State of Climate Adaptation

Regional District of Central Kootenay Area J - 2017

CONTENTS

INTRODUCTION

Purpose

Welcome to the Regional District of Central Kootenay Area J’s 2017 baseline report for the State of Climate Adaptation and Resilience in the Basin (SoCARB) indicator suite. The SoCARB indicator suite measures community progress on climate adaptation across five climate impact pathways: extreme weather and emergency preparedness, wildfire, water supply, flooding, and agriculture. SoCARB indicators were designed to provide data and insights relating to climate change, including local environmental impacts and community impacts (e.g., economic impacts), as well as information to help build adaptive capacity and track local actions.

This report summarizes the results of an analysis of SoCARB indicators for Area J, and has been prepared as part of a two-year Columbia Basin Rural Development Institute (RDI) pilot project to test and refine the SoCARB indicator suite in communities across the Columbia Basin-Boundary region. This project is partially funded by the Real Estate Foundation of British Columbia.

Climate-related events like flooding, drought, and higher temperatures can be critical events for communities. Flooding poses a risk to water infrastructure and contributes to turbidity in surface sources. Drought has implications for water supply, local food production and increasing wildfire risk. Higher temperatures can impact vulnerable populations, including the elderly, socially isolated, chronically ill, and infants.

The information presented in this report is intended to highlight trends, changes, and impacts to the local climate and surrounding environment, and to inform local planning and decision-making. This includes changes in indicators outside of the Regional District’s jurisdiction such as glacier extent and wildfire starts, recognizing that a better understanding of trends associated with these indicators can help the community prepare for current and future changes. For other indicators, like 72-hour emergency preparedness and per capita water consumption, for example, local governments are better positioned to identify and track where their actions could increase community climate resilience.

Not all 58 SoCARB indicators are reported here. Indicators that Area J has not identified as a priority, as well as all indicators from SoCARB’s Community Resilience Index (see page 2), have been excluded. Some indicators may be updated annually as part of the Regional District’s annual reporting, while others may be updated over a longer time scale as time and resources allow.

Report Highlights

- Area J’s climate is changing, with data showing trends toward higher average temperatures, higher annual precipitation, and more extreme heat days.
- Shifts in these basic climate metrics are becoming evident through changes in environmental conditions. For example, peak streamflow appears to be moving earlier and the amount of heat energy available for crop growth is on the rise. Some environmental impact indicators lack

sufficient data to infer conditions or trends, suggesting potential focal points for efforts to enhance climate adaptation monitoring, planning, and action.

- The RDCK has taken important steps to prepare for future changes. These actions are primarily related to planning initiatives related to emergency preparedness, interface fire management, floodplain/geohazard mapping, and water conservation for the Lucas Road system. Opportunities exist to further Area J's readiness to adapt, which include expanded water conservation efforts, implementation of data collection and sharing programs, and support for adaptation efforts at the household scale.
- While some datasets are not lengthy or complete enough to evaluate trends that would indicate the effectiveness of Area J's adaptation efforts, the analyses conducted for this project provide a baseline assessment against which future progress can be compared.

Methods

The State of Climate Adaptation and Resilience in the Basin indicator suite was developed in 2015 by a team of climate change professionals. The full suite groups indicators into two instruments:

1) a set of **five thematic pathways** (wildfire, water supply, agriculture, flooding, and extreme weather) that, through 58 indicators, measure climate change, climate change impacts, and climate change adaptation; and
2) a **Community Resilience Index** that uses an additional 20 indicators to provide insights on socio-economic conditions in the community that contribute to its capacity to adapt.

The Water Supply pathway (Figure 1), as an example, illustrates how SoCARB conceptualizes the relationships between categories of indicators. Climate changes have direct and indirect impacts on communities. Indirect impacts are experienced through environmental impacts. Impacts can be addressed through adaptation actions and capacity building, and the results of such efforts improve adaptation outcomes.

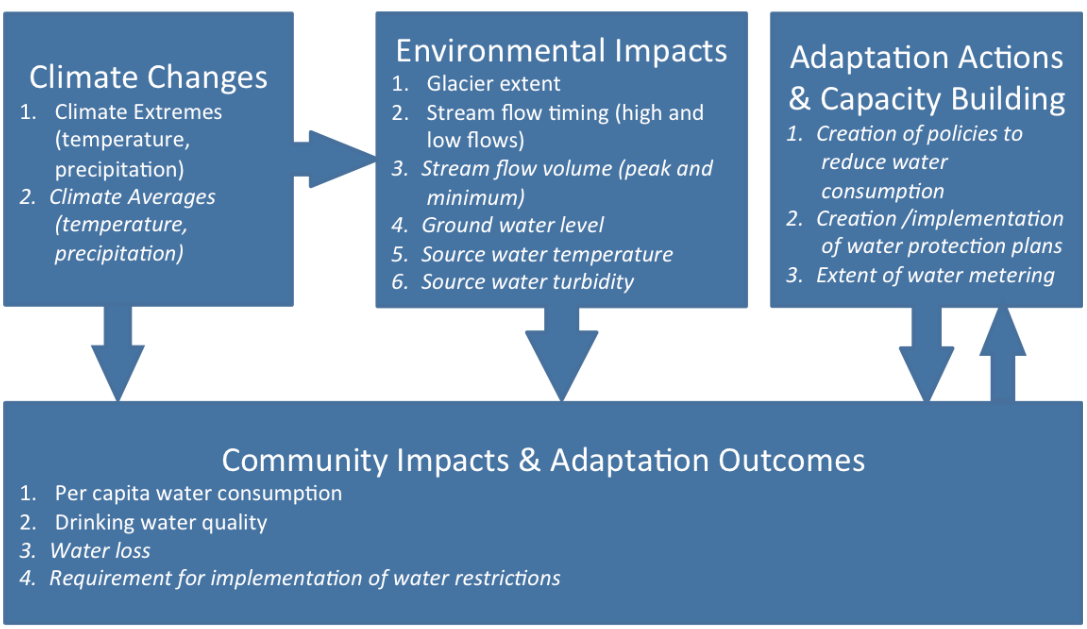

Figure 1: Water Supply pathway from the SoCARB indicator suite

For this report, Regional District personnel identified the SoCARB indicators that reflect local priorities. Community Resilience Index indicators were not assessed as part of this report; however, most are addressed in the RDI's annual State of the Basin reporting. This report includes an introductory Climate section, which presents climate change indicators common to all five thematic pathways, followed by pathway-specific sections structured similar to Figure 1.

This report is accompanied by full datasets along with detailed information related to the data source, analysis method, and reporting for every indicator. These files allow for more detailed analysis of indicators of interest and support ongoing tracking of climate adaptation progress.

Notes to the Reader

The indicators and related data sets range from simple to complex. Additional detail on any of the datasets or analytical methods is available from the RDI. Understanding the data and its limitations is important for many reasons. The points below are general notes to keep in mind while reviewing this report.

- **Climate trends are complex**. It is difficult to look at climate trends over the short or medium term because there are other factors beyond climate change that can influence trends. Basin climate experts were consulted when analysing and interpreting data for this report.
- **Use of proxy data**. For some indicators, there is no local data source. Where feasible and appropriate, proxy (or stand-in) data sources were used. For example, the closest long term, quality-controlled climate dataset for Area J comes from Warfield. For this reason, climate data have been modeled for Castlegar. More details are provided in the body of the report.
- **Confounding factors**. An indicator can be influenced by several factors, making it difficult to distinguish the cause of a change. For example, trends in water consumption may be influenced by water conservation initiatives, but other factors (e.g., anomalous weather) should also be considered.
- **No obvious trend**. Some data may show no obvious trend. However, this data still has value as a trend may eventually emerge, and the information can still help inform decision making.

CLIMATE

Four climate change indicators are common to most pathways: averages and extremes for both temperature and precipitation. These are presented first since changes in temperature and precipitation are key drivers of both environmental and community impacts. These indicators all use two datasets—both of which are discussed for comparative purposes. Adjusted and Homogenized Canadian Climate Data (AHCCD) from Environment Canada provides long-term (since the early 1900s) observed data for Warfield. ERA-Interim reanalysis data from the European Centre for Medium-Range Weather Forecasts provides shorter-term (since 1979) modeled data for Castlegar[i]. To provide regional context, results of a composite analysis of average temperature and precipitation from AHCCD data available for six stations in the Southwest Canadian Columbia Basin are also discussed[ii].

The Overall Picture

Average annual temperatures are rising in Area J, with the winter warming at a faster rate than other seasons. Annual precipitation also appears to be increasing, with precipitation in the spring and summer seasons driving this trend. Trends in climate extremes, which can have a pronounced impact on communities in terms of emergency and infrastructure planning, are not clear for Area J.

Average annual and winter temperatures are increasing

Various analyses of climate data from stations in or near Area J generally show increasing temperatures over time (see Table 1 and Figure 2).

	Annual	Winter	Spring	Summer	Fall
Castlegar (since 1979)	+2.8°C/century	not available			
Warfield (since 1928)	*+0.1*	+1.8	*-0.7*	*-0.4*	*+0.1*
Southwest Columbia Basin (since 1915)	+1.6	+1.9	+1.1	+0.8	+1.0

Table 1: Annual and seasonal average temperature trends for Castlegar, Warfield and the Southwest Basin, in degrees Celsius per century. Results that are not statistically significant (reliable) are in italics.

Annually, modeled data shows that Castlegar temperatures have averaged 9.1°C since 1979 and ranged from 7.7°Cin 1985 to 10.5°C in 2015. Trends for Castlegar and the Southwest Columbia Basin are statistically significant (reliable) and show that annual average temperatures have increased at a rate of 2.8°C and 1.6°C per century, respectively, since the beginning of the temperature record.

