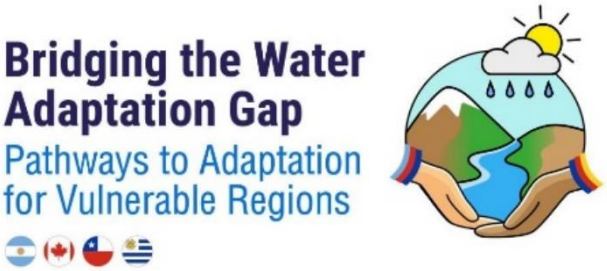
Bridging the Water Adaptation Gap (BWAG) - Pathways to Adaptation for Vulnerable Regions



Primary Economic Activities Sector

Focus Group Analysis

October 26, 2023

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada
Canada

Bridging the Water Adaptation Gap (BWAG) is a five-year international research project investigating how vulnerable agricultural regions may develop sustainable adaptation strategies to address water issues exacerbated by climate change. Regions have been selected in Canada, Chile, Argentina, and Uruguay for similarities in their reliance on agriculture, and their unique vulnerabilities to water shortages (scarcity, drought) and water-related natural hazards (excess water, severe storms, catastrophic flooding). The four countries have been conducting focus groups for four sectors (Livelihoods, Ecosystems, Primary Economic Activities, and Infrastructure) as Objective 3 i.e., assess the risks and possible impacts to regional sectors after the completion of Objective 2 (an attempt to identify regional socio-ecological systems risks). This document aims to describe the analysis of Canada's Primary Economic Activities Focus Group conducted via Zoom on September 13, 2023.

The Primary Economic Activities sector addresses how economic activities use water resources to produce goods and services, and how water-related events, like floods and droughts, impact economic sectors (i.e., agriculture, water supplies, energy production, industry, mining, forestry, recreation, human health, and society). The focus group was online, i.e., the meeting was held over Zoom and was co-moderated by Dr. Harry Diaz and Dr. Oscar Zapata.

Canada's Primary Economic Activities Focus Group Agenda

Moderators: Polo Diaz and Oscar Zapata

Research Assistant: Gabriela Beltran

A.- Welcome and Introductions & Numbers assigned

B.- Purpose of the Focus Group (start recording)

- Our research project is focused on climate risk regional situations in 4 countries. We are focusing on the components of risk: hazards, impacts, vulnerabilities and potential adaptive capacities, with the purpose of developing a regional adaptation program with a group of partners in each country.
- Our attention is focused on five sectors: ecosystems, livelihoods, primary economic activities, infrastructure, and governance. We are starting the research component of the project. We have already done an inventory of the main hazards in the four regions, and we are moving now into an initial understanding of the impacts and their complexities.
- The purpose of this Focus Group is to gather information from you on the present and future impacts of hydro-climatic risks to primary economic activities. Hydro-climatic risks include floods, droughts, extreme weather, wildfires, snow, ice, wind, etc. Risks and impacts can include… from the period 2000 – 2023.

C.- Consent

- Consent by participating
- Right to withdraw or to pass
- Distribution of the final report

D.- Rules of the Debate

- Coordinator leads discussion
- Do not interrupt
- Raising your hand
- Identify yourself using the number assigned to you
- Disagreements are allowed

E.- Questions

1. Ice break question: What are the most important economic sectors/activities in the province/region/watershed?

2. Question about climate events characterized by water scarcity: What are the impacts of water scarcity (i.e., droughts) on the most important economic sectors/activities (i.e., agricultural and livestock units) in the province/region/watershed?

3. Question about climate events characterized by the existence of excessive water: What are the impacts of events with abundance of water (i.e., floods, heavy rains) on the most important economic sectors/activities (i.e., agricultural and livestock units) in the province/region/watershed?

4. The discussion should go beyond common places and obvious impacts. For example, water scarcity can reduce income levels of farmers/ranchers/companies, which may constitute an immediate impact. However, we are interested in identifying longer-term effects of water-related climate events; for instance: How do water-related events (i.e., water scarcity and excess) reduce the investment capacity of economic units in the immediate future and the long-term?

5. Exposure and differentiated impacts of water events (i.e., droughts and excessive water) on economic units: Are some economic units more exposed to and affected by water events than others? What are the factors explaining the differentiated exposure and impacts across economic units?

Participants in the focus group were quite informative on the themes discussed and spoke from their expertise and positionality. This conversation was recorded both on audio and video and transcribed. The transcript was then analyzed on Nvivo using 6 general codes decided upon by the sector leads of all four countries to look for the recurrence of themes (presented in Table 2). These general codes for the Primary Economic Activities sector are shown in the table below.

General codes for the Primary Economic Activities sector

Themes	Code	Description
Economic activities in the province/region/watershed	**PEA_Identif_XX** (XX: plus country code)	Identification of the most important economic sectors/activities in the province/region/watershed
Impacts of drought on primary economic activities	**PEA_DrouImp_XX** (XX: plus country code)	The diversity of impacts that drought or water scarcity have on the most important economic activities
Impacts of excess water on primary economic activities	**PEA_ExWImp_XX** (XX: plus country code)	The diversity of impacts that extreme water abundance (i.e. floods) conditions have on the most important economic activities
Impacts of other climatic hazards on primary economic activities	**PEA_OtCLImp_XX** (XX: plus country code)	The diversity of impacts that **climate events** (other than droughts and extreme water abundance) have on different primary economic activities, such as ice storms, heat waves, hail, and others.
Impacts of non-climatic hazards on primary economic activities	**PEA_NoCLImp_XX** (XX: plus country code)	The diversity of **non-climate impacts** on different primary economic activities, such as economic crisis, labor, trading, and others
Impacts of compounds hazards on primary economic activities	**PEA_ComImp_XX** (XX: plus country code)	The impacts that compounded hazards, where climatic and non-climatic events could be combined, have on primary economic activities in the short and long term.

Table 1: Primary Economic Activities general codes for Nvivo.

Canada's Primary Economic Activities Focus Group Coding

Codes

Name	Description	Files	References
PEA_Identif_CA	Identification of the most important economic sectors/activities in the province/region/watershed	1	11
PEA_Identif_Agri_CA	Agriculture (Farming, Ranching, Food processing)	1	1
PEA_Identif_Ener_CA	Energy Industry (Oil, gas, biomass)	1	2
PEA_Identif_Fore_CA	Forestry Industry	1	1
PEA_Identif_Infr_CA	Infrastructure	1	1
PEA_Identif_Manu_CA	Manufacturing Industry	1	2
PEA_Identif_Min_CA	Mining Industry	1	1
PEA_Identif_Recr_CA	Recreational activities (tourism, fishing, hunting)	1	2
PEA_Identif_Trans_CA	Transportation	1	1
PEA_DrouImp_CA	The diversity of impacts that drought or water scarcity have on the most important economic activities	1	13
PEA_ExWImp_CA	The diversity of impacts that extreme water abundance (i.e. floods) conditions have on the most important economic activities	1	11
PEA_OtCLImp_CA	The diversity of impacts that climate events (other than droughts and extreme water abundance) have on different primary economic activities, such as ice storms, heat waves, hail, and others.	1	3
PEA_NoCLImp_CA	The diversity of non-climate impacts on different primary economic activities, such as economic crisis, labor, trading, and others	1	10
PEA_ComImp_CA	The impacts that compounded hazards, where climatic and non-climatic events could be combined, have on primary economic activities in the short and long term.	1	10

Table 2: Nvivo Codebook for Primary Economic Activities Sector in Canada.

As shown in Table 2, the most important economic sectors/activities identified in the province/region/watershed *(PEA_Identif_CA)* by focus group participants are Agriculture (farming, ranching, food processing), Energy industry (oil, gas, biomass), Forestry industry, Municipal infrastructure, Manufacturing Industry, Mining Industry, Recreational activities

(tourism, fishing, hunting) and Transportation. This code was referenced in the focus group 11 times.

The diversity of impacts that drought or water scarcity has on the most important economic activities *(PEA_DrouImp_CA)* was referenced 13 times, which happens to be the most referenced code during this research effort.

The diversity of impacts that extreme water abundance (i.e. floods) conditions have on the most important economic activities *(PEA_ExWImp_CA)* was referenced a total of 11 times.

The diversity of impacts that climate events (other than droughts and extreme water abundance) have on different primary economic activities, such as ice storms, heat waves, hail, and others *(PEA_OtCLImp_CA)* was referred 3 times during the conversation.

The diversity of non-climate impacts on different primary economic activities, such as economic crisis, labor, trading, and others *(PEA_NoCLImp_CA)* was referenced 10 times.

And finally, the impacts that compounded hazards, where climatic and non-climatic events could be combined, have on primary economic activities in the short and long term *(PEA_ComImp_CA)* was referenced 10 times during the course of the focus group (2 hours).

Summary of the primary economic activities focus group's results in Canada

Code	Description	Summary of the findings
PEA_Identif_CA	Most important economic sectors/activities in the province/region/watershed.	• Agriculture (farming, ranching, food processing) • Energy industry (oil, gas, biomass) • Forestry industry • Municipal infrastructure • Manufacturing industry • Mining industry • Recreational activities (tourism, fishing, hunting) • Transportation
PEA_DrouImp_CA	Impacts of drought/water scarcity on economic activities.	• Knock-on effects in the agricultural and forestry area. • Around 50% death loss rate in Agriculture. • Drought conditions impact animals, biodiversity, and cattle production. • Increase the incidence of forest fires. • Glaciers which are a significant source of water for major urban and industrial developments in Saskatchewan are decreasing. • Investing in planned infrastructure projects to expand irrigation in the province will help make the agricultural industry a lot more drought resilient. • Once agriculture goes through a drought cycle there's also extra pressure on provincial support programs.
PEA_ExWImp_CA	Impacts of extreme water abundance conditions on economic activities.	• As flood events increase, all types of insurance (not just agricultural crops) will begin to be denied. • High vulnerability for anything that's developed in a flood plain and is not flood tolerant. • Industry adapting to changes in terms of harvesting or collecting resources. • Infrastructure (shut down highways). • Certain business communities are still quite vulnerable to flooding, as they're built in low areas (for example the city of Yorkton). • Significant impact on crop production and grain quality. • Drainage systems aren't really set up to deal with floods or don’t have the proper flow controls in place.
PEA_OtCLImp_CA	Impacts of other climate events (ice storms, heat waves, hail, etc.) on economic activities.	•The wind factor is something that affects all the extreme weather events. And most of it is going to be in a negative aspect. •With extreme storms and wind, it would involve all sectors to go back and look at their structure design and their equipment, to see whether it is necessary to make modifications to it, to be able to resist high windstorms or extreme winter snowstorms.
PEA_NoCLImp_CA	Non-climate impacts (economic crisis, labour,	• The water policy assumes that domestic use is free and business and industrial use are charged at the going rates for water. But a city is considered to be a hundred percent

	trading, etc.) on economic activities.	domestic use and as a consequence, they don't charge any fees for industrial, or business water use to cities. • At the household level, there is a lack of understanding of what threats are there in regard to groundwater and surface water sources. • Municipalities and taxpayers bear the immediate costs of improving aging water infrastructure. • The developments of climate change will certainly change the insurance industry. In the short term, there will be an increase in insurance rates. • Land ownership and large farm operations can have an economic impact during extreme weather events. • Private ownership plan policy must look at a different approach to be more resilient in working together than just building and makings decisions in silos. • Technological advances have helped improve water use efficiency • Pandemic, interest rates, and inflation.
PEA_ComImp_CA	Impacts of compounded hazards (climatic and non-climatic events could be combined) on economic activities in the short and long term.	• With the ultimate goal of managing water variability a variety of tools come into play there, like irrigation, conservation drainage practices, AI technology and land use. • Infrastructure investments are usually considered to be long term investments, so in order to do a proper job it is necessary a significant amount of evaluation and planning. •Adaptive in actions and in policy acceptance and implementation. (There are some policies that can be province-wide, but there are also some policies that will not work in some areas but will work well with others.) • Look at plant breeding opportunities to develop crops that actually are shorter, will come to yield in a shorter timeframe, or perhaps have more disease resistance, or pest resistance. • WSA - Water stewardship policy to promote agricultural drainage in a responsible fashion. • Water allocation policies. (When there are water shortages, who gets the water? A lot of those decisions haven't been made or aren't even being discussed right now.) •Concerted efforts to improve water use efficiency across all of the sectors will make us more resilient and it should be made a priority politically.

Table 3: Summary of the Primary Economic Activities Focus Group's results in Canada

Table 3 outlines the main findings of Canada's Primary Economic Activities Focus Group according to each of the 6 general codes.

PEA_Identif_CA reference list:

<Files\\PEA Coding BWAG> - § 4 references coded [4.85% Coverage]

Reference 1 - 1.17% Coverage

recreational activities, including aquatic sports or aquatic activities, going to the river, going to the lake, going fishing, it can also be related to camping. But then we have economic sectors, in this case, households, they use water as a consumption good. So, water enriches households wellbeing, just because these households are able to enjoy water related activities. And then we have economic sectors that are basically defined as activities that use water as an input to produce something else. So, we have farming and ranching that, of course, have specific goods that are being produced. Industry can be mining, or beer craft, for example. Businesses like the hospitality industry, restaurants, hotels, and events. Tourism in general, especially water-related activities again. And also, utilities, public utilities, including water energy mostly.

