Prepared for:

Ministry of Transportation & Highways
(Kootenays)

Prepared by:

Reid Crowther & Partners Limited

KOOTENAY LAKE
FERRY STUDY
FINAL REPORT

Project No. 31541-000

June 1990

Reid Crowther

Please refer to file 31541

June 14, 1990

Ministry of Transportation & Highways
310 Ward Street
Nelson, B.C.
V1L 5S4

Attention: Mr. Gordon Sutherland, P. Eng.

Dear Sirs:

Re: Kootenay Lake Ferry Study - Final Report

We are pleased to submit four (4) copies of our Final Report for the Kootenay Lake Ferry Study, as discussed at the review meeting on May 10th, 1990.

We would like to thank you for the opportunity to work on this interesting project and would be glad to assist you in any way in the future phases of the project.

Yours truly,

REID CROWTHER & PARTNERS LIMITED

T.A. Tasaka, P. Eng.
Manager, Marine Division

GV/lkf
Encl.
cc: Ian Smart (2 copies of Report)

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EXECUTIVE SUMMARY

KOOTENAY LAKE FERRY STUDY

EXECUTIVE SUMMARY

The Kootenay Lake Ferry is operated and maintained by the Ministry of Transportation and Highways between terminals at Balfour and Kootenay Bay.

Two vessels are available to service the route, the MV Balfour and the MV Anscombe.

Reid Crowther and Partners have been retained by M.O.T.H. to look at ways of improving the existing service in order to accommodate increased demand.

The purpose of this report is, therefore, to assess the ways in which the ferry service can be improved and evaluate the alternatives in terms of environmental, operational, economic and other key issues.

Two methods of improving the service have been identified and this report focuses on these methods, namely:

- Modify the vessel to increase capacity.
- Reduce the crossing time by shortening the route.

Conceptual design of proposed modifications to MV Balfour has been carried out by Marine Design Associates of Victoria. The modifications to the ferry will increase its carrying capacity from approximately 36 cars to 60 cars. This has the effect of increasing the average maximum capacity for the route from 45 cars per hour to 60 cars per hour.

Increasing the size of one of the vessels will require modifications to existing marine structures at Balfour and Kootenay Bay in order to accommodate both the existing vessel MV Anscombe and the modified vessel MV Balfour.

The following marine works will be required at the two terminals:

Balfour

- Remove existing dolphin structures
- Modify existing apron
- Construct new floating leads and anchoring system

Kootenay Bay

- Remove existing wingwall and dolphin structures
- Modify existing apron
- Construct new floating wingwalls and leads and anchoring system

The cost of these modifications is estimated at $1.1M for Balfour and $1.6M for Kootenay Bay. The extra cost at Kootenay Bay is reflected by the requirement to provide new wingwalls at the terminal. A schedule of 10 months for the design and construction of these modifications is required.

The second method of improving ferry service has been identified as shortening the route.

Nine alternative sites (including the two existing sites at Balfour and Kootenay Bay) were evaluated as part of the study.

As a result of our feasibility study and various discussions during the project, especially at the workshop session, the following sites are considered to warrant further study during the functional design stage.

- Balfour) Existing Sites
- Kootenay Bay)
- Pilot Point - at the site of the old smelter
- Queens Bay (North) - west of McEwen Point
- Queens Bay (South) - at the site of previous temporary facility

Further, more detailed information with regard to survey, geotechnical, hydrographic, environmental and social issues should be obtained during the functional design phase of the project. It is also recommended that public input is sought at this stage.

Based on the sites listed above, six alternative routes are possible including the existing route between Balfour and Kootenay Bay.

Each route offers some merit, depending on the priorities which are given. The purpose of the next phase of the project (Functional Planning) should be to obtain further, more relevant information and develop public input to the project. A brief description of some of the advantages of each route is included here. Figure 8 also shows a summary of some of the relevant factors.

- **Route A: Kootenay Bay - Balfour (existing route).**

  Easiest solution for cost and implementation, but the capacity of the route is always limited because this is the longest route.

- **Route B: Queens Bay (North) - Kootenay Bay**

  Moderate cost and significant increase in ferry capacity. Local issues may be a problem.

- **Route C: Queens Bay (South) - Kootenay Bay**

  The site of the temporary ferry landing is probably the best alternative on the Balfour side of the lake. Does not achieve big increase in capacity.

- **Route D: Balfour - Pilot Point**

  Offers reasonable increase in capacity, but requires construction of highway upgrade from Kootenay Bay to Pilot Point.

- **Route E: Queens Bay (South) - Pilot Point**

  Significant increase in ferry capacity and both sites are reasonable for a terminal. High cost, however, due to construction of two new terminals and highway upgrade.