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[i] Data and analyses were provided by Charles Cuell and Climate Resilience Consulting. It is important to note that modeled trends based on the ERA-Interim dataset encompass only 37 years of data. Relatively speaking, this is a short record for climate trends. Short climate records are vulnerable to inordinate influence by natural fluctuations (“oscillations”) in the climate cycle. For this reason, trends based on ERA-Interim data should be viewed and used with consideration of these limitations.
[ii] This analysis was provided by Mel Reasoner and Columbia Basin Trust.

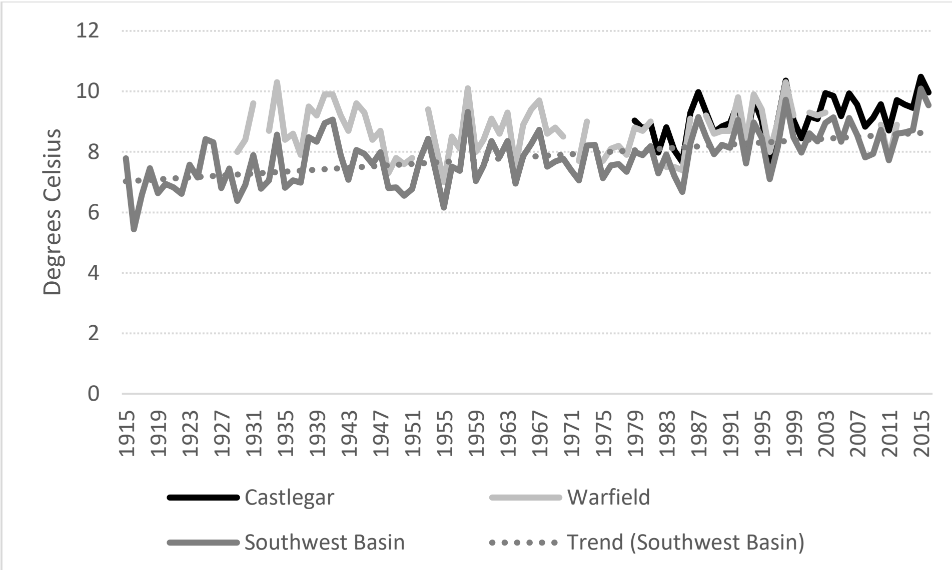

Figure 2: Average annual temperature for Castlegar, Warfield and the Southwest Columbia Basin

Winter, spring, summer, and autumn average temperatures have also all increased in the Southwest Basin over the period of record. Winter temperatures have increased at the highest rate, at 1.9°C per century since the early 1900s. The Warfield station also shows a statistically significant increase in winter temperatures. Trends for the other seasons at the Warfield station are not statistically significant.

Annual precipitation is increasing

Annual records from the various datasets analysed also generally show increasing trends in precipitation (see Figure 3 and Table 2).

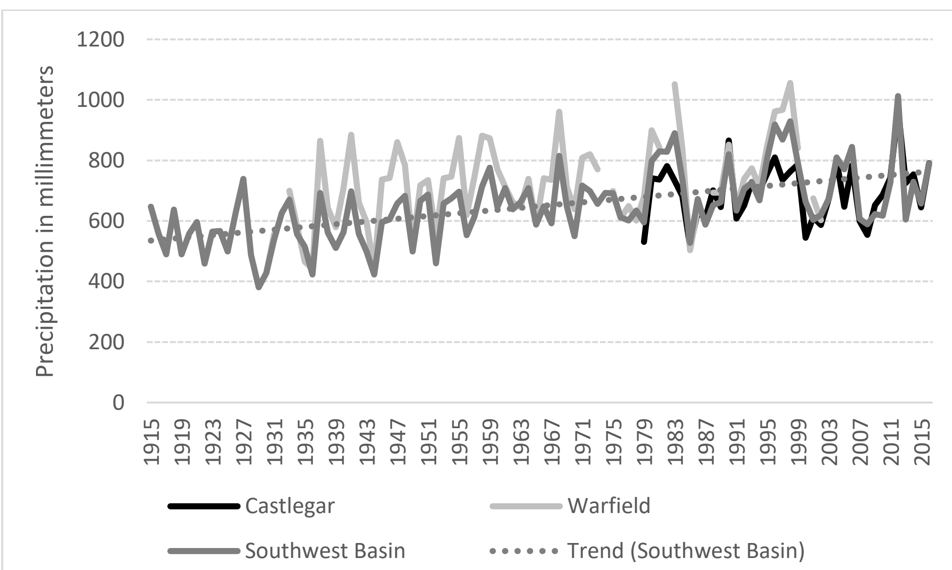

Figure 3: Total annual precipitation for Castlegar, Warfield and the Southwest Columbia Basin

Modeled data for Castlegar shows that, since 1979, total annual precipitation has ranged from 516 mm in 1985 to 971 in 2012, averaging 697 mm. The trend in annual precipitation for Castlegar is not statistically significant; however, annual precipitation in the Southwest Basin has increased at the rate of 218 mm per century since 1915. Warfield also shows a statistically significant increasing trend in annual precipitation of 247 mm per century since 1928.

Seasonally, spring and summer total precipitation records show increasing trends in Warfield and the Southwest Basin. Winter and fall precipitation trends are less clear.

	Annual	Winter	Spring	Summer	Fall
Castlegar (since 1979)	*+144 mm/century*	not available			
Warfield (since 1928)	+247	*-5*	+119	+115	*+43*
Southwest Columbia Basin (since 1915)	+218	*+18*	+104	+62	+53

Table 2: Annual and seasonal total precipitation trends for Castlegar, Warfield and the Southwest Basin, in millimetres per century. Results that are not statistically significant (reliable) are in italics.

No trend in frequency of hot days

The extreme temperature indicator measures the percentage of days where the temperature exceeds the 90th percentile for the baseline period (1961-1990). For Warfield since 1929, this percentage has ranged between a low of 2.2% (8 days) in 1964 and a high of 24.1% (88 days) in 2015. For Castlegar, it has ranged between a low of 1.8% (7 days) in 2000 and a high of 18.9% (69 days) in 1987, averaging 10.9% (40 days) since 1979 (see Figure 4). Though both datasets show slight increasing trends in the number of hot days, these trends are not statistically significant.

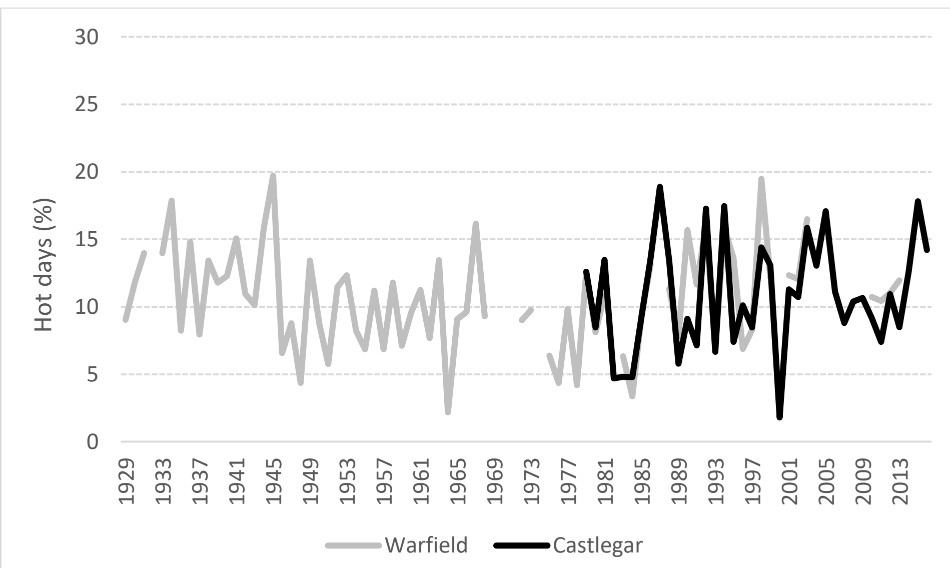

Figure 4: Hot days (% of annual days where temperatures exceed the 90th percentile for the baseline period) in Warfield and Castlegar

No trend in amount of precipitation falling during heavy rainfalls

The extreme precipitation indicator measures the annual sum of daily precipitation exceeding the 95th percentile for the baseline period (1961-1990), and can also be described as the annual amount of rain that falls during very heavy rainfall days. In Warfield, this has averaged 145 mm annually since 1930. In Castlegar, the average is slightly lower (121 mm) and annual values have ranged from 15 mm in 2008 to

285 mm in 2012 (Figure 5). Again, though both datasets show slight increasing trends in the amount of rainfall during very heavy rainfall days over time, these trends are not statistically significant.

