



Leachate: Redirect, Rollback, and Reduce with EGCs

NYS Federation Conference, May 24th, 2022





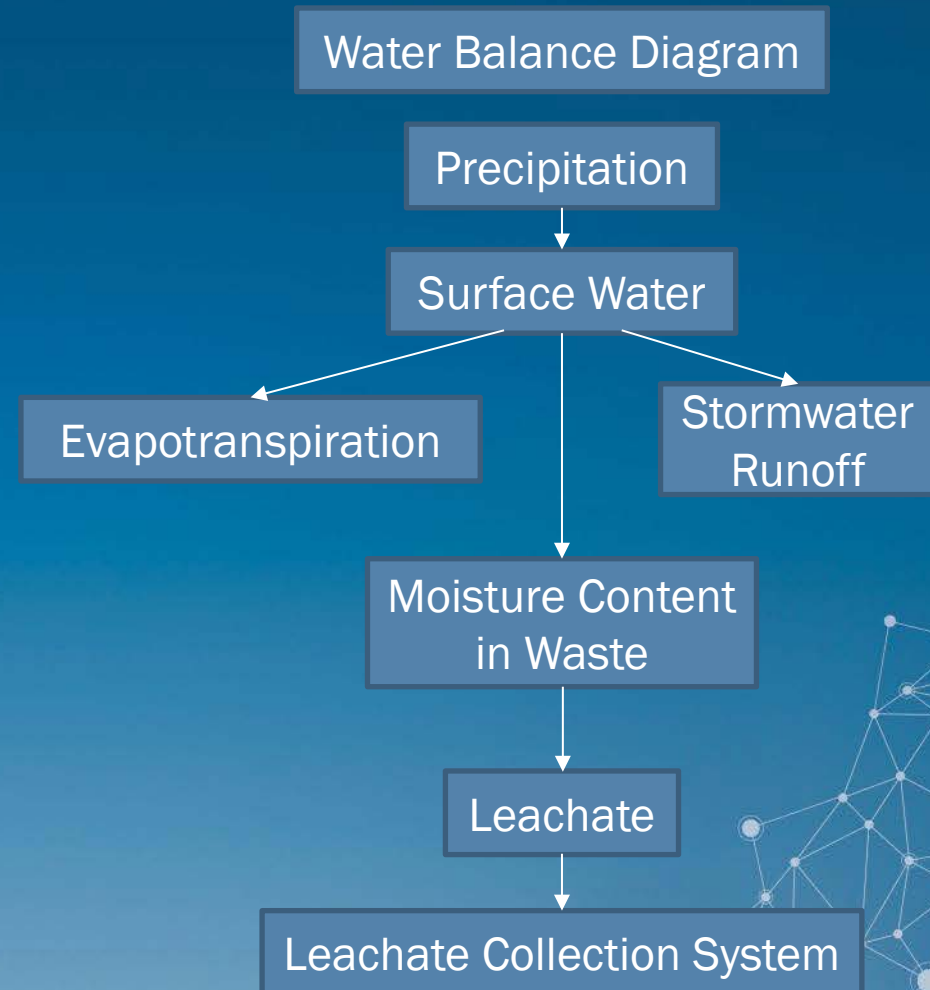
Outline

- Basics of Leachate Generation
- Regulatory Considerations
- EGC Case Study on Northeastern US site
- Costs and Volumes
- Summary and Recommendations



Leachate Generation

- Precipitation (Climate)
- Infiltration (Cover Type)
- Moisture Content (Waste)
- Additional Liquids (Recirculation)
- Operational History





