

**AGENDA
SUMMER VILLAGE OF GHOST LAKE
MEETING OF COUNCIL**

November 25th, 2023, 1 p.m.
Super 8, Cochrane

ITEM	DESCRIPTION
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1.0	CALL TO ORDER
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1.1	Land Acknowledgement
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"We are very grateful to be located within the Treaty 7 territory, traditional lands and home of the Bearspaw, Chiniki and Good Stoney Nation, the Kainai, Piikani, Siksika Nations, the Tsuut'ina Nation, and Region 3 Métis People. We are honoured to live, work and play in their territory and commit to the work of reconciliation. "

2.0	APPROVAL OF AGENDA
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2.1	Approval of Agenda for the November 25 th , 2023 Regular Meeting
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3.0	APPROVAL OF MINUTES
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3.1	Approval of Minutes for the September 6 th , 2023 Regular Meeting
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4.0	OLD BUSINESS
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4.1	Community Playground update
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4.2	Community Hall Construction update
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4.3	Lake shore riprap
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4.4	Carraig Ridge update
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4.5	Water tank
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4.6	Village Signage
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4.7	Village Mailbox
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4.8 Website Upgrade 2024

5.0 FINANCIAL

5.1 Cheque Register (Sept 1 – Oct 31, 2023)

5.2 November 2023 Financial Update

5.3 2024 Operating & Capital Budget

6.0 NEW BUSINESS

6.1 Procedural Bylaw

6.2 Land Use Bylaw Steering Committee

6.3 Climate Resilience Capacity Project Completion

6.4 Dock Spring Cleanup

7.0 CORRESPONDENCE

8.0 COMMITTEES

8.1 Emergency Services Community

8.2 FireSmart Program

8.3 Public Works

8.4 Dock Committee

8.5 Community Association

8.6 Natural Environment and Lake Stewardship

9.0 ADJOURNMENT



Report Date: Nov 20, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 4.1
Meeting Date: Nov 25, 2023

TO: Council

FROM: Administration

Subject: Community Playground Update

RECOMMENDATION: THAT Council accept this report as an update from administration regarding the Community Playground project.

REPORT SUMMARY

Administration is working with KJ Street Consulting to pursue grants applicable for the village's playground redevelopment project.

Some of the grants that administration has previously applied to include the Government of Alberta Community Facility Enhancement Program (CFEP), Alberta Blue Cross Built Together, and the New Horizons for Seniors Program.

The goal for this playground is to focus on accessibility, inclusivity and engagement within the community.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.



Report Date: Nov 20th, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 4.1
Meeting Date: Nov 25th, 2023

TO: Council

FROM: Administration

Subject: Community Hall Construction Update

RECOMMENDATION: THAT Council accept this report as information regarding the status of the Community Hall Renovation project

REPORT SUMMARY

The Community Hall Renovation commenced in mid August 2023. The project is expected to be completed by mid December 2023. Administration aims to work with the contractors to ensure the success of the project, and also plans to host an open house to celebrate the hall's grand opening early next year.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.



Report Date: Nov 21st, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 4.5
Meeting Date: Nov 25th, 2023

TO: Council

FROM: Administration

Subject: Water Tank

RECOMMENDATION: THAT Council accept this report as information regarding the status of acquiring a firewater tank for the village

REPORT SUMMARY

Administration is working to finalize the purchase order of a water tank from Xerxes, and will aim to have the tank installed by the end of the following year.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.

REPORT

BACKGROUND/CONTEXT

Administration has been working to acquire a water tank designated for firefighter purposes, which would be used by Jamieson Road Fire Dept if needed.

DISCUSSION

The village has been working with the Jamieson Road Fire Dept and engineering consultants Project Worx to determine the required specifications of the water tank and is working to finalize the purchase of a 10,000 gallon tank from Xerxes. The water tank design is currently pending review by the engineer. The estimated cost of the tank (no transport/installation fees included) is around \$27,000-35,000.

Administration has also reached out to J.T Setters & Sons Construction Ltd. for installation of the tank. A quote will be provided once the final details of the water tank are confirmed.



Report Date: Nov 20th, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 4.6
Meeting Date: Nov 25th, 2023

TO: Council

FROM: Administration

Subject: Village Signage

RECOMMENDATION: THAT Council accept this report as information

REPORT SUMMARY

Administration has ordered three “No Lake Access” signs for the village from the City of Calgary Sign Shop.

The signs cost \$60 each, and will be picked up within the upcoming week

CHIEF ADMINISTRATIVE OFFICER’S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.



Report Date: November 21, 2023
Contact: Suzanne Gaida
Agenda Item Number: 5.1
Meeting Date: November 25, 2023

TO: Council

FROM: Suzanne Gaida, Finance Manager

Subject: Cheque Register September 1 – October 31, 2023

RECOMMENDATION: That Council accept the cheque register for September 1 – October 31, 2023 as information.

REPORT SUMMARY

The cheque register, outlining payments of direct withdrawals and cheques 2153-2170 for September 1, 2023 thru October 31, 2023 in the amount of \$175,967.22 is attached. This is provided for Council information and Administration can provide specifics on any payments outlined in the attached report for Council.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.

REPORT

BACKGROUND/CONTEXT

This cheque register includes a payments for the Community Hall Upgrades, payments for the final work on the Climate Resilient Groundwater Assessment and Implementation Plan, payment for the Shoreline Rip Rap Project, the SVGL Contribution to the AEUB Appeal, payment for Fire Services Annual Contract and the third installment of the School Tax Requisitions.

CONCLUSION

That Council accept the cheque register for September 1 – October 31, 2023 as information.

Summer Village of Ghost Lake

Cheque Register

As of 31 October 2023

Num	Name	Memo	Amount
310-120	Bank - TD Canada Trust		
Debit	ASFF - Provincial Tresu...	September 2023 Public School Requisition	-29,444.06
Debit	Waste Management of ...	September 2023 Service	-1,385.52
Debit	Cochrane Lake Gas Co...	August 2023 Gas	-45.95
Debit	Epcor Energy Sevices	August 2023 Power	-141.60
Debit	TD Canada Trust	September 6, 2023 Credit Card - CAO	-798.63
Debit	TD Canada Trust	September 6, 2023 Credit Card Bill - Mayor	-6.25
Debit	TD Canada Trust	September 6, 2023 Credit Card Bill - Deputy Mayor	-20.00
Debit	Cochrane Lake Gas Co...	September 2023 Gas	-107.47
Debit	Waste Management of ...	October 2023 Service	-1,385.52
Debit	Epcor Energy Sevices	September 2023 Power	-181.92
Debit	Receiver General	Q3 Payroll Liabilities (July - September 2023)	-3,663.52
Debit	TD Canada Trust	October 5, 2023 Credit Card Bill - Mayor	-6.25
Debit	TD Canada Trust	October 5, 2023 Credit Card - CAO	-160.10
2153	Jack Fritz	August Payroll	-1,003.51
2154	Morrison Hershfield Lim...	SVGL Groundwater Assessment	-28,349.03
2155	Calgary RCSSD No 1	Seperate School Requisition September 2023	-750.07
2156	Ghost Lake Village Co...	Annual Contribution for Insurance and Operating Costs	-1,500.00
2157	Hassan Saeed	September Payroll & Expenses	-946.44
2158	Mustafa Hashimi	September 2023 Payroll	-2,905.48
2159	Suzanne Gaida	September 2023 Finance Manager Contract & Expenses	-1,119.30
2160	2197798 Alberta Ltd.	Outdoor Tables and Chairs For Community Hall	-1,000.00
2161	Benchmark Assessmen...	October - December 2023 Assessment Fee	-1,443.75
2162	Hassan Saeed	October 2023 Payroll	-714.00
2163	MD of Bighorn	2023 Fire Services Agreement	-3,000.00
2164	Morrison Hershfield Lim...	SVGL Groundwater Assessment	-22,774.08
2165	Mustafa Hashimi	October Payroll & Expenses	-3,405.09
2166	ProjectWorx Engineerin...	Engineering for Water Tank	-2,992.50
2167	Rod Keller	SVGL Contribution to Community Led AEUB Appeal Mediation as per Council ...	-2,500.00
2168	Suzanne Gaida	October 2023 Finance Manager Contract	-1,119.30
2169	W. Downer Holdings Ltd.	Rip Rap Supply & Delivery	-10,072.88
2170	R Space Ltd.	Progress Invoice for Community Hall Upgrade Project	-53,025.00
Total 310-120 · Bank - TD Canada Trust			-175,967.22
TOTAL			-175,967.22



Report Date: November 21, 2023
Contact: Suzanne Gaida
Agenda Item Number: 5.2
Meeting Date: November 25, 2023

TO: Council

FROM: Suzanne Gaida, Finance Manager

Subject: November 2023 Financial Report

RECOMMENDATION:

That Council accepts the November 2023 Finance Report as information.

REPORT SUMMARY

The November 2023 Financial Report shows all revenues and expenses as of November 21, 2023 and includes Operating and Capital Budgets. The intent of this report is to make it clear to Council the current state of the budget in relation to true costs.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.

REPORT

BACKGROUND/CONTEXT

Administration will present to Council at all Council meetings a year-to-date report outlining revenues and expenditures for the Operating and Capital Budgets. This will ensure Council understands where things are at financially with the Budgets and Administration and Council will be able to identify any concerns early and not be surprised at the end of the year.

Operating Highlights

- This report shows all revenue & expenses up to November 21, 2023.
- All 2023 taxes and requisitions have been collected.
- Climate Change Grant work is complete. 100% of the grant equal to \$79,940 has been received and \$79,940 has been expensed for the work.
- Administrative Services is trending to be overbudget by \$6,000.
- 2022 and 2023 TransAlta Recreational Lease were paid in 2023 as no bill was received in 2022
- LUB work has not started so no funds have been expensed to date.
- FRIAA Grant funding have not been received yet for the \$2,688 expenses to date.

Capital Highlights

- \$71,672 has been spent on the Community Hall Project and will be completed in 2024.
- \$344 has been spent on the Community Sign and will be completed in 2023
- \$9,593 has been spent on the Shoreline Rip Rap Project and is completed.
- \$2,850 has been spent on the Water Reservoir Project and will be completed in 2024
- Playground Project will be completed in 2024.

DISCUSSION

Administration can answer any questions Council has on the Financial Update.

November 2023 Financial Report

2023 Operating		
	2023 Budget	2023 YTD
Revenue		
Other		
Grants - Other		\$ 79,940
Transfer from Operating Reserves	\$ 30,348	\$ -
Tax Penalties & Costs	\$ -	\$ 144
Other Income	\$ -	\$ 513
General Administration		
Admin Fees & Sale of Goods	\$ 100	\$ 180
Provincial Grants - MSI Operating	\$ 14,344	\$ 14,344
Fire & Emergency		
Fire & Emergency Services Grants	\$ -	\$ 500
Planning		
Planning Fees	\$ -	\$ 990
Parks & Recreation		
Recreation Operating Grants - STEP	\$ 13,680	\$ -
Regatta Income	\$ 6,500	\$ 50
Total Income	\$ 64,972	\$ 96,660
Expenses		
Council		
Honorariums	\$ 1,500	\$ -
Expenses	\$ 2,200	\$ 715
Total	\$ 3,700	\$ 715
General Administration		
Professional Services	\$ 15,149	\$ 7,551
Association & Membership Fees	\$ 2,105	\$ 1,944
Bank Service Charges	\$ 100	\$ 83
Administration Services	\$ 66,024	\$ 58,851
Office Expenses	\$ 9,205	\$ 7,854
Insurance	\$ 6,000	\$ 5,988
Other Grant Expenses		\$ 79,940
Total	\$ 98,583	\$ 162,210
Emergency & Protective Services		
EOC - Supplies	\$ 2,000	\$ -
Grant Expenses		\$ 2,688
Equipment Repair & Maintenance	\$ 500	\$ 113
Supplies	\$ 500	\$ 300
Fire Services - MD	\$ 3,439	\$ 3,000
Police Requisition	\$ 6,500	\$ 6,465
Total	\$ 12,939	\$ 12,566
Roads		
Contract Services	\$ 1,500	\$ -
Repairs & Maintenance	\$ 2,000	\$ -
Total	\$ 3,500	\$ -
Waste Management		
Repair & Maintenance	\$ 500	\$ -
Contract Services	\$ 20,000	\$ 15,206
Total	\$ 20,500	\$ 15,206

2023 Operating		
	2023 Budget	2023 YTD
Planning		
Planning Contract Services	\$ 20,500	\$ 1,596
Total	\$ 20,500	\$ 1,596
Community Services		
Contract Services	\$ 2,000	\$ -
Supplies	\$ 500	\$ 355
Repairs & Maintenance	\$ 3,500	\$ 1,493
Utilities	\$ 4,390	\$ 2,632
STEP Grant Expenses	\$ 17,280	\$ 3,253
Regatta	\$ 6,500	\$ 1,050
Community Association	\$ 1,500	\$ 1,500
Waterfront Contract Maintenance	\$ 2,000	\$ -
Waterfront Permits and Fees	\$ 1,000	\$ 2,000
Total	\$ 38,670	\$ 12,283
Cultural		
Supplies	\$ 100	\$ 49
Marigold System Fees	\$ 1,108	\$ 1,085
Total	\$ 1,208	\$ 1,134
Total Expense	\$ 199,600	\$ 205,710
Difference	-\$ 134,628	-\$ 109,050

Taxes

Requisitions	2023 Budget	2023 YTD
School - ASFF	\$ 120,646	\$ 88,332
School - CCSB	\$ 3,010	\$ 2,250
Designated Industrial	\$ 5	\$ -
Total	\$ 123,661	\$ 90,582
Collections		
School Levy	\$ 117,764	\$ 117,765
Municipal Taxes	\$ 134,240	\$ 134,240
Linear Taxes	\$ 197	\$ 201
Total	\$ 252,201	\$ 252,206

2023 Capital

Project	2023 Budget	2023 YTD
Water Reservoir	\$ 80,000	\$ 2,850
Community Sign	\$ 3,000	\$ 344
Playground	\$ 75,000	\$ -
Community Hall Upgrades	\$ 200,000	\$ 71,672
Shoreline Rip Rap	\$ 10,000	\$ 9,593
Total	\$ 368,000	\$ 84,459



Report Date: November 21, 2023
Contact: Suzanne Gaida
Agenda Item Number: 5.3
Meeting Date: November 25, 2023

TO: Council

FROM: Suzanne Gaida, Finance Manager

Subject: 2024 Operating and Capital Budget

RECOMMENDATION:

That Council approve the 2024 Operating & Capital Budget.

REPORT SUMMARY

The 2024 Operating and Capital Budgets are being presented to Council for discussion, debate and approval. The Municipal Government Act requires municipalities to have budgets in place by December 31 of each year. Any changes or unforeseen costs required throughout 2024 can be done through a budget adjustment.

There is an overall increase to tax support from the 2023 Budget to the 2024 Draft Budget of \$15,473. This equates to an 11.5% increase over the 2024 Budget. This does not mean taxes will increase by 11.5% as tax rates are not set until Property Assessments have been finalized in May.

The Provincial Government is changing the MSI (Municipal Sustainability Initiative) grant program in 2024 to the LGFF (Local Government Fiscal Framework). The amount of funding has not yet been released. The budget is based on funding remaining the same moving forward.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.

REPORT

BACKGROUND/CONTEXT

2024 Operating Budget Highlights

- Land Use Bylaw Update is budgeted for \$20,000 funded from Operating Reserves
- \$2,000 for the webpage update has been budgeted and funded from Operating Reserves
- \$3,500 for a Municipal Emergency Plan and \$2,500 for an Emergency Social Services Plan have been budgeted and funded from Operating Reserves.
- The Provincial Operating Grant has been budgeted at the historical amount. There has been no indication of how much will be allocated as part of the new LGFF program.
- The Community Hall rental revenue and expenses have been included in the budget. Revenue has been budgeted at 25 rentals at \$200 each. Expenses are an increase to Community Services Contract Services for cleaning of \$1,000, an increase to supplies of \$500 and an increase to utilities of \$3,000. The net of the budget for the rentals is \$500 in profit.
- Community Hall utilities budget still accounts for internet service in the building.
- No expenses or revenues for Regatta have been budgeted for as the Community Association has taken this function over completely.
- STEP Grant is not being budgeted for as there is no guarantee it will be received. If received then seasonal hours can be adjusted.
- An increase of \$1,400 is budgeted for the seasonal position to allow for more hours to be worked.
- Administration Services budget is the same as anticipated actuals for 2023. There will be a shift from employees to contractors resulting in a savings of approximately \$4,000 and then an overall increase of 4% has been budgeted for a cost of living increase.
- There has been an increase of 10% applied to Insurance
- There is a 50% increase applied to the Police Requisition as recommended by the Province and a \$500 increase is budgeted for the Fire Services Contract.
- Administration is recommending reducing Association and Membership Fees by \$1,000 and to no longer be a member of FCM and ASVA as the value is not being seen.
- Reduction in expenses have been budgeted in Roads and Community Services.
- Waste Contract has been increased by 10%
- There is no budget in 2024 for the Community Association
- No transfer to reserves has been budgeted for 2024. A plan for building reserves should be discussed by Council in 2024 to insure future years include contribution to reserves.

2024 Capital Budget Highlights

- The Water Reservoir Project from 2023 will be completed in 2024
- The 2024 Budget includes an additional \$75,000 towards the Playground Project funded from the LGFF
- 2025 Capital Plan includes solar for the Community Hall and garage currently showing funding from LGFF but Administration will seek other grants for this project as they become available
- 2025 Capital Plan includes \$50,000 for the Tennis Court Resurfacing funded from the MR Reserve and LGFF
- 2027 Capital Plan has \$300,000 budgeted for Marina Upgrades and Breakwater Repairs funded from LGFF and CCBF
- Projects in the 2025-2029 Capital Plan have not been fully scoped and will require further details in future budgets and Council will revisit this plan each year as they set the annual budget.

DISCUSSION

These Budgets are being presented for discussion, debate and approval by Council.

CONCLUSION

Approval of the Budget will ensure a budget is in place by December 31, 2023 as is required by the Municipal Government Act and will allow Administration to begin work on the projects included in the budget early in 2024

REVIEWED AND APPROVED BY

2024 -2027 Budget

	2023 Budget	2023 Anticipated	2024 Budget	Notes	2025 Plan	2026 Plan	2027 Plan
Revenue							
Other							
Grants - Other	\$ -	\$ 79,940		2023 - Groundwater Assessment	\$ -	\$ -	\$ -
Transfer from Operating Reserves	\$ 30,348		\$ 28,000	\$2,000 Webpage; \$20,000 LUB; \$3,500 MEP & \$2,500 SSP	\$ -	\$ -	\$ -
Investment Income		\$ -			\$ -	\$ -	\$ -
Tax Penalties & Costs		\$ 144			\$ -	\$ -	\$ -
General Administration							
Admin Fees & Sale of Goods	\$ 100	\$ 100	\$ 100		\$ 100	\$ 100	\$ 100
Provincial Grants - Operating	\$ 14,344	\$ 14,344	\$ 7,172	Budgeted historic grant dollars	\$ 7,172	\$ 7,172	\$ 7,172
Fire & Emergency							
Fire GrantsSmart & FRIAA		\$ 3,188			\$ -	\$ -	\$ -
Planning & Development							
Development Fees and Charges		\$ 1,503	\$ 513	Reimbursement for 1/2 GIS Contract from SVW	\$ 513	\$ 513	\$ 513
Parks & Recreation							
Community Hall Rentals	\$ -	\$ -	\$ 5,000	25 rentals at \$200	\$ 5,000	\$ 5,000	\$ 5,000
Recreation Operating Grants - STEP	\$ 13,680	\$ -	\$ -	Not Budgeting for Grant in 2024 as no guarantee to receive it	\$ -	\$ -	\$ -
Regatta Income	\$ 6,500	\$ 50	\$ -	Regatta - fully moved to CA	\$ -	\$ -	\$ -
Total Income	\$ 64,972	\$ 99,269	\$ 40,785		\$ 12,785	\$ 12,785	\$ 12,785

2024 -2027 Budget

	2023 Budget	2023 Anticipated	2024 Budget	Notes	2025 Plan	2026 Plan	2027 Plan
Expenses							
Council							
Honorariums	\$ 1,500	\$ 1,500	\$ 1,500		\$ 1,500	\$ 1,500	\$ 1,500
Expenses	\$ 2,200	\$ 2,200	\$ 2,200		\$ 2,200	\$ 2,200	\$ 2,200
Total	\$ 3,700	\$ 3,700	\$ 3,700		\$ 3,700	\$ 3,700	\$ 3,700
General Administration							
Professional Services	\$ 15,150	\$ 15,150	\$ 12,783	Increase to Assessment Services as per agreement	\$ 13,422	\$ 14,093	\$ 14,798
Association & Membership Fees	\$ 2,105	\$ 1,944	\$ 1,100	No ASVA and FCM Membership	\$ 1,100	\$ 1,100	\$ 1,100
Bank Service Charges	\$ 100	\$ 83	\$ 100		\$ 100	\$ 100	\$ 100
Administration Services	\$ 66,023	\$ 71,000	\$ 71,000	Includes 4% COLA increase for 2024 and a switch to contract employees for CAO & Policy	\$ 73,840	\$ 77,532	\$ 81,409
Office Expenses	\$ 9,205	\$ 9,205	\$ 9,175	Includes \$2,000 one time cost for Website paid from Reserves	\$ 7,100	\$ 7,100	\$ 7,100
Insurance	\$ 6,000	\$ 5,988	\$ 6,600	10% increase budgeted	\$ 7,260	\$ 7,986	\$ 8,785
Election	\$ -	\$ -	\$ -		\$ -	\$ 3,000	\$ -
Other Grant Expenses	\$ -	\$ 79,940	\$ -	Groundwater Assessment	\$ -	\$ -	\$ -
Total	\$ 98,583	\$ 183,310	\$ 100,758		\$ 102,822	\$ 110,911	\$ 113,291
Emergency & Protective Services							
EOC - Supplies	\$ 2,000	\$ -	\$ 6,000	Complete MEP - \$3,500 & SSP - \$2,500	\$ 2,000	\$ 2,000	\$ 2,000
Equipment Repair & Maintenance	\$ 500	\$ 200	\$ 500		\$ 500	\$ 500	\$ 500
Supplies	\$ 500	\$ 500	\$ 500		\$ 500	\$ 500	\$ 500
FireSmart & FRIAA Grant Expenses	\$ -		\$ -				
Fire Services - MD	\$ 3,439	\$ 3,439	\$ 4,000	Fire Service Contract Increase	\$ 4,500	\$ 5,000	\$ 5,500
Police Requisition	\$ 6,500	\$ 6,465	\$ 9,750	Increase of 50% as recommended by Province to cover 30% cost recovery (2023 was 20% cost recovery)	\$ 10,725	\$ 11,798	\$ 12,977
Total	\$ 12,939	\$ 10,604	\$ 20,750		\$ 18,225	\$ 19,798	\$ 21,477

