CMEI Public Engagement Meeting
RE: Proposed FRSC Crane Mountain Landfill Expansion

CRANE MOUNTAIN
ENHANCEMENT INC.

Crane Mountain Enhancement Inc.
EXP Services Inc.
March 19, 2024

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Outline

- Introduction
- Overview of Proposed Expansion
- Approvals Process and Status
- Key Issues
  - What is an engineered landfill;
  - What is leachate and do landfills leak;
  - Viewplanes;
  - Landfill Gas and Odour;
  - Site Setting.
- Summary

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Who is CMEI?

- Crane Mountain Enhancement Inc. (CMEI) is a citizen's committee representing the host community interests.
- CMEI's mandate is outlined in a formal agreement established in 1999 including the operator (FRSC) and NBDELG.
- Through funding provided by the agreement, CMEI has overseen Total Grants awarded to end of 2023 of $2,049,486.00.
- Key landfill related studies have included:
  - opposed an original 2004 request to increase the height;
  - commissioned and oversaw a 2005 Review of Crane Mountain Landfill;
  - Commissioned and oversaw a 2009 Update of the 2005 review;
  - addressed with FRSC the seagull problem in 2009 and odours in 2010;
  - Opposed 2019 proposal for development of clay pit and quarry;
  - Liaised with the FRSC as part of completion of a Groundwater Flow Model funded by NB Environmental Trust Fund.
- Current priority is opposing the FRSC's proposed expansion of the facility.

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Who is EXP?

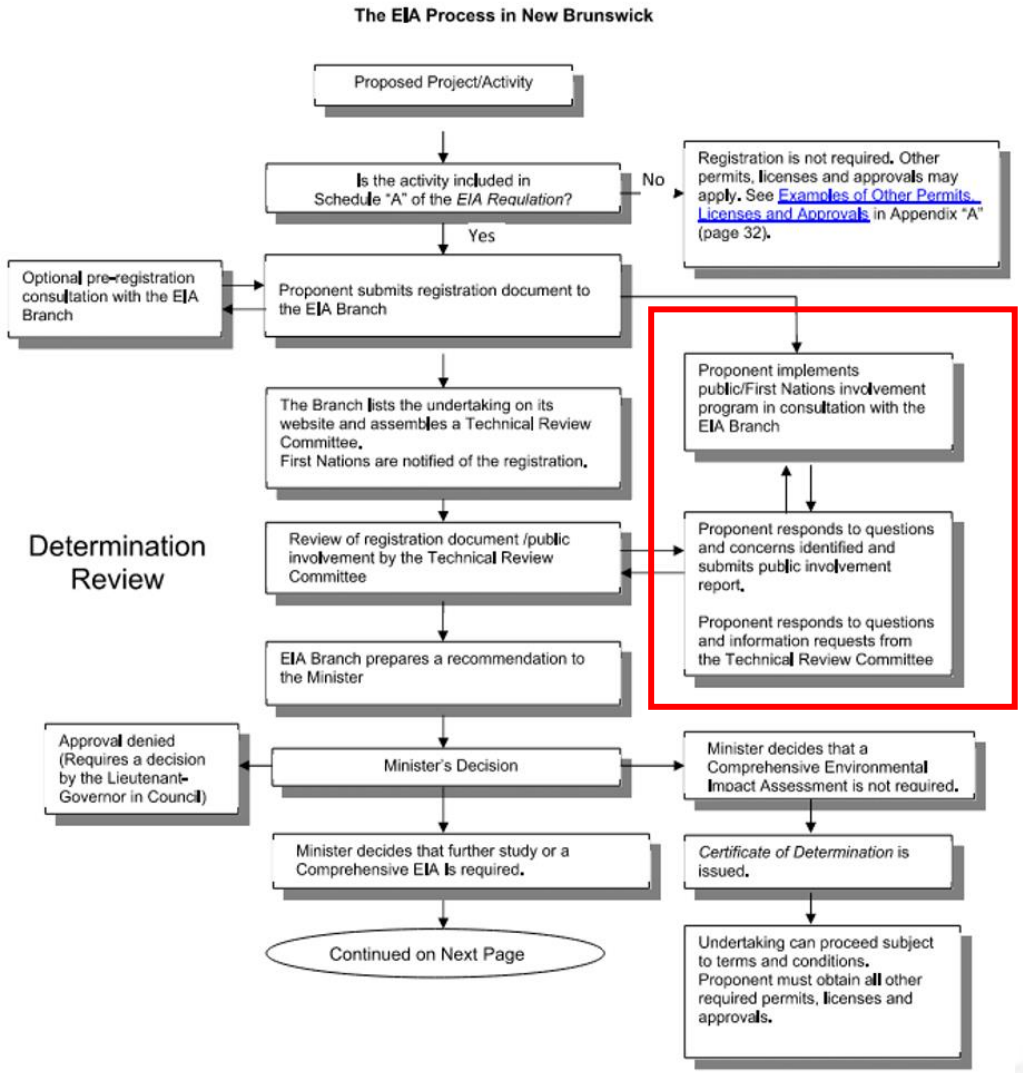
- EXP is part of the EXP Global group of companies, a multidisciplinary engineering, environmental and architectural consulting firm.
- Approximately 4,000 employees located mainly in Canada and the United States.
- Extensive experience in landfill siting, design and construction for other NB regional commissions, and internationally.
- Has assisted CMEI since 2005 in their review of operations and monitoring of the Crane Mountain landfill
- Is currently assisting CMEI in technical review of the proposed landfill expansion.

Proposed Landfill Expansion

- The Landfill (FRSC) is applying for a significant increase in the allowable solid waste that can be disposed in the landfill.
- The proposal will:
  - Significantly increase the amount of solid waste disposed relative to the originally approved facility;
  - Increase the landfill final elevation from 90 m to 117.5 m – **a 27.5 m increase!!!**;
  - Will increase the current closure timeline from circa 2048 to 2070;
  - Significant additional environmental and socio-economic implications to the host community, e.g.:
    - Significant increase in contaminant mass disposed in the watershed;
    - Increased potential to impact the community's potable water aquifer and recharge area;
    - Exacerbate existing and longer-term issues, e.g. odour, community aesthetics;
    - Pose potential constraints on near and longer-term community development, e.g. attracting new residents, impact on existing and future property values.

Approvals Process

- The Landfill must register the project under the NBDELG Environmental Impact Assessment (EIA) process.
- Application was submitted June 21, 2023 and is currently under review.
- Public consultation is a key component of the EIA review and decision process and includes the opportunity for the public to review, ask questions and comment on the proposed undertaking.
  - An online public session was held by the proponent in October 2023;
  - An in-person session was held by the proponent January 18, 2024;
  - All comments, questions and the proponent's response are submitted to the NBDELG Technical Review Committee.



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EIA Status

- It is CMEI's impression that the landfill operator **in their opinion** considers their application to have addressed the key technical and public consultation aspects required before receiving official approval.
- It is CMEI's position that the project warrants outright rejection for environmental, community aesthetics, and socio-economic reasons.

CMEI's main reasons for opposition include:

- the landfill is not and never was properly located based on hydrogeological site selection criteria and good practice - **It is located upgradient of a significant number of private wells and in a fractured bedrock setting!!!**
- Scope of EIA as submitted is mainly a desk-top study - for many issues it is simply a cursory review and is inadequate relative to the proposed scale of the undertaking, and assessment of the actual and potential implications to the host community; ;
- Inadequate assessment of alternatives – normally a key aspect of any proper EIA;
- The single composite liner should have been upgraded to a double composite liner given the site setting;
- Does not include a "state-of-the-art" assessment of potential leakage from the site, and its implications to groundwater quality, flow and transport;
- Assumes that existing and potential future mitigative measures will be adequate to address problems, e.g.,:
  - odour issues – even with current measures this continues to be a real and ongoing problem;
  - what will be done if aquifer is impacted? The cost for a centralized system is prohibitive.

