township of

terrace bay

waterfront development study

BACKGROUND REPORTS

Stage 1 Report (February 2013)

Conceptual Geotechnical Investigation (August 27, 2013)

Terrace Bay Waterfront Development - Coastal Engineering (March 2014)

Pre-Engineering Infrastructure Assessment and Cost Estimate (June 18, 2014)

June, 2014

The Planning Partnership
FORM Architecture Engineering
Baird & Associates
PLAN B Natural Heritage
TCI Management Consultants
True Grit Consulting Ltd.

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STAGE 1 REPORT

March, 2014

The Planning Partnership
FORM Architecture Engineering
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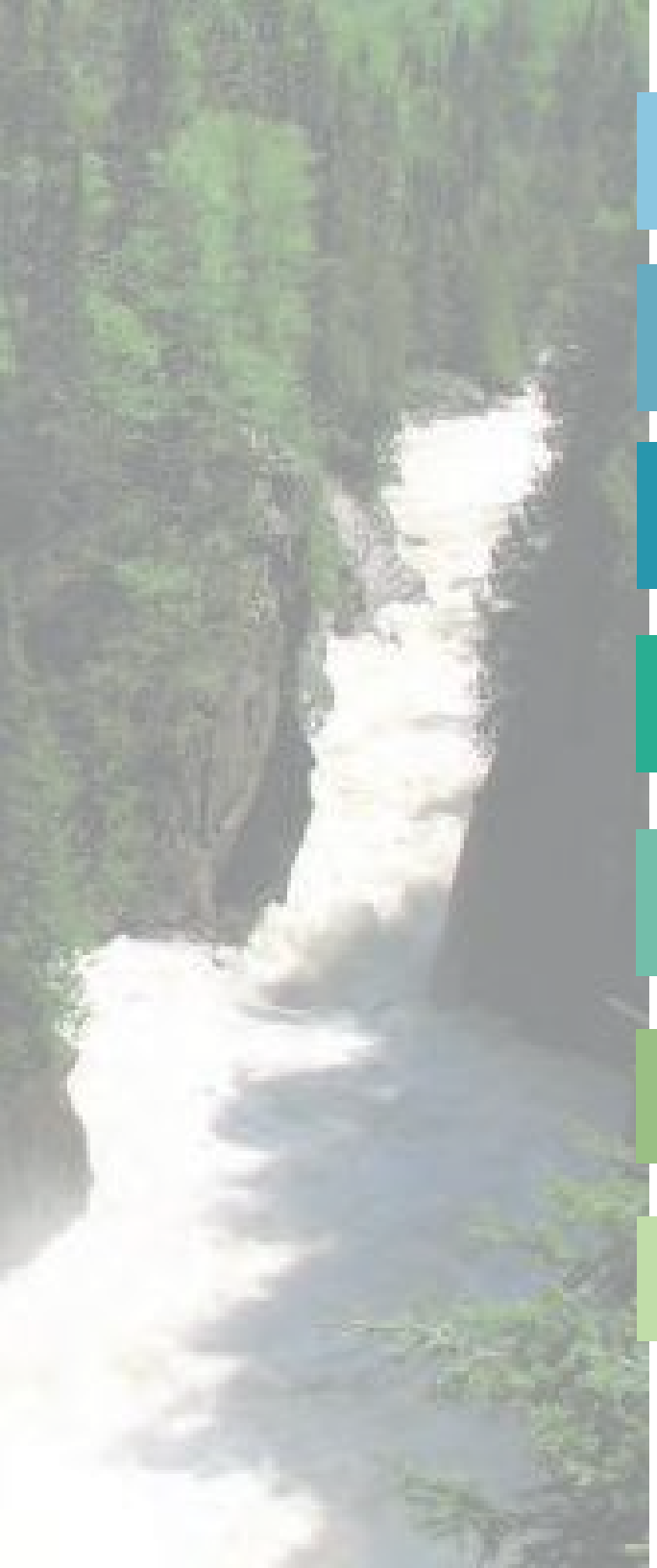
Aguasabon Gorge



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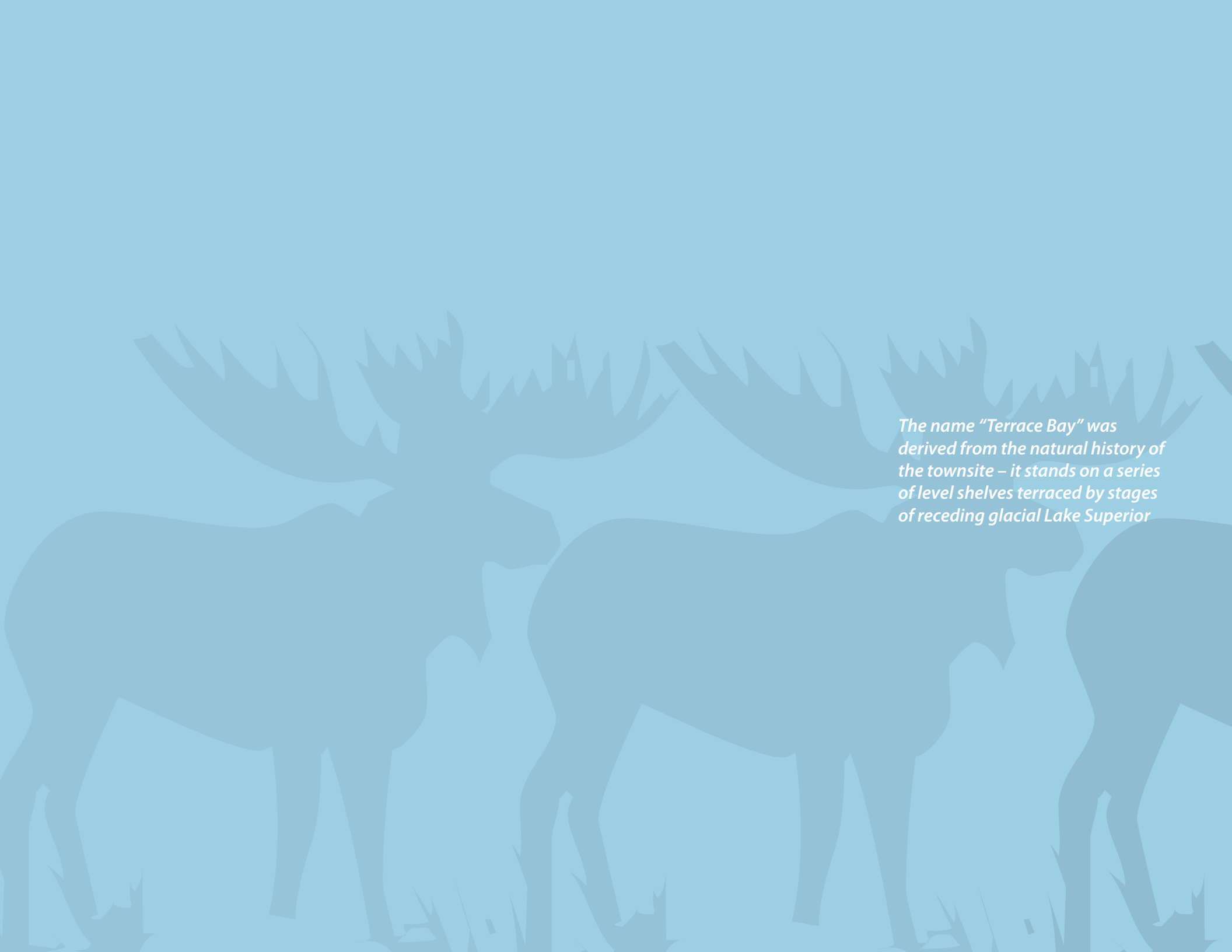


The name "Terrace Bay" was derived from the natural history of the townsite – it stands on a series of level shelves terraced by stages of receding glacial Lake Superior

1 background reports

Superior North Tourism Corridor Study
Final Report
Hough Stansbury & Woodland Limited
February 1989

The purpose of this study was to take a fresh look at the resources and market framework for tourism development along the Trans Canada Hwy on the north shore of Lake Superior. The study area extends from Pigeon River, 48km southwest of Thunder Bay to Sault Ste. Marie, on the eastern tip of Lake Superior. The objective was to develop concept plans for a series of significant historical, scenic, geological, or other attractions within the study area.

The corridor was broken up into 6 zones and 90 sites were assessed on their potential for development and rated based on access, available areas for development, quality of terrain and other factors.

Zone A: Sault Ste. Marie to MacGregor Cove

Zone B: MacGregor Cove to Wawa

Zone C: Wawa to Marathon

Zone D: Marathon to Nipigon

Zone E: Nipigon to Thunder Bay

Zone F: Thunder Bay to Minnesota Border

Summary of Initial Findings

- Corridor exhibits a good variety of resource assets with differences in quality, frequency of occurrence, and types of features
- Good distribution and frequency of provincial parks offering recreational activities, interpretive programs, picnic areas, camping
- Well spaced frequency of towns offering a variety of goods and services
- Absence of special identity or designation of the route
- Too many route names which is confusing to visitors
- Poor visual and physical access to scenic area features and uncoordinated sign system making it difficult for travellers to locate them
- Lack of quality accommodations outside of the two major cities
- Limited amount of reliable information on area activities and attractions

Key Opportunities

- Scenic Roadsides: Improving facilities along existing picnic areas and roadside stops and proposing new sites where significant views or natural features are
- Improvements and expansions of interpretive centres
- Extend recreational attractions to year round activities such as winter sports, and wilderness skills development
- Expansion and improvement of marina facilities

Recommendations for Zone D: Marathon to Nipigon

- New roadside picnic and viewing stations at Bottle Point, Terrace Bay, Red Rock and Nipigon
- Number of possibilities for interpretive centres along this corridor such as shipwrecks located in this area, prisoner of war camp at Neys, burial grounds at Pukaskwa Pits to name just a few
- Opportunities for interpretive centre in Terrace Bay based on tours of the pulp mill offered, as well as the area's geology, gravel terraces and falls
- Terrace Bay already offers scuba diving, golfing and boat charters (including visits to Slate Island) and potentially sailing and boating
- Develop hiking trail between the Aguasabon Falls and the beach in Terrace Bay
- Expanded marina potential in Terrace Bay, Rossport and Nipigon would make this zone attractive to boaters with a possibility for boat tours
- Detailed studies of the marina in Terrace Bay should be undertaken

Recommendations for overall study area

- Route Tours by bus, boats or fly overs
- Art Packages, photography tour where famous group of seven have painted. Lectures in nearby interpretive centres

1995

Long Lake Aguasabon Kenogami Waterway Development Study; May 1995 EDA Collaborative Inc./ The Economic Planning Group of Canada

- Recreational Vehicle Packages; establishing key drop-off and pick-up locations for vehicles and RV's at Thunder Bay and Sault St. Marie.
- Establishment of strong identity for the route, with the creation of a single name and a single organization responsible for promoting it
- Coordinated approach with 4 provincial ministries, Ministry of Tourism and Recreation, Natural Resources, Transportation and Northern development and Mines
- Continue improvements by Ministry of Natural Resources to public parks
- Cohesive program of development of all zones along the corridor

The purpose of this study was to develop a commercially viable tourist attraction through the development of a feasible concept or vision that will capitalize on the resources of the area. The study area encompasses the Long Lake/Aguasabon area along Long Lac that links to Terrace Bay, approx. 120 km. between the northern and southern routes of the Trans Canada Hwy. There are two main corridors in the Study area, the "Voyageur Tourist Route" southern corridor and north corridor or "Frontier Tourist Route"

South Corridor

- South corridor follows Lake Superior north shore and travels through Terrace Bay along main CPR line, Hwy 17 carries travellers through lakeside communities
- Estimated daily traffic for the southern route is 4,925 at the time of this study

North Corridor

- Hwy 11 links north communities and provides inland route for tourists
- Estimated daily traffic is 913 at the time of this study

Findings of the study

- Linkages between two corridors is very limited
- Access to remote lakes and rivers is through logging roads but facilities along these roads is virtually non-existent and discourages travellers from exploring areas further inland
- Terrace Bay and Long Lac have existing services and facilities for tourists and can potentially become more important tourist centres along the waterway
- Six Provincial Parks are situated near the waterway such as Neys Provincial Park between Terrace Bay and Marathon
- good interpretive opportunities such as 6 historical themes identified for Terrace Bay Area
- Potential for canoeing along Long Lake should be explored
- MNR identified areas suitable for commercial outposts for fly-in access to remote areas

Cottages

- In 1971 the government instituted a cottage development program resulting in several lake development plans
- By 1980 there were 356 developed cottage lots in Terrace Bay
- In the Terrace Bay land use guidelines MNR placed high priority to provide additional cottage development but there is currently a moratorium on selling crown land for cottage development throughout Ontario

Key Opportunities

- Marina at Hays Lake
- Cottage development
- Lodge/resort development

1996

Terrace Bay Tourism Development Strategy Phase II Final Report The Planning Partnership September 1996

- Development of trails
- Development of sports and heritage events

Development Concept

- Provide economic stimulation through greater tourism and recreational activities while minimizing environmental impact
- Concept focused on "eco" tourism, or tourism as a tool for conservation and sustainable development through responsible travel that conserves the environment and sustains the well-being of local people

Concept - 3 Zones

1. **Northern Gateway Zones: Long Lac/ Geraldoton, Long Lake Indian Reserve Ginoogaming**
2. **Southern Gateway Zone: Terrace Bay/ Schreiber**
3. **Waterway Centred Zone**

Key Objectives

- Create destination level opportunities for short and long term (baby boomers and aging population)
- Create "waterway adventure" themes
- Highlight speciality market appeal for interpretive tours such as photography wildlife viewing, survival archaeology, northern lights native culture etc.
- Identify gateways at north and south ends
- Strong signage program
- Provide destination or arrival knuckle in waterway centre zone
- Control access for environmental protection reasons
- Investigate optional modes of transportation such as tour buses, dog team electrical boats
- Create trails linking north and south destinations and east/west routes by snowmobile, dogsled mountain bike hiking
- Promote gateways as service centres
- Community interpretation centres
- Commercial marina and lake access point at northern end of Long lake, possibly along Hwy 11
- Marina and service centre at south end
- Build wilderness cabins at several key nodes along trail system
- Upgrade existing roads
- Develop pedestrian only "wilderness outpost village centre" in conjunction with interpretive centre with fixed roof accommodations, food service, learning and activity centre
- Develop specially themed retreats at red pine lodge site with fly-in or water access only
- Link events and festivals between communities and coordinate programs

The purpose of this study was to expand on Terrace Bay's original strategy prepared by Council and the Tourism Committee, and to serve as a basis for the Terrace Bay's tourism initiatives for the next five years.

Key findings

- The broad curve along the Trans Canada Hwy through town slows down traffic and positions Terrace Bay in an ideal location for a rest stop
- The tourist market is generally recreation-oriented
- The original strategy has resulted in an increase of tourists stopping in Terrace Bay.
- More tourists are making only small brief stops for information and to use facilities, but not staying to spend money in the community
- Many facilities already exist, including trails, beaches and accommodations but could be improved and expanded

Objectives of the Plan

- Take greater advantage of the existing short-term market
- Extend the average length of stay
- Involve relatively low capital expenditures
- Be consistent with the growing role as a rest stop
- Explore the potential of a wilderness excursion destination

2000

Terrace Bay Regional Gateway Development Feasibility Study, February 2000 The Planning Partnership, Schollen + Co., Kuch Stephenson Architects, Cumming Cockburn

Key Recommendations

- Establish an Adventure Centre as a launching point for wilderness trips
- Continue improvements to the beach area, to Aguasabon Gorge and to Centennial Park, all of which were already underway at the time of this study
- Extension of the Casque Isles Hiking Trail to include walking path from Terrace Bay Beach easterly to the Pumphouse Beach and the creation of some observation areas
- Expand the snowmobile trail network
- Gateway structure facing the tourism centre
- Clearly defined signage and footpath from the Visitor Centre to local shops that are under utilized by stop-over tourists
- Market Terrace Bay attractions to bus tour companies by developing special promotions with the tour companies
- Digital Marketing through the use of new information technology
- Partnership with Parks Ontario to promote tours of Slate Island, using Terrace Bay Visitor Centre as a launching point
- Create more accommodations for visitors such as Bed and Breakfasts and open lots to cottage development
- Create a town mascot, such as a Caribou which will be visible by the highway

The purpose of this Study is to create a vision for a Regional Gateway concept in Terrace Bay as the gateway to Lake Superior Adventures, completing a link in the regional chain of tourism attractions between Sault Ste. Marie and Thunder Bay.

The concept was supported with an economic plan which identified development opportunities and an implementation plan. The study area encompasses an extensive area of private land between Hydro Bay (Terrace Bay) and the Aguasabon River, south of the Trans-Canada Highway. It is approx. 420 ha., and includes 8 km. of shoreline.

- 13,001 tourists visited the Information Centre in Terrace Bay in a six month period in 1999
- Based on data gathered by MTO in 1996, 511,000 vehicles travel through the Hwy. 17 link from Marathon to Nipigon each year
- The closure of the mill in 1996 has caused the population to decline
- Adventure tourism is the fastest growing market in the travel and leisure industry
- Terrace Bay is located at the eastern gate of the proposed Lake Superior National Marine Conservation Area
- Lake Superior Adventure is envisioned as a catalyst for the development of adventure tourism for the North of Superior Region
- Terrace Bay is within the Great Lakes Heritage Coast, a project initiative of The Ministry of Natural Resources, to promote the areas rugged landscape, sandy beaches, exceptional mix of plan and animal species, parks and protected areas, First Nations history and culture to name just a few
- The Northern Tourism Marketing Corporation (NTMC) is developing a program to market Northern Ontario as a single unified tourism destination

Lake Superior Adventures key buildings include two core facilities; Tourist Information Centre, located on the highway, is the first point of contact for highway travellers, and a new Waterfront Centre overlooking Lake Superior and Slate Island as the base of adventure tourism operators where activities are staged.

Key Concept Recommendations

- Development of a strong and recognizable theme for the concept such as the rugged natural landscape and using materials such as heavy timber, rocks, plant material found in the area
- Extension of the Tourist Information Centre which will include booking facilities connected to day adventure operators, a retail area, food service, and an exhibit hall which can accommodate a number of adventure operators
- Revenues from the extended Centre may come through rental space to day adventure operators as well from commission charges for packages sold
- A Waterfront Centre to include facilities for the LSNMCA with educational programming and interpretive centre, retail/food area, accommodations, booking services for day adventures, marina

2004

Lake Superior Provincial Park Visitor Centre Brochure (Reich + Petch)

facilities and boat tours of Slate Island

- A new marina at Danny's Cove with floating docks and which can accommodate up to 45 slips
- Some additional amenities for the marina such as interpretive stations, canoe/kayak launch, fishing dock, picnic shelters, signage, trail system and lookout
- Two types of day adventure operations are considered; those operating out of the Lake Superior Adventures facilities and those operated elsewhere in the region but promoted through the facility
- Coordinated marketing of the Lake Superior Adventures through distinctive identity packages, brochures, newsletters, presentations, and electronic materials
- Additional accommodations incorporated into the Waterfront Centre and 6 cabins on site in the form of a Waterfront Inn or Bread and Breakfast operators
- Develop cottage lot properties on the waterfront at Lyda Bay and along central cove
- Possible expansion of the golf course

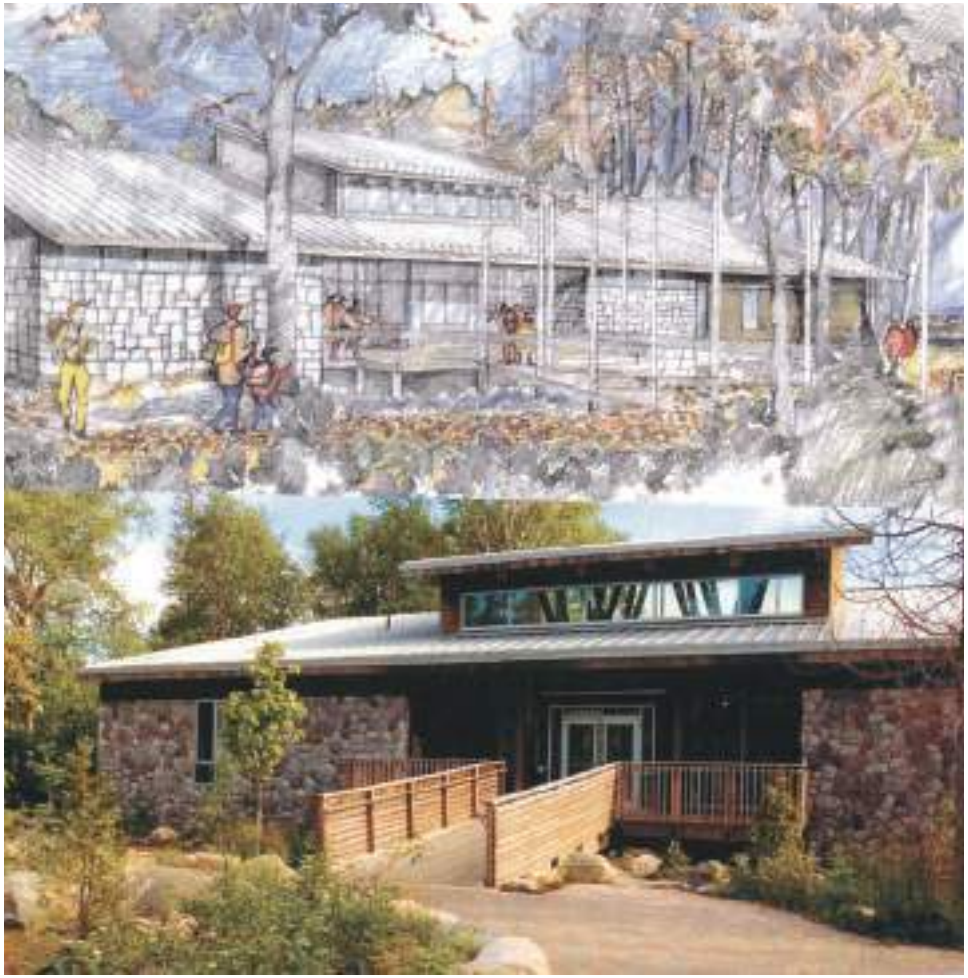
The visitor centre is located on the east shore of Agawa Bay and opened in 2004. It is the 1st of 4 centres to be built along the Great Lakes Heritage Coast.

Important feature of Visitor Centre

- Large interpretive hall
- Information and program services
- Visitor amenities
- Shop for local and seasonal campers

Key aspects of design

- Deliberately massed to respond to location of nearby creeks
- Building was raised off the ground to minimize impact of water flow and preserve the natural vegetation
- Design materials were chosen to reflect he site and area for their sustainability and beauty
- Creates a dramatic presence
- Provides views to throughout to the surrounding natural environment
- "Power of the Lake" story line through audio visual exhibit captures the power of the lake in a November storm with waves crashing around visitors
- Bay windows in the Hall provide views to the beachfront and lake to the north and west with a voice over audiotape that recounts stories of "Voyageurs and early Settlers"
- "Tip of the Lake" 3 dimensional map where visitors can tip the map in which water pours from Lake Superior to other Great Lakes demonstrating that Lake Superior water volume is the largest
- Shipwrecks and Disasters Display, audiovisual narrative of the story of the sinking of the Edmund Fitzgerald
- Interactive Natural History Discovery Area is a media display of weather, geology, flora and fauna of area



Lake Superior Provincial Park Visitor Centre Brochure

Premier Ranked Tourism Destination (PRTD)
Final Report
North of Superior Tourism Region
A Vision for our Region 2008

PRTD is a process developed by the Ontario Ministry of Tourism, Culture and Recreation to help tourist destinations evaluate themselves and determine their potential within tourist marketplace. Based on these criteria, the PRTD Partnership (Tourism Thunder Bay and North Superior Tourism Association NOSTA) used this study to evaluate tourism potential for the North of Superior Tourism Region. The study area is bordered on the North of Albany River, South by the Canada/US border, West by Hwy 599 and Quetico Park, and east by District of Algoma. This is one of the largest tourism regions in Ontario, encompassing 155,000 square kilometers.

Criteria for Evaluation based on 3 dimensions

1. Product (distinctive core attractions, quality, value, accessibility, accommodation base)
2. Performance (visitation, occupancy + yield, critical acclaim)
3. Futurity (destination + market, product renewal, managing with carrying capacities)

Key Findings

- Significant core attractions determined to be fishing, hunting, snowmobiling & canoe/kayak
- Supporting attractions include snowshoeing, nature observation, skiing, bird watching, golfing, water activities, historical sites, museums, galleries, casino and unique gift shops
- Emerging tourism products include aboriginal & sports tourism
- Relatively low percentage of people surveyed for this study learned about the region through internet resources

Summary of region's core and supporting attractions

- Attractions are linked physically and historically to region
- Region's attractions offer opportunities for supporting the development of packages and themed routes
- Outside of Thunder Bay some regions lack core attractions and products that can attract visitors in winter seasons
- Key opportunities include development of more festivals and events (aboriginal festivals, pow wows etc.)

Recommendations

- NOSTA will focus on internet as marketing tool to implement new website and e-marketing program
- Snowmobile trail development
- Municipalities to assume operational responsibility of non-operating parks
- Investigate roadblocks to accessing low cost loans and identify solutions
- Packaging and binding first nations products and experiences between tourist operators, regional communities and first nations to strengthen partnerships and alliances
- Pursue discussions with different levels of government to assume responsibility for development and maintenance of snowmobile trails
- Develop culturally and historically themed touring route
- Create sustainable development of waterfronts with mixed use plan based with public/private partnership
- Asset mapping projects be undertaken and expanded into the region
- Promote products that differ from other north of superior products
- Strengthen communications with Canadian Tourism Commission to ensure North Ontario has a presence on their website
- Create awareness of region wide campaign about the importance of tourism through community based trade shows
- Support recommendations from the "Preparing For Change Report" that a 10 year action plan be developed for corridor standards along Hwy 11/17 that is attractive and caters to travellers need through signage, rest areas and viewing points
- Improve accessibility for persons with disabilities
- Provide opportunities for tourists to learn about

aboriginal culture and history in region

- Expand RV accommodations
- Additional and increased promotion of hiking and aboriginal walks

Aboriginal community

- Research and catalogue aboriginal tourism products
- Develop strategies to promote what is offered
- Small business management training
- Establish Partnerships with business owners and aboriginal business owners to share resources and expertise
- Use internet to market Ontario Parks Recommendations
- Consider data derived from PRTD
- Sport tourism be used as a means to attract more visitors
- Enhance use of technology to better promote events (i.e. online registration, publish scores and results)
- Focus on developing facilities with the capacity and ability to host such events

There are certain provincial-level and municipal policy documents that are germane to the development of the waterfront plan in Terrace Bay. These are listed below, with a brief assessment as to how they can be supportive of the plan developed here.

2008

Northwestern Ontario – Preparing for Change, R. Rosehart

Key Conclusions/Recommendations

Three areas of focus prompted by downturn in forestry sector and need to examine ways and means of promoting economic diversification.

1) stabilize the curt economy
2) build capacity for the new economy
3) grow a prosperous northwest Ontario economy

Recommendations made in several areas:

- Vision and Governance
- Aesthetics and the Environment
- Region-Province Nation-Building
- Forestry Sector
- Mining Sector
- Tourism Sector
- Energy Delivery and Regulation
- Agriculture
- Aboriginal Economy
- Municipalities and Business
- Education Sector
- Research and Innovation

Implications for Terrace Bay generally and Waterfront Development Plan specifically

- overall, philosophical direction of report (strengthening existing economic base while building a new one) supports underpinnings of community development generally in TB, as well as specific waterfront improvement
- if recommendations implemented, some potential for the tourism components of the Waterfront Development Plan, including:
- potential to be a pilot location for tourism marketing demonstration project
- certain aspects of the plan (e.g. adventure kiosk) fit with key suggested programs ('Crown Land for Adventure Tourism' initiative)
- potential for some funding from 'destination attraction competition' initiative, should that proceed

2011

Growth Plan for Northern Ontario, Ontario Ministry of Infrastructure, and Ministry of Northern Development, Mines and Forestry (2011)

Key Conclusions/Recommendations

- The purpose of the plan is to guide decision-making in northern Ontario over the next 25 years, especially in light of developments such as the Ring of Fire, the new Mining Act, forest management systems, etc.
- The northern Ontario component of the province-wide Places to Grow initiative:

  major commitments announced in terms of:
  training programs for aboriginals
  Ring of Fire Coordinator office
  Northern industrial Electricity Rate program for large qualifying industrial facilities
  Increased funding for NOHFC
  Funding for investment in tourism infrastructure
  Expansion of space at northern colleges and universities
  Investment of $1.2 billion in northern Ontario infrastructure
  Creation of Northern Policy Institute

Implications for Terrace Bay generally and Waterfront Development Plan specifically

- infrastructure and energy initiatives will be of use to the revitalized mill
- commitment to tourism infrastructure development could be of assistance to some of the tourism-related developments on the waterfront
- possibly infrastructure assistance associated with any new residential development that will be part of the overall development

Terrace Bay Strategic Plan, Township of Terrace Bay, (2007 – 2013)

Key Conclusions/Recommendations

Vision: The Progressive Community that is Welcoming the World to Our Home

Mission Statement: "TB provides services that advance the quality of life for our citizens and visitors alike. We do this through string leadership committes to maintaining the integrity that TB is known for."