2024 -2027 Budget

	2023 Budget	2023 Anticipated	2024 Budget	Notes	2025 Plan	2026 Plan	2027 Plan
Roads							
Contract Services	\$ 1,500	\$ -	\$ 1,500		\$ 1,500	\$ 1,500	\$ 1,500
Repairs & Maintenance	\$ 2,000	\$ -	\$ 1,000	Reduction of \$1,000	\$ 1,000	\$ 1,000	\$ 1,000
Total	\$ 3,500	\$ -	\$ 2,500		\$ 2,500	\$ 2,500	\$ 2,500
Waste Management							
Repair & Maintenance	\$ 500	\$ -	\$ 500		\$ 500	\$ 500	\$ 500
Contract Services	\$ 20,000	\$ 16,600	\$ 18,260	Increased 2023 fees by 10%	\$ 20,086	\$ 22,095	\$ 24,304
Total	\$ 20,500	\$ 16,600	\$ 18,760		\$ 20,586	\$ 22,595	\$ 24,804
Planning							
Planning Contract Services	\$ 20,500	\$ 3,000	\$ 22,700	Includes \$20,000 from LUB funded from Reserves	\$ 3,500	\$ 3,500	\$ 3,500
Total	\$ 20,500	\$ 3,000	\$ 22,700		\$ 3,500	\$ 3,500	\$ 3,500
Community Services							
Contract Services	\$ 2,000	\$ -	\$ 3,000	Cleaning	\$ 3,000	\$ 3,000	\$ 3,000
Goods	\$ 500	\$ 500	\$ 1,000	Increased for rentals	\$ 1,000	\$ 1,000	\$ 1,000
Repairs & Maintenance	\$ 3,500	\$ 1,500	\$ 2,500	Reduction of \$1,000	\$ 2,500	\$ 2,500	\$ 2,500
Utilities	\$ 4,390	\$ 3,000	\$ 7,000	Increased usage - rentals	\$ 7,000	\$ 7,000	\$ 7,000
Summer Position Payroll	\$ 17,280	\$ 3,253	\$ 5,000	\$1,400 increase for more hours	\$ 5,000	\$ 5,000	\$ 5,000
Regatta	\$ 6,500	\$ 1,050	\$ -				
Community Association	\$ 1,500	\$ 1,500	\$ -				
Waterfront Contract Maintenance	\$ 2,000	\$ -	\$ 1,000	Reduction of \$1,000	\$ 1,000	\$ 1,000	\$ 1,000
Waterfront Permits and Fees	\$ 1,000	\$ 2,000	\$ 1,000		\$ 1,000	\$ 1,000	\$ 1,000
Total	\$ 38,670	\$ 12,803	\$ 20,500		\$ 20,500	\$ 20,500	\$ 20,500
Cultural							
Supplies	\$ 100	\$ 100	\$ 100		\$ 100	\$ 100	\$ 100
Marigold System Fees	\$ 1,108	\$ 1,085	\$ 1,118	\$10.96 x 102 - Marigold Fee 2024	\$ 1,200	\$ 1,200	\$ 1,200
Total	\$ 1,208	\$ 1,185	\$ 1,218		\$ 1,300	\$ 1,300	\$ 1,300
Total Expense	\$ 199,600	\$ 231,202	\$ 190,886		\$ 173,133	\$ 184,803	\$ 191,072

2024 -2027 Budget

	2023 Budget	2023 Anticipated	2024 Budget	Notes	2025 Plan	2026 Plan	2027 Plan
Tax Levy	-\$ 134,628	-\$ 131,933	-\$ 150,101	\$15,473 increase - major shifts - budget LGFF operating grant back to \$7,172 (\$7, 172 reduction); \$5,000 from reserves in 2023 to cover operating costs not included in 2024; Admin increase \$4,000; Policing increase \$3,250; Insurance increase \$600; overall increase to revenue after expense of \$500 for Community Hall Rentals; \$1,400 increase for summer student; \$5,449 reduction in expenses throughout.	-\$ 160,348	-\$ 172,018	-\$ 178,287

2024- 2029 Capital Budget

Project	2023 Budget	2024	2025	2026	2027	2028	2029
Water Reservoir	\$80,000 MSI						
Playground	\$75,000 CCBF	\$75,000 LGFF					
Community Hall Upgrades	\$200,000 MSI						
Shoreline Rip Rap	\$10,000 MSI						
Solar for Hall & Garage			\$20,000 LGFF				
Tennis Court Resurface			\$50,000 (\$34,553 MR Reserve & \$15,447 LGFF)				
Marina Upgrades & Breakwater Repairs					\$260,000 LGFF \$40,000 CCBF		
Equipment Upgrades							
West End Road Upgrades							
Total	\$75,000 CCBF \$290,000 MSI	\$75,000 LGFF	\$35,447 LGFF \$34,553 MR Reserve		\$260,000 LGFF \$40,000 CCBF		

MSI Program Replaced by LGFF in 2024

	2023	2024	2025	2026	2027	2028	2029
CCBF (Annual \$10,133)	\$ 77,344	\$ 12,477	\$ 22,610	\$ 32,743	\$ 42,876	\$ 13,009	\$ 23,142
LGFF (Annual \$39,541)	\$ 503,441	\$ 252,982	\$ 217,523	\$ 221,617	\$ 261,158	\$ 40,699	\$ 80,240

MSI - Municipal Sustainability Initiative

LGFF - Local Government Fiscal Framework

CCBF - Canada Community Building Fund



Report Date: Nov 18th, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 6.1
Meeting Date: Nov 25th, 2023

TO: Council

FROM: Administration

Subject: Procedural Bylaw

RECOMMENDATION: THAT Council review and approve the amended Procedural Bylaw #2023-02.

REPORT SUMMARY

The amended bylaw changes section 4.1 and 3.2 to follow the guidelines set forth in the Alberta Municipal Government Act regarding elected officials and meetings of Council.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.

SUMMER VILLAGE OF GHOST LAKE
BY-LAW NO. 2023-02

Being A Bylaw of The Summer Village of Ghost Lake in The Province of Alberta and to amend the Procedural Bylaw 2022-01, To Provide the Organizational and Procedural Matters of Council, Council Committees and Councilors

WHEREAS, the Municipal Government Act (MGA), S.A. 2000 Chapter M-26, as amended, provides that a Council may pass bylaws in relation to the procedure and conduct of Council, and committees established by Council, and may regulate the conduct of Councilors and members of committees established by Council;

AND WHEREAS, Council has deemed it necessary to regulate the procedure and conduct at meetings of Council and committees established by Council

NOW THEREFORE, the Council of the Summer Village of Ghost Lake, duly assembled, enacts as follows:

1.0 Title

This Bylaw shall be called the “Procedural Bylaw”.

2.0 Definitions

In this bylaw:

- a) “Delegation” means any person that has permission of Council to appear before Council or a committee of Council to provide pertinent information and views about the subject before Council or Council committee
- b) “CAO” means the Chief Administrative Officer or his/her delegate, for the Municipality.
- c) “Member” means a councilor or person at large appointed by Council to a committee of council.
- d) “Meetings” means meetings of Council and Council committees.
- e) “Municipality” means the Summer Village of Ghost Lake, a municipal corporation of the Province of Alberta and includes the area contained within the boundaries of the Municipality.
- f) “Municipal Website” means the official website of the Municipality
- g) “Term” means the four-year election cycle

3.0 Chief and Deputy Chief Elected Official

3.1 In accordance with the MGA, the chief elected official shall have the title of Mayor and one member of council shall have the title of Deputy Mayor.

3.2 At the beginning of each Council Term, at the organizational meeting of Council, or as required in the event of a resignation and/or byelection, Council shall elect the Mayor and Deputy Mayor.

4.0 Meetings of Council

4.1 The Organizational meeting of Council shall be held annually, not later than the thirty-first day of August

4.2 The dates, times, and place of regular meetings of Council shall be established at the Organizational meeting or at a Council meeting by motion of Council at any time.

- 4.3 Any changes to the time, date or location of a regular scheduled meeting will be done a minimum of twenty-four (24) hours in advance of the scheduled meeting. A Special Meeting of Council will be called by the Mayor to approve the changes.
- 4.4 The CAO shall record the time of arrival and departure of Council members at meetings should a member of Council arrive late at a meeting or depart prior to the completion of a meeting.
- 4.5 If a quorum is not present within thirty minutes after the time fixed for regular or special meetings, the CAO shall record the names of the members present and the meeting shall stand adjourned until the next regular or special meeting.
- 4.6 A Meeting may be conducted by means of electronic or other communication facilities if:
- a) notice is given to the public of the meeting, including the way in which it is to be conducted
 - b) the facilities enable the public to watch or listen to the meeting at a place specified in the notice.
 - c) the facilities enable all the meeting's participants to watch and hear each other

5.0 Conduct of Meetings

- 5.1 Every delegate to a regular Council meeting and each member of Council shall address the chair but shall not speak until recognized by the chair.
- 5.2 The Mayor or other presiding officer may, upon request of a member of Council, authorize a person in the public gallery to address Council, only on the topic being debated at that time in the meeting and with time limits specified by the Mayor or other presiding officers.
- 5.3 A motion does not require a seconder.
- 5.4 A motion may be withdrawn by the mover at any time before voting.
- 5.5 The following motions are not debatable:
- i) Adjournment.
 - ii) Take a Recess.
 - iii) Question of Privilege.
 - iv) Point of Order.
 - v) Limit Debate on the Matter before Council.
 - vi) Division of a Question.
 - vii) Table the Matter to Another Meeting.
- 5.6 When the Mayor or other presiding officer is of the opinion that a motion is contrary to the rules and privileges of the Council or Council committee, they shall apprise the member thereof immediately, before putting the question to discussion and shall cite

the rule or authority applicable to the case without argument or comment, unless otherwise decided by a two thirds majority vote of the members present.

- 5.7 In all cases not provided for in the proceedings of the Council a two-thirds majority of Council shall determine to uphold the ruling of the presiding officer or not, as may be the case.
- 5.8 When all items on an approved agenda have been dealt with, the Mayor or other presiding officer may adjourn the meeting without requiring a motion or vote of Council.

6.0 Delegations

- 6.1 A person or a representative of any delegation or group of persons who wishes to bring any matter to the attention of the Council or who wishes to have any matter considered by the Council shall address a letter, an email or other communication to the Council outlining the subject to be discussed. The letter shall be typewritten or legibly written and delivered, emailed, or mailed to the office of the CAO so that it arrives by at least 4:00 in the afternoon seven calendar days immediately preceding the meeting at which it is to be presented, and it shall contain the full mailing address of the writer. If he or she wishes to appear before Council, it shall be so stated in the letter.
- 6.2 Delegations shall be granted a maximum of fifteen (15) minutes to present the matter outlined in their letter. Where the Mayor or other presiding officer determines that sufficient time has been granted to a delegation to present the matter outlined in their letter the Mayor or other presiding office may limit the length of time granted to the delegation.
- 6.3 Delegations who have not submitted a letter in accordance with this section may speak during the Residents Dialogue session immediately preceding the regular meeting.

7.0 Agenda

- 7.1 Prior to each regular meeting, the CAO shall prepare a statement of the order of business to be known as the “Agenda” of all business to be brought before the Council at the regular meeting.
- 7.2 To enable the CAO to prepare a proper agenda, all documents and notice of delegations intended to be submitted to the Council shall be submitted to the CAO seven days before the regular meeting, unless extenuating circumstances occur.
- 7.3 Additions placed on the agenda at the meeting shall be discouraged, however, an addition may be made to the agenda with a simple majority consent of Councilors present. Actions resulting from the agenda additions require unanimous consent

given by those Councilors present. Exception to actions given by unanimous consent is a tabling motion or that the agenda item be received as information.

- 7.4 The CAO shall ensure Council has access to the agenda at least four (4) days prior to the meeting date.

8.0 Resident Dialogue

- 8.1 Council shall provide a maximum of twenty (20) minutes at the forefront of each regular council meeting, prior to calling the meeting to order, for informal resident dialogue.
- 8.2 Each resident present will be allowed a maximum of ten (10) minutes to speak to Council, but the total time allocated for resident dialogue shall not exceed twenty (20) minutes in total time unless unanimously agreed to by all council members present
- 8.3 No proceedings of Resident Dialogue shall be recorded in the minutes of the meeting.

9.0 Council Committees and Boards

- 9.1 Committees may be established by Council from time to time as are necessary or advisable for the orderly and efficient handling of the affairs of the Summer Village of Ghost Lake and shall establish the Terms of Reference for said Committees as set out in Schedule B attached to and forming part of this Bylaw.
- 9.2 When establishing a Committee, Council must adopt a Terms of Reference for the Committee that:
- a) names it;
 - b) establishes membership, purpose and authority;
 - c) sets the terms or directs that the committee exists on an on-going basis;
 - and
 - d) allocates any necessary budget or other resources.
- 9.3 Council may appoint by resolution Members, employees or public-at-large to Committees in accordance with the approved Terms of Reference and any applicable statute or bylaw.
- 9.4 The Committee member selection process will be as follows:
- a) Member of Council
 - i. To be appointed by Council to a Committee at the annual Organizational meeting
 - b) Public-at-Large
 - i. All public-at-large vacancies on Committees shall be advertised to request formal submission of applications on the Municipal Website
 - ii. Public-at-large member selection will be made by Council from those applicants responding to the advertised need.

iii. To be considered, applicants must be a property owner, the spouse of a property owner or a permanent resident in the Summer Village of Ghost Lake.

- 9.5 The Mayor shall be an ex-officio member of all Committees unless prohibited by statute or bylaw and as such has the same rights and privileges as other Committee members.
- 9.6 At its first meeting each year, a Committee shall elect a Chairperson for a one (1) year term to preside over Committee meetings.
- 9.7 A Committee shall conduct its meetings in public in accordance with the provisions of the MGA.
- 9.8 Meetings will be scheduled at the call of the Chairperson, with times and locations posted on the Municipal Website.
- 9.9 Minutes will be taken recording Committee members present, all proceedings and decisions made by the Committee, signed by the Committee Chairperson and posted on the Municipal Website.
- 9.10 All Committee members shall have an equal vote on any decision before the Committee.
- 9.11 Committees shall report to Council as required.

10.0 Public Notification

- 10.1 Public notice of regular meetings shall be posted at least seven (7) days in advance of the meeting on the Municipal Website indicating time, date, and location of the meeting.
- 10.2 Special meetings shall be posted at least twenty-four (24) hours in advance of the meeting, indicating time, date, location, and purpose of the meeting on the Municipal Website.
- 10.3 In the event a special meeting is called with less than twenty-four (24) hours notice and a waiver of notice is signed pursuant to the Act, there is no requirement to post notification on the Municipal Website.
- 10.4 Each notice postponing a meeting shall state the reason and be posted on the Municipal Website. When available, the time and day and place the postponed regular or special meeting will be held shall be posted on the Municipal Website.
- 10.5 Meeting agenda will be posted on the Municipal Website within one (1) day following the distribution of the agenda to the Councilors for council meetings and to the committee members for committee meetings.

11.0 Public Circulation of Minutes

- 11.1 A copy of Council and Committee meeting minutes shall be posted on the Municipal Website within fourteen (14) days of the adjournment of the meeting.
- 11.2 In the event, the minutes have not been adopted within the fourteen (14) day period, they shall be clearly marked as “Unadopted Draft”.
- 11.3 When all Council minutes for a calendar year have been adopted, an archive copy of all signed minutes for the year shall be prepared and posted on the Municipal Website and the unadopted draft minutes removed from the Municipal Website.

12.0 Public Hearing Procedures

- 12.1 Notwithstanding any other section of this bylaw, Sections 12.2 through 13.6 apply to public hearings.
- 12.2 Public Hearings are a statutory requirement in accordance with Section 230 of the MGA whereby when this or another enactment requires Council to hold a public hearing on a proposed bylaw or resolution, the public hearing must be held, unless another enactment specifies otherwise,
 - a) before second reading of the bylaw, or
 - b) before council votes on the resolution.
- 12.3 If a public hearing is held on a proposed bylaw or resolution, Council must conduct the public hearing during a regular or special council meeting.
- 12.4 The Summer Village will give notice of a Public Hearing by:
 - a) posting the notice on the Municipal Website,
 - b) placing an advertisement in a newspaper published at least once a week for 2 consecutive weeks, having general circulation in the area prior to the public hearing date, and
 - c) mail or deliver a notice to every residence in the area to which the proposed bylaw, resolution or other thing relates
- 12.5 Detailed procedures for Public Hearings are available in Schedule A, attached.
- 12.6 Any person, group, or representative of a person or group who is providing a verbal presentation at a public hearing shall be physically present.
- 12.7 The presiding officer shall ensure all members of the public present at a public hearing feel safe to participate by requiring those present to:
 - a) Speak respectfully,
 - b) Refrain from using any offensive or disrespectful language,
 - c) Directly address the item without repetition or reference to matters irrelevant to the public hearing
 - d) Maintain order and quiet,

- e) Refrain from interrupting any speech or action of members of council or any other member of the public that is addressing council, and
- f) Refrain from displaying placards or signs supporting a particular outcome of the topic under discussion

12.8 After considering the representations made to it about a proposed bylaw or resolution at a public hearing and after considering any other matter it considers appropriate, the Council may:

- a) pass the bylaw or resolution,
- b) make any amendment to the bylaw or resolution it considers necessary and proceed to pass it without further advertisement or hearing, or
- c) defeat the bylaw or resolution.

13.0 Public Hearing Records

13.1 Following the adjournment of a public hearing the CAO shall prepare:

- a) A record of public submissions, and
- b) Minutes of the public hearing.

13.2 The record of public submissions shall include:

- a) Written submissions received from administration, the applicant, and members of the public, and
- b) An electronic copy of the video recording of the meeting if one was made.

13.3 A member of the public wishing to have a written submission included in the record of public submissions shall ensure one copy of the submission is received by the CAO between the time Council sets a date for a public hearing and the close of the public hearing.

13.4 Where a person provides more than one identical or largely identical written submission, only one will be included in the record of public submissions.

13.5 The minutes of a public hearing shall record:

- a) The names of administration and the applicant, or representatives of the applicant, who presented at the hearing; and
- b) The names of the members of the public who provided written and/or verbal submissions along with a general indication of support or opposition, but not a summary of the presentations and/or a copy of any written materials provided.

13.6 The minutes of a public hearing will be reviewed and adopted by Council resolution at the next regular or special Council meeting following a public hearing.

14.0 General Matters

14.1 Bylaw Number 237 and any amendments thereto are hereby rescinded in their entirety.

14.2 This Bylaw shall come into full force upon final reading thereof.

READ a first, second and third time this __ day of _____

Mayor

Chief Administrative Officer

BYLAW NO. 2023-01
SCHEDULE A
PUBLIC HEARING PROCEDURES

CALL HEARING TO ORDER

1. Chair / Vice Chair to call the public hearing to order.
2. Chair may introduce all Members of Council and Administrative Staff.

EXPLAIN PURPOSE OF HEARING AND PROCEDURES

3. Chair to advise those present that:
 - a. The Council is here to listen to the information presented, and to make a decision on the matter that is the subject of the hearing.
 - b. This is a formal hearing and is not a debate. Everyone wishing to speak will be given an opportunity to speak once to the matter.
 - c. The Chair shall call upon those individuals who added their name to the Speakers List in the order recorded. An individual who does not identify themselves on the Speakers List will not be given the opportunity to speak.
 - d. Presenters are to stay within a five (5) minute time limit on the presentation and are encouraged when speaking to keep the presentation to the point, and refrain from restating points raised by previous speakers if possible.
 - e. Each presenter must first state their name, address, and their interest in this matter, including whether in support or non-support.

HEARING TO COMMENCE

4. The Hearing is to commence as follows:
 - a. Chair to call on designated staff member to introduce the subject (or bylaw) of the hearing.
 - b. Chair to call on the Chief Administrative Officer (or designate) to read any relevant correspondence received.
 - c. Chair and Members of Council may ask for clarification relating to the subject (or bylaw).

PRESENTATIONS

5. Chair to call on applicant(s) to speak to the application, if applicable.
6. Chair to call on any individual(s) who recorded their names on the Speakers List to speak in the order they were recorded.
7. Chair and members of Council may call on technical and administrative staff to provide information/clarification for Council.

8. The Chief Administrative Officer will read aloud the names of anyone who supplied written comments.

FINAL COMMENTS

9. Chair may invite administration an opportunity to provide closing comments

CLOSE OF HEARING

10. Chair announces that this concludes the public hearing.

COUNCIL DECISION

11. Following the conclusion of the public hearing, Council will discuss comments made by the public and render a decision on the subject (or bylaw). No further public comment can be received.

BYLAW NO. 2023-01
SCHEDULE B
Committee Terms of Reference

**FIRESMART & PUBLIC WORKS COMMITTEE
TERMS OF REFERENCE**

PURPOSE	To act as an advisory body to Council and Administration regarding matters of FireSmart, public works and community safety.
MEMBERSHIP	<ul style="list-style-type: none">• One (1) Council Member• Two (2) Public-At-Large representatives• One (1) Industry Liaison
AUTHORITY	<p>The Committee will:</p> <ul style="list-style-type: none">• Review, discuss and plan FireSmart activities for the community.• Assist with the development and implementation of FireSmart public education and awareness initiatives.• Promote community involvement in the FireSmart program.• Support and coordinate annual stewardship programs.• Direct and lead the development of the Wildfire Preparedness Guide• Research and assist in grant applications.• Review and discuss issues pertaining to safety of the community• Review and provide input into planning of the community as it relates to FireSmart, community safety and public works.• Identify trails within the community requiring maintenance• Monitor and ensure the Community Services Building maintenance is completed.• Advise and make recommendations to Council and Administration in relation to FireSmart, public works and safety.• Provide input into budget as it relates to the work of the committee.• Comply with the Summer Village of Ghost Lake Procedural Bylaw and the Municipal Government Act.
TERM	On-going
FUNDING	As authorized by Council during the annual budget cycle
APPROVAL DATE	May 9, 2022

RECREATION COMMITTEE
TERMS OF REFERENCE

PURPOSE	To assist Council with policies and operations relating to the summer village recreation program and facilities.
MEMBERSHIP	<ul style="list-style-type: none">• One (1) Council Member• Four (4) residents
AUTHORITY	<p>The Committee will:</p> <ul style="list-style-type: none">• The Committee may make recommendations to the Council of the Summer Village of Ghost Lake, for their approval, on matters related to recreation services and facilities in the Summer Village.• The Committee shall be concerned with all matters pertaining to recreation facilities owned or controlled by the Village and with matters pertaining to a broad range of recreation services that will provide opportunity for people of all ages to use their leisure in a wholesome and satisfying manner.• The Committee shall make recommendations to the Council for the approval of and passing of such rules and regulations as it may deem necessary from time to time.• In the interest of a well balanced coordinated recreation program, the Committee shall cooperate with and encourage all organizations within its jurisdiction which are supporting, promoting and working for recreation in its broadest application.• The committee shall hear and consider representations by an individual, organization or delegation of citizens with respect to recreation and act on such recommendations arising there from as the Committee shall deem to be in the general interests of all citizens.
TERM	On-going
FUNDING	As authorized by Council during the annual budget cycle
APPROVAL DATE	May 9, 2022



Report Date: Nov 20th, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 6.2
Meeting Date: Nov 25th, 2023

TO: Council

FROM: Administration

Subject: Land Use Bylaw Steering Committee

RECOMMENDATION: THAT Council accept this report as information regarding the Land Use Bylaw Revision process

REPORT SUMMARY

Administration is working with Greg Birch from Birch Consulting to conduct a review for the village's existing Land Use Bylaw. A steering committee of 6 members has been established. The first meeting to kickoff the process will be taking place by the end of November, 2023.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.



Report Date: Nov 20th, 2023
Contact: admin@ghostlake.ca
Agenda Item Number: 6.3
Meeting Date: Nov 25th, 2023

TO: Council

FROM: Administration

Subject: Climate Resilience Capacity Project Completion

RECOMMENDATION: THAT Council accept this report as information regarding the completion of the Climate Resilience Capacity Project.