Reference 2 - 0.55% Coverage

think that this list is much too short and too general, there are a lot of things that will be affected by climate change in positive and negative ways that aren't on this list. And just to name a few, I would start by adding transportation. I would separate industry and mining because they're really two different areas. I would add municipal infrastructure or perhaps just infrastructure in general.

Reference 3 - 1.77% Coverage

The main one is the energy industry. A second one would be the forestry area. And a third one would be manufacturing, which would be a subset of the industry group. So, industry would have a subgroup of manufacturing and mining would have a subgroup of mineral extraction. We've got farming and ranching there, but I would make that more broad to be called agriculture in general, which would include farming and ranching, but also would include agricultural processing, so, all of the food processing or agricultural processing plants that we have here whether those are cattle auctions, or whether those are, you know, seed processing plants or canola processing plants, or whatever, Those are things that I think are probably relevant and would enable a different discussion than just farming and ranching. There's also an emerging sector, of course, part of the energy area is the oil and gas sector, right? So that would be a subset that we should discuss under oil and gas. But there's also a large area for life sciences and biomass and that sort of thing. Primarily run through the hospitals and the universities, but it is an area that is a significant component of our economy and could be affected by climate change outcomes. So, those are things I would suggest being added to the list.

Reference 4 - 1.35% Coverage

I was glad to see the manufacturing on the list, and the reason I mentioned that is from the agricultural perspective when you look at the innovation and the changes that have occurred, and I'll use the equipment as an example in agriculture when you look at the number of industries in this province that have developed worldwide export because of the initiation of adaptations and changes in the agricultural industry. I'll use (name of a location) (27:18) as an example, they reduce the amount of soil erosion, they reduce the amount of impact of the changes in weather. And now that is a distribution worldwide. So our ability to adapt and change not only affects each individual industry, but does create additional industries. Because when you go to the Northern in US, you look at the amount of Saskatchewan equipment that is manufactured and exported into the Northern in US. Just as a small example, whether it be brand industries or Degelman or whoever, far beyond what we do here.

PEA_Identif_Agri_CA reference list:

<Files\\PEA Coding BWAG> - § 1 reference coded [0.73% Coverage]

Reference 1 - 0.73% Coverage

We've got farming and ranching there, but I would make that more broad to be called agriculture in general, which would include farming and ranching, but also would include agricultural processing, so, all of the food processing or agricultural processing plants that we have here whether those are cattle auctions, or whether those are, you know, seed processing plants or canola processing plants, or whatever, Those are things that I think are probably relevant and would enable a different discussion than just farming and ranching.

PEA_Identif_Ener_CA reference list:

<Files\\PEA Coding BWAG> - § 2 references coded [0.63% Coverage]

Reference 1 - 0.05% Coverage

The main one is the energy industry

Reference 2 - 0.58% Coverage

There's also an emerging sector, of course, part of the energy area is the oil and gas sector, right? So that would be a subset that we should discuss under oil and gas. But there's also a large area for life sciences and biomass and that sort of thing. Primarily run through the hospitals and the universities, but it is an area that is a significant component of our economy and could be affected by climate change outcomes.

PEA_Identif_Fore_CA reference list:

<Files\\PEA Coding BWAG> - § 1 reference coded [0.05% Coverage]

Reference 1 - 0.05% Coverage

A second one would be the forestry area.

PEA_Identif_Infr_CA reference list:

<Files\\PEA Coding BWAG> - § 1 reference coded [0.11% Coverage]

Reference 1 - 0.11% Coverage

I would add municipal infrastructure or perhaps just infrastructure in general.

PEA_Identif_Manu_CA reference list:

<Files\\PEA Coding BWAG> - § 2 references coded [1.47% Coverage]

Reference 1 - 0.07% Coverage

So, industry would have a subgroup of manufacturing

Reference 2 - 1.39% Coverage

I guess I was going to comment I was glad to see the manufacturing on the list, and the reason I mentioned that is from the agricultural perspective when you look at the innovation and the changes that have occurred, and I'll use the equipment as an example in agriculture when you look at the number of industries in this province that have developed worldwide export because of the initiation of adaptations and changes in the agricultural industry. I'll use (name of a location) (27:18) as an example, they reduce the amount of soil erosion, they reduce the amount of impact of the changes in weather. And now that is a distribution worldwide. So our ability to adapt and change not only affects each individual industry, but does create additional industries. Because when you go to the Northern in US, you look at the amount of Saskatchewan equipment that is manufactured and exported into the Northern in US. Just as a small example, whether it be brand industries or Degelman or whoever, far beyond what we do here.

PEA_Identif_Min_CA reference list:

<Files\\PEA Coding BWAG> - § 1 reference coded [0.26% Coverage]

Reference 1 - 0.26% Coverage

And a third one would be manufacturing, which would be a subset of the industry group. So, industry would have a subgroup of manufacturing and mining would have a subgroup of mineral extraction.

PEA_Identif_Recr_CA reference list:

<Files\\PEA Coding BWAG> - § 2 references coded [1.71% Coverage]

Reference 1 - 0.71% Coverage

We've seen impacts on tourism. I know, here at the Quill Lakes there were a number of communities that were focusing on eco-tourism and when the lakes were dry, there was no birds to watch or animals to watch, so that negatively affected the tourism business and the opportunity for people to stop in the area and view wildlife. We also saw, you know, with drought conditions, and less so, I think, with floods, we tend to see some fairly significant landscape changes and landscape practices when those things happen.

Reference 2 - 1.00% Coverage

Another thing that wasn't mentioned sort of on the recreation side was outfitting. This area is fairly important for outfitting there's lots of guiding that goes on for big game and waterfowl hunting. There's a lot of tourists that come to this area for hunting in the fall and fishing in the summer. So other economic potential impacts that were when those are affected. And I guess, related to that, too, seeing with recreation, we tend to be seeing a decline in our water quality in many of our lakes, it seems to be getting worse, more frequent algae blooms, the lakes are getting greener in general, and you know, that's going to impact people's recreation abilities and their enjoyment of the of the resources in the province.

PEA_Identif_Trans_CA reference list:

<Files\\PEA Coding BWAG> - § 1 reference coded [0.25% Coverage]

Reference 1 - 0.25% Coverage

there are a lot of things that will be affected by climate change in positive and negative ways that aren't on this list. And just to name a few, I would start by adding transportation.

PEA_DrouImp_CA reference list:

<Files\\PEA Coding BWAG> - § 13 references coded [12.92% Coverage]

Reference 1 - 0.68% Coverage

in the agriculture category, I guess what I've been seeing that's been caused by drought recently is an increasing amount of irrigation that's been developed in the province. So, there's been records about the amount of new irrigation systems being installed, utilizing different water sources to help provide more resilience against droughts for cropping systems and as trends continue to increase on a year-year basis, and a lot of it has to do with just because of this job that we've been seeing.

Reference 2 - 0.71% Coverage

One of the areas that we're finding here over the last 20 years is when there's drought, the water table drops and certainly with the small trees and shrubs, you actually can't keep them alive. With the water table dropping too far you just can't water them fast enough, so we're finding a lot of about 50% death rate in our loss. And the water table, I think, is not even looked at adequately in Saskatchewan, it really fluctuates dramatically, and plants don't. Contrary to belief plants don't go looking for water.

Reference 3 - 0.52% Coverage

drought conditions also affect animals, which is, you know, does have economic impacts, although it's a bit more an indirect impact. So as Number 8 mentioned, you know, there are impacts to trees and shrubs. But all that also has impacts on, you know, habitats, and that will impact animals, biodiversity, which certainly has, you know, an indirect but substantial economic impact

Reference 4 - 0.53% Coverage

when you're talking about drought and affecting the animals, there's many ranchers, cattle producers, that are selling off, breeding stock or replacement stock, because they don't have enough water or feed, which will dramatically affect the long-term cattle production. So, it's not just the short term, it becomes a long-term because it takes a number of years to replace those animals.

Reference 5 - 1.35% Coverage

the effect on forestry. The increase in drought causes an increase in forest fires, causes a decrease in available timber for forestry, causes a loss of environmental carbon sinks with respect to climate change, and that's a sort of a vicious circle. But there are other things, for example, we've seen that the glaciers are decreasing and so everybody here will probably know that the glaciers in Alberta are a significant source of water for Saskatchewan, at least in the southern half of the province, feeding the Saskatchewan River system, which is a significant source of water for our major urban and industrial developments, and we can foresee that water supply diminishing, which is going to make it really important that we become very water efficient in all of our industries and all of our urban areas. And that's going to be a significant task for a lot of places. some places have started, and some places are doing very well, other places have not really looked at it at all.

Reference 6 - 1.35% Coverage

The Steel Company has invested the money to do it probably 3 decades ago, and it is something that is going to be front and center for most of us with the decrease in the water supply.
Other things I would say, I mean, somebody mentioned the obvious already, and that is irrigation systems. They depend on a supply of water from somewhere else, which comes back to the glaciers in the mountains in Alberta, and you know, if we're counting on that to provide us with irrigation water, we need to reevaluate that. And there are other things that will be important, you know, in all the various sectors that we talked about. For example, there is a fair bit of water use in the mining sector and in the oil and gas sector, that will have to be looked at, and as well as in the energy sector and power plants, and so on for cooling, and those things will all have to be looked at with a view to a reduced supply. So those are just a number of things I would suggest that need to be considered.

Reference 7 - 0.75% Coverage

I wanted to mention to you with increasing years of drought, it's important that we also best use our water supply in the province. So, we do have abundance of water in certain areas that could be utilized more efficiently, such as Lake Beef Maker. I think investing in some of the planned infrastructure projects that the province has to expand irrigation in the province will help make

our agricultural industry a lot more drought resilient and ensure that we have food supply for valley out of processors and feed for our livestock sector as well.

Reference 8 - 0.45% Coverage

other important part of the drought aspect is once agriculture goes through a drought cycle like this, there's also extra pressure on provincial support programs I would say, so whether it's crop insurance or it's different programs to help support the livestock side of things, we have that other kind of after effect as well.

Reference 9 - 4.45% Coverage

Focusing, I guess, most on drought, I know other things we've seen within the watershed are wells going dry. There are a lot of rural residents that rely on their own well, or communities that rely on groundwater or well sources or some water reservoirs. And I know we have seen examples of some communities' water sources being go dry and having to truck them in. We've seen impacts on tourism. I know, here at the Quill Lakes there were a number of communities that were focusing on eco-tourism and when the lakes were dry, there was no birds to watch or animals to watch, so that negatively affected the tourism business and the opportunity for people to stop in the area and view wildlife. We also saw, you know, with drought conditions, and less so, I think, with floods, we tend to see some fairly significant landscape changes and landscape practices when those things happen. So, you know, drought provides an opportunity for access to a lot of land that maybe, isn't all that accessible during a wet year. And so, we see tendency, quite a bit of wetland loss during those dry years. And how that affects and increases vulnerability from a climate change perspective with, you know, less cover on the landscape, whether it be in the forms of natural vegetation, game forages, wetlands, those sorts of things can make the impacts greater. We've also seen the opposite in terms of business or economic development we had during a drought period in the Quill Lakes, we actually saw a Brine shrimp fishery startup. They were able to harvest brine shrimp at the quill lakes because the water was so shallow and the shrimp were so concentrated, and when the lake returned to normal levels and flooded, they went out of business. So, probably one of the few cases where drought actually helped economic activity. Conversely, Big Quill resources or compass minerals on the shores of Big Quill Lake during flood they actually had to shut the point down. They had lost infrastructure, and they were closed for a number of months while they had to rebuild, that affected all their suppliers, businesses, for example, in the town of Wadena that make pallets for them to ship their product, they were more able to, you know, provide those pallets because they weren't needed. So, it's all those sort of domino effects that happened and were mentioned before within the agriculture industry and others in terms of you know the supply chain, and how different effects, you know, kind of funnel through. So just a couple of things. Another thing that wasn't mentioned sort of on the recreation side was outfitting. This area is fairly important for outfitting there's lots of guiding that goes on for big game and waterfowl hunting. There's a lot of tourists that come to this area for hunting in the fall and fishing in the summer. So other economic potential impacts that were when those are affected. And I guess, related to that, too, seeing with recreation, we tend to be seeing a decline in our water quality in many of our lakes, it seems to be getting worse, more frequent algae blooms, the lakes are getting greener in general, and you know, that's going to impact people's recreation abilities and their enjoyment of the of the resources in the province.

Reference 10 - 0.21% Coverage

I guess when you get a 50-bushel acre canola crop, and you get a drought that's down to 10 or less, there's definitely going to be an economic impact there.

Reference 11 - 0.40% Coverage

I guess the other thing is the spin off problem high production, whether it be grain bins, green bags, new equipment, etc., etc., to the loss of the inputs that were put into the soil when the drought comes along and you know, grasshoppers, etc., etc., that come along with a drought area.

Reference 12 - 1.08% Coverage

I think, with the long-term trends of global warming, it's gonna create some opportunities, especially for the agricultural and value-added industry in Saskatchewan. So, as we see more droughts in places like California, where traditionally a lot of our produce and higher value crops are grown that we export, and as we see temperatures slowly rise in Saskatchewan, it'll provide more of an opportunity for Saskatchewan to grow a lot more of these high value crops along with developing our Eurasian sector to ensure that we can actually grow your drops in the province. So, I think there's a big opportunity there to really become more of a exporter of not just wheat and canola, and more conventional crops in the province, but also higher value crops, including fruits and vegetables.

