

Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

Environmental Statement

Volume 4

Appendix 7.6: Earthworks Dewatering and Groundwater Flow Disruption

June 2021







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Location	Phase of works	Type of works	Name / Ref	Excavation works deeper than 1m (Y, N)	Depth excavation (m)	Max anticipated GW level (m bgl)	Dewatering expected (Y, N)	K (m/s)	Length excavation (m)	Width excavation (m)	Drawdown	Ro	Re	Zone of influence	SPZ identify	SPZ impact	SPZ Value	SPZ Magnitude	SPZ Significance	PWS identify	PWS impact	PWS Value
	Enabling works phase	Lagoon	Lower Houses Compound Attenuation Ponds	Ŷ	2	1	Ÿ	2.00E-06	20	20	1	4.24	11.28	15.53	No SPZ identified within zone of influence.	none	n/a	n/a	n/a	No PWS are with the zone of influence. However, PWS3- 12 and PWS3-16 are located approximately 350 m and 200 m down gradient respectively.	PWS3-12 is expected to be a borehole, but exact location and depth have not been confirmed. The type of supply for PWS3-16 is unknown. Potential flow impacts on both supplies are unlikely, however uncertainties remain.	Medium
	Enabling works phase	Access road	Lower Houses Compound Access Track/ Haul Road	N	1	1	N	2.00E-06		5					No SPZ identified within zone of influence.	none	n/a	n/a	n/a	No PWS exist within the footprint of the construction.	None	n/a
	Enabling works phase	Access road	Lower Houses Compound Permanent Access Track	N	1	1	N	2.00E-06		5					No SPZ identified within zone of influence.	none	n/a	n/a	n/a	No PWS exist within the footprint of the construction.	None	n/a
r Houses																						
Lower																						
	Enabling works phase	Building	Lower Houses Compound Permanent Building	N	0	1	N	2.00E-06							No SPZ identified within zone of influence.	none	n/a	n/a	n/a	No PWS exist within the footprint of the construction.	None	n/a
	Construction phase	Open-cut	Lower Houses Compound Multi-line Connection - open cut section connecting the existing pipeline to the tunnel	Y	5	1	Y	2.00E-06	42	50	4	16.97	n/a	16.97	No SPZ identified within zone of influence.	none	n/a	n/a	n/a	No PWS are within the zone of influence. However PWS3 12 and PWS3-16 are located approximately 200 m down gradient.	PWS3-12 is expected to be a borehole, but exact location and depth have not been confirmed. The supply type for PWS3-16 is unknown. Potential flow impacts on these supplies are unlikely, however uncertainties remain.	Medium
	Construction phase	Open-cut	Lower Houses Compound Single-line Connection - open cut section connecting the existing pipeline to the Proposed Bowland Tunnel	Y	5	1	Y	2.00E-06	125	5	4	16.97	n/a	16.97	No SPZ identified within zone of influence.	none	n/a	n/a	n/a	No PWS are within the potential zone of influence.	None	n/a
	Enabling works phase and construction	Compaction	Lower Houses Compound Area	N											No SPZ identified within zone of influence.	none	n/a	n/a	n/a	PWS3-16 is situated within the compound area.	Direct disruption of source by construction activities.	Medium
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PWS Magnitude	PWS Significance	GWDTE identify	GWDTE impact	GWDTE Value
Negligible	Neutral	Lower House Cottage West - approx. 100m west, upgradient and located on other side of Cod Gill. No impacts predicted.	n/a	n/a
n/a	n/a	Lower House Cottage - moderate groundwater dependent habitat 160m downgradient. Lower House Cottage West - approx. 65m north, cross- gradient and located on other side of Cod Gill. No impacts	Loss of groundwater flow due to dewatering. n/a	Medium (moderate gw dependence, not designated) n/a
		predicted. Lower House Cottage - moderate groundwater dependent habitat 230m downgradient.	Interception of groundwater flows in the short term.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - moderate groundwater dependent habitat 230m downgradient.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - moderate groundwater dependent habitat 230m downgradient.	suspended solids.	medium (moderate gw dependence, not designated)
n/a	n/a	Lower House Cottage - approx. 25m northwest, cross- /downgradient.	Interception of groundwater flows in the short term.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - approx. 25m northwest, cross- /downgradient.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	Medium (moderate gw dependence, not designated)
