



Focus on Risk: Severe Summer Weather

Recommendation: That Council receive this update for information

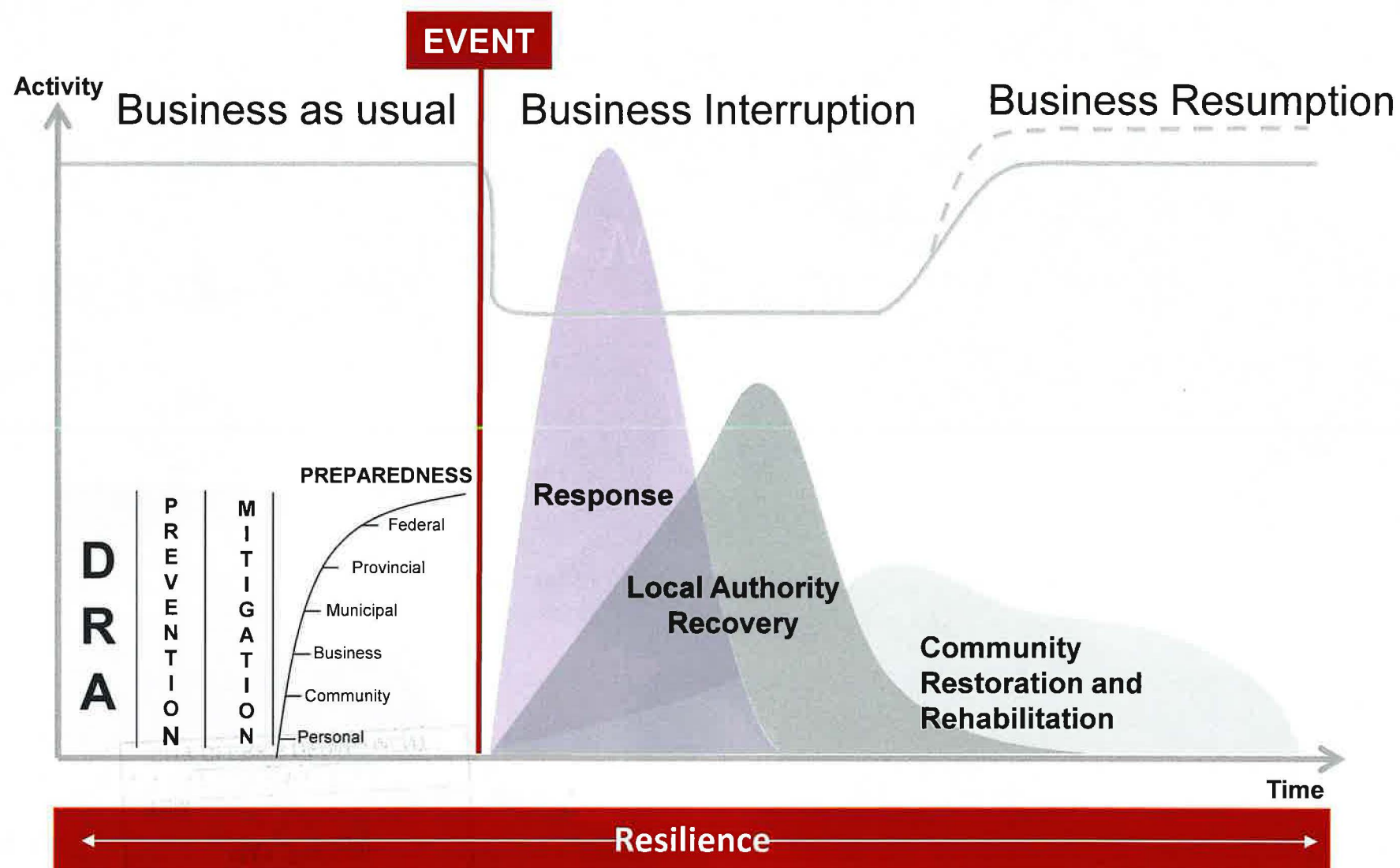
Presentation to Emergency Management Committee of Council

2021 May 25

Image Source: CBC



CEMA: Comprehensive Emergency Management





DRA – Severe Spring/Summer Weather



- Extreme cold
 - Major rail incident
 - Severe storm - blizzard
 - Major dam breach – Bow River
 - Severe storm - winter storm
 - Catastrophic riverine flooding Elbow River (1:100)
 - Major critical infrastructure failure or disruption
 - Catastrophic riverine flooding Bow (1:100)
 - **Severe storm - heavy rainstorm**
 - Mass casualty incident
 - Major hostage incident
 - Major drought
 - **Tornado**
- Pandemic



Calgary



Environment and Climate Change Canada

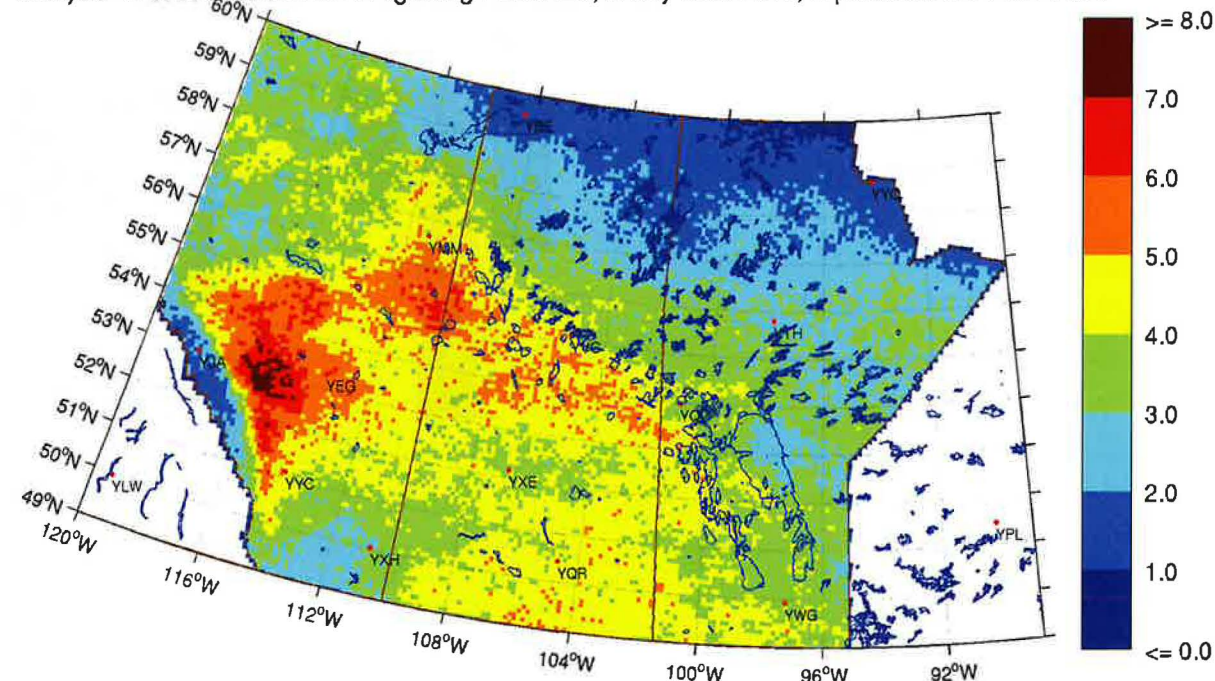
Kyle Fougere – Warning Preparedness Meteorologist



