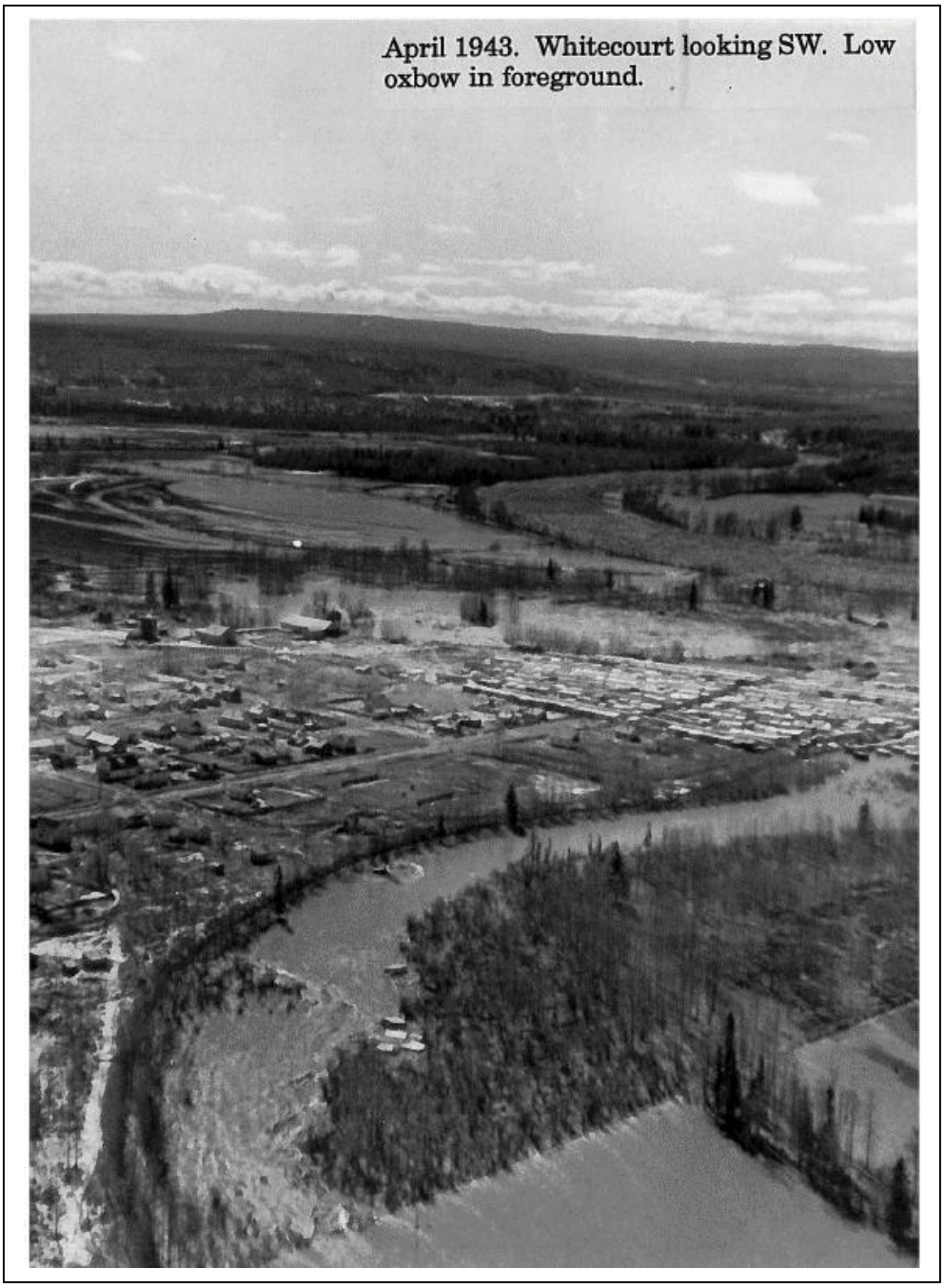
Town of Whitecourt
Flood Mitigation Projects for Infrastructure Protection Report



May 2024

Description

The primary purpose of the report is to identify projects that may be eligible for funding through the Alberta Drought and Flood Protection Program (DFPP), a provincial government grant program intended to mitigate the impact of floods and droughts on communities. The report identifies municipal infrastructure that is affected by flooding and could be protected by mitigation actions.

This report focuses on protection of public infrastructure to allow it to continue operating or minimize disruptions in the event of disastrous flooding. Some private property may share in the benefits of infrastructure protection; however, this is a secondary consideration.

Whitecourt has incurred costs to address flooding, land movement, wildfires, and wind damage. Flooding is the disaster considered in this report as the community has a significant history of flood events, as recent as 2023 when 1:100 Open Water Flooding affected private and public property.

Grant Program

The Provincial Government has established the DFPP to support communities in the development of long-term resilience, while supporting integrated planning and healthy, functioning watersheds. The program will distribute $125 million over a five-year period, starting in 2024. The DFPP contribution to municipal projects will be up to 70% of the project cost, with a maximum project value of $ 10 million.

