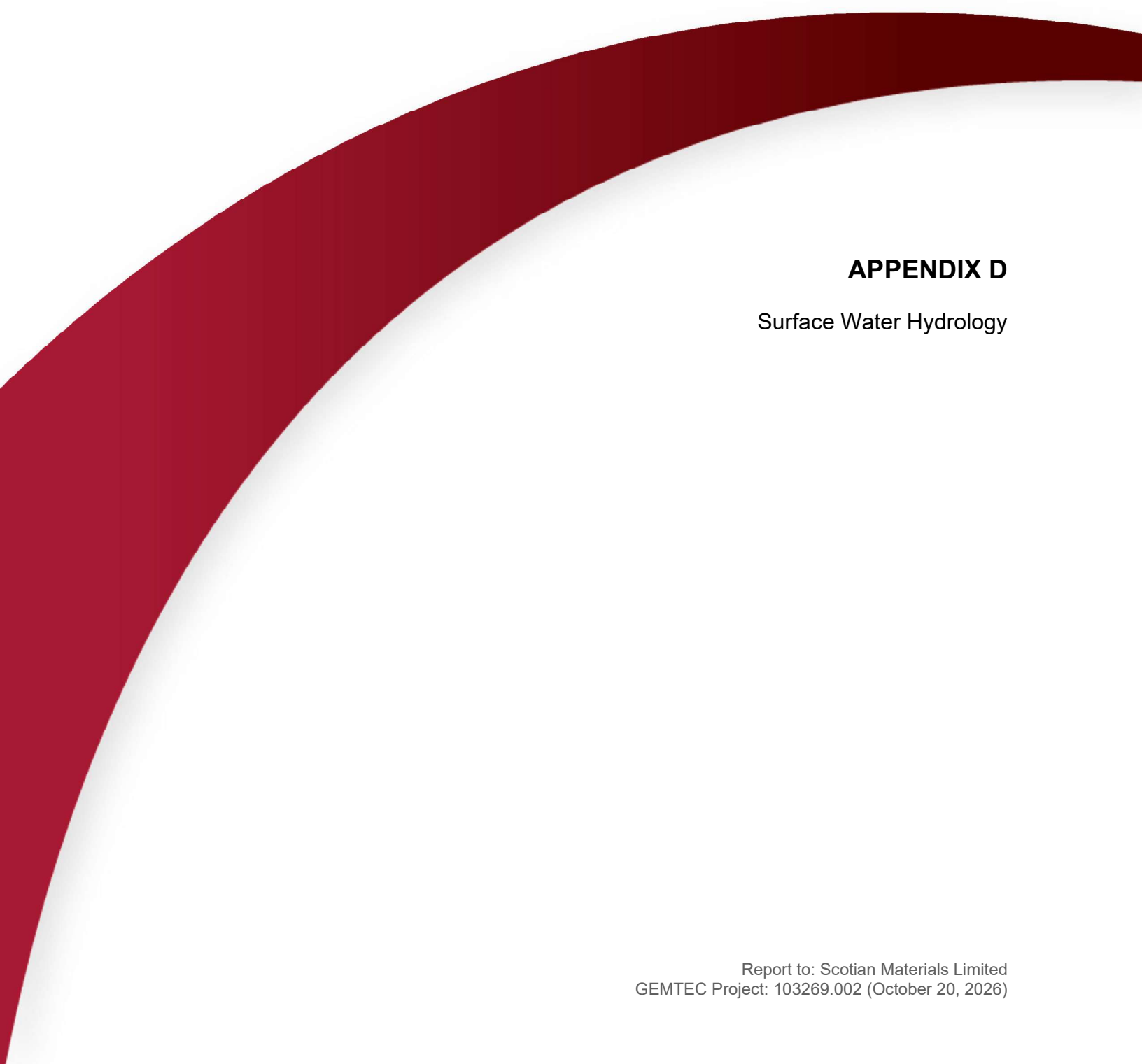




APPENDIX D

Surface Water Hydrology

Figure D1 - Rating Curve SW1a

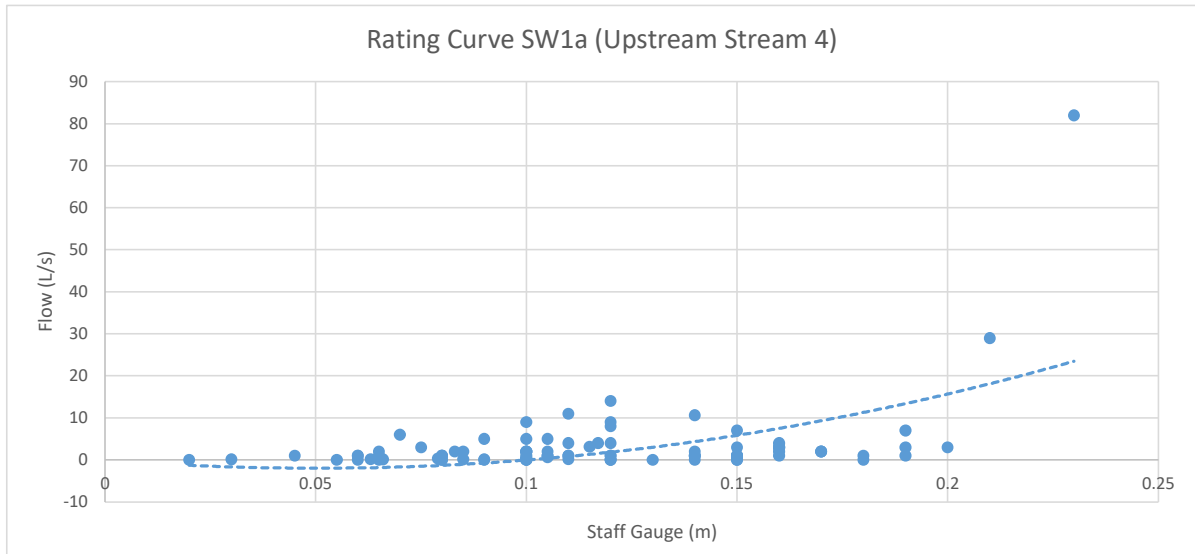


Figure D2 - Rating Curve SW2a

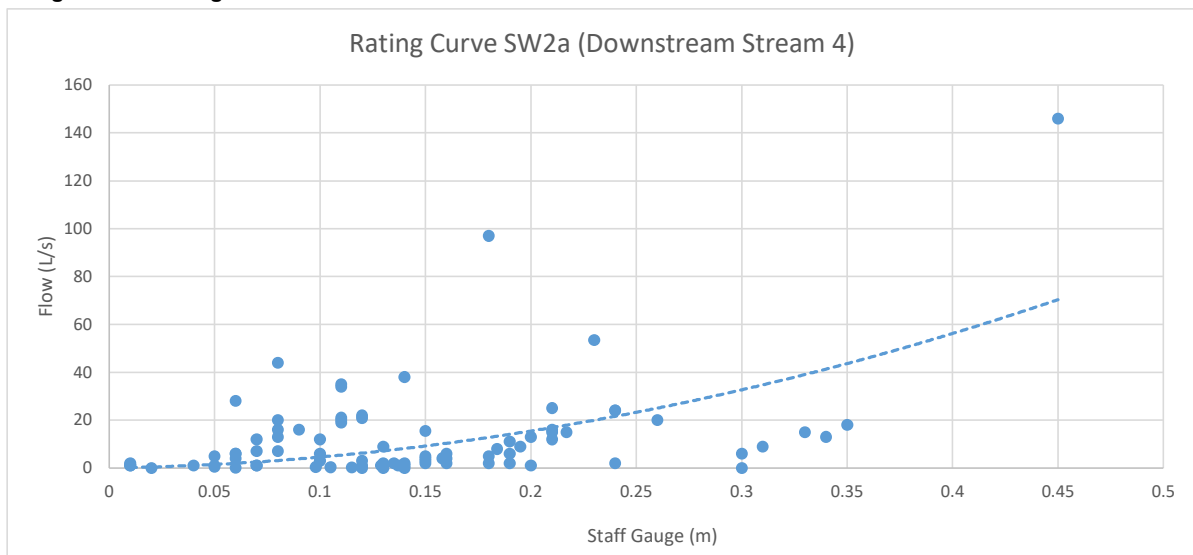


Figure D3 - Rating Curve SW3

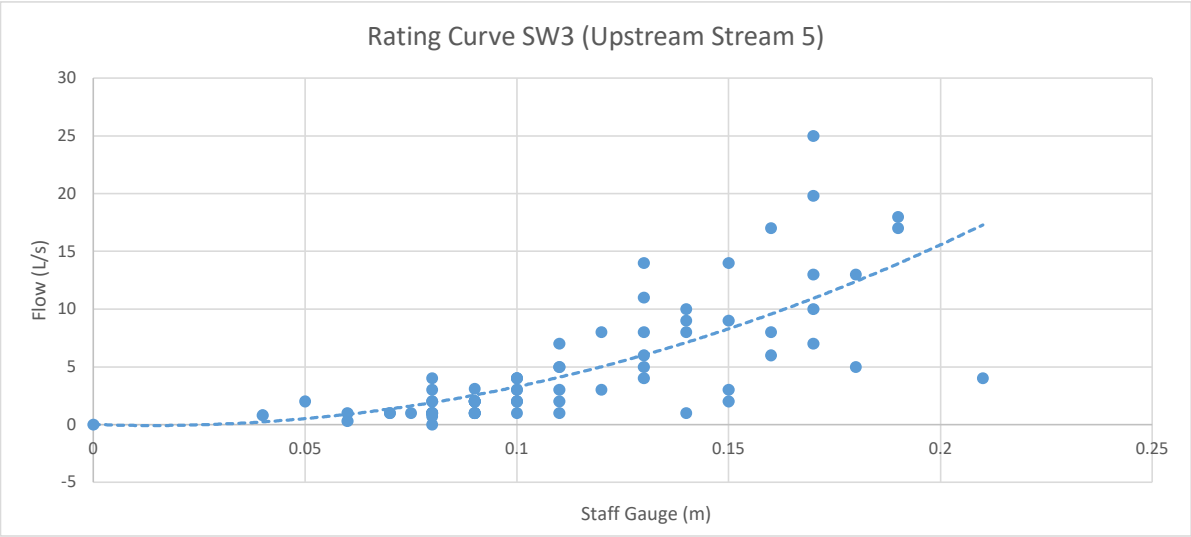


Figure D4 - Rating Curve SW4

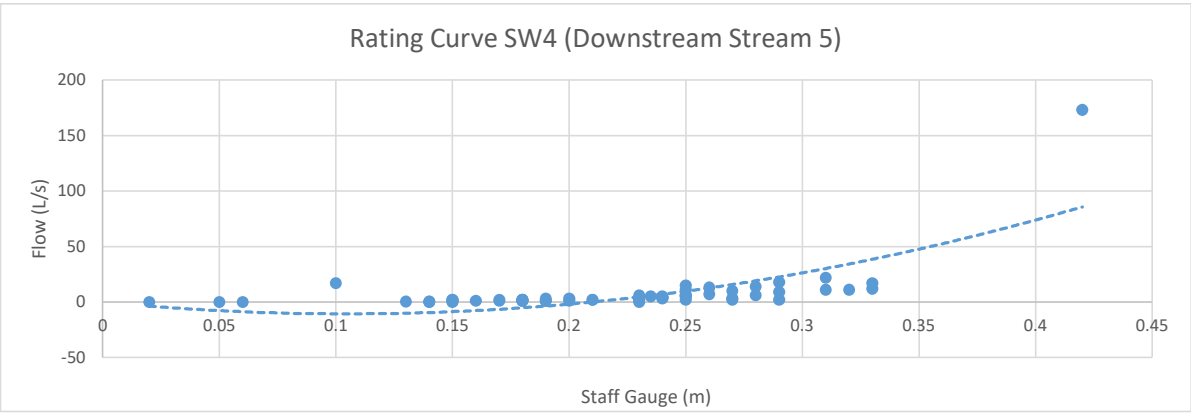


Figure D5 - Rating Curve SW1

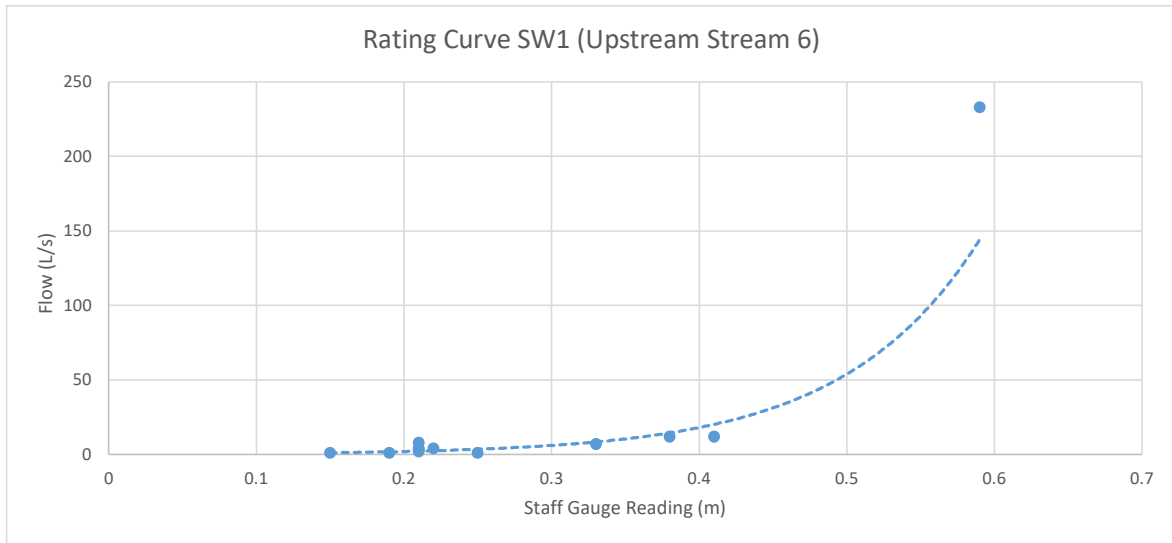


Figure D6 - Rating Curve SW2

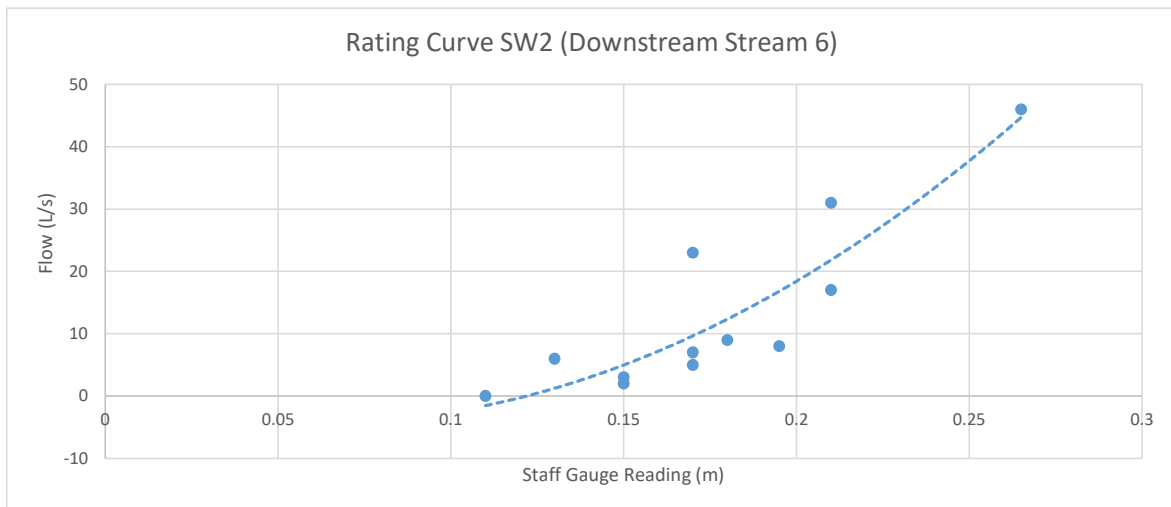


Figure D7 - Flow Graph SW1a

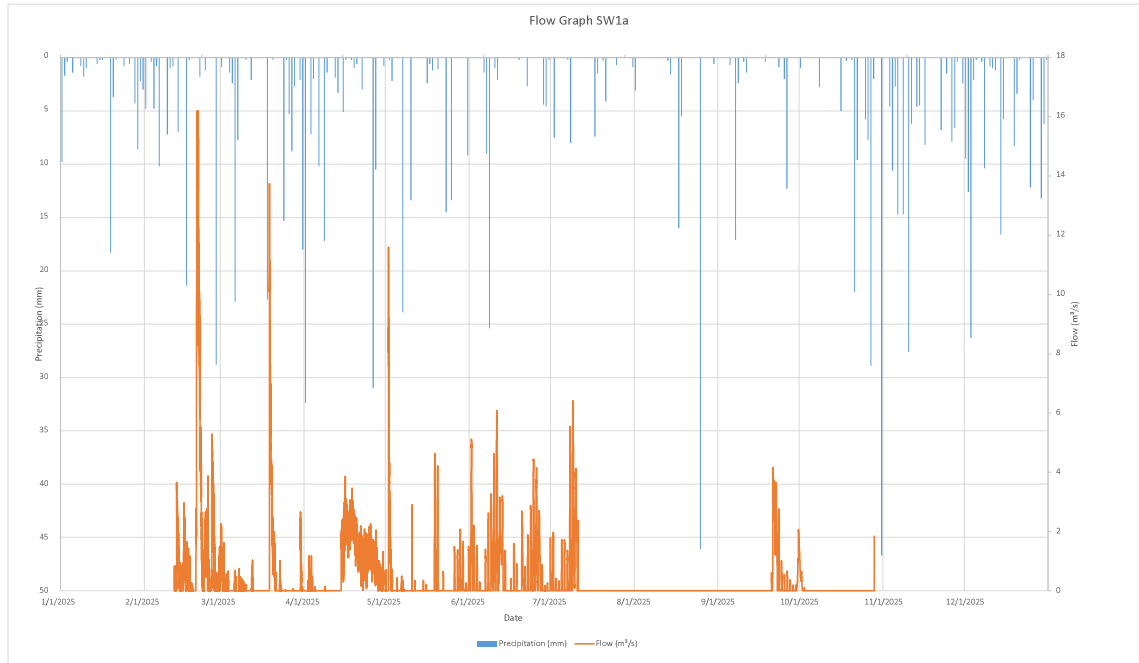


Figure D8 - Flow Graph SW2a

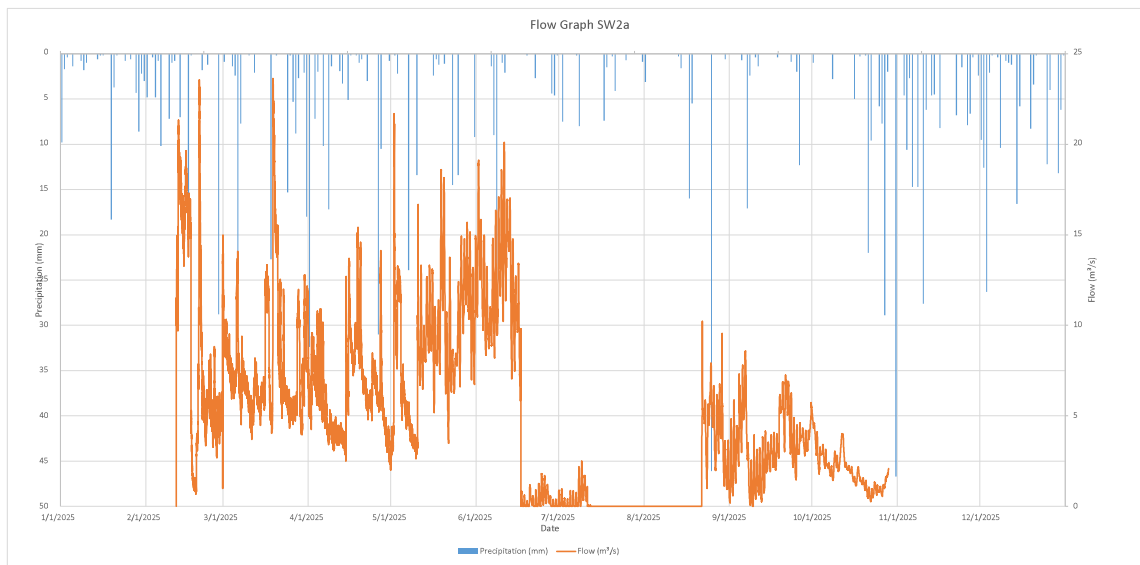


Figure D9 - Flow Graph SW3

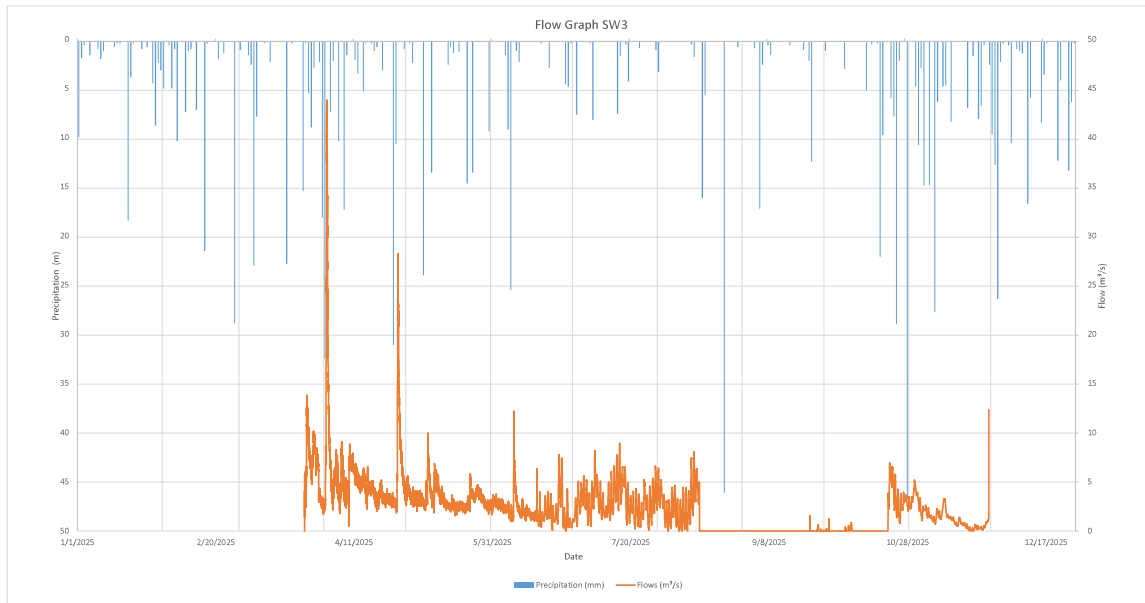


Figure D10 - Flow Graph SW4

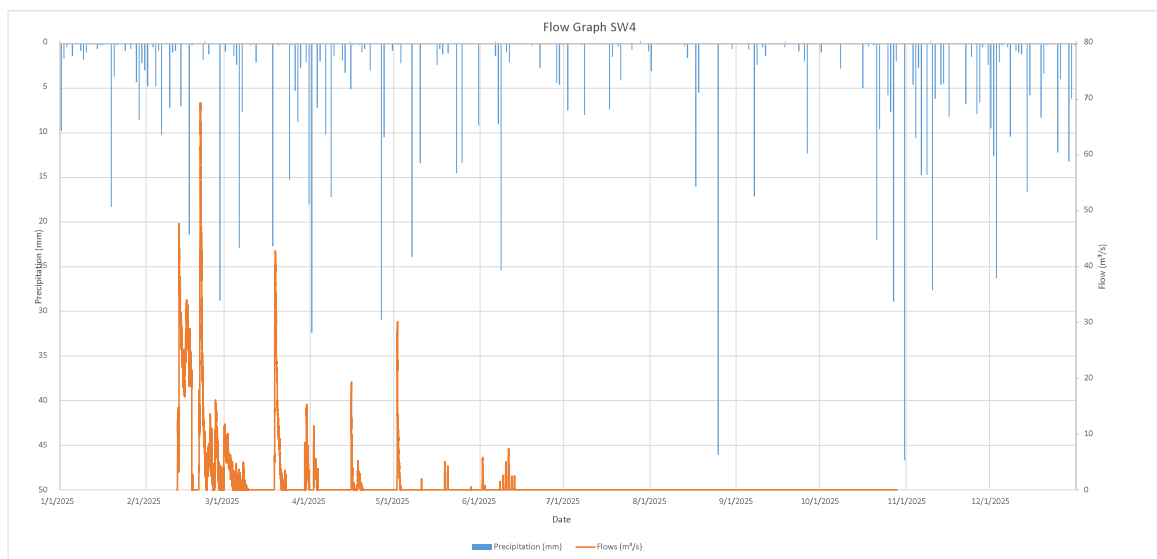


Figure D11 - Flow Graph SW1

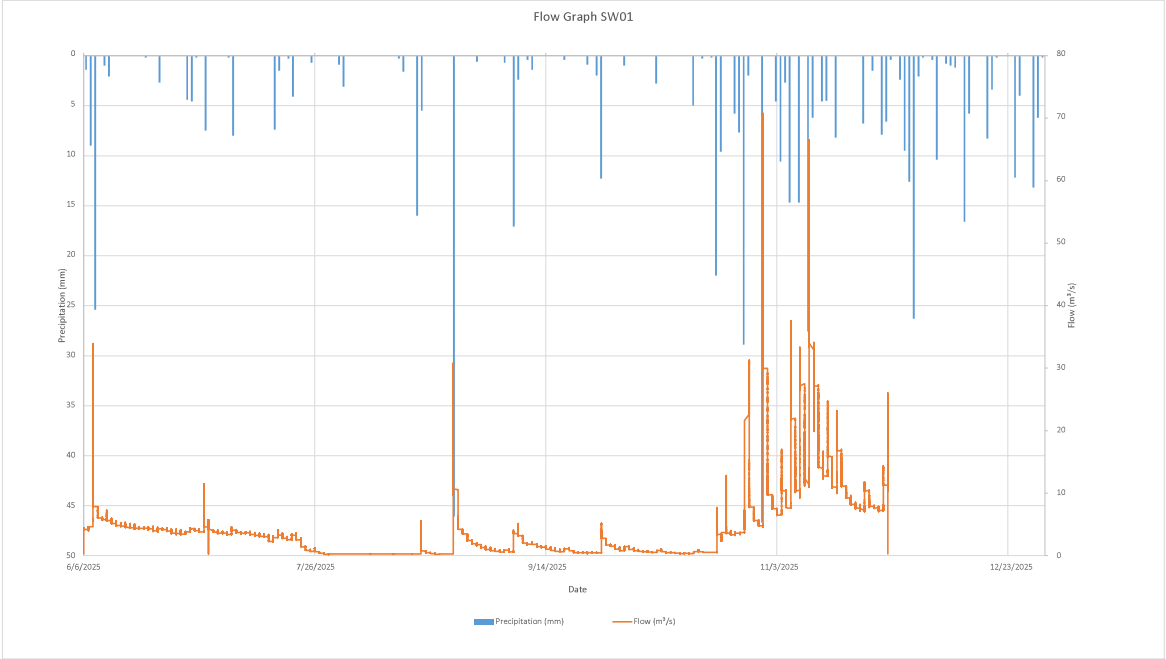
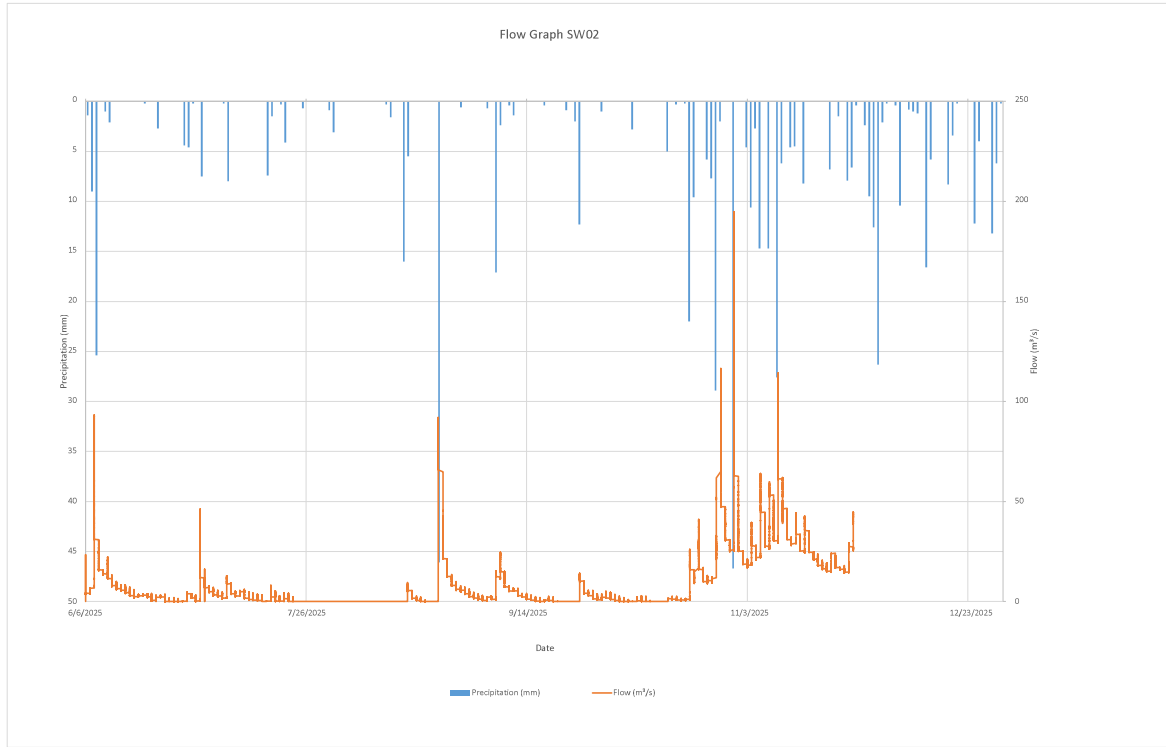


Figure D12 - Flow Graph SW2



Stream 4 at Property Boundary, Pre-Development

Table D-1
Water Balance for Pre-Development Condition at Stream 4 and 5

Total Area: 200677 m ²											
Quarry Floor (Existing)			Silty Sand (Fine Sandy Loam) Mature Forests			Silty Sand (Fine Sandy Loam) Pasture and Shrub			Welland Precip-RE		
VHVC			VHVC			VHVC			VHVC		
Total Area (m ²)			Total Area (m ²)			Total Area (m ²)			Total Area (m ²)		
Infiltration Factor			Infiltration Factor			Infiltration Factor			Infiltration Factor		
0			0.4			0.5			0.0		
Surplus			Surplus			Surplus			Surplus		
Actual Evapotranspiration			Actual Evapotranspiration			Actual Evapotranspiration			Potential Evapotranspiration		
(mm)			(mm)			(mm)			(mm)		
0			0			0			0		
125.9			125.9			125.9			125.9		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
0			0			0			0		
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0			0			0			0		
0			0			0			0		
0											

Stream 4 (Near Property Boundary): Post-Development

Table D-2
Water Balance for Post-Development Condition at Stream 4

Total Area: 197287		m²		Silty Sand (Fine Sandy Loam) Pasture and Shrub										Silty Sand (Fine Sandy Loam) Mature Forest										Wetland											
				100 mm Infiltration Factor		VWC		Total Area (m²)		100 mm Infiltration Factor		VWC		Total Area (m²)		100 mm Infiltration Factor		VWC		Total Area (m²)		100 mm Infiltration Factor		VWC		Total Area (m²)		100 mm Infiltration Factor		Precip-PE		100 mm Infiltration Factor		VWC	
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4			
				0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4									

The Surplus values are calculated using rainfall, snow melt, and Actual Evapotranspiration