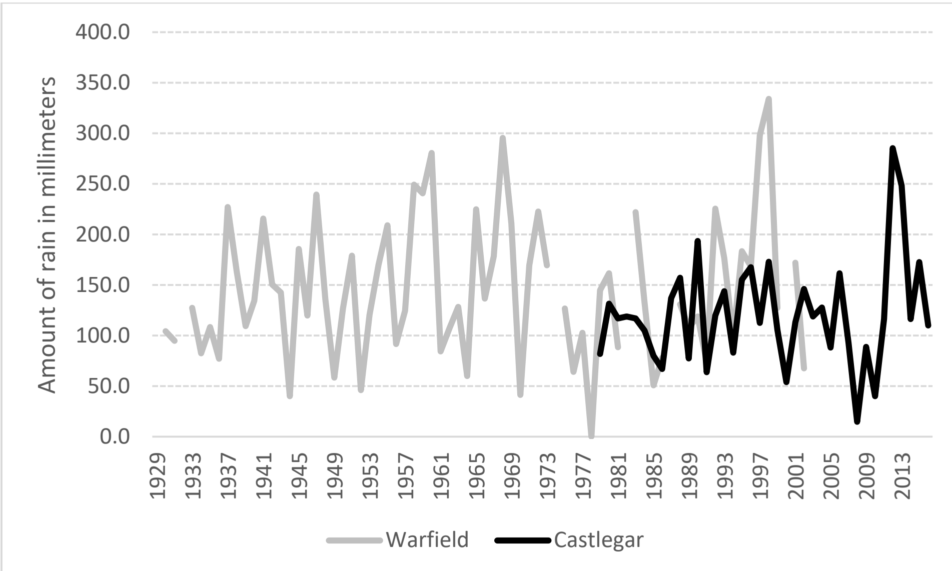

Figure 5: Amount of rain falling during heavy rainfalls (sum of daily precipitation exceeding 95th percentile for the baseline period) in Warfield and Castlegar

EXTREME WEATHER AND EMERGENCY PREPAREDNESS

Extreme weather events, such as extreme snowfall, windstorms and heat, can have significant impacts on communities, both positive and negative. Future projections suggest an increase in some extreme weather events, such as extreme warm days and extreme wet days. Communities can prepare for extreme weather events with adaptations such as emergency preparedness plans, backup power sources, and home emergency preparedness kits.

The Overall Picture

Some extreme weather patterns are changing in Area J, with the frequency of extreme heat days increasing and the frequency of extreme snowfall events decreasing. Continued monitoring of highway closures and implementation of continuous wind monitoring will help establish a better understanding of trends related to these variables. The RDCK is taking action to prepare for emergency events through its emergency planning processes, and there may be an important opportunity for residents to enhance their level of preparedness for extreme weather.

Climate Changes

As discussed in the Climate section, trends in hot days and the amount of rain falling during heavy rainfalls are not clear for Area J. Additional climate indicators related to the Extreme Weather pathway are discussed below.

More extreme heat days

Modeled temperature data for Castlegar shows an upward trend in frequency of days over 30°C since 1979 (Figure 6). The number of extreme heat days has increased at a rate of 38 days per century and averages approximately 31 days per year. Longer term data for the Warfield station does not show a statistically significant trend, though the annual values roughly align with those for Castlegar since the late 1970s. Heat waves and heat extremes can have negative health impacts on vulnerable populations such as the elderly, socially isolated, chronically ill, and infants.

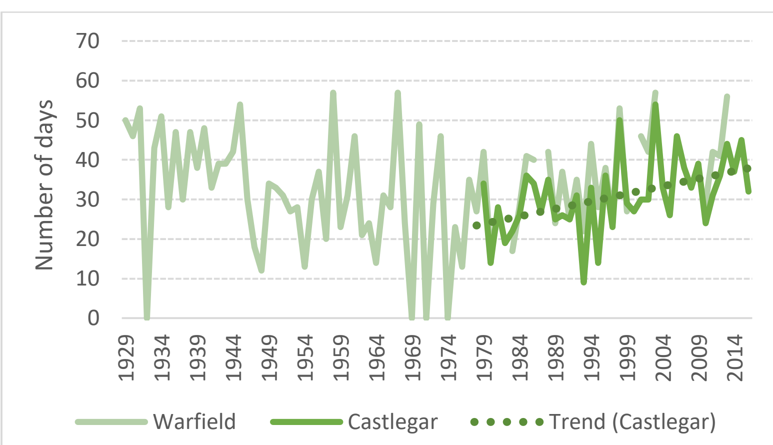

Figure 6: Extreme heat days for Warfield and Castlegar

Fewer extreme snowfall events

Weather stations at the Castlegar airport and Hugh Keenleyside Dam have monitored daily snowfall since 1966 and 1970, respectively. The airport station, located at 496 m elevation, shows a downward trend in extreme snowfall days (those with 15 or more centimeters of recorded snowfall) of -2.7 days per century (Figure 7). There is no trend in the data from the Hugh Keenleyside Dam station (435 m elevation), nor is there a trend in mean daily snowfall at either station. At the airport, there has been an average of 2 extreme snowfall days per year since 1966.

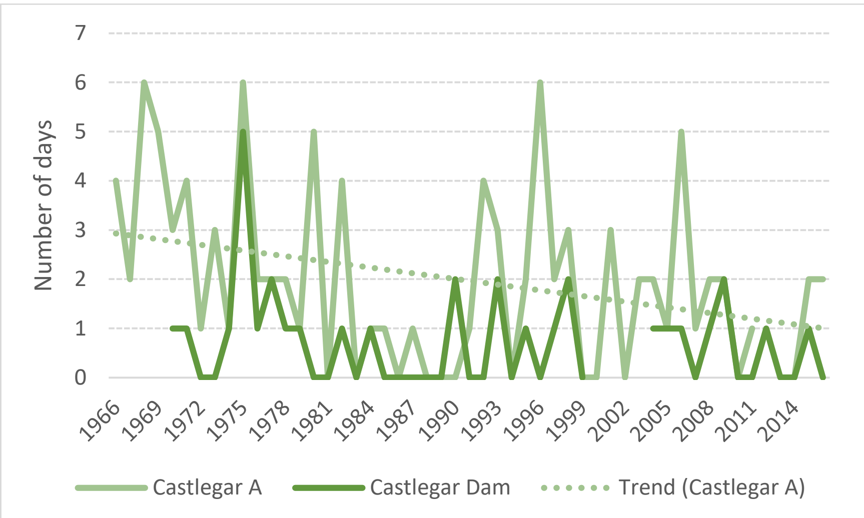

Figure 7: Annual extreme snowfall days at the Castlegar Airport and Hugh Keenleyside Dam stations

Wind data precludes analysis of trends in strong wind events

The strong wind event indicator is measured as total number of days each year with sustained wind of 70 km/h or more and/or gusts of 90 km/h or more. Wind storms can damage infrastructure, bring down power lines, and cause power outages. Wind monitoring in Area J does not currently allow for assessment of strong wind events. The Castlegar Airport and Celgar Mill stations have recorded some wind data in the past, but are not currently monitoring this variable. The BC Wildfire Service operates a station at Norns Creek, but the dataset is too incomplete to evaluate trends.

Uncertain trend in maximum 1-day rainfall

Maximum 1-day rainfall is the amount of rain that falls on the highest rainfall day in a year. Modeled data for Castlegar shows an average annual maximum 1-day rainfall of 21 mm since 1979, which is lower than Warfield’s average of 32 mm over the period 1930-2002. The Warfield data shows an upward trend of 11 mm per century, but data is not available for the past 15 years. There is no statistically significant trend in the Castlegar data. Heavy rainfall is a major cause of flooding of creeks and rivers, and can cause stormwater management issues. A warming climate increases the risk of extreme rainfall events.

Adaption Actions and Capacity Building

Emergency Preparedness Plan being updated

The Regional District of Central Kootenay has an active emergency preparedness plan that includes several critical components. The entire plan is currently under full review. Plan components that are in development include a hazard risk assessment, an emergency social services plan, and a public communications plan (see Table 3). The current evacuation plan is also being revamped and expanded. Though formal MOUs with other agencies involved in emergency response are not yet in place, the RDCK's role as a coordinating agency during past periods of emergency response has resulted in development of working relationships with relevant organizations.

	Yes	In Progress
Hazard risk assessment	☐	☑
Emergency procedures	☑	☐
Business continuity plan	☐	☑
Community evacuation plan	☑	☐
Public communication plan	☐	☑
Designated emergency response centre	☑	☐
Emergency program coordinator	☑	☐
Designated emergency response team	☑	☐
Identified emergency roles and responsibilities	☑	☐
Action list for each type of hazard	☑	☐
Designated emergency/reception shelter	☑	☐
Plan for shelter stocking	☐	☑
Training and emergency exercise plan for response personnel	☐	☑
Contact list for all response personnel	☑	☐
Fan-out call list or emergency alert system	☑	☐
MOUs with any agencies helping in response (e.g. neighbouring municipalities, school board, local service groups)	☐	☑

Table 3: Inclusion of important components in the RDCK's emergency preparedness plan

Partial implementation of emergency backup power

Backup power for essential services is important to maintain delivery of services to residents in the event of a power failure. The RDCK has full backup power in place for its Emergency Operations Centre (located at the main office in Nelson) and a backup generator to ensure delivery of water to West Robson water users in the event of an extended power outage. Backup power is not in place for the Lucas Road system, but this system is exclusively a distribution system and is served directly by the City of Castlegar. The Ootischenia Fire Hall has backup power for its radio system, but not for the building itself. The Robson Fire Hall has no backup power. The RDCK does not operate any sanitary sewer systems or public works yards in Area J, therefore backup power for these services is not required.

Many residents do not have complete emergency preparedness kits

In November and December 2017, the project team distributed a survey in Area J to attempt to gather information from residents on their level of personal emergency preparedness. The response rate to this survey was too low to publish results. Information from Statistics Canada's 2014 Survey of Emergency Preparedness and Resilience in Canada provides information on emergency preparedness in small BC communities, though it is not specific to Area J. Statistics Canada reports that residents of BC's rural areas are generally more prepared for emergencies than residents of BC or Canada as a whole. The proportion of residents in small BC communities with an emergency supply kit (57%), backup generator (41%), and alternate heat source (64%) was higher than the proportion of all BC residents (55%, 22%, and 55%, respectively). Rural BC residents noted that they would seek assistance from their local government in the event of a food or water shortage, industrial or transportation accident, or extended power outage.