Severe Thunderstorm Risks For Calgary

- The foothills in Alberta are a near ideal thunderstorm growth region
- Alberta averages 890 000 strokes of lightning per year
- The frequency of thunderstorms typically increases the third week of May, with the peak month being July
- Thunderstorm frequency drops rapidly by mid August

Analysis* of 8785858 ARCHIVED lightning FLASHES, in July 1999-2018, in provinces AB + MB + SK.

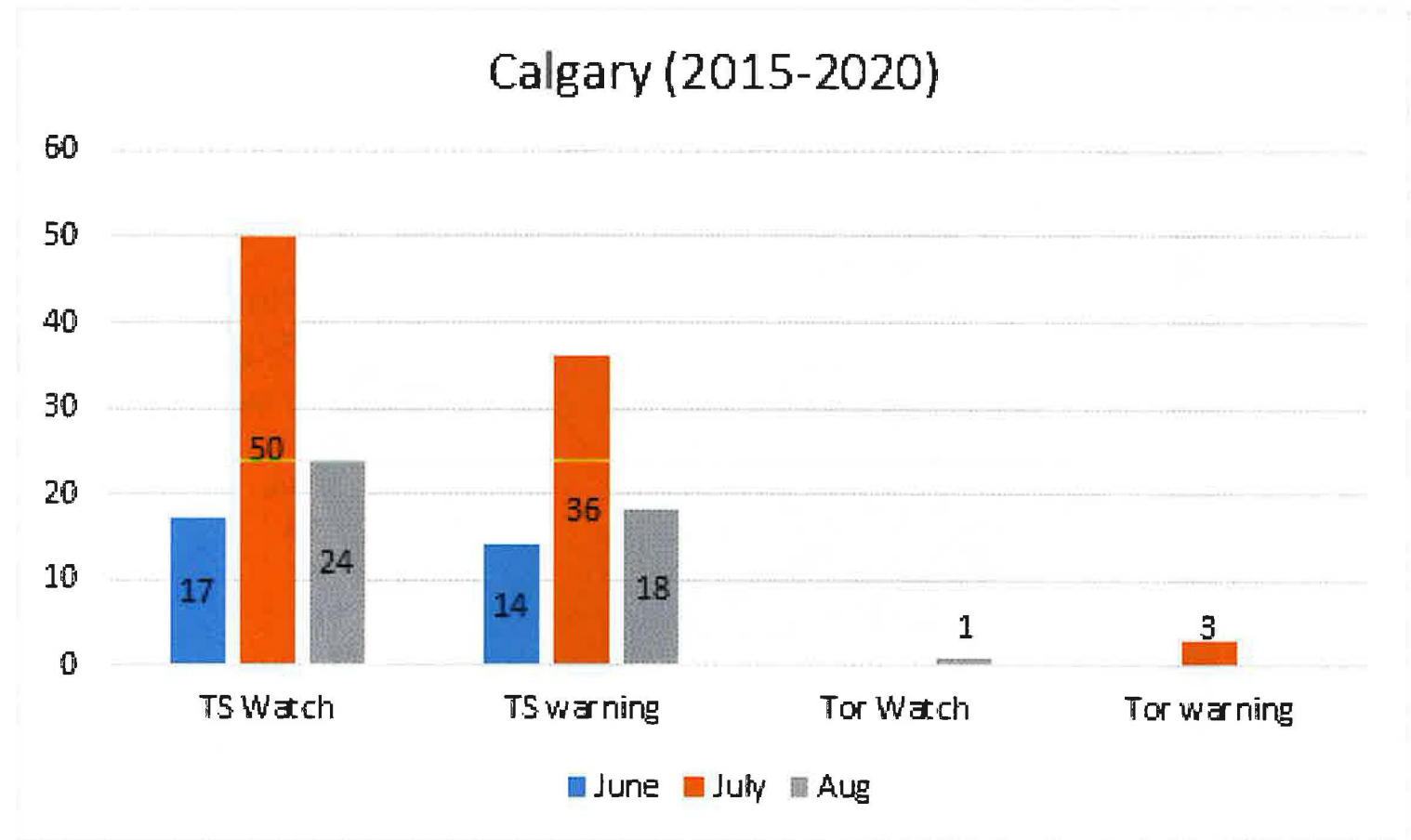


* Colours show number of lightning days per year in each grid cell.



