

**Valentine Gold Project: Federal
Information Requirements**

Round Four Information Requirements:
Response to IR(4)-11



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IR 4 Reference #:	IR(4)-11
IR 3 Reference #:	IR(2)-11 IR(2)-12 IR(2)-14 IR(2)-15
EIS Reference:	Appendix 6A, Sections 4.3.3, 4.3.4, 4.4,5.2.1.3, 5.3.1.2, 5.2.2, and 5.3.2, Tables 4-2, 4-3, 5-1, 5-2, 5-3, 5-4, 5-6, and 5-7, Figures 4.1, 4.2, 4.3, 4.4 5.2 and 5.4
Context and Rationale:	<p>Context and Rationale:</p> <p>To reduce inconsistencies within the numerical groundwater model, as described in IR(3)- 11, the Proponent has presented an acceptable update to the calibration of the model.</p> <p>The model results presented in response to IR(3)-11 resolve many of the issues with the modelling results raised in IR(2)-11, -12, -14, -15.</p> <p>However, the Proponent has not provided information regarding the effect of the updated modelling on the seepage discharge points and seepage discharge rates from the tailings management facilities (TMF), waste rock, and low grade ore stockpiles. The effect of the updated calibration on these results is required to understand changes to groundwater fluxes (as per Section 7.2.2 of the EIS Guidelines), and subsequently impacts to surface water, and fish and fish habitat.</p> <p>Additional Detail:</p> <p>As noted in IR(2)-11, and shown in the response Table IR(2)-11.1 (e.g. for watercourse NT3), the reporting of net flux values for MODFLOW RIVER boundaries can mask numerical instability in the results. To support the assessment of groundwater-surface water interactions, as they relate to fish and fish habitat, model results for RIVER boundaries should be presented as flux into the model and flux out of the model, along with net flux.</p> <p>Based on the updated model results, which show a reduction in simulated baseline groundwater discharge to surface water, the proponent has determined that the assessment of effects to groundwater quantity are unchanged from the original EIS. Following that conclusion, the updated results were not carried forward through the assessment of surface water and fish and fish habitat. The description of the model updates and presentation of the updated model results are not sufficient to confirm this approach.</p> <p>Although the model updates resulted in reductions to baseline groundwater seepage to surface relative to the EIS, no apparent updates were made to the numerical representation of the waste rock storage and TMF. Should</p>



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	<p>that be the case, seepage quantity from these facilities is expected to be the same as those presented in the EIS, and would then comprise a larger portion of the total groundwater discharge to surface water, with potential implications for surface water and fish and fish habitat.</p> <p>To support the conclusions of the assessment, groundwater balances should be provided for the waste rock storage and TMF (i.e., a description of the recharge to the facilities, the simulated seepage quantity, and the seepage discharge locations (including the ditch network)). Maps showing particle tracking results should accompany the flow balances.</p> <p>Results should be presented for both operations and post-closure conditions.</p>
Information Requirement:	<p>For waterbodies represented using the MODFLOW RIVER boundary in the updated model, provide a complete groundwater flow balance as provided in response to IR(2)-11, Table IR(2)-11.1.</p> <p>For the end of operations and post- closure conditions provide groundwater balances for the waste rock and tailings management facilities that include:</p> <ol style="list-style-type: none"> a. Recharge into the facility b. Seepage quantity from the facility c. Seepage discharge locations (including the ditch network), and the proportion of the total seepage discharging at each location <p>Provide particle tracking results in plan view for the end of operations and post- closure conditions.</p> <p>To further clarify the items listed above, the Proponent should provide updated versions of the following from Appendix 6A of the EIS:</p> <ul style="list-style-type: none"> • Figures 5-3 and 5-5 (with TMF particle tracks, as provided for previous IR responses) • Tables 5-4 and 5-7 (with TMF seepage proportions)
Response:	<p>The EIS groundwater model was revised in response to NRCan’s technical review of the EIS for the Valentine Gold Project. Model revisions are described in Appendix IR(3)-11.1 - Technical Memo on Updated Groundwater Modelling submitted on January 7, 2022. This revised groundwater model has been used to evaluate changes in predicted groundwater flow due to proposed Project refinements, as described in two letters provided to the Impact Assessment Agency of Canada (IAAC) dated September 8, 2021 and January 10, 2022. Specifically, these Project refinements include relocation / reconfiguration of the Marathon Low-Grade Ore (LGO) Stockpile and Waste Rock Pile, and a revised footprint for the tailings management facility (TMF) and ditches associated with these facilities. As further discussed below, the results of this current remodel do</p>



