REPORT

Town of Onoway

Climate Vulnerability and Risk Assessment

February 2024

EXECUTIVE SUMMARY

Project Overview and Approach

The Town of Onoway (the Town) engaged Associated Engineering and All One Sky Foundation to develop an understanding of climate vulnerabilities and risks to Town owned infrastructure and assets. The Town is conducting this work with funding from the Municipal Climate Change Action Centre (MCCAC) Climate Resilience Capacity Building Program.

A series of risk identification and assessment workshops were conducted with the Town using the Public Infrastructure Engineering Vulnerability Committee (PIEVC) High Level Screening Guide (HLSG) Process. PIEVC is currently administered by the PIEVC Program Alliance consisting of Institute for Catastrophic Loss Reduction, the Climate Risk Institute, and Deutsche Gesellschaft fur Internationale Zusammernarbeit. The assessment was conducted on the following assets and areas:

- Water
- Wastewater
- Stormwater
- Solid Waste
- Facilities
- Roads
- Parks

The purpose of this assessment is to conduct a climate-based risk analysis for the Town's infrastructure and to summarize the highest-priority climate risks. In addition, the assessment also identified facilities that would benefit from additional assessment efforts.

The project scope can be illustrated in **Figure E-1** showing the scope of the climate risk assessment conducted on the following:

- Built environment with consideration of municipal infrastructure and building assets, as well as the level of service that these assets provide.
- Community-wide social, health, and local economy.

This encompassing evaluation allowed the assessment to recognize the dependencies between people and the services that the assets provide.

Figure E-1 Climate Risk Assessment on Community-Wide Asset and Services

Climate Hazards Impacts

Based on the climate model projection data for the Onoway area, some climate hazards are showing an increasing trend into the future. **The largest shifts are for extreme heat (days above +30°C), number of cooling days, frost-free seasons, annual precipitation.** Lightning, hailstorm, wildfire, drought, and high winds are not quantified, but the studies and consultation with our climate scientist suggested that more frequent events will be observed.

On the contrary, some climate events have a decreasing trend that may be beneficial to the Town. These climate events are **low temperature days (days below -30°C), and number of freeze-thaw events**. Precipitation with **extreme rainfall events and persistent rainfall** are increasing, but the climate model is not showing a high increase.

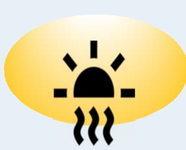
Results

Specific to the built infrastructure, the results for each infrastructure components aimed to answer the following **two key questions**:

1. **Which climate hazards have the highest impacts on the infrastructure?**
2. **Which infrastructure components are the most vulnerable?**

The two key questions illustrate which climate hazards may impact the asset the most and where efforts should be allocated. It is also important to note that other individual asset components with high-risk scores that are not necessarily listed under the risks, but are also noteworthy and should be reviewed as part of the Town asset management plan. The **five highest risk climate hazards in mid to far future (2050 and 2080)** are shown in **Table E-4.**

Table E-4 Five Highest Risk by Climate Hazards to Town Owned and Operated Assets

Rank	Climate Hazard		Impacts
1		High Winds	• Damage to buildings, trees, signs • Tree fall/branches blocking roadways • Increase flying debris at landfills
2		Wildfire and Smoke	• Reducing visibility • Increasing maintenance on equipment filtration system • Increasing emergency services attending to health issues • Health impacts on employees working outdoors • Damage to property
3		River Flooding	• Flooding of stormwater systems, including storm ponds, catch basins, and drainage ditches • Flooding of buildings and basements • Washouts of gravel roads and trails
4		Hottest Days (Above 30°C)	• Increasing use of energy to cooling buildings • Gravel and asphalt surface deterioration • Equipment running hot result in potential damage • Health impact on employees working outdoor • Resulting in poorer water quality • Stress on ornamental vegetation

Rank	Climate Hazard		Impacts
5		Hailstorm	• Damage to exterior of buildings, outdoor equipment, vehicles • Damage to trees • Blocking catch basins • Causing injuries to outdoor staff

The infrastructure systems ranked from most impacted by the climate hazards in descending order are:

1. Roads
2. Parks and Playgrounds
3. Stormwater Management
4. Buildings
5. Wastewater
6. Water
7. Solid Waste

Priority would be given to the high-risk assets; however, attention should also be given to the low risk items to ensure level of service is met.

Table E-5 below shows highest risks impacting the community, as determined through the community-wide risk assessment. The impacts noted are mainly affecting the health and well being of the community.

Table E-5 Community-Wide Highest Risk Results

Impact	Historic Likelihood	Future Likelihood	Consequence Score	Risk Score	Risk Level
Water Supply Shortage	3	5	5	25	HIGH
Extended Heat Wave	3	5	4	20	HIGH
Increased Space Cooling Costs	3	5	4	20	HIGH
Drought Damage To Landscapes	3	5	4	20	HIGH
Drought Damage To Agricultural Crops	3	5	4	20	HIGH
Increased Water Consumption	3	5	4	20	HIGH
Major Hail Event	3	4	5	20	HIGH

Adaptation Planning

The Community Climate Adaptation Planning Guide developed by All One Sky Foundation was used in guiding the discussion. The recommended options for adaptation actions are listed in the following:

1. **No Action** – no additional actions are required, business as usual.
2. **Conduct Research, Studies, or Assessments** to obtain further information on the nature of the risk to better inform the decision-making process.
3. **Update Policies, Plans, Standards, Guidelines, or Bylaws** that considered climate risks and opportunities.
4. **Modify Operations and/or Maintenance Schedules, and Activities** that considered climate impacts.
5. **Build New or Upgrade Existing Infrastructure** to provide protection against climate risks.
6. **Increase Awareness and Education** to help community better understand risks and adaptation actions.
7. **Incorporate Emergency Management** such as response and evacuation planning, hazard mapping, and early warning, or alert systems.
8. **Consider Human Resourcing** options and evaluate the need for additional staff time allocated to climate adaptation planning, implementation, and establishing task force.

Associated Engineering facilitated the discussions, which identified the adaptation actions for each asset. These actions were examined for the medium to high-risk climate impacts. The discussions highlighted the following:

- Recommended adaptation actions
- Time frame of implementation
- Climate hazards scores (medium to high-risk)

Recommendations

1. **Prioritize Actions**. The critical infrastructure that has high impacts are Roads, Park, Stormwater, Buildings, and Wastewater systems. Priority consideration should be given to these assets to ensure level of service to the community is maintained. A list of recommended actions has been provided in **Section 5** for the Town to consider and implement. Starting with low costs actions, these can be implemented with planned policy or bylaw updates.
2. **Cross Cutting Discussion and Information Sharing.** The Town is encouraged to share this information with other relevant departments and inform asset managers for future planning. Furthermore, the cross-departmental discussion can help to identify, assess, and address common problematic areas to protect assets.

Table ES-6 Potential Cross Cutting Adaptation Actions Applicable to All Departments/Corporations

All Departments/Corporation
Increase public engagement and community awareness of climate change impacts and adaptations through public open houses, schools, and other discussion forums.
Employ an adaptive management approach to climate adaptation planning.
Increase staff training on climate change impacts and adaptations across all departments.
Promote sharing of Town's maps and emergency information to improve emergency response.
Promote the use of renewable energy sources in homes and buildings.

All Departments/Corporation
Avoid flood prone areas through zoning, planning, and development restrictions.
Identify funding opportunities for green infrastructure and buildings to increase resilience.

1. **Monitor, Assess, and Update Risk Scores, and Adaptation Actions.** The Town is encouraged to identify performance or tolerance threshold (e.g., temperature, precipitation) of the asset so that it provides a baseline for monitoring. As the Town improves or make modifications to reduce the risks and vulnerabilities to the assets, the adaptation plans can be updated. This encourages improvements and furthering the reduction and removal of risks.
2. **Continual Review of Climate Data.** The Town, overtime, should also monitor the ongoing evolution of climate projections. This will allow the Town to update the risk score and evaluate its vulnerabilities and exposure based on current and science-based information. Adaptation actions will be adjusted accordingly while staying flexible and adaptable to the potential market fluctuations.

ACKNOWLEDGEMENTS

We would like to acknowledge the following key people who supported and participated in the workshops, and provided valuable feedback in this project:

Town of Onoway

- Jennifer Thompson, Chief Administrative Officer
- Gino Damo, Director of Corporate and Community Services
- Gary Michalyk, Public Works Manager

This report was developed with valuable input from the Town, and we appreciate the time, effort, and knowledge contributed to this assessment to help build resilience in the community.

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1 INTRODUCTION

1.1 Project Background

The Town of Onoway (the Town) engaged Associated Engineering to develop an understanding of the climate vulnerabilities and risk for the Town's municipal infrastructure. The results of this risk assessment will guide future adaptation action planning to reduce the impacts of climate change. This project was conducted with funding from Municipal Climate Change Action Centre (MCCAC) Climate Resilience Capacity Building Program.

Municipal Climate Change Action Centre

A series of risk identification and assessment workshops were conducted with the Town using the Public Infrastructure Engineering Vulnerability Committee (PIEVC) High Level Screening Guide Process. PIEVC is currently administered by the PIEVC Program Alliance consisting of Institute for Catastrophic Loss Reduction, the Climate Risk Institute, and Deutsche Gesellschaft fur Internationale Zusammernarbeit. The assessment was conducted on the following assets owned and/or operated by the Town:

- Water distribution system within the Town
- Wastewater lagoon and collection system
- Stormwater
- Facilities
- Roads
- Parks

Solid waste was reviewed, briefly noting that this service is provided privately by in-town contractor, GFL. The Town does not own any trucks, bins, transfer station, or landfills.

In addition, the risk assessments also captured discussions on impacts to municipal operations staff, public users, and the impacts to service delivery.

1.2 Purpose

The purpose of this assessment is to conduct a climate-based risk analysis for the Town's infrastructure and to summarize the highest-priority climate risks. In addition, the assessment also identified assets that would benefit from additional assessment efforts.

The results of this study will assist the Town in integrating climate risks discussion and adaptation measures into capital upgrades, operations and maintenance, future land use planning, engineering design standards, operational practices, infrastructure assessment, and human resource programming.

1.3 Project Scope

The project scope included:

- Research on climate hazards relevant to the Town considering historic values and future climate projections.
- A high-level climate risk assessment of the Town's assets.

- High level community-wide risk assessment relevant to the well being, and economic health of the community.
- Development of a list of high-level adaptation measures to address the highest risks facing the infrastructure.

The project boundaries can be illustrated in **Figure 1-1** showing the scope of the climate risk assessment conducted on the following:

- Built environment with consideration of municipal linear and vertical assets, as well as the level of service that these assets provide.
- Community-wide social, health, and local economy.

This encompassing evaluation allowed the assessment to recognize the dependencies between people and the services that the assets provide.

Figure 1-1 Climate Risk Assessment on Community-Wide Asset and Services

The **PIEVC High Level Screening Guide Process**, lead by Associated Engineering, was used to assess the municipal assets and services. The assessment considered:

- **Direct** physical damages/impacts to assets – e.g., stormwater, water, wastewater, solid waste, roads, fleet, equipment, buildings/recreation facilities, playparks, sports field.
- **Direct** services losses, such as a flooded roadway that is impassable or an outdoor facility being closed because of smoke or heat.
- **Indirect** effects of those direct impacts –impact to the Town staff's ability do the work.

The **Community-Wide Climate Risk Assessment** was led by All One Sky Foundation and considered all potential climate-related impacts affecting the Town. The assessment considered the natural environment, non-municipal assets and services, the economy, and the health and well being of people in the community. The work followed best practices for municipal climate change risk assessment, namely the International Organization for Standardization (ISO)

Guideline 14092 – Climate adaptation planning for local governments and the **Climate Resilience Express – Community Climate Adaptation Planning Guide** developed by All One Sky Foundation. The assessment considered:

- **Direct Impacts** to public safety (loss of life, morbidity, injury, disease, etc.), quality of life (recreation, lifestyle, evacuations, etc.), municipal finances, and the local economy.
- **Indirect Impacts** to public safety (loss of life, morbidity, injury, disease, etc.), quality of life (recreation, lifestyle, etc.), or the local economy, as a result of impacts and damage to property & infrastructure, and interruption of services.

The scope is limited to the following:

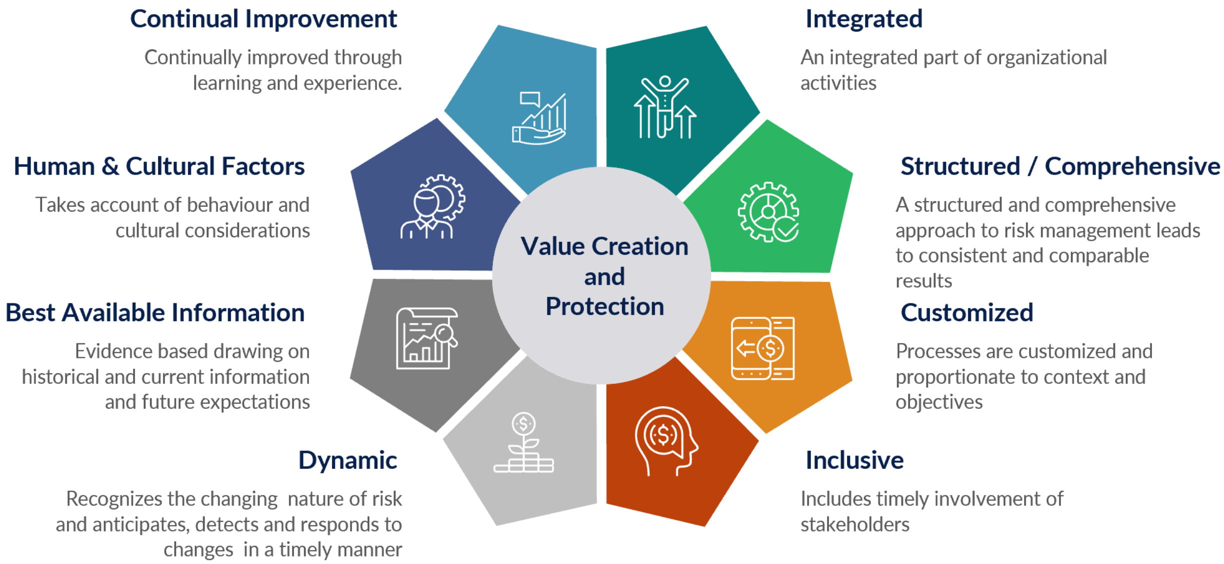
Scope
• Impacts within the geographic boundaries of the Town of Onoway.
• Impacts on the Town of today. While considering climate projections out to the 2080's, changes were considered in terms of the Town today (in terms of development, land use patterns, and resource capacity). This allowed us to determine the climate adaptations that were necessary to implement now, to be resilient to climate changes anticipated in the future.
• Impacts that are worsening (becoming more frequent or severe) as a result of climate change.
• Climate change may also provide some benefits, in terms of increased opportunities for recreation or agriculture. These potential benefits were also excluded.
• Risk assessment of economic analysis and human well being are based on qualitative discussions and knowledge of the project team as well as the participants from the Town.

Note that the risk assessment did not consider impacts outside the influence of the Town. For example, provincial policy or legislative changes, broad economic impacts, or impacts related to demographic or population changes that might affect the local economy and/or health services.

1.4 Risk Assessment Process

The risk assessment process that this project adopted was based on the ISO 31000's principles of risk management. The principles followed a systematic cycle of actions to create and protect the value of the community. **Figure 1-2** illustrates the process starting from integration of organizational activities that requires the collaboration of all departments, using a structured approach to assess risk that was customized for the appropriate context. The discussion was also inclusive and dynamic, drawing from evidence-based information. Finally, the risk management process identified a continual improvement through leaning and experience.

Figure 1-2 Principals of Risk Management (ISO 31000)



Another ISO guideline that was consulted is ISO 14092. Our approach to the climate risk assessment employed a 'best practice' methodology, which was based on the "*Climate Resilience Express – Community Climate Adaptation Planning Guide*" (https://mccac.ca/app/uploads/CRE_Planning-Guide_Final.pdf), which was developed by All One Sky Foundation for the Municipal Climate Change Action Centre and the Climate Resilience Capacity Building Program. Our work is also aligned with the recently published International Standards Organization (ISO) guideline 14092: Adaptation to Climate Change—Requirements and guidance on adaptation planning for local governments and communities, and with the Intergovernmental Panel on Climate Change's (IPCC) latest conceptualization of climate risk assessment methods.

1.5 Definitions

In the PIEVC guidance, **Risk** is defined as the product of the likelihood of the "impact" and the consequence of the "impact" on the system. The "impact" in this discussion referred to the climate change impacts or climate hazards.

Vulnerability is defined as how the system fares against the climate hazards when exposed. It can also be viewed as the ability of the system to absorb the inundation of the climate hazards. In other words, vulnerability is the inability of a system to cope with the adverse effects of climate change and the climate variability. The sensitivity of the system when exposed to the climate change is often evaluated based on level of use, service life/age, maintenance/operations costs, and replacement costs. Adaptive capacity is assessed based on the cost and time required for the system to resume to its original service.

In this report, vulnerability was not assessed in detail for all services, but was assessed qualitatively within the consequence scoring. During consequence scoring, which took place in a series of workshops, Town of Onoway staff were asked how their infrastructure systems would behave when exposed to the various climate hazards at their current conditions. Their qualitative assessment was based on their engineering/technical experience and their understanding of their assets/infrastructure. This **qualitative vulnerability** discussion, coupled with the risk assessment, provides an overall understanding of the current status of the Town's infrastructure. This initial assessment of risk will allow the Town to formulate a more focused and detailed risk and vulnerability assessment for the components of each infrastructure system.

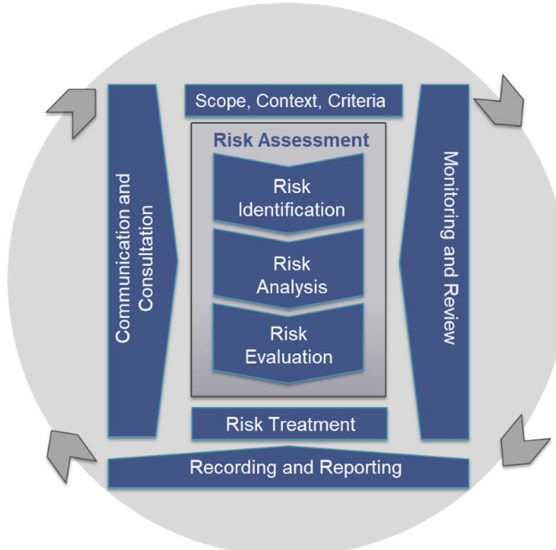


Figure 1-3 ISO 31000 Risk Management Process (High Level Screening)

The **adaptation** measures identified in this report will provide the Town will potential activities to consider, plan and implement. The international standard for risk management, ISO 31000 shows the progression from Risk assessment to treatment that will require monitoring, review, consultation, and communication (**Figure 1-3**).

In this project, risks to Town's assets were identified, setting the stage for the development of risk reduction and risk treatment measures. Beyond this project, the Town can identify site-specific risk reduction strategies and activities.

2 CLIMATE PROJECTIONS

2.1 Climate Data

The Government of Canada has several data sources where historical climate data and future climate projections can be obtained. The PIEVC High Level Screen Guideline (HLSG) indicates that although climate data is now available in higher spatial and temporal resolution, there are some climate parameters and geographic areas that are more difficult to obtain. Where possible, proxy datasets and modelled data was used to cover the gaps. Some complex parameters including extreme wind, complex precipitation events like hail, snowfall, and lightning do not have quantitative modelled data for evaluation, but they are based on accumulation of research indicating the likelihood of increasing or decreasing trend. For this assessment, the Climate Atlas of Canada and Climate Data Canada were used to obtain data and projections. The climate parameters, projections, and sources are listed in **Appendix A**.

2.2 Timescale and Parameters

For this project, the time horizons for assessment were chosen to align with the design life/expected lifecycle of the infrastructure, or period of time before a planned retrofit or reassessment of climate impacts. This assessment considered the following climate periods:

- 2020s (2011 – 2040)
- 2050s (2041 – 2070)
- 2080s (2071 – 2100)

Parameters were selected based on potential ongoing and future impacts to the physical infrastructure, as well as impacts to operation and maintenance. In all cases, the Representative Concentration Pathway 8.5 (RCP8.5, i.e., upper-end, most emissions) scenario was chosen to reflect a worse-case scenario for the infrastructure. Climate parameters investigated in this assessment are noted in **Table 2-1** below.

Table 2-1 Climate Parameters

Climate Parameters	Climate Sub-Parameters
Temperature	• Mean annual temperature (∘C) • Number of Days Above +30∘C • Hottest Day • Cooling (i.e. space cooling) Degree Days (days above 18∘C) • Number of Days below -30∘C • Frost-free Season (days) • Freeze/Thaw Events
Precipitation	• Annual Total Precipitation • Maximum 1-day Total Precipitation • Maximum 5-day Consecutive Precipitation • Short Duration 1:100-year Rainfall (mm/hr) – Overland Flooding • Winter Precipitation (mm) • Hailstorm
River Flooding	• 24 hour 100-year Rainfall (mm/hr)
Drought	• Relative Change in Standardized Precipitation Evapotranspiration index based

Climate Parameters	Climate Sub-Parameters
Wildfire	• Change in Average Annual Forested Area Burned
Heavy Winds	• 1-in-50 Year Gust Pressures
Lightning	• Lightning
Shifting Ecosystem	• Changing seasons and ecosystem, insect, invasive plants, and disease

For all parameters, quantitative present and future values were determined from reputable and widely used national climate data sources, and peer-reviewed scientific literature. Datasets were sourced to be as relevant as possible to identified infrastructure vulnerabilities. Detailed climate data, projections for each climate parameter for each timeframe, and a brief description are included **Appendix A**.

3 RISK ASSESSMENT

3.1 Method

The project was conducted in the phases shown in **Figure 3-1** below.

