

# **M.D. of Foothills Proposal for a Highwood / Little Bow Flood Risk Mitigation Program**



Submitted to the Government of Alberta  
by the MD of Foothills No. 31  
October, 2016



## Executive Summary

In June of 2013, southern Alberta experienced unprecedented and catastrophic flooding. The Town of High River received extensive damage and subsequent to the event constructed mitigation works along the Highwood River to protect the Town from future extreme flood events. The construction of these flood mitigation works has impacted the flow split between the Highwood and Little Bow Rivers as well as the amount of water storage available in a large flood event. This has resulted in increased flood risk to properties in the M.D. of Foothills in proximity to the Town and downstream on the Highwood River.

The M.D of Foothills, with the support of the Government of Alberta retained *Advisian WorleyParsons Group and AMEC Foster Wheeler Environment and Infrastructure* to undertake detailed study to determine what impacts could be expected from the mitigation works in the vicinity of High River. The objectives of this work were as follows:

- identifying and describing flood related risks to M.D. residents and infrastructure along the Highwood and Little Bow Rivers and Stimson and Pekisko Creeks;
- undertaking high level flood risk evaluation of the impacts of existing and proposed flood control and mitigation measures within the Town of High River as well as natural flooding/erosion mechanisms; and
- proposing mitigation options to address identified risks and protect M.D. residents along the Highwood River downstream from the Women's Coulee inlet and along the Little Bow River to the M.D.'s southern boundary.

The Study found that there were no areas of concern in the upper Highwood River or Stimson Creek or Pekisko Creek except for several push-up dams which may warrant further study. It determined that the Hoeh Dike has significant local effects but probably not regional effects and that it should be reinforced but not altered. The Study also found that the mitigation constructed within the Town of High River would result in additional flows of up to 290 m<sup>3</sup>/s on the Highwood River downstream of the Town and a reduction in flow of approximately 155 m<sup>3</sup>/s on the Little Bow River, in a flood event of equivalent magnitude to the 2013 event. The impact in these changes to the flow split were examined on a property by property basis to determine where there were areas of increased or decreased inundation, what the predicted change in water levels at residences or ancillary buildings could be and where increases in velocity might create additional risk of erosion.

Once the draft Scoping Study was complete and had been presented to Council, the municipality undertook a public consultation process which involved holding two public open houses and then a series of individual landowner meetings to ensure that impacted landowners were able to access the best information possible to assist them in making decisions. The individual meetings were also used to gather input from landowners as to what their preferred outcome might be with respect to their property, would they prefer being bought out, protected or that nothing be done.

With the draft Scoping Study complete, the M.D is proposing the next step is for the Government of Alberta and the M.D. of Foothills work in partnership to:

- undertake additional study to address deficiencies in the work done to date;
- reinforce the Hoeh Dike as recommended in the Scoping Study; and
- implement the *Highwood / Little Bow Flood Risk Mitigation Program* to address identified risks, to buy-out or protect Foothills landowners with impacted residences and to compensate business owners or agricultural operators who can be demonstrated to have been negatively impacted by mitigation works constructed to protect the Town of High River.

The M.D. of Foothills is proposing that the Province allocate a budget based on this proposal whereby the M.D. would administer a program within the municipality to undertake measures necessary to protect Foothills landowners from future damage and to compensate those who have been exposed to additional risk due to mitigation works that have already been constructed or are proposed along the Highwood and Little Bow Rivers.

Based on the direction given by M.D. Council that Foothills landowners should be protected to the same level as residents of High River have been (i.e. the 2013 event plus one metre freeboard), it is proposed that the program be implemented throughout the study area downstream from the Women's Coulee inlet. The proposal divides the study area into four zones A-D:

- Zone A includes lands downstream from the Town of High River on the Highwood River (See *Figure 5 - Zone A Parcels*, page 13);
- Zone B encompasses the properties upstream from the Town to Women's Coulee inlet (See *Figure 6 - Zone B Parcels*, page 14);
- Zone C includes those parcels in the overland flooding area in proximity to the southwest corner of High River that are predicted to be negatively impacted by the mitigation works in the Town (See *Figure 7 - Zone C Parcels*, page 15);
- Zone D follows the Little Bow River downstream from the Town to the M.D.'s boundary (See *Figure 8 - Zone D Parcels*, page 16).

While Zone A (Lower Highwood) has been prioritized due to the increased flood risk that it will see due to the mitigation around the Town of High River, the M.D. is suggesting that Zone B (Upper Highwood) and Zone D (Little Bow) be included in the proposed program as well. The rationale for this is outlined in the following paragraphs. It is understood that the land owners in Zone C will be dealt with by the Town of High River as part of the work they are doing in support of their application to Alberta Environment and Parks for the southwest dike.

There are a number of landowners with properties in Zone B that were offered buy-outs under DRP in the months following the 2013 flood but did not take them. However, M.D. Council feels these landowners should be given another opportunity to take a buy-out for several reasons:

- In the days and weeks following the 2013 flood many of the impacted landowners were traumatized by the event and were not in a suitable state of mind to make critical decisions;
- there seems to have been significant confusion around exactly how the process was supposed to work and some landowners did not understand that they had to make an

application and follow through the steps, thinking instead that someone would contact them with an offer to purchase their land; and

- There had been considerable media attention around the possibility that there would be a large diversion constructed on the Highwood to mitigate future flooding. Some of the landowners in this area did not take a buyout believing that there would be a diversion that would protect them.

None of the impacted landowners in Zone D were offered buyouts subsequent to the 2013 flood event because they were not in a mapped floodway due to the fact that no flood hazard mapping had been undertaken on the Little Bow River. However, there are landowners in this Zone who reported 1.5 – 1.8 m water at their residence in 2013. While properties on the Little Bow River are generally predicted to see less water in future events due to the mitigation constructed around High River, some will still see significant flood risk at their residence. It is proposed that they should not be penalized for being in an area where flood mapping has not been undertaken. In addition, modelling of flows of 750 m<sup>3</sup>/s on the Highwood River indicates that at peak flows around this level Zone D properties will be negatively impacted by the mitigation works at High River.

Based on the above, the M.D. of Foothills is proposing a mitigation program for Zones A, B, and D with the goal of moving as many residents as possible away from flood hazard areas and making room for the river as per the recommendations of the Deltares report (Deltares, 2015). Should the Province approve this proposal and approve the funding, the M.D. is prepared to move forward with implementation of the program immediately

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# 1 Introduction/ Purpose of Report

In June of 2013, southern Alberta experienced unprecedented and catastrophic flooding. The Town of High River received extensive damage and was forced to issue a mandatory evacuation order for the entire town because of damage to critical infrastructure. In order to protect the Town from future major flood events, the Province of Alberta funded the construction of significant flood protection infrastructure in the form of diking along the Highwood River through the Town and on the north side of the Town.

During the design process for the construction the Town's dikes it was determined that these mitigation measures were likely to have an impact on the flow split between the Highwood and Little Bow rivers. Diking through the Town would prevent water from overtopping the banks of the Highwood and flowing through the Town and into the Little Bow River. Hence, in a future significant flood event the peak flows downstream on the Highwood River are likely to be higher than they would have been prior to mitigation measures being constructed.

In light of the new understanding of the magnitude of flooding that is possible as well as the predicted increase in peak flows in extreme flood events on the Highwood River due to the mitigation measures in and around High River, the M.D. of Foothills was left with several concerns:

- ensuring the safety and security of Foothills residents with property in mapped floodways as well as those with property in areas that had not previously been mapped but were impacted by the 2013 event;
- ensuring the integrity of existing infrastructure along the rivers including dikes, bridges, roads etc;
- having a mechanism to avoid future development in areas that were known to have been impacted by the 2013 event; and
- understanding the impact of existing and proposed mitigation in the vicinity of High River on M.D. landowners in order to predict what might be expected in an event equivalent in magnitude to the 2013 flood.

It was agreed that scientific study was needed to address these concerns, and that the work should be premised on the decision by M.D. of Foothills Council that Foothills landowners should have their residences protected to a level equivalent to the protection that is being provided for Town of High River residents, that is the 2013 flood magnitude (simulated for mitigated conditions) plus one meter.

Now that the Scoping Study has been completed, there is a need for the implementation of a program to:

- undertake additional study;
- address deficiencies in existing infrastructure;
- buy-out, protect Foothills landowners with impacted residences; and

- compensate landowners, business owners or agricultural operators who can be demonstrated to have been negatively impacted by mitigation works, in the High River area (This is proposed as a subsequent phase of the program).

To this end, the M.D. of Foothills is proposing to partner with the Government of Alberta to implement a program whereby the Province would allocate a budget based on this proposal to enable the M.D. to administer a flood risk mitigation program within the municipality. The implementation of this program will require a case by case evaluation of impacted properties, discussions with property owners and working with qualified professionals to determine fair market values, design mitigation works, relocate buildings or determine appropriate compensation when risk has been increased due to mitigation constructed to protect High River.

## 2 Background

Prior to the 2013 flood event, the Town of High River and the M.D. of Foothills had identified a need to undertake a scientific study of the Highwood River to better understand potential flood hazards. The Town and the M.D. formed the Highwood River Advisory Committee (HRAC) and retained Advisian WorleyParsons Group (then WorleyParsons) to create a 2-D model of the Highwood River. This model was completed in early 2013.

This initial model included the Highwood River from Women's Coulee Inlet to the Highway 2 crossing near Aldersyde and the Little Bow River from the Town of High River to the Highway 2 crossing south-east of High River. Following the flood of 2013, empirical data collected was used to interrogate the model and make refinements. The model was then used extensively to assist in the design of mitigation works for the Town.

When the M.D. of Foothills identified concerns around understanding the impacts of the mitigation works on Foothills landowners and ensuring the safety of residents downstream, the Government of Alberta provided funding to both extend the geographic boundaries of the model and to undertake a high level cost benefit analysis of property buy-outs versus the construction of flood mitigation to protect residents.