The objectives of the DFPP are to:

- Foster a culture of resilience by empowering communities to develop proactive plans and providing the resources to manage the most pressing and impactful issues.
- Empower Alberta communities to champion drought and flood mitigation measures that promote resilient communities.
- Promote resilience by investing in the design and implementation of projects that minimize risks and impacts to critical infrastructure from droughts and flooding and help to ensure public safety is protected

The projects identified in this report are intended to strengthen the resilience of at risk infrastructure against failure due to floods that could result in:

- threats to health and safety;
- threats to critical infrastructure, including interruptions in essential services;
- significant disruptions in economic activity; and/or
- high costs for recovery and replacement

Eligible projects under the DFPP includes a category of Critical Infrastructure Protection. The identified projects include modification and reinforcement of existing infrastructure to protect critical facilities and their access.

Approach

This report considers the potential of flood events occurring that would affect the Town's ability to provide services to residents and the consequences of these events. It presents potential infrastructure solutions to mitigate the situations. The Town of *Whitecourt Flood Mitigation Plan* (2020, with 2022 updates) is a primary resource for this report, supplemented by the Province's *Flood Hazard Identification Study of the McLeod and Athabasca Rivers*.

The *Flood Mitigation Plan* evaluated the risks and costs of flooding in Whitecourt, and provided recommendations to reduce flood damages. The Plan estimates that the Average Annual Damage (AAD) due to flooding is $1,395,000, predominantly due to damages expected from ice jam floods ($1,001,000 AAD). The plan evaluated the cost of protecting areas against the values being protected, and proposed a series of dikes that would protect the McLeod Industrial Area, the land north of Highway 43 east of the McLeod (Quality Inn and land to the east, Millar Western

site, Rotary Park), at an estimated cost of between $ 4.2 and $ 17.1 million. Riverside Mobile Home Park and Stratton Industrial Area were not considered cost effective to protect. The proposed dikes would protect the Town's infrastructure and private property. More detailed study and engineering is required before a project of this scale can be reasonably evaluated. With three exceptions, diking projects have not been included in this report.

The Plan also identified other impacts of flooding that could affect the operations of the Town. These impacts have the potential to significantly affect residents and property that are not within flooded areas, but are reliant on infrastructure that may be damaged by flooding**.** The interruption of municipal services and economic costs of lost business are identified as issues.

Infrastructure that would be exposed to flood hazards was identified, evaluated for the risk and consequence of a flood, and mitigation options identified. The cost of mitigation options was estimated, using recent construction costs, with professional fees and contingencies added. As the projects are at a very preliminary stage, a contingency of 30% is used in this report.

Projects

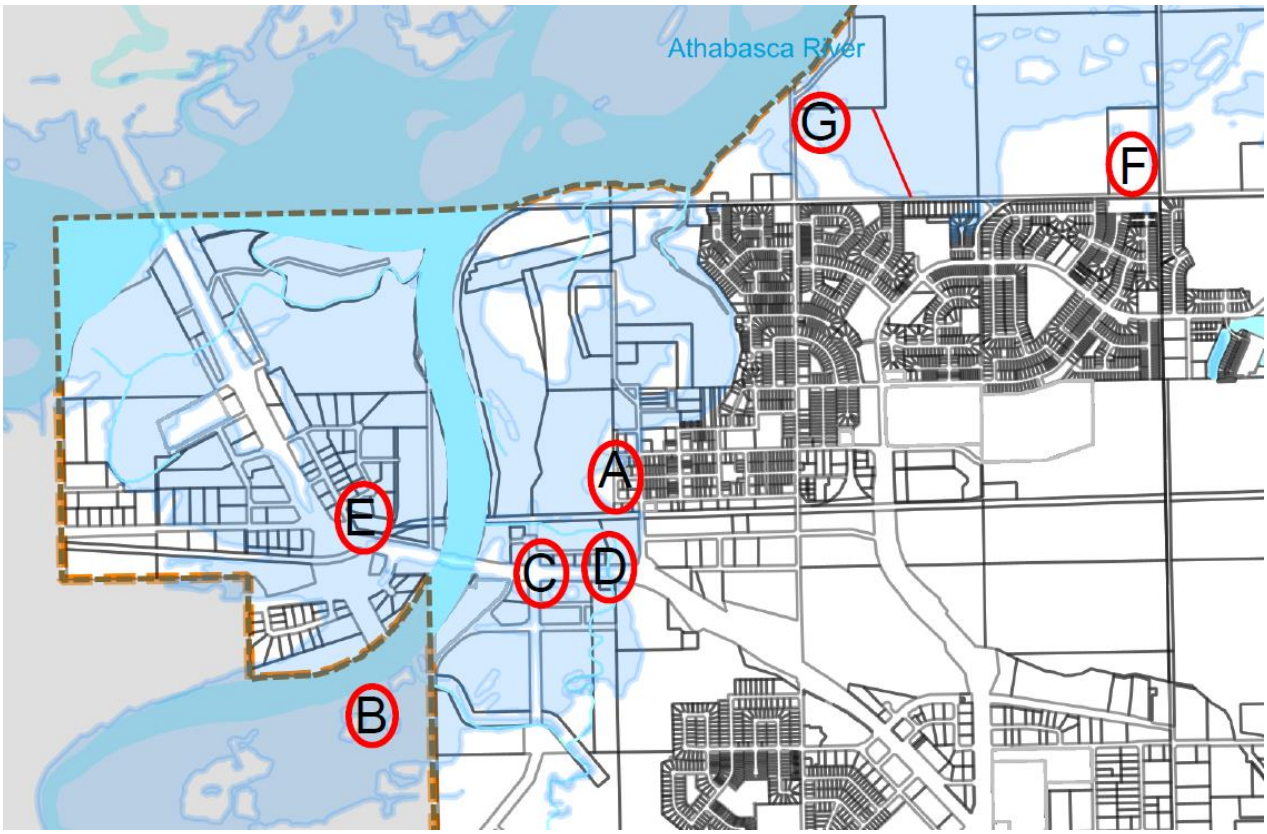
We have identified seven projects to protect public infrastructure that may be eligible for grant funding, and provided summary evaluations for each.