The Strategic Plan outlines several key areas for actions & initiative:

1. Quality of Life

1.A. Health & Welfare

1.B Seniors Community

1.C Active Living Centre

1.D Recreation

1.E Parks

1.F Cenotaph

1.G Municipal Services

2. Excellence in Governance

2.A. Code of Conduct

2.B Leadership

2.C By-laws & Regulations

3. Sustainable Economy

3.A Downtown Revitalization

3.B Highway Commercial

3.C AV Terrace Bay

3.D Business Retention and Expansion

3.E Investment Readiness

3.F Aguasabon Falls & Gorge

3.G Waterfront Development

3.H National Marine Conservation Area

4.Healthy Environment

4.A Recycling

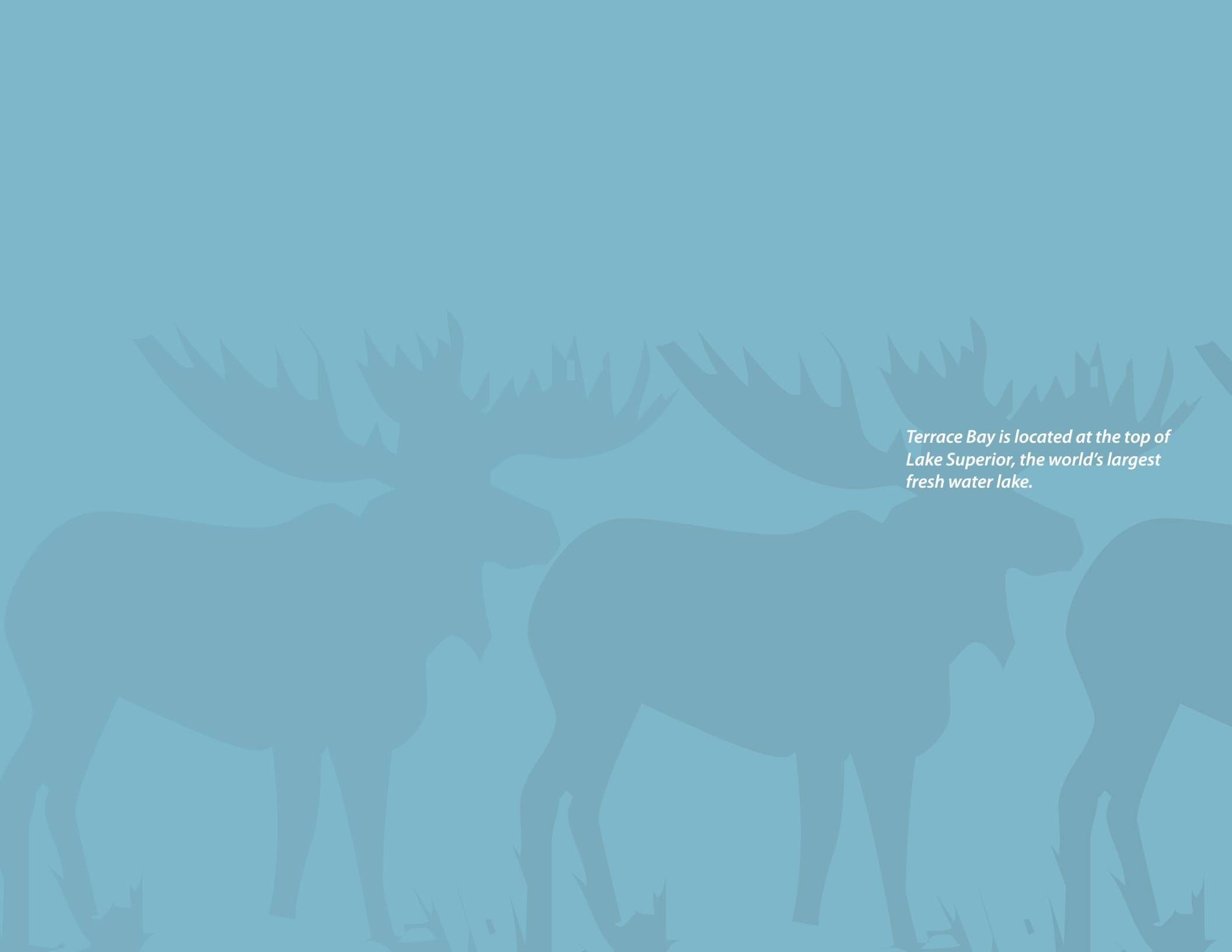
4.B Maintain Green Space

4.C Energy Efficiency

4.D Community Aesthetics

Implications for Terrace Bay generally and Waterfront Development Plan specifically

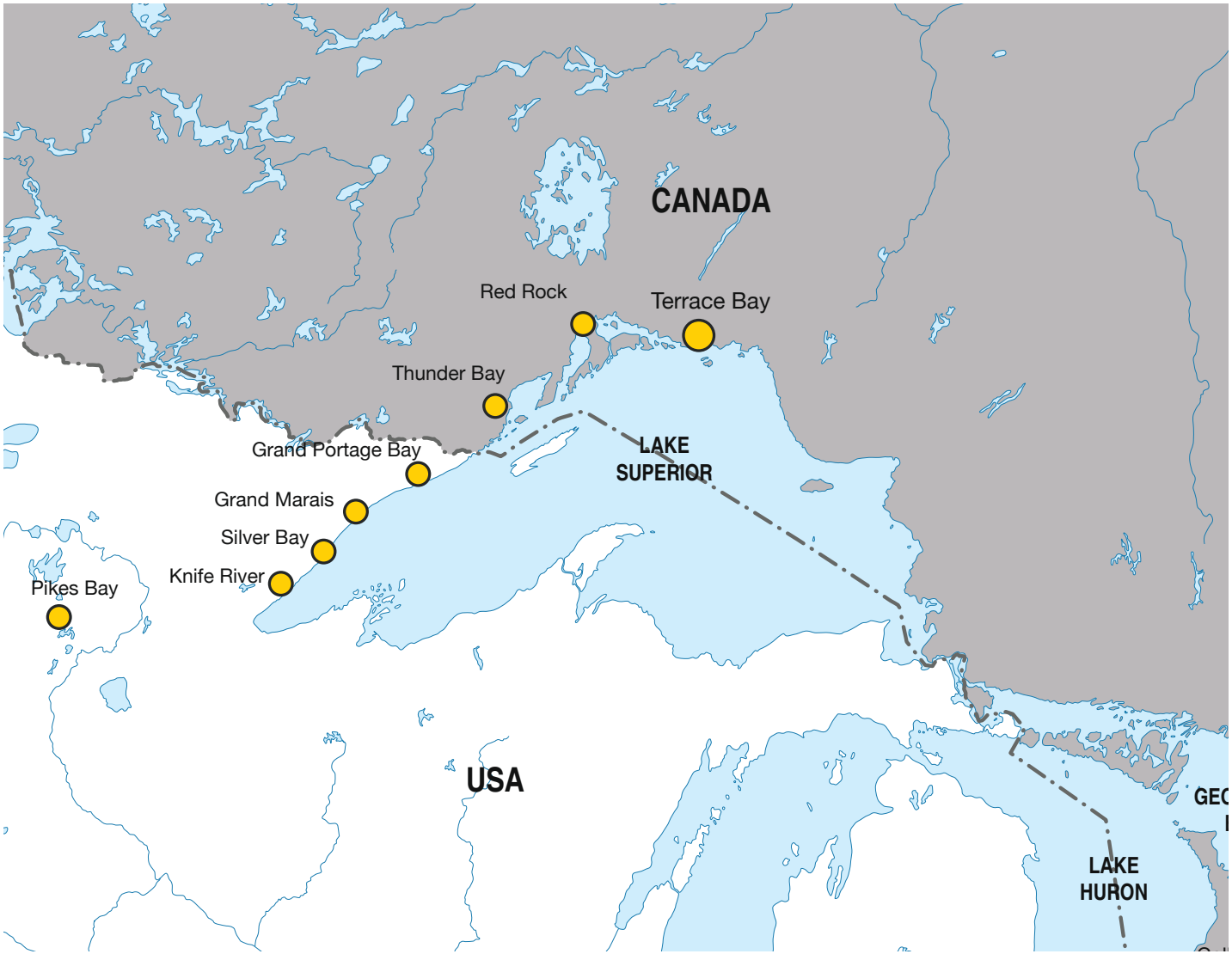
- clearly, strategies 3.F, G and H relate strongly to the Waterfront Development Plan and provide the impetus and basis for the plan itself
- also will be important to respect other aspects of the Township's plan overall in terms of the type and nature of development, particularly:
- importance of active living and recreation: the plan must incorporate trails, beach and water access points, etc.
- importance of business attraction: the plan must contain elements where the private sector can invest in order to meet market need and generate a return on investment (thus creating new businesses and jobs)
- importance of community aesthetics: the plan needs to develop the waterfront area in a beautiful and aesthetic way, complementary to other the standards seen in other public area improvements in the community
- ecological sustainability: all development should be sustainable, carbon-neutral (where possible) and perceived to be 'green'
- downtown revitalization: development in the area should be complementary to (as opposed to competing with and cannibalizing) existing businesses in the downtown (as well as highway commercial areas)



Terrace Bay is located at the top of Lake Superior, the world's largest fresh water lake.

2 best practices

USA


CANADA
Red Rock
Terrace Bay
Thunder Bay
Grand Portage Bay
LAKE
SUPERIOR
Grand Marais
Silver Bay
Knife River
Pikes Bay
USA
LAKE
HURON

grand portage bay

Ancillary Development

- RV campground, convenience store
- Restaurant, motel, casino

The ancillary developments are close by not immediately adjacent and predate the marina development.

Developer/Funder

The Grand Portage Band of the Chippewa own and operate this marina and access which was developed as a component of the Minnesota Department of Natural Resources Small Craft Safe Harbor and Protected Access Program.

Description

The marina has approximately 22 slips, it is located within the Grand Portage Bay which provides some protection for boaters, although the bay itself is shallow and in spots may impede deeper draft boat navigation. The Grand Portage Band also operates the Voyager Marina across Grand Portage Bay, it has a boat launch and parking. There is a charge for daily launching and parking at both facilities.

Services available:

- Launch ramp and docking
- Gravel parking for 40+ car/trailers
- Restroom facilities
- Fuel, repair, other marina amenities
- Public phone
- Pump-out

grand marais

Developer/Funder

This Department of Natural Resources facility is located within the City of Grand Marais, in the commercial harbor. It was developed in the early 1980s in cooperation with the City of Grand Marais.

Description

The city operates a small marina within the harbor and provides some mooring for transient boats.

Services available

- 2 ramps
- 2 docks
- paved parking, approximately 40 car/trailers spaces
- satellite restrooms
- walking distance to local attractions, parks, downtown business,
- public phone
- shore fishing
- fuel
- pumpout

Ancillary Development

- walking distance to local attractions, parks, downtown business,
- Grand Marais Downtown

Significant synergies exist between the harbor & city marina and the downtown commercial businesses due to their co-location. The DNR is providing technical assistance to the Grand Marais Safe Harbor and Marina Advisory Committee as it investigates the development of a Safe Harbor and possible new or expanded marina.

Developer / Funder

This safe harbor and marina facility completed in 1999 includes a marina, a public access and a day use park. It was built in cooperation with the City of Silver Bay, and the U.S. Army Corps of Engineers. The City of Silver Bay operates the facility, the DNR provides operational oversight and capital improvements.

Services available:

The marina has 108 slips, 68 seasonal and 40 for transients or guest dockers. The marina has gas and diesel fuel, pump-outs, restroom, shower and laundry facilities, food and beverage services, a deck and gazebo overlooking the lake are available for use by the public and marina users.

Amenities:

- 2 ramps
- 3 docks
- dock boxes
- paved parking for 20+ car/trailers at the access
- parking areas for marina and park users
- permanent restrooms
- public phone, vending machines, and food service
- divers access, fish cleaning station, day use picnic area,
- protected launch ramps within 7 acre safe harbor
- 110 and 220 volt power
- potable water

Ancillary Development

- picnic area with additional restrooms
- winter storage
- food and beverage services

The marina and safe harbor is located in close proximity to the City of Silver Bay which it is hoped will benefit from interaction with transient boaters. The residents of Silver Bay also make use of the marina and ancillary facilities. We are not aware of any other ancillary development either adjacent to the marina or in the City that can be attributed to the development of the safe harbor and marina

knife river

Silver Bay Access / Safe Harbour

Developer / Funder

This facility was developed in the early 1970s. Previously operated as a private marina under Lake County ownership, the Minnesota Department of Natural Resources acquired the property in 2001 to assure public access to the Lake and continue as a link in the North Shore harbor system.

Services available:

This 100 slip, full-service marina with a public boat access is operated by a concessionaire. Future improvements and redevelopment plans are being discussed in cooperation with the Knife River Marina Advisory Board, and the U.S. Army Corps of Engineers.

Amenities:

- Double ramp
- 2 docks-fuel dock and 1 roll-in
- paved and gravel parking for 25car/ trailers
- satellite restrooms
- public beach adjacent to harbor
- full service marina including:
- fuel, pump-out, public phone, tran- sient slips,
- boat repair, haul out, and winter storage
- the launch area is within the 4.5 acre basin

Ancillary Development

- none

The marina and safe harbor is located in close proximity to the town of Knife River which it is hoped will benefit from interaction with transient boaters. The residents of Knife River also make use of the marina and ancillary facilities.

We are not aware of any other ancillary development either adjacent to the marina or in the town that can be attributed to the development of the safe harbor and marina. Knife River is only 18.5 miles from the Duluth Harbor.

pikes bay

The marina is located in close proximity to the Town of Bayfield in the Apostle Islands and benefits from the intense boating activity in the region centred on Bayfield. There is ancillary residential development apparent in the photographs however we have been unable to determine its nature or its relationship to the marina development.

Developer / Funder

Privately owned and developed.

Description

With 208 slips Pikes Bay Marina offers floating dockage with wide piers and wide fairways. Slips range in size from 30 to 60 feet and side-ties are available up to 90 feet. Freshwater, 30 and 50 amp power, WiFi, cable and telephone hook-ups are located at each slip. Full service gasoline, diesel and sanitary pump-out are also available.

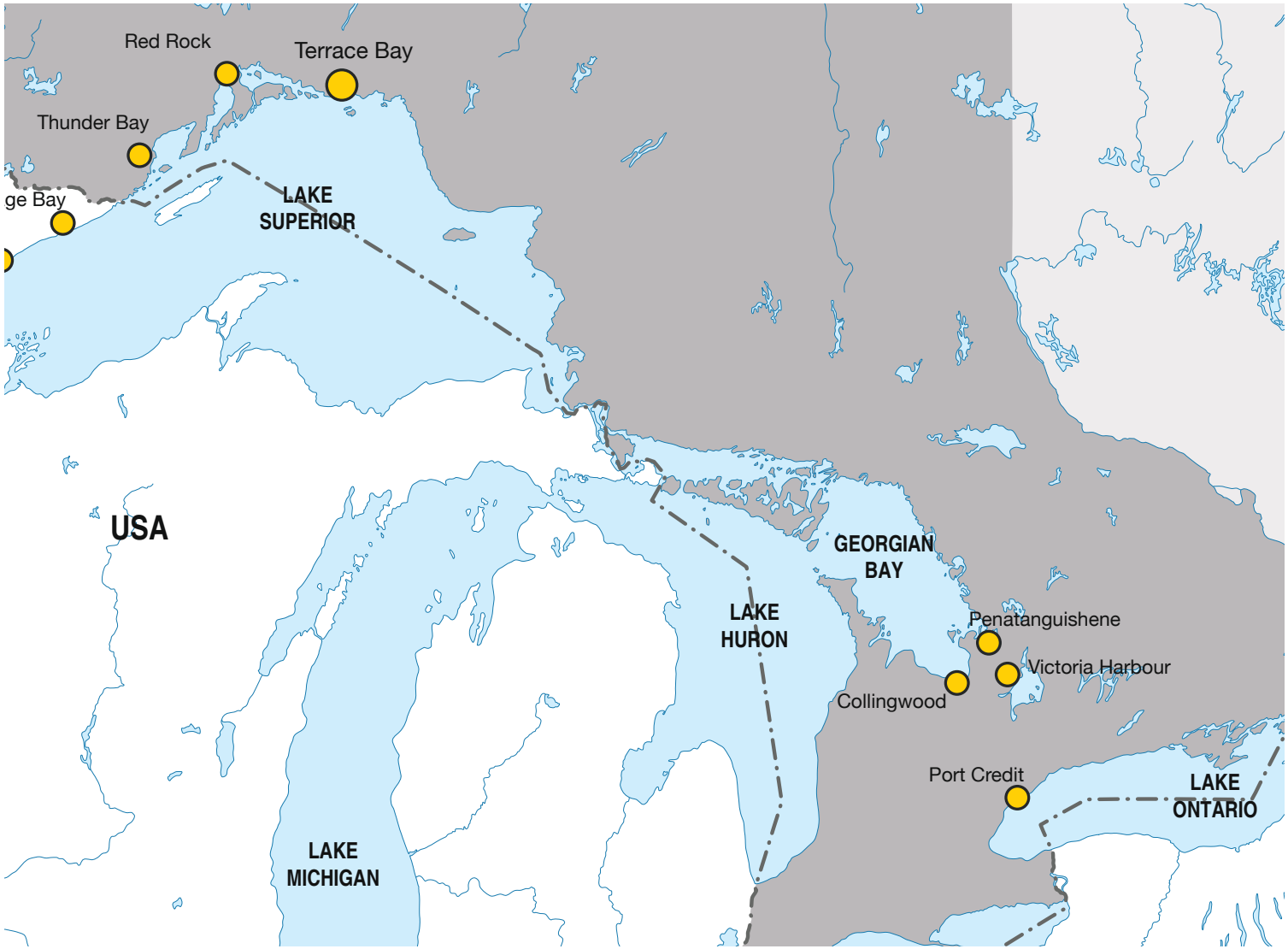
Amenities:

- Launching facilities
- restrooms complete with private showers and dressing rooms
- paved and gravel parking
- fuel, pump-out, public phone, transient slips,
- Clubhouse with WiFi service, a conference room and kitchen and laundry facilities.
- Boater lounges

Ancillary Development

- full service marina including: boat repair, haul out, and winter storage
- adjacent residential development

CANADA


Red Rock
Terrace Bay
Thunder Bay
ge Bay
LAKE
SUPERIOR
USA
GEORGIAN
BAY
LAKE
HURON
Penatanguishene
Victoria Harbour
Collingwood
Port Credit
LAKE
ONTARIO
LAKE
MICHIGAN

red rock

The Marina enhancements began in 1992 with the construction of the breakwall that was built as an innovative demonstrative project of the Lake Superior Programs Office. It integrates fish and wildlife habitat into standard breakwall design. Phase II of the Marina is the Timber-Frame Straw bale Building housing the marina and boater services offices, washrooms and showers as well as a historical exhibit area, multi-purpose room and small snack bar / restaurant concession.

Amenities:

- Wi-Fi access, restaurant and souvenir shops.
- Restrooms complete with private showers and dressing rooms
- Gas and diesel fuel,
- Pump out,
- Water,
- Electrical,
- launch facilities

Ancillary Development

- Adjacent camping areas and festival grounds

The marina is located in close proximity to the Town of Red Rock and the Red Rock Inn. There are no ancillary developments other than noted above nor is any anticipated in the near future. The Red Rock Inn enjoys limited benefits in term so room occupancy and restaurant use by transient boaters.

The Marina in Red Rock is in the secure freshwater harbour of Nipigon Bay. It has deep water access from the Simpson Channel all the way to a fully-serviced Marina. The Marina hosts a state-of-the-art security system operating 24 hours of surveillance recording. The Marina entrance has a depth of 3 meters (9'8") up to and along the fueling peninsula. The Marina has three docks with a capability of docking 82 vessels.

The Marina enhancements began in 1992 with the construction of the breakwall that was built as an innovative demonstrative project of the Lake Superior Programs Office. It integrates fish and wildlife habitat into standard breakwall design. Phase II of the Marina is the Timber-Frame Straw bale Building. The building will offer boaters washroom, shower and laundry facilities. Additional amenities include: Wi-Fi access, restaurant and souvenir shops.

Gas and diesel fuel, pump out, water, electrical and launch facilities are available at the marina between the months of May to October.

Developer / Funder

This marina area and waterfront has been developed in phases by the Town of Red Rock with funding assistance from various levels of government.

Description

The Marina in Red Rock is in the secure freshwater harbour of Nipigon Bay. It has deep water access from the Simpson Channel all the way to a fully-serviced Marina. The Marina hosts a state-of-the-art security system operating 24 hours of surveillance recording. The Marina entrance has a depth of 3 meters (9'8") up to and along the fueling peninsula. The Marina has three docks with a capability of docking 82 vessels.

port credit

Port Credit Village, Mississauga

- 410 housing units – townhouses, condos and live/work units
- 1,400 square metres of office space
- 3700 square metres of retail space
- 10.5 ha
- Compact, mixed-use residential community built on a brownfield site
- The redevelopment of the area has allowed the previously disjointed community to re-establish a connection between the East and West Villages
- Opened up public access to the waterfront
- Blends into existing adjacent neighbourhoods
- Pedestrian-oriented, medium density structure
- Close to the GO station
- Mostly underground parking
- High level of consistency in the built form
- Lots of open spaces, parks, plazas, civic squares

collingwood

Redevelopment of the old Shipyards in Collingwood

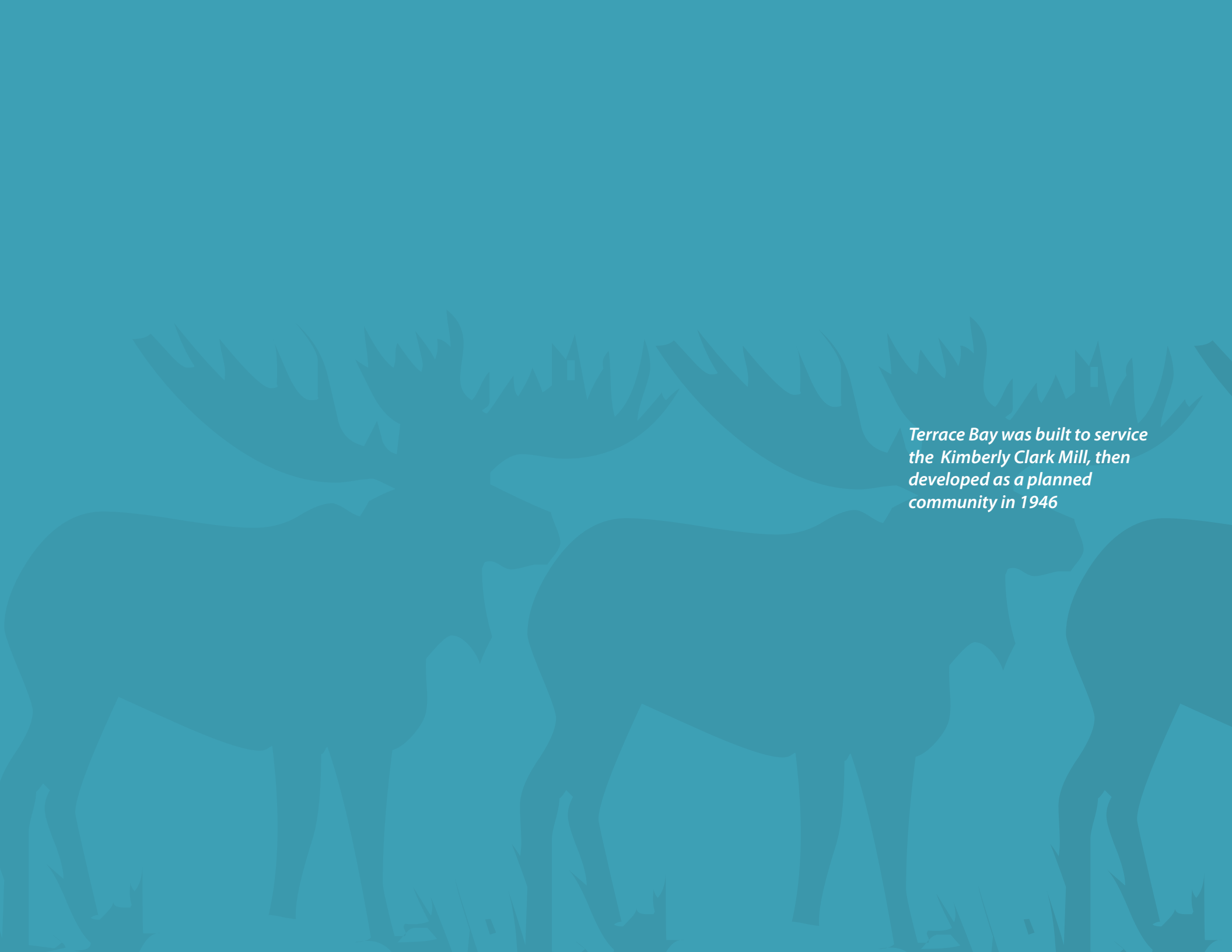
- residential community includes a mix of ground and low rise apartments
- water's edge is open for continuous public access
- community is a short walk to downtown Collingwood

penatanguishene

- mix of residential development adjacent to the waterfront
- includes senior's housing
- public access is disrupted in some locations by private lands at water's edge

victoria harbour

- residential development at water's edge
- mix of units
- medium density
- public access restricted to waterfront parks
- residential lots extend to water's edge eliminating continuous waterfront access



Terrace Bay was built to service the Kimberly Clark Mill, then developed as a planned community in 1946

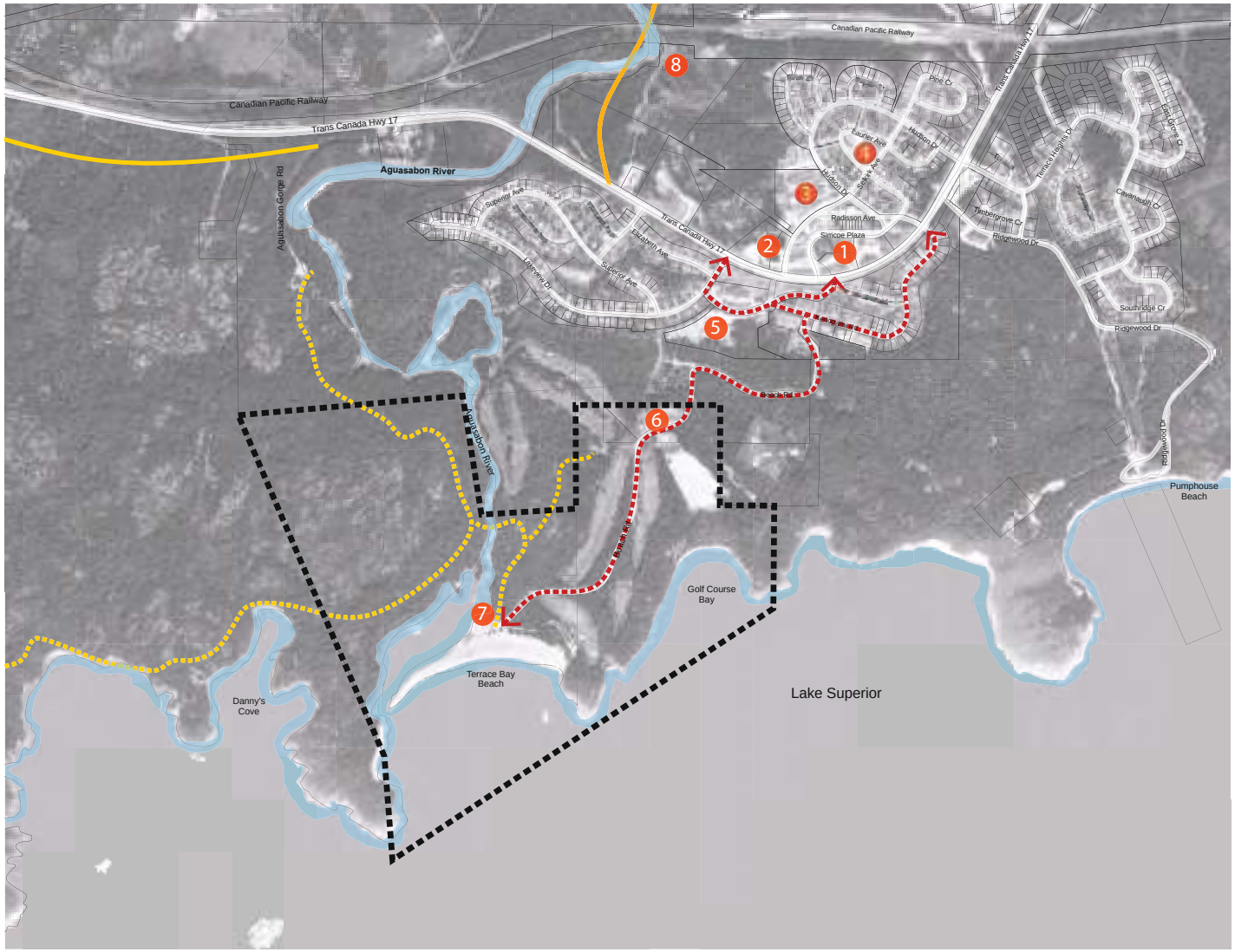
3 context

Study Area

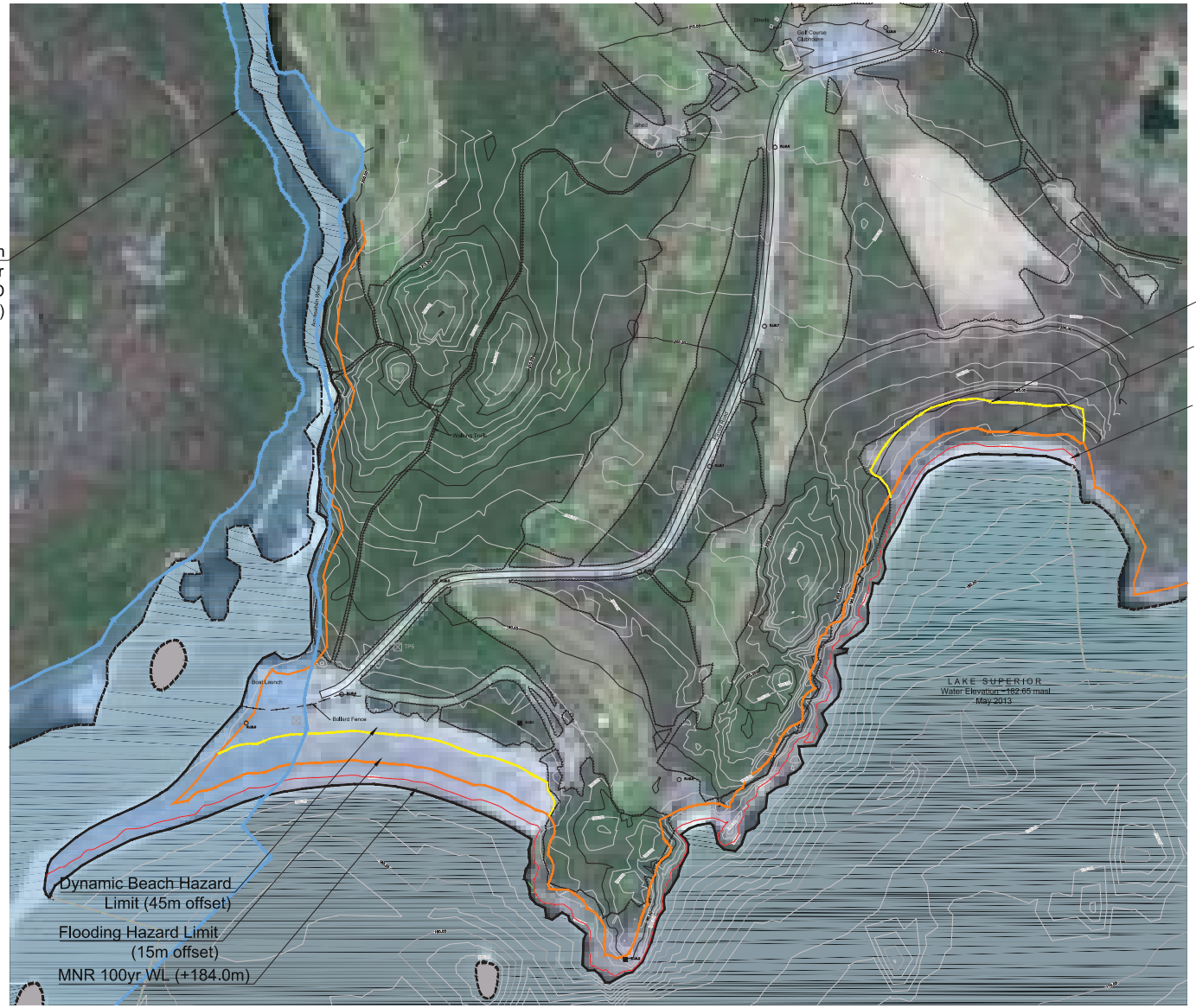
The study area encompasses the shoreline of Lake Superior, including Terrace Bay Beach, Pumphouse Beach, Golf Course Beach, and the mouth of the Aguasabon River. Portions of a nine-hole golf course and a driving range are located within the study area, as well as a well marked public trail system that traverses a variety of terrain ranging from sandy/rocky shorelines to upland boreal forest.

