

Improving Community Resilience:
2020 Overland Flood Considerations in the
Regional Municipality of Wood Buffalo

July 7, 2020

Executive Summary

In the aftermath of the 2020 spring flood, which inundated Taiga Nova Eco-Industrial Park and the surrounding area, Downtown, Ptarmigan Court, Waterways and Draper, the Regional Municipality of Wood Buffalo (RMWB) is re-visiting how development occurs in flood hazard areas. While flood mitigation (in the form of berms and retaining walls) is being constructed, it is not planned in all areas, nor does it eliminate all risk should the berm fail or be overtopped.

The current flood mitigation project is based on the 1:100-year flood event, which the Government of Alberta currently sets as the minimum flood hazard level. Disaster recovery costs are steadily rising throughout the country, and Alberta is now the highest recipient of federal funding support, having received a total of \$2.3 billion as of 2015. Both the Federal and Provincial governments have signalled a desire to shift their approach to providing disaster funding, so the RMWB must position itself for this policy change and improve our resilience in the face of future disasters.

Merely providing structural flood protection does not maximize this region's resiliency, and still leaves residents and businesses exposed. This report puts forward various options for each flood-affected area, premised on the intention to increase community resiliency in the long term. Options range from only providing structural flood mitigation, to re-establishing flood-proofing requirements in the Land Use Bylaw, limiting new development below 250m (which is synonymous with the 1:100), buyout of properties below 250m, and full buyout of the entire area.

These options were evaluated in accordance with *CSA 31000-10: Risk Management - Principles and Guidelines* which is published by the Standards Council of Canada. Evaluation criteria included cost as well as residual risk to social, built, economic and natural environments. Options vary from area to area and were assembled into different combinations to create more resilient treatments, ranging from least to most resilient (and often least to most expensive). Results for each community are as follows:

Taiga Nova Eco-Industrial Park and Area: the recommended approach is to construct new flood mitigation and enhance existing berms, in addition to limiting development below 250m, while at the same time introducing enhanced flood provisions in the Land Use Bylaw for new development above 250m.

Downtown: the recommended approach is to continue with the Municipality's structural flood mitigation project, in addition to limiting development below 250m, while at the same time introducing enhanced flood provisions in the Land Use Bylaw for new development above 250m.

Ptarmigan Court: the recommended approach is a full buyout of all properties in the area.

Waterways: the recommended approach is a buyout of properties below 250m and enhanced flood provisions in the Land Use Bylaw for new development above 250m.

Draper: the recommended approach is a full buyout of all properties in the area.

These options are presented as policy advice, and if adopted would reflect the Municipality's ongoing commitment to increasing community resilience. However, community feedback is critical to ensuring the successful implementation of these policies. While not included as part of this report, the results of public engagement will be presented separately for consideration.

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Intent

The intent of this document is to frame and consider land development options for areas impacted by overland flooding with a view to reducing disaster risk and increasing community resilience over the long-term. A risk management approach consistent with *CSA 31000-10: Risk Management - Principles and Guidelines* is used to frame this policy advice. Land development options will be considered for the following communities/areas that are at risk of overland flooding due to ice jam floods at the junction of the Athabasca and Clearwater Rivers: Draper, Waterways, Ptarmigan Court, Lower Townsite, and Taiga Nova Eco-Industrial Park.

As part of the Municipality's recovery efforts after the ice jam flooding in April 2020, the *Road to Resilience – RMWB 2020 Flood Recovery Campaign Plan* (Appendix A) was created to provide high level guidance that creates common understanding of the disaster's impact, complexity, and subsequent coordination efforts. The plan identifies eight Recovery Principles:

- 1) Do no harm;
- 2) Increase community resilience: think long-term;
- 3) Do not set the conditions for a repeat event;
- 4) Understand the impact, complexity, and context;
- 5) Focus on the well-being of the community;
- 6) Maximize existing government support programs;
- 7) Employ a planned and adaptive approach; and
- 8) Engage stakeholders and communicate in a transparent manner.

Using the Risk Management Principles and Framework described in CSA 31000-10 and the Flood Recovery Campaign Plan as a basis, this report identifies risks and potential solutions for increasing resilience before making recommendations for impacted areas. A risk management policy will be identified that clearly states the organization's objectives for, and commitment to, risk management as part of the ongoing development of a Community Resilience Strategy since the 2016 Horse River Wildfire.

Background

Beginning on April 26, 2020, a major flood event occurred in the Regional Municipality of Wood Buffalo. An ice jam on the Athabasca River caused serious flooding in many parts of Fort McMurray, including the Taiga Nova Eco-Industrial Park, Lower Townsite, Waterways, and Ptarmigan Court, as well as the rural community of Draper. Significant portions of these areas lie below the 250m contour interval, which is commonly associated with the 1:100-year flood level.

While it is recognized that building in a flood hazard area presents risks to property owners, the Regional Municipality of Wood Buffalo (RMWB) sought to mitigate these risks through the ongoing construction of berms built to withstand a 1:100-year flood event. Most cities around the world are built along oceans, lakes and rivers, as water formed the backbone of most transportation routes. Fort McMurray is no different, as the Hudson's Bay Company established its presence at the confluence of the Athabasca and Clearwater Rivers in 1870. These rivers formed the backbone of an extensive and busy transportation network. The city consequently grew up around these corridors and built on the flood plain, as the high plateaus, unstable slopes, and muskeg made the surrounding area unattractive for early development.

Fort McMurray's current downtown has therefore continued to grow up around these two major rivers, and the city has long grappled with the impacts of flood events. Downtown (also commonly known as the Lower Townsite) and Waterways have been subject to flooding dating as far back as the early 1800s. At least 15 notable floods have occurred since 1835, and all but one of them were caused by ice jams that occur during annual spring river breakup. The 2020 flood was no different and as it is the latest – and so far, costliest flood event; it has been a catalyst for re-visiting how development should occur in the flood hazard area.

It is important to note that overland flooding can have negative consequences for a community beyond the cost to repair and replace damaged infrastructure. These include:

- 1) population displacement;
- 2) disruption of critical infrastructure;
- 3) business interruption;
- 4) output loss due to capital damage and displacement of workers;
- 5) threats to physical health; and
- 6) threats to mental health.

The RMWB goal is to establish policy that reflects the intention to enhance community resilience whereby vulnerability to further flood events is reduced to an acceptable level. Resilience considers the social, built, economic, and natural environments which effectively support policy advice and ensure a balanced approach to safe and orderly development. As a result of the flood, more than \$200 million in insured damages have been incurred to-date¹ and we are now faced with a difficult decision: how do we reduce disaster risk and increase community resilience? While considering the answer to this question, we must not lose sight of the fact that flooding remains a very real threat to human life and well-being.

¹ Insurance Bureau of Canada, 2020.

Changing Policy Landscape

This section will describe the policy landscape for disaster funding and highlight indicators that higher levels of government are considering options to transfer risk for flood disaster funding to lower levels of government. Effectively increasing the disaster risk liability borne by municipalities, businesses and private property owners.

Federal Disaster Funding Assistance Arrangements

The Disaster Funding Assistance Arrangements (DFAA) is a federal program that assists provinces and territories with the portion of the costs of dealing with a disaster where those costs would otherwise provide a significant burden on the provincial economy and would exceed what they might reasonably be expected to fully bear on their own. The DFAA are intended to support the province in providing or reinstating the necessities of life to individuals, including help to repair and restore damaged homes; re-establishing or maintain the viability of small businesses and working farms; repairing, rebuilding, and restoring public works and the essential community services to their pre-disaster capabilities; and funding limited mitigation measures to reduce the future vulnerability of repaired or replaced infrastructure. Provinces and territories are responsible to design, develop, and deliver disaster response and assistance programs within their own jurisdictions; thereby, establishing the financial assistance criteria they consider appropriate for response and recovery.

As natural disasters are increasing in both frequency and severity, all levels of government are responding by altering their policies in a manner that may result in changes to and reductions in disaster relief program spending; thereby transferring more risk to the municipalities and people in flood hazard areas. In 2016, the Federal Government authored a report analyzing the DFAA entitled *Estimate of the Average Annual Cost for DFAA due to Weather Events*. Over the last 20 years, the annual cost² for DFAA for weather events has been steadily increasing.

Inflated to 2014 values using nominal gross domestic product (GDP), the average DFAA cost from 1970 to 1994 amounted to \$54 million per year; between 1995 and 2004 this annual average cost had risen to \$291 million, and between 2005 and 2014,³ it reached \$410 million per year. Given the substantial increase in DFAA event costs over the past 20 years, the Parliamentary Budget Officer (PBO) set out to determine if these high costs would increase further, stay the same or return to their previous levels.

The report noted that the DFAA do not cover expenses where “insurance coverage for a specific hazard for the individual, family, small business owner, or farmer was available in the area at reasonable cost.”⁴ At the time the report was published, individual (private property) overland flood insurance at a reasonable cost did not exist. Based on the availability and affordability of overland flood insurance, the Federal Government has likely been highly relied upon for disaster funding. However, the report also noted that the program’s design does not incentivize active flood damage mitigation in many of the affected areas.

Between 1970 and 2014, Alberta received more than \$2.3 billion from the DFAA, which exceeds that of any other province. The table below compares Alberta with the rest of Canada but does not include DFAA funding that Alberta received for the 2016 Horse River Wildfire or the 2020 flooding that occurred throughout the province.

² Cost refers to the sum of the payments due to all weather events that occurred in a particular year. The actual payments to provinces can occur several years after the actual event.

³ Some of the values included in the 2005 to 2014 average are estimates since all costs and their eligibility for some events have not been determined.

⁴ Public Safety Canada (2015d) p. 14.

DFAA payments by province and territory*

\$ millions in 2014

Province	\$ all years	% of total	Per capita	2005-2014	% of total	Per capita
NL	296	4%	561	174	4%	329
PE	32	0%	220	3	0%	21
NS	134	2%	143	16	0%	17
NB	269	3%	357	87	2%	115
QC	2,062	25%	251	166	4%	20
ON	387	5%	28	125	3%	9
MB	1,505	18%	1,174	767	19%	598
SK	914	11%	812	812	20%	722
AB	2,325	28%	564	1,758	43%	427
BC	391	5%	84	162	4%	35
NT	9	0%	200	6	0%	131
YT	25	0%	693	12	0%	332

Sources: DFAA and Parliamentary Budget Office.

Notes: Per capita is based on 2014 population.

*Nunavut is not included in this analysis since it was only created in 1999 and only has had one event (\$5.3 million flood in 2008)

Over the 45-year history of the DFAA, the Prairie Provinces (Manitoba, Saskatchewan, and Alberta) have exhibited consistently high use of the program, with Saskatchewan and Alberta seeing a proportionally higher reliance over the past 10 years because of a number of large flood and fire events.

Currently, flooding is Canada's most costly natural hazard and accounts for roughly three quarters of DFAA payments. However, residential losses account for only 5-15% of that total – a greater portion by far, perhaps as much as 70%, is spent on recovery of public infrastructure⁵. The PBO estimated that over the period 2017 to 2022, the DFAA program can expect claims of \$673 million per year for floods. Recognizing this trend, the Federal Government established an Advisory Council on Flooding in early 2018 with the purpose of advancing the national agenda on flood risk management. This led to the creation of a public-private sector Working Group on the Financial Management of Flood Risk, co-chaired by Public Safety Canada (PSC) and the Insurance Bureau of Canada (IBC).

Provincial Disaster Recovery Program

At the provincial level, disaster recovery is overseen by the Alberta Emergency Management Agency (AEMA) and funded through a mechanism known as the Disaster Recovery Program (DRP). The DRP is funded primarily through the DFAA. The DRP provides disaster recovery assistance to residents, small businesses, agriculture operators, and provincial and municipal governments when a disaster occurs that is considered:

- 1) extraordinary,
- 2) when the event is widespread, and
- 3) when insurance is not reasonably or readily available.

The Emergency Management Act (EMA) defines a disaster as an event resulting in serious harm to safety, health or welfare of people or in widespread property damage. After a disaster, the affected municipality can apply for the

⁵ Insurance Bureau of Canada (2019). P.6.

DRP and if the municipal application is approved, affected residents can subsequently apply for financial assistance. According to the Alberta Disaster Assistance Guidelines, DRPs assist with:

- 1) providing or reinstating the basic essentials of life to individuals, including financial assistance to help repair and restore damaged homes;
- 2) re-establishing or maintaining the viability of small businesses and working farms; and
- 3) repairing, rebuilding and restoring public works and the essential community services specific in the Guidelines to their pre-disaster functional capabilities.

According to the *Alberta Disaster Assistance Guidelines*, the federal guidelines for DFAA prescribe procedures that must be followed for the cost-sharing of DRP. The federal guidelines stipulate that only provinces and territories are eligible for disaster financial assistance. Federal assistance is available when Alberta's eligible expenses incurred in carrying out its own programs are above \$3.25 per capita of the provincial population⁶. Once the threshold is exceeded in any given event, the federal government will provide financial assistance in accordance with the following formula:

DFAA cost sharing formula

From January 1, 2020 to December 31, 2020

Eligible cost sharing of provincial expenses after per capita threshold met	Government of Canada share
First \$3.25 (per capita)	0%
Next \$6.51 (per capita)	50%
Next \$6.51 (per capita)	75%
Remainder	90%

Both the Federal and Provincial Government are looking at the severity and frequency of disasters and seeking to understand potential future recovery costs. Given the increasing costs highlighted above, there are indications that the Province may be changing the format of the Disaster Recovery Program, resulting in disaster recovery costs being redistributed to municipalities and property owners alike. As such, the RMWB cannot assume that DRP funding will be available to cover future disasters and must therefore position itself for this potential policy shift.

Provincial Floodplain Designations

In Alberta, floodplains are based upon a 1:100-year flood event. In 2013, Calgary experienced flooding that was estimated to be less than a 1:50-year flood⁷ but neighbourhoods that fell outside the designated 1:100 floodplain (including Bowness) experienced flooding. This would suggest that current provincial flood mapping may be inaccurate, and thus supports the RMWB efforts to work with the Province to ensure that local flood mapping is up to date.

⁶ Population figures are as estimated by Statistics Canada to exist on July 1st in the calendar year of the disaster. The per capita threshold is adjusted annually by Public Safety Canada for inflation on January 1st of every year, starting in 2016.

⁷ Shook and Pomeroy (2015)

Across the country, flood plain designations vary, with jurisdictions adopting a flood level of 1:100, 1:200, or higher. This choice can affect the likelihood of a building being flooded, since a structure constructed at the 1:200 floodplain boundary is less likely to get flooded than one built at the 1:100 floodplain boundary.

A 1:100 threshold is considered the lowest level of protection in Canada⁸ and translates into a 63% chance of a 1:100-year flood occurring in 100 years. Using a 1:200 threshold would reduce the likelihood to 39% in 100 years.

Presently, Alberta adheres to a 1:100 floodplain protection level, while most urban areas in Canada use a 1:200 flood level.⁹ For example, in Western Canada, British Columbia follows a 1:200-year protection level¹⁰ and Saskatchewan has a 1:500-year standard.¹¹

Insurance Industry

A recent report from the National Working Group on Financial Risk of Flooding published in June 2019, *Options for Managing Flood Costs of Canada's Highest Risk Residential Properties*, focussed primarily on measures to transfer residential property risk from public sector disaster financial assistance programs, which are funded by the taxpayer, to private sector insurance solutions, which are primarily funded by the property owner. However, the report recognized that many homeowners, particularly those with low incomes, simply cannot afford the premiums that would be required to cover that risk.

The report advocates for a new approach to disaster-related insurance that is inclusive, efficient, and financially sustainable while providing optimal compensation to residential property owners and reducing reliance on ongoing taxpayer-funded subsidies. The optimal approach would be financially self-sufficient; create the conditions necessary for expansion of private market insurance coverage; elevate risk awareness; and incent de-risking efforts amongst Canadians.