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	<p>not change the conclusions presented in the EIS regarding potential Project effects on Groundwater Resources, Surface Water Resources, and Fish and Fish Habitat Valued Components (VCs). The results from the revised groundwater model, in consideration of the Project refinements referenced above, continue to show reduced effects on groundwater baseflows to surface water features as compared to those presented in the EIS. As a result, the effects assessed in the EIS are more conservative than the effects predicted using the revised modelling and refined project footprint, and the conclusions presented in the EIS for the Groundwater Resources, Surface Water Resources, and Fish and Fish Habitat VCs have not changed.</p> <p>Tables IR(4)-11.1, IR(4)-11.2, and IR(4)-11.3 present groundwater balances for the boundary condition representing individual waterbodies for Baseline, End of Operations, and Post-Closure conditions, respectively. Total inflow, total outflow, and net flow for each boundary condition type are presented for each waterbody. The locations of these waterbodies are shown on the revised Figures 5-3 and 5-5 from Appendix 6A the EIS (presented below as Figures IR(4)-11.1 and IR(4)-11.2).</p> <p>Tables IR(4)-11.4 and IR(4)-11.5 present groundwater balances for waste rock piles and the TMF for the end of operations and post-closure conditions, respectively.</p> <p>The proportions of total seepage from waste rock piles, the LGO stockpiles, and the TMF that discharge to individual waterbodies, are presented in the updated Tables 5-4 and 5-7 from Appendix 6A the EIS. These are presented below as Tables IR(4)-11.6 and IR(4)-11.7.</p> <p>Figures 5-3 and 5-5 from Appendix 6A the EIS (presented below as Figures IR(4)-11.1 and IR(4)-11.2) have also been updated showing particle traces from the waste rock piles, the LGO stockpiles, and the TMF. Although not evident in the figure resolution, ditches are included and considered through the model.</p> <p>The revised groundwater model results presented previously in Appendix IR(3)-11.1 - Technical Memo on Updated Groundwater Modelling (submitted to NRCAN on January 7, 2022) and in this current response show an overall decrease in estimated baseflows to surface water receptors compared to the model results presented in the EIS. As also noted in Appendix IR(3)-11.1, the changes in baseflows during Project operation and closure are only slightly changed. Therefore, the predicted effects on changes in groundwater flows due to the Project did not change as a result of the revised groundwater model and neither did the determination in the EIS that the Project would not result in significant</p>



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	<p>adverse effects to Groundwater Resources or ultimately to the Surface Water Resources or Fish and Fish Habitat VCs.</p> <p>The present model results using the revised groundwater model from Appendix IR(3)-11.1 with the refined Project footprint are not substantively different from those presented in Appendix IR(3)-11.1, and therefore, the refined Project footprint also does not change the conclusions presented in the EIS with respect to residual Project effects on Groundwater Resources, Surface Water Resources or Fish and Fish Habitat. This is consistent with the assessment and conclusions presented in the Project refinements letter submitted to IAAC on January 10, 2022 (refer to Section 2.2 of Attachment A).</p>
Appendix:	None



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Table IR(4)-11.1 Pre-mining Baseline Groundwater Balance for Individual Waterbodies/ Receptors