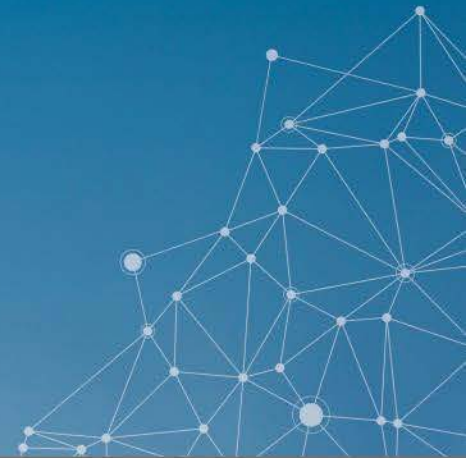
Leachate Costs

- Overall cost to transport and dispose of leachate typically ranges between \$0.08 and \$0.20 per gallon
- When the landfill post-closure period (30-years) is accounted for, leachate treatment costs (capital and operational) can constitute over 50% of the total landfilling costs
 - *1999, World Bank - Guidance Note on Leachate Management for MSW Landfills
- Cost of leachate prevention is less than cost of leachate collection and treatment

Post-Closure Care and Financial Assurance



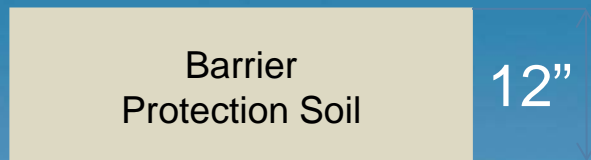
- 6 NYCRR 360-22-Financial Assurance
- Requires the owner / operator of a landfill to provide financial assurance to cover the costs to perform closure, post-closure care, custodial care, and corrective measures if needed
- Must manage leachate during minimum rolling 30-year post-closure care period





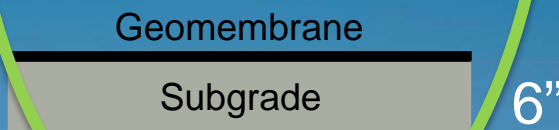
Types of Landfill Covers

Intermediate Cover

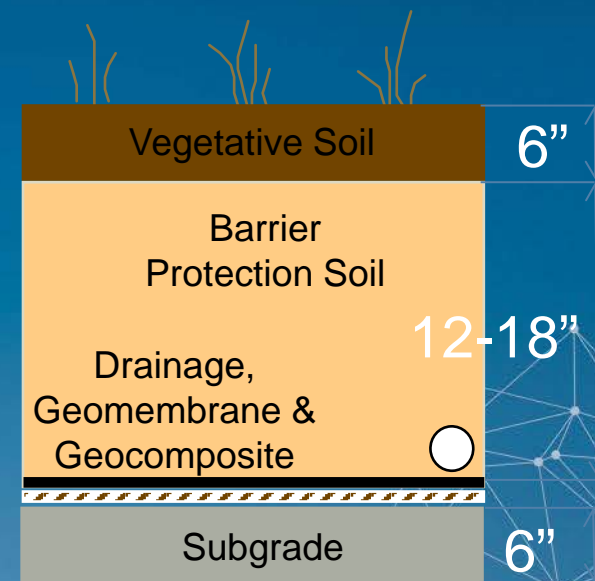


EGC

10+/- years,
or longer?



Final Cover





Potential Benefits of Utilizing EGC

- Faster install and less expensive than permanent covers
- Can provide time for planning of future landfill cover or expansion alternatives
- May not require certification or specialty contractor
- Reduced maintenance time and cost
- Can be effective tool in odor control and mitigation
- Improved stormwater quality
- *Reduces infiltration/Reduces leachate generation*



Example of EGC Application in Northeast US

- ~ 25 Acres of EGC installed in 2016
- ~Concurrently installed with 25 acres of final cover on same cells
- 40-mil LLDPE
- ~ \$60,000 per acre cost (2016) for the EGC
- EGC used for potential overflow areas



Northeast EGC

- Combination anchor trenches and earth anchors



Northeast EGC

- Sideslope application only – not installed on plateau area
- Built-in Perimeter Stormwater Channel





“HELP” MODEL

Hydrologic Evaluation of Landfill Performance

- Tool developed and required by USEPA for LF closure design
- Applies to active or closed sites
- **Calculates average values of:**
 - runoff
 - evapotranspiration;
 - drainage;
 - leachate collection; and
 - liner leakage.