Figure 3-1 Project Overview

During the **Workshop 1A, PIEVC Orientation**, Associated Engineering provided a discussion of climate change principles and parameters, the PIEVC High Level Screen Guide (HLSG) process, and an overview of the project. Following this, we provided a presentation template for Town staff to help understand the types and scale of assets for different service lines. Each group presented the information on the assets during **Workshop 1B, Tell Us About Your System**. The initial information was used to create asset lists and provide insights for **Workshop 2, Risk Assessment**. In the last series of workshops, **Workshop 3, Adaptation Planning,** looked at how to reduce the risks with high level adaptation planning for infrastructure and vulnerable community members at medium to high risk.

The risk assessment workshops were conducted virtually using Mural Board to facilitate the discussions. The workshops occurred between June and November 2023:

Workshop 2 Series, Risk Assessment, consisted of the following sessions:

- **Workshop 2A:** Water, Wastewater, Stormwater, Parks, and Solid Waste
- **Workshop 2B**: Buildings and Roads
- **Workshop 2C:** Community-wide (social aspects and local economy)

Workshop 3 Series, Risk Reduction/Treatment (Adaptation), was conducted in the following sessions:

- **Workshop 3A:** Water, Wastewater, Stormwater, Roads, Parks, Buildings, Solid Waste
- **Workshop 3B:** Community-wide (social aspects and local economy)

3.2 Risk Identification and Assessment

Risk is discussed in terms of likelihood and consequences. The likelihood is described as the hazards, events or conditions that could occur, and consequence as the result occurring in varying levels of negative or positive impacts or effects. In quantitative terms, risk is evaluated as the product of the likelihood and consequence.

In terms of climate risk, we begin to understand how the variability of climate patterns impact the built environment and environment, and in turn, how this impacts the society. For this project, the PIEVC HLSG process was used in assessing the built infrastructure and assets. The methods are discussed in the following sections.

3.3 Climate Likelihood Scoring

The likelihood scoring in PIEVC High Level Screening was based on the climate projections. The climate parameter trends and projections were translated into likelihood scores (L), with increasing/decreasing values reflecting increasing/decreasing occurrence over the specified time horizon. Translation into likelihood scores normalized the various climate change trend measures into a common numerical ranking. For each climate parameter, an appropriate likelihood score was applied to determine the direction-of-change for potential impact. **Table 3-1** lists the method for determining climate likelihood scores. For the Town of Onoway assessment, we have used the PIEVC Middle Baseline Approach for likelihood scoring.

Table 3-1 PIEVC Likelihood Scoring

Likelihood Score (L)	Middle Baseline Approach – Establish Base	Method
1	↑	Likely to occur less frequently than current climate
2		
3	Establish Current Climate Baseline Per Parameter	Likely to occur as frequently as current climate
4		
5	↓	Likely to occur more frequently than current climate

3.4 Consequence Scoring

The assessment was completed by evaluating the consequences of the interactions between each climate parameter and each piece of infrastructure or assets. The determination of consequence was guided by a consequence rubric shown in **Table 3-2**, which focus on the following general categories:

- Built assets including linear and vertical infrastructure
- Health and Wellbeing
- Economic/Financial
- Natural Environmental/Parks

During the virtual Workshop, each participant from the Town provided the consequence scoring (**Figure 3-2**) of the asset categories that were described in Workshop 1A.

Figure 3-2 Virtual Workshop Consequence Scoring

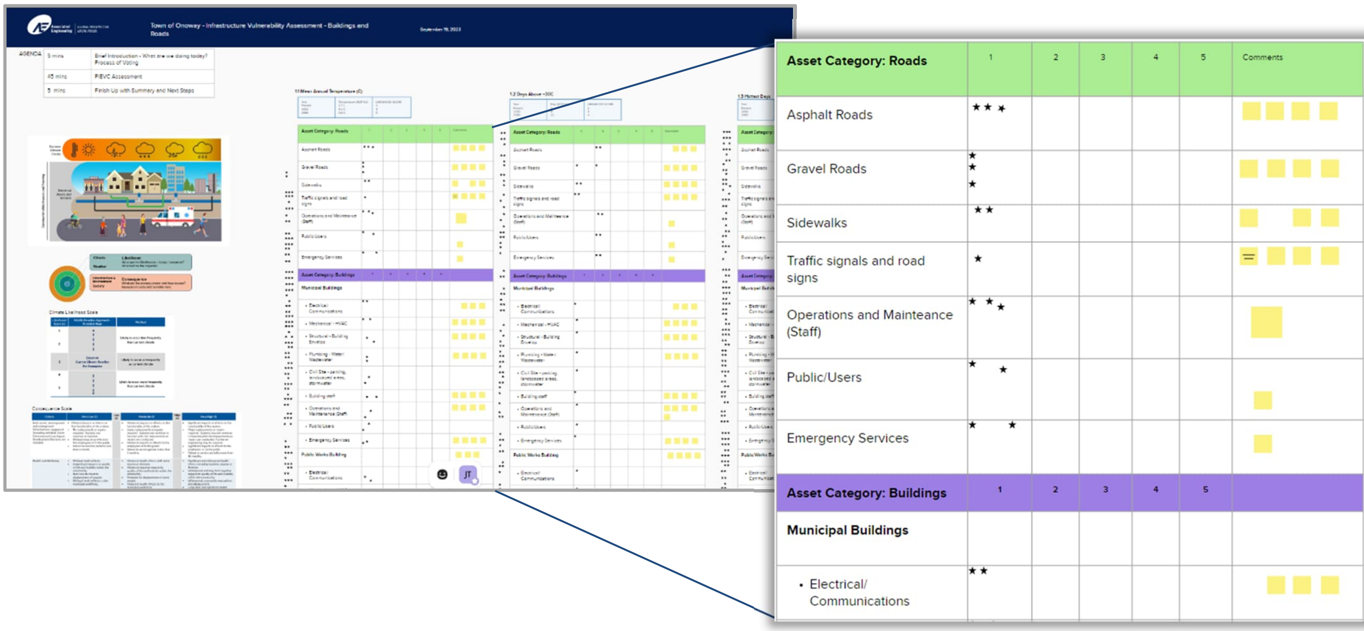


Table 3-2 Consequence Scale

Criteria	Very Low (1)	Low (2)	Moderate (3)	High (4)	Very High (5)
Built Assets; above ground and underground Infrastructure; equipment (including vehicles). Green Infrastructure/Low Impact Development Elements are included.	• Minimal impacts or effects on the functionality of the system. • No replacements or repairs required. Systems can continue to function. • Minimal impacts or effects to the employees or to the public. • Return to services period is less than 1 month.		• Moderate impacts or effects on the functionality of the system. • Some replacements or repairs required. Systems can continue to function after the replacements or repairs are conducted. • Moderate impacts or effects to the employees or to the public. • Return to service period is less than 5 months.		• Significant impacts or effects on the functionality of the system. • Major replacements or repairs required. Systems may not continue to function after the replacements or repairs are conducted. Further re-engineering may be required. • Significant impacts or effects to the employees or to the public. • Return to service period is more than 10 months.
Health and Wellbeing	• Minimal health effects. • Insignificant impacts to quality of life and livability within the community. • Not likely to result in displacement of anyone. • Minimal health effects to the municipal workforce.		• Moderate health effects with some injuries or illnesses. • Moderate negative impacts to quality of life and livability within the community. • Potential for displacement of some people. • Moderate health effects to the municipal workforce.		• Significant and widespread health effects including fatalities, injuries, or illnesses. • Widespread and long-term negative impacts to quality of life and livability within the community. • Widespread community evacuations and displacement. • Long-term and significant health effects to the municipal workforce.
Economic/Financial	• No disruption of local businesses. • No job losses or reductions in productivity. • Very minimal financial cost to the municipality.		• Moderate and medium-term (days-weeks) disruption of some local businesses or economic sectors. • Some job losses and/or reduced productivity affecting some local businesses and economic sectors. • Moderate financial costs to the municipality, which is manageable within existing reserve funds.		• Significant long-term (months-years) disruption of many local businesses or economic sectors. • Widespread job losses and/or reduced productivity affecting most local businesses and economic sectors. • Significant financial costs to the municipality, well beyond existing reserve funds.
Natural Environment/Parks	• Insignificant alteration of the natural environment in and around the community • Natural systems can easily recover.		• Moderate damage or disturbance to the natural environment, including environmentally significant areas such as wetlands, forested areas, and wildlife corridors. • Moderate damage or disturbance to trees, parks, trails, and open spaces within the community.		• Widespread, long-term, and potentially irreversible, damage or disturbance to the natural environment, including environmentally significant areas such as wetlands, forested areas, and wildlife corridors • Widespread, long-term, and potentially irreversible damage or disturbance to trees, parks, trails, and open spaces within the community.

3.5 Risk Scoring

Using the likelihood and consequence scoring, the final risk score for each infrastructure component falls on a scale between **0 and 25** (shown as an example on **Figure 3-3**):

- Between 0 and 9 are considered low risk
- Between 10 and 19 are considered medium risk (yellow)
- Between 20 and 25 are considered high-risk (**red**) items

Upon completion of the risk assessment, the risk scores across all climate-infrastructure interactions were assessed.

This review was completed to establish confidence in the professional judgement employed in the process, as well as to identify any unexpected or surprising results in terms of risk. Unexpected results were not necessarily erroneous, as they highlighted where climate changes were anticipated to introduce new issues and challenges.

The results of the assessment for each infrastructure category were compiled on a master worksheet. **Section 4** summarizes the results of the assessment.

Figure 3-3 Risk Assessment Matrix Example Scoring

5	CONSEQUENCE	Catastrophic	0	5	10	15	20	25
4		Major	0	4	8	12	16	20
3		Moderate	0	3	6	9	12	15
2		Minor	0	2	4	6	8	10
1		Insignificant	0	1	2	3	4	5
0		No Effect	0	0	0	0	0	0
			Negligible Not Applicable	Highly Unlikely Improbable	Remotely Possible	Possible Occasional	Somewhat Likely Normal	Likely Frequent
			LIKELIHOOD					
			0	1	2	3	4	5

4 RESULTS

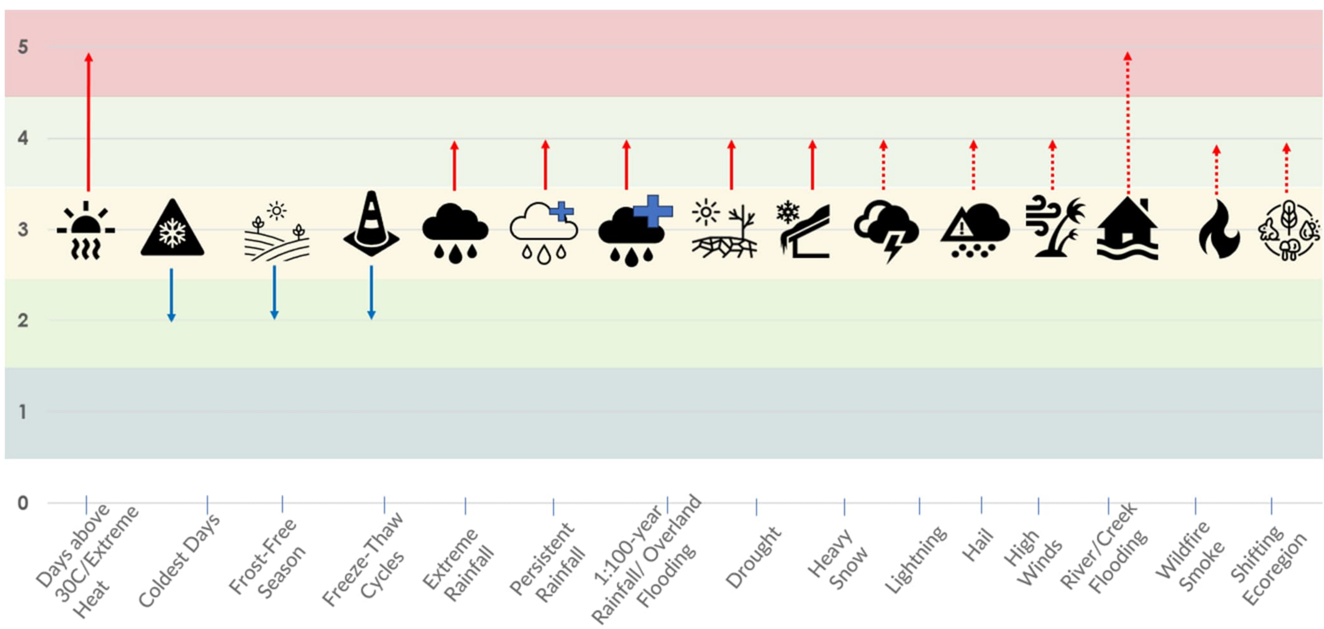
4.1 Change in Climate Hazards Over Time

Many hazards will see an increase in likeliness to occur between now and 2080. The largest shifts are for extreme heat (days above +30°C), number of cooling days, frost-free seasons, annual precipitation. These climate hazards have likelihood scores increasing from 3 to 5. The climate changes to lightning, hailstorm, wildfire, drought, and high winds, although not specifically quantifiable, the projections are suggesting that more frequent and long periods will be observed.

The climate hazards that could see a decrease in likelihood between now and 2080 are low temperature days (days below -30°C), number of freeze-thaw events. Precipitation with extreme rainfall events and persistent rainfall are increasing, but the climate model is not showing a high increase.

The change in climate hazard likelihood scores is shown in **Figure 4-1** with the base line starting at "3", either increasing or decreasing. Tables for the change in each climate parameter are given in **Appendix A**.

Figure 4-1 Change in Hazard Likelihood (2020 to 2080)



4.2 Results for All Assets (PIEVC HLSG Assessment)

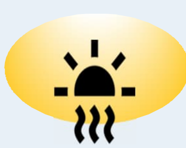
The risk scores for each asset were calculated for each climate hazard and asset by multiplying the likelihood score (1 to 5) by the consequence score (1 to 5), with the highest risk score of 25. The total risk score across all the assets in the system was calculated to determine which hazards posed the greatest risk and which assets were most at risk from those hazards. Specific to the built infrastructure, the results for each infrastructure components aimed to answer the following **two key questions**:

1. **Which five climate hazards have the highest impacts on the infrastructure?**
2. **Which top five infrastructure components are the most vulnerable?**

The two key questions illustrate which climate hazards may impact the asset the most and where efforts should be allocated. It is also important to note that other individual asset components of high-risk scores that not necessarily listed under the top five risks are also noteworthy and should be reviewed as part of the Town asset management plan.

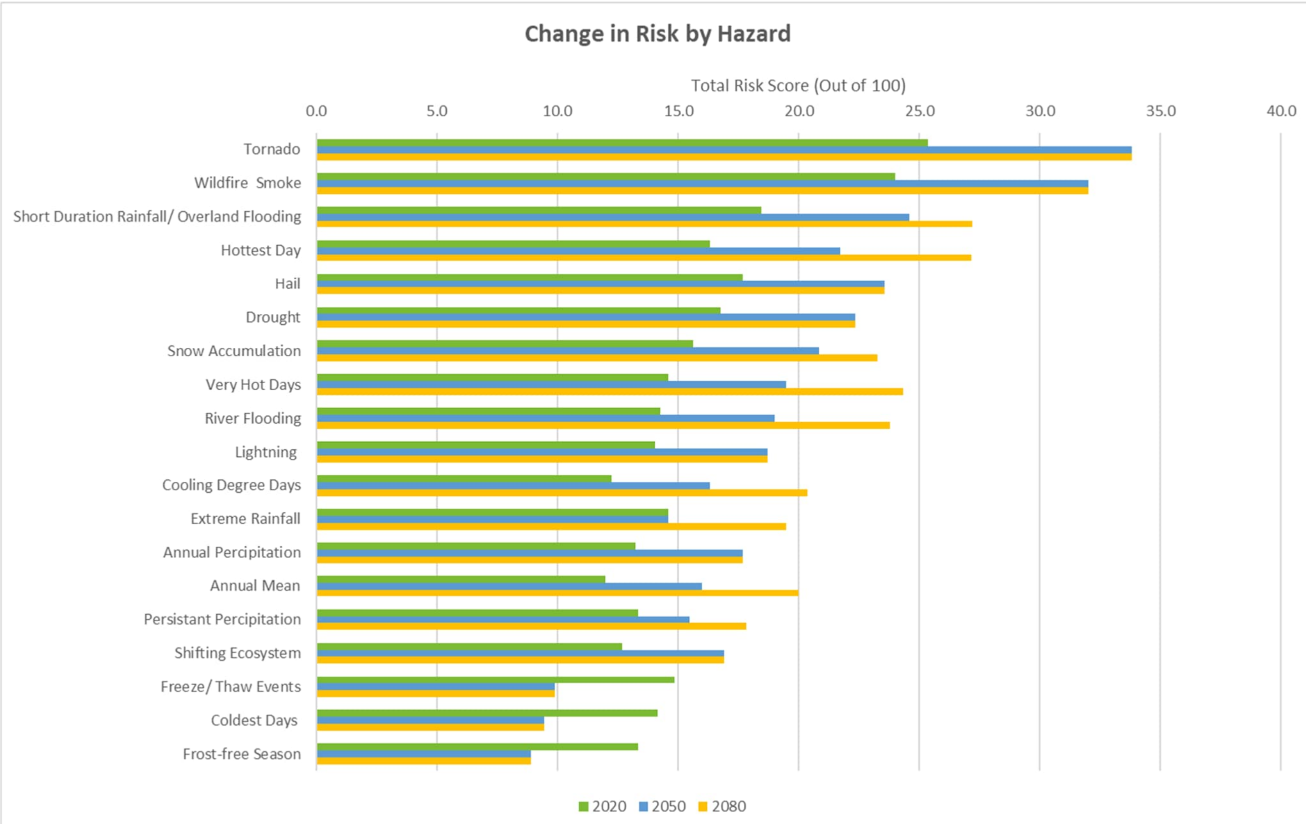
The **five highest risk climate hazards in 2080** are shown in **Table 4-1.**

Table 4-1 Five Highest Risk by Climate Hazards to Town Owned and Operated Assets

Rank	Climate Hazard		Potential Impacts
1		High Winds	• Damage to buildings, trees, signs • Tree fall/branches blocking roadways • Flying debris at landfills
2		Wildfire Smoke	• Reducing visibility • Increasing maintenance on equipment filtration system • Increasing emergency services attending to health issues • Increasing health impacts on employees working outdoors • Damage to property
3		River Flooding	• Flooding of water stormwater systems, including storm ponds, catch basins, and drainage ditches • Flooding of buildings and basements • Washouts of gravel roads and trails
4		Hottest Days (Above 30°C)	• Increasing use of energy to cooling buildings • Gravel and asphalt surface deterioration • Equipment running hot resulting in potential damage • Health impact on employees working outdoor • Potential poorer water quality • Stress on ornamental vegetation
5		Hailstorm	• Damage to exterior of buildings, outdoor equipment, vehicles • Damage to trees • Blocking catch basins • Causing injuries to outdoor staff

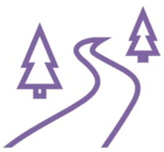
The change in risk for each climate hazard across all assets over time is shown in **Figure 4-2.** The risk scores were normalized to 100 for comparison of climate hazards. Also noting that coldest days and freeze-thaw days are decreasing in risk progressing towards 2080.

Figure 4-2 Change in Risk by Climate Hazards (Present to 2080)



When we analyze the risk data for the assets based on these climate hazards, the five highest risk infrastructure systems are shown on **Table 4-2**.

Table 4-2 Infrastructure Systems of Highest Risk

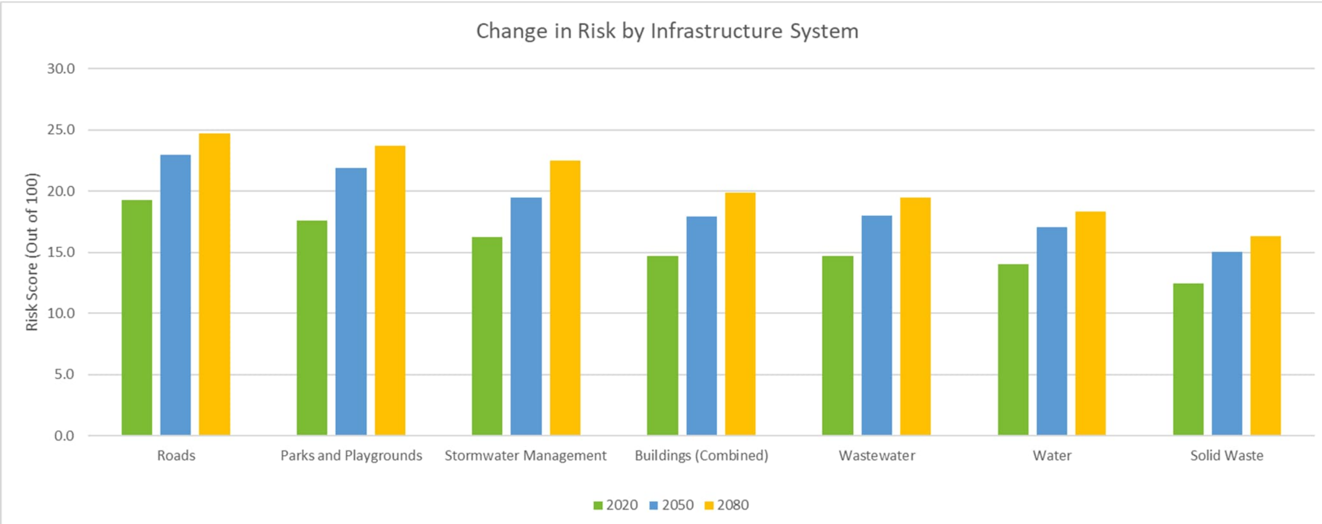
Rank	Infrastructure System	Assets Impacted (High Score)	Top Impacts
1	 **Roads**	• Sidewalks • Gravel and Asphalt Roads • Operations and Maintenance • Emergency Services	• Extreme hot temperatures cause surface cracking and deterioration in asphalt paved roads. • Heavy snow resulting in more wear and tear on roads due to more snow ploughing, sanding, and scraping. • Freeze-thaw cycles resulting in surface deterioration. • Heavy rainfall or persistent rain events resulting in subsoil saturation and ponding resulting in road structure deterioration. • Drought resulting in drying out of subgrades and more maintenance on gravel roads, as well as dust control. • High winds resulting in debris or fallen objects (trees, poles) blocking roadways. • Wildfire smoke results in low visibility.
2	 **Parks and Playground**	• Community Trails, Bretzlaff Park, Elks Memorial Park, Centennial Park, and Ruth Cust Park • Operations and Maintenance	• Hot temperatures increase usage of water usage for irrigation. • Drought resulting in replacement of vegetation and die-offs. • Increasing operations and maintenance to repair wear and tears, clean ups, removal of water, etc. • Shorter season for winter activities. • High winds and hail resulting in structural damage to park spaces and vegetation. Fallen branches, leaves, and trunks result in clean ups and risk to park users. Damaged structures will require repair or replacement. • River flooding resulting in damage to the park by the river (specific discussion to Elks Memorial Park). • Overland flooding resulting in water ponding (specific to Elks Memorial Park, and Centennial Park)
3	 **Stormwater**	• Overland Drainage • Outfall into the Creek • Collectors, Trunks, and Lateral Mains • Stormwater Manholes and Catch Basins • Operations and Maintenance	• Short duration high intense rainfall resulting in overland ponding/flooding, high discharge to the creek, and overwhelming stormwater collectors, lateral mains, trunks and manholes/catchbasins. This result in potential flooding in areas and clean ups required after water subside. • Heavy winter snow will result in high spring runoff. • Clean out of catch basin will be more frequent to avoid backups due to plugged systems.