- Study Area
- Hiking Trail
- Snowmobile Trail
- Access to Waterfront

1. Simcoe Plaza/Lighthouse
2. Municipal/Recreation Centre
3. School, Pool, Skateboard Park
4. Terrace Bay Cultural Centre
5. McCausland Hospital
6. Aguasabon Golf Course
7. Boat Launch
8. Ski Hill



Flood Hazard



Surveyed Shoreline

Approximate Shoreline (derived from Aerial photography)

Dynamic Beach Hazard Limit (45m offset)

Flooding Hazard Limit (15m offset)

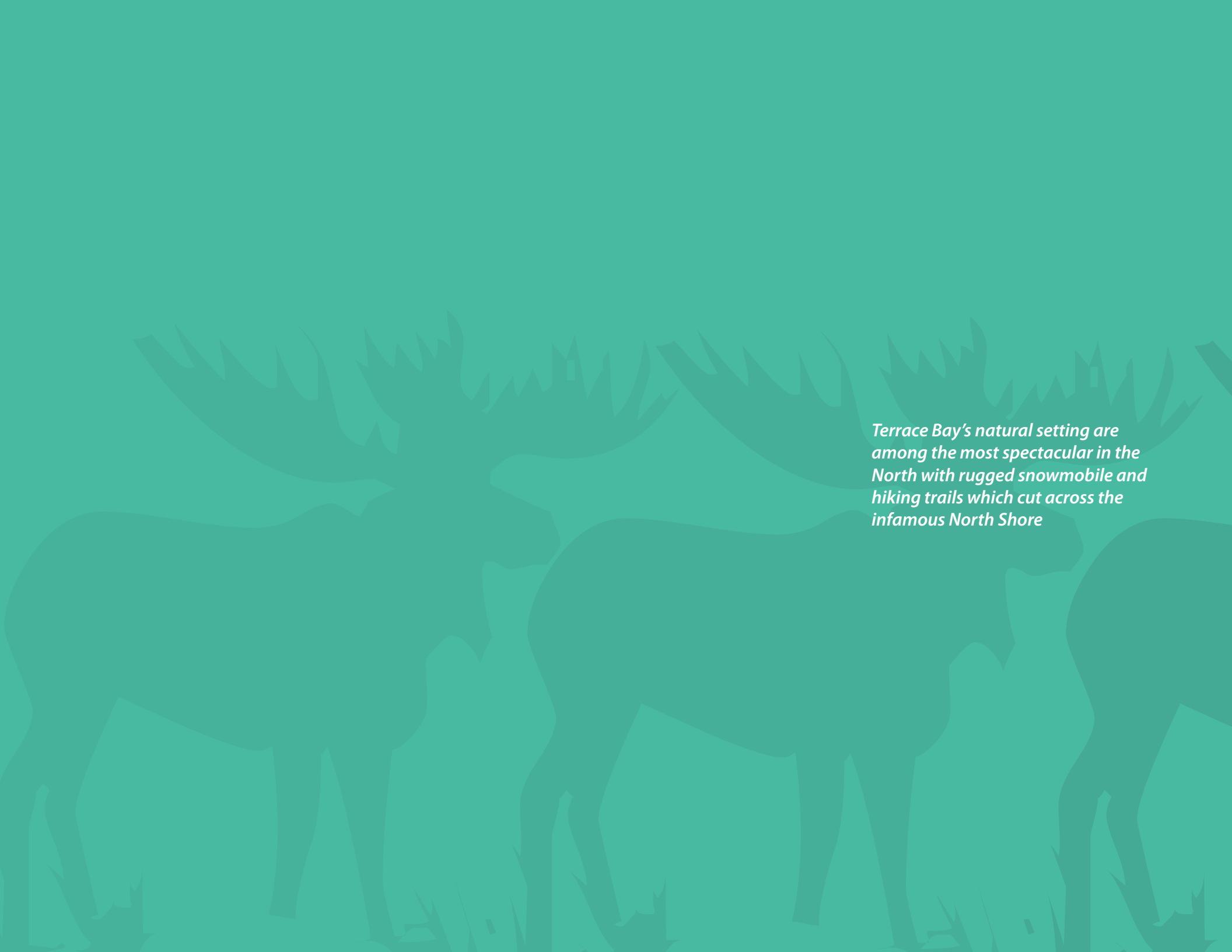
MNR 100yr WL (+184.0m)

Probable Maximum Flood (PMF)
Water Surface (per ONTARIO POWER GENERATION)

Benchmark Data Table

RIB1	Northing: Easting: Elevation:	5402284.830m 491853.439m 198.517m
RIB2	Northing: Easting: Elevation:	5402177.148m 491781.575m 196.332m
RIB3	Northing: Easting: Elevation:	5402166.722m 491572.767m 190.841m
RIB4	Northing: Easting: Elevation:	5402051.788m 491477.245m 185.687m
RIB5	Northing: Easting: Elevation:	5401964.645m 491822.193m 188.850m
RIB6	Northing: Easting: Elevation:	5402610.915m 491920.229m 206.045m
RIB7	Northing: Easting: Elevation:	5402427.933m 491909.272m 201.581m
RIB8	Northing: Easting: Elevation:	5402732.970m 492033.190m 210.300m
RIB9	Northing: Easting: Elevation:	5402022.396m 491379.834m 184.800m
SIB1	Northing: Easting: Elevation:	5402022.370m 491659.533m 187.833m
SIB2	Northing: Easting: Elevation:	5401780.917m 491767.428m 189.533m

Coordinates expressed in UTM NAD 83, Zone 16U and derived using information processed through the Canadian Spatial System to provide geodetic reference



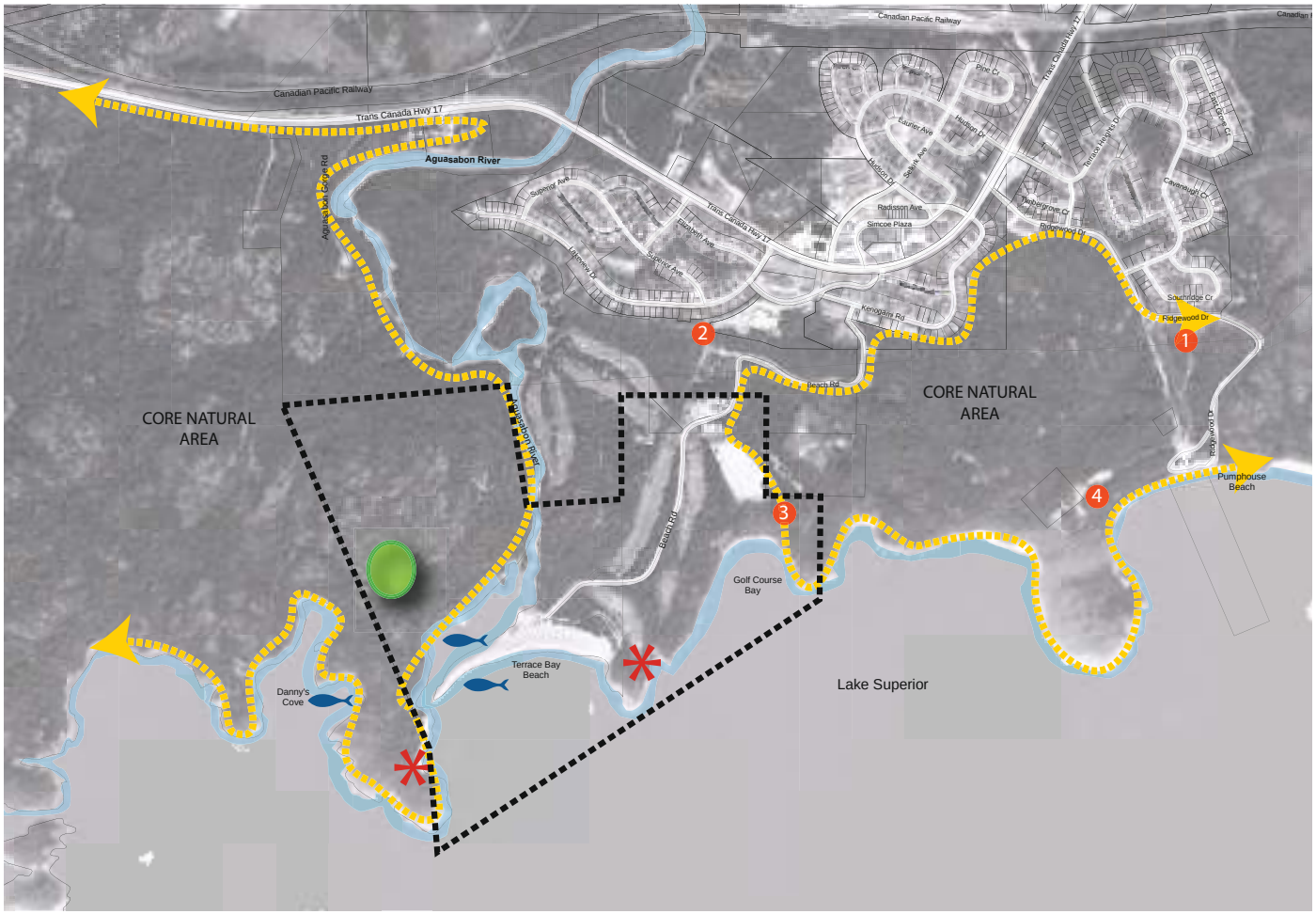
Terrace Bay's natural setting are among the most spectacular in the North with rugged snowmobile and hiking trails which cut across the infamous North Shore

4 natural environment

- Study Area
- Core Natural Area
- Rare Plant Communities
  - American Dune Grass
  - Great Lakes Arctic Alpine
- Rare Plants
- Fish Spawning Habitat

Earth Science Site

1. Nipissing Shore
2. Nipissing Shore
3. Raised Shores
4. Sub-Sault Shore



Key Natural Features

The following section provides an overview level description of the existing conditions and constraints within the Terrace Bay Waterfront Strategy study area. As part of the analysis, the following tasks were performed:

- Initial site reconnaissance on December 12th and 13th, 2012;
- Air photo and Ontario Base Mapping interpretation;
- Review of Fisheries Site Description Study Results for a Proposed Marina Development at Danny's Cove, Lake Superior, Terrace Bay (North Shore Environmental Services, 1999);
- Contact with MNR Nipigon District Office staff for background mapping and data;
- Review of MNR Natural Heritage Information Centre Bio-Diversity Explorer for rare species occurrences, presence/absence of rare plant communities and earth science/life science features; and,
- Review of MNR Life Inventory Office (LIO) GIS shape file data.

The dry-fresh and fresh-moist boreal forest associations within the study area are comprised of a mixture of white birch, trembling aspen, white spruce, balsam poplar and jack pine. Shallow, sandy soils over bedrock with bedrock outcrops and rolling terrain characterize the upland forest associations. Low lying, poorly drained areas and transitional areas support a mixture of tamarack, balsam poplar, white/black spruce, and white birch. The understorey shrub layer is comprised of Labrador tea, speckled-alder, mountain maple, meadowsweet, beaked hazel, eastern white cedar, honeysuckles, high-bush cranberry, currants, red-osier dogwood and shrub willow. The ground cover layer supports a rich assemblage of ferns, club-mosses, and herbaceous plants.

The Lake Superior shoreline is characterized as a rugged mosaic of bedrock outcrops, ledges and drop-offs, interspersed with sandy/rocky beaches. The bottom substrates are comprised of hard packed sand with cobbles and boulders of varying size.

From a fisheries perspective, the shoreline in the general vicinity of the study area, including Danny's Cove to the west and the mouth of the Aguasabon River, provides very good potential spawning habitat for resident lake trout, whitefish species and lake herring. Fish species collected in 1999 (North Shore Environmental Services 1999) from the vicinity of Danny's Cove, just to the west of the study area, consisted mainly of northern pike, lake trout, round whitefish, lake herring and lake chubb. The combination of water depth, substrate type/size and prevailing winds are factors, which contribute to the excellent fish habitat conditions that occur along the Lake Superior shoreline, in proximity to the study area.

Terrace Bay's location along the Lake Superior shoreline is centered within local tributaries that support coastal runs of salmonid fish species, notably brook and rainbow trout, and coho, chinook and pink salmon. Large coastal runs of fish occur to the east of Terrace Bay in the Steel, Prairie and Little Pic rivers, and in the Gravel and Cypress Rivers to the west of the town.

The Lake Superior National Marine Conservation Area provides habitat for over 70 species of freshwater fish. The boundary of this protected area is located just off-shore from Terrace Bay. The near pristine waters of Lake Superior provide suitable habitat conditions that support a diverse aquatic community.

Aguasabon River

The following description is taken from text provided by the MNR Nipigon District Office.

The mouth of the river is a cascading falls that the MNR have not studied, but know that numerous fish species navigate to reach upstream areas for spawning, and possibly feeding. These species include rainbow trout, coho, pink and chinook salmon, round whitefish, white sucker, and possibly northern pike. Northern pike are also known to use the bay in the spring for spawning along the shoreline. Brook trout, lake whitefish and walleye inhabit this section of the Aguasabon, as well, but it is not known if they migrate up from the lake or are just residents.

The flows in this section of the river are for most of the time dependent upon natural flows coming from the terrain below the Hays Lake Dam. The dam is operated on a spill basis only, in that when there is too much flow to use for generation at the plant (west of town) then it gets spilled over the dam down this section of the river to Lake Superior. This generally happens only in the spring but the flows can be quite large, in the order of 200 cubic meters per second (CMS). Normally the natural flows in the river are less than one CMS.

The outflow of the Aguasabon River below the hydro generation plant likely accounts for most of the productive area for fish around Terrace Bay. Fishing is generally done at the mouth of the Aguasabon in the spring or fall for migrating salmonids. The off-shore Slate Islands support lake fishing for brook trout and lake trout within the protected areas of the islands.

Earth Science Sites

The study area also contains several earth science sites associated with the former shoreline and raised shoreline of Lake Nipissing, as well as the sub-Sault Shoreline. The earth science sites are not provincially significant but are representative of the geomorphology of the study area and past geological processes, which have created the topography and character of the existing shoreline.

Rare Plant Communities

The MNR Natural Heritage Information Centre indicates that two rare plant communities (S2 and S3 provincial rank) have been previously recorded from the vicinity of the study area. These plant community types include:

- American Dune Grass - Beach Pea - Sand Cherry Dune Grassland; and,
- Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline Type.

The American Dune Grass community type typically occurs on sandy shorelines with a dune component created by wind. The cove dunes along the north shore of Lake Superior are not very extensive, with the largest example occupying 0.9 km2 at Prisoner's Cove in Neys Provincial Park (Bakowsky 1997).

The vegetation in these dune communities is usually dominated by herbaceous species such as Beachgrass "Ammophila breviligulata", American Dune Grass "Leymus mollis or Elymus mollis", Beach Pea, Wormwood and Canada Wild Rye. Other species frequently occurring include Lyre-leaved Rock Cress "Arabis lyrata", Red Anemone "Anemone multifida", Slender Wheatgrass "Elymus trachycaulus", and Sweet Grass "Hierochloe odorata". Shrubs such as Red-osier Dogwood, Common Juniper, Creeping Juniper, Sand Cherry, Soapberry "Shepherdia canadensis" and Bush Honeysuckle "Diervilla lonicera" may form extensive patches. Sheltered areas, such as the bottoms and lee of slopes or old blowouts, allow opportunities for small patches of White Spruce "Picea glauca" forest to develop. A number of arctic coastal plant species are also known to occur on the dunes along Lake Superior. This dune grassland community type is ranked S2 in the Province of Ontario, which is an "imperilled" status due to fewer than 20 provincial occurrences.

Lake Superior has long been known to support assemblages of arctic plant species along its cold rocky shores, as well as western and alpine species (Bawkowsky 1998). Some of these occurrences were first described by Louis Agassiz in 1850 during his exploration of Lake Superior. It is thought that the presence of these species here, so widely disjunct from their principal range, is a "relict" occurrence. It is also hypothesized that their distribution was previously more widespread along the margins of the Wisconsinan ice sheet, which formerly covered this region. As the glaciers receded, the vegetation which occurred along the ice margin either disappeared or followed the ice margin northward, to be replaced ultimately in the Lake Superior region by boreal forest. The colder-than-normal microclimate immediately adjacent to the lake enabled conditions to persist for which these species are adapted. Boreal forest was also prevented from occupying these sites by other factors, such as ice-scour and wave wash. The richest sites usually exhibit the greatest diversity of structure, including crevices, rock pools, boulder fields and shore platforms.

This vegetation community type is classified as S3, which is considered vulnerable in the Province of Ontario due to less than 80 provincial occurrences. A number of herbaceous, graminoid (sedges, grasses), and shrubs species are typical in these exposed habitats, including: Yarrow "Achillea lanulosa", Sand Cress "Arabis lyrata", Bearberry "Arctostaphylos uva-ursi", Bluejoint Grass "Calamagrostis canadensis", Harebell "Campanula rotundifolia", Lenticular Sedge "Carex lenticularis", Umbellate Sedge "C. umbellata", Tufted Hairgrass "Deschampsia cespitosa", Rocky Mountain Fescue "Festuca saximontana", Spreading Juniper "Juniperus horizontalis", Ninebark "Physocarpus opulifolius", Common Butterwort "Pinguicula vulgaris", Inland Bluegrass "Poa interior", Shrubby Cinquefoil "Potentilla fruticosa", Three-toothed Cinquefoil "P. tridentata", Mistassini Primrose "Primula mistassinica", Knotted Pearlwort "Sagina nodosa", Tufted Club-rush "Scirpus cespitosus", Rand's Goldenrod "Solidago simplex ssp. simplex", Trisetum Grass "Trisetum spicatum", and Rusty Woodsia "Woodsia ilvensis" (Bakowsky 1998).

Lichens may be prominent, especially crustose lichens, Reindeer Lichen (Cladina spp.), and the orange lichen Xanthoria elegans. Small seedlings and saplings of trees from adjacent forested areas may also be present, including White Spruce "Picea glauca", Eastern White Cedar "Thuja occidentalis", White Pine "Pinus strobus", and Balsam Poplar "Populus balsamifera" (Bakowsky 1998).

In addition to the above rare plant communities, the NHIC database also revealed historical records of S2 and S3 ranked plants species for the study area, including scabrous black sedge, oval-leaved bilberry and Laurentian bladder fern.

Wildlife

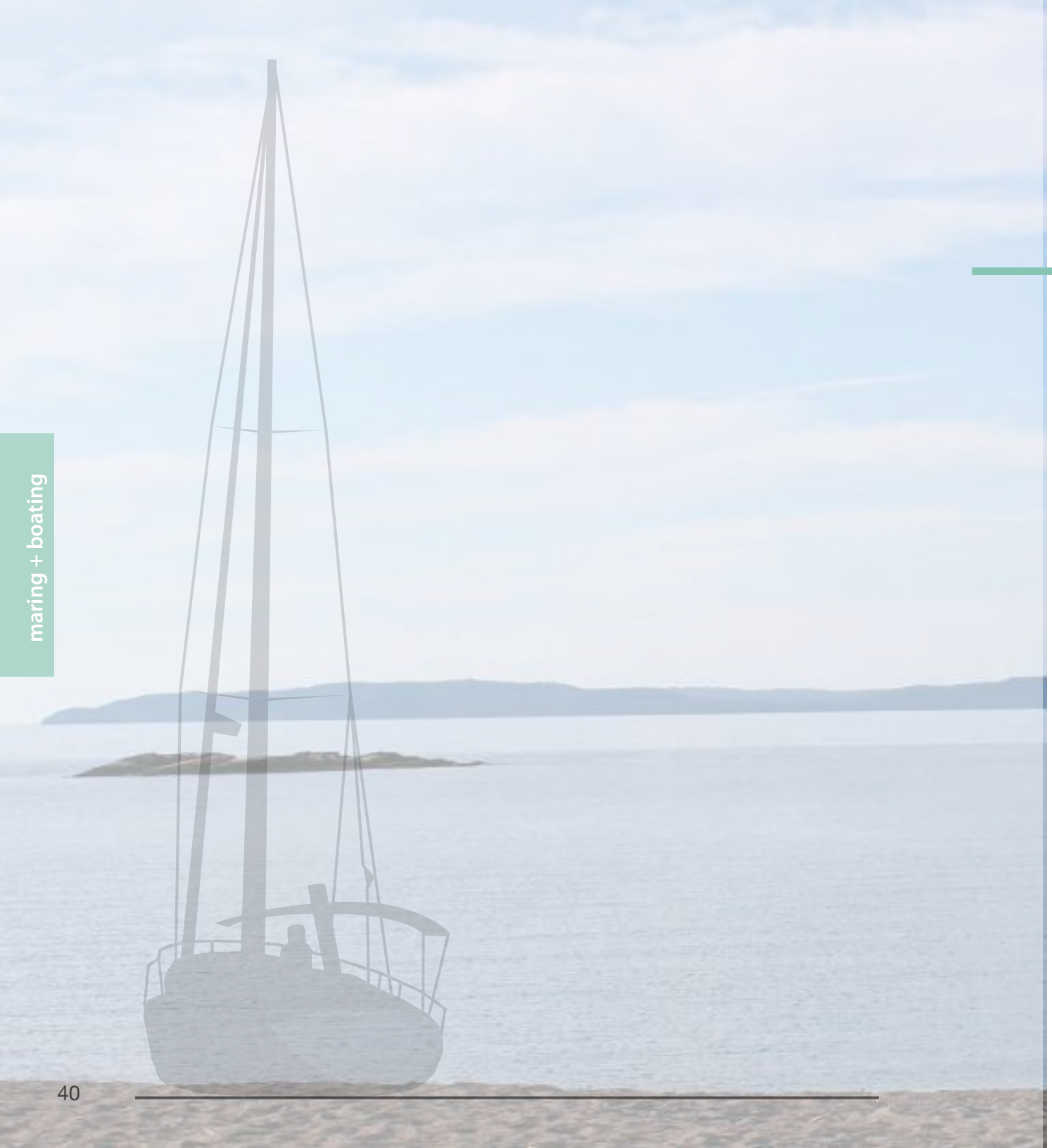
The boreal forest within the study area provides habitat for a variety of hardy, fur bearing mammals, as well as habitat for pine marten and moose. With the exception of the gaps in the tree canopy created by the golf course, the forest associated with the shoreline is very expansive, forming a contiguous block of habitat with direct access to Lake Superior and the Aguasabon River. It is expected that the study area would also provide habitat for a wide variety of bird species due to a combination of factors such as habitat diversity, proximity to a major great lakes shoreline and the Aguasabon River confluence, and the presence of cove beaches and near-shore fish habitat.

The study area also contains historical records of long-eared bat, a mammal species that is currently being considered for protection under the Endangered Species Act. This species forages in forest interior habitat and hibernates in cool, damp caves.

The off-shore Slate Islands provide habitat for woodland caribou, a Threatened species protected under the *Endangered Species Act*.

Terrace Bay is the nearest community to The Slate Islands which were formed by the impact of a giant meteorite and boast the southernmost herd of caribou in the world. The Slate Island Lighthouse is also the tallest lighthouse in the Great Lakes area.

marina + boating 5



This section provides a summary of previous studies and relevant background reports provided by the Township that are specific to a marina operation in Terrace Bay.

1989

1991

2008

Marina Site Development, Lake Superior Access Study, Township of Terrace Bay (Cumming Cockburn Limited, 1989)

Alternative locations for a marina to support sport fisheries were assessed in response to the District Fisheries Management Plan. Three pre-determined marina sites were reviewed considering engineering requirements. The three sites included: the Aguasabon River, Lyda Bay and Hydro Bay. The study considered a basic marina (access road, boat ramp, temporary mooring, no breakwater protection). A more significant marina development with capacity for 30 boats was also considered. The study included limited hydrographic surveys at each location and this represents the best available data to date.

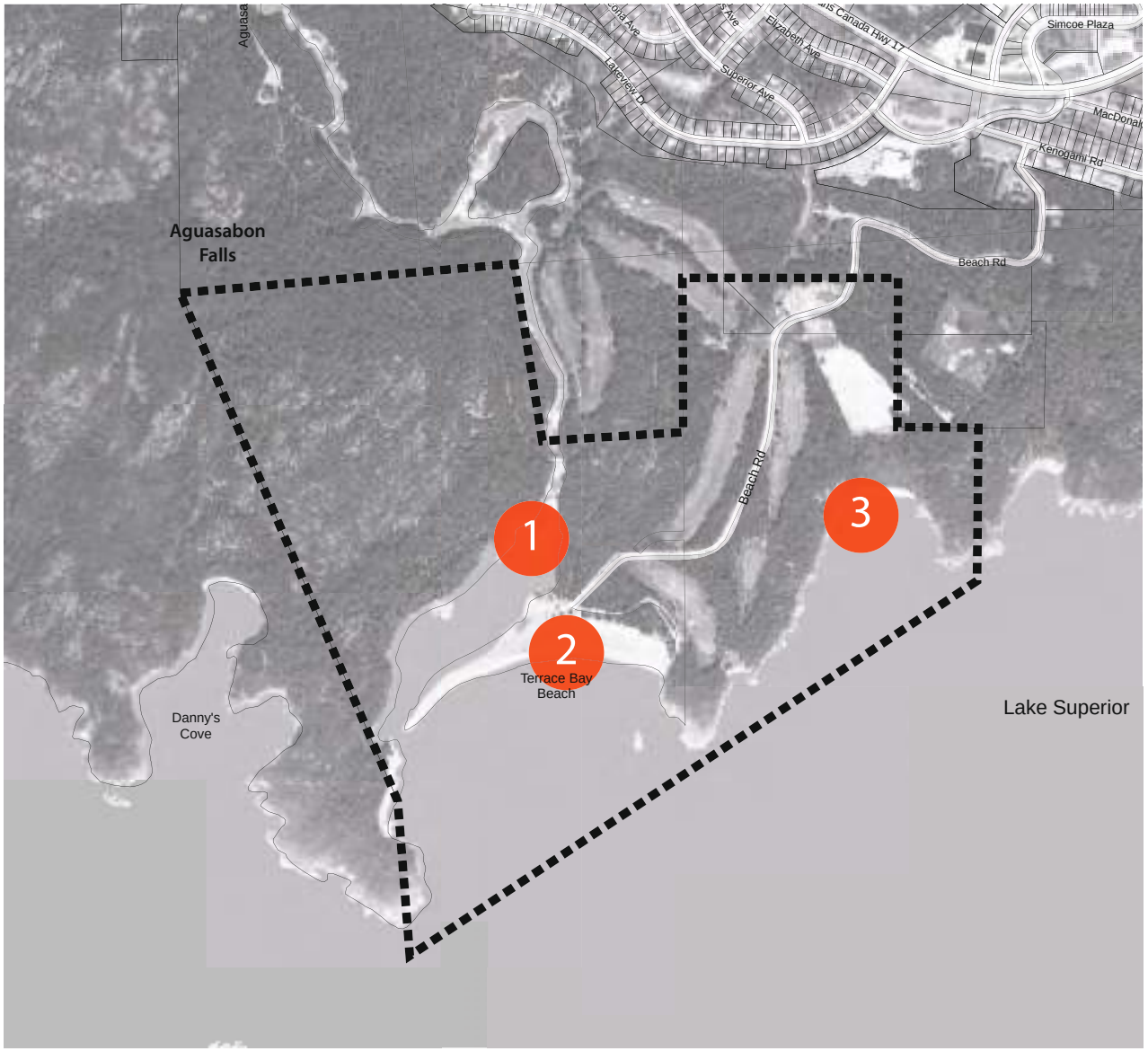
The study concluded the Aguasabon River was not suitable for full development due to issues related to the stability of the sand beach and flow conditions in the river, however more limited development was considered viable. Lyda Bay was recommended as a good alternative, with sufficient space for a full marina and on-shore facilities. Its remote location and distance from Terrace Bay were identified as drawbacks. Hydro Bay was also identified as a possible location for a full marina, though it was noted that it is more exposed than Lyda Bay. Further study of the currents from the hydro generating station was recommended. The estimated costs for the limited development alternatives were less than $100,000 and the full development alternatives were $1.3 million at Lyda Bay and $1 million at Hydro Bay. These costs were preliminary and are outdated now.

Coastal Engineering and Hydraulic Study (Environmental Hydraulics Group, 1991)

This study was prepared as follow-up to the 1989 study, which concluded the preferred location for a marina was the mouth of the Aguasabon River. The study objective was to develop feasible alternatives for a marina located at the river mouth. It included an assessment of engineering constraints considering river hydraulics and coastal processes. Concerns identified included: a submerged rock shoal within the proposed navigation channel, maintenance of the navigation channel, stability of the sand beach at the river mouth and impacts on fish habitat. The preferred solution included capital dredging to create a navigation channel from the proposed marina location in the river to the bay, and maintenance dredging as required to maintain a minimum 2 m depth in the navigation channel. Safety concerns related to operation of the Ontario Hydro facility located in the Aguasabon River and possible issues related to high flows were discussed briefly.

Terrace Bay Marina Sites (IBI Group, 2008)

Five alternative marina locations were evaluated by the IBI Group in 2008. A complete copy of the report was not available at the time of writing this report in progress, and will be requested on the next site visit. The report includes marina concepts for Lyda Bay, between Danny's Cove and Lyda Bay, Danny's Cove, Terrace Bay Beach and Golf Course Bay. Each alternative includes breakwaters, docks for approximately 44 slips, a boat ramp, gas and pumpout.



The focus of the coastal investigations is a review of potential marina sites. Within the study area, there are three possible marina locations. Other sites outside the study limits have been assessed in terms of their suitability for a marina development as discussed in previous studies, however further consideration of these sites is beyond the scope of this work. A site reconnaissance was undertaken on Dec. 13, 2012 and a brief summary is provided in this section.

1

Aguasabon River

This site is located at the mouth of the Aguasabon River. The river is dammed upstream for hydropower. There is a bay head beach in Terrace Bay, located at the river mouth. A number of docks, located on the north side of the beach are used by boats launching at this site. The docks were pulled out for winter, as shown in the adjacent photograph. This site has good access from shore and adequate space for land facilities including parking. Issues include concerns related to sedimentation and movement of the bay head beach, gravel shoals and depths in the river and high flow events in the river. Discussions with DFO and MNR would be required to identify permitting concerns.

2

Terrace Bay Beach

The Aguasabon River empties into a bay contained between two rock headlands. There is a 600 m long sand beach at the bay head. This site has good access from shore and adequate space for land facilities including parking. Although this site could potentially be used to develop a marina, this would result in significant impacts to the existing beach, including some loss of beach. Other issues include concerns related to sedimentation. Previous hydrographic surveys (EHG, 1991) show sand bars offshore of the beach. Discussions with DFO and MNR would be required to identify permitting concerns.

3

Golf Course Bay

Golf Course Bay is located east of Terrace Bay Beach. The bay is approximately 150 m across and there is a sand beach at the bay head. Anecdotal information from a committee member suggests that depths are adequate for shallow draught boats in the bay. This will have to be confirmed with a hydrographic survey. Access to the bay by land is challenging. The topography is steep, there is currently no road access and the shoreline is characterized by a series of steep terraces which are the remains of historic lake shorelines. In addition, there is limited space for land based facilities, though this could be developed. Discussions with DFO and MNR would be required to identify permitting concerns.

Bathymetry

Bathymetry is an important consideration when evaluating alternative marina locations. The approaches and marina site must have adequate depths to accommodate the design boat draft. Alternatively dredging or blasting may be considered but these result in added costs and additional permitting requirements. Limited bathymetry data exists for the Terrace Bay shoreline as described below:

- The Canadian Hydrographic Service (CHS) is the authoritative source for historical bathymetric surveys. A search of their archives revealed two surveys providing nearshore depths, collected in 1913-1914 at a scales of 1:48,000 (ID#: FS407) and 1:73,000 (ID#: FS370).
- CCL (1989) includes bathymetric surveys for Hydro Bay, Lyda Bay and the mouth of the Aguasabon River. The surveys were completed in 1988

Docks pulled out for winter.