Surveys conducted in other communities participating in the SoCARB pilot project suggest a lower level of personal emergency preparedness than that reported by Statistics Canada. In Rossland, Kimberley, and Regional District of East Kootenay Area F, only 25-37% of residents reported that they had a 72-hour emergency kit, with the presence of important kit items like a battery-powered radio, cash, and emergency plan information being even less common.

Community Impacts and Adaptation Outcomes

Few extreme weather-related highway closures on record

Since 2006, there have been two weather-related highway closures in Area J. The first, in 2008, was due to a rockslide on Highway 3 two kilometres east of Castlegar. The second, in 2015, was due to avalanche control along the Blueberry-Paulson pass, which is approximately 30 kilometers west of Castlegar along Highway 3.

No provincial emergency assistance payments in recent years

Regional District staff provided anecdotal information indicating that, over the past five to ten years, there have been no emergency events in Area J associated with emergency assistance payments from the Province. Note that this information cannot be confirmed through a review of data due to a lack of availability of a geographically-referenced dataset from either the RDCK or the Province.

WATER SUPPLY

Projected changes to the climate could influence both the supply of and demand for fresh water for human use. Shifts in temperature and precipitation could change the amount of water stored in the snowpack and the timing of surface water availability in the spring. The Water Supply pathway focuses on the quality and quantity of water available for consumptive use and adaptation actions that help to conserve and protect the water supply. The Regional District owns and operates two water systems in Area J—the Lucas Road and West Robson systems serving six and 105 connections, respectively. Lucas Road is sourced from the Columbia River (via Castlegar's municipal system) while West Robson is sourced from two wells. Other community water systems of note in the area include the Ootischenia Improvement District (sourced by three wells) and Robson-Raspberry Improvement District (sourced by Pass Creek). The RDCK-owned systems are the focus of this report; however, select data from the Ootischenia system is included to help the RDCK understand the adaptation context for systems managed by private or community-based water user groups.

The Overall Picture

While the trend toward a wetter spring and summer in Area J may have positive implications for water supply, the warming trend may have the opposite effect. Water supply may be further challenged by a decline in glacier extent and a trend toward earlier peak stream flows. Despite these changes, security of the water supply does not appear to be a current priority for Area J water systems, as evidenced by a generally low level of implementation of water conservation policies or practices. The presence of the Columbia River in Area J—a major water body that is less vulnerable to shifts in streamflow timing or volume—mitigates water supply concerns for some systems. However, water systems relying on smaller surface sources are more vulnerable. Reliable data is an important precursor to effective planning and action. Efforts to address a lack of data related to source water quality and water loss could help the RDCK and Area J better understand its vulnerability to potential shifts in water quantity or quality.

Climate Changes

As discussed in the Climate section, average annual and winter temperatures are increasing in Area J, as is annual and spring/summer precipitation. Trends in extreme weather related to water supply (including the frequency of hot days and the amount of rain falling during heavy rain days) are not clear for Area J.

Environmental Impacts

Glacier extent is decreasing

Glacier extent in the Canadian Columbia Basin declined by 20%from 1985 to 2005, and has declined further since then. Though there is no glaciated terrain in Area J itself, a decline in glacier extent and glacial meltwater has implications for stream flow and water temperatures in the Columbia River. Due to the scale of this river system, shifts in stream flow and water quality would need to be sizeable to have a measurable impact on Area J water users supplied by the Columbia River, including residences connected to the Lucas Road system.

Date of peak stream flow moving earlier

Stream flow timing is sensitive to climate change, especially in snowmelt-dominated river systems such as those in the Canadian Columbia Basin. Studies generally discuss a trend toward earlier peak flows, which results in a longer period of low flows; however, while present in the western Rockies of the U.S., this trend has not yet been widely confirmed in the Canadian Columbia Basin. Low summer stream flows mean less water is available for human use at the time of year when it is typically in highest demand. Low flows also result in higher water temperatures, which presents challenges for both ecosystems and water quality.

Deer Creek (near Deer Park) is the only active, long term stream flow monitoring site in Area J. The factors that influence stream flow (e.g., size, aspect, and slope of watershed) are complex, so readers should not assume that the same conditions or trends exist for other watersheds. Over the period of record (since 1958) at the Deer Creek streamflow monitoring station, there is a statistically significant trend toward an earlier date of annual maximum daily discharge of approximately 21 days per century (Figure 8). The trend toward an earlier half total flow date (the date at which half of a stream's total annual discharge flows through the monitoring station) is not statistically significant. Trends in the timing of flow for the Columbia River were not analysed due to the influence of dams on flow conditions in this watercourse.

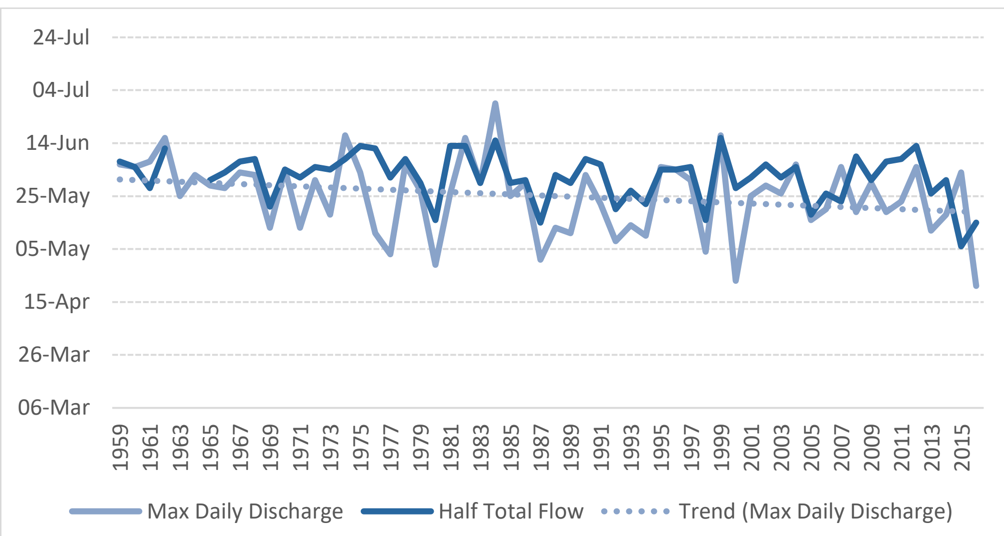

Figure 8: Annual date of maximum daily discharge and half total flow for Deer Creek

No trend in stream flow volume

The volume of annual maximum daily discharge can be an indicator of flood risk, whereas late summer minimum daily discharge can be an indicator of water supply constraints. Data from the Deer Creek station does not show trends for either of these variables. Annual maximum daily discharge for Deer Creek ranged from 4 to 15 m^3/s between 1958 and 2016, while late summer minimum daily discharge ranged from 0.01 to 0.35 m^3/s during the same time period.

Limited groundwater data shows stable conditions

Some community water supplies in Area J rely on groundwater sources, including the RDCK-run system at West Robson and the Ootischenia Improvement District. Groundwater sources are not as well monitored as surface sources, and ongoing groundwater monitoring data was not available for the well serving the West Robson system (the most recent data was from 2001). A groundwater observation well in Ootischenia has been classified by the provincial government as “stable”, with the 26-year trend for that well showing the water surface depth below ground as increasing at a rate of approximately 0.2 metres per year.

Source water quality data precludes trend analysis

Temperature and turbidity (cloudiness) can be important determinants of water quality. Higher temperatures can promote growth of bacteria, and higher turbidity associated with rapid snowmelt or high streamflow volumes can render water treatment processes less effective. Source water temperature data was not available for the RDCK-run water system at West Robson, which is sourced by two wells located off Broadwater Road. Turbidity data from this source provides limited insights over the period of record (since 2012). Water quality advisories are issued on unfiltered drinking water in Canada when the turbidity exceeds 1 NTU. Average monthly turbidity has remained below 1.0 NTU during this time, but data from shorter time intervals was not available. Short term data from the Ootischenia Improvement District shows late-summer source water temperatures ranging between 10°C and 19°C in 2015 and 2017, and turbidity readings ranging between 0.06 and 1.3 NTU during the same time period. The short records of these data sets do not allow for an evaluation of trends.

Adaptation Actions and Capacity Building

Moderate implementation of policies to reduce water consumption

As shown in Table 4, the RDCK’s implementation of various water conservation policies on its West Robson and Lucas Road systems has been minimal to moderate. Full implementation of only two actions—public education and outreach related to water conservation, and adoption of a watering restrictions bylaw—is complete. Both systems participated in the 2017 RDCK Water Smart program, which involved development of a strategy to reduce system leakage, increase efficiency, and reduce outdoor water system use. As a result, the RDCK’s implementation of the policies and actions listed in Table 4 is anticipated to improve in future years.

	Level of Implementation			
	Full	Moderate	Minimal	None
Water metering	☐	☐	☑	☐
Public education and outreach on water conservation	☑	☐	☐	☐
Public education and outreach on water consumption trends	☐	☐	☑	☐
Water meter data analysis	☐	☐	☑	☐
Consumer billing by amount of water used (volumetric)	☐	☐	☑	☐
Implementation of water utility rates sufficient to cover capital and operating costs of water system	☐	☐	☑	☐

Water conservation outcome requirements for developers	☐	☐	☑	☐
Water conservation targets	☐	☐	☑	☐
Stage 1 through 4 watering restriction bylaw	☑	☐	☐	☐
Enforcement of watering restriction bylaw	☐	☑	☐	☐
Drought management plan	☐	☐	☐	☑
Actions to address water system leaks:				
Targeted leak repair	☐	☐	☑	☐
Water operator training	☐	☑	☐	☐
Replacement of aging mains	☐	☑	☐	☐
Addressing private service line leakage	☐	☐	☑	☐
Pressure management solutions	☐	☑	☐	☐
Solicitation of community input	☐	☐	☑	☐

Table 4: Level of implementation of specific water conservation policies and practices for West Robson and Lucas Road Systems

The Ootischenia Improvement District has implemented some water conservation policies and practices. System representatives report that universal metering is in progress, and establishment of water conservation targets, adoption of a watering restrictions bylaw, and water operator training related to leak reduction have been fully implemented.