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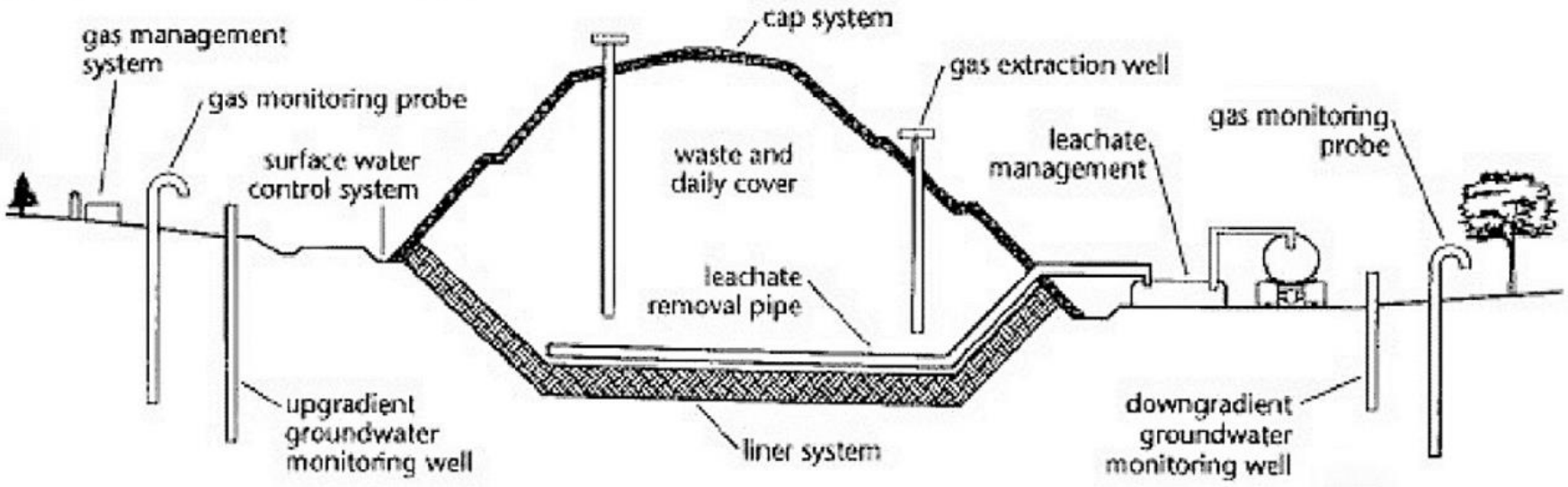
Key Issues

- Landills and Liners
- Landfill Implications
  - Leachate impacts to the environment, in particular potential for groundwater contamination;
  - Odour - an ongoing management issue with potential for significant impacts on the community quality of life;
  - Community aesthetics and socio-economic implications.
- Site Setting and Groundwater

Engineered Landfill



A typical schematic design of an engineered landfill with a full leachate and gas management. Source: UNEP (2002)

Key environmental protection measures include

- engineered low permeability liner
- underdrains
- monitoring wells
- landfill gas management

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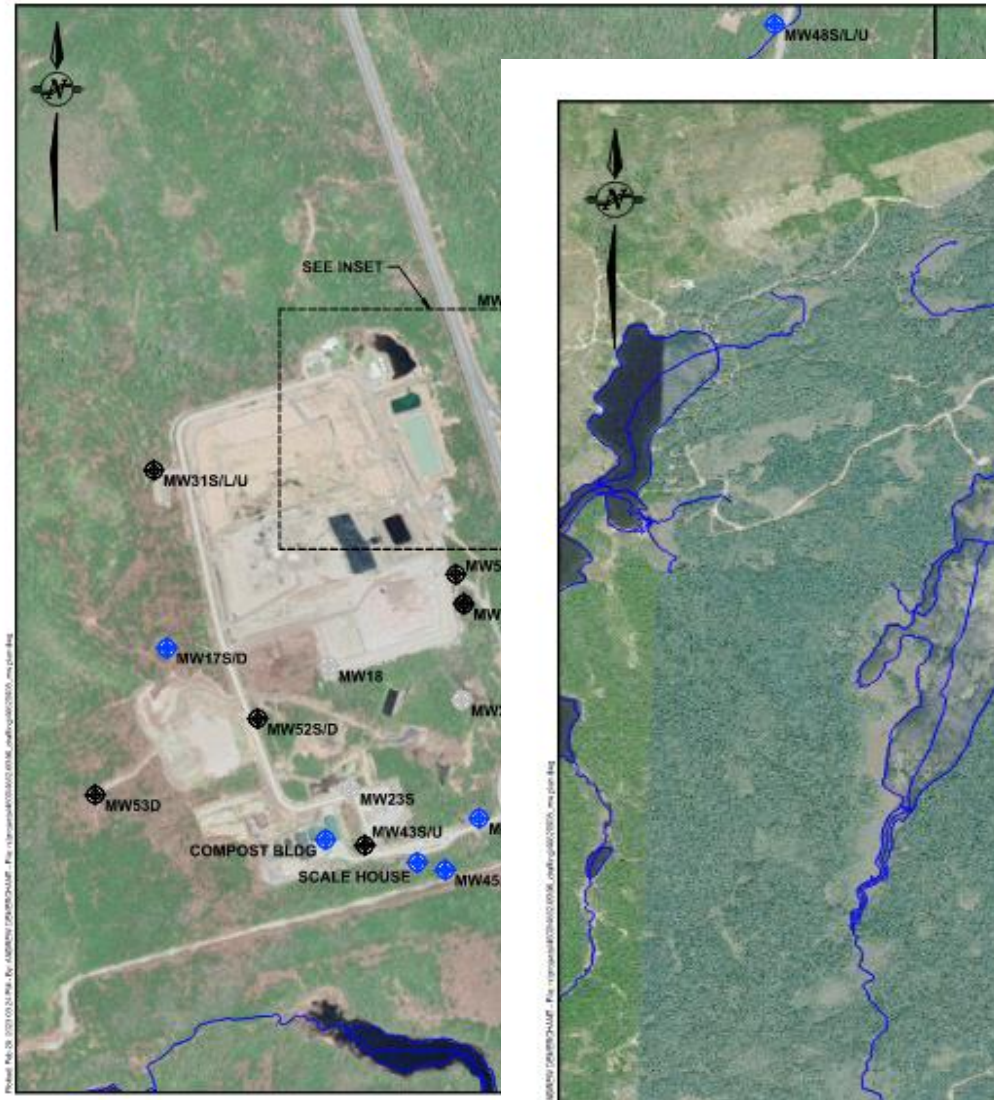
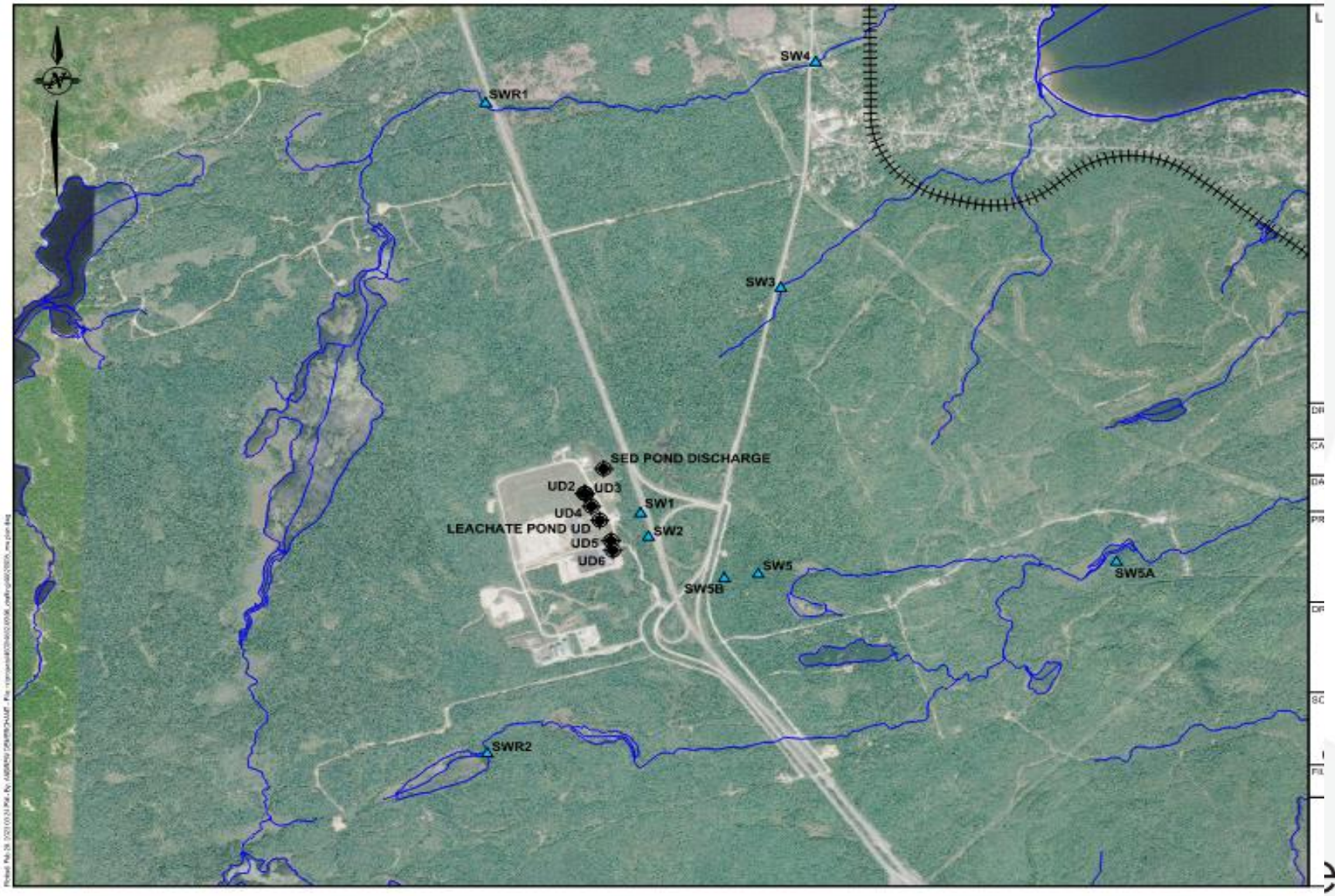
Groundwater Monitoring System