Note:

$P = ET + R + I + S$

Quarry Footprint to Stream 4: Post-Development

Total Area: 346854				m²		Silty Sand (Fine Sandy Loam) Channel Quarry										Silty Sand (Fine Sandy Loam) Cleared and stripped (Impervious)									
Month	Days	Temp (°C)	Precipitation (mm)	Adjusted Potential Evapotranspiration (mm)	Actual Evapotranspiration (mm)	Surplus (mm)	10 mm Infiltration Factor	VWC	Gully Flow (Starting At: A2, A3 Channel Quarry)	10 mm Infiltration Factor	VWC	Total Area (m²)	100 mm Infiltration Factor	VWC	Total Area (m²)	100 mm Infiltration Factor	VWC	Surplus							
January	31	-5.7	125.9	0	0	125.9	0	0	0	0	0	293883	0	0	83071	0.3									
February	29	-4.2	119	0	0	119	0	0	0	0	0	293883	0	0	83071	0.3									
March	31	-6.9	120.2	0	0	120.2	0	0	0	0	0	293883	0	0	83071	0.3									
April	30	4.5	23.73	23.73	23.73	0	82.67	21875.14	0	23.73	23.73	8687.49	82.67	21875.14	0	120.2	8687.49	0							
May	31	15.2	89.8	100.62	100.62	0	142	11615.58	0	100.62	100.62	3493.71	142	11615.58	0	120.2	3493.71	0							
June	30	15.2	89.8	100.62	100.62	0	142	11615.58	0	100.62	100.62	3493.71	142	11615.58	0	120.2	3493.71	0							
July	31	18.2	86.7	125.76	95.7	0	0.00	0	0.00	113.7	113.7	-27	-27	-27	-27	-27	-27	-27							
August	31	15.2	89.8	116.16	95.5	0	0.00	0	0.00	102.5	102.5	-12	-12	-12	-12	-12	-12	-12							
September	30	15.2	89.8	116.16	95.5	0	0.00	0	0.00	102.5	102.5	-12	-12	-12	-12	-12	-12	-12							
October	31	9.2	139.8	42.3	42.3	0	97.5	3021.37	42.3	42.3	42.3	8508.42	97.5	3021.37	42.3	42.3	8508.42	0							
November	30	3.8	159.1	14.22	14.22	0	144.68	3021.37	14.22	14.22	14.22	14.68	144.68	3021.37	14.22	14.22	14.68	14.68							
December	31	-1.9	146.9	0	0	146.9	0	0	0	0	0	146.9	0	0	146.9	0	0	146.9							
Annual	365		1393.5	695.19	485.55	908.55	237462.34	645.48	645.48	645.48	645.48	70964.35	645.48	645.48	70964.35	645.48	645.48	645.48							



APPENDIX E

Vegetation Inventory

Scientific Name	Common Name	Provincial S-Rank	COSEWIC Status	SARA Status	NS SARA Status
2018 EA					
<i>Abies balsamea</i>	Balsam Fir	S5	—	—	—
<i>Acer pensylvanicum</i>	Striped Maple	S5	—	—	—
<i>Acer rubrum</i>	Red Maple	S5	—	—	—
<i>Acer saccharum</i>	Sugar Maple	S4S5	—	—	—
<i>Acer spicatum</i>	Mountain Maple	S5	—	—	—
<i>Achillea millefolium</i>	Common Yarrow	S5	—	—	—
<i>Actaea rubra</i>	Red Baneberry	S5	—	—	—
<i>Agalinis tenuifolia</i>	Slender Agalinis	SNA	—	—	—
<i>Agrostis scabra</i>	Rough Bent Grass	S5	—	—	—
<i>Agrostis stolonifera</i>	Creeping Bent Grass	S5	—	—	—
<i>Alisma triviale</i>	Northern Water Plantain	S5	—	—	—
<i>Alnus incana</i>	Speckled Alder	S5	—	—	—
<i>Ambrosia artemisiifolia</i>	Common Ragweed	S5	—	—	—