The projects protect critical infrastructure to allow the Town to maintain service delivery in the event of flooding to the design flood level. These projects provide protection to 0.3m above the design flood level (100 Year Ice Jam Flood for the McLeod River, 100 Year Open Water Flood for the Athabasca River), to provide freeboard and protection from ice damage. They are listed below in order of priority with regard to the consequences of a flood at the design level.

A. Fire Hall Flood Protection
B. Water Intake flood protection
C. Water Treatment Plant and Ambulance Facility Access Flood Protection
D. Lower Town Sanitary Manhole Flood Protection
E. West Whitecourt Sewer Lift Station Flood Protection
F. Sewer Plant Access and Inlets Flood Protection
G. Natural Gas Gate Station 47th Street North

In addition to the floods affecting municipal infrastructure, flooding of Highways #32 and #43 was reviewed. As these roads are Provincial infrastructure, the issues were presented to Alberta Transportation (ATEC) for consideration.

Project Locations



A. Fire Hall Flood Protection

Situation

The Fire Hall is located at the intersection of 51st Street and 52nd Avenue. It is the administration, communication, and operations base for fire and rescue emergency response for Whitecourt and the surrounding area in Woodlands County. It is located in the flood hazard area of McLeod River ice jams.

The design flood level at this location is 0.25m above the floor level of the equipment bays, and 0.9m above the access to 51st Street. The facility would not be accessible or functional during a flood, requiring the relocation of equipment and operations before the flood level is reached. The equipment bays would not be damaged, however the communication, training and administration areas on the lower level would be destroyed, requiring relocation of operations for an extended period.

	Elevation	Flood Exposure
Design Flood (Ice Jam)	694.5m (Alberta Environment)	
Fire Hall Bay Floor	694.25m (survey)	0.25m
51st Street at Bay 2 Access	693.6m (LiDAR)	0.9m
51st Street at Volunteer Parking Access	693.3m (LiDAR)	1.2m

Risk and Consequence

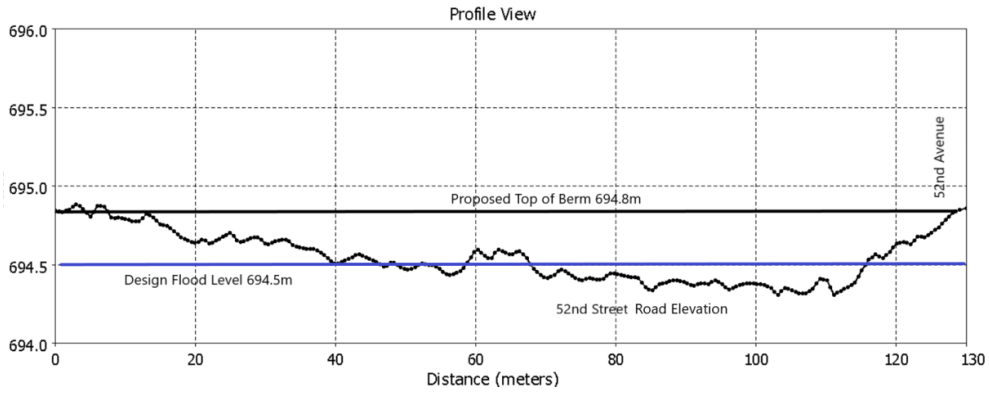
The flood risk at this site is rated at 1:100. At this location, the 1:100 Ice Jam Flood Level is 0.6m above the 1:500 Open Water Flood Level. The risk of this site being damaged is high, with operations interrupted during and after a major flood event.

Shutdown of this facility will affect emergency services to the Town and County, with a population of over 14,000. The consequences of the facility being out of service are high.

Mitigation Options

a. A flood wall around the building with flood gates closed during major events would protect the facility from damage, however relocation of operations would be required for the duration of the flood.
b. Low level berming could be constructed in the boulevard west of 52nd Street, south of 52nd Avenue, to protect from flows crossing the mill site. The berm would extend from the Canfor Office north to the raised land within the mill site

Option B Berming Profile



Cost

a. Flood Wall and Gates (130m, 0.75m high) $ 650,000
b. Berming to design flood level plus 0.3m $33,304.