Terrace Bay Beach

Golf Course Bay

Township Docks

Terrace Bay Beach

Next Steps

1. Marina demand survey and cost benefit analysis to confirm if a marina is economically viable.
2. Confirm the sites to be assessed.
3. Develop concepts and costing for marina options at selected sites.
4. Hydrographic survey to be completed in spring.
5. Selection of preferred alternative.

The large majority of businesses are located on the main street, Simcoe Plaza, which saw a major revitalization effort in 2011. At the same time, a 50 foot lighthouse attraction was constructed for visitors to climb and take in views of Lake Superior, the nearby Slate Islands, and the rest of the Municipality.

6 market analysis

Demographic Transition of the Resident Population

This section provides an overview of some of the key market parameters that will influence waterfront development in Terrace Bay.

Demographic transition of the resident population

Seasonal population trends

Economic development in the community

Land-based tourism market

Water-based tourism market

Preliminary implications for development opportunities

Demographic Segment	Terrace Bay Census Division	Thunder Bay District
Total Population in 2011	1,471	146,057
Total Population in 2006	1,695	149,063
Total Population Change	**-9.5%**	**-2.0%**
Population Under Age 20, 2011	285	31,655
Population Under Age 20, 2006	380	35,325
Change in Population Under Age 20	**-25.0%**	**-10.4%**
Population Age 65 and Over, 2011	245	24,370
Population Age 65 and Over, 2006	220	22,615
Change in Population Age 65 and Over 65	**+11.4%**	**+7.8%**

Terrace Bay has experienced a drop of almost 10% in its overall population base over the 2006 – 2011 period – somewhat greater than the larger Thunder Bay District of which it is a part (which has essentially remained static with only a slight decline) – locally, this is in large part due to the closure of the mill by Terrace Bay Pulp Inc. in 2009, although as the comparison to the District overall indicates, this is part of a larger district-wide demographic and population transition.

However, this overall population decline masks some sub-group demographic transitions occurring the Township – with a large decrease in the under 20 age segment (25% drop compared to a 10% decline in the District overall) but a large percentage increase in the 65 and over group (11% locally and nearly 8% in the entire District).

This may imply some additional demand for housing even despite the overall population drop, as often those in the 65 and older group are seeking retirement homes and smaller residences – to the extent that Terrace Bay can draw upon the larger regional marketplace this may represent a significant opportunity.

Seasonal Household Trends

Demographic Segment	Terrace Bay Census Division	Thunder Bay District
Total Households in 2011	822	71,235
Permanent Resident Households in 2011	675	62,318
Seasonal Households in 2011	147	8,917
% Seasonal Households, 2011	**17.8%**	**12.5%**
Total Households in 2006	838	71,635
Permanent Resident Households in 2006	691	61,836
Seasonal Households in 2006	147	9,799
% Seasonal Households, 2006	**17.5%**	**13.7%**
Change in number of Seasonal Households, 2006 – 2011	**0**	**- 882**

Nearly 18% of Terrace Bay's total number of households are seasonal residences: this would have the effect of increasing the population by approximately 360 in the summer season.

Terrace Bay's seasonal population has remained essentially static over the last 5 years (at 147 households) – compared to a decline in the District overall of nearly 900 households.

Economic Development in the Community

There are several developments that have the potential to reverse the population decline seen in recent years; in particular these are:

- **the conversion of the mill:** the recent purchase of the mill by Aditya Birla and its conversion to a wood pulp-to-rayon facility is expected to generate additional jobs in the community – the conversion, which is anticipated to be complete by 2016, will support an estimated 345 jobs in the community, based upon recent (April 2013) discussions with the new HR Manager – in addition, there will be temporary construction and trades jobs generated in the community as a result of the conversion of the mill facility
- **land sales:** at the present time some 4,500 acres (7 sq. miles) in ten parcels, in and around Terrace Bay, is for sale – there are the former mill lands (owned by Terrace Bay Pulp Inc.) – they may be purchased for residential, recreational, commercial or 'ecological' (i.e. land reserve) purposes – the sale and development of these lands will clearly have some impact on the future economic development prospects of the community
- **supply depot to the 'Ring of Fire'** the Ring of Fire discover 500 km. north of Terrace Bay is a multi-billion potential development – some 35 companies have registered claims, and there have been significant discoveries of chromium, copper, zinc, nickel, platinum, vanadium and gold – while Terrace Bay will not likely be a major beneficiary of this activity, there may be some potential for the establishment of supply-related businesses
- **The Stillwater Mine in Marathon** (80 km. and 1 hour to the east of Terrace Bay) is another key development that will likely impact upon the community. The mine itself is located 10 km. north of Marathon, and it is anticipated that commercial production (of copper, palladium, platinum and gold) will begin in 2015. The lifetime of the mine is estimated to be approximately 12 years. Construction of the mine and milling operation is anticipated to create 400 jobs, while throughout its production phase it is estimated that 350 will be directly employed at the mine and mill. In addition to this direct employment there will be a number of additional jobs created throughout northwest Ontario in various supply capacities. Some of the employees during both the construction and operating phases of the Stillwater opera-

tion will likely choose to live (or continue to live in the case of current residents) in Terrace Bay as a result of the quality of life and amenities provided in the community. As well, some of the supply businesses indirectly created by the mine will likely reside in Terrace Bay. Either way, the Stillwater mine development can be expected to present - to some extent - additional housing demand in Terrace Bay. This factor will be further assessed throughout the course of the study

'Rubber-Tire' (Land-Based) Tourist Market

Size of the Market

The land-based tourist market has two components: first, those tourists driving by Terrace Bay each year (primarily summer); and second, those who actually stop off in the community and spend time and money.

The size of the first component is estimated using highway traffic counts from Ontario Ministry of Transportation; this is done as follows:

- average annual average daily traffic (AADT) counts for Terrace Bay - averaging the 2009 count (the most recent available) for the easternmost segment (from Sawmill Creek to Terrace Bay) and the westernmost (from Terrace Bay to CPR OH) gives 2,450 vehicles a day, or 894,000 vehicles per year
- average daily winter traffic (WADT) using the same procedure was 1,825 vehicles per day, or 666,000 vehicles per year
- assuming that WADT is a reasonable measure of base traffic throughout the year (commuters to and from work, truck traffic, etc.) the difference between the AADT and the WADT totals can be considered additional traffic that is generated in the spring, summer and fall periods (=228,000 vehicles)
- some of this will be additional truck traffic, which increases in the summer months) but most is likely to be tourist traffic
- accordingly, discounting this figure by 10% to account for additional truck traffic yields an estimate of approximately 205,000 tourist vehicles
- at an estimated 2.6 persons per vehicle , this translates to a tourist market of approximately 554,000 persons per year
- this is the size of the potential tourist market passing by the Terrace Bay on the highway each year

Tourists actually stopping in Terrace Bay for any amount of time come to the area for its natural and cultural attractions, and many will come to the area to visit friends and relatives (the so-called VFR market) or be en-route to visiting friends and relatives beyond the area. Through previous work in the tourism industry, we have found that an area's share of total population in a region is a reasonable proxy for the number of tourists it will receive annually.

Terrace Bay is within Regional Tourism Organization area 13c – consisting of Thunder Bay District, Kenora District, and Rainy River District. In 2011, the total population of this region was just over 224,000. Terrace Bay, with a population of 1,471 (see above) has 0.66 percent of this regional population.

According to the Ontario Ministry of Tourism, Culture and Sport, RTO 13c attracts on the order of 1,837,000 person visits annually (2010 figure, the most recent available at the time of writing). Some 63% of these are overnight stays (at least 1 night or more) and 37% are day trips - assuming 0.66 % of these trips are to the Terrace Bay area (according to the methodology outlined above), and that the characteristics of these Terrace Bay visitors are the same as that of other tourist in the RTO 13c) area, the following estimates can be made:

Ontario Ministry of Tourism, Culture and Sport, Regional Tourism Organization Profiles, RTO 13c: http://www.mtc.gov.on.ca/en/

Number of tourists actually stopping / staying in Terrace Bay	12,124
Average party size (according to RTO 13c) profile	2.6
Implied number of vehicles stopping in Terrace Bay (assuming 1 party per vehicle)	4,663
'Market share' of total tourist traffic (224,000 vehicles – see above)	2.1%

We understand from the Township that the Lighthouse right in the main town area receives on the order of 10,000 visitors per year and that most visitors stopping in the area make a point of visiting that attraction. This is roughly consistent with the 12,000 + visitors calculated using the RTO data as explained above (certainly within the order of magnitude error that could be expected from using this approximate estimating procedure) and provides a separate point of validation on this number.

Characteristics of Tourists

Information from the recent Tourism Data Collection Project reveals the following characteristics of tourists to Terrace Bay (from a survey of 381 tourist parties representing 840 tourist visitors):

- 17% were individual travellers
- 54% were couples
- 20% were families
- 8% were organized groups
- 14% were age 24 and under
- 22% were aged 25 to 44
- 56% were aged 45 to 64
- 16% were over age 65
- 42% indicated that this was their first visit to Terrace Bay
- 58% indicated that had stopped in Terrace Bay previously
- the overwhelming reason for stopping in Terrace Bay according to most visitors was 'passing through' (87%); other reasons mentioned were 'Circle Tour' (which is a variation on 'passing through') at 4%, and eco-adventure at 1%
- 88% of visitors reported that they were not staying overnight in the community; 7% were spending 1 night in town; and 5% were spending 2 or more nights (with 2% staying 5 or more nights)
- of those spending 1 or more nights in the community (i.e. the 12% alluded to above):
- 40% were camping
- 40% were staying in a hotel or motel or resort
- 20% were other (staying with friends and relatives, B&B, etc.)

Boater Market

The boating market in Terrace Bay has two components: demand from residents of the Township and immediate region who would wish to moor their boats at a Terrace Bay facility during the season and store them nearby in the winter, and the transient boater market who would make a stop in Terrace Bay as part of a longer-term trip. The transient boaters could come from Thunder Bay or Sault Ste. Marie, or even further afield.

It is difficult to obtain precise figures on the size of the boating market, but the general situation along the north shore of Lake Superior is that the market is thin, the season is short, and the demand for slips has plateaued or even diminished in recent year. This is particularly true of the market since the financial crisis of 2008 and the resulting economic uncertainty since then. Boating has always been a reasonably upscale and luxury type activity, and has suffered as many households 'cut back on the frills' and focus on the necessities.

The Gateway Study in 2000 showed that even at that time, a marina operation in Terrace Bay was a somewhat marginal operation, and since then, the market has only diminished.

Terrace Bay Regional Gateway Development Feasibility Study, The Planning Partnership, February, 2000.

Slate Island Lighthouse

Terrace Bay boasts a multitude of sandy beaches on the shores of Lake Superior as well as smaller inland lakes. Accessible by vehicle and hiking trails, the Lake Superior beaches boast waves in the late summer months that bring a variety of water sport lovers to the town including surfers, and body boarders. The inland lakes provide warm sheltered swimming for the many hikers and campers that come to the area

7

possibilities to consider

This overview has identified on a very preliminary and 'ballpark' basis, some development opportunities that should be considered for the waterfront. Based on the preliminary waterfront concepts to be developed in the Stage 2 of the Study, development opportunities will be thoroughly researched and assessed in terms of a market feasibility and business plan assessment:

Residential Development

This review has indicated that, while population in the Township overall has declined, there has been significant growth in the older age segments that may be more likely to purchase new homes as a result of downsizing, uncoupling or interest in a second home property. The economic prospects facing the community look very likely to turn the corner as a result of positive signs in terms of economic development. A conservative estimate of the number of new housing units that might be supported as a result of these factors could be as follows:

- assume (conservatively) that 200 new jobs at the redeveloped mill are created
- assume that these are phased in over the 10-year period after 2016 when the conversion of the mill is completed
- assume that 50% of these new jobs are taken up by existing residents or new employees moving into town who occupy existing residences
- this implies that 100 jobs created in the community will require housing over the 10-year period
- assume that half of this new housing demand could be satisfied by new housing development on the waterfront (or in the waterfront study area covered by this study) = 5 units per year over a 10-year period
- this demand would only be augmented by demand for waterfront property with amenities from the older individuals and households from the larger District who are looking for retirement properties or second homes
- given the likely market for such a development, an appropriate mix for this housing would be primarily higher density (e.g. duplex, townhouse) with some single family-type units

Hotel / Resort / Spa / Restaurant

Given the redevelopment of the mill, and its subsequent operation, there will likely be a demand for additional accommodation in the area. This will initially take the form of increased capacity utilization of existing accommodation and possibly an expansion of these operations. However, there will likely be a demand for some 'higher end' type accommodation such as a small resort or spa, which could cater to several market segments:

- senior management and special visitors to the mill, who will require somewhat higher-end accommodation;
- friends and relatives of those living in the new waterfront-based residences developed (who may not wish to stay at the residence itself for whatever reason);
- those living in the larger District (extending to Thunder Bay) looking for a getaway weekend or longer visit (especially drawing on that rapidly-growing older age demographic who may be looking for higher-end short trip experiences); and
- tourists travelling through the area who similarly might be looking for a higher-end dining or overnight experience - a conservative estimate of the number of units that might be supported as a result of these factors could be as follows:
- assume (conservatively) that the market share of the drive-by tourist market in Terrace Bay could be increased by one half of one percent by the existence of a dining / spa / hotel facility (= 2,700 users) in the spring / summer / fall season
- assume that 10% of these users

would like to stay overnight (=270 nights)

- assume that this use is matched by demand from mill visitors, District residents, and those visiting friends and relatives in Terrace Bay and area
- this equates to 540 room-nights
- assuming a seasonal operation of (say 150 days) this would imply a 3 room facility at full occupancy, and a 5-room facility at an 75% occupancy rate
- revenues from such an operation would be augmented by revenues from a day-use spa and restaurant facility (if part of operation)

Thus it would appear that there could be demand for a upscale small-scale accommodation / spa and dining facility of on the order of 5 rooms

Marina

The 2000 Terrace Bay Gateway study examined the demand for a marina operation in the community. A 25-slip operation was examined and the overall conclusion was that this would be an expensive project (nearly $1.6 million at the time) and a net return after revenues and costs of approximately $16,000 per year. While there was some positive economic impact generated in the community as a result of the expenditures of boaters, the overall conclusion at that time was that the marina was an expensive capital undertaking that was only marginally justified in terms of an investment vehicle. Since that time, the amount of pleasure boating activity on the Great Lakes and the resulting demand for marina spaces has plateaued or even declined in light of recent economic circumstances (particularly post-2008) – accordingly, this preliminary analysis suggest that a municipally-operated marina not be considered to be part of the development plan – however if a private operator wished to incorporate a marina into their development plans (particularly something that might be part of an overall upscale housing development or small-scale inn / spa / restaurant) the plan should make provision for this.

Gateway Concept

The aforementioned 2000 plan proposed the establishment of a 'Gateway Centre' where Terrace Bay would be the springboard to a number of eco-adventures (e.g. kayaking trips to the Slate Islands; rock-climbing; cycling tours; Group of Seven tours ; etc). This concept still has merit, given the size of the potential tourist market and the apparent small share of this market currently seen by Terrace Bay. While this concept would be seasonal in nature and relatively small-scale in terms of economic impact, it would have the potential to put Terrace Bay 'on the map' as it would be a truly unique offering, at least in terms of the activities available along the north shore of Lake Superior. The waterfront development plan should ensure that there is some provision for such a development should this ever come about.

Other Development Possibilities

There are a number of other development possibilities that should be considered over the life of the plan created here, and would be very complementary to the overall development of the site – these include:

- interpretive centre for the Lake Superior National Marine Conservation Area: possibly modeled on the facilities in Geraldton (Interpretive Centre), Duluth (Great Lakes Aquarium) or Ashland, WI (Northern Great Lakes Interpretive Centre). *Note in this regard that RTO 13 is currently investigating the potential for Group of Seven tours along the north shore.*
- research facility: another possibility could be a research facility associated with a post-secondary institution: models could be the Waterloo Summit Centre for the Environment in Huntsville, the Huntsman Marine Science Centre in St. Andrews, N.B., or the Bonne Bay Research Station in Newfoundland – clearly this would require further investigation and dialogue with potential proponents

FORM Architect and Engineering

Conceptual Geotechnical Investigation

Waterfront Development Study

Terrace Bay, Ontario

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Appendices

Figure

1.0 Introduction

True Grit Consulting Ltd. (TGCL) has been retained by FORM Architect and Engineering to conduct a preliminary geotechnical investigation in the proposed waterfront development area at Terrace Bay, Ontario.

The purpose of this investigation was to examine the subsoil and groundwater conditions at specified locations, by carrying out a limited number of test pits as shown on the attached site plan (Figure 1). Based on an interpretation of the test pit data, TGCL will provide preliminary general engineering recommendations for the geotechnical design of future development, such as foundation options, excavation and groundwater condition, backfill, drainage, erosion hazard and landslide hazard locations. Findings of this report will be integrated with next phase of work.

Photo 1: Test pitting at location No. 1

2.0 Project Description

In general, proposed area is rugged and scenic with landscapes and ecological features and a boulder field in the lower ground areas. Outcrops and bedrock ridges are visible predominantly along the western side near the Test Pit 4 area. The area is covered dominantly by vegetation communities of white birch and spruce. The site plan is shown in Figure 1.

TGCL carried out field investigations as part of the preliminary site investigation for infrastructure development. Five locations were allocated by TGCL for geotechnical investigation. These locations were generally on the south side of Beach Road and approximately 140 m to 450 m distant from the Lake Superior shoreline. The test pits were conducted to analyze the overburden soil strata down to the allowable excavation machine reach and access. Test pit locations can be seen in Figure 1.

Based on geological information available from *Ontario Geology Survey Map 42DNW*, the geology of the site is glaciolacustrine delta, and the primary material is sand, sandy. Relief is low; less than 15 m and drainage conditions are dry.

A firm development plan was not available at the time of report preparation, however it is assumed that the development will consist of multiple 1- to 2-storey structures, parking lots and underground utilities, landscaping, a work/storage yard, etc.

3.0 Field Investigation Procedures and Laboratory Testing

3.1 Field Investigation

Fieldwork was carried out on May 29, 2013 utilizing a Hitachi EX270LC excavator. The geotechnical investigation consisted of five (5) test pits excavated between 2.5 m to 6.0 m depth within the proposed development area. Geotechnical in situ testing (Static Cone Penetrometer tests) were conducted in the undisturbed test pit soil. Water levels were observed in the open test pits at the time of excavation. Test pit locations are shown on the site plan, Figure 1.

The field program was selected based on the proposed project details in order to obtain sufficient information to aid in the geotechnical assessment.

The fieldwork was supervised on a full-time basis by TGCL personnel Eric Osvath, EIT. The soil samples were identified in the field, placed in labelled bags and transported to TGCL's laboratory in Thunder Bay for further analyses.

After completing test pit logs (Appendix B) and in situ sampling, the test pits were backfilled by the excavated material and levelled to match existing surrounding ground. The ground surface elevations at the test pit locations were surveyed by TGCL personnel with RTK-GPS survey equipment and referenced to geodetic benchmark. The ground surface elevation at the test pit locations are shown in Table 3-1.

Table 3-1
Test Pit Elevations

Test Pit No.	Elevation (m)
Test Pit 1	210.031
Test Pit 2	201.200
Test Pit 3	197.700
Test Pit 4	188.520
Test Pit 5	185.000

3.2 Geotechnical Laboratory Tests on Soils

Physical and index tests were carried out in the TGCL Thunder Bay laboratory on the collected soil samples. Laboratory tests consisted of moisture content (ASTM D2216-05), hydrometer tests (ASTM D3360-96) and grain size distribution tests (ASTM 6913-04). Natural moisture content tests (w, % of dry weight) were conducted on all samples collected from test pits.

The natural moisture content of each sample was determined using the following equation:

$$w = W_w/W_s \times 100\%, \text{ where } W_w \text{ is weight of water and } W_s \text{ is weight of solid.}$$

A moisture content test was conducted on all soil samples collected in the field.

Four (4) grain size and one (1) hydrometer tests were carried out on selected samples from all test pits. All grain size test and hydrometer test results were plotted as graphs (Appendix C). Moisture content tests were performed on selected soil samples and are shown in the test pit logs (Appendix B).

4.0 Description of Subsurface Conditions

The generalized stratigraphy at the site area consists of fine- and coarse-grained sand. The overburden soil thickness measured at the test pit location ranged from 2.5 to 6.0 m

Subsurface conditions at the five test pit locations are detailed in the test pit logs (Appendix B) and are discussed in detail below.

Sand

Compact to loose sand with trace fines was encountered at Test Pits 1 to 5 between surface to 6.0 m depth. Gradation analyses was conducted on four sample from Test Pits 1, 2, 4 and 5 indicate gravel, sand, and fines contents in the range of 0.0 to 0.6%, 99.2% to 99.7% and 0.2% to 0.7% respectively. The moisture content of sample was found in the range of 3.8% to 5.9%.

Table 4-1
Gradation Analysis Test Summary

Test Pit Number	Gravel (%)	Sand (%)	Fines (%)
TP 1 (0.0 to 1.0 m)	0.0	99.3	0.7
TP 2 (0.4 to 4.0 m)	0.0	99.3	0.7
TP 4 (0.5 to 2.5 m)	0.6	99.2	0.2
TP 5 (0.3 to 3.5 m)	0.1	99.7	0.2

Silt

A silt layer was encountered in Test Pit 3 at depths between 3.5 m and 5.5 m below surface. The thickness of this stratum was found to be 2.0 m. As indicated by the hydrometer test carried out on the sample extracted from Test Pit 3, sand, silt and clay contents were 0.8%, 86.5% and 12.7%, respectively. The moisture content of the silt sample was found to be 12.7%.

Bedrock or Boulder

Based on excavation refusal, possible bedrock or boulders were encountered in Test Pit 4 at 2.50 m depth from existing ground level.

Groundwater

Generally, the soils encountered in the test pits were dry. A water seepage depth was recorded at Test Pits 3 and 5 during excavation at a depth of approximately 5.20 and 2.0 m respectively (Table 4-2). It should be noted that the water table fluctuates seasonally and in response to climatic conditions. Caving of the side walls was encountered during digging Test Pit 5. This can be due to shallow ground water table and loose or weak shear strength of the pit walls.

Table 4-2
Water Level

Test pit No.	Groundwater Depth Below Grade (m)	Relative Groundwater Elevation (m)
3	5.20	192.500
5	2.0	183.000

5.0 Feasibility for Development

5.1 Preliminary Discussion

A subsurface investigation by test pitting was completed across the area of the proposed development. At all five investigated locations, the dominant soil type in the upper 3.0 m soil strata is loose to compact, fine- and coarse-grained sand. A silt layer was also found below 5.0 m at Test Pit 3. The groundwater condition varies from investigated area to area. Test Pits 1 and 2, the groundwater was below 6.0 m depth and not reached during test pitting. Test Pits 3 and 5, a water level was observed at 5.20 m and 2.0 m depths respectively. Test Pit 4 encountered shallow refusal with no groundwater observed. Seasonal groundwater fluctuation can be expected.

The preliminary discussion and recommendation provided below should used as general understanding and guidelines when considering pre-development feasibility and project complexity forecasting. More detailed investigation shall be performed for buildings and other infrastructure services at specific locations when finalized plans become available.

5.2 Foundation Considerations

Foundation support for structures will depend on the structure loads/design elements and site location/subsurface conditions. At a conceptual level and founded our investigation interpretation, the geotechnical conditions of the site are considered suitable for future building development using standard industry methods for foundation construction, which can be determine at the detail design stages.

5.3 Shallow Foundations

Based on the test pit findings, shallow foundations on conventional footings are practical in all investigated areas. However, in areas of loose soil conditions within the upper few metres of soil strata, special attention should be given for foundation base preparation. Compaction of loose layers and replacing by compacted engineered fill should be considered, depending on the design loads.

Foundation placement on the natural undisturbed soil in the areas of Test Pits 1 to 4 appears may be suitable based on the in-situ soil densities encountered. Further analysis should be performed for varying footing depths to assess acceptability.

At Test Pit 4, excavation refusal was encountered at 2.50 m depth, most likely due to bedrock. If bedrock is shallow in this area, foundation on bedrock may be a suitable option. More investigation will be required for determining bedrock quality and surface elevations of the proposed area.

At Test Pit 5, the water level was found at 2.0 m depth and caving was encountered below water level, possibly due to very loose soil conditions. Allowable bearing pressure of soil near the water level will be very low due to loose soil and shallow and saturated water conditions.

5.4 Deep Foundations

Each foundation scheme should be considered in the design stage from feasibility, economical and practical standpoints. A deep foundation option can also be considered depending on site, grade, and loading conditions.

Based on the geotechnical investigation by test pitting, a deep foundation option may be required except at Test Pit 4, where bedrock was encountered at a shallow depth. When considering deep foundation options, loose and unsuitable soils will be allowed to remain in place (depends on working area) and would not require extensive dewatering. This is a particularly important consideration in Test Pits 3 and 5 where water was encountered at a shallow level.

The proposed structure may be supported by pile caps set onto high-capacity H piles, circular steel piles or pressure treated timber piles into the competent natural soils or into the bedrock. The actual pile-driving criteria would depend on the driving hammer and pile sizes. The criteria will be detailed when information related to deep foundation is available.

Deep foundations may also be considered for the commercial mixed use design structure near Test Pit 5 (near the beach area). Additional site investigation and analysis will be required to confirm the subsoil to provide the geotechnical parameters, such as bedrock depth, bedrock quality etc.

Fulltime geotechnical inspection must be provided by a qualified geotechnical engineer to validate the bearing capacity and confirm the site soil conditions during construction.

5.5 Hydrogeology

During test pitting, water levels were recorded at Test Pits 3 and 5. At the end of Beach Road, the water level was shallow in comparison to other investigated areas. Evaluation of hydrogeologic conditions will be important to understand due to changes in the subsurface soils resulting from development, in combination with the existing pervious and impervious layers. Reduced infiltration may impact groundwater depending on the development intensity. Further study in conjunction with detailed subsurface investigation shall be applied.

5.6 Excavation

The shallow excavations to install footings for structures and infrastructures are expected to be into native sand. Any water seepage in the Test Pit 5 area should be controllable by standard sump pumping techniques.

Natural sand in all test pit locations can be classified as Type 3 soil. Side slopes of temporary excavations must meet Health and Safety Regulations. Temporary excavations made in Type 3 soil and whose walls are sloped are required to have a slope with a minimum gradient of one horizontal to one vertical unit.

In wet silty and sandy soils such as those encountered in Test Pits 3 and 5 at 5.0 and 2.2 m depth respectively, side slopes may require flatter angles of about two to three horizontal to one vertical unit.

5.7 Site Preparation and Backfill

According to the laboratory test results, soil samples do not meet Granular B and A type soil standards. The results of sieve analyses are attached in Appendix C. Backfill material should meet with Granular B type 1 material. Backfill material should be utilized in structure and parking lot areas with fines particles less than 8% to reduce frost effects. Backfill materials shall be engineered fill placed with 100% compaction of a standard proctor density.

Before any construction begins, any soft or weak soils should be excavated under the direction of a geotechnical engineer down to sound material and then backfilled with engineered fill material.

5.8 Sidewall Slopes

Soils encountered in all test pit sites are classified as Type 3 soils. For excavation above the groundwater table in soil, the sidewalls can be sloped at 1H:1V. The water table was encountered at a shallow depth in Test Pit 5; sidewalls of slopes below the water table should stand at a 2H:1V slope. It may be necessary to provide flatter slopes to reduce sloughing or loosening of the sidewall soils in cases where groundwater is encountered.

5.9 Frost Penetration

Generally in the Terrace Bay area, frost penetration can reach up to 2.3 m below the exposed surface grade. For the most part, it should be noted that frost penetration is deeper in dry well-drained soils than in saturated soils.

5.10 Erosion Concern Areas

Erosion concern areas that are prone to soil erosion including and sensitive sedimentation are in upland areas near the shore line and the west-side shoreline at the main beach area.

Soil cut locations will require protective measures, particularly surrounding and upgradient of waterways and drainage paths. The primary erosion concern is areas of development that require excavation and stripping of vegetation layers near the shore line. Temporary erosion control measures and best management practices will be required during construction, which may require regulatory approvals from the Lakehead Regional Conservation Authority (LRCA) and the Ministry of Natural Resources (MNR) to mitigate and permit the construction project. Permanent erosion protection will be required where surface flow may be collected or channelized as a condition of post-development.

5.11 Landslide Concern Areas

Areas of landslide concern are defined as those susceptible to landslides and subsidence that could include movement of soil, rock or other geologic strata. Generally, the steeper, unsupported shoreline areas may have some landslide and lateral spreading potential. In the event

these conditions are present, development should be offset far enough from the shoreline such that stability will not be affected If development is adjacent to the shoreline areas, the development should be at safe offset from shoreline where instability will not be affected. This condition may warrant site-specific studies once individual projects have been identified.

5.12 Earth Pressure

Structures may be designed to resist lateral earth pressures. When a structure or retaining wall is to be built on different grade elevations, the design may be based on passive and active lateral earth pressures.

5.13 Drainage Consideration

Drainage is an important factor in pavement performance and service life. As a general recommendation, drainage should consist of positively-graded channels (ditches) adjacent to the pavement structure and connected to appropriate outlets to prevent water from infiltrating the sub-base of the pavement structure. The road cross-section shall have a crowned surface to ensure there is no surface water ponding. A crowned surface slope of 2 percent towards the drainage channel/ditch side is recommended. Triangular or trapezoidal-shaped ditches may be utilized, as appropriate, to accommodate storm water management.

Open ditches would ensure positive drainage for the pavement structure. Normally, ditch depth should be a minimum of 250 mm below the top of subgrade (bottom of granular fill). The roadway subgrade should be cut such that 3% cross fall drains towards the ditch.

Centerline drainage items used as water management conveyance, such as culverts, shall be installed in accordance with the treatments identified in OPSD 802 and 803, as applicable to the design.

5.14 Pavement Development Considerations

With the limited geotechnical investigation by test pitting, generally soil condition seems appropriate to use as subgrade. Performance Graded Asphalt Cement (PGAC) with a rating of 52-34 may be used. A minimum 5% of asphalt cement (AC) for both asphalt surface and binder course may be used

6.0 Closure

A description of limitations that are inherent in carrying out site investigation studies is given in Appendix A and this forms an integral part of this report.

All recommendations and insight provided in this report are of a conceptual nature for information purposes only, as such, further detailed geotechnical investigations shall be performed to determine the actual foundation needs of development.

It should be recognized that unanticipated conditions might be encountered during construction; therefore, it is recommended that TGCL be retained to observe construction and perform testing relative to geotechnical issues, as discussed in this report.

We trust that this satisfies your present needs. If you have any further questions or comments, please contact the undersigned at your convenience.

Respectfully submitted by:

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Appendix A:
Limitations of Report

Limitations

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the Client. Note that no scope of work, no matter how exhaustive, can identify all conditions below ground. Subsurface and groundwater conditions between and beyond the test pits may differ from those encountered at the specific locations tested, and conditions may become apparent during construction which were not detected and could not be anticipated at the time of the site investigation. Conditions can also change with time. It is recommended practice that TGCL be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the test pits.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

Unless otherwise noted, the information contained herein in no way reflects on environmental aspects of either the site or the subsurface conditions.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test pits may not be sufficient to determine all the factors that may affect construction methods and costs, e.g. the thickness of surficial soil layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

Similarly, TGCL cannot warranty the accuracy of information supplied by the client.