		25m northwest, cross- /downgradient.	suspended solids.	gw dependence, not designated)
		Park House Lane - moderate groundwater dependence habitat adjacent to end of access track.	Interception of groundwater flows in the short term.	Medium (moderate gw dependence, not designated)
		Park House Lane - moderate groundwater dependence habitat adjacent to end of access track.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	Medium (moderate gw dependence, not designated)
		Park House Lane - moderate groundwater dependence habitat adjacent to end of access track.	Mobilisation of suspended solids.	Medium (moderate gw dependence, not designated)
		Park House Lane - low groundwater dependence habitat 20m northeast of end of access track. Park House Lane - low	Interception of groundwater flows in the short term. Accidental leaks / spills,	Low (low gw dependence, not designated) Low (low gw
		groundwater dependence habitat 20m northeast of end of access track. Park House Lane - low	of fuels and chemicals, including cement and sewage. Mobilisation of	dependence, not designated) Low (low gw
		groundwater dependence habitat 20m northeast of end of access track.	suspended solids.	dependence, not designated)
n/a	n/a	nya	n/a	nya
Negligible	Neutral	Lower House Cottage - approx. 20m downgradient of open cut.	Loss of groundwater flow due to dewatering.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - approx. 20m downgradient of open cut.	Interception of groundwater flows in the short term.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - approx. 20m downgradient of open cut.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - approx. 20m downgradient of open cut.	Mobilisation of suspended solids.	Medium (moderate gw dependence, not designated)
n/a	n/a	n/a	n/a	n/a
Major Adverse	Large	Lower House Cottage West - approx. 25m northwest, cross- gradient of compound area. Located on other side of Cod Gill. No impacts predicted.	n/a	n/a
		Lower House Cottage - approx. Sm northeast, downgradient of compound area.	Interception of groundwater flows in the short term.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - approx. 5m northeast, downgradient of compound area.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	Medium (moderate gw dependence, not designated)
		Lower House Cottage - approx. 5m northeast, downgradient of compound area.	Mobilisation of suspended solids.	Medium (moderate gw dependence, not designated)

Location	Phase of works	Type of works	Name / Ref	Excavation works deeper than 1m (Y, N)	Depth excavation (m)	Max anticipated GW level (m bgl)	Dewatering expected (Y, N)	K (m/s)	Length excavation (m)	Width excavation (m)	Drawdown	Ro R	Zone of influence	SPZ identify	SPZ in	mpact SP	Z Value	SPZ Magnitude SPZ Significance	PWS identify	PWS impact	PWS Value	PWS Magnitude	PWS Significance	GWDTE identify	GWDTE impact	GWDTE Value
																								Park House Lane - moderate groundwater dependence habitat adjacent to end of access track.	Interception of groundwater flows in the short term.	Medium (moderate e gw dependence, not designated)
Houses																								Park House Lane - moderate groundwater dependence habitat adjacent to end of access track.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	Medium (moderate gw dependence, not designated)
Lower																								Park House Lane - moderate groundwater dependence habitat adjacent to end of access track.	Mobilisation of suspended solids.	Medium (moderate gw dependence, not designated)
	Enabling works phase and construction phase	Compaction	Lower Houses Compound Area	N										No SPZ identifie within zone of influence.	ed none	n/a	a	n/a n/a	PWS3-16 is situated within the compound area.	Direct disruption of source by construction activities expected.	Medium	Major Adverse	Large	n/a	n/a	n/a