Water protection plan(s) lacks system-specific climate considerations

The RDCK adopted a Regional Water Management Plan in 2009 which highlights projected climate changes, identifies potential impacts at the regional scale, and broadly discusses measures that could address these impacts. Climate-related risks and adaptation actions are not addressed in a system-specific manner. Though the need to develop a wellhead protection plan for the West Robson system has been identified, this has not yet been implemented.

Minimal implementation of water loss detection practices

Addressing water loss in the distribution system is one of the most effective methods of reducing system-wide water demand and therefore improving resilience to potential water shortages associated with climate change. The RDCK has fully implemented district water metering on its Area J water systems, but has not or only minimally implemented the remaining water loss detection practices listed in Table 5. Water loss detection for Area J systems has not been a priority for the RDCK because, to the best of staff's knowledge, these systems do not experience significant leakage. The Ootischenia Improvement District reports that it has moderately implemented residential water meters, and minimally implemented night flow analysis.

	Level of Implementation			
	Full	Moderate	Minimal	None
District water meters	☑	☐	☐	☐
Residential water meters	☐	☐	☑	☐
Night flow analysis	☐	☐	☐	☑
Water loss audits	☐	☐	☑	☐

Acoustic leak detection	☐	☐	☑	☐
Leak noise correlation testing	☐	☐	☐	☑

Table 5: Level of implementation of specific water loss detection practices for the West Robson and Lucas Road systems

Community Impacts and Adaptation Outcomes

Per capita water consumption data precludes analysis of conditions or trends

This indicator measures water use attributable to user demand and system water loss. Long-term per capita water consumption data was not available for the RDCK-run water systems in Area J; however, current or recent data provides a baseline against which future conditions can be compared. For the West Robson system, total water consumption ranged from 49,614 m^3 in 2012 to 92,853 m^3 in 2017 with water consumption consistently rising year after year over this period. Using the RDCK's estimate of 220 residents served by this system, total system demand equated to approximately 1160 litres per person per day in 2017. For the Lucas Road system, demand appears to be lower. In 2016, a total of 2,176 m^3 was delivered to the five active connections. Using an estimate of 2.5 residents per connection, this equates to approximately 480 litres per person per day. For comparison, results from the Columbia Basin Water Smart program indicate that average consumption among participating communities was 865 litres per person per day in 2016.

Data from the Ootischenia Improvement District was only available for January through August 2017. Over this period, daily demand ranged from 0.9 m^3 per household in February (360 litres per person using an estimate of 2.5 water users per connection) to 9.3 m^3 per household (3720 litres per person) in August. This limited data points to high use during the irrigation season. More information on the nature of water use on this system is needed to better understand this data.

Drinking water quality indicates insufficient water treatment among private systems

Drinking water quality can be adversely affected by source water quality issues caused by the higher air temperatures, more extreme precipitation patterns, or more rapid snowmelts that may accompany climate change. From 2005 to mid-December 2017, seven water systems in Area J were subject to a Water Quality Advisory or Boil Water Notice, including the West Robson system which experienced two separate notices in 2010 and 2011. The average length of all notices was 241 days, with the most common reason being presence of total coliforms. Due to the variability in reasons for implementation of a water quality notice, it is not possible to link trends in this data to climate change impacts. However, the number of long term advisories that have been issued in Area J points to a more general issue among non RDCK-owned systems related to insufficient treatment of surface water sources, which is common to many areas in rural Canada. Robust, multi-barrier treatment systems can help communities reduce their vulnerability to source water quality problems that may accompany climate change.

No data on implementation of watering restrictions

The RDCK adopted a new water use bylaw in 2016 that includes detailed and staged water conservation measures that apply to all RDCK-run systems. Stage 1 restrictions automatically go into effect from June 1st to September 30th each year and Stage 2 to 4 restrictions are implemented on an as-needed basis. Data on the period of implementation of Stage 2 to 4 restrictions was not available for the West Robson or Lucas Road systems. The Ootischenia Improvement District also adopted a new water use bylaw in 2016 that regulates outdoor water use year round, but does not include provisions for staged implementation of more restrictive water conservation measures.

No data on water loss

As reported above, the RDCK has implemented some measures to assess water loss in the Lucas Road and West Robson systems. However, data from these assessments was not available.

FLOODING

Projected climate changes for the Columbia Basin, including more intense rainstorms and warmer, wetter winters, indicate a potential for higher flood risk. Flooding affects communities through damage to homes and infrastructure, and negative impacts on water quality. While operation of the Hugh Keenleyside Dam largely mitigates flooding concerns in portions of Area J that border the Columbia River, areas adjacent to creeks and streams are vulnerable to flooding or debris flows. In some cases, flooding occurs gradually, allowing impacts to be somewhat mitigated with proper planning. In other cases, such as those resulting from severe storms, flooding occurs rapidly, requiring implementation of emergency measures.

The Overall Picture

Trends toward higher spring temperatures and more spring rainfall may indicate a higher risk near Area J creeks of rapid flooding associated with the freshet; however, the impact of these trends is not yet being seen in streamflow volume data for Deer Creek. The RDCK is making important steps to improve its capacity to adapt to potential shifts in flood risk by undertaking a significant update of its floodplain and hazard mapping, which is currently out of date and/or insufficiently supported by geotechnical assessments. This work will help clarify the number of Area J properties that are at risk of flooding or debris flows.

Climate Changes

As discussed in the Climate and Extreme Weather sections, Area J is not yet witnessing the increase in extreme precipitation that has been projected for the Columbia Basin and observed in historical data from other communities. One additional climate change indicator in the Flooding Pathway is discussed below.

Freeze-thaw days average 65 per year

The frequency of freeze-thaw cycles is an important parameter for engineering design in cold regions. Modeled data for Castlegar shows an annual average of 65 days experiencing a freeze-thaw cycle, ranging from a minimum of 35 in 2010 to a maximum of 89 in 1985 and 2001. The dataset shows a slight downward trend in the frequency of the freeze-thaw cycle; however, the trend is not statistically significant.

Environmental Impacts

As discussed in the Water Supply section, Deer Creek is showing a trend toward an earlier date of peak streamflow, and there is no statistically significant trend in peak streamflow volume. One additional environmental impact indicator from the Flooding Pathway is covered below.

Uncertain trend in April 1st snowpack

Snowpack depth and snow water equivalent (the amount of water contained in the snowpack) provide indications of the amount of stored winter precipitation available to contribute to water supplies and potential for flooding. Monthly manual surveys have been conducted at Koch Creek (southeast of

Edgewood at 1813 m) since 1959 and automated data has been continuously collected at Barnes Creek (northwest of Fauquier at 1620 m) since 1957. April 1st snow depth at Koch Creek has averaged 210 cm over the period of record, and data shows a statistically significant downward trend of 57 cm per century. Snow depth data is not available for Barnes Creek. Climate scientists prefer to use snow water equivalent to evaluate long-term trends in the snowpack since it accounts for variation in snow density. Data for the Koch Creek and Barnes Creek sites does not show statistically significant trends in snow water equivalent over the period of record.

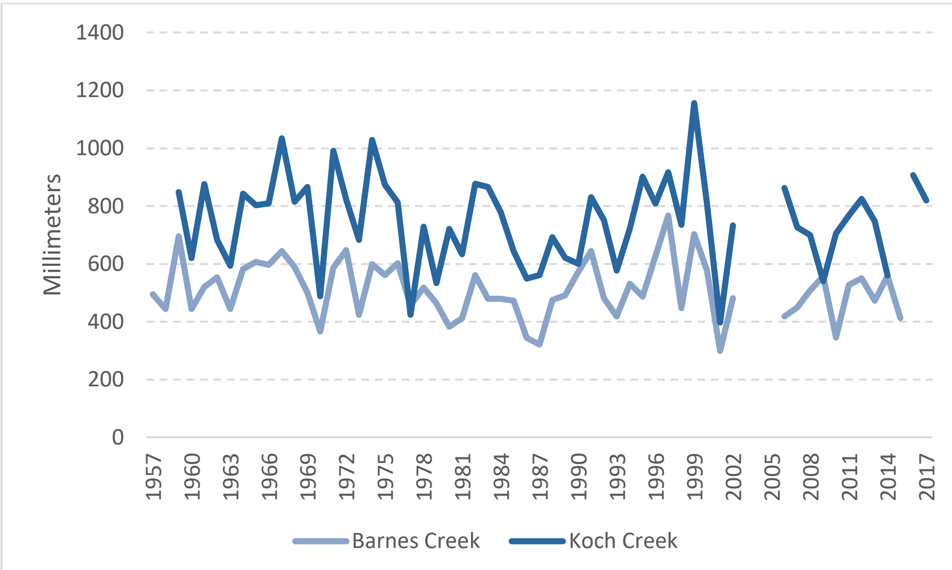

Figure 9: Annual April 1st snow water equivalent at Koch Creek and Barnes Creek

Adaptation Actions and Capacity Building

As discussed in the Extreme Weather section, the Regional District of Central Kootenay has an Emergency Preparedness Plan in place, with several additional components currently being developed. Results for one additional indicator of adaptive capacity for the Flooding pathway are presented below.