Reference 13 - 0.45% Coverage

things that are highly subject to drought. And it's not clear, if you look at the IPCC report, it's not clear that we will necessarily have that much more droughts as compared to flooding. But if we do get more drought, there's going to be knock-on effects as we discussed in the agricultural area as well as in the forestry area.

PEA_ExWImp_CA reference list:

<Files\\PEA Coding BWAG> - § 11 references coded [11.97% Coverage]

Reference 1 - 1.50% Coverage

I wanted to bring up was somebody touched on agricultural crop insurance. And I think that you're going to see that. Not just in crop insurance, but you're going to see it in all kinds of insurance being denied, you know, as the number of windstorms goes up, and then the number of flooding events in cities where people have built in floodplains, you're going to find that eventually insurance will be denied to those kinds of things. So, it is imperative that we start to do some significant planning around those kinds of things and make some changes. The province is already working to do flood mapping for most of the city areas that are affected. But that's just the beginning. The next step will be to change the way we use those flood areas and change the way we plan for alternate drought and flooding, because in the flood years, in many instances, it is expected that one will no longer be able to get insurance against flooding if you're built in a flood prozone. So, there are a lot of follow-on consequences to not doing your homework in terms of planning for climate change issues.

Reference 2 - 1.93% Coverage

I guess the one that comes to mind most often is infrastructure cuts in the sense that if you have a road that's washed out, then that, you know, limits the ability of people to get around, especially if we're looking at an economy where it's a very much a just in time delivery process, we end up with, you know significant shortfalls there, you know. I look at some of the not necessarily floods, but the winter storms that we've had where it's literally shut down the number one highway. You know that can have a probably broader impact than simply just an individual landowner, or homeowner region. And so, that's where I think we need to be assessing our infrastructure a lot more readily, so that we can start, maybe, for instance, move a lot more stuff back on rail necessarily into transport, so that, you know, things can still get to Regina or small towns that still have access to rail that would maybe, being caught with a cut highway or a flooded highway, or that type of thing. I know, when most of Maple Creek got hit by, I think someone said it was a one in 2000-year flood, with all the water that they got on that time. You know, you hit something like that onto number one highway. And, yeah, that'd be almost in some respects would, you know, shut down half of Regina, you know, and just because the food would be coming scarce and materials wouldn't be getting in, and all that kind of stuff.

Reference 3 - 0.35% Coverage

I think that what that says is that it behooves us to go in and do the planning to be resilient to those things. So, to move the things that we've developed in flood plains out of the flood plains and only build things in flood plains that are flood resistant.

Reference 4 - 0.37% Coverage

I would also go back to the comments we talked earlier with respect to insurance and flood planning. I think that, given the changes that are likely to happen in the insurance business, it will pay us rather well to have done our homework on planning against flood damage.

Reference 5 - 0.69% Coverage

in Saskatchewan a lot of our reservoirs do provide a lot of flood protection for different municipalities and areas, so I think building in flood protection into the operating funds of the larger reservoirs and ensuring that we draw down reservoirs to the appropriate level in the fall, to offer flood production in spring will be very important. And also, just making sure that if we do draw down the reservoirs lower on fall, that we're using that water in the most economically beneficial way possible.

Reference 6 - 1.11% Coverage

if we're talking about excess water, again I think it's you know, we always say water is best when it's managed, so whether you have too much or you have too little and when it comes to the agriculture side there's a lot of field efficiencies to be gained by managing excess water on the landscape. So, for example, if you are turning around a bunch of different potholes that hold temporary water on the landscape, you are basically increasing your overlap, you're decreasing your nutrient efficiency, you are decreasing your yield effects, you're also increasing your far

carbon footprint by the amount of turning you're doing in that field, going around, you know, different areas. So, I think land efficiency comes into play that can also benefit the environment as well. So just wanna make a comment on that.

Reference 7 - 2.83% Coverage

I guess in terms of flood, we have seen that certain businesses communities are still quite vulnerable to flooding. They're built on low areas, you know, we saw, for example, city of Yorkton and one of the major rain events have some other downtown core flooded, businesses closed. So, there's that aspect of the flood. I think, in terms of agriculture, and specifically more so, I think the grain producers, the timing of these events is critical as well. So, you know, we may have an example, say where you know we have a fair bit of moisture, and you know a lot of those sort of seasonal wetlands that can be farmed through in the drier years aren't available to be farmed through. So, you know, that would reduce the acreage that producers have, and extreme flood events in the spring delay seeding. So, you know, farmers aren't able to get on the land as quickly as they'd like to, and delayed seeding means the late harvest, the late growing season, you know, if we get a heavy downpour in the middle of the growing season, depending on how long that water sits on the land, it can significantly in crop and impact crop production so reduced yields. And then, if it happens later and during harvest, then it delays harvest, and that can result in significant declines and grain quality going from, say, you know, number one quality whatever to feed quality and that has significant impacts as well. So, timing is just as critical as the event itself, and the duration of the event, is also more of a comment on sort of our land use practices in terms of our drainage systems that are in place, most of them aren't really set up to deal with flood and drought. They're typically designed to move water off the land as quickly as possible. So, what we see is that you know those works actually can cause flooding to be far more extreme downstream. There's, you know, tends to be not an effort to hold water back on a lot of the systems., they tend to be self operating so that the water just flows out in those wet years. And so that can cause all kinds of problems, too.

Reference 8 - 1.00% Coverage

there may be an advantage for the agricultural sector to consider a technique that has been used in the urban development area, which is stormwater detention rather than retention versus drainage techniques. So, there would be a technique where you would hold that water for a small period of time in order to avoid the flooding downstream problems, and also to reduce the investment that you need to make in the conveyance equipment or the equipped conveyance structures to take that water away. So, we've seen cities move to stormwater detention in a big way in order to reduce their storm drainage costs and to reduce their downstream flooding effects. And that might be something that could be used in the agricultural area too.

Reference 9 - 1.11% Coverage

there definitely is some drainage on the landscape that, you know, maybe isn't necessarily or doesn't necessarily have the proper flow controls in place. However, I'd also like to clarify that there's lots of highly functioning drainage networks that actually reduce flooding and save communities from flooding. And there's also lots of different practices on the ground for retaining water, holding back water. Some farmers are holding back upwards of 150 acres of water in the springtime or during high extreme events, to basically provide that flood reduction and that

holding capacity. There's also conservation drainage practices where they're actually holding water underground in drainage tile to that basically sub-irrigate crops. So, there's lots of different technologies there for that piece as well.

Reference 10 - 0.23% Coverage

the increase in flood events, we're going to see high vulnerability for anything that's developed in a flood plain and is not flood tolerant. So that's an obvious one.

Reference 11 - 0.85% Coverage

compass minerals are big quill resources on the shores of big Quill Lake, they extract potassium, sulfate, their processing plant from the lake itself, they have a filtering process, and when the lake flooded the concentration of potassium sulfate, diluted so much that they weren't able to efficiently process the water and extract the mineral. So, they had to retool their entire operation to build in filters such that they could still extract the product but in a much dilute, when it was in a much diluted form. So, you know, basically, industry adapting to changes in terms of harvesting or collecting the resource.

PEA_OtCLImp_CA reference list:

<Files\\PEA Coding BWAG> - § 3 references coded [2.72% Coverage]

Reference 1 - 1.33% Coverage

So there's way beyond just a drought, and I guess the other factor that keeps entering in my mind, anyway, is the effect of the wind. You can have a dry day and no wind, and there's not going to be near the evaporation of any soil or water there is when you're going to get a 50 or an 80-kilometer hour wind, your evaporation rate is going to dramatically change. So, to me wind has a major impact, and that can be as simple as on a out combining, and you get a breeze in the evening, you can keep combining quite a bit later. If you get a rain and no wind, it takes a long time for that crop to dry up then, so it can be combined. So same thing in the spring, if you have lots of water around, and the wind comes along it dries things up quickly, and also then when a drought situation you get that wind, it even dries it out even deeper. So the whole wind factor is something that affects all the extreme weather events. And most of it is going to be in a negative aspect.

Reference 2 - 1.24% Coverage

It includes with respect to droughts going back and making the effort to become much more water efficient, and with extreme storms and wind, it would involve all sectors, and by that I would include agriculture as well as industry, and others to go back and look at their structures and their equipment, to see whether you need to make modifications to it, to be able to resist the heavy storms. Now, of course, there's not a lot you can do to resist a tornado. But there is a lot of things you can do to resist high windstorms, or you know, extreme winter snowstorms by just changing the design of your structures. And so, I think that there's a lot of work to do there to be able to resist what's coming. I agree with the comments that have been made about infrastructure. We

need to go back and rework some of that instrument structure so that it's resistant to the increased storms that we are going to get.

Reference 3 - 0.14% Coverage

water supply is going to be another vulnerability and we're going to need to look at that pretty closely.

PEA_NoCLImp_CA reference list:

<Files\\PEA Coding BWAG> - § 10 references coded [12.85% Coverage]

Reference 1 - 1.09% Coverage

And I'll give you 2 examples of the good and the ugly. Example of the ugly, I would say, would be the restaurant business, that there is virtually no effort to conserve water in the in the restaurant business across much of Canada, and it uses a lot of water. A second example I would give is the water policy that we have of assuming that domestic use is free and business and industrial use is charged the going rates for water. The only problem we have with that is that a city is considered to be a hundred percent domestic use, which we know not to be true, and so, as a consequence, they don't feel that they can charge any fees for industrial or business water use to cities. That's a policy that needs to change if we're going to change the practices around the use of water inside cities.

Reference 2 - 1.58% Coverage

And then I'll give you an example of good performance, which I happen to be familiar with, and that is the steel mill north of Regina. Most electric arc furnace steel mills worldwide, according to the study by the International Iron and Steel Institute, use approximately 28 cubic meters of water per ton of steel produced, metric ton of steel produced. So that's 28,000 liters. So, there are things you can do to improve your water performance and most of them, if not all of them, have been done at the Regina plant, such that it is quite different than most steel plants you'll see around the world that have giant pipes bringing water to them, and giant pipes, taking water away from them. That is not the case at Regina, there is a rather small pipeline, I think it's 16 inch diameter, supplying treated water from the city to the plant, and there is no discharge line, and that is because the plant has re-engineered all of their water processes to make sure that they don't have any discharge, and that they really control their water use with a net result that they use less than one cubic meter of water per ton of steel compared to 28 worldwide.

Reference 3 - 1.56% Coverage

I guess, starting at the household level, I think that what we've seen across the provinces is a first of all a lack of understanding of what threats are there in regard to groundwater sources as well as even surface water sources. But I don't think we've necessarily tapped into better use of water, and I guess I'll go to example both in Regina there is a household bill that essentially set up at what would be considered a grey water system in their house, and they were able to cut their water bill quite literally in Regina from the Buffalo Pound Lake by 50%. I think we've got to, as

number 5 was commenting, we've got to move much more to what one might call a passive system rather than necessarily an active system, so we've got to be getting much more into rainwater harvesting, you know, collection of stormwater so that we that can be re-utilized locally rather than simply just sent down the pipe and out away from wherever you have. So, I think, like I said, both urban as well as even rural. I think we better become much more self-sufficient in our water use, and not necessarily depend upon external sources for that water.

Reference 4 - 1.14% Coverage

when you looked at land agricultural land ownership in this province, it's becoming larger and larger operations. So, like 100,000 acres is not an uncommon item now, or a few producers. And in where, if we're focusing on, you know, flooding and lots of excess water on the lab. So, the large operations have large pieces of equipment, and they're not gonna be able to either physically, or consider going in and seeding an acre here, an acre there, you know, maybe 1015 acres whatever at a spot, whereas if you have someone that will say less than 10,000 acres, they can take one identify those areas that they can go in and seeded a few acres and get a crop in a wet year and utilize the water that's around. So, the whole aspect of land ownership and large farm operations can have an effect economically in some extreme weather events.

Reference 5 - 1.15% Coverage

I guess this is more of an example, perhaps, or something that although it's not directly related to what we're talking about, we've just gone through a 3-year pandemic, and it might be valuable to see if there's ways that we can capture some of that understanding and knowledge and impact of that incident as it might relate then to something like a flood or a drought, or some other thing that we're dealing with right now. I get seemed almost in some respects, and pardon upon, but almost a perfect storm, in the sense of what it did to you know, to this province and to other places, that it might be a way to understand how something like that would hit on a local or a provincial level. Just a thought. I don't know whether there's anybody getting into that assessment, but it might be worth at least exploring it a little bit, perhaps.

Reference 6 - 1.84% Coverage

I think in terms of some of the more immediate costs of some of these extreme weather events, you know, you pointed out insurance, and I think that's a really really big one. I think that maybe commercial residential buildings are somewhat more insulated from the prospect of, you know, rapidly in increasing insurance costs in Saskatchewan, as compared to some other provinces and municipalities where they have maybe a bit more flood-prone regions, or there is, you know, more residential, and vacation spots built out closer to a forest like there is one in BC where horse fire risks brought on by joke conditions are more of an issue. But in in Saskatchewan I think, you know, we're still gonna see certainly in the short-term increasing insurance rates due to extreme weather events. And further, I think there is an immediate cost to upgrade infrastructure that maybe hadn't been on the horizon 10, 15 years ago. A lot of the, you know, water infrastructure that we use to sort of manage, you know, large precipitation events in cities was built for climate and rain modeling that is now outdated, and they are having to, you know, switch out and upgrade infrastructure on a more advanced timeline that I think they were anticipating which certainly has more media costs to municipalities and taxpayers. So those are the 2 that I would mention.