Waterbody/Receptor	Drain Outflow (m³/d)	River Inflow (m³/d)	River Outflow (m³/d)	Net River Inflow - Outflow (m³/d)	GHB in (m³/d)	GHB out (m³/d)	Net GHB Inflow - Outflow (m³/d)
Middle and East Pond and Tributaries EP1	0	1,265	1,417	-153	951	1,693	-742
West Pond and Tributaries WP1	0	2,059	3,083	-1,023	0	405	-405
Unnamed Tributary to Victoria Lake Reservoir NT1	-366	284	241	43	-	-	-
Unnamed Tributary to Victoria Lake Reservoir NT2	-685	-	-	-	-	-	-
Frozen Ear Lake and Tributaries NT3	0	1,899	3,073	-1,174	-	-	-
Unnamed Tributary to Valentine Lake NT4	0	189	141	49	0	49	-49
Unnamed Tributary to Valentine Lake NT5	-74	261	201	59	53	88	-35
Unnamed Tributary to Victoria Lake Reservoir ST1	-138	451	409	43	29	174	-146
Unnamed Tributary to Victoria Lake Reservoir ST2	0	769	1,495	-726	347	920	-573
Unnamed Tributary to Victoria River ST3	0	337	601	-264	45	0	45
Unnamed Tributary to Victoria River ST4	0	4,387	5,638	-1,251	-	-	-
Unnamed Tributary to Victoria River VR1	0	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR2	0	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR3	-214	-	-	-	50	0	50
Unnamed Tributary to Victoria River VR4	-635	-	-	-	62	0	62
Victoria River	-	1,084	3,567	-2,482	62,174	79,127	-16,953
Wetlands	-1,762			0			0
Note: GHB = General Head Boundary.							



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Table IR(4)-11.2 End of Operations Baseline Groundwater Balance for Individual Waterbodies/Receptors

Waterbody/Receptor	Drain Outflow (m³/d)	River Inflow (m³/d)	River Outflow (m³/d)	Net River Inflow - Outflow (m³/d)	GHB in (m³/d)	GHB out (m³/d)	Net GHB Inflow - Outflow (m³/d)
Middle and East Pond and Tributaries EP1	0	1,305	1,295	10	780	1,154	-374
West Pond and Tributaries WP1	-1,037	-	-	-	-	-	-
Unnamed Tributary to Victoria Lake Reservoir NT1	-359	284	241	43	-	-	-
Unnamed Tributary to Victoria Lake Reservoir NT2	-589	-	-	-	-	-	-
Frozen Ear Lake and Tributaries NT3	0	1,809	3,232	-1,423	-	-	-
Unnamed Tributary to Valentine Lake NT4	0	181	172	9	0	56	-56
Unnamed Tributary to Valentine Lake NT5	-7	230	241	-11	39	104	-65
Unnamed Tributary to Victoria Lake Reservoir ST1	-1	397	480	-83	27	189	-162
Unnamed Tributary to Victoria Lake Reservoir ST2	0	739	1,551	-811	346	926	-580
Unnamed Tributary to Victoria River ST3	0	190	385	-195	-	-	-
Unnamed Tributary to Victoria River ST4	-1,571	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR1	0	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR2	0	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR3	-223	-	-	-	106	0	106
Unnamed Tributary to Victoria River VR4	-619	-	-	-	2	0	2
Victoria River	0	1,070	3,637	-2,567	59,124	83,071	-23,948
Wetlands	-18,760	-	-	-	-	-	-
Marathon Pit	-1,870	-	-	-	-	-	-
Leprechaun Pit	-1,466	-	-	-	-	-	-
LP-SP-03B	-100	-	-	-	-	-	-
LP-SP-02B	-86	-	-	-	-	-	-
LP-SP-02A	-1,154	-	-	-	-	-	-
LP-SP-03A	-428	-	-	-	-	-	-



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Table IR(4)-11.2 End of Operations Baseline Groundwater Balance for Individual Waterbodies/Receptors

Waterbody/Receptor	Drain Outflow (m³/d)	River Inflow (m³/d)	River Outflow (m³/d)	Net River Inflow - Outflow (m³/d)	GHB in (m³/d)	GHB out (m³/d)	Net GHB Inflow - Outflow (m³/d)
LP-SP-01B	-90	-	-	-	-	-	-
LP-SP-01A	-172	-	-	-	-	-	-
TMF_POND	0	-	-	-	177	0	177
Marathon LGO Ditch	-669	-	-	-	-	-	-
Marathon WRSA East Ditch	0	-	-	-	-	-	-
Marathon WRSA West Ditch	-2,222	-	-	-	-	-	-
TMF Ditch	-903	-	-	-	-	-	-
Other Ponds	-6,994	-	-	-	-	-	-
Other Discharge	-2,075	-	-	-	-	-	-
Valentine and Victoria Lakes GHB; other DRAINS	-5,733	-	-	-7,653	-	-	-21,407

