Green Steel Monofills

MONOFILL LEACHATE PRODUCTION PREDICTIONS

Method Notes:

General Notes on the leachate production modelling:

1 Two calculation methods have been applied to estimate leachate produ
Method A - Data Approach: based on actual landfill / monofill le
Method B - Calculation Approach - Based on the Water Balance

2 Leachate volume predictions to date have been based on a % of annual

3 These figures have been sourced from site operational data and records
in the Auckland and Waikato Regions of NZ over many years. Our experi

4 A first principles check has been made using actual monthly rainfall data
This data includes the Auckland Anniversary Weekend floods in January
The 2023 year has been specifically identified for monthly rainfall % patt
The % monthly splits can be amended by easily adjusting the %'s
Historical data of high rainfall years (1964 to 1971) was also sourced.

5 Calculating monthly production rates provides better information on the
Therefore, monthly flow rates are provided from month methods of calc

6 **Method A is our preferred calculation approach at this Concept Design**
• Storage or Field Capacity effects of the floc fill material
• Evaporation data specific to the Hampton Downs site and determinati

7 Model Inputs:
Annual Rainfall selected is considered appropriate, based actual data:
• Note (i): Groundwater potential in-flow is taken as zero due to effectiv
• Note (ii): Liquid waste input is taken as zero

8 Shortcomings of the current modelling
Method A is simplistic and should be expanded (more detailed) at the D
Method B is arguably based on first principles, but predictions can be hu
Method B predictions of evaporation effects can be too sensitive with ze
Lag Times in leachate production is common, and high leachate flows be
• lag times must be estimated and the model adjusted when actual ope

9 HELP Model Shortcomings
Limitation

Simplified water balance
Static soil/waste properties
Limited ET/vegetation modeling
Poor short-term dynamics
Minimal calibration
Sensitive to input uncertainty

In our opinion, for the Green Steel Monofill leachate production determ
regulatory compliance tool rather than a precise forecasting tool for lea
Many landfill/monofill engineers and researchers pair HELP with site-spe
models for detailed design or research purposes.

10 Rationale for storage assumptions used in Method B approach:

- Final Capping SW Monofill Stage 1 - (storage set to **5%**)
  Some storage in the wastes with perched water tables still forming, l
- Final Capping SW Monofill Stage 2 - (storage set to **10%**)
  Slightly increased storage across slightly graded (flat) base of the SW
- Final Capping NE Monofill Stages 1 & 2 - (storage set to **0%**)
  Base is small with limited flattened area to store leachate and side sl
- Final Capping Long Term (all Monofill Stages) - (storage set to
  Leachate perched water tables now formed and preferential flow pa
  The size of the SW monofill outweighs the NE, thus the 10% coming

27/01/2026

ction rates from the Green Steel Monofills i.e.

achate data

(L = P - R - ET - ΔS) often written as "B (Balance) = R (Rainfall) - E (Evaporation) + ( )"

rainfall as follows (for Method A):

Operational Area	Intermediate Cover	Final Cover (Capping)
20%	**12%**	**7%**

from operating landfills

ence from other landfills is also considered.

for the last 3 years.

2023.

terns for the data provided herein.

e leachate flow rate variability

culation of leachate production.

Stage due to uncertainty in:

on of these losses

1.4m

ve under-liner drainage

etailed Design Phase

ugely conservative

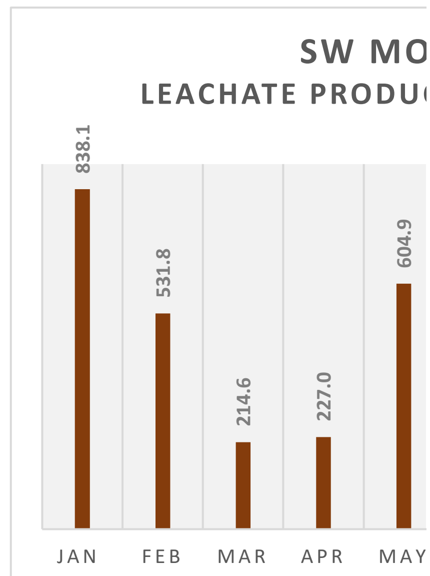
ero monthly leachate production resulting in some months

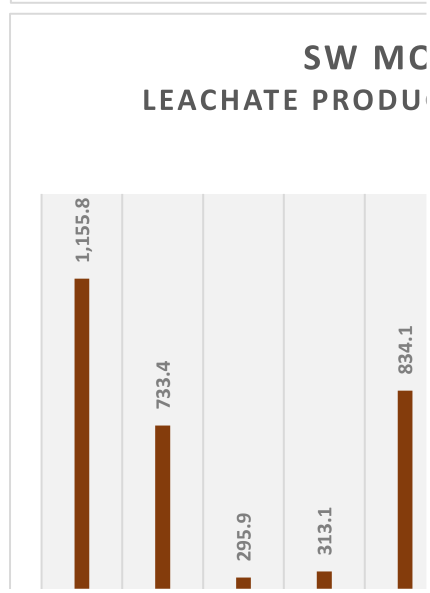
e dalayed by weeks to months from time of high rainfall events