REPORT SUMMARY

Climate resilience planning involves conducting risk assessments of key climate hazards within the Ghost Lake area, and creating an adaptation plan accordingly. To address the need to prepare for potential impacts of climate change, the Summer Village of Ghost Lake retained Morrison Hershfield to develop a Climate Resilience and Adaptation Plan.

The project involved hosting community information sessions, conducting water quality testing and risk analysis based on the potential climate hazards of Ghost Lake. The project has now been completed, and the SVGL Climate Resilience and Adaptation Plan is attached in this report for review.

CHIEF ADMINISTRATIVE OFFICER'S COMMENTS

The Chief Administrative Officer has reviewed and approved this report.

SUMMER VILLAGE OF GHOST LAKE

CLIMATE RISK ASSESSMENT & ADAPTATION PLAN

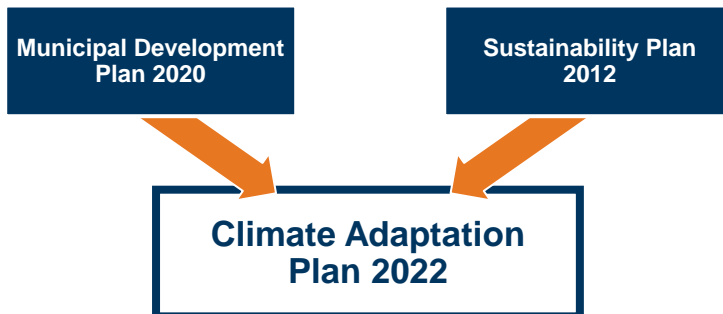
Community Bulletin #2

December 5, 2022

OUR PLAN

Climate change is a global challenge which requires collective local action to address the degree of change and adapt to the changing climate and its associated impacts. SVGL has a role to play in building the resilience of Canadian communities.

Acknowledging that SVGL values self-sufficiency and citizen action, this Plan is intended to achieve a balance between governance and community approaches, prioritizing multi-solving solutions and actions with co-benefits wherever possible to help overcome the capacity and resourcing challenges that come with being a small rural municipality. To facilitate an effective climate adaptation planning process for the Summer Village of Ghost Lake, this Plan is centered around four key pillars of the community (right).



COMMUNITY PILLARS



Homes & People

Key elements include: roads, community hall, community amenities, fire prevention and response, waste management, planning and development approvals process, utilities.



Municipal Buildings & Services

Key elements include: flora and fauna, shoreline, natural spring, wetlands, parks and recreational areas, undeveloped forest and grassland areas.



Parks, Greenspace, & Recreation

Key elements include: groundwater, public and private wells, septic systems, surface water, Ghost Lake reservoir.



Water

Key elements include: safety, community values and interests, communication and interaction, land use, building forms, streetscape and public environment, maintenance of private buildings and property.

This project was funded by the Municipal Climate Change Action Centre (MCCAC). MCCAC is a partnership of Alberta Municipalities, Rural Municipalities of Alberta, and the Government of Alberta.



Questions? Comments?
Stories about climate impact in SVGL?

CONTACT US

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Morrison Hershfield
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The projected changes from the risk assessment are summarized here, as well as the highest priority action from each of the four pillars. The plan contains a total of 20 community actions and some ideas about how residents can participate in helping SVGL achieve their resilience goals.

HIGH PRIORITY ACTIONS



Develop an emergency management plan and associated community engagement programs for residents to understand how to remain safe during extreme events.



Develop and review a fire fighting response plan, including access to water when the lake is at normal level and low level.



Develop and implement a fire-smart climate resilient landscaping program for parks and recreational areas, including actions such as planting drought-tolerant grass and plant species.



Conduct a detailed groundwater assessment to evaluate the likelihood and consequence of climate impacts on well quantity and quality, and explore the feasibility of more specific adaptation actions (where appropriate).



Summary of Projected Changes

Baseline Conditions (1981-2010)

6	139	49	19	0	11
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Projected 2080s Conditions (2071-2100)

33	71	23	42	17	38
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- High and extreme risk interactions for SVGL under projected future conditions resulted from extreme heat, wildfire, wind and extreme combination events, invasive species, extreme precipitation, riverine flooding, and drought and dry conditions.



SUMMER VILLAGE OF GHOST LAKE

Presented To

Mustafa Hashimi
Chief Administrative Officer

Climate Resilience & Adaptation Plan





MORRISON HERSHFIELD

SUMMER VILLAGE OF GHOST LAKE

Climate Resilience & Adaptation Plan

Presented to:

Mustafa Hashimi
Chief Administrative Officer

Report No. 220264800
December 2022

EXECUTIVE SUMMARY

Climate change is a global challenge which requires collective local action to address the degree of change and adapt to the changing climate and its associated impacts; there is overwhelming evidence to show that the earth's climate is changing (IPCC, 2001). These changes will have a multitude of impacts on the built and natural environment that will be seen from global to local levels. The Summer Village of Ghost Lake (SVGL) has a role to play in building the resilience

The Summer Village of Ghost Lake will build capacity within its means wherever possible, to ensure that our community and its residents remain safe, resilient, responsive, and self-sufficient, in the face of a changing climate for generations to come.

of Canadian communities, and the community recognizes the need to prepare for these potential impacts and is committed to increasing its resiliency to the effects of a changing climate. It is crucial that communities of all sizes prioritize resilience to climate impacts even though there is still uncertainty about where, when, and how severe these impacts may be. This planning exercise has set out to reduce some of this uncertainty for SVGL, so that staff and residents can continue on a journey to learn what works, what doesn't, and what actions can be taken to remain resilient in the face of such uncertainty.

To address this need to prepare for the potential impacts of climate change, the Summer Village of Ghost Lake retained Morrison Hershfield to develop a Climate Resilience and Adaptation Plan. Acknowledging that SVGL values self-sufficiency and citizen action, this Plan is intended to achieve a balance between governance and community approaches, prioritizing multi-solving solutions and actions with co-benefits wherever possible to help overcome the capacity and resourcing challenges that come with being a small rural municipality. To facilitate an effective climate adaptation planning process for the Summer Village of Ghost Lake, this Plan is centered around 4 key pillars of the community:

- Municipal Buildings & Services
- Homes & People
- Parks, Greenspace, & Recreation
- Water

This Plan will assist the Summer Village of Ghost Lake in understanding how the climate is projected to change into the future and to prioritize climate change resilience actions that have been determined to address significant climate change impacts on the four community pillars. Further, it is designed to build the capacity of the Summer Village of Ghost Lake's staff and residents to be able to assess their actions through the lens of a changing climate and ensure that projected future climate conditions are adequately considered during decision-making. The plan includes a complete climate profile for the Village outlining future predicted climate conditions as well as highlighting potential climate related hazards to the Village. Using these predictions, a risk assessment of the Village's municipal and community infrastructure and operations was conducted. Elements at risk in the Village were identified and adaptation actions were recommended to address these risks.

For the Summer Village of Ghost Lake, climate adaptation planning needs to prioritize actions that reduce the negative impacts of climate change and protect individuals and community resources from said impacts; all with an eye to remaining practical, affordable, and implementable for a small community with limited capacity and resources. To this end, the risk assessment was conducted by Morrison Hershfield engineers and specialists in their respective fields, followed by the development of adaptation actions and risk treatment options. This Plan will support SVGL in identifying and implementing local actions to manage the risks stemming from these changes as well as capitalize on opportunities that may present, to ensure the community is resilient in the face of a changing climate.

This Plan identifies 20 key priority actions the Summer Village of Ghost Lake could implement to increase the community's resilience in the face of a changing climate while respecting existing capacity and resource limitations, as well as retaining valued community attributes. Many of these actions build upon and are supported by the analysis and actions already contained within the SVGL's Municipal Development Plan and Sustainability Plan. Small investments in actions that help reduce vulnerability and risk can result in many social, economic, and environmental co-benefits. The actions presented in this Plan are not mandatory, but it is recommended that SVGL prioritize the implementation of these actions recognizing that the community is vulnerable to climate change, and there are steps that can be taken to become more resilient to climate change impacts.

ACKNOWLEDGEMENTS

Land Acknowledgement

The Summer Village of Ghost Lake respectfully acknowledges that our community is located on the traditional lands of the Stoney Nakoda peoples of the Chiniki, Bearspaw and Wesley Bands, the Tsuut'ina, the Niitsitapi (Blackfoot) peoples of Siksika, Piikani and Kainai Band.

Morrison Hershfield Team

Clarissa Huffman - Climate Risk Project Manager

Alexander Templeman - Climate Risk Analyst

Joelle Doubrough - Senior Climate Risk Analyst / Environmental Planner

Andrew Harkness - Director, Climate Change Practice Lead

SVGL Staff

Mustafa Hashimi - Chief Administrative Officer

Hassan Saeed - Planning and Development Technologist

This project was funded by the Municipal Climate Change Action Centre (MCCAC).

MCCAC was established in 2009 as a partnership initiative between the Alberta Municipalities, Rural Municipalities of Alberta, and the Government of Alberta. They provide municipalities, schools, and non-profit community related organizations with support, technical assistance, and funding programs to implement energy efficiency and renewable energy projects that reduce greenhouse gas emissions and energy costs while increasing community resilience.

DEFINITIONS

Climate Parameters: Broader categories of measurable climate conditions in relation to which specific climate hazards or indicators can be defined. Climate parameters include temperature, precipitation, sea-level rise, wind, etc. (PIEVC, 2021)

Climate Hazard: A specific impactful event related to the broader climate parameter category. (PIEVC, 2021)

Climate Hazard Indicators: Specific climate values (TMax > 35°C; Precip > 100mm; Freezing Rain > 30 mm, etc.) that are defined by their ability to impact an infrastructure system or component (i.e., exceed a threshold) (PIEVC, 2021)

Cooling Degree Days: The annual sum of daily mean temperature above 18°. It indicates the amount of cooling that may be required to maintain comfortable conditions within a building during hotter/warmer months. Cooling degree days are calculated by measuring the difference between the daily mean temperature and the threshold of 18°C. Each degree above the threshold equates to one cooling degree day. (For example, a daily mean temperature of 21°C would equate to 3 cooling degree days for that day.) The summation of all cooling degree days is then taken to provide the annual number of cooling degree days in a year.

Freeze-Thaw Conditions: Conditions resulting from air temperature fluctuating between freezing and non-freezing temperatures.

Global Climate Models: Complex mathematical representations of the drivers of earth's climate system such as the atmosphere, oceans, land surface, ice, and their interactions at the global scale. Used in the study of global climate system dynamics and the prediction of future climate scenarios.

Heat Wave: For the purposes of this assessment, heat waves are defined as three consecutive days of 30°C or higher.

Heating Degree Days: The annual sum of daily mean temperature below 18°C indicates the amount of heating that may be required to maintain comfortable conditions within a building during colder/cooler months. Heating degree days are calculated by measuring the difference between the daily mean temperature and the threshold of 18°C. Each degree below the threshold equates to one heating degree day. (For example, a daily mean temperature of 15°C would equate to 3 heating degree days for that day.) The summation of all heating degree days is then taken to provide the annual number of heating degree days in a year.

Invasive Species: Species of flora and fauna that are not native to the given region they are found in.

Regional Climate Models: Downscaled from global climate models, regional climate models are complex mathematical representations of the drivers of the earth's climate system and their interactions at a regional level.

Representative Concentration Pathways: Representative Concentration Pathways (RCPs) represent predictions of future greenhouse gas emission scenarios. Developed by the IPCC and used in the AR5 and AR6 reports, each pathway has representative risks and impacts based on the associated amount of predicted net emissions. The most common scenarios used are RCP2.5, RCP4.5, and RCP8.5 representing low, moderate, and high emission scenarios, respectively. RCP8.5 high emissions scenario was used as the basis for climate data used in this report as it currently represents the most likely emissions pathway and associated impacts.

Tropical Nights: Describes days where the minimum temperature does not fall below 20°C during the night.

Uncertainty in Climate Data: While it is known with certainty that the climate is changing and will continue to change, the complex nature of the climate system leads to a level of uncertainty when trying to predict specific climate parameters at a given place and time. Uncertainty in climate predictions comes from several sources such as natural climate variability, and uncertainties within the emission scenarios related to potential future human, policy, and industrial trends. To mitigate this uncertainty, an ensemble of models and emission scenarios are used to capture the range in model outputs.

Urban Heat Island: A metropolitan area that has consistently higher temperatures than surrounding areas. This effect is due to factors of the urban environment such as lack of vegetation, and low albedo of building and road materials.

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APPENDICES

APPENDIX A: Detailed Climate Profile

APPENDIX B: Detailed Climate Risk Assessment Methodology and Results

1. CALL TO ACTION

Data and research continue to demonstrate that climate change is already impacting our communities and that these impacts are expected to continue to increase in rate and intensity. While some of these impacts may be difficult to quantify with certainty, especially for smaller communities with limited resources, it is important to act now, even in the face of uncertainty. Climate change is a global challenge which requires collective local action to address the degree of change and adapt to the changing climate and its associated impacts; the Summer Village of Ghost Lake (also referred to within as 'SVGL' and 'the Village') has a role to play in building the resilience of Canadian communities.

Acknowledging that SVGL values self-sufficiency and citizen action, this Plan is intended to achieve a balance between governance and community approaches, prioritizing multi-solving solutions and actions with co-benefits wherever possible to help overcome the capacity and resourcing challenges that come with being a small rural municipality.

SVGL VISION

The Summer Village of Ghost Lake will build capacity within its means wherever possible, to ensure that our community and its residents remain safe, resilient, responsive, and self-sufficient, in the face of a changing climate for generations to come.

1.1 Climate Change

Climate change refers to long term shifts in atmospheric conditions such as temperature and weather systems (IPCC, 2001). These changes are mainly driven by the addition of greenhouse gases to the atmosphere (IPCC, 2001). These greenhouse gases trap heat in the atmosphere leading to an increase in average global temperatures and shifts in weather systems. The Canadian prairies, including Alberta communities, have seen higher rates of warming when compared to other regions of southern Canada (Sauchyn et al., 2020).

Community responses to climate change fall generally into two broad categories: mitigation (reducing our inputs to climate change) and adaptation (responding to impacts caused by a changing climate). This is summarized in Figure 1. Increasingly, actions that achieve emissions reductions while simultaneously helping communities adapt to climate change are preferred in order to maximize efficiency; this emerging work is called low-carbon resilience, as illustrated in the middle portion of the Venn Diagram (Figure 1).

Historic and existing greenhouse gas emissions have already resulted in observed changes to our climate resulting in impacts that we must respond to (Canadian Institute for Climate Choices, 2020). Examples of climate change hazards include but are not limited to increases in wildfire events, increases in flooding frequency and intensity, more intense droughts and water scarcity issues, more severe and frequent storm systems, human health impacts, and a loss in biodiversity (IPCC, 2022). These changes in climate change hazards will have significant impacts on people, infrastructure, and natural ecosystems.

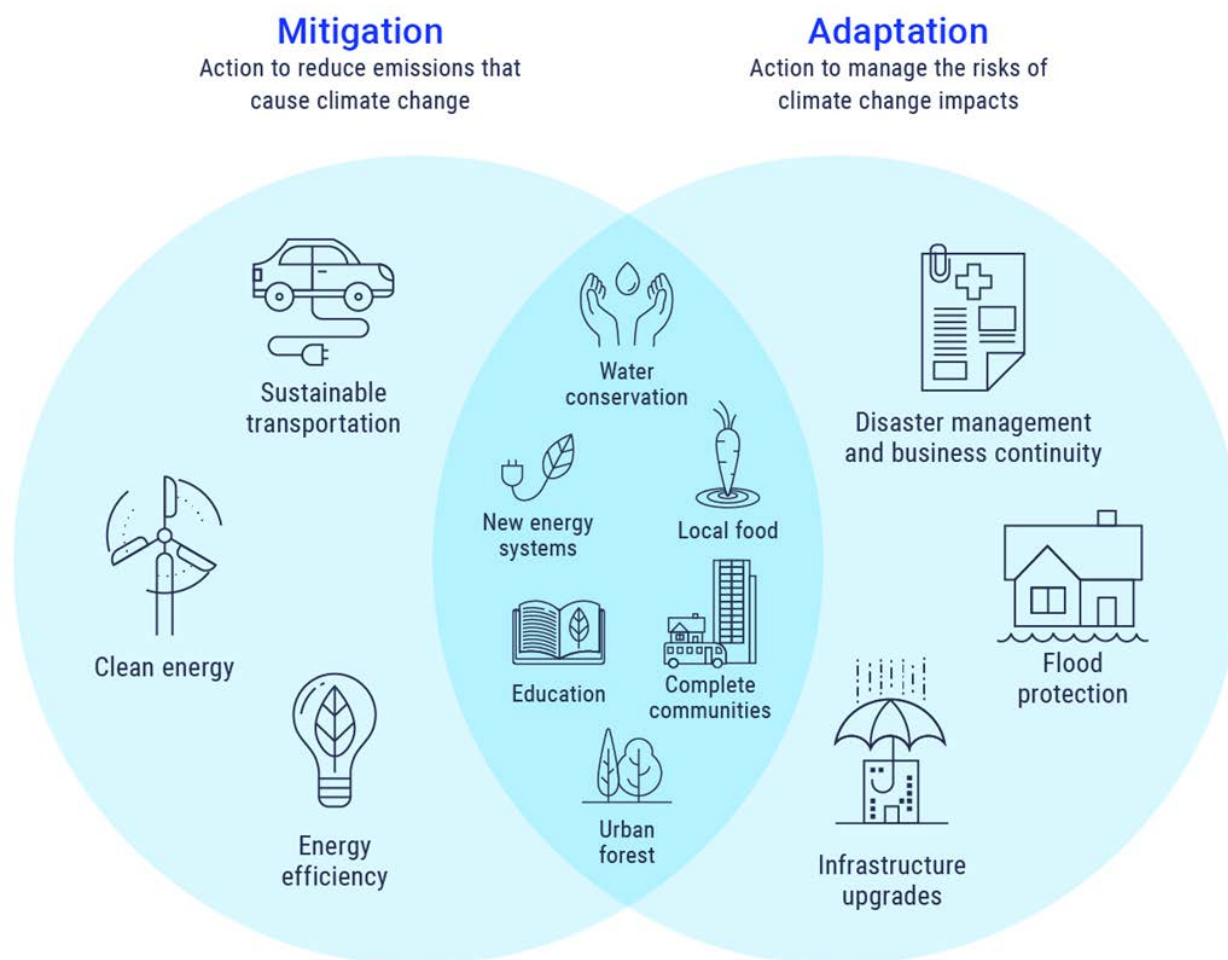


Figure 1: Climate Change Adaptation and Mitigation (Sauchyn et al., 2020)

1.2 Regional Climate Context

Climate related impacts will be felt globally by communities of all sizes including the Summer Village of Ghost Lake. For example, the southern Prairies, including the Bow River watershed, typically have a more limited and variable water supply compared to other Prairie regions, relying largely on groundwater (Sauchyn et al., 2020). Further, the 2013 flooding in Calgary and the 2016 wildfire in Fort McMurray were two of the most expensive disasters in Canadian history, and many Prairie communities are working to adopt and implement policies and programs to build resilience in response to these extreme types of events (Sauchyn et al., 2020). Other potential climate hazard impacts predicted to impact the Village include extreme heat, wildfire, and wind and storm events. To best deal with these changes and impacts, proper planning and adaptive measures must be taken.

SVGL's geographic context is shown in Figure 2. This report aims to outline potential climate related hazards and interactions and their associated impacts on the Summer Village of Ghost Lake. Recommendations to adapt to these impacts within the context of what is possible and realistic for a small community with limited resources and capacity are included. With proper knowledge and planning the Summer Village of Ghost Lake can increase its resiliency to potential future climate related hazards.

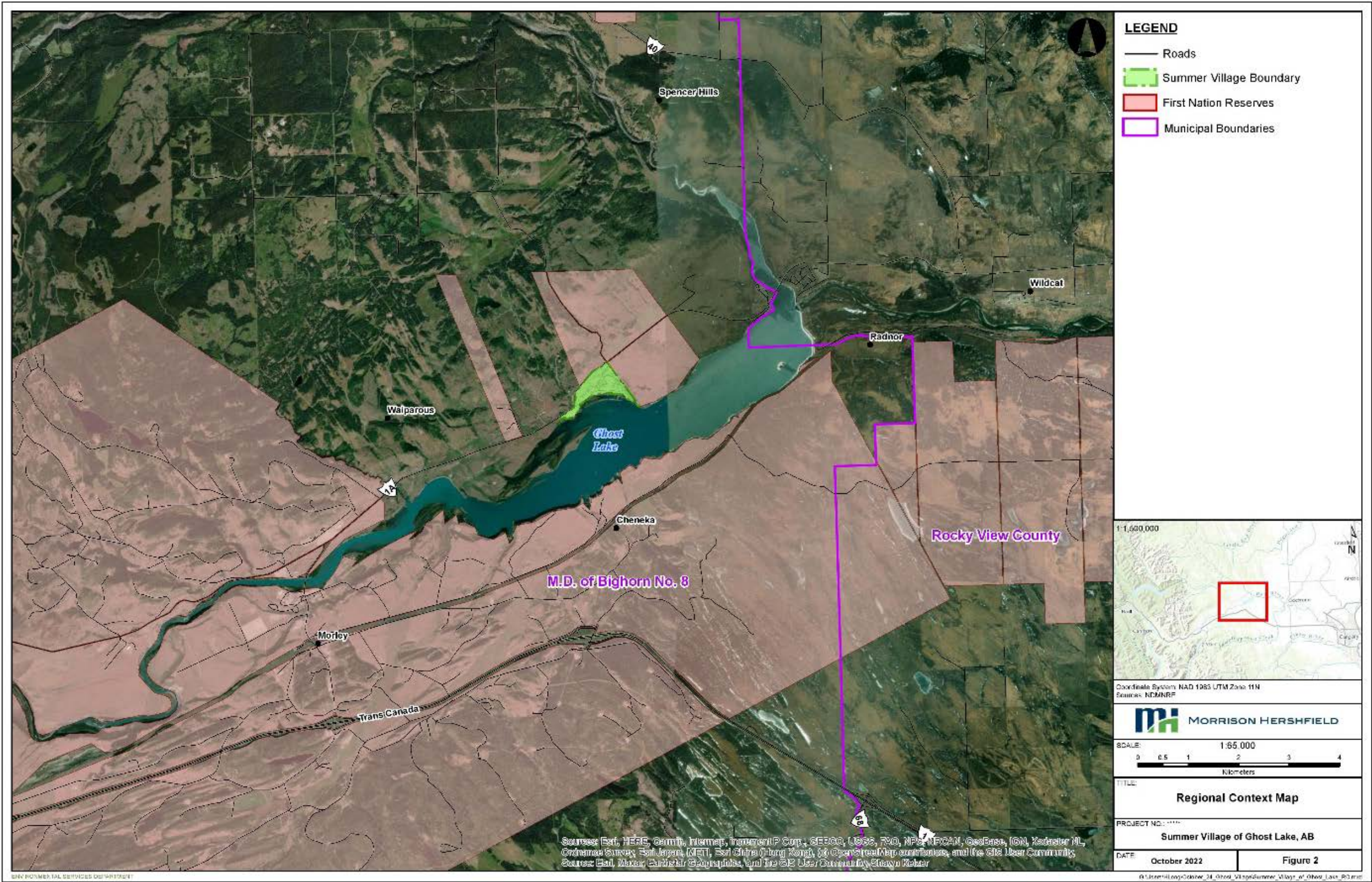


Figure 2: Regional Context Map

1.3 Climate Adaptation for Summer Village of Ghost Lake

Climate adaptation planning is a process for us to identify current and potential climate change impacts and establish a working plan to proactively (wherever possible) respond to these impacts and to better prepare our community, natural spaces, buildings, and infrastructure to climate change impacts. The adaptation planning process also allows communities to take advantage of opportunities by prioritizing co-benefits and multi-solving solutions. Climate resilience, in a nutshell, is the ability to prepare for, recover from, and adapt to, disturbances caused by climate change impacts.