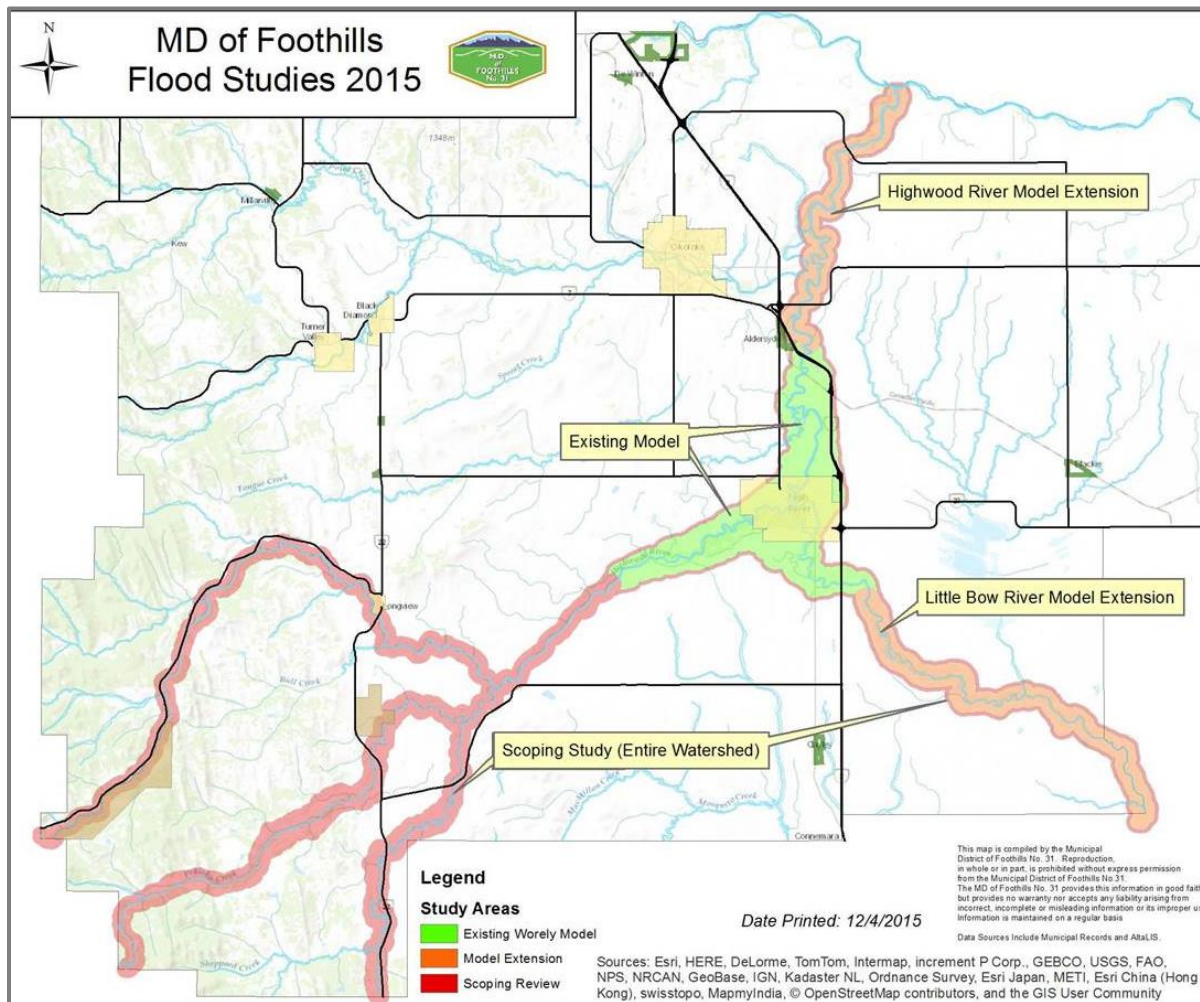
With the assistance of this Provincial funding, Advisian WorleyParsons Group was retained to extend the model on the Highwood River to its confluence with the Bow River and on the Little Bow River to the M.D.'s southern boundary. At the same time AMEC Foster Wheeler Environment and Infrastructure together with Advisian were tasked with using the results of the modelling to undertake Phase 1 of the *Scoping Study of Flood Related Areas of Concern on the Highwood River and Little Bow River within the M.D. of Foothills*. The objectives of this work were as follows:

- identifying and describing flood related risks to M.D. residents and infrastructure along the Highwood and Little Bow Rivers and Stimson and Pekisko Creeks;
- undertaking high level flood risk evaluation of the impacts of existing and proposed flood control and mitigation measures within the Town of High River as well as natural flooding/erosion mechanisms; and



- proposing mitigation options to address identified risks and protect M.D. residents along the Highwood River downstream from the Women's Coulee inlet and along the Little Bow River to the M.D.'s southern boundary.

**Figure 1 – Study Areas for Model Extension and Scoping Study**



**Figure 1 – Study Areas for Model Extension and Scoping Study** shows the extents of the original 2D model which was produced for the Town and the M.D. in 2012-2013 as well as the Study Areas for the 2D model extension and the Scoping Study.

### 3 Summary of Scoping Study Findings

#### 3.1 Flood Issues on the Upper Highwood River and Pekisko Creek and Stimson Creek

##### Upper Highwood:

This area is defined as the Highwood River Downstream of the M.D.'s Western Boundary and Upstream of Woman's Coulee Canal Inlet.

The majority of the residential development in this area, which does not include the Pekisko and Stimson Creek sub-watersheds, is located on upper benches above incised canyons or on elevated terraces within the greater Highwood River valley. Because of this, there was relatively little residential flood damage reported with this river segment during the 2013 flood. Damages in this area included bridge damage, road damage, and limited damage to private property.

##### Pekisko Creek and Stimson Creek:

These two creeks have similar sized watersheds and are both significant tributaries to the Highwood River. The flow of Stimson Creek is regulated by the dam on the Chain Lakes Reservoir.

Relatively few flood issues were documented for these watersheds after the 2013 flood and no areas of concern or data gaps were identified on Pekisko and Stimson Creeks that would have a significant impact on the Highwood River downstream of their confluence.

#### 3.2 Woman's Coulee Canal Inlet

This structure located approximately 10 km upstream from the Town of High River (See *Figure 2 – Highwood River Features between Women's Coulee Canal Inlet and Town of High River*), is intended to send water from the Highwood River into Mosquito Creek and ultimately into the Little Bow River system. It is located on the south bank of the Highwood River and diverts water into a canal which drains southeast. The inlet was damaged during the 2013 flood and the Government of Alberta has been undertaking repairs.

The Scoping Study recommended that any future alterations to this structure be done in consideration of potential impacts on the main channel and floodplain flow paths and flow distribution, which could have an impact on downstream infrastructure such as the Hoeh Dike as well as residential properties.

#### 3.3 The Hoeh Dike

The Hoeh Dike parallels the Highwood River for approximately 2,000 meters and is located approximately 7 km upstream of the Town and just downstream of the Woman's Coulee Canal inlet (See *Figure 2 – Highwood River Features between Women's Coulee Canal Inlet and Town of High River*). This structure was constructed in several pieces over the course of the past century. The Hoeh Dike plays a significant role in directing floodwaters away from Baker Creek

and subsequently the Town and the Little Bow River basin. Modelling of Hoeh Dike failure scenarios for a 2013 equivalent event suggests that dike failure appears to have significant local effects but only minimal regional effects.

The Scoping Study recommends that the dike be upgraded to reduce risk of failure but that the height and footprint of the structure should remain unchanged. It is worth note that there is currently no access agreement in place for the Hoeh Dike. Purchase of an easement for the purposes of accessing the Dike for maintenance or repairs should be considered.

### 3.4 Baker Creek Dike

This dike, located just west of 72<sup>nd</sup> Street (*See Figure 2 – Highwood River Features between Women's Coulee Canal Inlet and Town of High River*) consists of an earthen berm approximately 125 m long elevated approximately 0.5 to 1.0 m above the natural upstream and downstream bank levels. This structure was likely constructed to protect the railway and/or the southern portion of High River. Modelling of the removal of this structure suggests that the impacts of doing so would be localized and relatively minor; however, there are currently no plans to remove this dike. If this dike is to remain in place long term, purchase of an access easement to facilitate maintenance and repairs is worth consideration.

### 3.5 Flood Hazards - Not Under Foothills' Jurisdiction or Downstream of Study Area

#### Infrastructure Not Under M.D. of Foothills Jurisdiction

The Scoping Study identified potential impacts to the CP Railway Bridge, Highway 2 Bridge and Highway 547 Bridge. The Scoping Study recommends that parties responsible for operation and maintenance of this infrastructure be notified so appropriate design checks can be undertaken.

