

APPENDIX 'D'

DESIGN REQUIREMENTS FOR UNBONDED GRP LINERS (WR_c TYPE 2)

Design Requirements for Unbonded GRP Liners (WRc Type 2)

Thickness Requirements for GRP Egg Shaped Liners

Sewer Shape	Sewer Asset ID(s)	Street	Nominal Host Pipe Dimensions		Maximum Liner (Outside) Dimensions		Max Design Invert Depth (m)	Host Pipe Deterioration State	Live Load Model	Minimum Liner Design Thickness Requirements (mm) <small>(Design thickness shall be the greater of Eq. 1 & Eq. 2)</small>	
			Height (mm)	Width (mm)	Height (mm)	Width (mm)				Eq. 1: Long Term Flexural Strength in hoop direction (MPa)	Eq. 2: Long Term Flexural Modulus in hoop direction (MPa)
Egg	S-MA50013611	Archibald St	2950	1950	2950	1950	8.35	Partially Deteriorated	AASHTO HS25	$t = 341.57S_L^{-0.483}$	$t = 530.06S_L^{-0.324}$
Egg	S-MA70019579 & S-MA70032662	Dawson Rd N	2700	1800	2700	1800	8.30	Partially Deteriorated	AASHTO HS25	$t = 311.66S_L^{-0.483}$	$t = 483.79E_L^{-0.324}$
Egg	S-MA50013486	Dawson Rd N	2750	1825	2750	1825	7.95	Partially Deteriorated	AASHTO HS25	$t = 309.37S_L^{-0.483}$	$t = 484.41E_L^{-0.324}$
Egg	S-MA40011001	#19 Watt St	2060	1625	2060	1625	8.30	Partially Deteriorated	AASHTO HS25	$t = 229.99S_L^{-0.477}$	$t = 356.76E_L^{-0.321}$

Nomenclature and Design Parameters	
Design Method:	WRc Sewerage Rehabilitation Manual, Type 2 Design
Applicable Long Term Flexural Strength (S_L):	15.5 MPa - 200 MPa
Applicable Long Term Flexural Modulus (E_L):	862 MPa - 7000 MPa
Minimum Design Liner Thickness (t):	Greater of Eq. 1 and Eq. 2 (mm)
Lateral Earth Coefficient:	0.4
Soil Density:	18.85 kN/m ³
Assumed Water Table Depth:	2.0 m below ground elevation
Soil Stress Model:	Effective Stress
Factor of Safety on Applied Stresses:	2.0
Profile Coefficient:	1.0