SOURCE: GEMTEC, 2022 Annual Monitoring Report

Underdrains and Surfacewater Monitoring Stations





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Engineered Landfill Construction

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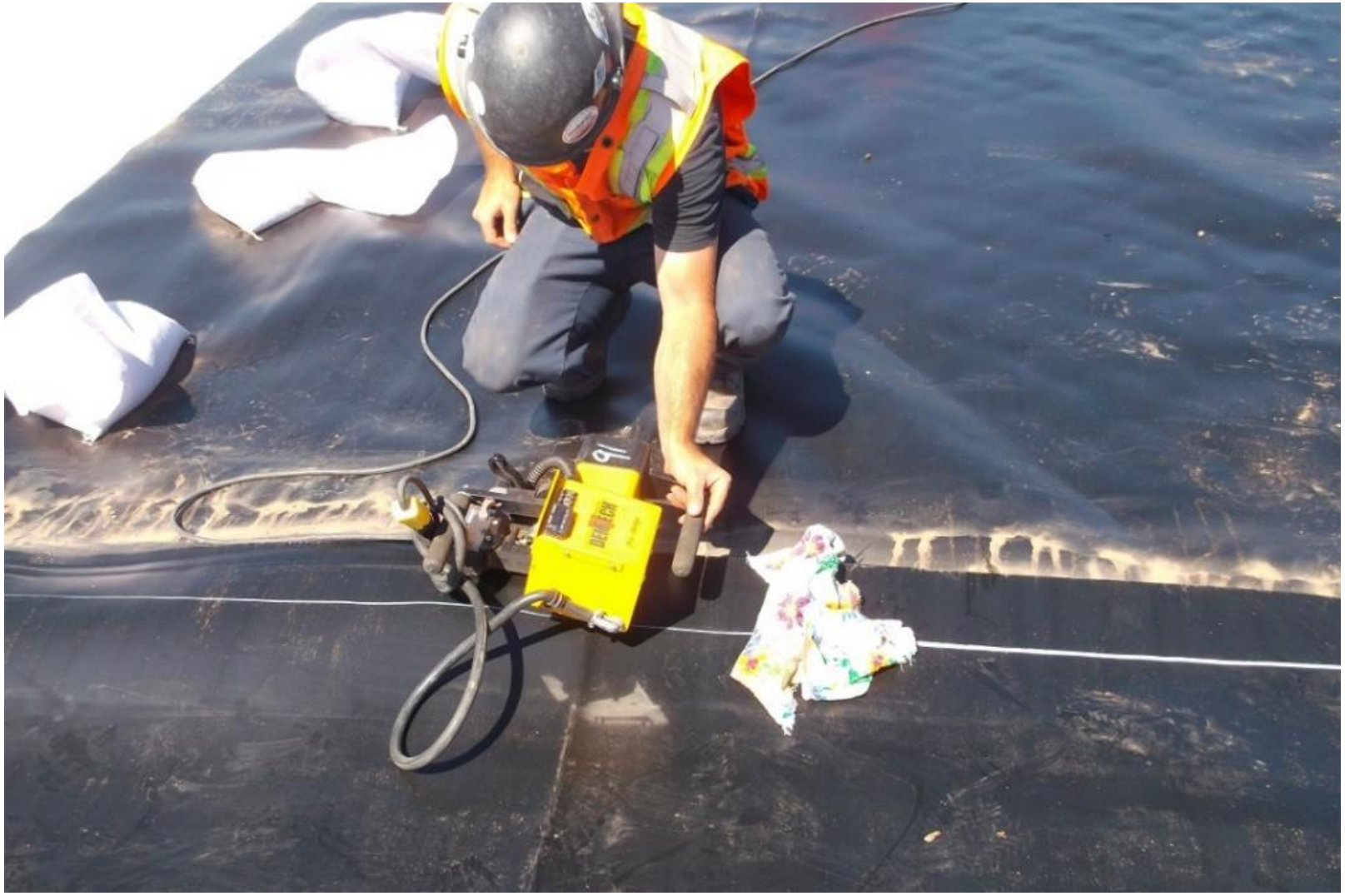
Representative Landfill Construction - Excavate and prepare subgrade (and place underdrain layer, if applicable), place and compact low hydraulic conductivity soil base liner prior to geomembrane liner construction.



Representative Landfill Construction – Place geomembrane liner over recompacted low hydraulic conductivity soil base liner. Geomembrane is typically 80 mil HDPE. NOTE – wrinkles in liner; degree of wrinkles can vary widely but is important!!

Representative Landfill Construction – Place drainage layer and piping (not shown) for leachate collection.