B. Water Intake Flood Protection

Situation

The Raw Water Intake and Pumphouse, located on the east bank of the McLeod River south of the creek diversion, supplies untreated water to the Town's treatment plant and Millar Western's mill site. Interruption of its operation results in the shut down of the treatment plant and shut down of the pulp mill. In the event of a raw water service interruption, reservoirs can supply 7000 cubic metres of treated water (about 22 hours at peak demand, 42 hours' low demand) while maintaining the required reserve supply for firefighting. A service interruption greater than 22 hours requires the Town to have water hauled by truck from nearby communities to continue the support of fire protection and domestic use.

The intake site is about 0.27m below the 1:100 ice jam flood level. Ice jam flooding will result in ice blocks being forced against the intake structure, onto the site, and against the building. Damage to the intake and building would render the pumphouse inoperable until repaired. Flooding of the site would interrupt the power supply, shutting the system down. Flooding into the building would result in pump shutdowns.

The access road to the intake site is below the 1:100 ice jam flood level. Operating the facility requires that staff have access to the site at all times. Flooding of the access requires a shutdown of the intake. Access flooding takes place at the 1:100 Open water flood.

The power supply to the facility (transformer) was found to be at the 1:100-year flood level during the 2023 flood of this magnitude, however temporary protection was placed to ensure service continuity.

	River Cross Section	Ice Jam Flood Elevation	Ground Elevation	Flood Exposure
Pumphouse/Intake	M 13	697.03m	696.70m	0.33m
Road North West Section	M 13	697.03m	696.57m	0.46m
Road Central Section	M 13	697.03m	696.40m	0.63m
Road South Section	M14	697.22m	697.73m	----

Risk and Consequence

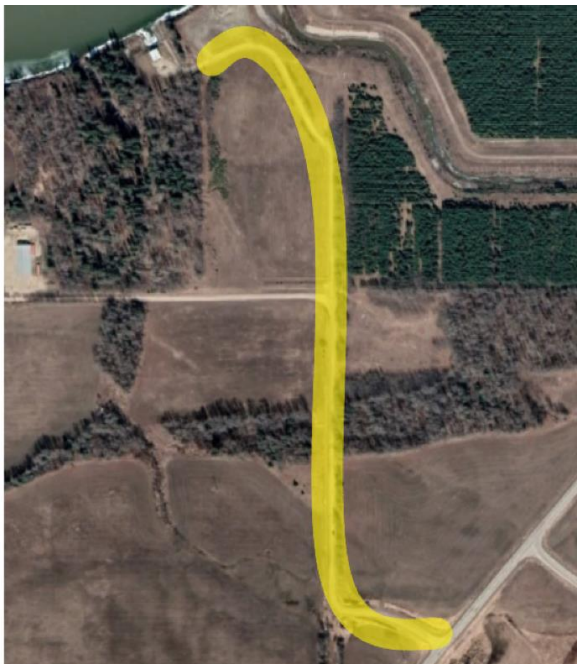
The flood risk at this site is rated at 1:100. A 1:100 ice jam flood has the potential to destroy the facility. The risk of this site being damaged or destroyed is high. An ice jam flood at a lower level would eliminate access and require shutdown of the facility.

Prolonged shutdown of this facility will interrupt the potable water supply and fire protection for over 10,000 people, as well as industrial operations. The consequences of the facility being out of service are high. Hauling water during a treatment plant outage in 2021 cost $64 per cubic metre. With water restrictions, consumption is about 4000 cu m/day, or $250,000 per day for trucking, if supplies are available.

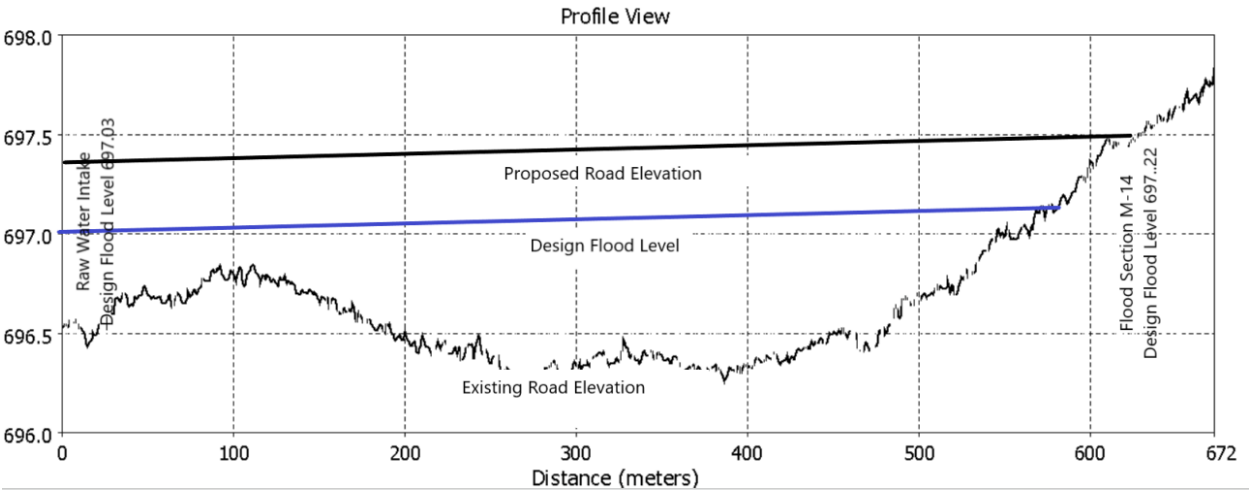
Mitigation Proposal

1. Install flood wall sheet piling with reinforced rails to protect the intake from ice damage.
2. Construct diking to prevent flooding of site and ice damage to building (200m 0.8m high).
3. Raise the gravel access road (630m of gravel roadway needs to be raised an average of 0.7m to ensure continued access for operations).