<i>Amelanchier bartramiana</i>	Bartram's Serviceberry	S5	—	—	—
<i>Anaphalis margaritacea</i>	Pearly Everlasting	S5	—	—	—
<i>Antennaria neglecta</i>	Field Pussytoes	SU	—	—	—
<i>Aralia hispida</i>	Bristly Sarsaparilla	S5	—	—	—
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5	—	—	—
<i>Arctium minus</i>	Common Burdock	SNA	—	—	—
<i>Athyrium filix-femina</i>	Common Lady Fern	S5	—	—	—
<i>Atriplex patula</i>	Spreading Orache	SNA	—	—	—
<i>Betula alleghaniensis</i>	Yellow Birch	S5	—	—	—
<i>Betula papyrifera</i>	Paper Birch	S5	—	—	—
<i>Betula populifolia</i>	Gray Birch	S5	—	—	—
<i>Bidens cernua</i>	Nodding Beggarticks	S5	—	—	—
<i>Brachyelytrum erectum</i>	Bearded Shorthusk	SNA	—	—	—
<i>Bromus ciliatus</i>	Fringed Brome	S5	—	—	—
<i>Bromus inermis</i>	Smooth Brome	SNA	—	—	—
<i>Calamagrostis canadensis</i>	Bluejoint Reed Grass	S5	—	—	—
<i>Callitriche palustris</i>	Marsh Water-starwort	S5	—	—	—
<i>Campanula rotundifolia</i>	Common Harebell	S4	—	—	—
<i>Carex aquatilis</i>	Water Sedge	S4S5	—	—	—
<i>Carex arctata</i>	Black Sedge	S5	—	—	—
<i>Carex brunnescens</i>	Brownish Sedge	S5	—	—	—
<i>Carex crinita</i>	Fringed Sedge	S5	—	—	—
<i>Carex debilis</i>	White-edged Sedge	S5	—	—	—
<i>Carex echinata</i>	Star Sedge	S5	—	—	—
<i>Carex flava</i>	Yellow Sedge	S5	—	—	—
<i>Carex folliculata</i>	Northern Long Sedge	S5	—	—	—
<i>Carex gynandra</i>	Nodding Sedge	S5	—	—	—
<i>Carex interior</i>	Inland Sedge	S4S5	—	—	—
<i>Carex intumescens</i>	Bladder Sedge	S5	—	—	—
<i>Carex lurida</i>	Sallow Sedge	S5	—	—	—
<i>Carex magellanica</i>	Boreal Bog Sedge	S5	—	—	—
<i>Carex michauxiana</i>	Michaux's Sedge	S4	—	—	—
<i>Carex pedunculata</i>	Long-stalked Sedge	S4	—	—	—
<i>Carex</i> spp.	Sedges	?	—	—	—
<i>Carex stipata</i>	Awl-fruited Sedge	S5	—	—	—
<i>Carex stricta</i>	Tussock Sedge	S5	—	—	—
<i>Carex trisperma</i>	Three-seeded Sedge	S5	—	—	—
<i>Carex utriculata</i>	Northern Beaked Sedge	S5	—	—	—
<i>Centaurea nigra</i>	Black Knapweed	SNA	—	—	—
<i>Cerastium fontanum</i>	Common Chickweed	SNA	—	—	—
<i>Chamaedaphne calyculata</i>	Leatherleaf	S5	—	—	—
<i>Chamerion angustifolium</i>	Fireweed	S5	—	—	—
<i>Chara</i> sp.	Chara	?	—	—	—
<i>Chelone glabra</i>	White Turtlehead	S5	—	—	—
<i>Chrysosplenium americanum</i>	American Golden Saxifrage	S5	—	—	—
<i>Cicuta bulbifera</i>	Bulbous Water-hemlock	S5	—	—	—
<i>Circaea alpina</i>	Small Enchanter's Nightshade	S5	—	—	—
<i>Cirsium arvense</i>	Canada Thistle	SNA	—	—	—
<i>Clematis virginiana</i>	Virginia Clematis	S5	—	—	—
<i>Clintonia borealis</i>	Yellow Bluebead Lily	S5	—	—	—
<i>Comptonia peregrina</i>	Sweet-fern	S5	—	—	—
<i>Coptis trifolia</i>	Goldthread	S5	—	—	—