Flood mapping currently being updated

The RDCK is currently undertaking significant work to update its floodplain mapping and hazard risk assessments using a LiDAR survey for data collection. At present, the RDCK's Floodplain Management Bylaw identifies a 200-year floodplain, as well as Non Standard Flooding and Erosion Areas (NSFEAs) in Area J, but this data has not been updated since it was transferred to the Regional District from the Province in the early 2000s. NSFEAs are areas that have been identified as prone to debris flows and/or floods through engineer/geoscientist reports or air photo interpretation in circumstances where such reports do not exist. Many NSFEAs in Area J have a "G" classification, indicating that they have been delineated solely by air photo interpretation and are associated with geological features that are only *potentially* active. Updated floodplain mapping, when available, will provide more accurate data regarding specific areas of risk.

Community Impacts and Adaptation Outcomes

No flood-related highway closures in recent years

Since the provincial government began tracking highway events in 2006, there have been no road closures in Area J due to flooding. A washout near the Bombi Summit in 2012 caused single-lane alternating traffic. A longer-term dataset is needed to evaluate trends.

Developed properties in the floodplain

The influence of the Hugh Keenleyside Dam on the Columbia River greatly mitigates flooding in Area J. As a result, few properties lie within the floodplain identified along the Columbia River. One hundred Area J address points lie within Non Standard Flooding and Erosional Areas which, as discussed above, represent geographic features (e.g., alluvial fans) that are prone to flooding or debris flows (Figure 10). In Area J, these addresses are concentrated in the areas surrounding Allendale Creek, Deer Creek, Balfour Creek, and Norns Creek.

Figure 10: Addresses in a "G" classified NSFEA at Deer Creek

AGRICULTURE

Climate has a significant, but complex, impact on food growing activities, with some projected climate changes expected to increase productivity and others reducing it. Climate change also has the potential to negatively affect food production in other parts of the world, which means that locally produced food and local food self-sufficiency could become important climate adaptations in coming years. The Agriculture Pathway tracks the climate-related viability of food production, the impact of climate change on agricultural activity, and the degree to which farmers and backyard growers are prepared to deal with climate change.

The Overall Picture

A trend toward higher temperatures is influencing the growing climate in the region, with Castlegar experiencing more growing degree days than in the past. Notably, however, higher temperatures have not been accompanied by a significant change in the length of the growing season. Continued monitoring of drought levels will help planners understand how a trend toward higher precipitation levels may be affecting agricultural viability and local food production. The declining amount of land being farmed and low agricultural productivity in Area J reflect common economic challenges that must be addressed in order to reinvigorate small scale agricultural production in our region.

Climate Changes

As discussed in the Climate section, average annual and seasonal temperatures are increasing, as is annual and spring/summer precipitation. To date, Area J has not witnessed a trend in extreme temperature or precipitation variables that may impact agriculture, including the frequency of hot days and the amount of precipitation falling as heavy rainfall.

Environmental Impacts

Drought Index tracking began in 2010

The BC drought index is comprised of four core indicators: basin snow indices, seasonal volume runoff forecast, 30-day percent of average precipitation, and 7-day average streamflow. While this data set is only available for seven years and therefore too short to infer any kind of trend, these initial years will contribute to creating a baseline against which future conditions can be assessed. Since 2010, the Lower Columbia Basin (in which Area J lies) has witnessed an average of 28 “dry days” and 10 “very dry days” per year. 2017 was an especially dry year, with a total of 70 dry and very dry days recorded for the Lower Columbia.

Length of the growing season remains unchanged

A longer growing season[iii] allows for greater diversity of crops (especially crops requiring longer days to maturity), greater flexibility in early planting avoiding late summer drought, and more time for plant

[iii] For the purposes of this report, growing season is defined as the number of days annually between the first and last five consecutive days with a mean temperature of 5°C.

growth. Some communities in the Columbia Basin are experiencing a longer growing season[iv]; however, data for Warfield and Castlegar do not show a statistically significant trend. Modeled data show that, since 1979, Castlegar's growing season has lasted for an average of 236 days per year.

Growing degree days appear to be increasing

Growing degree days[v] describe the amount of heat that is available for plant growth, providing better insight on how plants are affected by temperatures than straight temperature data. Growing degree day calculations for Castlegar (1979-2016) show a statistically significant increasing trend of 416 degree days per century since 1979 (Figure 11). Annual growing degree days have averaged 1165 over this time period. Other communities in the Columbia Basin, including Cranbrook, Creston, Fauquier and Kaslo are also witnessing an increasing number of growing degree days[vi], though it is important to note that the methodology to calculate growing degree days for these other communities was slightly different than that used for this report.

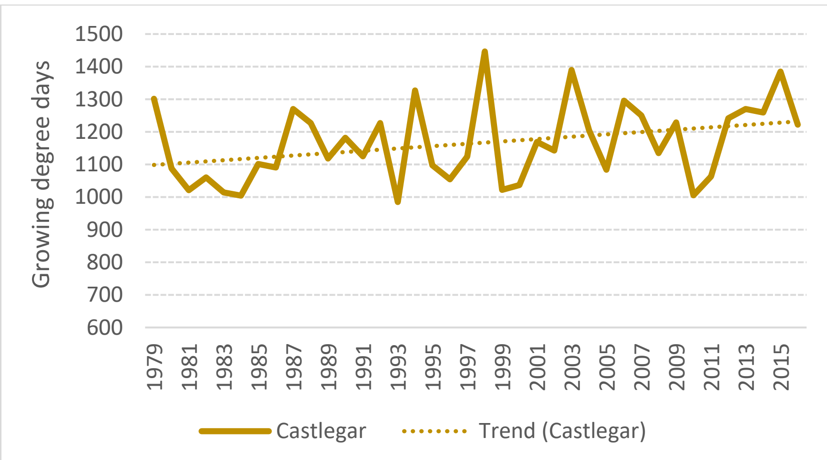

Figure 11: Annual number of growing degree days in Castlegar

Almost 50 documented species of invasive plants

Warming trends associated with climate change can create a more hospitable environment for invasive plants. Invasive plants can challenge agricultural production by outcompeting native or cultivated plants. Some invasive species (e.g., Hoary alyssum) are also toxic to livestock. The provincial government's Invasive Alien Plant Program has recorded a total of 9.6 km^2 in Area J that is occupied by invasive plants, representing approximately 0.5% of the total landmass in Area J. The most widespread documented species of invasive plants include Spotted knapweed (with total documented coverage of 5.4 million m^2), Hoary alyssum (1.5 million m^2) and Sulphur cinquefoil (1.0 million m^2). There are not yet any recorded instances of Leafy spurge in Area J, which is the species of highest concern for livestock toxicity in the

[iv] See: http://datacat.cbrdi.ca/sites/default/files/attachments/Trends_Analysis_Growing_Season_Fall_2014.pdf
[v] For the purposes of this report, growing degree days was calculated by multiplying the number of days that the mean daily temperature exceeds 10 C by the number of degrees above that threshold. Studies often use different definitions of growing degree days; therefore, caution should be exercised when comparing these results to other research.
[vi] See: http://datacat.cbrdi.ca/sites/default/files/attachments/RDI-Agricultural-Climate-Brochure-April-2016-02-WEB-1%5B1%5D.pdf

Central Kootenay region. Caution should be exercised when comparing this data to future years. As the current inventory is incomplete, trends may be indicative of a change in the scope of the Invasive Alien Plant Program rather than a change in the extent of each species.

No trend in consecutive dry days

There is no statistically significant trend in the annual maximum number of consecutive dry days for either Warfield (1929-2002) or Castlegar (since 1979). Castlegar tends to have shorter dry periods, with an average of 23 days annually versus 27 for Warfield.

Adaptation Actions and Capacity Building

Limited amount of land being irrigated

The necessity to irrigate cultivated land is anticipated to increase with the warming and drying trends associated with climate change. Two sources of agricultural information are available for Area J. The Census of Agriculture, completed most recently in 2016 by Statistics Canada, reports that 38 hectares are currently irrigated in the Central Kootenay J census consolidated subdivision (which includes Area I). This figure is roughly unchanged from 2011, when 37 hectares were irrigated. The RDCK's recently-completed Agricultural Land Use Inventory provides property-level data and found that only 13 hectares of land in Area J were irrigated.

No data on community food production

The community food production indicator tracks the number of people in the community who grow at least some of their own food, giving a sense of local self-sufficiency and food security. In November and December 2017, the project team distributed a survey in Area J to attempt to gather information on the degree to which residents engage in 'backyard' food production. The response rate to this survey was too low to publish results and, unfortunately, no suitable proxy dataset exists. The Central Kootenay Food Policy Council launched a survey in late 2017 to gather data from commercial producers in the region. Results from this initiative may help understand the total amount of food being produced in Area J.

Community Impacts and Adaptation Outcomes

Less area being farmed

The annual number of hectares being farmed gives some indication of agricultural viability and the amount of food being produced in an area. Based on an analysis of aerial imagery and a 'windshield' survey of agricultural properties in Area J, the RDCK's Agricultural Land Use Inventory found that 71 hectares were being actively farmed. In contrast, the Census of Agriculture reported 802 hectares of total farm area for Areas J and I in 2016, down 10% from five years prior. The trend towards less area being farmed is also present at regional, provincial, and national scales.

Net agricultural productivity in negative values

The agricultural productivity indicator measures an area's ratio of agricultural inputs to outputs with outputs measured in market value. It provides an indication of agricultural viability in a region, which could be affected by shifting climatic conditions. According to the Census of Agriculture, in Areas J and I, gross farm productivity (gross farm receipts/hectares farmed) stood at $615 per hectare in 2016, up from $469/ha in 2011. However, reported farm expenses in the area have been higher than receipts for the past two census cycles. Therefore, net farm productivity was valued at -$224/ha in 2016, down from -$173 in 2011 (Table 6).