Reference 7 - 1.08% Coverage

I just wanted to add another item to the list, and that is, I think the insurance issue is a vulnerability, because in my role as the ISO Mirror Committee chair for Canada for climate change related standards, we have been talking with the office of the superintendent of financial institutions about what's going to happen with respect to insurance and climate change, and it is expected that there will be a need to develop plans for the vulnerabilities there, and is also expected that the availability of insurance will decrease, and to I think was number 7's point, but generally points made about the reliance of the agricultural industry on insurance. It's going to become more difficult just because of the developments of climate change that are going to change the insurance industry.

Reference 8 - 1.33% Coverage

Both the whole agriculture industry has adapted and changed in the last, I guess, pretty near a hundred years now. So, I guess the whole thing is, how fast and what can we do to adapt and be able to manage the changes that are kind of coming in the climate. The other one that we've talked a little bit about, it's been forest fires. Let's throw that as to a prairie fire which used to be common in the 18 hundreds in this area and come towards the end of this month, if we have a prairie fire, stubble fire get out of control on a windy day, you're gonna run into the same thing that happened and that (location) swift current county few years ago. And there was infrastructure went down, there was major impacts, and like we're talking minutes or less than an hour, these things can take over, and to me that is something that is a little bit scary if it gets out of control as to how you can control that, or how you mitigate something like that. So, I'll leave it at 5 days.

Reference 9 - 1.34% Coverage

I'd make the observation a lot of the discussions that I've been involved with have dealt with the water issue based on a private ownership plan. And it doesn't really look at the public good, nor does it look at the needs of the environment itself, and a lot of the decisions then, are made in silos, so that one person's use of water is a problem for somebody else. But there's no real mechanism right now other than maybe an environmental impact assessment. So, I think the policies are gonna have to look at, how do groups get together to prioritize, and then how do the landless, and those that are impacted on the public side get involved, because more and more of it is moving into the private sector and even water, for instance, in BC is being controlled by access to water by owning the land around it. So, I think we're going to have to look at a different approach that we're a way more resilient in working together than we are in just building our own little silos.

Reference 10 - 0.74% Coverage

I just wanted to say, like in terms of the irrigation industry, there has been a lot of technological advances that have helped improve water use efficiency. Also wanted to mention that provincial and federal funding programs do help support increasing water use efficiency too, such as varying high pressure sprinkler systems to low pressure drop nozzles. And we're seeing even more efficient technology start to become more common in Saskatchewan to such as sub service you're using where you have next to 0 losses in terms of evaporation.

PEA_ComImp_CA reference list:

<Files\\PEA Coding BWAG> - § 10 references coded [17.03% Coverage]

Reference 1 - 2.15% Coverage

when it comes to the agriculture side, and I think often, you know, we often say water drives agriculture, which it absolutely does, and we see these fluctuations from year to year, where we might have, you know, some excess water on the landscape, and then we're in situations like this year again, where we're looking at some drought. And you know it's pockets, and it's variability across the province. So, I guess the ultimate goal is to manage that variability. And there's a variety of tools that come into play there, so, of course, it's the irrigation side of it. It's also the drainage side and when I talk drainage, I'm talking responsible drainage, looking at different conservation drainage practices as well, which couldn't include consolidation of some water on these drier years. Also, AI technology is a big piece, I think, of primary economic activities along with that manufacturing piece, looking at different advancements there to help manage that water, and ultimately, at the farm level, it's water table management, and that relays into production, it relates into soil health, it relates back into those live stock numbers that were previously mentioned, and the one thing about the livestock sector is, once they sell off those cows, they're losing genetics. And they're also not bringing heifers into that herd. So, we're looking at like a 2% reduction in the Canadian cattle herd, which is probably going to end up being more around that 15% level. So, those are some huge impacts on that land use as well, those cattle are no longer on that land.

Reference 2 - 1.23% Coverage

I think one of the areas that need to be looked at are the policies of local resilience versus an international supply chain. I think, we're into a system of growth and continuous growth in a world that's not allowing that, and we don't really have a good set of policies to decouple. One of the ones that came up was mentioned use of grey water, I wasn't aware that the building code had been changed so that we could use grey water because we didn't used to be able to, and even irrigating with great grey water you can do it in Australia, but you couldn't do it here. So, I think, we're finding that water quality pollution and so forth. There's redefinitions of it, and we think that probably we have to look at a policy that says, how do we live within the environmental constraints as opposed to just bringing in technology to somehow solve those problems because they're not doing very well.

Reference 3 - 3.98% Coverage

Just a couple of things that I would point out. First of all, things like the pandemic, interest rates, and inflation are rather short-term issues that we are going to have to deal with irrespective of climate change. And secondly, as anyone who has looked at it will remember the latest intergovernmental panel on Climate Change reports suggests that if we go with business as usual, instead of achieving the Paris accord, we're going to see significant change to the climate by 2050. And we've already caused a serious amount of change in the climate and in the global systems related to it. So, for example, we have already caused a climate temperature rise of 1.1 degrees. So, it's not a question of whether it's going to happen. It is happening and it is

questionable whether we will achieve the 1.5-degree target under the Paris accord, and if I'm any judge, many of the major emitters are not going to do that. Even if Canada met its standards or its targets, you have to know that people like India and China, and even the United States, are unlikely to meet their targets, and since they are the major emitters, that means that we are going to likely have to deal with bigger climate change numbers. So, I guess what I'm getting at is that our hopes for preventing this are some negative numbers and that means that we have to get busy and work on adaptation, and we need to do it sooner rather than later, because it's going to happen. It's already happening, and it's going to happen more before we're done. And I guess the other thing I would point out, is that infrastructure investments are usually considered to be long term investments, life spans and 30 to 50 years and so in order to do a proper job of that, we need to do a significant amount of evaluation and planning, because let's just take an example. Let's suppose that we have 2 replace. I'm gonna pick a number, 30% of our built infrastructure, and we have to do that like within the next 10 years in order to be in a position where we can weather the storm, sort to speak. That's a significant financial hurdle, and it's going to be added to the financial loads that we are considering putting in place right now to try and reduce the greenhouse gas emissions at the same time. Doing that exercise is not going to be free, it's going to be quite expensive, and it's going to take a big investment. So, in a result of that is that we're going to have to re-look at business plans, we're gonna have to re-look at tax levels and financial support for common entities, such as municipalities, and so on, to fix that infrastructure. And so, there's going to be a really significant demand for resources to be invested in the next 10 years. And so that's gonna have an effect on every sector that we've talked about here. And I think that many people haven't started to address that, and we need to get down to some brass tacks here and do it.

Reference 4 - 1.05% Coverage

I guess, you know, any extreme weather event, and I'll use, you know, flooding, and was mentioned about the flooding in Yorkton, you know, within hours there was from that being a major rain event, there was a reaction, whereas in we'll say, Regina, upstream of Regina, a similar event may take days for it to affect Regina. So, depending on where you go in the province, you can have a different reaction to a similar rain event or major weather event. And I guess I think the same thing as far as policies go. There are some policies that can be province wide. But there's also some policies that will not work in some areas but will work well in others. We've got to be adaptive, not only in what we do, but in adaptive in our policy acceptance and implementation.

Reference 5 - 2.01% Coverage

when it comes to the agriculture side for immediate and long-term effects, I mean the cost of lending definitely has an impact, the cost of crop inputs, farming is more expensive, equipment is more expensive, and when you get into these extremes, you look at losing yield, and that definitely affects your bottom line of your business. I think water management is a crucial aspect of farming. And again, whether you're irrigating or whether you're managing your water with drainage. But you also look at different effects like crop rotation changes, and how that affects the economy and food processing within Saskatchewan. Looking at different like plant breeding opportunities to develop crops that actually are shorter, that will come to yield in a shorter timeframe, or perhaps have more disease resistance, or pest resistance as well, as the insect population changes with these different weathers. And then, looking at the next generation, we talk about, you know, 98% of Canadian farms are family owned. And within Saskatchewan. I'm not entirely sure what that statistic is, but we do have some bigger landowners within

Saskatchewan, but we also want to retain those family farms that are operating at about those that 10,000 acre mark, or less. So when it comes to long term effects and water management and resilience to the different climate events, you know, we wanna make sure that we're trying to retain that next generation of family farms in Saskatchewan.

Reference 6 - 3.36% Coverage

I guess another vulnerability in terms of long-term short-term effects would also be sort of parts of the watershed where we have terminal basins, and of course Quill lakes would be one of those where the water doesn't drain anywhere it all ends up in the Quill lakes. So, you know, we saw a major flood began in 2004 and 2005, and here we are 2023, and the lakes are still flooded. There's still crop, land and pastureland underwater and no signs of that. They're going away any time soon, so sort of the vulnerability, I think, is critical when we look at sort of our watershed and those terminal parts, you know, we've seen similar situations with highways through terminal basins, where you know, the highways been flooded, and they continually have to keep raising the highway because the lake level or water levels just continue to rise. From a policy perspective, you know, we see producers when their land is flooded, you know, might be eligible for payments in that first year, but I believe in following years they may not be eligible. So, you know, that's a challenge. And you know, we've seen some producers that have been flooded not being able to receive any compensation for the land. So, you know, they've got land that is part of their business, part of their income that they're not generating any income on because they're not able to even grow a crop on it. So that's an issue. We also have, for example, Crown land sales in this province, so we tend to sell off most of the Crown land in Saskatchewan is sort of in a natural state, and when those lands are sold, they tend to be sold without any sort of restrictions, so those lands could be broken, drained, cleared, brought into production, and so, you know, we're again, we're losing that natural ability for the landscape to resist extreme events. And then we currently have, the Water Security Agency developing a water stewardship policy which the goal is to promote agricultural drainage in a responsible fashion. So, we will see more drainage in this province as a result of this policy, and whether that'll be good or bad, depending on how it rolls out for our vulnerability to climate change, I guess, remains to be seen. It will result in the loss of more wetlands, and we know wetlands fight climate change by storing carbon and reducing the effects of floods and droughts. So what mechanisms will be brought into place to sort of mitigate those impacts have yet to been revealed.

Reference 7 - 1.00% Coverage

I guess stating the obvious in terms of agriculture, I mean as an industry it's very weather dependent for the growing season, and sort of when we get moisture, how we get moisture, all those sorts of things are extremely critical to being able to produce a crop or grow forages for cattle, and we see that every time we have a major event, either flood or drought, the challenges that creates. I think, less so in terms of other industries, you know, unless they're built on the flood plain and are completely destroyed, you know there's opportunities to improve their infrastructure so that they're less vulnerable rebuild retool whatever but clearly, I think of all the agricultures by far the most vulnerable to change in climate.

Reference 8 - 0.29% Coverage

Basically, there's two ways farmers can mitigate weather, and it's managing water, whether it's in short supply or excess supply and insurance. So, definite reliance there on weather and water for that industry.

Reference 9 - 1.04% Coverage

one challenge we're gonna see going forward to with more interest in irrigation to combat drought and water storage is prior to you overuses when that. So, when we do have water shortages, who gets the water? A lot of those decisions haven't been made or aren't even being discussed right now. And so, as we contemplate expanding irrigation, you know, do cities get first dibs on that water? Or they get a certain portion? you know. Where do the producers sit in this? or industry sit in this? In terms of you know, they built infrastructure and invested in irrigation, for example, to grow crops, and then suddenly they might be told, well, you're not going to get any water because we're in a drought. So, gonna be some hard decisions, I think in the future.

Reference 10 - 0.94% Coverage

The first one is that in any water use area you can increase the value of a product by recycling more of it. So that includes when you recycle you get the value of the inputs back again, and one of those inputs for most products that we use nowadays is water. So, anything we can do to increase recycling will decrease the amount of water we have to use. The second thing is that, as I mentioned earlier, I think that a concerted effort to improve our water use efficiency across all of the sectors will make us more resilient, and will provide us with ways to weather the storms that are coming here on water supply. And I think that that should be made a priority, really, politically.