It is unclear what approach the Federal Government and insurance industry will adopt and the timeline for implementation. What is clear is that the Federal Government has given strong indications that it does not consider the current disaster relief framework financially sustainable in the long run. In the interim, it is anticipated that insurance will continue to be difficult to obtain at reasonable rates for private property in flood hazard areas.

⁸ Pomeroy, Stewart and Whitfield (2015).

⁹ Jakob and Church (2011 *ibid*).

¹⁰ Professional Engineers and Geoscientists of BC (2012).

¹¹ Kovacs and Sandink (2013).

Review of Existing Flood Protection Measures

The 2014 *Feasibility Study – Athabasca River Basins Report* by IBI Group and Golder Associates, projected costs of approximately \$385 million resulting from a 1:100 ice jam flood event in Fort McMurray, translating to \$10.45 million in average annual damages for the municipality in 2014 dollars. This section will briefly review the structural and non-structural approaches the RMWB has adopted to reduce flood damage. Structural approaches consist of methods to control the extent of flooding by the construction of protective works such as berms and retaining walls. Conversely, non-structural approaches limit the susceptibility of development to flood damage primarily through land use controls, but also include policy statements and relocation of people and property. The table below provides an overview of the flood damage reduction approaches undertaken by the RMWB.

Structural Flood Mitigation Strategy

The Municipality is currently undertaking a \$282 million capital project to ensure flood mitigation (in the form of berms and retaining walls) is in place around the Downtown area and Waterways. The project is underway, with approximately \$78.9M committed to-date, and construction remaining on Reaches 5, 6, 7, 8, 9, 10, and 11 at a cost of \$202.7 million. The berms and retaining walls are being constructed to withstand a 1:100-year flood, which translates to a height of 250m above sea level, plus one half-metre of freeboard, for a total of 250.5m above sea level.

A detailed update on the status of the Flood Mitigation Strategy was provided to Mayor and Council at the Council Meeting on June 23, 2020.

Given the dynamic and unpredictable nature of flood levels, a risk of flooding will continue to exist even with the flood mitigation fully in place. As has been witnessed in other cities around the world, berms can eventually fail or be overtopped by a flood event that exceeds the structural design criteria. This underscores the importance of taking further action to reduce disaster risk and ensure that flood susceptible areas are resilient to future inundation. By only committing to structural flood mitigation, residents and businesses behind the berm may feel a false sense of security. This confidence may lead to further investment in the flood hazard area, ultimately increasing damages and costs arising from a future flood that the berm was unable to withstand. This sense of security is known as the “levee effect.”

Land Use Bylaw Provisions

In addition to ongoing flood mitigation capital projects, the RMWB will seek to re-establish flood provisions in the Land Use Bylaw. In 2017, Section 60 (Development in the Flood Plain (Clearwater River/Athabasca River Flood Plain Area)) was repealed following the 2016 Horse River Wildfire. Municipal Council made this decision in good faith, owing to the increased costs and time of rebuilding homes to these requirements; however, it left the Municipality unable to address flood impacts on private lands.

These land use provisions prohibited development below 248m (flood way) and sought to see it occur above 250m. However, for development between 248m and 250m (flood fringe), Section 60 required specific flood proofing measures and supporting documentation by registered professionals proving that the subject site was adequately protected, and neighbouring properties were not negatively impacted. The flood provisions that will be brought forward to Council will eliminate the distinction between flood way and flood fringe and prevent any new development or major redevelopment in the 1:100 year flood plain (i.e. below 250m elevation).

Re-establishing flood provisions in the Land Use Bylaw will not remove the risk of flood damage to existing structures that were built below the 250m elevation without flood protection should an ice jam flood event breach or overtop the 1:100-year structural flood mitigation.

Ice Jam Flooding Risk Reduction – Methodology

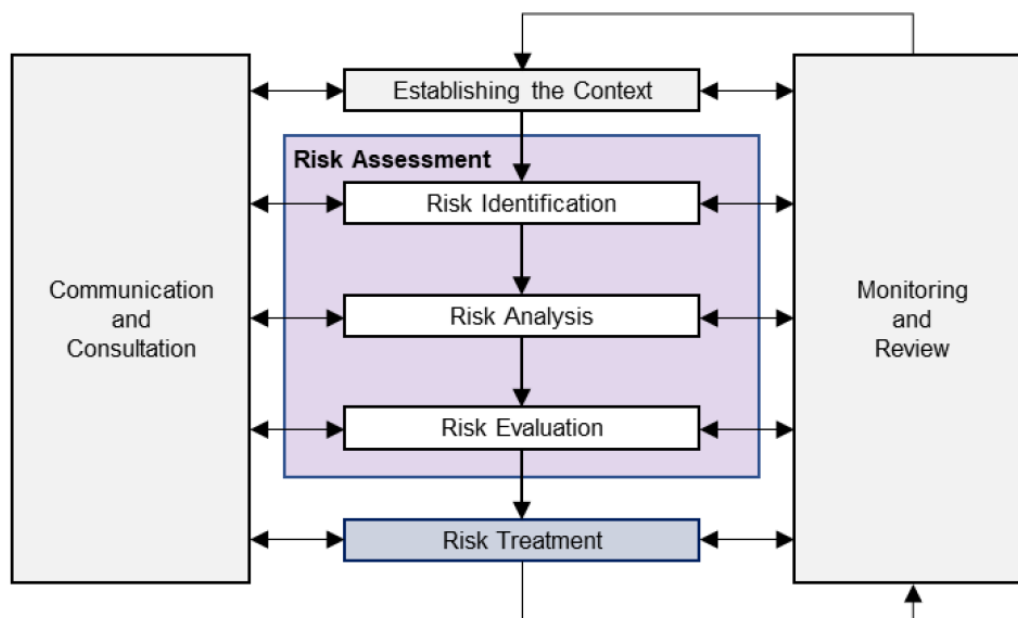
This section will describe the risk-based methodology used to develop and evaluate land development policy options for each of the five areas in this report. The foundation for this methodology is the Canadian standard for risk management, CSA 31000-10 *Risk Management – Principles and Guidelines*.

To ensure a common understanding of the description of the methodology, the following definitions are provided.

- 1) Community Resilience – the ability of a community exposed to hazards to resist, absorb, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basis structures and functions.
- 2) Disaster Risk - the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or society over some specified future time period.
- 3) Residual Risk – the risk remaining after risk treatment.

CSA 31000-10

This standard provides principles and guidelines that can be used to effectively manage disaster risk. It follows a five step, iterative process as depicted in the figure below.



Establishing the Context

The purpose of this step is to articulate the objectives; define the external and internal parameters to be considered; and set the scope and risk criteria in the risk management process. A key component of this step is to establish the tolerable risk level in order to assess the effectiveness of risk treatments in managing the residual disaster risk to an acceptable level.

Risk Assessment

Risk assessment is the overall process of risk identification, risk analysis, and risk evaluation.

Risk Identification

The purpose of risk identification is to generate a comprehensive list of disaster risks that could affect the RMWB. This report focuses solely on overland flooding due to ice jams at the convergence of the Athabasca and Clearwater Rivers.

Risk Analysis

The purpose of risk analysis is to develop an understanding of disaster risk by considering the causes and sources of risk and determining their consequences and likelihood, and other attributes of the risk. For this report, the likelihood, consequences, and attributes of ice jam flooding in Fort McMurray is well understood due to historical data, numerous studies, and the 2020 flooding event.

Risk Evaluation

The purpose of risk evaluation is to support decision making regarding which risks require treatment and the priority of those risk treatments based on the outcome of the risk analysis. This report will focus on the decisions required to treat the disaster risk caused by ice jam flooding.

Risk Treatment

The purpose of risk treatment is to select one or more options to change the probability and/or consequence of a risk and to implement those options. This is followed by a re-assessment to evaluate the residual risk and compare it to the tolerable risk level to decide if further treatment is required. Risk treatment options are not necessarily mutually exclusive or appropriate in all circumstances. The table below describes the seven risk treatment options.

Option	Description	Relevant Examples
Risk avoidance	Avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk.	Land Use Bylaw provisions that restrict any new development in the flood hazard area. Removing all private and public infrastructure from the flood hazard area.
Risk taking	Taking or increasing the risk in order to pursue an opportunity.	Not applicable in this context.
Risk prevention	Removing the risk source.	Diverting the flood water caused by an ice jam away from the community. ¹²
Risk mitigation	Changing the likelihood of the risk.	Not applicable in this context. ¹³
	Changing the consequence of the risk.	Structural flood mitigation that will protect the community from the consequences of the event. Consequences are only limited to the design criterion for the flood mitigation. Land Use Bylaw provisions that elevate critical infrastructure above the designed flood event or permit development that is resilient to flood damage (i.e. parks and green spaces).

¹² Studies to divert the floodwater resulting from an ice jam upstream have determined that option is neither practical nor feasible for Fort McMurray.

¹³ The likelihood and water level of an ice jam flood is determined by natural factors such as hydrology, topography, weather, and climate.

Option	Description	Relevant Examples
Risk sharing	Sharing the risk with another party or parties (including contracts and risk financing).	Overland flood insurance. DRP funding for floods exceeding the 1:100-year return period.
Risk retention	Retaining the risk by informed decision.	Accepting the residual disaster risk to the community by keeping private and public infrastructure in the flood hazard area.

Treatment options can be considered and implemented individually, or in combination, and treatment plans need to identify the priority for implementation of individual treatments. Selection of treatment options involves balancing the costs of implementation against the benefits derived relative to the stated policy intent of reducing disaster risk and increasing community resilience over the long-term (CSA, 2010a, pp. 18).

Assumptions and Limitations

The following planning assumptions and limitations were used in the options development and evaluation process.

1. Further shifts in federal (beyond the DFAA change in 2015) and provincial policies are anticipated due to an increase in natural disasters. We anticipate that costs associated with disasters will be transferred to municipalities and property owners. This could be in the form of decreased publicly funded disaster recovery programs and increased reliance on insurance programs. It is reasonable to assume that the Alberta Disaster Recovery Program (DRP) will not continue in its same form in the coming years. It may also become increasingly difficult for property owners who own land in flood prone areas to access insurance at a reasonable cost.
2. According to the Insurance Bureau of Canada, the insurance industry is advocating for a new approach to disaster-related insurance. We anticipate that insurance at reasonable rates for property in known flood hazard areas will not be readily available.
3. Site-specific information at the parcel level is unknown with regards to servicing, ownership, compliance issues, financial liabilities, current litigation, etc.
4. There is no feasible solution to build structural flood mitigation around Ptarmigan Court that does not include buying out some of the properties to provide sufficient space for dike construction.
5. The tolerable risk level for the RMWB is equal to the option that ensures the community remains eligible for DRP funding for events greater than the 1:100-year ice jam flood. This is the equivalent to the residual risk that remains if the community has structural flood protection equal to or greater than the 1:100-year ice jam flood or if no one lives below the 250m elevation. Essentially, this means the RMWB is willing to tolerate flooding above the 1:100, but not anything less. It is understood that the policy shift will result in DRP funding only being available for properties that are protected by 1:100 flood mitigation, or those that are above the 250m elevation.

Regional Context

The following relevant information was considered in the options development and evaluation process.

Taiga Nova: Taiga Nova and the surrounding area along Highway 63 employs a considerable number of people, as it is comprised entirely of commercial and light industrial lands. In its present location, it provides services for the oil industry (i.e. Diversified bussing, ACDEN head offices, lodging for visitors, and equipment rental). It consists of

medium to large-scale businesses on 81 private parcels. Many can be found lining both sides of Highway 63, but the majority are located in an eco-industrial park with high architectural and site design standards. Out of the 81 properties in this area, 42 were impacted by the 2020 flood. Flood mitigation includes an existing berm flanking the Taiga Nova Eco-Industrial Park, but further improvement to the berm may be necessary. Refer to Appendix B for a full community profile.

Downtown: Consists of small to large-scale commercial, residential and institutional uses spread across more than 6,600 parcels with buildings of varying age and intensity. Important facilities and services include Northern Lights Regional Health Centre, Willow Square Continuing Care, Keyano College, Composite High School, Dr. Karl A. Clark Elementary, Father Turcotte Omi School, and a plethora of critical social profits. Infrastructure such as lift stations provide service to Abasand, Beacon Hill, and other southern portions of Fort McMurray. Downtown functions as the administrative and retail heart of not only Fort McMurray but the entire region. Owing to its central location, Downtown acts as a bridge between the northern and southern areas of Fort McMurray, providing residents on either side of town with a short and direct trip. During the 2020 flood, 2753 properties were impacted. Flood mitigation is partially complete for Reach 1-4, and underway for Reach 5-9. Refer to Appendix C for a full community profile.

Ptarmigan Court: Consists of 70 private lots occupied with manufactured homes, most of which were recently replaced after the 2016 Horse River Wildfire. All developed properties were impacted by the 2020 flood. Mitigation considered a variety of techniques, including a demountable wall and berm. Studies to-date indicate that a demountable wall is not a technically acceptable solution, and there is no other structural flood mitigation solution which does not impact on the current footprint of this community. Refer to Appendix D for a full community profile.

Waterways: Historically served as the original settlement area in Fort McMurray and is the site of the Royal Canadian Legion and Athabasca Tribal Council offices. It consists of 162 private properties, 145 of which were impacted by the 2016 Horse River Wildfire. As of June 2020, 77 homes have been rebuilt. 64 properties were impacted by the 2020 flood. Flood mitigation in the form of a berm is partially complete for Reaches 10-11, and plans exist to connect to the Secondary Egress Road into Saline Creek. Refer to Appendix E for a full community profile.

Draper: Comprised of 98 large lot residential properties, 64 of which are located below 250m, with 34 above. During the 2016 Horse River Wildfire, 33 homes were impacted, 9 of which have rebuilt. During the post-fire recovery period, greater awareness was placed on geotechnical concerns that are present along the hillside. During the 2020 flood, 51 properties were impacted. No structural mitigation has been formally considered. Refer to Appendix F for a full community profile.

Structural Flood Mitigation

Flood mitigation measures being implemented by the Municipality are designed to withstand a 1:100-year flood event, which typically brings waters up to the 250m contour interval. These measures reduce the risks, but do not eliminate residual risk. Residual risks include failure of the flood mitigation system, or the arrival of a more significant flood event that overtops the mitigation system, i.e. the 1:350-year event experienced in 1875, which brought waters that reached an elevation of 252m. The estimated return period for an ice jam flood that exceeds the current flood construction levels (which are between 248.5m and 250.5m) is approximately 1-in-160, with a 30% chance of occurring within the next 50 years.

Non-Structural Flood Mitigation

If inundation does occur, there are other precautions aside from a structural flood mitigation system the Municipality can take to better safeguard residents and businesses. Namely, flood mitigation measures for individual properties are being proposed in the newly re-written Land Use Bylaw. In other cases, a buyout may be more appropriate.

Risk Sharing

If existing and/or future development is allowed to remain, the Municipality is sharing risk with residents, business owners, and their respective insurers. Insurance coverage may not be available for those in flood impacted areas, and in instances where it is available, rates may be very high. Additionally, franchise utilities (ATCO, Telus, Shaw, etc.) have extensive utilities located in the flood hazard areas and as such would be sharing the risk should development be allowed to continue in these areas.

Options Development

To meet the tolerable risk level for overland flooding an approach must ensure the community remains eligible for DRP funding for events greater than a 1:100-year ice jam flood. This is equivalent to the residual risk that remains if the community has structural flood protection equal to or greater than the 1:100-year ice jam flood or if no one lives below the 250m elevation. Options were identified by selecting risk treatments, or combinations of risk treatments, that, as a minimum, satisfied the defined tolerable risk level and also sought to achieve the ideal outcome. Any option that did not meet the tolerable risk level was considered unacceptable and as such not included in the evaluation.