	Gross Farm Productivity ($Receipts/ha)		**Net Farm Productivity (($Receipts-$Expenses)/ha)**	
	2016	2011	2016	2011
Canada	$1,079.94	$787.84	$185.39	$136.87
BC	$1,439.79	$1,124.27	$219.92	$120.70
RDCK	$2,143.36	$1,388.97	$324.57	$198.35
Central Kootenay J & I	$614.90	$468.69	$(224.18)	$(172.63)

Table 6: Agricultural productivity ($/ha) in Canada, BC, the RDCK and Areas I & J

WILDFIRE

Wildfire can cause serious damage to community infrastructure, water supplies, and human health. It is projected that climate change may increase the length of the wildfire season and the annual area burned by wildfire due to warmer, drier summers. The Wildfire Pathway tracks fire risks and impacts on communities as well as adaptation actions being undertaken by communities. Area J is situated in the Arrow Fire Zone, which falls within the boundaries of BC's Southeast Fire Centre.

The Overall Picture

At larger geographic scales, wildfires are becoming more frequent and studies generally suggest that this trend, along with a trend to more area burned, will continue. Local-scale data relating to wildfire danger, frequency, and size does not show reliable trends, but provides a baseline for future assessments. Area J communities feel the impact of active fire years through poor air quality and lengthy campfire bans. Though interface fires have not historically been a frequent occurrence in Area J, the RDCK and communities are taking steps to prepare for an anticipated increase in fire risk through implementation of community wildfire protection efforts. Ongoing monitoring of fire incidents will help the RDCK understand the level of risk that wildfire poses to Area J and continued monitoring of the environmental and economic impacts of fire will help the RDCK evaluate the effectiveness of its adaptation actions.

Climate Changes

Number of days in high and extreme danger class peaks in August

The BC Wildfire Service establishes wildfire danger ratings using the Canadian Forest Fire Danger Rating System. The number of days in the high and extreme danger classes provides an indication of how weather and water availability are influencing fire risk. Results for the Octopus Creek fire weather station (located just north of the Area J boundary) show that, since 1999, the years with the highest fire danger were 2003 (4 days in extreme danger, 38 days in high danger), 2007 (3 days, 36 days), and 2017 (1 day, 32 days) (Figure 12). Over the period of record, the month of August shows a total of 119 days in high or extreme danger classes, followed by 67 in September, and 29 in July. Long term tracking of this indicator is necessary to establish a trend.

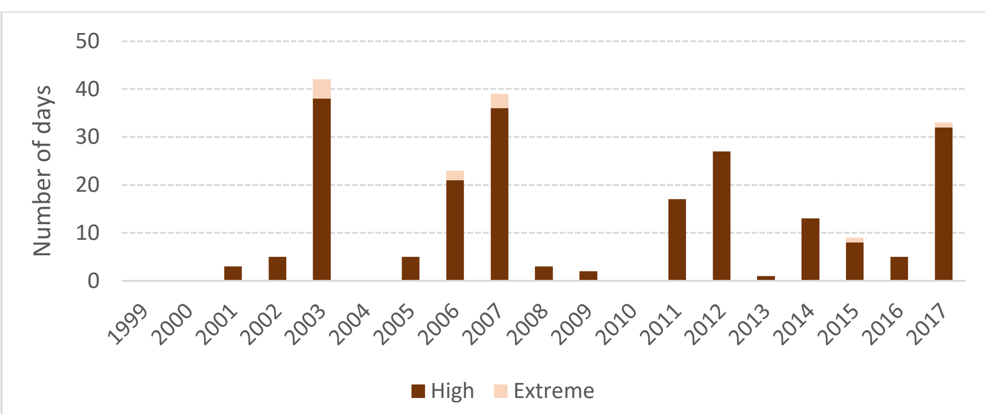

Figure 12: Annual number of days in high and extreme danger class at Octopus Creek

Environmental Impacts

Air quality declines in active fire years

This indicator reports concentrations of fine particulate matter ($PM_{2.5}$), an air quality variable that is strongly influenced by wildfire. High $PM_{2.5}$ concentrations can have significant impacts on human health. A station at Zinio Park in Castlegar tracks air quality on a continuous basis throughout the year. A change in instrumentation at this station in 2012 prevents analysis of historic trends. However, comparison of data from 2017 (a year with a relatively active wildfire season) to 2016 (a year with less wildfire activity) clearly shows how air quality in Area J is influenced by smoke from wildfires (Figure 13). $PM_{2.5}$ readings exceeded the provincial 24-hour air quality objective of 25 micrograms per cubic metre (µg/m^3) several times during the 2017 fire season. Long term tracking of this indicator is needed to better understand how climate change may influence air quality through wildfire.

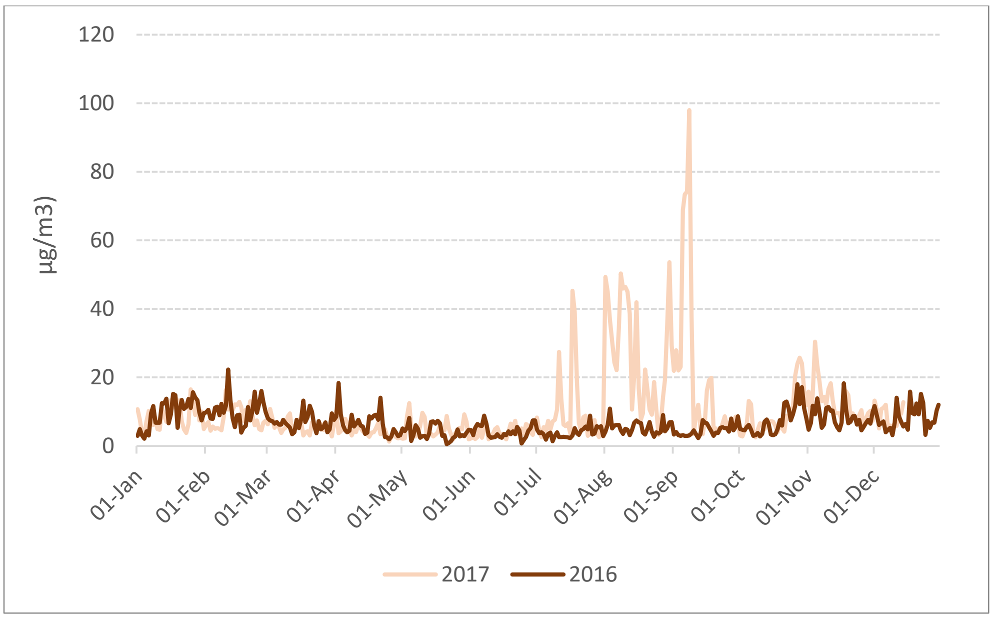

Figure 13: Daily average $PM_{2.5}$ readings at Castlegar Zinio Park in 2016 and 2017

Increasing number of wildfires at regional scale

This indicator tracks the total number of human-caused and lightning-caused wildfire starts per year. Though national-scale data points to increasing frequency of wildfires, there is no statistically significant trend in the number of wildfires started annually in the Arrow Fire Zone or Area J. However, the small geographic scale of this dataset may be preventing effective evaluation of trends. A notable upward trend is apparent in the number of fires in the Southeast Fire Centre that are mapped by the BC Wildfire Service, indicating that they grew to at least 1 ha in size (see Figure 14).

The ratio of fires caused by humans and lightning can be influenced by both climate and public awareness. While roughly one third of wildfires in the Southeast Fire Centre are human-caused, Area J sees an even split between human-caused and lightning-caused fires. This indicator shows that education on wildfire awareness and risk reduction may be useful to reduce the incidence of human-caused fires.

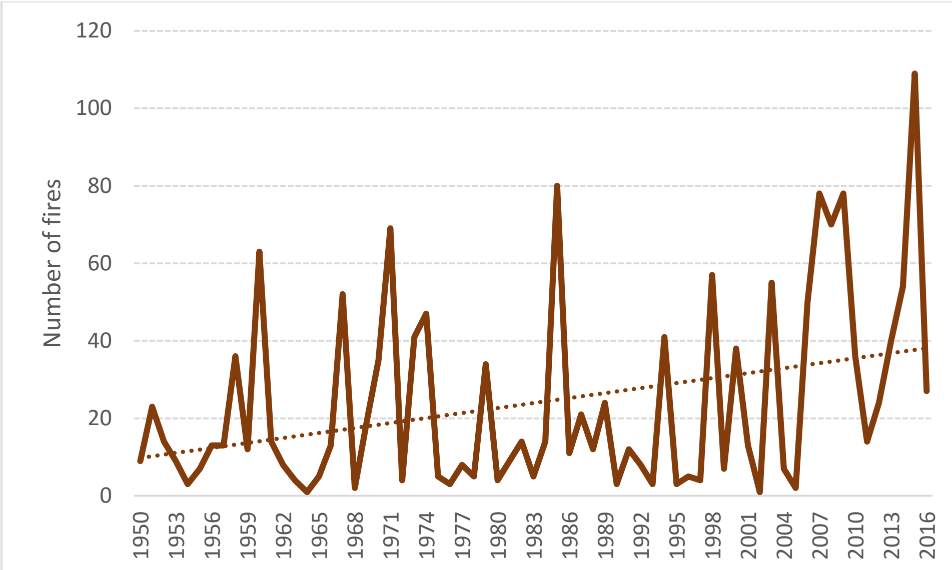

Figure 14: Number of fires greater than 1 ha in the Southeast Fire Centre region, 1950-2016

No trend in area burned annually

This indicator provides a direct measure of how much fire is occurring in a specific landscape. Since 1950, Area J has seen an average of 47 hectares burned by wildfire on an annual basis. Area J's biggest fire year on record was in 2015 when 1106 hectares burned, primarily due to a lightning-caused fire in the Deer Creek drainage. Over this same time period, there is no statistically significant trend in area burned annually at the scale of the Southeast Fire Centre, Arrow Fire Zone, or Area J.