Scientific Name	Common Name	Provincial S-Rank	COSEWIC Status	SARA Status	NS SARA Status
Corallorhiza maculata	Spotted Coralroot	S4	—	—	—
Cornus canadensis	Bunchberry	S5	—	—	—
Cornus sericea	Red Osier Dogwood	S5	—	—	—
Corylus cornuta	Beaked Hazel	S5	—	—	—
Cypripedium acaule	Pink Lady's-Slipper	S5	—	—	—
Dalibarda repens	Dewdrop	S4S5	—	—	—
Danthonia spicata	Poverty Oat Grass	S5	—	—	—
Daucus carota	Queen Anne's Lace	SNA	—	—	—
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	S5	—	—	—
Dicranum sp.	Forkmoss	?	—	—	—
Diervilla lonicera	Northern Bush Honeysuckle	S5	—	—	—
Doellingeria umbellata	Hairy Flat-top White Aster	S5	—	—	—
Drosera intermedia	Spoon-Leaved Sundew	S5	—	—	—
Drosera rotundifolia	Round-leaved Sundew	S5	—	—	—
Dryopteris carthusiana	Spinulose Wood Fern	S5	—	—	—
Dryopteris cristata	Crested Wood Fern	S5	—	—	—
Dryopteris intermedia	Evergreen Wood Fern	S5	—	—	—
Dulichium arundinaceum	Three-Way Sedge	S5	—	—	—
Eleocharis acicularis	Needle Spikerush	S5	—	—	—
Elymus virginicus	Virginia Wild Rye	S5	—	—	—
Epigaea repens	Trailing Arbutus	S5	—	—	—
Epilobium ciliatum	Northern Willowherb	S5	—	—	—
Epilobium palustre	Marsh Willowherb	S5	—	—	—
Equisetum arvense	Field Horsetail	S5	—	—	—
Equisetum pratense	Meadow Horsetail	S3	—	—	—
Equisetum sylvaticum	Woodland Horsetail	S5	—	—	—
Equisetum variegatum	Variegated Horsetail	S3	—	—	—
Erechtites hieraciifolia	Eastern Burnweed	S5	—	—	—
Eriophorum virginicum	Tawny Cottongrass	S5	—	—	—
Eupatorium maculatum	Spotted Joe-pye-weed	S5	—	—	—
Eupatorium perfoliatum	Common Boneset	S5	—	—	—
Eurybia macrophylla	Large-leaved Aster	S5	—	—	—
Euthamia graminifolia	Grass-leaved Goldenrod	S5	—	—	—
Fagus grandifolia	American Beech	S5	—	—	—
Fragaria virginiana	Wild Strawberry	S5	—	—	—
Fraxinus americana	White Ash	S5	—	—	—
Fraxinus nigra	Black Ash	S1S2	—	—	Threatened
Galium triflorum	Three-flowered Bedstraw	S5	—	—	—
Gaultheria hispida	Creeping Snowberry	S5	—	—	—
Gaultheria procumbens	Eastern Teaberry	S5	—	—	—
Gaylussacia baccata	Black Huckleberry	S5	—	—	—
Geum laciniatum	Rough Avens	S5	—	—	—
Geum rivale	Water Avens	S5	—	—	—
Glyceria canadensis	Canada Manna Grass	S5	—	—	—
Glyceria grandis	Common Tall Manna Grass	S4S5	—	—	—
Glyceria striata	Fowl Manna Grass	S5	—	—	—
Gnaphalium uliginosum	Marsh Cudweed	SNA	—	—	—
Gymnocarpium dryopteris	Common Oak Fern	S5	—	—	—
Hamamelis virginiana	American Witch-Hazel	S5	—	—	—
Hieracium caespitosum	Field Hawkweed	SNA	—	—	—
Hieracium scabrum	Rough Hawkweed	S5	—	—	—
Hydrocotyle americana	American Marsh Pennywort	S5	—	—	—
Hylocomium splendens	Stairstep Moss	S5	—	—	—
Hypericum canadense	Canada St John's-wort	S5	—	—	—
Hypericum perforatum	Common St. John's-wort	SNA	—	—	—
Ilex verticillata	Common Winterberry	S5	—	—	—
Impatiens capensis	Spotted Jewelweed	S5	—	—	—
Iris versicolor	Harlequin Blue Flag	S5	—	—	—
Juncus articulatus	Jointed Rush	S5	—	—	—
Juncus brevicaudatus	Narrow-Paniced Rush	S5	—	—	—
Juncus canadensis	Canada Rush	S5	—	—	—
Juncus effusus	Soft Rush	S5	—	—	—
Juncus filiformis	Thread Rush	S5	—	—	—
Juncus pelocarpus	Brown-Fruited Rush	S5	—	—	—
Juncus tenuis	Slender Rush	S5	—	—	—
Kalmia angustifolia	Sheep Laurel	S5	—	—	—

Scientific Name	Common Name	Provincial S-Rank	COSEWIC Status	SARA Status	NS SARA Status
Lactuca canadensis	Canada Lettuce	S5	—	—	—
Larix laricina	Tamarack	S5	—	—	—
Ledum groenlandicum	Common Labrador Tea	S5	—	—	—
Leucanthemum vulgare	Oxeye Daisy	SNA	—	—	—
Leucobryum glaucum	White Pincushion Moss	S5	—	—	—
Linaria vulgaris	Butter-and-Eggs	SNA	—	—	—
Linnaea borealis	Twinflower	S5	—	—	—
Lobaria pulmonaria	Lungwort Lichen	S5	—	—	—
Lonicera canadensis	Canada Fly Honeysuckle	S5	—	—	—
Lonicera sp.	Honeysuckle	?	—	—	—
Ludwigia palustris	Marsh Seedbox	S5	—	—	—
Luzula multiflora	Common Woodrush	S5	—	—	—
Lycopodiella inundata	Northern Bog Clubmoss	S5	—	—	—
Lycopodium annotinum	Stiff Clubmoss	S5	—	—	—
Lycopodium clavatum	Running Clubmoss	S5	—	—	—
Lycopodium dendroideum	Round-branched Tree-clubmoss	S5	—	—	—
Lycopus americanus	American Water Horehound	S5	—	—	—
Lysimachia ciliata	Fringed Yellow Loosestrife	S4	—	—	—
Lysimachia terrestris	Swamp Yellow Loosestrife	S5	—	—	—
Lythrum salicaria	Purple Loosestrife	SNA	—	—	—
Maianthemum canadense	Wild Lily-of-The-Valley	S5	—	—	—
Maianthemum trifolium	Tree-leaved False Solomon's Seal	S5	—	—	—
Matricaria discoidea	Pineapple Weed	SNA	—	—	—
Matteuccia struthiopteris	Ostrich Fern	S5	—	—	—
Melilotus albus	White Sweet-clover	SNA	—	—	—
Mitchella repens	Partridgeberry	S5	—	—	—
Mitella nuda	Naked Bishop's-Cap	S4S5	—	—	—
Monotropa uniflora	Indian Pipe	S5	—	—	—
Morella pensylvanica	Northern Bayberry	S5	—	—	—
Myrica gale	Sweet Gale	S5	—	—	—
Nemopanthus mucronatus	Mountain Holly	S5	—	—	—
Oclemena acuminata	Whorled Wood Aster	S5	—	—	—
Oenothera biennis	Common Evening Primrose	S5	—	—	—
Onoclea sensibilis	Sensitive Fern	S5	—	—	—
Osmunda cinnamomea	Cinnamon Fern	S5	—	—	—
Osmunda claytoniana	Interrupted Fern	S5	—	—	—
Osmunda regalis	Royal Fern	S5	—	—	—
Oxalis montana	Common Wood Sorrel	S5	—	—	—
Oxalis stricta	European Wood Sorrel	S5	—	—	—
Petasites frigidus	Northern Sweet Coltsfoot	S4	—	—	—
Phalaris arundinacea	Reed Canary Grass	S5	—	—	—
Phegopteris connectilis	Northern Beech Fern	S5	—	—	—
Picea glauca	White Spruce	S5	—	—	—
Picea mariana	Black Spruce	S5	—	—	—
Picea rubens	Red Spruce	S5	—	—	—
Pinus strobus	Eastern White Pine	S5	—	—	—
Plantago major	Common Plantain	SNA	—	—	—
Platanthera clavellata	Club Spur Orchid	S5	—	—	—
Platanthera dilatata	White Bog Orchid	S4S5	—	—	—
Pleurozium schreberi	Red-stemmed Feather Moss	S5	—	—	—
Poa annua	Annual Blue Grass	SNA	—	—	—
Pogonia ophioglossoides	Rose Pogonia	S4	—	—	—
Polygonum arifolium	Halberd-leaved Tearthumb	S2	—	—	—
Polygonum cilinode	Fringed Black Bindweed	S5	—	—	—
Polygonum lapathifolium	Pale Smartweed	S5	—	—	—
Polygonum sagittatum	Arrow-leaved Smartweed	S5	—	—	—
Polystichum acrostichoides	Christmas Fern	S5	—	—	—
Populus grandidentata	Large-toothed Aspen	S5	—	—	—
Populus tremuloides	Trembling Aspen	S5	—	—	—
Potamogeton epihydrus	Ribbon-leaved Pondweed	S5	—	—	—
Potentilla simplex	Old Field Cinquefoil	S5	—	—	—
Prenanthes altissima	Tall Rattlesnakeroot	S5	—	—	—
Prenanthes trifoliolata	Three-leaved Rattlesnakeroot	S5	—	—	—
Prunella vulgaris	Common Self-heal	S5	—	—	—
Prunus pensylvanica	Pin Cherry	S5	—	—	—
Prunus virginiana	Chokecherry	S5	—	—	—