Appendix B:
Test Pit Logs

TEST PIT TP-1

CLIENT FORM Architecture
PROJECT NAME Terrace Bay Waterfront Development Study
PROJECT NUMBER 13-095-16E
PROJECT LOCATION Terrace Bay

DATE STARTED 05/29/13 **COMPLETED** 05/29/13 **GROUND ELEVATION** 210.031 m **TEST PIT SIZE**
EXCAVATION CONTRACTOR Norcon **GROUND WATER LEVELS:**
EXCAVATION METHOD Hitachi EX270LC Excavator **AT TIME OF EXCAVATION** —
LOGGED BY EO **CHECKED BY** AR **AT END OF EXCAVATION** —
NOTES Water table deeper than 6m **AFTER EXCAVATION** —

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (kPa)	DRY UNIT WT. (kN/m³)	SPT N-VALUE / PWR. CONTENT (%)
1		**SAND** - Fine grained, trace gravel, tanned, dry to dam, loose to compact	GB S1					
2		**SAND** - Coarse grained, some gravel, dark grey/ light brown, moist, compact	GB S2					
3								
4		**SAND** - Fine grained, trace silt, light grey, damp	GB S3					
5								
6								
		END TEST PIT - Extent of machine. Bottom of test pit at 6.00 m.	GB S4					

TEST PIT TP-2

CLIENT FORM Architecture
PROJECT NAME Terrace Bay Waterfront Development Study
PROJECT NUMBER 13-095-16E
PROJECT LOCATION Terrace Bay

DATE STARTED 05/29/13 COMPLETED 05/29/13 GROUND ELEVATION 201.2 m TEST PIT SIZE
EXCAVATION CONTRACTOR Norcon
EXCAVATION METHOD Hitachi EX270LC Excavator
LOGGED BY EO CHECKED BY AR
NOTES Water table deeper than 6m

GROUND WATER LEVELS:
AT TIME OF EXCAVATION —
AT END OF EXCAVATION —
AFTER EXCAVATION —

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (kPa)	DRY UNIT WT. (kg/m³)	SPT N VALUE / PLWC CONTENT (%)
0		**TOP SOIL** - sand, organics, dark brown, humid						
		SAND - Fine grained, some silt, trace organics and humus, reddish brown, loose, humid	GB S-1					
1		**SAND** - Fine grained, some silt, light grey, loose to very loose, moist						
			GB S-2					
2								
3								
4								
		SILTY SAND - Fine grained, light grey, damp	GB S-3					
5								
6								
		END TEST PIT - Extent of machine Bottom of test pit at 6.00 m.						

TEST PIT TP-3

CLIENT FORM Architecture
PROJECT NAME Terrace Bay Waterfront Development Study
PROJECT NUMBER 13-095-16E
PROJECT LOCATION Terrace Bay

DATE STARTED 05/29/13 **COMPLETED** 05/29/13 **GROUND ELEVATION** 197.7 m **TEST PIT SIZE**
EXCAVATION CONTRACTOR Norcan
GROUND WATER LEVELS:
EXCAVATION METHOD Hitachi EX270LC Excavator
AT TIME OF EXCAVATION 5.20 m / Elev 192.50 m
LOGGED BY EO **CHECKED BY** AR
AT END OF EXCAVATION —
NOTES Water table at 5.2m
AFTER EXCAVATION —

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (kPa)	DRY UNIT WT (kg/m³)	SPT N VALUE / PARTICLE CONTENT (%)
0		**TOP SOIL** - sand, organics, dark brown, humid						
		SAND - Fine grained, some silt, trace organics and humus, reddish brown, loose, damp						
1		**SAND** - Fine grained, trace silt, light grey, loose to compact, moist						
2			GB S-1					
3								
4		**SILT** - some clay, trace sand, light grey, wet	GB S-2					
5								
6		**SILT** - some clay, trace sand, grey, very soft, wet	GB S-3					
		END TEST PIT - Extent of machine Bottom of test pit at 6.00 m.						

TEST PIT TP-4

CLIENT FORM Architecture
PROJECT NAME Terrace Bay Waterfront Development Study
PROJECT NUMBER 13-095-16E
PROJECT LOCATION Terrace Bay

DATE STARTED 05/29/13 COMPLETED 05/29/13 GROUND ELEVATION 188.52 m TEST PIT SIZE
EXCAVATION CONTRACTOR Noiron
EXCAVATION METHOD Hitachi EX270LC Excavator
LOGGED BY EO CHECKED BY AR
NOTES Bedrock at 2.5m

GROUND WATER LEVELS:
AT TIME OF EXCAVATION —
AT END OF EXCAVATION —
AFTER EXCAVATION —

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (kPa)	DRY UNIT WT (kg/m³)	SPT N VALUE / PWDD CONTENT (%)
0		**TOP SOIL** - sand, organics, dark brown, humid						
		SAND - fine grained, trace silt, trace organics and humus, reddish brown, compact, damp						
		SAND - Fine grained, trace silt, light grey, loose to compact, moist	GB S-1					
2		**END TEST PIT** - Refusal at possible bedrock. Bottom of test pit at 2.50 m.	GB S-2					

TEST PIT TP-5

CLIENT FORM Architecture
PROJECT NUMBER 13-095-15E
PROJECT NAME Terrace Bay Waterfront Development Study
PROJECT LOCATION Terrace Bay

DATE STARTED 05/29/13 COMPLETED 05/29/13
EXCAVATION CONTRACTOR Norton
EXCAVATION METHOD Hitachi EX270LC Excavator
LOGGED BY EO CHECKED BY AB
NOTES Water table at 2m

GROUND ELEVATION 185 m TEST PIT SIZE
GROUND WATER LEVELS:
AT TIME OF EXCAVATION 2.00 m / Elev 183.00 m
AT END OF EXCAVATION —
AFTER EXCAVATION —

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (kPa)	DRY UNIT WT (kg/m³)	SPT N VALUE / Resist. Content (%)
0		**SAND** - Fine grained, trace silt, some organics, light grey, compact, humid						
1		**SAND** - Fine grained, trace silt, light grey, loose to compact, damp to saturated	GB S-1					
2			GB S-2					
3		**END TEST PIT** - Testpit was stopped due to caving, unstable testpit walls. Bottom of test pit at 3.10 m.						

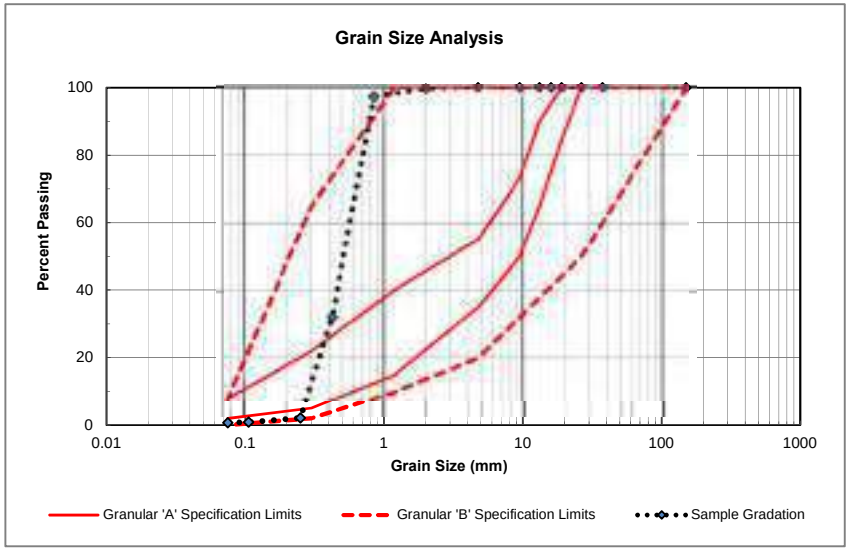
Appendix C:
Laboratory Test Results

TRUE GRIT CONSULTING LTD
1263 Innovation Drive
Thunder Bay, ON P7B 0A2
T 807.626.5640 F 807.623.5690

Grain Size Analysis Test Report

Client:	FORM Architecture
Project Description:	Terrace Bay Waterfront Study
True Grit Project No.:	13-095-16E
Location:	Terrace Bay
Material Type:	Testpit Sample
Source:	TP1-S1
Depth:	0m - 1m
Sampled By:	EO
Date Sampled:	29-May-13
Lab No.:	632A
Specification:	OPSS 1010, Table 2
Date Received:	7-Jun-13
Tested By:	BD
Date Tested:	12-Jun-13

Grain Size Analysis			
Sieve Sizes	Percent Passing		
(mm)	TP1-S1	'A' Spec.	'B' Spec.
150	100		100 - 100
37.5	100		
26.5	100	100 - 100	50 - 100
19	100	85 - 100	
16	100		
13.2	100	65 - 90	
9.5	100	50 - 73	
4.75	100	35 - 55	20 - 100
2	99.6		
1.18		15 - 40	10 - 100
0.85	97.1		
0.425	32.2		
0.3		5 - 22	2 - 65
0.25	2.1		
0.106	0.9		
0.075	0.7	2 - 8	0 - 8



Remarks: -Tested in accordance with LS-601/602
- 4.3% Moisture. 0% Gravel, 99.3% Sand, 0.7% Silt/Clay

CCIL

Results reviewed by:

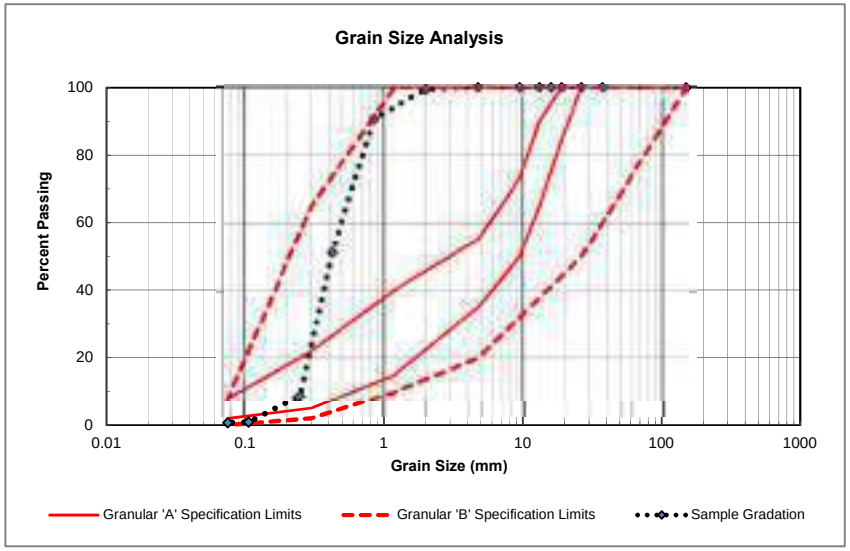
Shauna Gismondi
Supervisor, Materials Testing

TRUE GRIT CONSULTING LTD
1263 Innovation Drive
Thunder Bay, ON P7B 0A2
T 807.626.5640 F 807.623.5690

Grain Size Analysis Test Report

Client:	FORM Architecture
Project Description:	Terrace Bay Waterfront Study
True Grit Project No.:	13-095-16E
Location:	Terrace Bay
Material Type:	Testpit Sample
Source:	TP2-S2
Depth:	0.4m - 4m
Sampled By:	EO
Date Sampled:	29-May-13
Lab No.:	632B
Specification:	OPSS 1010, Table 2
Date Received:	7-Jun-13
Tested By:	SG
Date Tested:	12-Jun-13

Grain Size Analysis			
Sieve Sizes	Percent Passing		
(mm)	TP2-S2	'A' Spec.	'B' Spec.
150	100		100 - 100
37.5	100		
26.5	100	100 - 100	50 - 100
19	100	85 - 100	
16	100		
13.2	100	65 - 90	
9.5	100	50 - 73	
4.75	100	35 - 55	20 - 100
2	99.3		
1.18		15 - 40	10 - 100
0.85	90.6		
0.425	51.1		
0.3		5 - 22	2 - 65
0.25	8.8		
0.106	0.9		
0.075	0.7	2 - 8	0 - 8



Remarks: -Tested in accordance with LS-601/602
- 5.3% Moisture. 0% Gravel, 99.3% Sand, 0.7% Silt/Clay

CCIL

Results reviewed by:

Shauna Gismondi
Supervisor, Materials Testing

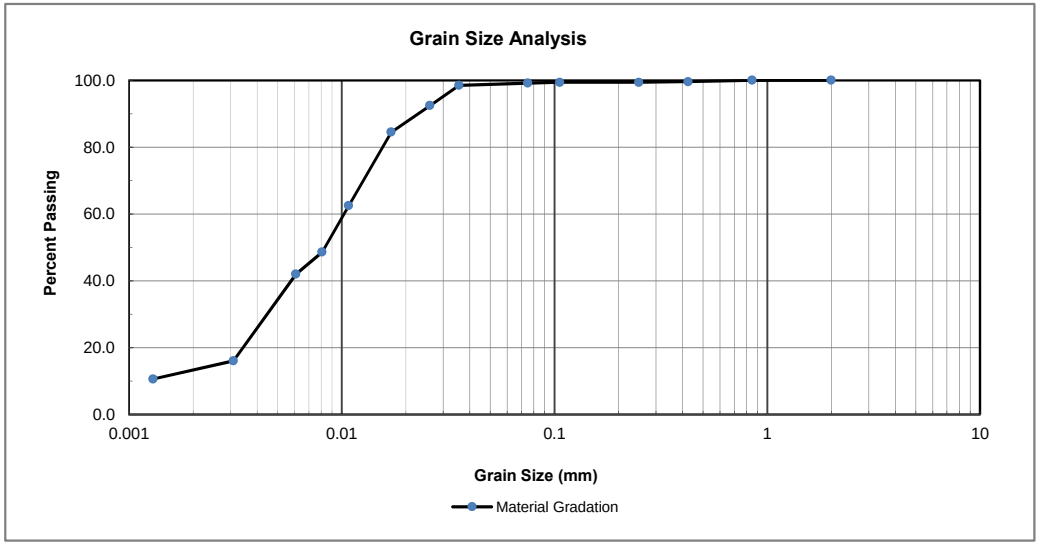
TRUE GRIT CONSULTING LTD
1263 Innovation Drive
Thunder Bay, ON P7B 0A2
T 807.626.5640 F 807.623.5690

Grain Size Analysis Test Report

Client:	FORM Architecture
Project Description:	Terrace Bay Waterfront Study
True Grit Project No	13-095-16E
Client Project No.:	N/A
Material Type:	Test Pit Sample
Source:	TP3-S3
Sample Location:	3.5m - 5.5m depth
Sampled By:	EO
Date Sampled:	29-May-13
Lab No.:	632C
Specification:	N/A
Date Received:	7-Jun-13
Tested By:	SG
Date Tested:	13-Jun-13

Sieve Analysis	
Sieve Sizes,mm	**Percent Passing**
2	100.0
0.85	100.0
0.425	99.6
0.25	99.4
0.106	99.4
0.075	99.2

Hydrometer Analysis	
Particle Sizes,mm	**Percent Smaller**
0.0356	98.5
0.026	92.5
0.0171	84.5
0.0108	62.5
0.0081	48.6
0.0061	42.0
0.0031	16.0
0.0013	10.6



Remarks: Sieve analysis combined with hydrometer analysis on the soil fraction passing 75 µm sieve to obtain the complete grain size distribution data.

Initial Moisture (%) - 21.2%
% Sand = 0.8
% Silt = 86.5
% Clay = 12.7

Results reviewed by:

Shauna Gismondi
Supervisor, Materials Testing

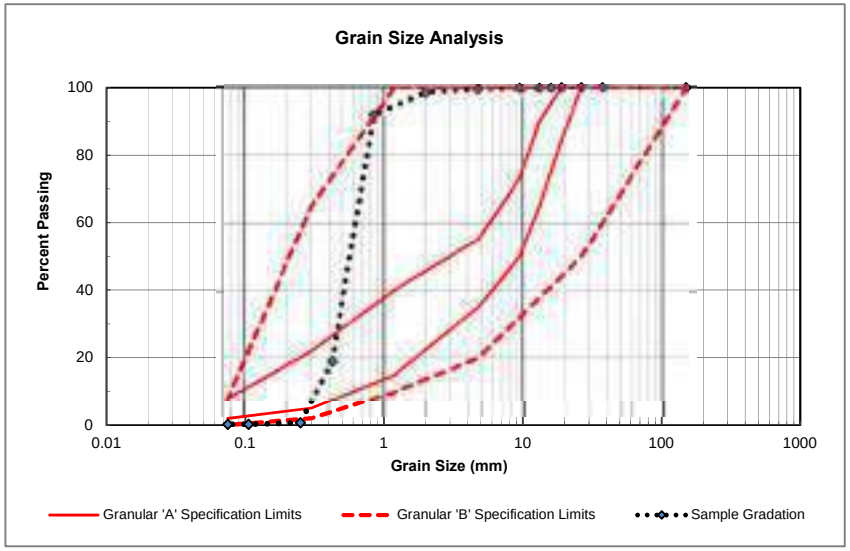
TRUE GRIT CONSULTING LTD

1263 Innovation Drive
Thunder Bay, ON P7B 0A2
T 807.626.5640 F 807.623.5690

Grain Size Analysis Test Report

Client:	FORM Architecture
Project Description:	Terrace Bay Waterfront Study
True Grit Project No.:	13-095-16E
Location:	Terrace Bay
Material Type:	Testpit Sample
Source:	TP4-S2
Depth:	0.5m - 2.5m
Sampled By:	EO
Date Sampled:	29-May-13
Lab No.:	632D
Specification:	OPSS 1010, Table 2
Date Received:	7-Jun-13
Tested By:	BD
Date Tested:	12-Jun-13

Grain Size Analysis			
Sieve Sizes	Percent Passing		
(mm)	TP4-S2	'A' Spec.	'B' Spec.
150	100		100 - 100
37.5	100		
26.5	100	100 - 100	50 - 100
19	100	85 - 100	
16	99.8		
13.2	99.8	65 - 90	
9.5	99.8	50 - 73	
4.75	99.4	35 - 55	20 - 100
2	98.4		
1.18		15 - 40	10 - 100
0.85	91.8		
0.425	19.1		
0.3		5 - 22	2 - 65
0.25	0.7		
0.106	0.2		
0.075	0.2	2 - 8	0 - 8



Remarks: -Tested in accordance with LS-601/602
- 5.9% Moisture. 0.6% Gravel, 99.2% Sand, 0.2% Silt/Clay

Results reviewed by:

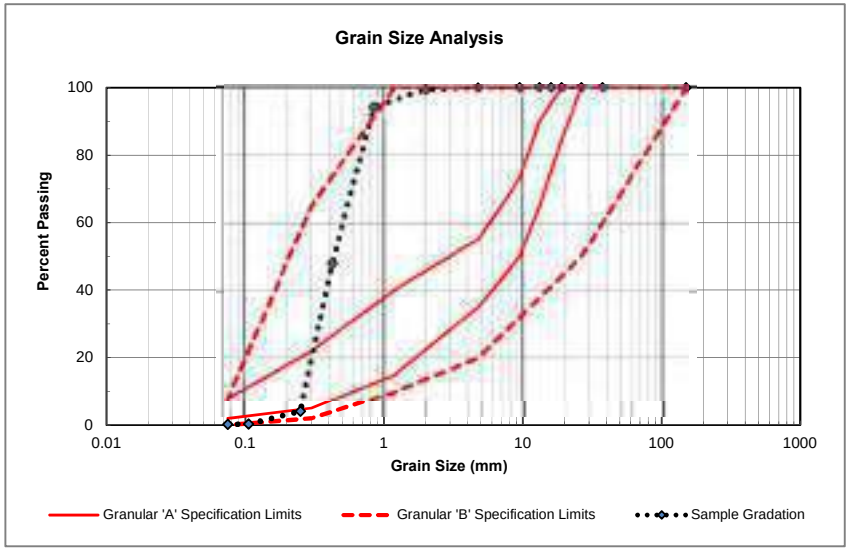
Shauna Gismondi
Supervisor, Materials Testing

TRUE GRIT CONSULTING LTD
1263 Innovation Drive
Thunder Bay, ON P7B 0A2
T 807.626.5640 F 807.623.5690

Grain Size Analysis Test Report

Client:	FORM Architecture
Project Description:	Terrace Bay Waterfront Study
True Grit Project No.:	13-095-16E
Location:	Terrace Bay
Material Type:	Testpit Sample
Source:	TP5-S2
Depth:	0.3m - 3.5m
Sampled By:	EO
Date Sampled:	29-May-13
Lab No.:	632E
Specification:	OPSS 1010, Table 2
Date Received:	7-Jun-13
Tested By:	BD
Date Tested:	12-Jun-13

Grain Size Analysis			
Sieve Sizes	Percent Passing		
(mm)	TP5-S2	'A' Spec.	'B' Spec.
150	100		100 - 100
37.5	100		
26.5	100	100 - 100	50 - 100
19	100	85 - 100	
16	100		
13.2	100	65 - 90	
9.5	100	50 - 73	
4.75	99.9	35 - 55	20 - 100
2	99.2		
1.18		15 - 40	10 - 100
0.85	94.1		
0.425	47.9		
0.3		5 - 22	2 - 65
0.25	4.1		
0.106	0.3		
0.075	0.2	2 - 8	0 - 8



Remarks: -Tested in accordance with LS-601/602
- 3.8% Moisture. 0.1% Gravel, 99.7% Sand, 0.2% Silt/Clay

Results reviewed by:

Shauna Gismondi
Supervisor, Materials Testing

Figure:
Test Pit Locations

Plot Size: ANSI A (8.50 X 11.00 INCHES)

File No. TEST PIT LOCATION

FORM Architecture
Terrace Bay Waterfront Development
Terrace Bay

Test Pit Locations

TRUE GRIT CONSULTING LTD

Designed By: TR
Approved By: AR
Date: June 24, 2014

N

Scale

0 75 150 m

SCALE 1:7500

FIGURE 1

Baird

oceans
engineering
lakes
design
rivers
science
watersheds
construction

Terrace Bay Waterfront Development Feasibility Study

Coastal Engineering

March 11, 2014
12044.101

Terrace Bay Waterfront Development Feasibility Study

Coastal Engineering

Prepared for

The Planning Partnership

Prepared by

W.F. Baird & Associates Coastal Engineers Ltd.

For further information please contact
Fiona Duckett at (905) 845-5385

12044.101

Revision	Date	Status	Comments	Reviewed by	Approved by
0	1 Feb 2013	Working Draft	Client review	FJLD	
1	18 Dec 2013	Draft	Client review	FJLD	MOK
2	11 Mar 2014	Final			FJLD

TABLE OF CONTENTS

1.0 INTRODUCTION

The Township of Terrace Bay is located on the north shore of Lake Superior, approximately 225 km east of Thunder Bay. The town is located on either side of the Trans Canada Highway and extends south, approximately 1.5 km, to Lake Superior. In 2013, the Township retained The Planning Partnership, with Baird & Associates to complete a Waterfront Development Feasibility Study.

The purpose of the study is to create a community more attractive for tourists to visit, attract new business investment and to create a sustainable waterfront that residents will use and enjoy in all the four seasons. The Township intends to develop a Lake Superior Waterfront Area to create a regional tourist destination. This currently includes a full service marina with parking. Baird's scope of work is the coastal engineering components of the study including:

- Review of previous coastal engineering studies for marina alternatives;
- Review of available information and data to define coastal conditions (bathymetry, water levels waves);
- Delineation of natural hazards;
- Development of concept level marina alternatives; and
- Assessment of permitting requirements related to the marina development.

This report summarizes our findings.

2.0 SITE DESCRIPTION

The study area shown in Figure 2.1, includes the Lake Superior shoreline from the west bank of the Agauasabon River to the eastern limit of Golf Course Bay, and extends inland to include approximately 1 km of the Aguasabon River.

A key focus of the coastal study is the development of concept level marina alternatives. Three possible locations for a marina were identified with input from the Township. A site reconnaissance was undertaken on December 13, 2012 and a brief description of each site follows.

Aguasabon River

This site is located at the mouth of the Aguasabon River. The river is dammed upstream for hydropower. There is a bay head beach located at the river mouth. Docks located on the north side of the beach are used by boats launching at the site. The docks were pulled out for winter (see Figure 2.2. This site has good access from shore and adequate space for land facilities including parking. Issues include concerns related to sedimentation, gravel shoals and shallow depths in the river; the dynamic beach that partially obstructs the river mouth; and high flow events. Based on discussions with Ontario

Power Generation (OPG), they would have significant issues with a marina in the river. DFO and MNR would have to be contacted to identify permitting concerns.

Terrace Bay Beach

The Aguasabon River empties into a bay contained between two rock headlands. There is a 600 m long sand beach at the bay head (see Figures 2.1 and 2.3). This site has good access from shore and adequate space for land facilities including parking. Although this site could potentially be used to develop a marina, this would result in significant impacts to the existing beach, including some loss of beach. Other issues include concerns related to sedimentation and maintaining adequate depths. Previous hydrographic surveys (EHG, 1991) show sand bars offshore of the beach. Discussions with DFO and MNR would be required to identify permitting concerns.

Golf Course Bay

Golf Course Bay is located east of Terrace Bay Beach. The bay is approximately 150 m across and there is a sand beach at the bay head. The bay location is shown in Figure 2.1 and photos are provided in Figures 2.4, 2.5 and 2.6. The hydrographic survey completed for this project demonstrates that depths are adequate for a marina (see Section 3.1). Access to the bay by land is challenging. The topography is steep, there is currently no road access and the shoreline is characterized by a series of steep terraces which are the remains of historic lake shorelines. In addition, there is limited space for land based facilities, though this could be addressed. Discussions with DFO and MNR would be required to identify permitting concerns.

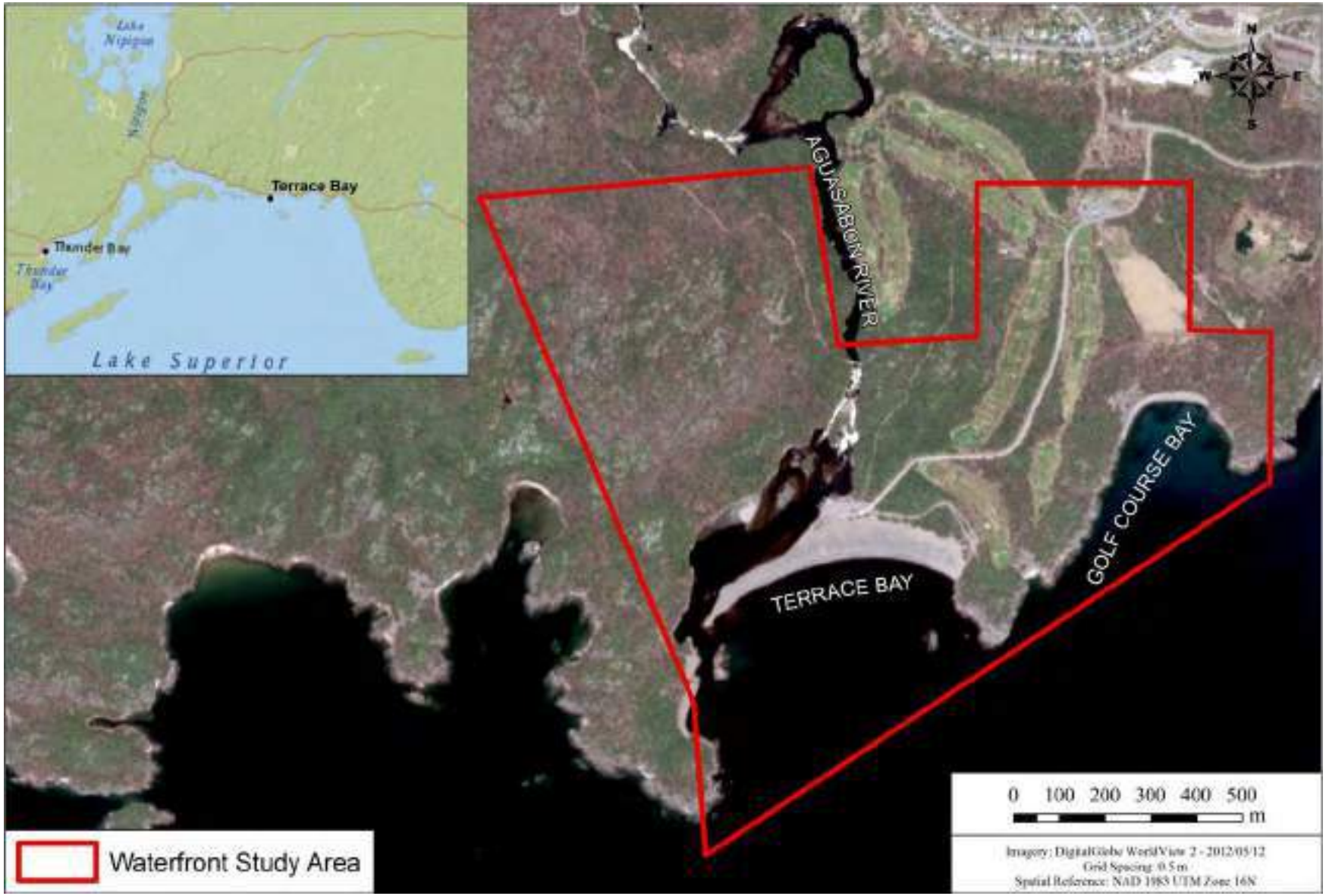


Figure 2.1 Map showing Site Location

Figure 2.2 Docks on Aguasabon River (Dec. 12, 2012)

Figure 2.3 View west on Terrace Bay Beach (Dec. 12, 2012)

Figure 2.4 Golf Course Bay (Dec. 12, 2012)

Figure 2.5 Beach at Golf Course Bay (Dec. 12, 2012)

Figure 2.6 Backshore at Golf Course Bay (Dec. 12, 2012)

3.0 BACKGROUND STUDIES AND COMMITTEE FEEDBACK

3.1 Background Studies

This section provides a summary of previous studies and relevant background reports provided by the Township for review.

Marina Site Development, Lake Superior Access Study, Township of Terrace Bay (Cumming Cockburn Limited, 1989)

Alternative locations for a marina to support sport fisheries were assessed in response to the District Fisheries Management Plan. Three pre-determined marina sites were reviewed considering engineering requirements. The three sites included: the Aguasabon River, Lyda Bay and Hydro Bay. The study considered a basic marina (access road, boat ramp, temporary mooring, no breakwater protection). A more significant marina development with capacity for 30 boats was also considered. The study included limited hydrographic surveys at each location.

The study concluded the Aguasabon River was not suitable for full development due to issues related to the stability of the sand beach and flow conditions in the river, however more limited development was considered viable. Lyda Bay was recommended as a good alternative, with sufficient space for a full marina and on-shore facilities. Its remote location and distance from Terrace Bay were identified as drawbacks. Hydro Bay was also identified as a possible location for a full marina, though it was noted that it is more exposed than Lyda Bay. Further study of the currents from the hydro generating station was recommended. The estimated costs for the limited development alternatives were less than $100,000 and the full development alternatives were $1.3 million at Lyda Bay and $1 million at Hydro Bay. These costs were preliminary and are outdated.

Coastal Engineering and Hydraulic Study (Environmental Hydraulics Group, 1991)

The Environmental Hydraulics Group study was prepared as follow-up to a 1990 study
prepared by Cumming Cockburn Limited (CCL), which reportedly concluded the preferred location for a marina was the mouth of the Aguasabon River. The 1990 CCL study was not available for review. The objective of the 1991 study was to develop feasible alternatives for a marina located at the river mouth. It included an assessment of engineering constraints considering river hydraulics and coastal processes. Concerns identified included: a submerged rock shoal within the proposed navigation channel, maintenance of the navigation channel, stability of the sand beach at the river mouth and impacts on fish habitat. The preferred solution included capital dredging to create a navigation channel from the proposed marina location in the river to the bay, and maintenance dredging as required to maintain a minimum 2 m depth in the navigation channel. The estimated cost of this alternative was $150,000 to $200,000 for the capital dredging plus the cost of annual maintenance dredging to maintain the channel. Safety concerns related to operation of the Ontario

Hydro facility located in the Aguasabon River and possible issues related to high flows were discussed briefly.