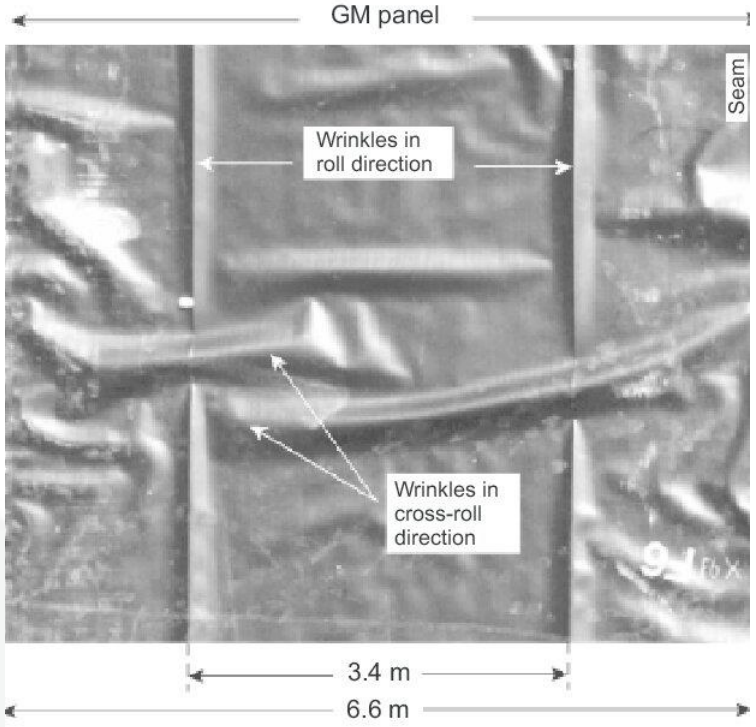
Representative Landfill Construction – Constructed cell essentially complete (some drainage gravel along center line remaining to be spread over central collection pipe (under gravel).

Landfill Leachate

- The liquid formed when water percolates through landfill waste;
- Contains various components that can pose environmental risks;
- Landfill leachate is one of the most difficult wastewaters to treat;
- Emerging contaminants issues (PFAS, PFOS, microplastics);
- It is reasonable to expect that treatment requirements and cost will increase over time.

All landfills will leak - Why do they leak?

- No liner is impermeable due to advective and diffusive transport processes, and imperfections during manufacture and installation = wrinkles, pinholes, etc.



January 2007Geosynthetics International 14(4):219-227

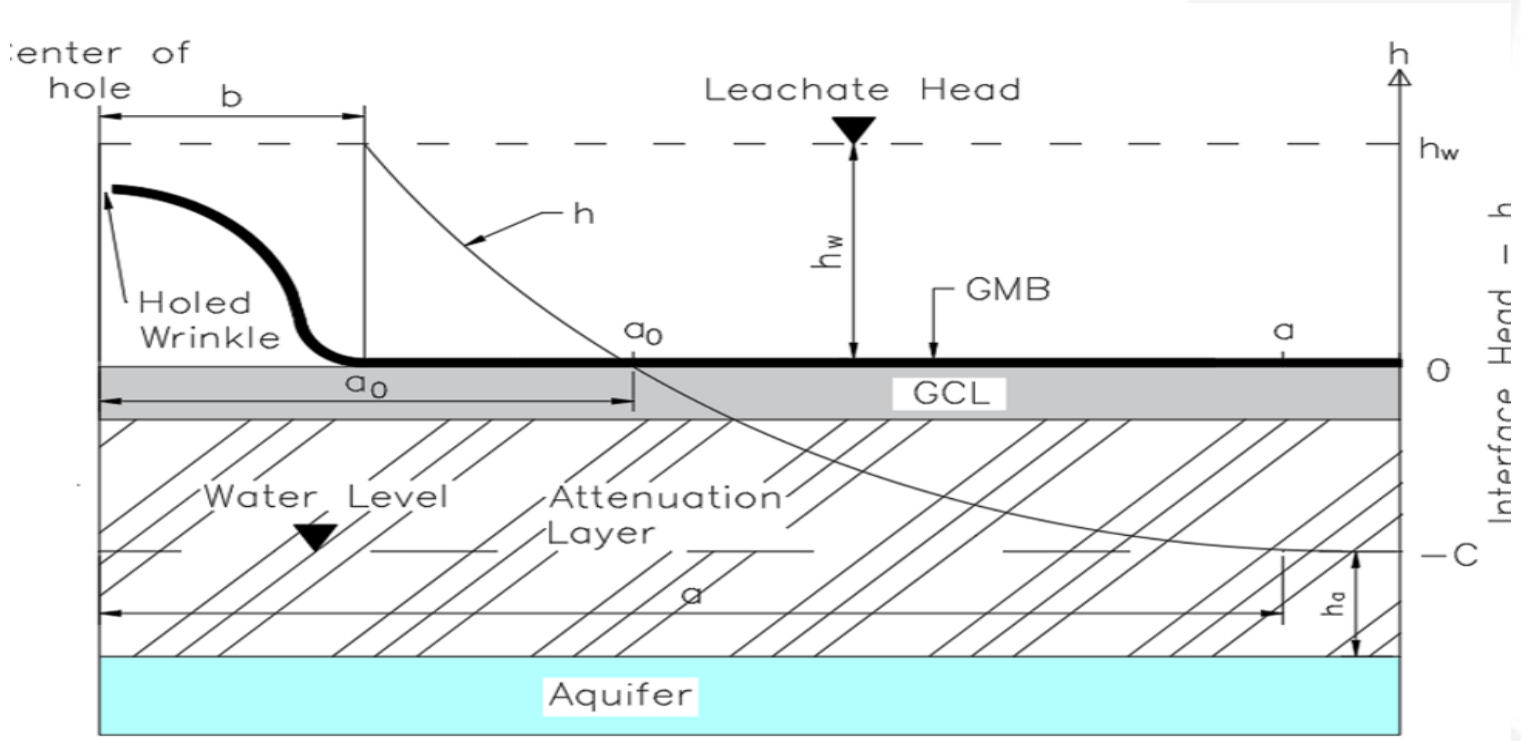


Fig. 1. Schematic showing extent of wetted distance beneath a holed wrinkle.