Scientific Name	Common Name	Provincial S-Rank	COSEWIC Status	SARA Status	NS SARA Status
Pteridium aquilinum	Bracken Fern	S5	—	—	—
Pyrola americana	Round-leaved Pyrola	S5	—	—	—
Ranunculus acris	Common Buttercup	SNA	—	—	—
Ranunculus repens	Creeping Buttercup	SNA	—	—	—
Rhinanthus minor	Little Yellow Rattle	SNA	—	—	—
Rhododendron canadense	Rhodora	S5	—	—	—
Rhynchospora alba	White Beakrush	S5	—	—	—
Rhytidiadelphus triquetrus	Electrified Cat's-tail Moss	S5	—	—	—
Ribes glandulosum	Skunk Currant	S5	—	—	—
Rubus allegheniensis	Alleghaney Blackberry	S5	—	—	—
Rubus hispidus	Bristly Dewberry	S5	—	—	—
Rubus idaeus	Red Raspberry	S5	—	—	—
Rubus pubescens	Dwarf Red Raspberry	S5	—	—	—
Rubus canadensis	Smooth blackberry	S5	—	—	—
Rumex acetosella	Sheep Sorrel	SNA	—	—	—
Rumex orbiculatus	Greater Water Dock	S5	—	—	—
Sagittaria cuneata	Northern Arrowhead	S5	—	—	—
Salix bebbiana	Bebb's Willow	S5	—	—	—
Sambucus racemosa	Red Elderberry	S5	—	—	—
Sanicula marilandica	Maryland Sanicle	S4	—	—	—
Scirpus cyperinus	Common Woolly Bulrush	S5	—	—	—
Scirpus microcarpus	Small-fruited Bulrush	S5	—	—	—
Scirpus sp.	Bulrush	?	—	—	—
Sisyrinchium montanum	Mountain Blue-eyed-grass	S5	—	—	—
Solanum dulcamara	Bittersweet Nightshade	SNA	—	—	—
Solidago bicolor	White Goldenrod	S5	—	—	—
Solidago canadensis	Canada Goldenrod	S4S5	—	—	—
Solidago flexicaulis	Zigzag Goldenrod	S5	—	—	—
Solidago puberula	Downy Goldenrod	S5	—	—	—
Solidago rugosa	Rough-stemmed Goldenrod	S5	—	—	—
Solidago sp.	Goldenrod	?	—	—	—
Solidago uliginosa	Northern Bog Goldenrod	S5	—	—	—
Sonchus arvensis	Field Sow Thistle	SNA	—	—	—
Sorbus americana	American Mountain Ash	S5	—	—	—
Sparganium americanum	American Burreed	S5	—	—	—
Spartina sp.	Cord grass	?	—	—	—
Sphagnum magellanicum	Magellan's Peat Moss	S5	—	—	—
Sphagnum sp.	Sphagnum Moss	?	—	—	—
Spiraea alba	White Meadowsweet	S5	—	—	—
Spiraea tomentosa	Steeplebush	S5	—	—	—
Spiranthes cernua	Rough-stemmed Goldenrod	S5	—	—	—
Streptopus lanceolatus	Rose Twisted-stalk	S5	—	—	—
Symphotrichum lateriflorum	Calico Aster	S5	—	—	—
Tanacetum vulgare	Common Tansy	SNA	—	—	—
Taraxacum officinale	Common Dandelion	SNA	—	—	—
Taxus canadensis	Canada Yew	S4S5	—	—	—
Thalictrum pubescens	Tall meadow rue	S5	—	—	—
Thelypteris noveboracensis	New York Fern	S5	—	—	—
Thelypteris palustris	Eastern Marsh Fern	S5	—	—	—
Thelypteris simulata	Bog Fern	S4	—	—	—
Thuidium delicatulum	Delicate Fern Moss	S5	—	—	—
Toxicodendron rydbergii	Northern Poison Oak	S5	—	—	—
Triadenum fraseri	Fraser's Marsh St John's-wort	S5	—	—	—
Trichophorum caespitosum	Tufted Clubrush	S5	—	—	—
Trientalis borealis	Northern Starflower	S5	—	—	—
Trifolium repens	White Clover	SNA	—	—	—
Trillium undulatum	Painted Trillium	S5	—	—	—
Tussilago farfara	Coltsfoot	SNA	—	—	—
Typha angustifolia	Narrow-Leaved Cattail	S5	—	—	—
Typha latifolia	Broad-leaved Cattail	S5	—	—	—
Utricularia intermedia	Flat-leaved Bladderwort	S5	—	—	—
Uvularia sessilifolia	Sessile-leaved Bellwort	S4S5	—	—	—
Vaccinium angustifolium	Late Lowbush Blueberry	S5	—	—	—
Vaccinium macrocarpon	Large Cranberry	S5	—	—	—
Vaccinium myrtilloides	Velvet-leaved Blueberry	S5	—	—	—
Vaccinium oxycoccos	Small Cranberry	S5	—	—	—

Scientific Name	Common Name	Provincial S-Rank	COSEWIC Status	SARA Status	NS SARA Status
<i>Veronica officinalis</i>	Common Speedwell	S5	—	—	—
<i>Viburnum lantanoides</i>	Hobblebush	S4S5	—	—	—
<i>Viburnum nudum</i>	Northern Wild Raisin	S5	—	—	—
<i>Vicia cracca</i>	Tufted Vetch	SNA	—	—	—
<i>Viola cucullata</i>	Marsh Blue Violet	S5	—	—	—
<i>Viola</i> sp.	Violet	?	—	—	—

2025 Incidental Observations

<i>Fraxinus nigra</i>	Black Ash	S1S2	Threatened	Threatened	-
<i>Fraxinus americana</i>	White Ash	S4	-	-	-
<i>Deparia acrostichoides</i>	Silvery Glade Fern	S4	-	-	-
<i>Solidago uliginosa</i> var. <i>uliginosa</i>	Bog Goldenrod	S4S5	-	-	-
<i>Fragaria virginiana</i>	Wild Strawberry	S5	-	-	-
<i>Rubus pubescens</i>	Dwarf Red Raspberry	S5	-	-	-
<i>Polystichum acrostichoides</i>	Christmas fern	S5	-	-	-
<i>Prunella vulgaris</i>	Common Self-heal	S5	-	-	-
<i>Doellingeria umbellata</i>	Hairy Flat-top White Aster	S5	-	-	-
<i>Amauropelta noveboracensis</i>	New York Fern	S5	-	-	-
<i>Dryopteris cristata</i>	Crested Wood Fern	S5	-	-	-
<i>Glyceria striata</i> var. <i>striata</i>	Fowl Mannagrass	S5	-	-	-
Rough-stemmed Goldenrod	<i>Solidago rugosa</i>	S5	-	-	-
<i>Betula alleghaniensis</i>	Yellow Birch	S5	-	-	-
<i>Linnaea borealis</i>	Twinflower	S5	-	-	-
<i>Vaccinium angustifolium</i>	Late Lowbush Blueberry	S5	-	-	-
<i>Lysimachia borealis</i>	Northern Starflower	S5	-	-	-
<i>Abies balsamea</i>	Balsam Fir	S5	-	-	-
<i>Ilex mucronata</i>	Mountain Holly	S5	-	-	-
<i>Symphyotrichum lateriflorum</i>	Calico Aster	S5	-	-	-
<i>Epilobium ciliatum</i>	Northern Willowherb	S5	-	-	-
<i>Claytonomunda claytoniana</i>	Interrupted Fern	S5	-	-	-
<i>Gaultheria procumbens</i>	Eastern Teaberry	S5	-	-	-
<i>Lonicera canadensis</i>	Canada Fly Honeysuckle	S5	-	-	-
<i>Symphyotrichum puniceum</i>	Purple-stemmed Aster	S5	-	-	-
<i>Cornus canadensis</i>	Bunchberry	S5	-	-	-
<i>Oclemena acuminata</i>	Whorled Wood Aster	S5	-	-	-
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5	-	-	-
<i>Rhododendron canadense</i>	Rhodora	S5	-	-	-
<i>Maianthemum canadense</i>	Wild Lily-of-The-Valley	S5	-	-	-
<i>Ilex verticillata</i>	Common Winterberry	S5	-	-	-
<i>Gaultheria hispida</i>	Creeping Snowberry	S5	-	-	-
<i>Oclemena nemoralis</i>	Bog Aster	S5	-	-	-
<i>Thelypteris palustris</i>	Eastern Marsh Fern	S5	-	-	-
<i>Lycopus uniflorus</i>	Northern Water Horehound	S5	-	-	-
<i>Osmunda regalis</i>	Royal Fern	S5	-	-	-
<i>Oclemena x blakei</i>	Wild White Panicked American-As	S5	-	-	-
<i>Osmunda cinnamomea</i>	Cinnamon Fern	S5	-	-	-
<i>Acer rubrum</i>	Red Maple	S5	-	-	-
<i>Alnus incana</i>	Speckled Alder	S5	-	-	-
<i>Solidago canadensis</i>	Canada Goldenrod	S5	-	-	-
<i>Onoclea sensibilis</i>	Sensitive Fern	S5	-	-	-
<i>Picea glauca</i>	White Spruce	S5	-	-	-
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5	-	-	-
<i>Typha latifolia</i>	Broad-leaved Cattail	S5	-	-	-
<i>Osmundastrum cinnamomeum</i>	Cinnamon Fern	S5	-	-	-
<i>Thalictrum pubescens</i>	Tall Meadow-Rue	S5	-	-	-
<i>Betula pubescens</i>	Silver Birch	SNA	-	-	-



APPENDIX F

Lichen Survey Report



GEMTEC

www.gemtec.ca

Scotian Materials Inc.
171 Resource Road
Goffs, Nova Scotia
B2T 0L2

**Environmental Baseline Report
Lichens
Environmental Impact Assessment
Goffs Quarry Expansion
Phases 3 and 4
Goffs, Nova Scotia**

June 24, 2026
GEMTEC Project: 103269.002

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND TERMINOLOGY	IV
1.0 INTRODUCTION.....	5
1.1 Regulatory Context.....	5
1.2 Project Description	5
1.3 Scope of Assessment.....	5
1.4 Description of Valued Component (VC)	5
2.0 METHODOLOGY.....	6
2.1 Spatial Boundaries	6
2.1.1 Project Development Area (PDA).....	6
2.2 ACCDC Rare Lichen Records	1
2.3 Lichen Survey Methodology	1
2.4 Lichen Specimen Collection	3
3.0 RESULTS.....	4
3.1 Habitats within the PDA.....	4
3.2 Lichens observed within the PDA.....	4
3.2.1 Rare Lichen Species	4
3.2.2 Lichen Inventory within the PDA	5
4.0 REFERENCES.....	1

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LIST OF TABLES

Table 2.1	Rare lichens within a 5 km radius.....	1
Table 2.2	Rare lichens within a 100 km radius.....	Error! Bookmark not defined.
Table 3.2	Lichen species observed within the PDA.	1

LIST OF FIGURES

Figure 2.1	Project Development Area (PDA) for Goffs Quarry expansion.	7
Figure 2.2	Track log from Lichen Survey within PDA at Goffs Quarry, Phases 3 and 4.	2

LIST OF ABBREVIATIONS AND TERMINOLOGY

EIA – Environmental Impact Assessment

ELC – Ecological Land Classification

Land Base Inventory – NRED’s land cover classification system, including Forests, Non-Forest, and Wetlands

ACCDC – Atlantic Canada Conservation Data Centre

PDA – Project Development Area

LAA – Local Assessment Area

RAA – Regional Assessment Area

NSECC – Department of Environment and Climate Change

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

SARA – Species at Risk Act

SAR – Species at Risk

SOCC – Species of Conservation Concern

VC – Valued Component

LIST OF APPENDICES

Appendix F-1	Photographs of Lichens Observed
Appendix F-2	Letter from ACCDC on Lichen Identifications

1.0 INTRODUCTION

This baseline report is provided as an appendix to the Environmental Assessment (EA) Registration document prepared by GEMTEC for Goffs Quarry **Expansion Phases 3 and 4**, on behalf of Scotian Materials Inc. (Scotian Materials).

1.1 Regulatory Context

The proposed Goffs Quarry Expansion Phases 3 and 4 is subject to the *Environmental Assessment Regulations* under Section 49 of the Environment Act S.N.S. 1994-95, c. 1. It is considered a 'Class I Undertaking' pursuant to paragraphs (c) and (d) in 'Schedule A' subsection B(2). As such, an EA Registration document must be submitted to the Department of Environment and Climate Change (NSECC) for registration review before the project can proceed. As part of the provincial EA process, descriptions of the existing environment at the project site must be provided, and the potential effects of the project on the exiting environment must be assessed. This report describes the existing conditions for one Valued Component (VC) of the existing environment – Lichens.

1.2 Project Description

Goffs Quarry Expansion Phases 3 and 4 (the Project) has been proposed by Scotian Materials Inc. (the Proponent).

The Project consists of an expansion to the existing aggregate quarry. A detailed project description is provided within the main EA Registration document. The project is located at 171 Resource Road, in Goffs, Nova Scotia (PID 00505941).

1.3 Scope of Assessment

This report provides a detailed description of the baseline conditions of Lichens within the undeveloped portions at the project site, where Phases 3 and 4 will be developed. The spatial extents of this assessment are outlined in the next section.

This report does not include effects assessment or mitigation.