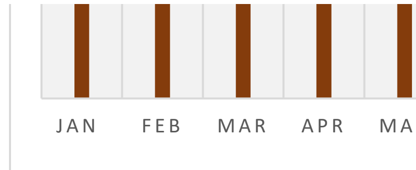
rational data becomes available

Impact on Leachate Prediction

Leachate Production Grapl







Input highly susceptible to 'garbage IN' = 'garbage OUT'
Misses time evolution of landfill/monofill behavior
Misestimates evapotranspiration losses
Inaccurate daily/event scale
Doesn’t capture lateral variability
Under or over-estimates leachate generation

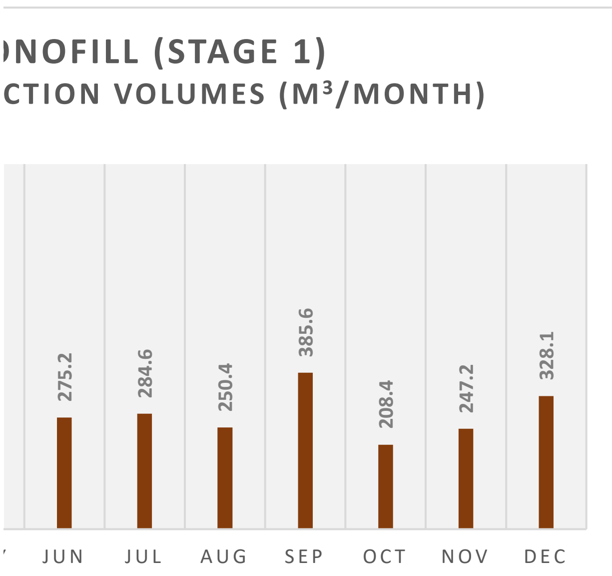
ination: HELP is best used as a screening or
chate volumes in complex real-world scenarios.
ecific data calibration or use more physically based

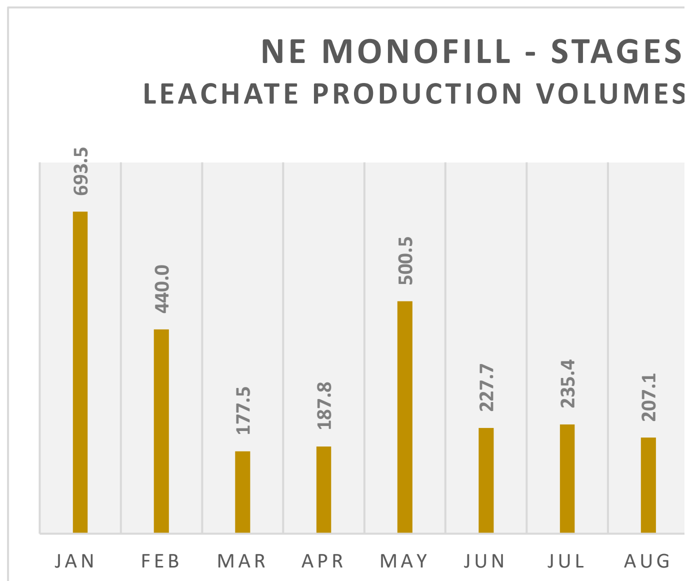
but generally floc undergoing consolidation and early exit of leachate prevalent

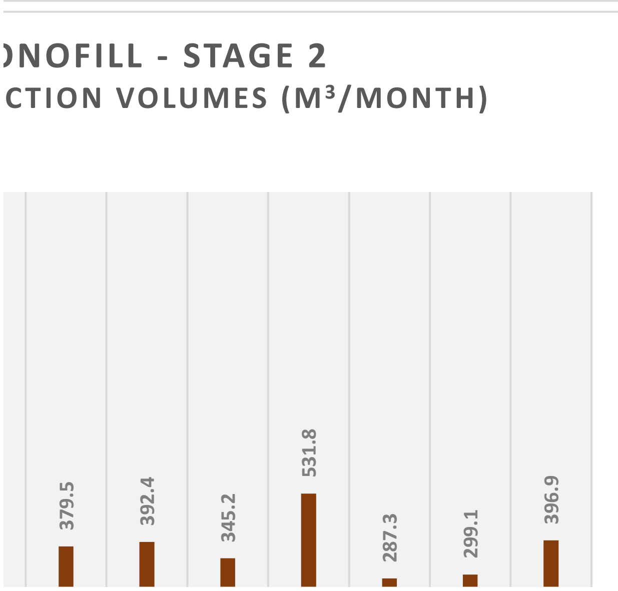
monofill – ability to retain more leachate with the formation of the perched pools of leachate within the waste body