Flood Wall and Dike



Road To be raised between 0.6m and 0.8m



Road Profile

Cost

Initial estimate is estimated $1,014,484 (protection to design flood level plus 0.3m).

C. Water Treatment Plant and Ambulance Facility Access Flood Protection

Situation (Water Treatment Plant)

The Water Treatment Plant, south of Highway #43 at West Mountain Road, supplies treated water for domestic consumption and fire protection to the Town and serviced areas of Woodlands County. The plant, pump house, and reservoir are constructed to not have any openings below the design flood level, however the road to the site and the land surrounding the facilities are below the ice jam flood level. Access to the plant would not be available during a flood, resulting in shutting down the plant and pump house. The remote Hilltop Reservoir can supply domestic for 6 hours at normal flow (12 hours at reduced flow) while maintaining required fire protection reserves. Water hauling would be required from other communities if access is lost for a longer period.

The ice jam flood level at the site is 696.68m, approximately 1.1 metres above the parking lot elevation of 695.6m. The adjacent roadway (West Mountain Road) acts as a dike, protecting the site from direct flooding by the river, however flood waters enter the site as backflow through the 5m culvert under Highway #43. The backflow flood level is estimated at than 696.63m (River Section M 09), 1.0m above ground level.

Flooding of the site would damage the road surface and landscaping, but more importantly result in a shutdown of the water treatment plant operations.

	River Cross Section	Ice Jam Flood Elevation	Ground Elevation	Flood Exposure
Water Treatment Plant Access Direct Exposure	M 11	696.68m	695.6m	1.1m
Backflood	M 9	696.63m	695.6m	1.0m

Risk and Consequence

The flood risk at this site is rated at 1:100. The risk of damage to this site is low, however the risk of the site being shut down is high as operations would be interrupted when the access is flooded.

Prolonged shutdown of this facility will interrupt water supply and fire protection for over 10,000 people and hundreds of businesses. The consequences of the facility being out of service are high.

Mitigation Options

a. Access to the site can be maintained by raising the parking lot and road to above the design flood level of backflooding ($ 685,000)
b. Flooding of the site can be prevented by installing a valve/gate on the culvert under Highway #43. ($165,000)
c. Flooding of the site can be prevented by raising Mill Road, north of Highway #43 and installing a culvert gate a Mill Road. This option would protect access to the Ambulance Facility and the pulp mill, and prevent flooding of the Valley Centre Mall. ($406,000)
d. Flooding of the site can be prevented by installing a flood wall from Highway #43 to the CN Rail Line, between the Quality Inn and the McLeod River. This option would protect access to the Ambulance Facility and the pulp mill, prevent flooding of the Quality Inn and the Valley Centre Mall. ($1.6 to $3.2 million)

Situation (Ambulance Facility)

The Ambulance Facility located north of Highway #43 on 48th Avenue is the Whitecourt base for Emergency Medical Services. It is an operations base, with equipment storage and staff accommodation. It was constructed above flood level, however the access (48th Avenue) is 1.58m below the ice jam flood level. The site would be inaccessible during flooding, isolating equipment and personnel.

	River Cross Section	Design Flood Elevation	Elevation	Flood Exposure
48th Avenue at	M 08	696.58m	695.0m	1.6 m
Ambulance Facility	M 08	696.58m	696.71m	-0-
Highway #43	M 09	696.63m	697.3m (LiDAR)	-0-

Risk and Consequence

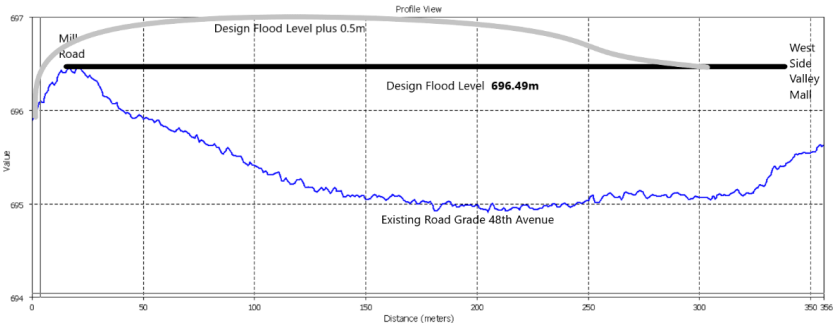
The flood risk at this site is rated at 1:100. The 1:100 Ice Jam Flood Level is 0.02m above the 1:1000 Open Water Flood Level. The risk of this site being damaged is low, however operations would be interrupted for the duration of a major flood event.

Shutdown of this facility will affect emergency medical services to the Town and County, with a population of over 14,000. The consequences of the facility being out of service are moderate to high.