Severe Thunderstorm Risks For Calgary

- Calgary itself is frequently impacted by thunderstorms due to its close proximity to the foothills where storms form
- In the last 6 years, Calgary has had:
 - 91 Thunderstorm Watches (avg. 15/year)
 - 68 thunderstorm warnings (avg. 11/year)
 - 1 tornado watch and 3 tornado warnings
- Main risks from thunderstorms include:
 - Flooding
 - Hail
 - Wind
 - Tornadoes





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Flooding

Calgary is susceptible to two types of flooding:

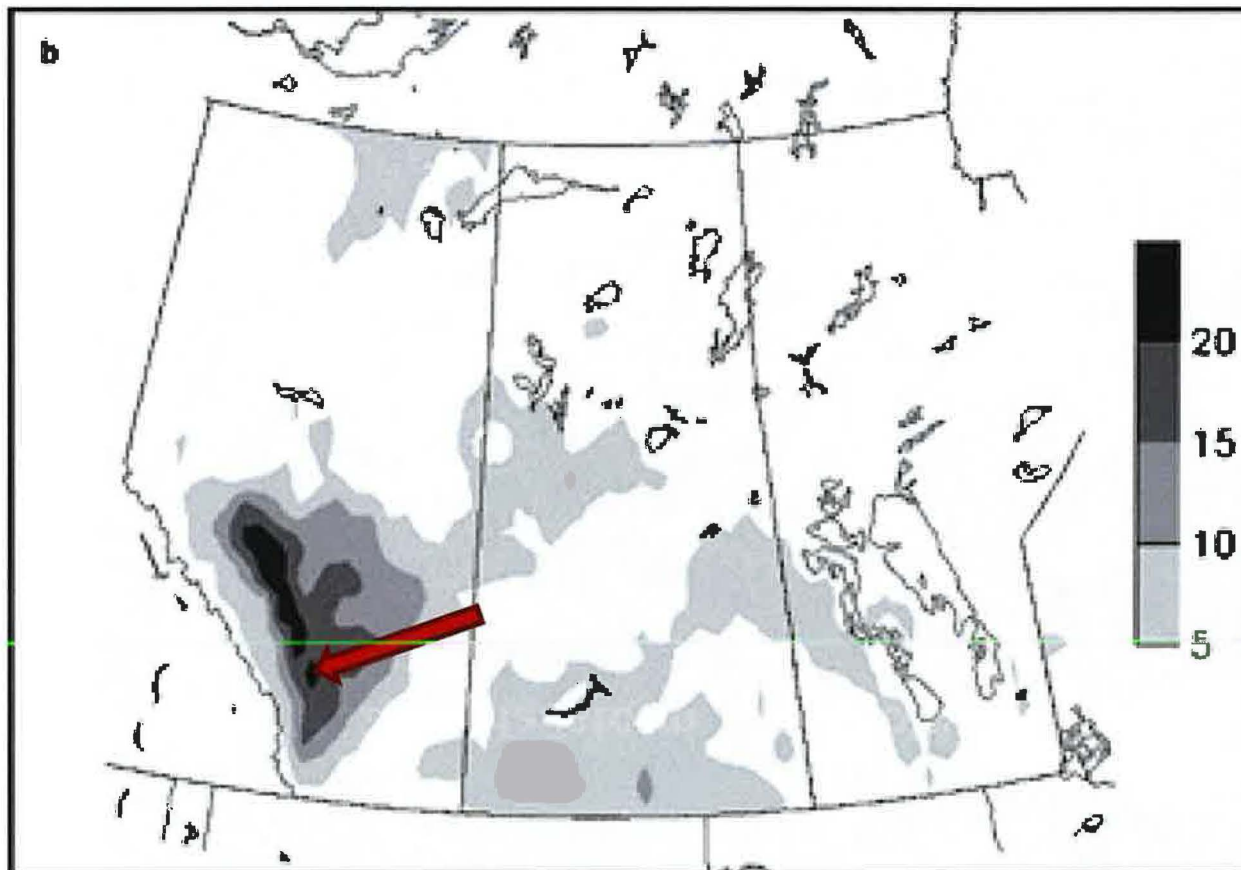
- 1) Flash flooding from slow moving thunderstorms
 - 2) Overland flooding often caused by heavy rain falls over a longer duration within a single watershed (examples: 2005, 2013 floods)
- Both types of flooding can be created by a weather system called a Cold Low
 - We average 3 to 4 cold lows a year, with June being the most common month.





Hail

- Calgary is located in 'Hail Alley'
- There is a high incidence of thunderstorms, particularly between Calgary and Red Deer, with atmospheric conditions favouring hailstorms
- Storms develop over the foothills and move east towards the populated areas of highway 2
- Extreme Hail (50+ mm) occurs in the Calgary area (within 50Km) every 1.62 years
- Multiple extremely damaging events in the Calgary area in 1991, 2010, 2012, 2014, 2020



Accumulated number of forecasted severe hail days at each GEM model grid point over the Canadian prairie provinces between 1 Jun and 31 Aug 2000. (Brimelow et al 2006)



Thunderstorm Winds and Downbursts

- Severe Thunderstorms frequently created strong winds in excess of 90 km/h and sometimes over 130km/h
- These winds can be developed over areas much larger than their parent thunderstorm, and can extend over 100km from the storm
- These winds can create wide swaths of damage, frequently damaging rooves, breaking branches or whole trees, and resulting in power outages.
- Aug 1st, 2009, strong outflow winds from a thunderstorm collapsed a stage at the Big Valley Jamboree, resulting in 1 fatality and 40+ injured.
- This situation has occurred at several other festivals in north America and around the world
- Thunderstorm outflow winds or downbursts have also resulted in plane crashes and planes overshooting runways (e.g. Toronto, 2005)