Note: GHB = General Head Boundary; TMF=Tailings Management Facility; LGO=Low Grade Ore; WRSA = Waste Rock Pile

Table IR(4)-11.3 Post-closure Groundwater Balance for Individual Waterbodies/Receptors

Waterbody/Receptor	Drain Outflow (m³/d)	River Inflow (m³/d)	River Outflow (m³/d)	Net River Inflow - Outflow (m³/d)	GHB in (m³/d)	GHB out (m³/d)	Net GHB Inflow - Outflow (m³/d)
Middle and East Pond and Tributaries EP1	0	1,288	1,318	-30	780	1,154	-374
West Pond and Tributaries WP1	-1,421	-	-	-	-	-	-
Unnamed Tributary to Victoria Lake Reservoir NT1	-362	284	241	43	-	-	-
Unnamed Tributary to Victoria Lake Reservoir NT2	-633	-	-	-	-	-	-
Frozen Ear Lake and Tributaries NT3	0	1,809	3,233	-1,424	-	-	-
Unnamed Tributary to Valentine Lake NT4	0	181	172	9	0	56	-56
Unnamed Tributary to Valentine Lake NT5	-7	230	241	-11	43	106	-64
Unnamed Tributary to Victoria Lake Reservoir ST1	-1	395	481	-86	27	189	-162



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Table IR(4)-11.3 Post-closure Groundwater Balance for Individual Waterbodies/Receptors

Waterbody/Receptor	Drain Outflow (m³/d)	River Inflow (m³/d)	River Outflow (m³/d)	Net River Inflow - Outflow (m³/d)	GHB in (m³/d)	GHB out (m³/d)	Net GHB Inflow - Outflow (m³/d)
Unnamed Tributary to Victoria Lake Reservoir ST2	0	739	1,551	-811	346	926	-580
Unnamed Tributary to Victoria River ST3	0	190	400	-210	-	-	-
Unnamed Tributary to Victoria River ST4	-1,660	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR1	0	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR2	0	-	-	-	-	-	-
Unnamed Tributary to Victoria River VR3	-223	-	-	-	49	0	49
Unnamed Tributary to Victoria River VR4	-657	-	-	-	60	0	60
Victoria River	0	1,070	3,123	-2,053	59,072	83,438	-24,366
Misc. Wetlands	-18,821	-	-	-	-	-	-
Marathon Pit	-1,065	-	-	-	-	-	-
Leprechaun Pit	-634	-	-	-	-	-	-
LP-SP-03B	-198	-	-	-	-	-	-
LP-SP-02B	-49	-	-	-	-	-	-
LP-SP-02A	-1,219	-	-	-	-	-	-
LP-SP-03A	-499	-	-	-	-	-	-
LP-SP-01B	-91	-	-	-	-	-	-
LP-SP-01A	-172	-	-	-	-	-	-
TMF_POND	0	-	-	-	172	-	-
Marathon LGO Ditch	-678	-	-	-	-	-	-
Marathon WRSA East Ditch	-4	-	-	-	-	-	-
Marathon WRSA West Ditch	-2,344	-	-	-	-	-	-
TMF Ditch	-940	-	-	-	-	-	-
Other Ponds	-7,080	-	-	-	-	-	-
Other Discharge	-2,145	-	-	-	-	-	-
Valentine and Victoria Lakes; miscellaneous other discharge	-5,751	-	-	-7,654	-	-	-21,587q
Note: GHB = General Head Boundary; TMF=Tailings Management Facility; LGO=Low Grade Ore; WRSA = Waste Rock Pile							



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Table IR(4)-11.4 End of Operations Waste Rock Piles and Tailings Management Facility Groundwater Balance

Facility	Recharge In (m ³ /d)	Seepage In (m ³ /d)	Seepage Out (m ³ /d)	Tailings Pond Seepage In (m ³ /d)
Leprechaun WRSA	3,863	3,252	7,116	-
Marathon WRSA-east	977	0	977	-
Marathon WRSA-west	3,139	1,702	4,841	-
TMF	1,872	42	2,085	177

Note: TMF=Tailings Management Facility; WRSA = Waste Rock Pile

Table IR(4)-11.5 Post-closure Waste Rock Piles and Tailings Management Facility Groundwater Balance