Transcript

Bridging the Water Adaptation Gap Project

Primary Economic Activities Focus Group Transcription

Held on September 13, 2023, from 9:00-11:30 over Zoom

Polo Janice: Co-moderator
Oscar Zapata: Co-moderator
Gabriela Beltran: Research Assistant
1: Ducks Unlimited
2: Planning and Reporting Ministry of Environment
3: Wascana & Upper Qu'Appelle Watersheds Association Taking Responsibility (WUQWATR)
4: Wascana & Upper Qu'Appelle Watersheds Association Taking Responsibility (WUQWATR)
5: Saskatchewan Chamber of Commerce
6: Water Security Agency
7: Prairies Economic Development Canada
8: Saskatchewan Association of Recreational Professionals

9: Saskatchewan Farm Stewardship Association
10: Agriculture and AgriFood Canada

[for context/clarification, text in square brackets was added by Gabriela Beltran]

Polo Janice: …It is part of a project that is oriented to understand the impact of climate change upon the water resources in 4 different countries. Canada, Argentina, Chile, and Uruguay. What we are doing here, is we are trying to understand how climate change impact the water resource of a region. We are not too concerned about specific individuals, but rather how a region could react to climate change. And the reason to do this is because at the end we would like to develop an adaptation to climate change strategy for each one of these regions. So, in order to study the region, we decided to focus on 4 main sectors: infrastructure, primary economic activities, ecosystems, and livelihoods. And in addition to that, we are doing an assessment of the capacity of regional and national government to react to the challenge of climate change. We decided to focus on the issue of regional risk. And regional risk, according to the definition of the IPCC, basically involves 3 main components. The first one of them is a climate hazard, it could be a drought, it could be too much water or fires. We are also interested on the impact of this hazard upon different activities. Finally, we are interested in the vulnerability of different regional sectors to climate change and the capacity of these sectors to reduce their vulnerability through an adaptation program. We have already finished, in the Canadian case, a sort of inventory of the main hazards that we have had in Saskatchewan between 2000 and 2023. We have been working on a final report on this. If later on you are interested in this report on hazard, we will be more than happy to facilitate this.
Now, at this moment in terms of our research, we are moving into an understanding of the impacts. This focus group is related to this activity. We are basically interested in developing an initial understanding of the impact of different climate hazards on different primary economic activities in the region. And this will be in this case the focus of this discussion. For us, hazards in this case are mainly related to scarcity of water, what we call drought and availability of too much water, floods. But we are also interested in other hazards related to extreme weather, snow, ice, extreme winds, etc., etc.
In relation to primary economic activities, we have defined a certain number of them. Let me ask Oscar to describe to you what these main economic activities are all about. But later on, we also would like to hear from you if you would like to add whatever you have of other types of economic activities that are relevant.

Oscar Zapata: Yeah, thank you Polo. So, from a previous review of literature and official documents, and considering the economic structure of Saskatchewan, we have identified, of course, farming and ranching as very important activities, but also industrial ones, including mining steel, and other smaller industries especially in urban areas like the hospitality industry, including restaurants, hotels. And what is interesting about it, is that water can be consumed, it can be a consumption good in that sense. So, we do that at home, of course. We do that in different places, also for recreational purposes, so touristic activities, tourism is also an important sector that is very much related to weather, especially during summer in Saskatchewan we love to do aquatic sports, aquatic activities, going to rivers, going to lakes, doing fishing, things like that. But also, water is an input for many production processes. That's why we're interested also in understanding changes in water availability, whether this is too much or too little water and how these changes in weather availability are affecting economic sectors in general, especially those

that I have mentioned. But probably you will have interesting ideas about the specific sectors that are being impacted by changes in water quantity and water quality. So, changes in the quality of water can also have economic impacts on these sectors and these activities. We are also looking at the present, while we're considering the period 2023. But also, we are interested in anticipating what could happen in the years to come. So expected future events can also impact the economy in the province. So that is basically the sectors, how we are conceiving water as an important element for the economy of the province. Of course, considering again the economic structure of our region.

Polo Janice: Thank you, Oscar. Now, before I ask you to express your opinion about what are the basic economic activities in the province. A couple of administrative things. Number one the issue of consent. I think that we sent all of you a consent form that you are supposed to fill out, sign, and send it back. Some of you did it, some others didn't do it. So, the simplest thing to deal with this issue is that by participating in this focus group you agree to provide your consent to be part of this. If by any chance you decide not to participate or not to give your consent, then you should leave this focus group. Consent is a very important thing to us and is part of the ethics program that defines all the research activities in the university. So, we are asked to ask you for this consent. Also let me tell you that at any moment you have all the right to withdraw from the focus group without any explanation, as well you have all the right to pass on any question that we ask you, okay? So basically, you are not forced in this case to give you an opinion. We are planning to write a final report on the focus group in November or December, as soon as we have the report for this focus group, we'll send it back to you. This is our commitment to you. Now in relation to the conversation, to the dialogue, we are going to have, Oscar and I will be acting as moderators and to that extent then we are leading the schedule. Let's follow the basic rules of any conversation. Please do not interrupt when somebody else is talking. If by any chance you want to say something just raise one hand and whenever you talk, please identify your number, and in that way then your opinion will be recorded in the proper way. And finally, of course, remember agreements and disagreements are totally allow in this conversation, okay? We're not trying to reach a consensus. We just want to listen the opinion of each one of you.

Polo Janice: Number 5.

5: Number 5 speaking here. I was wondering whether or not you have a document that showed the list of areas of interest in the discussion that Oscar brought up there that you could put on the screen.

Polo Janice: Oscar, do you have something like that?

Oscar Zapata: I have the report with me.

5: Could you copy the page that has the list and put that on the screen for our viewing?

Polo Janice: I think that Number 5 wants to know what are considered to be the primary economic activities, a list of those.

Oscar Zapata: Right, I don't have the list as such. In the document, we provide a description of the water sector in Saskatchewan, and all the activities involved and affected by water either positively and or negatively. But let me briefly do this and I will show that on the screen for sure.

5: Thanks.

Polo Janice: Too many documents on that computer.

Oscar Zapata: Just organizing and summarizing the sectors as I have them in the document.
So hopefully, you can see my screen now. So, from the household perspective, we have recreational activities that are important and that are considered economic activities from the perspective of families. So, what I was saying before recreational activities, including aquatic sports or aquatic activities, going to the river, going to the lake, going fishing, it can also be related to camping. But then we have economic sectors, in this case, households, they use water as a consumption good. So, water enriches households wellbeing, just because these households are able to enjoy water related activities. And then we have economic sectors that are basically defined as activities that use water as an input to produce something else. So, we have farming and ranching that, of course, have specific goods that are being produced. Industry can be mining, or beer craft, for example. Businesses like the hospitality industry, restaurants, hotels, and events. Tourism in general, especially water-related activities again. And also, utilities, public utilities, including water energy mostly. So, this is, of course, just an aggregated list of sectors. We could have a longer list, a more disaggregated one, but probably or hopefully this starting list will provide us with some background to start this discussion. But any questions that you may have as Polo was saying we will be happy that to answer them.

Polo Janice: Anybody? Yes, number 5.

5: Number 5 here. I think that this list is much too short and too general, there are a lot of things that will be affected by climate change in positive and negative ways that aren't on this list. And just to name a few, I would start by adding transportation. I would separate industry and mining because they're really two different areas. I would add municipal infrastructure or perhaps just infrastructure in general. And there are probably a few others that will come to me later here.

Polo Janice: Okay, well, Oscar maybe you should stop sharing your screen. Is that okay with everybody?

5: Okay.

Polo Janice: Thank you. Well, this is very much the first question that we have for all of you. I mean, we provide you with a list of what we consider to be primary economic activities. And yes, they are general because we want to give a space to everybody to go into them and make some more specific details. Are there any other primary economic activities that you would like to mention? I mean, number 5 already has suggested transportation, and the separation of mining and industry, but perhaps other people would like to mention some of them.
I'm sorry, number 5, would you like to say something? Your hand is still raised.

5: Yes, I've raised it again. This is Number 5 here. There are several that I didn't think of right at the moment, but we should add them. The main one is the energy industry. A second one would be the forestry area. And a third one would be manufacturing, which would be a subset of the industry group. So, industry would have a subgroup of manufacturing and mining would have a subgroup of mineral extraction. We've got farming and ranching there, but I would make that

more broad to be called agriculture in general, which would include farming and ranching, but also would include agricultural processing, so, all of the food processing or agricultural processing plants that we have here whether those are cattle auctions, or whether those are, you know, seed processing plants or canola processing plants, or whatever, Those are things that I think are probably relevant and would enable a different discussion than just farming and ranching. There's also an emerging sector, of course, part of the energy area is the oil and gas sector, right? So that would be a subset that we should discuss under oil and gas. But there's also a large area for life sciences and biomass and that sort of thing. Primarily run through the hospitals and the universities, but it is an area that is a significant component of our economy and could be affected by climate change outcomes. So, those are things I would suggest being added to the list.

Polo Janice: Okay, number 5, number 6,

6: Yeah, for sure. Just to clarify. Are we wanting to break these into subsections at this point, or just keep them broad or variation topics and then hopefully discuss them individually?

Polo Janice: I think we should keep it at a general level. I forgot to mention that after the focus groups. We are going to have several interviews with specific individuals and of course, we are going to contact each one of you in case you would like to participate in the interviews. And at that moment, we will go into more detail. But at this moment we are very much interested in the general impact that climate hazard might have upon some economic activities. Of course, I mean, if you want to go into very specific economic activities and discuss the impact of climate you are more than welcome to do it, is that okay?
Anybody else who would like to somehow, discuss the list of primary economic activities just to clarify our mind about what we are discussing.

Polo Janice: Number 4.

4: I guess I was going to comment I was glad to see the manufacturing on the list, and the reason I mentioned that is from the agricultural perspective when you look at the innovation and the changes that have occurred, and I'll use the equipment as an example in agriculture when you look at the number of industries in this province that have developed worldwide export because of the initiation of adaptations and changes in the agricultural industry. I'll use [name of a location] (27:18) as an example, they reduce the amount of soil erosion, they reduce the amount of impact of the changes in weather. And now that is a distribution worldwide. So our ability to adapt and change not only affects each individual industry, but does create additional industries. Because when you go to the Northern in US, you look at the amount of Saskatchewan equipment that is manufactured and exported into the Northern in US. Just as a small example, whether it be brand industries or Degelman or whoever, far beyond what we do here.

Polo Janice: Thank you. Anybody else? Number 9, for example, anything that you would like to add to this list of primary economic activities.

9: No, I think everyone's done a good job of kind of outlining that. And I guess I would echo number six's comments whether you know, we're digging really deep into defining these specific categories or keeping it rather more general.

Polo Janice: Yeah, at this moment, again, I think I would like to give them at the general level. But if by any chance you want to mention some very specific economic activities, of course, feel free to do it. It will be very helpful later on, when we have to do the interviews.
Let me now jump into the second question or the second topic for this discussion. and this is related drought. Drought has been a very important climate hazard in the province, especially in the southwest part of the province we have had the drought there for 3 or 4 years, and of course, they have affected in a very drastic way the economic activities of those regions.
I wonder if you could present or discuss what you think are the most important impacts of drought on the different types of economic activities.
Who wants to be the first one to jump into the swimming pool and start swimming? Number 6.

6: Yeah, for sure. So, in the agriculture category, I guess what I've been seeing that's been caused by drought recently is an increasing amount of irrigation that's been developed in the province. So, there's been records about the amount of new irrigation systems being installed, utilizing different water sources to help provide more resilience against droughts for cropping systems and as trends continue to increase on a year-year basis, and a lot of it has to do with just because of this job that we've been seeing.

Polo Janice: Thank you. Anybody else? Number 8

8: One of the areas that we're finding here over the last 20 years is when there's drought, the water table drops and certainly with the small trees and shrubs, you actually can't keep them alive. With the water table dropping too far you just can't water them fast enough, so we're finding a lot of about 50% death rate in our loss. And the water table, I think, is not even looked at adequately in Saskatchewan, it really fluctuates dramatically, and plants don't. Contrary to belief plants don't go looking for water.

Polo Janice: Thank you. Anybody else? Number 7.

7: You know, I think, that the drought conditions also affect animals, which is, you know, does have economic impacts, although it's a bit more an indirect impact. So as Number 8 mentioned, you know, there are impacts to trees and shrubs. But all that also has impacts on, you know, habitats, and that will impact animals, biodiversity, which certainly has, you know, an indirect but substantial economic impact.

Polo Janice: Yeah, it usually has a significant impact of ranching. We remember that we did a study long time ago in the southwestern part of the province about the drought of 2001 and 2002, people were moving their animals into another province, mainly Manitoba in order to secure the future of the ranch, and of course, that is a very expensive adventure.
Anybody about the impact of drought on other types of economic activities, mining, for example, or oil and gas? Number 4.

4: Yes, I was going to mention when you're talking about drought and affecting the animals, there's many ranchers, cattle producers, that are selling off, breeding stock or replacement stock, because they don't have enough water or feed, which will dramatically affect the long-term cattle production. So, it's not just the short term, it becomes a long-term because it takes a number of years to replace those animals.

Polo Janice: Thank you. Number 5.