Rowe and Barakat PFOS Computers&Geotechnics 137 (2021)_104280

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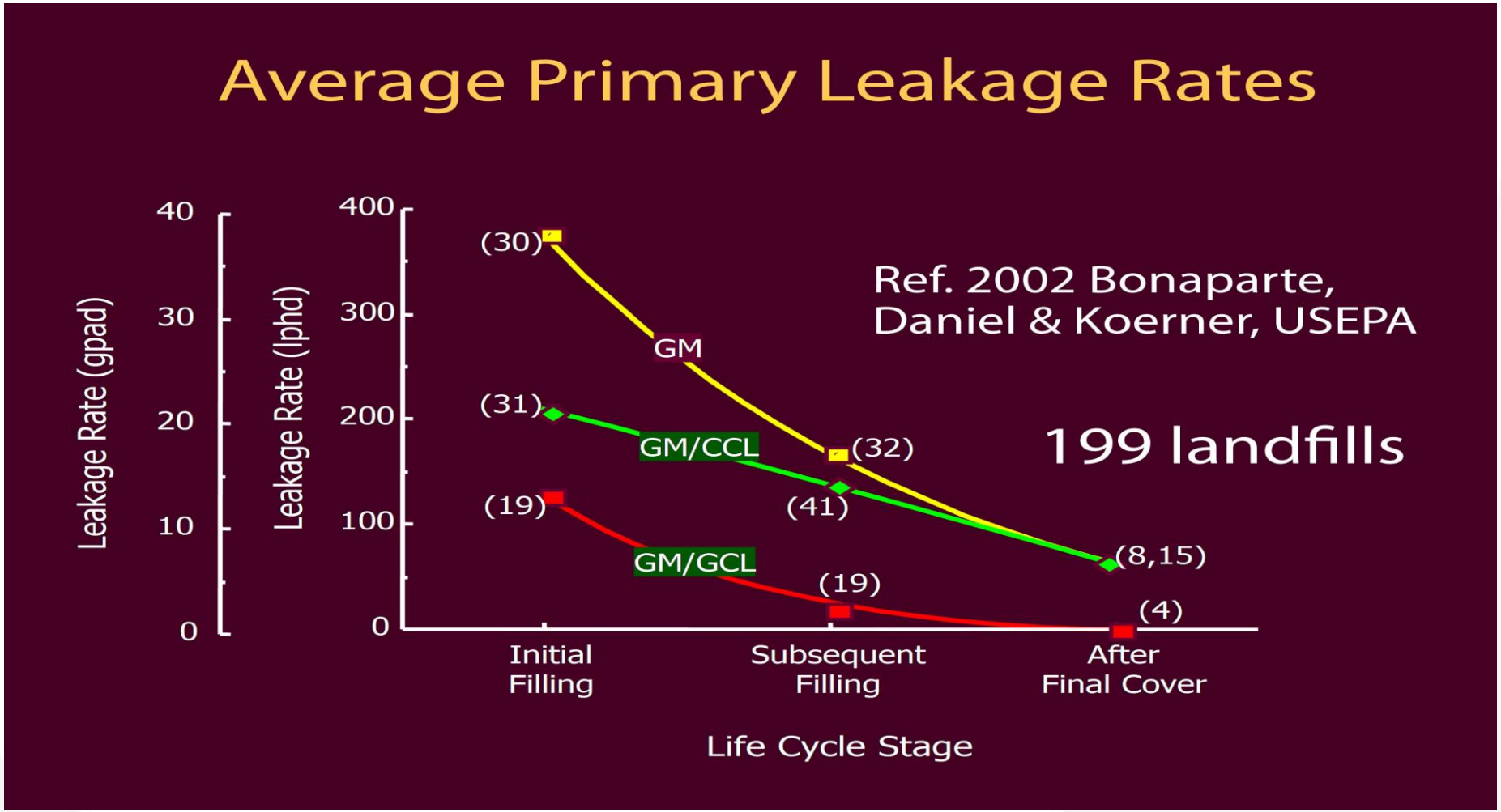
How much do landfills leak?



Single Composite Liner Leakage Rate – an example:

Table 6.1. Probability, P, that the leakage, Q, through a single composite liner will be exceeded (based on New York State landfills, Beck 2015)

Q (lphd)	P (%)	Q (lphd)	P (%)	Q (lphd)	P (%)
10	91	75	48	300	8
20	82	100	38	400	6
30	74	150	24	500	5
40	67	200	16	750	4
50	61	250	11	1000	4

Source: Rowe, R.K. and Jefferis, S. (2022) "**Protecting the environment from contamination with barrier systems: advances and challenges**", Proceedings of the 20th International Conference on Soil Mechanics and Geotechnical Engineering, Sydney, Australia.

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Liner Design and Leakage Rate

- The literature indicates that a double composite liner offers significantly better leakage protection!!!

- The 2005 CMEI/EXP study had recommended consideration of changing to a double liner but this liner design change was not implemented.

- Emerging leachate contaminants " **<u>…..create the need to re-evaluate the safety of our existing landfills</u>** "[1]

  – **Source:** Rowe, R.K. and Jefferis, S. (2022) "Protecting the environment from contamination with barrier systems: advances and challenges", Proceedings of the 20th International Conference on Soil Mechanics and Geotechnical Engineering, Sydney, Australia.

WHY WASN'T THE LINER UPGRADED TO A DOUBLE LINER????

EXP (ADI-2009 update report to 2005 review)

5.2.3 Landfill Liner

A one page summary of PROS/ CONS of double liner versus single liner system was developed by GEMTEC, which essentially dismissed consideration of upgrading to a double liner system. It is ADI's understanding that selection of materials, layered systems, and attention to proper construction can result in significantly lower rates of leachate leakage through composite liners. For example, a common design for engineered landfills in New Brunswick is double geomembrane liners separated by a geonet drainage layer. This type of system provides the advantage of reducing the hydraulic head on the lower components of the liner system; hydraulic head (height of liquid buildup on the liner) is a significant variable in determining advective breakthrough and flux (leakage) through the liner. A second potential advantage is for the geonet between the liners to serve as a secondary leachate collection system in event of leakage through the primary liner.

Leakage, cont'd….

- How much will the Crane Mountain Landfill leak??????
- Is there an acceptable amount of leakage?????
- What are the implications to the bedrock aquifer potable water supply????
- Will the Landfill Well Monitoring system and program detect leakage???
  - Monitoring for landfill leakage in a fractured bedrock setting is subject to significant uncertainty;
  - it is CMEI's and EXP's opinion that the related Domestic Well monitoring program has been marginalized over time (e.g. due to privacy legislation) and its usefulness as a robust potable water quality assurance program is considered limited.

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Landfill Gas and Odour

- The **odorous emissions** from landfills can significantly impact residents' **quality of life** and potentially health.

- The EIA suggests that odour can be adequately addressed through active landfill gas collection and destruction…**HOWEVER**
  - to date, despite considerable efforts on the part of the landfill operator, active landfill gas collection and management has been inadequate to eliminate odour issues for the community.

- It is reasonable to expect that raising waste height will only exacerbate the existing odour problems.

Landfill Gas and Odour, cont'd…

- **Example -** CBC Mar 13, 2023 - In October 2021, the Fredericton Region Solid Waste landfill was granted approval by the province to pile garbage as high as 88 metres…..
- Residents point to Fredericton landfill expansion as culprit in worsening odour | CBC News

  - *….Rotten eggs, rotten meat, sometimes dirty diapers…"* is how some residents of the neighbourhood describe a smell they say has been wafting more frequently — and with a higher potency — from the nearby regional landfill and into their homes….And they contend **the problem is the result of the Capital Region Service Commission being allowed to start piling garbage almost 30 metres higher.**
  - *"We're smelling it pretty much every single day, and it's affecting our lives,"* said a resident who lives about 1.5 kilometres east of the landfill. *"Since the expansion, it's been more on a regular basis,…It's not every day, but it's most days, whereas in the past it might have been two days a week or three days a week, but now it's more like four or five days a week*.
  - *When they were pushing their proposals forward, they were saying* ***'No, there won't be any … more significant of a smell, it's not going to impact the area.'" But that's wrong. It's completely wrong. We're being impacted by it*.**

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Quality of Life

- Viewplane(s) –
  - The issue of viewplanes was a significant consideration in limiting the original allowable height of the landfill;
  - In CMEI's opinion the current EIA study viewplane analysis is inadequate.
- Socio-Economic – in CMEI's opinion the implications to the host community have not been adequately assessed, e.g.:
  - potential for constraint on expanding residential development(s) and consequently providing for additional tax base to maintain and enhance infrastructure;
  - Viewplane and odour limiting attractiveness of the community to newcomers;
  - Ongoing issues of odour and aesthetics.

Viewplanes

Source EIA Submission

Crane Mountain Landfill
3D Model of current approved height +90 m

Crane Mountain Landfill
3D Model – Proposed height increase to +117.5 m

Will an additional 27.5 m (>90 ft!!!) of waste height be very noticeable……?