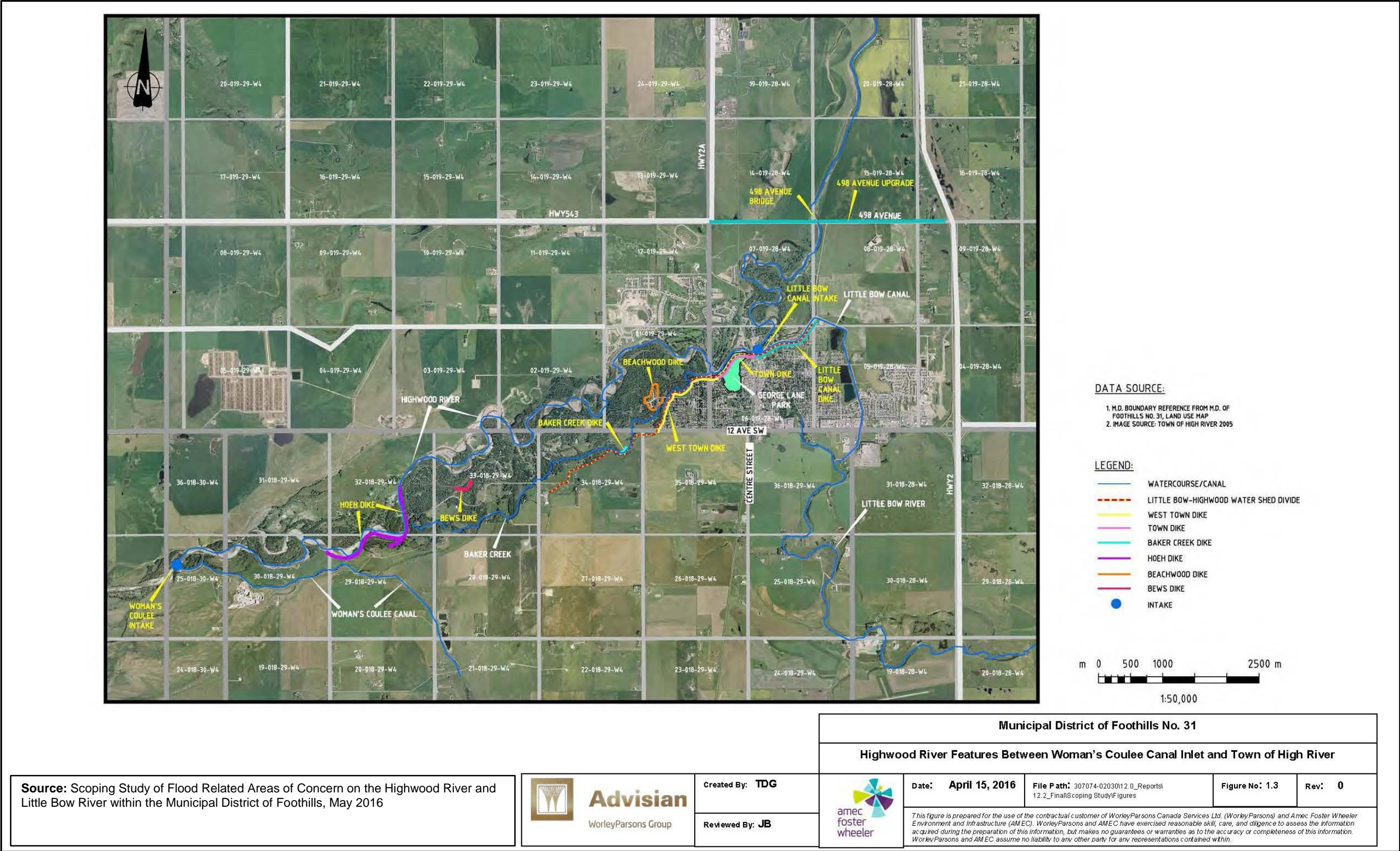
#### The Bow River Downstream of the Study Area

The predicted increase in peak flow of approximately 290 m<sup>3</sup>/s in the lower Highwood River in a 2013 equivalent event could have a significant impact on the Bow River. The magnitude of the impact would depend on the timing of the peaks on the two rivers during a flood event. Due to the loss of storage a significant additional volume of water would need to be managed at downstream reservoirs such as the Bassano Dam.

The Scoping Study recommends that dam operators be notified and a detailed analysis be undertaken in future studies to assist in better understanding these effects and the associated risk in greater detail.



Figure 2 – Highwood River Features between Women’s Coulee Canal Inlet and Town of High River





### Little Bow River Downstream of the M.D.

The flood modelling undertaken predicts a decrease in flood magnitude of 155 m<sup>3</sup>/s on the Little Bow River in a 2013 equivalent event. However the performance of the Town's flood mitigation structures during a very large (low probability infrequent) flood event, such as the design probable maximum flow (PMF) of the Twin Valley Dam and Travers Dam (which is in the order of 3,000 m<sup>3</sup>/s) is not well understood.

The Scoping Study recommends that changes to the flow split and the configuration of the Town's flood protection infrastructure should be discussed with the owners/operators of the Twin Valley and Travers Dams.

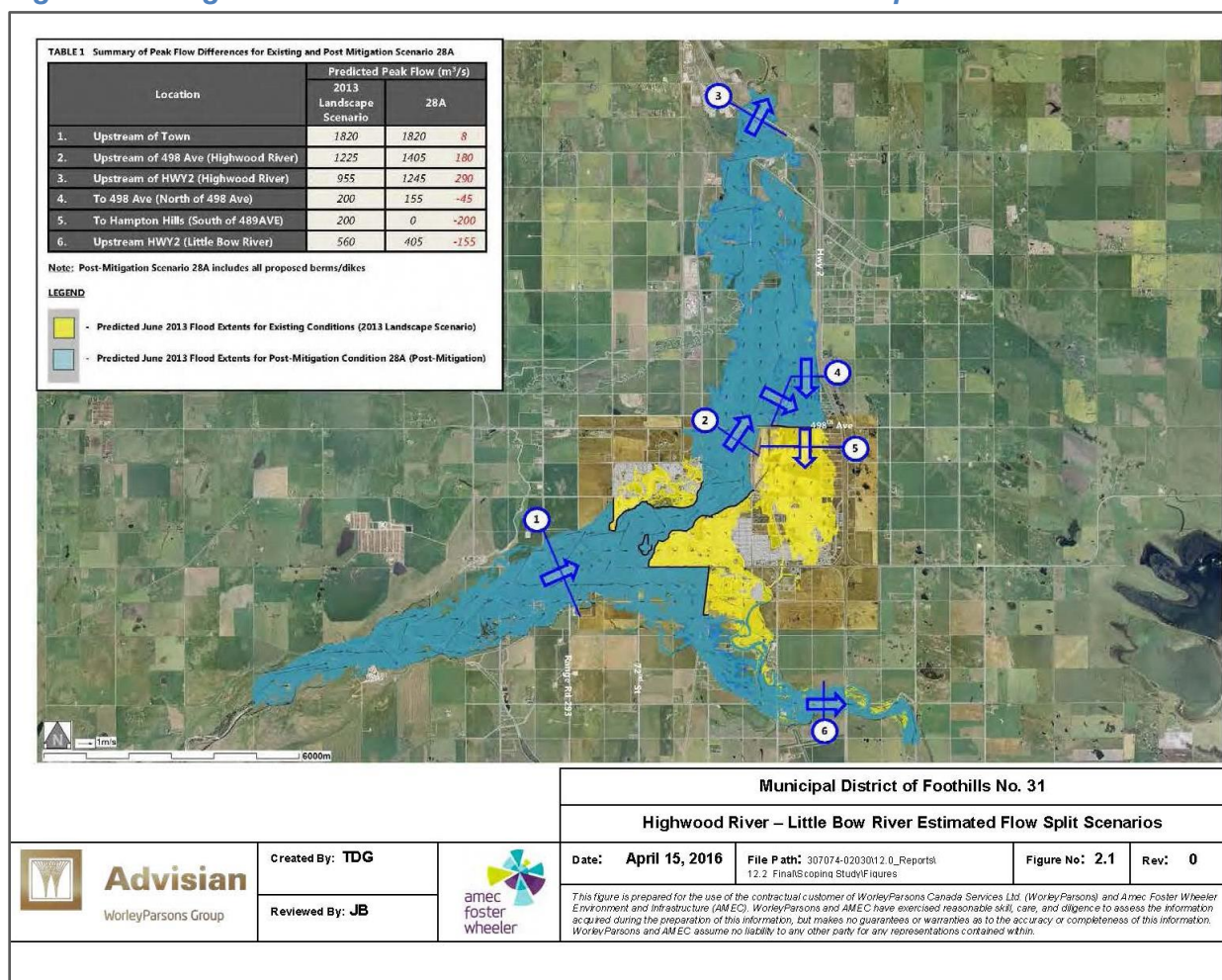
### **3.6 Change to Highwood – Little Bow Flow Split**

Historic observations and model analyses indicate that when the Highwood River experiences peak flows greater than approximately 600 to 700 m<sup>3</sup>/s (gauged upstream of Woman's Coulee Canal inlet), water from the Highwood "spills" to the Little Bow. The spill boundary begins downstream of Woman's Coulee Canal Inlet and extends downstream to the Little Bow Canal Dike. The construction of diking along the south bank of the Highwood River has changed the amount of water that can make its way to the Little Bow during these larger events by not allowing the river to overflow its banks and travel through the Town. The end result of this is that more water remains in the Highwood River and eventually travels downstream to the Bow River.

It is estimated that as a result of the constructed and planned flood mitigation in the vicinity of the Town of High River, in a future 2013 equivalent event there would be additional flow of approximately 290 m<sup>3</sup>/s down the Highwood River due to the change in the flow split and loss of storage south of 498<sup>th</sup> Ave. Conversely, it is predicted the Little Bow River downstream from 104<sup>th</sup> Street E would receive approximately 155 m<sup>3</sup>/s less flow in a 2013 equivalent event due to the change in the flow split (See *Figure 3A - Highwood River – Little Bow River Estimated Flow Split Scenarios*).

During the 2013 flood event, water also overtopped the banks of the Highwood River north of High River and flowed south over 498<sup>th</sup> Avenue flooding neighbourhoods on the east side of the Town. The raising of 498<sup>th</sup> Avenue was subsequently undertaken to protect this area. This measure has resulted in the loss of flood storage area and would contribute to additional flows downstream on the Highwood River in a flood event of more than approximately 1000 m<sup>3</sup>/s (gauged upstream of Woman's Coulee Canal inlet).