5: Yes, well, I think there are a lot of impacts, and if you think back to the list of sectors that we just went through, certainly one that jumps to mind, given recent news, is the effect on forestry. The increase in drought causes an increase in forest fires, causes a decrease in available timber for forestry, causes a loss of environmental carbon sinks with respect to climate change, and that's a sort of a vicious circle. But there are other things, for example, we've seen that the glaciers are decreasing and so everybody here will probably know that the glaciers in Alberta are a significant source of water for Saskatchewan, at least in the southern half of the province, feeding the Saskatchewan River system, which is a significant source of water for our major urban and industrial developments, and we can foresee that water supply diminishing, which is going to make it really important that we become very water efficient in all of our industries and all of our urban areas. And that's going to be a significant task for a lot of places. some places have started, and some places are doing very well, other places have not really looked at it at all. And I'll give you 2 examples of the good and the ugly. Example of the ugly, I would say, would be the restaurant business, that there is virtually no effort to conserve water in the in the restaurant business across much of Canada, and it uses a lot of water. A second example I would give is the water policy that we have of assuming that domestic use is free and business and industrial use is charged the going rates for water. The only problem we have with that is that a city is considered to be a hundred percent domestic use, which we know not to be true, and so, as a consequence, they don't feel that they can charge any fees for industrial or business water use to cities. That's a policy that needs to change if we're going to change the practices around the use of water inside cities. And then I'll give you an example of good performance, which I happen to be familiar with, and that is the steel mill north of Regina. Most electric arc furnace steel mills worldwide, according to the study by the International Iron and Steel Institute, use approximately 28 cubic meters of water per ton of steel produced, metric ton of steel produced. So that's 28,000 liters. So, there are things you can do to improve your water performance and most of them, if not all of them, have been done at the Regina plant, such that it is quite different than most steel plants you'll see around the world that have giant pipes bringing water to them, and giant pipes, taking water away from them. That is not the case at Regina, there is a rather small pipeline, I think it's 16 inch diameter, supplying treated water from the city to the plant, and there is no discharge line, and that is because the plant has re-engineered all of their water processes to make sure that they don't have any discharge, and that they really control their water use with a net result that they use less than one cubic meter of water per ton of steel compared to 28 worldwide. So that's an example of where we need to go in order to line up with what's going to happen to our water supplies in the future. And that same principle is going to apply, not just to the steel industry, it's going to apply to all of the sectors that we just listed, and there's going to have to be a really concerted effort made to accomplish that. And it's going to take an investment, it's not free to do. The Steel Company has invested the money to do it probably 3 decades ago, and it is something that is going to be front and center for most of us with the decrease in the water supply.
Other things I would say, I mean, somebody mentioned the obvious already, and that is irrigation systems. They depend on a supply of water from somewhere else, which comes back to the glaciers in the mountains in Alberta, and you know, if we're counting on that to provide us with irrigation water, we need to reevaluate that. And there are other things that will be important, you know, in all the various sectors that we talked about. For example, there is a fair bit of water use in the mining sector and in the oil and gas sector, that will have to be looked at, and as well as in the energy sector and power plants, and so on for cooling, and those things will all have to be

looked at with a view to a reduced supply. So those are just a number of things I would suggest that need to be considered.

Polo Janice: Thank you very much number 5. Number 3.

3: Yes, thank you. Its's number 3, just one, maybe bring it back, much more, I guess, starting at the household level, I think that what we've seen across the provinces is a first of all a lack of understanding of what threats are there in regard to groundwater sources as well as even surface water sources. But I don't think we've necessarily tapped into better use of water, and I guess I'll go to example both in Regina there is a household bill that essentially set up at what would be considered a grey water system in their house, and they were able to cut their water bill quite literally in Regina from the Buffalo Pound Lake by 50%. I think we've got to, as number 5 was commenting, we've got to move much more to what one might call a passive system rather than necessarily an active system, so we've got to be getting much more into rainwater harvesting, you know, collection of stormwater so that we that can be re-utilized locally rather than simply just sent down the pipe and out away from wherever you have. So, I think, like I said, both urban as well as even rural. I think we better become much more self-sufficient in our water use, and not necessarily depend upon external sources for that water.

Polo Janice: Thank you, number 3. Number 9.

9: I just want to add a couple of comments into this conversation when it comes to the agriculture side, and I think often, you know, we often say water drives agriculture, which it absolutely does, and we see these fluctuations from year to year, where we might have, you know, some excess water on the landscape, and then we're in situations like this year again, where we're looking at some drought. And you know it's pockets, and it's variability across the province. So, I guess the ultimate goal is to manage that variability. And there's a variety of tools that come into play there, so, of course, it's the irrigation side of it. It's also the drainage side and when I talk drainage, I'm talking responsible drainage, looking at different conservation drainage practices as well, which couldn't include consolidation of some water on these drier years. Also, AI technology is a big piece, I think, of primary economic activities along with that manufacturing piece, looking at different advancements there to help manage that water, and ultimately, at the farm level, it's water table management, and that relays into production, it relates into soil health, it relates back into those live stock numbers that were previously mentioned, and the one thing about the livestock sector is, once they sell off those cows, they're losing genetics. And they're also not bringing heifers into that herd. So, we're looking at like a 2% reduction in the Canadian cattle herd, which is probably going to end up being more around that 15% level. So, those are some huge impacts on that land use as well, those cattle are no longer on that land.

Polo Janice: Thank you, number 9. Number 6,

6: Yeah, for sure, as I wanted to mention to you with increasing years of drought, it's important that we also best use our water supply in the province. So, we do have abundance of water in certain areas that could be utilized more efficiently, such as Lake Beef Maker. I think investing in some of the planned infrastructure projects that the province has to expand irrigation in the province will help make our agricultural industry a lot more drought resilient and ensure that we have food supply for valley out of processors and feed for our livestock sector as well.

Polo Janice: Thank you. Anybody else? Yes, number 9.

9: Sorry I forgot one other important part of the drought aspect is once agriculture goes through a drought cycle like this, there's also extra pressure on provincial support programs I would say, so whether it's crop insurance or it's different programs to help support the livestock side of things, we have that other kind of after effect as well.

Polo Janice: Thank you. Anybody else? Number 1.

1: Yeah, I guess I would echo a lot of the comments that have been made previously. Focusing, I guess, most on drought, I know other things we've seen within the watershed are wells going dry. There are a lot of rural residents that rely on their own well, or communities that rely on groundwater or well sources or some water reservoirs. And I know we have seen examples of some communities' water sources being go dry and having to truck them in. We've seen impacts on tourism. I know, here at the Quill Lakes there were a number of communities that were focusing on eco-tourism and when the lakes were dry, there was no birds to watch or animals to watch, so that negatively affected the tourism business and the opportunity for people to stop in the area and view wildlife. We also saw, you know, with drought conditions, and less so, I think, with floods, we tend to see some fairly significant landscape changes and landscape practices when those things happen. So, you know, drought provides an opportunity for access to a lot of land that maybe, isn't all that accessible during a wet year. And so, we see tendency, quite a bit of wetland loss during those dry years. And how that affects and increases vulnerability from a climate change perspective with, you know, less cover on the landscape, whether it be in the forms of natural vegetation, game forages, wetlands, those sorts of things can make the impacts greater. We've also seen the opposite in terms of business or economic development we had during a drought period in the Quill Lakes, we actually saw a Brine shrimp fishery startup. They were able to harvest brine shrimp at the quill lakes because the water was so shallow and the shrimp were so concentrated, and when the lake returned to normal levels and flooded, they went out of business. So, probably one of the few cases where drought actually helped economic activity. Conversely, Big Quill resources or compass minerals on the shores of Big Quill Lake during flood they actually had to shut the point down. They had lost infrastructure, and they were closed for a number of months while they had to rebuild, that affected all their suppliers, businesses, for example, in the town of Wadena that make pallets for them to ship their product, they were more able to, you know, provide those pallets because they weren't needed. So, it's all those sort of domino effects that happened and were mentioned before within the agriculture industry and others in terms of you know the supply chain, and how different effects, you know, kind of funnel through. So just a couple of things. Another thing that wasn't mentioned sort of on the recreation side was outfitting. This area is fairly important for outfitting there's lots of guiding that goes on for big game and waterfowl hunting. There's a lot of tourists that come to this area for hunting in the fall and fishing in the summer. So other economic potential impacts that were when those are affected. And I guess, related to that, too, seeing with recreation, we tend to be seeing a decline in our water quality in many of our lakes, it seems to be getting worse, more frequent algae blooms, the lakes are getting greener in general, and you know, that's going to impact people's recreation abilities and their enjoyment of the of the resources in the province.

Polo Janice: Thank you. Number 5.

5: Yes, one of the points I wanted to bring up was somebody touched on agricultural crop insurance. And I think that you're going to see that. Not just in crop insurance, but you're going to see it in all kinds of insurance being denied, you know, as the number of windstorms goes up, and then the number of flooding events in cities where people have built in floodplains, you're going to find that eventually insurance will be denied to those kinds of things. So, it is imperative that we start to do some significant planning around those kinds of things and make some changes. The province is already working to do flood mapping for most of the city areas that are affected. But that's just the beginning. The next step will be to change the way we use those flood areas and change the way we plan for alternate drought and flooding, because in the flood years, in many instances, it is expected that one will no longer be able to get insurance against flooding if you're built in a flood prozone. So, there are a lot of follow-on consequences to not doing your homework in terms of planning for climate change issues.

Polo Janice: Thank you. Number 4,

4: It may be stating the obvious, but I guess when you get a 50-bushel acre canola crop, and you get a drought that's down to 10 or less, there's definitely going to be an economic impact there.

5: Yep.

4: I guess the other thing is the spin off problem high production, whether it be grain bins, green bags, new equipment, etc., etc., to the loss of the inputs that were put into the soil when the drought comes along and you know, grasshoppers, etc., etc., that come along with a drought area. So there's way beyond just a drought, and I guess the other factor that keeps entering in my mind, anyway, is the effect of the wind. You can have a dry day and no wind, and there's not going to be near the evaporation of any soil or water there is when you're going to get a 50 or an 80-kilometer hour wind, your evaporation rate is going to dramatically change. So, to me wind has a major impact, and that can be as simple as on a out combining, and you get a breeze in the evening, you can keep combining quite a bit later. If you get a rain and no wind, it takes a long time for that crop to dry up then, so it can be combined. So same thing in the spring, if you have lots of water around, and the wind comes along it dries things up quickly, and also then when a drought situation you get that wind, it even dries it out even deeper. So the whole wind factor is something that affects all the extreme weather events. And most of it is going to be in a negative aspect.

Polo Janice: Thank you number 4. So, allow me now to jump into the next question. In the future we are expecting very serious impact of climate change on Saskatchewan. One of them, of course, is an increase in the intensity of climate event. Right now, we could have a 2-year drought, 3-year drought, but in the future we are expecting to have maybe a 5 years of drought. But the future is not only about drought, but it's also a more intense precipitation. We are expecting to have torrential rains, all the rain off one year in just a couple of hours, and of course this is associated then with the issue of floods just the opposite of drought. I wonder if you would like to tell us something about the impact of excess of water. Again, the range of rains flood on the different type of economic activities.

Oscar Zapata: And if I may Polo to say something else. Especially. It would be interesting to listen from you, what you expect to see, or what you have seen in terms of the decisions that producers are forced to make in terms of cutting employment, for example, or cutting investment

plans, or increase depth to cover the economic losses of droughts or floods in this case. How these decisions are changing from the perspective of who is in charge of these economic activities? So, if you can say something about that it would be very interesting as well.

Polo Janice: Anybody? Number 3.

3: Yeah, this is number 3. I guess the one that comes to mind most often is infrastructure cuts in the sense that if you have a road that's washed out, then that, you know, limits the ability of people to get around, especially if we're looking at an economy where it's a very much a just in time delivery process, we end up with, you know significant shortfalls there, you know. I look at some of the not necessarily floods, but the winter storms that we've had where it's literally shut down the number one highway. You know that can have a probably broader impact than simply just an individual landowner, or homeowner region. And so, that's where I think we need to be assessing our infrastructure a lot more readily, so that we can start, maybe, for instance, move a lot more stuff back on rail necessarily into transport, so that, you know, things can still get to Regina or small towns that still have access to rail that would maybe, being caught with a cut highway or a flooded highway, or that type of thing. I know, when most of Maple Creek got hit by, I think someone said it was a one in 2000-year flood, with all the water that they got on that time. You know, you hit something like that onto number one highway. And, yeah, that'd be almost in some respects would, you know, shut down half of Regina, you know, and just because the food would be coming scarce and materials wouldn't be getting in, and all that kind of stuff. So, I guess that's where my interest is in this question.

Polo Janice: Thank you. Anybody else? Yes, number 5.

5: Just a couple of things, you know, we touched on these subjects earlier. But if we're going to have increased extreme events, these are going to include floods, droughts, and extreme storms and wind. So, I think that what that says is that it behooves us to go in and do the planning to be resilient to those things. So, to move the things that we've developed in flood plains out of the flood plains and only build things in flood plains that are flood resistant. It includes with respect to droughts going back and making the effort to become much more water efficient, and with extreme storms and wind, it would involve all sectors, and by that I would include agriculture as well as industry, and others to go back and look at their structures and their equipment, to see whether you need to make modifications to it, to be able to resist the heavy storms. Now, of course, there's not a lot you can do to resist a tornado. But there is a lot of things you can do to resist high windstorms, or you know, extreme winter snowstorms by just changing the design of your structures. And so, I think that there's a lot of work to do there to be able to resist what's coming. I agree with the comments that have been made about infrastructure. We need to go back and rework some of that instrument structure so that it's resistant to the increased storms that we are going to get. And I would also go back to the comments we talked earlier with respect to insurance and flood planning. I think that, given the changes that are likely to happen in the insurance business, it will pay us rather well to have done our homework on planning against flood damage.

Polo Janice: Thank you. Number 6,

6: Yeah, for sure. So, in Saskatchewan a lot of our reservoirs do provide a lot of flood protection for different municipalities and areas, so I think building in flood protection into the operating

funds of the larger reservoirs and ensuring that we draw down reservoirs to the appropriate level in the fall, to offer flood production in spring will be very important. And also, just making sure that if we do draw down the reservoirs lower on fall, that we're using that water in the most economically beneficial way possible.