Co-Benefits: Beneficial outcomes that are not directly related to climate change. Examples of co-benefits to climate adaptation might include healthier green spaces and wildlife habitat, improved air and water quality, creation of new job and economic development opportunities, or an increased sense of place/community cohesion.

Multi-Solving Solutions: Working across diverse silos and sectors of our community to develop solutions that contribute to solving more than one issue at a time. For example, tree planting initiatives help to reduce GHGs in the atmosphere through carbon sequestration, can decrease energy consumption due to shade, reduce urban heat island effect, and have a positive impact on stormwater management efforts.

While climate change is a global concern, it requires local attention, as many of the most effective actions we can take to become more resilient to climate change are within the jurisdiction of local governments. Actions we take today to respond to climate change can influence how our communities respond to impacts in the future; therefore, it is important to use this process as a starting point to adopt a climate lens, where climate considerations are a part of all decision-making processes.

To facilitate an effective climate adaptation planning process for the Summer Village of Ghost Lake, this Plan is centered around 4 key pillars of the community

(Figure 3). These 4 pillars will be further defined and explored throughout the Plan.



Photo 1: Image of the Study Area



Figure 3: Four Pillars of Climate Change



Successful climate action will require the integration of climate considerations into municipal decision-making and planning processes, including decisions about infrastructure and services. This is most effective when climate adaptation is included as a key consideration or policy goal at the very beginning of a planning process. This section will look at the key buildings, infrastructure, and service offerings owned and maintained by the Summer Village of Ghost Lake. For example:

- SVGL owns and maintains one multi-functional community building.
- Roads in the community are owned by the province but are maintained by SVGL.
- SVGL relies on porous local soils, low development density, and a rural road cross-section design with open drainage ditches and culverts for stormwater management.
- SVGL collects municipal solid waste (garbage) for disposal at a landfill site in Calgary. Recycling and yard waste are also collected and disposed of at the appropriate facilities.



This Plan will consider climate risks that may impact these assets and services, as well as actions that can be taken to increase resilience so that SVGL can continue to offer the level of service expected by residents. The Plan will further have consideration for expanding 'green' initiatives, as these types of initiatives were previously identified as an area of interest during community engagement for the Sustainability Plan and the Municipal Development Plan.



Homes & People

The majority of developed land in SVGL is residential, with single detached dwellings occupying the majority of lots. Effective climate adaptation actions will consider how to support the people living in the community, as well as the homes they live in, to become more resilient to climate change impacts. Current building design is based on historic climate conditions and may not be as suitable under future climate conditions. This may impact:

- Residents financially through increased cooling costs
- Comfort and well-being in extreme heat events
- Physical assets, such as leaks in homes
- Water quantity in domestic use groundwater wells



Photo 2: Image of Study Area

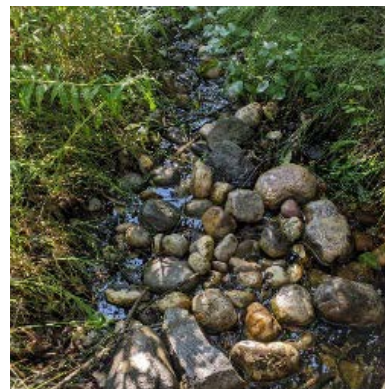
These impacts can be reduced through proper planning, monitoring, and implementation of suitable resiliency measures. As noted in the Village's Municipal Development Plan, the population of SVGL is not expected to grow. This will allow SVGL to prioritize keeping existing infrastructure and residents safe and resilient to future climate impacts.



Parks, Greenspace, & Recreation

Natural spaces are very important to the community, and there is an interest to preserve remaining vacant land in a naturalized state. The following elements of natural spaces are identified as socio-culturally significant in the Summer Village of Ghost Lake include:

- Wetland and decorated trails
- Sensitive fescue grasslands
- Wooded areas with walking trails
- Waterfront with bird nesting areas
- Undeveloped natural areas



Forest, grassland, and parkland ecosystems are expected to shift at variable rates due to climate change, with disturbances such as development and the success of adaptation actions affecting the rate of change (Sauchyn et al., 2020). However, when managed well and given space to function as intended, natural systems can also have strong multi-solving properties (Eyquem et al, 2022). SVGL is in an ideal position to leverage these benefits as a component of their climate response by looking to the ecosystem services and resilience solutions that can reduce capacity constraints and increase efficiency. Finally, recreational opportunities such as parks & leisure areas, the golf course, and the Ghost Lake reservoir are all part of this pillar, as they are impacted significantly by the health and resilience of the natural systems that support them.



Water

There is no municipal or common water system in SVGL. Instead, water is obtained from private wells and cisterns located on individual properties. Sewage is also handled through private systems, typically traditional septic tank and tile field systems or holding tanks. As previously mentioned, the southern Prairies are susceptible to variations in water availability, which will be a key consideration for SVGL moving forward. Hydrological drought (or low water tables) can impact municipal water supplies relying on groundwater. However, the extensive management of water flows in this region makes it difficult to tell whether changes and impacts are caused by climate change or other human-induced strains on water systems (e.g., development pressures). SVGL will also want to consider the impacts of:

- Heat waves
- Increased average temperatures
- Longer snow-free periods on surface water levels (such as the community's wetland areas)

1.4 This Plan

This Plan is designed to build the capacity of the Summer Village of Ghost Lake's staff and residents to be able to assess their actions through the lens of a changing climate and ensure that projected future climate conditions are adequately considered during decision-making.

To be able effectively plan for climate adaptation and resilience, it is important to understand what climate hazards could potentially impact the community, and what elements of the community are most at risk. From there, conceptualization on how to use this information to plan for and respond to these risks can begin.

Determination of climate risk requires looking at:

- What hazards could potentially impact the community
- What elements of the community are exposed to these hazards
- The likelihood that the exposure will happen

Consideration of the above, informs an understanding of community vulnerability. We then look to understand the consequences of the interaction or understanding the significance of, say, the indirect effects of wildfire impacts like air quality on recreational resources like the golf course or beachfront. The output of this process is an understanding of the overall climate risk. Finally, we can use the results of this risk assessment to frame out the community's plan to respond to these risks, including what we need to do and how we need to do it. This framework has been carried through in the layout of this Plan, with the remaining sections of this report containing the information as follows:

- **Section 2** describes the methodology of this process in more detail.
- **Section 3** describes the climate profile, including the potential climate hazards that were assessed and the data that supports the decision to include or exclude certain hazards from the risk assessment and resilience planning process. It also explores the planning context of this report, including exploring the Summer Village of Ghost Lake's Municipal Development Plan and Sustainability Plan to set the stage for climate adaptation planning.
- **Section 4** describes the overall results of the climate risk assessment process.
- **Section 5** lays out the most significant actions that the Summer Village of Ghost Lake can implement over the short-medium term to increase the community's resilience to a changing climate
- **Section 6** outlines the various resources required to achieve the actions identified in Section 5.
- **Section 7** provides some commentary on next steps, including how to evaluate success and keep this Plan relevant over time.

2. DEVELOPING THE PLAN

2.1 Methodology

The climate adaptation and resilience planning process used to develop this Climate Adaptation Plan generally followed the approach described in the All One Sky Climate Express Process (All One Sky, 2021), the Climate Lens General Guidance (Infrastructure Canada, 2019), and the PIEVC High Level Screening Guide (PIEVC, 2021).

This Plan will assist the Summer Village of Ghost Lake in understanding how the climate is projected to change into the future and to prioritize climate change resilience actions that have been determined to address significant climate change impacts on the four community pillars. This Plan will support SVGL in identifying and implementing local actions to manage the risks stemming from these changes as well as capitalize on opportunities that may present, to ensure the community is resilient in the face of a changing climate. Figure 4 shows the 4-step process followed in to complete this Plan, with each step further described in the subsections that follow, and Figure 5 shows the Village boundary, which largely informs the study area. The main exception is the beach area and marina, which is not part of the Village but is culturally and socially significant.



Figure 4: Climate Adaptation Planning Process



Figure 5: Map of the Summer Village of Ghost Lake

2.1.1 Step 1: Define Scope and Collect Data

2.1.1.1 Scope of the Assessment

The first step of the climate action planning process is to define the scope. As part of this scoping, several decisions needed to be made very early on. The following determinations were made to inform the scope of the project:

- A higher-level screening and a simple process would be most suitable for the Summer Village of Ghost Lake, as a very small community with limited staff and resources.
- The process was designed to be shorter in duration so that it could be completed in a few months, allowing SVGL to spend limited time and resources as efficiently as possible.

The Plan and associated climate risk assessment would be qualitative in nature, based on secondary research and the planning documents that SVGL has already published. This approach required limited public engagement, though the project team worked to keep SVGL staff and community members informed as the project proceeded.

2.1.1.2 Defining Community Elements

To define the community elements that are valued and should be included in the Plan, the project team used existing planning documents and publicly available research in collaboration with SVGL project representatives. These community elements will be explained in greater detail in the following sections. For an initial example, during this process we identified that water supply was a major concern, particularly considering that as the reservoir levels change, this can impact well water, and considering a lack of pressurized water in the event of a wildfire. We also learned that while riverine flooding is a common concern in many Canadian municipalities, this is not particularly relevant for SVGL due to the village's siting on a controlled reservoir. These are all important considerations for the scoping. We also learned that hazards of particular concern include extreme heat, drought events, and wildfires. These community concerns help us to ensure we scope the risk assessment appropriately.

Finally, to perform the climate risk assessment in Step 2, we needed to know how the climate in SVGL is projected to change in the future. The final activity in the scoping exercise was to compile this information. A detailed description of the climate data synthesized for the Summer Village of Ghost Lake can be found in Section 3.2.

2.1.1.3 Climate Change Projection Data

The climate risk assessment process started with a series of climate impact statements which described the links between the projected changes and the related hazards that have the potential to impact SVGL now and into the future. During this step of the process, the project team defined the scope and timescale of the climate related data that would inform the temporal boundaries for the assessment. The assessment used two climate change projection time horizons (historic and projected future (2080s)), following standard best practice by applying Representative Concentration Pathway (RCP) 8.5 as a high future global GHG emissions scenario. The 2080 time period was selected given the lifespan of the infrastructure in the Village and to facilitate long term planning. Since shorter timeframes were not considered, for

this reason, near term impacts were not captured in the assessment. Climate Atlas and ClimateData.ca were primary sources for climate data, as they present an amalgamation of climate science outputs and modelled climate projections and are supported by the Canadian Centre for Climate Services of Environment and Climate Change Canada.

The result of this exercise presents a picture of how the climate is expected to change in the SVGL under a continued high GHG emissions scenario, through to the time horizon of the 2080s. The full climate profile can be viewed in APPENDIX A.

2.1.2 Step 2: Assess Risks and Opportunities

In Step 2, the project team collected information relevant to the scope of work to further understand the interactions between valued community elements, and climate hazard indicators. With support from our team of technical specialists, the project team used this collected data to conduct a climate risk assessment. For a more detailed breakdown of risk assessment methodology including definitions and limitations please refer to APPENDIX B.

Using likelihood and consequence rating systems, the project team qualitatively assessed climate risks.

$$\text{Risk} = \text{Exposure (E)} \times \text{Likelihood (L)} \times \text{Consequence (C)}$$

Exposure: Exposure of a valued community element to a specific climatic condition. Exposed elements receive a score of 1 with non-exposed elements receiving a score of 0. This results in non-exposed elements to “screen out” of the assessment.

Likelihood: The likelihood of a particular climate event occurring during a specific time-period. Based on observed trends and climate projection data with scores between 1-5. Existing conditions typically receive a score of 3. Similar future conditions, receive a similar likelihood score; increasing climatic trends receive an increased likelihood score; decreasing climatic trends receive a decreasing likelihood score.

Consequence: The potential consequences/severity of an interaction arising from the climate event exposure. These scores were determined in the risk assessment workshop by relevant technical leads at MH. Scores are between 0-5 with 0 being no consequence and 5 being very high consequence.

Interaction: The relationship between a given climate hazard and community element where an exposure has been identified.

A simple numeric rating system was defined for each likelihood and consequence to generate a qualitative risk analysis for each community element.

First, each element was assessed to determine if it had the potential to be exposed to the climate hazard. If no exposure was anticipated, the element was ‘screened out’ of the assessment. Where exposures were identified, the pre-assigned likelihood scores were applied (Table 1).

Likelihood scores were assigned using the ‘middle baseline’ approach. This means that current/recent climate considerations received a score of 3. When comparing to future projected conditions to the future time horizon of the 2080s, the degree of change from the baseline was considered. Reductions in intensity or frequency will receive scores lower than 3, while increases in intensity or frequency receive higher scores, with degree of change in likelihood scores dependent on the degree of change in climate trends. In some cases, where future conditions are projected to stay roughly the same, the likelihood will not change. Next, the project team assigned consequence scores. This process was conducted using a facilitated workshop approach, where the team of subject-matter experts systematically assessed each interaction to determine the potential exposure and associated consequences of each community element to a given climate hazard (Table 2). When assigning consequence scores, consideration of the various ways that a community element might be impacted by a potential exposure to a climate hazard was included. If a score was low for one community response consideration, but moderate for another, the more conservative (higher consequence) score was applied.

Table 1: Likelihood Score Definitions (PIEVC HLSCG, 2021)

LIKELIHOOD SCORE	PIEVC HLSCG METHOD	RATIONALE
1 – VERY LOW	Unlikely	5-100% reduction in frequency or intensity when compared to baseline mean
2 – LOW	Likely to occur less frequently than current climate	10-50% reduction in frequency or intensity when compared to baseline mean
3 – MODERATE	Likely to occur as frequently as current climate	Baseline mean conditions or a change in frequency and intensity $\pm 10\%$ when compared to baseline mean
4 – HIGH	Likely to occur more frequently than current climate	10-50% increase in frequency or intensity when compared to baseline mean
5 – VERY HIGH	Almost certain to occur	50-100% increase in frequency or intensity when compared to baseline mean

Table 2: Consequence Score Definitions (Adapted from PIEVC HLSCG, 2021)

CONSEQUENCE SCORE		
1	Very Low	Insignificant
		Little to no financial loss or increase in operational plan/operational expenses. Little to no impact on cohesion, or health and safety of residents. Little to no impact on green spaces and water supply.
2	Low	Minor
		Additional operating costs or small financial loss. Small changes in site operations and maintenance. Small impact to cohesion, or health and safety of residents. Small impact to green spaces and water supply.
3	Moderate	Moderate
		Moderate financial loss. Significant changes in operations and maintenance/operating expenses/repairs. Moderate impact on cohesion, or health and safety of residents. Moderate impact on green spaces and water supply.
4	High	Major to Serious
		Impact to load capacity. Major financial loss. Closure for repairs (short-term or extended). Major impact to cohesion, or health and safety of residents. Major impact on green spaces and water supply.
5	Very High	Hazardous to Catastrophic
		Complete loss of function. Extreme financial loss. Partial or full rebuild required. Extreme impact to cohesion, or health and safety of residents. Extreme impact on green spaces and water supply.

Community response considerations assist in examining how exactly a community is vulnerable and to what extent climate change or extreme weather events might affect its built, natural, and social components. Figure 6 outlines some of the community response considerations that were considered in the determination of potential consequences within the context of this assessment.

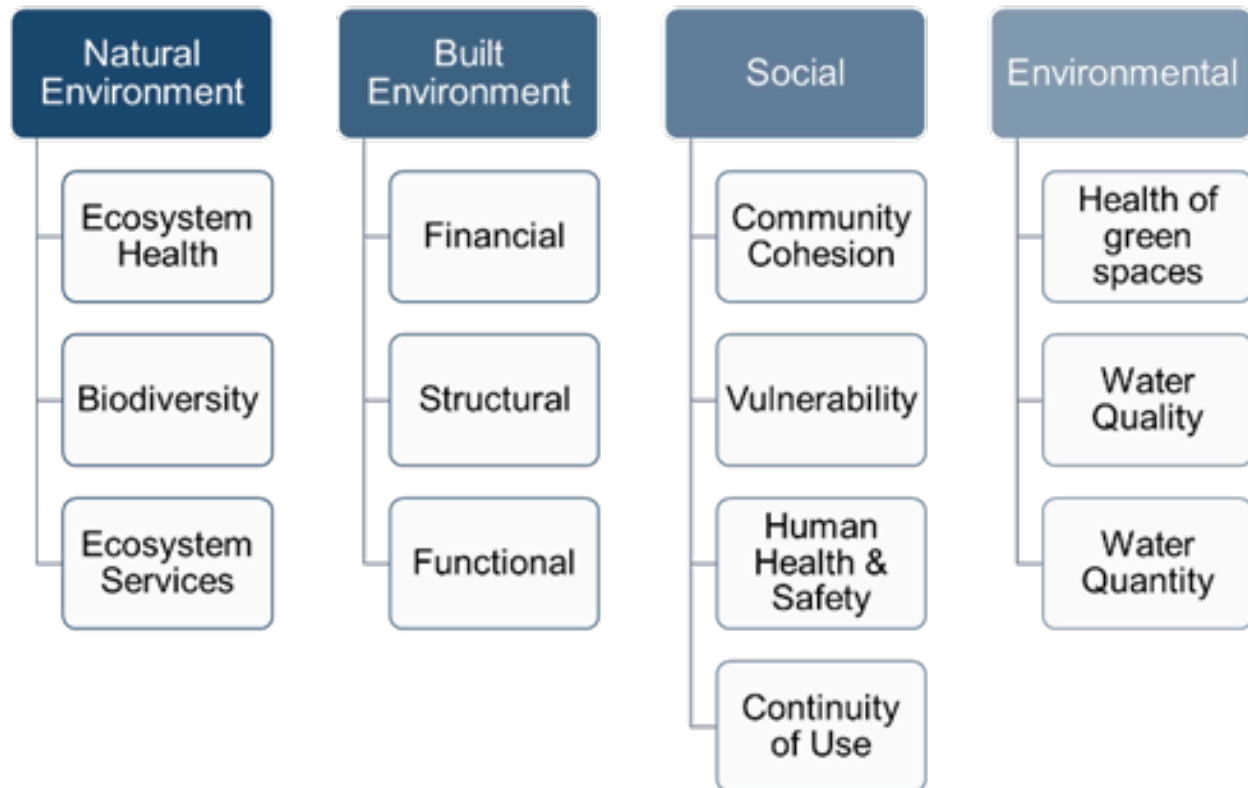


Figure 6: Community Response Considerations

The results of the consequence and likelihood scoring exercise are combined at this stage to generate an overall risk rating for each climate impact interaction. Putting all of this together, each interaction was assigned a qualitative risk score based on the relationship between exposure, likelihood, and consequence. A matrix was used to assign the category of risk, as shown in Figure 7.

Risk ratings can be defined as follows:

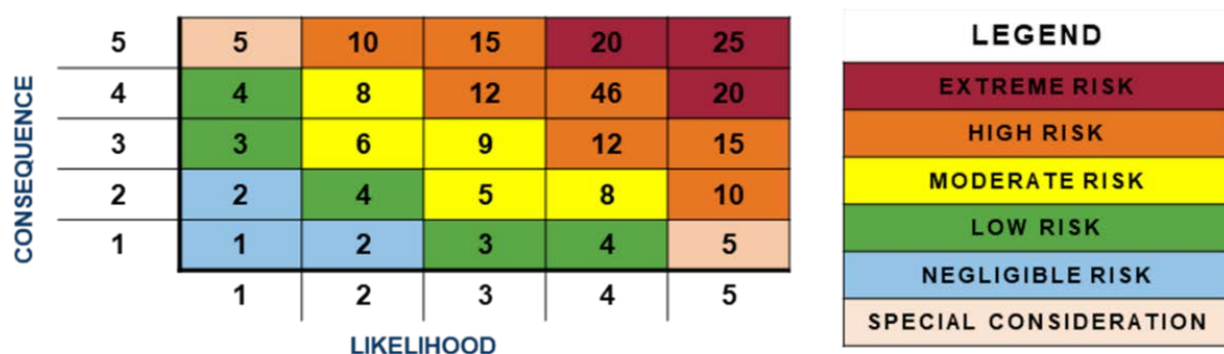


Figure 7: Risk Score Matrix

Our analysis has considered how SVGL might be able to prepare for higher consequence interactions/risks in ways that support the prioritization of limited resources while limiting the negative consequences of a potentially damaging or catastrophic event.

Negligible Risk (Risk Scores Between 1 and 2): Risk events do not require further consideration.

Low Risk (Risk Scores Between 3 and 4): Risk requiring minimal action. Controls are not likely required.

Moderate Risk (Risk Scores Between 6 and 9): Risk that may require further action. Some controls may be required to reduce risks to lower levels.

High Risk (Risk Scores Between 10 and 19): Risks that require action. High-priority control measures may be required.

Extreme Risk (Risk Scores Between 20 and 25): Risks that require immediate action. Immediate controls may be required.

Special Consideration: Describes two unique scenarios. Low likelihood and high consequence interactions would consider events such as tornados, where the likelihood of a direct hit is very low, but the overall consequence could be catastrophic; and high likelihood low consequence events such as ongoing deterioration of elements resulting from continued exposure to various climatic conditions.

2.1.3 Step 3: Action Planning

Identifying resilience strategies, categorizing them, and prioritizing them is the final step in the climate change adaptation and resiliency planning process. Through this Plan, risk treatment and adaptation actions were developed for interactions that fall into high and extreme risk categories. Low-moderate items as well as special consideration items have been flagged for reference for monitoring by SVGL into the future, but are not carried forward into the action planning stage in order to focus limited resources and capacity on the highest risks. Step 3 consisted of the following components:

1. Identifying actions to reduce or avoid the harmful consequences of priority climate risks. Our team reviewed each of the high and extreme risks and proposed a series of action items that could be implemented to address each one. Recognizing that a consolidated, streamlined list of actions was a stated priority for SVGL, this long list of actions was then consolidated by looking for areas of efficiency and actions that could be merged or modified to reduce duplication and high crossover.
2. Evaluating actions against key decision criteria and implementation considerations to help determine priorities for implementation. These decision criteria include order of magnitude cost and complexity level. Additionally, an aggregated order of magnitude priority level was developed, which combined both professional judgement and community perspectives on relative priority level. Community perspectives on relative priority level were identified during a virtual engagement session with Council members, staff, and community members in attendance.
3. Characterizing priority actions and developing an implementation plan. Based on the order of magnitude implementation considerations identified above, a detailed implementation plan was developed for the consolidated list of community actions, including identifying one key priority per pillar.

2.1.4 Step 4: Implementation

Step 4 is where the Summer Village of Ghost Lake will take the information that has been synthesized as part of this project, and the implementation plan that was subsequently developed, and begin to take action to increase the community's overall resilience in the face of a changing climate. Implementation should be monitored to assess the success of the action and ways to improve in the future.