Specific Risk Treatments

Risk treatments for overland flooding may differ for each of the five impacted areas due to unique circumstances. As such the subsequent approaches to increasing resilience in the five areas may also differ. The following risk treatments could be used individually or in combination to reduce the risk from ice jam flooding to a tolerable risk level.

- 1) **Flood Mitigation Strategy (Structural Mitigation):** Since 2013, the RMWB has embarked on a flood mitigation strategy to protect low-lying areas, specifically the Downtown and Waterways from the 1:100-year flood event with berms and retaining walls. Older portions were built to 248.5, while newer portions have been built to 250.5. Plans are underway to ensure that the entire downtown and Waterways are protected to the 250.5m level. Taiga Nova also has a berm that was constructed by the developer but may have spots that require enhancement. Refer to Appendix G for full extent and status of flood mitigation in the downtown and Waterways.
- 2) **Land Use Bylaw (LUB) Flood Provisions (Structural and Non-structural):** All new development within at least the 1:100-year flood level (coterminous with the 250m contour) would be required to adhere to provisions in the Land Use Bylaw that include requirements for flood-proofing structures and property (i.e. raising utility rooms, mechanical equipment, habitable space). If this option is combined with a treatment option that includes buyouts of land below 250m, the LUB provisions could apply to development within a higher flood level (i.e. 1:200).
- 3) **No new (prospective) development below 250m elevation (Non-structural):** No new development would be allowed below the 250m contour. When combined with the Flood Provisions treatment option above, existing (grandfathered) structures within the 250m contour will be allowed to redevelop their interior spaces and make minor additions (the maximum may be customized to specific uses) so long as they follow the flood proofing requirements. Making these allowances for grandfathered buildings allows existing spaces to remain viable, while prohibiting new buildings below 250m ensures no new assets are introduced into the risk area.
- 4) **Buyout / land swap properties in the flood hazard area (below and/or above 250m):** The Municipality could purchase lands within the flood hazard area to keep private lands from being at risk of inundation from a future flood event. Either a full buyout of the community or a partial buyout comprising only the lands below 250m could be considered

Note: **Land Swap:** In the event a buyout is pursued, a land swap may be considered to maintain local residency following a buyout. There are about 350 hectares of shovel-ready land in the neighborhoods of Parsons Creek and Saline Creek that the RMWB could purchase from the current landowners. About 450 hectares of additional land is already planned for and can be developed in Parsons and Saline Creek. While these communities can provide more than enough land to offer residents an alternative location, further work is required to subdivide the land into lots and ensure that services are available at the property line.

Options Evaluation

It is assessed that the ideal flood risk treatment plan would result in zero residual risk, at no cost (or generate savings), and receive full support from the RMWB. Therefore, evaluation criteria were derived based on this ideal scenario as described in the table below.

Evaluation Criteria		Definition
Cost		Limited to the estimated net cost to implement each policy option. It also includes avoided infrastructure costs for the municipality. It does not include opportunity costs, loss/disruption of income and revenue for residents, businesses or the municipality, or expected future flood damages.
Residual Risk	Social	Residual risk to physical, physiological, and psychosocial well-being of residents and the community; as well as the network of relationships in the community.
	Built	Residual risk to residential homes, commercial and industrial infrastructure, as well as municipal and provincial essential services and infrastructure.
	Economic	Residual risk from the loss of livelihoods, loss of employment, economic losses associated with property losses, decreased business revenue due to work stoppages, loss of employees, infrastructure damage, loss of childcare and school facilities, and opportunity costs related to future flood events.
	Natural	Residual risk from loss or contamination of greenspaces, woodlands, cropland and rangeland, degradation to air, soil and water quality, and impacts to the watershed.
Community Support		Community resilience is important. The RWMB needs to engage the residents and business owners of the region to assess sentiment relating to potential risk treatments for overland flooding. In addition to the assessment of policy options against cost and residual risk, community sentiment needs to be understood by decision-makers as they consider and select the best option to increase resilience. Results of community engagement will be presented separately from this report.

Scoring

Cost: Scores are based on the net cost of each option for the area under consideration. They correlate to a scale that spans the full cost range (lowest to highest costs) possible for the area. Costs that fall within the same bracket (i.e. \$50-99 million) will be assigned the same score. Scores are based on the number of brackets in the scale, not the number of options available. Cost scores are **not relative** and are assigned a value based on the actual cost associated with the treatment.

Residual Risk: Policy options are scored **relative** to each other in four residual risk environments – social, built, economic, and natural. The scoring identifies the least relative residual risk amongst the policy options considered. The policy option with the lowest residual risk will score a 1, while the policy option with the highest residual risk (up to 6 depending on the number of options available).

The total score for each policy option is the sum of the points assigned for each assessment criteria multiplied by the weight. The lowest scoring policy option becomes the recommended policy option for each community/area.

Costs

This section provides a summary of the cost figures used to evaluate the cost of each option.

Buy Out Costs

While the actual buyout costs would depend on the buyout method chosen by Council, Administration has estimated the minimum cost of a full buyout of private land by using 2020 assessment values and estimated reclamation costs, shown in the table below.

Area	Private Property	Assessment Value
Taiga Nova & Area		
Total	81	\$463,414,220
Above 250m	15	\$112,935,160
Below 250m	66	\$350,479,060
Downtown		
Total	6231	1,908,528,930
Above 250m	1857	633,359,070
Below 250m	4374	1,275,169,860
Ptarmigan Court		
Total	69	\$13,999,980
Above 250m	1	\$69,380
Below 250m	69	\$13,930,600
Waterways		
Total	162	\$56,745,040
Above 250m	68	\$31,239,850
Below 250m	94	\$25,505,190
Draper		
Total	98	\$60,304,000
Above 250m	34	\$20,369,410
Below 250m	64	\$39,934,590

It is important to note that this analysis is based on **2020 assessed values only**. The actual and full cost of a buyout could be higher and would be influenced by what buyout method is chosen, associated costs (assessed vs fair market value), desire for a land swap, legal costs, land titles fees, etc.

Potential Capital Project Cost Savings

Should a buyout be considered, the following costs may be saved by terminating future capital projects. However, it is important to note that these costs will have to be compared not only to the buyout costs, but with costs to re-develop and maintain bought-out areas. The costs below reflect potential savings that result from reducing population in only the affected areas. Since residents may wish to re-locate to another area in Fort McMurray, projects that continue to service the broader population do not appear on this list, as those must still be carried out to service existing and future population levels.

1. **\$40 million** - approximate remaining costs for flood mitigation in Waterways. This includes the portion of Saline Creek Secondary Egress Road that contributes to flood mitigation.
2. **\$22.8 million** for flood protection in Ptarmigan¹⁴ Court or **\$23.5 million** for the temporary relocation and raising of properties in Ptarmigan Court (rough estimates only).
3. **\$27 million** for Rural Water and Servicing Project for Draper.
4. **\$5 million** for private service connections in Draper.
5. **\$0.3 million** for Community Gathering Place Project in Draper.
6. **\$2.3 million** for Jubilee Major Maintenance.
7. **\$36 million** for Clearwater Drive – Riedel Street to Franklin Design and Construction.
8. **\$1.5 million** for four-laning Franklin Avenue.
9. **\$1 million** for Waterways landscaping Improvement.

In addition to the savings noted above, some costs could also be saved by not continuing with subsequent phases of the following ongoing capital projects:

1. **\$150 – 202.7 million** for remaining Flood Mitigation work (\$202.7 million reflects the budgeted cost; actual costs may be lower based on current market conditions); and
2. **\$1.6 million** for downtown portions of Urban Infrastructure Rehabilitation Construction:
 - a. **\$845,000** remaining for Morrison and Main Street deep utility excavation, and
 - b. **\$750,000** remaining for Pond Crescent.

¹⁴ Flood mitigation in Ptarmigan Court could entail purchase of some riverside properties, as available space is limited. These buyout costs have not been accounted for in the \$22.8 million estimate.

Evaluation and Recommended Policy Option by Area

The following section of this report contains the evaluations for each of the five flood-impacted areas. Areas are presented in geographic order from north to south. Each area begins with a summary of the available treatment options, followed by key points, the evaluation, and finally, recommendations. This was a risk management exercise intended to address community resilience through a technical assessment approach. Community feedback, while critical, was not factored into this methodology but will be available and shared separately at a later date.

Taiga Nova Eco-Industrial Park & Area

Singular and combined risk treatments for Taiga Nova are shown in Table 1 below. For the purposes of this analysis, this area stretches from the Taiga Nova Eco-Industrial Park in the north, to just beyond the Northstar Ford dealership in the south, and covers properties on both sides of Highway 63.

Table 1: Taiga Nova & Area Policy Options (risk treatments and combinations)

Risk Treatments	Policy Options					
	Flood Mitigation Only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions, & Limited Development below 250m	Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Flood Mitigation Strategy	X	X	X	X		
Land Use Provisions		X	X	X	X	
No new (prospective) development below 250 m			X			
Buy out / land swap all properties below 250 m				X	X	
Buy out / land swap all properties in community						X

Key Points

1. Flood mitigation currently exists around the Taiga Nova Eco-Industrial Park, but the broader area along the shoreline of the Athabasca River is not included in the Municipality's current Flood Mitigation Strategy and lacks any structural protection.
2. The stretch of Highway 63 between Taiga Nova and the Confederation Way interchange is also within the 1:100 flood level, presenting a threat to mobility in the event of a significant flood.
3. New berms and enhancement of the existing Taiga Nova berm are expected to cost at least \$25.2 million, based on current market conditions.
4. No residential uses, but it consists of 81 private properties and is home to 65 businesses and hundreds of employees. 35 businesses impacted by the flood reported having almost 700 employees pre-flood.
5. 66 private properties (81% of the total) are below the 250m elevation, of which 42 (52%) were affected by the 2020 flood.
6. 15 private properties (19% of the total) are above the 250m elevation, of which none were affected by the 2020 flood.

Table 2: Taiga Nova & Area Evaluation Matrix

Evaluation Criteria		Weight	Policy Options Evaluation					
			Flood Mitigation only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions, & Limited Development below 250m	Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Minimize Cost		4	1	1	1	7	6	8
Minimize Residual Risk	Social	1	6	5	4	1	2	3
	Built	1	6	5	4	2	3	1
	Economic	1	6	5	4	2	3	1
	Natural	1	6	5	4	3	2	1
Total Score			28	24	20	36	34	38
Total Treatment Cost			\$25.2M	\$25.2M	\$25.2M	\$375.7M	\$350.5M	\$463.4M
Flood Mitigation Costs			\$25.2M	\$25.2M	\$25.2M	\$25.2M	~	~
Buyout Costs			~	~	~	\$350.5M	\$350.5M	\$463.4M
Reclamation Costs			~	~	~	***	***	***
Total Cost Saved			~	~	~	~	\$25.2M	\$25.2M
Flood Mitigation			~	~	~	~	\$25.2M	\$25.2M
Net Cost			\$25.2M	\$25.2M	\$25.2M	\$375.7M	\$325.3M	\$438.2M
Net Cost Per Capita			\$336	\$336	\$336	\$5,009	\$4,337	\$5,843

*** Note: Reclamation costs were not added owing to the already high costs of all buyout options. Reclamation costs would only cause the (already high) total score of each option to increase and would not change the recommendation.

Table 3: Taiga Nova & Area Cost Scale

Cost Bracket	Score	Cost Bracket	Score
< \$100 million	1	300 – 349 million	6
10 – 149 million	2	350 – 399 million	7
150 – 199 million	3	400 – 449 million	8
200 – 249 million	4	450 – 499 million	9
250 – 299 million	5	500 million +	10

Proposed Approach for Taiga Nova & Area

1. According to Table 1, the preferred approach is to **construct new flood mitigation and enhance existing berms, in addition to limiting development below 250m, while at the same time introducing enhanced flood provisions in the Land Use Bylaw**. The Taiga Nova Eco-Industrial Park is already protected by a berm, and further structural protection and enhancements could be provided. However, as it would only withstand a 1:100-year flood event, it is advisable to resist further intensification of areas below 250m to avoid substantial further increases in damage should the berm fail or be overtopped. The Land Use Bylaw provisions should apply up to a higher flood elevation (such as the 1:200) so that new development above 250m can be afforded a higher degree of protection from a flood event that exceeds the 1:100.
 - a. Portions of Taiga Nova and the surrounding area lie below the 250m contour, and a significant amount of investment has been made there in recent years. Existing development would be grandfathered but, to provide owners some flexibility, they could be permitted to make interior changes and minor exterior modifications, provided the exterior modifications do not exceed a maximum threshold (so as to limit future damages). New buildings would not be permitted below the 250m contour.
 - b. While buyouts offer greater community resiliency, the extraordinary cost of even a buyout of lands below 250m is very expensive and could place the Municipality in financial risk. Per capita costs of a buyout below 250m amount to at least \$4,337 and to almost \$6,000 for a full buyout, likely making both objectionable to taxpayers. The CSA 31000-10 requires treatment options to be assessed with a view to whether any new risks arise from the selected option; selecting such an option would present financial risk with potentially negative consequences on the quality of life of all local residents and businesses, not just those in the flood hazard areas.
 - c. A full buyout also creates an array of consequences, including a significant change in traffic patterns. The only shovel-ready industrial and commercial land available to accommodate the businesses in Taiga Nova & Area are on the south side of Fort McMurray. This would require employees – many of whom may live in Parsons Creek, Timberlea and Thickwood – to travel south to the other end of Fort McMurray, increasing their commute times and even the chances of a traffic accident.
 - d. Since prohibiting new development below 250m will sterilize vacant parcels, it could be viewed as a form of down-zoning. Consequently, the Municipality may have to consider buying out those vacant parcels. Should buyouts be undesirable, the **second preferred approach could be continuing with the flood mitigation project and introducing Land Use Bylaw provisions** that require all new development to adhere to flood-proofing measures (i.e. raising utility rooms, mechanical equipment and habitable or occupiable space) within a prescribed flood level. That flood level could be increased from the minimum 1:100-year standard to a higher standard such as the 1:200 if desired. Doing so would ensure that at least a minimum level of additional protection is offered, reducing full reliance on the berm (deriving too much comfort from the presence of a berm or any other structural protection is known colloquially as the “levee effect”).
1. The proposed policy for Taiga Nova & Area is to maintain the area’s role as northern Fort McMurray’s primary industrial area, home to many industrial support services critical to the success of the oil sands, Fort McMurray and the region. Opportunity exists to set a higher standard for the flood level, i.e. 1:200, which is more in keeping with minimum standards throughout the rest of the country and would increase community resiliency for those areas above the current 1:100.
2. Potential future uses will be more of the same: commercial and industrial.

What degree of residual risk remains from overland flooding?

1. Risk of flooding still remains since no properties are being removed from the hazard area. Flood mitigation is only being constructed to the 1:100-year level, so it is only a matter of time before the berm is overtopped by a higher flood event or suffers a failure. Land Use Bylaw provisions are only intended to protect sensitive mechanical systems, and require habitable floor space to be above the 250m level; they will not necessary protect the building from being flooded, so damage will still likely occur to interior spaces, particularly on the ground level.

What was the cost of the risk reduction?

1. The cost of this treatment option is estimated to be at least \$25.2 million. This cost is largely attributable to constructing new flood mitigation along the Athabasca River, and enhancing the existing berm at Taiga Nova. While this estimate considers existing conditions, design and construction work, it is only an estimate and is subject to change once more detailed study has taken place.

What new risks (if any) are generated by the risk treatment?

1. No new known risks are anticipated.

Downtown

Singular and combined risk treatments for Downtown are shown in Table 4 below.