Adaptation Actions and Capacity Building

Interface fire risk reduction and planning underway

Interface fire risk reduction involves assessing and treating high risk areas to reduce wildfire risk. Since 2007, operational fuel treatments in Area J have occurred in Pass Creek Regional Park (0.9 ha) and Ootischenia (13.7 ha). Area J's Community Wildfire Protection Plan, which was originally established in 2008, is currently being updated. Identified fuel treatment areas will be prioritized to undergo prescriptions and treatment work following provincial approval of the plan. The RDCK anticipates that operational work in RDCK-owned properties will begin in 2019.

FireSmart recognition for Robson

This indicator reports on the number of neighbourhoods recognized through FireSmart Canada's Community Recognition Program, providing a measure of citizen involvement in reducing the risk of wildfire to their homes. Mountain Street in Robson has achieved recognition, and the community received a FireSmart Community Protection Achievement Award in 2017. The Robson Volunteer Fire Department has been instrumental in promoting adoption of FireSmart principles in its community.

Community Impacts and Adaptation Outcomes

Few interface fires on record

This indicator measures the annual number of wildfires within 2 km of address points in Area J. Since the onset of concerted wildfire suppression efforts in the mid-1900s, Area J has seen relatively few interface fires, averaging one fire every four years (Figure 15). These fires are much more likely to be caused by people as opposed to lightning. Increased fire prevention education may therefore be beneficial.

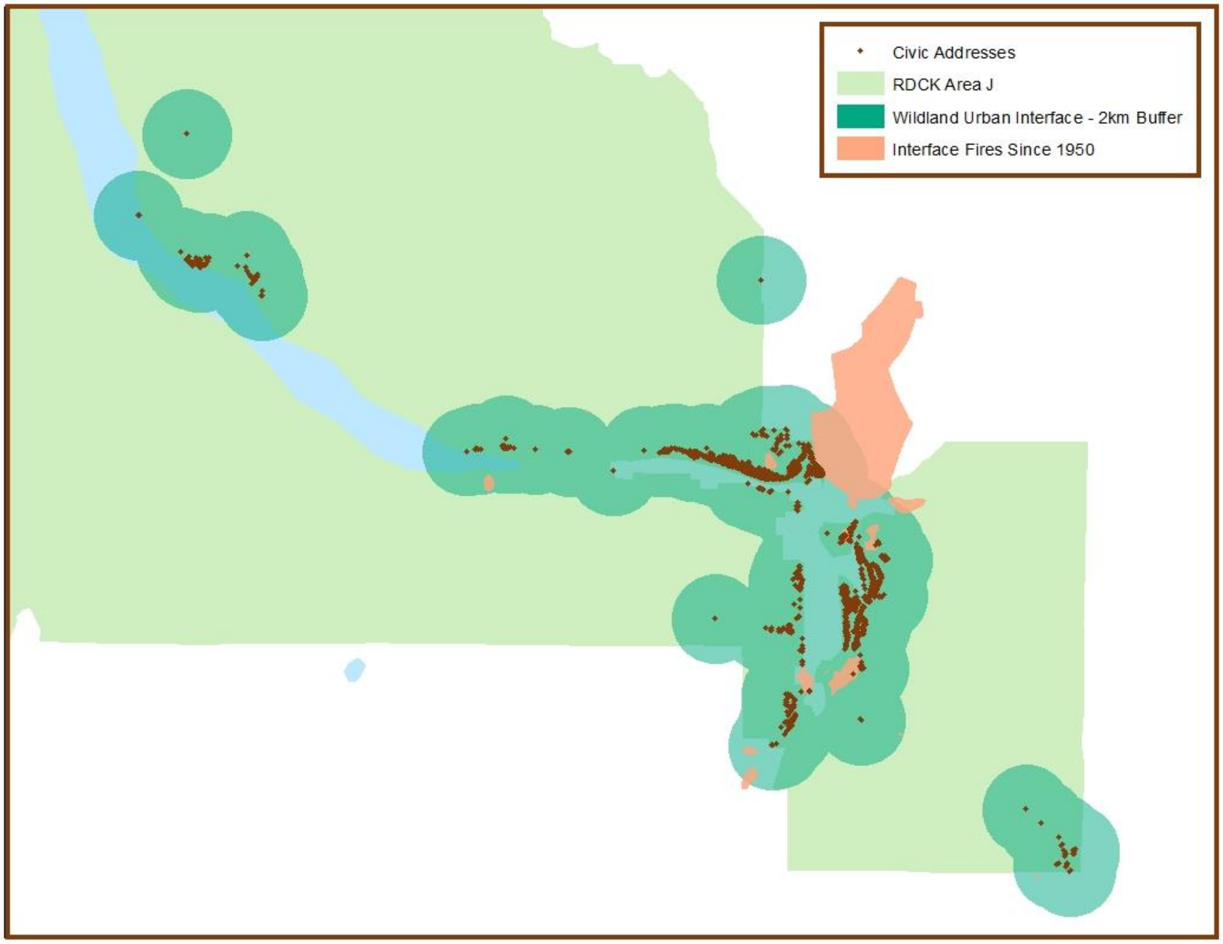

Figure 15: Interface fires in Area J since 1950

Cost of fire suppression averages $4.1M per year

The average annual cost of fire suppression in the Arrow Fire Zone over the ten-year period spanning 2006-2015 was $4.1 million. This value peaked in 2007 ($22.4 million) and dropped as low as $116,000 in 2011. Costs of fire suppression will vary from year to year, and will be significantly influenced by prevailing weather conditions.

No fire-related highway closures or evacuation orders

The RDCK reports that there have been no wildfire-related evacuation orders issued for Area J in the past. Historic highways data also confirms that there have been no road closures due to wildfire within Area J boundaries.

Annual days under campfire ban is highly variable

This indicator tracks the number of days annually for which the BC Wildfire Service has issued a campfire ban for the Southeast Fire Centre. It provides a measure of the social cost of the increasing wildfire risk that is projected to accompany climate change. Since 2000, there have been six years with campfire bans. 2017 saw the lengthiest fire ban, at 77 days. Long term tracking of this indicator is necessary to establish a trend.

NEXT STEPS

Action Areas

Assessment results indicate that the RDCK is engaged in important work to build Area J's capacity to adapt to climate change (e.g., updates to the Emergency Preparedness Plan, floodplain mapping and Community Wildfire Protection Plan), but some services remain vulnerable to shifts in climatic or environmental conditions. Five areas for consideration are discussed below:

- **Water conservation and water loss management.** The RDCK's Water Smart program demonstrates its recognition of the value of efforts to reduce water consumption, both in terms of the impact conservation efforts can have on resilience to climate change and the economic benefits that can be realized through water conservation. Implementation of the water conservation strategies identified through Water Smart, along with other best practices in water conservation and water loss management, could improve the capacity of the RDCK's Area J water systems to respond to potential shifts in water supply. The RDCK may also consider opportunities to build the capacity of community-owned systems—where the limited data available suggests that rates of water use are very high—to reduce water demand.
- **Data collection and record keeping.** In order to effectively plan and implement water conservation initiatives (and other initiatives that could improve Area J's adaptation to climate change), the RDCK requires access to reliable data. A lack of available data related to ground water level, source water temperature, and water loss prevents evaluation of conditions or trends. It is possible that the RDCK can access data that can help with these assessments (water testing results, district meter data, etc.) but if so, this data is not currently accessible or in a format that can be shared. Efforts to collect and publish these types of records would be in line with the 'open data' policies increasingly being adopted by governments.
- **Local food production.** A declining amount of land being farmed combined with low levels of agricultural productivity suggest that there is a substantial opportunity to introduce policies or programs that improve the economic viability of agriculture in Area J. Local food self sufficiency can be an important contributor to the resilience of a community. The RDCK's pivotal role in the Central Kootenay Food Policy Council demonstrates its acknowledgement of this opportunity in our region.
- **Adaptation among residents.** Many important climate adaptation considerations relevant to Area J are outside the scope of the specific services offered by local government. That said, as local governments are often viewed as the 'front line' for residents when disaster strikes, they have a role to play in promoting preparedness at the household level. The RDCK has engaged in this type of work in the past through its FireSmart Ambassador program, which supports households in their efforts to reduce vulnerability to wildfire. An expansion of past efforts to enhance residents' level of personal emergency preparedness (e.g., through education around the importance of 72-hour emergency kits) and food security (e.g., through promotion of backyard growing or other forms of local food production) could further benefit the resilience of Area J.

- **Communication with residents.** This project's attempt to engage Area J residents through a survey on household-level adaptation resulted in very few responses when compared to similar surveys delivered in other Basin-Boundary communities. Other community surveys were distributed via effective communication methods (e.g., community email lists, well-subscribed social media pages) that were not available for Area J. Efforts to build direct and timely communication pathways between the RDCK and Area J residents could support enhanced community engagement on adaptation issues and allow for rapid communications during emergencies.

Future Assessments

Though some SoCARB indicators should be monitored on an annual basis, it is recommended that the next full assessment be conducted in five years (2022). A recommended update cycle is included with the documentation provided for specific indicators. Many SoCARB indicators are also tracked as part of the State of the Basin initiative, which means substantial data may be available through the RDI.

ACKNOWLEDGEMENTS

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