

Appendix J

Wetland Water Balance Risk Assessment



Project: Alloa
 Project No.: 2448-6683
 Date: June 4, 2024
 Created By: CM
 Checked By: EF

Evaluation of Hydrologic Change to Wetlands

Impervious Cover Score (S) Equation:

$$S = \frac{IC \cdot C_{dev}}{C}$$

where: IC = Percent Impervious Cover planned within the Proponent's Holdings (%)
 C_{dev} = Total Development Area within Wetland Catchment (ha)
 C = Total Catchment Area to Wetland (ha)

Wetland ID ¹	Wetland Area ¹ (ha)	Impervious Cover Score					Wetland Catchment		Water Taking / Discharge				Impact to Recharge Areas				
		Pre-Development Catchment Area to Wetland (C, ha)	Total Development Area of Wetland Catchment (C _{dev} , ha)	Area of the Wetland Catchment Owned by the Proponent (ha)	Accum. Area of the Wetland Catchment Owned by the Proponent (ha)	% Impervious Cover Planned within the Proponent's Holdings (IC, %)	Impervious Cover Score ² (S)		Post-Development Catchment Area to Wetland (C _{post} , ha)	Percent Increase or Decrease in Catchment Size (%)		Proposed Water Taking or Discharge (L/day)	Anticipated Duration of Water Taking or Discharge (# of months)	Notes/ Assumptions:	Hydrologic Risk Assessment Due to Water Taking or Discharge		
							Low Magnitude (<10%)	High Magnitude (>25%)		Low Magnitude (<10%)	Medium Magnitude (10-25%)				High Magnitude (>25%)	Low Magnitude (50,000-400,000L/d for <6mos)	Medium Magnitude (50,000-400,000L/d for >6mos OR >400,000L/d for <6mos)
1	0.83	227.22	57.80	8.33	8.33	0%	0%	170.41	25%	0	0	Not anticipated to be groundwater fed	LOW			0%	
2	0.76	103.73	24.69	9.93	9.93	48%	11%	77.80	25%	0	0	Not anticipated to be groundwater fed	LOW			0%	
3	0.54	189.56	35.50	29.96	29.96	29%	6%	142.17	25%	0	0	Not anticipated to be groundwater fed	LOW			0%	
4	0.91	9.88	3.02	9.88	9.88	22%	7%	7.41	25%	193,334	60	See groundwater taking table	MEDIUM			0%	
5	0.16	5.34	1.28	4.40	4.40	15%	4%	4.01	25%	134,325	60	See groundwater taking table	MEDIUM			0%	
6	0.15	28.70	11.38	4.70	4.70	18%	7%	21.53	25%	0	0	Not anticipated to be groundwater fed	LOW			0%	
7	0.27	86.30	67.07	74.98	74.98	51%	39%	64.72	25%	266,138	60	See groundwater taking table	MEDIUM			0%	

Areas estimated from Alloa Secondary Plan, and Tertiary Plan-Phase 1 by GSAI, June 2024.
 Notes: Catchment areas provided by Urbantech, June 2024

Post-Development Percent Impervious Calculations

Town of Caledon Standard Runoff Coefficients:

Landuse	C
Residential (Low-Density)	0.60
Residential (Medium-Density)	0.70
Residential (High-Density)	0.75
Commercial	0.90

Landuse	C
Institutional (Schools & Churches)	0.75
Parks / Open Space	0.25
Woodlot	0.25
SWM Pond	0.50

CN	0.78
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Runoff coefficients, C, as per Town of Caledon Development Standards Manual 2019 - STD DWG 103.