Facility	Recharge In (m ³ /d)	Seepage In (m ³ /d)	Seepage Out (m ³ /d)	Tailings Pond Seepage In (m ³ /d)
Leprechaun WRSA	3,863	3,663	7,526	-
Marathon WRSA-east	977	0	977	-
Marathon WRSA-west	3,139	1,705	4,844	-
TMF	1,872	42	2,081	173

Note: TMF=Tailings Management Facility; WRSA = Waste Rock Pile



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Table IR(4)-11.6 Estimated Groundwater Seepage Rates (as percentage of Total Infiltration from TMF, Waste Rock Piles and LGO Stockpiles) - Operation Phase (Update of Table 5-4 in Appendix 6A of the EIS)

Leprechaun Complex				TMF
Receptor	WRSA		LGO Stockpile	
Leprechaun Pit	10%		-	-
TMF Ditch	-		-	-
LP-SP-01A	-		47%	-
LP-SP-01B	-		-	-
LP-SP-02A	24%		-	-
LP-SP-02B	1%		-	-
LP-SP-03A	9%		-	-
LP-SP-03B	-		-	-
LP-SP-04	-		-	-
Unnamed Tributary to Victoria Lake Reservoir ST1	-		20%	-
Unnamed Tributary to Victoria Lake Reservoir ST2	-		6%	-
Unnamed Tributary to Victoria Lake Reservoir ST3	-		-	8%
West Pond and Tributaries WP1	14%		-	-
Victoria Lake Reservoir	42%		26%	12%
Marathon Complex				TMF
Receptor	WRSA-west	WRSA-east	LGO Stockpile	
Marathon Pit	14%	57%	-	-
Marathon LGO Ditch	-	-	13%	-
Marathon WRSA East Ditch	-	-	-	-
Marathon WRSA West Ditch	17%	-	-	-
TMF Ditch	-	-	-	-
Frozen Ear Lake and Tributaries NT3	-	-	22%	-
Unnamed Tributary to Valentine Lake NT5	-	-	-	-
Unnamed Tributary to Victoria River ST4	18%	-	-	-
Unnamed Tributary to Victoria River VR3	-	-	-	4%
Unnamed Tributary to Victoria River VR4	-	-	18%	11%
Valentine Lake/Wetlands	50%	-	-	-
Victoria River	-	41%	46%	64%
Note: LGO=Low Grade Ore; WRSA = Waste Rock Pile; TMF=Tailings Management Facility				



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Table IR(4)-11.7 Estimated Groundwater Seepage Rates (as percentage of Total Infiltration from TMF and Waste Rock Piles) - Post-Closure (Update of Table 5-7 in Appendix 6A of the EIS)

Leprechaun Complex			TMF
Receptor	WRSA		
Leprechaun Pit	10%		-
TMF Ditch	-		-
LP-SP-01A	-		-
LP-SP-01B	-		-
LP-SP-02A	4%		-
LP-SP-02B	1%		-
LP-SP-03A	-		-
LP-SP-03B	-		-
LP-SP-04	-		-
Unnamed Tributary to Victoria Lake Reservoir ST1	-		-
Unnamed Tributary to Victoria Lake Reservoir ST2	-		-
Unnamed Tributary to Victoria Lake Reservoir ST3	-		4%
West Pond and Tributaries WP1	26%		-
Victoria Lake Reservoir	66%		-
Marathon Complex			TMF
Receptor	WRSA-west	WRSA-east	
Marathon Pit	13%	4%	-
Marathon LGO Ditch	-	-	-
Marathon WRSA East Ditch	-	-	-
Marathon WRSA West Ditch	-	-	-
TMF Ditch	-	-	11%
Frozen Ear Lake and Tributaries NT3	-	-	-
Unnamed Tributary to Valentine Lake NT5	1%	-	-
Unnamed Tributary to Victoria Lake Reservoir ST2	9%	-	-
Unnamed Tributary to Victoria River ST4	32%	1%	-
Unnamed Tributary to Victoria River VR3	-	-	4%
Unnamed Tributary to Victoria River VR4	-	-	12%
Valentine Lake/Wetlands	25%	-	8%
Victoria River	20%	95%	61%
Note: LGO=Low Grade Ore; WRSA = Waste Rock Pile; TMF=Tailings Management Facility			