Rank	Infrastructure System	Assets Impacted (High Score)	Top Impacts
			• Creek flooding impacts surrounding areas resulting in backups and surcharges in the storm collection and discharge system.
4	 Buildings	• Electrical • Mechanical -HVAC • Structural and Building Envelop • Plumbing – water and wastewater • Surrounding area – parking, drainage • Building Staff • Operations and Maintenance	• High winds damaging the exterior of the building. • Wildfire smoke impacting the HVAC system requiring more frequent replacement of filters with increased maintenance due to smoke particulates. Full upgrade of a better HVAC system may be required. • Smoke inhalation by the building staff and operations staff can be impacted if building HVAC is not filtering out the smoke effectively.
5	 Wastewater	• Lagoons and site infrastructure (access roads, level controls, etc.) • Operations and Maintenance	• Extreme hot temperatures may impact the treatment of the wastewater at the lagoons. Vegetation for erosion control may deteriorate under these conditions. • Hot temperatures impact staff working outdoors.

The normalized risk scores for all of Town's assets in 2020 up to 2080 is shown in **Figure 4-3**. Solid Waste Management and Water Treatment are not owned and operated by the Town, but they provide major service to the community, therefore, they are included in this discussion.

It is important to prioritize investments and actions to improve the resilience of these top five assets, which are presented as the highest risk; however, it is also important to consider the risks associated with Stormwater Management, Buildings, and Fleet to ensure proper and reliable performance. Adaptation Planning to reduce risk is further discussed in **Section 5**.

Figure 4-3 Change in Risk by Infrastructure



The **detailed results of the risk assessment completed using PIEVC HLSG** for each infrastructure system as well as each components are provided in **Appendix B**. The results show the likelihood and consequence scoring of each asset with the calculated risk scores.

4.3 Results for Community-Wide Assessment

As part of the community-wide assessment, the potential climate impact scenarios for the Town were described in **Table 4-3**. The impact scenarios outlined how the climate hazards identified in Section 2 could affect social systems, community assets, and/or the local economy. The impact scenarios characterized the cause-and-effect relationship, or impact chain, between climate hazards (or changes) and consequences. The impact scenarios were identified based on the information gathered through Workshop 1B (Tell us About Your System), and our team's experience with and review of, climate risk assessments from similar communities. The scenarios, listed in **Table 4-3**, were reviewed and updated with Town staff and stakeholders at the Climate Risk Assessment Workshop**. Table 4-3** includes the list of climate impact scenarios that were assessed for the Town of Onoway. Each scenario includes:

- The **climate driver** for each impact
- The climate **impact (or event)**
- A more detailed **description** of the potential impact

Table 4-3 Climate Impact Scenarios for the Town

Climate Driver	Impact/Event	Description
Hotter Temperatures	Extended heat wave	1. A heat event similar, or worse, than the 2021 heat wave with localized health impacts, particularly on vulnerable populations such as seniors and those with low income and/or housing challenged.
	Increased space cooling costs	2. Increased costs for residents, businesses, and the municipality to cool homes and buildings during the summer. Potential need to expand or add HVAC systems to existing homes and buildings.
Warmer Winter Temperatures	Loss of outdoor winter recreation opportunities	3. Reduced quality of life for residents that enjoy winter recreation (Nordic skiing, hockey, ice fishing, snowmobiling, sledding, etc.).
Drought (SPEI)	Drought damage to trees, gardens, and landscaping	4. Drier summer conditions overall with implications for local natural assets -trees, landscaping, etc.
	Drought damage to agricultural crops in the region	5. Local and regional economic impacts to the agricultural sector and local businesses.
	Increased water consumption	6. Increased costs and impacts to water utilities, and local businesses that rely on water.
	Water supply shortage	7. Shortage of water supply requires significant water restrictions. Impacts on local gardens, food security, and quality of life.
Extreme Weather (High wind)	High wind event with gust up to 90 km/hr and more	8. A windstorm with gusts of greater than 90km per hour: • Impact on local events (delays/cancellations). • Health impacts (injuries/fatalities). • Damage to utilities - power outage. • Property and structure damage – roofing, siding, windows, cars, cost to repair.
Extreme Weather (Tornado[1])	Large 'devastating' tornado (EF 4)[1]	9. A large devastating tornado with widespread damage to buildings and property, potential loss of life (injuries/fatalities), and long-term power outage.
Extreme Weather (Hailstorm)	Major hail event	10. Hailstorm with hail stones of 45 mm ("golf ball" sized) or greater: • Impact on local events (delays/cancellations). • Potential health impacts (injuries/fatalities). • Property damage – roofing, siding, windows, cars, cost to repair.
Hotter Temperatures / Extreme Weather	Freezing Rain - increasing future likelihood[2]	11. Precipitation event in which rain freezes on impact: • Impact on local events (delays/cancellations). • Health impacts (injuries/fatalities). • Damage to utilities - power outage. • Property damage – cost to repair. • Transport disruption/traffic accidents from icy roads. • Trees damaged, repair costs.

[1] An EF4 tornado is capable of producing winds speeds up to 322 km/hour and causing 'devastating' damage.

[2] Reference: Jeong, D., et al., 2019: Projected changes to extreme freezing precipitation and design ice loads over North America based on a large ensemble of Canadian regional climate model simulations, Nat. Hazards Earth Syst. Sci., 19, 857–872; and Cannon, A., Jeong, D., Zhang, X. and Zwiers, F. 2020. Climate-Resilient Buildings and Core Public Infrastructure: An Assessment of the Impact of Climate Change on Climatic Design Data in Canada. Environment and Climate Change Canada, Gatineau, QC, 106 p.

Climate Driver	Impact/Event	Description
Heavy Rainfall	Overland flooding	12. Short duration high intensity rainfall event requiring public 'intervention' - flood inundation of buildings/properties in low lying areas resulting in increase in clean up and repair costs.
Hotter Temperatures	Grass fire	13. A significant grass fire occurs within the municipal boundaries, causing damage to: • Property damage. • Temporary road closures. • Damage to utilities - power outage.
	Wildfire smoke	14. Smoke from wildfires causes significant health risks: • Health impacts (injuries/fatalities), particularly on vulnerable populations. • Impact to quality of life, reduced outdoor recreation. • Increased costs for home/building filtration systems.
Longer Summer (Frost-Free) Season	Invasive weed outbreak	15. A major outbreak of invasive weeds affecting the municipality and local farmers.
Extreme Weather / Increased Winter Precipitation	Heavy snowstorm	16. Snow loads on homes / businesses, costs of removal, transport disruption (emergency services), potential health impacts.

The risk score for each climate impact scenario was determined based on the multiplication of likelihood and consequence score, as discussed. The details of the lower risk results are shown in **Table 4-4**. Only those climate impact scenarios that were assessed as "high risks" (score 20 and 25) will be considered in the climate adaptation action planning process.

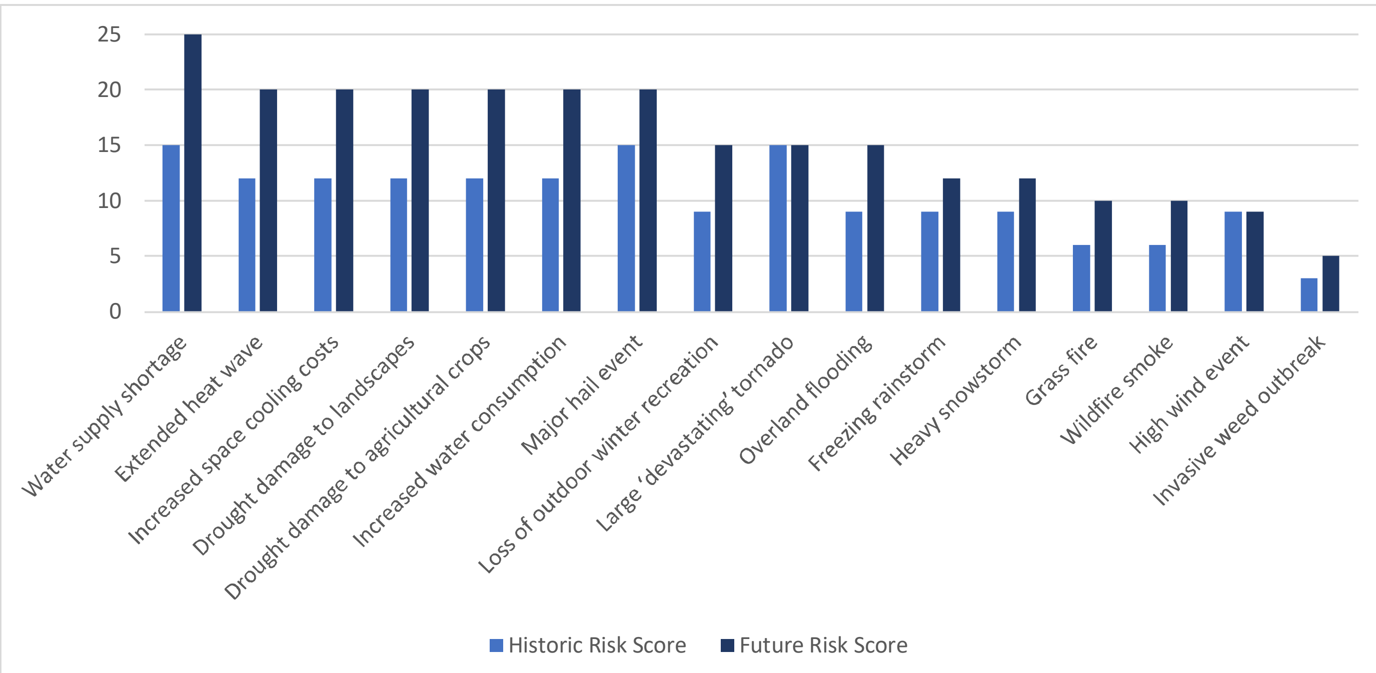
Table 4-4 Climate Risk Assessment Results

Impact	Historic Likelihood	Future Likelihood	Consequence Score	Risk Score	Risk Level
Water Supply Shortage	3	5	5	25	HIGH
Extended Heat Wave	3	5	4	20	HIGH
Increased Space Cooling Costs	3	5	4	20	HIGH
Drought Damage to Landscapes	3	5	4	20	HIGH
Drought Damage to Agricultural Crops	3	5	4	20	HIGH
Increased Water Consumption	3	5	4	20	HIGH
Major Hail Event	3	4	5	20	HIGH
Loss Of Outdoor Winter Recreation	3	5	3	15	MODERATE
Large 'Devastating' Tornado (EF 4)	3	3	5	15	MODERATE
Overland Flooding	3	5	3	15	MODERATE
Freezing Rainstorm	3	4	3	12	MODERATE
Heavy Snowstorm	3	4	3	12	MODERATE

Impact	Historic Likelihood	Future Likelihood	Consequence Score	Risk Score	Risk Level
Grass Fire	3	5	2	10	LOW
Wildfire Smoke	3	5	2	10	LOW
High Wind Event	3	3	3	9	LOW
Invasive Weed Outbreak	3	5	1	5	LOW

Figure 4-4 provides a summary of the climate risk assessment, comparing the historic, and future climate risk scores for each climate impact.

Figure 4-4 Summary of Climate Risk Scores Comparing Historic and Future



5 ADAPTATION ACTION PLANNING

A series of adaptation workshops, **Workshop 3**, were conducted in November 2023 with the Town's departmental leads. For continuity, the departmental leads who attended **Workshop 1** and **Workshop 2** attended this Workshop. The workshops facilitated by Associated Engineering and All One Sky Foundation are listed in the following:

- **Workshop 3A**: Water, Wastewater, Stormwater, Roads, Parks, Buildings, Solid Waste
- **Workshop 3B**: Community-wide (social aspects and local economy)

The Community Climate Adaptation Planning Guide developed by All One Sky Foundation was used in guiding the Workshop discussion. The recommended options for adaptation actions are listed in the following:

1. **No Action** – No additional actions required - business as usual.
2. **Conduct information collection, studies, or assessments** to obtain further information on the nature of the risk to better inform the decision-making process.
3. **Update policies, plans, standards, guidelines, or bylaws** that consider climate risks and opportunities.
4. **Modify operations and/or maintenance** schedules, activities with the consideration of climate impacts.
5. **Build new or upgrade existing** Infrastructure to provide protection against climate risks.
6. **Increase awareness and education** to help community better understand risks and adaptation actions.
7. **Incorporate emergency management** such as response and evacuation planning, hazard mapping, and early warning or alert systems.
8. **Consider human resourcing** options and evaluate the need for additional staff time allocated to climate adaptation planning, implementation, and establishing task force.

5.1 Infrastructure Systems

Associated Engineering facilitated the discussions during **Workshop 3A** which identified the adaptation actions for each infrastructure asset. These actions were examined for the medium to high-risk climate impacts. The discussions were summarized and tabulated in **Appendix C** for each infrastructure system and their respective components. Each summary table highlights the following:

- Recommended adaptation actions
- Time frame of implementation

The time frames were grouped into:

- 0 to 5 years as immediate to short-term
- Up to 10 years for longer term implementation.

5.2 Community-Wide Adaptation Consideration

The goal of the climate adaptation action planning process was to identify potential future actions that can be implemented by the Town to manage high priority climate change risks affecting the Community and local economy. An **Action Planning Workshop** was held on September 29, 2023 to consider:

1. What actions are currently being implemented to manage the social/economic consequences of each impact?

2. What new actions, or improvements/updates to existing actions, are needed to manage the social/economic consequences of each impact more effectively?

Table 5-1 provides a summary of recommended actions to be implemented by the Town of Onoway to manage high priority climate change risks affecting the local economy and community. For each recommended action, the following information is provided:

1. **What is the estimated timeframe for having this action implemented (operational)?**
   a. Ongoing
   b. Near-term (next 1-2 years)
   c. Short-term (2-5 years)
   d. Medium-term (5-10 years)
   e. Long-term (10+ years)

2. **Which priority climate impact does the action help to manage?**
   a. **Water:** Shortage of water supply and increased costs and impacts to water utilities, and local businesses that rely on water
   b. **Heat**: Extended heat wave with localized health impacts on vulnerable populations, and increased costs to cool homes and buildings
   c. **Drought**: Dry summer conditions damage landscapes and agricultural crops
   d. **Storms:** Large hailstorm or windstorm with impacts to local events, public health, and property damage.

Table 5-1 Climate Adaptation Action Recommendations – Community – Social - Economic

Recommended Action	Time	Water	Heat	Drought	Storms
1. Develop a drought response plan. The Plan should identify water restrictions (such as alternate watering days) aligned with the Government of Alberta's five stages of water shortage management[3]. The Plan should be communicated effectively to residents.	Near-term	✓			
2. Develop water conservation education. Develop targeted information for residents on how to conserve water, for example through xeriscaping and water re-use, and post on the Town website.	Short-term	✓			
3. Plant drought tolerant trees and grasses. Ensure trees and grasses planted by the Town are drought tolerant and climate-adapted[4]. Landscaping with drought tolerant and climate-adapted trees and grasses should be encouraged through the Land Use Bylaw, Municipal Development Plan, and other statutory plans.	Ongoing	✓		✓	

[3] For more information see: https://www.alberta.ca/drought

[4] For additional details on drought tolerant and climate suitable tree species in the Edmonton Region see: Guide to Urban Forest Management in a Changing Climate: https://static1.squarespace.com/static/5ed809f05c460126fe7f10e2/t/5ef3c2dd8b38a9767d98ca23/1593033454683/Guide%2Bto%2BUrban%2BForest%2BManagement%2Bin%2Ba%2BChanging%2BClimate%2B-%2BPhase%2B2%2BReport.pdf

Recommended Action	Time	Water	Heat	Drought	Storms
4. Develop a water re-use program. For example, by providing free or subsidized rain barrels or cisterns, and encouraging residents to conserve and re-use water.	Short-term	✓			
5. Develop an Extreme Heat Response Plan. The response plan should identify heat-related triggers at which point the activation of heat wave response is required. Triggers should be aligned with heat alerts issued by Environment and Climate Change Canada[5]. Heat responses should be focused on providing public education and communications, particularly targeted at vulnerable populations, for example, directing people to the Onoway Arena, or Museum and Heritage Centre[6]. The Extreme Heat Response Plan should be incorporated into the Emergency Management Plan.	Short-term		✓		
6. Incorporate shade structures in community developments. The Town should incorporate shade structures in any future developments, and encourage local residents, businesses to do the same. The incorporation of shade structures in developments should be encouraged through the Land Use Bylaw, Municipal Development Plan, and other statutory plans.	Ongoing		✓		
7. Respond rapidly to storm events. Support residents and businesses to recover from storm events by ensuring rapid response and clean up to keep roadways and access open following storm events. This may require the dedication of additional time or modifying staff job descriptions to ensure appropriate resources are available.	Ongoing				✓
8. Consider hailstorms in the Emergency Management Plan. The Emergency Management Plan should be updated to specifically consider a response plan for hailstorms. The response should be aligned with severe thunderstorm alerts issued by Environment and Climate Change Canada, which include hail[7].	Short-term				✓

[5] Public alerts are issued by Environment and Climate Change Canada when there are *2 or more consecutive days of daytime maximum temperatures above 29°C, and nighttime minimum temperatures above 14°C.* Source: https://www.canada.ca/en/environment-climate-change/services/types-weather-forecasts-use/public/criteria-alerts.html#heat

[6] The Government of Alberta has a toolkit of resources available related to communications for extreme heat events, see: https://www.alberta.ca/extreme-heat

[7] Public alerts are issued by Environment and Climate Change Canada when conditions are favourable for the development of severe thunderstorms which includes: Hail of two centimeters (cm) or larger in diameter. See: https://www.canada.ca/en/environment-climate-change/services/types-weather-forecasts-use/public/criteria-alerts.html#severeThunderstorm

6 RECOMMENDATION

The risk assessments and adaptation actions provided an overview of the risk and vulnerabilities of the built infrastructure, and the socio and economic aspects for the Town. The assessment enabled the Town to identify high-risk areas and allocate resources to take actions in preventing, reducing, or eliminating potential risks. The assessment focused on the Town's current condition and how the assets fared with future projected climate hazards. The following recommendations are or consideration as **Next Steps**:

1. **Prioritize Actions**. The critical infrastructure that has high impacts are Roads, Park, Stormwater, Buildings, and Wastewater systems. Priority consideration should be given to these assets to ensure level of service to the community is maintained. A list of recommended actions has been provided for the Town in **Section 5** to consider and implement. Starting with low costs actions, these can be implemented with planned policy or bylaw updates.
2. **Cross Cutting Discussion and Information Sharing.** The Town is encouraged to share this information with other relevant departments and inform asset managers for future planning. Furthermore, the cross-departmental discussion can help to identify, assess, and address common problematic areas to protect assets.

Table 6-1 Potential Cross Cutting Adaptation Actions Applicable to All Departments/Corporations

All Departments/Corporation
Increase public engagement and community awareness of climate change impacts and adaptations through public open houses, schools, and other discussion forums.
Employ an adaptive management approach to climate adaptation planning.
Increase staff training on climate change impacts and adaptations across all departments.
Promote sharing of Town's maps and emergency information to improve emergency response.
Promote the use of renewable energy sources in homes and buildings.
Avoid flood prone areas through zoning, planning, and development restrictions.
Identify funding opportunities for green infrastructure and buildings to increase resilience.

3. **Monitor, Assess, and Update Risk Scores, and Adaptation Actions.** The Town is encouraged to identify performance or tolerance threshold (e.g., temperature, precipitation) of the asset so that it provides a baseline for monitoring. As the Town improves or make modifications to reduce the risks and vulnerabilities to the assets, the adaptation plans can be updated. This encourages improvements and furthers the reduction and removal of risks.
4. **Continual Review of Climate Data.** The Town, over time, should also monitor the ongoing evolution of climate projections. This will allow the Town to update the risk score and evaluate its vulnerabilities and exposure based on current and science-based information. Adaptation actions will be adjusted accordingly while staying flexible and adaptable to the potential market fluctuations.

7 CLOSURE

A Climate Change Risk Assessment was conducted to identify and evaluate the potential impact climate change may have on the Town of Onoway's infrastructure and community, as a whole.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Engineering Alberta Ltd.