Planning Partnership (2000)

The Planning Partnership Development Feasibility Study included an assessment of three alternative locations for a marina development: Terrace Bay Beach, Danny's Cove and Lyda Bay. Danny's Cove was selected as the preferred location for the marina based on: adequate space for 45 slips, naturally protected from west and southwest waves, adequate water depth and a navigable entrance. The marina included a rubblemound breakwater, floating docks, harbour master building, boat launch, fuel facilities, power and water service and sewage pumpout.

IBI Group (2008)

Five alternative marina locations were evaluated by the IBI Group in 2008. A complete copy of the report was not available. The report includes marina concepts for Lyda Bay, between Danny's Cove and Lyda Bay, Danny's Cove, Terrace Bay Beach and Golf Course Bay. Each alternative includes breakwaters, docks for approximately 44 slips, a boat ramp, gas and pumpout.

3.2 Committee Feedback

The consulting team met with the Feasibility Study Committee on December 12, 2012. Ideas related to the marina are summarized below:

- Three possible sites within the study area have been identified as potential marina sites: Terrace Bay Beach, Aguasabon River and Golf Course Bay.
- DFO has expressed concerns with the Aguasabon River site.
- A phased approach may be used. Consider sustainability, maintenance requirements. Committee members are interested in a small marina with potential for future expansion.
- A market study will be required to ascertain demand for a marina and its viability.
- Marina should provide access to all, i.e. not cut off from public use, provide unfettered use of the area.
- Potential partners include MNR, NMCC, Provincial and Federal funding partners. It was noted that it is difficult to secure funding for projects that require more than 3 years to complete.

4.0 DATA

4.1 Bathymetry

Bathymetry is an important consideration when evaluating alternative marina locations. The approaches and marina site must have adequate depths to accommodate the design boat draft. Alternatively dredging or blasting may be considered but these result in added costs and additional permitting requirements.

The Canadian Hydrographic Service (CHS) is the authoritative source for historical bathymetric surveys. A search of their archives revealed two surveys providing nearshore depths, collected in 1913-1914 at scales of 1:48,000 (ID#: FS407) and 1:73,000 (ID#: FS370). These field sheets are shown in Appendix A. The data is sparse and there is insufficient information to develop marina concepts.

CCL (1989) includes bathymetric surveys for Hydro Bay, Lyda Bay and the mouth of the Aguasabon River. The surveys were completed in 1988.

Bathymetry data were collected by True Grit Consulting Limited on May 23, 2013 and June 19, 2013 at the three potential marina locations. A map showing the bathymetry data is provided in Figure 4.1. All depths are relative to Canadian Geodetic Datum (CGD).

4.2 Water Levels

Water levels on Lake Superior vary in the long-term and seasonally in response to general climatic conditions, and in the short term due to the passage of individual storm events. The typical seasonal variation on Lake Superior is approximately 0.3 m, with the average low occurring in March and the average high occurring in September. Over the past 100 years or so, the monthly mean lake level has varied over a range of about 1.2 m (from elevation 182.3 m CGD to 183.5 m CGD) as shown in Figure 4.2.

During a storm the lake level increases locally above the mean lake level due to wind setup or storm surge. Based on a Ministry of Natural Resources (MNR) report (1989), the 100-year return period storm surge at Rossport (the nearest station to Terrace Bay) is 0.76 m.

The flood level is defined as the peak instantaneous water level combining both the monthly mean lake level and the storm surge (MNR, 1989). The water level used to calculate the flood hazard (see Section 5.1) is the 100-year return period flood level. Based on MNR (1989), the 100-year flood level for Rossport (the nearest station to Terrace Bay) is 184.10 m CGD. The flood level does not include any allowance for wave action at the shoreline (i.e., wave height above mean water level, wave runup, or wave spray).

Figure 4.1 Bathymetry Data from True Grit Consulting Limited (May /June 201

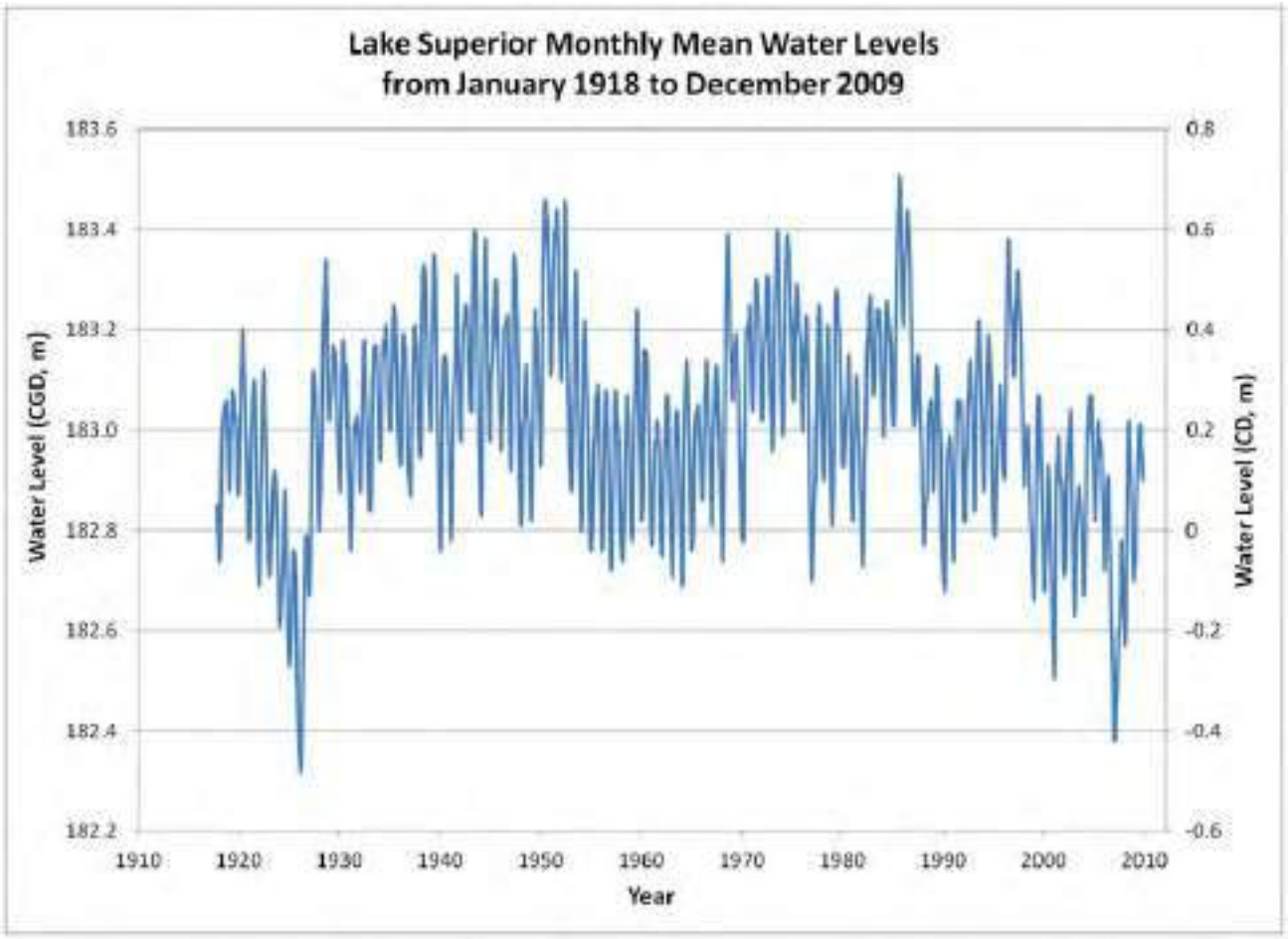


Figure 4.2 Monthly Mean Water Levels on Lake Superior (1918 to 2009)

4.3 Waves

Waves are the key driving force in establishing wave runup values for flood hazard limits and in the design of coastal structures. A wave climate database was developed for Lake Superior by the Ontario Ministry of Natural Resources (MNR, 1988). The database provides an hourly estimate of the wave conditions (height, period and direction) in deep water at locations throughout the lake for the 22 year period from 1962 to 1983. The deepwater wave hindcast location closest to the project site is just offshore of Rossport, which is west of Terrace Bay.

The frequency of occurrence of the deep water wave heights from the various compass directions are summarized as a wave rose in Figure 4.3. The time series below the rose indicates the quality of the data coverage (i.e., gaps in the coverage due to missing data; for example "100%" represents no gaps in the data). The time series shows that no data exist for the winter months.

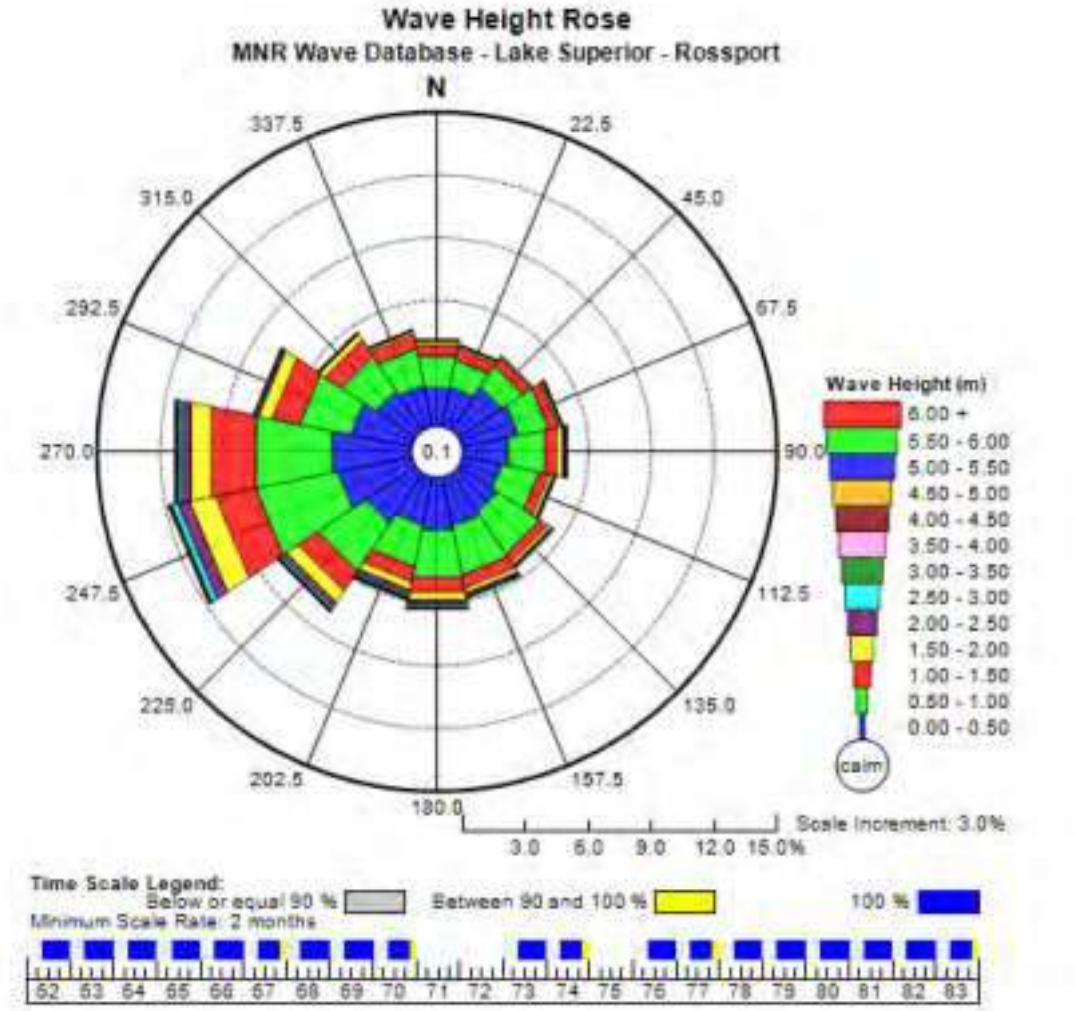


Figure 4.3 Wave Height Rose based on MNR Wave Hindcast Offshore of Rossport (1962-1983)

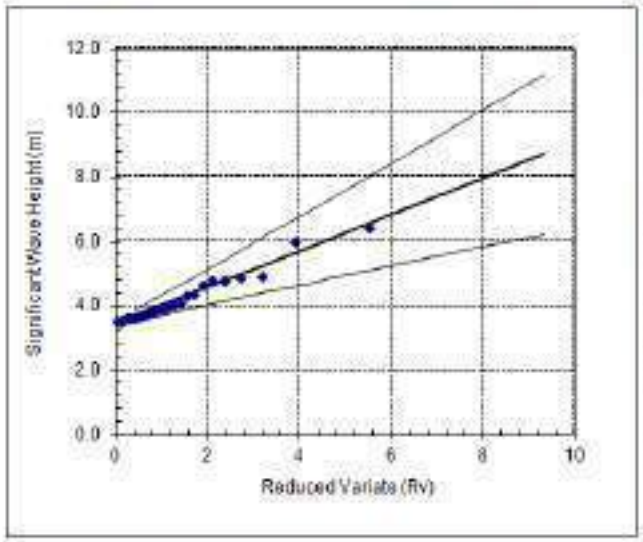
Most frequently, waves are from the west, with significant occurrences from the south and east. From all of these directions, offshore waves can exceed 3 m, with larger waves coming from the west.

A storm listing was generated based on the wave climate database. A peak-over-threshold (POT) analysis was then used to determine the wave height for a range of return periods. The results of the POT analysis are provided.

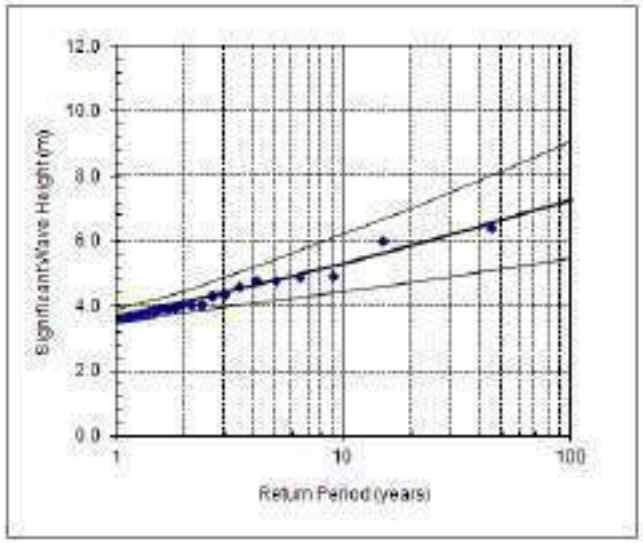
The 20-year return period deep water significant wave height is 5.9 m. It is noted that a 20 year hindcast was used in the POT analysis and the wave data did not include winter waves. There is a higher level of uncertainty for the longer return period events. This data should not be used for design purposes.

Peak over Threshold Extreme Value Analysis

Data Set: MNR Wave Database - Lake Superior - Point 3 - Rossport **Three Parameter Weibull Distribution**



Total Years of Data:	22
Total Storm Events:	35
Total No. Events Selected:	35
Events per year:	1.59
Sample Statistics	
Mean:	4.07
Maximum:	6.42
Minimum:	3.52
s:	0.69
Sample skewness:	0.00
Weibull Parameters	
Shape:	0.65
Scale:	0.561
Location:	3.458
Goodness of Fit	
Correlation:	0.988



Return Period

		Confidence Limit	
Tr	Hs (m)	Upper	Lower
1	3.69	3.9	3.5
2	4.12	4.6	3.8
5	4.78	5.4	4.2
10	5.32	6.2	4.4
20	5.87	7.0	4.7
25	6.06	7.3	4.8
50	6.64	8.2	5.1
100	7.25	9.0	5.4
200	7.86	10.0	5.8
500	8.70	11.2	6.2

Figure 4.4 POT Extreme Value Analysis for MNR Wave Data Offshore of Rossport

Baird

5.0 NATURAL HAZARD SETBACKS

Hazardous lands adjacent to the shorelines of the Great Lakes – St. Lawrence River System are those lands that are impacted by flooding, erosion, and/or dynamic beach hazards. The limit of the hazardous lands is the maximum of the erosion, flood or dynamic beach hazards as defined by the *Provincial Policy Statement* (2005). The Aguasabon River runs through the study area, and development is also restricted to areas outside the river flood hazard.

The *Provincial Policy Statement* (2005) states that development will generally be directed to areas outside of hazardous lands adjacent to the shorelines of the Great Lakes – St. Lawrence River. When development is proposed within hazardous lands, the protection works standard requires a reasonably safe combination of protection works, stable slope, building setback and access for maintenance (Provincial Policy Statement, 2005).

Although a detailed assessment of the hazard limits is outside the scope of this study, a preliminary assessment using standard approaches was undertaken to guide the planning process. A detailed assessment would be required prior to the development of detailed plans. The estimated hazard limits are shown in Figure 5.1 and discussed in the following sections.

5.1 Flood Hazard Limit

5.1.1 Great Lakes

The flood hazard limit is defined as the 100-year flood level plus an allowance for wave uprush and other related hazards. The 100-year flood level for Terrace Bay, as defined in MNR (1989) is 184.1 m CGD (refer to Section 4.2). The *Technical Guide* (MNR, 2001) requires a flooding allowance of 15 m, measured horizontally from the location of the 100-year flood level, or wave uprush may be determined by undertaking a study using accepted engineering and scientific principles.

The flood hazard limit was plotted for the study area using the 15 metre allowance for wave uprush and other water related hazards. A site specific engineering analysis to more accurately define the wave uprush was completed for specific areas near Golf Course Bay, where marina facilities are proposed.

Wave uprush was calculated using Eurotop (2007) for the 100-year flood level (184.1 m CGD) and an offshore significant wave height (H_{m0} = 6.4 m) and offshore peak wave period (T_P = 11 s). This approach uses the 2% wave uprush ($R_{2\%}$), which is the uprush that is reached or exceeded 2% of the time. Wave conditions are based on a 25-year return period wave. A shore slope of 1:5 (V:H) was used based on the True Grit topographic and bathymetric survey (May/June 2013).

The predicted wave uprush elevation, plotted in Figure 5.1 was 192.2 m CGD. The flood limit estimated using the predicted wave uprush elevation is similar to the flood limit defined using the 15 m wave uprush allowance (also plotted). The calculated wave uprush limit has been used to define the flood hazard setback in the vicinity of the marina development in Golf Course Bay as shown in Figure 5.1; for all other shorelines, the 15 m setback is used.

5.1.2 Aguasabon River

The Aguasabon River runs through the study area as shown in Figure 2.1. Ontario Power Generation (OPG) operates a dam and generating station on the Aguasabon River, approximately 3 km north of the river mouth on Lake Superior.

Flood mapping for the Aguasabon River was provided by Ontario Power Generation. The Probable Maximum Flood (PMF) Water Surface was identified by OPG as the prudent flood level for planning purposes. An incremental Inundation Area due to Dam Break which extends further inshore has also been plotted by OPG, however it was not used in this study. The PMF limit is shown in Figure 5.1.

5.2 Erosion Hazard Limit

The erosion hazard is calculated as the sum of the stable slope allowance plus an erosion allowance of 100 times the average annual recession rate, or a minimum erosion allowance of 30 m if sufficient recession data is not available (MNR, 2001).

The shoreline observed during the site reconnaissance was either Canadian Shield comprised of igneous and metamorphic rock or dynamic beach. Although bedrock does erode (albeit at a slower rate than cohesive shorelines), erosion rates for Canadian Shield are low, and for the purposes of this study, it has been assumed that either the dynamic beach hazard or the flood hazard will govern. For any shorelines that are not bedrock or beach, a detailed assessment of the shoreline erosion hazard should be completed prior to design of any structures that may be located within the natural hazard limit.

5.3 Dynamic Beach Hazard Limit

To protect development from dynamic beach hazards, the *Provincial Policy Statement* directs that development and site alterations will not be permitted within the dynamic beach. As outlined in the *Technical Guide* (MNR, 2001), for a beach to be considered a dynamic beach, it must satisfy the three following criteria:

- "Beach or dune deposits exist landward of the water line (e.g., land/water interface); AND
- Beach or dune deposits overlying bedrock or cohesive materials are equal to or greater than 0.3 m in thickness, 10 m wide and 100 m in length along the shoreline; AND
- Where the maximum fetch distance measured over an arc extending 60 degrees on either side of a line perpendicular to the shoreline is greater than 5 km"

Both beaches in the study area (Golf Course Bay and Terrace Bay) are dynamic beaches.

The dynamic beach hazard limit is defined as 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 30 metre dynamic beach allowance, plus a 100-year erosion allowance. The dynamic beach allowance may also be determined by undertaking a site specific study using accepted scientific and engineering principles.

The dynamic beach hazard limit was delineated using a 15 metre allowance for wave uprush plus a 30 metre dynamic beach allowance, measured landward from the 100-year flood level. We are not aware of erosion at the beaches and it has been assumed that the beaches are stable. An assessment of beach stability and any impacts of proposed structures on the beach should be undertaken prior to the development of detailed plans. The dynamic beach hazard limit is shown in Figure 5.1.

Figure 5.1 Flood and Dynamic Beach Hazard Limits

6.0 MARINA REQUIREMENTS AND ALTERNATIVES

6.1 General Requirements

The Township is interested in developing a "full service marina with parking", as specified in the Terms of Reference. The marina capacity was not specified and is dependent on the business analysis. A sensitivity analysis was undertaken and a range of marina sizes were developed along with an opinion of probable cost.

The marina would accommodate local residents and some transient and tourist boaters. Facilities include: a rubblemound breakwater, floating docks, fuel pumps and storage, sanitary pump-out, steel sheet pile wall for transient and temporary dockage.

6.2 Site Selection

A number of studies have been completed since 1989, evaluating marina alternatives for Terrace Bay (see Section 3). These studies considered locations at Terrace Bay Beach, the Aguasabon River, Lyda Bay, Hydro Bay, Danny's Cove and Golf Course Bay.

For this study, only sites within the study area (shown in Figure 2.1) were considered. These included: the Aguasabon River, Terrace Bay Beach and Golf Course Bay (see Section 2 for site descriptions). The sites were evaluated using technical criteria as summarized in Table 6.1.

Table 6.1 Evaluation of Marina Location Alternatives

Criteria	Aguasabon River	Terrace Bay Beach	Golf Course Bay
Sufficient Water Area	- limited capacity - up to approx. 12 boats	- yes - capacity for > 50 boats	- yes - capacity for > 50 boats
Protected Basin	- not exposed to significant wave action - OPG dam and generating station located upstream (flood risk)	- exposed site on Lake Superior - breakwater required	- exposed site on Lake Superior - breakwater required
Adequate Depth	- depth restrictions - gravel bars and shoals deposit in river - capital dredging required - maintenance dredging required to maintain required depths	- yes - located marina offshore of beach and sand bars	- yes
Access to Navigable Water	- depth restrictions - capital and maintenance dredging required to maintain access	- yes	- yes
Land Base	- adequate space is available	- adequate space is available - Terrace Bay Beach is a unique natural feature (600 m long beach) which would be impacted by a marina	- adequate space is available - topography presents some challenges

Based on the assessment above and discussions with the Client, the location at Golf Course Bay was selected as the preferred location for the marina. The Aguasabon River location presents a number of challenges; there is limited space available, depths and sedimentation in the river are a concern as is navigable access, and OPG indicated significant concerns with locating a marina downstream of the dam. The Terrace Bay beach location is a feasible alternative, however the beach is a unique natural feature that would be negatively impacted by a marina and this location was eliminated following discussions with the Client.

6.3 Alternatives

Six alternative marina concepts were developed for the location in Golf Course Bay. The key difference between the alternatives is the number of slips and the size of boats that can be accommodated. The six alternatives shown in Figures 6.1 to 6.6 are discussed below. This report describes marine facilities for the marina. Onshore facilities including the club house will be addressed by the Planning Partnership.

An opinion of probable cost for the marine facilities only was developed for each alternative and includes a 30% contingency. Considering the site location, length of

breakwater and resulting quantity of stone required, it is more likely cost effective to develop a new quarry for the project. An opinion of probable cost, assuming development of a new quarry for the project is presented in Table 6.2. The assumed cost for the development of a new quarry is $1,000,000 capital cost to locate, mobilize and close a new quarry.

Alternative I

Alternative I, shown in Figure 6.1 is the largest alternative, with 24 slips for 40 ft boats and 16 slips for 50 ft boats. Two rubblemound breakwaters (340 m and 125 m) in length provide shelter from waves. Marina facilities include floating docks, temporary docking for transient boats, parking, winter storage area for boats, jib crane, fuel and sanitary pumpout, power and water. Onshore facilities such as a club house/restaurant are being developed by The Planning Partnership. The estimated cost of this alternative is $24 million. The most costly item is the breakwater. Because the site is exposed and in deep water, the breakwater cross-section is large.

Alternative II

Alternative II, shown in Figure 6.2 has a similar capacity to Alternative I, providing 14 slips for 40 ft boats and 28 slips for 50 ft boats. A 310 m rubblemound breakwater provides shelter from waves. Marina facilities include floating docks, temporary docking for transient boats, parking, winter storage area for boats, jib crane, fuel and sanitary pumpout, power and water. Onshore facilities such as a club house/restaurant are being developed by The Planning Partnership. The estimated cost of this alternative is $16 million.

Alternative III

Alternative III, shown in Figure 6.3 has 20 slips for 30 ft boats. A 165 m rubblemound breakwater provides shelter from waves. Marina facilities include floating docks, temporary docking for transient boats, parking, winter storage area for boats, power and water. Onshore facilities such as a club house/restaurant are being developed by The Planning Partnership. The estimated cost of this alternative is $8 million.

Alternative IV

Alternative IV, shown in Figure 6.4 has 30 slips for 30 ft boats. A 180 m rubblemound breakwater provides shelter from waves. Marina facilities include floating docks, temporary docking for transient boats, parking, winter storage area for boats, power and water. Onshore facilities such as a club house/restaurant are being developed by The Planning Partnership. The estimated cost of this alternative is $10 million.

Alternative V

Alternative V, shown in Figure 6.5 is a minimal option. It has 10 slips for 30 ft boats. A 130 m rubblemound breakwater provides shelter from waves. Marina facilities include floating docks, temporary docking for transient boats, parking, power and water. Onshore facilities such as a club house/restaurant

are being developed by The Planning Partnership. The estimated cost of this alternative is in the range of $6 million.

Alternative VI

Alternative VI, shown in Figure 6.6 is a second alternative for a small marina with 10 slips for 30 ft boats. A 140 m rubblemound breakwater provides shelter from waves. Marina facilities include floating docks and temporary docking for transient boats parking, power and water. The marina has been shifted northward into the bay where the water is shallower. This results in lower costs for the breakwater structure. The estimated cost of this alternative is in the range of $5 million.

Alternative Approach to Breakwater Construction

As shown in Table 6.2, the largest cost item in each of the alternatives is the breakwater. An alternative approach to the breakwater construction, consisting of sinking a decommissioned ship to provide shelter from waves was considered. Although not conventional, this approach was investigated as a possible cost saving option. It has been used at a couple of sites on the Great Lakes including Ontario Place in Toronto and Port Credit Harbour Marina. At Port Credit, a 170 m long ship filled with crushed rock was sunk onto a stone mattress placed on the lakebed in 1962.

This alternative is contingent on the availability of a ship and the cost of the ship is difficult to assess. The estimated cost of the stone fill and mattress for a 170 m long ship is in the range of $1.8 million, so it is not clear that this option would result in significant cost savings. Another consideration over the long term would be possible issues with the hull cracking.

6.4 Summary

Three sites were considered for the marina development: the Aguasabon River, Terrace Bay Beach and Golf Course Bay. Based on the evaluation of alternatives presented in Section 6.2 and discussions with the Client, the location at Golf Course Bay was selected as the preferred location for the marina.

The estimated cost of developing a marina in Golf Course Bay ranges from $16 million for a 42 slip marina with full amenities (Alternative II) to $5 million for a 10 slip marina with limited amenities (Alternative VI). Alternative I, which provides the same number of slips as Alternative I is in the range of $24 million.

The most costly item in all cases was the rubblemound breakwater. Golf Course Bay is directly exposed to wave action from Lake Superior. In addition, the bay is relatively deep. This provides adequate depths for boat draft, however it also results in a large breakwater cross-section, requiring large volumes of stone for construction.

Some of the bays to the west of Terrace Bay may offer more natural shelter and a more economically viable alternative. However, considering the exposure on Lake Superior, a breakwater would be required in any case.

It is noted that this study presents concept level alternatives. Additional studies will be required to develop preliminary and detailed designs including but not limited to a detailed wave analysis, nearshore wave transformation, geotechnical investigations and an assessment of any impacts of proposed structures on sediment processes.