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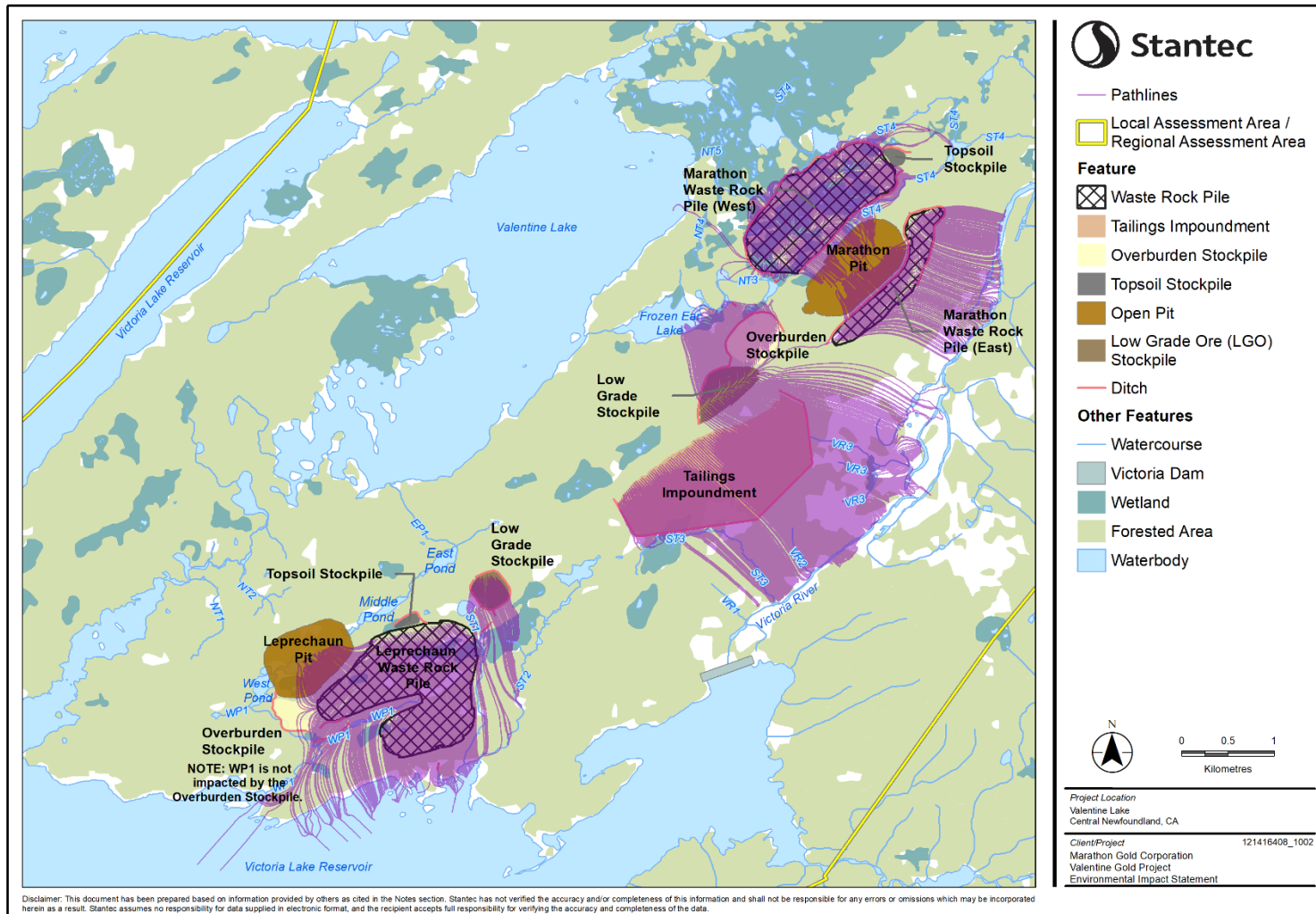


Figure IR(4)-11.1 Particle Traces Illustrating Flow Paths from Waste Rock Piles, LGO Stockpiles and TMF at End of Project Operation (Update of Figures 5-3 from Appendix 6A of the EIS)