Table 4: Downtown Policy Options (risk treatments and combinations)

Risk Treatments	Policy Options					
	Flood Mitigation Only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions, & Limited Development below 250m	Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Flood Mitigation Strategy	X	X	X	X		
Land Use Provisions		X	X	X	X	
No new (prospective) development below 250 m			X			
Buy out / land swap all properties below 250 m				X	X	
Buy out / land swap all properties in community						X

Key Points

1. Flood mitigation is significantly underway (Reaches 1 – 9), with plans to protect the entire Downtown area. Some reaches have been completed, some are under construction or construction will start in summer 2020, and some are still in the design stage.
2. Remaining components of flood mitigation are currently expected to cost \$70 million, based on current market conditions. Costs have been decreasing compared to initial budgeted amount.
3. Population of Downtown is 10,993 as of the 2018 Census and consists of 6,231 private properties.
4. 4374 private properties (70% of the total) below 250m, of which 2582 (41.44%) were affected by the flood.
5. 1857 private properties (30% of the total) above 250m, of which 44 (0.71%) were affected by the flood
6. Very few private properties were damaged or destroyed during the Horse River Wildfire, none of which were in the flood affected area.
7. In our region, this is an area that presents the greatest degree of concern with respect to the “levee effect” whereby residents and businesses behind the berm may feel a false sense of security. This confidence may lead to further investment in the flood hazard area, ultimately increasing damages and costs arising from a future flood that the berm was unable to withstand.

Table 5: Downtown Evaluation Matrix

Evaluation Criteria		Weight	Policy Options Evaluation					
			Flood Mitigation	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions, & Limited Development below 250m	Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Minimize Cost		4	2	2	2	10	9	14
Minimize Residual Risk	Social	1	6	5	4	2	3	1
	Built	1	6	5	4	2	3	1
	Economic	1	6	5	3	2	4	1
	Natural	1	6	5	4	3	2	1
Total Score			32	28	23	49	48	60
Total Treatment Cost			\$70M	\$70M	\$70M	\$1.37B	\$1.3B	\$1.9B
Flood Mitigation Costs			\$70M	\$70M	\$70M	\$70M	~	~
Buyout Costs			~	~	~	\$1.3B	\$1.3B	\$1.9B
Reclamation Costs			~	~	~	***	***	***
Total Cost Saved			~	~	~	~	\$70M	\$111.4M
Flood Mitigation			~	~	~	~	\$70M	\$70M
Jubilee Maintenance			~	~	~	~	~	\$2.3M
Clearwater Design & Const.			~	~	~	~	~	\$36M
4-Laning Franklin Ave.			~	~	~	~	~	\$1.5M
Infrastructure Rehab			~	~	~	~	~	\$1.6M
Net Cost			\$70M	\$70M	\$70M	\$1.37B	\$1.23B	\$1.79B
Net Cost Per Capita			\$933	\$933	\$933	\$18,267	\$16,400	\$23,867

*** Note: Reclamation costs were not added owing to the already high costs of all buyout options. Reclamation costs would only cause the (already high) total score of each option to increase and would not change the recommendation.

Table 6: Downtown Cost Scale

Cost Bracket	Score	Cost Bracket	Score
< 50 million	1	1.4 – 1.49 billion	11
50 – 99 million	2	1.5 – 1.59 billion	12
100 – 199 million	3	1.6 – 1.69 billion	13
200 – 399 million	4	1.7 – 1.79 billion	14
400 – 499 million	5	1.8 – 1.89 billion	15
500 – 699 million	6	1.9 – 1.99 billion	16
700 – 899 million	7	2 – 2.29 billion	17
900 – 999 million	8	2.3 – 2.39 billion	18
1 – 1.29 billion	9	2.4 – 2.49 billion	19
1.3 – 1.39 billion	10	2.5 billion +	20

Proposed Approach for Downtown

1. According to Table 4, the preferred approach is to **continue with the Municipality's structural flood mitigation project, in addition to limiting development below 250m, while at the same time introducing enhanced flood provisions in the Land Use Bylaw**. The flood mitigation program is already substantially underway, but since it is only being built to withstand a 1:100 year flood event, it is advisable to resist further intensification of areas below 250m so as to avoid substantial further increases in damage should the berm fail or be overtopped. The Land Use Bylaw provisions should apply up to a higher flood elevation (such as the 1:200) so that new development above 250m can be afforded a higher degree of protection from a flood event that exceeds the 1:100.
 - a. Substantial portions of Downtown lie below the 250m contour, and a significant amount of investment has been made there in recent years. Existing development would be grandfathered but, to provide owners some flexibility, they could be permitted to make interior changes and minor exterior modifications, provided the exterior modifications do not exceed a maximum threshold (so as to limit future damages). New buildings would not be permitted below the 250m contour.
 - b. While buyouts offer greater community resiliency, the extraordinary cost of even a buyout of lands below 250m is prohibitively expensive and could place the Municipality in financial risk. Per capita costs of a buyout below 250m amount to at least \$16,400 and to almost \$24,000 for a full buyout, likely making both objectionable to taxpayers. The CSA 31000-10 requires treatment options to be assessed with a view to whether any new risks arise from the selected option; selecting such an option would present an unacceptable financial risk with negative consequences on the quality of life of all local residents and businesses, not just those in the flood hazard areas.
 - c. A full buyout also creates an array of consequences, including drastically altering Fort McMurray's traffic patterns. There exist two locations that could potentially accommodate a relocated downtown: Parsons Creek to the north and Saline Creek to the south. Both areas contemplate a full range of land uses, from residential to institutional, to commercial (including small scale retail and big box). A significant shift in the location of downtown services and employment lands will require employees and patrons to utilize the transportation network in different ways, likely creating additional stresses on roadways in other parts of the city.
 - d. Since prohibiting new development below 250m will sterilize some vacant parcels downtown, it could be viewed as a form of down-zoning. Consequently, the Municipality may have to consider buying out those vacant parcels. Should buyouts be undesirable, the **second preferred approach could be continuing with the flood mitigation project and introducing Land Use Bylaw provisions** that require all new development to adhere to flood-proofing measures (i.e. raising utility rooms, mechanical equipment and habitable or occupiable space) within a prescribed flood level. That flood level could be increased from the minimum 1:100-year standard to a higher standard such as the 1:200 if desired. Doing so would ensure that at least a minimum level of additional protection is offered, reducing full reliance on the berm (deriving too much comfort from the presence of a berm or any other structural protection is known colloquially as the "levee effect").
2. The policy for Downtown will be to maintain its central role and function in Fort McMurray and the RMWB while implementing as many structural and non-structural safety precautions as possible to protect lives and property. Opportunity exists to set a higher Land Use Bylaw standard for the flood level, i.e. 1:200, which is more in keeping with minimum standards throughout the rest of the country, and would increase community resiliency for those areas above the current 1:100.

3. Potential future uses will be more of the same: commercial, residential and institutional development.

What degree of residual risk remains from overland flooding?

1. Risk of flooding still remains since no properties are being removed from the hazard area. Flood mitigation is only being constructed to the 1:100-year level, so it is only a matter of time before the berm is overtopped by a higher flood event or suffers a failure. Land Use Bylaw provisions are only intended to protect sensitive mechanical systems, and require habitable floor space to be above the 250m level; they will not necessary protect the building from being flooded, so damage will still likely occur to interior spaces, particularly on the ground level.

What was the cost of the risk reduction?

1. The cost of this treatment option is estimated to be up to \$70 million. This cost is largely attributable to the remaining work on the unfinished portions of the flood mitigation project. Implementing regulatory changes through the Land Use Bylaw carries minimal costs and are carried out during Administration's typical operations.

What new risks (if any) are generated by the risk treatment?

1. No known new risks are created.

Ptarmigan Court

Singular and combined risk treatments for Ptarmigan Court are shown in Table 7 below. Structural flood mitigation for the community would require buy out of some properties to create space to construct the flood protection.

Table 7: Ptarmigan Court Policy Options (risk treatments and combinations)

Risk Treatments	Policy Options	
	Flood Mitigation ¹⁵	Buyout all properties / Land Swap
Flood Mitigation Strategy	X	
Land Use Regulations		
No new (prospective) development below 250 m		
Buy out / land swap all properties below 250 m		
Buy out / land swap all properties in community		X

Key Points

1. Studies to-date indicate that there is no structural flood mitigation solution for Ptarmigan Court which does not impact the current footprint of this community.
2. Flood mitigation is estimated to cost at least \$22.8 million.
3. Population of Ptarmigan Court is included within Waterways (population 232) in the 2018 Census.
4. 68 private properties (99% of the total) are below the 250m elevation, of which 49 are developed.
5. 1 private property (1% of the total) is above the 250m elevation but is vacant.
6. 51 private properties (74%) were affected during the Horse River Wildfire, of which 33 have rebuilt (48%).

¹⁵ Structural flood mitigation for the community will require buy out of some properties to create space to construct the flood protection.

Table 8: Ptarmigan Court Evaluation Matrix

Evaluation Criteria		Weight	Policy Options Evaluation	
			Flood Mitigation	Buyout all properties / Land Swap
Minimize Cost		4	5	1
Minimize Residual Risk	Social	1	2	1
	Built	1	2	1
	Economic	1	2	1
	Natural	1	2	1
Total Score			28	8
Total Treatment Cost			\$22.8M	\$21.8M
Flood Mitigation Costs			\$22.8M	~
Buyout Costs			~	\$14M
Reclamation Costs			~	\$7.8M
Total Cost Saved			~	\$22.8M
Flood Mitigation			~	\$22.8M
Net Cost			\$22.8M	\$0.00
Net Cost Per Capita			\$304	\$0.00

Table 9: Ptarmigan Court Cost Scale

Cost Bracket	Score	Cost Bracket	Score
< \$5 million	1	15 – 19.9 million	4
5 – 9 million	2	20 – 24.9 million	5
10 – 14.9 million	3		

Proposed Approach for Ptarmigan Court

1. According to Table 7, the preferred approach is **Buyout of all Properties** and potential land swap. This option sees all 69 private residential properties removed from the flood hazard area. Not only is the installation of flood mitigation more expensive than the minimum buyout costs but installing flood mitigation may require buyout of some riverfront properties regardless. This option provides the maximum community resilience by removing residents from the flood hazard area so that neither they nor the Municipality have to contend with future disaster remediation costs.
2. The proposed policy for Ptarmigan Court is to pursue maximum community resilience by removing residents from the hazard area.
3. Potential future uses are more limited owing to the area's smaller size but may include parkland or a naturalized area.

What degree of residual risk remains from overland flooding?

1. Little residual risk remains, as private properties and structures have been removed from the hazard area. Residual risks would be limited to remediation of any future parkland that may be established in the area.

What was the cost of the risk reduction?

1. Achieving this risk reduction carries no additional cost to taxpayers, owing to the cost-savings realized by not providing flood protection. This does not include the cost of procuring land for a land swap, as this is an optional step which may or may not be pursued; it therefore does not affect the evaluation of this risk treatment.
2. Reclamation costs are estimated to be about \$7.8 million, but a significant portion (nearly \$3 million) comprises grading and landscaping. These costs would depend on the future use of the area and may not need to be included if the area is allowed to return to its natural state.
3. Minor cost savings would be realized as municipal services (water, sewer, road maintenance, garbage pick-up, etc.) need not be provided in future years.

What new risks (if any) are generated by the risk treatment?

1. No new risks are anticipated by buying out the area.

Waterways

Singular and combined risk treatments for Waterways are shown in Table 10 below.

Table 10: Waterways Policy Options (risk treatments and combinations)

Risk Treatments	Policy Options					
	Flood Mitigation Only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions & Limited Development below 250m	Flood Mitigation, LUB Provisions & Buyout Below 250m / Land Swap	LUB Provisions and Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Flood Mitigation Strategy	X	X	X	X		
Land Use Provisions		X	X	X	X	
No new (prospective) development below 250 m			X			
Buy out / land swap all properties below 250 m				X	X	
Buy out / land swap all properties in community						X

Key Points

1. Structural flood mitigation is planned for this community (Reaches 10 & 11) but construction has not begun.
2. Flood mitigation is estimated to cost at least \$20 million. It is part of a larger project to tie into the Saline Creek Secondary Egress Road which is also anticipated to cost \$20 million, bringing the total cost of this project to approximately \$40 million.
3. Population is 232 as of the 2018 Census and consists of 164 private properties.
4. 94 private properties (48% of the total) are below the 250m elevation, of which 43 are developed.
5. 68 private properties (42% of the total) are above the 250m elevation, of which 48 are developed.
6. 140 private properties (90%) were affected during the Horse River Wildfire, of which 73 have rebuilt (45%).

Table 11: Waterways Evaluation Matrix

Evaluation Criteria		Weight	Policy Options Evaluation					
			Flood Mitigation Only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions, & Limited Development below 250m	Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Minimize Cost		4	3	3	3	8	2	6
Minimize Residual Risk	Social	1	6	5	4	2	3	1
	Built	1	6	5	4	2	3	1
	Economic	1	6	5	4	2	3	1
	Natural	1	6	5	4	3	2	1
Total Score			36	32	28	41	19	28
Total Treatment Cost			\$20M	\$20M	\$20M	\$75.5M	\$35.5M	\$72.3M
Flood Mitigation Costs			\$20M	\$20M	\$20M	\$20M	~	~
Buyout Costs			~	~	~	\$25.5M	\$25.5M	\$56.7M
Reclamation Costs			~	~	~	\$10M	\$10M	\$15.6M
Total Cost Saved			~	~	~	~	\$20M	\$21M
Flood Mitigation			~	~	~	~	\$20M	\$20M
Landscaping Improvements			~	~	~	~	~	\$1M
Net Cost			\$20M	\$20M	\$20M	\$75.5M	\$15.5M	\$51.3M
Net Cost Per Capita			\$266	\$266	\$266	\$1,006	\$207	\$684

Table 12: Waterways Cost Scale

Cost Bracket	Score	Cost Bracket	Score
< \$10 million	1	50 – 59 million	6
10 – 19 million	2	60 – 69 million	7
20 – 29 million	3	70 – 79 million	8
30 – 39 million	4	80 – 89 million	9
40 – 49 million	5	90 million +	10

Proposed Approach for Waterways

1. According to Table 10, the preferred approach is **enhanced Land Use Bylaw Provisions and Buyout Below 250m** with the opportunity for a land swap. This option sees 94 properties removed from the flood hazard area, while 68 would remain on land that is above the 1:100 flood level. This option removes the properties most at risk of flooding. The Land Use Bylaw provisions should apply to a higher flood elevation (such as the 1:200) so that new development above the 250m can be afforded a higher degree of protection from a flood event that exceeds the 1:100.
 - a. The second preferred option is a **complete buyout of all properties**. This option scored higher, but may still be considered for the following reasons (this option tied with Flood Mitigation, LUB Provisions & Limited Development below 250m, but in the event of a tie, the option that provides greater overall resilience is selected):
 - i. It is the safest solution from a life-safety perspective. If the area was not fully bought out, residents on higher land would be without road access during a future 1:100 or higher flood event (roads leading to some portions of the community are below 250m and would be inundated by floodwaters). First responders would have difficulty accessing properties and would be putting their own lives in danger if the need to access a flooded property arose.
 - ii. The RMWB may choose not to proceed with the remainder of the planned flood mitigation in Waterways, budgeted at about \$20 million. **This would offset a portion of the buyout cost.** This cost saving excludes the tie-in to the Saline Creek Secondary Egress Road. Were this egress road to also be terminated, the cost savings would rise to \$40M, as the tie-in to that road would no longer be required.
 - iii. Existing underground infrastructure has outlived its life cycle and needs to be replaced. Further, after the 2016 Horse River Wildfire, there was discussion regarding the possibility of burying overhead power lines as is commonplace in other areas of Fort McMurray. Costs for this work have not been determined.
 - iv. Existing infrastructure will not need to be continually maintained to service the remaining population. Further, a partial buyout of the community may increase servicing and maintenance costs for underground infrastructure, as the current infrastructure is designed for larger volumes and may not adequately perform with lesser volume/flows.
 - v. A patchwork of remaining houses could be avoided, along with the associated disjointed appearance.
2. The proposed policy for Waterways is partial avoidance of flood risk by removing those exposed to 1:100-year flood events from the hazard area.
3. Potential future use of the areas bought out below 250m may include parkland. This new park space could be integrated into the current riverfront parkland.
4. If a complete buyout of all properties is pursued, opportunity exists for the Municipality to establish a sizeable festival ground or park space. Further opportunity exists to incorporate historical sites commemorating the shipping, rail and industrial heritage of Waterways.

