Baird

oceans
engineering
lakes
design
rivers
science
watersheds
construction

Rural Municipality of Victoria Beach
Shoreline Management Plan
Lake Winnipeg, Manitoba

February 7, 2014
11930.201

Rural Municipality of Victoria Beach
Shoreline Management Plan

Prepared for

Rural Municipality of Victoria Beach

Prepared by

Baird

W.F. Baird & Associates Coastal Engineers Ltd.

For further information please contact
Pete Zuzek or Jennifer Ogrodnick at (905) 845-5385

11930.401

PROFESSIONAL GEOSCIENTIST
PETER J. ZUZEK
PRACTISING MEMBER
1121
ONTARIO

LICENSED PROFESSIONAL ENGINEER
J. L. S. OGRODNICK
100102531
7/Feb/2014
PROVINCE OF ONTARIO

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The beaches and residential development around the Rural Municipality of Victoria Beach (RMVB) are threatened by erosion hazards. These beaches are one of the things that make Victoria Beach unique and close to the hearts of all the residents and visitors. The Public Reserve that was established by the RMVB almost 100 years ago to provide public access along the shoreline has been eroding overtime and has almost disappeared in some locations. If erosion is allowed to continue without engineering intervention, the shoreline will be located within the private property parcels. If this were to happen, the RMVB would lose control of one of their most valuable assets, the beaches.

Baird & Associates (Baird) were retained by the RMVB to prepare a Shoreline Management Plan (SMP). The purpose of the SMP is to develop a vision for the RMVB shoreline, identify the unique characteristics of the shoreline valued by the community, and provide guidance for appropriate beach building and erosion mitigation alternatives. The SMP was developed with the support of a detailed study that included the following phases that took place over 2 years:

- **Oct. 2011**: Initial site observation and data collection.
- **Dec. 2011**: Meeting with Victoria Beach Council and Stakeholders.
- **2012 to present**: Technical investigation on erosion and sedimentation processes.
- **Apr. 2012**: Governance review and vision planning.
- **July 2012**: Additional data collection and stakeholder meeting.
- **August 2012**: Additional data collection and stakeholder meeting.
- **June 2013**: Top of bank survey.
- **July 2013**: Stakeholder presentation and open house.
- **August 2013**: Preliminary geotechnical investigation of select sites.
- **July 2013**: Development of final shoreline management recommendations.
- **August 2013**: Stakeholder presentation and meeting.
- **January 2014**: Draft SMP issued to the RMVB Council for review and approval.

As part of the SMP, options for erosion mitigation measures were developed for the shoreline of Victoria Beach. The basis for the shoreline management options was the technical study (Baird, in press) which provided a thorough understanding of the coastal processes and the mechanisms for erosion and sedimentation, the vision in the draft Development Plan, and community feedback. The options considered all practical possibilities, with the primary purpose of not only preserving, but enhancing the popular public beaches and protecting the waterfront lots from erosion hazards. These options were presented to the community of Victoria Beach as part of the public consultation process to develop this SMP (July 2013). Initially, the community of Victoria Beach had different opinions of how the erosion should be mitigated. However, the majority of the Victoria Beach

residents agree that preserving the public beaches in perpetuity and protecting the waterfront homes should be the top priority of the SMP. The vast range of feedback from the community was considered by Baird, and final recommendations were developed. A second presentation was made to the community (Aug. 2013) and the comments received pertained more to details of the recommendations as opposed to fundamental differences in option with respect to the shoreline. Ultimately a majority consensus was reached on a way forward.

The final recommendations and priorities for the Victoria Beach SMP are summarized in Table 1. The reaches classified as high priorities include Connaught South, King Edward and Alexandra Beach, Patricia and Arthur Beach, and the Sand Bluffs.

Table 1: Summary of Shoreline Management Recommendations

Reach	Recommended Management Plan	Priority
Reach 2: Connaught South	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 3: King Edward and Alexandra	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 5 (North): Patricia and Arthur Beach	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 10 (North and South) and Gibson Drive	Conduct detailed geotechnical investigation to assess slope stability and develop mitigation options.	High
Reach 5 (South): Clubhouse Beach	Beach nourishment with anchoring structures (groynes).	Moderate
Reach 11: Wanasing Beach	Maintain existing structure and monitor shoreline. If beaches are not stable, remove ad-hoc structures and design a uniform solution to maintain the beach. Elevation of sand bag dyke should be monitored with maintenance completed as required.	Moderate
Reach 7: Bayview to Pelican Point	Monitor and maintain existing engineering structures.	Low
Reach 4: Scott Point Headland	Monitor erosion, and if continues and is a concern then construct a rock revetment.	Low
Reach 2: Connaught North	Monitor erosion and maintain existing structures.	Low
Reach 6: Federal Wharf/Safe Harbour	Maintain existing structures (by owner).	Low
Reach 9: Highway 504 to Hamptons	Install infrastructure to control over land runoff. Monitor erosion. If erosion is threatening private land, then land owners to construct and maintain rock revetments.	Low
Reach 10 (North): Sunrise	Monitor erosion and maintain existing structures. If erosion continues consider upgrading the shoreline protection.	Low
Reach 12: Albert Beach	Elevation of sand bag dyke should be monitored with maintenance completed as required. Construct parking lot for Albert Beach access (optional).	Low

The recommendations presented in Table 1 for the high priority reaches should be finalized in terms of the type of structures, number of structures and location in a final design investigation. Additional recreational features can also be included in the design, such as controlled access walkway to make the beaches more accessible.

Given the importance of the beaches and other natural areas around Victoria Beach, it is important to enhance the shoreline development guidelines to preserve these natural features that make Victoria Beach so unique and protect existing and future development from erosion and flooding hazards. Adopting development setbacks is also beneficial to the developer/proponent as it limits the risk of damage from coastal hazards for new development. When the Development Plan is finalised for the RMVB, this SMP should be referenced or linked, thus providing additional clarity on appropriate actions along the shore.

1.0 INTRODUCTION

Baird & Associates (Baird) were retained by the Rural Municipality of Victoria Beach (RMVB) to prepare a Shoreline Management Plan (SMP). The purpose of the SMP is to develop a vision for the RMVB shoreline, identify the unique characteristics of the shoreline valued by the community, and provide guidance for appropriate erosion mitigation alternatives. The goals of the SMP are as follows:

- Identify critical infrastructure threatened by erosion hazards and protect.
- Provide options for preserving the public beaches in perpetuity.
- Reach a majority consensus for dealing with erosion hazards and beach access for the shoreline.
- Improved guidance for new shoreline development, and re-development.

This report outlines the process undertaken to develop the SMP, including conducting a detailed technical study to characterise the conditions of the existing shoreline (refer to Section 2.0), evaluating shoreline management approaches (refer to Section 3.0), holding various community consultations (refer to Section 4.0), and developing recommendations for Victoria Beach (refer to Section 5.0).

1.1 Background Information

The RMVB is a small peninsula located in the southern basin of Lake Winnipeg (refer to Figure 1.1). Elk Island is located immediately north of the RMVB and separated by a shallow water sand spit. During low lake levels an isthmus exists that connects Victoria Beach to Elk Island.

The Victoria Beach Company was created in 1910 to develop a summer resort community. Initially, the only access to Victoria Beach was via boat. In 1916, a rail connection was constructed from the mainland, which enhanced the flow of goods and services to the area. The Victoria Beach officially became a municipality in 1919; and was followed by a road connection in 1952. The development pattern in Victoria Beach is focused on one of its greatest assets, the shoreline and the beaches. The interior of the municipality is largely undeveloped, with the exception of a golf course built in the 1920s.

Over time the Victoria Beach shoreline has been eroding in some areas. Without active engineering interventions, buildings that are now threatened by erosion will eventually be destroyed by bank recession. Similarly, if popular public beaches are not enhanced with innovative engineering techniques, some will eventually be wholly located on private land, raising legal questions about ownership and access.

Figure 1.1 Study Area

1.2 Regulatory Framework for the Shoreline Management Plan

The regulatory framework for the SMP includes the Planning Act for the Province of Manitoba, which is supported by the Shoreline Erosion Technical Committee (SETC) and the Development Plan for the RMVB. The SMP has been developed strategically to link to this existing regulatory framework.

1.2.1 The Planning Act of Manitoba

The Planning Act of Manitoba provides a legal approach for the creation and adoption of Development Plans by Municipal Governments across the province. These plans and any bylaws developed at the local level are the primary regulatory mechanism to manage shorelines in the Province of Manitoba. This differs significantly from other jurisdictions in North America, where Provinces and States with freshwater and ocean coastlines develop uniform regulations that govern activities in the coastal zone. The Province of Manitoba has setup the Shoreline Erosion Technical Committee (SETC), which is described in the following section (1.2.2).

1.2.2 Shoreline Erosion Technical Committee (SETC)

SETC is a multi-disciplinary committee of representatives from the Federal Government, the Province of Manitoba and local government representatives across the Province of Manitoba. Permits for shoreline protection are forwarded to SETC from Planning Districts or Municipal Governments. SETC comments on the relative merits of the proposed erosion mitigation alternative and provides recommendations for additional analysis (if necessary). They do not recommend alternative options. Their comments are forwarded back to the local planning authority for consideration. SETC has no regulatory authority and does not issue permits for shore protection.

1.2.3 Rural Municipality of Victoria Beach Development Plan

Section 43(1) of the Planning Act states Development Plans should set out plans and policies of municipalities respecting their purpose and objectives relative to social, environmental and economic conditions. The Development Plan for the RMVB is based on sustainable development principals and is the primary land use strategy for the community.

A principal goal of the plan is to maintain the unique history, character and lifestyle of Victoria Beach. Given the strong community ties to summer recreation, maintaining access to the local beaches and other natural areas for all residents of the rural municipality is highlighted in the Development Plan. Further, maintaining this access for future generations is also stressed in the plan. Given the acute nature of shoreline erosion around the Victoria Beach peninsula and the potential impacts to private property and beaches, the Development Plan substantiates the need for a more robust planning approach to shoreline management in the Rural Municipality. Sections in the Development Plan directly related to the SMP include:

- Section 3.3.17 provides regulation with regards to stable slopes.
- Section 3.3.18 provides regulation with regards to the minimum distance a development must be from the 100 year flood.
- Section 3.3.19 provides regulation with regards to erosion.

At the time of this report, the RMVB was in the process of finalizing its Draft Development Plan with the assistance of staff from Community Regional Planning Services at Manitoba Local Government.

1.3 October 2010 Storm – A Call to Action

On October 27, 2010, there was a storm event with strong NNW winds that persisted for most of the day when the lake was already at a high level. This storm caused significant erosion around the shoreline of Victoria Beach, and is locally referred to as the "weather bomb". It was this "weather bomb" that raised awareness about the coastal erosion hazards and ultimately initiated the development of the SMP. Some examples of the erosion as a result of this storm are shown in Figure 1.2 through to Figure 1.5.

Figure 1.2 King Edward Beach
Fall 2010 after "weather bomb"

Figure 1.3 Connaught Beach
Fall 2010 after "weather bomb"

Figure 1.4 Arthur Beach
Fall 2010 after "weather bomb"

Figure 1.5 Patricia Beach
Fall 2010 after "weather bomb"

During the storm event in October 2010, the 24 hour average wind speed at the Victoria Beach gauge was 17 m/s (61 km/hr) with a maximum recorded hourly wind speed of 19.2 m/s (69 km/hr). The water level at the time of the storm was 219.56 m ASL (720 ft) at the Victoria Beach Gauge (05SA003). To put this water level into context, the high end of the regular operating range of the Lake by Manitoba Hydro is 217.9 m ASL (715 ft). It was predicted by Baird in the Technical Study for the RMVB (in press) that the wave height (Hs) offshore of the project site reached 2.9 m during the peak of the storm.

1.4 Relevant Previous Studies

Relevant previous studies include: "The Community Perspectives – Community Solutions" report prepared by the RMVB Advisory Committee, "Lake Winnipeg Shoreline Management Handbook", the Baird Technical Report for the RMVB (in press), and the Golder 2013 Preliminary Geotechnical report. They are briefly described in the following subsections.

1.4.1 Community Perspectives – Community Solutions (June 2012 report by RMVB Advisory Committee)

The Victoria Beach Advisory Committee on Shoreline and Beach Management consisted of seven members of the RMVB, a Chair from outside the community, and the Chair of SETC. Following extensive public engagement they prepared a report in June 2012, entitled "Community Perspectives – Community Solutions". This report provides a detailed summary of the community opinions and perspectives on coastal erosion based on their consultations. A series of issues at Victoria Beach are described, including legal, planning, science, equity, community, governance, financial, and ecological.

1.4.2 Lake Winnipeg Shoreline Management Handbook (March 2001)

The Lake Winnipeg Shoreline Management Handbook provides a comprehensive overview of erosion and flooding processes for the southern basin of the lake. Various management approaches are outlined for dealing with coastal hazards, from establishing setback limits for new construction, to non-structural improvements, building relocation, and construction of a range of light and heavy shoreline protection options. The document should be consulted by those looking for general background information on erosion and flooding hazards. Since the document provided a lakewide perspective, it does not provide detailed technical information on erosion, sediment transport and depositional patterns at Victoria Beach. Nor does it provide sufficient detail to address the complex interrelationship between private property hazards, shoreline protection options to mitigate erosion, and long-term beach access within the Rural Municipality.

1.4.3 Baird Technical Report

A report in preparation by Baird includes a summary of the technical investigations undertaken prior to the development of the SMP. These technical studies included analysis of the erosion processes through data gathering (bathymetric, topographic, and sediment data) and numerical

modelling. The numerical modelling included preparing a wind-wave hindcast, conducting hydrodynamic modelling, and sediment transport modelling. The results were then used to prepare a regional sediment budget.

The main findings from the technical investigation include:

- Shoreline erosion is a natural process.
- The shoreline has been eroding since the RMVB was created in some locations.
- The eroding banks are threatening assets along several of the west coast beaches.
- The significant volumes of sand eroded from Elk Island do not migrate southward to provide replenishment for the popular swimming beaches; rather it is deposited in the sand spit between the RMVB and Elk Island.
- The primary source of sediment for beach building is the eroding sand banks within the RMVB.

1.4.4 Golder Geotechnical Report

Golder Associates Ltd. (Golder) completed geotechnical inspections at a number of locations along the shore of the Victoria Beach peninsula. Field work was conducted in August 2013, and included traversing the entire length of the shoreline from Sunrise to Sand Bluffs; visiting locations along King Edward, Alexandra, Patricia and Clubhouse Beach; and visiting the existing RMVB sand/gravel pit. A summary of Golders findings are provided below:

- For the majority of the shoreline from Sunrise to the Sand Bluffs, the steep banks are an erosional state due to wave erosion at the slope toe. The exception to this was the Sand Bluffs, which appears to be displaying larger rotational bank failures that extend further inland. This part of the shoreline displays evidence of rotational slope failures that extend inland (to the west), beyond the influence of recent wave action. Potential remedial options for Reach 10 at the Sand Bluffs include toe loading with rip rap or an alternative retaining structure, which would result in the loss of sand beach in the area; construction of a reinforced slope, which would also result in the loss of sand beach in the area; crest unloading (benching), which would disturb the land to the west of the current main scarp affecting four to five residential structures; or shear keys through the clay layer, which may be the most expensive option (but the area could potentially be reclaimed to near current conditions).
- Locations along King Edward, Alexandra, Patricia, and Clubhouse Beach were documented with a series of photographs during the site visit. In summary, no significant rotational failures were observed at any of the locations inspected along the west shore.
- It was recommended that a detailed geotechnical investigation and analysis be conducted for the Sand Bluffs, which display rotational failures. This would include drilling a series of boreholes to confirm the local geology and groundwater conditions, conducting laboratory testing of representative soil samples to determine physical properties and strength, conducting an elevation survey of the area, completing a slope stability analysis of the failure condition using a two-dimensional numerical model(s), and evaluating potential

remedial options using the model. Interim observations of the slopes at fixed intervals should be recorded by the local residents at fixed measurement locations and, especially following significant changes in the bluff slope.

1.5 Development of the Shoreline Management Plan

The SMP presented in this document, was developed through a number of phases as outlined below:

- **October 5 – 6, 2011**: Initial site observation and data collection.
- **December 6 – 7, 2011**: Meeting with Victoria Beach Council and Stakeholders.
- **2012 to present**: Technical investigation on erosion and sedimentation processes. Analysis included preparing a wind-wave hindcast measuring historical erosion rates, conducting hydrodynamic modelling, sediment transport modelling and preparing a sediment budget.
- **April 2012**: Governance review and vision planning. A series of tasks were completed to review the existing shoreline regulations of the RMVB and the Province of Manitoba, and develop a clear vision for the future of the shoreline.
- **July 23 – 24, 2012**: Additional data collection and stakeholder meeting.
- **August 27 – 28, 2012**: Additional data collection and stakeholder meeting.
- **June 2013**: Top of bank survey.
- **July 22 – 23, 2013**: Stakeholder presentation and open house to receive feedback on the technical study and the shoreline management options.
- **August 2013**: Preliminary geotechnical investigation of select sites.
- **July/August 2013**: Development of final shoreline management recommendations.
- **August 21 – 22, 2013**: Stakeholder presentation and meeting to receive feedback on the final recommendations.
- **January, 2014**: Draft SMP issued to the RMVB for review and comment.

The above phases were all instrumental in the development of the SMP. Various deliverables have been issued throughout the phases of this study, and provide valuable supplementary information to this report.

2.0 EXISTING SHORELINE CONDITIONS

Victoria Beach is located in the southern basin of Lake Winnipeg, with about 17 km of shoreline. Lake Winnipeg is the sixth-largest freshwater lake in Canada. It has an elongated shape, extending 416 km from the northern to the southern end, and 30 to 45 km across for the southern basin. The dominant wind conditions are from the northwest and south. When there are large winds from the northwest, there can be surge events at Victoria Beach in the order of 1 m. It is during these high water level events that the most severe erosion and flooding occur along the shoreline of Victoria Beach.

2.1 Existing Conditions for Shoreline Reaches

The risk of erosion and flooding changes based on the shoreline topography, geology type and exposure to waves. As a result, for the purpose of developing this SMP, the municipality has been subdivided into the following reaches, which are also shown on Figure 2.1:

- Reach 1: West side of Elk Island Provincial Park (only used for Technical Study)
- Reach 2: Connaught Beach
- Reach 3: King Edward and Alexandra Beach
- Reach 4: Scott Point Headland
- Reach 5: Patricia to Clubhouse Beach
- Reach 6: Federal Wharf and Safe Harbour
- Reach 7: Bayview to Pelican Point
- Reach 8: East side of Elk Island Provincial Park (only used for Technical Study)
- Reach 9: Highway 504 to Hamptons
- Reach 10: Sunrise to Sand Bluffs
- Reach 11: Wanasing Beach
- Reach 12: Albert Beach

In order to assess the existing conditions and determine the risk of coastal hazards, the shoreline recession rate was estimated through the analysis of historical aerial photographs in the Baird Technical Study (in press). When creating property parcels historically, the RMVB set aside a buffer between Lake Winnipeg and the lakeward edge of the private property parcels; this is locally know as the "Reserve". A top of bank survey was completed during the summer of 2013 and this survey is compared to the existing buildings for the individual property parcels to determine how much of the Reserve is left, as illustrated in Figure 2.2. Specific details of how much Reserve is left are discussed in the following subsections for each reach.