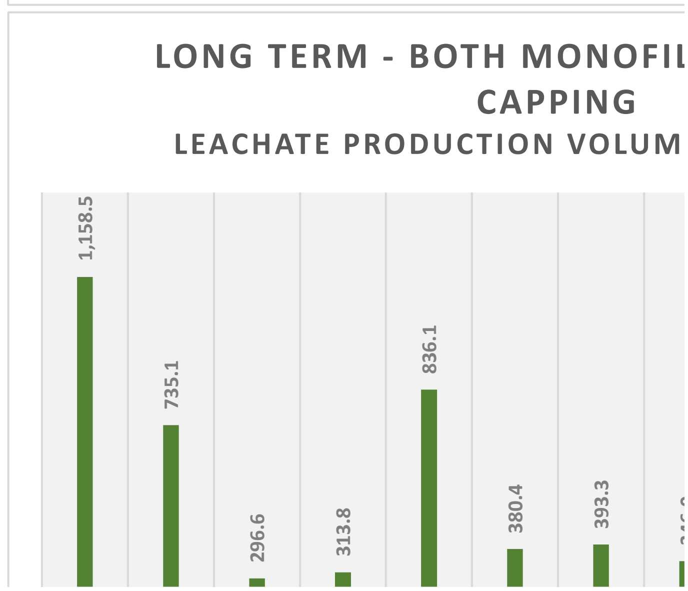
lopes drainage offers short travel times for leachate to travel from the waste body into an available drainage medium. Tl
10%)
ths reduced with waste consolidation over time.
into effect for both.

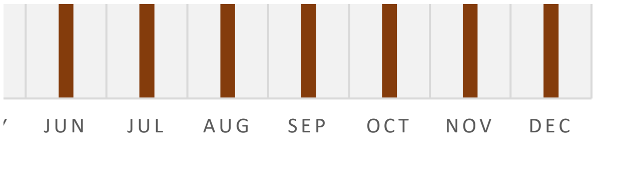
hs Provided from Modelling herein:

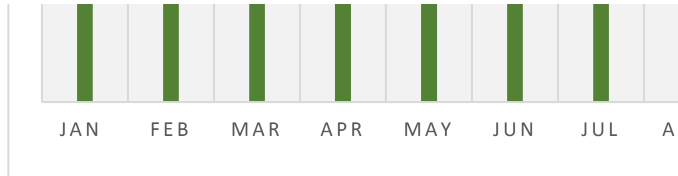


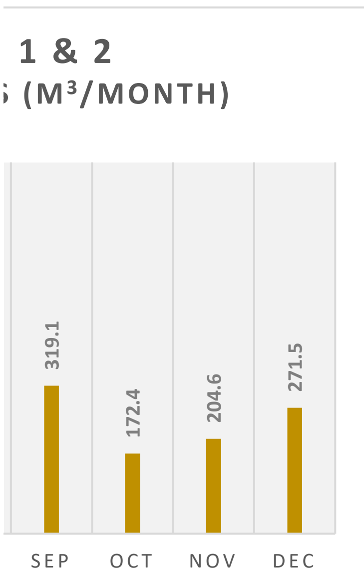


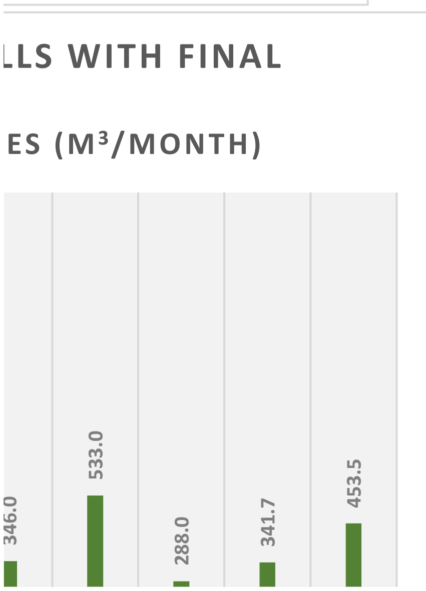


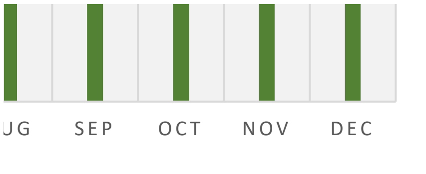



JUN
JUL
AUG
SEP
OCT
NOV
DEC


JAN
FEB
MAR
APR
MAY
JUN
JUL


1 & 2
(M³/MONTH)
319.1
172.4
204.6
271.5
SEP
OCT
NOV
DEC


LLS WITH FINAL
ES (M³/MONTH)
346.0
533.0
288.0
341.7
453.5



UG
SEP
OCT
NOV
DEC