HELP Model Generation Example

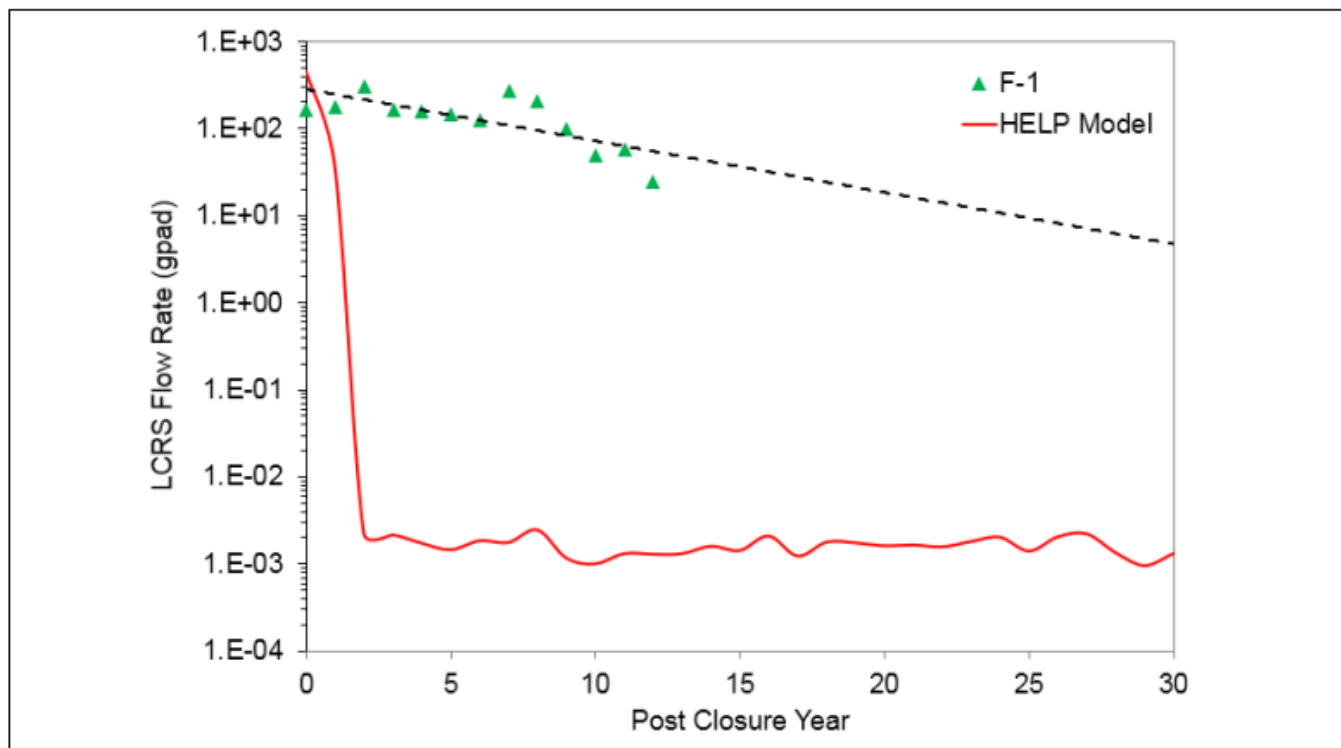


Figure 4-13. Trends in long-term LCRS flow, F-1

* November 2017 – USEPA – “Post-Closure Performance of Liner Systems at RCRA Subtitle C Landfills”



Leachate Generation Following Closure

- EPA Developed Methodology in 2002
- 2017 report suggested LCRS flow rate declines post-closure may be three to five slower than reported in 2002 (and even slower than HELP Predictions)
- Approximately an order of magnitude decrease every 15 to 20 years
- Rate of decrease in leachate generation correlates with the maximum leachate generation at closure
 - (Cells that had higher leachate flows at closure continued to have relatively high flow well into their PCC period)