	Enabling works phase	Access road	Access track/ haul road within Newton-In-Bowland Compound	N	1	1	N	2.00E-06	1000	5	0	0.00 n/	/a 0.00	No SPZ identifie within zone of influence.	ed none	n/:	a	n/a n/a	No PWS are within the potential zone of influence	None	n/a	n/a	n/a	Gamble Hole Farm Pasture in footprint of access track.	Direct interception of groundwater flows in the short term.	High (high gw e dependence, non- stat designated)
																								Gamble Hole Farm Pasture in footprint of access track.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage.	High (high gw dependence, non- stat designated)
																								Gamble Hole Farm Pasture in footprint of access track.	Mobilisation of suspended solids.	High (high gw dependence, non- stat designated) Medium (moderate
																								aroundwater dependent habitat approx. 80m downgradient. The Coach House - moderate groundwater dependent babitat approx. 90m	Accidental leaks / spills, of fuels and chemicals,	Medium (molecule e gw dependence, not designated) Medium (moderate gw dependence, not designated)
																								downgradient. The Coach House - moderate groundwater dependent habitat approx. 80m downgradient.	sewage. Mobilisation of suspended solids.	Medium (moderate gw dependence, not designated)
p	Enabling works phase	Access road	Construction Access route to/from Newton-in- Bowland Compound	N										No SPZ identifie within zone of influence.	ed none	n/:	a	n/a n/a	No PWS identified within zone of influence.	None	n/a	n/a	n/a	River Hodder North - highly groundwater dependent habitat within footprint of access track.	Direct interception of groundwater flows in the short term.	Medium (high gw dependence, not designated)
1-Bowla																								River Hodder North - highly groundwater dependent habitat within footprint of access track. River Hodder North - highly	Accidental leaks / spills, of fuels and chemicals, including cement and sewage. Mobilisation of	Medium (high gw dependence, not designated) Medium (high gw
ton-ir	Construction	Open-cut	Multi-line Connection	×	2	1		6.00E-06	155	50	2	14.70	/2 14.70	No SP7 identifie	ad none	0/		n/a n/a	PWC2-9 is within range	DWS2.9 is in range of the potential zone of	Medium	Major Adverse	Large	groundwater dependent habitat within footprint of access track.	suspended solids.	dependence, not designated)
New	phase	Open-cat	within Newton-in-Bowland Compound	T	3	1		0.002-00	133	JU	2	14.70 11	/d 14.70	within zone of influence.	u none	11/1	a	iya iya	approximately 7 m from the construction footprint.	influence of groundwater drawdown. Therefore a reduction in capacity of the PWS is expected.	,	Wajor Adverse	Large	eastern part of site is within dewatering zone of influence.	due to dewatering.	dependence, non- stat designated)
																			Fober farm spring (PWS3-11 and PWS3-14 are outside the zone of influence but located 30 m down gradien	5) Potential flow disruption due to groundwater drawdown. Therefore, a reduction in capacity o the PWS is expected. it.	Medium	Moderate Adverse	Moderate	Gamble Hole Farm Pasture - eastern corner of site is within footprint of open cut.	Direct interception of groundwater flows in the short term.	High (high gw dependence, non- stat designated)
																								Gamble Hole Farm Pasture - eastern corner of site is within footprint of open cut. Gamble Hole Farm Pasture - eastern corner of site is within	Accidental leaks / spills, of fuels and chemicals, including cement and sewage. Mobilisation of suspended solids.	High (high gw dependence, non- stat designated) High (high gw dependence, non-
	Construction phase	Open-cut	Single-line overflow within Newton-in-Bowland	Ŷ	3	1	Ŷ	6.00E-06	110	5	2	14.70 n/	/a 14.70	No SPZ identifie within zone of	ed none	n/a	'a	n/a n/a	PWS3-8 is within the potential zone of influence	PWS3-8 is in range of the potential zone of influence of groundwater drawdown. Therefore	Medium	Major Adverse	Large	footprint of open cut. Gamble Hole Farm Pasture - immediately downgradient of	Loss of groundwater flow due to dewatering.	v High (high gw dependence, non-
			Compound											influence.					and located within the construction footprint.	a reduction in capacity of the PWS is expected. Direct disruption of source by construction activities possible.				dewatering zone of influence.		stat designated)