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The Association of Professional Engineers
and Geoscientists of Alberta

APPENDIX A – CLIMATE PROJECTED DATA

Climate Variable	Brief Description	Baseline (1976-2005)	Near Future (2021-2050)	Distant Future (2051-2080)	Resource
Mean Annual Temperature (°C)		2.7°C	4.2°C	6.8°C	Climateatlas.ca – Wabamun Lake Region data used
Mean Summer Temperature (°C)		14.7°C	16.8°C	19 °C	Climateatlas.ca – Wabamun Lake Region data used
Number of Days Above +30°C (#)	The number of days with a maximum temperature (T_{max}) greater than 30°C. Use the Variable menu option to view annual, monthly, or seasonal values for this index.	2 days	11 days	23 days	Climatedata.ca
Number of Heatwaves (#)	The average number of heat waves per year. A heat wave occurs when at least three days in a row reach or exceed 30 °C	0.2	1.1	2.8	Climateatlas.ca
Hottest Day	The Hottest Day describes the warmest daytime temperature in the selected time period. In general, the hottest day of the year occurs during the summer months.	29.7°C – 31.3°C	31.7°C – 35.3°C	33.8°C – 39°C	Climatedata.ca
Cooling Degree Days	The number of degree days accumulated above 18°C in the selected time period. Use the Variable menu option to view the annual, monthly, or seasonal values for this index. Visit the Analyze page to calculate degree days using different threshold temperatures.	40 degree days	125 degree days	269 degree days	Climatedata.ca
Mean Winter Temperature (°C)	The average temperature of the day in winter.	-10.7°C	-8.4°C	-6.2°C	Climateatlas.ca – Wabamun Lake Region data used
Number of Days Below -30°C (#)	The number of days with a minimum temperature (T_{min}) less than -30°C.	9.9	5.2	2.2	Climateatlas.ca – Wabamun Lake Region data used

Climate Variable	Brief Description	Baseline (1976-2005)	Near Future (2021-2050)	Distant Future (2051-2080)	Resource
Mild Winter Days Below -5°C	A Mild Winter Day is a day when the temperature drops to at least -5 °C.	138.4	117.7	98.7	Climateatlas.ca – Wabamun Lake Region data used
Frost-free season (days)	The number of days between the date of the last spring frost and the date of the first fall frost, equivalent to the number of consecutive days during the 'summer' without any daily minimum temperatures below 0°C. Use the Variable menu option to view values for this index on the map.	126	148	168	Climatedata.ca
Freeze-thaw cycle	A freeze-thaw cycle occurs when the daily maximum temperature (T_{max}) is higher than 0°C and the daily minimum temperature (T_{min}) is less than or equal to -1°C.	106.2	95.5	85.2	Climateatlas.ca – Wabamun Lake Region data used
Annual Total Precipitation (mm)	The total amount of precipitation (mm) accumulated in the selected time period. Use the Variable menu option to view the annual, monthly, or seasonal values for this variable. Rain and snow included.	452 mm	473 mm	479 mm	Climatedata.ca
Number of Days with >10 mm Precipitation (#)	The number of days with precipitation >= 10 mm.	8 to 12 days	8 to 13 days	9 to 13 days	Climatedata.ca
Wet Days >= 20 mm	The number of days with precipitation >= 20 mm. Rain and snow included	2	2	3	Climatedata.ca
Maximum 1-day Total Precipitation	The largest precipitation total that falls in a single day in the selected time period. Includes both rain and snow.	35 mm	35 mm	38 mm	Climatedata.ca

Climate Variable	Brief Description	Baseline (1976-2005)	Near Future (2021-2050)	Distant Future (2051-2080)	Resource
Maximum 5 -day Consecutive Precipitation (mm)	The maximum total precipitation that falls over a consecutive 5-day period.	61 mm	63 mm	69 mm	Climatedata.ca
Short Duration Rainfall / Overland Flooding	Based on 1:100 year 24 hour event. RCP8.5	4.9 mm/hr	5.1 mm/hr	5.7 mm/hr	ClimateData.ca – data was taken from Stoney Plain for the closest station.
Maximum No. of Consecutive Dry Days	The maximum number of consecutive days with precipitation below 1mm/day, within the selected time period.	27 days	26 days	26 days	Climatedata.ca
Drought (SPEI)	SPEI (12 months), The Standardized Precipitation Evapotranspiration Index (SPEI) is a drought index based on the difference between precipitation (P) and potential evapotranspiration (PET). Negative (positive) values indicate water deficit (surplus).	General drier conditions in the summer; however, noting that the excessive moisture due to extreme rainfall with annual variability also increase with warmer climate.			Conversation with Dave Sauchyn, August 18, 2023.
		-0.1	-0.5	-0.5	Climatedata.ca (rounded up to nearest 10^{th} decimal)
Winter Precipitation	Snow accumulation over winter months (December, January, February)	69 mm	75 mm	81 mm	Climateatlas.ca
Lightning		Complex model generated considering wind shear, temperature, moisture. Increasing severe weather events modelled increasing lightning occurrence.			Dominique Paquin, et. Al., 2014. Change in North American Atmospheric Conditions Associated with Deep Convection and Severe Weather using CRCm4 Climate Projections, ISSN 0705-5900.
Hailstorm	Precipitation in the form of lumps	Historical likelihood is 1 large hail day every 6-7 years [3.5 to 5 large hail days over period 1971-2000]. ~14% annual probability of large hail day occurring historically. There is an increasing likelihood of about 1 additional large hail day per season [1 large hail day every 5-6 years]. ~18% annual probability of large hail day occurring.			Brimelow, J. et al., 2017, The changing hail threat over North America in response to anthropogenic climate change, Nature Climate Change, DOI: 10.1038/NCLIMATE3321.

Climate Variable	Brief Description	Baseline (1976-2005)	Near Future (2021-2050)	Distant Future (2051-2080)	Resource
		Report indicates an historic likelihood of 4 (likely). Likelihood is noted as health and wellbeing (2 – low), economic (4 – high), natural environment (2 – low), built environment (4 – high)			
Tornado	Violently rotating column of air that extends from a cumuliform cloud to the surface.	There has been one "strong" or higher tornado in the region—Edmonton, Beaumont, Millet, etc., on 31.07.1987 <1% annual probability of strong tornado	Insufficient evidence to determine trend <1% annual probability of strong tornado	Insufficient evidence to determine trend <1% annual probability of strong tornado	• Beaumont, Millet, etc. on 31.07.1987. • Elsner, J. et al, 2014, Tornado Intensity Estimated from Damage Path Dimensions, PLoS ONE 9(9): e10757.
High Wind	Sustained wind at 70 km/hr or gust up to 90 km/hr and more.	Minor changes from 2020 to 2080. Some data are inclusive and will need more research.			https://www.canada.ca/en/environment-climate-change/services/types-weather-forecasts-use/public/criteria-alerts.html#wind https://publications.gc.ca/collections/collection_2021/eccc/En4-415-2020-eng.pdf
Riverine Flooding	Excessive rainfall raises the water level in rivers and creeks across the region overflows onto the neighboring land. High flows: 1:100 year, 1-day stream flow to 200 year flood level.	There is no major river through the Town. However, there is creek that is within town and has caused some issues. Assumed increase potential flooding from the creek.			Conversation with the Town.
Wildfire Smoke	Wildfire smoke causes health conditions. Wildfire smoke reduces visibility to 2km or less causing unhealthy air quality conditions.	16 occurrences where visibility fell below 2km between 1961-2021 Annual probability about 27%	Increasing. Projected 30-70% [mid-point of 50%] increase in the number of wildfire spread[1] days in fire zones that could affect smoke levels in the region.		Edmonton International Airport for "smoke days". Based on studies for the Edmonton Municipal Region in 2023.
Wildfire	Uncontrolled ground fire spread resulted from flammable biomass, weather, topography, and ignition	Using the resource data, AE generated a data base showing the potential increase of burned area from baseline 1981 to 2080s. Based on RCP 8.5 scenario, the projected % change in annual number of fires			Wang, Xianli, Tom Swystun, and Mike D. Flannigan. "Future wildfire extent and frequency determined

Climate Variable	Brief Description	Baseline (1976-2005)	Near Future (2021-2050)	Distant Future (2051-2080)	Resource
	sources. Ignition sources may be natural (e.g. lightning) or due to human error.	greater than 50 ha is 10% from 2020s to 42% in 2080s. % change in average annual area burned increases from 33% in 2020s to 190% in 2080s.			by the longest fire-conducive weather spell." *Science of the total environment* 830 (2022): 154752. Wang, Xianli, et al. "One extreme fire weather event determines the extent and frequency of wildland fires." *Environmental Research Letters* 16.11 (2021): 114031. Wang, Xianli, et al. "Projected changes in daily fire spread across Canada over the next century." *Environmental Research Letters* 12.2 (2017): 025005. Wang, Xianli, et al. "The potential and realized spread of wildfires across Canada." *Global change biology* 20.8 (2014): 2518-2530.
Shifting Ecosystem	Changing seasons and ecosystems	Unknown, as it depends on disturbances to the landscape (to create windows for change) as well as changes to the climate envelope of each ecoregion			Schneider, R., 2013, Alberta's Natural Subregions Under a Changing Climate: Past, Present, and Future, Report prepared by Department of Biological Sciences, University of Alberta for the Biodiversity Management and Climate Change Adaptation Project, 97p.

A "spread day" measures of the number of days suitable for active fire growth within the potential or observed lifetime of a fire. They are conditional on the joint occurrence of a drying period where fuel moisture is expected to support fire ignitions and survival, b) extensive fuels to support fire spread, c) extreme fire weather (hot, dry, and windy).

APPENDIX B – ASSETS RISK RESULTS FROM PIEVC HLSG PROCESS

PIEVC Risk Matrix
Water Distribution System

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

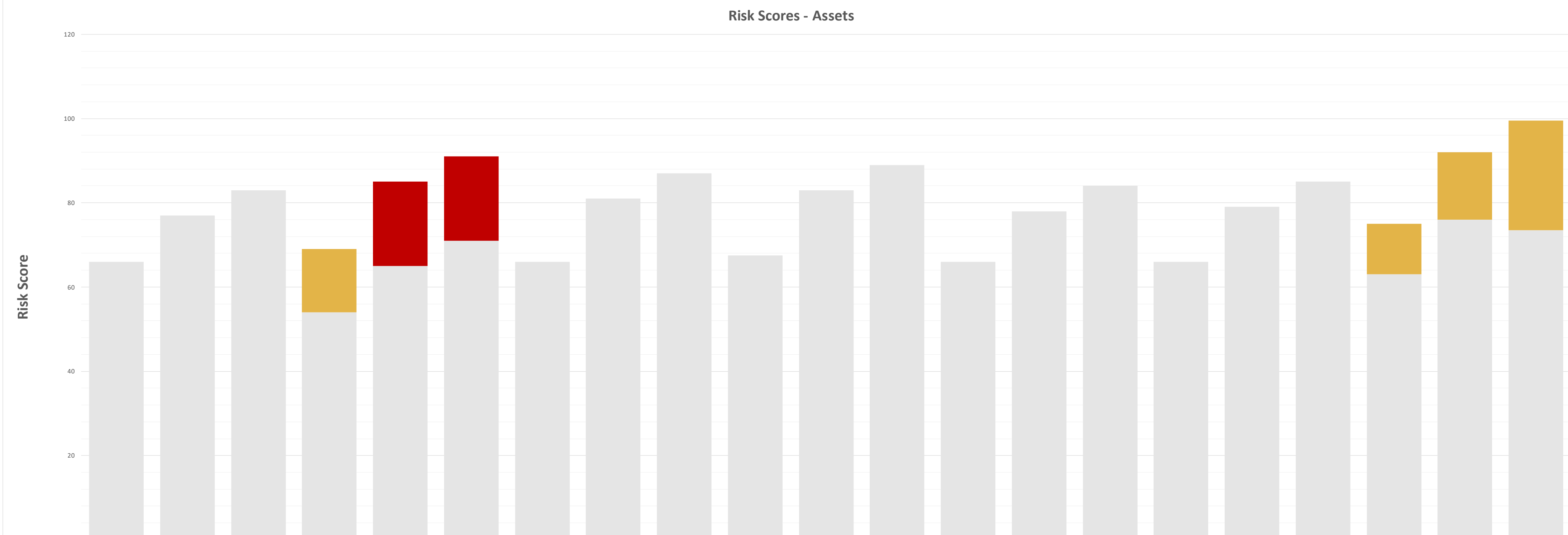
Climate Parameter

		Temperature																											
		Mean Annual Temperature (-C)				Days above +30ºC				Warmest Day Time Temperature				Cooling Degree Days (Degree Days)				# of Days Below -30ºC				# Days Without Frost				# Freeze/ Thaw Events			
		Annual Mean				**Very Hot Days**				**Hottest Day**				**Cooling Degree Days**				**Coldest Days**				**Frost-free Season**				**Freeze/ Thaw Events**			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3			126	3			106.7	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2			148	2			95.5	2		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2			168	2			85.2	2		
Water Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Distribution Water Mains and Service (including hydrants/valves)	Present		3		3		3		3		3		3		3		3		3		6		3		3		3		6
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	2	4	Y	2	1	2	Y	2	2	4
	2080		5		5		5		5		5		5		5		5		2		4		2		2		2		4
Regional Water Supply Security	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
Water Reservoir and Pump House	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
Communication/SCADA (Sheltered)	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		6		3		3		3		4.5
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	2	4	Y	2	1	2	Y	2	1.5	3
	2080		5		5		5		5		5		5		5		5		2		4		2		2		2		3
Public/Users	Present		3		3		3		3		3		3		3		3		3		6		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	2	4	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		4		2		2		2		2
Emergency Services	Present		3		3		3		4.5		3		6		3		3		3		4.5		3		3		3		3
	2050	Y	4	1	4	Y	4	1.5	6	Y	4	2	8	Y	4	1	4	Y	2	1.5	3	Y	2	1	2	Y	2	1	2
	2080		5		5		5		7.5		5		10		5		5		2		3		2		2		2		2

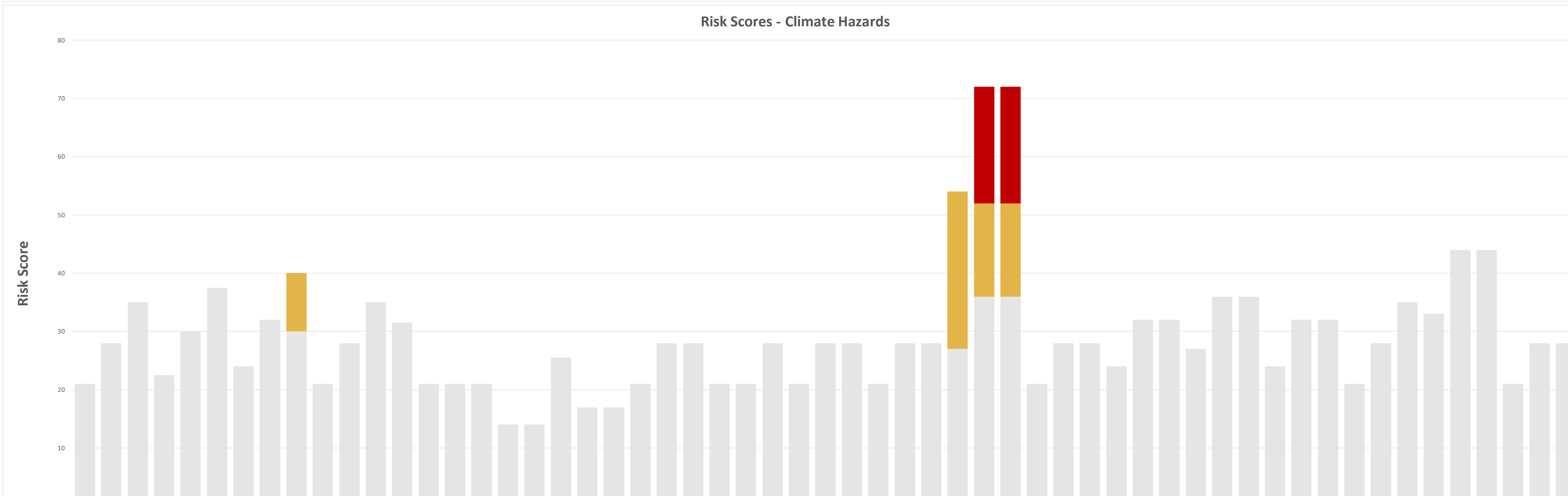
		Precipitation																							
		Annual Total Percipitation (mm)				Maximum 1-Day Total Percipitation (mm)				Maximum 5-day Consecutive Percipitation (mm)				Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr)				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)				Total Percipitation in the Winter Months			
		Annual Percipitation				**Extreme Rainfall**				**Persistant Percipitation**				**Short Duration Rainfall/ Overland Flooding**				**Drought**				**Winter Percipitation**			
Climate Projections	Present	452	3			35	3			61	3			4.9	3			-	3			69	3		
	2050	473	4			35	3			63	4			5.1	4			+	4			75	4		
	2080	479	4			38	4			69	4			5.7	4			++	4			81	4		
Water Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Distribution Water Mains and Service (including hydrants/valves)	Present		3		3		3		3		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		8		4		4
Regional Water Supply Security	Present		3		3		3		3		3		3		3		3		3		15		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	5	20	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		20		4		4
Water Reservoir and Pump House	Present		3		3		3		3		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		8		4		4
Communication/SCADA (Sheltered)	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		4		4		4
Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		8		4		4
Public/Users	Present		3		3		3		3		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		8		4		4
Emergency Services	Present		3		3		3		3		3		3		3		3		3		12		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	4	16	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		16		4		4

		Extreme Events																				Shifting Natural Ecoregions			
		Lightning				Hail Storm				High Wind/ Tornado				Flooding				Climate Moisture Deficit				Shifting Natural Ecoregions			
		Lightning				**Hail**				**Tornado**				**River Flooding**				**Wildfire Smoke**				**Shifting Ecosystem**			
Climate Projections	Present	-	3			-	3				3			-	3			-	3			-	3		
	2050	+	4			+	4				4			+	4			+	4			+	4		
	2080	++	4			+	4				4			++	5			+	4			+	4		
Water Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Distribution Water Mains and Service (including hydrants/valves)	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		4		4
Regional Water Supply Security	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		4		4
Water Reservoir and Pump House	Present		3		3		3		6		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		8		4		4		5		5		4		8		4		4
Communication/SCADA (Sheltered)	Present		3		6		3		6		3		6		3		3		3		4.5		3		3
	2050	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	4	1.5	6	Y	4	1	4
	2080		4		8		4		8		4		8		5		5		4		6		4		4
Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		4.5		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1.5	6	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		6		4		4
Public/Users	Present		3		3		3		3		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		8		4		4
Emergency Services	Present		3		3		3		3		3		3		3		3		3		6		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		8		4		4

PIEVC Risk Scores
Water Distribution System



Asset	Period	High Risk Score	Medium Risk Score	Low Risk Scores
Distribution Water Mains and Service (including hydrants/valves)	Present	0	0	66
	2050	0	0	77
	2080	0	0	83
Regional Water Supply Security	Present	0	15	54
	2050	20	0	65
	2080	20	0	71
Water Reservoir and Pump House	Present	0	0	66
	2050	0	0	81
	2080	0	0	87
Communication/SCADA (Sheltered)	Present	0	0	67.5
	2050	0	0	83
	2080	0	0	89
Operation and Maintenance	Present	0	0	66
	2050	0	0	78
	2080	0	0	84
Public/Users	Present	0	0	66
	2050	0	0	79
	2080	0	0	85
Emergency Services	Present	0	12	63
	2050	0	16	76
	2080	0	26	73.5



Climate Hazard	Period	High Risk	Medium Risk	Low Risk Scores
Annual Mean	Present	0	0	21
	2050	0	0	28
	2080	0	0	35
Very Hot Days	Present	0	0	22.5
	2050	0	0	30
	2080	0	0	37.5
Hottest Day	Present	0	0	24
	2050	0	0	32
	2080	0	10	30
Cooling Degree Days	Present	0	0	21
	2050	0	0	28
	2080	0	0	35
Coldest Days	Present	0	0	31.5
	2050	0	0	21
	2080	0	0	21
Frost-free Season	Present	0	0	21
	2050	0	0	14
	2080	0	0	14
Freeze/ Thaw Events	Present	0	0	25.5
	2050	0	0	17
	2080	0	0	17
Annual Percipitation	Present	0	0	21
	2050	0	0	28
	2080	0	0	28
Extreme Rainfall	Present	0	0	21
	2050	0	0	21
	2080	0	0	28
Persistant Percipitation	Present	0	0	21
	2050	0	0	28
	2080	0	0	28
Short Duration Rainfall/ Overland Flooding	Present	0	0	21
	2050	0	0	28
	2080	0	0	28
Drought	Present	0	27	27
	2050	20	16	36
	2080	20	16	36
Winter Percipitation	Present	0	0	21
	2050	0	0	28
	2080	0	0	28
Lightning	Present	0	0	24
	2050	0	0	32
	2080	0	0	32
Hail	Present	0	0	27
	2050	0	0	36
	2080	0	0	36
Tornado	Present	0	0	24
	2050	0	0	32
	2080	0	0	32
River Flooding	Present	0	0	21
	2050	0	0	28
	2080	0	0	35
Wildfire Smoke	Present	0	0	33
	2050	0	0	44
	2080	0	0	44
Shifting Ecosystem	Present	0	0	21
	2050	0	0	28
	2080	0	0	28