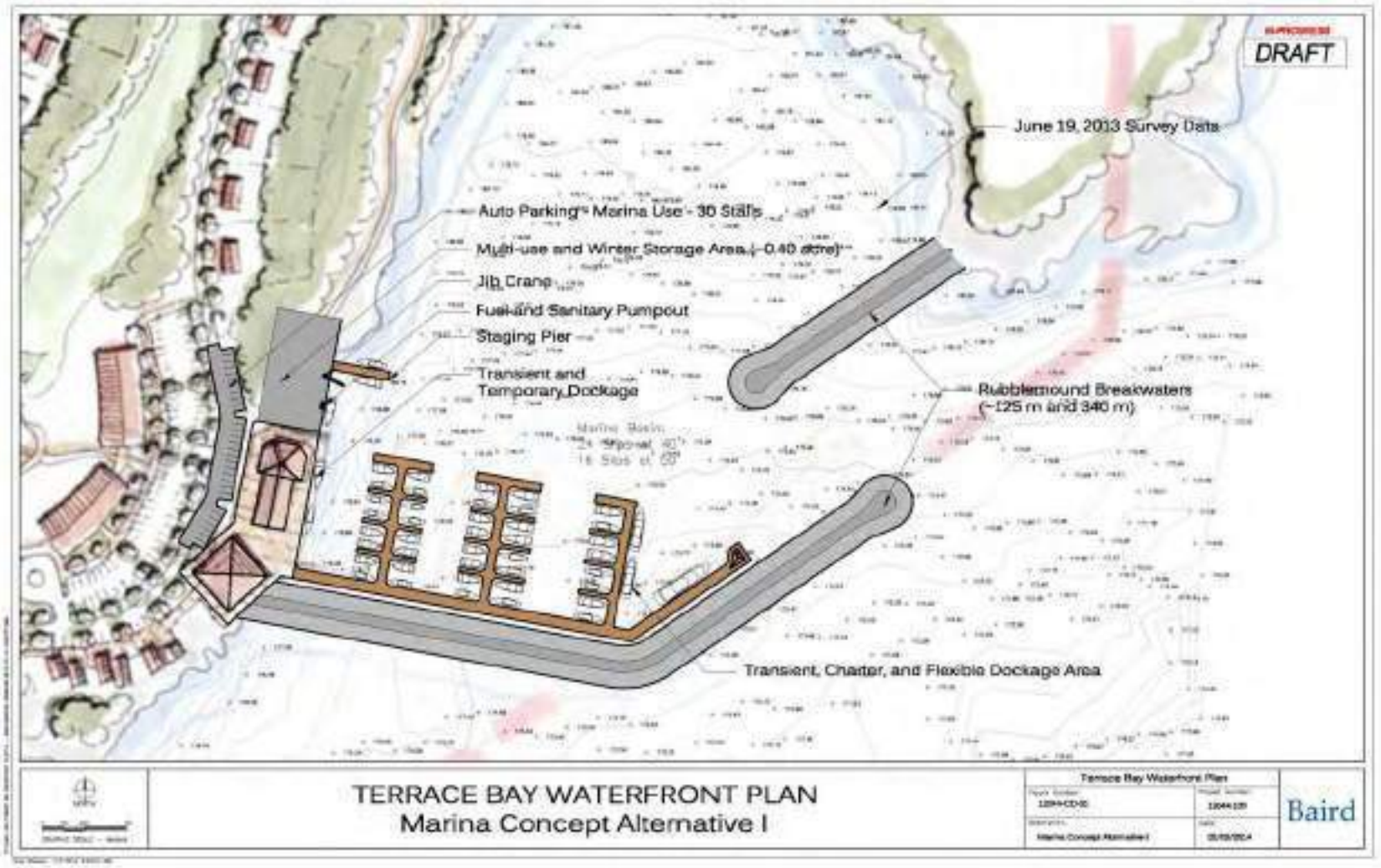


Figure 6.1 Marina Concept Alternative I

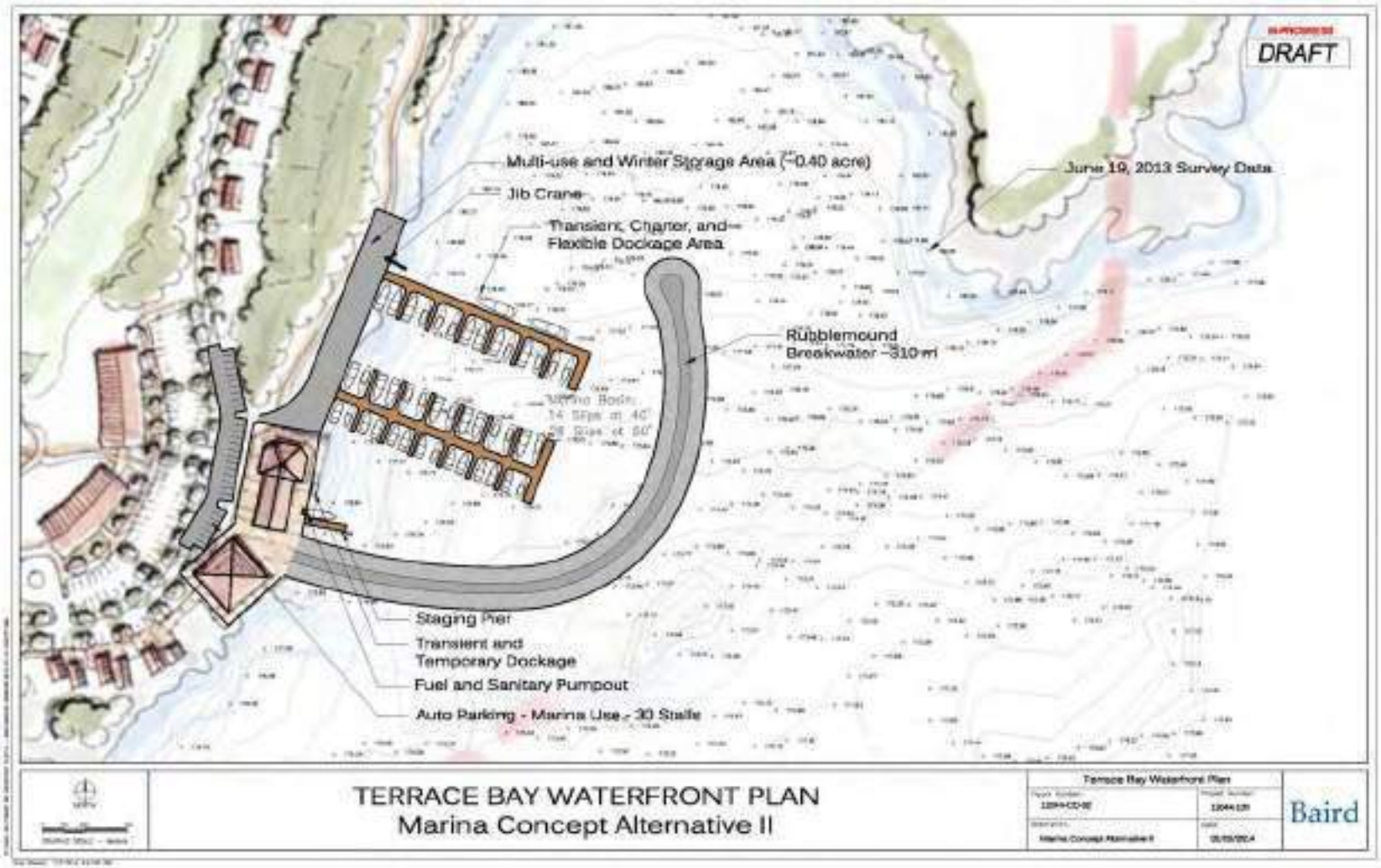


Figure 6.2 Marina Concept Alternative II

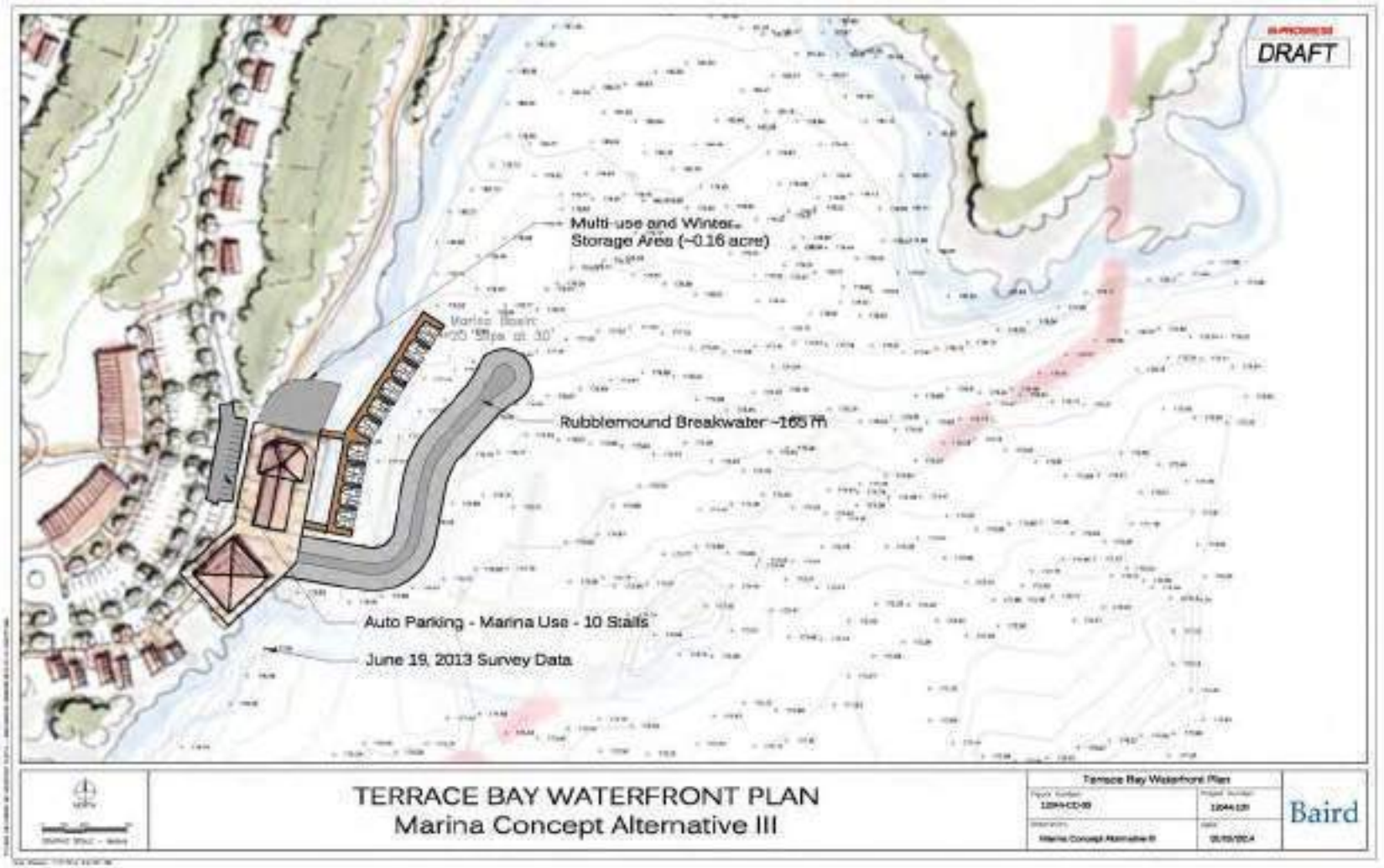


Figure 6.3 Marina Concept Alternative III

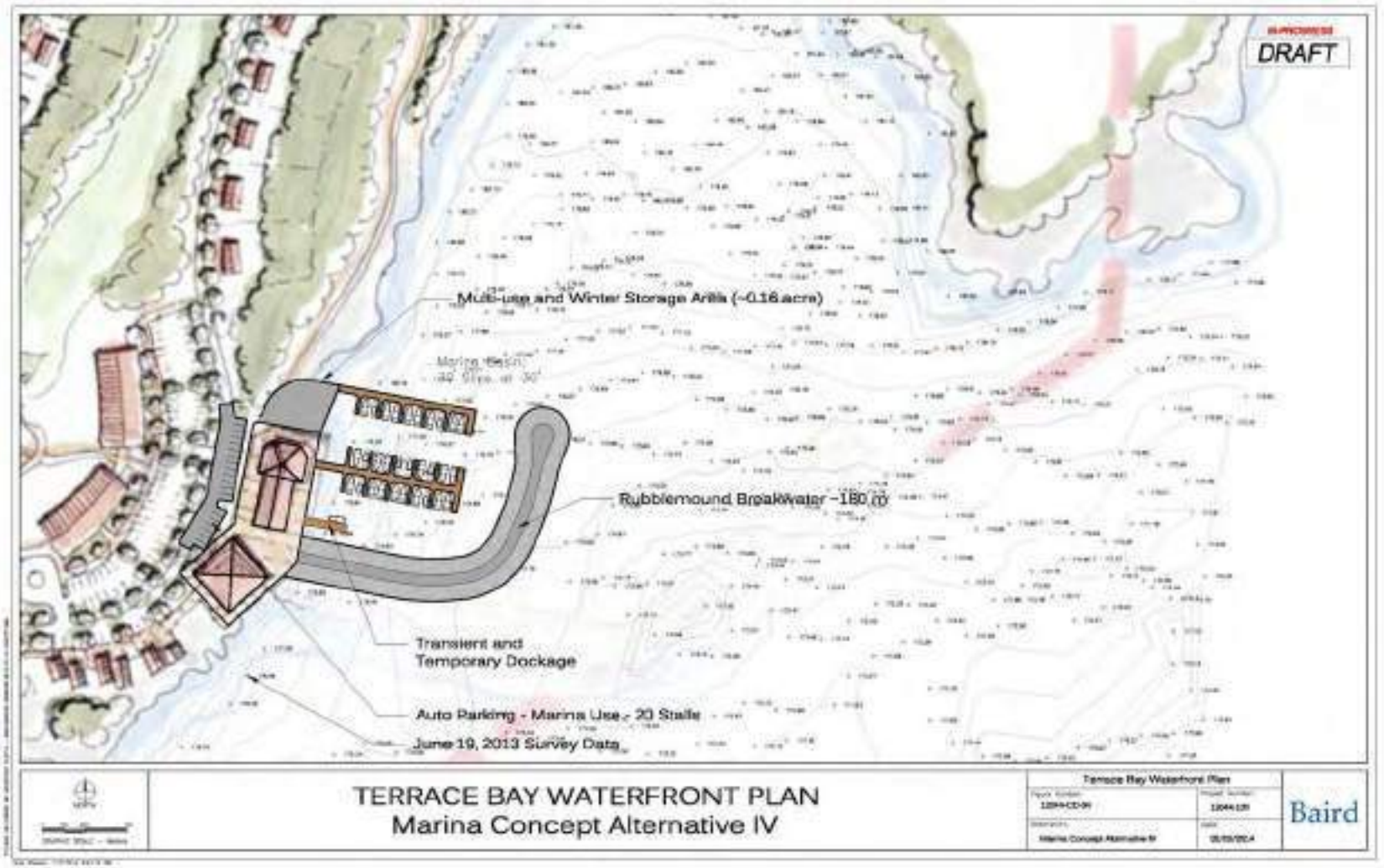


Figure 6.4 Marina Concept Alternative IV

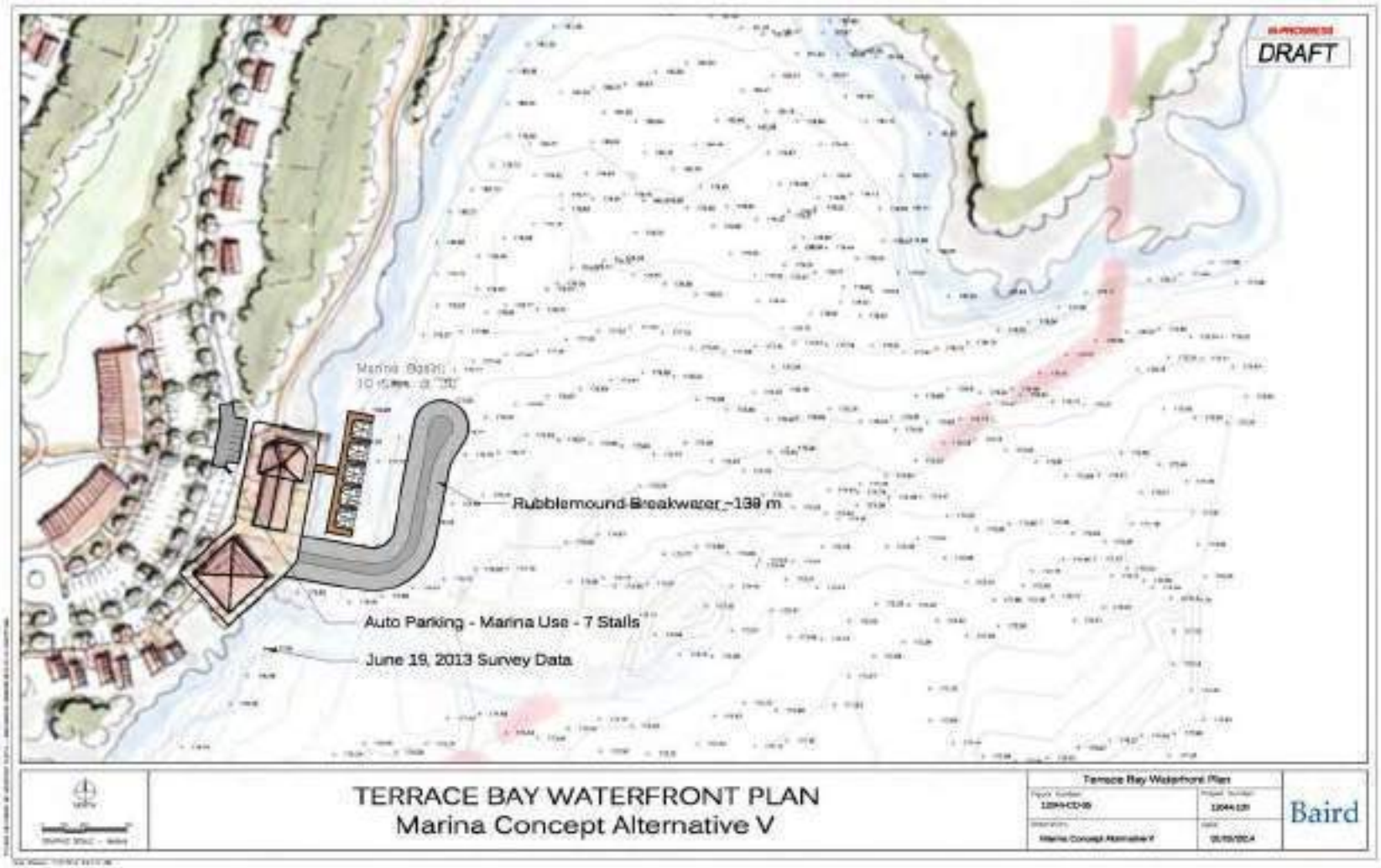


Figure 6.5 Marina Concept Alternative V

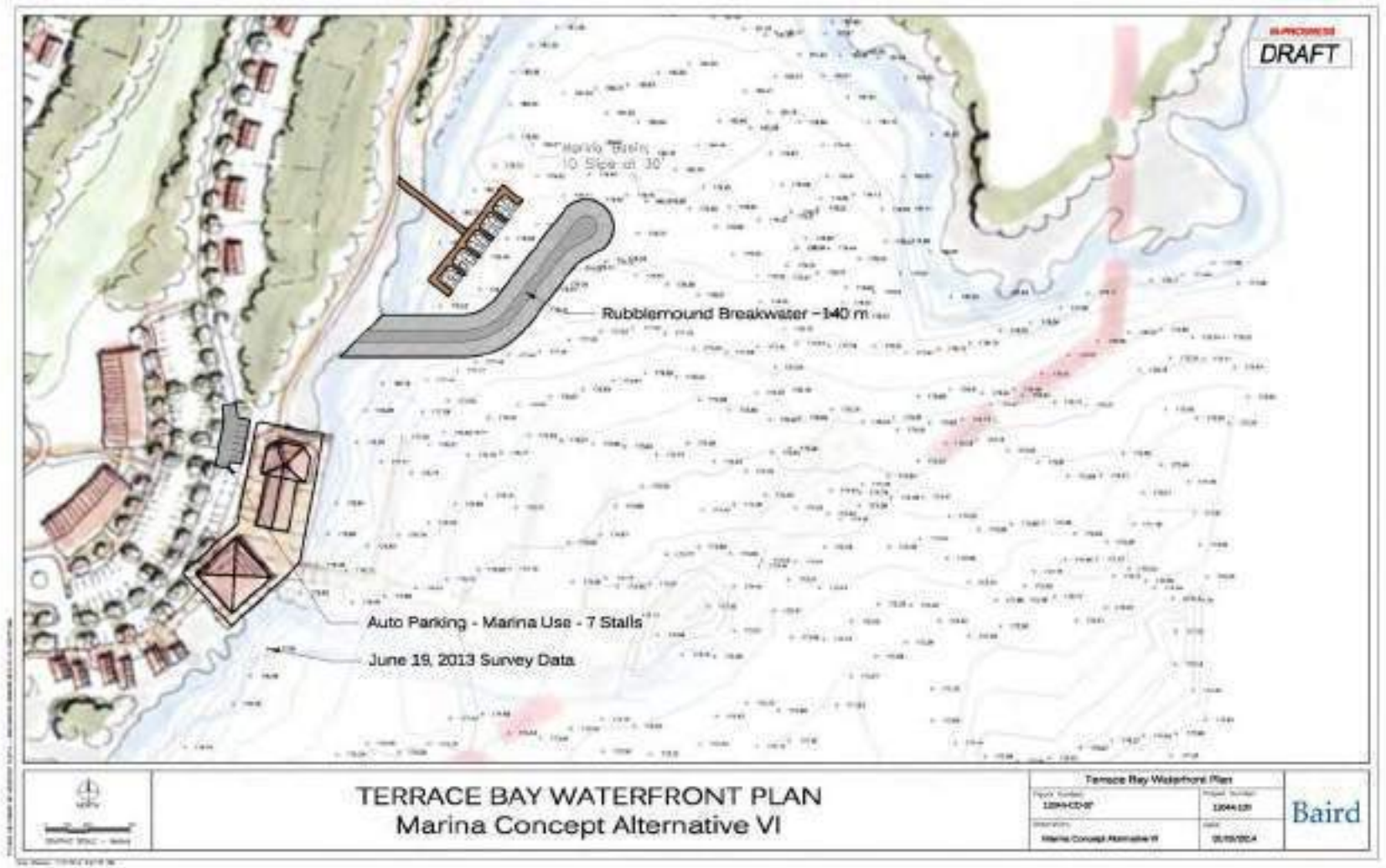


Figure 6.6 Marina Concept Alternative VI

Table 6.2 Summary of Opinion of Probable Costs for Marina Alternatives (Develop New Quarry for Stone Source)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Mobilization	$200,000	$200,000	$120,000	$150,000	$100,000	$100,000
Marina Floating Dockage	$1,342,000	$951,000	$400,000	$633,000	$200,000	$200,000
Fuel System	$300,000	$300,000	-	-	-	-
Sanitary System	$50,000	$50,000	-	-	-	-
Marina Wall (Transient and Temporary Dockage)	$825,000	$880,000	$715,000	$715,000	$578,000	$578,000
Utilities	$400,000	$400,000	$250,000	$300,000	$200,000	$200,000
Multiuse and Winter Storage Area	$400,000	$400,000	$163,000	$163,000	-	-
Auto Parking	$400,000	$115,000	$52,000	$80,000	$31,000	$31,000
Breakwater(s) - New Quarry	$14,800,000	$9,100,000	$4,500,000	$5,400,000	$3,800,000	$2,600,000
Subtotal	$18,717,000	$12,396,000	$6,200,000	$7,441,000	$4,909,000	$3,709,000
Contingency and Engineering (30%)	$5,615,100	$3,718,800	$1,860,000	$2,232,300	$1,472,700	$1,112,700
Total[1]	$24,332,000	$16,115,000	$8,060,000	$9,673,000	$6,382,000	$4,822,000

[1] Totals rounded to nearest thousand.

7.0 PERMITTING

The marine components of a marina development are subject to numerous regulatory requirements. Key requirements are discussed in this section. Additional permits may be required for landbased components of the marina development.

7.1 Fisheries Act (Fisheries and Oceans Canada)

On June 29, 2012, amendments to the *Fisheries Act* received Royal Assent. The changes focus the *Act* on protecting the productivity of recreational, commercial and Aboriginal fisheries. The development of all in water works (e.g., docks, breakwaters, dredging, lakefilling) was previously subject to approvals under the federal *Fisheries Act* and in water works were required to meet the intent of the no net loss of the productive capacity of fish habitat policy of DFO. Considering the recent changes, DFO will be contacted to discuss the marina concepts and the requirements under the *Fisheries Act*.

7.2 Canadian Environmental Assessment Act (CEAA)

The CEAA was amended in 2012 to streamline the EA process. CEAA 2012 now applies to a relatively small number of projects described in the regulations as Designated Physical Activities. It is not clear at this time that a marina would trigger CEAA, however this should be confirmed prior to the preliminary design phase of the project.

7.3 Navigable Waters Protection Act (Canada Coast Guard)

The primary purpose of the *NWPA* is to protect the public right of navigation in Canadian waters. Amendments to the *NWPA* received Royal Assent in December 2012 and are expected to come into force in April 2014. Lake Superior is listed in the schedule of major waterways for which regulatory approval is required prior to construction of a work. In addition, some works will now be pre-approved and the list of pre-approved works has not been finalized. Requirements under the *NWPA* should be confirmed prior to design.

7.4 Public Lands Act (MNR)

A Work Permit is required from the Ministry of Natural Resources for any work undertaken on Crown Land. The lakebed is considered Crown Land unless a water lot has been purchased.

7.5 Lakes and Rivers Improvement Act (MNR)

Based on discussions with the MNR during this project, a permit is required under the Lakes and Rivers Improvement Act (LRIA) based on proposed changes to the lakebed that would occur as a result of the marina development.

7.6 Endangered Species Act (MNR)

The Endangered Species Act protects species at risk and their habitat. This may have implications for the marina construction in terms of timing windows for construction and for removal of quarry stone, depending on where the quarry is

located. MNR noted that the community is within Caribou range. During the design stage, MNR should be contacted to provide direction under the Endangered Species Act.

8.0 REFERENCES

Cumming Cockburn Limited, 1989. Marina Site Development, Lake Superior Access Study, Township of Terrace Bay. A study prepared for the Ministry of Natural Resources of Ontario.

Environmental Hydraulics Group, 1991. Coastal Engineering and Hydraulic Study. Aquasabon River Marina, Terrace Bay. A report prepared for the Corporation of the Township of Terrace Bay. Dated November 1991.

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Pullen, T., et al. "EurOtop wave overtopping of sea defences and related structures: assessment manual." (2007).

The Planning Partnership, 2000. Terrace Bay Regional Gateway Development Feasibility Study. Final report dated February 2000.

APPENDIX A
BATHYMETRIC CHARTS

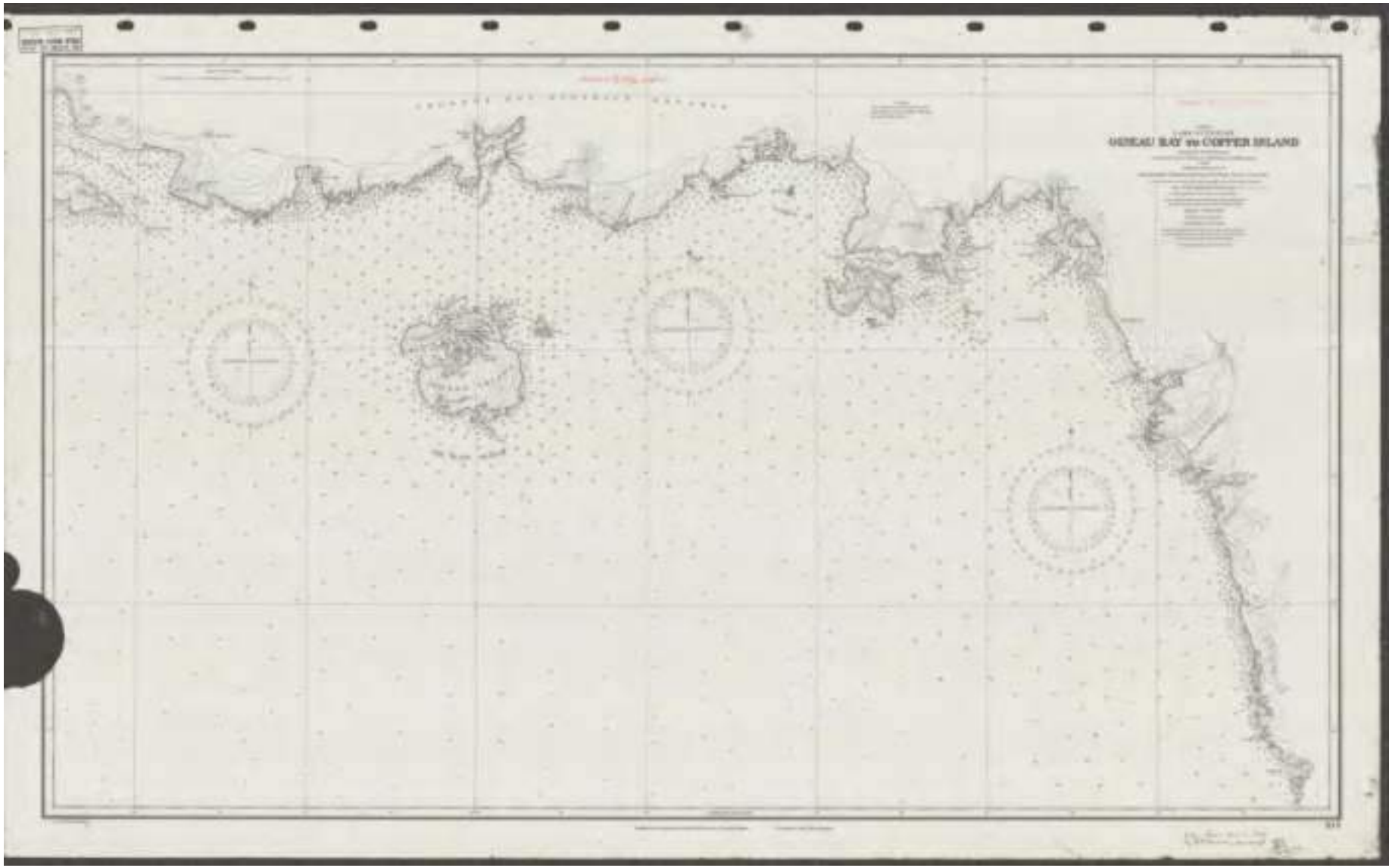

Figure A.1 CHS Field Sheet ID#FS 370 dated 1913 to 1914 showing Approaches to Terrace Bay

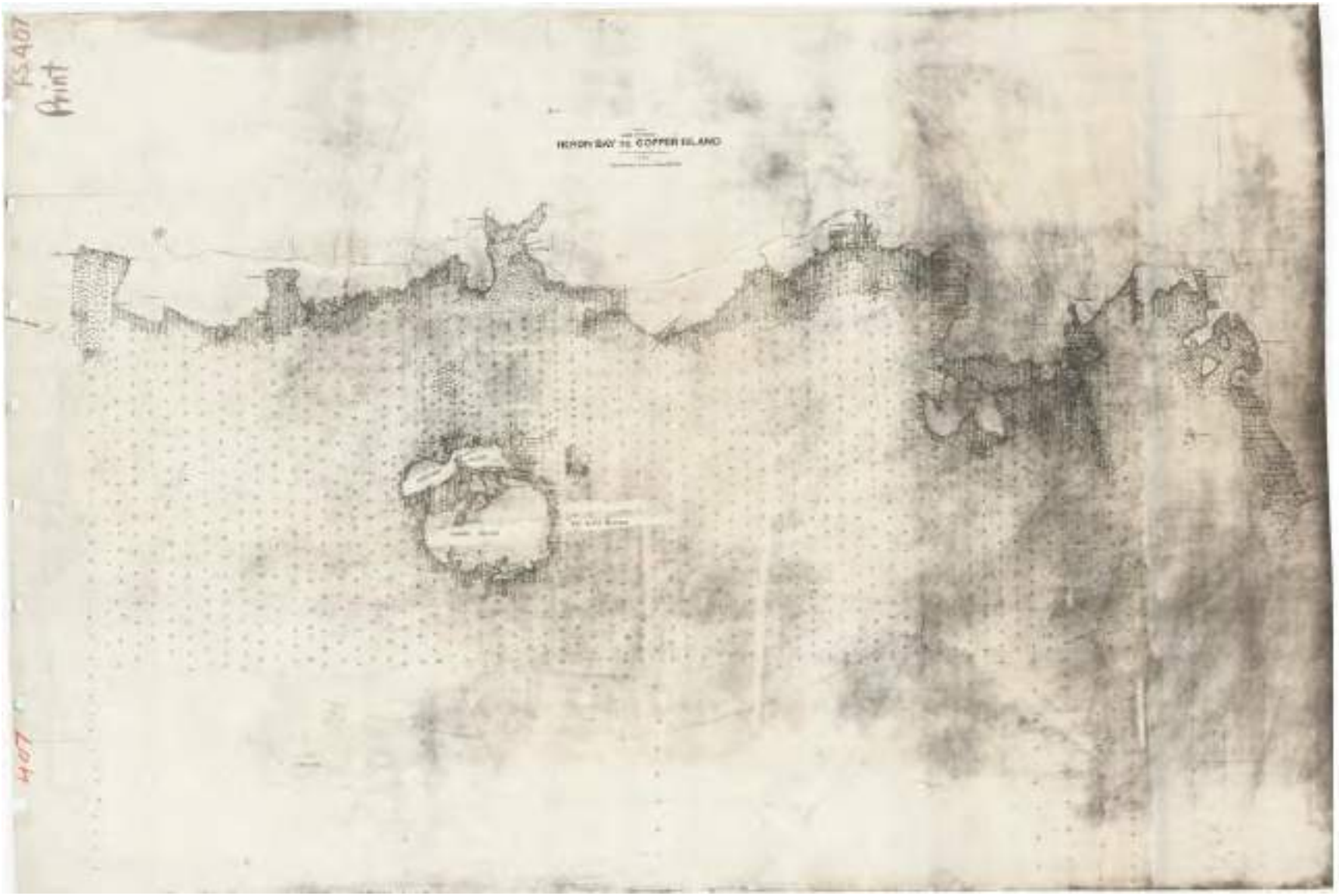

Figure A.2 CHS Field Sheet ID#FS 407 dated 1913 showing Approaches to Terrace Bay

TRUE GRIT CONSULTING LTD

June 18, 2014 Project No. 14-602-01E

VIA EMAIL: (dhinde@planpart.ca)

Donna Hinde, BES, MLA, OALA, FCSLA
Partner
The Planning Partnership
1255 Bay Street, Suite 201
Toronto, ON M5R 2A9

Dear: Ms. Hinde:

Re: Terrace Bay Waterfront Development (Revision 1)
Pre-Engineering Infrastructure Assessment and Cost Estimate

True Grit Consulting Ltd (TGCL) was retained by The Planning Partnership (TPP) to complete a conceptual infrastructure assessment for the proposed waterfront development in the Township of Terrace Bay, Ontario.