Figure 2.1 Shoreline Reach Boundaries

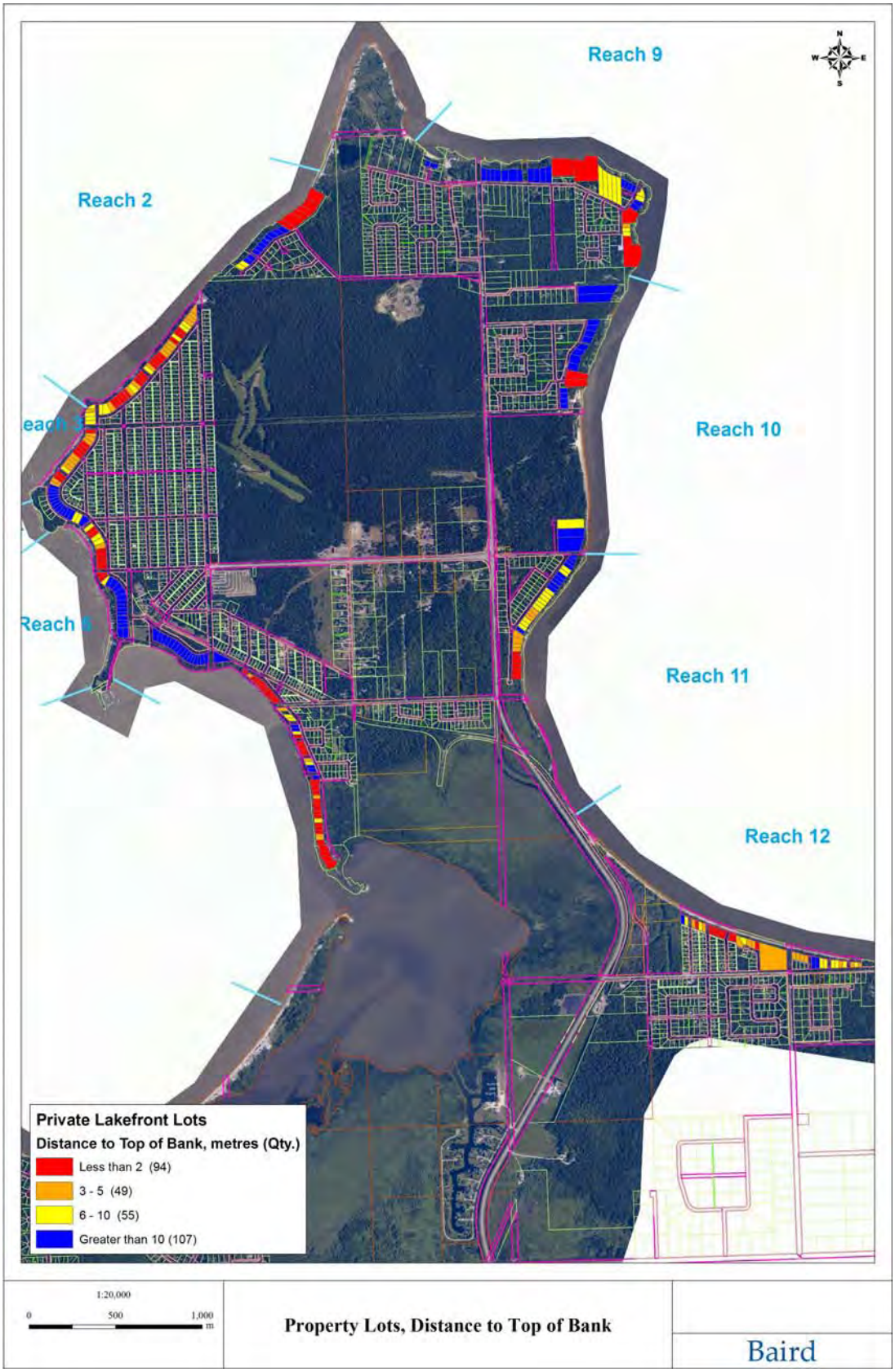


Figure 2.2 Private Lakefront Lots, Distance to Top of Bank

A summary of the coastal processes for each reach that correspond to the lands within the RMVB are provided in the following subsections. This information is also summarised on coastal facts sheets that are provided in Appendix A. Reach 1 and 8 are on Elk Island and were identified primarily for the technical studies and therefore are not part of this SMP.

2.1.1 Reach 2: Connaught Beach

The stretch of shoreline covered by Reach 2 is about 1,800 m long and includes Connaught Beach. The geology of this reach varies from the north to the south and as a result was subdivided into two sub-reaches as described below.

2.1.1.1 North

The northern end of Connaught beach is comprised mainly of engineering structures and natural rocks in the nearshore . An example of the type of structures is shown in Figure 2.3.

The top of bank surveyed in 2013 is less than 2 m from the edge of the property parcels for 30% of the reach. However, since the shoreline has been stabilized by existing engineering structures, the risk of additional erosion is expected to be minimal if the existing structure are maintained.

Figure 2.3 North Connaught Beach October 2011

2.1.1.2 South

The south end of Connaught beach features a narrow beach backed by a sand bluff. This stretch of the shoreline has been eroding over time at an average rate of about 0.18 m/yr ± 0.03 m.

The 2013 top of bank survey is within 2 meters of the lakeward edge of about 50% of the private property parcels and the remaining parcels are within 3 to 10 m. This reach is at high risk for additional erosion.

Some ad-hoc structures have been placed along the shoreline including some loosely placed rock groynes and cobbles placed at the toe of the bluff as shown in Figure 2.4. Due to the orientation of the shoreline, when the water level is high and there are large waves from the northwest, the sand

Figure 2.4 Connaught Beach October 2011

banks erode and the sediment is generally transported towards the north. This conclusion is supported by the numerical modelling completed for the technical study and the sediment accretion measured at Elk Island Provincial Park. The erosion is currently threatening homes located on the bluff and municipal infrastructure (pump house).

2.1.2 Reach 3: King Edward and Alexandra Beach

The shoreline at Kind Edward and Alexandra Beach can be characterised as a sand beach backed by an eroding sand bluff as shown in Figure 2.5. This stretch of the shoreline has been eroding over time at an average rate of about 0.14 m/yr ± 0.02 m. The top of bank surveyed in 2013 is less than 2 m from the edge of the property parcels for about 25% of the reach. The majority of the remaining parcels are is within 5 m of the top of bank. This reach is at high risk for additional erosion.

Some ad-hoc structures have been placed along the shoreline including some loosely placed rock groynes and sand bags placed at the toe of the bluff. Due to the orientation of the shoreline, when the water level is high and there are large waves from the northwest, the sand cliffs erode and the sediment is transported to the nearshore area. Due to the presence of the headland to the north, the longshore transport is generally directed towards the south during an event from the northwest, which is the opposite direction for neighbouring Connaught Beach.

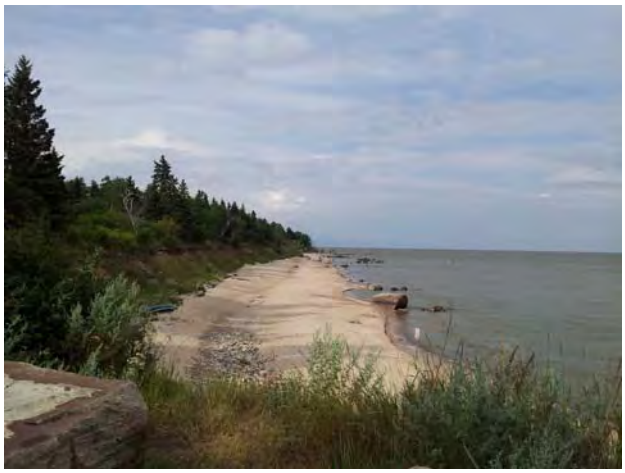


Figure 2.5 Alexandra Beach July 2013

2.1.3 Reach 4: Scott Point Headland

Scott Point is a headland that mainly consists of glacial till as shown in Figure 2.6. Scott Point has been eroding over time at an average rate of about 0.15 m/yr ± 0.05 m.

The top of bank surveyed in 2013 is more than 30 m from the edge of the property parcels. This reach is therefore at low risk of the shoreline eroding to the lakeward limit of the private property parcels. However, it is municipal park land that is eroding and a long-term erosional mitigation solution may be desirable in the future. Due to the orientation of the shoreline, when the water level is high and there are large waves from the northwest, the sediment is transported to the south.

Figure 2.6 Scott Point Headland October 2011

2.1.4 Reach 5: Patricia to Clubhouse Beach

The stretch of shoreline covered by Reach 5 is about 1,000 m long and extends from Patricia Beach to Clubhouse Beach; Arthur Beach is just to the south of Patricia Beach. The geology of this reach varies from the North to the South and as a result was subdivided into two sub-reaches as described below.

2.1.4.1 North

The shoreline including Patricia Beach and Arthur Beach can be characterised as a narrow beach backed by sand bluffs. A typical site photograph is provided in Figure 2.7. This stretch of the shoreline has been eroding over time at an average rate of about 0.12 m/yr ± 0.05 m. The top of bank surveyed in 2013 is less than 2 m from the edge of the private property parcel for about 50% of the reach and the remaining parcels are within 3 to 10 m. This reach is at high risk for additional erosion.

Some ad-hoc structures have been placed along the shoreline including some loosely placed rock groynes and a rock revetment at the toe of the bluff near the Arthur stairs.

Due to the orientation of the shoreline, when the water level is high and there are large waves from the northwest, the sand bluffs erode and the sediment is transported towards the south. Storms from the southwest have the potential to transport sand onto Patricia Beach from the nearshore area.

Figure 2.7 Patricia Beach August 2013

2.1.4.2 South

The southern portion of Reach 5, including Club House Beach, is comprised of a wide sandy beach backed by low sand dunes. A typical site photograph is provided in Figure 2.8.

The top of bank surveyed in 2013 is greater than 10 m from the lakeward edge of the private property parcels. Therefore, this reach is at relatively low risk of shoreline erosion to the edge of the private property parcels.

Figure 2.8 Club House Beach October 2011

2.1.5 Reach 6: Federal Wharf and Safe Harbour

Engineering structures make up the shoreline in the vicinity of the Federal Wharf and Safe Harbour. Structures include a steel sheet pile wharf, rock revetment, offshore breakwater and floating docks. Sediment that is travelling south along the shore to this point, is generally deposited at the end of the wharf in a shoal.

2.1.6 Reach 7: Bayview to Pelican Point

The shoreline from Bayview to Pelican Point consists of low banks with extensive shoreline armouring, such as gabions and rock revetments; an example is shown in Figure 2.9. Due to the existing structures along the shoreline, erosion is a low risk. However, due to the relatively low elevation in this area (especially along Pelican Point), it is susceptible to flooding.

Figure 2.9 Pelican October 2011

The top of bank surveyed in 2013 is less than 2 m from the edge of the private property parcel for about 50% of the reach. However this reach has been mainly stabilised by existing shoreline protection structures and therefore the risk of additional erosion is expected to be minimal, provided the existing structures are maintained.

Figure 2.10 Slope Stability Issues off Gibson Drive August 2013

Slope stability issues were observed in August 2013, just off Gibson Drive between 8th Avenue and Thornton Boulevard (across the road from house numbers 40 and 42 Gibson Drive) as shown in Figure 2.10. A geotechnical investigation is required to confirm the cause of the slope failure. However, trees have been up-rooted at the toe of bank from what appears to be a slope failure. There is also a swampy area near the toe of the bank indicating that groundwater may have also contributed to the slope instability.

2.1.7 Reach 9: 504 to Hamptons

The shoreline from Highway 504 to the Hamptons can be characterised as glacial till bluffs with isolated beach deposits. An example of the reach is shown in Figure 2.11.

This stretch of the shoreline has been eroding over time at an average rate of about 0.21 m/yr ± 0.01 m. There is no formal overland drainage infrastructure, and as a result gullies have formed along the shore due surface water flows. The top of bank surveyed in 2013 is within 2 m from the lakeward edge of the private property parcels for about 20% of the reach, and 30% is within 10 m. The lakeward edge of the private property parcels for the remaining 50% of the reach is greater than 10 m from the top of bank. Therefore, this reach is at moderate risk of shoreline erosion to the edge of the private property parcels.

Figure 2.11 Shoreline Modifications in Reach 9 August 2013

2.1.8 Reach 10: Sunrise to Sand Bluffs

The stretch of shoreline covered by Reach 10 is about 1,500 m long. The geology of this reach varies from the north to the south where there are sand bluffs, as described in the following two subsections.

2.1.8.1 North

The northern end of the reach consists mainly of engineering structures. A typical site photograph is provided in Figure 2.12. It has been eroding over time at an average rate of about 0.19 m/yr ± 0.05 m. The 2013 top of bank survey is within 2 m of the lake ward edge of about 10% of the private property parcels and the remaining parcels are greather than 20 m. Therefore, there is a relatively low risk of the shoreline eroding to the private property parcels if the existing engineering structures are properly maintained.

Figure 2.12 Sunrise October 2011

2.1.8.2 South

The southern end of the reach can be characterised as high sandy bluffs with variable beach width. A typical site photograph is provided in Figure 2.13.

This stretch of the shoreline has been eroding over time at an average rate of about 0.58 m/yr ± 0.11 m. The 2013 top of bank survey is greather than 10 m from the lakeward edge of the private property parcels. However, the Sand Bluffs area shows some signs of large rotational slope failures. Golder Associates Ltd. (Golder) conducted slope inspections on August 7, 2013, as discussed previously in Section 1.4.4. As a result of the geotechnical issues in Reach 10 South, this shoreline is at high risk for additional slope instabilities.

Figure 2.13 Sand Bluffs August 2013

2.1.9 Reach 11: Wanasing Beach

The shoreline from the south of Arthur Road including Wanasing Beach is low lying sandy beach and consequently is susceptible to flooding during storm events at high lake levels. To reduce the risk of flooding and erosion there are numerous ad-hoc structures present along the shore, such as rock gabians, groynes, and sand bag dykes. A typical site photograph is provided in Figure 2.14.

This stretch of shoreline has remained relatively stable overtime due to the existing structures. With the exception of the southern end of the beach where historically there has been some erosion.

Figure 2.14 Wanasing Beach August 2013

2.1.10 Reach 12: Albert Beach

Albert beach consists of a low lying sandy beach with variable width as shown in Figure 2.15. This reach is susceptible to flooding during storm events at high lake levels. To reduce the risk of flooding, a dyke has been installed at the back of the beach. There is also a rock revetment at the south end of the reach.

The top of bank surveyed in 2013 is within 2 m of the lakeward edge of about 30% of the private property parcels and the remaining parcels are greater than 5 m. This reach is at relatively low risk of shoreline eroding to the property parcels. Since it does not feature a long-term erosion rate, the buildings are at relatively high risk of flooding if the elevation of the sand bag dyke is not maintained in the future.

Figure 2.15 Albert Beach August 2013

3.0 SHORELINE MANAGEMENT APPROACHES

For Victoria Beach, it is important that a coordinated cooperative approach to shoreline management is adopted. Individual efforts to mitigate coastal hazards are often inefficient and the effectiveness can be significantly reduced if the adjacent shoreline is not managed with the same approach. A number of shoreline protection structures already exist along the Victoria Beach shoreline. Examples of the existing structures include dumped stone, sand bags, loosely placed rock groynes, and miscellaneous other materials. Based on our site observations, many of these structures are ad-hoc, have not been designed by a professional coastal engineer, and have not been done collaboratively with neighbours; this results in various levels of effectiveness.

In this section, the various types of shoreline management approaches are presented. Some examples of the types of existing shoreline protection structures that currently exist along the Victoria Beach shoreline are also provided in Section 3.4.

3.1 Hazard Setback for New Development

For new development, it is advisable to set-back buildings a distance from the shore that will reduce the risk of damage from all coastal hazards for a specified period of time (eg. 50 or 100 years), which is also known as the planning horizon. Coastal hazards include flooding, erosion and ice.

The flooding hazard setback typically includes the flood level and wave effects, including the amount the waves run-up the shore. Generally, the flood level is the sum of the lake level and storm surge with a combined probability of a 100-year return period (i.e. on average has a one percent probability of occurring in any given year).

An erosion hazard setback includes an allowance for a stable slope plus the estimated erosion over the specified planning horizon. The stable slope is determined through geotechnical investigation of the geology; for example, the stable slope through bed rock is steeper than the stable slope for sand. The erosion portion of the setback is calculated by multiplying the average annual recession rate (m/year) by the planning horizon (year).

A dynamic beach setback recognises that natural erosion and accretion cycles of the beach/dune system, in response to variable lake levels and storm events, is desirable and any new development should be located inland of this zone. The width of the dynamic beach setback is determined through the application of accepted engineering and scientific principles and is often specified as a minimum setback in the SMP (eg. 50 m).

Recommendations pertaining to minimum flooding, erosion and dynamic beach hazard limits for the RMVB are provided in Section 5.0.

3.2 Mitigating Hazards for Existing Development

Some existing development in Victoria Beach is already at risk to damage from coastal hazards. In these cases, it may be desirable to reduce this risk through beach enhancements, slope stability projects, and the design of engineering structures. For Victoria Beach, options for structures include beach nourishment, shore parallel structures, shore perpendicular structures, and slope regarding with vegetation.

3.2.1 Beach Nourishment

Beach nourishment projects add sand to an existing beach from another source such as an inland sand quarry. The beach design for a nourishment project is very complex. A properly designed beach width and slope can reduce storm damage by dissipating energy across the surf zone, protecting upland structures and infrastructure. Beach nourishment is typically done in conjunction with shore parallel and/or shore perpendicular structures to help contain the sand and reduce maintenance requirements. Most often the beach nourishment will require maintenance throughout the design life of the project. Beach nourishment is considered a soft engineering approach to reduce erosion while enhancing the beach resource for recreational purposes.

3.2.2 Shore Parallel Structures

Structures parallel to the shore include revetments and seawalls, both of which act to limit erosion by implementing a hard structure. At Victoria Beach, the main source of sand is the eroding sand bluffs. Therefore, if erosion of the sand bluffs is limited by the introduction of a hard shore parallel structure without an alternate sand source to replenish the beach, the beach will eventually erode.

When beach preservation is not a priority, well-designed and constructed armour stone revetments, using good quality, durable stone generally provide effective erosion protection. A key advantage of an armour stone revetment is that it is a relatively flexible structure that can accommodate some settlement and movement. Providing a proper allowance for nearshore profile downcutting, and coordination with adjacent properties to minimize outflanking erosion remain two key factors that will affect the expected design life of the structure. Another important consideration with revetments and all other types of shore protection, is potential impacts on the aquatic and terrestrial environment. A summary of the design considerations for an armour stone revetment are shown in Figure 3.1.