Polo Janice: Thank you. Anybody else?

Oscar Zapata: I think number 8.

Polo Janice: Sorry, please go ahead.

8: Yeah. I think one of the areas that need to be looked at are the policies of local resilience versus an international supply chain. I think, we're into a system of growth and continuous growth in a world that's not allowing that, and we don't really have a good set of policies to decouple. One of the ones that came up was mentioned use of grey water, I wasn't aware that the building code had been changed so that we could use grey water because we didn't used to be able to, and even irrigating with great grey water you can do it in Australia, but you couldn't do it here. So, I think, we're finding that water quality pollution and so forth. There's redefinitions of it, and we think that probably we have to look at a policy that says, how do we live within the environmental constraints as opposed to just bringing in technology to somehow solve those problems because they're not doing very well.

Polo Janice: Thank you. I have number 4, and then number 9.

4: Yeah, I think number 9 was first. But I'll take and keep on at number 4, anyway. There was a comment made that triggered something when you looked at land agricultural land ownership in this province, it's becoming larger and larger operations. So, like 100,000 acres is not an uncommon item now, or a few producers. And in where, if we're focusing on, you know, flooding and lots of excess water on the lab. So, the large operations have large pieces of equipment, and they're not gonna be able to either physically, or consider going in and seeding an acre here, an acre there, you know, maybe 1015 acres whatever at a spot, whereas if you have someone that will say less than 10,000 acres, they can take one identify those areas that they can go in and seeded a few acres and get a crop in a wet year and utilize the water that's around. So, the whole aspect of land ownership and large farm operations can have an effect economically in some extreme weather events.

Polo Janice: Thank you. Number 9.

9: I just kind of wanted to clarify the question that we're dealing with. Can you rephrase? Can you restate the question.

Polo Janice: Yeah, we are interested in getting your opinion on the impact of excess water, and here we are talking about torrential rains, we are talking about floods on different types of economic activities. Is that clear now?

9: Well, I think, if we're talking about excess water, again I think it's you know, we always say water is best when it's managed, so whether you have too much or you have too little and when it comes to the agriculture side there's a lot of field efficiencies to be gained by managing excess

water on the landscape. So, for example, if you are turning around a bunch of different potholes that hold temporary water on the landscape, you are basically increasing your overlap, you're decreasing your nutrient efficiency, you are decreasing your yield effects, you're also increasing your far carbon footprint by the amount of turning you're doing in that field, going around, you know, different areas. So, I think land efficiency comes into play that can also benefit the environment as well. So just wanna make a comment on that.

Polo Janice: Thank you. Anybody else? Yes number 1.

1: Yeah, I guess in terms of flood, we have seen that certain businesses communities are still quite vulnerable to flooding. They're built on low areas, you know, we saw, for example, city of Yorkton and one of the major rain events have some other downtown core flooded, businesses closed. So, there's that aspect of the flood. I think, in terms of agriculture, and specifically more so, I think the grain producers, the timing of these events is critical as well. So, you know, we may have an example, say where you know we have a fair bit of moisture, and you know a lot of those sort of seasonal wetlands that can be farmed through in the drier years aren't available to be farmed through. So, you know, that would reduce the acreage that producers have, and extreme flood events in the spring delay seeding. So, you know, farmers aren't able to get on the land as quickly as they'd like to, and delayed seeding means the late harvest, the late growing season, you know, if we get a heavy downpour in the middle of the growing season, depending on how long that water sits on the land, it can significantly in crop and impact crop production so reduced yields. And then, if it happens later and during harvest, then it delays harvest, and that can result in significant declines and grain quality going from, say, you know, number one quality whatever to feed quality and that has significant impacts as well. So, timing is just as critical as the event itself, and the duration of the event, is also more of a comment on sort of our land use practices in terms of our drainage systems that are in place, most of them aren't really set up to deal with flood and drought. They're typically designed to move water off the land as quickly as possible. So, what we see is that you know those works actually can cause flooding to be far more extreme downstream. There's, you know, tends to be not an effort to hold water back on a lot of the systems, they tend to be self operating so that the water just flows out in those wet years. And so that can cause all kinds of problems, too.

Polo Janice: Thank you. Well, I think it's time to move into the third question. Oscar, would you like to present that question?

Oscar Zapata: Yes, Polo. So, number 5 you have your hand raised, I don't know if you want to add something before we move to next question.

5: Yeah. I just wanted to come back to number one's point there and mentioned that there may be an advantage for the agricultural sector to consider a technique that has been used in the urban development area, which is stormwater detention rather than retention versus drainage techniques. So, there would be a technique where you would hold that water for a small period of time in order to avoid the flooding downstream problems, and also to reduce the investment that you need to make in the conveyance equipment or the equipped conveyance structures to take that water away. So, we've seen cities move to stormwater detention in a big way in order to reduce their storm drainage costs and to reduce their downstream flooding effects. And that might be something that could be used in the agricultural area too.

Oscar Zapata: Thank you. Number 9. I saw your hand.

9: Thank you. I'd just like to clarify a point that there definitely is some drainage on the landscape that, you know, maybe isn't necessarily or doesn't necessarily have the proper flow controls in place. However, I'd also like to clarify that there's lots of highly functioning drainage networks that actually reduce flooding and save communities from flooding. And there's also lots of different practices on the ground for retaining water, holding back water. Some farmers are holding back upwards of 150 acres of water in the springtime or during high extreme events, to basically provide that flood reduction and that holding capacity. There's also conservation drainage practices where they're actually holding water underground in drainage tile to that basically sub-irrigate crops. So, there's lots of different technologies there for that piece as well.

Oscar Zapata: Thank you. So now we can jump into the next question. Question 4. So, we have been talking about droughts and floods, or situations with water scarcity and situations with excess water. And there have been some other immediate impacts of these extreme events, and not only these, but other extreme events also as we said before, wildfires, ice storms, things like that. So, there might be some immediate effects, but there are also some potential long-term impacts, and a couple of comments have gone in that direction. It will be interesting to know from you and to listen from you this, if you can tell us something about this distinction between immediate and longer-term effects. So immediate effects can include, for example, the reduction in production of course in agriculture, reduction in income of business owners or producers, it can imply a reduction in employment happening immediately. But in the longer term these extreme events can impact other important economic decisions. For example, the investment plan for the next 2 or 3 or 5 years of these businesses or insurance, something that some of you have already mentioned. So, we may be seen an increase in the number of policies, insurance policies, crop insurance, other type of insurance as well. We are also seeing an increase coverage and also payments from insurance companies. So, it would be interesting to hear from you this distinction between immediate and longer-term impacts in terms of economic outcomes.

Polo Janice: Thank you, Oscar. Anybody? Okay, number 3.

3: I guess this is more of an example, perhaps, or something that although it's not directly related to what we're talking about, we've just gone through a 3-year pandemic, and it might be valuable to see if there's ways that we can capture some of that understanding and knowledge and impact of that incident as it might relate then to something like a flood or a drought, or some other thing that we're dealing with right now. I get seemed almost in some respects, and pardon upon, but almost a perfect storm, in the sense of what it did to you know, to this province and to other places, that it might be a way to understand how something like that would hit on a local or a provincial level. Just a thought. I don't know whether there's anybody getting into that assessment, but it might be worth at least exploring it a little bit, perhaps.

Polo Janice: Oscar, any reaction to that before 7?

Oscar Zapata: Yeah, I think that's a fundamental point. Because when we're talking about extreme events and responses to extreme events, there are other factors that can be playing a very important role. We had the pandemic. We are right now facing an increased level of inflation as well increased level of interest rates. So, that brings this additional challenge of being able to make the distinction between different causes when we see the reactions or the responses in

different sectors. The challenge is to be able to identify how these responses are actually reactions to specific factors that can trigger these responses. And that's something that we are planning to do. We are considering how these scenarios, is not only climate change, but we also have these other factors playing an important role. And that's something we are considering, and hopefully, with our project, we will be able to make the distinction between at least some of these elements. Of course, the pandemic has distorted many aspects of economic and social life, but this type of events and the interviews that Polo was mentioning before will provide us with more specific information to be able to say something about these different factors on how specifically climate change and climate change adaptation fit into this more comprehensive picture.

Polo Janice: Thank you, Oscar. Number 7, please, and then number 5.

7: I think in terms of some of the more immediate costs of some of these extreme weather events, you know, you pointed out insurance, and I think that's a really really big one. I think that maybe commercial residential buildings are somewhat more insulated from the prospect of, you know, rapidly in increasing insurance costs in Saskatchewan, as compared to some other provinces and municipalities where they have maybe a bit more flood-prone regions, or there is, you know, more residential, and vacation spots built out closer to a forest like there is one in BC where horse fire risks brought on by joke conditions are more of an issue. But in in Saskatchewan I think, you know, we're still gonna see certainly in the short-term increasing insurance rates due to extreme weather events. And further, I think there is an immediate cost to upgrade infrastructure that maybe hadn't been on the horizon 10, 15 years ago. A lot of the, you know, water infrastructure that we use to sort of manage, you know, large precipitation events in cities was built for climate and rain modeling that is now outdated, and they are having to, you know, switch out and upgrade infrastructure on a more advanced timeline that I think they were anticipating which certainly has more media costs to municipalities and taxpayers. So those are the 2 that I would mention.

Polo Janice: Thank you. Number 5.

5: Just a couple of things that I would point out. First of all, things like the pandemic, interest rates, and inflation are rather short-term issues that we are going to have to deal with irrespective of climate change. And secondly, as anyone who has looked at it will remember the latest intergovernmental panel on Climate Change reports suggests that if we go with business as usual, instead of achieving the Paris accord, we're going to see significant change to the climate by 2050. And we've already caused a serious amount of change in the climate and in the global systems related to it. So, for example, we have already caused a climate temperature rise of 1.1 degrees. So, it's not a question of whether it's going to happen. It is happening and it is questionable whether we will achieve the 1.5-degree target under the Paris accord, and if I'm any judge, many of the major emitters are not going to do that. Even if Canada met its standards or its targets, you have to know that people like India and China, and even the United States, are unlikely to meet their targets, and since they are the major emitters, that means that we are going to likely have to deal with bigger climate change numbers. So, I guess what I'm getting at is that our hopes for preventing this are some negative numbers and that means that we have to get busy and work on adaptation, and we need to do it sooner rather than later, because it's going to happen. It's already happening, and it's going to happen more before we're done. And I guess the other thing I would point out, is that infrastructure investments are usually considered to be long term investments, life spans and 30 to 50 years and so in order to do a proper job of that, we need to do a significant amount of evaluation and planning, because let's just take an example. Let's

suppose that we have 2 replace. I'm gonna pick a number, 30% of our built infrastructure, and we have to do that like within the next 10 years in order to be in a position where we can weather the storm, sort to speak. That's a significant financial hurdle, and it's going to be added to the financial loads that we are considering putting in place right now to try and reduce the greenhouse gas emissions at the same time. Doing that exercise is not going to be free, it's going to be quite expensive, and it's going to take a big investment. So, in a result of that is that we're going to have to re-look at business plans, we're gonna have to re-look at tax levels and financial support for common entities, such as municipalities, and so on, to fix that infrastructure. And so, there's going to be a really significant demand for resources to be invested in the next 10 years. And so that's gonna have an effect on every sector that we've talked about here. And I think that many people haven't started to address that, and we need to get down to some brass tacks here and do it.

Polo Janice: Thank you. Yes, number 4.

4: I guess, you know, any extreme weather event, and I'll use, you know, flooding, and was mentioned about the flooding in Yorkton, you know, within hours there was from that being a major rain event, there was a reaction, whereas in we'll say, Regina, upstream of Regina, a similar event may take days for it to affect Regina. So, depending on where you go in the province, you can have a different reaction to a similar rain event or major weather event. And I guess I think the same thing as far as policies go. There are some policies that can be province wide. But there's also some policies that will not work in some areas but will work well in others. We've got to be adaptive, not only in what we do, but in adaptive in our policy acceptance and implementation.

Polo Janice: Thank you. Number 6.

6: Yeah. So, I think, with the long-term trends of global warming, it's gonna create some opportunities, especially for the agricultural and value-added industry in Saskatchewan. So, as we see more droughts in places like California, where traditionally a lot of our produce and higher value crops are grown that we export, and as we see temperatures slowly rise in Saskatchewan, it'll provide more of an opportunity for Saskatchewan to grow a lot more of these high value crops along with developing our Eurasian sector to ensure that we can actually grow your drops in the province. So, I think there's a big opportunity there to really become more of a exporter of not just wheat and canola, and more conventional crops in the province, but also higher value crops, including fruits and vegetables.

Polo Janice: Thank you. Anybody else on this point? Yes, number 9.