What degree of residual risk remains from overland flooding?

1. Remaining residents will still be at risk from future floods, particularly if a flood event larger than a 1:100 occurs. Risk to property above 250m remains, and those residents may still experience difficulty obtaining flood insurance.
2. Little residual risk remains if a full buyout is pursued, as people and property would not be present in the hazard area.

What was the cost of the risk reduction?

1. Achieving this risk reduction carries a net \$15.5 million cost to taxpayers. The cost to implement the preferred option is a minimum of \$35.5 million to buy out properties below 250m and remediate the area, but this is offset by cost-savings in other areas. The buyout cost is based on 2020 assessed values only, not fair market value. This figure does not include the cost of procuring land for a land swap, as this is an optional step which may or may not be pursued; it therefore does not affect the evaluation of this risk treatment.
2. The net cost to implement the second preferred option is a minimum of \$51.3 million. This also does not include the cost of procuring land for a land swap as this is an optional step.
3. Reclamation costs are estimated to be about \$10 million, but one-third (nearly \$3 million) includes grading and landscaping. The grading and landscaping costs would depend on the future use of the area and could be avoided if the area were allowed to return to its natural state.
4. Reclamation costs for the second preferred option are estimated to be about \$15.5 million, but nearly \$3 million comprises grading and landscaping. Again, these costs would depend on the future use of the area and could be avoided if it were allowed to return to its natural state.
5. Cost savings would be realized as municipal services (water, sewer, road maintenance, garbage pick-up, etc.) need not be provided in future years.

What new risks (if any) are generated by the risk treatment?

1. No known new risks are created.

Draper

Singular and combined risk treatments for Draper are shown in Table 13 below. While there is currently no plan to provide flood mitigation for this community, leaving existing homes unprotected is not consistent with the defined tolerable risk level. A rough estimate for the work was generated for evaluation purposes.

Table 13: Draper Policy Options (risk treatments and combinations)

Risk Treatments	Policy Options					
	Flood Mitigation Only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions & Limited Development below 250m	Flood Mitigation, LUB Provisions & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Flood Mitigation Strategy	X	X	X	X		
Land Use Provisions		X	X	X	X	
No new (prospective) development below 250 m			X			
Buy out / land swap all properties below 250 m				X	X	
Buy out / land swap all properties in community						X

Key Points

1. No structural flood mitigation is planned for this community.
2. Flood mitigation around built-up areas is estimated to cost \$118 million.
3. Population is 187 as of the 2018 Census and consists of 98 private properties.
4. 64 private properties (65% of the total) are below the 250m elevation, of which 34 are developed.
5. 34 private properties (35% of the total) are above the 250m elevation, of which 28 are developed.
6. 33 private properties (34%) were affected during the Horse River Wildfire, of which 9 have rebuilt (9%).

Table 14: Draper Evaluation Matrix

Evaluation Criteria		Weight	Policy Options Evaluation					
			Flood Mitigation Only	Flood Mitigation & LUB Provisions	Flood Mitigation, LUB Provisions, & Limited Development below 250m	Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap	LUB Provisions & Buyout Below 250m / Land Swap	Buyout all properties / Land Swap
Minimize Cost		4	6	6	6	9	1	1
Minimize Residual Risk	Social	1	6	5	4	2	3	1
	Built	1	6	5	4	2	3	1
	Economic	1	6	5	4	2	3	1
	Natural	1	6	5	4	3	2	1
Total Score			48	44	40	45	15	8
Total Treatment Cost			\$118M	\$118M	\$118M	\$166.8M	\$48.8M	\$76.9M
Flood Mitigation Costs			\$118M	\$118M	\$118M	\$118M	~	~
Buyout Costs			~	~	~	\$40M	\$40M	\$60.3M
Reclamation Costs			~	~	~	\$8.8M	\$8.8M	\$16.6M
Total Cost Saved			~	~	~	~	\$118M	\$150.3M
Flood Mitigation			~	~	~	~	\$118M	\$118M
Rural Water Sewer Servicing			~	~	~	~	~	\$27M
Private Service Connections			~	~	~	~	~	\$5M
Community Gathering Place			~	~	~	~	~	\$300,000
Net Cost			\$118M	\$118M	\$118M	\$166.8M	\$0.00	\$0.00
Net Cost Per Capita			\$1,573	\$1,573	\$1,573	\$2,224	\$0.00	\$0.00

Table 15: Draper Cost Scale

Cost Bracket	Score	Cost Bracket	Score
< \$20 million	1	100 – 119 million	6
20 – 39 million	2	120 – 139 million	7
40 – 59 million	3	140 – 159 million	8
60 – 79 million	4	160 – 179 million	9
80 – 99 million	5	180 – 199 million	10

Proposed Approach for Draper

1. According to Table 13, the preferred approach is a community-wide **buyout of all properties**. This option may be considered for the following reasons:
 - a) It is the safest solution from a life-safety perspective. If the area was not bought out, not only would residents be trapped during a future 1:100 or higher flood event (Draper Road would be covered by water and impassable), but first responders would have difficulty accessing properties and would be putting their own lives in danger if the need to access a flooded property arose.
 - b) While a full buyout would cost a minimum of \$60.4 million based on 2020 assessed values, the **cost would be significantly offset by the \$32 million saved by not proceeding with the Draper portion of the Rural Water Sewer Servicing project** (which will be introducing services to Draper at a cost of \$27 million, plus \$5 million for providing private connections). This cost-saving would not be realized if only the properties below 250m were bought out, as 34 remaining properties would still have to be serviced.
 - c) The buyout would also be **entirely offset by the cost savings realized by not providing flood mitigation**. It is impractical to provide property-specific protection (such as ring dykes around homes), making a berm protecting larger groups of homes the only viable option. This collection of berms carries a significant estimated cost of nearly \$118 million.
 - d) The RMWB need not proceed with a community gathering place, budgeted at \$300,000.
 - e) Draper is also characterized by homes that are built upon and near a slope with geotechnical concerns. A buyout of not only flood-hazard lands but also properties on steep slopes would eliminate more than just risks from flood, but also slope failure.
7. The proposed policy for Draper is to remove all people and property from the area thus completely avoiding the hazard, maximizing disaster risk reduction, and increasing community resilience over the long-term.
8. Potential future uses may include naturalization of the area, or pursuit of agricultural activities throughout the floodplain, as Draper is the RMWB's only source of fertile, farmable land. With residential properties no longer in the area, land use conflicts would be minimized.

What degree of residual risk remains from overland flooding?

1. Little residual risk remains, as private properties and structures have been removed from the flood hazard area. Residual risks would be limited to remediation of any low-impact uses that may be established.

What was the cost of the risk reduction?

1. Achieving this risk reduction carries no additional cost to taxpayers, owing to the cost-savings realized by not providing flood protection, and not proceeding with capital projects. This does not include the cost of procuring land for a land swap, as this is an optional step which may or may not be pursued; it therefore does not affect the evaluation of this risk treatment.
2. Reclamation costs are estimated to be about \$16 million, but a significant portion (nearly \$5 million) includes grading and landscaping. These costs would depend on the future use of the area and may not need to be accounted for if the area is allowed to return to its natural state.

What new risks (if any) are generated by the risk treatment?

1. No new risks are anticipated by buying out the area.

Appendices

Appendix A - Road to Resilience – RMWB 2020 Flood Recovery Campaign Plan

Appendix B - Taiga Nova Eco-Industrial Park & Area Community Profile

Appendix C - Downtown Community Profile

Appendix D - Ptarmigan Court Community Profile

Appendix E - Waterways Community Profile

Appendix F - Draper Community Profile

Appendix G - Extent and Status of RMWB Flood Mitigation

Road to Resilience – RMWB 2020 Flood Recovery Campaign Plan

Version 4.0 dated June 10th, 2020

Our Story

To date, 2020 is characterized by a unique combination of challenges for the residents of the Regional Municipality of Wood Buffalo (RMWB). These include:

- A collapse in global oil prices;
- State of Local Emergency (SOLE) declared for the ongoing COVID-19 pandemic; and a
- SOLE declared for the April 2020 ice jam flooding, which resulted in the evacuation of approximately 13,000 residents and damage to more than 1,200 structures.

Layered into the above is a sustained downward pressure on the regional and provincial economies as well as the enduring, historical impacts of flooding events in 1997 and 2013 coupled with the ongoing recovery from the 2016 Horse River Wildfire. These provide a backdrop of continued economic, social, and disaster risk to our region. In short, the municipality has experienced compounding and concurrent crises which have further reinforced the need for a comprehensive resilience program to foster long-term social sustainability within the region. The municipality should address the primary objectives within the Social, Built, Economic, and Natural key action areas described below to mitigate hazards that will continue to threaten the long-term viability of our region.

Campaign Plan Intent

The intent of this plan is to provide strategic, high-level guidance on a single-page, effectively orienting the reader to our community's flood recovery efforts. It creates common understanding of the disaster's impact and complexity amongst numerous stakeholders, aligns recovery efforts, supports coordination between numerous stakeholders, and highlights the need for coordinating the delivery of existing, related projects.

The plan reflects learnings from the 2016 Horse River Wildfire, historical flood events within the province, the ongoing development of the RMWB Community Resilience Strategy, and the changing policy landscape for disaster-related financial support. It is designed with the intent of positioning the RMWB to fully recover from the 2020 flood, while improving regional resilience for future generations. This Campaign Plan should be viewed in the following order:

Our Story. Describes the recent disaster and related challenges that the RMWB has experienced.

Key Action Areas. Represent logical groupings of tasks and projects identified during planning to effectively recover our community.

Primary Objectives. Describe the relevant objectives to achieve the desired outcomes.

Desired Outcomes. Represent the contributions of the four key action area towards the RMWB's goal of becoming a resilient community.

End-State. Describes how the RMWB envisions itself upon fully recovering.

Risks. Define events or conditions that could negatively affect achievement of the plan's end-state.

Key Performance Indicators. Measure progress of the flood recovery within the context of a pandemic and an oil price shock.

Recovery Principles. Proven principles to test recovery decisions and actions against.

Key Action Areas

Social

Enhance the social environment and support to regional governance:

1. Provide psycho-social support through the implementation of a robust, community-based plan focused on wellness and personal resilience.
2. Ensure residents are informed and positioned to make risk-informed decisions.
3. Enable effective engagement with First Nations and Métis partners.
4. Examine resilience strategies to reduce exposure and disaster risk for the vulnerable population.
5. Ensure all have the opportunity to actively participate in locally organized leisure, sports, and recreational activities.
6. Coordinate delivery of flood recovery with existing social sustainability endeavours.

Built

Enable effective reconstruction of our community, incorporating strategies to increase resilience:

1. Understand and address the full extent of flood damage across the RMWB.
2. Enable the insurance and banking industries, the Canadian Red Cross and all NGOs, as well as other agencies, to effectively fulfill their roles.
3. Implement an interim housing plan that supports the community through the reconstruction activities.
4. Make timely policy decisions that enable reconstruction to occur safely and efficiently.
5. Consider transformative opportunities for the RMWB from both a public safety and long-term land use perspective.
6. Consider, identify, and pursue opportunities for disaster risk reduction from an all-hazards lens, effectively mitigating known risks to our community.

Economic

Reinvigorate economic recovery and business resumption:

1. Enable businesses to recover from the consequences of the flood during the current pandemic.
3. Maximize local economic benefits of recovery operations to the RMWB business community.
4. Reaffirm and enhance government's ability to provide regional services and programs.
5. Seize economic diversification opportunities as part of recovery.
6. Coordinate the existing Downtown Revitalization and Downtown Area Redevelopment activities with flood recovery efforts.
7. Coordinate flood recovery efforts directly with the WBEDC to ensure mutually beneficial outcomes.

Natural

Assess and remediate the environmental impacts of the flood:

1. Ensure the safety of residents while promoting strong environmental stewardship.
2. Implement a process to identify, remediate, and assess the long-term health of flood-affected areas.
3. Ensure the proper disposal of waste and debris generated by the flood while seeking opportunities to capture and recycle materials.
4. Re-establish and actively promote the development of green spaces including maximizing their ability to mitigate the effects of overland flooding.
5. Seek to implement transformative opportunities during the recovery that betters the natural environment of the RMWB.

Desired Outcomes

- RMWB-promoted inclusion of First Nations and Métis partners.
- Residents were engaged and actively supported, increasing the resilience of our region.
- Flood-related health and well-being impacts were effectively mitigated.
- Recovery was guided by risk-informed decision-making.

- All flood damage was repaired or remediated.
- Residents were able to live in the RMWB during the recovery process.
- Policy decisions enabled the RMWB to build back better, thus increasing resilience.
- Disaster risk reduction strategies were fully explored and implemented.

- Regional economy displays no lasting negative impact associated with the 2020 flood and pandemic.
- Flood-related financial impacts are mitigated.
- Opportunities for regional businesses to assist in the recovery of our community were maximized.
- Support from the provincial Disaster Recovery Program was maximized.

- Environmental impacts of the 2020 flood relative to air, land, water, and biodiversity were understood and remediated.
- Opportunities to minimize the environmental impact on the region were seized during recovery.
- Innovative environmental initiatives were implemented.

End-State

The RMWB has fully recovered from the 2020 flood, which occurred during an economic downturn and the COVID-19 pandemic. Risk-informed decision-making is integrated within all related programs and processes. We are a more resilient community that has reduced disaster risk from an all-hazards lens.

Risks

- Increasing likelihood of disasters.
- Changes to the flood construction level (FCL).
- Reduction in disaster recovery funding from Federal and Provincial governments.
- Pre-disaster economic downturn and pandemic deters a full regional recovery.
- Economic investment into our region is deterred due to energy sector uncertainty.
- Ineffective communications and public engagement.
- Ineffective recovery program management.

Key Performance Indicators

- Confidence of our residents.
- Community resilience levels as compared to pre-disaster.
- Vulnerability and exposure levels.
- Health and well-being of our residents.
- Regional economic output levels.
- Long-term impact to the natural environment.
- Processing and completion of the province's disaster recovery program claims.
- Duration to achieve community recovery.

Recovery Principles

- Do no harm.
- Increase community resilience: think long-term.
- Do not set the conditions for a repeat event.
- Understand the impact, complexity, and context.
- Focus on the well-being of the community.
- Maximize existing government support programs.
- Employ a planned and adaptive approach.
- Engage stakeholders and communicate in a transparent manner.

