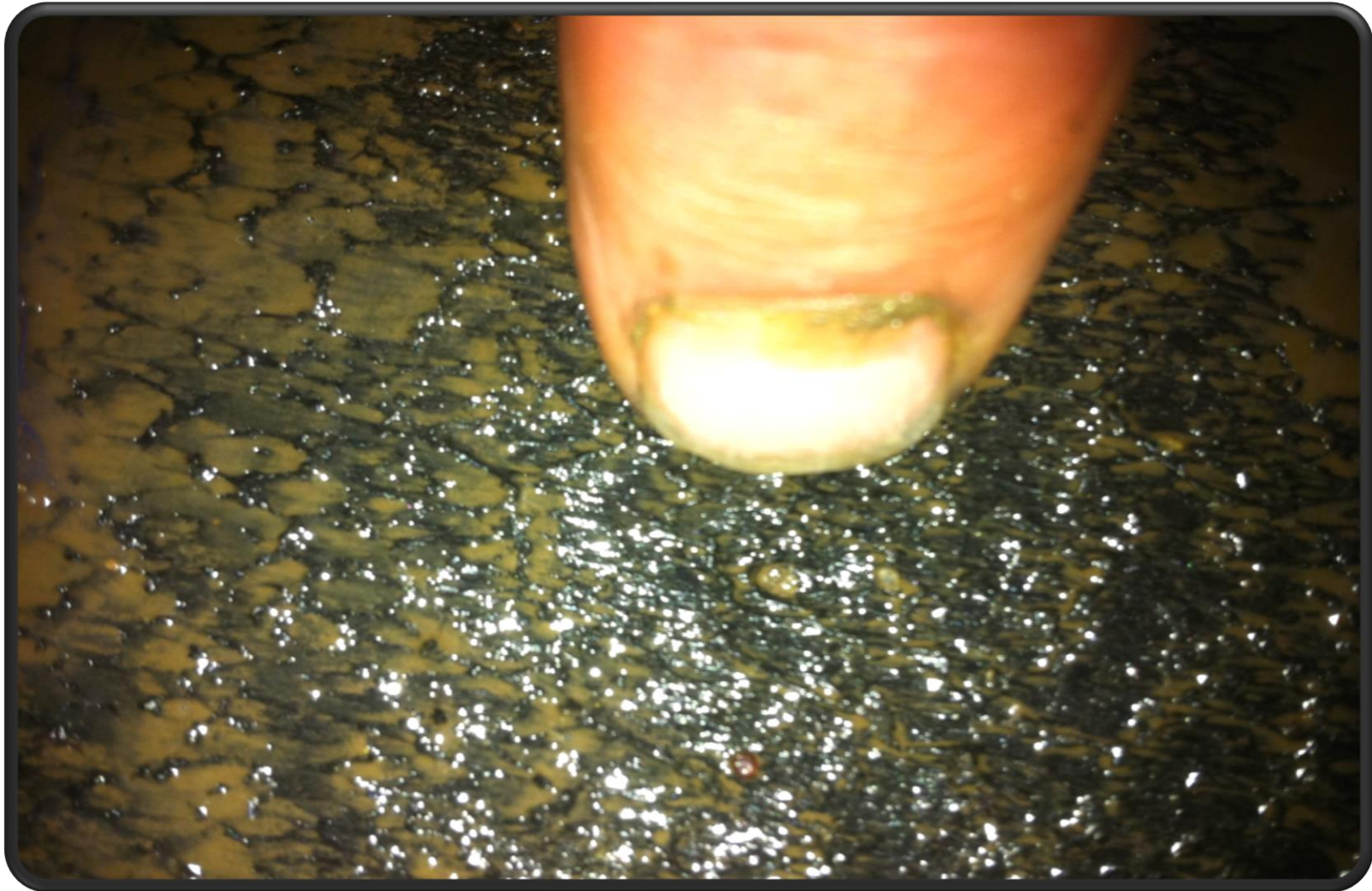
Construction Damage



Cut in Primary Geomembrane Detected Under 18 Inches of Sand



Cut in Primary Geomembrane Detected Under 18 Inches of Gravel



Survey Over Drainage Gravel Double –Lined Cell



Soil Covered Geomembrane

Advantages

- Only method capable of detecting construction damage Under soil cover
- Best method for testing landfills and other environmentally sensitive soil covered sites

Limitations

- Must have adequate moisture both above and below geomembrane being tested and cooperation of weather
(cannot be performed in freezing temperatures)

Soil Test Takeaways

- Electrical leak location soil surveys are the only method of finding construction damage after soil placement
- Construction damage is a much greater liner performance issue than seam failures
- Electrical leak location is a time-tested 25-year old technology and the most viable solution for minimizing leaks in active cells

Time for Change

Currently 9 States Require Leak Location

- **New Jersey**
- **New York – (New Regs.)
In 2018)**
- **California**
- **Washington**
- **Ohio**
- **Wisconsin**
- **Minnesota**
- **Texas (Part B)**
- **Florida**

- Proper Isolation
- Adequate Moisture in Conductive Layers
- Proper Survey Grid Spacing
- Proper Temperature – Above Freezing
- Removal of Compromising Elements to Include Sediment

Designed and Built for Leak Testing

- Conductive Elements Under Layers to be Tested
- Continuity of Ground Path
- Possible Steep Slope Solutions –
Conductive Liners and Conductive Geotextiles
- Proper Welding of Conductive Geomembranes
(If used)
- Isolation of Cell Structures / Limiting Perforations

- Bare Liner Surveys – 3.5 to 4 acres/man/day
- Wading or Shallow Water Surveys – 2.5 Acres/Man/Day
- Deep Water (30" + depth) Surveys – 2 Acres/Man/Day
- Soil Surveys – Average of 2.5 to 5 Acres/Man/Day
Depending on Sensitivity

- Bare Liner Surveys – 10 acres (baseline) 1.00
- Wading (Shallow Water) Surveys - x 1.17
- Deep Water (30" + depth) Surveys x 1.29
- Soil Surveys – Depending on Sensitivity x 1.04 to 1.29

Typically, Leak Location Surveys Comprise Less Than .5 – 1.0% of the Total Cost of a Project (ex. – Project Cost of \$10,000,000 x .005 = \$50,000 (CHEAP INSURANCE!))

Questions?

Thank You For Attending!

Matthew Kemnitz
Leak Location Services, Inc.
(210) 408-1241
6,001.09



www.llsi.com

Matthew Kemnitz

President

Leak Location Services, Inc.

mattk@llsi.com

Timothy D. Stark Ph.D., P.E.

Professor of Civil & Environmental
Engineering

University of Illinois at Urbana-Champaign

Technical Director

Fabricated Geomembrane Institute

tstark@illinois.edu

Jennifer Miller, M.S.

Coordinator

Fabricated Geomembrane Institute

University of Illinois at Urbana-Champaign

fabricatedgeomembrane@gmail.com

Post Closure Care of Landfills

Tuesday, May 19, 2020 at Noon CDT

Free to Industry Professionals

1.0 PDH

Presenter:

Jeremy Morris, Ph.D., P.E.

Geosyntec Consultants

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