PIEVC Risk Matrix
Wastewater Management System

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter – Temperature

		Mean Annual Temperature (◦C)				Days above +30ºC				Warmest Day Time Temperature				Cooling Degree Days (Degree Days)				# of Days Below -30°C				# Days Without Frost				# Freeze/ Thaw Events			
		Annual Mean				**Very Hot Days**				**Hottest Day**				**Cooling Degree Days**				**Coldest Days**				**Frost-free Season**				**Freeze/ Thaw Events**			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3			126	3			106.7	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2			148	2			95.5	2		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2			168	2			85.2	2		
Wastewater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
1 WW Collection Lines and Services (including manholes)	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
	Present		3		3		3		6		3		6		3		3		3		3		3		3		3		3
4 Lagoons + Infrastructure on Site (Level controls, access roads, etc.)	2050	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		10		5		10		5		5		2		2		2		2		2		2
	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
6 Lift Station (Wet/dry well) + Force Main to Lagoon	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
7 Dialer for Lift Station Level Control	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
	Present		3		3		3		6		3		6		3		3		3		3		3		3		3		3
8 Operations and Maintenance	2050	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		10		5		10		5		5		2		2		2		2		2		2
	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
8 Public/Customers	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
9 Emergency Services	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2

Climate Parameter – Precipitation

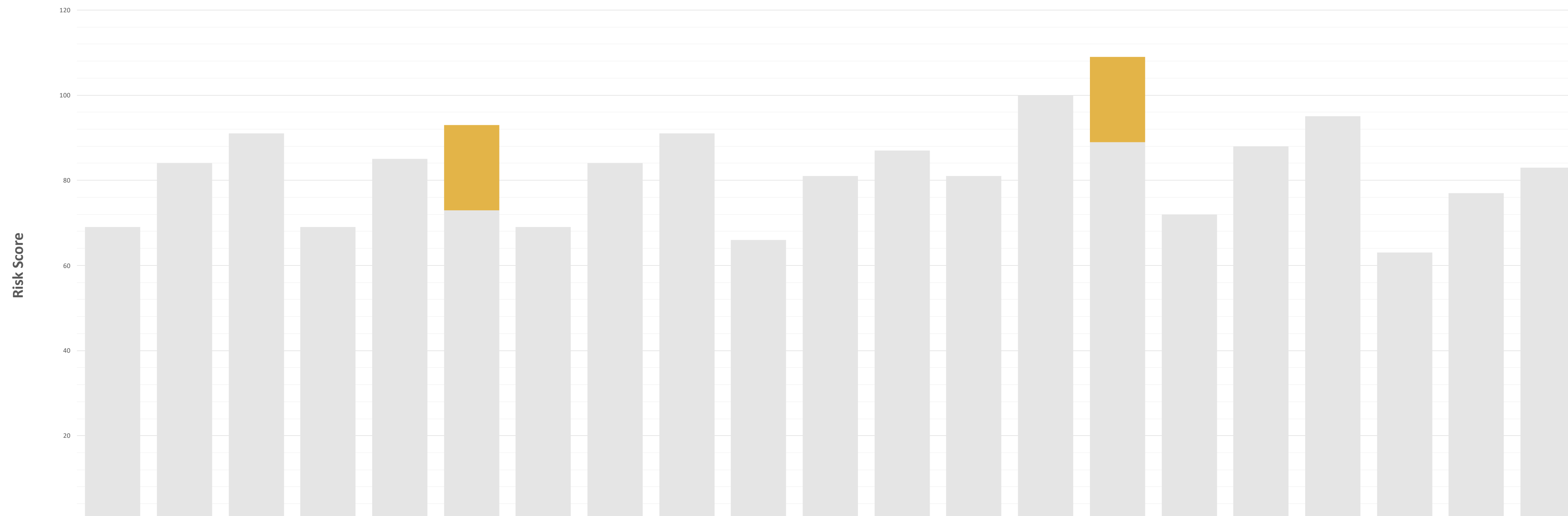
		Annual Total Percipitation (mm)				Maximum 1-Day Total Percipitation (mm)				Maximum 5-day Consecutive Percipitation (mm)				Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr)				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)				Total Percipitation in the Winter Months			
		Annual Percipitation				**Extreme Rainfall**				**Persistant Percipitation**				**Short Duration Rainfall/ Overland Flooding**				**Drought**				**Winter Percipitation**			
Climate Projections	Present	452	3			35	3			61	3			4.9	3			-	3			69	3		
	2050	473	4			35	3			63	4			5.1	4			+	4			75	4		
	2080	479	4			38	4			69	4			5.7	4			++	4			81	4		
Wastewater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
	Present		3		3		3		6		3		6		3		6		3		3		3		3
1 WW Collection Lines and Services (including manholes)	2050	Y	4	1	4	Y	3	2	6	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		8		4		8		4		4		4		4
	Present		3		3		3		3		3		3		3		3		3		3		3		3
4 Lagoons + Infrastructure on Site (Level controls, access roads, etc.)	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		4		4		4
	Present		3		3		3		6		3		6		3		6		3		3		3		3
6 Lift Station (Wet/dry well) + Force Main to Lagoon	2050	Y	4	1	4	Y	3	2	6	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		8		4		8		4		4		4		4
	Present		3		3		3		3		3		3		3		3		3		3		3		3
7 Dialer for Lift Station Level Control	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		4		4		4
	Present		3		3		3		6		3		6		3		6		3		3		3		3
8 Operations and Maintenance	2050	Y	4	1	4	Y	3	2	6	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		8		4		8		4		4		4		4
	Present		3		3		3		6		3		6		3		6		3		3		3		3
8 Public/Customers	2050	Y	4	1	4	Y	3	2	6	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		8		4		8		4		4		4		4
	Present		3		3		3		3		3		3		3		3		3		3		3		3
9 Emergency Services	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		4		4		4

Climate Parameter – Extreme Events / Shifting Natural Ecoregions

		Lightning				Hail Storm				High Wind/ Tornado				Flooding				Climate Moisture Deficit				Shifiting Natural Ecoregions			
		Lightning				**Hail**				**Tornado**				**River Flooding**				**Wildfire Smoke**				**Shifting Ecosystem**			
Climate Projections	Present	-	3			-	3				3			-	3			-	3			-	3		
	2050	+	4			+	4				4			+	4			+	4			+	4		
	2080	++	4			+	4				4			++	5			+	4			+	4		
Wastewater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
	Present		3		3		3		6		3		3		3		3		3		3		3		3
1 WW Collection Lines and Services (including manholes)	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		4		5		5		4		4		4		4
	Present		3		3		3		3		3		3		3		3		3		6		3		6
4 Lagoons + Infrastructure on Site (Level controls, access roads, etc.)	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	2	8
	2080		4		4		4		4		4		4		5		5		4		8		4		8
	Present		3		3		3		6		3		3		3		3		3		3		3		3
6 Lift Station (Wet/dry well) + Force Main to Lagoon	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		4		5		5		4		4		4		4
	Present		3		6		3		3		3		6		3		3		3		6		3		3
7 Dialer for Lift Station Level Control	2050	Y	4	2	8	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		8		4		4		4		8		5		5		4		8		4		4
	Present		3		3		3		6		3		3		3		3		3		6		3		6
8 Operations and Maintenance	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	2	8
	2080		4		4		4		8		4		4		5		5		4		8		4		8
	Present		3		3		3		6		3		3		3		3		3		6		3		3
8 Public/Customers	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		8		4		4		5		5		4		8		4		4
	Present		3		3		3		3		3		3		3		3		3		6		3		6
9 Emergency Services	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	2	8
	2080		4		4		4		4		4		4		5		5		4		8		4		8

PIEVC Risk Scores
Wastewater Management System

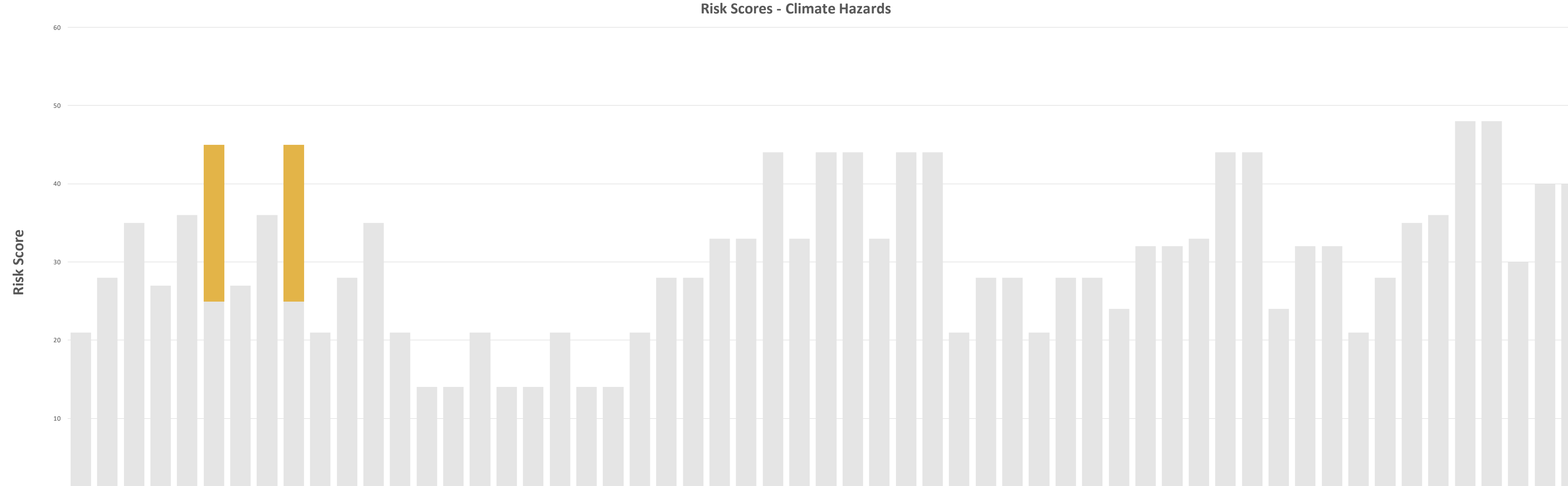
Risk Scores - Assets



	WW Collection Lines and Services (including manholes)			Lagoons + Infrastructure on Site (Level controls, access roads, etc.)			Lift Station (Wet/dry well) + Force Main to Lagoon		
	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	0	0	0	0	20	0	0	0
Low Risk Scores	69	84	91	69	85	73	69	84	91

	Dialer for Lift Station Level Control			Operations and Maintenance			Public/Customers			Emergency Services		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	0	0	0	0	20	0	0	0	0	0	0
Low Risk Scores	66	81	87	81	100	89	72	88	95	63	77	83

Risk Scores - Climate Hazards



	Annual Mean			Very Hot Days			Hottest Day			Cooling Degree Days			Coldest Days		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	20	0	0	20	0	0	0	0	0	0
Low Risk Scores	21	28	35	27	36	25	27	36	25	21	28	35	21	14	14

	Frost-free Season			Freeze/ Thaw Events			Annual Percipitation			Extreme Rainfall			Persistant Percipitation		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	21	14	14	21	14	14	21	28	28	33	33	44	33	44	44

	Short Duration Rainfall/ Overland Flooding			Drought			Winter Percipitation			Lightning			Hail		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	33	44	44	21	28	28	21	28	28	24	32	32	33	44	44

	Tornado			River Flooding			Wildfire Smoke			Shifting Ecosystem		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	24	32	32	21	28	35	36	48	48	30	40	40

PIEVC Risk Matrix
Stormwater Management System

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Temperature

Component	Period	Mean Annual Temperature (-C) – **Annual Mean**				Days above +30ºC – **Very Hot Days**				Warmest Day Time Temperature – **Hottest Day**				Cooling Degree Days (Degree Days) – **Cooling Degree Days**			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3		
	2050	4.2	4			11	4			35.3	4			125	4		
	2080	6.8	5			23	5			39.0	5			269	5		
Stormwater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Overland Drainage	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5
Outfall/Discharge into Creek	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5
Collectors, Trunks, and Lateral Mains	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5
Stormwater Manholes and Catch Basins	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5
Operations and Maintenance	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5
Public/Customers	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5
Emergency Services	Present		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		5		5		5		5		5		5

Component	Period	# of Days Below -30ºC – **Coldest Days**				# Days Without Frost – **Frost-free Season**				# Freeze/ Thaw Events – **Freeze/ Thaw Events**			
Climate Projections	Present	9.9	3			126	3			106.7	3		
	2050	5.2	2			148	2			95.5	2		
	2080	2.2	2			168	2			85.2	2		
Stormwater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Overland Drainage	Present		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		2		2		2		2		2		2
Outfall/Discharge into Creek	Present		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		2		2		2		2		2		2
Collectors, Trunks, and Lateral Mains	Present		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		2		2		2		2		2		2
Stormwater Manholes and Catch Basins	Present		3		6		3		3		3		3
	2050	Y	2	2	4	Y	2	1	2	Y	2	1	2
	2080		2		4		2		2		2		2
Operations and Maintenance	Present		3		6		3		3		3		3
	2050	Y	2	2	4	Y	2	1	2	Y	2	1	2
	2080		2		4		2		2		2		2
Public/Customers	Present		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		2		2		2		2		2		2
Emergency Services	Present		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		2		2		2		2		2		2

Precipitation

Component	Period	Annual Total Percipitation (mm) – **Annual Percipitation**				Maximum 1-Day Total Percipitation (mm) – **Extreme Rainfall**				Maximum 5-day Consecutive Percipitation (mm) – **Persistant Percipitation**			
Climate Projections	Present	452	3			35	3			61	3		
	2050	473	4			35	3			63	3		
	2080	479	4			38	4			69	4		
Stormwater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Overland Drainage	Present		3		6		3		6		3		6
	2050	Y	4	2	8	Y	3	2	6	Y	3	2	6
	2080		4		8		4		8		4		8
Outfall/Discharge into Creek	Present		3		3		3		6		3		6
	2050	Y	4	1	4	Y	3	2	6	Y	3	2	6
	2080		4		4		4		8		4		8
Collectors, Trunks, and Lateral Mains	Present		3		4.5		3		6		3		6
	2050	Y	4	1.5	6	Y	3	2	6	Y	3	2	6
	2080		4		6		4		8		4		8
Stormwater Manholes and Catch Basins	Present		3		6		3		4.5		3		6
	2050	Y	4	2	8	Y	3	1.5	4.5	Y	3	2	6
	2080		4		8		4		6		4		8
Operations and Maintenance	Present		3		3		3		6		3		6
	2050	Y	4	1	4	Y	3	2	6	Y	3	2	6
	2080		4		4		4		8		4		8
Public/Customers	Present		3		4.5		3		6		3		6
	2050	Y	4	1.5	6	Y	3	2	6	Y	3	2	6
	2080		4		6		4		8		4		8
Emergency Services	Present		3		4.5		3		3		3		3
	2050	Y	4	1.5	6	Y	3	1	3	Y	3	1	3
	2080		4		6		4		4		4		4

Component	Period	Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr) – **Short Duration Rainfall/ Overland Flooding**				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August) – **Drought**				Total Precipitation in the Winter Months – **Winter Percipitation**			
Climate Projections	Present	4.9	3			-	3			69	3		
	2050	5.1	4			+	4			75	4		
	2080	5.7	5			++	4			81	5		
Stormwater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Overland Drainage	Present		3		9		3		3		3		6
	2050	Y	4	3	12	Y	4	1	4	Y	4	2	8
	2080		5		15		4		4		5		10
Outfall/Discharge into Creek	Present		3		9		3		3		3		6
	2050	Y	4	3	12	Y	4	1	4	Y	4	2	8
	2080		5		15		4		4		5		10
Collectors, Trunks, and Lateral Mains	Present		3		6		3		3		3		3
	2050	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		5		10		4		4		5		5
Stormwater Manholes and Catch Basins	Present		3		6		3		3		3		6
	2050	Y	4	2	8	Y	4	1	4	Y	4	2	8
	2080		5		10		4		4		5		10
Operations and Maintenance	Present		3		7.5		3		3		3		9
	2050	Y	4	2.5	10	Y	4	1	4	Y	4	3	12
	2080		5		12.5		4		4		5		15
Public/Customers	Present		3		9		3		3		3		9
	2050	Y	4	3	12	Y	4	1	4	Y	4	3	12
	2080		5		15		4		4		5		15
Emergency Services	Present		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		5		5		4		4		5		5

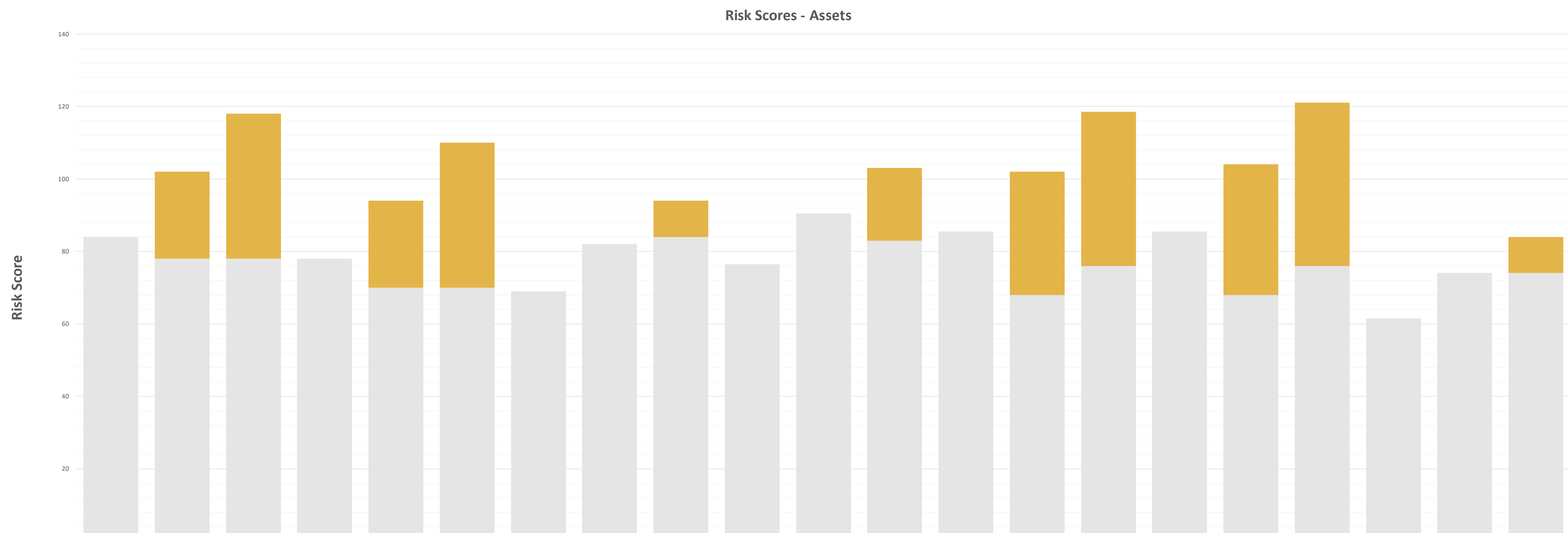
Extreme Events

Component	Period	Lightning – **Lightning**				Hail Storm – **Hail**				High Wind/ Tornado – **Tornado**				Flooding – **River Flooding**			
Climate Projections	Present	-	3			-	3				3			-	3		
	2050	+	4			+	4				4			+	4		
	2080	++	4			+	4				4			++	5		
Stormwater Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Overland Drainage	Present		3		3		3		6		3		3		3		9
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	3	12
	2080		4		4		4		8		4		4		5		15
Outfall/Discharge into Creek	Present		3		3		3		3		3		3		3		9
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	3	12
	2080		4		4		4		4		4		4		5		15
Collectors, Trunks, and Lateral Mains	Present		3		3		3		4.5		3		3		3		3
	2050	Y	4	1	4	Y	4	1.5	6	Y	4	1	4	Y	4	1	4
	2080		4		4		4		6		4		4		5		5
Stormwater Manholes and Catch Basins	Present		3		3		3		6		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		4		5		5
Operations and Maintenance	Present		3		3		3		6		3		3		3		9
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	3	12
	2080		4		4		4		8		4		4		5		15
Public/Customers	Present		3		3		3		6		3		3		3		9
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	3	12
	2080		4		4		4		8		4		4		5		15
Emergency Services	Present		3		3		3		3		3		3		3		6
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8
	2080		4		4		4		4		4		4		5		10

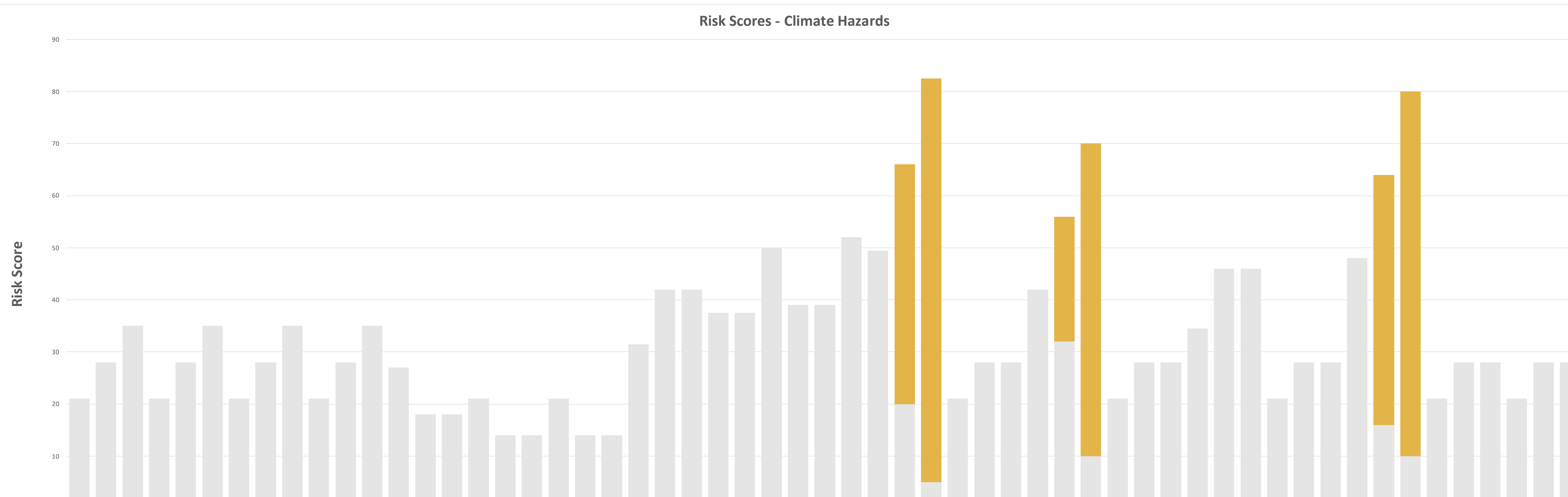
Extreme Events / Shifting Natural Ecoregions