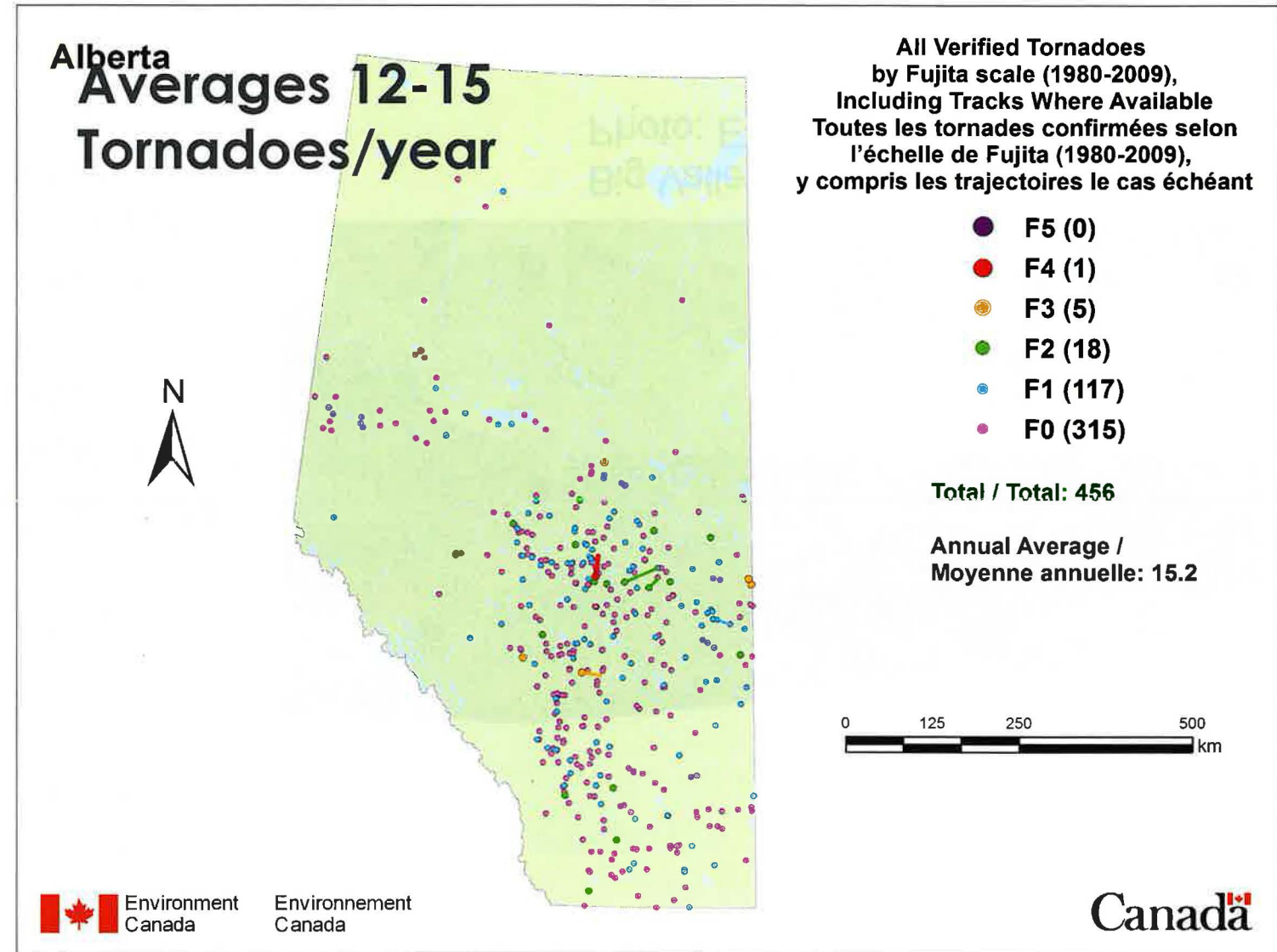
Big Valley Jamboree Stage Collapse
Photo: Ed Kaiser, Edmonton Journal



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Tornadoes

- Alberta averages 12-15 confirmed tornado reports per year
- The actual number of tornadoes that occur is likely higher, as we are reliant on receiving reports of the tornadoes from the public
- Impacts from tornadoes on population centres are rare, but mostly because cities and towns occupy a very small area compared to fields and forests





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Edmonton Tornado

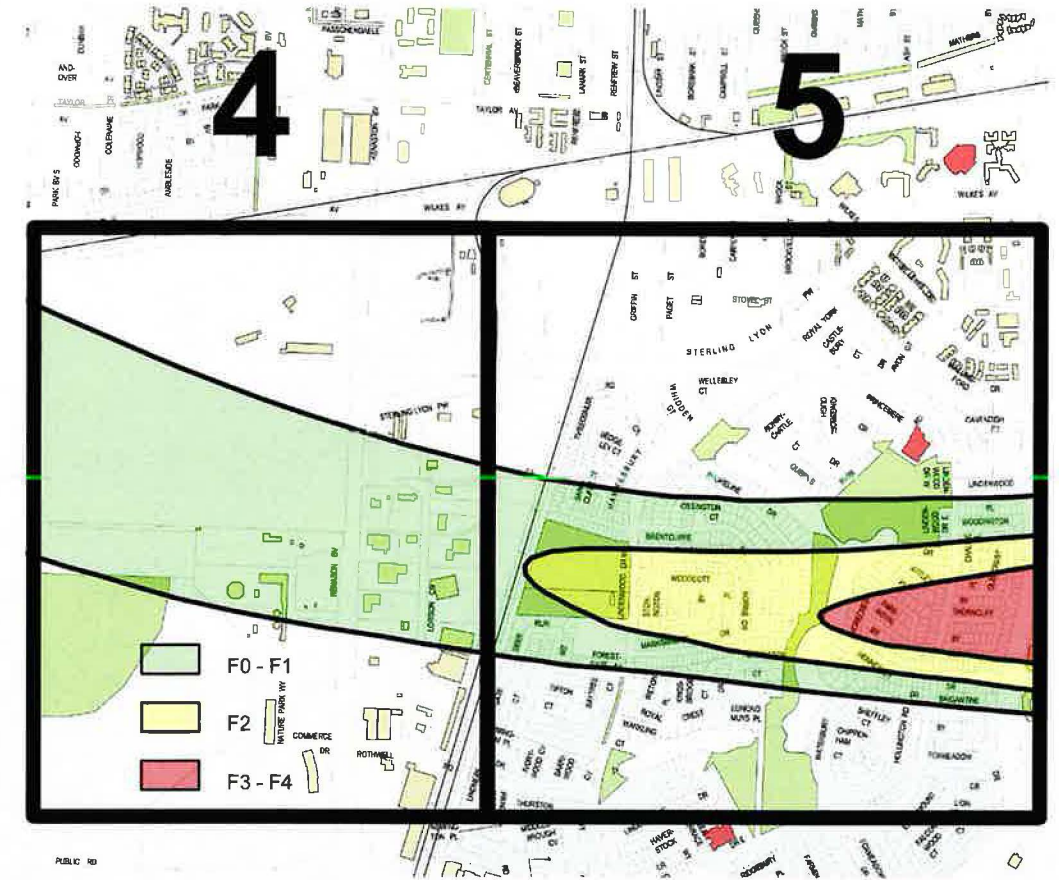
- 27 fatalities, 300 injured
- F4 tornado
- Lasted ~90 minutes (3pm to ~4:30pm)
- Track length 30.8 km
- Up to 1.3km wide
- Destroyed 200 mobile homes with 15 fatalities in Evergreen Mobile Home Park





What if a Canadian City Suffered an EF4?