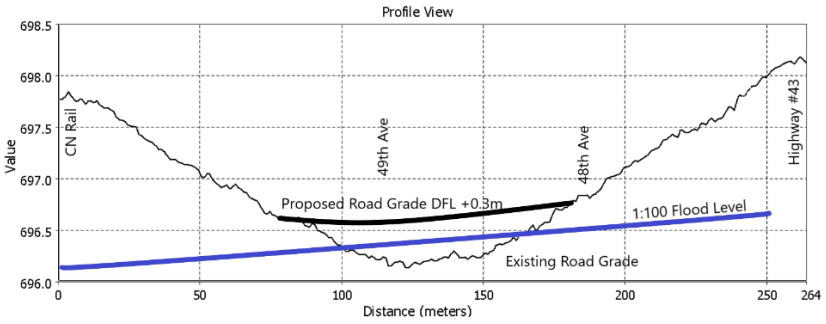
Mitigation Options

a. Access to the site can be maintained by raising 48th Avenue and a portion of Mill Road above the design flood level. ($ 560,000)
b. Flooding of the access can be prevented by raising Mill Road, north of Highway #43 and installing a culvert gate at Mill Road and enhancing the diking at the CN trestle. This option would also protect access to the Water Treatment Plant south of the highway and access to the pulp mill site, and prevent flooding of the mall site. ($406,000)
c. Flooding of the access can be prevented by installing a flood wall from Highway #43 to the CN Rail Line, between the Quality Inn and the McLeod River. This option would protect access to the Water Treatment Plant and the pulp mill, prevent flooding of the Quality Inn and the Valley Centre Mall. ($1.6 to $3.2 million)
d. Access to the site could be maintained by constructing a new approach to Highway #43. This may present ongoing operational and safety issues for the highway. ($125,000)

Options to Protect Access to Ambulance Base



Option Raise 48th Avenue



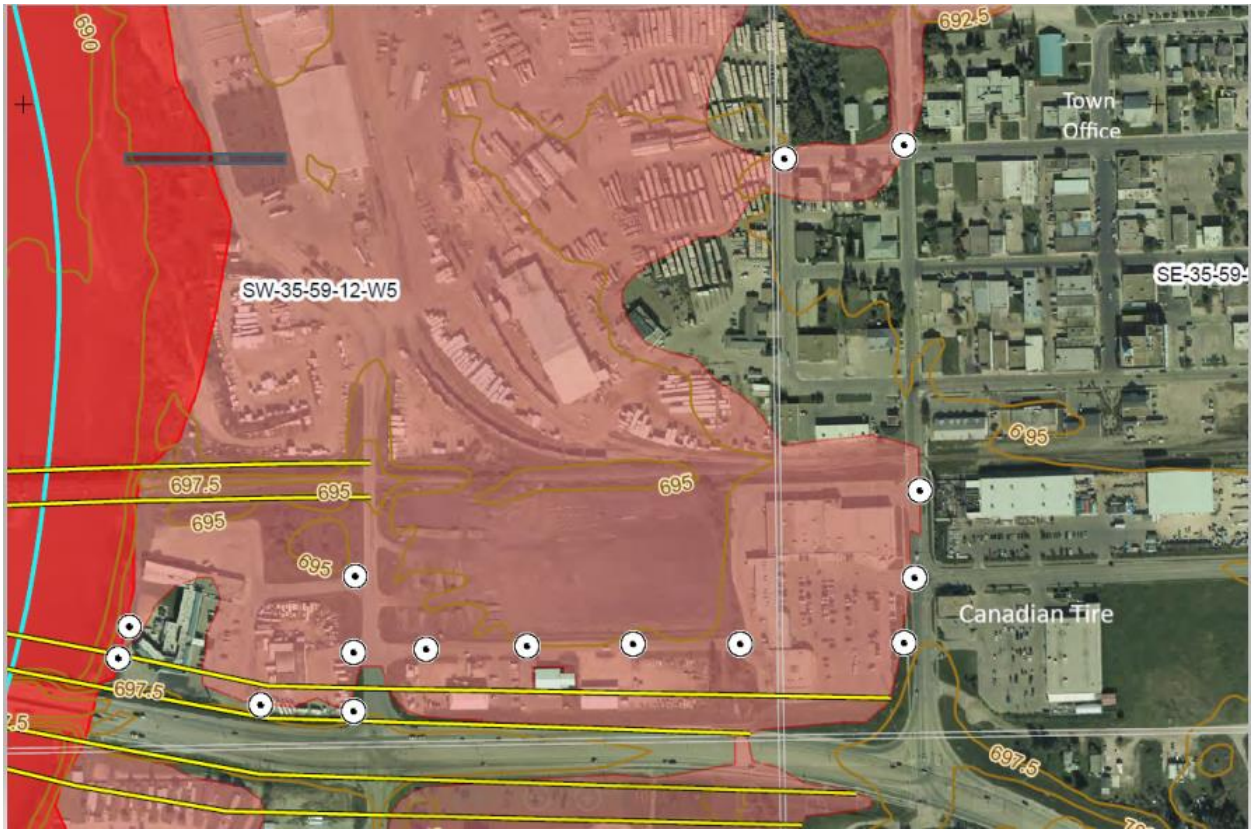
Option Raise Mill Road

D. Sanitary Manhole Flood Protection

Situation

Standard manhole lids have four 2.5cm 'finger' holes, to allow ventilation and ease of removal. Water can enter these holes when the surface is flooded, and surcharge the sewer main. Flood waters can enter buildings through sewer connections to main lines when the sanitary sewer is flooded. New buildings are provided with backflow prevention to reduce this risk. In buildings without backflow protection, the resulting flood can reach the level of the water entering the sewer. Lower levels of the Town Office, Fire Hall, and private buildings would be flooded during floods that surcharge the sewer system. The main lift station (47th Street and 51st Avenue) may also be flooded out in a sewer flood event due to the additional flows. The 200mm (8") sewers common to the downtown core could surcharge when two manholes are under 0.6m of water or four manholes are under 0.3m of water.