Proposed Site Conditions

TIMP = 100 * (RC - 0.25) / (0.90 - 0.25)

Weighted Runoff Coefficient C:

Wetland Catchment	Landuse	Area (ha)	C	XIMP	TIMP
1	Residential (Low-Density)	0.00	0.60	42%	54%
	Residential (Medium-Density)	0.00	0.70	54%	69%
	Residential (High-Density)	0.00	0.75	60%	77%
	Woodlot	8.33	0.25	0%	0%
	Institutional (School)	0.00	0.75	60%	77%
	Commercial/Industrial	0.00	0.90	78%	100%
	Parks and Open Space	0.00	0.25	0%	0%
	SWM Pond	0.00	0.50	30%	38%
	Roads	0.00	0.95	78%	100%
	Total/ Weighted C:	8.33	0.00	0%	0%
2	Residential (Low-Density)	0.00	0.60	47%	54%
	Residential (Medium-Density)	6.90	0.70	55%	69%
	Residential (High-Density)	0.00	0.75	59%	77%
	Woodlot	3.03	0.25	20%	0%
	Institutional (School)	0.00	0.75	59%	77%
	Commercial	0.00	0.90	70%	100%
	Parks and Open Space	0.00	0.25	20%	0%
	SWM Pond	0.00	0.50	39%	38%
	Roads	0.00	0.95	74%	100%
	Total/ Weighted C:	9.93	0.00	44%	48%

3	Residential (Low-Density)	0.00	0.60	47%	54%
	Residential (Medium-Density)	12.75	0.70	55%	69%
	Residential (High-Density)	0.00	0.75	59%	77%
	Woodlot	17.20	0.25	20%	0%
	Institutional (School)	0.00	0.75	59%	77%
	Commercial	0.00	0.90	70%	100%
	Parks and Open Space	0.00	0.25	20%	0%
	SWM Pond	0.00	0.50	39%	38%
	Roads	0.00	0.95	74%	100%
	Total/ Weighted C:	29.96	0.00	0%	29%
4	Residential (Low-Density)	0.54	0.60	47%	54%
	Residential (Medium-Density)	1.84	0.70	55%	69%
	Residential (High-Density)	0.00	0.75	59%	77%
	Woodlot	6.8579	0.25	20%	0%
	Institutional (School)	0.00	0.75	59%	77%
	Commercial	0.00	0.90	70%	100%
	Parks and Open Space	0.00	0.25	20%	0%
	SWM Pond	0.00	0.50	39%	38%
	Roads	0.64	0.95	74%	100%
	Total/ Weighted C:	9.89	0.40	31%	22%
5	Residential (Low-Density)	0.00	0.60	47%	54%
	Residential (Medium-Density)	0.80	0.70	55%	69%
	Residential (High-Density)	0.00	0.75	59%	77%
	Woodlot	3.53	0.25	20%	0%
	Institutional (School)	0.00	0.75	59%	77%
	Commercial	0.00	0.90	70%	100%
	Parks and Open Space	0.00	0.25	20%	0%
	SWM Pond	0.00	0.50	39%	38%
	Roads	0.11	0.95	74%	100%
	Total/ Weighted C:	4.44	0.35	27%	15%
6	Residential (Low-Density)	0.45	0.60	47%	54%
	Residential (Medium-Density)	0.45	0.70	55%	69%
	Residential (High-Density)	0.00	0.75	59%	77%
	Woodlot	3.53	0.25	20%	0%
	Institutional (School)	0.00	0.75	59%	77%
	Commercial	0.00	0.90	70%	100%
	Parks and Open Space	0.00	0.25	20%	0%
	SWM Pond	0.00	0.50	39%	38%
	Roads	0.30	0.95	74%	100%
	Total/ Weighted C:	4.73	0.37	29%	18%
6	Residential (Low-Density)	31.90	0.60	47%	54%
	Residential (Medium-Density)	31.90	0.70	55%	69%
	Residential (High-Density)	0.00	0.75	59%	77%
	Woodlot	13.00	0.25	20%	0%
	Institutional (School)	2.13	0.75	59%	77%
	Commercial	0.00	0.90	70%	100%
	Parks and Open Space	0.00	0.25	20%	0%
	SWM Pond	7.00	0.50	39%	38%
	Roads	0.10	0.95	74%	100%
	Total/ Weighted C:	86.03	0.01	45%	51%



Project:
Project No.:
Date:
Created By:
Checked By:

Alloa
2448-6683
June 4, 2024
Azimuth
CM

Evaluation of Wetland Sensitivity

Wetland ID ¹	Notes/ Assumptions	Vegetation ²			Fauna ³						Flora ³				
		Vegetation Community Type	ELC Code	Sensitivity	Herpetofauna Species	Sensitivity	Bird Species	Sensitivity	Mammal Species	Sensitivity	Fish Species	Sensitivity	Flora Species (Scientific Name)	Flora Species (Common Name)	Sensitivity
1	To be evaluated in future submissions - assume High Sensitivity			HIGH											
2	To be evaluated in future submissions - assume High Sensitivity			HIGH											
3	To be evaluated in future submissions - assume High Sensitivity			HIGH											
4		Swamp Maple Mineral Deciduous Swamp	SWD3-3	Medium	gray treefrog	High	common yellowthroat	Low							
5		Swamp Maple Organic Deciduous Swamp	SWD6-3	Medium	gray treefrog	High	common yellowthroat	Low							
6	Amphibian Breeding Habitat	Broad-leaved Cattail Mineral Shallow Marsh	MAS2-1A	Medium	gray treefrog	High	common yellowthroat	Low			brook stickleback	Low			
					American toad	Medium	alder flycatcher	Low			fathead minnow	Low			
					green frog	Medium									
					northern spring peeper	High									
					wood frog	High									
					midland painted turtle	High									
7		Swamp Maple Mineral Deciduous Swamp	SWD3-3	Medium	gray treefrog	High	common yellowthroat	Low			brook stickleback	Low			
					green frog	Medium					fathead minnow	Low			

Notes: Flora is pending CEA evaluation in Fall 2024



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WATER TAKING CALCULATIONS

Table 1: Evaluation of Groundwater Fed Wetlands							
Wetland ID ¹	Wetland Area ¹ (ha)	Avg. Ground Elevation ² (masl)	Estimated Seasonal High Groundwater Elevation ³ (masl)	Nearest Monitoring Well ³	Groundwater Flora Indicators ⁴	Groundwater Fed (Y/N)	Reasoning
1	227.22	262-261	260.82-261.59	MW24-1, MW24-2	-		
2	103.73	265	265.65-264.99	MW24-7	-		
3	189.56	257	262.03	MW24-11	-		
4	9.88	261	261.7	MW23-411	-	Y	groundwater evaluation > ground elevation
5	5.34	261	261.07	MW23-411	-	Y	groundwater evaluation > ground elevation
6	28.70	265	264.59	MW23-409	-		
7	86.30	260	260.14	MW101 D/S, MW104 D/S	-	Y	groundwater evaluation > ground elevation

Table 2: Summary Table			
ESTIMATED DEWATERING VOLUMES			
Wetland ID	Total Estimated Short Term Dewatering Volumes (L/day)		Estimated Duration of Open Excavation or Dewatering Activity
		with SF of 2	
1			
2			
3			
4	96,667	193,334	60
5	67162	134325	60
6			
7	133,069	266,138	60

CALCULATION TABLES

TABLE 4a - Wetland 4 Catchment				
ESTIMATE CONSTRUCTION DEWATERING VOLUME CALCULATIONS				
Based on Dupuit Equation for Radial Flow to a Well or Point Source Excavation in an Unconfined Aquifer				
Component	Variable	Units	Value	Note
Hydraulic Conductivity of Soil	K	m/s	2.50E-06	
Base of Aquifer		masl	258.40	
Groundwater Elevation		masl	261.70	
Elevation Requiring Dewatering		masl	257.00	
Extent of Excavation		masl	259.00	
Equivalent Radius of the Well	r _w	m	344.79	
Excavation Area		m ²	373288	
Calculations				
Hydraulic Head of Water Table	H	m	3.30	
Hydraulic Head at Max. Dewatering	h	m	-1.40	
Radius of Influence	R ₀	m	367.09	
Pumping Rate	Q	m ³ /s	1.12E-03	
Dewatering Volume per Day	Q	L/day	96667.24	
TOTAL ESTIMATED CONSTRUCTION DEWATERING VOLUME			Q =	96667 L/day
TOTAL ESTIMATED CONSTRUCTION DEWATERING VOLUME W/ SAFETY FACTOR OF 2.0			Q =	193334 L/day