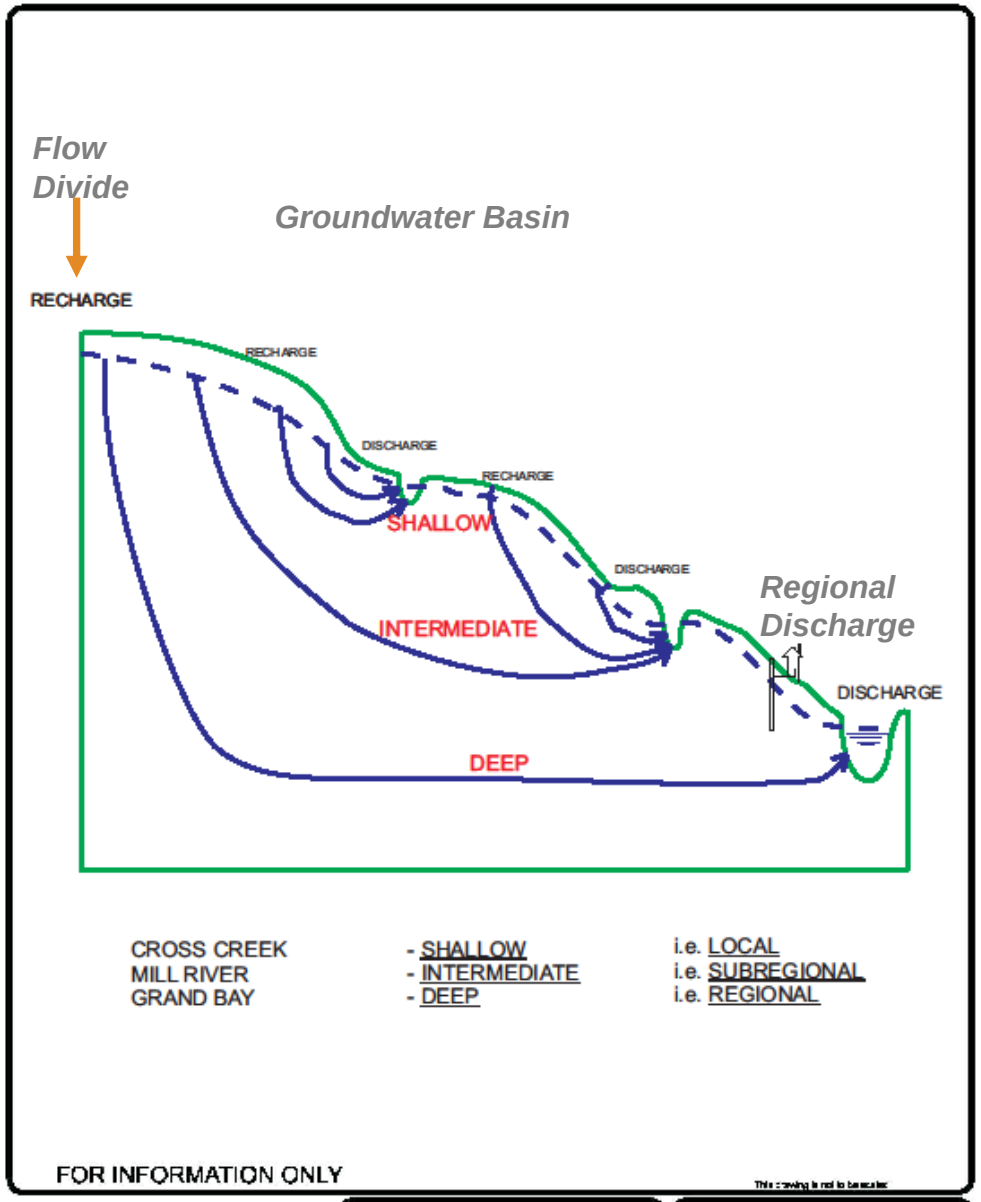
Potential Capacity Increase

Source EIA Submission

Site Setting and Groundwater

- Part of the rationale for allowing an increase in height is that two of the Province's landfills received approval;
- Approval for these other sites does not justify a similar approval in height for the Crane Mountain;
- WHY?
  - Each landfill is unique and Crane Mountain is particularly unique amongst the Province's regional landfill facilities given its site setting;
    - Located upgradient of approximately 1000 private wells.
    - Fractured bedrock.
    - Direction of groundwater flow potentially complex due to topography and geology.

Site Setting



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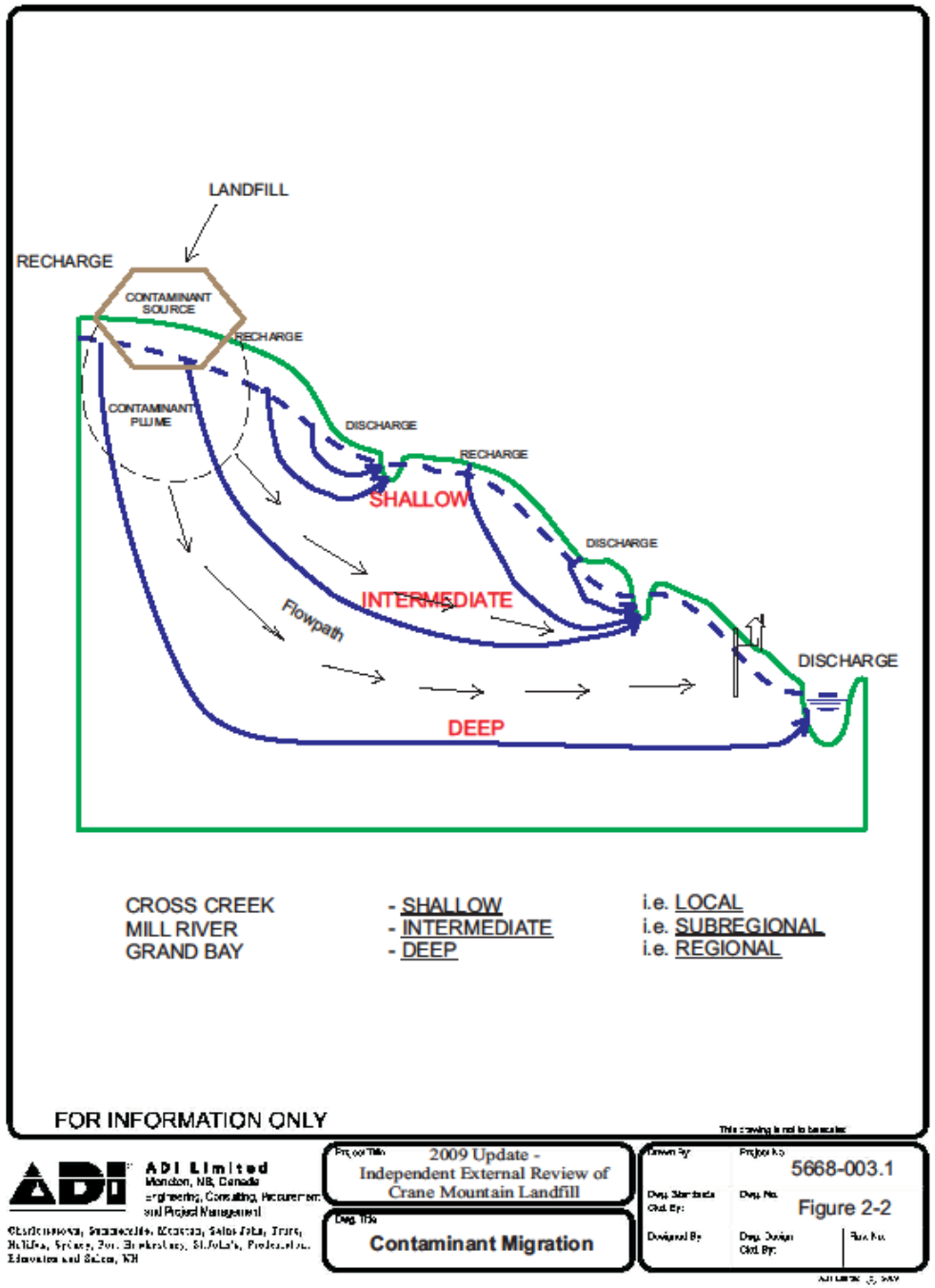
Landfill Location in Flow System