																			Fober farm spring (PWS3-11 and PWS3-14 are outside the zone of influence but located 30 m down gradien	5) Potential flow disruption due to groundwater drawdown. Therefore, a reduction in capacity o these PWS is expected. it.	Medium	Moderate Adverse	Moderate	Gamble Hole Farm Pasture - downgradient of open cut.	Interception of groundwater flows in the short term.	High (high gw dependence, non- stat designated)
																								Gamble Hole Farm Pasture - downgradient of open cut.	Accidental leaks / spills, of fuels and chemicals, including cement and sewage	High (high gw dependence, non- stat designated)
																								Gamble Hole Farm Pasture - downgradient of open cut.	Mobilisation of suspended solids.	High (high gw dependence, non- stat designated)

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Location	Phase of works	Type of works	Name / Ref	Excavation works deeper	Depth	Max anticipated GW	Dewatering expected (Y,	K (m/s)	Length excavation ex	Width xcavation Dr	awdown Ro	Re	Zone of	SPZ identify	SPZ impact	SPZ Value	SPZ Magnitud	le SPZ Significance	PWS identify	PWS impact	PWS Value	PWS Magnitude	PWS Significance	GWDTE identify	GWDTE impact	GWDTE Value
	Enabling works	Lagoon	Newton-in-Bowland	Y	2	1	Y	2.00E-06	(m) 35.1	(m) 14.7	1 4.2	4 12.82	17.06	No SPZ identified	none	n/a	n/a	n/a	No PWS identified within	None	n/a	n/a	n/a	None identified.	n/a	n/a
	phase	Ĩ	Compound Attenuation Pond											within zone of influence.		-			zone of influence.							
	Enabling works	Compaction	Newton-in-Bowland	N										No SPZ identified	none	n/a	n/a	n/a	Fober Farm spring supply	Direct disruption of source by construction	Medium	Major Adverse	Large	Gamble Hole Farm Pasture -	Direct interception of	High (high gw
	phase and construction		Compound Envelope											influence.					(PWS3-15) is within the construction envelope.	activities.				highly groundwater dependent habitat within footprint of	short term.	e dependence, non- stat designated)
	phase																							compound area.		
																			PWS3-8 is within the construction envelope.	Direct disruption of source by construction activities.	Medium	Major Adverse	Large	Gamble Hole Farm Pasture - highly groundwater dependent	Accidental leaks / spills, of fuels and chemicals,	High (high gw dependence, non-
																								habitat within footprint of compound area.	including cement and sewage.	stat designated)
												-							PWS3-14 is within the	Direct disruption of source by construction	Medium	Major Adverse	Large	Gamble Hole Farm Pasture -	Mobilisation of	High (high gw
																			construction envelope.	activities.				highly groundwater dependent habitat within footprint of	suspended solids.	dependence, non- stat designated)
																								compound area.		
																								The Coach House - moderate groundwater dependent	Interception of groundwater flows in th	Medium (moderate gw dependence, not
																								habitat (SE sub-site) approx. 5m downgradient of	short term.	designated)
																								compound area.		
																								The Coach House - moderate	Accidental leaks / spills,	Medium (moderate
pue																								habitat (SE sub-site) approx.	including cement and	designated)
Ň																								compound area.	Schuge.	
Ŗ																								The Coach House - moderate	Mobilisation of	Medium (moderate
-i																								habitat (SE sub-site) approx.	suspended solids.	designated)
to																								compound area.		
ē																								Dunsop Bridge Road - highly	Interception of	Medium (high gw
z																								habitat adjacent to compound	short term.	designated)
																								area access.		
																								groundwater dependent	of fuels and chemicals,	dependence, not
																								habitat adjacent to compound area access.	including cement and sewage.	designated)
												-					-							Dunsop Bridge Road - highly	Mobilisation of	Medium (high gw
																								groundwater dependent habitat adjacent to compound	suspended solids.	dependence, not designated)
																								area access.		