- ECCC did a study to see what would happen if an EF4 tornado moved through a major population center
- Damage was based on previous tornadoes in other localities and used the Edmonton track
- Estimated damage numbers:
 - 6800 homes damaged/destroyed
 - Over 200 businesses/commercial buildings
 - over 3000 injuries, 100 deaths
 - at least \$1.5B damage from tornado alone
 - additional \$150m - \$1B hail damage

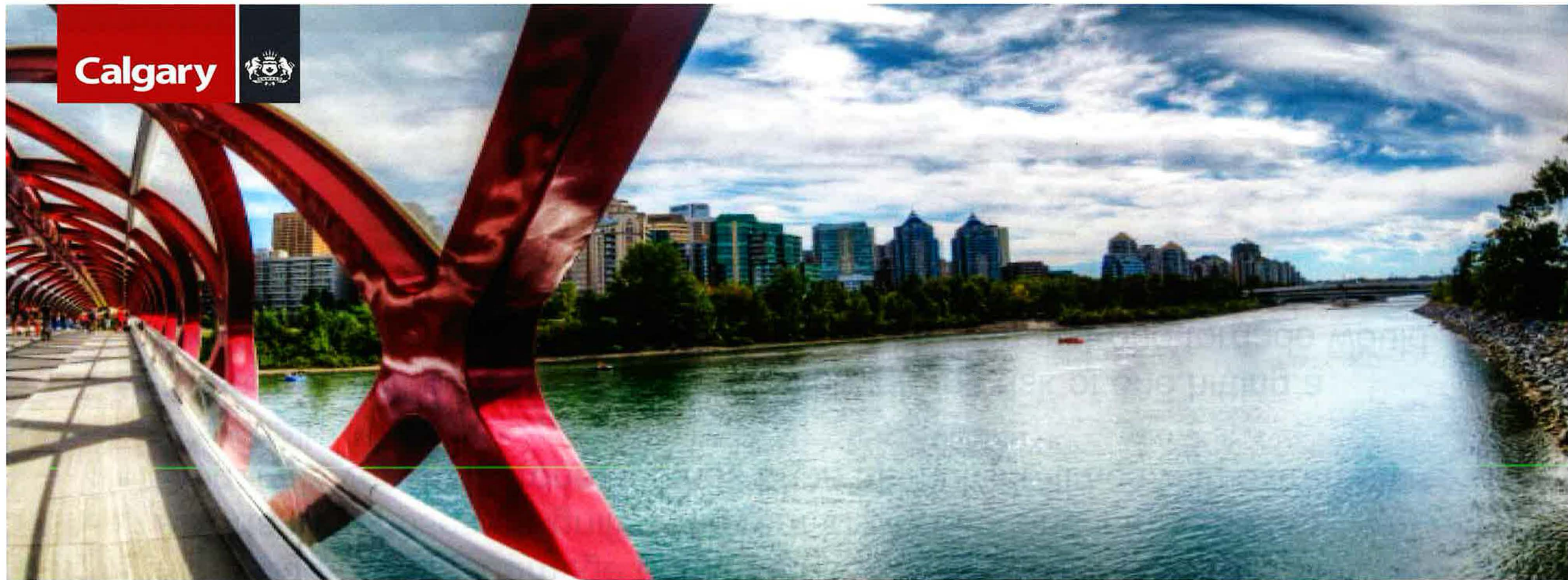


Areas 4-5: Tuxedo Industrial Park and Lindenwoods



Summary

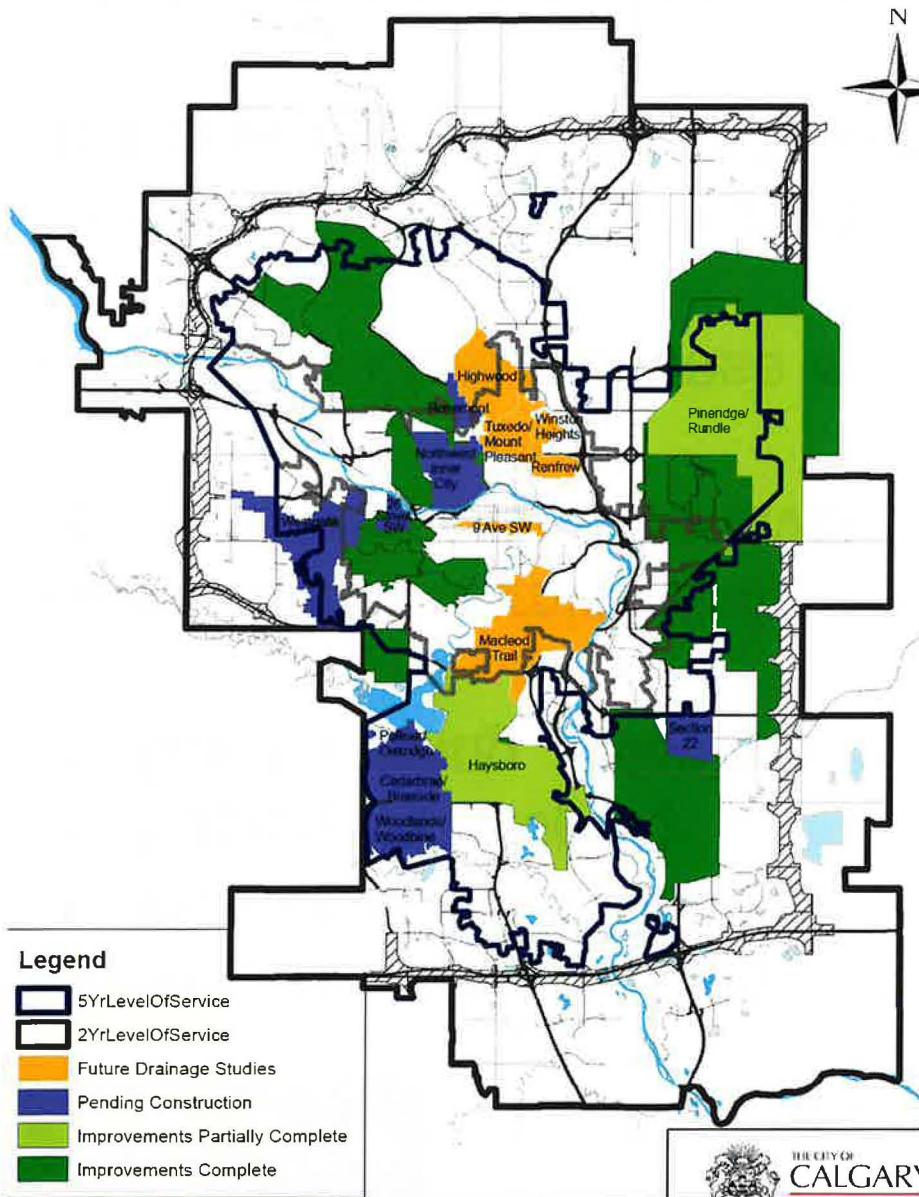
- Calgary is situated in a very thunderstorm prone location
- Flooding and wind damage from thunderstorms occurs frequently in Alberta, and poses a significant threat to property and infrastructure
- Calgary is very hail prone and has been hit multiple times with extremely large hail
- Tornadoes do occur in Alberta, and although the risk of one hitting a specific city is small, the results of a direct hit from a strong tornado would be catastrophic.