- **Route F: Queens Bay (North) - Point Point**

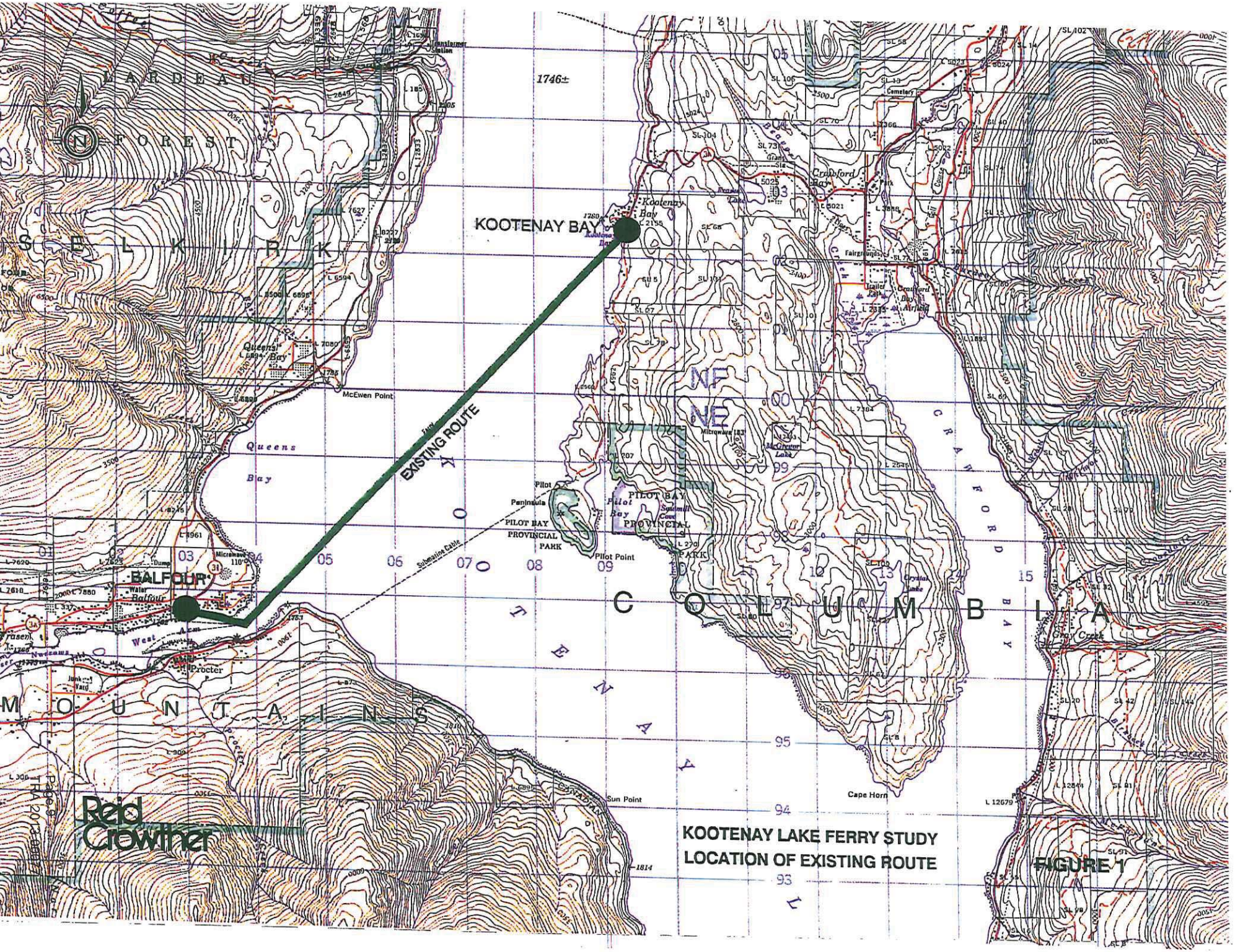
  Highest capacity route, may be sensitive to local issues at Queens Bay (North). Similar high cost as Option E.

The cost of relocating the terminal to each of the alternative sites has been estimated in 1990 dollars as follows:

Pilot Point	$6.9M
Queens Bay (North)	$4.4M
Queens Bay (South)	$4.2M

The schedule for completion of design and construction of the new terminals is estimated at 24 - 30 months.

In order to maintain continuity in this project and benefit from the experience gained so far, we would recommend that the detailed design of modifications to the existing terminals is carried out as soon as possible. We would also recommend that functional design of new terminal sites, together with public input, proceeds in the near future.


KOOTENAY BAY
EXISTING ROUTE
BALFOUR
Queens Bay
McEwen Point
Pilot Bay Provincial Park
Pilot Point
Sun Point
Cape Horn
Crawford Bay
Kootenay Bay
Procter
Submarine Cable
1746±
SELKIRK MOUNTAINS
COLUMBIA MOUNTAINS
KOOTENAY LAKE FERRY STUDY
LOCATION OF EXISTING ROUTE
FIGURE 1
Reid Crowther

1.0 INTRODUCTION

1.0 INTRODUCTION

The Ministry of Transportation & Highways is responsible for the operation and maintenance of a vehicle and passenger ferry service across the Kootenay Lake between Balfour and Kootenay Bay. Figure 1 shows the location of the existing ferry route.

The Ferry currently operates with two vessels, the M.V. Balfour and the M.V. Anscombe. The approximate capacity of the M.V. Balfour is 36 cars, while the M.V. Anscombe is 40 cars.

During the summer months, both ferries are used, operating on a 50 minute schedule. In the winter months, only one ferry generally operates. Additional crossings are used on long weekends and during the early summer to augment the winter schedule.

Recent trends indicate a need to improve the capacity of the existing ferry in order to accommodate present and future traffic loads.

Improvements to the Kootenay Lake Ferry have therefore been identified by M.O.T.H. as being a high priority project.

In order to study the ways in which ferry capacity can be increased, Reid Crowther and Partners Ltd. have been retained by M.O.T.H. to carry out a preliminary feasibility study.

This study will look at the various options and assess the alternatives in terms of environmental, operational and other important issues.

The work on this project was undertaken in February and March of 1990. It involved site visits to the Kootenay Lake area, meetings with local Highways and Ferries operating personnel, a workshop held in Vancouver and a draft report submitted in April 1990.

This report is the Final Report for the Study. It outlines our findings for increasing the capacity of the ferry, evaluates alternative sites and routes, and provides conceptual designs and preliminary cost estimates for the necessary marine related works.

2.0 STUDY OBJECTIVES

2.0 STUDY OBJECTIVES

The main objective of this study is to look at alternative ways of increasing the capacity of the Kootenay Lake Ferry and evaluate them in terms of environmental, operational, economic and other important issues.

There are two main ways by which the capacity of the ferry can be increased:

- modify the vessel to increase its car carrying capacity;
- reduce the crossing time by shortening the route.

This study will look at the ramifications of both the above measures.

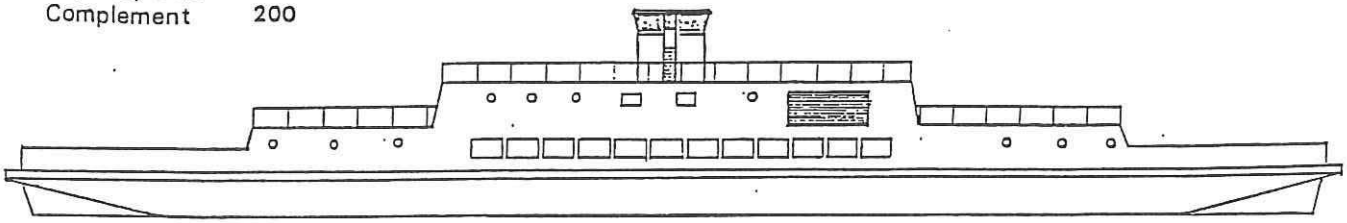
It is also important that any proposed improvement to the ferry system can fit into a reasonable budget and schedule. Where possible, preliminary cost estimates have been produced and schedules for completing the various stages of the project have been developed.