9: I think we've you know there's lots of points that have already been addressed, but when it comes to the agriculture side for immediate and long-term effects, I mean the cost of lending definitely has an impact, the cost of crop inputs, farming is more expensive, equipment is more expensive, and when you get into these extremes, you look at losing yield, and that definitely affects your bottom line of your business. I think water management is a crucial aspect of farming. And again, whether you're irrigating or whether you're managing your water with drainage. But you also look at different effects like crop rotation changes, and how that affects the economy and food processing within Saskatchewan. Looking at different like plant breeding opportunities to develop crops that actually are shorter, that will come to yield in a shorter timeframe, or perhaps have more disease resistance, or pest resistance as well, as the insect population changes with these different weathers. And then, looking at the next generation, we talk about, you know, 98%

of Canadian farms are family owned. And within Saskatchewan. I'm not entirely sure what that statistic is, but we do have some bigger landowners within Saskatchewan, but we also want to retain those family farms that are operating at about those that 10,000 acre mark, or less. So when it comes to long term effects and water management and resilience to the different climate events, you know, we wanna make sure that we're trying to retain that next generation of family farms in Saskatchewan.

Polo Janice: Thank you. Anybody else? Yes, number one.

1: So yeah, I guess another vulnerability in terms of long-term short-term effects would also be sort of parts of the watershed where we have terminal basins, and of course Quill lakes would be one of those where the water doesn't drain anywhere it all ends up in the Quill lakes. So, you know, we saw a major flood began in 2004 and 2005, and here we are 2023, and the lakes are still flooded. There's still crop, land and pastureland underwater and no signs of that. They're going away any time soon, so sort of the vulnerability, I think, is critical when we look at sort of our watershed and those terminal parts, you know, we've seen similar situations with highways through terminal basins, where you know, the highways been flooded, and they continually have to keep raising the highway because the lake level or water levels just continue to rise. From a policy perspective, you know, we see producers when their land is flooded, you know, might be eligible for payments in that first year, but I believe in following years they may not be eligible. So, you know, that's a challenge. And you know, we've seen some producers that have been flooded not being able to receive any compensation for the land. So, you know, they've got land that is part of their business, part of their income that they're not generating any income on because they're not able to even grow a crop on it. So that's an issue. We also have, for example, Crown land sales in this province, so we tend to sell off most of the Crown land in Saskatchewan is sort of in a natural state, and when those lands are sold, they tend to be sold without any sort of restrictions, so those lands could be broken, drained, cleared, brought into production, and so, you know, we're again, we're losing that natural ability for the landscape to resist extreme events. And then we currently have, the Water Security Agency developing a water stewardship policy which the goal is to promote agricultural drainage in a responsible fashion. So, we will see more drainage in this province as a result of this policy, and whether that'll be good or bad, depending on how it rolls out for our vulnerability to climate change, I guess, remains to be seen. It will result in the loss of more wetlands, and we know wetlands fight climate change by storing carbon and reducing the effects of floods and droughts. So what mechanisms will be brought into place to sort of mitigate those impacts have yet to been revealed.

Polo Janice: Thank you. Well, let me move now into the last question and is related to the issue of vulnerability. There are, of course, some economic activities that tend to be more affected than others or the way in which we said that they are not exposed to the climate event and to that extent, then they are more vulnerable. I wonder if you could tell me what you think are the most vulnerable economic activities in the province, and perhaps, if you could explain the reason why you consider them to be the most vulnerable ones.

Oscar Zapata: And if I may Polo again, we can see that different exposure and vulnerability and impacts within the same industry, within the same region. So, it would be interesting to hear from you, why is that the case? The reasons or the factors that can explain why some family farms are more vulnerable than others, for example things like that.

Polo Janice: Number 5.

5: Thanks. Well, I think there are some obvious items there, I mean with the increase in flood events, we're going to see high vulnerability for anything that's developed in a flood plain and is not flood tolerant. So that's an obvious one. I think another obvious one is, things that are highly subject to drought. And it's not clear, if you look at the IPCC report, it's not clear that we will necessarily have that much more droughts as compared to flooding. But if we do get more drought, there's going to be knock-on effects as we discussed in the agricultural area as well as in the forestry area. So, you know, those are, I guess two points that I think would be early obvious in the in the immediate term.

Polo Janice: Thank you very much. Anybody else? Number 3.

3: Yes, I guess, so one that comes to mind, and again, it's not necessarily a sectoral impact, but I guess I would call it vulnerable populations. You know, we look at what happened in BC, whether there was over 600 deaths, you know, as a redirect result of the heat dome that hit it. And so, I think our ability to manage our populations and our health, you know, is going to be impacted. Notwithstanding the comments of number 5 made around agriculture. I guess the other one that comes to mind, and this is more related to in the vicinity of Regina, when your land elevations are, you know, less than you know, half a dozen inches over quarter section of land you're much more vulnerable than if you're you know, have some hills and valleys, yeah, within that property to allow you to still have some portion of the land that say not get not getting flooded. I'll leave it at that.

Polo Janice: Thank you. Somebody else? Yes, number 1.

1: Yeah, I guess stating the obvious in terms of agriculture, I mean as an industry it's very weather dependent for the growing season, and sort of when we get moisture, how we get moisture, all those sorts of things are extremely critical to being able to produce a crop or grow forages for cattle, and we see that every time we have a major event, either flood or drought, the challenges that creates. I think, less so in terms of other industries, you know, unless they're built on the flood plain and are completely destroyed, you know there's opportunities to improve their infrastructure so that they're less vulnerable rebuild retool whatever but clearly, I think of all the agricultures by far the most vulnerable to change in climate.

Polo Janice: Yeah, we might see some very drastic changes in the future as a result of the combination of climate change, wrong policies, wrong behaviours, I mean, if you remember well, 90 years ago a large number of farmers were forced to move out of their farms and they have to go either to the cities or go to the North in order to survive. So maybe we should expect a very drastic change in relation to agriculture. Anyway, number 5.

5: One more thing, I think that given the discussions we've just had, water supply is going to be another vulnerability and we're going to need to look at that pretty closely.

Polo Janice: Yes. Number 9.

9: I would just like to agree with number one's point. Basically, there's two ways farmers can mitigate weather, and it's managing water, whether it's in short supply or excess supply and insurance. So, definite reliance there on weather and water for that industry.

Polo Janice: Thank you. Yes, number 1.

1: I guess further to number 5's point, one challenge we're gonna see going forward to with more interest in irrigation to combat drought and water storage is prior to you overuses when that. So, when we do have water shortages, who gets the water? A lot of those decisions haven't been made or aren't even being discussed right now. And so, as we contemplate expanding irrigation, you know, do cities get first dibs on that water? Or they get a certain portion? you know. Where do the producers sit in this? or industry sit in this? In terms of you know, they built infrastructure and invested in irrigation, for example, to grow crops, and then suddenly they might be told, well, you're not going to get any water because we're in a drought. So, gonna be some hard decisions, I think in the future.

Polo Janice: Thank you. I have some people here on the list, first number 5, then number 4, and then number 6.

5: I'll be brief. I just wanted to add another item to the list, and that is, I think the insurance issue is a vulnerability, because in my role as the ISO Mirror Committee chair for Canada for climate change related standards, we have been talking with the office of the superintendent of financial institutions about what's going to happen with respect to insurance and climate change, and it is expected that there will be a need to develop plans for the vulnerabilities there, and is also expected that the availability of insurance will decrease, and to I think was number 7's point, but generally points made about the reliance of the agricultural industry on insurance. It's going to become more difficult just because of the developments of climate change that are going to change the insurance industry.

Polo Janice: Thank you. Number 4.

4: Is everyone just anticipating what I'm going to say about agriculture. Talking to an older fellow that would be in his eighties or nineties and he was referring to some of the recent droughts events we've had compared to the 1930, and he said, if we had had the kind of agricultural operations that we do in the 2000 back in the thirties the drought in the thirties would not have been nearly as severe. Both the whole agriculture industry has adapted and changed in the last, I guess, pretty near a hundred years now. So, I guess the whole thing is, how fast and what can we do to adapt and be able to manage the changes that are kind of coming in the climate. The other one that we've talked a little bit about, it's been forest fires. Let's throw that as to a prairie fire which used to be common in the 18 hundreds in this area and come towards the end of this month, if we have a prairie fire, stubble fire get out of control on a windy day, you're gonna run into the same thing that happened and that [location] swift current county few years ago. And there was infrastructure went down, there was major impacts, and like we're talking minutes or less than an hour, these things can take over, and to me that is something that is a little bit scary if it gets out of control as to how you can control that, or how you mitigate something like that. So, I'll leave it at 5 days.

Polo Janice: Thank you very much. Number 6.

6: Yeah, I just wanted to clarify the point to you on priority of use for water usage in the province. So, the way that Water Security Agency currently licenses water is that we issued on a percent availability. So, I heard there's concern about who we get water first, would it be irrigators or your cities or industrial? So, the way that irrigators are issued their licenses is typically a 7 out of 10-year availability, meaning 3 out of 10 years, and more than likely to get shortages. For industrial use and municipal use, they are issued allocations at a firm drought, which means they're guaranteed that water supply a hundred percent of the time. So, an instance of shortages which have happened the province, irrigation would be told to turn off to ensure the supply issued to municipality and industrial use because of the way it's licensed that guaranteed from draft. And another thing I wanted to bring up to mentioned that water supply is a vulnerability, which is the case in a lot of areas of the province. But I do think it is also a benefit to in certain areas. For example, like Diefenbaker even Diefenbaker we know there's over a million cubic decimeters of available water there that could be used for irrigation or industrial use. So, make sure that we utilize the excess water that we have in the province I think this can be very important.

Polo Janice: Thank you. Number 5.

5: Yeah, just two things. I mean his statements about how water is allocated, I think, lend poignancy to what we need to do around supply. If we want to not run into those kinds of crunches where we have to say to somebody, you can't have water, we really need to get busy on improving the efficiency of our water use. So that we can make the reduced supplies go further in reducing supply years, and also keeping in mind that the supply is going to reduce over the next 30 or 40 years. So, what we have right now in Diefenbaker will not be what we will have in Diefenbaker 30 years from now. And the other thing is it really points up the importance of pushing everybody who uses water to improve the efficiency of that use, so that we can, you know, get by on less, because certainly less I in our future.

Oscar Zapata: Number 8, would you like to say something about this?

8: Yeah, I'd make the observation a lot of the discussions that I've been involved with have dealt with the water issue based on a private ownership plan. And it doesn't really look at the public good, nor does it look at the needs of the environment itself, and a lot of the decisions then, are made in silos, so that one person's use of water is a problem for somebody else. But there's no real mechanism right now other than maybe an environmental impact assessment. So, I think the policies are gonna have to look at, how do groups get together to prioritize, and then how do the landless, and those that are impacted on the public side get involved, because more and more of it is moving into the private sector and even water, for instance, in BC is being controlled by access to water by owning the land around it. So, I think we're going to have to look at a different approach that we're a way more resilient in working together than we are in just building our own little silos.

Polo Janice: Thank you. Anybody else who would like to have the last word? Oscar anything else you would like to add?

Oscar Zapata: I don't know if there are any final thoughts about specific characteristics of, you have mentioned some of the industries or some of the economic activities that are most exposed to weather events. But if we can discuss, or we can say something about specific characteristics of these businesses, maybe in agriculture is more evident, for example, the different ways they

manage water or different ways to grow crops, or adaptation in terms of adopting other crops that can be weather resistant, drought resistant. So, I guess my point is if you can say something about these attributes of different economic activities or economic units that can make them more adaptable or more resilient to climate change. So, we have been talking about making water users more efficient. So, do you see any attributes of these users that can make them more adaptable or open to become more weather efficient?

Polo Janice: Number 1.

1: I can give you an example of one, for example, compass minerals are big quill resources on the shores of big Quill Lake, they extract potassium, sulfate, their processing plant from the lake itself, they have a filtering process, and when the lake flooded the concentration of potassium sulfate, diluted so much that they weren't able to efficiently process the water and extract the mineral. So, they had to retool their entire operation to build in filters such that they could still extract the product but in a much dilute, when it was in a much diluted form. So, you know, basically, industry adapting to changes in terms of harvesting or collecting the resource. That's the one I'm familiar most with

Polo Janice: Anybody else? Number 5.

5: Yeah, just a couple of things. The first one is that in any water use area you can increase the value of a product by recycling more of it. So that includes when you recycle you get the value of the inputs back again, and one of those inputs for most products that we use nowadays is water. So, anything we can do to increase recycling will decrease the amount of water we have to use. The second thing is that, as I mentioned earlier, I think that a concerted effort to improve our water use efficiency across all of the sectors will make us more resilient, and will provide us with ways to weather the storms that are coming here on water supply. And I think that that should be made a priority, really, politically.

Polo Janice: Thank you. Number 6.

6: Yeah, for sure. I just wanted to say, like in terms of the irrigation industry, there has been a lot of technological advances that have helped improve water use efficiency. Also wanted to mention that provincial and federal funding programs do help support increasing water use efficiency too, such as varying high pressure sprinkler systems to low pressure drop nozzles. And we're seeing even more efficient technology start to become more common in Saskatchewan to such as sub service you're using where you have next to 0 losses in terms of evaporation.

Polo Janice: Thank you. Well, people, it's very much the end of this session. Thank you very much for all your comments, for your all your opinions. You gave us a lot of material. We'll have to work hard now to produce a report for this focus group. And again, as I indicated before, we will send it to you, I guess, by the end of the year. Again, thank you very much, I hope you have a wonderful day.

Oscar Zapata: Absolutely, Polo. I just want to say a big thank you for all your contributions and thank you for being so generous with your time, I appreciate that. Have a great day.