Water Resources / Water Services

Frank Frigo – Leader, Watershed Analysis

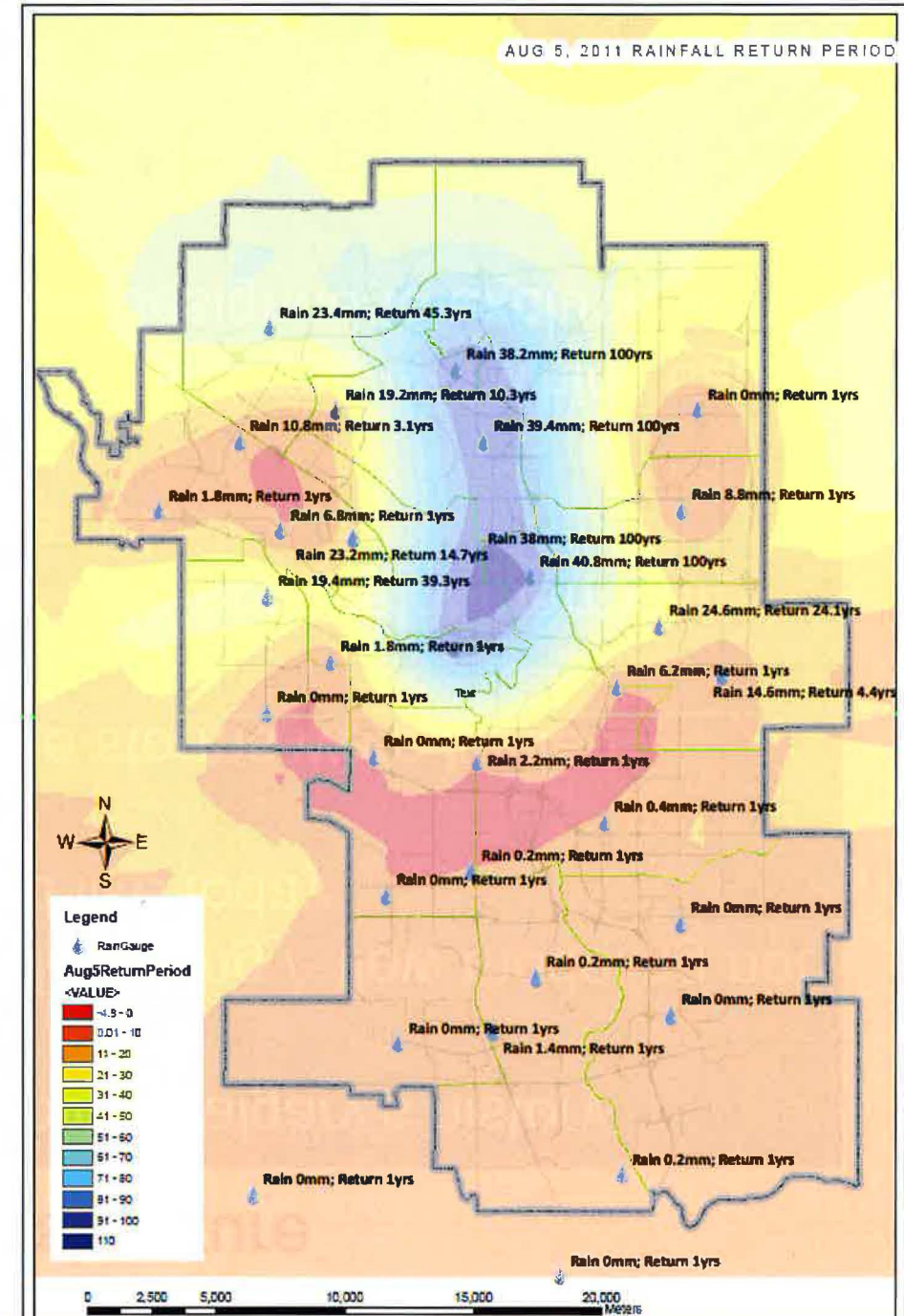
Stormwater Management & Infrastructure

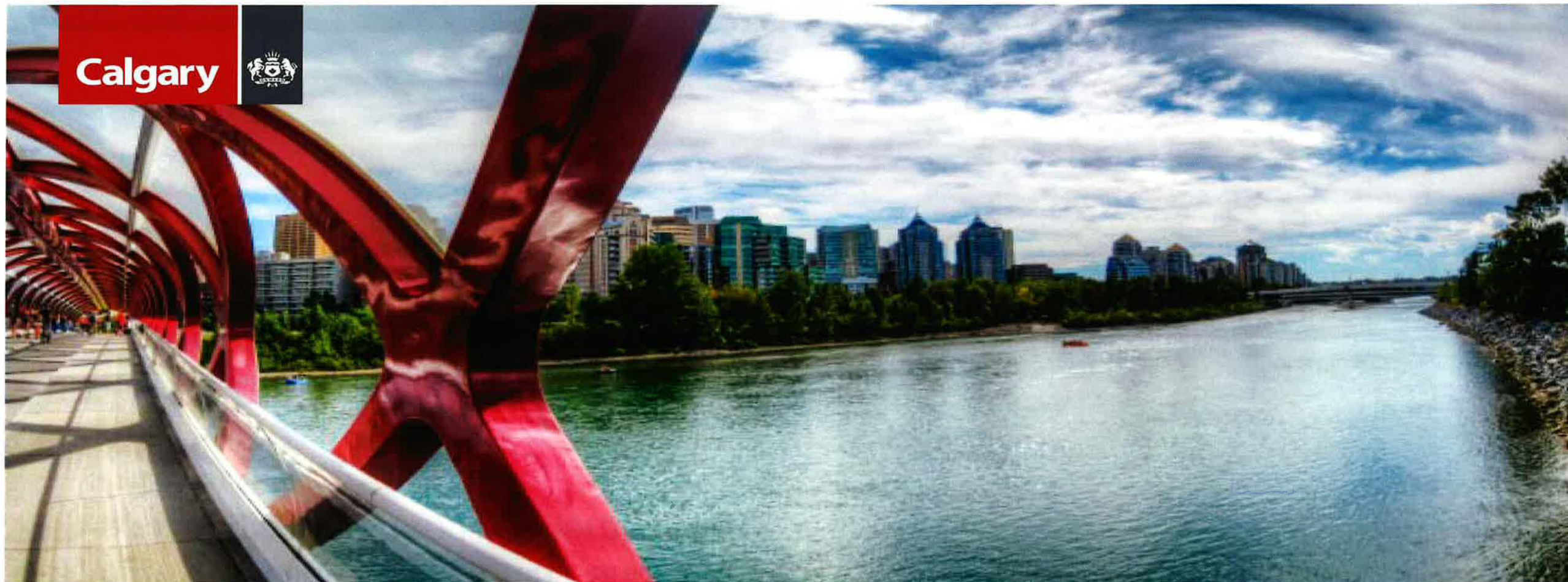


- SWM has evolved over Calgary's history
- Pre-1980s overland grading / flow modeling not analyzed / designed like today
- Datasets on extreme storms were limited
- Soils, slope and the type of development can combine to increase risk
- Calgary's convective cells bring hail which can block inlets and pipes designed to exclude debris
- Runoff response happens in minutes

Water Forecasting

- Convective cells are often:
 - very localized; 10-50 km²
 - Rapidly developing
 - Quick moving, selective