The manholes shown on the attached image are below the design flood level, and subject to inflow during the 1:100 Ice Jam Flood. Additional below level manholes are located on private property (Millar Western site, Riverside Mobile Homes) and should be addressed as well.



Sanitary Manholes Subject to Flooding

	River Cross Section	Design Flood Elevation	Ground Elevation	Flood Exposure
South of Quality Inn	M 09	696.63m	696.0m	0.6m
48th Avenue	M 08	696.58m	695.0m to 696.5m	1.6 m

Risk and Consequence

The flood risk for this situation is rated at 1:100.

Sewer surcharge would result in closure of the Town Office and the classroom training facilities in the Fire Hall for an extended clean up and repair period. The flooding of the Main Lift Station would interrupt sanitary sewage services for the downtown commercial area and over 250 residences, with potential for sewer backup damage. The consequences of sewer flooding are high.

Mitigation Options

a. Install solid (no finger hole) manhole covers and install sealant on the risers in all sanitary manholes within the flood risk area ($64,000)
b. Install backflow prevention devices on all sewer service connections that would be affected by sewer flooding. Backflow prevention devices vary in cost with the application. More detailed analysis would be required for cost estimating.

E. West Whitecourt Lift Station Flood Protection

Situation

The West Whitecourt Sewage Lift Station is located at the intersection of 51st Avenue and 59th Street, in the McLeod Industrial Area. This lift station pumps sewage from industrial and residential properties in West Whitecourt and the serviced portion of Woodlands County to the gravity sewer system east of the McLeod River. A service interruption at this site can result in sewage backups and overflows throughout West Whitecourt.

Ice jam flood level at the lift station is 695.4m, approximately 1.2 metres above the ground level of 694.2m. Flooding of the site would damage the electrical system and controls, resulting in a prolonged shutdown of the sewer system in West Whitecourt.

	River Cross Section	Ice Jam Flood Elevation	Ground Elevation	Flood Exposure
West Whitecourt Lift Station	Between M05 and M06	695.4m	694.2m	1.2m

Risk and Consequence

The flood risk at this site is rated at 1:100. The risk of this site being damaged is high.

Prolonged shutdown of this facility will interrupt sewage disposal for over 150 households and more than 60 businesses. Sewage overflows from the flooded lift station would enter roadside ditches and the McLeod River. Sewage backups at connected properties would contaminate buildings and land. The consequences of the facility being out of service are moderate to high.

Mitigation Proposal

The lift station is within a 20 sq. m building on a 200 sq. m site. There is not sufficient room on the site for diking. A 1.5m high flood wall, built on the site boundary, could provide protection. Provisions for access through a waterproof gate with a pump system for surface water discharge will be required. The facility would not be accessible for maintenance during a flood, however it could continue in operation and would not be damaged if protected. ($ 228,000)

F. Waste Water Treatment Plant Access and Manhole Flood Protection

Situation

The Waste Water Treatment Plant north of Flats Road treats municipal sewage for release to the Athabasca River. The plant and supporting facilities are constructed to not have any openings below the design flood level, however a portion of the road to the site and the land surrounding the facilities are below the 1:100 open water flood level. Access would not be available during a flood, resulting in shutting down the plant.

Flooding of the site would damage the road surface and landscaping, but more importantly result in a shutdown of the treatment plant operations. Plant shutdown could result in discharge of untreated sewage to the environment or sewage back up into basements.

Two manholes on the main sewer line to the treatment plant are below the design flood and subject to major inflow. Water infiltration in the manholes on the trunk line to the plant could overload the plant and surcharge the lines in Rodeo Way and Poplar Drive, leading to sewer back up basement flooding. The 1:100 flood level at the site is 686.67m (River section A 19), approximately 0.17metres above the lowest road elevation of 686.5m and 0.2 m above the manhole tops.

	River Cross Section	1:100 Flood Elevation	Ground Elevation	Flood Exposure
Waste Water Treatment Plant	A 19	686.67m	686.5m to 687.4m	Max 0.17m
Road	A 19	686.67m	686.5m	0.17m
Sewer Manhole	A 19	686.67m	686.45m	.22m