3. DATA COLLECTION

The climate data most relevant to the SVGL, including past and historic events that informed plan development, are included within this section of the report. The section also explores the Summer Village of Ghost Lake planning context with the intent of highlighting existing policy language that can help inform climate action and create efficiencies between the various plans. Finally, it summarizes the community elements that were analyzed during this Plan as being material to SVGL's climate response.

3.1 Community Elements

Elements were chosen based on discussions with the Summer Village of Ghost Lake, review of the Village's municipal documents such as the Municipal Development Plan (SVGL, 2020) and the Village's Sustainability Plan (SVGL, 2012) as well as input from relevant MH staff. A summary of the community elements included in the analysis is shown in Table 3. The development of the community elements list was also supported by a site visit to SVGL on August 24, 2022. The visit helped to inform an understanding of historic exposures, responses, and existing conditions of the community elements included in the assessment. Elements included in this assessment as well as their descriptions and reason for inclusion can be seen below in Figure 8.

As described in Section 2.1, these community valued elements formed the basis of the climate risk assessment. Each community element was assessed against the relevant climate hazards as described in Section 3.1. In Step 3 of the climate adaptation planning process, adaptation measures proposed for each interaction that was classified as a high or extreme risk. Types of adaptation measures considered for this assessment include but are not limited to those shown in Figure 8.

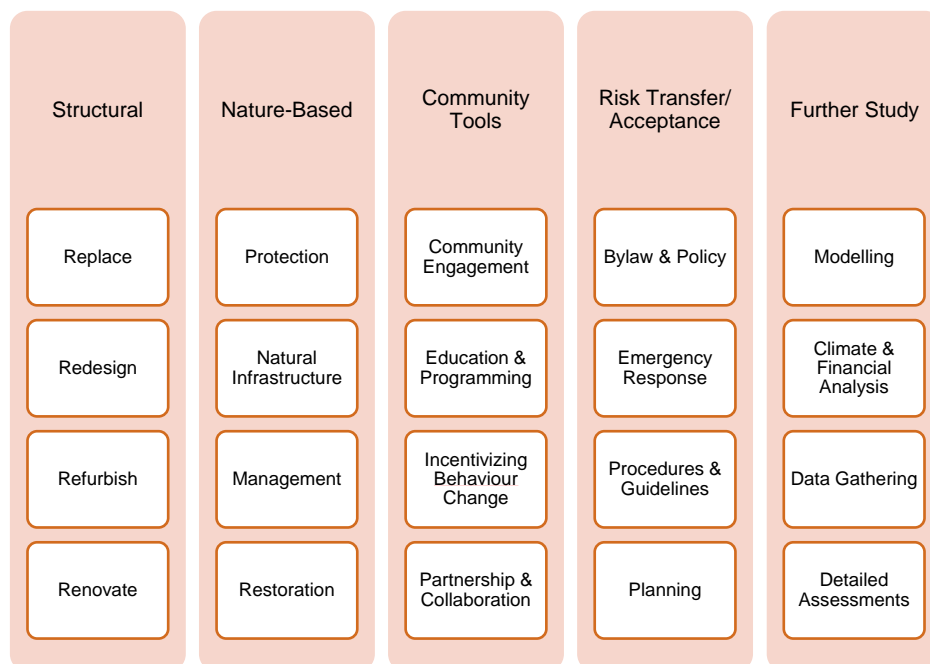






Figure 8: Types of Adaptation Actions

Table 3: Summary of Community Elements Included in Assessment

Community Pillar	Element	Description	Reason for Inclusion
 Municipal Buildings & Services	Community Hall	SVGL Community Hall	The Community Hall is noted as the main social hub and meeting hall for the Village.
	Municipal Services	Garbage collection, etc.	Services to the community may be impacted by future climate conditions.
	Roads & Stormwater Management	Overland Drainage, Ditches, Culverts, etc.	Provides essential civil services to the community which may be impacted by future climate conditions.
	Leased Property	Leased Property from TransAlta	Leased property may have different operation and maintenance procedures.
	Management & Changes Outside of Village Control	Forest Management, Reservoir Management, etc.	Certain impacts may fall outside municipal control but are still significant to consider, particularly when identifying adaptation actions.
 Homes & People	Staff	Municipal Staff	Health, safety, and overall working conditions for staff may be impacted by future climate conditions.
	Residents	SVGL Residents (Local and Tourist)	Health, safety, quality of life, and overall well-being of residents may be negatively impacted by changes in climate conditions.
	Residential Buildings	Building property of SVGL residents	Building infrastructure of residents in the Village may be vulnerable to changes in climate conditions.
	Residential Soft and Hard Landscaping	Hard and soft landscaping infrastructure of SVGL residents	Hard and soft landscaping elements on residential property may be impacted by future climate conditions.
	Private Septic Systems	Septic systems of SVGL residents	Provides civil services to the community and may be impacted by future climate conditions.

Community Pillar	Element	Description	Reason for Inclusion
 Parks, Greenspace, & Recreation	Golf courses	Specific purpose greenspace area for golfing and walking activities.	Provides recreational activities for the community. Natural areas may be impacted by future climate conditions.
	Marina	Sheltered Marina for docking boats.	Provides shelter for resident boats and provides access to related recreational activities to the community. Noted as important infrastructure in the Municipal Development Plan.
	Beachfront	Ghost Lake Beach Front	Developed recreational area for the community Provides access to lakefront activities. Natural areas may be impacted by future climate conditions.
	Parks and Green spaces	All SVGL parks and green spaces excluding sensitive ecosystems	Provides recreational services and greenspaces for the community. Natural areas may be impacted by future climate conditions.
	Sensitive Ecosystem - Native Grasslands	Sensitive Grassland Species	Sensitive ecosystems may be vulnerable to changes in climate.
 Water	Groundwater Quantity/Supply	Wells and natural springs	Main water source for most residents. May be impacted by future climate conditions.
	Groundwater Quality	Quality of groundwater supply	Water quality is essential for community health and may be impacted by future climate conditions.
	Surface Water	Surface water quality and quantity, including wetlands	Water quality and quantity are essential for community health and may be impacted by future climate conditions.

3.2 Community Climate Profile




In general, by 2080 under a high global GHG emissions scenario, the Summer Village of Ghost Lake is projected to become warmer with increasing intensity and frequency of precipitation. Periods of extreme heat (heat waves) are predicted to increase, as are extreme annual maximum temperatures. The timing of seasons is expected to shift, and a decrease in freeze-thaw cycles is projected. Precipitation is expected to increase in all seasons with the most notable changes in the winter and shoulder seasons. Increases in temperature and evapotranspiration are predicted to lead to increases in the frequency of intensity of drought and dry conditions. Total average snowfall is projected to decrease leading to a possible reduction in the total snowpack, further exacerbating seasonal drought and dry conditions. Conditions for convective events such as wind and storms are predicted to increase in the region (City of Calgary, 2022)



Climate related hazards included in this assessment include:

- | | |
|----------------------------------|------------------------------------------|
| ▪ Average annual temperature | ▪ Rain on snow and freezing rain |
| ▪ Extreme heat/hot temperatures | ▪ Riverine flooding |
| ▪ Extreme cold/cold temperatures | ▪ Drought and dry conditions |
| ▪ Total precipitation | ▪ Wind and extreme combination events |
| ▪ Extreme Rainfall and Snowfall | ▪ Invasive species |
| ▪ Average snowfall | ▪ Wildlife (Direct and Indirect Impacts) |

Table 4 is an overview of the results of the scenario analysis, demonstrating the overall trends for the hazards that have the potential to impact the community due to climate change.

Table 4: Climate Trend Summary

Category	Climate Hazard	Direction of Change
TEMPERATURE 	Average Temperature	⬆️
	Extreme Hot Temperatures	⬆️
	Cold and Extreme Cold Temperatures	⬇️
PRECIPITATION 	Total Annual Precipitation	⬆️
	Extreme Rainfall	⬆️
	Riverine Flooding	⬆️
	Extreme Snowfall	⬇️
	Rain-on-Snow Events	⬆️
	Freezing Rain Events	⬆️
	Drought/Dry Conditions	⬆️
WILDFIRE 	Forest Fires – Wildfire Interface	⬆️
	Indirect Impacts – Reduced Air and Water Quality	⬆️

Category	Climate Hazard	Direction of Change
WIND AND EXTREME COMBINATION EVENTS 	Wind Gusts	⬆️
	Severe Storms	⬆️
	Hail	⬆️
	Tornadoes	⬆️
	Lightning Events	⬆️
	Wind-Driven Rain	⊖
OTHER 	Invasive Species	⬆️

High and extreme risk interactions for SVGL are projected to result from extreme heat, wildfire, wind and extreme combination events, invasive species, extreme precipitation, riverine flooding, and drought and dry conditions. The following sections explore these hazards in more detail.

3.2.1 Extreme Hot Temperatures



Extreme hot temperatures are expected to increase by the 2080 time period. The Summer Village of Ghost Lake is predicted to see a significant increase in the number of days over 30°C annually, with less than two days per year projected at baseline increasing to over 55 days per year by the 2080s (Climate Data, 2019). Days over 32°C are projected to increase by approximately 23 times by the 2080s with days over 37°C increasing approximately 3 times by the 2080s compared to current baseline conditions (Climate Data, 2019).

3.2.2 Extreme Precipitation

Extreme precipitation events are expected to increase in frequency and severity by the 2080 time period (Climate Data, 2019). Max total one day precipitation is expected to increase by 33% by the 2080 time period (Climate Data, 2019). Precipitation is predicted to increase during all seasons with the most notable increases in the fall, winter, and spring and less significant increases during the summer season (Climate Data, 2019).



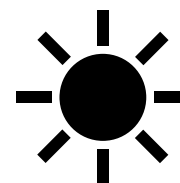
3.2.3 Riverine Flooding



The Government of Alberta is currently incorporating climate projections into provincial flood mapping data sets, which are not yet publicly available at the time of writing this report (Government of Alberta, 2022). That said, increases in riverine flooding have been predicted for most of western Canada (Sauchyn et al., 2020) as well as regionally (City of Calgary, 2022). Max total one day precipitation is to increase by 33% by the 2080 time period (Climate Data, 2019). Sudden intense and/or prolonged precipitation events could increase the likelihood of riverine flooding within the watershed, though it is important to note that the local hydrological conditions at the SVGL are largely influenced by the Bow River Dam infrastructure.

3.2.4 Drought/Dry Conditions

Drought and dry conditions are predicted to increase slightly in the region by the 2080 time period (City of Calgary, 2019). The number of periods with five or more consecutive dry days (days with less than 1 mm of precipitation) is projected to increase by 18% by the 2080 time period (Climate Data, 2019).



3.2.5 Wildfire



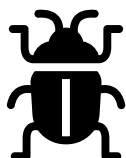
Wildfires are predicted to increase in severity and frequency in the region under future projected climate conditions (Sauchyn et al., 2020). The risk of extreme wildfire is said to already have increased by a factor of 1.5 to 6 due to changes in climate conditions from human influence (Sauchyn et al., 2020). Increases in temperatures and dry conditions in the future will likely increase this risk (Sauchyn et al., 2020).

3.2.6 Extreme Combination Events

Extreme weather events with increased intensity and severity due to changing climate conditions will be the most challenging consequence to the prairie provinces related to climate change (Sauchyn et al., 2020). Wind and storm events have the potential to have severe negative impacts on natural and built infrastructure. In addition, the frequency of the events has a high level of uncertainty and are very difficult to forecast. Favorable conditions for severe storm formation are predicted to increase by 77% for the region by the 2080 time period (City of Calgary, 2022).



3.2.7 Invasive Species



The number of growing degree days (above a threshold temperature of 5°C) is projected to increase by approximately 101% by the 2080 time period (Climate Data, 2019). Local greenspaces, agriculture, and crop production may benefit from increases in temperatures in the region, however, these benefits will be contrasted with impacts such as an increase in pests and invasive species (Sauchyn et al., 2020). Future projected climate conditions are expected to lead to an increase in invasive species (Sauchyn et al., 2020).

3.3 Summer Village of Ghost Lake Planning Context

Two key planning documents informed the development of the Summer Village of Ghost Lake's Climate Resilience and Adaptation Plan (Figure 9). These two documents also have the ability to work alongside this Plan for more effective and resource-efficient implementation.

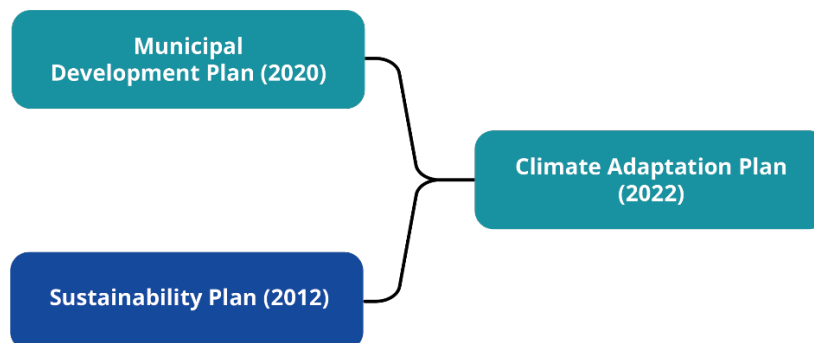


Figure 9: SVGL Planning Context

3.3.1 Sustainability Plan

The Sustainability Plan (SP) was adopted by Council in 2012. During the consultation for the Municipal Development Plan (MDP) in 2020, most residents felt that the SP was still relevant, despite being an older planning tool, therefore it was not updated, and the MDP was developed using the SP as a foundation. The SP identifies village values such as respect, safety, environmental stewardship, and local governance. The vision further describes these values and prioritizes preserving the village lifestyle alongside environmental stewardship. Many priority initiatives can be explored from a climate resilience perspective, including actions related to learning about and preserving the natural environment features that are fundamental to the community's identity and sense of place.

3.3.2 Municipal Development Plan

The Summer Village of Ghost Lake's Municipal Development Plan (MDP) was approved by bylaw in April 2020 and is intended to address future land use and development. The MDP also lays out a vision for the community's future and establishes goals and policies to help the community move toward that vision. As explained in the MDP, SVGL has several unique aspects regarding population and development constraints. SVGL has numerous seasonal landowners, as well as children and family members who may not have been counted in the population due to being classed as 'visiting'. The community also has a higher-than-average population of older adults (65+) – 23.5% as compared to Alberta's 12.3%. This may have implications for climate resilience, as youth and seniors/elderly populations may be more vulnerable to climate-related impacts. The MDP identifies development constraints such as Highway 1A, areas of steep slopes, TransAlta lease area (along the shoreline for recreational purposes), wetlands, and natural water springs. These constraints also require consideration from a climate resilience perspective. For example, steep slopes may be susceptible to erosion during extreme weather events; drought may impact surface water levels in wetlands, and leased areas mean that there can be limited municipal authority to take proactive action on land not owned.

There is limited commercial development in SVGL, therefore commercial areas were not included in the community elements assessed in this project. Likewise, agriculture is common in the landscapes surrounding SVGL, but there is no agricultural land within the municipal boundaries, therefore this was also excluded.

MDP Vision: *"In 10 to 15 years, the Summer Village of Ghost Lake will remain a small, cohesive and self-reliant municipality where commitment to the community is readily apparent, and where people take advantage of retained open spaces and direct access to the Ghost Reservoir for recreation and relaxation."*

4. RISKS AND OPPORTUNITIES – RESULTS SUMMARY

Using the methodology as described in Section 2, 234 interactions (18 elements cross-referenced with 13 hazards) were assessed. Of these interactions, 17 extreme risks, 42 high, 23 moderate, 71 low, 33 negligible, 10 no risk, and 38 special consideration items were identified under projected 2080s conditions (Figure 10).



Figure 10: Risk Summary Under Projected Future Conditions

The changes in the risk profile from the baseline time period to the projected future 2080s time period are summarized in Figure 11 and detailed below.

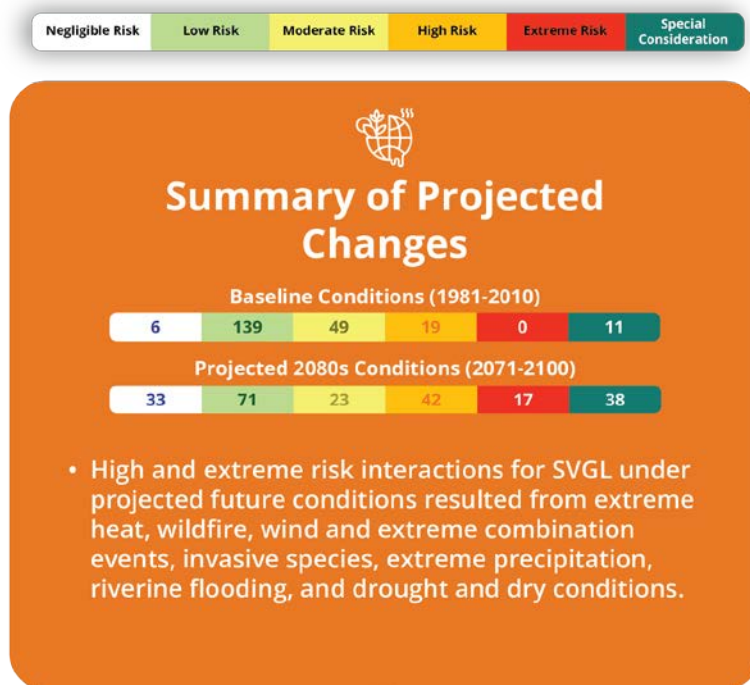


Figure 11: Summary of Changes from Baseline to Projected Future Conditions

4.1 Baseline Conditions Risk Profile

The risk profile for baseline conditions consists of 6 negligible, 139 low, 49 moderate, 19 high, 0 extreme, and 11 special consideration risk interactions. High risk interactions are dominated by interactions with extreme heat and wind and extreme combination events with 5 and 10 interactions respectively. These risks result from interactions with exposed municipal and community-built infrastructure; natural spaces; as well as residents and staff. Other high-risk interactions included one of each of the following climate hazard interactions: riverine flooding, drought, and dry conditions, indirect wildfire impacts, and invasive species. High risk interactions were seen for most elements in baseline conditions with the exception of the leased TransAlta property, hard and soft landscaping, water supply, groundwater quality, private septic systems, and surface water quality and quantity.

4.2 Future Conditions Risk Profile

Future projected conditions for the 2080 time period consisted of 33 negligible, 71 low, 23 moderate, 42 high, 17 extreme, and 38 special consideration risk interactions. Climate interactions resulting in high and extreme risks are similar to baseline conditions including extreme heat, wind, and extreme combination events, riverine flooding, drought, and dry conditions, indirect wildfire events, and invasive species. However, the 2080 period also sees the addition of risk interactions resulting from average temperature, extreme precipitation, and direct wildfire interface.

All elements evaluated had at least one high risk interaction identified, except for water supply and private septic systems.

Most elements had at least one extreme risk interaction except for:

- The leased TransAlta property
- Hard and soft landscaping
- Water supply
- Groundwater quality
- Private septic systems
- Surface water quality and quantity
- Management changes outside SVGL control

There is a distinct shift to higher levels of risk interactions for elements in SVGL during the 2080 time period when compared to baseline conditions. This shift is mainly driven by increasing likelihood scores of temperature, precipitation, wildfire, wind and extreme combination events, and invasive species.





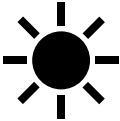

4.3 High and Extreme Risks Carried Forward

High and extreme risk items were carried forward in the process, meaning that the project team recommended risk treatment and adaptation options for these risks to help SVGL prioritize the actions that will have the most impact when considering how to increase community resilience. All assessed elements had at least one high or extreme risk interaction except for water supply and private septic systems.

Moderate and low risk items do not require any further actions at this time. It is worthwhile to revisit this risk assessment periodically as an important part of plan monitoring and evaluation, to ensure that risk scores are still accurate over time. There is the possibility that as data and projections improve, or as SVGL's situation changes, risk scores may change, and something that is moderate at the time of this assessment may elevate to a high risk in the future, meaning that action may be required.

No extreme risk interactions were identified under current conditions. Projected extreme risk interactions for the 2080 time period resulted mainly from extreme heat and extreme combination events with remaining extreme risks coming from wildfires (indirect), and invasive species as shown in Table 5. Table 6 is a full summary of the results of the risk assessment, grouped by the four community pillars. The full results are compiled in APPENDIX C.

Table 5: Extreme Risk Interactions

Climate Hazard	Interactions
 Average Annual Temperature	<ul style="list-style-type: none"> Community Hall Golf Course Parks & Greenspaces Residential Buildings Residential Soft & Hard Landscaping
 Extreme Heat	<ul style="list-style-type: none"> Community Hall Golf Course Municipal Staff Municipal Services Sensitive Ecosystems - Native Grasslands Residential Buildings Residents Residential Hard & Soft Landscaping Surface Water (Quality & Quantity) Management & Changes Outside of Village Control
 Extreme Precipitation	<ul style="list-style-type: none"> Roads & Stormwater Management Sensitive Ecosystems - Native Grasslands
 Riverine Flooding	<ul style="list-style-type: none"> Management & Changes Outside of Village Control
 Drought and Dry Conditions	<ul style="list-style-type: none"> Management & Changes Outside of Village Control
 Extreme Combination Events (Wind Gusts, Severe Storms, Hail,	<ul style="list-style-type: none"> Community Hall Golf course Marina Beachfront





Climate Hazard	Interactions
Tornadoes, Lightning, Wind-Driven Rain)	<ul style="list-style-type: none"> ▪ Parks & Greenspaces ▪ Roads & Stormwater Management ▪ Municipal Staff ▪ Municipal Services ▪ Residential Buildings ▪ Residents ▪ Residential Soft & Hard Landscaping ▪ Surface Water (Quality & Quantity) ▪ Management & Changes Outside of Village Control
 Wildfire - Indirect Impacts	<ul style="list-style-type: none"> ▪ Community Hall ▪ Golf Course ▪ Marina ▪ Beachfront ▪ Parks & Greenspaces ▪ Municipal Staff ▪ Residential buildings ▪ Residents ▪ Groundwater Quality ▪ Surface Water (Quality & Quantity)
 Wildfire - Direct Impacts	<ul style="list-style-type: none"> ▪ Community Hall ▪ Golf Course ▪ Marina ▪ Parks & Greenspaces ▪ Municipal Staff ▪ Municipal Services ▪ Leased Property ▪ Residential buildings ▪ Residents ▪ Residential Soft & Hard Landscaping ▪ Groundwater Quality ▪ Management & Changes Outside of Village Control
 Invasive Species	<ul style="list-style-type: none"> ▪ Golf Course ▪ Marina ▪ Beachfront ▪ Parks & Greenspaces ▪ Sensitive Ecosystems - Native Grasslands ▪ Residential Soft & Hard Landscaping ▪

Table 6: Risk Workshop Summary

		Baseline Conditions (1981-2010)					Projected 2080s Conditions (2071-2100)						
		Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration
	Municipal Buildings and Services (M)	-	42	8	7	-	4	8	19	4	11	5	14
	Homes and People (H)	1	42	9	7	-	4	10	23	3	11	7	9
	Parks, Greenspaces, & Recreation (P)	2	36	19	5	-	3	9	21	6	16	5	8
	Water (W)	3	19	13	-	-	-	6	8	10	4	-	7

5. CLIMATE ADAPTATION PLAN

For the Summer Village of Ghost Lake, climate adaptation planning needs to prioritize actions that reduce the negative impacts of climate change and protect individuals and community resources from said impacts; all with an eye to remaining practical, affordable, and implementable for a small community with limited capacity and resources. As this Plan has conveyed thus far, all governments, sectors, and communities have a role to play in the local and global responses to climate change. It is crucial that communities of all sizes prioritize resilience to climate impacts even though there is still uncertainty about where, when, and how severe these impacts may be. This planning exercise has set out to reduce some of this uncertainty for SVGL, so that staff and residents can continue on a journey to learn what works, what doesn't, and what actions can be taken to remain resilient in the face of such uncertainty.