**Figure 3A – Highwood River – Little Bow River Estimated Flow Split Scenarios**

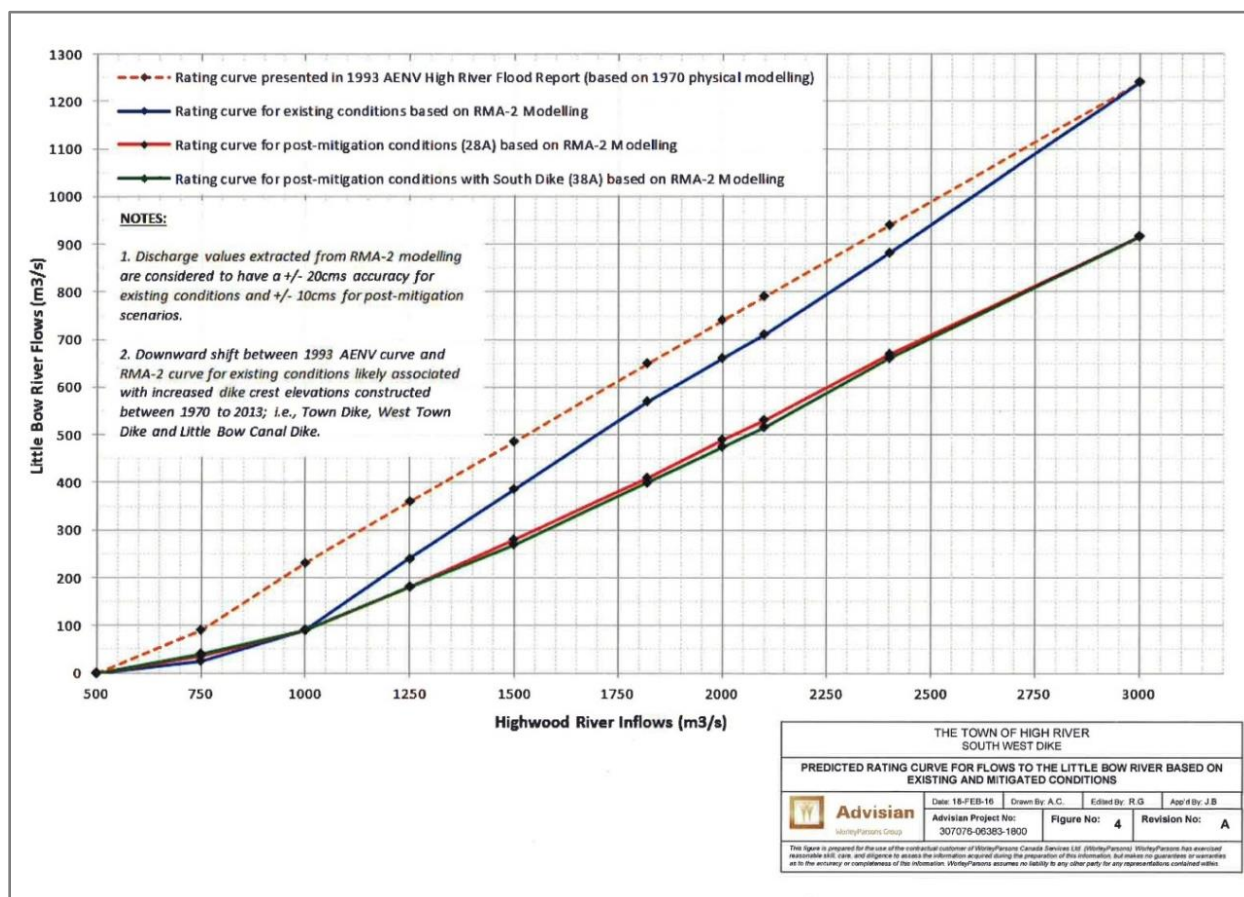


**Source:** Amec Foster Wheeler Environment & Infrastructure and Advisian WorleyParsons Group (2016): Scoping Study of Flood Related Areas of Concern on The Highwood River and Little Bow River Within the Municipal District of Foothills

In lower peak events, it is predicted that there would be slightly more flow down both the Highwood River and the Little Bow River due to a loss of storage in the Town. According to the Town's recent model (Model 44A-1) in a 750 m<sup>3</sup>/s event (gauged upstream of Woman's Coulee Canal inlet), there would be an additional 7 m<sup>3</sup>/s down the Little Bow River and an additional 15 m<sup>3</sup>/s down the Highwood River.

This is also predicted by the flow split rating curve shown in *Figure 3B - Predicted Rating Curve for Flows to Little Bow River*. This figure compares the predicted Little Bow River flows for different peak flows on the Highwood, with the different curves representing different conditions. While the post-mitigation curves (based on Models 28A and 38A) show decreased flows on the Little Bow River compared to pre-mitigation conditions for most peak flows, around the 750 m<sup>3</sup>/s level, the post-mitigation curves show increased flow down the Little Bow compared to pre-mitigation levels.

**Figure 3B – Predicted Rating Curve for Flows to Little Bow River**



Source: Town of High River SW Dike supplementary document for Alberta Environment and Sustainable Resource Development Regulatory Permit Application – Revision 2; July 14, 2016. Prepared by WorleyParsons Canada.

## 4 Public Consultation Process Undertaken Spring/Summer 2016

There were many Foothills landowners who were impacted by the flood of 2013 and many of them have been wondering how this event and the mitigation works that have been constructed since the event will impact their safety, their ability to continue to use and enjoy their property or the potential to further develop their land.

The Council of the M.D. of Foothills felt that it was important to release the results of the Scoping Study out to impacted landowners as soon as possible so that they could make informed decisions about their property. Once the draft study was complete and had been presented to Council, it was determined that the municipality would host two public open houses and then a series of individual landowner meetings to ensure that impacted landowners were able to access the best information possible to assist them in making decisions.

## 4.1 Public Open Houses

Public open house style information sessions on the results of the Scoping Study were held on May 26<sup>th</sup> and May 30<sup>th</sup> 2016 at the Highwood Memorial Centre in High River. The May 26<sup>th</sup> session was geared to residents north of High River downstream along the Highwood River. The May 30<sup>th</sup> session was geared towards residents upstream on the Highwood River and all along the Little Bow River to the M.D. boundary. Approximately 120 people attended the two sessions and most expressed appreciation for being provided with this information.

The information sessions were advertised in the Western Wheel newspaper and landowners in the study area were direct mailed invitations to attend the open house for their area. Impacted landowners were also given the opportunity to book individual meetings with municipal staff and elected officials to discuss the results of the study as they pertained to their property specifically.

At the two information sessions paper copies of the executive summary for the Scoping Study along with some key maps were made available for attendees to take home with them. There were presentation boards that outlined the key points in the study as well as large scale maps showing the results of the modelling that was done on the two rivers. There were binders of the complete report laid out on tables for attendees to examine and they could purchase a copy of the complete report to take with them. In addition, residents could visit one of two mapping stations and have maps printed of their individual property to look at the modelling results as they pertained to their own land.

Subsequent to the information sessions the presentation materials and the complete report were made available on the M.D. of Foothills website.

## 4.2 Individual Landowner Meetings

Through the months of June and July and into September municipal staff and elected officials conducted 52 individual landowner meetings. At each meeting the landowners were presented with maps of their property which described inundation (and change in inundation if applicable), predicted depth and velocity and change in depth for a 2013 equivalent event. The results were discussed, and information was provided by the property owners on what they actually experienced on their property in the 2013 event and whether it differed from what the model was predicting.

Municipal staff answered any questions regarding the modelling and the scoping study and then there was a discussion about what the landowners preferred outcome might be. Options such as buying out the property or just the buildings were discussed as well as the perimeter berms that were investigated in the Scoping Study. In some cases other possibilities that may be acceptable were also discussed such as moving a residence to a higher portion of the parcel or raising it up in its current location.

All of the discussion was recorded on a meeting record form and landowners were given a copy to take with them as a record of the discussion. Some of the results of these discussions are summarized in the property summary tables.



## 5 Description of Four Implementation Zones

To facilitate implementation of the proposed *Highwood / Little Bow Flood Risk Mitigation Program* we have divided the study area into four implementation zones (Zones A-D) based on the anticipated impacts of the mitigation works around High River. The locations of the four zones are shown in Figure 4 – Four Implementation Zones. It should be noted that these Zones differ from the divisions that were used in the Scoping Study.