Appendix B: Taiga Nova Eco-Industrial Park & Area

1. Total Number of Properties and Assessment:

Area	Total Number of Properties	% of Total No. of Properties	Assessed Value	% of Assessed Values
Above 250	19	20.21%	\$117,959,320.00	22.96%
Below 250	75	79.79%	\$395,787,220.00	77.04%
Taiga Nova/Total	94	100%	\$513,746,540.00	100%

2. Total Property Assessment

Sr. No.	Type	Number of Properties	Assessment Value	% of Assessment Values
1	Private	81	\$463,414,220.00	90.20%
2	Municipal	13	\$50,332,320.00	9.80%
Taiga Nova/Total		94	\$513,746,540.00	100%

3. Assessment Value for Total Number of Properties

Area	Number of Properties	% of Total No. of Properties	Assessment Value	Total
Private Properties				
Above 250m	15	18.52%	\$112,935,160.00	
Below 250m	66	81.48%	\$350,479,060.00	
Total	81	100.00%	\$463,414,220.00	\$463,414,220.00
Municipal Properties				
Above 250	4	30.77%	\$5,024,160.00	
Below 250	9	69.23%	\$45,308,160.00	
Total	13	100.00%	\$50,332,320.00	\$50,332,320.00
Taiga Nova Total	94			\$513,746,540.00

4. Total Flood Affected Private Properties:

Area	Total Number of properties	Number of Flood Affected Properties	% of Affected Properties in Taiga Nova
Private Properties			
Above 250	15	0	0.00%
Below 250	66	42	51.85%
Total	81	42	51.85%
Municipal Properties			
Above 250	4	0	0.00%
Below 250	9	9	69.23%
Total	13	9	69.23%
Taiga Nova/Total	94	51	54.26%

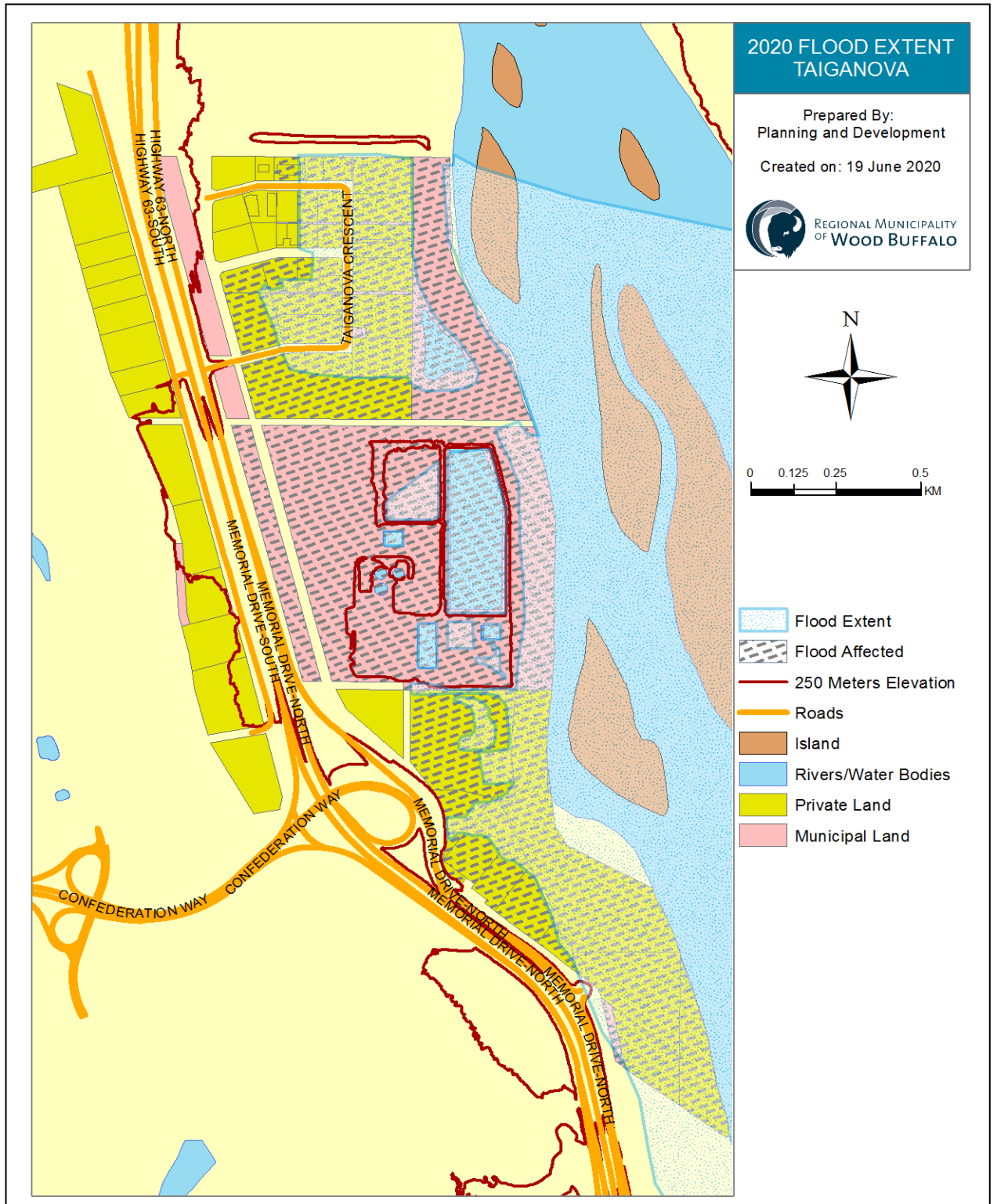
5. Total Flood Affected Private Properties and Assessment:

Area	Total Number of Properties Affected by Flood	% of Total No. of Properties affected by Flood	Assessed Value	% of Assessed Values
Above 250	0	0.00%	0	0.00%
Below 250	42	100.00%	\$256,479,580.00	100.00%
Taiga Nova/Total	42	100.00%	\$256,479,580.00	100.00%

6. Number of Businesses Affected by Flood:

Area	Total Number of Businesses	% of Businesses	Total Number of Businesses Affected by Flood	% of Businesses Affected by Flood	Total Employees (Pre-Flood)	Total Employees (Post-Flood)
Above 250	15	23.08	0	0%	0	0
Below 250	50	76.92	35	53.85 % (of total 65 Business)	692	605
Taiga Nova/Total	65	100.00	35	53.85 % (100% of affected businesses)	692	605

FLOOD EXTENT MAP FOR TAIGA NOVA



Appendix C: Downtown

1. Demography:

Details	Municipal Census 2015	Municipal Census 2018
Population	11703	10993
No. of dwellings	5036	5017

2. Total Number of Properties and Assessment:

Area	Total Number of Properties	Assessed Value	Number of Private Properties Affected by Flood	Assessed Value for Private Properties Affected by Flood
Private Properties				
Above 250	1857	\$ 633,359,070.00	44	\$ 7,528,360.00
Below 250	4374	\$ 1,275,169,860.00	2582	\$ 831,062,750.00
Total Private Properties	6231	\$ 1,908,528,930.00	2626	\$ 838,591,110.00
Properties without Classification*	5	\$ 2,451,890.00	0	0
Municipal Properties				
Above 250	247	\$ 75,427,310.00	0	0
Below 250	184	\$ 207,311,120.00	127	\$ 170,565,290.00
Total Municipal Properties	431	\$ 282,738,430.00	127	\$ 170,565,290.00
Downtown/Total	6667	\$ 2,193,719,250.00	2753	\$ 1,009,156,400.00

Note: * - 5 properties are without classification

3. Total Number of Private Properties and Assessment:

Area	Total Number of Properties	% of Total No. of Properties	Assessed Value	% of Assessed Values
Above 250	1857	29.80%	\$ 633,359,070.00	33.19%
Below 250	4374	70.20%	\$ 1,275,169,860.00	66.81%
Downtown/Total	6231	100%	\$ 1,908,528,930.00	100%

4. Total Flood Affected Properties and Area:

Area	Total Number of properties	Number of Flood Affected Properties	% of Affected Properties in Downtown	Total Downtown Area (Ha)	Total Flood Affected Area (Ha)	% of Flood Affected Area in Downtown
Above 250	1857	44	0.71 %	166	0	0.00 %
Below 250	4374	2582	41.44 %	471	342	53.69 %
Downtown/Total	6231	2626	42.14 %	637	342	53.69 %

5. Total Flood Affected Properties and Assessment:

Area	Total Number of Properties Affected by Flood	% of Total No. of Properties affected by Flood	Assessed Value	% of Assessed Values
Above 250	44	1.68 %	\$ 7,528,360	0.90 %
Below 250	2582	98.32 %	\$ 831,062,750	99.10 %
Downtown/Total	2626	100.00 %	\$ 838,591,110	100.00 %

6. Type of Residential Classification:

Area	Total	Type of Residential Properties Affected by Flood					
		Single Detached Dwelling	Manufactured Home/Mobile	Semi-detached/Duplex	Multiplex (fourplex, triplex)	Townhome/Row Housing	Apartment/Condo
Above 250	24	0	0	0	0	0	24
Below 250	1811	187	3	87	3	263	1268
Downtown/Total	1835	187	3	87	3	263	1292

Note: - Out of Total 6667 properties, Typology Data for flood affected properties is only available for 1391 properties.

Note: - Additional 444 flood affected apartment/condo properties were identified through desktop analysis.

7. Number of Flood Affected Multifamily and Mixed-Use Properties:

Area	Total number of Multifamily Residential and Mixed-Use Buildings	Total Number of Multifamily Residential Buildings	Total number of Multifamily Mixed-Use Buildings	Number of Residential Units in Multifamily and Mixed-Use Buildings Affected by Flood (Apartment/Condo)		Total Number Residential Units in Multifamily and Mixed-Use Buildings Affected by Flood (Apartment/Condo)
				Residential	Mixed Use	
Above 250	1	1	0	24	0	24
Below 250	22	11	11	550	718	1268
Downtown/Total	23	12	11	574	718	1292

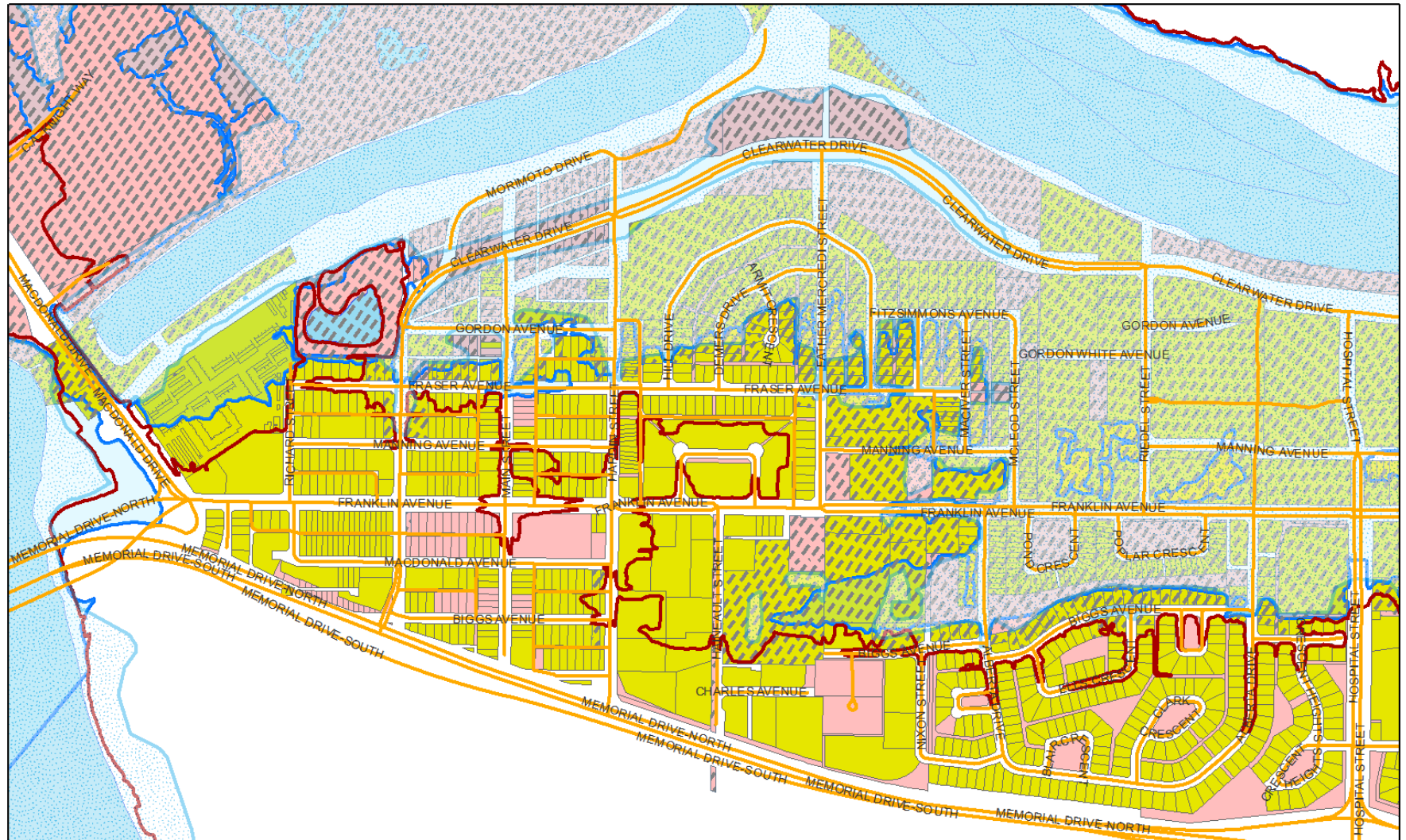
8. Number of Businesses Affected by Flood:

Area	Total Number of Businesses	% of Businesses	Total Number of Businesses Affected by Flood	% of Businesses Affected by Flood	Type of Businesses Affected by Flood		
					Commercial	Home Business	Home Occupation
Above 250	160	29.3%	0	0%	0	0	0
Below 250	386	70.7%	229	41.94% (of total 546 Business)	191 (83%)	2 (1%)	36 (16%)
Downtown/Total	546	100%	229	41.94% (100% of affected businesses)	191 (83%)	2 (1%)	36 (16%)

9. Overall Assessment Value of Flood Affected Areas:

Area	(A) Total Number of Properties Affected by Flood	Type		Assessed Value			Per Capita Cost	
		(B) Residential	(C) Commercial	(D) Residential	(E) Commercial	(F=D+E) Total Cost	(D/B) Residential	(E/C) Commercial
Above 250	44 (1.68%)	44 (1.68%)	0	7,528,360.00 (0.90%)	0	7,528,360.00 (0.90%)	171,099	0
Below 250	2582 (98.32%)	2289 (87.17%)	293 (11.16%)	436,914,140.00 (52.10%)	394,148,610.00 (47.10%)	831,062,750.00 (99.10%)	190,876	1,345,217
Downtown/Total	2626 (100%)	2333 (88.84%)	293 (11.16%)	444,442,500.00 (53.00%)	394,148,610.00 (47.10%)	838,591,110.00 (100%)	190,503	1,345,217

FLOOD EXTENT MAP FOR DOWNTOWN WEST



- | | |
|----------------------|----------------|
| Flood Extent | Roads |
| Flood Affected | Rivers |
| 250 Meters Elevation | Private Land |
| Flood Ways | Municipal Land |



0 0.125 0.25 0.5
KM

2020 FLOOD EXTENT DOWNTOWN

Prepared By: Planning and Development

Created on: 08 June 2020



REGIONAL MUNICIPALITY
OF WOOD BUFFALO

FLOOD EXTENT MAP FOR DOWNTOWN



- | | |
|----------------------|----------------|
| Flood Extent | Roads |
| Flood Affected | Rivers |
| 250 Meters Elevation | Private Land |
| Flood Ways | Municipal Land |



0 0.125 0.25 0.5
KM

2020 FLOOD EXTENT DOWNTOWN

Prepared By: Planning and Development

Created on: 08 June 2020

Appendix D: Ptarmigan Court

1. Demography:

Details	Municipal Census 2015	Municipal Census 2018
Population	667*	232*

Note: * - Total population for Ptarmigan Court is embedded within Waterways census data so exact population cannot be determined.