Component	Period	Climate Moisture Deficit – **Wildfire Smoke**				Shifting Natural Ecoregions – **Shifting Ecosystem**			
Climate Projections	Present	-	3			-	3		
	2050	+	4			+	4		
	2080	+	4			+	4		
Stormwater Components		Y/N	L	C	R	Y/N	L	C	R
Overland Drainage	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4
Outfall/Discharge into Creek	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4
Collectors, Trunks, and Lateral Mains	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4
Stormwater Manholes and Catch Basins	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4
Operations and Maintenance	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4
Public/Customers	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4
Emergency Services	Present		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4

PIEVC Risk Scores
Stormwater Management System



Asset	Period	High Risk Score	Medium Risk Score	Low Risk Scores
Overland Drainage	Present	0	0	84
Overland Drainage	2050	0	24	78
Overland Drainage	2080	0	40	78
Outfall/Discharge into Creek	Present	0	0	78
Outfall/Discharge into Creek	2050	0	24	70
Outfall/Discharge into Creek	2080	0	40	70
Collectors, Trunks, and Lateral Mains	Present	0	0	69
Collectors, Trunks, and Lateral Mains	2050	0	0	82
Collectors, Trunks, and Lateral Mains	2080	0	10	84
Stormwater Manholes and Catch Basins	Present	0	0	76.5
Stormwater Manholes and Catch Basins	2050	0	0	90.5
Stormwater Manholes and Catch Basins	2080	0	20	83
Operations and Maintenance	Present	0	0	85.5
Operations and Maintenance	2050	0	34	68
Operations and Maintenance	2080	0	42.5	76
Public/Customers	Present	0	0	85.5
Public/Customers	2050	0	36	68
Public/Customers	2080	0	45	76
Emergency Services	Present	0	0	61.5
Emergency Services	2050	0	0	74
Emergency Services	2080	0	10	74



Climate Hazard	Period	High Risk	Medium Risk	Low Risk Scores
Annual Mean	Present	0	0	21
Annual Mean	2050	0	0	28
Annual Mean	2080	0	0	35
Very Hot Days	Present	0	0	21
Very Hot Days	2050	0	0	28
Very Hot Days	2080	0	0	35
Hottest Day	Present	0	0	21
Hottest Day	2050	0	0	28
Hottest Day	2080	0	0	35
Cooling Degree Days	Present	0	0	21
Cooling Degree Days	2050	0	0	28
Cooling Degree Days	2080	0	0	35
Coldest Days	Present	0	0	27
Coldest Days	2050	0	0	18
Coldest Days	2080	0	0	18
Frost-free Season	Present	0	0	21
Frost-free Season	2050	0	0	14
Frost-free Season	2080	0	0	14
Freeze/ Thaw Events	Present	0	0	21
Freeze/ Thaw Events	2050	0	0	14
Freeze/ Thaw Events	2080	0	0	14
Annual Percipitation	Present	0	0	31.5
Annual Percipitation	2050	0	0	42
Annual Percipitation	2080	0	0	42
Extreme Rainfall	Present	0	0	37.5
Extreme Rainfall	2050	0	0	37.5
Extreme Rainfall	2080	0	0	50
Persistant Percipitation	Present	0	0	39
Persistant Percipitation	2050	0	0	39
Persistant Percipitation	2080	0	0	52
Short Duration Rainfall/ Overland Flooding	Present	0	0	49.5
Short Duration Rainfall/ Overland Flooding	2050	0	46	20
Short Duration Rainfall/ Overland Flooding	2080	0	77.5	5
Drought	Present	0	0	21
Drought	2050	0	0	28
Drought	2080	0	0	28
Winter Percipitation	Present	0	0	42
Winter Percipitation	2050	0	24	32
Winter Percipitation	2080	0	60	10
Lightning	Present	0	0	21
Lightning	2050	0	0	28
Lightning	2080	0	0	28
Hail	Present	0	0	34.5
Hail	2050	0	0	46
Hail	2080	0	0	46
Tornado	Present	0	0	21
Tornado	2050	0	0	28
Tornado	2080	0	0	28
River Flooding	Present	0	0	48
River Flooding	2050	0	48	16
River Flooding	2080	0	70	10
Wildfire Smoke	Present	0	0	21
Wildfire Smoke	2050	0	0	28
Wildfire Smoke	2080	0	0	28
Shifting Ecosystem	Present	0	0	21
Shifting Ecosystem	2050	0	0	28
Shifting Ecosystem	2080	0	0	28

PIEVC Risk Matrix
Buildings - Municipal Building

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Temperature

Infrastructure Components		Mean Annual Temperature (◦C) – Annual Mean				Days above +30°C – Very Hot Days				Warmest Day Time Temperature – Hottest Day				Cooling Degree Days (Degree Days) – Cooling Degree Days				# of Days Below -30°C – Coldest Days				# Days Without Frost – Frost-free Season				# Freeze/ Thaw Events – Freeze/ Thaw Events			
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3			126	3			106.7	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2			148	2			95.5	2		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2			168	2			85.2	2		
1 Electrical - Electrical and Communications	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
2 Mechanical - HVAC	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
3 Structural - Building Envelop	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
4 Plumbing - Water, Wastewater	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
6 Building Staff	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
7 Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
8 Public/ Users	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
9 Emergency Services	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2

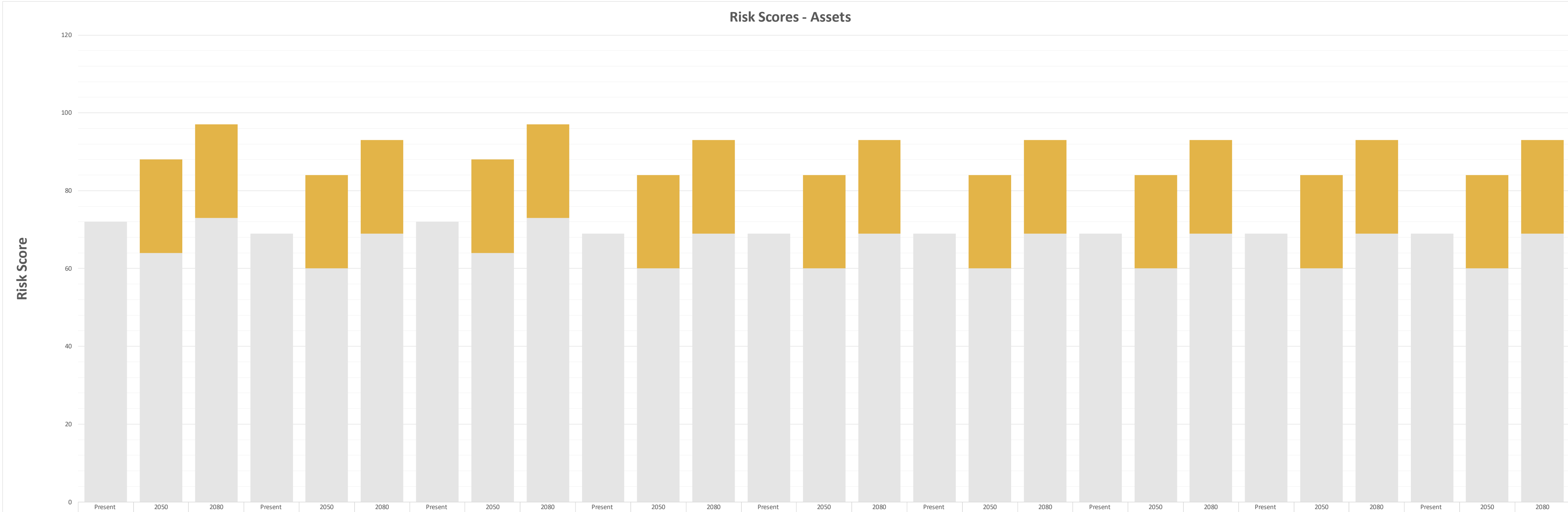
Precipitation

Infrastructure Components		Annual Total Percipitation (mm) – Annual Percipitation				Maximum 1-Day Total Percipitation (mm) – Extreme Rainfall				Maximum 5-day Consecutive Percipitation (mm) – Persistant Percipitation				Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr) – Short Duration Rainfall/ Overland Flooding				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August) – Drought				Total Percipitation in the Winter Months – Winter Percipitation			
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Climate Projections	Present	452	3			35	3			61	3			4.9	3			-	3			69	3		
	2050	473	4			35	3			63	3			5.1	4			+	4			75	4		
	2080	479	4			38	4			69	4			5.7	5			++	4			81	5		
1 Electrical - Electrical and Communications	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
2 Mechanical - HVAC	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
3 Structural - Building Envelop	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
4 Plumbing - Water, Wastewater	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
6 Building Staff	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
7 Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
8 Public/ Users	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
9 Emergency Services	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5

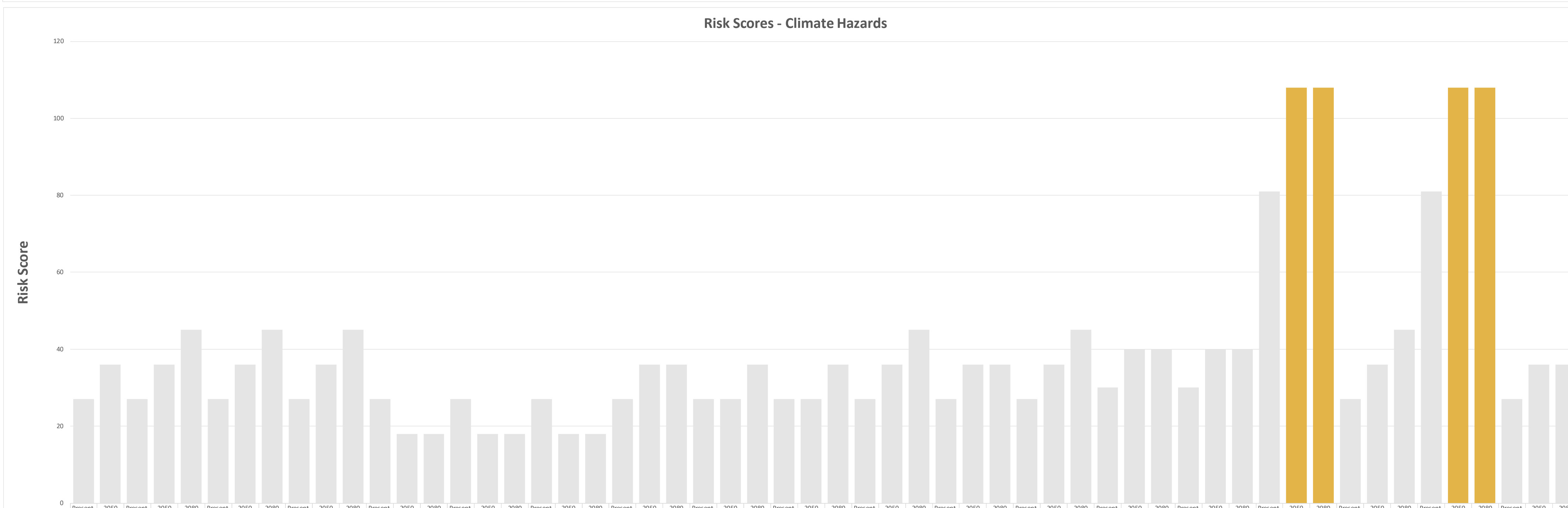
Extreme Events / Shifting Natural Ecoregions

Infrastructure Components		Lightning – Lightning				Hail Storm – Hail				High Wind/ Tornado – Tornado				Flooding – River Flooding				Climate Moisture Deficit – Wildfire Smoke				Shifting Natural Ecoregions – Shifting Ecosystem			
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Climate Projections	Present	-	3			-	3				3			-	3			-	3			-	3		
	2050	+	4			+	4				4			+	4			+	4			+	4		
	2080	++	4			+	4				4			++	5			+	4			+	4		
1 Electrical - Electrical and Communications	Present		3		6		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	2	8	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		8		4		4		4		12		5		5		4		12		4		4
2 Mechanical - HVAC	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
3 Structural - Building Envelop	Present		3		3		3		6		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		8		4		12		5		5		4		12		4		4
4 Plumbing - Water, Wastewater	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
6 Building Staff	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
7 Operation and Maintenance	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
8 Public/ Users	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
9 Emergency Services	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4

PIEVC Risk Scores
Buildings - Municipal Building



Asset	Period	High Risk Score	Medium Risk Score	Low Risk Scores
Electrical - Electrical and Communications	Present	0	0	72
	2050	0	24	64
	2080	0	24	73
Mechanical - HVAC	Present	0	0	69
	2050	0	24	60
	2080	0	24	69
Structural - Building Envelop	Present	0	0	72
	2050	0	24	64
	2080	0	24	73
Plumbing - Water, Wastewater	Present	0	0	69
	2050	0	24	60
	2080	0	24	69
Civil - Site, Parking, Landscaped Areas, Stormwater	Present	0	0	69
	2050	0	24	60
	2080	0	24	69
Building Staff	Present	0	0	69
	2050	0	24	60
	2080	0	24	69
Operation and Maintenance	Present	0	0	69
	2050	0	24	60
	2080	0	24	69
Public/ Users	Present	0	0	69
	2050	0	24	60
	2080	0	24	69
Emergency Services	Present	0	0	69
	2050	0	24	60
	2080	0	24	69



Climate Hazard	Period	High Risk	Medium Risk	Low Risk Scores
Annual Mean	Present	0	0	27
	2050	0	0	36
Very Hot Days	Present	0	0	27
	2050	0	0	36
	2080	0	0	45
Hottest Day	Present	0	0	27
	2050	0	0	36
	2080	0	0	45
Cooling Degree Days	Present	0	0	27
	2050	0	0	36
	2080	0	0	45
Coldest Days	Present	0	0	27
	2050	0	0	18
	2080	0	0	18
Frost-free Season	Present	0	0	27
	2050	0	0	18
	2080	0	0	18
Freeze/ Thaw Events	Present	0	0	27
	2050	0	0	18
	2080	0	0	18
Annual Percipitation	Present	0	0	27
	2050	0	0	36
	2080	0	0	36
Extreme Rainfall	Present	0	0	27
	2050	0	0	27
	2080	0	0	36
Persistant Percipitation	Present	0	0	27
	2050	0	0	27
	2080	0	0	36
Short Duration Rainfall/ Overland Flooding	Present	0	0	27
	2050	0	0	36
	2080	0	0	45
Drought	Present	0	0	27
	2050	0	0	36
	2080	0	0	36
Winter Percipitation	Present	0	0	27
	2050	0	0	36
	2080	0	0	45
Lightning	Present	0	0	30
	2050	0	0	40
	2080	0	0	40
Hail	Present	0	0	30
	2050	0	0	40
	2080	0	0	40
Tornado	Present	0	0	81
	2050	0	108	0
	2080	0	108	0
River Flooding	Present	0	0	27
	2050	0	0	36
	2080	0	0	45
Wildfire Smoke	Present	0	0	81
	2050	0	108	0
	2080	0	108	0
Shifting Ecosystem	Present	0	0	27
	2050	0	0	36
	2080	0	0	36

PIEVC Risk Matrix
Buildings - Public Works Building

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Temperature

		Mean Annual Temperature (°C)				Days above +30°C				Warmest Day Time Temperature				Cooling Degree Days (Degree Days)				# of Days Below -30°C				# Days Without Frost				# Freeze/ Thaw Events			
		Annual Mean				**Very Hot Days**				**Hottest Day**				**Cooling Degree Days**				**Coldest Days**				**Frost-free Season**				**Freeze/ Thaw Events**			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3			126	3			106.7	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2			148	2			95.5	2		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2			168	2			85.2	2		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Electrical - Electrical and Communications	Present		3		3		3		3		3		3		3		6		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		10		2		2		2		2		2		2
2 Mechanical - HVAC	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
3 Structural - Building Envelop	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
4 Plumbing - Water, Wastewater	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
6 Building Staff	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
7 Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
8 Public/ Users	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
9 Emergency Services	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2

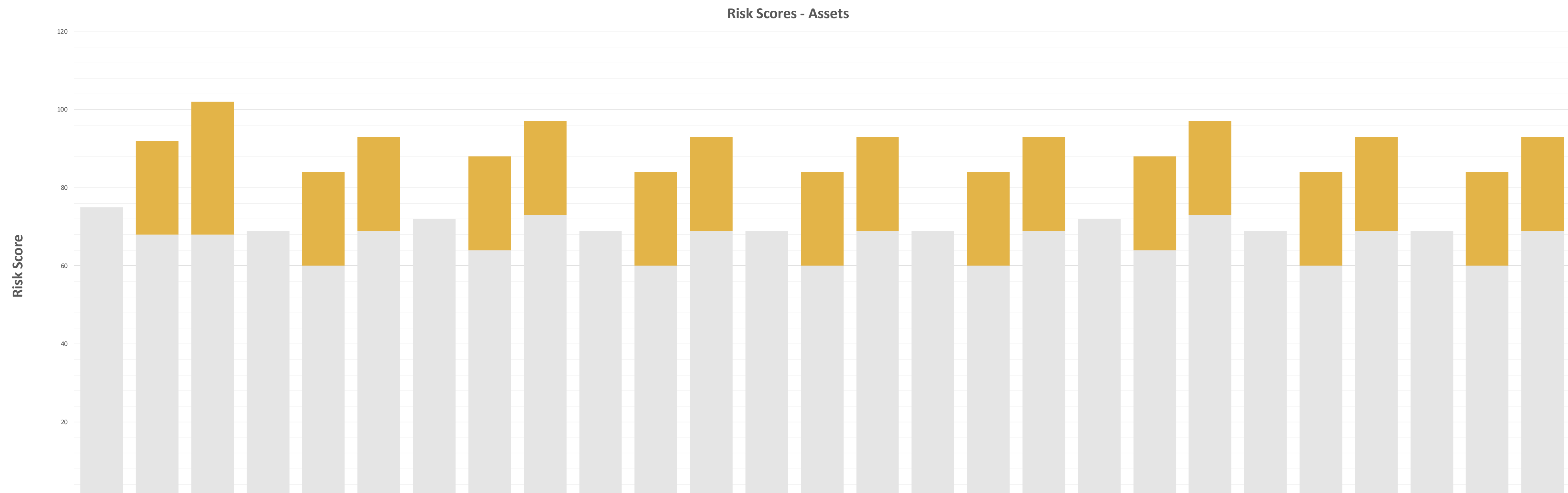
Precipitation

		Annual Total Percipitation (mm)				Maximum 1-Day Total Percipitation (mm)				Maximum 5-day Consecutive Percipitation (mm)				Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr)				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)				Total Percipitation in the Winter Months			
		Annual Percipitation				**Extreme Rainfall**				**Persistant Percipitation**				**Short Duration Rainfall/ Overland Flooding**				**Drought**				**Winter Percipitation**			
Climate Projections	Present	452	3			35	3			61	3			4.9	3			-	3			69	3		
	2050	473	4			35	3			63	3			5.1	4			+	4			75	4		
	2080	479	4			38	4			69	4			5.7	5			++	4			81	5		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Electrical - Electrical and Communications	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
2 Mechanical - HVAC	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
3 Structural - Building Envelop	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
4 Plumbing - Water, Wastewater	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
6 Building Staff	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
7 Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
8 Public/ Users	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5
9 Emergency Services	Present		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	3	1	3	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		5		5		4		4		5		5

Extreme Events / **Shifting Natural Ecoregions**

		Lightning				Hail Storm				High Wind/ Tornado				Flooding				Climate Moisture Deficit				Shifting Natural Ecoregions			
		Lightning				**Hail**				**Tornado**				**River Flooding**				**Wildfire Smoke**				**Shifting Ecosystem**			
Climate Projections	Present	-	3			-	3				3			-	3			-	3			-	3		
	2050	+	4			+	4				4			+	4			+	4			+	4		
	2080	++	4			+	4				4			++	5			+	4			+	4		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Electrical - Electrical and Communications	Present		3		6		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	2	8	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		8		4		4		4		12		5		5		4		12		4		4
2 Mechanical - HVAC	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
3 Structural - Building Envelop	Present		3		3		3		6		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		8		4		12		5		5		4		12		4		4
4 Plumbing - Water, Wastewater	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
6 Building Staff	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
7 Operation and Maintenance	Present		3		3		3		6		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		8		4		12		5		5		4		12		4		4
8 Public/ Users	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4
9 Emergency Services	Present		3		3		3		3		3		9		3		3		3		9		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	1	4
	2080		4		4		4		4		4		12		5		5		4		12		4		4