3.0 INCREASED CAPACITY BY MODIFICATIONS TO THE FERRY

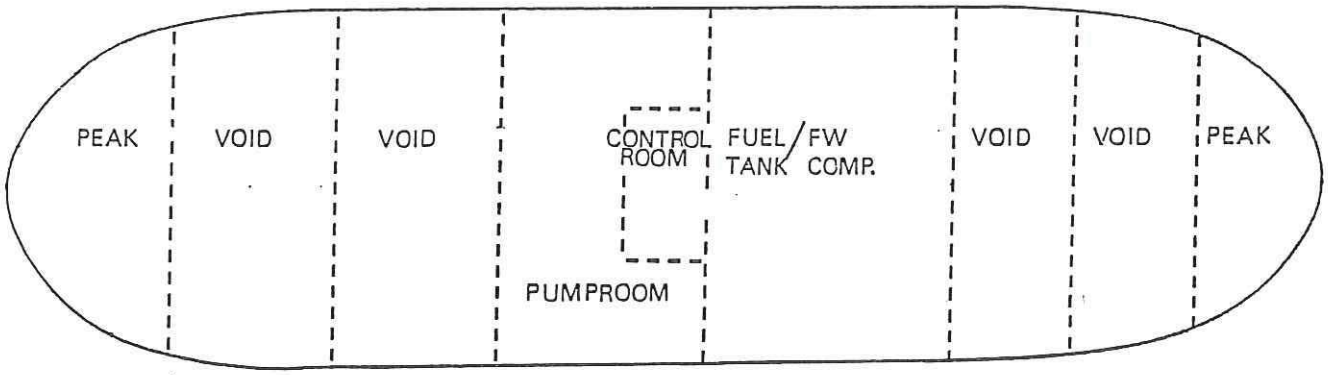
PARTICULARS

Length	241-6
Breadth	69-0
Depth	8-0
Capacity cars	60
Complement	200

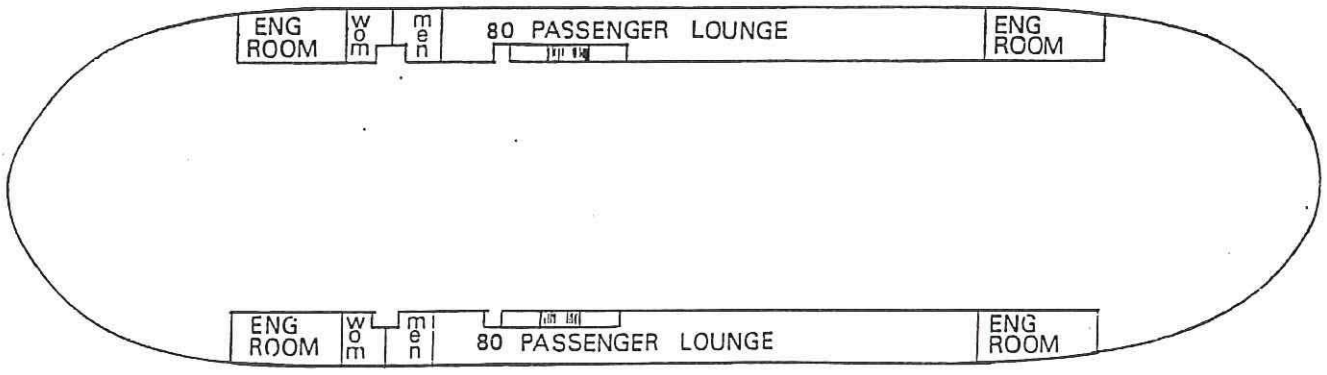
M.V. BALFOUR MODIFIED



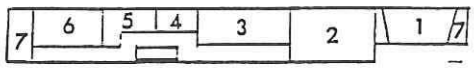
NEW SUPERSTRUCTURE



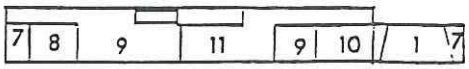
WATERTIGHT BULKHEADS & COMPARTMENTS



MAIN DECK & PASSENGER LOUNGES



1 GAS CYLINDERS
2 MASTER & ENG. OFFICE
3 ELECTRICAL COMP
4 STORE
5 OFFICERS WASHROOMS
6 EMERGENCY GEN
7 FAN ROOM
8 SHIPS OFFICE
9 CREW LKRS
10 CREW WASHROOMS
11 CREWS MESS



BOAT DECK ARRANGEMENT

M.D.A. MARINE DESIGN ASSOCIATES LTD.
947 Fort Street, Victoria, British Columbia, Canada V8V 3K3

FIGURE A

3.0 INCREASED CAPACITY BY MODIFICATIONS TO THE FERRY

One method by which the capacity of the ferry service on Kootenay Lake can be increased is by modifying the existing ferry to accommodate more vehicles.

Marine Design Associates of Victoria, naval architects, have been retained by M.O.T.H. to design suitable modifications to one of the ferries, M.V. Balfour.