																								River Hodder North - highly groundwater dependent	Direct interception of groundwater flows in th	Medium (high gw e dependence, not
																								habitats within the footprint of compound area access.	short term.	designated)
												-												River Hodder North - highly	Accidental leaks / spills,	Medium (high gw
																								groundwater dependent habitats within the footprint of	of fuels and chemicals, including cement and	dependence, not designated)
																								compound area access.	sewage.	
																								River Hodder North - highly groundwater dependent	Mobilisation of suspended solids.	Medium (high gw dependence, not
																								habitats within the footprint of	suspended sonas.	designated)
																								Diver Hodder South	No impacts producted	n/a
																								45m south of compound area	nio impacts predicted.	11/ 0
																								located on other side of River		
																								nodder.		

Location	GWDTE Magnitude	GWDTE Significance	Surface Water identify	/ Surface Water impact	Surface Water Value	Surface Water Magnitude	Surface Water Significance	Infrastructure / Building identify	Infrastructure / Building impact	Infra / Building Value	Infra / Building Magnitude	Infra / Building Significance	Cultural Heritage identify	Cultural Heritage impact	Heritage Value	Heritage Magnitude	Heritage Significance	Contaminated Land identify	Contaminated Land impact	Aquifer Value	Contamination Magnitude	Contamination Significance
	n/a	n/a	No surface water feature lies within	None	n/a	n/a	n/a	Lunesdale North Well building (10 m in length) is	Potential settlement effects due to dewatering during construction.	Medium	Minor Adverse	Slight	No Heritage features identified within the	None	n/a	n/a	n/a	No areas of contaminated land exist	None	n/a	n/a	n/a
			zone of influence .					within zone of influence.					zone of influence.					within the construction footprint.				
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	Watercourse 169 crosses the footprint of the construction.	No groundwater dewatering activity is required. Therefore there will be no impact on watercourse 169 as a result of groundwater flow disruption.	Medium	n/a	n/a	No infrastructure or buildings exist at the footprint of the construction	None	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	None	n/a	n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Moderate Adverse	Moderate	No surface water feature crosses the construction footprint.	None	n/a	n/a	n/a	Minor road (unnamed road) between Park House Lane and Helks Brow joins the access track.	No dewatering proposed at this location therefore no significant impact anticipated.	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	None	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ş	Minor Adverse	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
r House	Negligible	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lowe	Negligible	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Negligible	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	No surface water feature crosses the construction footprint.	None	n/a	n/a	n/a	No infrastructure or buildings exist at the footprint of the construction	None	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	None	n/a	n/a	n/a
	Negligible	Neutral	Cod Gill watercourse (W206) lies within zone of influence.	Reduced contribution to baseflow during dewatering.	Medium	Minor Adverse	Slight	One small building (3.5 m in length) is within the zone of influence of groundwater drawdown, approx. 3 m from construction footprint	Potential settlement effects due to dewatering during construction.	Medium	Minor Adverse	Slight	No Heritage features identified within the zone of influence.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	None	n/a	n/a	n/a
	Negligible	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	No surface water feature lies within zone of influence.	None	n/a	n/a	n/a	No infrastructure or buildings exist at the footprint of the construction	None	n/a	n/a	n/a	No Heritage features identified within the zone of influence.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	None	n/a	n/a	n/a
	n/a	n/a	Cod Gill watercourse (W206) runs close to the compound.	No groundwater dewatering activity is required. Therefore there will be no impact on Cod Gill watercourse as a result of groundwater flow disruption.	n/a	n/a	n/a	The existing Lunesdale North Well building (10 m in length) is within the Compound	No dewatering proposed at this location therefore no significant impact anticipated.	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	None	n/a	n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a