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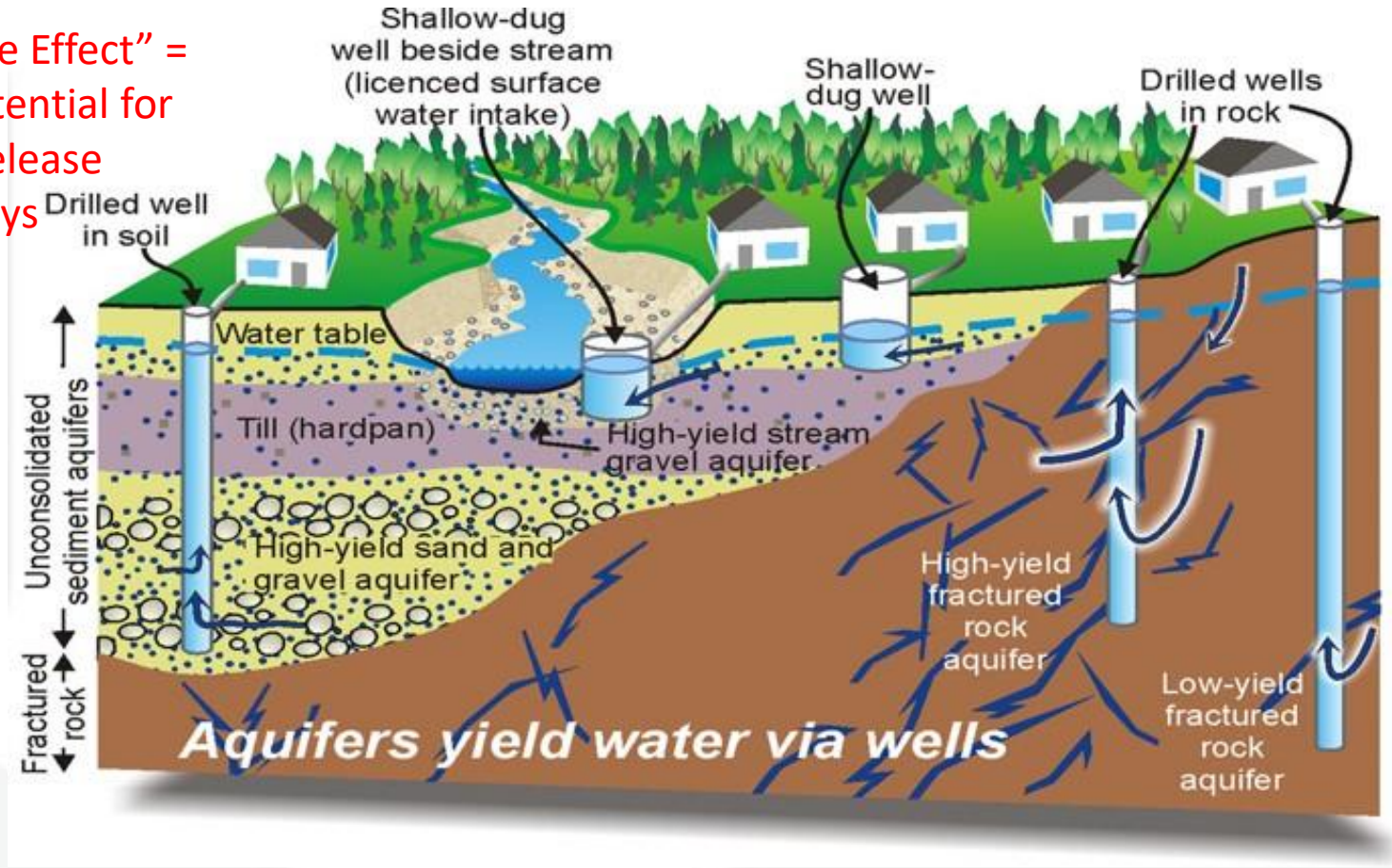
Recharge Area
Landfill
Discharge Area

FRACTURED BEDROCK VERSUS GRANULAR GROUNDWATER FLOW

Aquifer Type – Bedrock vs. Sand and Gravel

In fractured rock aquifers, groundwater is stored in the fractures, joints, bedding planes and cavities of the rock mass. Water availability is largely dependent on the nature of the fractures and their interconnection.

"Sponge Effect" = less potential for rapid release pathways



Fractures = much greater potential for rapid release pathways and high flow velocities

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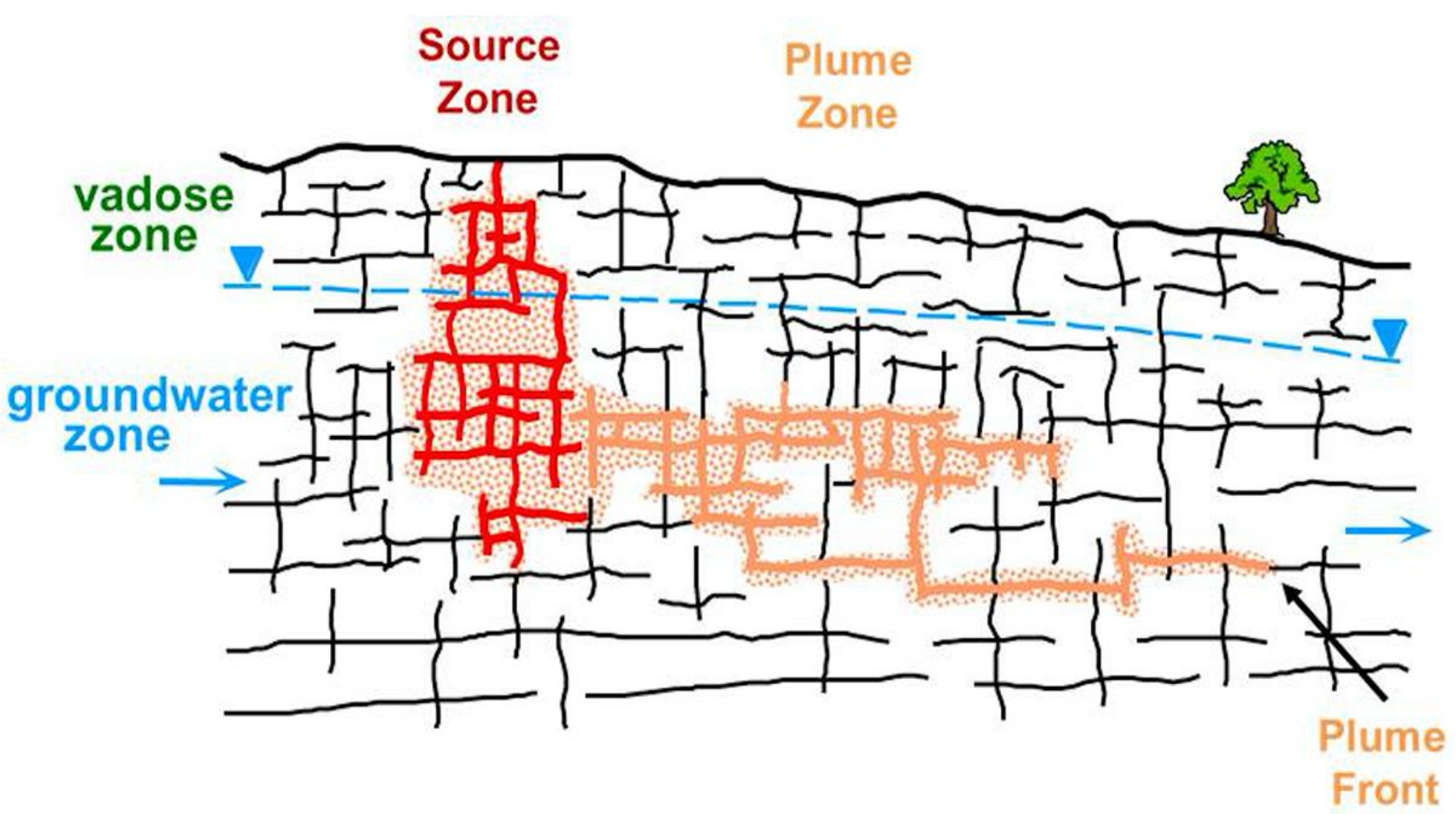

Contaminant flow and transport in fractured rock aquifers is very complex!