### 5.1 Zone A – Downstream from High River on the Highwood River

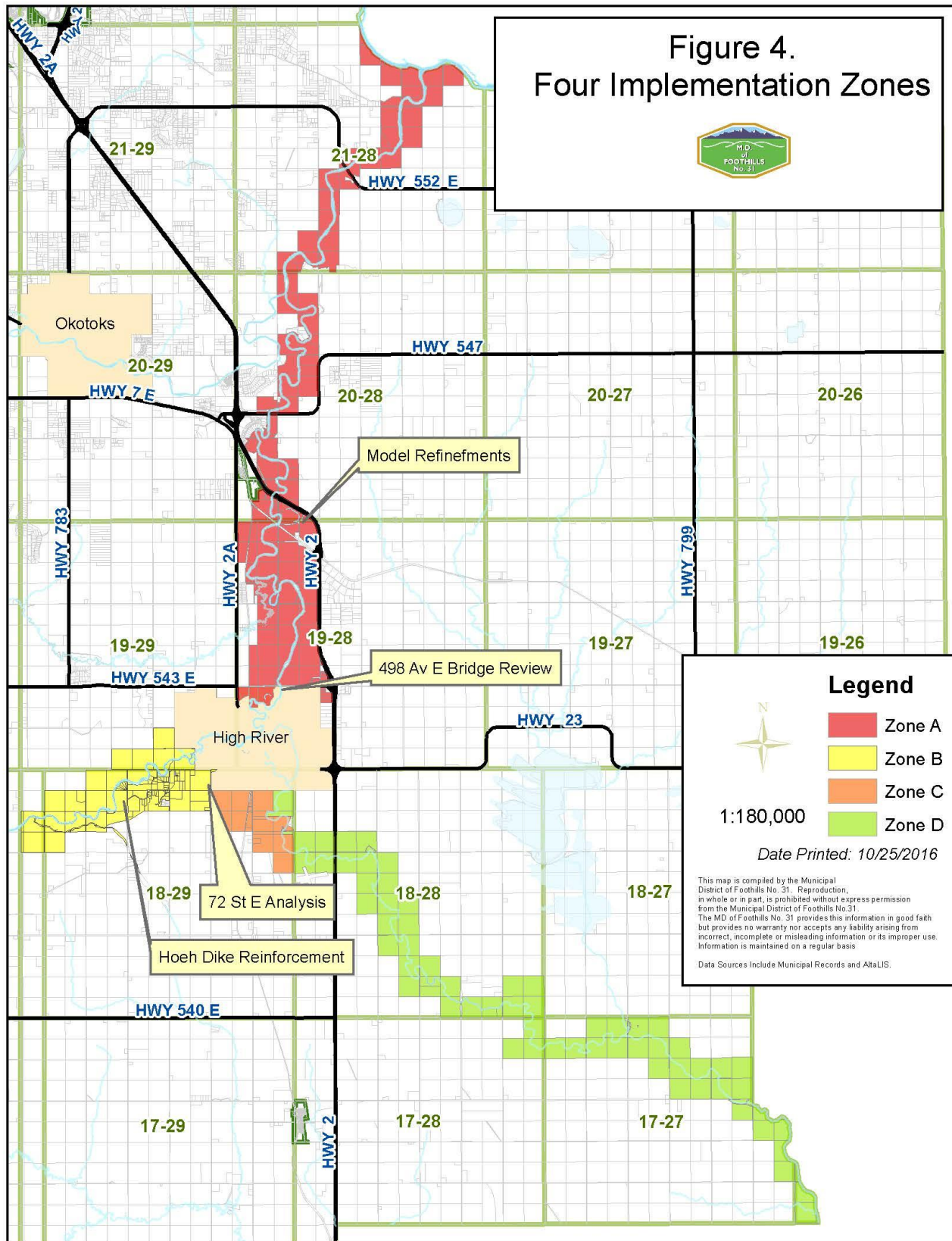
Zone A includes lands along the Highwood River downstream of the Town (from 498<sup>th</sup> Avenue to the confluence of the Highwood with the Bow River), as well as two parcels within the Town of High River (see *Figure 5 - Zone A Parcels*). As outlined in Section 3.6, the Highwood River downstream from the Town of High River will be subject to a significant increase in flow due to the change in the flow split and loss of water storage area that has resulted from the mitigation works constructed in the vicinity of the Town. It is estimated that the impacts of these changes could begin to be evident at peak flow levels above approximately 1000 m<sup>3</sup>/s (gauged upstream of Woman's Coulee Canal inlet).

Within Zone A, 111 properties were identified as having increased flood risk. Of these, 15 properties (including the two parcels in the Town) have residences that are at an increased risk for flooding. The remaining properties have either non-residential structures that are predicted to be impacted or bare land that is predicted to have additional areas of inundation and/or increased risk of erosion due to the mitigation that has been constructed around the Town of High River. There is one property in Zone A that is not shown by the model to be impacted, but that it is suspected to have been impacted in 2013. It is located in an area where the model requires refinement. If future modelling predicts that the residence on this parcel will be impacted, this parcel will be included into the second phase of the program.

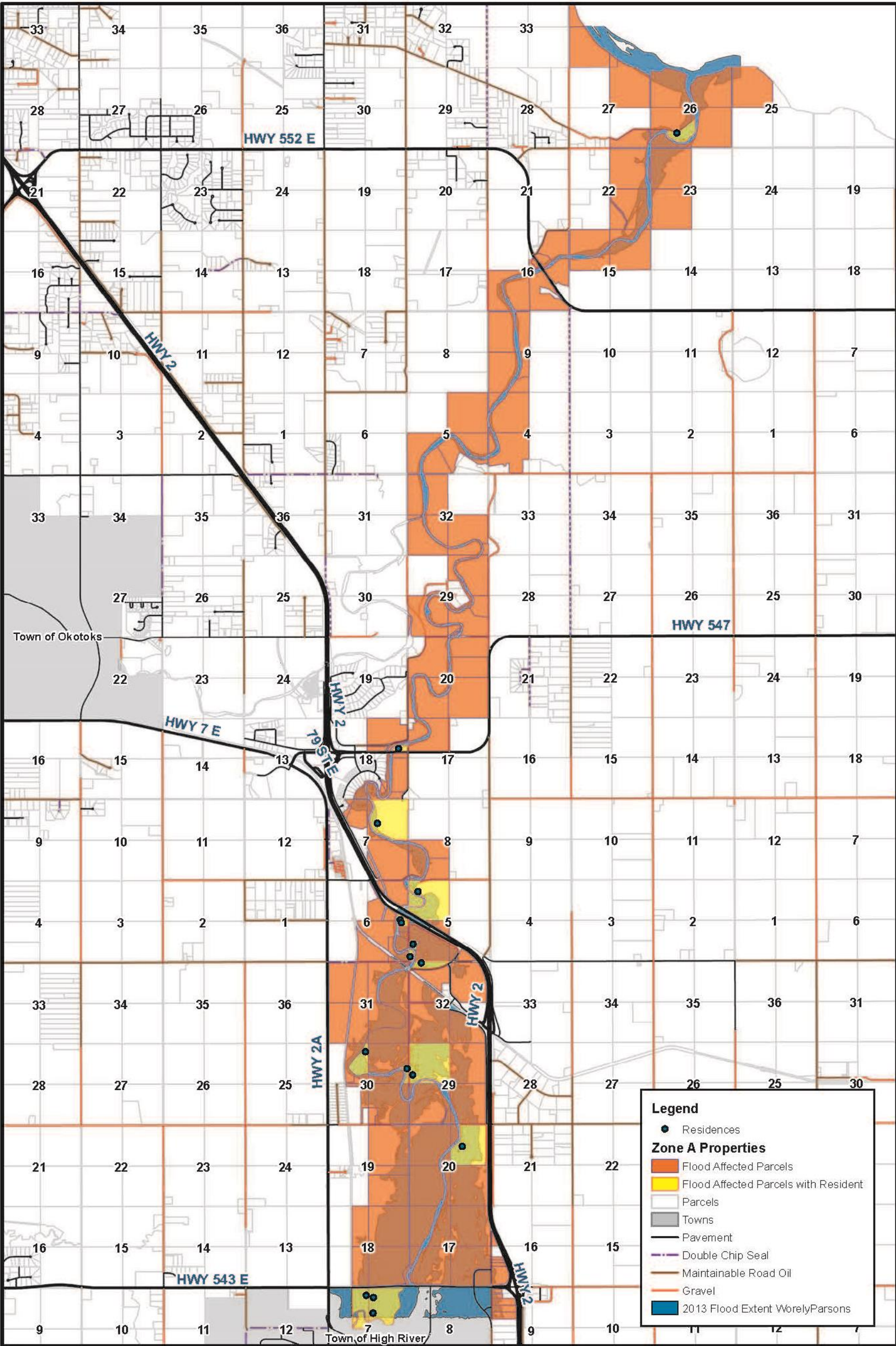
To determine potential solutions for the protection of M.D. residents at risk of flooding and to address the increased risk that the people in Zone A now experience, the Scoping Study compared the cost of protecting residences to the level of a mitigated 2013 event using perimeter berms vs. the cost to buyout either the entire property or just the buildings. Additional options such as raising residences or moving them to higher ground were discussed during the one-on-one meetings conducted as part of the public consultation process undertaken by the M.D.

### 5.2 Zone B – Upstream of High River on Highwood River

Zone B includes lands along the Highwood River from Women's Coulee Canal Inlet to West Boundary of Town, (see *Figure 6 - Zone B Parcels*). This area is generally not predicted to be impacted by the mitigation works constructed or proposed to protect the Town, except for one property which is predicted to be subject to an increase in water level at the residence of less than 0.05 m even in an extreme flood event with a peak flow of 3000 m<sup>3</sup>/s gauged above Women's Coulee Inlet (based on Scenario 44A).