1.4 Description of Valued Component (VC)

The Lichens Valued Component (VC) encompasses all lichen species observed within the PDA, with particular emphasis on epiphytic taxa found on trees, and excludes bryophytes and vascular plants.

2.0 METHODOLOGY

This survey employed a systematic approach to document the diversity and distribution of lichens within the designated study area (PDA, see below). Fieldwork was conducted using standard lichenological techniques, including visual identification, photographic documentation, and sample collection for laboratory analysis as needed. Data were recorded digitally, including substrate type, coordinates, photographs, and associated habitat information.

2.1 Spatial Boundaries

This baseline description of existing conditions for **Lichens** is primarily focused on the immediate Project Development Area (PDA), although a general overview of the vegetation within the surrounding local and regional area is provided within Atlantic Canada Conservation Data Centre (ACCDC) Report No. 8690, acquired for the Project (APPENDIX A of main EA Registration document).

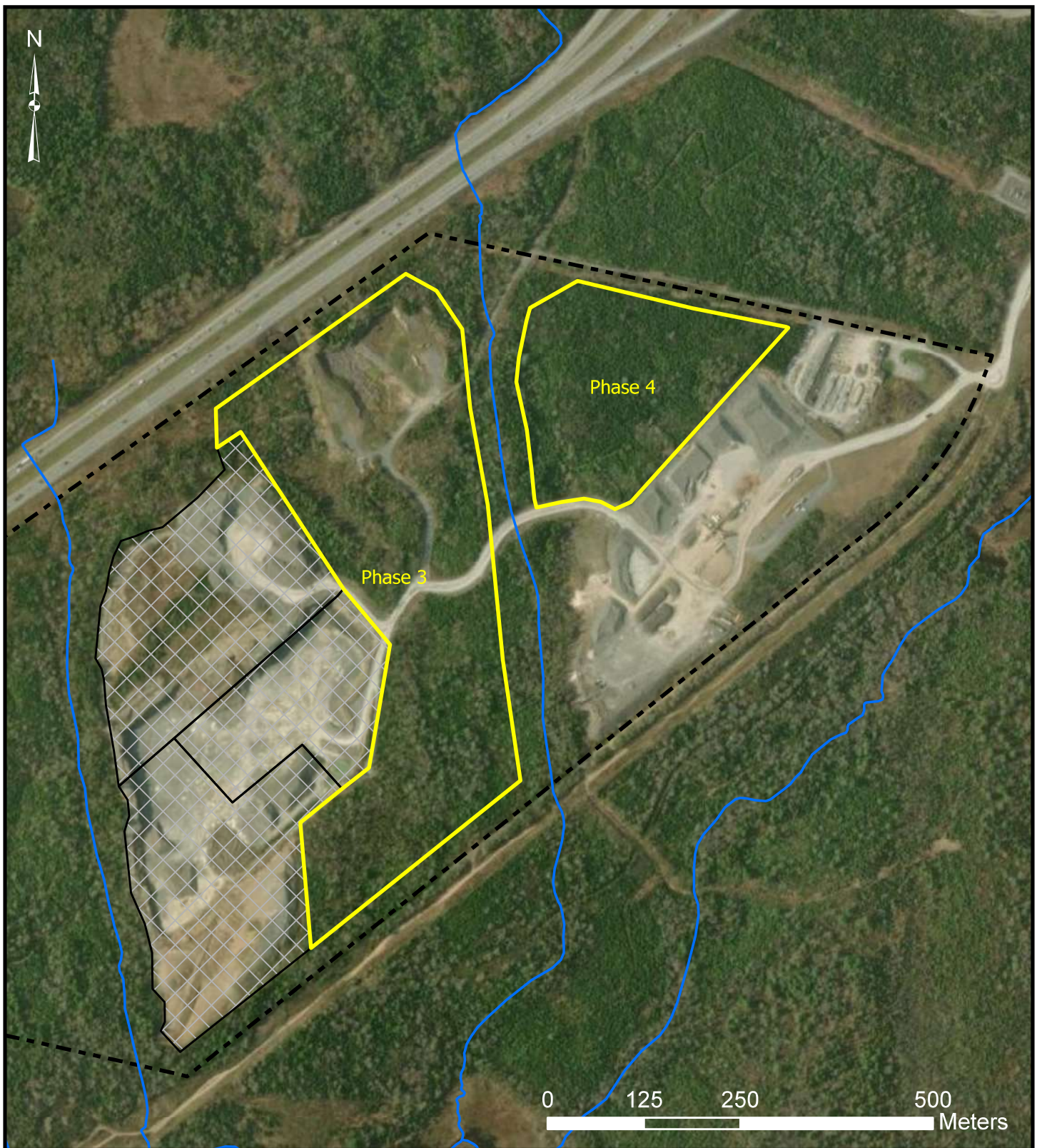
2.1.1 Project Development Area (PDA)

The Project Development Area (PDA) refers to the immediate project footprint used to assess direct impact pathways associated with the proposed development (Figure 1). It includes the portion of the property where aggregate extraction is planned, along with associated areas required for development activities such as stockpiling. The total PDA is approximately 24.3 hectares.

Although the PDA does not include the riparian buffers surrounding the watercourses, these areas were still surveyed. This was done in recognition of the potential for indirect impacts from the quarry expansion such as changes in moisture levels, temperature, or contaminant dispersion to extend into these sensitive zones.

The PDA for Goffs Quarry Expansion Phases 3 and 4 is shown in Figure 1 below.

The LAA and RAA defined for the project are not discussed in this baseline report.



Legend:

 Existing Phases

 Property Boundary (PID 00505941)

 Project Development Area (PDA)

 Watercourses (NSHN)

Note:

1. Coordinate system: NAD83 CRS UTM Zone 20.
2. Aerial Imagery Retrieved from: ESRI World Imagery

Project: Goffs Quarry
Phase 3 & 4 Expansion
Goffs, Nova Scotia

Drawing: Project Development Area (PDA)

Client: Scotian Materials Ltd.

Drawn by: JC
Checked by: SG
Date: November 2025

Project Number: 103269.002

Drawing Number: Figure 1

Revision No. 2



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2.2 ACCDC Rare Lichen Records

A data report was acquired from the Atlantic Canada Conservation Data Centre (ACCDC) for a 5 km radius around the Project site (ACCDC Report No. 8690). The ACCDC report provides the location of recorded flora and fauna SAR or SOCC, the presence or absence of any location sensitive species, and the location and information on significant or managed natural areas. The report also includes lichens, in addition to vascular plants. The ACCDC report is provided in Appendix A of the main EA Registration document. Species records across taxa were reported by ACCDC for a 100 km radius as well; these records are not discussed here.

Table 2.1 Rare lichens within a 5 km radius (ACCDC Report #8690).

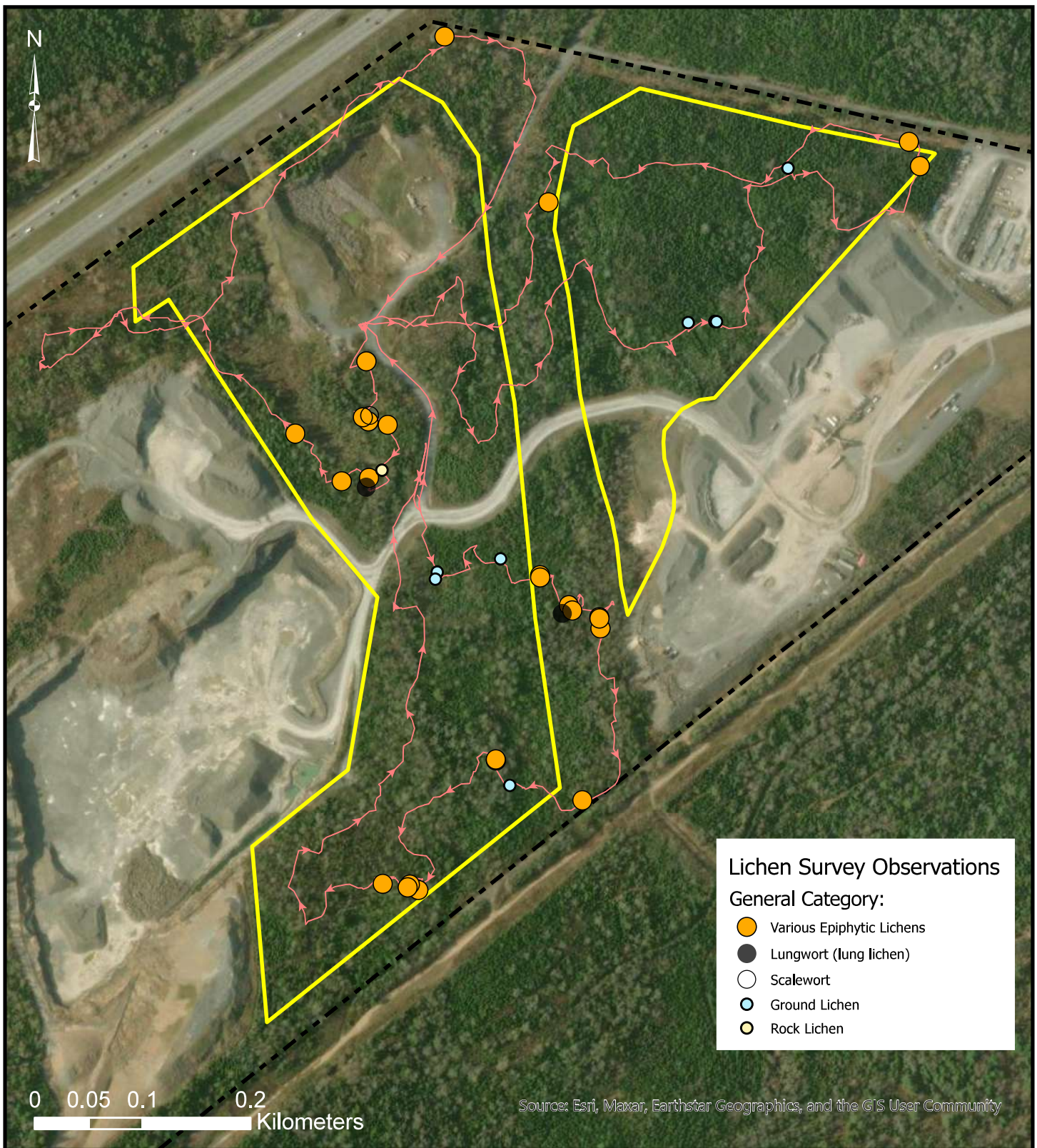
Scientific Name	Common Name	COSEWIC	SARA	NS Endangered Species Act	Prov Rarity Rank	Distance (km)
<i>Pectenium plumbea</i>	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	1.3 ± 0.2
<i>Collema nigrescens</i>	Blistered Tarpaper Lichen	-	-	-	S3	1.7 ± 0.2
<i>Sticta fuliginosa</i>	Peppered Moon Lichen	-	-	-	S3S4	0.9 ± 0.5
<i>Scytinium subtile</i>	Appressed Jellyskin Lichen	-	-	-	S3S4	0.8 ± 0.2
<i>Leptogium corticola</i>	Blistered Jellyskin Lichen	-	-	-	S3S4	1.7 ± 0.2
<i>Coccocarpia palmicola</i>	Salted Shell Lichen	-	-	-	S3S4	1.3 ± 0.2

2.3 Lichen Survey Methodology

Field surveys were carried out to characterize the diversity of lichens within the PDA and identify any rare lichens (S-rank S1-S3). All data was recorded on handheld mobile devices with [ArcGIS Field Maps](#), which collects coordinates with an accuracy of approximately 10 m. All observation data and attached photos are uploaded to an ArcGIS Online (AGOL) database (Feature Service).

The lichen survey was conducted over approximately two days, on May 5th and 6th, 2025. The location of at least one individual organism for each species observed was recorded in a Field Maps point layer. Field personnel aimed to also collect at least one photograph of every species observed within the PDA; photos were attached to individual species point records in Field Maps. A photo log of species observed is attached to this report in Appendix F-1.

All lichens were identified to species level where possible. A lichen species list for Nova Scotia was downloaded in May 2025 from the ACCDC website: <http://accdc.com/en/ranks.html>, which was used for scientific names and most common names.



Lichen Survey Observations

General Category:

- Various Epiphytic Lichens
- Lungwort (lung lichen)
- Scalewort
- Ground Lichen
- Rock Lichen

Legend:

- Property Boundary (PID 00505941) → Field Track
- Project Development Area (PDA)

Note:

1. Coordinate system: NB; Stereographic projection, NAD83 (CSRS) Datum.
2. Contains information licensed under the Open Government License - New Brunswick.
3. Aerial Imagery Retrieved from: ESRI World Imagery

Project:

Goffs Quarry Expansion
Environmental Assessment

Drawing: Lichen Survey: track log
and field observations.