TABLE 4b - Wetland 5 Catchment

ESTIMATE CONSTRUCTION DEWATERING VOLUME CALCULATIONS

Based on Dupuit Equation for Radial Flow to a Well or Point Source Excavation in an Unconfined Aquifer

Component	Variable	Units	Value	Note
Soil	K	m/s	2.50E-06	
Base of Aquifer		masl	258.40	
Groundwater Elevation		masl	261.70	
Dewatering		masl	257.00	
Extent of Excavation		masl	259.00	
Well	r _w	m	236.24	
Excavation Area		m ²	175239	

Calculations

Hydraulic Head of Water	H	m	3.30	
Hydraulic Head at Max.	h	m	-1.40	
Radius of Influence	R ₀	m	258.53	
Pumping Rate	Q	m ³ /s	7.77E-04	
Dewatering Volume per	Q	L/day	67162.31	

TOTAL ESTIMATED CONSTRUCTION DEWATERING VOLUME Q = 67162 L/day
TOTAL ESTIMATED CONSTRUCTION DEWATERING VOLUME W/ SAFETY FACTOR OF 2.0 Q = 134325 L/day

TABLE 4c - Wetland 7 Catchment

ESTIMATE CONSTRUCTION DEWATERING VOLUME CALCULATIONS

Based on Dupuit Equation for Radial Flow to a Well or Point Source Excavation in an Unconfined Aquifer

Component	Variable	Units	Value	Note
Soil	K	m/s	2.50E-06	
Base of Aquifer		masl	256.90	
Groundwater Elevation		masl	260.14	
Elevation Requiring Dewatering		masl	256.00	
Extent of Excavation		masl	258.00	
Well	r _w	m	387.97	
Excavation Area		m ²	472647	

Calculations

Hydraulic Head of Water	H	m	3.24	
Hydraulic Head at Max.	h	m	-0.90	
Radius of Influence	R ₀	m	407.61	
Pumping Rate	Q	m ³ /s	1.54E-03	
Dewatering Volume per	Q	L/day	133069.19	

TOTAL ESTIMATED CONSTRUCTION DEWATERING VOLUME Q = 133069 L/day
TOTAL ESTIMATED CONSTRUCTION DEWATERING VOLUME W/ SAFETY FACTOR OF 2.0 Q = 266138 L/day



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Summary of Wetland Risk Evaluation

Wetland ID ¹	Wetland Area ¹ (ha)	Hydrological Changes				Sensitivity of the Wetland		
		Impervious Cover Score (S)	Percent Increase or Decrease in Catchment Size (%)	Hydrologic Risk Assessment Due to Water Taking or Discharge	Percent Impact to Recharge Areas (%)	Sensitivity of Vegetation Type (ELC)	Maximum Sensitivity of Present Fauna Species	Maximum Sensitivity of Present Flora Species
		Low Magnitude (<10%)	Low Magnitude (<10%)	Low Magnitude (50,000-400,000L/d for <6mos)	Low Magnitude (<10%)	Low Sensitivity	Low Sensitivity	Low Sensitivity
		Medium Magnitude (10-25%)	Medium Magnitude (10-25%)	Medium Magnitude (50,000-400,000L/d for >6mos OR >400,000L/d for <6mos)	Medium Magnitude (10-25%)	Medium Sensitivity	Medium Sensitivity	Medium Sensitivity
		High Magnitude (>25%)	High Magnitude (>25%)	High Magnitude (>400,000L/d for >6mos)	High Magnitude (>25%)	High Sensitivity	High Sensitivity	High Sensitivity
1	0.83	0%	25%	LOW	0%	HIGH	No Survey	No Survey
2	0.76	11%	25%	LOW	0%	HIGH	No Survey	No Survey
3	0.54	6%	25%	LOW	0%	HIGH	No Survey	No Survey
4	0.91	7%	25%	MEDIUM	0%	Medium	HIGH	No Survey
5	0.16	4%	25%	MEDIUM	0%	Medium	HIGH	No Survey
6	0.15	7%	25%	LOW	0%	Medium	HIGH	No Survey
7	0.27	39%	25%	MEDIUM	0%	Medium	HIGH	No Survey