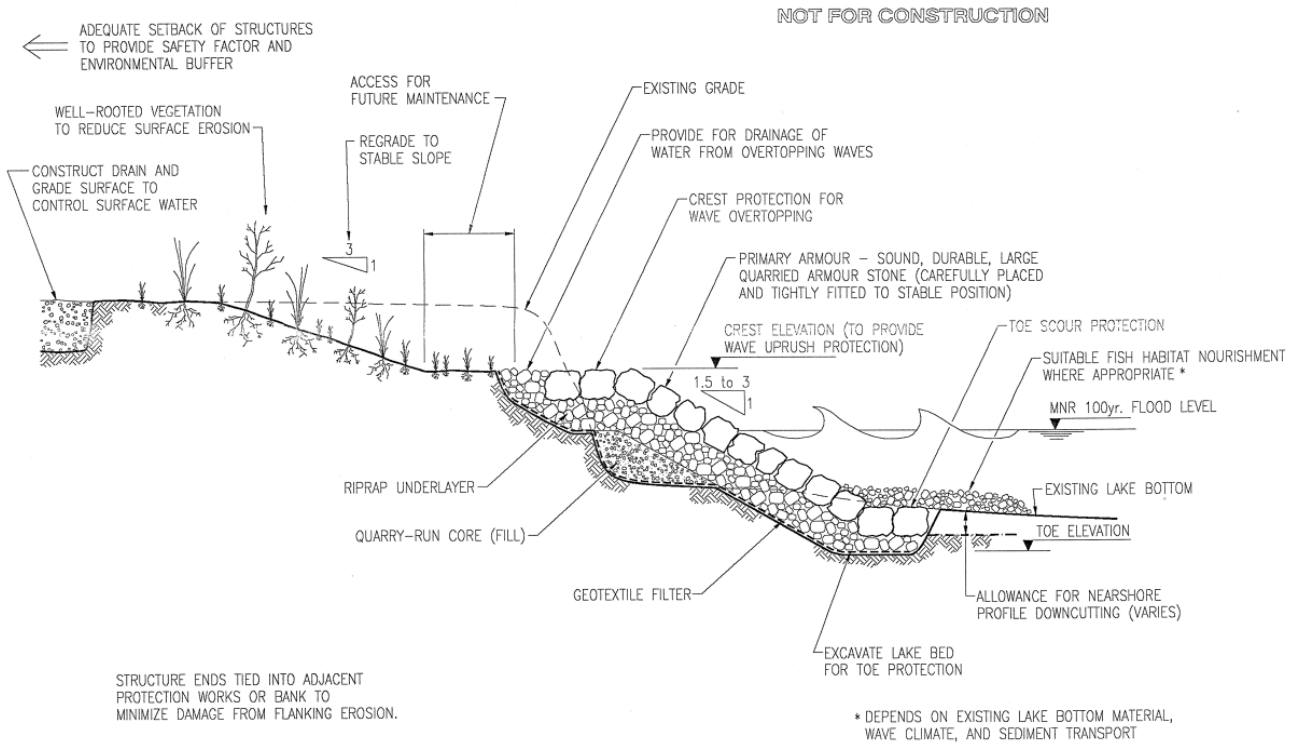


Figure 3.1 Typical Armour Stone Revetment Design Considerations (Not to Scale)

Seawalls are frequently used as shore protection and they may be constructed of cast-in-place concrete, stacked concrete, armour stone blocks (refer to Figure 3.2), stacked gabians or steel sheet piling (refer to Figure 3.3).

Figure 3.2 Example of a Stacked Armour Stone Wall

Figure 3.3 Example of Steel Sheet Pile Wall

Stacked stone and block walls must carefully consider the foundation conditions, as they are less flexible than revetments and more prone to collapse due to settlement and undermining. Vertical, impermeable walls (e.g., concrete and steel sheet pile) are generally not recommended due to concerns with wave reflection and scour. Vertical walls are rigid and have much less reserve strength (i.e., ability to withstand wave conditions exceeding the design wave) than armour revetments. Gabion baskets often have a limited life span when used on exposed shorelines and are generally not recommended for use on a water body the size of Lake Winnipeg.

3.2.3 Shore Perpendicular Structures

Shore perpendicular structures, including groynes and headlands, are generally used to anchor beaches and minimise the long-term erosion rate. These structure are quite complex and require careful design due to potential downdrift impacts as shown schematically in Figure 3.4.

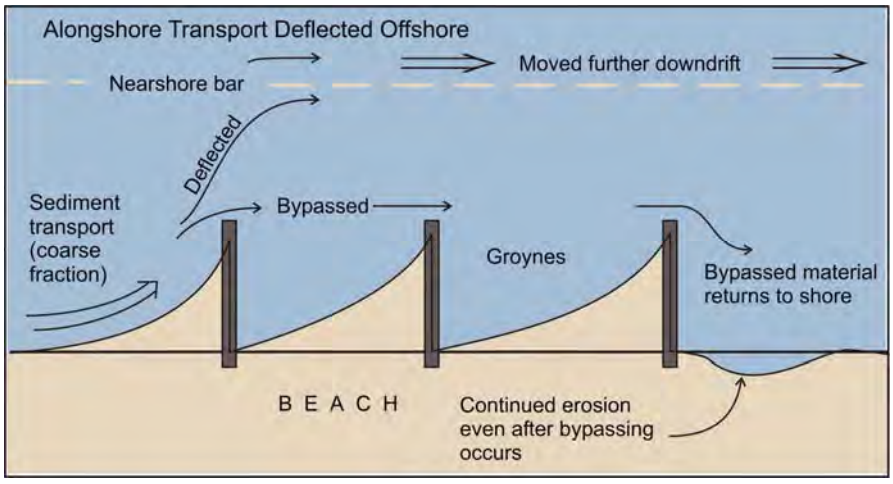


Figure 3.4 Potential Downdrift Impacts of Groynes

Although groynes have historically been a popular form of shore protection that may increase beach stability and width at low water levels, in general, groynes on their own may not provide adequate protection to the backshore during storms at high water levels. Headlands are more substantive beach anchors than groynes.

3.2.4 Reducing Bank Recession through Toe Protection, Slope Re-grading, Vegetation and Drainage Infrastructure

The steep exposed sand banks that can be observed around the shoreline of Victoria Beach can be susceptible to additional erosion from overland run-off during rainfall events as shown in Figure 3.5. The uncontrolled runoff can lead to gully erosion and in severe cases, the development of large ravines. This erosion risk could be reduced through the installation of drainage infrastructure to manage over-land run-off. Bio-engineering techniques, such as planting vegetation on the slope to stabilize the soil and absorb water will reduce the amount of surface erosion during rainfall events and spring thaw events.

Figure 3.5 Erosion due to Gully formed by Overland Runoff at King Edward Stairs in August 2013

3.2.5 Maintenance of Structural Protection

It is important to note, that with all engineering structures some level of maintenance is required over the design life. The level of maintenance is dependent on the type of structure. For example, beach nourishment may require a higher degree of maintenance compared to a rock revetment, but will also enhance the beach for recreation. Regardless of the structure chosen, the cost of monitoring and maintenance should be incorporated into the project budget and be available for future works as required.

3.3 Consideration of Environmental Impacts and Habitat Enhancement

Recognition of the potential environmental impacts of shoreline protection includes, but is not limited to:

1. Impairment of aquatic and terrestrial habitat;
2. Loss of beach habitat;

3. Cumulative impact of reducing sediment supply to downdrift shoreline; and
4. Diverting and/or blocking longshore transport.

Successful shoreline protection, by definition, will reduce erosion of the shore for a prescribed period of time. Reduction of the sediment supply to beaches by building shoreline protection will also negatively impact the downdrift beaches. When properly designed, shoreline protection structures can also enhance beach access and habitat, and this should be the guiding principle for all shoreline protection structures in Victoria Beach.

3.4 Review of Existing Structures in Victoria Beach

Existing structures along the shoreline of Victoria Beach include both shore perpendicular and shore parallel, as briefly discussed in the following subsections.

3.4.1 Shore Parallel Structures

There are various types of shore parallel structures along the shore of Victoria Beach, including: revetments (refer to Figure 3.6 and Figure 3.7), gabian stacked walls (refer to Figure 3.8), concrete seawalls (Figure 3.9), and sand bag dykes (Figure 3.10). The structures that have been well engineered and constructed have been successful at reducing the long-term erosion rate. Poorly designed and/or constructed revetments, such as the structure in Figure 3.7, will not provide long-term erosion mitigation.

Figure 3.6 Example of Revetment (King Edward)

Figure 3.7 Example of Revetment (504 to Hamptons)

Figure 3.8 Example of Gabian Stacked Wall (Pelican)

Figure 3.9 Example of Concrete Seawall

Figure 3.10 Example of Sand Bag Dyke along Albert Beach

3.4.2 Shore Perpendicular Structures

Shore perpendicular structures in the RMVB mainly consist of ad-hoc rock groynes, such as these constructed many years ago on Connaught Beach (refer to Figure 3.11). These groynes are now loosely packed, low crested, and are not effective at trapping sand or mitigating erosion.

Figure 3.11 Example of Groynes (Connaught)

A series of ad-hoc structures have been constructed on Wanasing Beach over the years and have been moderately successful at trapping sand due to the smaller wave heights found on this side of the peninsula. Refer to a typical structure in Figure 3.12.

Figure 3.12 Example of Ad-Hoc Shore Perpendicular Structures along Wanasing Beach

4.0 COMMUNITY CONSULTATION

The community consultation process was integral for engaging the community and receiving feedback on the draft shoreline management approaches. Two separate community consultation sessions were held during the development of the SMP. The meetings were held in the summer of 2013, when the population in Victoria Beach is at a maximum. Overall the community consultation process was very successful and generated ideas, lots of feedback, and comments.

4.1 First Public Meeting and Open House

The first session was held on July 22 - 23, 2013 with a focus on the coastal process study and the presentation of various shoreline management options. The options that were presented at the meeting are organized by Reach and are provided in Appendix B. A summary of the various management options considered for each Reach are presented in Table 4-1.

Table 4-1 Summary of Shoreline Management Options for Each Reach in Victoria Beach

Reach	Beach Nourishment	Revetments	Beach Anchoring Structures (e.g. groynes/offshore breakwaters)	Toe Protection, Slope Re-grading, Vegetation & Drainage Infrastructure
Reach 2: Connaught North	✗	✓	✗	✓
Reach 2: Connaught South	✓	✗	✓	✓
Reach 3: King Edward and Alexandra Beach	✓	✗	✓	✓
Reach 4: Scott Point Headland	✗	✓	✗	✗
Reach 5: Patricia to Clubhouse Beach	✓	✗	✓	✓
Reach 6: Federal Wharf and Safe Harbour	✗	✗	✗	✗
Reach 7: Bayview to Pelican Point	✗	✗	✗	✗
Reach 9: Highway 504 to Hamptons	✗	✓	✗	✓
Reach 10: Sunrise to Sand Bluffs	**Further geotechnical investigation is required prior to recommending options.**			
Reach 11: Wanasing Beach	✓	✗	✓	✗
Reach 12: Albert Beach	✗	✓	✗	✗
Note: Maintenance of all Existing Shoreline Protection Structures is Assumed.				

On July 22nd Baird made a presentation to the public followed by a question and answer session. On July 23rd Baird hosted an open house where members of the community could come at their leisure, and ask specific questions about the technical study and the SMP options on a one-on-one basis.

Comments sheets were distribution so formal feedback could be received from the community. A copy of a blank comment sheet is provided in Appendix C. A total of 99 comment sheets were returned. There were a few common themes that emerged, as follows:

- Most people agree that preserving the beaches in perpetuity should be the first priority.
- Most people agree that reducing the risk of shoreline erosion is important.
- Beach access and the ability to walk along the beaches are important.
- Strong support for beach nourishment to preserve beaches.
- Majority support groynes provided they do not impede access along the beach.
- Majority opposed to revetments along public beaches.
- Several requests for further information.

After all the community comments were received on the options presented, recommendations were prepared for each reach by Baird based on the guidance in the draft Development Plan.

4.2 Second Public Meeting and Open House

A second community consultation session was held on August 21 – 22, 2013 with a focus on shoreline management recommendations. On August 21st Baird made a presentation to the public. The main purpose of the meeting was to present the recommendations for each Reach, which are also presented in Section 5.1 of this report. Baird took this opportunity to also discuss with the community why some options were considered not feasible. A sample of this discussion is provided in Table 4-2.

Table 4-2 Feasibility of Various Ideas for Shoreline Management

Idea	Feasibility Discussion
Beach Nourishment first then Monitor Need for Structures	Possible if the Public Reserve was wider. With the reserve at a minimum or non-existent, there is no buffer to do a trial and observe the results.
Managed Retreat and Keep Beaches Natural	Not viable since the public reserve is almost gone. Once the eroding bank is on private land, the beaches will no longer be on public land.
Build Revetments on King Edward and Alexandra (Reach 3)	Beaches will eventually disappear and property values will depreciate once the beaches disappear. This is not consistent with the Draft Development Plan or the culture of the community. Therefore, revetments are not viable for Reach 3.
Buy Waterfront Lots and Let Erosion Occur Naturally	This option would maintain natural beaches. However, the cost to purchase the waterfront property would greatly exceed the cost of the remedial alternatives proposed. eg. 18 lots along King Edward and Alexandra, estimated value of $6M; an engineered solution would be less.

On August 22nd Baird hosted an open house where members of the community could come at their leisure, and ask specific questions about the SMP. It was evident that the community consultation process had been a success, because there were a lot less people with concerns about the proposed recommendations compared to the July meetings.

5.0 SHORELINE MANAGEMENT PLAN

The purpose of the SMP is to present the vision, identify the unique characteristics of the shoreline by Reach, and provide guidance for appropriate Shoreline Management in the future. The goals of the SMP are as follows:

- Identify critical infrastructure threatened by erosion hazards.
- Preserve public beaches in perpetuity.
- Reach a majority consensus for dealing with erosion hazards and beach access for the ten shoreline reaches.
- Develop different options for each reach.
- Improved guidance for locating new shoreline development.

The basis for the SMP is the technical study (in press), to which provided a thorough understanding of the coastal processes and the mechanisms of erosion and sedimentation at Victoria Beach. The community also played a large role in the development of the plan, through the extensive community consultation process that was completed for the project.

5.1 Recommendations by Reach

A summary of the recommendations for each reach is provided in Table 5-1, including a priority ranking. High priority reaches include Connaught South, King Edward and Alexandra Beach, Patricia and Arthur Beach, and the Sand Bluffs. More detail for each reach is provided in the following subsections.

Table 5-1 Summary of Shoreline Management Recommendations (Organized by Priority)

Reach	Recommended Management Plan	Priority
Reach 2: Connaught South	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 3: King Edward and Alexandra	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 5 (North): Patricia and Arthur Beach	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 10 (North and South) and Gibson Drive	Conduct detailed geotechnical investigation to assess slope stability and develop mitigation options.	High
Reach 5 (South): Clubhouse Beach	Beach nourishment with anchoring structures (groynes).	Moderate
Reach 11: Wanasing Beach	Maintain existing structure and monitor shoreline. If beaches are not stable, remove ad-hoc structures and design a uniform solution to maintain the beach. Elevation of sand bag dyke should be monitored with maintenance completed as required.	Moderate
Reach 7: Bayview to Pelican Point	Monitor and maintain existing engineering structures.	Low

Reach 4: Scott Point Headland	Monitor erosion, and if continues and is a concern then construct a rock revetment.	Low
Reach 2: Connaught North	Monitor erosion and maintain existing structures.	Low
Reach 6: Federal Wharf/Safe Harbour	Maintain existing structures (by owner).	Low
Reach 9: Highway 504 to Hamptons	Install infrastructure to control over land runoff. Monitor erosion. If erosion is threatening private land, then land owners to construct and maintain rock revetments.	Low
Reach 10 (North): Sunrise	Monitor erosion and maintain existing structures. If erosion continues consider upgrading the shoreline protection.	Low
Reach 12: Albert Beach	Elevation of sand bag dyke should be monitored with maintenance completed as required. Construct parking lot for Albert Beach access (optional).	Low

5.1.1 Reach 2: Connaught Beach (North)

The northern end of Connaught beach is comprised mainly of engineering structures and natural rocks in the nearshore. Therefore this stretch of the shoreline has remained relatively stable over time. It is recommended that existing structures are maintained and erosion is monitored.

5.1.2 Reach 2: Connaught Beach (South)

This reach is a popular swimming beach and features homes at high risk to erosion damage for the status quo scenario. To enhance the beach and reduce the amount of erosion, it is recommended that the beach is nourished and rock structures, either groynes or offshore breakwaters are used to anchor the sand and reduce the maintenance requirements over the design life. The location and number of structures required to anchor the beach nourishment will be determined during the design phase. A walkway will be maintained at the back of the beach to allow for easy pedestrian access. A schematic is provided in Figure 5.1 to illustrate how a rock groyne might be incorporated into the beach design.

Figure 5.1 Example of Rock Groyne, Beach Nourishment, Toe Protection and Slope Re-grading and Vegetation

To stabilise the slope, it is recommended it is re-graded, vegetated and toe protection is used to reduce the bank erosion during high lake levels and storm events. In order to preserve the beach, it is important that the toe protection is done in conjunction a with beach nourishment program. Additional sand may be required in the future.

5.1.3 Reach 3: King Edward and Alexandra Beach

Both King Edward and Alexandra are popular swimming beaches and waterfront homes are at high risk of damage. To enhance the beach and reduce the erosion threat to the homes, it is recommended that the beach is nourished and rock structures, either groynes or offshore breakwaters are used to anchor the sand and reduce the maintenance requirements over the design life. The location and number of structures required to anchor the beach nourishment will be determined during the design phase. A walkway will be maintained at the back of the beach to allow for easy pedestrian access. A schematic is provided in Figure 5.2 to illustrate how a rock groyne might be incorporated into the beach design. Figure 5.3 illustrates how an offshore beakwater can be incorporated into the design.

Figure 5.2 Example of Rock Groyne, Toe Protection and Slope Re-grading and Vegetation

To stabilise the slope, it is recommended it is re-graded, vegetated and toe protection is used to reduce the bank erosion during high lake levels and storm events. In order to preserve the beach, it is important that the toe protection is done in conjunction with beach nourishment that is maintained over time.

Figure 5.3 Example of Offshore Breakwater, Toe Protection and Slope Re-grading and Vegetation

5.1.4 Reach 4: Scott Point Headland

The private waterfront lots at Scott Point are more than 30 m from the eroding bank. Therefore, it is recommended that the shoreline be maintained at 10 year intervals.

5.1.5 Reach 5: Patricia to Arthur Beach (North)

This reach includes Patricia and Arthur Beach, which is a popular swimming area and the waterfront homes are at risk to further erosion. To enhance the beach and reduce the erosion threat, it is recommended that the beach is nourished and rock structures, either groynes or offshore breakwaters, are used to anchor the sand and reduce the maintenance requirements over time.

The location and number of structures required to anchor the beach nourishment will be determined during the design phase. A walkway will be maintained at the back of the beach to allow for easy pedestrian access. A schematic is provided in Figure 5.4 to illustrate how a rock groyne might be incorporated into the beach design.

Figure 5.4 Example of Rock Groyne, Toe Protection and Slope Re-grading and Vegetation

5.1.6 Reach 5: Arthur to Clubhouse Beach (South)

This reach includes Clubhouse Beach, which is a popular swimming beach but is relatively wide and has been historically stable. It is recommended that the width of this beach is monitored and if erosion becomes a concern, then the beach can be enhanced with beach nourishment and a rock structure at the southern end of the reach, as shown schematically in Figure 5.5.

Figure 5.5 Example of Rock Groyne

5.1.7 Reach 6: Federal Wharf and Safe Harbour

The Federal Wharf and Safe Harbour consists mainly of engineering structures. Therefore this stretch of the shoreline has remained relatively stable over time. It is recommended that existing structures are maintained by the owner of the structures.

5.1.8 Reach 7: Bayview to Pelican Point

The shoreline from Bayview to Pelican Point consists mainly of engineering structures and is not actively eroding. It is recommended that existing structures are maintained and erosion is monitored. Structure upgrades may be required in the future.