- Forecasting / warning possible at general and community or City-wide level
- Makes proactive response impractical
- Places onus on design safeguards and infrastructure that operates automatically and for hail
- City has been using TBL evaluation tools to assess non-structural resilience measures potential





Waste and Recycling Services

Melanie Cooke – Manager, Strategic Services



Waste and Recycling Services

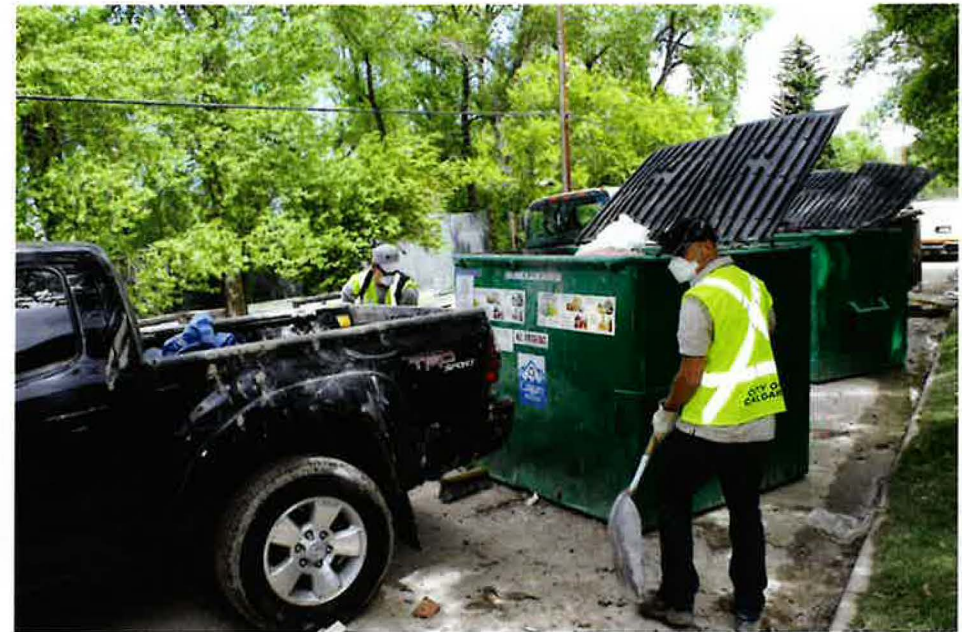
- WRS supports Calgarians impacted by a major storm event by collecting, transporting and managing the debris generated by the event.
- WRS Debris Management Response Plan supports decision making, and coordination of response and resources.