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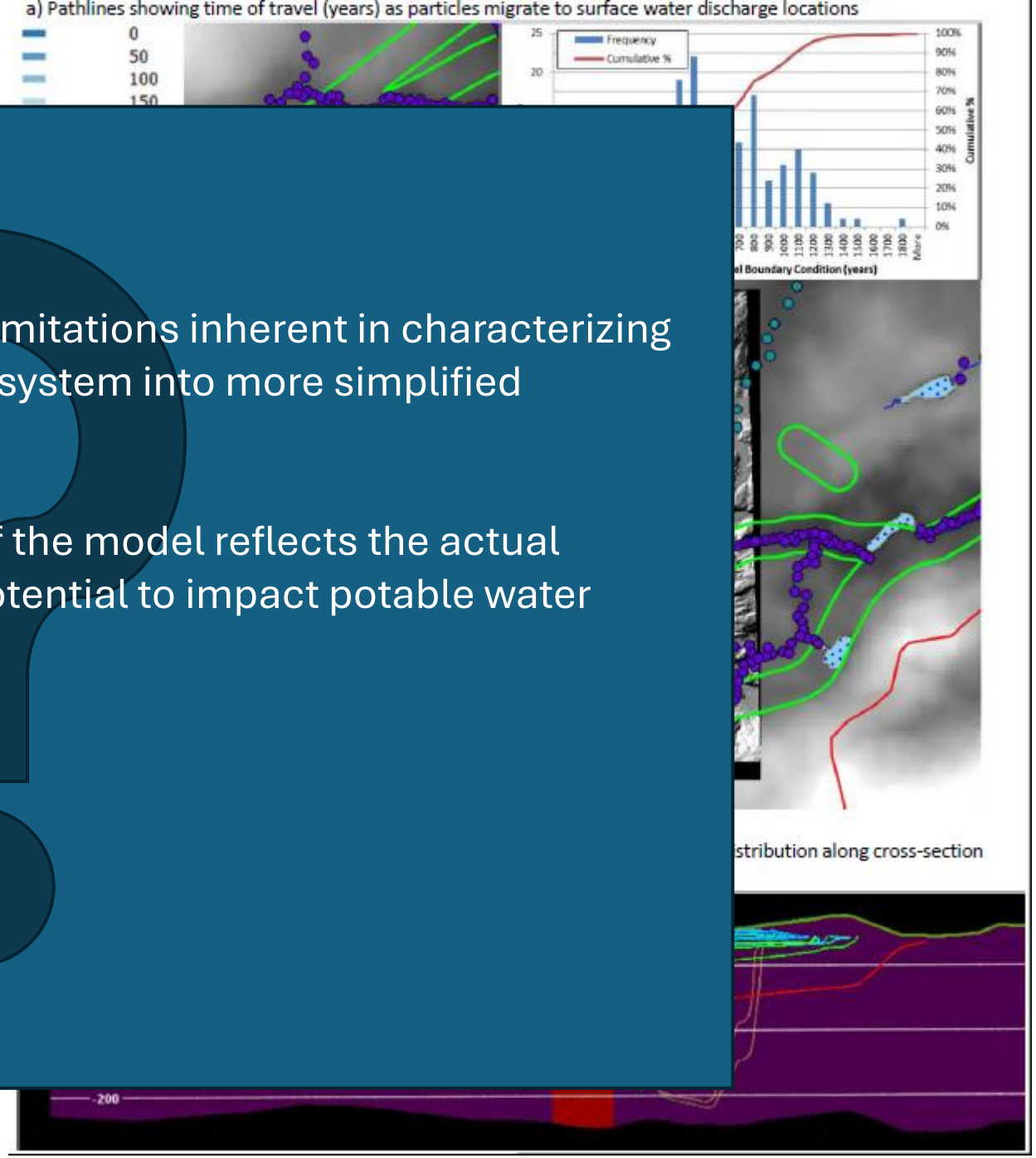
Groundwater Flow Model

- To begin to better understand the site setting, FRSC and CMEI determined that Development of a Numerical Groundwater Flow Model for the site was warranted;

- A two-part study was completed in 2017/2018;
  - 1) Part 1 – Development of GIS Database and Conceptual Hydrogeological Model;
  - 2) Part 2 – Numerical Groundwater Flow Model.

Key Model Findings of Study:

- Seepage from landfill discharges
- features d
- Landfill see
- migrate as
- residential
- shore
- The faults
- influence i
- groundwat
- Time of tra
- groundwat
- (decades t
- year)
- Flow is pre
- to the east
- flow comp
- west



- ....the model...is subject to the limitations inherent in characterizing a complex hydrogeological flow system into more simplified models...

- There is significant uncertainty if the model reflects the actual groundwater flow system and potential to impact potable water wells.

Summary

- The FRSC is applying to significantly increase the amount, height and extend the timeline for active operations of waste disposal at the Crane Mountain Landfill;
- CMEI is strongly opposed with reasons including:
  - The EIA as submitted for many key aspects is essentially a desk top study –
    - it is CMEI's opinion that this is significantly inadequate in terms of providing for an unbiased and technically rigorous assessment of the proposed undertaking and its potential impacts on the host community given the significant expansion proposed;
  - The original approval for siting the landfill did not adequately account for the unique site setting – a significant increase in waste disposed in the landfill can only further exacerbate this aspect;
  - It has been suggested that because two other landfill have received approval, that the Crane Mountain landfill warrants approval, given the unique site setting this rationale is not warranted;

Summary, cont'd…

- As early as 2005 CMEI had recommended that changing containment to a double composite liner be considered – **this design change was not implemented** – recent research indicates that the single composite liner has a much higher probability of leakage and much lower level of protection;
- Viewplane impacts were a significant factor in consideration of the landfill's original design height. The proposed increase in landfill/ waste elevation is significant will therefore in CMEI's opinion will significantly impact on viewplanes;
- Groundwater Flow Model assumptions and results require verification;
- Expanding the site will impose significant additional actual and potential impacts on the host community due to:
  - Significant increase in contaminant loading within the watershed/ flow system;
  - Ongoing and likely exacerbated problems and issues with landfill odour;
  - Socio-economic implications on quality of life, viewplanes and likelihood to impact property values and attractiveness of the community to new residents.

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Questions / Discussion

info@cmei.ca

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References

- ADI Limited (heritage firm to EXP Services Inc.), *2009 Update - Independent External Review of Crane Mountain Landfill*, Report (85) 5668-003.1, November, 2009.
- EIA Registration Document, *Environmental Impact Assessment Registration Document Fundy Regional Service Commission Crane Mountain Landfill Capacity Augmentation and Life Extension Project*, GEMTEC Project: 100018.012, June 21, 2023.
- Rowe, R.K. and Jefferis, S. (2022) "*Protecting the environment from contamination with barrier systems: advances and challenges*", Proceedings of the 20th International Conference on Soil Mechanics and Geotechnical Engineering, Sydney, Australia.
- Rowe R.K. and Barakat F. B., *Modelling the transport of PFOS from single lined municipal solid waste landfill, Computers&Geotechnics ,* 137 (2021)_104280, June 17, 2021.
- January 2007, Geosynthetics International 14(4):219-227.

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