Slope stability issues were observed in August 2013, just off Gibson Drive between 8th Avenue and Thornton Boulevard (across the road from house numbers 40 and 42 Gibson Drive). A geotechnical investigation is required to confirm the cause of the slope failure and should be combined with the proposed study for Reach 10.

5.1.9 Reach 9: Highway 504 to Hamptons

The Reach 9 shoreline, from the northern end of Highway 504 to the Hamptons is eroding and features some shoreline protection. It is recommended that existing structures are maintained and erosion is monitored.

Once erosion threatens existing development, rock revetments are recommended with slope re-grading and planting of vegetation to reduce the amount of erosion during from overland runoff as shown in Figure 5.6.

Figure 5.6 Example of Rock Revetment with Slope Re-grading and Vegetation

5.1.10 Reach 10: Sunrise to Sand Bluffs (North)

The northern end of Reach 10 consists mainly of engineering structures at the water's edge. Therefore it is recommended that the existing structures are maintained and erosion is monitored. This reach should be included in the proposed geotechnical study for Reach 10.

5.1.11 Reach 10: Sunrise to Sand Bluffs (South)

The sand bluffs at the southern end of the reach are at high risk of rotational failures, leading to large erosion events. Overland runoff due to the lack of vegetation and the pedestrian traffic on the dune also contributes to the long-term erosion of the slope. It is recommended that a detailed geotechnical investigation be conducted to assess slope stability. The study should include options for a stable slope design and setback requirements for future development. The stable slope design may include a rock revetment with slope re-grading and vegetation as shown in Figure 5.7.

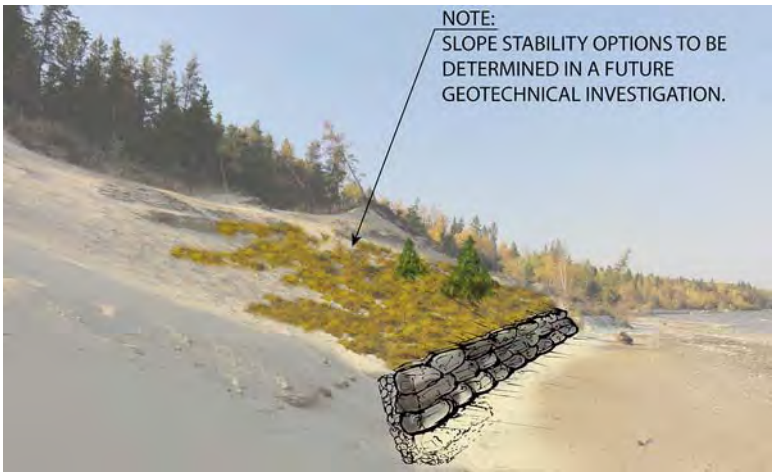


Figure 5.7 Example of Toe Protection to Stabilize Slope with Slope Re-grading and Vegetation (this is conceptual only)

In the immediate short term, signage can also be used to educate beach users of the damage caused by sliding down the sand dunes.

5.1.12 Reach 11: Wanasing Beach

Wanasing Beach features a sand beach and a variety of ad-hoc shore perpendicular structures. A sand bag dyke is also located at the back of the beach. It is recommended that existing structures are maintained over 10 years and upgraded as required.

If bed erosion occurs in the future, it is recommended that the existing ad-hoc structures are removed and a uniform cohesive design be implemented as shown in Figure 5.8.

Figure 5.8 Example of Beach Nourishment with Rock Groyne

Wansign Beach is susceptible to flooding during storm events at high lake levels. To reduce the risk of flooding a dyke has been installed at the back of the beach. It is recommended that the existing sand bag dyke be monitored to ensure it is still functional and the elevation is sufficient to reduce flooding. Should the sand bag dyke need repairs, it should be repaired.

5.1.13 Reach 12: Albert Beach

Albert Beach is susceptible to flooding during storm surge events at high lake levels. To reduce the risk of flooding, a dyke has been installed at the back of the beach. It is recommended that the existing sand bag dyke be monitored to ensure it is still functional and the elevation is sufficient to reduce flooding. Should the sand bag dyke need repairs, it should be repaired.

5.2 Other Erosion Mitigation Options

Additional structural elements can be incorporated into the beach design to enhance the recreational features, while providing extra protection for the sand cliffs and sand dunes from pedestrian traffic. Examples include a board walk incorporated into the toe protection as shown in Figure 5.9. A number of walkways along the top of the bluff have been eroded away, as an alternate a boardwalk made of natural material could be incorporated into the toe protection. The boardwalk could be tied into the stairs to maximize accessibility. Another example is a controlled access point to the beach as shown in Figure 5.10. This type of structure is suitable for sand dune areas, such as Club House Beach.

Figure 5.9 Example Boardwalk Incorporated into Toe Protection

Figure 5.10 Example of Controlled Beach Access Point and Slope Re-grading and Vegetation

5.3 Stormwater Management and Drainage Infrastructure

There is a lack of stormwater management and drainage infrastructure in the municipality controlling overland runoff. As a result, the overland runoff takes the path of least resistance to Lake Winnipeg forming gullies through the sand bluffs, which can exacerbate the erosion problem. Therefore, it is recommended that a stormwater management study be completed to look at cost effective options for this rural municipality.

6.0 RURAL MUNICIPALITY OF VICTORIA BEACH DEVELOPMENT PLAN

Existing regulations are in place to govern land use and development decisions in Victoria Beach. At the time of this report, the RMVB was in the process of finalizing its Draft Development Plan with the assistance of staff from Community Regional Planning Services at Manitoba Local Government. In this section, recommendations are made to enhance the Development Plan with specific information relating to coastal hazards, including flooding, erosion, and dynamic beach hazards.

6.1 Development Plan Background Information

Section 43(1) of the Planning Act states Development Plans should set out plans and policies of municipalities respecting their purpose and objectives relative to social, environmental and economic conditions. The Development Plans is based on sustainable development principals and is the primary land use strategy for the community.

A principal goal of the plan is to maintain the unique history, character and lifestyle of Victoria Beach. Given the strong community ties to summer recreation, maintaining access to the local beaches and other natural areas for all residents of the rural municipality is highlighted in the Development Plan. Further, maintaining this access for future generations is also stressed in the plan. Given the acute nature of shoreline erosion around the Victoria Beach peninsula and the potential impacts to private property and beaches, the Development Plan substantiates the need for a more robust planning approach to shoreline management in the Rural Municipality.

6.2 Recommendations for Changes to the Development Plan

Given the importance of the beaches and other natural areas around Victoria Beach, it is important to provide strict development guidelines to preserve these natural features that make Victoria Beach so unique. The adoption of a development setback as outlined in Section 3.1, also benefit the development program, as their investment(s) are protected from hazards.

The model adopted by Ontario to manage development along the Great Lakes and St. Lawrence River while preserving the natural features and reducing the risk of damage from coastal hazards is outlined in the Technical Guide prepared by the Ministry of Natural Resources (MNR, 2001). It is recommended that a similar approach be adopted by the RMVB. Specific details relating to flooding hazards, erosion hazards and dynamic beach hazards are discussed in the following sections.

6.2.1 Flood Hazard Setback

The flooding hazard setback is defined by the combination of "flood level" and the "flood allowance for wave uprush and other water related hazards" (see Figure 6.1). The flood level is the

sum of the lake level and storm surge with a combined probability of a 100-year return period (i.e., on average, has a 1 percent probability of occurring in any given year).

The recommended minimum setback is a flooding allowance of 15 m, measured horizontally from the location of the 100-year flood level. Given that the extreme wave heights on Lake Winnipeg are smaller than those found on the Great Lakes, the absolute setback distance should be evaluated in a separate study.

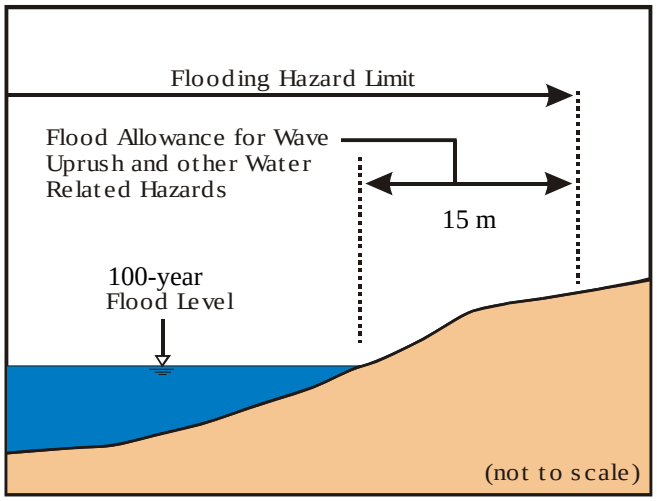


Figure 6.1 Flooding Hazard Limit with Wave Uprush

Where the shoreline is overtopped or ponding occurs, it is recommended that the limit of the flooding hazard be determined by a study using accepted engineering and scientific principles (see Figure 6.2). Wave heights are to be determined on a site-specific basis, but are typically depth limited (i.e. the depth of water physically limits the wave height). Note, a future study could provide a wave height table for the Victoria Beach shoreline.

The Ontario model includes mechanisms in the planning process to provide proponents the opportunity to undertake a detailed study, using accepted scientific and engineering principles to challenge the landward limit of the flood allowance for wave uprush and other water related hazards.

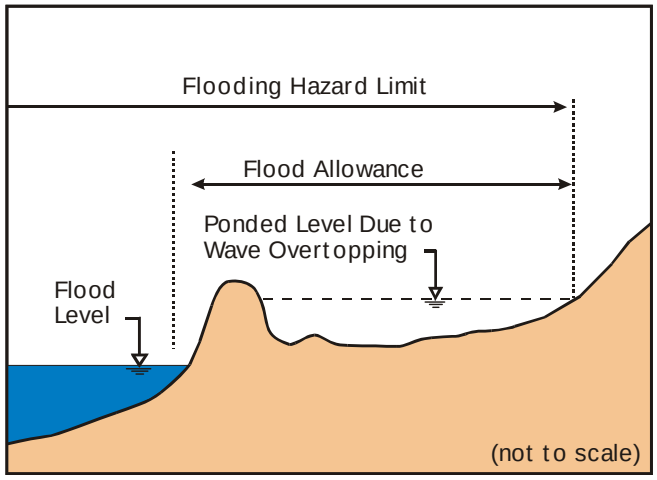


Figure 6.2 Flooding Hazard Limit With Wave Overtopping

Section 3.3.16 and Section 3.3.18 of the draft Development Plan discuss flooding hazards, as follows:

> *3.3.16 For lands subject to periodic or seasonal flooding, structural development shall be discouraged unless the constraints to development can be overcome to the satisfaction of the Municipality and/or the Provincial authority holding jurisdiction. (RMVB, 2012)*
>
> *3.3.18 Development will generally be directed away from lands subject to a 100 year flood, or a recorded flood exceeding the 100 year flood; and lands which would within a 50 year period be eroded or become unstable due to the action of water contained in an adjacent waterway or water body. (RMVB, 2012)*

Modifications to the above are provided in the form of one clause related to flooding. Section 3.3.18 is modified with relation to the erosion hazard discussed in Section 6.2.2. The recommended changes have been developed to clearly define the flooding hazard and provide minimum setbacks, as follows:

3.3.18 For lands along the shoreline, structural development shall not be permitted within the flooding hazard limit. The calculation of the flooding hazard limit involves the cumulative impact of the 100 year flood level, wave uprush and other water related hazards. The allowance for wave uprush and other water related hazards shall be a minimum of 15 m unless a technical study is completed using accepted engineering principles to suggest a smaller setback is technically justified at a specific site.

For systems where flooding and/or wave action overtops a natural bank or protection works, causing ponding landward of the 100 year flood level, the flood allowance for wave uprush and other related hazards is to be determined by a study using accepted engineering principles.

6.2.2 Erosion and Slope Stability Hazard Setbacks

Erosion and slope stability hazard are a serious concern in Victoria Beach. Following the model adopted in Ontario (see Figure 6.3) the calculation of the erosion hazard setback is a two-step process:

- Calculate the horizontal extent of a 3:1 stable slope allowance (eg. 15 m setback for a bank 5 m higher).
- Calculate the horizontal extent of the erosion allowance, which is 100 times the average annual recession rate (eg. 50 years x 0.2 m/year = 10 m).

Based on the example provided, the erosion hazard is 25 m measured from the toe of bank.

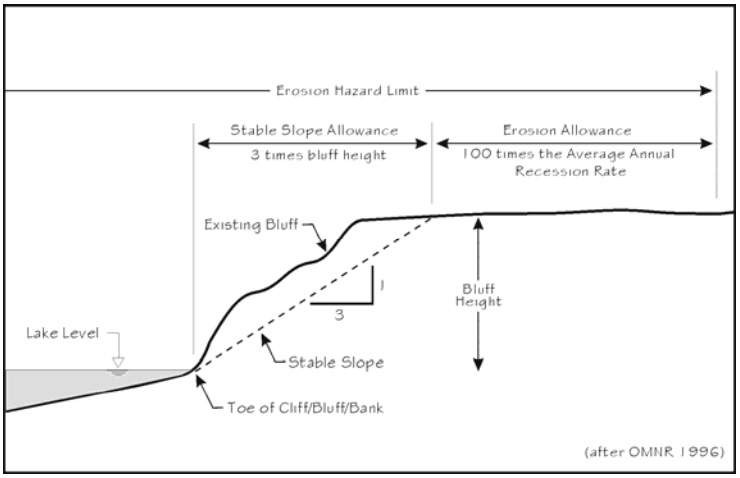


Figure 6.3 Erosion Hazard Limit

The average annual recession rate is used to determine the erosion allowance over 100 years. Recession rates can be calculated by comparing shoreline feature positions from different time periods. Longer time periods are preferred for analysis because they reduce the variability of localized erosion and provide more accurate annualized recession rates. Generally, at least 35 years of sound recession information is required for the unprotected shoreline to determine an annual average recession rate (AARR). The standard approach is to use the top of bluff edge, not the water/shoreline to determine the recession rate because of the variability of water levels. Where there is insufficient reliable recession information, a minimum 30 m setback distance is recommended to allow for future erosion. Information on the historical recession rate for Victoria Beach is provided in the Baird (in press) technical report.

In the absence of detailed geotechnical data, we recommend a stable slope allowance of 3:1 (i.e., three times the bluff height, measured from the toe of slope) be adopted until site specific data is collected.

Section 3.3.17, 3.3.18, and 3.3.19 of the draft Development Plan discuss the erosion hazards, as follows:

> *3.3.17 For steep slopes, existing vegetation shall be substantially retained on all slope faces. If vegetation cannot be substantially retained or proven effective at preventing erosion and/or slope instability, then an Environmental Impact Assessment (EIA) or appropriate related documentation that addresses specific mitigation measures shall be required as determined by the Municipality and/or the Provincial Authority holding jurisdiction. The EIA may also address the visual and environmental integrity of such lands, among other matters. (RMVB, 2012)*
>
> *3.3.18 Development will generally be directed away from lands subject to a 100 year flood, or a recorded flood exceeding the 100 year flood; and lands which would within a 50 year period be eroded or become unstable due to the action of water contained in an adjacent waterway or water body. (RMVB, 2012)*
>
> *3.3.19 Activities that alter existing slopes and may accelerate or promote erosion or bank instability should be prohibited unless appropriate mitigation measures are taken to eliminate the potential of such erosion or bank instability. Mitigating measures should be defined by way of an appropriate geo-technical, engineering or environmental assessment, if requested by the Municipality and/or the Provincial Authority holding jurisdiction. (RMVB, 2012)*

Modifications to the above are provided in the form of one clause related to erosion. The recommended changes have been developed to clearly define the erosion hazard and provided default minimum setbacks, as follows:

3.3.17 For lands along the shoreline, structural development shall not be permitted within the erosion hazard limit. The erosion hazard is the sum of the stable slope allowance plus the erosion allowance of 50 times the average annual recession rate or a minimum erosion allowance of 15 m if sufficient recession data is not available. If the stable slope allowance is not determined through a study using accepted geotechnical principles, then the stable slope allowance is measured landward from the toe of the shoreline cliff, bluff, or bank, equivalent to 3.0 times the height of the cliff, bluff, or bank (i.e., difference in elevation between the top or first landward break in slope and the toe of the shoreline cliff, bluff, or bank.

3.3.18 For lands along the shoreline, existing vegetation shall be substantially retained on all slope faces. If vegetation cannot be substantially retained or proven effective at preventing erosion and/or slope instability, then an Environmental Impact Assessment (EIA) or appropriate related documentation that addresses specific mitigation measures shall be required as determined by the Municipality and/or the Provincial Authority holding jurisdiction. The EIA may also address the visual and environmental integrity of such lands, among other matters.

3.3.19 Altering existing slopes is prohibited unless appropriate mitigation measures are taken to eliminate the potential of future erosion or bank instability. Mitigating measures should be defined by way of an appropriate geo-technical, engineering or environmental assessment.

6.2.3 Dynamic Beach Hazards

The term dynamic beach is used to describe beach profiles which undergo changes on a broad range of time scales in response to changing wave, wind and water level conditions and to change in the rate of sediment supply. The dynamic beach hazard is only applied where: a beach or dune deposit exists landward of the water line as noted in Figure 6.4.

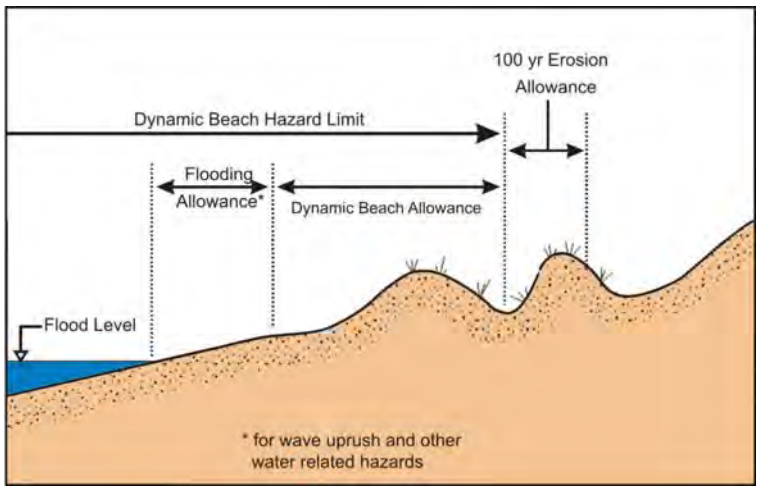


Figure 6.4 Dynamic Beach Hazard Limit

There are no sections within the draft Development Plan that address the dynamic beach hazard. Therefore, it is recommended the following clause be included:

> For lands along the shoreline, structural development shall not be permitted within the dynamic beach hazard limit. The dynamic beach hazard is only applied where:
>
> - A beach or dune deposit exists landward of the water line, and
> - Beach or dune deposits overlying bedrock or cohesive material are equal to or greater than 0.3 metres in thickness, 10 metres in width, and, at least 100 meters in length along shoreline.
>
> The criteria used to define and classify a section of shoreline as a dynamic beach are intended to be applied over a stretch of shoreline on the order of 100 metres or more in length. Where shorter sections of sediment occur on a rocky or cohesive shoreline they are likely to be transitory. Beach width and thickness should be evaluated under calm conditions and at water levels between datum and the average annual low water level. When lake level conditions are higher, consideration should be given to the submerged portion of the beach.
>
> If it is determined that there is a dynamic beach, the hazard limit is defined as:
>
> - The landward limit of the flooding hazards (100 year flood level plus a flood allowance for wave uprush and other water related hazards) plus a 30 metre dynamic beach allowance, or
> - The landward limit of the flooding hazard (100 year flood level plus a flood allowance for wave uprush and other water related hazards) plus a dynamic beach allowance based on a study using accepted scientific and engineering principles.