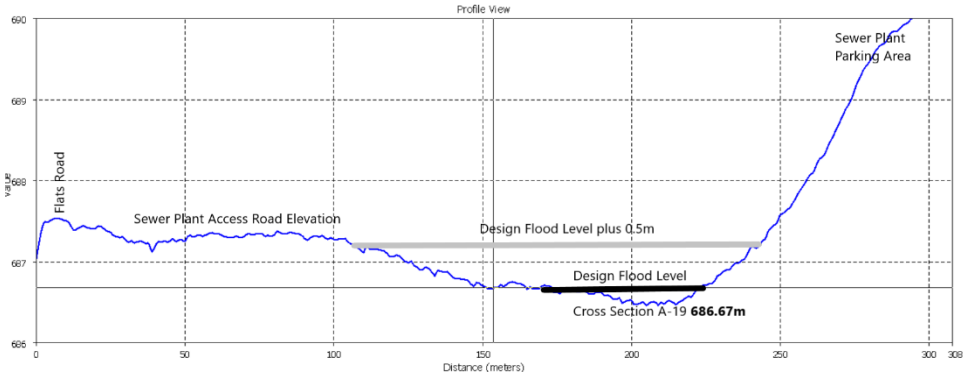
Risk and Consequence

The flood risk at this site is rated at 1:100. The risk of damage to this site is low, however the risk of the site being shut down is high as operations would be interrupted when the access is flooded. The risk of backflow damage to two residential areas is medium.

Prolonged shutdown of this facility will interrupt sewage treatment for over 10,000 people and more than 200 businesses. The consequences of the facility being out of service are high. The likelihood of sewer line surcharging is very low, however the consequences are very high, and easily prevented.

Mitigation Option

Access to the site can be maintained by raising the road to above the design flood, while back flooding of manholes can be prevented by raising manhole rims and installing solid lids. ($ 52,000)



G. Natural Gas Gate Station Access

Situation

The Natural Gas Gate Station east of 47th Street on the golf course property supplies natural gas to several residences, the golf course, and the Wastewater Treatment Plant. Though the mechanisms in the facility are not subject to flood damage, continued access to the facility is required for inspection and maintenance. The primary interest of the Town in this facility is the provision of natural gas to the Waste Water Treatment Plant. The plant uses natural gas for facility heating, however the critical aspect is that the backup generator at the plant uses natural gas for fuel. If the gate station shuts down, the waste water plant's emergency generator will not operate during a power outage. In the event of a power failure during a flood, the wastewater plant would be shut down, with potential release of untreated sewage to the Athabasca River.

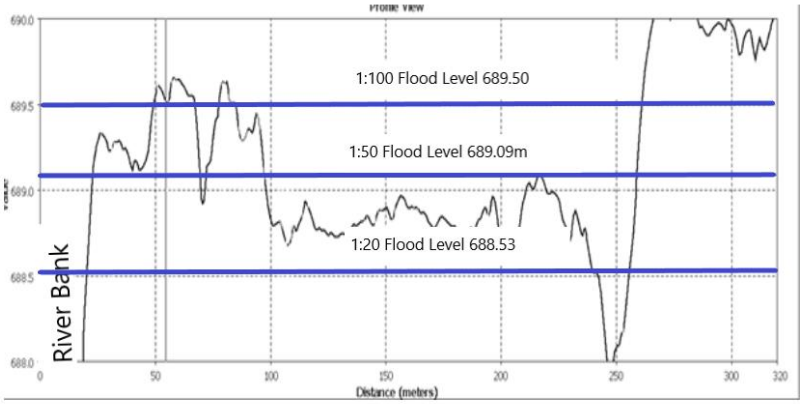
Risk and Consequence

The flood risk at this site is rated at 1:20. The risk of damage to this site is low, however the risk of the site being shut down is high as operations would be interrupted when the access is flooded.

Prolonged shutdown of this facility and a subsequent power failure will interrupt sewage treatment for over 10,000 people and more than 200 businesses. The consequences of the facility being out of service are high.

Mitigation Options

1. It is difficult to protect the site access to the 1:100 level, due to its proximity to the river and the back flooding of water through adjacent properties.
2. Protection of the site access to the 1:50 level can be accomplished by raising 47th Street. ($ 276,000)
3. Access to the site can be protected above the 1:20 event be by raising a portion of 47th Street, blocking a low gully, and installing a gated (valved) culvert. ($ 85,000). Lesser access protection, allowing for ATV only access, can be provided for about $ 25,000.



Costs

Preliminary cost estimates for the preferred options have been prepared. Costs are based on similar civil work carried out in Whitecourt in 2021 and 2022, and include a 30% contingency to address current and projected inflation.

Project Costs

Project	Life Safety	Infrastructure Protection	Population Affected	Cost (Construction, Contingency, Engineering)	DFPP Grant	Town Share
Fire Hall Protection	*	*	14,000	$ 33,304	$ 0.00	**$ 33,304**
Water Intake Site and Road*	*	*	11,000	$ 1,014,484	$ 710,139	**$ 304,345**
Water Treatment Plant and Ambulance Base Access Protection	*	*	11,000	$ 405,744	$ 284,021	**$ 121,723**
Sanitary Manhole Protection		*	1000	$ 64,400	$ 45,080	**$ 19,320**
West Whitecourt Lift Station		*	400	$ 228,620	$ 160,034	**$ 68,586**
Sewer Plant Access and Inflow		*	11,000	$ 51,520	$ 36,064	**$ 15,456**
Natural Gas Gate Station Access		*	11,000	$ 276,920	$ 193,844	**$ 83,076**
				Total Costs	**Grant**	**Town**
				$ 2,074,992	**1,429,182**	$ 645,810