This section of the Plan is structured around the four community pillars introduced in Section 1.3 and carried throughout. For each pillar, there is a guiding principle statement, intended to help the reader understand the intended outcomes of the selected action item. Each pillar also includes a prioritized action list, developed based on prioritized short-term actions that the Summer Village of Ghost Lake can take to improve the community's resilience to climate impacts while continuing to live within their means. To be more manageable, adaptation actions in this section have been presented for high and extreme risk actions, and proposed action items prioritize co-benefits and multi-solving solutions wherever possible. This section specifically calls out one action for each pillar to serve as the immediate priority, to focus attention and resources where they have the potential to be most impactful, as well as a high-impact action for residents to consider. Thus, Section 5 describes the highest priority action items in each pillar. The full list of 20 adaptation actions is included in Section 6.

Many adaptation actions were designed specifically to minimize risk in more than one category. Adaptation actions also prioritize things that are within SVGL's sphere of influence, or actions that the community has direct control over. In some cases, actions are also considered where there are opportunities to partner with other actors, participate in other programs, and/or advocate for solutions by other actors and jurisdictions (e.g., the provincial government) that aim to increase the community's resilience. Finally, each pillar contains some information about how residents and community members can take individual action, and what they can do within their own sphere of influence to contribute to the goals of the Plan.



Municipal Buildings & Services

Guiding Principle: Municipal buildings, along with other infrastructure (such as roads), are upgraded using climate informed data and decision-making processes when the time comes. The municipality is adequately prepared to continue service delivery at the levels expected by residents despite the potential future impacts of climate change.

Resident Action: Assess your property to understand how and where stormwater flows and take steps to manage stormwater without it leaving your property.

Action M.6 Develop/Review Fire Fighting Response Plan, including access to water both when the lake is at a normal and low level.



Homes & People

Guiding Principle: Residents have the tools and information they need to make climate information decisions and enhance the resilience of their homes and properties. Residents and community members have safe spaces to shelter from acute climate impacts.

Resident Action: Develop an emergency management plan for your home to ensure that everyone knows how to respond in the event of an extreme event.

Action H.3 Develop an emergency management plan in coordination with neighbouring municipalities, as well as associated community engagement programs to ensure all residents understand how to remain safe during extreme events.



Parks, Greenspace, & Recreation

Guiding Principle: The community works together to protect and conserve both recreational and natural greenspaces for their intrinsic and recreational values, which helps to leverage nature-based solutions to enhance the community's resilience to a changing climate.

Resident Action: Engage in climate resilient landscaping practices such as removing invasive species and choosing to plant native and naturalized species over ornamental varieties.

Action P.3 Develop and implement a fire-smart climate resilient landscaping program for parks and recreational areas.



Water

Guiding Principle: All residents, community members, and visitors have a source of safe and reliable drinking water. Both surface and groundwater sources are protected as our water provides many benefits beyond drinking water, including supporting natural systems and recreation.

Action W.4 Conduct a detailed groundwater assessment to assess the likelihood and consequence of climate impacts on well quantity/quality.

Resident Action: Take steps to ensure your household conserve water wherever possible (e.g., low flow fixtures), and be sure to responsibly dispose of materials that could contaminate water supply (such as paint, fertilizer, etc.).

6. PLAN IMPLEMENTATION

This Plan identifies 20 key priority actions the Summer Village of Ghost Lake could implement to increase the community's resilience in the face of a changing climate while respecting existing capacity and resource limitations, as well as retaining valued community attributes. Many of these actions build upon and are supported by the analysis in the Municipal Development Plan and the Sustainability Plan.

Small investments in actions that help reduce vulnerability and risk can result in many social, economic, and environmental co-benefits. The actions presented in this Plan are not mandatory, but it is recommended that SVGL prioritize the implementation of these actions recognizing that the community is vulnerable to climate change, and there are steps that can be taken to become more resilient to climate change impacts. This section provides a high-level assessment of how the Summer Village of Ghost Lake can implement the priority actions, based on an order of magnitude assessment of costs, complexity, and combined priority level. The combined priority level is based on inputs on relative priority from both MH staff and the Village. In the event that the priority levels differed by one level (i.e., Low vs Moderate), the higher priority was used to take the most conservative approach, as shown in Table 7. Table 8 provides implementation considerations for the full list of recommended actions based on an assessment of what SVGL could realistically achieve in the short-medium term to respond to the high and extreme risks identified during this planning process. By including order of magnitude implementation considerations, this portfolio of actions is intended to serve as a resource for SVGL, allowing decision-makers to draw upon this list where funding, resources, and capacity allows.

Table 7: Resilience Strategy Implementation Order of Magnitude Definitions













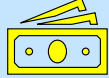

















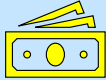


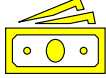








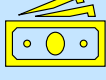


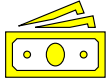














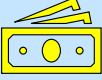





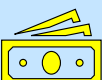


Cost		Complexity		Combined Priority	
<p>\$</p> 	Lowest Cost Implementation	<p>Low</p> 	Low complexity projects can be completed in a shorter timeframe, for example 6-12 months. They are likely to be simple and straight forward, with minimal ongoing elements.	<p>Low</p> 	Low priority recommendations are the nice-to-dos. Lower priority items may have high costs and long-term implementation timelines. The community may feel that these are the least impactful for their overall resilience.
<p>\$\$</p> 	Moderate Cost for Implementation	<p>Medium</p> 	Medium complexity projects need a bit more time but could be expected to be completed within 1-2 years. These projects might have elements that are longer/more complicated, thus extending the timeline.	<p>Moderate</p> 	Moderate priority recommendations will address the values of most concern to the community, though they may not necessarily represent treatment of the greatest risk, and/or largest number of resilience items.
<p>\$\$\$</p> 	Highest Cost of Implementation	<p>High</p> 	High complexity projects are those that are expected to take 2+ years. They are commonly made more complex by multi-stakeholder processes and elements that are out of the sphere of control of SVGL.	<p>High</p> 	These strategies will address the highest risk elements or the largest number of risks. Implementation is strategic to reduce risk to the greatest extent possible for the SVGL

Table 8: High-Level Implementation Plans

Action ID	Action Description	Action Category	Risks Addressed	Cost	Complexity	Combined Priority
M.1	Update planning processes to account for changes to operating costs and resilience to a changing climate, such as upgrading emergency power options, upgrading to high temperature sealants at the time of renewal, developing an external power outage operations management plan, clearing pathways for overhead utility lines, stormproof siding/windows, etc.	Structural, Further Study	AT-1; EH-1; WEC-1; WEC-9; WFD-1; WFI-1	\$ 	Low 	Moderate 
M.2	Develop climate-related safety policies and procedures for staff to protect human health and safety and identify procedures for safely continuing or resuming service delivery, such as identifying safe working temperatures and procedures for extreme heat events.	Risk Transfer/Acceptance	EH-3; EH-4; EH-9; WEC-12; WEC-7; WEC-8; WFD-5; WFD-6; WFD-7; WFI-6	\$ 	Low 	Moderate 
M.3	Detailed condition and risk assessment of the Community Hall to identify specific upgrades and resilience measures to ensure the facility can continue to act as a climate shelter during extreme and/or poor air quality events, as well as remain resilient to changing climate conditions to support service delivery. Could consider programs such as FCM's Municipal Retrofit pathway.	Structural, Further Study	EH-7; WEC-10; AT-1; EH-1; WEC-1; WEC-9; WFD-1; WFI-1	\$ 	Medium 	Moderate 
M.4	Conduct a stormwater analysis to identify properties which are at risk of overland flooding due to extreme precipitation events and prepare measures to protect those properties. This should include a program to ensure roads, ditches, and culverts are maintained in a state of good repair.	Further Study	HP-1	\$ 	Low 	Moderate 
M.5	Work with other levels of government (e.g., Province of Alberta) to consult on future dam construction, riverine flooding, and drought risk to mitigate potential future impacts to SVGL.	Community Tools, Risk Transfer/Acceptance	RF-1; DD-1	\$ 	High 	Moderate 
M.6	Develop/Review Fire Fighting Response Plan. Including access to water both when the lake is at normal and low level.	Risk Transfer/Acceptance	WEC-8; WEC-9; WFD-1; WFD-2; WFD-10; WFD-11	\$ 	Low 	High 
H.1	Support homes and residential buildings in identifying resources to achieve high efficiency cooling upgrades to counter solar heat gain, as well as protection from extreme events, such as fire breaks. Consider combining with energy-efficiency measures to leverage funding, for example through FCM's local home-energy upgrade financing program.	Community Tools	AT-4; EH-6; EH-8; WFD-8; WFI-7	\$ 	Medium 	Low 

Action ID	Action Description	Action Category	Risks Addressed	Cost	Complexity	Combined Priority
H.2	Develop and implement community education and participation programs on water use and drought tolerant landscaping, for example, rain barrel programs, tree planting programs, and so on. Could consider programs such as TD's Friends of the Environment to help offset costs.	Community Tools	AT-5	\$ 	Low 	Moderate 
H.3	Develop an emergency management plan in coordination with neighbouring communities and develop associated community engagement programs to ensure all residents understand how to remain safe during extreme events (including for both essential and recreational activities).	Risk Transfer/Acceptance	EH-7; WEC-10; WEC-11; WFD-3; WFD-9; WFI-3; WFI-4; WFI-5; WFI-8	\$ 	High 	High 
P.1	Add an irrigation system to the golf course to improve the resilience to high temperatures and drought. An irrigation system would most likely require to support the water demand.	Structural	AT-2; AT-3; WFD-4	\$\$ 	Medium 	Low 
P.2	Accept a 'go golden' approach to parks and maintained greenspaces, to reduce watering needs during periods of high temperatures and drought.	Risk Transfer/Acceptance	AT-2; AT-3; WFD-4	\$ 	Low 	Moderate 
P.3	Develop and implement a fire-smart climate resilient landscaping program for parks and recreational areas, including actions such as planting drought-tolerant grass and plant species, installing wood chips around large vegetation to support moisture retention, planting species that can act as wind breaks, and planting trees with large canopies to support shading of recreational and naturalized spaces.	Community Tools, Risk Transfer/Acceptance	AT-2; AT-3; EH-10; EH-2; EH-8; WEC-11; WEC-2; WEC-3; WEC-5; WFD-4; WFI-2; EH-5	\$ 	Medium 	High 
P.4	Conduct further analysis into strategies to protect native grasslands from erosion and flooding due to extreme precipitation events. Examples of strategies might include designing retaining ponds to prevent water from pooling in sensitive areas, planting water-tolerant native species in areas prone to pooling/flooding, or relocating/creating compensation areas for native grasslands where other conservation strategies are not possible.	Further Study	HP-2	\$ 	Low 	Moderate 
P.5	Prepare and implement detailed Invasive Vegetation Management plan that provides best management practices on how to eradicate and prevent the growth of invasive species, and includes considerations of how native ranges may shift over time in a changing climate.	Risk Transfer/Acceptance, Further Study	IS-1; IS-2; IS-3; IS-4; IS-5; IS-6	\$\$ 	Medium 	Moderate 
P.6	Conduct an assessment on trees in landscaped and maintained areas to assess the health and condition of trees, identify high-risk trees that may pose potential threats to public safety, and develop mitigation strategies to balance tree health with human safety.	Further Study	WEC-2; WEC-3; WEC-5; WEC-6; WFD-4	\$\$ 	Low 	Moderate 

Action ID	Action Description	Action Category	Risks Addressed	Cost	Complexity	Combined Priority
P.7	Explore the feasibility of mitigation measures to protect the beachfront area from wind and extreme storm events, such as retaining walls to protect infrastructure and/or planting sand tolerant species to develop a robust root network to combat erosion.	Further Study	WEC-4; WEC-5	\$ 	Medium 	Low 
W.1	Develop a program to monitor surface and groundwater quality following wildfire or storm events to confirm water quality is not impacted, and to mitigate contamination due to debris or contamination.	Community Tools	WEC-13; WFI-10; WFI-9	\$ 	Medium 	Moderate 
W.2	Develop a community education and participation program to educate the community on potential surface and groundwater impacts and encourage community members to report potential impacts observed on surface water.	Community Tools	WEC-13; WFI-10; WFI-9	\$ 	Low 	Moderate 
W.3	Develop plans for backup water supply if the groundwater supply has been impacted.	Risk Transfer/Acceptance, Structural	WFI-9	\$ 	Medium 	Moderate 
W.4	Conduct a detailed groundwater assessment to assess the likelihood and consequence of climate impacts on well quantity/quality and explore the feasibility of more specific adaptation actions where appropriate.	Further Study	WFI-9	\$ 	Medium 	High 

7. MONITORING AND EVALUATION

The actions recommended in this Plan provide a path forward for the Summer Village of Ghost Lake to respond to climate risk and increase community resilience. This Plan and its implementation should be evaluated regularly; it is recommended that implementation is assessed on an annual basis to help understand where to prioritize future resources. An evaluation of this Plan should occur at least every five years, using the most up to date data available. Through the ongoing monitoring and evaluation process, SVGL can assess what has been achieved, what challenges have arisen, what lessons have been learned, and what new actions need to be added to the prioritized list of actions.

8. CLOSURE

The Summer Village of Ghost Lake retained Morrison Hershfield to conduct the work described in this report, and this report has been prepared solely for this purpose.

This document, the information it contains, the information and basis on which it relies, and factors associated with implementation of suggestions contained in this report are subject to changes that are beyond the control of the authors. The information provided by others is believed to be accurate and may not have been verified.

Morrison Hershfield does not accept responsibility for the use of this report for any purpose other than that stated above and does not accept responsibility to any third party for the use, in whole or in part, of the contents of this document. This report should be understood in its entirety, since sections taken out of context could lead to misinterpretation.

We trust the information presented in this report meets Client's requirements. If you have any questions or need additional details, please do not hesitate to contact one of the undersigned.

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APPENDIX A: Detailed Climate Profile



CLIMATE HAZARD CONTEXT

This section of the assessment will document the data collected relevant to the analysis of climate hazards with consideration of historic data and climate projections for the 2080 time horizon (2071-2100) under a high greenhouse gas (GHG) emissions scenario of RCP8.5; and relevant climate hazard thresholds.

Climate Projection Timeframe

Historic and projected future climate information on relevant climate factors for locations at or near the Summer Village of Ghost Lake have been compiled. Future climate projections have been compiled for a period of 60 years into the future (+/- 2080) based on climate models for the Intergovernmental Panel on Climate Change's (IPCC's) Fifth Assessment Report (AR5) Representative Concentration Pathway 8.5 (RCP8.5) for a high greenhouse gas emission scenario.

Climate Scenario Selection

Given the uncertainty of human behavior and how greenhouse gas emissions may change in the future, various greenhouse gas emissions scenarios ('emissions scenarios') have been developed by the IPCC. These emission scenarios present insight into a range of potential climatic futures based on the amounts of greenhouse gases in the atmosphere. Climate change projections are developed using varying future emissions scenarios, also called Representative Concentration Pathways, (RCPs) (Charron, 2016).

RCP scenarios present various future "what-if" scenarios based on combinations and assumptions related to population growth, economic activity, energy intensity, and land use changes to name a few (ClimateData.ca, 2019). A highlight of the three RCP scenarios considered for this assessment is presented in **Exhibit 1** below.

Exhibit 1: Climate Scenario Selection

Greenhouse Gas Emissions Scenario/ Representative Concentration Pathway	Overview	Selection
RCP2.6	<ul style="list-style-type: none">▪ Low emissions scenario▪ Human-caused climate change is limited▪ Carbon emissions peak almost immediately▪ Current trajectory will need to change to reach this scenario	x
RCP4.5	<ul style="list-style-type: none">▪ Moderate emissions scenario▪ Some measures implemented to limit human-caused emissions▪ Requires carbon emissions to stabilize by end of the century on a global scale	x

	<ul style="list-style-type: none">▪ Current trajectory will need to change to reach this scenario.	
RCP8.5	<ul style="list-style-type: none">▪ High emissions scenario▪ Assumed that emissions continue to increase throughout this century▪ Current trajectory based on the current global context	✓

Representative Concentration Pathway 8.5

When possible, projections corresponding to the ‘high emissions scenario (RCP 8.5 or equivalent) were selected for the analysis within this Climate Risk Assessment, as this is considered a conservative approach for the relevant climate hazards and the potentially long-lived nature of the project asset.

IPCC Sixth Assessment Report (AR6)

The IPCC is currently on its sixth assessment cycle in which it is producing the Sixth Assessment Report (AR6). The Physical Science Basis Report was released on August 9, 2021, to address the most up-to-date physical understanding of the climate system and the changing climate. The Climate Change 2022: Impacts, Adaptation, and Vulnerability report was released on February 28, 2022, to address the impacts of climate change, looking at ecosystems, biodiversity, and human communities at global and regional levels. SSPs are scenarios of projected socioeconomic global changes up to the year 2100.

These new reports continue to use the RCP8.5 high emission scenario with the AR6 reports having additional consideration for Shared Socioeconomic Pathways (SSPs). These SSPs present scenarios of projected socioeconomic global changes up to the year 2100 (IPCC, 2022).

CLIMATE MODEL SELECTION

The data used in this assessment were gathered from ClimateData.ca (2019) unless otherwise noted. ClimateData.ca is part of a national suite of publicly available climate data portals.

ClimateData.ca primarily utilizes model data generated by the Pacific Climate Impacts Consortium (PCIC), including 24 CMIP5 global climate models (GCMs) for RCP4.5 and RCP8.5 emissions scenarios. In general, GCMs evaluate global-scale climate conditions and are calculated at coarse spatial resolutions, which can impact the value of GCMs for the projection of local-scale climate changes. To correct for systemic bias within the models for use at a local scale, PCIC has downscaled its data using the Bias-Correction/ Constructed Analogues with Quantile mapping reordering method, Version 2 (BCCAQv2).

Climate Data Limitations and Uncertainty

Sources of uncertainty exist in climate projections related to what exactly our climate future may look like. Given differences in global future possible scenarios, there are differences between the climate model outputs, with each model having notable strengths and weaknesses. To ensure a range of possible climate conditions is captured within the assessment the data is presented as the output of the range of models.

The data from ClimateData.ca presented within this report depicts the median (50th percentile) of the statistically downscaled data from 24 climate models. The data selected for this study is representative of a range of models which encompasses the uncertainty associated with the climate modeling process, and thus the 10th and 90th percentiles are also presented. Each of the data compiled in climate models simulates the climate for baseline conditions and plausible future scenarios, in response to the three emission scenarios as described above (ClimateData.ca, 2019).

Data sourced from ClimateData.ca (Climate Data, 2019) references a 10x6 km grid that encompasses the Village and the majority of Ghost Lake.

Baseline Data

Various sources of the baseline time period (1976-2005) climate data exist including weather station data, interpolated data for locations away from weather conditions, adjusted and homogenized data, and modeled baseline data. Modeled baseline data has been used in this report as it is recommended for comparing future projections to baseline time period conditions (ClimateData.ca, 2019).

Modeled baseline data corrects for biases of the modeled data simulations to provide a better comparison with future projections (ClimateData.ca, 2019). Given climate models are mathematical representations generated to simulate values over larger areas, they generate some systematic differences from observed station data (ClimateData.ca, 2019). The baseline time period datasets available on ClimateData.ca are noted to exhibit similar average values and variability when compared with observed conditions for the baseline time period (ClimateData.ca, 2019), and thus the modeled baseline data sets have been used for comparative purposes.

Computerized Tool for the Development of Intensity-Duration-Frequency Curves under Climate Change – Version 6.0

Intensity-Duration-Frequency (IDF) curves play an important role in municipal water management in Canada. IDF_CC (Western University, 2021) is a publicly available web-based IDF tool that provides data to scale local extreme rainfall statistics to climate change scenarios for different time horizons. This tool provides an approach for updating IDF curves under a changing climate and is pre-loaded with data from 898 Environment and Climate Change Canada (ECCC) rain stations. Version 6.0 of the tool uses version 3.20 of the Environment Canada IDF dataset, released in March 2021. The tool allows users to select any rain station with 10 or more years of data and develop projected IDF curves based on this baseline time period data adjusted to reflect climate change projections. The tool also allows the development of IDF curves for ungauged locations in Canada.

The IDF_CC tool provides precipitation accumulation depths for a variety of return periods (2, 5, 10, 25, 50, and 100 years) and durations (5, 10, 15, and 30 minutes and 1, 2, 6, 12, and 24 hours), and allows users to generate IDF curve information based on baseline time period data, as well as future climate conditions. Curves can either be presented as rainfall intensity (mm/hr) for the given return period and duration, or as total precipitation (mm). The ungauged IDF curve estimates, for all durations (5, 10, 15, 30 min, 1, 2, 6, 12, and 24 hrs) and return periods (2, 5, 10, 25, 50, and 100 years), are extracted directly from the gridded dataset produced for the IDF_CC tool. Ungauged IDF curve estimates for the location of the asset have been used within this assessment.

Due to the nature of the IDF dataset and variable ranges of historic rain station data, the modified baseline time period used for projections at ungauged stations is not explicitly defined, therefore some uncertainty is associated with using this baseline data.

Projected data used from the IDF_CC tool in this assessment corresponds to the median (50th Percentile) value for the 2080 (2071-2100) time horizon under RCP8.5 using CMIP5 models.

The IDF_CC tool allows users to see some statistics pertaining to the range of data in each projected outcome (i.e., for varying return periods and durations). Available statistics include the 25th and 75th percentile values from the projections, as well as the “low” and “high” range values, or the minimum and maximum values from the projections. Because the 10th and 90th percentile values were not readily available for this dataset, the “low” and “high” values were substituted for all illustrations of data ranges to represent the spread of future projections.

Additional Sources of Information

Where climate projection data was not available for potential climate hazards and indicators, additional resources were reviewed including but not limited to the following:

- Canada’s Changing Climate Report (2019)
- Canada’s Changing Climate Report – Regional Perspective Reports (2020)
- Climate Projections for Calgary (2022)

The Climate Projections for Calgary Report (2022) served as a regional proxy dataset for the SVGL as Calgary is approximately 60 km away. Where primary data was not available for the

SVGL, The Climate Projects for Calgary Report was used as regionally, the municipalities will experience similar trends. The report is based on data from a regional scale analysis completed for The City of Calgary and The Calgary Airport Authority by GHD referred to as the Climate Data for Hydrologic and Hydraulic Analysis Project. Specifically, this data comes from a technical memo '11203679-MEM-2-Technical Memorandum 2 Final'. These documents were not publicly available at the time of this assessment.

Potential Climate Parameters and Hazards

A list of potentially relevant climate parameters for the SVGL was developed based on a review of published reports, studies, and federal climate data sets.