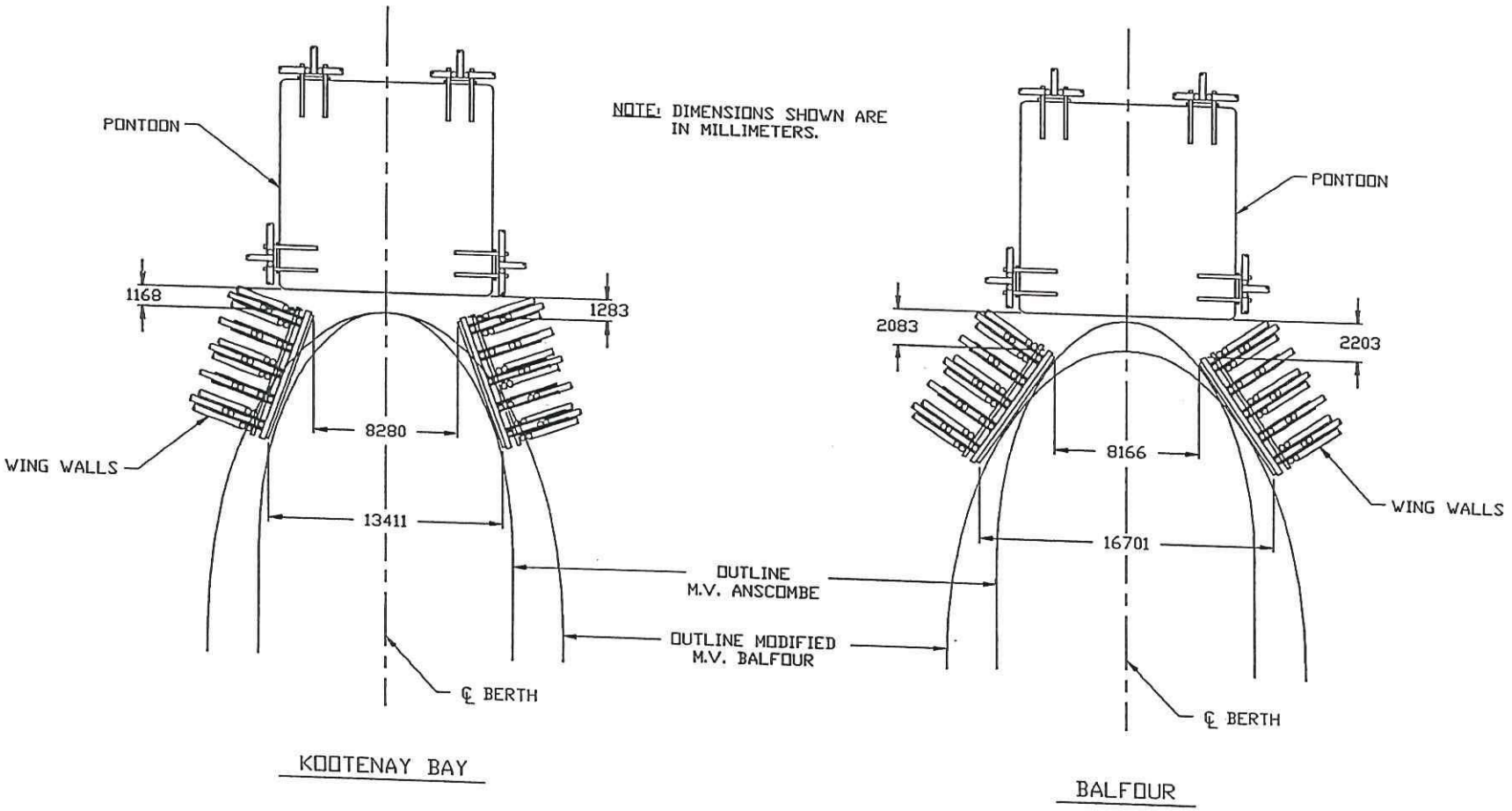
In broad terms the final configuration of the Balfour will be approximately 60 feet longer and 19 feet wider after modification. The arrangement of modified ferry is shown in Figure A on the opposite page.

The full load displacement of the vessel will also be increased from 650 tonnes to approximately 1075 tonnes.

The carrying capacity of the Balfour will be increased from 36 cars to 60 cars by this modification.

Increasing the size of one vessel, while maintaining the existing dimensions of the second vessel will have significant implications with regard to the terminal marine structures.

It will therefore be necessary to modify the existing terminals at Balfour and Kootenay Bay to accommodate both the existing ferry and the modified ferry.



EXISTING BERTH DIMENSIONS

FIGURE 2

3.1 Existing Structures

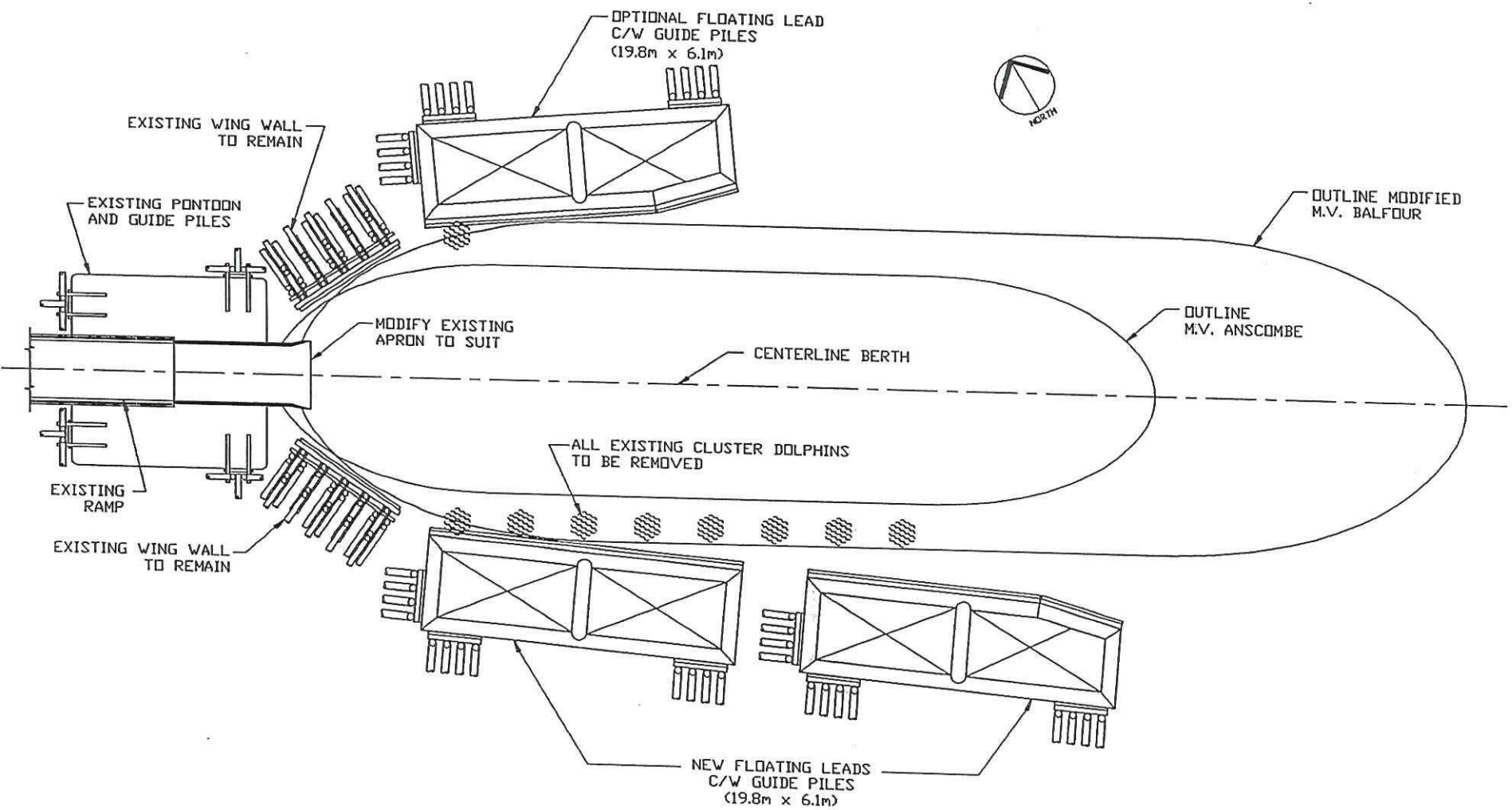
The layout of the ferry berths at Balfour and Kootenay Bay are shown in Figures 2, 3, 3A and 4. Also shown on these plans are the conceptual layout of the modified berths to accommodate the existing and new vessels. "Footprints" of the vessels are also shown.