Since there are few remaining dynamic beaches within the RMVB (eg. the barrier beach located south of Pelican Point and possibly Club House Beach), the other option is simply zoning these lands so future development does not occur.

6.2.4 Zoning By-laws

Section 3.3.20 of the draft Development Plan discusses a relevant zoning by-law related to setbacks:

> *3.3.20 The Zoning By-law may establish building setbacks from the margins of unsuitable lands if, in the opinion of the Municipality, the extent of severity of the constraint warrants it. All development upon limited use lands shall be integrated into the landscape while protecting and/or enhancing the natural feature. (RMVB, 2012)*

It may be desirable to use this by-law to strengthen the adoption of the hazard setbacks.

7.0 CONCLUSIONS

The SMP prepared for the RMVB identifies the unique characteristics of the shoreline by reach and provides guidance for appropriate shoreline management alternatives. The SMP was developed with the support of a detailed study that included a number of phases and took place from October 2011 to January 2014.

The beaches and residential development around the RMVB are threatened by erosion hazards. These beaches are one of the things that make Victoria Beach unique and close to the hearts of all the residents and visitors. The Public Reserve that was established by the RMVB almost 100 years ago to provide public access along the shoreline has been eroding overtime and has almost disappeared in some locations. If erosion is allowed to continue without engineering intervention, the shoreline will be located within the private property parcels. If this were to happen the RMVB will lose control of one of their most valuable asset, the beaches.

Through the public consultation process to develop this SMP, initially it was determined that the community of Victoria Beach had different opinions of how the erosion should be mitigated. The development of the SMP has united the community and there is now a majority consensus on a way forward. The majority of the Victoria Beach residents agree that preserving the public beaches in perpetuity and protecting the waterfront homes should be the top priority of the SMP.

Options for erosion mitigation measures were developed for the shoreline of Victoria Beach. The basis for the shoreline management options was the technical study (Baird, in press) which provided a thorough understanding of the coastal processes and the mechanisms for erosion and sedimentation. The options considered all practical possibilities, with the primary purpose of not only preserving but enhancing the popular public beaches and protecting the waterfront lots from erosion hazards.

The final recommendations and priorities for the Victoria Beach SMP are summarized in Table 7-1. The reaches classified as high priorities include Connaught South, King Edward and Alexandra Beach, Patricia and Arthur Beach and the Sand Bluffs. The recommendations presented in Table 7-1 should be finalized in terms of the type of structures, number of structures and location in a final design investigation. Additional recreational features can also be included in the design, such as controlled access to make the beaches more accessible.

There is a lack of drainage infrastructure in the municipality controlling overland runoff. As a result, the overland runoff takes the path of least resistance to Lake Winnipeg forming gullies through the sand bluffs and exacerbating the erosion problem. Therefore, it is recommended that a study be completed to look at the feasibility of implementing drainage solutions for this rural municipality.

Table 7-1 Summary of Shoreline Management Recommendations

Reach	Recommended Management Plan	Priority
Reach 2: Connaught South	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 3: King Edward and Alexandra	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 5 (North): Patricia and Arthur Beach	Beach nourishment with anchoring structures (groynes or offshore breakwater) and toe protection for the sand bluff.	High
Reach 10 (North and South) and Gibson Drive	Conduct detailed geotechnical investigation to assess slope stability and develop mitigation options.	High
Reach 5 (South): Clubhouse Beach	Beach nourishment with anchoring structures (groynes).	Moderate
Reach 11: Wanasing Beach	Maintain existing structure and monitor shoreline. If beaches are not stable, remove ad-hoc structures and design a uniform solution to maintain the beach. Elevation of sand bag dyke should be monitored with maintenance completed as required.	Moderate
Reach 7: Bayview to Pelican Point	Monitor and maintain existing engineering structures.	Low
Reach 4: Scott Point Headland	Monitor erosion, and if continues and is a concern then construct a rock revetment.	Low
Reach 2: Connaught North	Monitor erosion and maintain existing structures.	Low
Reach 6: Federal Wharf/Safe Harbour	Maintain existing structures (by owner).	Low
Reach 9: Highway 504 to Hamptons	Install infrastructure to control over land runoff. Monitor erosion. If erosion is threatening private land, then land owners to construct and maintain rock revetments.	Low
Reach 10 (North): Sunrise	Monitor erosion and maintain existing structures. If erosion continues consider upgrading the shoreline protection.	Low
Reach 12: Albert Beach	Elevation of sand bag dyke should be monitored with maintenance completed as required. Construct parking lot for Albert Beach access (optional).	Low

7.1 Integration of Shoreline Management Plan with Development

Given the importance of the beaches and other natural areas around Victoria Beach, it is important to enhance the shoreline development guidelines to preserve these natural features that make Victoria Beach so unique and protect existing and future development from erosion and flooding hazards. Adopting development setbacks is also beneficial to the developer/proponent as it limits the risk of damage from coastal hazards for new development. When the Development Plan is finalised for the RMVB, this SMP should be referenced or linked, thus providing additional clarity on appropriate actions along the shore.

8.0 REFERENCES

Baird & Associates, 2013. Regional Municipality of Victoria Beach Coastal Process Study, Lake Winnipeg, Manitoba. Report prepared for the Rural Municipality of Victoria Beach.

Dibajnia, M., 1995. Sheet flow transport formula extended and applied to horizontal plane problems. Coastal Engineering in Japan, Vol. 38, No. 2, pp. 179-194.

Dibajnia, M., Moriya, T. and Watanabe, A., 2001. A representative wave model for estimation of nearshore local transport rate. Coastal Engineering Journal, Vol. 43, No.1, pp. 1-38.

Dibajnia, M. and Watanabe, A., 1992. Sheet flow under nonlinear waves and currents. Proceedings of 23rd International Conference on Coastal Engineering, Venice, ASCE, pp. 2015-2028.

Environment Canada, 2013. Hydrometric Data, Access to Archived Hydrometric Data from HYDDAT. http://www.wsc.ec.gc.ca/applications/H2O/index-eng.cfm, last accessed on 16 May 2013.

Isobe, M., 1987. A parabolic equation model for transformation of irregular waves due to refraction, diffraction and breaking. Coastal Engineering in Japan, Vol. 30, No.1, pp. 33-47.

Karlsson, T., 1969. Refraction of continuous ocean wave spectra, Journal of Waterways and Harbors Division. Proceedings of ASCE, Vol. 95, No. WW4, pp. 437-448.

Manitoba Goverment, 2013. Flood Information - Lake Winnipeg. http://www.gov.mb.ca/flooding/fighting/lake_winnipeg.html, last accessed on 7 June 2013.

Ministry of Natural Resources, 2001. Technical Guide for Great Lakes – St. Lawrence River Shorelines, Flooding, Erosion and Dynamic Beaches.

Nairn, R.B. and Southgate, H.N., 1993. Deterministic Profile Modelling of Nearshore Processes. Part II. Sediment Transport and Beach Profile Development. Coastal Engineering, 19. pp. 57-96.

Nishimura, H., 1988. Computation of nearshore current. In: Horikawa, K. (Editor), Nearshore Dynamics and Coastal Processes, University of Tokyo Press, Tokyo, pp. 271-291.

Rural Municipality of Victoria Beach, 2012. Draft Development Plan. Draft submitted to community and Manitoba Local Government for review in May 2012.

Southgate, H.N. and Nairn, R.B., 1993. Deterministic Profile Modelling of Nearshore Processes. Part I. Waves and Currents. Coastal Engineering, 19. pp. 27-56.

APPENDIX A

COASTAL FACTS SHEETS

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- Low sandy bluffs and beach with variable width
- Randomly placed loose rock groynes
- Rock revetment in select locations at bluff toe

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Public and private beach access facilities
- Water management plant and wooden access stairs
- Municipal road allowances

SHORELINE HAZARDS

- Eroding sand bluffs, average annual erosion rate of 0.18m/year +/- 0.03 (standard deviation)
- Bluff slope instability
- Homes will be threatened by ongoing erosion unless mitigated

COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 2
CONNAUGHT BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- High sandy bluffs and beach with variable width
- Randomly placed rock piles
- Sand bags at bluff toe for a portion of the reach
- Northern and southern boundary consists of eroding glacial till headlands

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- King Edward and Alexandra wooden staircase for beach access
- King Edward and Alexandra municipal road allowances

SHORELINE HAZARDS

- Eroding sand bluffs, average annual erosion rate of 0.14 m/year +/- 0.02 (standard deviation)
- Bluff slope instability
- Homes will be threatened by ongoing erosion unless mitigated

PHOTO

GLACIAL TILL HEADLAND

RECENTLY UPGRADED REVETMENT

KING EDWARD RD.

KING EDWARD STAIRCASE

SAND BAGS ALONG TOE OF BLUFF

LAKE WINNIPEG

ALEXANDRA STAIRCASE

ALEXANDRA RD.

1 AVE.

2 AVE.

3 AVE.

4 AVE.

ERODING GLACIAL TILL HEADLAND

N

0 50 100m

COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 3
KING EDWARD & ALEXANDRA BEACH

LEGEND

REACH EXTENTS

AERIAL IMAGERY (2011)

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- Eroding glacial till headland

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Scott Park

SHORELINE HAZARDS

- Eroding glacial till, average annual erosion rate of 0.15m/year +/-0.05 (standard deviation)
- Municipal park will continue to erode unless mitigated
- Access for emergency vehicles is limited

1 AVE

PHOTO

LAKE WINNIPEG

N

0 25 50m

COASTAL FACT SHEET

Baird

REACH 4
SCOTT POINT HEADLAND

LEGEND
REACH EXTENTS

DATE: 7/17/2013

AERIAL IMAGERY (2011)

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- High sandy bluffs and beach with variable width (north)
- Sand dunes and beach at Clubhouse with variable width (south)
- Randomly placed loose rock groyne
- Rock revetment at toe of bluff (new)
- Older rock revetment at toe of bluff

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Patricia, Arthur and Clubhouse beach access points
- Private beach access points
- Patricia, Arthur and Clubhouse beach

SHORELINE HAZARDS

- Eroding sand bluffs, average annual erosion rate of 0.25 m/year +/- 0.05 (standard deviation) at Patricia
- Bluff slope instability
- Sand dunes dynamic equilibrium but pressure from pedestrian traffic and storms
- Homes will be threatened by ongoing erosion unless mitigated for Patricia and Arthur

COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 5
PATRICIA TO CLUB HOUSE BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

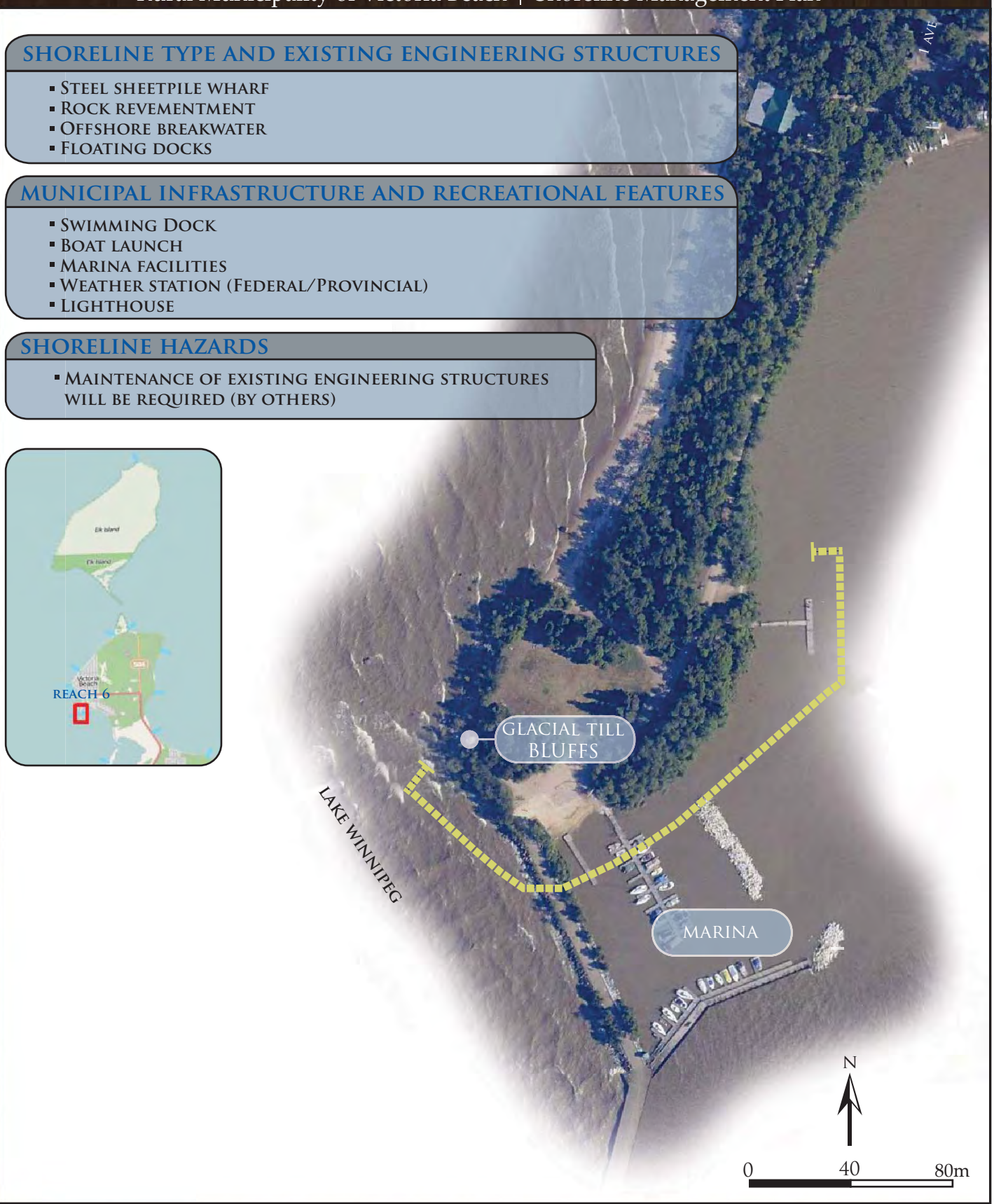
- Steel sheetpile wharf
- Rock revementment
- Offshore breakwater
- Floating docks

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Swimming Dock
- Boat launch
- Marina facilities
- Weather station (Federal/Provincial)
- Lighthouse

SHORELINE HAZARDS

- Maintenance of existing engineering structures will be required (by others)



COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 6
FEDERAL WHARF & SAFE HARBOUR

LEGEND

REACH EXTENTS

AERIAL IMAGERY (2011)

YACHT CLUB

SLOPE STABIILITY POTENTIAL ISSUE (TO BE VERIFIED)

PHOTO

LAKE WINNIPEG

GIBSON DR.

PINE RD.

THORTON BLVD.

PELICAN POINT RD.

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- Low bank with extensive shoreline armouring consisting of gabians and rocks revetments
- Natural inlet and barrier beach to south

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Yacht Club
- Private beach access points
- Barrier beach inlet provides access to residences in the marsh
- Beaches along southern barrier beach accessible only by boat

SHORELINE HAZARDS

- Flooding during high lake levels
- Sedimentation issues in the inlet channel (dredging has been required)
- Existing shoreline protection will require maintenance or homes will be threatened by the onset of erosion
- Slope stability potential issue off Gibson Dr. (to be verified

INLET PROVIDES ACCESS TO RESIDENTIAL DEVELOPMENT

NATURAL BEACH

N

0 200 400m

COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 7
BAYVIEW TO PELICAN POINT

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- Glacial till bluffs and isolated beach deposits

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Beach access from private property
- Municipal road allowance and informal boat launch

SHORELINE HAZARDS

- Eroding glacial till bluffs, average annual erosion rate of 0.21m/year +/- 0.1 (standard deviation)
- Bluff slope instability
- Lack of overland drainage infrastructure leads to gully erosion
- Homes will be threatened by ongoing erosion unless mitigated

COASTAL FACT SHEET

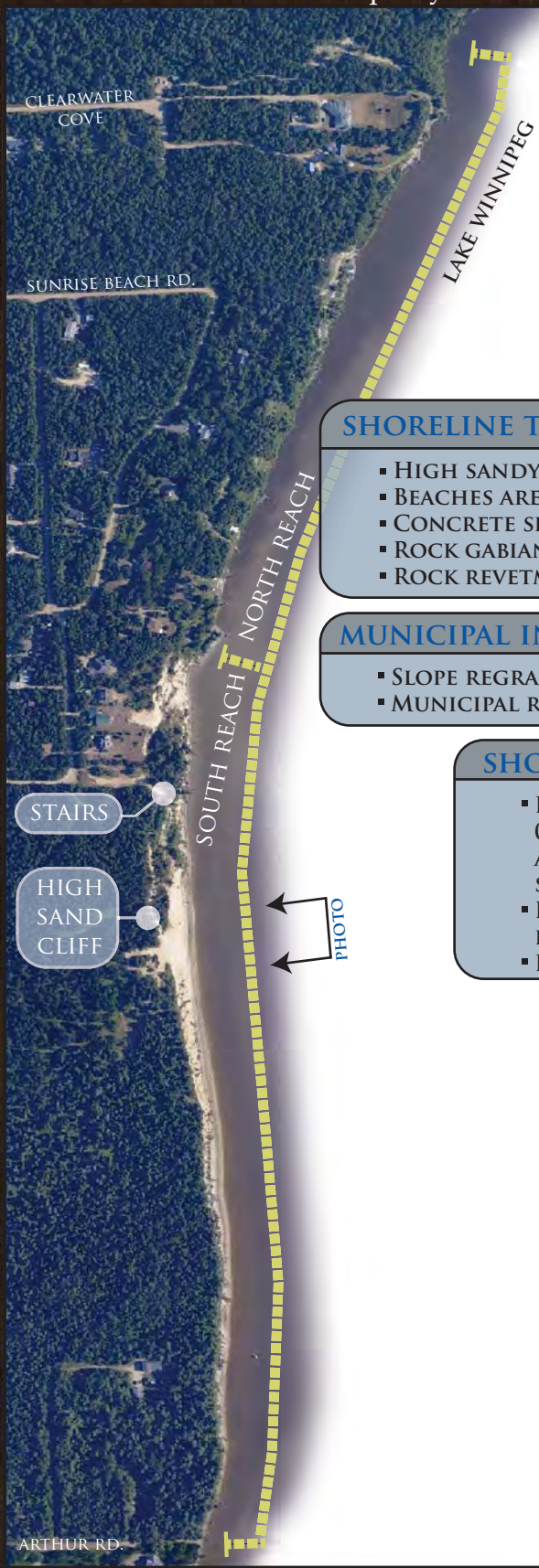
Baird

DATE: 7/17/2013

REACH 9
504 TO HAMPTONS

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)



SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- High sandy bluffs and beach with variable width
- Beaches are a combination of sand, rock and exposed clay
- Concrete seawalls at toe of bluff
- Rock gabians at toe of bluff
- Rock revetment at toe of bluff