WRS' support for a tornado/severe weather event includes:

- ✓ Establishing debris drop-off locations in affected communities
- ✓ Transporting debris from drop-off locations to the City's Waste Management Facilities (WMF)
- ✓ Collecting debris from the front of affected homes as feasible
- ✓ Managing disaster debris material at the WMF





Calgary Neighbourhoods

Brett Whittingham – Business Continuity & Emergency Planner

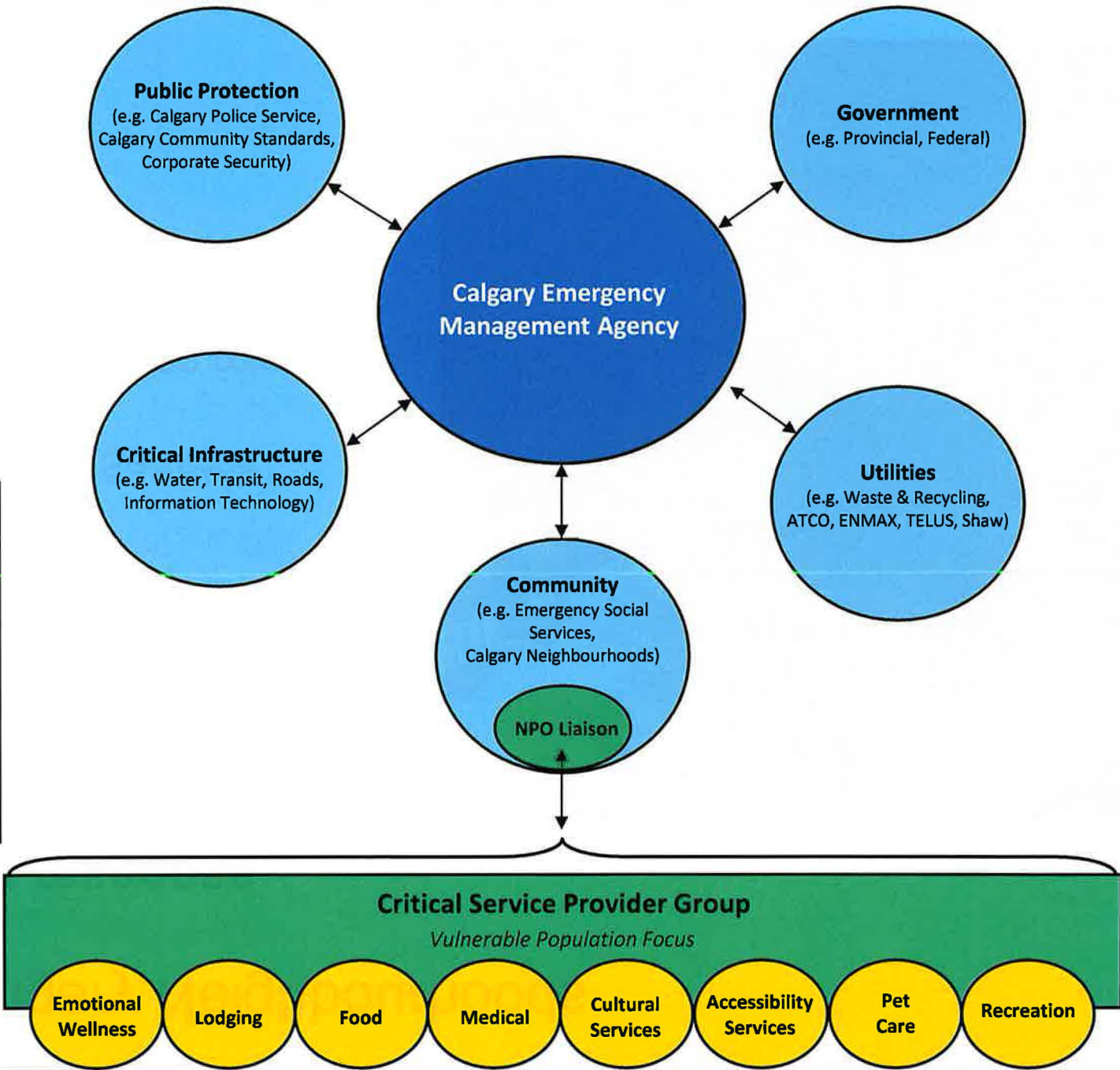
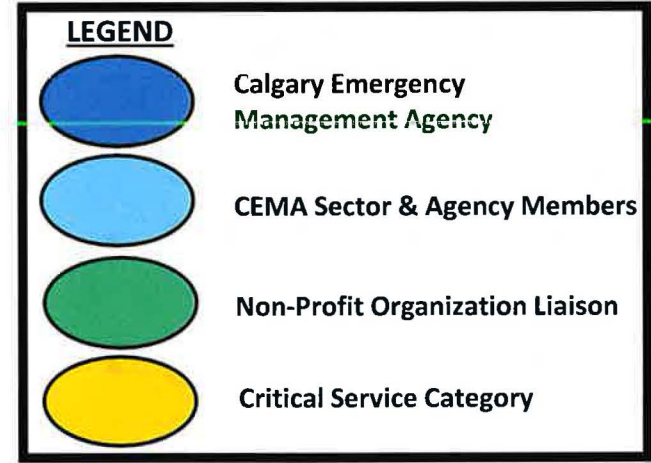


Role in emergency response

- Connections with community and partners
- Understanding impacts to communities and populations experiencing vulnerability
- Strategic support for CEMA Emergency Social Services
- Non-Profit Organization Liaison role



Image source: 680 News





Emergency Wellness Response Team

- Provision of coordinated psychosocial wellness support to impacted individuals





Preparing for a severe weather event

- Connectivity, relationship building, networking
- Emergency response exercises
- Emergency preparedness best practices
- Integrated Non-Profit Business Continuity Project



Emergency Social Services and Emergency Wellness Response Team Exercise - 2018

Responding to a severe weather event



Emergency Social Services Centre
Resource Fair - 2016



Community Support Centre
Public Engagement Event - 2020

Municipal Emergency Plan – Hazard Annexes



Spring & Summer Severe Storm
Incident Plan



Tornado Incident Response
Plan



CEMA - Severe Weather Response Readiness



High Winds



Tornadoes



In case of severe weather,
your best available
refuge area is:

Conclusion and Q&A