The existing facility consists of an approach trestle leading to a 39 metre long steel loading ramp which is supported on a floating steel pontoon at the ferry end. A steel apron is hydraulically operated for vehicle loading and unloading.

Conventional timber piled and faced wingwalls protect the loading/unloading area together with untreated timber pile clusters for dolphin structures.

The layout of the wingwall structures at Balfour and at Kootenay Bay are quite different.

Figure 2 shows the as-built dimensions of these wingwalls with the outline of the two vessels for both terminals. These measurements were confirmed in March 1990 by M.O.T.H. survey crew.



BERTH LAYOUT AT BALFOUR FERRY TERMINAL

FIGURE 3

3.2 Modifications to Balfour Terminal

Figure 3 shows the conceptual design for the berth layout at Balfour. The structures are oriented such that the existing wingwalls can be retained with modifications to the steel apron. These modifications would involve lengthening the apron and possibly flaring it to accommodate both vessels.

Existing timber dolphins would have to be removed and these would be replaced by floating leads.

The leads would be constructed from steel pipe material with timber superstructure, bracing and facing.

Anchoring of the floating structures would be achieved by means of steel guide piles, although a system of stud-chain and concrete anchors could be used if water depths restrict the use of guide piles.

Figure 3A shows an alternative arrangement at Balfour, with the outside floating lead anchored using concrete anchors and stud-line chain. The leads adjacent to the wingwalls should be anchored using guide piles, but some cost saving may be derived from using the alternative system shown.

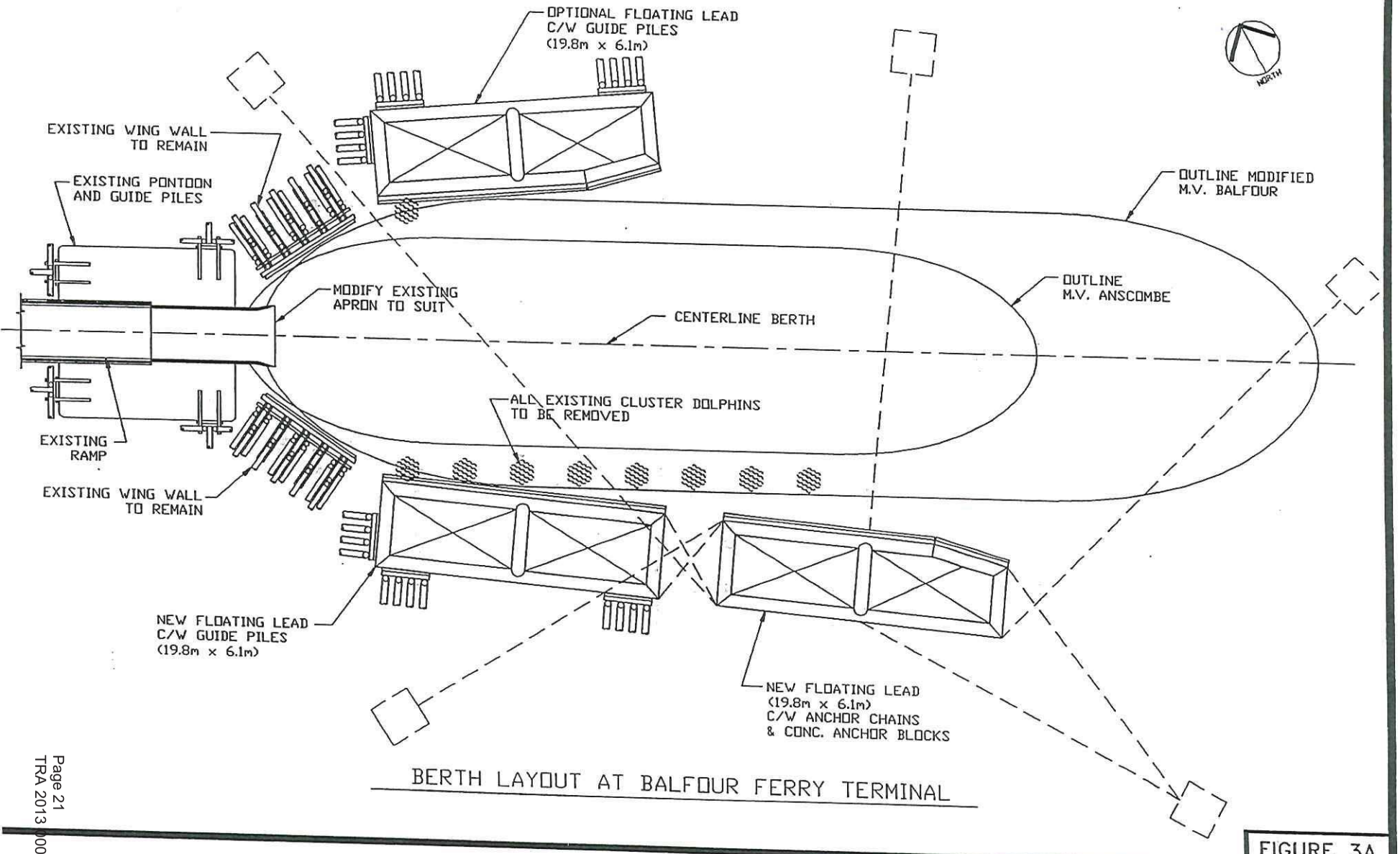
The floating lead on the north side of the terminal has been marked as optional, although it is recommended that input from the Ferry Captains is sought to evaluate the requirement for this lead.

