SCS ENGINEERS

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JOB NO.   02218208.17   -   Bristol SWP 498
SHEET NO.   1   OF   1
CALCULATED BY   TRW   DATE   2/10/2023
CHECKED BY   CJW   DATE   2/17/2023
SUBJECT   IV - ESTIMATED MAXIMUM SETTLEMENT

Purpose:

Estimate the maximum amount of settlement of the final cover system that may occur.

Given:

Based upon assumed base grades for the SWP #498 landfill provided by others and the design final closure grade, the maximum depth of waste may be estimated as:

Maximum Waste Depth ≈   **50**   ft

Based upon historical experience and research, SCS estimates the long-term waste settlement as **10%** of the original depth. SCS believes this estimate to be conservative due to the age of the waste and the previous landfill mining activities at the site.

Approximate Waste Settlement ≈   **10**   %

Calculation

$Estimated\ Settlement = Waste\ Depth \times Settlement\ \% = 50ft \times 10\% =$ 5   ft

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SUBJECT	IV - LLDPE STRESS DUE TO SUBSIDENCE			

Purpose:

Determine the stress in the final cover geomembrane (40 mil textured LLDPE) due to potential severe (approx. worse case) differential settlement and compare with the geomembrane break strength.

Given:

The required strength (σ_{reqd}) of the geomembrane may be calculated as:
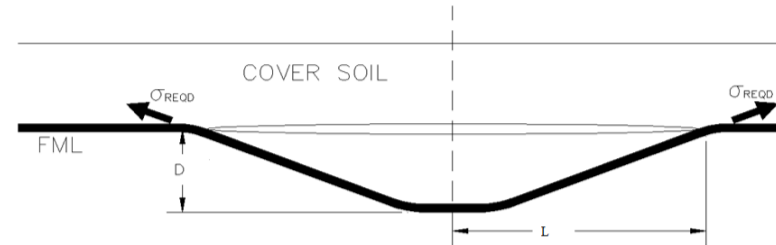
$$\sigma_{reqd} = \frac{2DL^2\gamma_{CS}H_{CS}}{3t(D^2 + L^2)}$$

Reference: Design and Construction of RCRA-CERCLA Final Covers
United States Environmental Protection Agency
Office of Research and Development, May 1991

where:

D	= differential settlement	=	assumed 5 foot, see figure
L	= radius of settlement area	=	assumed 10 feet, see figure
t	= thickness of geomembrane	=	40 mil, see technical specifications
H_{CS}	= height of cover soil	=	2 feet, see final cover details
γ_{CS}	= unit weight of cover soil	=	assumed 110 pcf

The 40 mil LLDPE geomembrane break strength is specified as 60 lb/in (1500 psi) by the technical specifications.

Calculation

$$\sigma_{reqd} = \frac{2DL^2\gamma_{CS}H_{CS}}{3t(D^2+L^2)} = \frac{2(5ft)(10ft)^2(110pcf)(2ft)}{3(\frac{.040}{12}ft)((5ft)^2+(10ft)^2)} = 176{,}000 \text{ lb/ft}^2 = 1222 \text{ lb/in}^2$$

1222 lb/in^2 is required to resist the stress from assumed differential settlement

The factor of safety is given by:

$$FS = \frac{\sigma_{break\ strength}}{\sigma_{reqd}} = \frac{1500\ psi}{1222\ psi} \qquad = \qquad \textbf{1.23} \quad \textbf{OK}$$