For the purposes of this assessment, climate hazard thresholds, as defined by Climate Data.ca (Climate Data, 2019), are presented in **Exhibit 2**, along with asset-specific response considerations

In general, under the RCP8.5 high greenhouse gas emissions scenario for the 2080's time horizon, the SVGL is projected to become warmer with increasing intensity and frequency of precipitation. Periods of extreme heat are predicted to increase, as is an increase in extreme temperatures. The timing of seasons is expected to shift, and a decrease in freeze-thaw cycles is projected. Precipitation is expected to increase in all seasons with the most notable changes in the winter and shoulder seasons. Increases in temperature and evapotranspiration are predicted to still lead to increases in the frequency of intensity of drought and dry conditions. Total average snowfall is projected to decrease with possible increases in freezing rain leading to a possible reduction in the total snowpack.

Climate change parameters and potential future climatic trends relevant to the SVGL are listed in **Exhibit 2**. This list was used for the preliminary screening process, to determine which hazards were specifically applicable to the project and merited more detailed data collection and greater investigation. For each hazard, a comment is included to capture the rationale behind its inclusion in or exclusion from the assessment.

Exhibit 2: Climate Change Hazard – Preliminary Screening

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
Average Annual Temperature	Average Annual Temperature	<p>Temperatures are projected to increase over the various time horizons in the SVGL Region. An increase in average annual temperatures is well analyzed and is most likely to occur. (Climate Data, 2019).</p> <p>Shoulder seasons will see the greatest degree of increase, with summer and winter also increasing in average temperatures, though to a lesser degree.</p>	<p>An increase in average temperatures is predicted to occur. In addition to average annual temperatures, seasonal considerations have been included: Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (cooling requirements) ▪ Water Quantity (potential increased demand including groundwater demand from wells) ▪ Water Quality (conditions favorable for algal blooms) ▪ Sewage Quantity (potentially increased loading as a result of increased water consumption) ▪ Recreational Greenspace (longer summer recreational seasons) ▪ Natural Environment (growing degree days) 	<p>1976 – 2005 annual average temperature</p> <p>1976 – 2005 mean annual accumulated Heating Degree Days (HDD)</p> <p>1976 – 2005 mean annual accumulated Cooling Degree Days (CDD)</p>	✓
Extreme Hot Temperatures	Extreme Hot Temperatures	<p>An increase in the frequency and intensity of extreme warm/hot temperatures is well analyzed and will most likely occur. (Climate Data, 2019)</p>	<p>An increase in the frequency and intensity of extreme warm/hot temperatures is predicted to occur. Potential interactions may include but are not limited to:</p>	<p>1976-2005 Days with Tmax ≥30°C</p> <p>1976-2005 Days with Tmax ≥32°C</p> <p>1976-2005 Days with Tmax ≥37°C</p>	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
			<ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (cooling requirements) ▪ Municipal Staff and Community Residents (health and safety) ▪ Water Quantity (potential increased demand including increased groundwater demand from wells) ▪ Water Quality (conditions favorable for algal blooms) ▪ Sewage Quantity (potentially increased loading as a result of increased water demand) ▪ Recreational Greenspace (longer summer recreational seasons) ▪ Natural Environment (growing degree days) ▪ Utility (Power) Connections (grid outages) 		
	Heat Waves	Heatwaves are projected to increase in length and duration in the future.	<p>For the purposes of this assessment, heat waves refer to daily maximum air temperature $\geq 30^{\circ}\text{C}$ for 3 days or more. (Prairie Climate Centre, 2019)</p> <p>Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (cooling requirements) ▪ Municipal Staff and Community Residents (health and safety) 	<p>1976-2005 Annual Number of Heat Waves (Prairie Climate Centre, 2019)</p> <p>1976-2005 Average length of Heat Waves (Prairie Climate Centre, 2019)</p>	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
			<ul style="list-style-type: none"> Vulnerable Populations (health and safety) Water Quantity (potential increased demand including an increase on groundwater from wells) Water Quality (conditions favorable for algal blooms) Sewage Quantity (potentially increased loading as a result of increased water demand) Recreational Greenspace (longer summer recreational seasons) Natural Environment (growing degree days) Utility (Power) Connections (grid outages) 		
Extreme Cold Temperatures	Extreme Cold Temperatures	Cold temperatures are projected to rise, resulting in a decrease in the number of very cold days and winter days.	Decreases in the number of cold and winter days are potential benefits related to overall energy savings. However, there still is potential for extreme cold days in the future and thus risks should be addressed. Extreme cold days could pose threat to residents, particularly vulnerable residents. Extreme cold days could impact houses more with a reduction in insulation from snowpack. Risks associated with changing winter temperatures are evaluated with consideration of associated precipitation events.	1976-2005 Days with Tmax ≤ -15°C 1976-2005 Days with Tmax ≤ -25°C	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
			<p>Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (heating requirements) ▪ Municipal Staff and Community Residents (health and safety) ▪ Vulnerable Populations (health and safety) 		
Freeze-Thaw Cycles	Winter Freeze-Thaw Cycle Days	The annual projected number of freeze-thaw cycle days is projected to decrease, though seasonal variation is anticipated with this trend. Freeze-thaw-cycle days are days when the air temperature fluctuates between freezing and non-freezing.	<p>Annual freeze-thaw is typically associated with the slow onset of risk associated with the expansion and contraction of built materials. A reduction in the projected number of annual freeze-thaw cycles may be a potential benefit to the built community infrastructure.</p> <p>This climate hazard indicator will not be carried forward for further risk assessment.</p>	N/A	✗
Total Precipitation	Total Annual Precipitation	Increases in total precipitation are projected for all seasons with the most significant changes seen in the winter and spring seasons.	<p>Total precipitation and shifts in seasonal precipitation will inform other precipitation indicators (such as water shortage and drought) that may affect civil and structural elements, and residents related to more extreme events.</p> <p>Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Water Quantity (water balance) 	1976 - 2005 annual total precipitation (mm)	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
Drought and Dry Conditions	Drought/Dry Conditions	The maximum number of consecutive dry days (annual) and the number of periods with 5 or more consecutive dry days (annual) are anticipated to increase.	<p>Evaporation and transpiration (evapotranspiration) will increase with warmer temperatures, leading to more frequent and intense droughts and soil moisture deficits over the southern Prairies during summer (Sauchyn et al., 2020). Potential interactions may include but are not limited to</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (seals) ▪ Municipal Staff and Community Residents (health and safety) ▪ Vulnerable Populations (health and safety) ▪ Water Quantity (Groundwater level drop and shortage in water supply wells) ▪ Recreational Greenspace (golf course maintenance) 	<p>1976-2005 maximum number of consecutive dry days (annual)</p> <p>1976-2005 number of periods with 5 or more consecutive dry days (annual)</p> <p>1960-2014 Annual Evapotranspiration (mm/yr) (City of Calgary, 2022)</p>	✓
Extreme High Precipitation	Extreme Precipitation Events	Precipitation events are predicted to increase in frequency and intensity. This aligns with a projected increase in total precipitation, projected over the same number of wet days.	<p>Extreme precipitation is projected to increase for multiple duration events. Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (overland flood potential for below-grade components, roof drainage) 	<p>Changes in Max 1-day Precipitation (mm)</p> <p>Changes in Max 3-day Precipitation (mm)</p> <p>Changes in Max 5-day Precipitation (mm)</p> <p># days greater than 10 mm</p>	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
			<ul style="list-style-type: none"> Water Quality (increased runoff affecting both surface and groundwater) Recreational Greenspace (increased runoff) Municipal Infrastructure (overland flood potential for roads and culverts) 	# days greater than 20 mm	
Riverline Flooding	Riverine Flooding	Projected increases in riverine flooding are likely for the region (City of Calgary, 2022). Warmer temperatures and increased precipitation in the spring months could lead to more flooding, with quicker snowmelt also playing a role.	<p>SVGL does not have any flood mapping zones in the land use planning. Studies are currently being conducted on the local upper bow river system including the construction of a dam that could potentially impact the reservoir (Government of Alberta, 2022). With this uncertainty comes a certain level of risk.</p> <p>Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> Municipal and Residential Buildings (below grade components) Water Quality (increased runoff and deposited debris affecting both groundwater and surface water) Recreational Greenspace (beachside and marina spaces) Emergency Planning 	Flood Mapping Studies (Government of Alberta, 2022)	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
Changing Snow and Ice	Changing Snow and Ice	Ice days are a useful indicator in the prediction of snow formation and retention. A reduction in annual ice days (regionally) indicates that days favorable to snow formation/retention are decreasing.	<p>Snowfall accumulation can act as an insulator during cold and extreme cold events. Though temperatures are warming and the number of extremely cold days are reducing, they are still projected to occur.</p> <p>Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (frozen service lines from wells) ▪ Municipal Infrastructure (operations and maintenance costs and schedule) 	Change in # Icing Days	TBD Based on Site Visit
Extreme Snowfall	Extreme Snowfall	High year-to-year variability makes it difficult to predict extreme snowfall events. Increases in precipitation frequency and variability have the potential to lead to increases in extreme snowfall events. (Bush et al., 2019).	<p>Extreme snowfall events have the potential to affect roadway and residential travel leading to unsafe conditions and closures.</p> <p>Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (structural loads) ▪ Municipal Infrastructure (operations and maintenance) ▪ Emergency and Municipal Service Delivery ▪ Municipal Staff and Community Residents (health and safety) ▪ Vulnerable Populations (health and safety) 	N/A – continue to plan for the future	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
			<ul style="list-style-type: none"> Greenspace and Natural Systems (breaking branches) 		
Rain-on-Snow and Freezing Rain	Frequency of Rain-on-Snow Events	Conditions favorable to the formation of freezing rain and rain-on-snow are projected to increase (regionally).	<p>Rain-on-snow events and freezing rain events result in icy conditions with a heavy weight of precipitation. Potential interactions may include but are not limited to:</p> <ul style="list-style-type: none"> Municipal and Residential Buildings (structural loads) Municipal Infrastructure (operations and maintenance) Emergency and Municipal Service Delivery Municipal Staff and Community Residents (health and safety) Vulnerable Populations (health and safety) Utility (Power) Connections (grid outages) Greenspace and Natural Systems (breaking branches) Overland SWM infrastructure (culverts can be frozen in these conditions leading to further flooding/freezing conditions) 	<p>1976-2005 Average total winter precipitation (mm)</p> <p>1960-2014 Number of winter freeze-thaw cycles (City of Calgary, 2022)</p> <p>Change in # Icing Days</p>	✓
Wildfire	Direct Wildfire Impacts – Wildfire Interface	Future projections indicate the potential for increases in wildfire events (City of Calgary, 2022)	Wildfire events could pose risk to <u>all elements</u> within the community.	Wildfire weather is predicted to increase in future predictions. The risk of extreme fires in western Canada has already increased by a factor of 1.5 to 6 due to	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
				human-caused climate change (Sauchyn et al., 2020). Proximity mapping with respect to forested areas	
	Indirect Wildfire Impacts	Projected increases in wildfire conditions for the region are projected. Reduced air quality may be a result of both regional fires and fires outside of the region.	Wildfires could lead to reduced air quality (City of Calgary, 2022) from smoke and ash particles contaminating the air. Downstream effects of wildfire include additional sediment, soot, and debris in watercourses. Potential interactions may include but are not limited to: <ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (ventilation maintenance) ▪ Emergency and Municipal Service Delivery ▪ Municipal Staff and Community Residents (health and safety) ▪ Vulnerable Populations (health and safety) ▪ Recreational Areas (beach) 	Wildfire weather is predicted to increase in future predictions. The risk of extreme fires in western Canada has already increased by a factor of 1.5 to 6 due to human-caused climate change (Sauchyn et al., 2020).	✓
Wind Gusts and Storms	Severe and Convective Storms	Convective storms are often characterized by intense precipitation, thunder, lightning, hail, strong winds (>90 km/hr), and	Convective storm events could pose risk to <u>all elements</u> within the community. The degree of consequence will be dependent on the type and severity of the storm.	Average annual convective events/conditions (City of Calgary, 2022)	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
		sometimes the potential for tornado development (City of Calgary, 2022). The occurrence of potential convective precipitation days in the region is projected to increase.			
	Extreme Weather Event - Wind Gusts	Wind speeds are predicted to remain relatively stable in future scenarios (City of Calgary, 2022). There is some uncertainty in this projection as modeling is limited by coarse spatial resolution.	Strong winds events could pose risk to <u>all elements</u> within the community.	Number of days per year exceeding the threshold (40 km/h gusts (% increase in frequency) (Chen et al., 2014) Number of days per year exceeding the threshold (70 km/h gusts (% increase in frequency) (Chen et al., 2014)	✓
Other	Invasive Species	Climate change, particularly temperature changes are expected to lead to both the expansion of native species and the arrival of new invasive species in the Prairie Provinces	Potential risks to the community are the result of a potential increase in invasive pests, changes in native pollinator populations, and competitive species. Certain pests such as termites can be detrimental to wood construction and local tree species, while others may spread disease. Potential interactions may include but are not limited to:	1976-2005 average number of frost days 1976-2005 average number of Growing Degree Days (5°C) 1976-2005 average number of Growing Degree Days (10°C) 1960-2014 Frost season length (Average) (days)	✓

Category	Climate-Related Hazard	Climate Projections/ Statements	Potential Community Interactions	Relevant Climate Hazard Thresholds	Included in the Assessment
		(Sauchyn et al., 2020).	<ul style="list-style-type: none"> ▪ Municipal and Residential Buildings (wood construction) ▪ Recreational and Greenspaces (golf course and parks) ▪ Recreational Areas (beach and marina) 	(City of Calgary, 2022)	

Historic and Future Climate Hazard Data Collection and Analysis

The most current, publicly available climate information was used to guide this Assessment. No primary research or additional site-specific climatological analyses (climate modeling or downscaling of climate projections) was conducted for this report. As climate science evolves and emissions patterns shift, climate projections may change. This could result in variations in the overall climate risk profile for the community. For this reason, the assessment should be reviewed periodically to identify potential deviations resulting from newer, better climate information.









When possible, projections corresponding to the ‘high emissions scenario (RCP8.5 or equivalent) were selected for this analysis, as this is considered a conservative approach for the relevant climate hazards and the potentially long remaining life of the project asset. The data used in this assessment were gathered primarily from ClimateData.ca (2019) unless otherwise noted.

Exhibit 3 highlights the climate change parameter, climate hazard indicator, direction, projected degree of change between baseline and 2080’s climatic conditions, and potential asset and climate hazard interactions.








The following potential climate hazards have been excluded from this assessment per the screening exercise documented in **Exhibit 2**:

- Winter Freeze-Thaw Cycles




Exhibit 3: Climate Projections








Category	Climate Hazard	Climate Change Hazard Indicator	Direction and Projected Degree of Change	Potential Asset/Climate Interactions
Average Temperature	Average Temperature	Change in average annual temperature (°C)	 +164%	An increase in average temperatures is predicted to occur. Increases in average annual temperature are not considered to be a primary indicator of temperature-related risks. Potential increase in water and sewage demand. Potential impacts to greenspaces and natural ecosystems. Impacts on tourism as seasons shift.
	Winter Design Considerations	Change in Tropical Nights (Days with Tmin>18°C)	 2x Increase	Building cooling system design for increased average and extreme conditions should be considered. Potential to increase the cost of cooling homes for residents and municipal facilities.
		Change in Tropical Nights (Days with Tmin>20°C)	 5x Increase	
		Change in Heating Degree Days (HDD)	 -31%	
		Change in Above Freezing Days	 +55%	
		Change in Winter Melting Days	 +177%	
		Change in Freezing Degree Days	 -54%	
		Change in January 1% design air temperatures	 +26%	

Category	Climate Hazard	Climate Change Hazard Indicator	Direction and Projected Degree of Change	Potential Asset/Climate Interactions
		Change in January 2.5% design air temperatures	↑ +28%	
	Summer Design Considerations	Change in Cooling Degree Days (CDD)	↑ +2200%	Changes in temperatures could increase demand for building cooling systems and increase the cost of cooling to residents.
		Change in July 2.5% design air temperatures	↑ +24%	Design components may need to consider future temperature projections
Extreme Hot Temperatures	Extreme Hot Temperatures	Change in the number of hot days (≥29°C)	↑ +607%	An increase in the frequency and intensity of warm/hot temperatures is predicted to occur. Building ventilation and cooling system design for extreme conditions should be considered as well as passive cooling options for residential buildings and municipal facilities. Heat stroke and other health hazards could impact residents. Potential increase in water and sewage demand. Potential impact on road systems. Potential impact on municipal service delivery.
		Change in # days over 30°C	↑ +2686%	
		Change in # days over 32°C	↑ +23x Increase	
		Change in # days over 37°C	↑ +3x increase	
	Heat Waves	Annual number of heat waves	↑ +3067%	
		Average length of heat waves	↑ +1684%	
Extreme Cold Temperatures	Extreme Cold Temperatures	Change in # days below -15°C	↓ -54%	Extreme cold days are predicted to decrease in the future.

Category	Climate Hazard	Climate Change Hazard Indicator	Direction and Projected Degree of Change	Potential Asset/Climate Interactions
		Change in # days below -25°C	 -49%	Potential decrease in heating demand and costs. Extreme cold days could pose threat to residents, particularly vulnerable residents.
Total Precipitation	Increases in Total Precipitation	Change to annual mean total precipitation (mm)	 +12%	Annual precipitation climate hazard as it relates to the SVGL may contribute to general wear and tear on building envelopes and associated components. Annual precipitation is not considered to be the primary indicator of risk. Extreme events and specific precipitation events have been further defined and included.
Extreme Precipitation	Increase in Extreme Rainfall	Change in 1-hr design storm (50-year event)	 +23%	Stormwater management components, overland flooding, roof components, residential areas below grade, and roadways may be affected.
		Change in 24-hr design storm (50-year event)	+23%	
Riverline Flooding	Riverine Flooding	Flood Hazard Mapping	 (Mapping)	Riverine flooding poses hazards to neighboring natural and built infrastructure including beachside areas.
		Change in max 1-day total precipitation	 +33%	
		Change in max 5-day total precipitation	 +21%	
Extreme Snowfall	Extreme Snowfall	Change in total annual snowfall accumulation (cm)	 -40%	Extreme snowfall events have the potential to affect roadway and residential travel leading to unsafe conditions and closures. Extreme snowfall events may also strain the roof and structural systems of buildings.

Category	Climate Hazard	Climate Change Hazard Indicator	Direction and Projected Degree of Change	Potential Asset/Climate Interactions
				<p>Extreme snowfall events could impact emergency service delivery.</p> <p>Extreme snowfall events could impact municipal service delivery.</p> <p>Potential increase in road maintenance.</p> <p>Potential isolation of vulnerable community members.</p>
Rain-on-Snow and Freezing Rain	Increased Frequency of Rain-on-Snow Events	Change in average total winter precipitation (mm)	↑ +31%	Civil and structural elements, mobility, movement and safety of residents, and maintenance costs may be affected by rain-on-snow and freezing rain events.
	Increased Frequency of Freezing Rain Events	Change in the number of winter freeze-thaw cycles	↑ +9%	<p>Rain-on-snow and freezing rain events could impact utility infrastructure such as powerlines, leading to potential power outages in the community.</p> <p>Rain-on-snow and freezing rain events could impact green spaces and vegetation, particularly the limbs of trees.</p> <p>Rain-on-snow and freezing rain events could impact municipal service delivery.</p>
Drought and Dry Conditions	Drought/Dry Conditions	Change in maximum # of Consecutive Dry Days	↑ +6%	Drought/dry conditions may deteriorate built elements with exposure.
		Change in # of periods with 5 or more consecutive dry days	↑ +18%	Natural green space, parks, and landscape elements may be affected by dry conditions.
		1960-2014 Annual Evapotranspiration (mm/yr) (City of Calgary, 2022)	↑ +15%	Water shortages are often associated with drought conditions. Water shortages may impact water balance within the watershed, including groundwater sources. This could impact residential water sources such as wells.

Category	Climate Hazard	Climate Change Hazard Indicator	Direction and Projected Degree of Change	Potential Asset/Climate Interactions
Wildfire	Forest Fires – Wildfire Interface	Wildfire weather is projected to increase in the region	 (Trend)	Wildfire events could pose risks to residents as well as natural and built infrastructure through a direct interface. Potential impact on roadways and access points of the Village. Potential impact on emergency service delivery.
	Reduced Air Quality			
Wind and Extreme Combination Events	Severe Storms	Average annual convective events/conditions	 +77%	Convective storm events could cause potential hazards to residents, as well as natural and built infrastructure. Risks include direct and indirect impacts of lightning strikes, hail, strong winds, and tornadoes. Hail events can be damaging to building envelope elements, vehicles, and residents, depending on hail size. Hail events have occurred in the province and should continue to be considered in the future. Tornado events have the potential to cause damage to people as well as natural and built infrastructure. Given the history of tornado events in the province, this hazard should be considered in this assessment.
	Extreme Weather Event - Hail			
	Extreme Weather Event - Tornadoes			
	Extreme Weather Event – Lightning Events			
	Extreme Weather Event - Wind Gusts	The number of days per year exceeding the threshold (40 km/h gusts (% increase in frequency)	 +4%	Lightning strikes causing server voltage surges may break down insulation and damage voltage-sensitive equipment in buildings should be considered

Category	Climate Hazard	Climate Change Hazard Indicator	Direction and Projected Degree of Change	Potential Asset/Climate Interactions
		The number of days per year exceeding the threshold (70 km/h gusts (% increase in frequency)	 +12%	<p>Lightning strikes could impact power utility infrastructure and lead to potential power loss in the Village.</p> <p>Strong winds and wind gusts can be damaging to building envelopes, roofs, off-site servicing, and landscape elements. Wind gusts could also pose hazards to residents through direct impact or flying debris. The ongoing potential for higher wind gusts should be considered.</p>
		The average number of days with maximum wind gusts is ≥ 90 km/hr	 -37%	
	Extreme Weather Event - Wind-Driven Rain	Frequency and intensity related to wind-driven rain events may be affected by climate change and should be reviewed		
Other	Invasive Species	Change in 1976-2005 average number of frost days	 -34%	<p>Potential risks to the community are the result of a potential increase in invasive pests, changes in native pollinator populations, and competitive species. Certain pests such as termites can be detrimental to wood construction and local tree species, while others may spread disease.</p>
		Change in 1976-2005 average number of Growing Degree Days (5°C)	 +101%	
		Change in 1976-2005 average number of Growing Degree Days (10°C)	 +201%	
		Change in 1960-2014 Frost season lengths (Average) (days) (City of Calgary, 2022)	 -20%	

APPENDIX B: Detailed Climate Risk Assessment Methodology and Results



DETAILED RISK ASSESSMENT METHODOLOGY AND RESULTS

The overall assessment process utilized for this assessment is consistent with the PIEVC Protocol High Level Screening Guide (HLSG). The PIEVC HLSG aligns with international risk management standards ISO 31000 and ISO 14090, and other risk assessment processes.

Risk Assessment Calculations

For the purposes of this assessment risk scores were calculated based on exposure of an element to a climatic condition (exposure), the likelihood of a particular climate event occurring under existing and future climate conditions (likelihood), and the potential consequences/severity of an interaction arising from the climate event exposure (consequence).

The risk analysis conducted for this assessment was based on a standard proxy risk calculation, as outlined in the PIEVC HLSG. For the purposes of this report.

$$\text{Risk} = \text{Exposure (E)} \times \text{Likelihood (L)} \times \text{Consequence (C)}$$

Exposure

Exposure is determined by examining the relationship between the element and the climate hazard (as defined by specific indicators). If the evaluated element “sees it”, or has exposure to a particular climate hazard, the exposure output is evaluated as a “1”. If the element is determined not to have exposure to a specific climate hazard, a score of “0” is applied, and the element fails to continue through the risk assessment process. Determination of asset element exposure to the determined climate hazards was completed in the Risk Assessment Workshop.