The main advantages of using floating structures for the modified berths are twofold:

- Floating structures can be constructed off-site with little disruption to ferry operation. Guide piles can be driven with existing structures maintained and the new leads floated into place after demolition of the existing dolphins.

- The floating leads and possibly the guide piles can be reused at other sites if it is decided to move the location of the terminal.

The use of floating structures is therefore seen as a good way to modify the existing berths, while maintaining ferry operation.

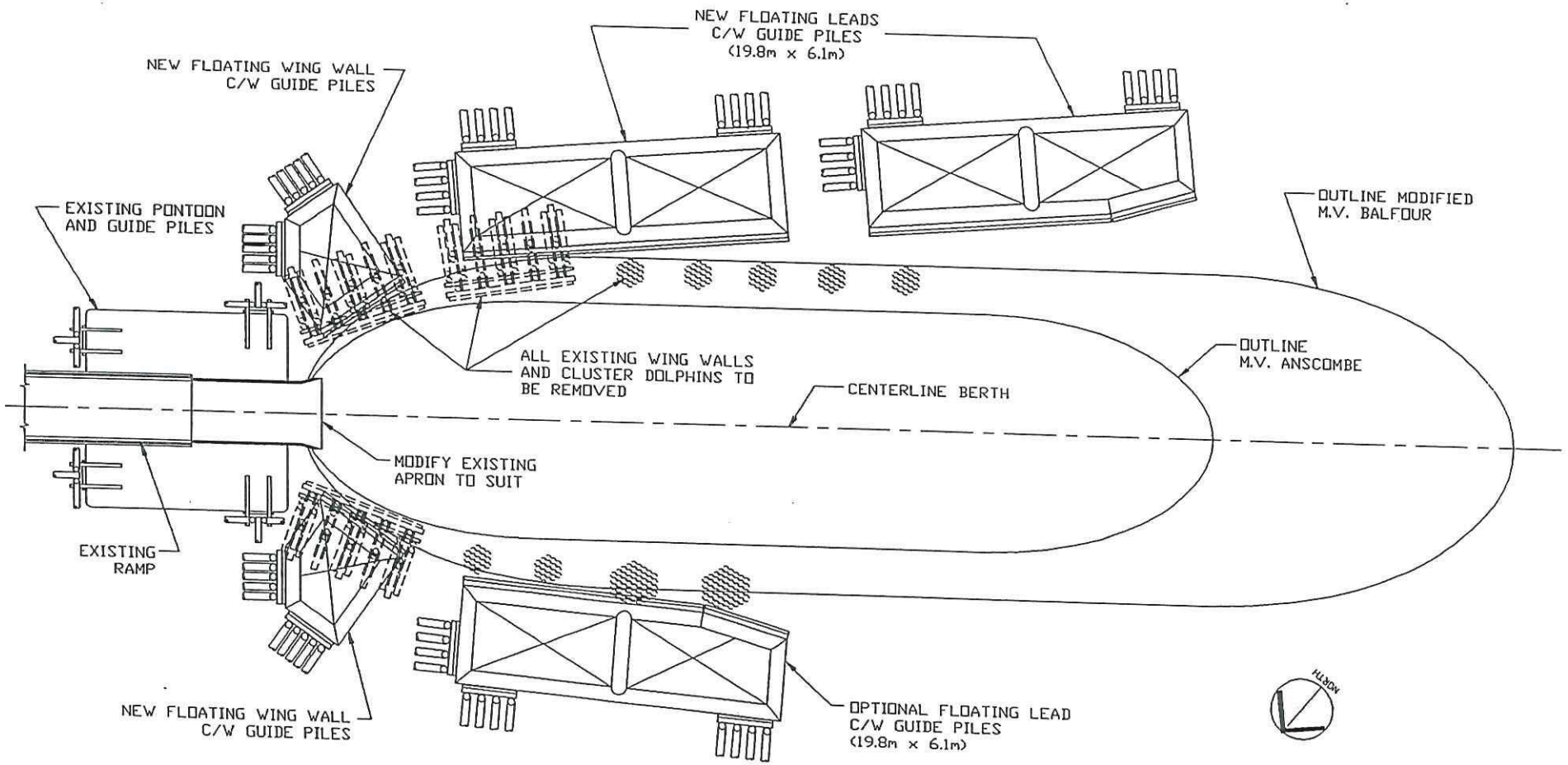


BERTH LAYOUT AT BALFOUR FERRY TERMINAL

FIGURE 3A

It would also offer the flexibility required because the structures can be used at other sites without any real difficulty.

Preliminary cost estimates and schedule are discussed in Section 5 of this report. At this stage, a cost of $1.1M for the modifications to the marine structures at Balfour is estimated, with a completion period of approximately 10 months.