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Slope regrading for shoreline access on private properties
- Municipal road allowance and stairway lead to Traverse Bay Beach

SHORELINE HAZARDS

- Eroding sand bluffs, average annual erosion rate of 0.19m/year +/- 0.05 (standard deviation) for the north and 0.58m/year +/-0.11 (standard deviation) for the south
- Bluff slope instability, sand cliffs very susceptible to large rotational failures
- Park users are at risk of slope failure and avalanching

N

0 125 250m

COASTAL FACT SHEET

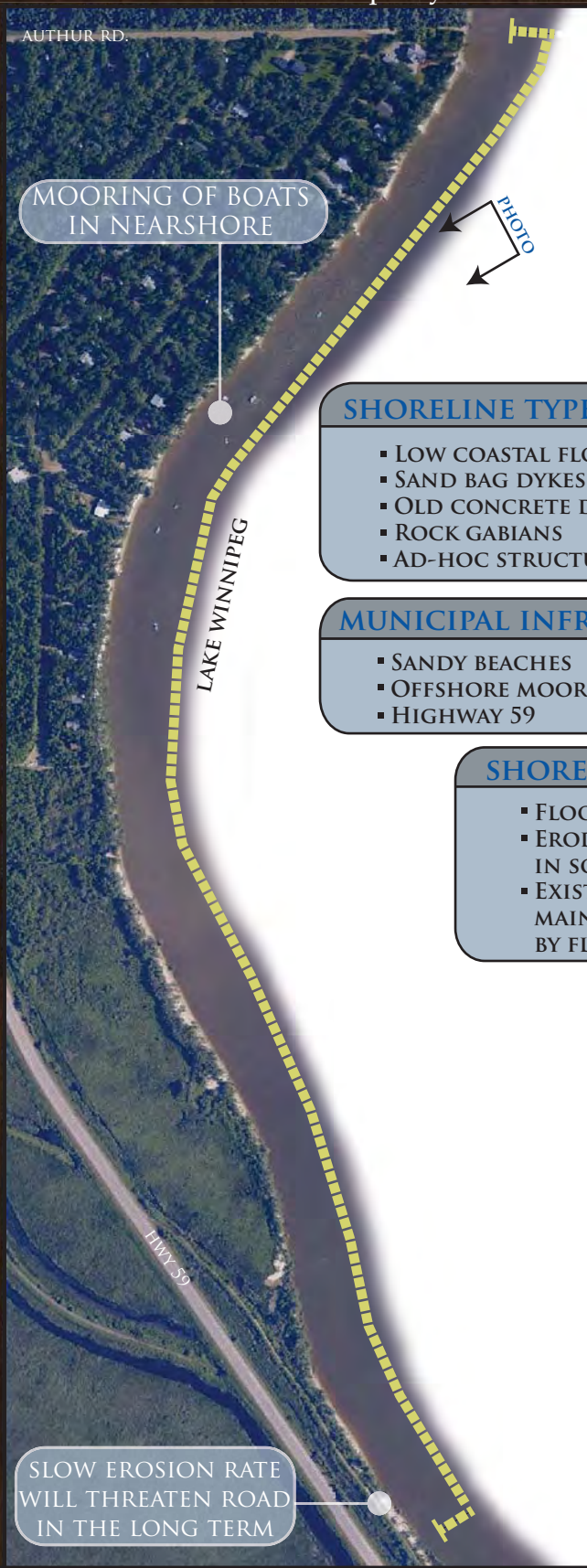
Baird

DATE: 7/17/2013

REACH 10
SUNRISE TO SAND BLUFFS

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)



SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

- Low coastal flood plain with sand beach
- Sand bag dykes
- Old concrete docks and groynes
- Rock gabians
- Ad-hoc structures

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Sandy beaches
- Offshore mooring of recreational boats
- Highway 59

SHORELINE HAZARDS

- Flooding during high lake levels
- Eroding shoreline may threaten the road (Hwy 59) in southern portion of the reach
- Existing dykes and shore protection will require maintenance & monitoring or homes will be threatened by flooding in the future

N

0 125 250m

COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 11
WANASING BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

SHORELINE TYPE AND EXISTING ENGINEERING STRUCTURES

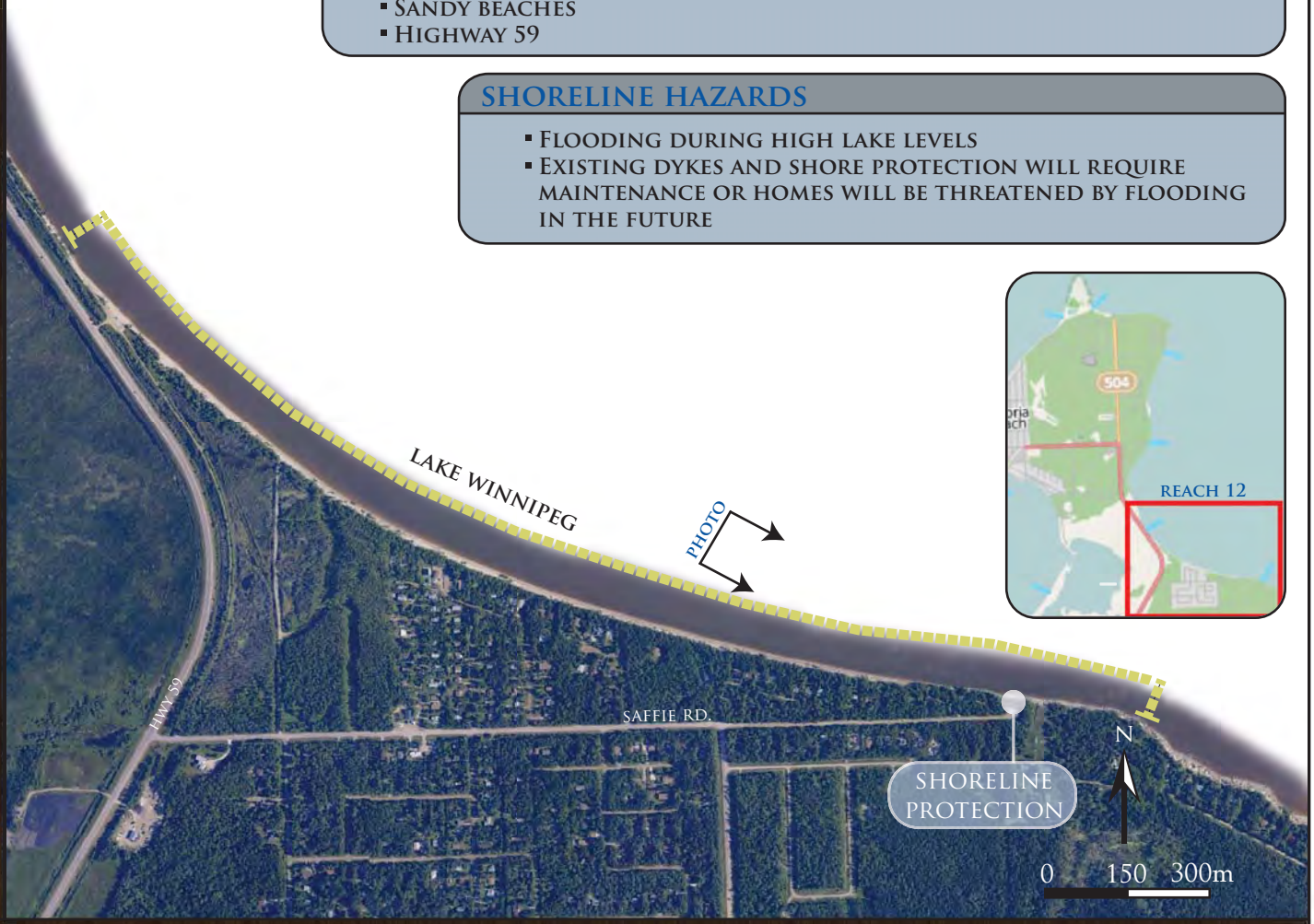
- Low sandy bluff
- coastal flood plain with stable sandy beach
- Rock revetment (south east shore)
- Buried flood dyke at back of beach
- Randomly placed rock piles

MUNICIPAL INFRASTRUCTURE AND RECREATIONAL FEATURES

- Sandy beaches
- Highway 59

SHORELINE HAZARDS

- Flooding during high lake levels
- Existing dykes and shore protection will require maintenance or homes will be threatened by flooding in the future



COASTAL FACT SHEET

Baird

DATE: 7/17/2013

REACH 12
ALBERT BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

APPENDIX B

SHORELINE MANAGEMENT OPTIONS

LONGTERM SHORELINE TREND

- MAJORITY OF SHORELINE IS STABLE DUE TO EXISTING STRUCURES

SOURCES OF BEACH SAND

- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- FUTURE MAINTENANCE OF EXISTING SHORE PROTECTION STRUCTURES WILL BE REQUIRED

LONGSHORE TRANSPORT DOMINANT DIRECTION

LAKE WINNIPEG

NORTH REACH

SOUTH REACH

N

0 75 150m

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 2: NORTH CONNAUGHT BEACH

LEGEND

REACH EXTENTS

TOP OF BANK POINT (SURVEYED JUNE 2013)

ESTIMATED TOP OF BANK POSITION

25 YEAR

50 YEAR

AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.18M/YEAR +/- 0.03 (STANDARD DIVIATION)

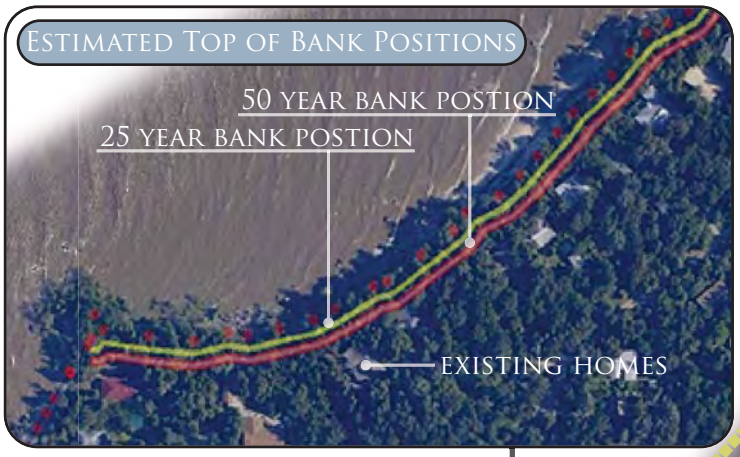
SOURCES OF BEACH SAND

- LOCALISED BLUFF EROSION (SOUTHERN PORTION OF REACH)
- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- OPTION 1: BEACH NOURISHMENT WITH PERIODIC MAINTENANCE
- OPTION 2: GROYNES AND BEACH NOURISHMENT (GROYNES ANCHOR THE NOURISHMENT AND REDUCE THE AMOUNT OF MAINTENANCE REQUIRED)
- OPTION 3: CONSTRUCT POCKET BEACH IN SOUTHERN PORTION OF REACH AND ARMOUR THE TOE OF THE BLUFF WITH A REVETMENT FOR THE REMAINING PORTION OF THE REACH

NOTE, FUTURE MAINTENANCE OF EXISTING SHORE PROTECTION STRUCTURES WILL BE REQUIRED



NORTH REACH

SOUTH REACH

LAKE WINNIPEG

LONGSHORE TRANSPORT DOMINANT DIRECTION

BLUFF TOE PROTECTION

OPTION 3 CONCEPTUAL SCHEMATICE: POCKET BEACH

NOTES:
THE POSITION OF THE TOP OF BANK IN 25 & 50 YEAR IS A PREDICTION BASED ON BEST AVAILABLE HISTORIC DATA. THESE PREDICTIONS WERE GENERATED FOR PLANNING PURPOSES AND ARE NOT PROVIDED WITH A GUARANTEE.

CONCEPTUAL SKETCH OF GROYNE POSITION, LENGTH AND BEACH NOURISHEMENT EXTENTS, NOT ENGINEERING DRAWINGS.

N

0 75 150m

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 2: SOUTH CONNAUGHT BEACH

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.14M/YEAR +/- 0.02 (STANDARD DIVIATION)

SOURCES OF BEACH SAND

- LOCALISED BLUFF EROSION
- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- OPTION 1: BEACH NOURISHMENT WITH PERIODIC MAINTENANCE
- OPTION 2: GROYNES AND BEACH NOURISHMENT (GROYNES ANCHOR THE NOURISHMENT AND REDUCE THE AMOUNT OF MAINTENANCE REQUIRED)
- OPTION 3: ARMOUR BLUFF TOE WITH ROCK REVETMENT (BEACH WILL EVENTUALLY DISAPPEAR)

KING EDWARD RD.

LONGSHORE TRANSPORT DOMINANT DIRECTION

LAKE WINNIPEG

1 AVE.

2 AVE.

3 AVE.

4 AVE.

OPTION 2 CONCEPTUAL SCHEMATIC: ROCK GROYNE WITH NOURISHMENT TO ENHANCE BEACHES WITH LOW MAINTENANCE

NOTES:
THE POSITION OF THE TOP OF BANK IN 25 & 50 YEAR IS A PREDICTION BASED ON BEST AVAILABLE HISTORIC DATA. THESE PREDICTIONS WERE GENERATED FOR PLANNING PURPOSES AND ARE NOT PROVIDED WITH A GUARANTEE.

CONCEPTUAL SKETCH OF GROYNE POSITION, LENGTH AND BEACH NOURISHEMENT EXTENTS, NOT ENGINEERING DRAWINGS.

N

0 50 100m

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 3
KING EDWARD & ALEXANDRA BEACH

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.15M/YEAR +/- 0.05 (STANDARD DIVIATION)

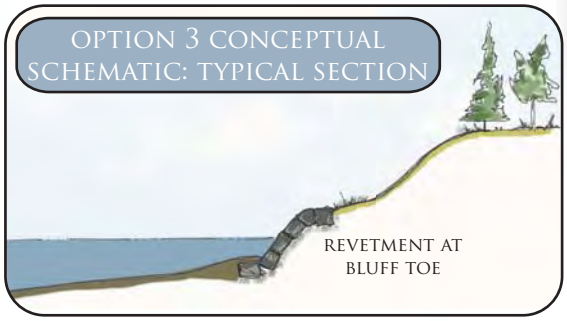
SOURCES OF BEACH SAND

- NO BEACH
- MINIMAL SAND FROM ANY SOURCE

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- OPTION 1: DO NOTHING (RELATIVELY LOW PRIORITY BUT MUNICIPAL PARK LAND WILL CONTINUE TO ERODE)
- OPTION 2: SLOW DOWN EROSION BY ARMOURING BLUFF TOE WITH LOCALLY AVAILABLE ROCK
- OPTION 3: ARMOUR BLUFF TOE WITH ROCK REVETMENT

LAKE WINNIPEG



NOTES:
THE POSITION OF THE TOP OF BANK IN 25 & 50 YEAR IS A PREDICTION BASED ON BEST AVAILABLE HISTORIC DATA. THESE PREDICTIONS WERE GENERATED FOR PLANNING PURPOSES AND ARE NOT PROVIDED WITH A GUARANTEE.

CONCEPTUAL SKETCH OF GROYNE POSITION, LENGTH AND BEACH NOURISHEMENT EXTENTS, NOT ENGINEERING DRAWINGS.

N

0 25 50m

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 4
SCOTT POINT HEADLAND

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- Option 1: Control pedestrian traffic through signage and walkways constructed out of natural materials such as wood and vegetation
- Option 2: Beach nourishment at Patricia and Arthur with periodic maintenance
- Option 3: Groynes and beach nourishment at Patricia & Arthur (groynes anchor the nourishment and reduce the amount of maintenance required)
- Option 4: Armouring bluff toe with rock revetment at Patricia & Arthur (the beach will eventually disappear) and construct groyne south of Clubhouse to enhance Clubhouse beach

Option 3 Conceptual Schematic: Enhance Patricia & Arthur Beach using rock groynes & beach nourishment

Patricia Rd.

Longshore transport dominant direction

Lake Winnipeg

Notes:
The position of the top of bank in 25 & 50 year is a prediction based on best available historic data. These predictions were generated for planning purposes and are not provided with a guarantee.

Conceptual sketch of groyne position, length and beach nourishement extents, not engineering drawings.

LONGTERM SHORELINE TREND

- 1948 to 2013 average annual erosion rate of 0.25m/year +/- 0.05 (standard diviation)

SOURCES OF BEACH SAND

- Localised bluff erosion
- Minimal sediment supply from adjacent sub-cells

North Reach

South Reach

N

0 40 60m

SHORELINE MANAGEMENT OPTIONS

Prepared by Baird & Associates

Baird

Date: 7/17/2013

REACH 5: NORTH
PATRICIA TO CLUB HOUSE BEACH

Legend

Reach extents

Top of bank point (surveyed June 2013)

Estimated top of bank position

25 year

50 year

Aerial imagery (2011)

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.25M/YEAR +/- 0.05 (STANDARD DIVIATION)

SOURCES OF BEACH SAND

- LOCALISED BLUFF EROSION
- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- OPTION 1: CONTROL PEDESTRIAN TRAFFIC THROUGH SIGNAGE AND WALKWAYS CONSTRUCTED OUT OF NATURAL MATERIALS SUCH AS WOOD AND VEGETATION
- OPTION 2: BEACH NOURISHMENT OF PATRICIA AND ARTHUR WITH PERIODIC MAINTENANCE
- OPTION 3: GROYNES AND BEACH NOURISHMENT AT PATRICIA & ARTHUR (GROYNES ANCHOR THE NOURISHMENT AND REDUCE THE AMOUNT OF MAINTENANCE REQUIRED)
- OPTION 4: ARMOURING BLUFF TOE WITH ROCK REVETMENT AT PATRICIA & ARTHUR (THE BEACH WILL EVENTUALLY DISAPPEAR) AND CONSTRUCT GROYNE SOUTH OF CLUBHOUSE TO ENHANCE CLUBHOUSE BEACH

NORTH REACH

SOUTH REACH

LAKE WINNIPEG

LONGSHORE TRANSPORT DOMINANT DIRECTION

OPTION 4 CONCEPTUAL SCHEMATIC: IF PATRICIA IS ARMOURED RATHER THAN MAINTAINING BEACH, THEN GROYNE IS REQUIRED TO ENHANCE CLUB HOUSE BEACH

NOTES:
THE POSITION OF THE TOP OF BANK IN 25 & 50 YEAR IS A PREDICTION BASED ON BEST AVAILABLE HISTORIC DATA. THESE PREDICTIONS WERE GENERATED FOR PLANNING PURPOSES AND ARE NOT PROVIDED WITH A GUARANTEE.

CONCEPTUAL SKETCH OF GROYNE POSITION, LENGTH AND BEACH NOURISHEMENT EXTENTS, NOT ENGINEERING DRAWINGS.