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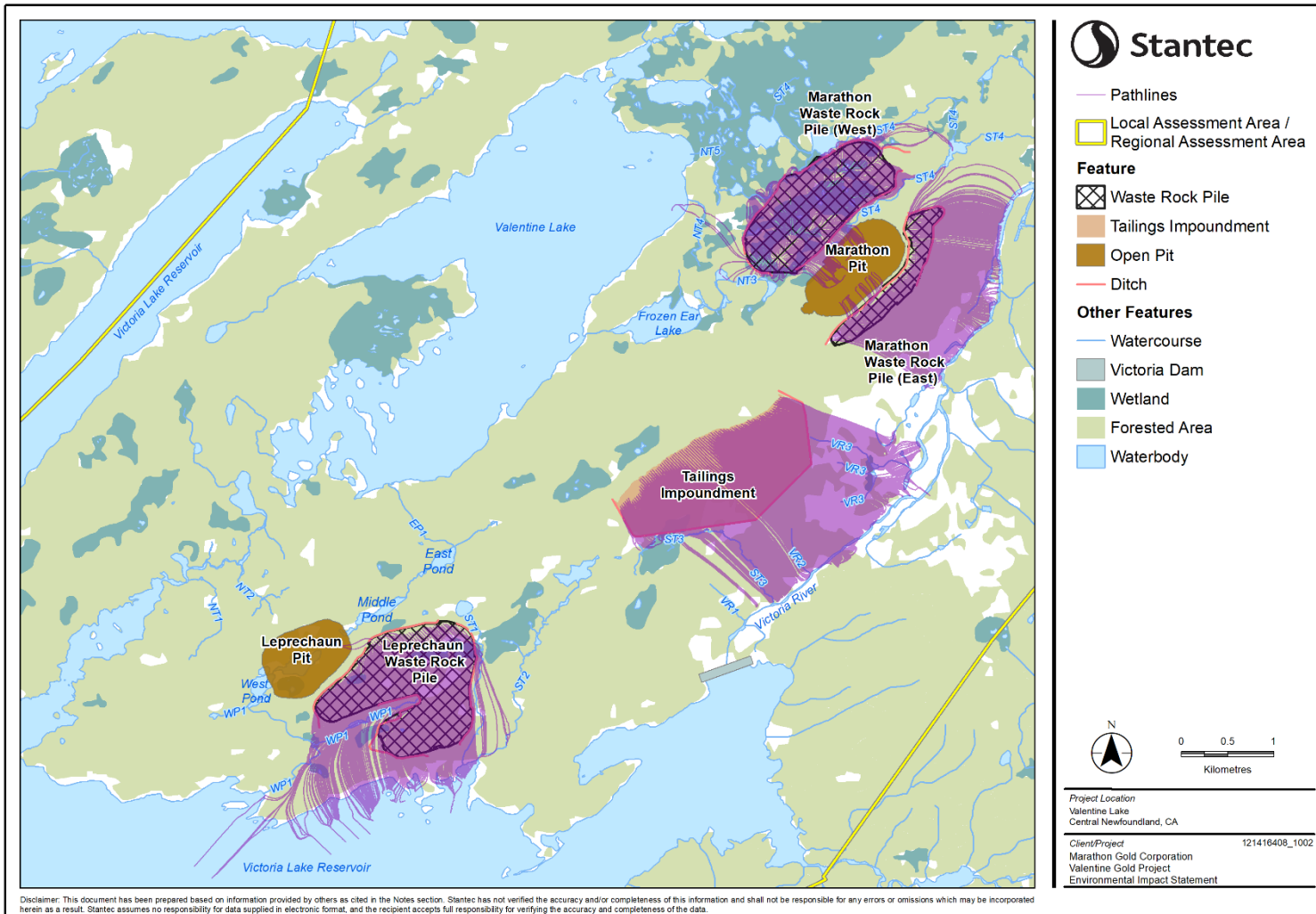


Figure IR(4)-11.2 Particle Traces Illustrating Flow Paths from Waste Rock Piles and TMF Post-Closure (Update of Figure 5-5 from Appendix 6A of the EIS)