BERTH LAYOUT AT KOOTENAY BAY FERRY TERMINAL

FIGURE 4

3.3 Modifications to Kootenay Bay Terminal

Figure 4 shows the layout at Kootenay Bay. Because the wingwalls at Kootenay Bay are much closer together than at Balfour, it will not be possible to retain these structures to accommodate the modified M.V. Balfour.

Both wingwall structures and all cluster dolphins will therefore have to be removed for the new ferry.

In order to maintain existing ferry service, floating wingwalls are proposed. Guide piles for these wingwalls can be driven ahead of time and the prefabricated wingwalls floated in after demolition of the existing wingwall structures.

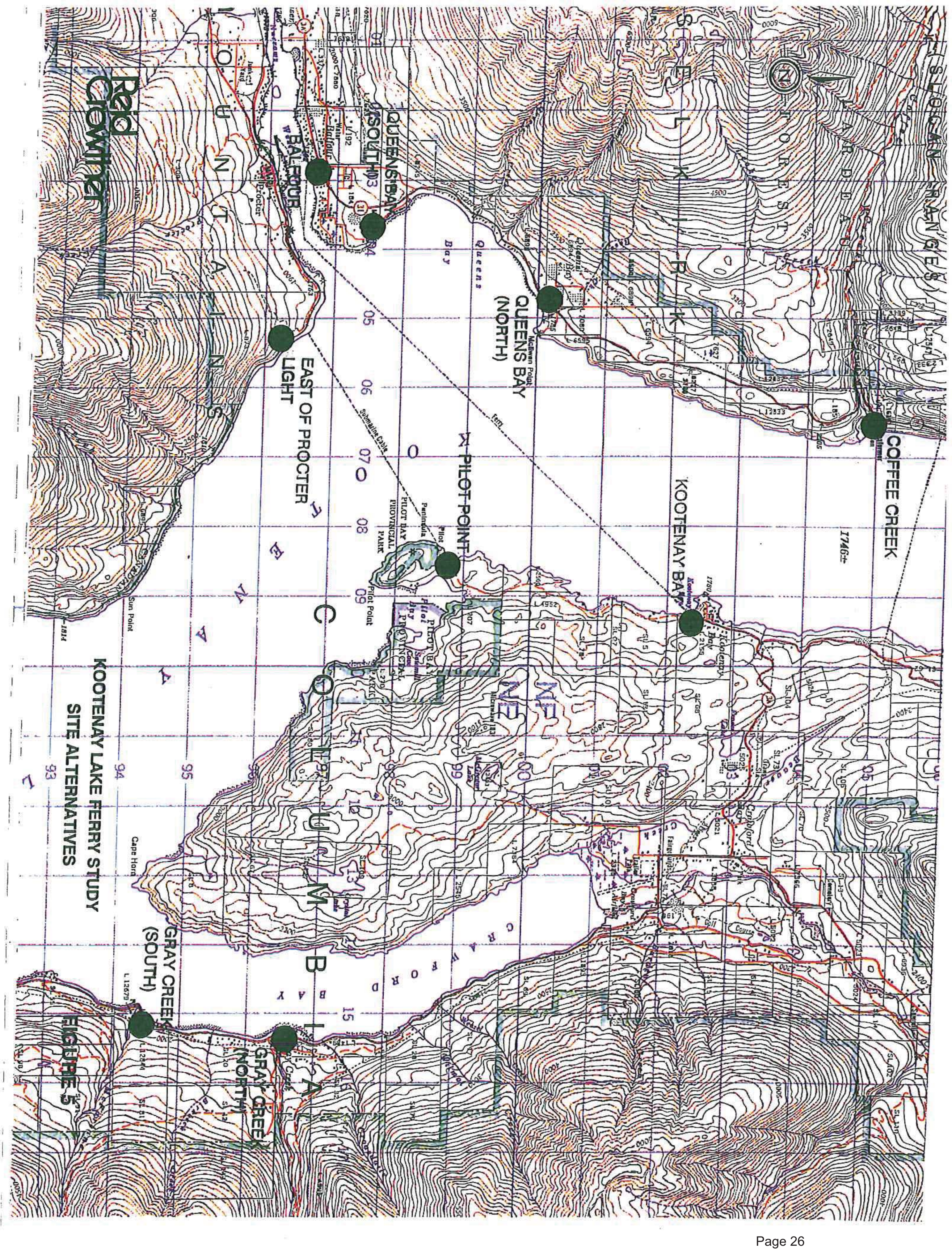
Floating leads with guide piles, similar to those proposed at the Balfour Terminal would also be utilized at Kootenay Bay. The use of a chain and concrete anchor system is also feasible, with a similar arrangement to the Balfour Terminal.

Preliminary estimate for the cost of modifications to the marine structures at Kootenay Bay is $1.6M with completion schedule of approximately 10 months.

Modifications to the Kootenay Bay and Balfour Terminals should run concurrently, i.e. the 10 month schedule would cover construction of modifications to both terminals.

As outlined in Section 5 of this report, it may be possible to advance the schedule slightly by early tender of the floating structures and procurement of materials ahead of time. Early procurement of materials may in fact be a requirement, if the construction schedule is tight.

4.0 SHORTENING THE ROUTE


KOOTENAY LAKE FERRY STUDY
SITE ALTERNATIVES
FIGURE 5
Red Crowther
COFFEE CREEK
KOOTENAY BAY
PILOT POINT
QUEENS BAY (NORTH)
QUEENS BAY (SOUTH)
BALFOUR
EAST OF PROCTER LIGHT
GRAY CREEK (NORTH)
GRAY CREEK (SOUTH)
SELKIRK
SLOCAN RANGES
KOOTENAY
COLUMBIA
CRAWFORD BAY
Queens Bay
Pilot Bay Provincial Park
Ferry
Submarine Cable

4.0 SHORTENING THE ROUTE

The existing ferry route between Balfour and Kootenay Bay provides for well sheltered terminals, however, in view of their distance apart (4.7 nautical miles), it is evident that the capacity of the ferry will always be restricted if the terminals remain at these locations.

In order to assess the feasibility of alternative sites for the terminal, several locations were investigated on both sides of the lake.

The following is a brief overview of each of the sites evaluated, with comments on the relative merits of each one. Alternative routes will be discussed later in this section.