Likelihood

For this high-level screening, a “middle baseline” approach was used to determine climate hazard likelihood as presented in **Exhibit 1**. This approach determines the current climate baseline per climate hazard indicator and assigns a likelihood ranking of 3 for the baseline conditions. Future climate scenarios are then assigned a likelihood score based on the event/condition occurring more or less frequently than current climate conditions, as described in **Exhibit 1**. Deviations from the “middle baseline” likelihood scoring approach, were based on professional judgment and associated with very low likelihood events that may be overstated with the middle-baseline approach.

Exhibit 1: Climate Likelihood Scoring Matrix

Likelihood Score	PIEVC HLSG Method	Rationale
1 – VERY LOW	Unlikely	50-100% reduction in frequency or intensity when compared to baseline mean.
		Not likely to occur during the period.
2 – LOW	Likely to occur less frequently than current climate	10-50% reduction in frequency or intensity when compared to baseline mean.

Likelihood Score	PIEVC HLSG Method	Rationale
		Likely to occur once between 30 and 50 years.
3 - MODERATE	Likely to occur as frequently as current climate	Baseline mean conditions or a change in frequency and intensity of $\pm 10\%$ when compared to the baseline mean
		Likely to occur once between 10 and 30 years.
4 - HIGH	Likely to occur more frequently than current climate	10-50% increase in frequency or intensity when compared to baseline mean.
		Likely to occur at least once per decade.
5 – VERY HIGH	Almost Certain to Occur	50-100% increase in frequency or intensity when compared to baseline mean.
		Likely to occur once or more annually.

Overall likelihood scoring was completed in advance of the Risk Assessment Workshop, though all likelihoods were presented, discussed, and adjusted as needed, based on consensus and professional judgment of the project team before proceeding to discussions of asset exposure and potential consequence.

Consequence

The consequence, or severity, of each potential interaction between the climate hazard and specific element, was assigned a numeric score using the criteria outlined in **Exhibit 2**. The score assigned for each potential impact was informed by professional judgment at the risk assessment workshop. Consequence scores are based on community response considerations.

Exhibit 2: Consequence Scoring Matrix

Consequence Score		
1	Very Low	Insignificant
		Little to no financial loss or increase in operational plan/ operational expenses. Little to no impact on cohesion, or health and safety of residents. Little to no impact on green spaces and water supply.
2	Low	Minor
		Additional operating costs or small financial loss. Small changes in site operations and maintenance. Small impact to cohesion, or health and safety of residents. Small impact to green spaces and water supply.
3	Moderate	Moderate
		Moderate financial loss.

		Significant changes in operations and maintenance / operating expenses/repairs. Moderate impact on cohesion, or health and safety of residents. Moderate impact on green spaces and water supply.
4	High	Major to Serious
		Impact to load capacity. Major financial loss. Closure for repairs (short-term or extended). Major impact to cohesion, or health and safety of residents. Major impact on green spaces and water supply.
5	Very High	Hazardous to Catastrophic
		Complete loss of function. Extreme financial loss. Partial or full rebuild required. Extreme impact to cohesion, or health and safety of residents. Extreme impact on green spaces and water supply.

Risk Rating and Classification

A numeric risk rating was determined for each impact based on the product of the exposure, likelihood, and consequence scores. The risk assessment matrix illustrated in **Exhibit 3** was used to derive a semi-quantitative measure of risk. Based on this methodology, risk ratings were determined as follows:

- **Negligible Risk** (risk scores between 1 and 2): Risk events do not require further consideration.
- **Low risk** (risk scores between 3 and 4) – risk requiring minimal action. Controls are not likely required.
- **Moderate risk** (risk scores between 6 and 9) – risk that may require further action. Some controls may be required to reduce risks to lower levels.
- **High risk** (risk scores between 10 and 19) – risks that require action. High-priority control measures may be required.
- **Extreme risk** (risk scores between 20 and 25) – risks that require immediate action. Immediate controls may be required.
- **Special Consideration** – describes two unique scenarios. Low likelihood and high consequence interactions would consider events such as tornados, where the likelihood of a direct hit is very low, but the overall consequence could be catastrophic; and high likelihood low consequence events such as ongoing deterioration of elements resulting from continued exposure to various climatic conditions.

Exhibit 3: Risk Assessment Matrix

Legend

Extreme Risk	High Risk	Moderate Risk	Low Risk	Negligible Risk	Special Consideration
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CONSEQUENCES	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		LIKELIHOOD				

Limitations

As our understanding of climate change improves, climate projections may change. This could cause changes to the risk profile. The work should be reviewed from time to time to identify potential changes resulting from newer climate information.

The projections used for this work were based on the business-as-usual (RCP 8.5) climate scenario. While this represents the upper limit of modeled climate results, it also covers extreme values. These outliers are included in the RCP8.5 information used in this analysis, but their impact may be reduced by averaging.

The work only contemplated two climate projection periods, the current (baseline) climate and model projections for the 2080s. Thus, the work may not reflect near-term climate conditions that may be reflected in the 2050s modeling outputs. The results reflect the team's best estimate of the worst-case climate events likely over the expected useful service life of the element.

This analysis is based on the combined professional judgment of the team. It reflects the team's best estimate of expected climate risk over the useful service life of the element being assessed. The team used data available at the time of the assessment.

There are uncertainties in every climate risk assessment. The work should be viewed as part of a continuing process. Results from the work reflect the state of climate change and element components at the time of the assessment. As climate science develops, periodic reviews of the risk profile and revisions when necessary are recommended.

The work was done as a high-level screening of elements to inform recommendations to improve resilience and included social, and environmental impacts. More data, analysis, and assessment would be needed to expand the work for wider applications.

Exhibit 4: SVGL Climate Risk Overview by Climate Parameter – Baseline Versus Projected 2080s Conditions

Condition	Baseline Conditions (1981-2010)						Projected 2080s Conditions (2071-2100)					
	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration
Average Annual Temperature	-	12	5	-	-	-	-	-	-	5	-	12
Extreme Heat	-	8	5	5	-	-	-	-	-	5	5	8
Extreme Cold	-	17	-	-	-	-	17	-	-	-	-	-
Total Precipitation	-	17	1	-	-	-	-	17	1	-	-	-
Extreme Precipitation	-	11	7	-	-	-	-	11	5	2	-	-
Riverine Flooding	-	12	5	1	-	-	-	12	5	1	-	-
Average Snowfall	-	16	1	-	-	-	16	1	-	-	-	-
Rain-on-Snow and Freezing Rain	-	16	2	-	-	-	-	16	2	-	-	-
Drought and Dry Conditions	-	11	6	1	-	-	-	11	6	1	-	-
Wildfire - Indirect Impacts	-	7	9	1	-	-	-	-	-	9	1	7
Wind and Extreme Combination Events	-	2	3	10	-	-	-	-	-	3	10	2
Invasive Species	-	9	5	1	-	-	-	-	-	5	1	9
Wildfire - Direct Wildfire Impacts	5	2	-	-	-	11	-	3	4	11	-	-

Exhibit 5: SVGL Climate Risk Overview by Community Element – Baseline Versus Projected 2080s Conditions

Category	Baseline Conditions (1981-2010)						Projected 2080s Conditions (2071-2100)					
	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration
Community Hall	-	8	2	2	-	1	2	5	-	3	2	1
Golf Course	-	6	5	1	-	1	2	4	1	5	1	-
Marina	-	8	3	1	-	1	2	4	1	3	1	2
Beachfront	1	9	2	1	-	-	2	6	-	2	1	2
Parks and Green Spaces	-	7	4	1	-	1	2	4	1	4	1	1



Category	Baseline Conditions (1981-2010)						Projected 2080s Conditions (2071-2100)					
	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Special Consideration
Roads & Stormwater Management (Overland Drainage, Ditches, Culverts, Etc.)	-	10	2	1	-	-	2	3	2	1	1	4
Staff	-	9	1	2	-	1	2	5	-	2	2	2
Services	-	9	1	2	-	1	2	4	1	1	2	3
Leased Property	-	12	-	-	-	1	2	5	-	1	-	5
Sensitive Ecosystem - Native Grasslands	1	6	5	1	-	-	1	3	3	2	1	3
Buildings	-	7	3	2	-	1	2	4	1	3	2	1
Residents	-	9	-	3	-	1	2	5	-	1	3	2
Soft and Hard Landscaping	-	8	4	-	-	1	2	5	-	5	-	1
Water Supply - Wells and Natural Springs	1	7	3	-	-	-	2	3	3	-	-	3
Groundwater Quality	1	6	4	-	-	-	2	3	3	1	-	2
Private Septic Systems	1	9	1	-	-	-	2	4	2	0	-	3
Surface Water (Quality and Quantity)	1	6	6	-	-	-	2	2	4	3	-	2
Management & Changes Outside of Village Control (Forest Management, Reservoir Management)	-	3	3	2	-	1	-	2	1	5	-	1



Exhibit 6: Baseline Risk Profile by Category

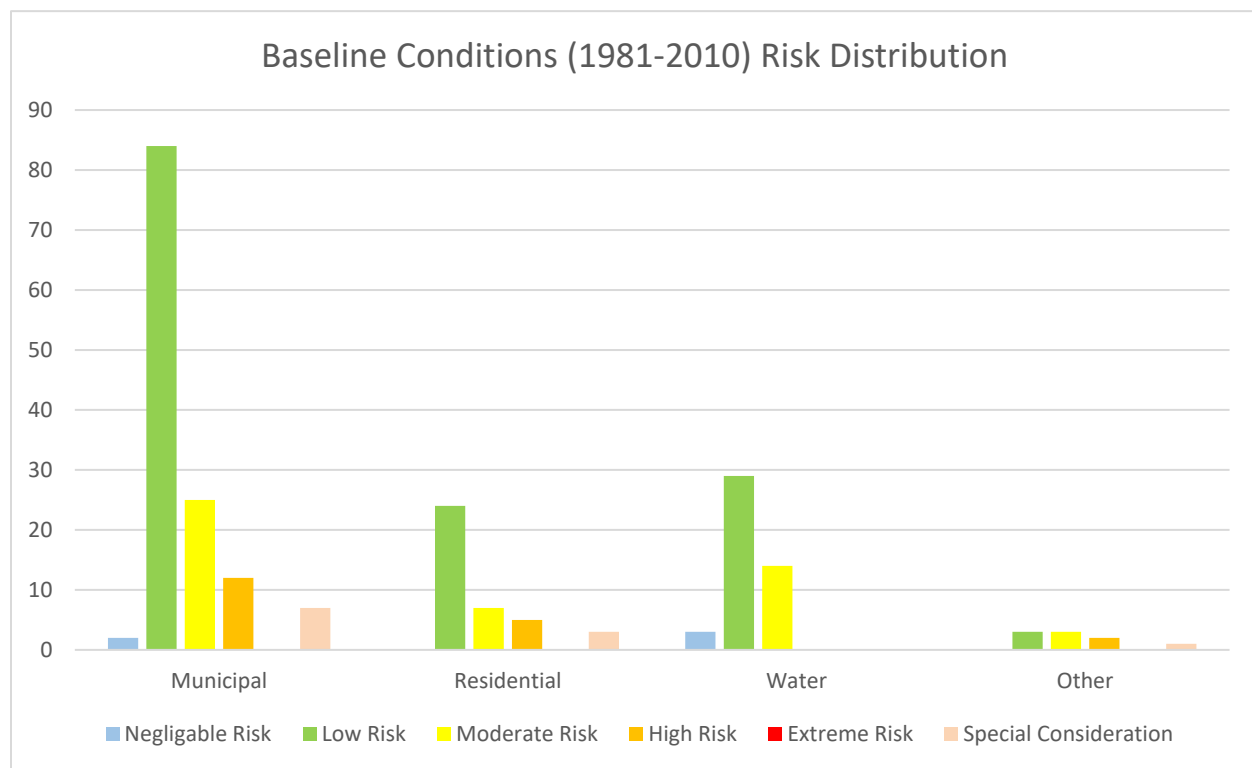


Exhibit 7: Projected 2080s Risk Profile by Category

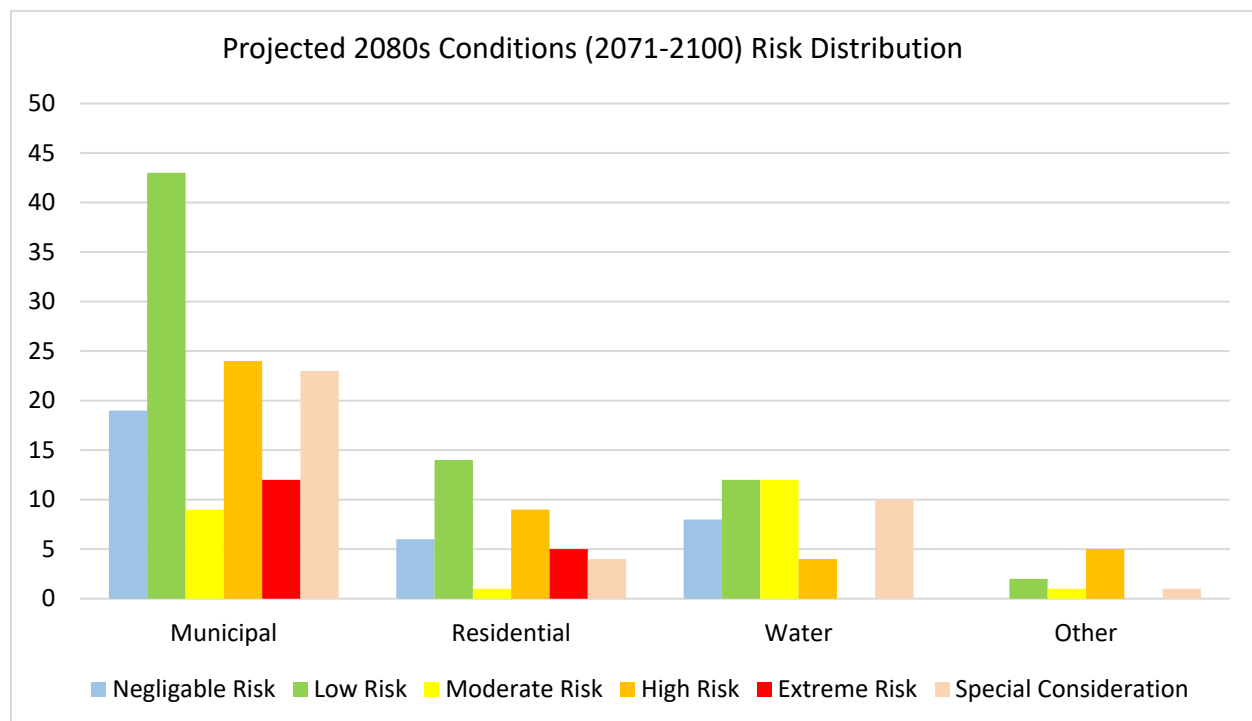


Exhibit 8: High and Extreme Risk Interaction Summary – Average Temperature

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
AT-1	Community Hall: Changes to operating costs and procedures.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	2	2	10
AT-2	Golf Course: Increases in water demand to greenspaces.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	2	2	10
AT-3	Parks and Green Spaces: Increases in water demand to greenspaces.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	2	2	10
AT-4	Residential Buildings: Increases in cooling costs in residential homes.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
AT-5	Residential Hard and Soft Landscaping: Increases to water demand on soft landscaping elements.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	2	2	10

* L = Likelihood C = Consequence R = Risk

Exhibit 9: High and Extreme Risk Interaction Summary – Extreme Heat

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
EH-1	Community Hall: Changes to operating costs and procedures. Potential for closure of facility during extreme heat events.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20
EH-2	Golf Course: Potential for financial loss from courses during extreme heat events.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
EH-3	Municipal Staff: Extreme heat events could lead to unsuitable work conditions for municipal staff.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20
EH-4	Municipal Services: Extreme heat events could impact municipal service delivery.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
EH-5	Sensitive Ecosystem – Native Grasslands: Extreme heat events could cause negative impacts to native grasslands.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	2	2	10
EH-6	Residential Buildings: Increases in cooling costs in residential homes.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20
EH-7	Residents: Extreme heat events could lead to negative health implications to residents.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
EH-8	Residential Hard and Soft Landscaping: Extreme heat events could negatively impact residential hard and soft landscaping leading to reduced lifespan of elements.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	2	2	10
EH-9	Management & Changes Outside of Village Control (Forest Management, Reservoir Management): Extreme heat events could potentially lead to changes in management of staff, visitors and residents.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
EH-9	Surface Water Quality/Quantity: Extreme heat could potentially raise water temperatures, causing impacts to fish and aquatic species or cause algal blooms.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10

* L = Likelihood C = Consequence R = Risk

Exhibit 10: High and Extreme Risk Interaction Summary – Heavy Precipitation

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
HP-1	Roads & Stormwater Management (Overland Drainage, Ditches, Culverts, etc.): Extreme precipitation events could potentially overload stormwater management systems such as ditches and culverts leading to overland flooding and washout of roadways.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	4	3	12
HP-2	Sensitive Ecosystem - Native Grasslands: Extreme heavy precipitation events could potentially flood and erode native grassland areas. Grasslands are traditionally dry areas and may not compensate for extreme excess water.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	4	3	12

* L = Likelihood C = Consequence R = Risk

Exhibit 11: High and Extreme Risk Interaction Summary – Riverine Flooding

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
RF-1	Management & Changes Outside of Village Control (Forest Management, Reservoir Management): Factors with unknown consequences to riverine flooding such as dam construction could impact flood risk.	High			High		
		L	C	R	L	C	R
		3	4	12	3	4	12

* L = Likelihood C = Consequence R = Risk

Exhibit 12: High and Extreme Risk Interaction Summary – Drought and Dry Conditions

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
DD-1	Management & Changes Outside of Village Control (Forest Management, Reservoir Management): Impacts related to drought conditions and management of reservoir.	High			High		
		L	C	R	L	C	R
		3	4	12	3	4	12

* L = Likelihood C = Consequence R = Risk

Exhibit 13: High and Extreme Risk Interaction Summary – Wildfire – Indirect Impacts

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
WFI-1	Community Hall: Potential for increase in operation and maintenance costs to ventilation system such as additional filters.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
WFI-2	Golf Course: Potential for financial loss from courses during air quality impacts.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
WFI-3	Marina: Potential for decrease in use during air quality impacts.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
WFI-4	Beachfront: Potential for decrease in use during air quality impacts.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
WFI-5	Parks and Greenspaces: Potential for decrease in use during air quality impacts.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
WFI-6	Municipal Staff: Air quality impacts could cause unsuitable working conditions for municipal staff.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
WFI-7	Residential Buildings: Potential for increase in maintenance costs to ventilation system such as additional filters.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
WFI-8	Residents: Air quality impacts could potentially lead to negative health implications for residents.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WFI-9	Groundwater Quality: Wildfire events could potentially contaminate groundwater supply and reduce water quality.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
WFI-10	Surface Water Quality/Quantity: Wildfire events could potentially contaminate surface water supply (with debris, ash) and reduce water quality.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15

* L = Likelihood C = Consequence R = Risk

Exhibit 14: High and Extreme Risk Interaction Summary – Wind and Extreme Combination Events

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
WEC-1	Community Hall: Wind and extreme combination events could potentially lead to loss of asset.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-2	Golf Course: Wind and extreme combination events could potentially lead to severe damage to courses and are a serious threat to users.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-3	Marina: Wind and extreme combination events could potentially lead to severe damage to the marina and are a serious threat to users.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-4	Beachfront: Wind and extreme combination events could potentially lead to severe damage to the beachfront and are a serious threat to users.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
WEC-5	Parks and Greenspaces: Wind and extreme combination events could potentially lead to severe damage to greenspaces and are a serious threat to users.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-6	Roads & Stormwater Management (Overland Drainage, Ditches, Culverts, etc.): Wind and extreme combination events could potentially lead to severe damage to roads and storm water management infrastructure.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20
WEC-7	Municipal Staff: Wind and extreme combination events are a serious threat to exposed municipal staff.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-8	Municipal Services: Wind and extreme combination events could potentially lead to service disruption.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20
WEC-9	Residential Buildings: Wind and extreme combination events could potentially lead to severe damage to residential buildings.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-10	Residents: Wind and extreme combination events are a serious threat to exposed residents.	High			Extreme		
		L	C	R	L	C	R
		3	5	15	5	5	25
WEC-11	Residential Hard and Soft Landscaping: Wind and extreme combination events could potentially lead to severe damage to hard and soft landscaping.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
WEC-12	Management & Changes Outside of Village Control (Forest Management, Reservoir Management): Opportunity for management procedures to cover policies related to wind and combination events.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
WEC-13	Surface Water Quality/Quantity: Wind & extreme storm events could potentially contaminate surface water supply with debris and reduce water quality.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10

* L = Likelihood

C = Consequence

R = Risk

Exhibit 15: High and Extreme Risk Interaction Summary – Invasive Species

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
IS-1	Golf Course: Invasive species could have negative impacts on natural areas and green spaces.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
IS-2	Marina: Invasive species could have negative impacts on natural areas and green spaces.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
IS-3	Beachfront: Invasive species could have negative impacts on natural areas and green spaces.	Moderate			High		
		L	C	R	L	C	R
		3	3	9	5	3	15
IS-4	Parks and Greenspaces: Invasive species could have negative impacts on natural areas and green spaces.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10
IS-5	Sensitive Ecosystem - Native Grasslands: Invasive species could have negative impacts on native grasslands.	High			Extreme		
		L	C	R	L	C	R
		3	4	12	5	4	20
IS-6	Residential Hard and Soft Landscaping: Invasive species could have negative impacts on soft landscaping elements.	Moderate			High		
		L	C	R	L	C	R
		3	2	6	5	2	10

* L = Likelihood C = Consequence R = Risk

Exhibit 16: High and Extreme Risk Interaction Summary – Wildfire – Direct Impacts

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
WFD-1	Community Hall: Wildfire events could potentially lead to severe damage to the community hall and are a serious threat to users.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-2	Golf Course: Wildfire events could potentially lead to severe damage to courses and are a serious threat to users.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15

	Potential Consequence Description	Risk Ranking					
		Present			2080s		
WFD-3	Marina: Wildfire events could potentially lead to severe damage to the marina and are a serious threat to users.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-4	Parks and Greenspaces: Wildfire events could potentially lead to severe damage to greenspaces and are a serious threat to users.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-5	Municipal Staff: Wildfire events are a serious threat to exposed municipal staff.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-6	Municipal Services: Wildfire events could potentially lead to service disruption.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-7	Leased Property: Wildfire events could potentially lead to severe damage to leased property and are a serious threat to users.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-8	Residential Buildings: Wildfire events could potentially lead to severe damage to residential buildings.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-9	Residents: Wildfire events are a serious threat to exposed residents.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-10	Residential Hard and Soft Landscaping: Wildfire events could potentially lead to severe damage to hard and soft landscaping	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15
WFD-11	Management & Changes Outside of Village Control (Forest Management, Reservoir Management): Opportunity for increased fire management procedures.	Special Consideration			High		
		L	C	R	L	C	R
		1	5	5	3	5	15

* L = Likelihood

C = Consequence

R = Risk