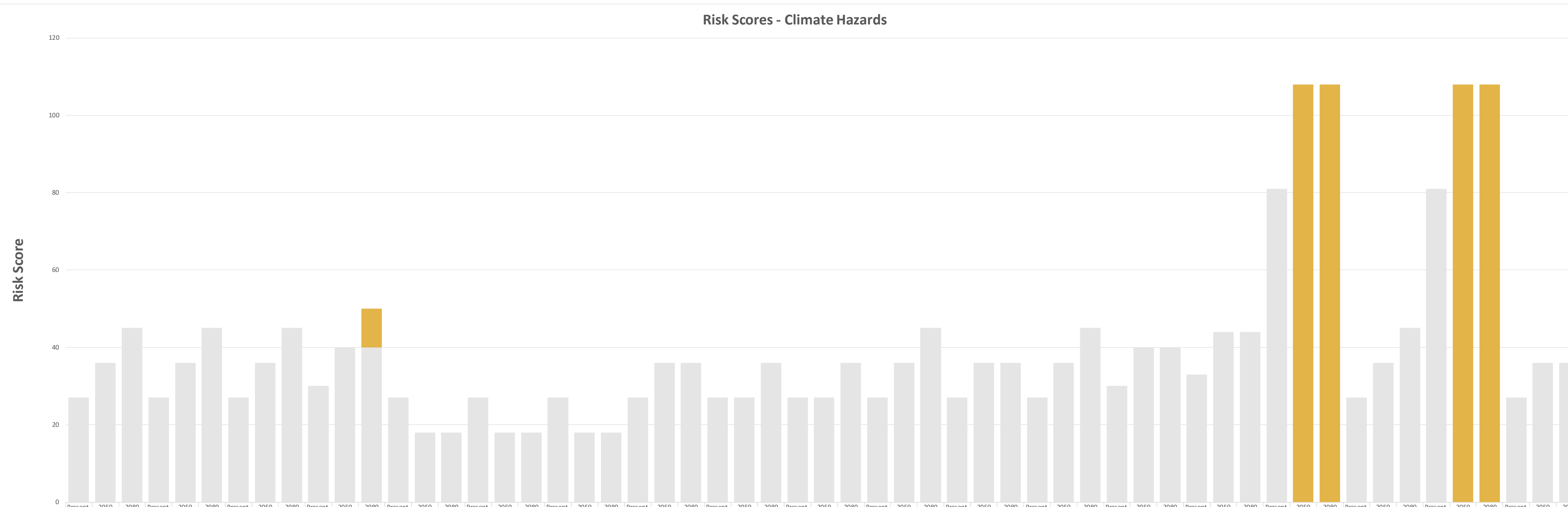
PIEVC Risk Matrix
Buildings - Public Works Building



	Electrical - Electrical and Communications			Mechanical - HVAC			Structural - Building Envelop		
	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	24	34	0	24	24	0	24	24
Low Risk Scores	75	68	68	69	60	69	72	64	73

	Plumbing - Water, Wastewater			Civil - Site, Parking, Landscaped Areas, Stormwater			Building Staff		
	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	24	24	0	24	24	0	24	24
Low Risk Scores	69	60	69	69	60	69	69	60	69

	Operation and Maintenance			Public/ Users			Emergency Services		
	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	24	24	0	24	24	0	24	24
Low Risk Scores	72	64	73	69	60	69	69	60	69



	Annual Mean			Very Hot Days			Hottest Day			Cooling Degree Days		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	10
Low Risk Scores	27	36	45	27	36	45	27	36	45	30	40	40

	Coldest Days			Frost-free Season			Freeze/ Thaw Events			Annual Percipitation		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	27	18	18	27	18	18	27	18	18	27	36	36

	Extreme Rainfall			Persistant Percipitation			Short Duration Rainfall/ Overland Flooding			Drought		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	27	27	36	27	27	36	27	36	45	27	36	36

	Winter Percipitation			Lightning			Hail			Tornado		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	108	108
Low Risk Scores	27	36	45	30	40	40	33	44	44	81	0	0

	River Flooding			Wildfire Smoke			Shifting Ecosystem		
	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	108	108	0	0	0
Low Risk Scores	27	36	45	81	0	0	27	36	36

PIEVC Risk Matrix
Parks and Playgrounds

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Infrastructure Components	Period	Annual Mean (Temperature: Mean Annual Temperature (-C))				Very Hot Days (Temperature: Days above +30°C)				Hottest Day (Temperature: Warmest Day Time Temperature)				Cooling Degree Days (Temperature: Cooling Degree Days (Degree Days))				Coldest Days (Temperature: # of Days Below -30°C)			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Community Trails	Present		3		3		3		3		3		6		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	2	1	2
	2080		5		5		5		5		5		10		5		5		2		2
2 Bretzlaff Park	Present		3		3		3		6		3		9		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	2	1	2
	2080		5		5		5		10		5		15		5		5		2		2
4 Elks Memorial Park	Present		3		3		3		6		3		9		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	2	1	2
	2080		5		5		5		10		5		15		5		5		2		2
5 Centennial Park	Present		3		3		3		6		3		9		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	2	1	2
	2080		5		5		5		10		5		15		5		5		2		2
6 Ruth Cust Park	Present		3		3		3		6		3		6		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	2	1	2
	2080		5		5		5		10		5		10		5		5		2		2

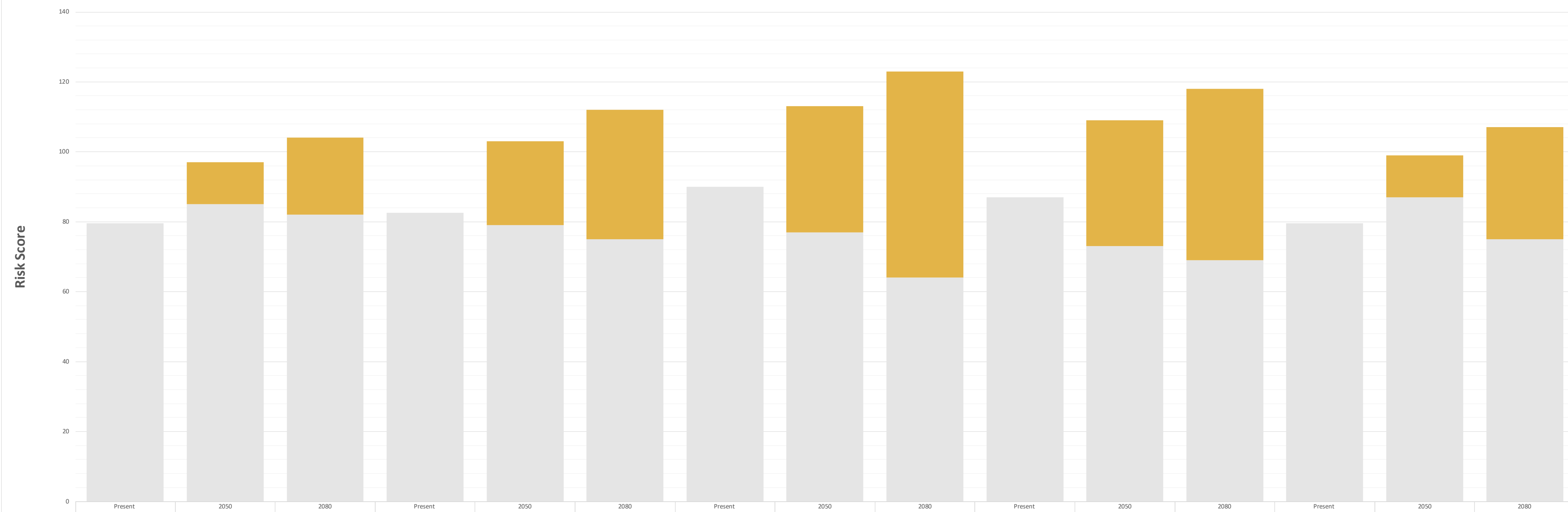
Infrastructure Components	Period	Frost-free Season (Temperature: # Days Without Frost)				Freeze/ Thaw Events (Temperature: # Freeze/ Thaw Events)				Annual Percipitation (Precipitation: Annual Total Percipitation (mm))				Extreme Rainfall (Precipitation: Maximum 1-Day Total Percipitation (mm))				Persistant Percipitation (Precipitation: Maximum 5-day Consecutive Percipitation (mm))			
Climate Projections	Present	126	3			106.7	3			452	3			35	3			61	3		
	2050	148	2			95.5	2			473	4			35	3			63	4		
	2080	168	2			85.2	2			479	4			38	4			69	4		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Community Trails	Present		3		3		3		6		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	2	4	Y	4	1	4	Y	3	1	3	Y	4	1	4
	2080		2		2		2		4		4		4		4		4		4		4
2 Bretzlaff Park	Present		3		3		3		3		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3	Y	4	1	4
	2080		2		2		2		2		4		4		4		4		4		4
4 Elks Memorial Park	Present		3		3		3		3		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3	Y	4	1	4
	2080		2		2		2		2		4		4		4		4		4		4
5 Centennial Park	Present		3		3		3		3		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3	Y	4	1	4
	2080		2		2		2		2		4		4		4		4		4		4
6 Ruth Cust Park	Present		3		3		3		3		3		3		3		3		3		3
	2050	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3	Y	4	1	4
	2080		2		2		2		2		4		4		4		4		4		4

Infrastructure Components	Period	Short Duration Rainfall/ Overland Flooding (Precipitation: Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr))				Drought (Precipitation: Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August))				Winter Percipitation (Precipitation: Total Percipitation in the Winter Months)				Lightning (Extreme Events: Lightning)				Hail (Extreme Events: Hail Storm)			
Climate Projections	Present	4.9	3			-	3			69	3			-	3			-	3		
	2050	5.1	4			+	4			75	4			+	4			+	4		
	2080	5.7	4			++	4			81	4			++	4			+	4		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Community Trails	Present		3		6		3		3		3		6		3		4.5		3		3
	2050	Y	4	2	8	Y	4	1	4	Y	4	2	8	Y	4	1.5	6	Y	4	1	4
	2080		4		8		4		4		4		8		4		6		4		4
2 Bretzlaff Park	Present		3		6		3		3		3		3		3		4.5		3		6
	2050	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	1.5	6	Y	4	2	8
	2080		4		8		4		4		4		4		4		6		4		8
4 Elks Memorial Park	Present		3		9		3		3		3		3		3		6		3		6
	2050	Y	4	3	12	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	2	8
	2080		4		12		4		4		4		4		4		8		4		8
5 Centennial Park	Present		3		9		3		3		3		3		3		6		3		6
	2050	Y	4	3	12	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	2	8
	2080		4		12		4		4		4		4		4		8		4		8
6 Ruth Cust Park	Present		3		6		3		3		3		3		3		6		3		4.5
	2050	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1.5	6
	2080		4		8		4		4		4		4		4		8		4		6

Infrastructure Components	Period	Tornado (Extreme Events: High Wind/ Tornado)				River Flooding (Extreme Events: Flooding)				Wildfire Smoke (Extreme Events: Climate Moisture Deficit)				Shifting Ecosystem (Shifting Natural Ecoregions: Shifting Natural Ecoregions)			
Climate Projections	Present		3			-	3			-	3			-	3		
	2050		4			+	4			+	4			+	4		
	2080		4			++	5			+	4			+	4		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Community Trails	Present		3		9		3		3		3		6		3		3
	2050	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		12		5		5		4		8		4		4
2 Bretzlaff Park	Present		3		9		3		3		3		6		3		3
	2050	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		12		5		5		4		8		4		4
4 Elks Memorial Park	Present		3		9		3		6		3		6		3		3
	2050	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	1	4
	2080		4		12		5		10		4		8		4		4
5 Centennial Park	Present		3		9		3		3		3		6		3		3
	2050	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		12		5		5		4		8		4		4
6 Ruth Cust Park	Present		3		9		3		3		3		6		3		3
	2050	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		12		5		5		4		8		4		4

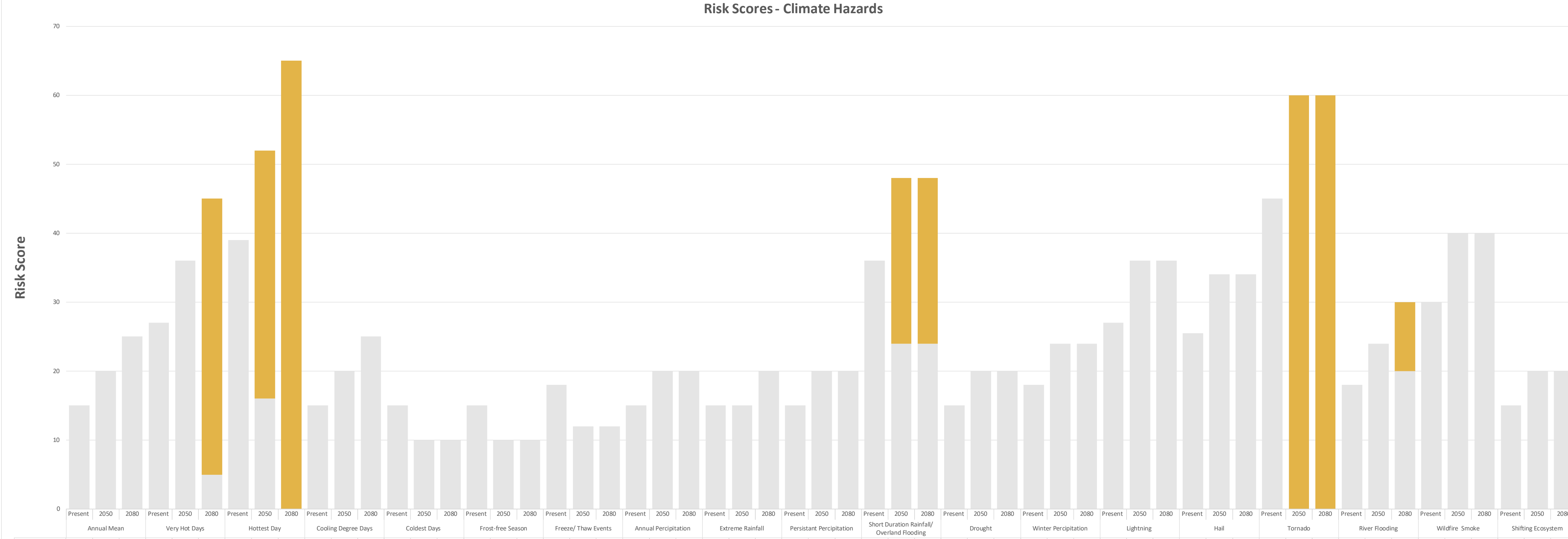
PIEVC Risk Scores
Parks and Playgrounds

Risk Scores - Assets



	Community Trails Present	Community Trails 2050	Community Trails 2080	Bretzlaff Park Present	Bretzlaff Park 2050	Bretzlaff Park 2080	Elks Memorial Park Present	Elks Memorial Park 2050	Elks Memorial Park 2080	Centennial Park Present	Centennial Park 2050	Centennial Park 2080	Ruth Cust Park Present	Ruth Cust Park 2050	Ruth Cust Park 2080
High Risk Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	12	22	0	24	37	0	36	59	0	36	49	0	12	32
Low Risk Scores	79.5	85	82	82.5	79	75	90	77	64	87	73	69	79.5	87	75

Risk Scores - Climate Hazards



	Annual Mean Present	Annual Mean 2050	Annual Mean 2080	Very Hot Days Present	Very Hot Days 2050	Very Hot Days 2080	Hottest Day Present	Hottest Day 2050	Hottest Day 2080	Cooling Degree Days Present	Cooling Degree Days 2050	Cooling Degree Days 2080	Coldest Days Present	Coldest Days 2050	Coldest Days 2080	Frost-free Season Present	Frost-free Season 2050	Frost-free Season 2080	Freeze/ Thaw Events Present	Freeze/ Thaw Events 2050	Freeze/ Thaw Events 2080	Annual Percipitation Present	Annual Percipitation 2050	Annual Percipitation 2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	40	0	36	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	15	20	25	27	36	5	39	16	0	15	20	25	15	10	10	15	10	10	18	12	12	15	20	20

	Extreme Rainfall Present	Extreme Rainfall 2050	Extreme Rainfall 2080	Persistant Percipitation Present	Persistant Percipitation 2050	Persistant Percipitation 2080	Short Duration Rainfall/ Overland Flooding Present	Short Duration Rainfall/ Overland Flooding 2050	Short Duration Rainfall/ Overland Flooding 2080	Drought Present	Drought 2050	Drought 2080	Winter Percipitation Present	Winter Percipitation 2050	Winter Percipitation 2080	Lightning Present	Lightning 2050	Lightning 2080	Hail Present	Hail 2050	Hail 2080	Tornado Present	Tornado 2050	Tornado 2080	River Flooding Present	River Flooding 2050	River Flooding 2080	Wildfire Smoke Present	Wildfire Smoke 2050	Wildfire Smoke 2080	Shifting Ecosystem Present	Shifting Ecosystem 2050	Shifting Ecosystem 2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	24	24	0	0	0	0	0	0	0	0	0	0	0	0	0	60	60	0	0	10	0	0	0	0	0	0
Low Risk Scores	15	15	20	15	20	20	36	24	24	15	20	20	18	24	24	27	36	36	25.5	34	34	45	0	0	18	24	20	30	40	40	15	20	20

PIEVC Risk Matrix
Roads

Consequence Score

- 0 - No Effect
- 1 - Insignificant
- 2 - Minor
- 3 - Moderate
- 4 - Major
- 5 - Catastrophic

Climate Parameter – Temperature

		Mean Annual Temperature (°C)				Days above +30°C				Warmest Day Time Temperature				Cooling Degree Days (Degree Days)				# of Days Below -30°C				# Days Without Frost				# Freeze/ Thaw Events			
		Annual Mean				**Very Hot Days**				**Hottest Day**				**Cooling Degree Days**				**Coldest Days**				**Frost-free Season**				**Freeze/ Thaw Events**			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3			126	3			106.7	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2			148	2			95.5	2		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2			168	2			85.2	2		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Asphalt Roads	Present		3		3		3		6		3		9		3		3		3		6		3		6		3		9
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	2	2	4	Y	2	2	4	Y	2	3	6
	2080		5		5		5		10		5		15		5		5		2		4		2		4		2		6
2 Gravel Roads	Present		3		3		3		6		3		9		3		3		3		6		3		6		3		9
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	2	2	4	Y	2	2	4	Y	2	3	6
	2080		5		5		5		10		5		15		5		5		2		4		2		4		2		6
3 Sidewalks	Present		3		3		3		3		3		6		3		3		3		6		3		6		3		9
	2050	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	2	2	4	Y	2	2	4	Y	2	3	6
	2080		5		5		5		5		5		10		5		5		2		4		2		4		2		6
4 Road Signs	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2
6 Operation and Maintenance	Present		3		3		3		6		3		9		3		3		3		6		3		6		3		9
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	2	2	4	Y	2	2	4	Y	2	3	6
	2080		5		5		5		10		5		15		5		5		2		4		2		4		2		6
8 Public/Users	Present		3		3		3		6		3		6		3		3		3		3		3		6		3		6
	2050	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	1	4	Y	2	1	2	Y	2	2	4	Y	2	2	4
	2080		5		5		5		10		5		10		5		5		2		2		2		4		2		4
9 Emergency Services	Present		3		3		3		6		3		3		3		3		3		3		3		6		3		6
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	2	4	Y	2	2	4
	2080		5		5		5		10		5		5		5		5		2		2		2		4		2		4

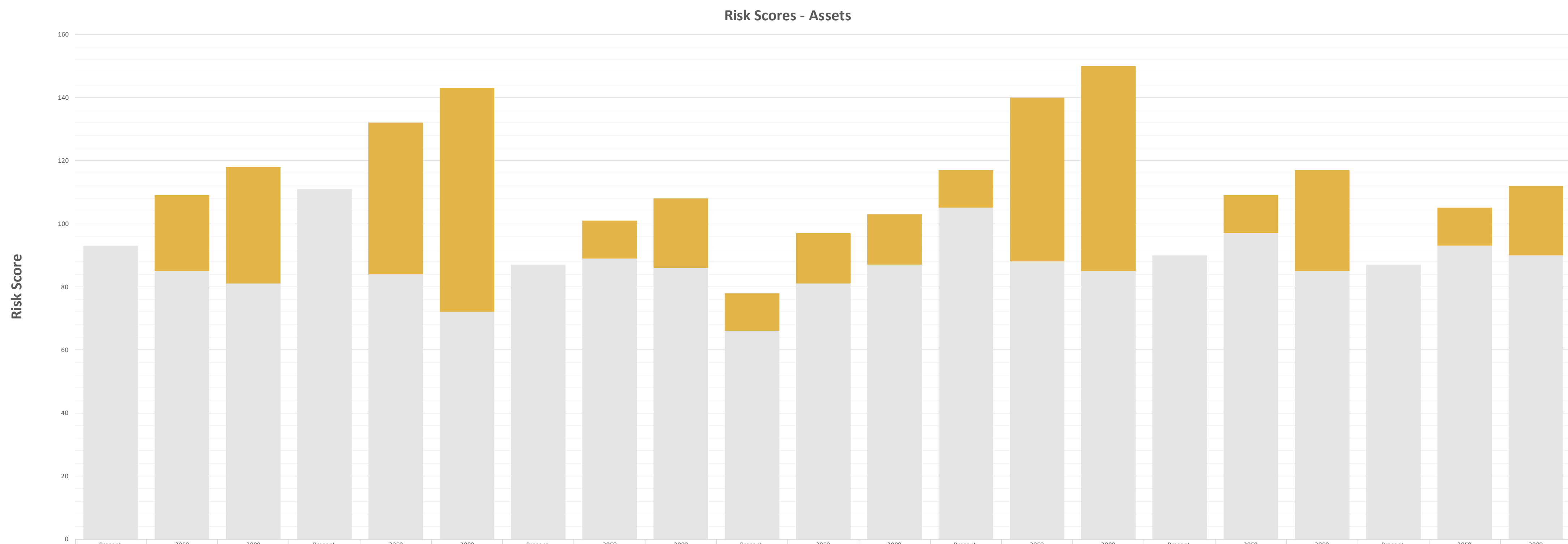
Climate Parameter – Precipitation

		Annual Total Percipitation (mm)				Maximum 1-Day Total Percipitation (mm)				Maximum 5-day Consecutive Percipitation (mm)				Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr)				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)				Total Percipitation in the Winter Months			
		Annual Percipitation				**Extreme Rainfall**				**Persistant Percipitation**				**Short Duration Rainfall/ Overland Flooding**				**Drought**				**Winter Percipitation**			
Climate Projections	Present	452	3			35	3			61	3			4.9	3			-	3			69	3		
	2050	473	4			35	3			63	4			5.1	4			+	4			75	4		
	2080	479	4			38	4			69	4			5.7	4			++	4			81	4		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Asphalt Roads	Present		3		3		3		3		3		3		3		6		3		9		3		6
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	2	8
	2080		4		4		4		4		4		4		4		8		4		12		4		8
2 Gravel Roads	Present		3		6		3		6		3		6		3		9		3		9		3		6
	2050	Y	4	2	8	Y	3	2	6	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	2	8
	2080		4		8		4		8		4		8		4		12		4		12		4		8
3 Sidewalks	Present		3		3		3		3		3		3		3		6		3		9		3		6
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	2	8
	2080		4		4		4		4		4		4		4		8		4		12		4		8
4 Road Signs	Present		3		3		3		3		3		3		3		6		3		6		3		3
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	1	4
	2080		4		4		4		4		4		4		4		8		4		8		4		4
6 Operation and Maintenance	Present		3		6		3		6		3		6		3		6		3		9		3		9
	2050	Y	4	2	8	Y	3	2	6	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	3	12
	2080		4		8		4		8		4		8		4		8		4		12		4		12
8 Public/Users	Present		3		3		3		3		3		3		3		6		3		6		3		6
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	2	8
	2080		4		4		4		4		4		4		4		8		4		8		4		8
9 Emergency Services	Present		3		3		3		3		3		3		3		6		3		6		3		6
	2050	Y	4	1	4	Y	3	1	3	Y	4	1	4	Y	4	2	8	Y	4	2	8	Y	4	2	8
	2080		4		4		4		4		4		4		4		8		4		8		4		8