It is understood that a new development is proposed at the waterfront area, within an existing golf course, adjacent to Lake Superior at the south end of Terrace Bay. The area is zoned as Urban Settlement Area according to the Township of Terrace Bay 2014-2034 Official Plan (Draft). The proposed development is to include the following major components:

- Construction of residential and commercial buildings;
- Reconstruction of the existing Beach Road and golf course;
- Construction of new roads; and
- Construction of a new marina.

The purpose of this conceptual assessment is to indicate the ability for existing infrastructure to accommodate the increased demands generated by the proposed development and evaluate the magnitude of work in terms of costs. In order to assess the potential systems, an understanding of the existing features is first determined. If the existing infrastructure is able to achieve adequate servicing to the proposed development, the results are reported. If the existing infrastructure is inadequate to service the site in its entirety, recommended infrastructure upgrades are speculated based on proposed loading estimates. The following available municipal infrastructure services in relation to the proposed development are assessed:

- Water Servicing;

- Sanitary Servicing and Treatment Facilities;
- Storm Water Management;
- Pavement Structure and Pedestrian Access; and
- Hydro Servicing (AG Engineering).

The following documents and resources were made available to TGCL for review when conducting the pre-engineering infrastructure assessment:

- *Draft Official Plan, Township of Terrace Bay Official Plan Review, 2014 (For the Planning Period 2014-2034)*, prepared by Tunnok Consulting Ltd., and Riverstone Environmental Solution Inc., dated February 6, 2014;
- *Planning Drawing, Township of Terrace Bay Waterfront Study,* prepared by The Planning Partnership, Barid & Associates, FORM Architecture, Plan B Natural Heritage and TCI Management, dated January 2014;
- *Terrace Bay Capital (Construction and Development) Cost Estimates,* prepared by TCI Management, dated February 25, 2014; and
- *2013 Section 11 Annual Report, Terrace Bay Drinking-Water System,* prepared by Ontario Clean Water Agency, dated February 2014.
- *Terrace Bay Drinking Water System Inspection Report,* Issued by the Ontario Ministry of the Environment, dated February 3, 2014.
- *Terrace Bay Water Treatment Plant Process Narrative,* dated October 21, 2004
- Township of Terrace Bay Municipal GIS system.

Proposed New Development

The proposed new development is expected to consist of five residential areas and one commercial area. The total area for residential and commercial use is approximately 10.2 and 4.6 hectares (ha), respectively.

The details of the buildings proposed in this development are tabulated below.

Table 1 Proposed Building Construction Summary			
Types of Building	**Location**	**Unit Number**	**Construction Assumptions**
Residential			
Apartment Complex 1	Existing club house	12	1,500 sq ft per unit 22,500 sq ft total 3 stories (RSM data)
Apartment Complex 2	south of existing Beach Rd, adjacent to proposed lodge	12	1,500 sq ft per unit 22,500 sq ft total 3 stories (RSM data)
Apartment Complex 3	Adjacent to proposed marina	12	1,500 sq ft per unit 22,500 sq ft total 3 stories (RSM data)
Apartment Complex 4	Adjacent to proposed marina	12	1,500 sq ft per unit 22,500 sq ft total 3 stories (RSM data)
Townhouses	East of Beach Rd	16	Not available
Single Detached House	East of Beach Rd	13	1,500 sq ft per unit
Executive House Area 1	East of Beach Rd	16	2,000 sq ft per unit
Executive House Area 2	West of Beach Rd	7	2,000 sq ft. per unit
Executive House Area 3	End of new Beach Rd (to be constructed)	7	2,000 sq ft per unit
Commercial			
Beach Pavilion	South end of Beach Rd	1	5,840 sq ft total 1,255 sq ft for enclosed washrooms 4,585 sq ft for non-enclosed covered area
Clubhouse/Multipurpose Facility (includes a restaurant)	South end of Beach Rd	1	12,540 sq ft total 5,025 sq ft enclosed main floor 4,835 sq ft enclosed second floor 2,680 sq ft second floor outdoor deck Second floor will be a restaurant
Lodge	South end of Beach Rd	10 rooms	4800 sq ft total 400 sq ft per room
Hotel Style Cottage	Along the shoreline	10	Not available

This new development is also proposed to improve the existing Beach Road and construct new roads. It is estimated that approximately:

- 2.0 km of the exiting paved Beach Road will require pulverizing and repaving. Starting from Kenogami Road continuing to the beach.
- 300 m of the gravel road from the south end of the existing Beach Road to the east end of the sand beach will require construction and pavement.
- 1.45 km of new roads will require clearing, construction and pavement.
- 2.9 km asphalt bike lane/pedestrian walkway and 0.85 km concrete sidewalk will require construction.

Water Servicing

Existing Water Treatment Plant and Distribution Systems

The Terrace Bay Water Treatment Plant (TBWTP) is located in the centre of the town, approximately 1.7 km northeast to the proposed development. The TBWTP was completed in 2007 and has a total design capacity of 3,880 m^3/day for a population of 5,000 people. As per the *Terrace Bay 2014 - 2034 Official Plan (Draft),* it is estimated that the town is currently using 38% of the total capacity, therefore, there should be sufficient remaining capacity to meet the requirements for future developments.

The main raw water supply of Terrace Bay is the Pump House Beach in Lake Superior. The raw water gravity feeds the wet well of the pump house located at the shore of Lake Superior. Three submersible vertical turbine pumps with a rated pumping capacity of 22.5 L/s (each) are available to pump water through 2.5 km of a 250 mm Ø transmission main to the TBWTP.

The Terrace Bay water distribution system consists mainly of 150 mm to 350 mm Ø watermains, hydrants, shutoff valves and pressure reducing valves at key locations. The distribution system was designed to provide the fire flows throughout the existing urban area.

Based on the GIS results of Terrace Bay, the watermains in the proximity of the proposed development area consist of 200 mm Ø cast iron pipes along the Lakeview Drive and 150 mm Ø cast iron pipes along the majority of Kenogami Road. In addition, a 200 mm Ø pipe of unknown material extended approximately 50 m to the Kenogami Road from the intersection of Cartier Road and Kenogami Road. The Township of Terrace Bay indicated that the water for the existing golf course clubhouse is supplied by a 150 mm Ø ductile iron pipe and a fire hydrant is located near the golf course clubhouse. However, the watermain and the fire hydrant were not shown on the GIS and may need further confirmation.

Requirements of the Integration of Water Service

For residential water demands, the estimation was conducted based on the projected population of the proposed development and the daily water consumption rate per capita. According to TPP, this development is proposed for a resident population of approximately 330 people. Utilizing an average domestic water

consumption rate of 600 L/capita/d specified in the *City of Thunder Bay Engineering and Development Standards, 2013 edition* (COTB-EDS 2013), the water demand for the residential use is calculated to be 198,000 L/d or 2.29 L/s.

For commercial operations, the water demands are estimated based on the values specified in the *Ontario Building Code 2006* (OBC 2006) and the Ontario Ministry of the Environment (MOE) *Design Guidelines for Drinking Water Systems* (2008). The results of the water demands for various commercial buildings in the proposed development are summarized in Table 2.

Table 2
Water Demands for Commercial Use

Types of Buildings	Estimated Daily Water Demands (L/d)
Beach Pavilion	8,000
Clubhouse/Multipurpose Building	22,315
Lodge (10 rooms)	4,000
10 Units of Cottage	10,000
Total	**44,315**

The water demand for the commercial use in the proposed development is estimated to be 44,315 L/d or 1.54 L/s when applying a typical business operation of 8 hours per day.

The required fire flow for the proposed development area was estimated based on the methodology outlined in the *Water Supply for Public Fire Protection* (Fire Underwrites Survey, 1999), which accounts for construction type, proposed occupancy, sprinkler system design, and proximity to neighbouring buildings. It is calculated that the fire flow for the proposed development is 150 L/s (9,000 L/min).

Integrating peaking factors (0.3 for minimum daily flow, 3.0 for maximum daily flow, and 4.5 for maximum hourly flow) specified in the MOE *Design Guideline for Drinking Water System* (2008), the total water demand estimation for the proposed development is tabulated in Table 3.

Table 3
Water Demand Summary

Type	Average Daily Flow ,L/s (m^3/d)	Min. Daily Flow L/s (m^3/d)	Max. Daily Flow L/s (m^3/d)	Max. Hourly Flow (L/s)
Residential	2.29 (198.0)	0.69 (59.4)	6.87 (594.0)	10.31
Commercial	1.54 (44.3)	0.46 (13.3)	4.62 (132.9)	6.93
Fire Flow	150	150	150	150
Total	**153.83**	**151.15**	**161.50**	**167.24**

In summary, the maximum daily water demand for both residential and commercial use is 726.9 m^3/d, which will consume approximately 19% of the TBWTP's current capacity. With the existing water demands of the entire town, it is projected that TBWTP will operate at 56% of its capacity after the proposed development is completed.

It is required by *COTB-DES* (2013) that the minimum size of watermains used for hydrant supply is 200 mm Ø, as a result, the new water main can be tied in from west of Lakeview Drive or east of Kenogami Road, which have an existing buried 200 mm Ø water main.

TGCL was also informed that the there is an irrigation system for the golf course. The water for the irrigation system is withdrawn directly from Lake Superior via a 150 mm Ø water intake pipe located behind fairway no.7. This water intake system may be considered for supplying water for fire hydrant.

Sanitary Servicing

Existing Servicing

It is understood that the urban service area of Terrace Bay is divided geographically and consequently there are two catchment areas (western and eastern) serviced respectively by two separate sewage treatment facilities. As the proposed development is located in the western area, the corresponding sewage treatment system was assessed (conceptually). Based on a drawing sketch from Kimberly Clark Pulp & Paper Co. Ltd. dated September 26, 1962, it appears that the treatment system had sedimentation tank(s) and a tile field. TGCL understands that the tile field has been decommissioned and the sedimentation tank(s) have been connected to a lagoon. The sedimentation tanks are located adjacent to Beach Road and the lagoon is approximately 170 m south/southwest of the sedimentation tanks and 300 m northeast of the proposed development. It was informed that the system has a Certificate of Approval (CofA) dated back several decades and thus, the design capacity and current flow rates are not known. All the sanitary sewage generated in the western urban area of Terrace Bay is drained by gravity to the sedimentation tanks and then to the lagoon, without the requirement of a lift station. The sanitary sewer pipes in town range from 150 mm Ø to 300 mm Ø.

Requirements for New Sanitary Services

The following table summarized the sanitary sewage that would be possibly produced as a result of the proposed development. It should be noted that the estimations and calculations are approximate, and are based on OBC 2006.

Table 4
Residential Dwellings Summary

Types of Building	Estimated Daily Sewage Flow (L/d)
4 Apartment Buildings [1]	39,600
16 Units of Town houses [1]	13,200
13 Units of Single Detached House [2]	14,300
30 Units of Executive House [3]	48,000
Beach Pavilion [4]	8,000
Clubhouse/Multipurpose Building (including a restaurant) [5]	22,315
Lodge (10 rooms)	2,500
10 Units of Cottage [6]	10,000
Total	**157,915**

Assumptions:
1. Based on an average of 3 persons in a unit.
2. Based on 2-bedroom houses.
3. Based on 3-bedroom houses.
4. Based on an average of 200 people using the pavilion daily.
5. Based on the assumption that the restaurant has a capacity of 150 seats.
6. Based on 2 persons per cottage.

Based on the calculations, it appears that the new development is to produce an average daily sewage rate of approximately 157,915 L/d or 157.92 m^3/d, corresponding to 1.83 L/s. Apply a peaking factor of 4.0 and a extraneous flow factor of 0.26 L/ha/sec, as per MOE *Design Guideline for Sewage Works* (2008) and COTB-EDS (2013), the maximum sanitary flow produced by this development is estimated to be 10.0 L/s.

As per the COTB-EDS (2013), the minimum size of all sanitary sewer pipes shall be 250 mm Ø, which has a full pipe capacity of 42 L/s, significantly higher than the projected maximum sanitary flow of 10.0 L/s. Therefore, 250 mm Ø sanitary sewer pipes would accommodate the sewage generated by the new development.

The topography of the area for the proposed development suggests that the sanitary sewage will generally drain to the south. Due to the approximately 22 m increase in elevation from the south end of the site to the existing sewage treatment facility (western), a lift station is proposed at the southwest corner of the site for pumping the sewage to the sedimentation tanks abutting the Beach Road, approximately 1.7 km northeast. However, it should be noted that no information is

available for evaluating the existing conditions of the treatment facility (i.e. sedimentation tanks and lagoon), and therefore other options such as communal sewage systems and/or on-site individual septic systems should be planned in case of insufficient capacity of the existing treatment facility.

At this time, TGCL cannot provide a recommendation or the associated costs for upgrades of the existing wastewater treatment system until a detail analysis of the system can be conducted.

Storm Water Management

The storm water runoff in the proposed development area is expected to follow the topography and generally drain to the south. The entire area appears to be divided geographically by two hills (east of the fairway no.1) into two drainage systems. The primary consideration of the storm water management for the entire area is quality control due to its location within a golf course. At conceptual level, it is proposed that two wetlands planned for the quality control of the storm water, one being at the southwest end of the existing Beach Road and the other at the southeast of the proposed two apartment buildings. The proposed location of the two wetlands is shown on Figure 1. After the development, runoff at the east of fairway no.1 is expected to drain over the paved road to the south and be detained in Wetland 1, and the runoff of the rest site is expected to flow through a constructed ditch running along Beach Road to the south/southwest and be detained in Wetland 2.

Based on an area of approximately 18 ha to be developed, the required water storage is estimated to be approximately 1,080 m^3, corresponding to a total wetland area of 3,600 m^2. Therefore, the proposed Wetland 1 and 2 will cover an area of 500 and 3,100 m^2, respectively. In addition, several storm water detention ponds can be constructed in vicinity of the existing fairways.

Pavement Structure

Roadways

Depending on the existing conditions of the road, different requirements are anticipated for roadway design and construction as summarized in Table 5.

Table 5
Residential Dwellings Summary

Road Identifier*	Existing Condition	Location	Length	Construction Requirements
Beach Road 1	Paved Road	From Kenogami Rd to the beach	2.0 km	Reclaimation and Re-pavement
Beach Road 2	Gravel Road	From the end of Beach Road 1 to the east end of Beach	300 m	Sub-base and New Pavement

Table 5 Residential Dwellings Summary				
Road Identifier*	**Existing Condition**	**Location**	**Length**	**Construction Requirements**
Beach Road 3	Trees	From the end of Beach Road 2 to the last proposed executive house	600 m	Tree Clearing, Sub-base and New Pavement
Branch Road 1	Trees	From the beginning of Beach Road 1 to the end of proposed 7-unit executive house area	250 m	Tree Clearing, Sub-base and New Pavement
Branch Road 2	Trees	Around the Single Detached House area, east of Beach Rd	600 m	Tree Clearing, Sub-base and New Pavement
Note: * Read in conjunction with Figure 1.				

As per the *Terrace Bay 2014-2034 Official Plan (Draft)*, the municipal roads shall generally be designed and constructed with a minimum right-of-way width of 20 metres. All the roads are to be built in compliance with the Ontario Provincial Standards (OPS) for Roads and Public Works regulated by the Ontario Ministry of Transpiration (MTO).

Two locations of new roads in the proximity of the proposed new marina may require slope stabilization due to the steepness of the existing site slope (1V:1H). The slope stabilization is anticipated to be completed by means of geotextile and rip rap treatment.

Sidewalks

It is required by the *Terrace Bay 2014-2034 Official Plan (Draft)* that new streets and subdivisions shall be constructed complete with sidewalks on at least one side.

To lower the cost, it is proposed that the existing Beach Road and its new extension (Beach Road 1 - 3, total length of 2.9 km) is to be constructed with a 3 m bicycle lane/pedestrian walkway, and the Branch Road 1 - 2 (total length of 0.85 km) are to be constructed with a 1.5 m concrete sidewalk. It should be noted that the bicycle lane/pedestrian walkway along Beach Road 1 - 3 could be replaced with concrete sidewalk at significantly higher costs.

Interpretative Trail Completion

As provided by TCI Management Consultants that a 1,550 m walkway with interpretive panels is proposed as part of the development. The walkway is planned to be along the beach to the east and west of the beach pavilion. This boardwalk will have periodic interpretive signs to explain the natural and historical features of the waterfront. It is preferred by Township of Terrace Bay that the walkway is constructed as an asphalt paved trail.

Missing Trails Re-link

TCI Management Consultants estimated 500 m of missing trails across the proposed development area may require construction to complete the trails network. It should be noted that the length of 500 m is a rough estimate and will require further confirmation.

Construction of Beach Pavilion

It is provided by TCI Management Consultant that a 5,840 sq ft Beach Pavilion is planned on the waterfront beach. The pavilion will consist of enclosed washrooms and an unenclosed roofed area for picnics.

Utility Servicing

Hydro

Hydro One would be the electrical service provider for the proposed development. It appears that the main hydro line runs from west to east across the north portion of the town and over the Terrace Bay Pulp Mill. No electrical infrastructure is identified in the proposed development area and therefore, installation of hydro poles and connection to the existing electrical grid are required.

AG Engineering has prepared a more detailed assessment report (Appendix A) regarding the electrical requirements for the proposed development. The assessment provides the electrical scope required to service the residential and commercial buildings as well as street lighting base on the assumption that the Hydro One Grid is provided to the entrance on Beach Road.

Gas

Terrace Bay has no access to natural gas, and therefore, the heating is accomplished through either heating oil supplied by local distributors, Esso and Mikus Fuels, or electricity through Hydro One. A feasible solution for heating service for the proposed area would be a communal heating facility powered by heating oil/fuel.

Telecommunication

The telecommunication service providers in Terrace Bay include Thunder Bay Telephone (TBaytel) for digital cellular service, and Bell Canada and Shaw Cable for high speed internet service. It is assumed that the telecommunication infrastructure could be accomplished in conjunction with the electrical infrastructure development.

Conceptual Cost Estimate

Table 6
Summary of Cost Estimate for Servicing the Proposed Development

Infrastructure Requirements	Cost
Site Preparation	$2,123,100
Water Servicing	$906,900
Sanitary Servicing	$1,259,600
Storm water Infrastructure	$116,000
Roads	$2,939,400
Beach Pavilion	$550,100
Electrical	$1,409,500
Miscellaneous	$42,100
Engineering (10%)	$934,700
Contingency (10%)	$934,700
Total (excluding HST)	**$11,216,100**

The above table contains a Class C cost estimate for servicing the proposed development. Since the design for the proposed development is in its early stage and is conceptual in nature, this cost estimate is strictly an indication (rough order of magnitude) of the final project cost. The parameters for the Class C estimate and corresponding measurements are provided in Appendix B.

Recommendations

Based on the results of the pre-engineering infrastructure assessment, the following recommendations are provided for consideration:

1. A detailed assessment of the western sewage treatment facilities should be performed to determine its existing conditions and remaining capacity.

2. A 3 m bicycle lane/pedestrian walkway along the Beach Road may be an option to significantly lower the cost compared to 1.5 m concrete sidewalk.

3. Due to lack of access to natural gas, a communal heating facility would be a feasible option for providing heating service to the proposed development.

4. A detailed engineering review/analysis including site assessment is required to confirm all aspects of this report.

Assessment Limitations

1. The assessment is based on the site plans and information provided by The Plan Partnership and the Township of Terrace Bay.

2. The population density for the potential development is estimated using values outlined by the COTB-EDS (2013), OBC (2006) and MOE Guidelines.

3. Design estimates throughout this report are for conceptual understanding only, and at no point should any of these calculations be put into practice.

4. Class C cost estimates (+/-15-20%) provided in this report are based on 2014 construction costs.

Closure

The information and data contained in this report, including without limitation, the results of any assessment, sampling and analyses conducted by TGCL pursuant to its Agreement with the client, have been developed or obtained through the exercise of TGCL's professional judgment and are set forth to the best of TGCL's knowledge, information and belief. Although every effort has been made to confirm that this information is factual, complete and accurate, TGCL makes no guarantees or warranties whatsoever, whether expressed or implied, with respect to such information or data.

The information and data presented in this report are based on the purpose and scope of the project and form the basis for any conclusions and recommendations presented herein. Any conclusions and recommendations presented herein do not preclude the existence of environmental or engineering concerns other than those that may have been identified.

Work performed by TGCL personnel employed sound environmental testing and engineering principles. TGCL cannot guarantee the accuracy and reliability of information provided by others or third parties. Therefore, TGCL does not claim responsibility for undisclosed concerns or conditions that may result in costs for environmental exceedances and/or remediation. This report is intended for information purposes only.

Sincerely,

TRUE GRIT CONSULTING LTD.

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Enclosures: Figure 1
Appendix A
Appendix B

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Figure 1

NOTE:
1. THE DRAWING IS DERIVED FROM THE DRAWING ENTITLED TOWNSHIP OF TERRACE BAY WATERFRONT STUDY PREPARED BY THE PLANNING PARTNERSHIP DATED JANUARY 2014.

LEGEND

- Beach Road 1
- Beach Road 2
- Beach Road 3
- Branch Road 1 & 2
- Proposed Wetland
- Proposed Lift Station

Scale

0 50 100 m

SCALE 1:5000

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YY/MM/DD	ISSUE/REVISION DESCRIPTION	DRN	CHK	DES	ENG
14/03/14	FINAL REPORT	SQ	AR	SQ	AR

The Planning Partnership
Waterfront Development
Terrace Bay, ON

Roads Identification and Wetlands and Lift Station Locations

PROJECT NUMBER	DRAWING NO.	REVISION
14-602-01E	01	01

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Appendix A

AG Engineering (Thunder Bay) Inc.
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Thunder Bay, Ontario P7C 1B7
Telephone: (807) 622-3654
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March 10, 2014 Rev2

Adam Rose, P.Eng
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Terrace Bay Waterfront Study–Electrical Background for Costing

This office looked at the overall presentation map of the proposed water front development and estimated the requirements, in very general terms, the electrical scope required to service the buildings as well as provide street lighting assuming the Hydro One Grid is provided to the entrance on Beach Road. The Following assumptions assisted in our order of magnitude costing provided.

Primary Service

It is proposed that a primary high voltage loop feed be entertained for the development with a main high voltage switch gear located at the start of Beach Road in coordination with Hydro One Networks. This Switch will have Load Break capabilities and two circuits feeding out to the site to create the loop feed proposed.

Based on the scale noted on the site map a complete loop will be in the range of 3000 meters following the road. Open trench is assumed and empty communications conduit and street lighting feeds would share this common trench.

Commercial Building Services

The commercial building will be feed via underground loop feed through pad mount transformers with integral HV switches as accounted for in the costing. The service size is based on commercial occupancy and heating source not being electrical. Each building will be serviced with a 600V service with final load calculations to be determined at time of detailed design. Communications service will be a simple rough with an empty 100mm conduit with pull rope.

Residential Building Services

The residential buildings including the townhouses, cottages and executive homes will be service with residential pad mounted transformers commonly used within residential subdivisions. It is assumed that one pad mounted transformer could serve 5 to 7 residential lots. This loading can be determined with final design. Transformer sizes and quantities are assumed based on heating source not being electrical. Standard 50mm communications conduit can be pulled into each residence.

Street Lighting

The street lighting is assumed to be standard residential cobra head LED type street lighting spaced approximately every 80 meters or so. Detailed design will be needed for exact spacing and photometric layouts.

Thank you for allowing us to provide you with these services and look forward to working with you on your future projects.

Sincerely,

Anthony Gazzola, P.Eng, PE, LEED® AP, Partner

AG ENGINEERING

March 10, 2014
Rev2

Township of Terrace Bay Waterfront Study - Electrical
Electrical Service and Road Lighting

No	Description	Cost
1	3250M of primary trench w/ 25kV cables in duct	$325,000
2	25kV HV Switch and Load Break qnty=1	$40,000
3	150kVA Carte Visitran at larger buildings qnty=6	$280,000
4	37.5kVA subdivision style pad mount transformers qnty=17	$127,500
5	600V, 400Aservice for Apartment bldg qnty= 4	$80,000
6	600V 200A commerical services qnty=3	$45,000
7	200A single phase residential services qnty= 60	$200,000
8	Street lighting allowance for 32 LED Cobra heads	$112,000
9	communications ducting, pull rope and pedestals 2500M	$25,000
10	general power allowance at marina dock	$75,000
11	Hydro One Connection allowance	$100,000
12	Contingency alloawance	$100,000
	Sub-Total	$1,509,500
	Engineering- 15%	$226,425
	Total Estimated Electrical Construction Cost	$1,735,925

Assumptions

- Hydro One can bring service to entracne at Beach Road
- All services will be burried
- All street lighting will be standard grade LED
- All loading for buildings based on past experience as systems are not known
-estimate based on loop primary feed

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Appendix B

Infrastructure Class C Cost Estimate

Terrace Bay Waterfront Development, Terrace Bay, ON **2014-06-11**
Project # 14-602-01E

		Qty	Unit Price	Unit	Total
1. Site Preparation					
1001	Mob/Demob	1	$31,500	each	$31,500
1002	Clearing and grubbing	176,000	$6	m^2	$1,108,800
1003	Earthworks and site grading	88,000	$8	m^3	$739,200
1004	Topsoil and mulch	176,000	$1	m^2	$138,600
1005	Bedrock excavation contingency	500	$210	m^3	$105,000
Total Costs-Site Prep					$2,123,100
2. Water Servicing					
2001	50mm HDPE C-901 water service	1,180	$105	m	$123,900
2002	150mm PVC C-900 fire service	105	$147	m	$15,400
2003	200mm PVC C-900 watermain	3,750	$189	m	$708,800
2004	Fire hydrant with appurtenances	7	$8,400	each	$58,800
Total Costs-Water Servicing					$906,900
3. Sanitary Servicing					
3001	135mm PVC SDR 28 sanitary service	770	$116	m	$88,900
3002	150mm PVC SDR 28 sanitary Service	410	$137	m	$56,000
3002	250mm PVC SDR 35 sanitary sewer	3,800	$168	m	$638,400
3003	1200 mm dia. sanitary manhole	35	$3,570	each	$125,000
3004	Lift Station and appurtenances	1	$110,250	each	$110,300
3005	150 mm PVC C-900 forcemain	1,700	$142	m	$241,000
Total Costs-Sanitary Servicing					$1,259,600
4. Stormwater Infrastructure					
4001	Constructed wetland 1	1	$18,900	each	$18,900
4002	Constructed wetland 2	1	$60,900	each	$60,900
4003	Culvert 600mm CSP	60	$200	m	$12,000
4004	Temporary sedimentation and erosion control (e.g. Silt fence, ponds)	1	$15,750	each	$15,800
4005	Permanent sedimentation and erosion control (e.g. ditch lines)	1	$8,400	each	$8,400
Total Costs-Stormwater Infrastructure					$116,000
5. Roads					
5.0 Repave of Existing Road (2.3 km at 7 m wide)					
5001	Reclamation	18,000	$3	m^2	$56,700
5002	HL4 hot mix asphalt 50mm depth	2,105	$116	t	$243,100
5003	Mountable curbing	4,600	$173	m	$797,000
5.1 Asphalt Bicycle Lane/Pedestrian Walkway (2.9 km at 3 m wide)					
5101	HL4 hot mix asphalt 50mm depth	1,137	$116	m^2	$131,400
5102	Granular B 250mm depth	5,024	$16	t	$79,100
5.2 Construction of New Road (1.45 km at 7 m wide)					
5201	HL4 hot mix asphalt 50mm depth	1,327	$116	t	$153,300
5202	Granular A 150mm depth	3,517	$19	t	$66,500
5203	Granular B 500mm depth	11,723	$16	t	$184,600
5204	Concrete sidewalk (0.85 km at 1.5 m wide)	1,275	$126	m	$160,700
5205	Mountable curbing	2,900	$173	m	$502,400
5206	Supply and Install Double Light Standards	94	$2,310	each	$217,100
5.3 Interpretative Trail Completion					
5301	Trail Construction	1,550	$150	m	$232,500
5304	Interpretative Panels and Signage	1	$10,000	LS	$10,000
5.4 Missing Trails Re-link					
5401	Trail re-link	500	$42	m	$21,000
5.5 Slope Stabilization					
5501	Site 1 close to the shoreline lodges	1	$31,500	each	$31,500
5502	Site 2 close to the proposed Marina	1	$52,500	each	$52,500
Total Costs-Roads					$2,939,400

Infrastructure Class C Cost Estimate

Terrace Bay Waterfront Development, Terrace Bay, ON **2014-06-11**
Project # 14-602-01E

6. Beach Pavilion Construction					
6001	Beach pavilion construction	5,840	$94	sq. ft	$550,100
Total Costs-Beach Pavilion					$550,100
7. Electrical					
7001	Electrical service and road lighting	1	$1,409,500	each	$1,409,500
Total Costs-Electrical					$1,409,500
8. Miscellaneous					
8001	Security gate	1	$15,750	each	$15,800
8002	Existing boat launch improvement	1	$26,250	LS	$26,300
Total Costs-Miscellaneous					$42,100
Sub-Total Cost					$9,346,700
Engineering					
	10% of Sub-Total Cost	0.1	$9,346,700		$934,700
Contingency					
	10% of Sub-Total Cost	0.1	$9,346,700		$934,700
Total Class C Costs for Infrastructure (Excluding HST)					**$11,216,100**

Note:
1. Watermain is assumed to start from the intersection of Kenogami Rd and Beach Rd.
2. Item 5.1 Asphalt Bicycle Lane/Pedestrian Walkway could be replaced by 1.5 m wide concrete sidewalk.
(cost: one side $319,000 , both side $638,000, not including granular B)
3. The cost for Item 5.3, 5.4 , 6 and 8002 are provided by TCI Management. Cost for Item 8002 may vary from $10,000 to $80,000.
4. No coastal protection is considered for Marina or Beach Pavilion.
5. No landscape, building footprint or electrical included in this cost estimate.
6. Item 6 Electrical Cost is provided by AG Engineering.
7. The cost for upgrading of existing sewage treatment system is not included in the Class C Cost Estimate due to lack of information.
8. Cost estimate based on 2014 construction costs.


TERRACE BAY