N

0 80 160m

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 5: SOUTH
PATRICIA TO CLUB HOUSE BEACH

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- Relatively stable due to engineering structures

SOURCES OF BEACH SAND

- No beach
- Minimal sand from any source

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- Maintenance of existing engineering structures will be required

SHORELINE MANAGEMENT OPTIONS

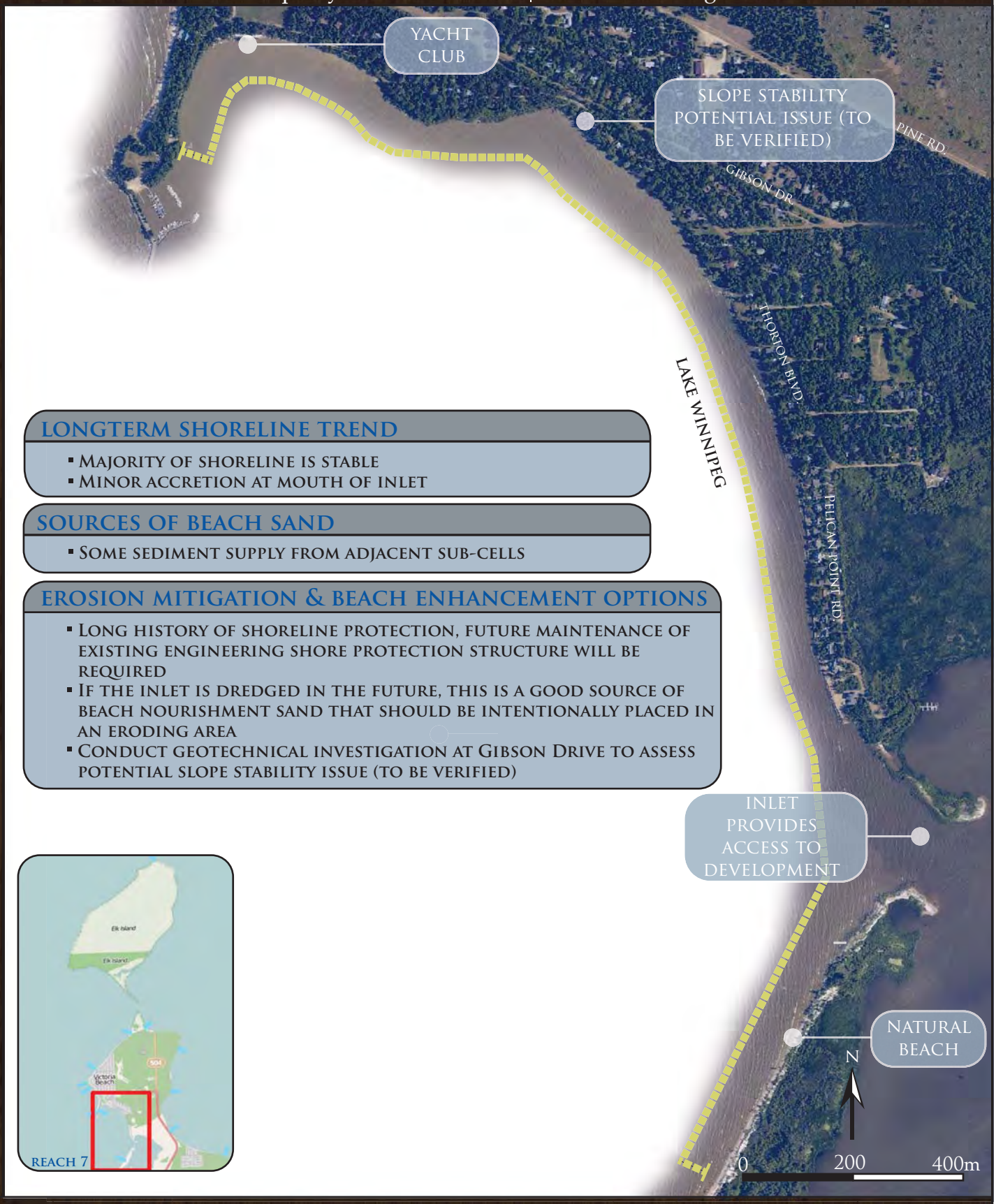
Baird

DATE: 7/17/2013

REACH 6
FEDERAL WHARF & SAFE HARBOUR

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)



LONGTERM SHORELINE TREND

- Majority of shoreline is stable
- Minor accretion at mouth of inlet

SOURCES OF BEACH SAND

- Some sediment supply from adjacent sub-cells

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- Long history of shoreline protection, future maintenance of existing engineering shore protection structure will be required
- If the inlet is dredged in the future, this is a good source of beach nourishment sand that should be intentionally placed in an eroding area
- Conduct geotechnical investigation at Gibson Drive to assess potential slope stability issue (to be verified)

SHORELINE MANAGEMENT OPTIONS

Baird

REACH 7
BAYVIEW TO PELICAN POINT

LEGEND
REACH EXTENTS

DATE: 7/17/2013

AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.21M/YEAR +/- 0.1 (STANDARD DIVIATION)

SOURCES OF BEACH SAND

- LOCALISED SAND BLUFF EROSION, SOME OF WHICH IS DUE TO OVERLAND DRAINAGE ISSUES
- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- OPTION 1: IMPLEMENT INFRASTRUCTURES TO CONTROL OVERLAND RUNOFF
- OPTION 2: ARMOUR BLUFF TOE WITH ROCK REVETMENT

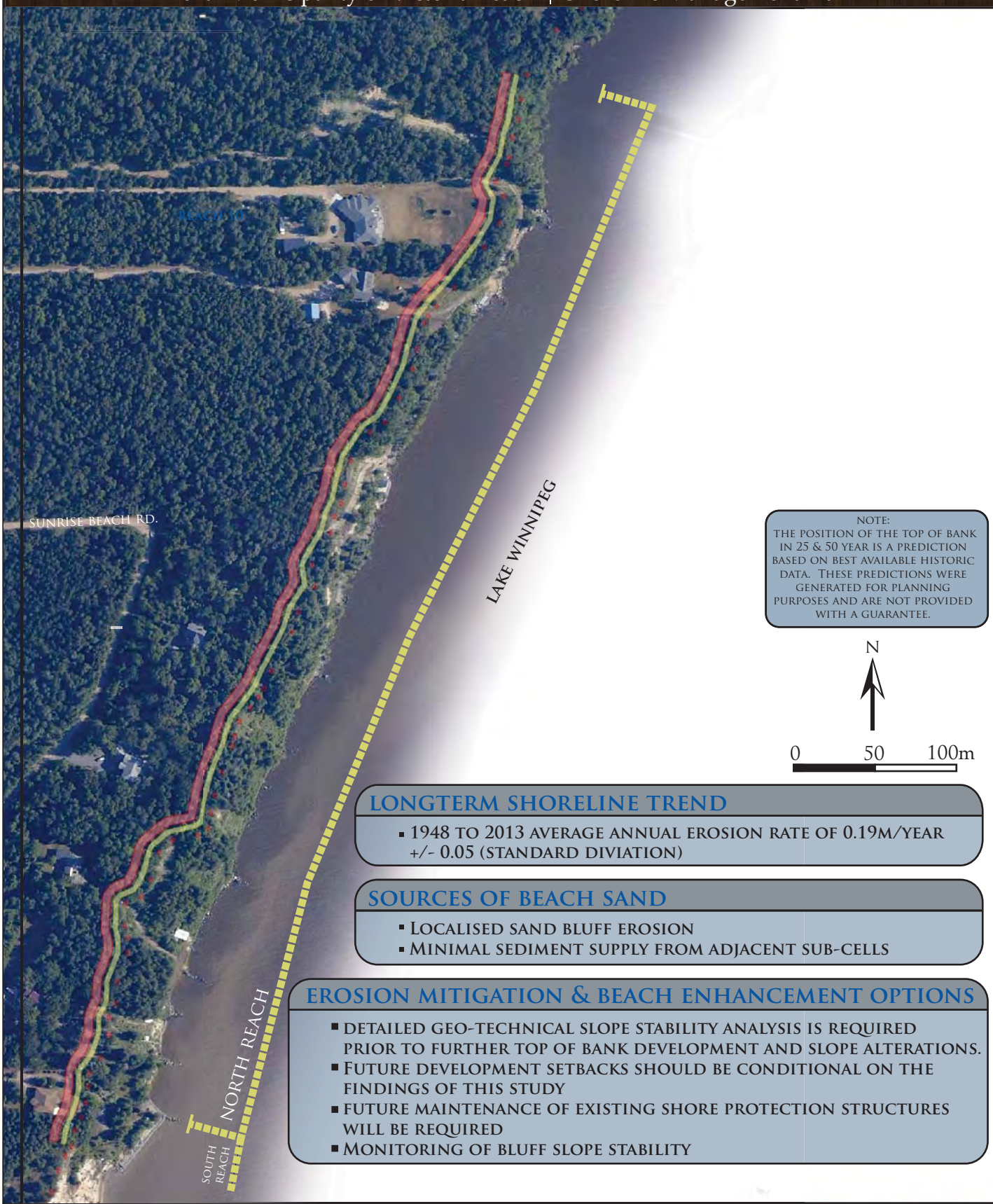
SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 9
504 TO HAMPTONS

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)



NOTE:
THE POSITION OF THE TOP OF BANK IN 25 & 50 YEAR IS A PREDICTION BASED ON BEST AVAILABLE HISTORIC DATA. THESE PREDICTIONS WERE GENERATED FOR PLANNING PURPOSES AND ARE NOT PROVIDED WITH A GUARANTEE.

N

0 50 100m

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.19M/YEAR +/- 0.05 (STANDARD DIVIATION)

SOURCES OF BEACH SAND

- LOCALISED SAND BLUFF EROSION
- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- DETAILED GEO-TECHNICAL SLOPE STABILITY ANALYSIS IS REQUIRED PRIOR TO FURTHER TOP OF BANK DEVELOPMENT AND SLOPE ALTERATIONS.
- FUTURE DEVELOPMENT SETBACKS SHOULD BE CONDITIONAL ON THE FINDINGS OF THIS STUDY
- FUTURE MAINTENANCE OF EXISTING SHORE PROTECTION STRUCTURES WILL BE REQUIRED
- MONITORING OF BLUFF SLOPE STABILITY

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 10 - NORTH
SUNRISE TO SAND BLUFFS

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- 1948 TO 2013 AVERAGE ANNUAL EROSION RATE OF 0.05M/YEAR +/- 0.05 (STANDARD DIVIATION)

SOURCES OF BEACH SAND

- LOCALIZED SAND BLUFF EROSION
- MINIMAL SEDIMENT SUPPLY FROM ADJACENT SUB-CELLS

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- A DETAILED GEO-TECHNICAL SLOPE STABILITY ANALYSIS IS REQUIRED PRIOR TO FURTHER TOP OF BANK DEVELOPMENT AND SLOPE ALTERATIONS. FUTURE DEVELOPMENT SETBACKS SHOULD BE CONDITIONAL ON THE FINDINGS OF THIS STUDY
- OPTION 1: IMPLEMENT SIGNAGE TO REDUCE THE AMOUNT OF PUBLIC TRAFFIC ON SAND BANKS. UNSTABLE SAND BANKS ARE A GEOTECHNICAL ISSUE
- OPTION 2: ENGINEERING DESIGN TO MITIGATE EROSION AND SLOPE STABILITY HAZARDS FOR EXISTING HOMES

NOTE, FUTURE MAINTENANCE OF EXISTING SHORE PROTECTION STRUCTURES WILL BE REQUIRED

IMPLEMENT SIGNAGE TO REDUCE PUBLIC TRAFFIC ON SAND BANKS

NOTE:
THE POSITION OF THE TOP OF BANK IN 25 & 50 YEAR IS A PREDICTION BASED ON BEST AVAILABLE HISTORIC DATA. THESE PREDICTIONS WERE GENERATED FOR PLANNING PURPOSES AND ARE NOT PROVIDED WITH A GUARANTEE.

N

0 75 150m

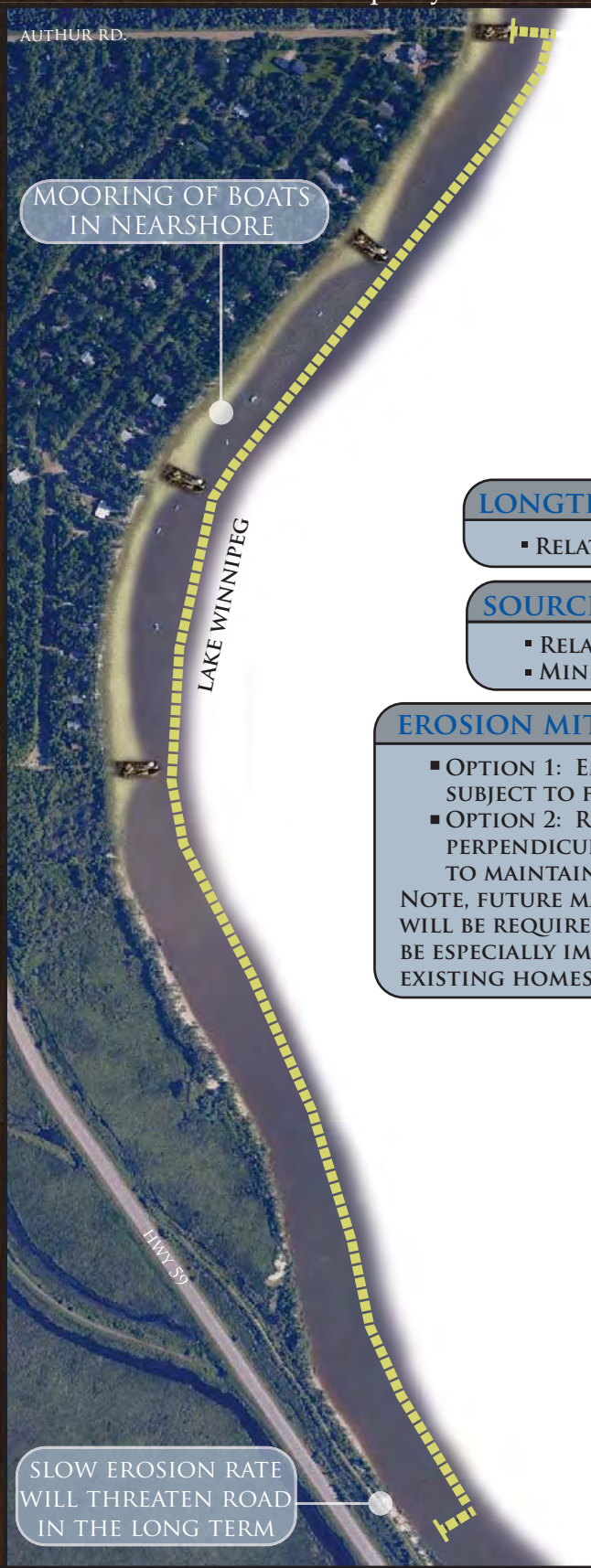
SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 10 - SOUTH SAND BLUFFS

LEGEND
REACH EXTENTS
TOP OF BANK POINT (SURVEYED JUNE 2013)
ESTIMATED TOP OF BANK POSITION
25 YEAR
50 YEAR
AERIAL IMAGERY (2011)



LONGTERM SHORELINE TREND

- Relatively stable due to existing engineering structures

SOURCES OF BEACH SAND

- Relatively dynamically stable beach
- Minimal sediment supply from adjacent sub-cells

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- Option 1: Enforce flood proofing measures for low lying areas subject to flooding risk during high lake levels
- Option 2: Remove existing ad-hoc structures (eg. shore perpendicular docks/groynes) and design a uniform solution to maintain the sand beach and protect the sand bag dyke

Note, future maintenance of existing shore protection structures will be required. Monitoring of the height of existing dykes will be especially important to reduce the risk of flooding to the existing homes at risk.

N

0 125 250m

SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 11
WANASING BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

LONGTERM SHORELINE TREND

- Relatively stable due to existing engineering structures

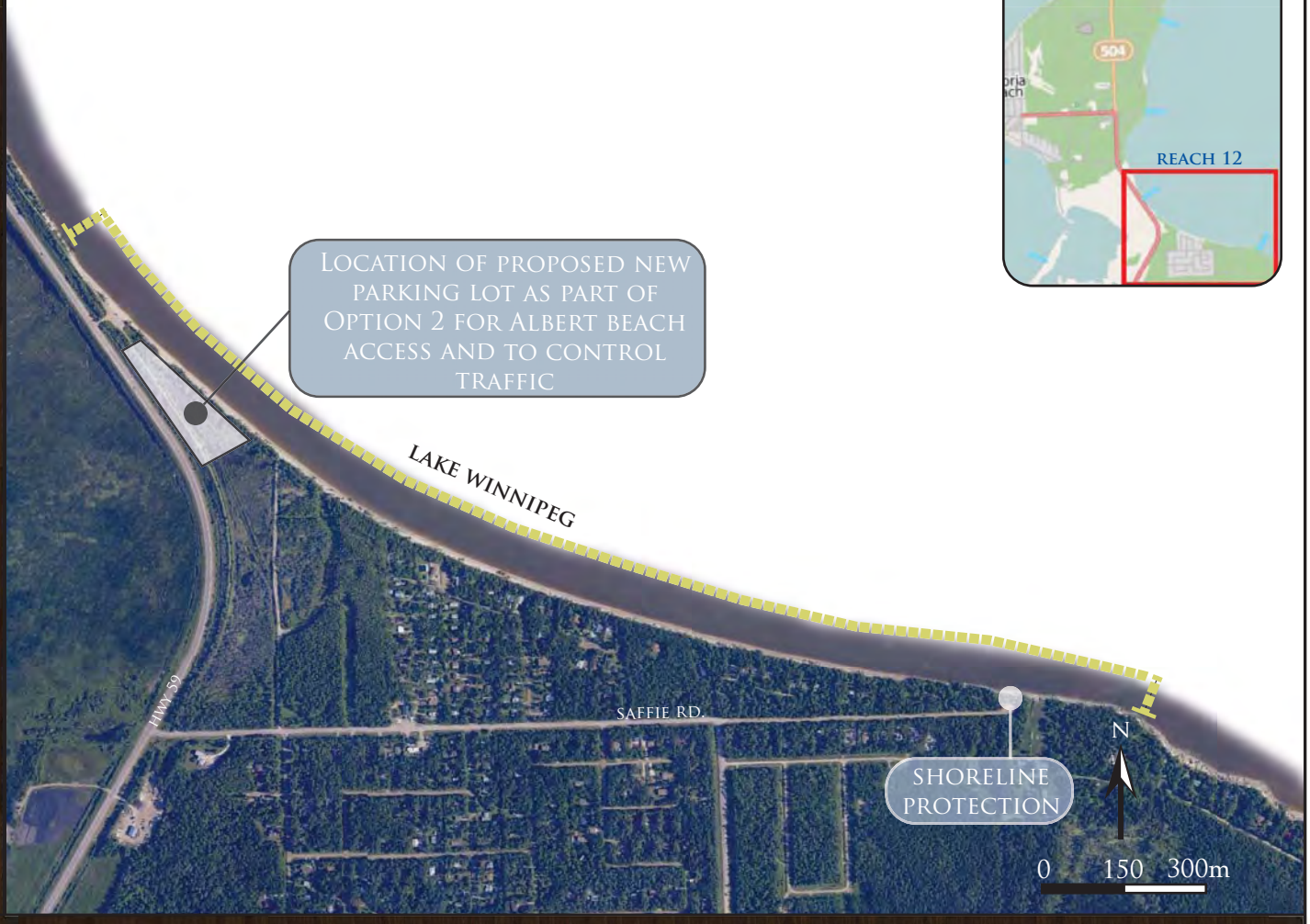
SOURCES OF BEACH SAND

- Relatively dynamically stable beach
- Sediment supply from adjacent sub-cells to the south

EROSION MITIGATION & BEACH ENHANCEMENT OPTIONS

- Option 1: Enforce flood proofing measures for low lying areas subject to flooding risk during high lake levels
- Option 2: Control car traffic with municipal parking lot for beach access

Note, future maintenance of existing shore protection structures will be required. Monitoring of the height of existing dykes will be especially important to reduce the risk of flooding to the existing homes at risk.