Ref: November 2017 – USEPA – “Post-Closure Performance of Liner Systems at RCRA Subtitle C Landfills”



EPA Methodology (2002)

$$\frac{L_t}{L_{peak}} = e^{-ft}$$

Where:

L_t = Leachate generation for the time step of interest

L_{peak} = Peak generation at a time soon after closure

t = year

f = slope factor



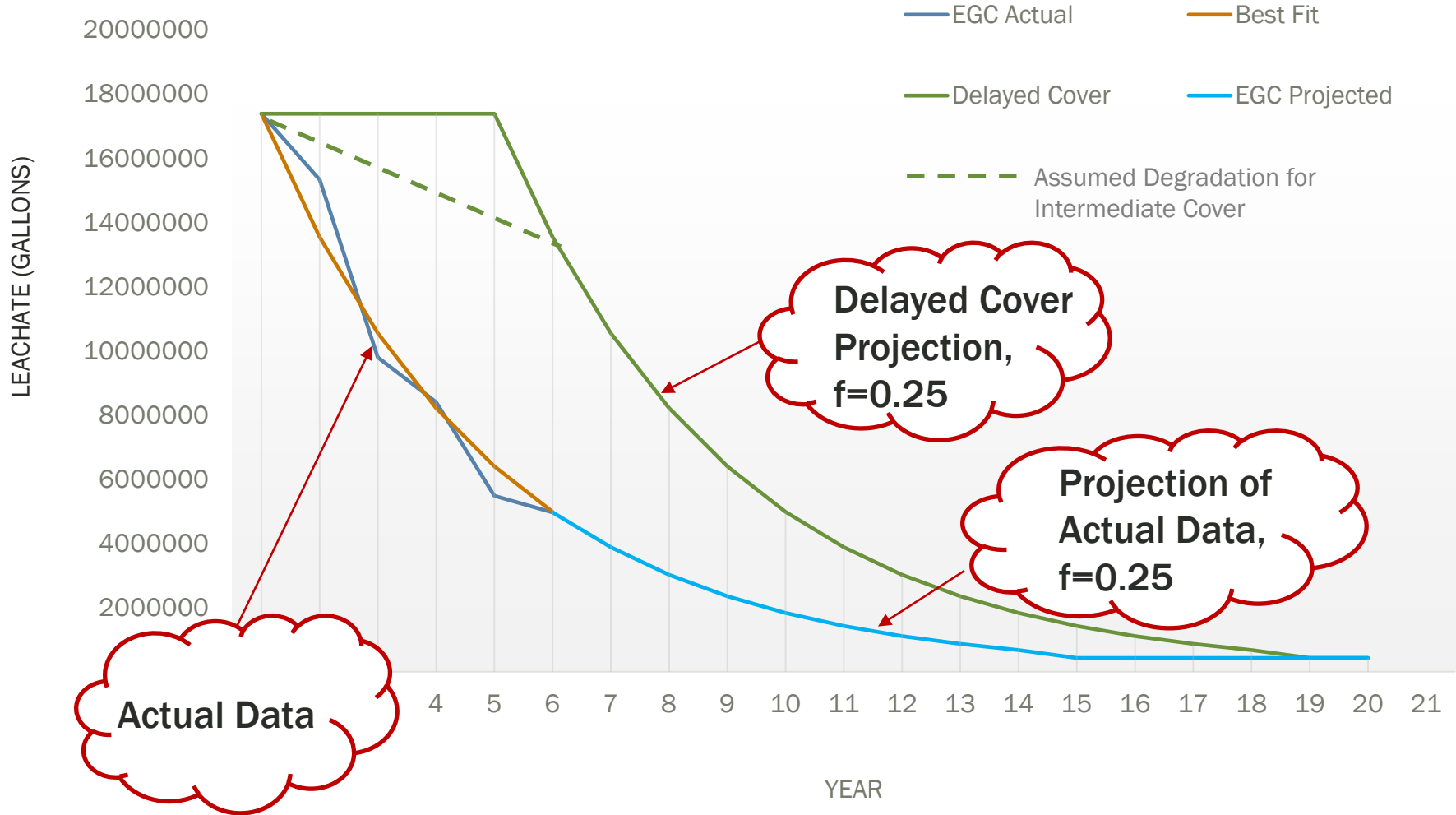
Typical Slope Factors (f)