2. General: Wildfire/Flood affected:

Sr. No.	Task	Total
1	Total Properties Analysed	80 (100%)
2	Total Private Properties	69 (86%)
3	Total Municipal Properties	11 (14%)
4	Wildfire unaffected (Empty Lots + developed)	29 (36%)
5	Wildfire affected	51 (64%)
6	Total No. of rebuilds from wildfire affected	33 (41%)
7	Total No. of properties signed agreements out of Total Rebuilds	21 (26%)
8	Waivers registered for signed agreements on Titles	0
9	Waiver Added in DP Condition	4 (5%)
10	Change in Ownership for Waiver signed properties since Rebuilt	1 (1%)
11	Flood Effected (Private Properties)	59 (74%)

3. Property Assessment:

Private Properties in Ptarmigan Court				Assessment Value
Details	Developed	Vacant	Total	
Total Private Properties	49 (71%)	20 (29%)	69 (100%)	13,999,980
Below 250 mt. contour level	49 (71%)	19 (28%)	68 (99%)	13,930,600
Above 250 mt. contour level	0	1 (1%)	1 (1%)	69,380
Properties Affected by Wildfire 2016	33 (48%)	18 (26%)	51 (74%)	10,572,530
Below 250 mt. contour level	33 (48%)	18 (26%)	51 (74%)	10,572,530
Above 250 mt. contour level	0	0	0	0
Rebuilt	33 (48%)	0 (0%)	33 (48%)	9,246,650
Below 250 mt. contour level	33 (48%)	0 (0%)	33 (48%)	9,246,650
Above 250 mt. contour level	0	0	0	0
Properties Affected by Flood 2020	41 (59%)	18 (26%)	59 (86%)	11,810,430
Below 250 mt. contour level	41 (59%)	18 (26%)	59 (86%)	11,810,430
Above 250 mt. contour level	0	0	0	0

Note: All % values are in reference of no. of total properties.

4. Total Property Assessment:

Sr No.	Type	Status	Assessment Value	Total Assessment Value
1	Private	Undeveloped	1,734,860	13,999,980
		Developed	12,265,120	
2	Municipal		300,510	300,510
	Grand Total Assessment Value			14,300,490

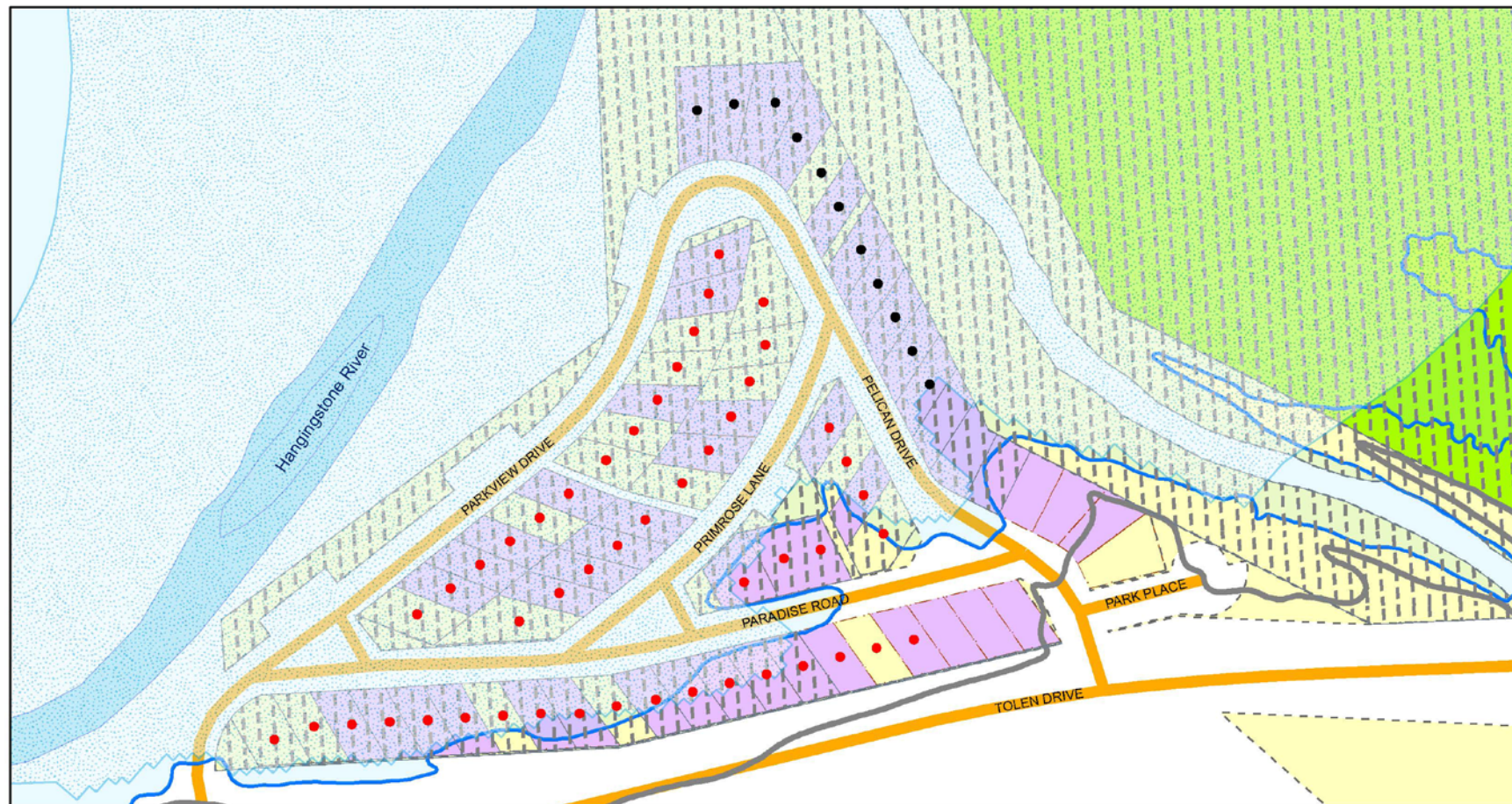
Reclamation Cost for Properties Below 250M Contour:

Sr. No	Item	Description	Quantity	Unit Measurement	Unit Rate	Total Cost
1	Mobile Demo	Mobile removal and disposal	49	each	\$15,000.00	\$735,000.00
2	Cut and Cap	Deep utility cut and capping at property line (Water and Sewer)	49	each	\$20,000.00	\$980,000.00
3	Pavement Structure Removal and Dispose	Removal of roadway pavement and base	11,960	sq.m	\$60.00	\$717,600.00
4	Grading/Contouring	Levelling lots post demo, and landscaping	147,000	sq.m	\$20.00	\$2,940,000.00
	Total					\$5,372,600.00
	Engineering Fees	10%				\$537,260.00
	Contingency	35%				\$1,880,410.00
(D)	GRAND TOTAL					\$7,790,270.00

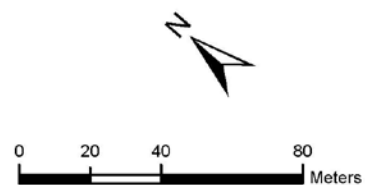
5. Average Assessment for Private Properties Below 250M Contour Level:

(A) Status	(B) Number of Properties	(C) Assessment Value	(D) Reclamation Cost	(C+D=E) Total Value	(E/B) Average Per Capita Value
Developed	49	\$12,265,120.00	\$7,790,270.00	\$20,055,390.00	\$409,293.67
Undeveloped	19	\$1,665,480.00	\$0.00	\$1,665,480.00	\$87,656.84
Total	68	\$13,930,600.00		\$21,720,870.00	\$319,424.55

FLOOD EXTENT MAP FOR PTARMIGAN COURT



- | | |
|-----------------------------|-------------------------|
| ● Destroyed (Wildfire) | ■ Rivers |
| ● Restricted Use (Wildfire) | ■ Roads |
| ● Unsafe (Wildfire) | ■ Municipal Land |
| ■ Flood Extent | ■ Private Land |
| ■ Flood Affected | ■ Developed Land |
| — 250 Meters Elevation | ■ Open-Space/Recreation |
| ■ Flood Way | ■ Vacant Land |



2020 FLOOD EXTENT PTARMIGAN COURT

Prepared By: Planning and Development

Created on: 22 May 2020



6. Reclamation Cost for Private Properties in Ptarmigan Court:

Sr. No	Item	Description	Quantity	Unit Measurement	Unit Rate	Total Cost
1	Mobile Demo	Mobile removal and disposal	49	each	\$15,000.00	\$735,000.00
2	Cut and Cap	Deep utility cut and capping at property line (Water and Sewer)	49	each	\$20,000.00	\$980,000.00
3	Pavement Structure Removal and Dispose	Removal of roadway pavement and base	11,960	sq.m	\$60.00	\$717,600.00
4	Grading/Contouring	Levelling lots post demo, and landscaping	147,000	sq.m	\$20.00	\$2,940,000.00
	Total					\$5,372,600.00
	Engineering Fees	10%				\$537,260.00
	Contingency	35%				\$1,880,410.00
(D)	GRAND TOTAL					\$7,790,270.00

7. Average Assessment for Private Properties in Ptarmigan Court:

(A) Status	(B) Number of Properties	(C) Assessment Value	(D) Reclamation Cost	(C+D=E) Total Value	(E/B) Average Per Capita Value
Developed	49	\$12,265,120.00	\$7,790,270.00	\$20,055,390.00	\$409,293.67
Undeveloped	20	\$1,734,860.00	\$0.00	\$1,734,860.00	\$86,743.00
Total	69	\$13,999,980.00		\$21,790,250.00	\$315,800.72

Appendix E: Waterways

1. Demography:

Details	Municipal Census 2015	Municipal Census 2018
Population	667*	232*

Note: * - Exact population of Waterways cannot be determined as the census data includes Ptarmigan Court.

2. General: Wildfire/Flood affected:

Sr. No.	Task	Total
1	Total Properties Analysed	224 (100%)
2	Total Private Properties	162 (72%)
3	Total Municipal Properties	62 (27%)
4	Wildfire unaffected (Empty Lots + developed)	55 (25%)
5	Wildfire affected	169 (75%)
6	Total No. of rebuilds from wildfire affected	73 (33%)
7	Total No. of properties signed agreements out of Total Rebuilds	16 (7%)
8	Waivers registered for signed agreements on Titles	0
9	Waiver Added in DP Condition	14 (6%)
10	Change in ownership for Waiver signed properties since Rebuilt	2 (1%)
11	Flood Effected	64 (29%)

3. Property Assessment:

Private Properties in Waterways Neighborhood				Assessment value
Details	Developed	Vacant	Total	
Total Private Properties	91 (56%)	71 (44%)	162 (100%)	56,745,040
Below 250 mt. contour level	43 (27%)	51 (31%)	94 (48%)	25,505,190
Above 250 mt. contour level	48 (30%)	20 (12%)	68 (42%)	31,239,850
Properties Affected by Wildfire 2016	77 (48%)	68 (42%)	145 (90%)	50,781,330
Below 250 mt. contour level	29 (18%)	48 (30%)	77 (48%)	19,541,480
Above 250 mt. contour level	48 (48%)	20 (12%)	68 (42%)	31,239,850
Rebuilt	73 (45%)	0	73 (45%)	38,617,000
Below 250 mt. contour level	28 (17%)	0	28 (17%)	13,068,930
Above 250 mt. contour level	45 (28%)	0	45 (28%)	25,548,070
Properties Affected by Flood 2020	32 (20%)	32 (20%)	64 (40%)	18,397,830
Below 250 mt. contour level	32 (20%)	32 (20%)	64 (40%)	18,397,830
Above 250 mt. contour level	0	0	0	0

Note: All % values are in reference of no. of total properties.

4. Total Property Assessment:

Sr. No.	Type	Status	Assessment Value	Total Assessment Value
1	Private	Undeveloped	10,053,610	56,745,040
		Developed	46,691,430	
2	Municipal		13,915,310	13,915,310
Grand Total Assessment Value				70,660,350

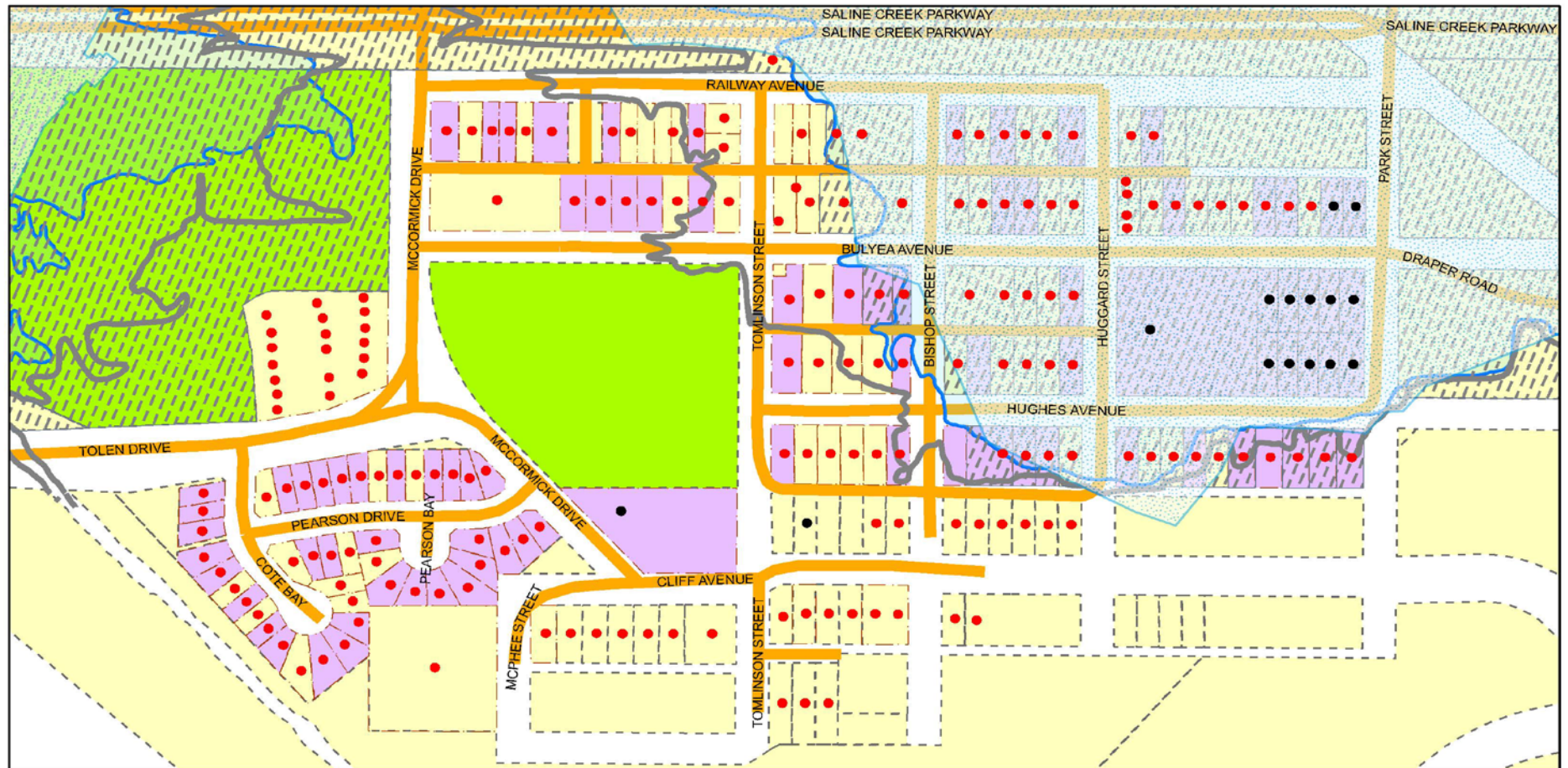
5. Reclamation Cost for Properties Below 250M Contour:

Sr. No	Item	Description	Quantity	Unit Measurement	Unit Rate	Total Cost
1	House Demo	House removal and disposal	38	each	\$60,000.00	\$2,280,000.00
2	Accessory/Building	Removal of accessory building	5	each	\$20,000.00	\$100,000.00
3	Cut and cap	Deep utility cut and capping at property line (Water and Sewer)	42	each	\$20,000.00	\$840,000.00
4		Cut and Cap for commercial at property line (Water and Sewer)	1	each	\$30,000.00	\$30,000.00
5	Pavement Structure Remove and Dispose	Removal of roadway pavement and base	14,000	sq.m	\$60.00	\$840,000.00
6	*Grading/Contouring	Levelling lots post demo and landscaping	141,000	sq.m	\$20.00	\$2,820,000.00
	TOTAL					\$6,910,000.00
	Engineering Fees	10%				\$691,000.00
	Contingency	10%				\$2,418,500.00
(D)	GRAND TOTAL					\$10,019,500.00