SHORELINE MANAGEMENT OPTIONS

Baird

DATE: 7/17/2013

REACH 12
ALBERT BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

APPENDIX C

COMMUNITY CONSULTATION

Rural Municipality of Victoria Beach
Comments on Draft Shoreline Management Plan

General Comments:

Comments on a Specific Beach:

Name and address (optional):_____

Please return to the Rural Municipality of Victoria Beach in person; or
Via mail to: 303 - 960 Portage Avenue, Winnipeg, Manitoba R3G 0R4
Via Information Booth in Victoria Beach
Via Fax: (204) 774-9834
Via email: vicbeach@mts.net

NOTE: All information will remain confidential and only aggregate findings will be presented in the report.

APPENDIX D

SHORELINE MANAGEMENT RECOMMENDATIONS

Risk of Erosion

- Top of bank surveyed in 2013 is less than 2 metres from the edge of the property parcels for 30% of the reach. However, the shoreline has been stabilized by existing engineering structures and natural rocks in the nearshore. Therefore, the risk of additional erosion is expected to be minimal if existing structures are maintained.

Erosion Mitigation and Beach Enhancement Recommendations

- Maintain existing engineering structures as required and monitor the shoreline.

LAKE WINNIPEG

NORTH REACH

SOUTH REACH

N

0 75 150m

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 2: NORTH CONNAUGHT BEACH

LEGEND

REACH EXTENTS

AERIAL IMAGERY (2011)

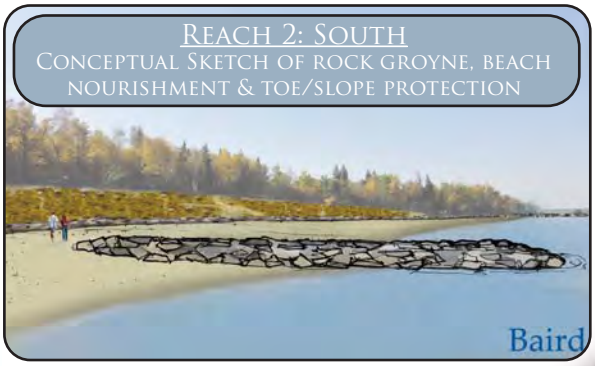
Risk of Erosion

- 2013 Top of bank survey is within 2 metres of the lakeward edge of about 50% of the private property parcels and the remaining parcels are within 3 to 10 metres. This reach is at high risk for additional erosion and, it is recommended a final design engineering study be conducted to prepare construction drawings.

Erosion Mitigation and Beach Enhancement Recommendations

- Commence final engineering to determine design parameters and optimize design
- recommended design includes beach nourishment & toe protection for bank.
- Rock structures in the form of groynes or offshore breakwaters will be required (see conceptual sketch) to anchor the sand (number and location to be confirmed during engineering design)

Reach 2: South
Existing conditions



Reach 2: South
Conceptual Sketch of rock groyne, beach nourishment & toe/slope protection

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 2: SOUTH
CONNAUGHT BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Risk of Erosion

- Top of bank surveyed in 2013 is less than 2 metres from edge of property parcels for about 25% of the reach. The majority of the remaining reach is within 5 metres. This reach is at high risk for additional erosion and therefore it is recommended that a detailed design engineering study be conducted.

Erosion Mitigation and Beach Enhancement Recommendations

- Commence final engineering to determine design parameters and optimize design.
- Recommended design includes beach nourishment & toe protection for bank.
- Rock structures will be required (see conceptual sketch) to anchor the beach nourishment, these could be offshore breakwaters or rock groynes (to be confirmed with engineering design)

Reach 3
Existing Conditions

Reach 3
Conceptual Sketch of beach Enhancement

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 3
KING EDWARD & ALEXANDRA BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Risk of Erosion

- Top of bank surveyed in 2013 is more than 30 metres from edge of private property parcels. This reach is at low risk of the shoreline eroding to the property parcels; however, the municipal park land is eroding.

Erosion Mitigation and Beach Enhancement Recommendations

- Monitor erosion
- If erosion continues, consider constructing a rock revetment, regrading the slope and planting vegetation, as shown in the conceptual sketch, in the areas at higher risk.

Monitor Bank Erosion

PHOTO

LAKE WINNIPEG

Reach 4
Existing Conditions

Reach 4
Conceptual Sketch

N

0 25 50m

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 4
SCOTT POINT HEADLAND

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Risk of Erosion

- Top of bank surveyed in 2013 is less than 2 metres from edge of private property parcels for about 50% of the reach and the remaining parcels are within 3 to 10 metres. This reach is at moderate risk for additional erosion due to southwest exposure and it is recommended that a final design engineering study be conducted to prepare construction drawings in the future.

Erosion Mitigation and Beach Enhancement Recommendations

- Commence final engineering to determine design parameters and optimise design.
- Recommended design includes beach nourishment & toe protection for bank.
- Slope regrading and vegetation is also recommended.
- Rock structures in the form of groynes or offshore breakwaters will be required (refer to conceptual sketch) to anchor sand (length and location to be confirmed with engineering design study).

Shoreline Management Recommendations

Baird

REACH 5: NORTH
PATRICIA TO ARTHUR BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Risk of Erosion

- Top of bank surveyed in 2013 is greater than 10 metres from lakeward edge of private property parcels. This reach is at relatively low risk for shoreline erosion to the private property parcels.

Erosion Mitigation and Beach Enhancement Recommendations

- Monitor erosion of dunes
- If erosion continues, consider beach nourishment and constructing a groyne at southern end of beach (refer to conceptual sketch).

Reach 5
Existing Conditions

Reach 5
Conceptual Sketch

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 5: SOUTH
ARTHUR TO CLUB HOUSE BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Risk of Erosion

- Not applicable, existing engineering structures have stabilized the shoreline

Erosion Mitigation and Beach Enhancement Recommendations

- Maintain existing engineering structures as required (by the owners).

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 6
FEDERAL WHARF & SAFE HARBOUR

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

YACHT CLUB

SLOPE STABILITY POTENTIAL ISSUE (TO BE STUDIED)

PHOTO

PINE RD.

GIBSON DR.

LAKE WINNIPEG

THORTON BLVD.

Risk of Erosion

- 2013 top of bank survey is within 2 metres from the lakeward edge of the private property parcels for about 50% of the reach. But this reach has been stabilized by existing engineering structures and therefore the risk of additional erosion in these areas is expected to be minimal if the structures are maintained.
- Slope stability isssues off Gibson Drive.

Erosion Mitigation and Beach Enhancement Recommendations

- Maintain existing engineering structures as required.
- If the inlet is dredged in the future, this sand should be used for beach nourishement on beaches to the north.
- Conduct geotechnical investigation at Gibson Drive to assess potential slope stability issues.

NATURAL BEACH

N

0 200 400m

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 7
BAYVIEW TO PELICAN POINT

LEGEND
REACH EXTENTS

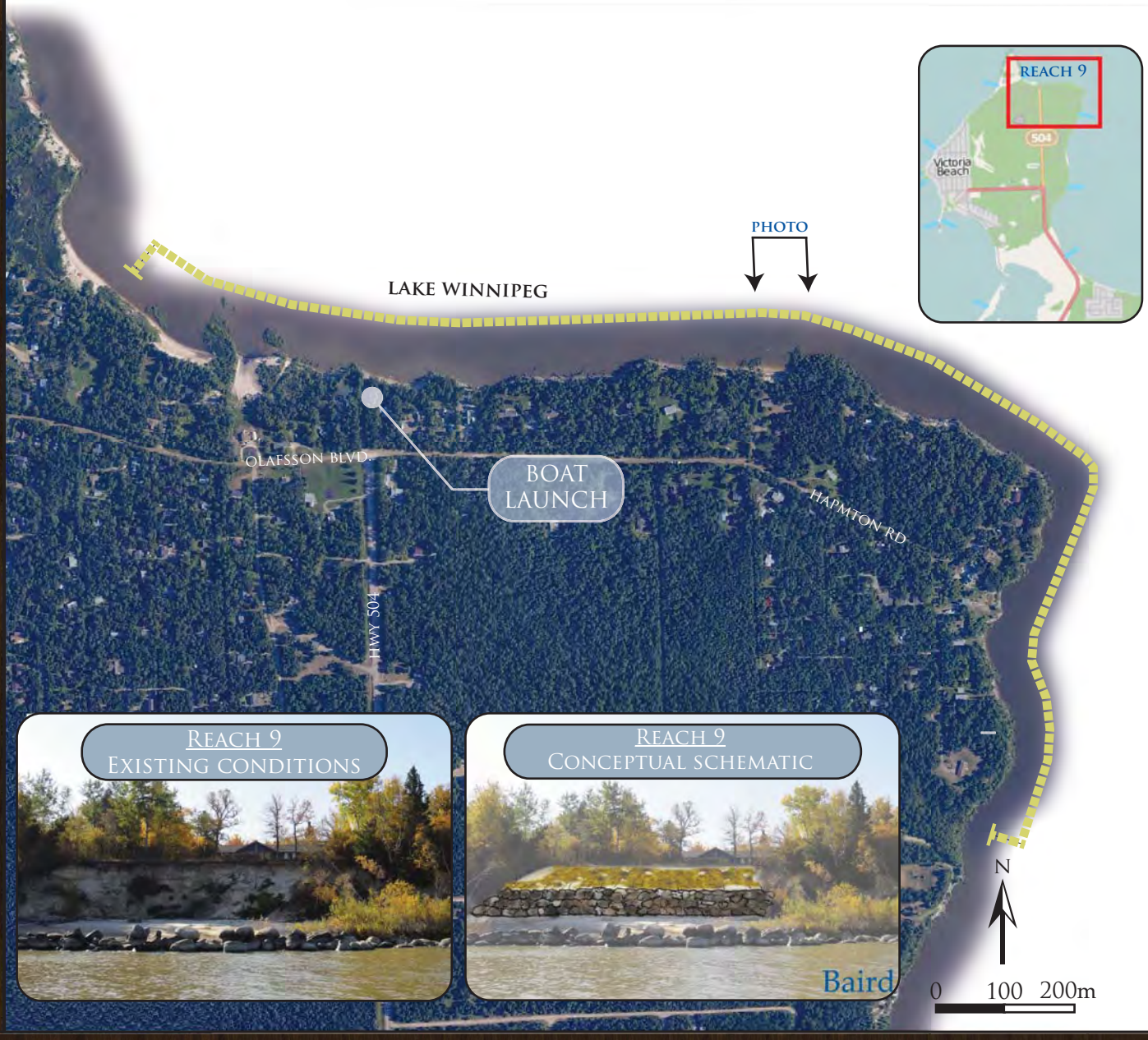
AERIAL IMAGERY (2011)

Risk of Erosion

- 2013 top of bank survey is within 2 metres of the lakeward edge of the private property parcels for about 20% of the reach (about 30% are within 10 metres and 50% are greater than 10 metres). This reach is at a moderate risk of shoreline eroding to the property parcels.

Erosion Mitigation and Beach Enhancement Recommendations

- Install infrastructure to manage over land runoff
- Monitor erosion
- Private landowners to construct rock revetment to address erosion risk in the future (see conceptual schematic)



SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 9
504 TO HAMPTONS

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Risk of Erosion

- 2013 top of bank survey is within 2 metres of the lakeward edge of about 10% of the private property parcels and the remaining parcels are greater than 20 metres. This reach is at relatively low risk of shoreline eroding to the property parcels provided existing protection is maintained. Slope stability issues are a concern.

Erosion Mitigation and Beach Enhancement Recommendations

- Monitor erosion & maintain existing shoreline protection structures. If erosion continues consider constructing a rock revetment in the areas at high risk, based on the results of the geotechnical investigation.

SUNRISE BEACH RD.

LAKE WINNIPEG

NORTH REACH

SOUTH REACH

N

0 50 100m

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 10 - NORTH
SUNRISE TO SAND BLUFFS

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

N

0 75 150m

RISK OF EROSION

- 2013 TOP OF BANK SURVEY IS GREATER THAN 10 METRES OF THE LAKEWARD EDGE OF THE PRIVATE PROPERTY PARCELS.
- HIGH RISK OF EROSION FROM SLOPE FAILURES.

EROSION MITIGATION AND BEACH ENHANCEMENT RECOMMENDATIONS

- IMPLEMENT SIGNAGE SUCH AS AN INFORMATION BOARD TO EDUCATE BEACH GOERS OF THE DAMAGE CAUSED BY SLIDING DOWN THE SAND DUNES. SUCH INFORMATION SHOULD INCLUDE AT A MINIMUM THE FOLLOWING:
  - DANGER OF SAND SLIDES CAUSING INJURY.
  - INCREASED EROSION DUE TO LACK OF VEGETATION WHICH ACTS TO STABILIZE THE SAND BANK.
- CONDUCT GEOTECHNICAL INVESTIGATION TO ASSESS SLOPE STABILITY AND BASED ON THE RESULTS OF THE GEOTECHNICAL INVESTIGATION, DEVELOP SETBACK REQUIREMENTS FOR FUTURE DEVELOPMENT.
- IN THE AREA OF HIGH RISK FOR LARGE ROTATIONAL FAILURES (NORTHERN END). IMPLEMENT RECOMMENDATIONS FROM THE GEOTECHNICAL INVESTIGATION, WHICH MAY INCLUDE A ROCK REVETMENT, SLOPE REGRADING AND VEGETATION IN AREAS WHERE SLOPE IS NOT STABLE (SEE CONCEPTUAL SCHEMATIC).
- ULTIMATE SOLUTION WILL DEPEND ON THE RESULTS OF THE GEOTECHNICAL INVESTIGATION.

SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 10 - SOUTH
SAND BLUFFS

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)

Reach 11 Conceptual Schematic

Reach 11 Existing Conditions

Risk of Erosion

- Existing structures have generally stabilized the shoreline.
- Historically, some erosion at the southern end of the beach.
- There is a moderate erosion risk in the future.

Erosion Mitigation and Beach Enhancement Recommendations

- Maintain existing structures as required in the short term, including the sand bag dyke.
- If erosion occurs in the future, remove existing ad-hoc structures (eg. shore perpendicular docks/groynes) and design a uniform solution to maintain the sand beach & protect the sand bag dyke (refer to Conceptual Schematic). This might include a series of short groynes with beach nourishment.

Shoreline Management Recommendations

Baird

Reach 11
Wanasing Beach

LEGEND
REACH EXTENTS

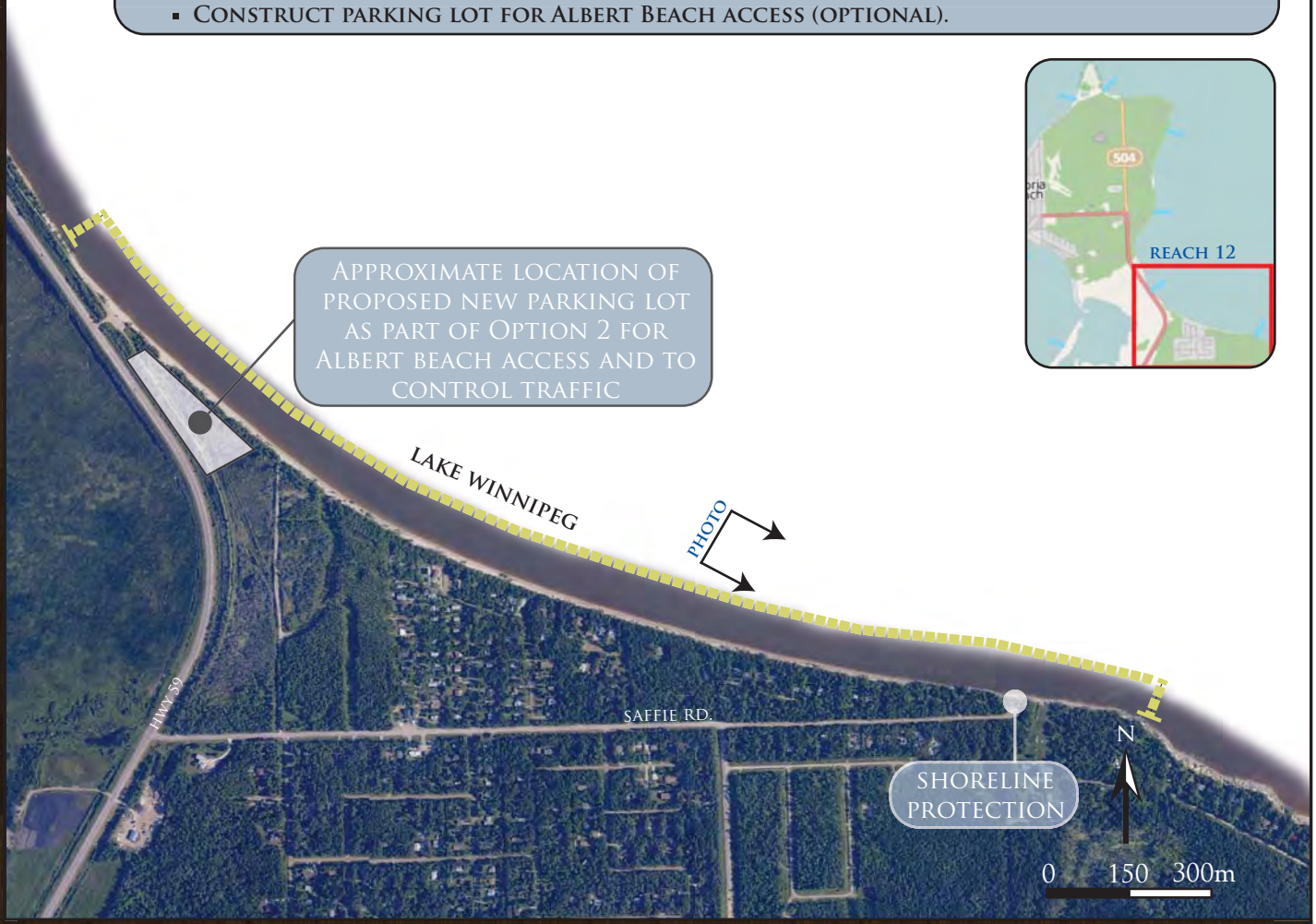
AERIAL IMAGERY (2011)

RISK OF EROSION

- 2013 TOP OF BANK SURVEY IS WITHIN 2 METRES OF THE LAKEWARD EDGE OF ABOUT 30% OF THE PRIVATE PROPERTY PARCELS AND THE REMAINING PARCELS ARE GREATER THAN 5 METRES. THIS REACH IS AT LOW RISK OF THE SHORELINE ERODING TO THE PROPERTY PARCELS.

EROSION MITIGATION AND BEACH ENHANCEMENT RECOMMENDATIONS

- EVALUATE STATE AND ELEVATION OF THE SAND BAG DYKE TO SEE IF IT PROVIDES ADEQUATE PROTECTION; IF NOT, REPAIR.
- CONSTRUCT PARKING LOT FOR ALBERT BEACH ACCESS (OPTIONAL).



SHORELINE MANAGEMENT RECOMMENDATIONS

Baird

REACH 12
ALBERT BEACH

LEGEND
REACH EXTENTS

AERIAL IMAGERY (2011)