Climate Parameter – Extreme Events / Shifting Natural Ecoregions

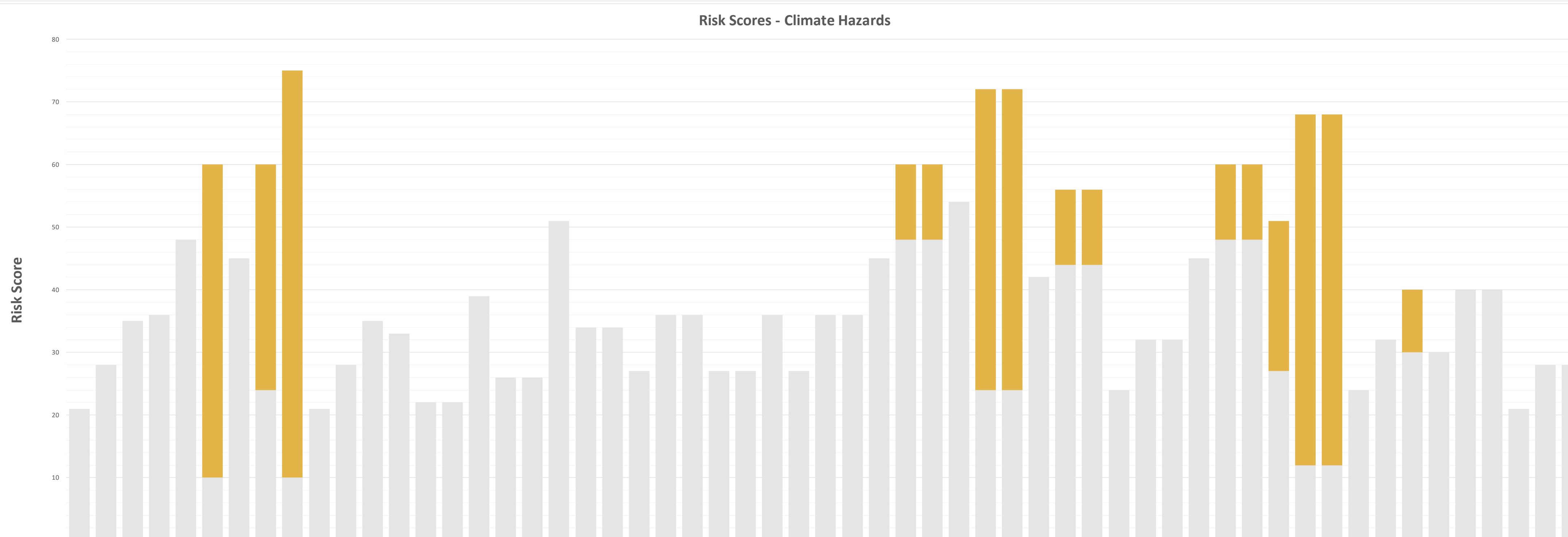
		Lightning				Hail Storm				High Wind/ Tornado				Flooding				Climate Moisture Deficit				Shifting Natural Ecoregions			
		Lightning				**Hail**				**Tornado**				**River Flooding**				**Wildfire Smoke**				**Shifting Ecosystem**			
Climate Projections	Present	-	3			-	3			-	3			-	3			-	3			-	3		
	2050	+	4			+	4			+	4			+	4			+	4			+	4		
	2080	+	4			+	4			+	4			++	5			+	4			+	4		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Asphalt Roads	Present		3		3		3		6		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		4		5		5		4		4		4		4
2 Gravel Roads	Present		3		3		3		9		3		3		3		6		3		3		3		3
	2050	Y	4	1	4	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4
	2080		4		4		4		12		4		4		5		10		4		4		4		4
3 Sidewalks	Present		3		3		3		6		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		8		4		4		5		5		4		4		4		4
4 Road Signs	Present		3		6		3		6		3		12		3		3		3		3		3		3
	2050	Y	4	2	8	Y	4	2	8	Y	4	4	16	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		8		4		8		4		16		5		5		4		4		4		4
6 Operation and Maintenance	Present		3		3		3		6		3		12		3		3		3		6		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	4	16	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		8		4		16		5		5		4		8		4		4
8 Public/Users	Present		3		3		3		6		3		9		3		3		3		6		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		8		4		12		5		5		4		8		4		4
9 Emergency Services	Present		3		3		3		6		3		9		3		3		3		6		3		3
	2050	Y	4	1	4	Y	4	2	8	Y	4	3	12	Y	4	1	4	Y	4	2	8	Y	4	1	4
	2080		4		4		4		8		4		12		5		5		4		8		4		4

PIEVC Risk Scores
Roads



	Asphalt Roads			Gravel Roads			Sidewalks			Road Signs		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	24	37	0	48	71	0	12	22	12	16	16
Low Risk Scores	93	85	81	111	84	72	87	89	86	66	81	87

	Operation and Maintenance			Public/Users			Emergency Services		
	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk Score	0	0	0	0	0	0	0	0	0
Medium Risk Score	12	52	65	0	12	32	0	12	22
Low Risk Scores	105	88	85	90	97	85	87	93	90



	Annual Mean			Very Hot Days			Hottest Day			Cooling Degree Days			Coldest Days		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	50	0	36	65	0	0	0	0	0	0
Low Risk Scores	21	28	35	36	48	10	45	24	10	21	28	35	33	22	22

	Frost-free Season			Freeze/ Thaw Events			Annual Percipitation			Extreme Rainfall			Persistant Percipitation		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	39	26	26	51	34	34	27	36	36	27	27	36	27	36	36

	Short Duration Rainfall/ Overland Flooding			Drought			Winter Percipitation			Lightning			Hail		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	12	12	0	48	48	0	12	12	0	0	0	0	12	12
Low Risk Scores	45	48	48	54	24	24	42	44	44	24	32	32	45	48	48

	Tornado			River Flooding			Wildfire Smoke			Shifting Ecosystem		
	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
High Risk	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	24	56	56	0	0	10	0	0	0	0	0	0
Low Risk Scores	27	12	12	24	32	30	30	40	40	21	28	28

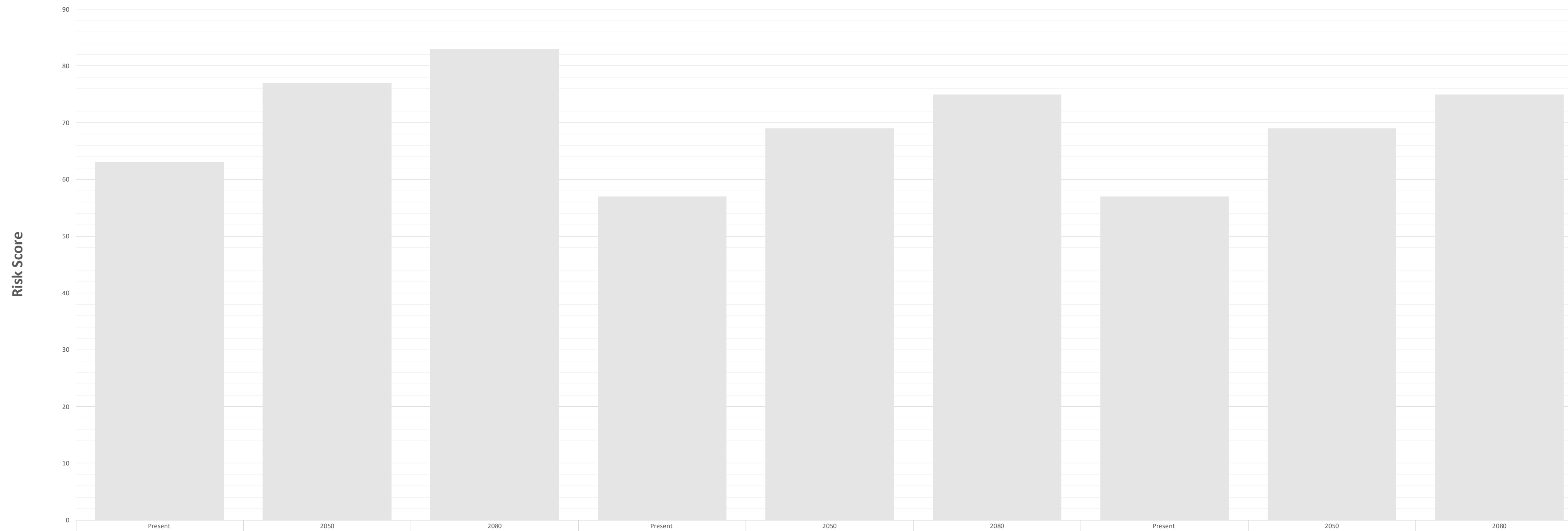
PIEVC Risk Matrix
Solid Waste Management System

Consequence Score 0 - No Effect 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic		Climate Parameter																																			
		Temperature																												Precipitation							
		Mean Annual Temperature (-C)				Days above +30ºC				Warmest Day Time Temperature				Cooling Degree Days (Degree Days)				# of Days Below -30ºC				# Days Without Frost				# Freeze/ Thaw Events				Annual Total Percipitation (mm)				Maximum 1-Day Total Percipitation (mm)			
		Annual Mean				**Very Hot Days**				**Hottest Day**				**Cooling Degree Days**				**Coldest Days**				**Frost-free Season**				**Freeze/ Thaw Events**				**Annual Percipitation**				**Extreme Rainfall**			
Climate Projections	Present	2.7	3			2	3			31.3	3			40	3			9.9	3			126	3			106.7	3			452	3			35	3		
	2050	4.2	4			11	4			35.3	4			125	4			5.2	2			148	2			95.5	2			473	4			35	3		
	2080	6.8	5			23	5			39.0	5			269	5			2.2	2			168	2			85.2	2			479	4			38	4		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Operation and Maintenance	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2		4		4		4		4
Public/Customers	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2		4		4		4		4
Emergency Services	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	2	1	2	Y	2	1	2	Y	2	1	2	Y	4	1	4	Y	3	1	3
	2080		5		5		5		5		5		5		5		5		2		2		2		2		2		2		4		4		4		4

		Precipitation																Extreme Events																						Shifting Natural Ecoregions			
		Maximum 5-day Consecutive Percipitation (mm)				Short Duration Rainfall IDF Data: 1:100 year 24 hour event (mm/hr)				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)				Total Percipitation in the Winter Months				Lightning				Hail Storm				High Wind/ Tornado				Flooding				Climate Moisture Deficit				Shifting Natural Ecoregions			
		Persistant Percipitation				**Short Duration Rainfall/ Overland Flooding**				**Drought**				**Winter Percipitation**				**Lightning**				**Hail**				**Tornado**				**River Flooding**				**Wildfire Smoke**				**Shifting Ecosystem**			
Climate Projections	Present	61	3			4.9	3			-	3			69	3			-	3			-	3				3			-	3			-	3			-	3		
	2050	63	4			5.1	4			+	4			75	4			+	4			+	4				4			+	4			+	4			+	4		
	2080	69	4			5.7	4			++	4			81	4			++	4			+	4				4			++	5			+	4			+	4		
Infrastructure Components		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Operation and Maintenance	Present		3		3		3		3		3		3		3		6		3		3		3		3		3		6		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	2	8	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		8		4		4		4		4		4		8		5		5		4		4		4		4
Public/Customers	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		4		4		4		4		4		5		5		4		4		4		4
Emergency Services	Present		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3
	2050	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4	Y	4	1	4
	2080		4		4		4		4		4		4		4		4		4		4		4		4		4		4		5		5		4		4		4		4

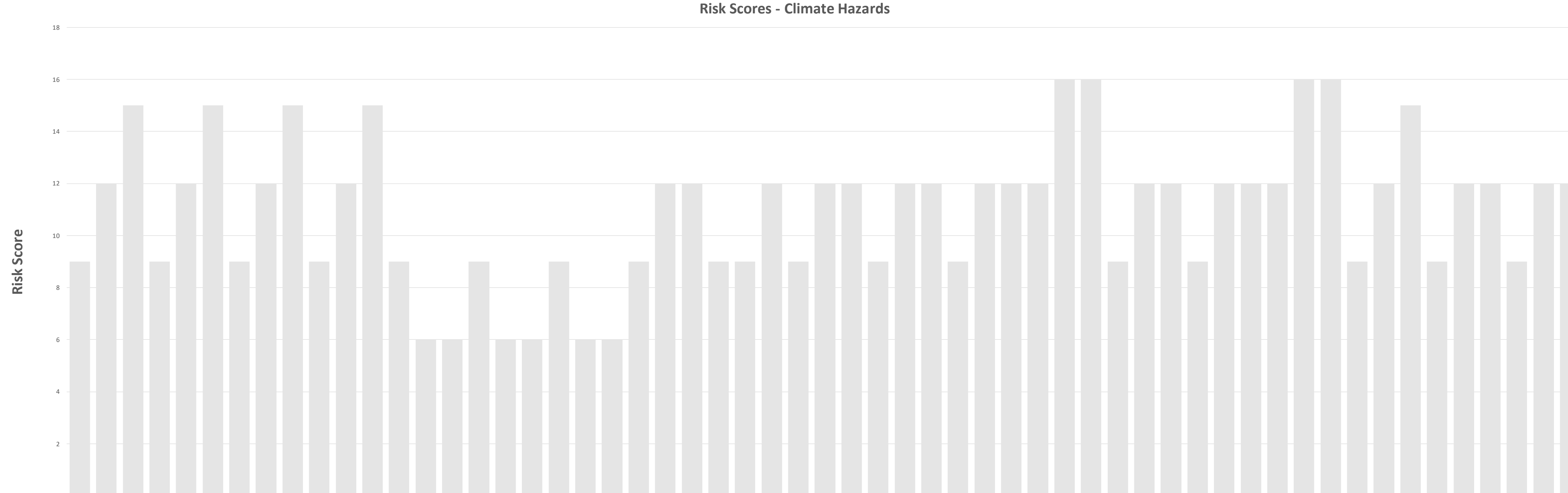
PIEVC Risk Scores
Solid Waste Management System

Risk Scores - Assets



	Present	2050	2080	Present	2050	2080	Present	2050	2080
	Operation and Maintenance			Public/Customers			Emergency Services		
High Risk Score	0	0	0	0	0	0	0	0	0
Medium Risk Score	0	0	0	0	0	0	0	0	0
Low Risk Scores	63	77	83	57	69	75	57	69	75

Risk Scores - Climate Hazards



	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
	Annual Mean			Very Hot Days			Hottest Day			Cooling Degree Days			Coldest Days			Frost-free Season			Freeze/ Thaw Events		
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	9	12	15	9	12	15	9	12	15	9	12	15	9	6	6	9	6	6	9	6	6

	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
	Annual Percipitation			Extreme Rainfall			Persistant Percipitation			Short Duration Rainfall/ Overland Flooding			Drought			Winter Percipitation		
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	9	12	12	9	9	12	9	12	12	9	12	12	9	12	12	12	16	16

	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080	Present	2050	2080
	Lightning			Hail			Tornado			River Flooding			Wildfire Smoke			Shifting Ecosystem		
High Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Risk Scores	9	12	12	9	12	12	12	16	16	9	12	15	9	12	12	9	12	12

APPENDIX C – ADAPTATION ACTIONS

Table C-1: Water Infrastructure Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Water Infrastructure			
1	**Conduct Research**	**Drought**: Review water consumption trends from the community and prepare/update a drought response plan. Further investigation to develop a water security plan in case City of Edmonton apply unexplained water restrictions.	0-5 years
2	**Business as Usual with Monitoring**	**Extreme Heat/Hot Days Above 30°C**: • Review and conduct stress test on equipment in water reservoir pump house. • Review back up power system and ensure system is in good working condition. • Review emergency management such that it addresses impacts due to hot days conditions.	0-5 years
3	**Increase Awareness and Education**	**Drought and Extreme Heat/Hot Days above 30°C**: • Provide education and awareness on water conservation during these extreme conditions. • Further discussion with City of Edmonton on water restriction and supply to provide clear understanding of how the water is shared amongst the various communities that the City supply. The intent is to avoid unexplained water restriction and enable the Town to prepare. **All Hazards**: Review with Operations on all safe work policies, plans, and guidelines. Practice and remind staff of all potential climate hazards. Identify changes need to be made.	0-5 years

Table C-2 Wastewater Infrastructure and Treatment Recommended Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Wastewater Infrastructure and Treatment			
1	Conduct Research	**Extreme Heat/Hot Days Above 30°C**: Research on high temperatures impacting lagoon treatment.	0-5 years
2	Operations and Maintenance	**High Precipitation and Flows:** The Master Plan (water and wastewater) identified some issues with the collection lines and manhole services required. This will be part of the operations and maintenance review to ensure the system continues to operate. Flushing and keeping pipes open and clean. **Extreme Heat/Hot Days Above 30°C**: • Monitor treatment at the lagoon during high temperatures and see how the treatment is being affected. • Review safe work policy and guidelines for staff working outside. Revise policy where required.	0-5 years

Table C-3 Stormwater Recommended Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Stormwater Management			
1	Operations and Maintenance	**Overland Flooding/Creek Flooding:** More frequent maintenance to keep waterways open and functioning. Continue with beaver control as part of the maintenance program.	0-5 years
2	Emergency Management	**1:100 year 24 hour Rainfall Event Overland Flood:** Review emergency response plan to include notifications to the residence and identify alternate routes for travels if necessary.	0-5 years
3	Increase Awareness and Education	**1:100 year 24 hour Rainfall Event Overland Flood**: Educate the home owners of flood protection on their properties and understand the insurance/loss protection coverage.	0-5 years

Table C-4 Solid Waste Recommended Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Solid Waste Management			
1	Operations and Maintenance	Business as usual as the Town contracts out the waste collection and Town does not own waste facilities. Review the current contract to ensure level of services provided by the contractor also address potential climate hazards – build in contingencies.	Ongoing
2	Emergency Management	Review plans for debris management as part of disaster planning – where to take the waste and what resources are available.	0-5 years

Table C-5 Roads and Sidewalks Recommended Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Roads and Sidewalks			
1	Conduct Research	**Extreme Heat/Hot Days above 30ºC**: Investigate asphalt mix design for hotter temperatures.	0-5 years
2	Update Policies, Plans, Standards, Guidelines, and Bylaws	**Extreme Heat/Hot Days above 30ºC**: Review, update or, upgrade policy for include outdoor safe work practices and stop work policy.	0-5 years
3	Increase Awareness and Education	**All climate hazards**: Review with Operations on all safe work policies, plans, and guidelines. Practice and remind staff of all potential climate hazards. Identify changes need to be made.	0-10 years
4	Operations and Maintenance	**Extreme Heat/Hot Days above 30ºC:** Increase operations and maintenance budget for resurfacing and repairs, and dust control on gravel roads. **Persistent Rain/Heavy Rains/River Flooding**: Increase in operations and maintenance budget for repairs and reconstruction of roads from washouts or flooding in roadways. **High Winds:** Replace signs as required. Increase debris management to clear road ways.	0-5 years
5	Emergency Management	**High Winds:** Obstruction removal to enable emergency vehicles to pass through. Review and update emergency routes.	0-5 years

Table C-6 Parks Recommended Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Parks and Playground			
1	Operations and Maintenance	**Drought/Extreme Heat/Hot Days above 30°C:** Select species that are more resilient to heat and drought. Identify watering needs based on supply and demand during these extreme climate conditions (extreme heat, drought). Replacement of damaged trees will be with species that are resilient to future climate.	0-10 years
2	Build New or Upgrade Existing Infrastructure	**Drought/Extreme Heat/Hot Days above 30°C:** Planting more trees for shading.	5-10 years
3	Emergency Management	**High Winds/Hail Storm:** Include debris management to remove broken or fallen trees/structures that impose safety to the public.	0-5 years

Table C-7 Buildings Recommended Adaptation Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Buildings – Municipal Building			
1	Operations and Maintenance	• **High Winds/ Wildfire and Smoke:** Assess and replace building components as required in response to climate events. Increase allocation of funds for replacement if require. Monitor filtration systems and replace as needed. • **Snow Accumulation:** Remove snow to avoid accumulation on roofs.	0-10 years
2	Build New or Upgrade Existing	• **Extreme Cold:** Furnace replacement was discussed – allocated funds for future replacements.	0-10 years
3	Emergency Management	• **All Hazards:** Review the need for backup power. Allocate funds to include back power for critical operations of the building	0-5 years
Building – Public Works Building			
1	Operations and Maintenance	• **High Winds/ Wildfire and Smoke:** Assess and replace building components as required in response to climate events. Increase allocation of funds for replacement if require. Monitor filtration systems and replace as needed. • **Snow Accumulation:** Remove snow to avoid accumulation on roofs. • **Overland Flooding/Persistent Rainfall: M**onitor ponding areas and address drainage around the building to prevent infiltration into the building.	0-10 years
2	Emergency Management	• **All Hazards:** Review the need for backup power. Allocate funds to include back power for critical operations of the building	0-5 years