Site Climate	Cover System	Slope Factor (f)
Wet	80-mil HDPE +Clay	0.04 - 0.09
Wet	40-mil LLDPE + GCL	0.13
Dry	80-mil HDPE + Clay	0.13
Dry	80-mil HDPE + Clay	0.03 - 0.06
Dry	40-mil LLDPE + GCL	0.07
Dry	40-mil LLDPE + GCL	0.10 - 0.13

Ref: November 2017 – USEPA – “Post-Closure Performance of Liner Systems at RCRA Subtitle C Landfills”

Effect of EGC on Leachate Generation

Annual Leachate Projection



Effect of EGC on Leachate Generation (cont.)



- Case with EGC/Geomembrane
- Total Leachate Generated =
~79 Million Gallons
@ \$0.10 per gallon
= ~ \$ 7.9 Million

- Case With Delayed EGC/Geomembrane
- Total Leachate Generated =
~135 Million Gallons
@ \$0.10 per gallon
= ~ \$ 13.5 Million



Effect of EGC on Leachate Generation (cont.)

Case Study Conclusions

- Significant reduction in leachate generation and disposal costs possible by installing EGC after final grade is achieved
- Savings in this case of over \$5.5 million at \$0.10 per gallon for leachate treatment
- Overall cost on the order of \$3.0 million for 50 ac. (if all EGC)
- Savings would increase with higher leachate disposal costs
- Leachate generation degradation rates – actually faster than what the 2017 EPA studies would suggest



2019 Costs Per Acre for Exposed Geomembrane Cover (Based on a 15 Acre Project)

Cost Item / Type of Cap	Low Range	Mid Range	High Range
	20 mil LLDPE	40 mil LLDPE	60 mil EVOH
Engineering	\$1,000	\$1,500	\$2,000
Survey	\$300	\$400	\$500
Mobilization / Unloading	\$1,000	\$1,500	\$2,000
Subgrade Prep	\$2,000	\$4,000	\$8,000
Undercap Collection	\$500	\$600	\$1,000
FML Material	\$7,000	\$13,000	\$27,000
FML installation	\$5,000	\$10,000	\$10,000
Boots	\$700	\$1,000	\$1,500
Anchorage	\$8,500	\$12,000	\$15,000
Edge Termination	\$4,000	\$4,000	\$4,000
Stormwater Improvements	\$1,000	\$2,000	\$3,000
CQA	\$2,000	\$3,000	\$4,000
Total Cost Per Acre	\$33,000	\$53,500	\$78,000



Cost of Installation

Material	2020 Material Cost Per Acre	Typical Life	Panel Size
8 mil LLDPE Smooth Skrim Reinforced	\$4,000	< 5 years	45,000 ft ²
12 mil LLDPE Smooth Skrim Reinforced	\$6,000	5 years	28,000 ft ²
20 mil LLDPE Smooth Skrim Reinforced	\$7,000	5 years	25,000 ft ²
40 mil LLDPE Textured	\$13,000	10+ years	16' x 500'
60 mil HDPE Textured	\$17,000	20 + years	16' x 700'
60 mil EVOH	\$24,000	10 to 20 + years	24' x 550'
Versacap Turf	\$48,000	20 years	12' x 300'
Closure Turf	\$80,000	100+ years	15'/23' x 300'



Closing

- EGCs are a cost effective cover system for managing leachate
- Improved gas collection efficiency
- Odor Management
- Improved stormwater quality
- Lower maintenance costs
- Traditional methodologies and studies may be underestimating leachate generation and more recent methodologies - overestimating
- Potential to be used in final cover system



Questions?

Contact

Rob Holmes, P.E.

rob.holmes@tetrattech.com

585.450.4007