Client: Scotia Materials Ltd.

Drawn by: JC
Checked by: SG

Date: November 2025

Project Number: 102814.002

Drawing Number: Figure 2

Revision No. 0



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2.4 Lichen Specimen Collection

For some lichen species that were particularly challenging to identify in the field, specimens were collected for identification later. Lichens were carefully removed or, when possible, collected from already detached thalli to minimize ecological impact. Each specimen was placed in its own folded paper packet labeled with species (if known), date, location (with coordinates), and substrate type and roughly organized in a field binder for short-term protection. At the end of each field day, samples were either gently pressed (for foliose and crustose types) or left loosely to air-dry (particularly for fruticose or brittle species), using a plant press with light pressure and ventilated layers to prevent distortion or mold. This method ensured specimens stayed intact and identifiable for later analysis.

Laboratory identification took place later in the spring of 2025 at the GEMTEC office in Hanwell, NB. Specimens were air-dried completely, examined under a digital dissection microscope, and referenced against identification keys typical of Nova Scotia lichenological standards.

The following texts were the primary resources used for plant identification:

Lichens of North America (Brodo, Sharnoff, & Sharnoff, Lichens of North America, 2001);
and

Identifying Lichens of Nova Scotia: A reference guidebook (Brodo, Cameron, Andrachuk, & Craig, 2007).

Several other papers and online resources were also used, including the Consortium of Lichen Herbaria web page: <https://lichenportal.org/portal/index.php>, and local iNaturalist examples (used cautiously, if verified by reputable biologists).

2.5 Taxonomic Verification by ACCDC

During an online meeting with EA technical reviewers from the NS Department of Natural Resources (DNR) in August 2025, a discussion was held on the required qualifications to undertake lichen surveys. Since GEMTEC's surveying biologist is not currently on the approved list of lichenologists in Nova Scotia, it was proposed that an approved lichenologist be engaged to verify the results of our findings. Following the meeting, the DNR Biodiversity staff provided a list of approved lichen specialists for Nova Scotia. From this list, GEMTEC sub-contracted the team from the Atlantic Canada Conservation Data Centre (ACCDC) to complete a review of species identifications based on photos of lichens observed by GEMTEC at Goffs. This review is provided in Appendix F-2.

Based on the ACCDC review, the identification of observations were revised where required and the species list for the project was updated. These are reflected in Section 3.0.

3.0 RESULTS

3.1 Habitats within the PDA

The PDA for the Goffs Quarry Expansion (Phases 3 and 4) includes a variety of forested and non-forested habitats, including wetlands and riparian areas, which support diverse vegetation communities and ecological functions.

Phase 3 includes a mosaic of mixedwood and coniferous forest stands, with evidence of natural disturbance and past land use. Dominant canopy species included red maple (*Acer rubrum*), fir (*Abies balsamea*), white birch (*Betula papyrifera*), and red spruce (*Picea rubens*). Areas of stunted fir and regenerating spruce forest are present, along with open patches and rock outcrops.

The Phase 4 area is more heavily forested and includes a mix of young coniferous and deciduous tree species. Red spruce and balsam fir dominate the canopy, with scattered red maple and white birch. However, the hardwood were mainly concentrated in the margins, along old, abandoned access roads, and near the riparian area.

The main riparian area that separates Phase 3 and 4 is associated with Watercourse 6, a tributary to Holland Brook. The canopy consisted of a mix of red maple, white ash (*Fraxinus americana*), and sugar maple (*Acer saccharum*) with numerous large, mature to overmature red spruce, which frequently hosted Eastern ragged-rim lichen (*Loxospora ochrophaea*). The understory is partially shaded and relatively open. Much of this riparian corridor has been historically preserved. Certainly, the greatest diversity of lichens observed within the PDA was within the riparian areas, where older intact forests persist. Most of the forested area outside of riparian areas and wetlands is young regenerating hardwood or softwood, with minimal epiphytic lichens. In these areas, most lichens observed were on rock and soil substrates (e.g., various *Cladonia* species).

3.2 Lichens observed within the PDA

A diversity of lichen species was observed within the PDA, especially within older riparian and wet forest stands. The habitat within the PDA supports a mixture of crustose, foliose, and fruticose lichens, many of which are known to be sensitive to changes in air quality and forest structure. The results of the field survey are provided below.

Representative photographs of species observed within the PDA are provided in Appendix F-1.

3.2.1 Rare Lichen Species

None of the lichen species observed within the PDA are listed as SAR or SOCC (S1-S3) at either the provincial or federal level. Furthermore, none of the identified species are currently listed under COSEWIC, SARA, or the Nova Scotia Endangered Species Act.

3.2.2 Lichen Inventory within the PDA

A lichen inventory was conducted within the PDA to document species presence and assess potential sensitivity to environmental change. The survey recorded a diverse assemblage of lichen taxa across forested areas, wetlands, and riparian habitats, with observations made on a range of substrates including hardwood and coniferous trees, exposed rock, and soil.

A total of 26 lichen taxa were identified within the PDA. The table below summarizes the lichen species recorded within the PDA, along with their Provincial Rarity Ranks, host species or other substrate (if recorded), and the general location of each observation.

Table 3.1 Lichen species observed within the PDA.

Family	Scientific Name	Common Name	Prov. Rarity Rank	Observed Host	Area	Notes
Baeomycetaceae	<i>Baeomyces rufus</i>	Brown Beret Lichen	S4	Not specified	Phase 3	
Cladoniaceae	<i>Cladonia sp.</i>	Unknown epiphytic lichen		Red maple	Phase 3	Originally identified as stubby stalked lichen, but ACCDC disagreed. They were unable to provide alternative suggestion. See photo log.
Cladoniaceae	<i>Cladonia fimbriata</i>	Trumpeting Lichen	S5	Soil	Phase 3	ACCDC review determined 'possibly correct' and stated "A reasonable guess, but not 100% identifiable from photo".
Cladoniaceae	<i>Cladonia rangiferina</i>	Gray Reindeer Lichen	S5	Soil	Phase 3	Common throughout
Cladoniaceae	<i>Cladonia crispata</i>	Organ-pipe Lichen	S5	Back side of old white birch	Phase 3	ACCDC determined "likely correct", noting "Need better macro photos and chemical tests to confirm".
Cladoniaceae	<i>Cladonia squamosa</i>	Dragon Lichen	S5	Not specified	Phase 4	ACCDC determined "likely correct".
Cladoniaceae	<i>Cladonia cristatella</i>	British Soldiers Lichen	S5	Not specified	Phase 4	ACCDC determined "likely correct" but noted "insufficient photo resolution to confirm ID".

<i>Cladoniaceae</i>	<i>Cladonia verticillata</i>	Ladder Lichen	S5	Near British soldier lichen	Phase 4	
<i>Cladoniaceae</i>	<i>Cladonia stellaris</i>	Star-tipped Reindeer Lichen	S5	Not specified	Phase 4	
<i>Cladoniaceae</i>	<i>Cladonia coniocraea</i>	Common Pixie Powderhorn	S5	Rock pile	Phase 3	ACCDC determined "Possibly Correct", noting "A reasonable guess, but need better macro photos and chemical tests to confirm."
<i>Collemataceae</i>	<i>Collema subflaccidum</i>	Tree Jelly	S5	Red maple	Phase 3, Stream 6 Corridor	ACCDC suggested likely <i>Collema subflaccidum</i> . One was originally identified as blue jellyskin.
<i>Collemataceae</i>	<i>Leptogium c.f. cyanescens</i>	Blue Jellyskin Lichen	S5	Sugar maple	Stream 6 Corridor	Originally identified as black-bordered shingle lichen (S5) but corrected based on ACCDC review. *however, we're relatively confident that black bordered shingle lichen also present at site.
<i>Lobariaceae</i>	<i>Lobaria scrobiculata</i>	Textured Lungwort Lichen	S5	Sugar maple	Stream 6 Corridor	
<i>Lobariaceae</i>	<i>Lobaria pulmonaria</i>	Lungwort Lichen	S5	Red maple, various other species	Phase 3, Stream 6 Corridor	

Nephromataceae *Nephroma laevigatum* Mustard S5 Red maple Phase 3

Sample collected and observed under microscope clearly showing mustard coloured medulla. ACCDC review determined “possibly correct” but recommended K test to differentiate from *N. helveticum* (S4S5). ACCDC later reviewed additional photos from dissection scope and were more comfortable with the identification.

K spot test later performed on old sample and was K+purple confirming the identification.

<i>Pannariaceae</i>	<i>Parmeliella triptophylla</i>	Black-bordered Shingles Lichen	S5	Various	Stream 6 Corridor
<i>Parmeliaceae</i>	<i>Alectoria sarmentosa</i>	Common Witch's Hair Lichen	S4	Not specified	Stream 6 Corridor
<i>Parmeliaceae</i>	<i>Menegazzia subsimilis</i>	Tree Flute Lichen	S4S5	Stunted old fir	Wetland 4
<i>Parmeliaceae</i>	<i>Parmotrema crinitum</i>	Salted Ruffle Lichen	S5	Not specified	Phase 3

ACCDC determined this ID is possibly correct but could also be *M. terebrata* (S4S5).

<i>Parmeliaceae</i>	<i>Usnea dasopoga</i>	Fishbone Beard Lichen	S5	Softwood and red maple trees	Wetland 4	Originally identified as nit beard lichen (<i>Usnea subfloridana</i>); however, ACCDC noted “ <i>Unable to ID to species. Perhaps Usnea dasopoga, based on the fishbone pattern branching.</i> ” Therefore, we’ve used <i>U. c.f. dasopoga</i> as a reasonable placeholder.
<i>Parmeliaceae</i>	<i>Parmelia squarrosa</i>	Bottlebrush Shield Lichen	S5	Red maple, Ash, fir	Phase 3, Wetland 4	Common throughout
<i>Parmeliaceae</i>	<i>Punctelia rudecta</i>	Rough Speckleback Lichen	S5	Dead yellow birch	Phase 3	ACCDC determined “likely correct” and noted “... <i>but photo isn’t close up enough to clearly show identification features (e.g. isidia vs soredia).</i> ”
<i>Parmeliaceae</i>	<i>Platismatia tuckermanii</i>	Crumpled Rag Lichen	S5	Grey birch branch	Phase 4	
<i>Peltigeraceae</i>	<i>Ricasolia quercizans</i>	Smooth Lung Lichen	S5	Sugar maple	Stream 6 Corridor	Present with blue jellyskin listed above.
<i>Phlyctidaceae</i>	Possible <i>Phlyctis</i> sp.	Whitewash Lichens	SU	Red maple	Phase 3	Originally identified as <i>P. argena</i> , but ACCDC noted “ <i>Need specimen to identify to species.</i> ”. Regardless, this white, unremarkable crustose lichen was common throughout site.
<i>Sarrameanaceae</i>	<i>Loxospora ochrophaea</i>	Eastern Ragged-rim Lichen	S5	Red Spruce, dead fir	Phase 3, Stream 6	

Corridor,
wetland 4

4.0 REFERENCES

- Brodo, I. M., Cameron, R., Andrachuk, H., & Craig, B. (2007). *Identifying Lichens of Nova Scotia; A Reference Guidebook*. Ecological Monitoring and Assessment Network (EMAN) Coordinating Office, Environment Canada.
- Brodo, I. M., Sharnoff, S. D., & Sharnoff, S. (2001). *Lichens of North America*. Yale University Press.
- Degtjarenko, P. (2016). *Impacts of alkaline dust pollution on biodiversity of plants and lichens: from communities to genetic diversity*. University of Tartu. .
- Farmer, A. (1993). *The effects of dust on vegetation – A review*. Environmental Pollution.



APPENDIX F-1

Photographs of Lichens Observed
Goff's Quarry, Nova Scotia



Common Witch's Hair Lichen (*Alectoria sarmentosa*)



Brown Beret Lichen (*Baeomyces rufus*)



Tree Flute Lichen (*Menegazzia subsimilis*)



Unidentified lichen (probably *Cladonia* sp.)



Leptogium cf. cyanescens in upper center,
Ricasolia quercizans at bottom right.