**Figure 5- Zone A Parcels**

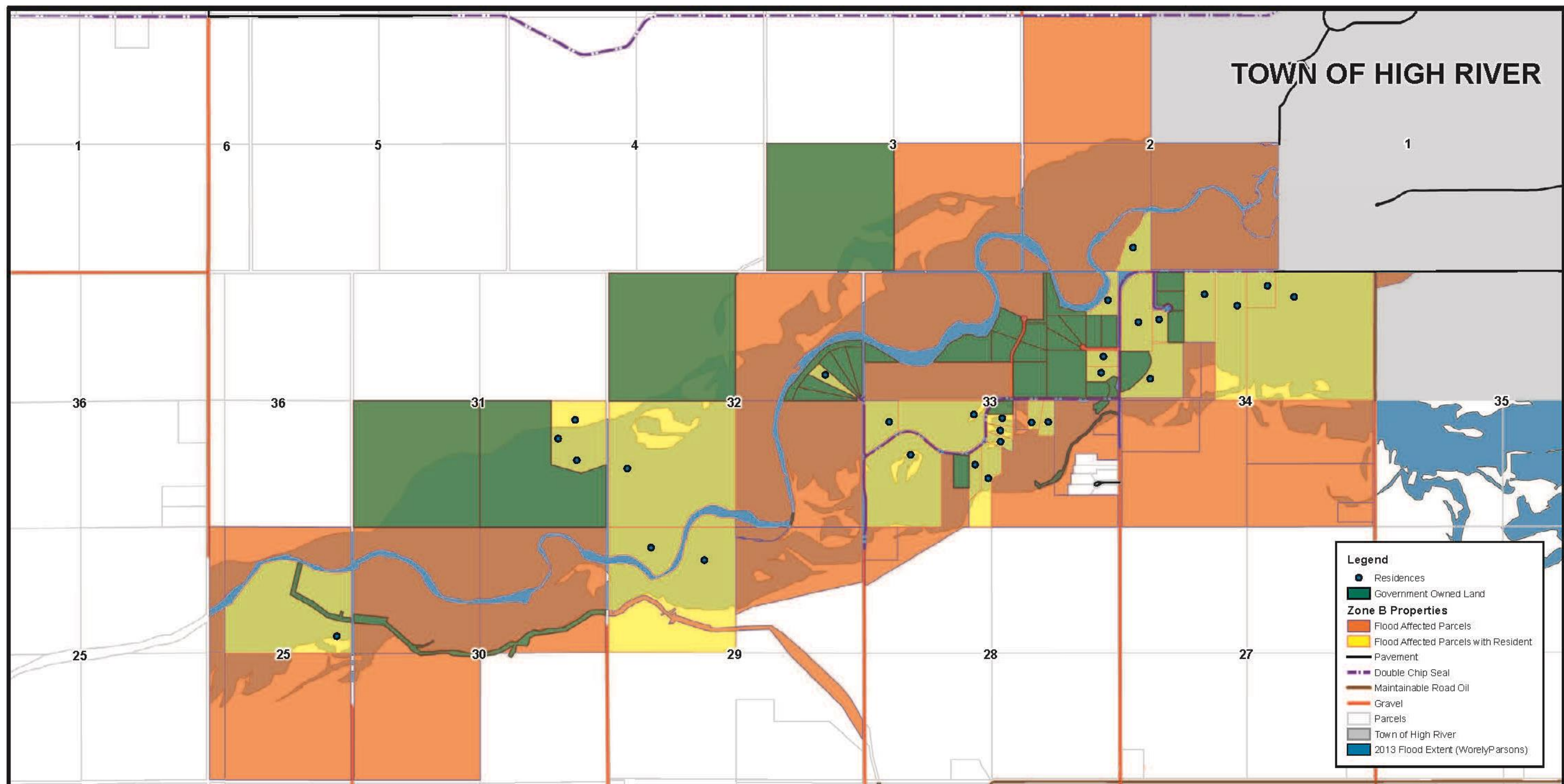


Date Created: 10/25/2016 1 centimeter = 780 meters



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**Figure 6 - Zone B Parcels**

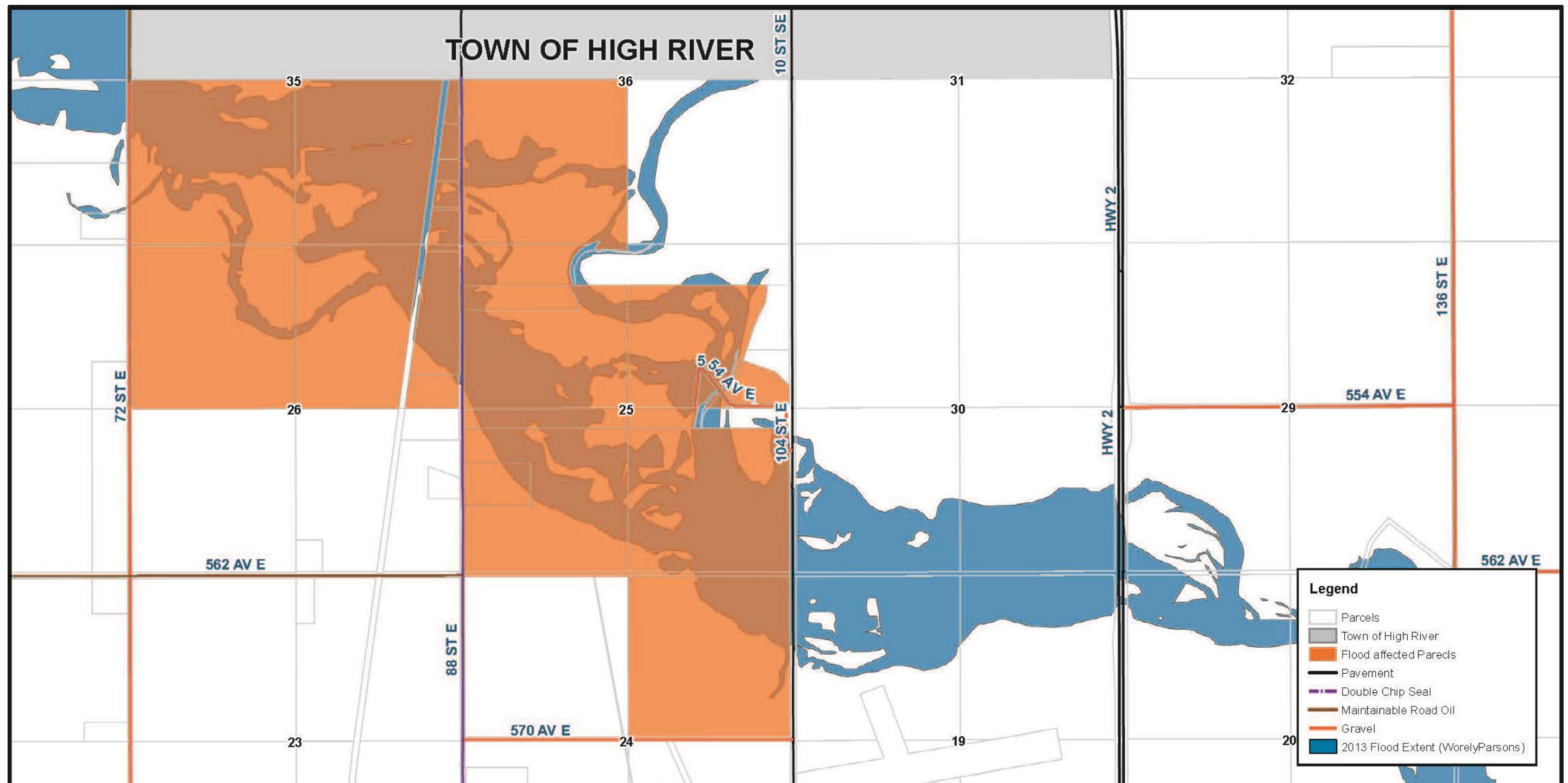


Date Created: 10/25/2016

1 centimeter = 260 meters

0 255 510 1,020 1,530 2,040 Meters

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**Figure 7 - Zone C Parcels**



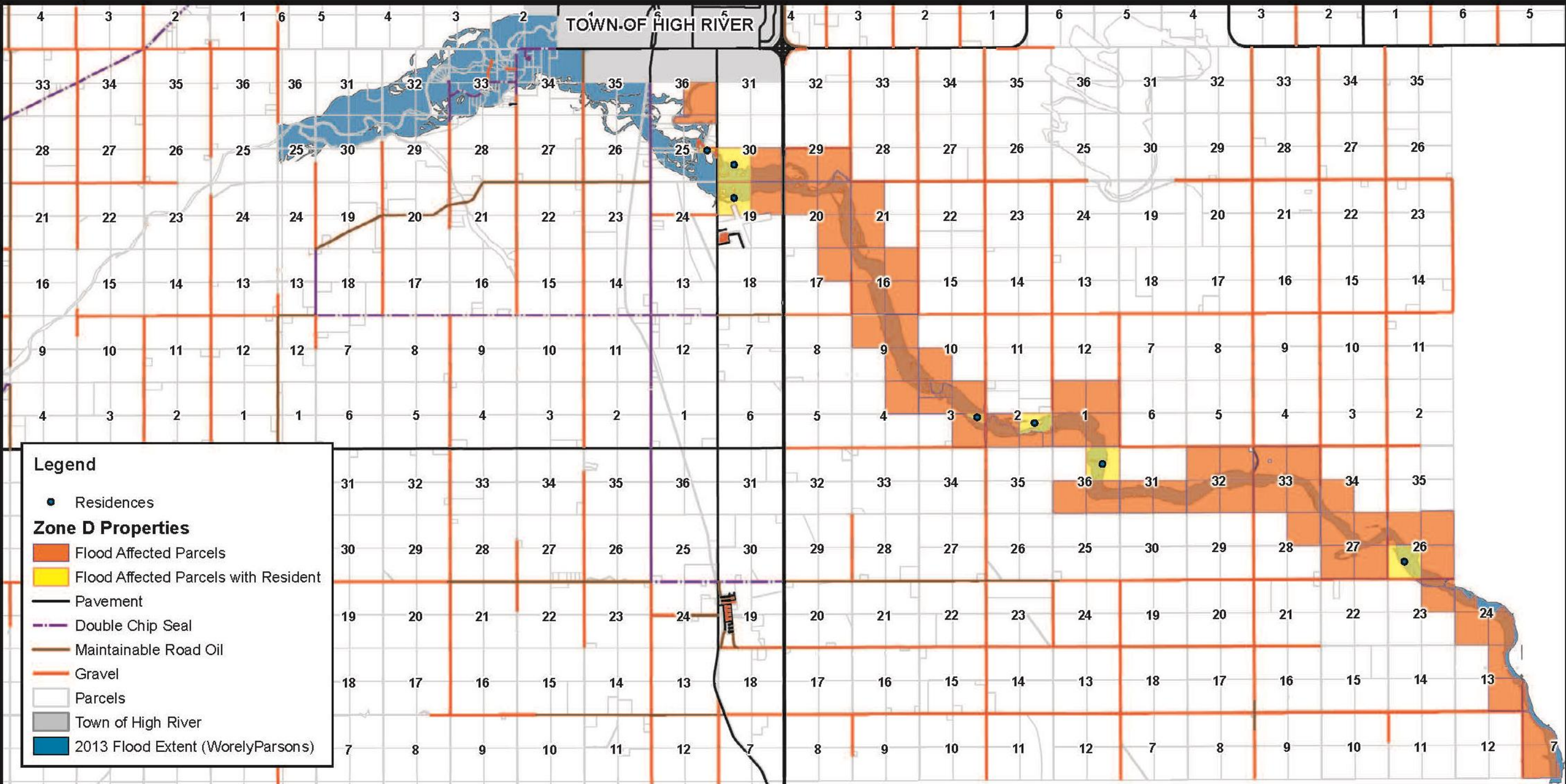
Date Created: 10/25/2016

1 centimeter = 200 meters

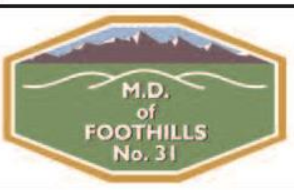
0 195 390 780 1,170 1,560 Meters

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**Figure 8 - Zone D Parcels**



Date Created: 10/25/2016

1 centimeter = 1,000 meters



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This area contains 24 properties that were purchased by Alberta Infrastructure subsequent to the 2013 flood under the Disaster Recovery Program (DRP). There are 39 remaining properties that were identified in the Scoping Study as being subject to inundation in 2013 (one parcel owned by the M.D. of Foothills was omitted). There are 26 properties that have buildings in the mapped floodway, 6 properties have buildings outside the floodway according to the existing (1992) Provincial Flood Hazard Mapping.