Location	GWDTE Magnitude	GWDTE Significance	Surface Water identify	/ Surface Water impact	Surface Water Value	Surface Water Magnitude	Surface Water Significance	Infrastructure / Building identify	Infrastructure / Building impact	Infra / Building Value	Infra / Building Magnitude	Infra / Building Significance	Cultural Heritage identify	Cultural Heritage impact	Heritage Value	Heritage Magnitude	Heritage Significance	Contaminated Land identify	Contaminated Land impact	Aquifer Value	Contamination Magnitude	Contamination Significance
	Minor Adverse	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
s	Minor Adverse	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
louse																						
er F	Minor Adverse	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Low																						
	n/a	n/a	Watercourse 169 lies within the compound.	Compaction from construction activities within the envelope could cause a barrier to groundwater flow and reduce the contribution of baseflow to the watercourse.	n/a	n/a	n/a	One small building (3.5 m in length) is within the Compound.	No dewatering proposed at this location therefore no significant impact anticipated.	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	None	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	n/a	n/a	n/a	n/a
	Major Adverse	Large	Watercourse 384 & 385 crosses the access	No flow or dewatering impact assumed according to currently available information.	Low	n/a	n/a	No infrastructure or buildings exist at the	none	n/a	n/a	n/a	No Heritage features identified within the	none	n/a	n/a	n/a	A historic stockpile location approximately	No excavation or dewatering associated with this activity.	n/a	n/a	n/a
			track construction location.					footprint of the construction.					zone of influence.					10,000 m2 in size, is shown crossing the proposed the access track (Geotech study). During the construction of the existing Haweswater Aqueduct, excavation materials were placed at various locations along the route corridor.	Therefore, no contaminant plume migration is expected.			
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Madarata Advarra	Moderate	2/2	2/2	n/2	n/2	2/2		2/2	2/2	2/2	2/2	2/2	n/2	n/2	2/2	n/2	n/n		2/2	n/2	n/2
	Woderate Auverse	Moderate	170	11/0	1/0	170	170	17 0	170	11/0	190	198	11/0	178	170	1,0	11/0	170	17.0	1/0	11/0	11/0
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
pu	Major Adverse	Large	The River Hodder crosses the access envelope.	No flow or dewatering impact assumed according to currently available information.	Medium	n/a	n/a	No infrastructure or buildings exist at the footprint of the construction.	n/a	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	n/a	n/a	n/a	n/a	No areas of contaminated land exist within the construction footprint.	n/a	n/a	n/a	n/a
owlan	Moderate Adverse	Moderate	Watercourses 384, 386 & 1312 cross the access envelope.	No flow or dewatering impact assumed according to currently available information.	Low	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
-in-B	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Newton	Major Adverse	Large	Watercourses 384 downgradient of zone of influence.	Watercourse is out of range of the zone of influence of drawdown. However, due to the surface water feature being down gradient of the dewatering activity, contribution to baseflow may be reduced if groundwater flows through superficial deposits.	Low	Minor Adverse	: Slight	One small building (6 m in length) is within the zone of influence of groundwater drawdown, approx. 10 m from construction footprint.	Potential settlement effects due to dewatering during construction.	Medium	Minor Adverse	Slight	No Heritage features identified within the zone of influence.	none	n/a	n/a	n/a	A historical valve house (Geotech Study no.12) is within the potential zone of influence of groundwater drawdown.	The drawdown effect could cause a potential contaminant plume to move towards the site of dewatering and potentially cause the abstracted water to be contaminated.	Bedrock aquifer - High sensitivity No Superficial deposits indicated on BGS mapping, 1.7m thickness recorded in BH021 PWS3-8 Medium sensitivity	Moderate Adverse	Moderate (potential effect on PWS3-8)
	Major Adverse	Large	Watercourse 385 downgradient of zone of influence.	Watercourse is out of range of the zone of influence of drawdown. However, it is down gradient of the dewatering activity,	Medium	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
				contribution to baseflow may be reduced if groundwater flows through superficial deposits.																		