Textured Lungwort Lichen (*Lobaria scrobiculata*)



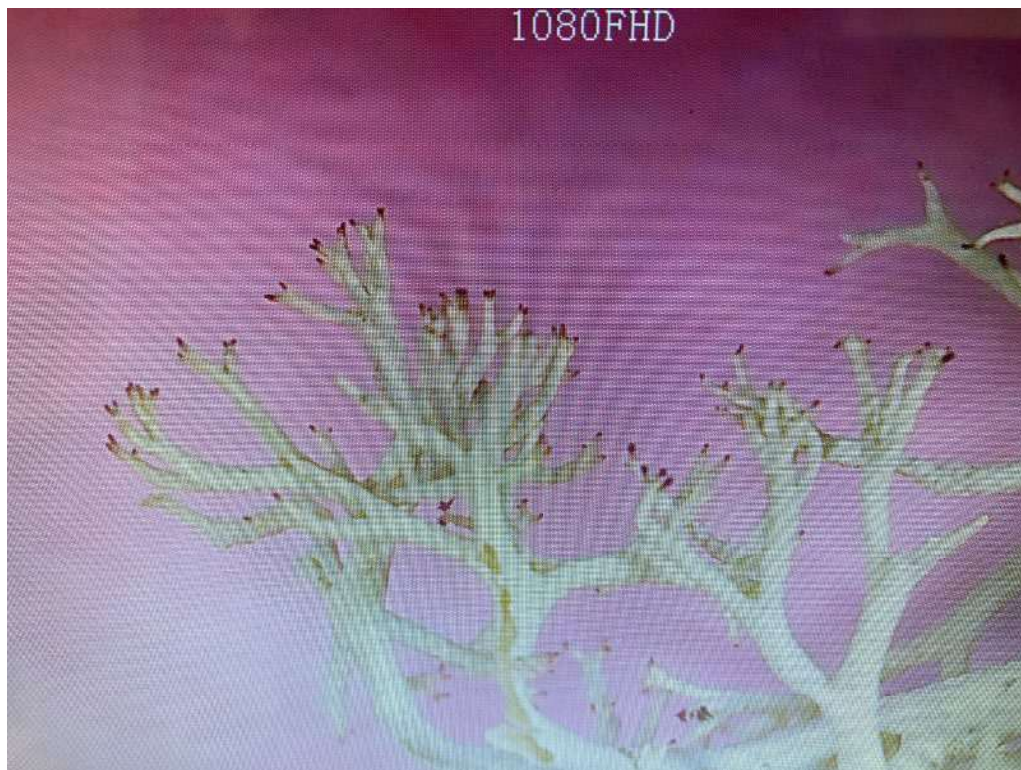
Tree Tarpaper Lichen (*Collema subflaccidum*)



Trumpeting Lichen (*Cladonia fimbriata*)



Blue Jellyskin Lichen (*Leptogium cyanescens*)



Gray Reindeer Lichen (*Cladonia rangiferina*)



Crumpled Rag Lichen (*Platismatia tuckermanii*)



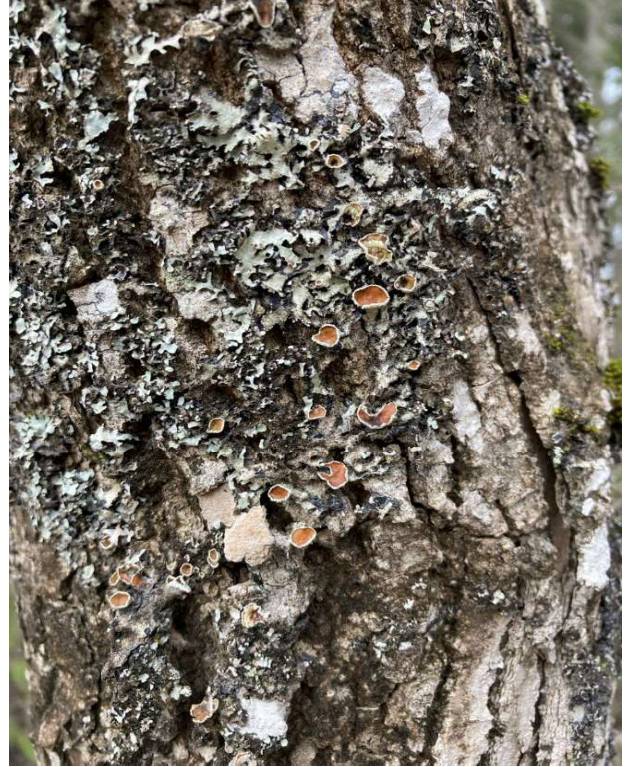
Rough Speckleback Lichen (*Punctelia rudecta*)



Dragon Lichen (*Cladonia squamosa*)



Ladder Lichen (*Cladonia verticillata*)



Bottlebrush Shield Lichen (*Parmelia squarrosa*)



Star-tipped Reindeer Lichen (*Cladonia stellaris*)



Eastern ragged-rim lichen (*Loxospora ochrophaea*)



Common Pixie Powderhorn (*Cladonia coniocraea*)



Whitewash Lichens (*Phlyctis argena*)



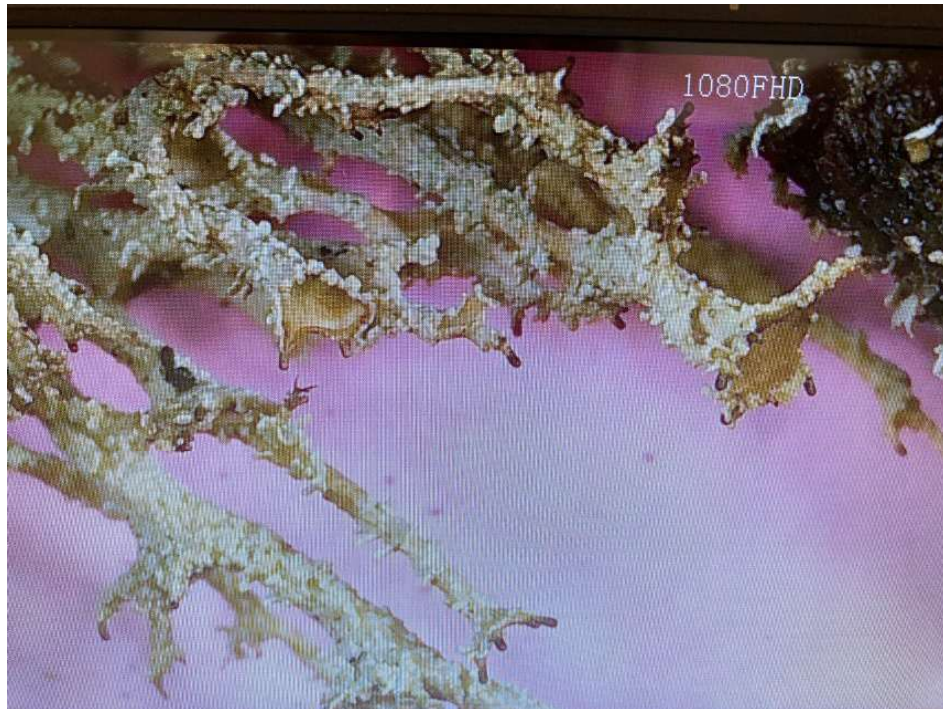
British Soldiers Lichen (*Cladonia cristatella*)



Lungwort Lichen (*Lobaria pulmonaria*)



Fishbone Beard Lichen (*Usnea* *c.f. *dasopoga*)



Organpipe Lichen (*Cladonia crispata*)



Mustard Kidney Lichen (*Nephroma laevigatum*)



Mustard Kidney Lichen under microscope



Salted Ruffle Lichen (*Parmotrema crinitum*)



APPENDIX F-2

Letter from ACCDC on Lichen Identifications

Goffs Quarry Lichen Identifications for Justin Chase, GEMTEC

Fiona Brooks, Iain Crowell and Sean Blaney

Atlantic Canada Conservation Data Centre, November 14, 2025

Background: On November 13, 2025, Justin Chase of GEMTEC requested identification review of 25 lichen photographs taken at the site of the Goffs Quarry expansion, Goffs, Halifax County, Nova Scotia. Atlantic Canada Conservation Data Centre (AC CDC) Nova Scotia Lichenologist Fiona Brooks and Maritimes Botanist / Lichenologist Iain Crowell reviewed the photos and provided identifications, indicating which species were correctly identified, potentially correctly identified but not conclusively identifiable to species, and which were incorrectly identified. AC CDC Executive Director Sean Blaney compiled the results into this report.

AC CDC's work on this project was restricted to identification of lichen photographs and we provide no comment on the methods or execution of the original survey work by GEMTEC.

Results: Identifications with notes are provided in Table 1 below. Nine species identifications were confirmed as correct and four identifications were confirmed as incorrect, with an alternate identification possible in one case. The photographs for twelve species provided insufficient detail to make a definite decision on identification. Of these, six species identifications were considered "likely correct", five identifications were considered "possibly correct", one identification was considered "likely incorrect"

Table 1. AC CDC identifications of lichen photographs from the Goffs Quarry expansion project area, Goffs, Halifax County, Nova Scotia.

Photo#	GEMTEC ID	Common Name	NS S-rank	AC CDC Determination	AC CDC Comments (Fiona Brooks & Iain Crowell)
1	<i>Alectoria sarmentosa</i>	Common Witch's Hair Lichen	[S4]	Likely correct	Ideally should confirm vs <i>Usnea</i> spp. by checking for a lack of central cord and longitudinal pseudocephalae
2	<i>Baeomyces rufus</i>	Brown Beret Lichen	S4	Correct	
3	<i>Menegazzia subsimilis</i>	Tree Flute Lichen	S4S5	Possibly correct	Can confirm that it is <i>Menegazzia</i> sp but need clear photos of multiple soralia in order to distinguish <i>M. subsimilis</i> from <i>M. terebrata</i>
4	<i>Cladonia caespiticia</i>	Stubby Stalked Lichen		Likely incorrect	Unable to confirm without Thin-Layer Chromatography (TLC). <i>Cladonia caespiticia</i> usually has globose, peach-coloured apothecia growing over squamules
5	<i>Nephroma laevigatum</i>	Mustard Kidney Lichen	[S5]	Possibly correct	Requires chemical test (K+ purple) on medulla to confirm laevigatum. Medulla colour can vary from yellowish to white.
6	<i>Parmotrema crinitum</i>	Salted Ruffie Lichen	S5	Correct	
7	<i>Parmeliella triptophylla</i>	Black-bordered Shingles Lichen		Incorrect	<i>Leptogium</i> cf. <i>cyanescens</i> in upper center, <i>Ricasolia quercizans</i> at bottom right
8	<i>Lobaria scrobiculata</i>	Textured Lungwort Lichen	S5	Correct	
9	<i>Collema subflaccidum</i>	Tree Tarpaper Lichen	S5	Correct	
10	<i>Cladonia rangiferina</i>	Gray Reindeer Lichen	[S5]	Likely correct	Not identifiable, but likely correct
11	<i>Cladonia fimbriata</i>	Trumpeting Lichen	[S5]	Possibly correct	A reasonable guess, but not 100% identifiable from photo
12	<i>Leptogium cyanescens</i>	Blue Jellyskin Lichen		Incorrect	Likely <i>Collema subflaccidum</i>
13	<i>Platismatia tuckermanii</i>	Crumpled Rag Lichen	S5	Correct	
14	<i>Punctelia rudecta</i>	Rough Speckleback Lichen	S5	Likely correct	<i>P. rudecta</i> is highly variable and very common so likely correct but photo isn't close up enough to clearly show identification features (e.g. isidia vs soredia)
15	<i>Cladonia squamosa</i>	Dragon Lichen	[S5]	Likely correct	
16	<i>Cladonia verticillata</i>	Ladder Lichen	S5	Correct	

Photo#	GEMTEC ID	Common Name	NS S-rank	AC CDC Determination	AC CDC Comments (Fiona Brooks & Iain Crowell)
17	<i>Parmelia squarrosa</i>	Bottlebrush Shield Lichen	S5	Possibly correct	Unable to distinguish identification features. Likely <i>Parmelia squarrosa</i> or <i>Parmelia sulcata</i>
18	<i>Cladonia stellaris</i>	Star-tipped Reindeer Lichen	S5	Correct	
19	<i>Loxospora ochrophaea</i>	a Lichen	S5	Correct	
20	<i>Cladonia coniocraea</i>	Common Pixie Powderhorn	[S5]	Possibly correct	A reasonable guess, but need better macro photos and chemical tests to confirm
21	<i>Phlyctis argena</i>	a Lichen		Incorrect	Need specimen to identify to species
22	<i>Cladonia cristatella</i>	British Soldiers Lichen	S5	Likely correct	Insufficient photo resolution to confirm ID
23	<i>Lobaria pulmonaria</i>	Lungwort Lichen	S5	Correct	
24	<i>Usnea subfloridana</i>	Nit Beard Lichen		Incorrect	Unable to ID to species. Perhaps <i>Usnea dasopoga</i> , based on the fishbone pattern branching
25	<i>Cladonia crispata</i>	Organpipe Lichen	S5	Likely correct	Need better macro photos and chemical tests to confirm