The Scoping Study compared the cost of protecting residences and ancillary buildings in Zone B, using perimeter berms, to the level of a 2013 event vs. the cost to buyout either the entire property or just the buildings. Some of the landowners in this zone attended individual meetings with the M.D. to discuss the results of the Scoping Study and their options going forward and in some cases additional options such as moving residences to higher ground or raising them up were discussed during these meetings.

### **5.3 Zone C – In Proximity to Flow Split and Proposed SW Dike**

Zone C includes lands in the M.D. of Foothills that are downstream of the location of the flow split between the Highwood and Little Bow rivers and are predicted to be negatively impacted by the mitigation works already constructed or by the proposed South-West Dike. This zone includes the majority of the parcels that are located below the embankment between 72<sup>nd</sup> street and 104<sup>th</sup> Street (see Figure 7 - Zone C Parcels).

### **5.4 Zone D – Downstream on Little Bow**

Zone D includes lands along the Little Bow River downstream from 72<sup>nd</sup> Street and the Town of High River excluding parcels in Zone C (see Figure 8 - Zone D Parcels). Parcels in Zone D are generally predicted to be positively impacted by the mitigation works around the Town of High River.

A total of 77 properties in Zone D were subject to flood damages in 2013. The residences at 8 of these properties were subject to inundation in the 2013 flood. Of these, there is one residence that is no longer predicted to be subject to inundation for a 2013 magnitude event. While it is anticipated that the diking undertaken around High River will have a positive impact on properties in Zone D, there are still 7 residences in this zone that would be subject to inundation in a 2013 equivalent event. In addition, recent modelling indicates that at 750 m<sup>3</sup>/s properties in Zone D would receive approximately 7 m<sup>3</sup>/s more flow than they would have prior to the mitigation being constructed. This could mean that landowners in this area may be flooded more often. Additional study is recommended to determine the impacts at floods with lower peak volumes than a 2013 equivalent event.

## 6 Proposed Highwood / Little Bow Flood Risk Mitigation Program

In the interest of expediency, the M.D. of Foothills is proposing that the Highwood / Little Bow Flood Risk Mitigation Program be established as a partnership between the Government of Alberta and the M.D. of Foothills whereby the Province would provide the funds and the M.D. would administer the program based on guidelines established in this proposal.

There are four parts to the proposed program which will be described in the following sections:

1. Further Study;
2. Infrastructure Projects;
3. Individual Property Mitigation, Compensation or Buy-Outs; and
4. Compensation for Negatively Impacted Agricultural Lands.

### 6.1 Further Study

#### **Phase 2 of Scoping Study:**

Based on the results of “Phase 1” of the Scoping Study, the following additional study is proposed:

- An examination of the of the Town’s dikes (both constructed and proposed) impact on the flow split between the Highwood and Little Bow rivers at flow regimes other than the 2013 equivalent event. It is suggested that model runs at approximately 750 m<sup>3</sup>/s and at the new 1:100 design flood (once determined) should be undertaken.
- Improvements to Advisian’s model of the Highwood River between the CPR bridge and Highway 2 to address deficiencies that have been identified in the current model.
- Investigation of the benefits and impacts of the Hoeh Dike and Baker Creek Dike at lower flows for example 500 m<sup>3</sup>/s, 750 m<sup>3</sup>/s and the new 1:100 design flood once determined.
- Investigation of the potential impacts of lowering or raising 72<sup>nd</sup> Street East.

It is proposed that this work would be done as a second phase of the Scoping Study based on the proposal submitted by Advisian and AMEC Foster Wheeler attached as Appendix A. The total estimate to complete this work is \$ 280,000.

#### **498<sup>th</sup> Avenue Bridge:**

The Scoping Study states that 2D modelling of Scenario 28A (with the mitigation works constructed through High River) indicates an increase in water levels and velocities in the order of 0.7 m and 0.4 m/s for a 2013 equivalent event.

The study suggests that the design level of the bridge and erosion protection should be reviewed considering the new flood flow regime.



#### Budget:

The preliminary level cost estimate for the evaluation of the 498<sup>th</sup> Avenue Bridge is \$ 23,076 based on a proposal submitted by AMEC Foster Wheeler, attached as Appendix B. This proposal includes: an assessment of the existing bridge hydraulics, updated bridge design criteria similar to the level provided for High River's dikes, identification of the suitability of the existing design based on the updated design criteria, and if deemed necessary, provision of conceptual designs for mitigating any outstanding flood risks resulting from the existing bridge design. The MD has an Engineering Services Agreement with AMEC that this evaluation could fall under or the MD could seek quotes from other firms if the Government of Alberta requires it.

## **6.2 MD of Foothills Infrastructure Projects**

#### **Hoeh Dike:**

The Scoping Study proposes upgrading of a 50 m section of the Hoeh Dike to mitigate the possibility of a breach in future flood events. As part of this project, an access easement should be acquired in order to ensure the ability to gain access to this infrastructure for future maintenance.

#### Budget:

The preliminary level cost estimate for the upgrading of the Hoeh Dike is \$ 253,597 based on the proposal submitted by AMEC Foster Wheeler, attached as Appendix C. Once again, this work could fall under the Engineering Services Agreement that the MD has with AMEC.

Estimated cost to acquire access easement: \$ 30,000

## **6.3 Individual Property Mitigation or Buy-Outs**

The M.D. of Foothills is proposing a mitigation program for Zones A, B, and D with the primary goal of moving as many residents as possible away from flood hazard areas and making room for the river as per the recommendations of the Deltares report (Deltares, 2015). Landowners in Zone C are to be dealt with by the Town of High River as part of their SW dike application to Alberta Environment and Parks.

It is proposed that in the initial phase, only properties with impacted buildings will be eligible for protection or buy-outs under the mitigation program; landowners with properties that will be subject to impacts only to land would be dealt with in a second phase. However, we are proposing that part of phase one would include retaining a qualified professional to provide a report outlining if compensation should be given to landowners with negatively impacted bare land, that is, land that will have additional areas of inundation and/or increased risk of erosion, and how the amount of compensation would be determined.

### 6.3.1 Proposed Program Specifics by Zone

#### **Zone A:**

In Zone A there are 111 properties predicted to be impacted by the mitigation constructed in the vicinity of the Town of High River. Of these, 15 properties have residences that are predicted to be affected in a 2013 equivalent event (See the Zone A Property Summaries in Appendix D).

Going forward with the implementation of the proposed program in Zone A, the M.D. would initiate a more detailed investigation into options deemed feasible and acceptable to the owners of properties with impacted residences. This may include market value assessments, quotes to move or raise up residences and ancillary buildings or detailed design of berms among other possibilities.

If a Zone A resident is interested in being bought-out, it is proposed that an independent market value assessment of the property be undertaken and an offer to purchase be made. In some cases, after remediation, the land could still be valuable as farm land and it is proposed that it could be sold to agricultural producers with an appropriate caveat on the title prohibiting future development.

If a landowner has indicated a desire to remain on their property and to be protected, the M.D. proposes that the possibility of berm construction, moving structures to higher ground (if available) or raising structures up be evaluated. This type of mitigation would only be considered if it were comparable to, or less expensive than the net cost of purchasing the property (where net cost is the buy-out cost plus remediation costs less what the bare land could be re-sold for with a caveat restricting future development).

For properties in Zone A without residences that are predicted to be negatively impacted, the Scoping Study documented the additional areas of inundation that could be expected or areas at additional risk of erosion in a future flood event due to mitigation completed at High River. What action would be most appropriate to address these impacts was not determined in the Scoping Study, but two possibilities which have been discussed are a one-time compensation for increased flood risk due to the mitigation in and around the Town of High River, or a program for future compensation for crop damage or loss if an extreme flood event were to occur. The M.D. proposes that a qualified professional be engaged to determine under what conditions compensation is appropriate and how the amount of compensation would be determined. This is discussed further in Section 6.4.

#### **Zone B:**

While there were properties in this zone that would have been eligible to be bought out under the DRP after the 2013 flood, the M.D. of Foothills is taking the position that the people in this area should be given a second chance to take a buy-out. The rationale for this is as follows:

- In the days and weeks following the 2013 flood many of the impacted landowners were traumatized by the event and were not in a suitable state to make critical decisions;
- there was confusion among landowners about exactly how the process was supposed to work and some landowners did not understand that they had to make an application and follow through the steps, thinking instead that someone would contact them with an offer to purchase their land;
- There had been considerable media attention around the possibility that there would be a large diversion constructed on the Highwood River upstream of High River to mitigate future flooding. Some of the landowners in this area did not take a buyout believing that a future diversion of the Highwood River would protect them; and
- It is believed that removing as many residents as possible from flood hazard areas will provide the most benefit going forward and should be a priority.