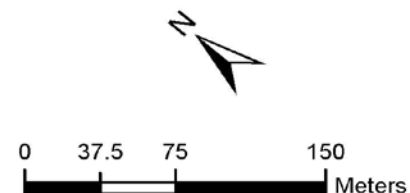
6. Average Assessment for Private Properties Below 250M Contour Level:

(A) Status	(B) Number of Properties	(C) Assessment Value	(D) Reclamation Cost	(C+D=E) Total Value	(E/B) Average Per Capita Value
Developed	43	\$19,284,330.00	\$10,019,500.00	\$29,303,830.00	\$681,484.42
Undeveloped	51	\$6,220,860.00	\$0.00	\$6,220,860.00	\$121,977.65
Total	94	\$25,505,190.00		\$35,524,690.00	\$377,922.23

FLOOD EXTENT MAP FOR WATERWAYS



- | | |
|-----------------------------|-----------------------|
| ● Destroyed (Wildfire) | — Roads |
| ● Restricted Use (Wildfire) | - - - Municipal Land |
| ● Unsafe (Wildfire) | - - - Private Land |
| Flood Extent | Developed Land |
| Flood Affected | Open-Space/Recreation |
| — 250 Meters Elevation | Vacant Land |
| Flood Way | |



2020 FLOOD EXTENT WATERWAYS

Prepared By: Planning and Development

Created on: 22 May 2020



7. Reclamation Cost for Private Properties in Waterways:

Sr. No	Item	Description	Quantity	Unit Measurement	Unit Rate	Total Cost
1	House Demo	House removal and disposal	86	each	\$60,000.00	\$5,160,000.00
2	Accessory/Building	Removal of accessory building	5	each	\$20,000.00	\$100,000.00
3	Cut and cap	Deep utility cut and capping at property line (Water and Sewer)	90	each	\$20,000.00	\$1,800,000.00
4		Cut and Cap for commercial at property line (Water and Sewer)	1	each	\$30,000.00	\$30,000.00
5	Pavement Structure Remove and Dispose	Removal of roadway pavement and base	14,000	sq.m	\$60.00	\$840,000.00
6	*Grading/Contouring	Levelling lots post demo and landscaping	141,000	sq.m	\$20.00	\$2,820,000.00
	TOTAL					\$10,750,000.00
	Engineering Fees	10%				\$1,075,000.00
	Contingency	10%				\$3,762,500.00
(D)	GRAND TOTAL					\$15,587,500.00

8. Average Assessment for Private Properties in Waterways:

(A) Status	(B) Number of Properties	(C) Assessment Value	(D) Reclamation Cost	(C+D=E) Total Value	(E/B) Average Per Capita Value
Developed	91	\$46,691,430.00	\$15,587,500.00	\$62,278,930.00	\$684,383.85
Undeveloped	71	\$10,053,610.00	\$0.00	\$10,053,610.00	\$141,600.14
Total	162	\$56,745,040.00		\$72,332,540.00	\$446,497.16

Appendix F: Draper

1. Demography:

Details	Municipal Census 2015	Municipal Census 2018
Population	215	187
No. of dwellings	64	57

2. General: Wildfire/Flood affected:

Sr. No	Task	Total
1	Total Properties Analysed	98 (100%)
2	Wildfire unaffected (Empty Lots + developed)	65 (66%)
3	Wildfire affected	33 (34%)
4	Total No. of rebuilt after wildfire 2016	9 (9%)
5	Flood Effectuated	51 (52%)

3. Property Assessment:

Private Properties in Draper Neighborhood				Assessment value
Details	Developed	Vacant	Total	
Total Private Properties	62 (63%)	36 (37%)	98 (100%)	60,304,000
Below 250 mt. contour level	34 (35%)	30 (31%)	64 (65%)	39,934,590
Above 250 mt. contour level	28 (29%)	6 (6%)	34 (35%)	20,369,410
Properties Affected by Wildfire 2016	24 (24%)	9 (9%)	33 (34%)	25,216,710
Below 250 mt. contour level	14 (14%)	7 (7%)	21 (21%)	17,130,010
Above 250 mt. contour level	10 (10%)	2 (2%)	12 (12%)	8,086,700
Rebuilt	9 (9%)	N/A	9 (9%)	9,039,390
Below 250 mt. contour level	7 (7%)	N/A	7 (7%)	7,320,240
Above 250 mt. contour level	2 (2%)	N/A	2 (2%)	1,719,150
Properties Affected by Flood 2020	19 (19%)	32 (33%)	51 (52%)	31,413,760
Below 250 mt. contour level	19 (19%)	31 (32%)	50 (51%)	30,317,630
Above 250 mt. contour level	0 (0%)	1 (1%)	1 (1%)	1,096,130

Note: All % values are in reference of no. of total properties.

4. Total Property Assessment:

Sr No.	Type	Status	Assessment Value	Total Assessment Value
1	Private	Undeveloped	15,797,630	60,304,000
		Developed	44,506,370	
	Grand Total Assessment Value			60,304,000

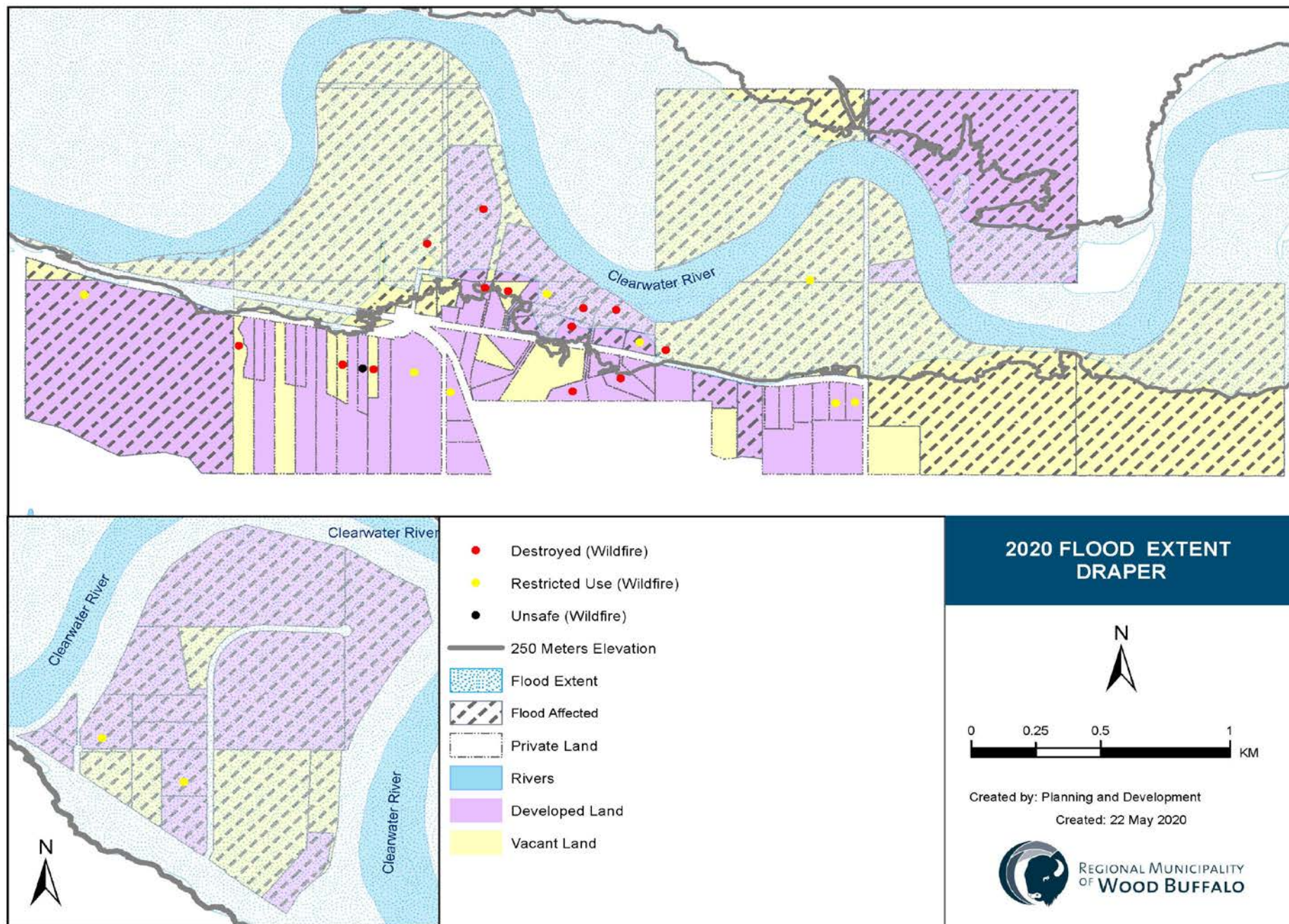
5. Reclamation Cost for Properties Below 250M Contour:

Sr. No	Item	Description	Quantity	Unit Measurement	Unit Rate	Total Cost
1	House Demo	House removal and disposal	34	each	120,000.00	4,080,000
2	Accessory/Building	Removal of accessory building	34	each	15,000.00	510,000
3	Cut and cap	Deep utility cut and capping at property line (Water and Sewer)	0	each	20,000.00	0.00
4		Cut and Cap for commercial at property line (Water and Sewer)	0	each	30,000.00	0.00
5	*Grading/Contouring	Levelling lots post demo and landscaping	136,000	sq.m	20.00	2,720,000
	TOTAL					7,310,000.00
	Engineering Fees	10%				731,000.00
	Contingency	10%				731,000.00
(D)	GRAND TOTAL					8,772,000.00

6. Average Assessment for Private Properties Below 250M Contour Level:

(A) Status	(B) Number of Properties	(C) Assessment Value	(D) Reclamation Cost	(C+D=E) Total Value	(E/B) Average Per Capita Value
Developed	34	\$26,935,290.00	\$8,772,000.00	\$35,707,290.00	\$1,050,214.41
Undeveloped	30	\$12,999,300.00	\$0.00	\$12,999,300.00	\$433,310.00
Total	64	\$39,934,590.00		\$48,706,590.00	\$761,040.47

FLOOD EXTENT MAP FOR DRAPER



7. Reclamation Cost for Private Properties in Draper:

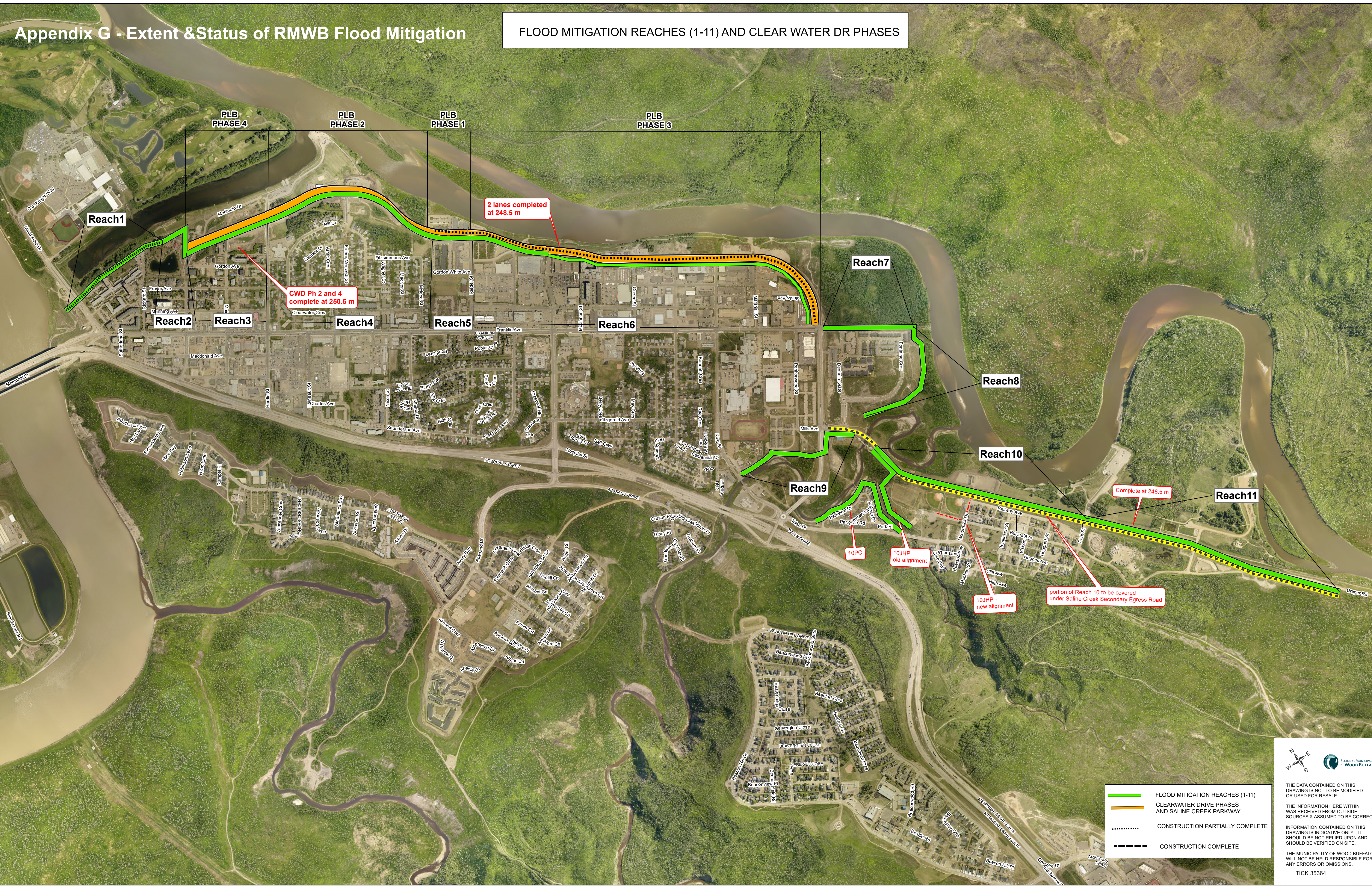
Sr. No	Item	Description	Quantity	Unit Measurement	Unit Rate	Total Cost
1	House Demo	House removal and disposal	62	each	\$120,000.00	\$7,440,000.00
2	Accessory/Building	Removal of accessory building	62	each	\$15,000.00	\$930,000.00
3	Cut and cap	Deep utility cut and capping at property line (Water and Sewer)	0	each	\$20,000.00	\$0.00
4		Cut and Cap for commercial at property line (Water and Sewer)	0	each	\$30,000.00	\$0.00
5	*Grading/Contouring	Levelling lots post demo and landscaping	248,000	sq.m	\$20.00	\$4,960,000.00
	TOTAL					\$13,330,000.00
	Engineering Fees	10%				\$1,333,000.00
	Contingency	10%				\$1,333,000.00
(D)	GRAND TOTAL					\$15,996,000.00

8. Average Assessment for Private Properties in Draper:

(A) Status	(B) Number of Properties	(C) Assessment Value	(D) Reclamation Cost	(C+D=E) Total Value	(E/B) Average Per Capita Value
Developed	62	\$45,602,500.00	\$15,996,000.00	\$61,598,500.00	\$993,524.19
Undeveloped	36	\$14,701,500.00	\$0.00	\$14,701,500.00	\$408,375.00
Total	98	\$60,304,000.00	\$15,996,000.00	\$76,300,000.00	\$778,571.43

Appendix G - Extent &Status of RMWB Flood Mitigation

FLOOD MITIGATION REACHES (1-11) AND CLEAR WATER DR PHASES



FLOOD MITIGATION REACHES (1-11)

CLEARWATER DRIVE PHASES AND SALINE CREEK PARKWAY

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CONSTRUCTION PARTIALLY COMPLETE

CONSTRUCTION COMPLETE

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