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Moderate Adverse	Moderate	Closest watercourses	Watercourses are out of range of the zone of	Low	Minor Adverse	e Slight	One small building (6 m in	Potential settlement effects due to	Medium	Minor Adverse	Slight	No Heritage features	none	n/a	n/a	n/a	A historical valve house	The drawdown effect could	Bedrock aquifer - High sensitivity	Moderate Adverse	Moderate (potential
			384 & 385 are downgradient of zone of influence.	influence of drawdown. However, they are down gradient of the dewatering activity, contribution to baseflow may be reduced if groundwater flows through superficial deposits	in .			length) is within the zone of influence of groundwater drawdown, approx. 10 m from construction footprint.	dewatering during construction.				identified within the zone of influence.					(Geotech Study no.12) is within the potential zone of influence of groundwater drawdown.	cause a potential contaminant plume to move towards the site of dewatering and potentially cause the abstracted water to be contaminated.	No Superficial deposits indicated on BGS mapping, 1.7m thickness recorded in BH021 PWS3-8 Medium sensitivity		effect on PWS3-8)
	Moderate Adverse	Moderate	Watercourse 385 out of range	Watercourse is out of range of the zone of influence of drawdown. However, it is down gradient of the dewatering activity, contribution to baseflow may be reduced if groundwater flows through superficial deposits	Medium	Moderate Adverse	Moderate	The existing Hodder North Well building (10 m in length) is within the zone of influence of groundwater drawdown.	Potential settlement effects due to dewatering during construction.	Medium	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a



Proposed Bowland Section Environmental Statement Volume 4 Appendix 7.6 Earthworks Dewatering and Groundwater Flow Distruption

Location	GWDTE Magnitude	GWDTE Significance	Surface Water identif	y Surface Water impact	Surface Water Value	r Surface Wate Magnitude	r Surface Water Significance	Infrastructure / Building identify	Infrastructure / Building impact	Infra / Building Value	Infra / Building Magnitude	Infra / Building Significance	Cultural Heritage identify	Cultural Heritage impact	Heritage Value	Heritage Magnitude	Heritage Significance	Contaminated Land identify	Contaminated Land impact	Aquifer Value	Contamination Magnitude	Contamination Significance
	n/a	n/a	Watercourse 384	Watercourses 384 approx. 10m from pond and within the zone of influence of drawdown.	Low	Moderate Adverse	Slight	No infrastructure or buildings exist at the footprint of the construction	none	n/a	n/a	n/a	No Heritage features identified within the zone of influence.	none	n/a	n/a	n/a	No contaminated land features are identified within the zone of influence of drawdown a the lagoon. However, a historical stockpile is located approximately 5 m to the east.	The drawdown effect has the potential to change the groundwater flow gradient such at that the contaminant plume is mobilised. Potentially causing contaminant migration towards 0 the site of dewatering and the abstracted water to be contaminated.	Bedrock aquifer - High sensitivit Superficial deposits: None / Till- medium sensitivity	y Minor Adverse	Slight potential effect on bedrock aquifer and Till.
	Major Adverse	Large	Watercourses 384 & 385 are located within the envelope.	Compaction from construction activities within the envelope could cause a barrier to groundwater flow and reduce the contribution of baseflow to the watercourse.	Low	Minor Advers	e Neutral	No infrastructure or buildings exist at the footprint of the construction	none	n/a	n/a	n/a	No Heritage features identified within the footprint of construction.	none	n/a	n/a	n/a	A historic stockpile >10,000 m2 in size is located within the envelope.	No excavation or dewatering associated with this activity. Therefore, no contaminant plume migration is expected as a result of this activity.	Bedrock aquifer - High sensitivit Superficial deposits: None/ Till - medium sensitivity	y n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	A historic Valve House (Geotech Study no.12) is located within the construction footprint.	No excavation or dewatering associated with this activity. Therefore, no contaminant plume migration is expected as a result of this activity.	Bedrock aquifer - High sensitivit Superficial deposits: None/ Till - medium sensitivity	y n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	A historic limestone quarry (Geotech Study no.3) is shown within th construction footprint.	No excavation or dewatering associated with this activity. e Therefore, no contaminant plume migration is expected as a result of this activity.	Bedrock aquifer - High sensitivit Superficial deposits: None/ Till - medium sensitivity	y n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
wland	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
wton-in-Bowla	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New	Minor Adverse	Slight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Negligible	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Negligible	Neutral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Major Adverse	Large	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Moderate Adverse	Moderate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Jacobs