There are 27 properties in Zone B with residences that are predicted to be impacted in a 2013 equivalent event (See Zone B property summaries in Appendix D).

In situations where Zone B landowners are interested in a buy-out it is proposed that market value assessments of properties be undertaken and offers to purchase be made in order to facilitate reducing development in the floodway and making room for the river. If landowners have indicated a desire to remain on their property and to be protected, the M.D. proposes that the potential berm construction or moving structures to higher ground be evaluated. This type of mitigation would only be considered if it were comparable or less expensive than the net cost of purchasing the property and if it could be done without subjecting other properties to increased risk.

There are some parcels without residences in Zone B that were impacted in the 2013 event. The risk of flooding and the amount of inundation that would be experienced in future floods in Zone B is unchanged therefore, the M.D. is not requesting consideration for compensation for lands without an impacted residence in this zone.

### **Zone C:**

The landowners in this area are not proposed to be included in the Highwood / Little Bow Flood Risk Mitigation Program as it has been determined that the Town of High River will come to agreements with these landowners as part of the work being done in support of the proposed SW Dike application to Alberta Environment and Parks.

The Town of High River has made a commitment to treating these impacted landowners fairly and has agreed to keep the M.D. informed about negotiations as they progress and to include M.D. staff in meetings where appropriate.

### **Zone D:**

As outlined in Section 5.4, while it is predicted that the diking undertaken around High River will have a positive impact on properties in Zone D in a 2013 equivalent event;

there are still 7 residences in this zone that would be subject to inundation in an event of that magnitude (See the Zone D property summaries in Appendix D).

None of the impacted landowners in Zone D were offered buyouts subsequent to the 2013 flood event because they were not in a mapped floodway due to the fact that no flood hazard mapping had been undertaken on the Little Bow River. However, some of these landowners reported water levels of up to 1.5 – 1.8 m at their residence in 2013. While properties on the Little Bow River are generally predicted to see less water in future events due to the mitigation constructed around High River, some are still subject to significant flood risk at their residence. It is proposed that these landowners should not be penalized for being in an area where flood mapping has not been undertaken. In addition, it is predicted that for events with flood peaks flows around 750 m<sup>3</sup>/s on the Highwood measured below the Women's Coulee inlet they actually have a slightly higher risk of flooding than they would have without the mitigation that has been constructed to protect the Town.

The Council of the M.D. of Foothills has taken the position that Foothills landowners should be protected to a level equivalent to that afforded residents of the Town of High River – that is to the level of the 2013 event plus one metre freeboard. Thus, it is proposed that the 7 landowners with residences that would be negatively impacted in a 2013 equivalent event should be offered protection or a buyout. It is proposed that buyouts would be offered at market value as determined by an independent qualified professional.

If these landowners wish to remain on their property and to be protected, the M.D. proposes that the possibility of perimeter berm construction, moving structures to higher ground (if available) or raising structures be evaluated. This type of mitigation would only be considered if it were comparable to or less expensive than the net cost of purchasing the property and if it could be done without subjecting other properties to increased risk.

With respect to properties without impacted residences and bare agricultural land in Zone D, since the risk of flooding and the amount of inundation that would be experienced in future floods is predicted to be significantly less in a future 2013 equivalent event, the M.D. is not requesting consideration for compensation for properties without an impacted residence in this Zone.

### **6.3.2 Proposed Process**

As part of the public consultation process undertaken by the M.D. 52 preliminary individual meetings have been held with impacted landowners in the study area. In each case, the landowner's preferred outcome was discussed. If the proposed program is approved, the M.D. would ensure that landowners for every parcel with an impacted residence (as described above) are contacted. For those who decline to meet, a letter will be sent indicating that we offered them the opportunity to participate in the program and that they had declined and that they will not receive any further notifications going forward.

Once discussions have taken place with all landowners with impacted buildings who are willing to meet, either a market value appraisal or an evaluation of other measures deemed viable will be undertaken for each property (in a few cases, both of these may end up being required). Once costs are determined, a course of action will be decided upon in consultation with the landowner and the decision will be documented. M.D. of Foothills Staff will then ensure that the actions outlined for each property are completed as soon as possible.

Should the Province approve this proposal and approve the funding, the M.D. is prepared to move forward with implementation of the program immediately.

### 6.3.3 Estimated Budget for Mitigation Program

The estimated budget has been developed using what is assumed to be a “worst-case scenario”, that is, the cost associated with buying out and remediating properties in Zones A, B and D that have structures predicted to be impacted in a future 2013 equivalent event. Property values used were an estimate of what current market value would be. Once again, it has been assumed that the Town of High River will be negotiating with landowners in Zone C.

The preliminary market values used to develop a budget for this proposal were determined by the M.D. of Foothills assessment department. It is proposed though that where buy-outs are being proposed a fair current market value appraisal should be undertaken by a third party. The preliminary market values for properties are included in the individual property summary tables.

Once again, in all zones, any flood mitigation options other than a buy-out for individual properties would need to be less expensive than the cost to buy-out the property (this would be the net cost – that is, including the remediation costs and less the predicted amount that could be recouped through the sale of the bare land for agricultural purposes) in order to be considered viable.

#### **Budget for Zone A:**

Cost for buy-out of all eligible properties:

2 THR parcels. + \$15,816,765 =	\$ 18,316,765
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Plus: cost to obtain market value appraisals:

15 Properties @ \$ 1750 (*estimate)	\$ 26,250
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Plus: cost to remediate:      \$ 500,000 + \$ 1,788,630	\$ 2,288,630
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Less: amount recouped through sale of bare land:	< <u>\$ 1,583,926</u> >
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<b>Total Estimated Budget for Zone A:</b>	<b>\$ 19,047,719</b>
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**Budget for Zone B:**

Cost for buy-out of all eligible properties:	\$ 25, 038,319
Plus cost to obtain market value appraisals:	
27 Properties @ \$ 1750	\$ 47,250
Plus cost to remediate:	\$ 3,602,600
Less amount recouped through sale of undevelopable Ag land:	< \$ 1,764,870>
<b>Total Estimated Budget for Zone B:</b>	<b><u>\$26,923,299</u></b>

**Budget for Zone D:**

Cost for buy-out of all eligible properties:	\$ 6,910,005
Plus cost to obtain market value appraisals:	
7 Properties @ \$ 1750	\$ 12,250
Plus cost to remediate:	\$ 809,418
Less amount recouped through sale of undevelopable Ag land:	< \$ 963,534>
<b>Total Estimated Budget for Zone D:</b>	<b><u>\$6,768,139</u></b>

**Budget for Program Administration:**

It is estimated that program administration would require one full time position for one year with benefits.

One Year temporary position:	<b><u>\$ 100,000</u></b>
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## **6.4 Compensation for Negatively Impacted Agricultural Land**

As stated in Section 6.3.1 the M.D. of Foothills supports the compensation of agricultural landowners in Zone A for the predicted additional inundation or increased risk of erosion that they are likely to experience in a 2013 equivalent event due to the mitigation works in the vicinity of High River. It is believed that this may be able to be accomplished by purchasing flood easements across negatively impacted agricultural lands. Once purchased, these easements would be registered on title of the property.

The feasibility of this approach or an alternative approach as well as the determination of what would be the fair cost to purchase easements will need to be determined by a qualified professional. This study would be undertaken as part of the implementation of the initial phase of the proposed program however any compensation program for negatively impacted Ag lands would be proposed as a second phase.

### **Budget:**

Budget for a report by qualified professional regarding a compensation program for negatively impacted agricultural land: \$ 48,060 based on proposal from IBI (See Appendix E). This quote was obtained for budgeting purposes, the project could be put out for quotes from other firms if the Province requires it.

## **6.5 Budget Summary**

Below is a summary of the budget for all four parts of the proposed Highwood / Little Bow Flood Risk Mitigation Program.

### **Further Study**

Phase 2 of Scoping Study:	\$ 280,000
498 <sup>th</sup> Avenue Bridge assessment:	\$ 23,076

### **Infrastructure Projects**

Hoeh Dike reinforcement	\$ 253,597
Purchase of access easement	\$ 30,000

### **Individual Property Mitigation or Buy-Outs**

Total Estimate for Zone A:	\$ 19,047,719
Total Estimate for Zone B:	\$ 26,923,299
Total Estimate for Zone D:	\$ 6,768,139
Program Administration:	\$ 100,000

### **Compensation re: Negatively Impacted Agricultural Lands**

Retaining Qualified Professional to Produce Report:	<u>\$ 48,060</u>
<b>TOTAL BUDGET FOR PROPOSED PROGRAM:</b>	<b><u>\$ 53,473,890</u></b>

## 7 References

AMEC Foster Wheeler Environment & Infrastructure and Advisian WorleyParsons Group (2016): Scoping Study of Flood Related Areas of Concern on The Highwood River and Little Bow River Within the Municipal District of Foothills, prepared for the Municipal District of Foothills No. 31. May 2016.

WorleyParsons Canada (2016): Town of High River SW Dike supplementary document for Alberta Environment and Sustainable Resource Development Regulatory Permit Application – Revision 2, prepared for the Town of High River. July 14, 2016.

Deltares (2015): Review of Flood Mitigation Proposals for High River (Alberta, Canada), prepared for Alberta Flood Recovery Task Force. February 2015.



## **Appendix A – Proposal for Phase 2 of the Scoping Study**

## **Appendix B – Proposal for Evaluation of Design Level and Erosion Protection for 498<sup>th</sup> Avenue Bridge**

## **Appendix C – Proposal for Hoeh Dike Reinforcement**

## **Appendix D - Property Summaries by Zone**

## **Appendix E – Proposal to Develop Agricultural Land Compensation Program**