Photographs of the general location of each site are included in Appendix A, at the end of this report.

4.1 Alternative Sites

Figure 5 shows the locations of the sites considered.

- **Coffee Creek**

Located on the west side of the lake, Coffee Creek is approximately 10 km north of Balfour. The main advantage of the site at Coffee Creek would be a very short run to the existing terminal at Kootenay Bay (approximately 2 nautical miles). On the other hand, Coffee Creek has many disadvantages.

Access to the highway would be difficult as the grades are quite steep. The existing highway does in fact loop back a considerable distance in order to cross the creek higher up. There is a restricted area available on the foreshore which may not be of sufficient area for a ferry terminal and the site is environmentally sensitive in terms of fish habitat, wildlife and recreational use. It is also a relatively exposed site from both the north and south.

Coffee Creek is not considered feasible for the ferry terminal site.

- **Kootenay Bay**

Located on the east side of the lake, Kootenay Bay is the site of the existing ferry terminal.

The obvious advantages of keeping the terminal at Kootenay Bay are that the transportation infrastructure is already in place and land acquisition would be kept to a minimum. These factors would impact on the cost of a new ferry terminal.

However, keeping the terminal at Kootenay Bay would always limit the capacity of the ferry, as the route into Kootenay Bay is relatively long. This is especially true if the terminal on the west side of the lake is located at or near Balfour.

The environmental issue is not quite so clear.

Initially, it appears that since the terminal is already located at Kootenay Bay, expansion would have little effect environmentally. However, it is clear that this area is becoming a popular recreational area ... a new breakwater has been built to help small boat landing and there are popular fishing and camping areas.

Moving the ferry terminal away from Kootenay Bay may therefore be of significant benefit to the environment, as this area could then be dedicated to purely recreational use.

- **Pilot Point**

Several potential sites were investigated on the east side of Kootenay Lake, to the south of the existing terminal at Kootenay Bay.

The best site in this area is considered to be "Pilot Point" at the location of an abandoned smelter known locally as Smelter Bay. This site will be referred to as Pilot Point in the report.

Pilot Point offers some significant savings in terms of the length of the ferry crossing and therefore would increase the capacity of the route significantly. The area also appears to have favorable topography for the location of a ferry terminal.

Comparatively, Pilot Point is assessed as a reasonably sheltered site for a ferry terminal.

Currently, during bad weather, the ferry heads directly for Pilot Point from Balfour and then stays close to the shore on the east side of the lake, while sailing north to Kootenay Bay.

The main disadvantage of the Pilot Point site is that there is no paved highway access in place. A new road would need to be re-constructed from Kootenay Bay approximately 4 km south to the site at Smelter Bay.

The Ministry of Highways does in fact own right of way for a road from Kootenay Bay to Pilot Point, although this may not be sufficient for the standard of road that would be required. Initial estimates indicate a cost of $2.5 M - $3.0 M to establish a highway link from Kootenay Bay to Pilot Point.

In terms of environmental impact, Pilot Point offers some important considerations. Currently, the site of the old smelter is in need of improvement. Construction of a ferry terminal could provide this, while returning the more attractive area at Kootenay Bay to recreational use.

Construction of highway access may not be as locally sensitive as first appears. A new road would provide much better access to the properties in the area and could also provide the additional benefit of access to the provincial park area south of the proposed terminal site, which is presently only accessible by water.

In view of the many advantages offered by the Pilot Point site, it is felt that this location is feasible for a ferry terminal site and warrants further consideration.

- **Queens Bay (North)**

As an alternative to the existing site at Balfour on the west side of the lake, sites at Queens Bay were considered.

The Queens Bay (North) site is located approximately 4.5 km north of Balfour and west of McEwen Point.

The main benefit of having the ferry terminal at Queens Bay (North) is that the route would be shortened considerably, if the terminal on the east side of the lake is located at either Kootenay Bay or Pilot Point. Queens Bay (North) therefore offers the route with the highest capacity.

Queens Bay (North) is well sheltered from the north, but is exposed to wind and swell from the south, although careful orientation of the dock facility should reduce this problem.

The main disadvantage of Queens Bay (North) is the requirement for land acquisition for the terminal and highway access. Potential objections from local residents are also anticipated. The Queens Bay area has many properties near the waterfront and the beach is a popular recreation spot.

However, in view of the potential benefits in terms of increased ferry capacity, Queens Bay (North) is considered to warrant further, more detailed evaluation.

- **Queens Bay (South)**

Queens Bay covers a fairly extensive area on the west side of Kootenay Lake. Another site which was considered is approximately 1.2 km northeast of the existing terminal at Balfour. This site is referred to as Queens Bay (South).

Initially, a site in the vicinity of the water pipeline access was considered. However, a second site slightly to the south where a temporary ferry access was used during ramp reconstruction in 1984 also warrants consideration and may be preferable for various reasons. In view of the proximity of these two sites, the area is generally referred to as Queens Bay (South), more specific positioning of the terminal location would be fixed after more detailed evaluation and survey during the functional design of the terminal.

Queens Bay (South) does not shorten the route significantly and would not have a dramatic effect on the capacity of the ferry. However, there may well be other important factors which affect the need to move the terminal away from its current location at Balfour.

In this regard, Queens Bay (South) may well be a viable alternative. The topography and highway access is favorable for a ferry terminal. The site is also reasonably sheltered and offered no real operational constraints when it was used as a temporary landing site in 1984. Careful location of the terminal could also reduce potential objections from local property owners in the Queens Bay (South) area.

Based on the desirability to move the terminal from its existing site at Balfour, Queens Bay South at the site of the temporary ferry landing is worth further consideration and evaluation.

- **Gray Creek (South)**

Several sites were looked at in the Gray Creek area on the east side of Crawford Bay.

These sites were considered in the context of an overall transportation plan for the area and may be the subject of future longer term planning studies. However, in the context of this report several important factors are evident.

Gray Creek (South) is located in Crawford Bay due east of the Cape Horn Peninsula. Although this site offers favorable topography for a ferry terminal and is close to the highway, the length of the ferry route would be increased significantly and therefore would actually reduce the capacity of the ferry.

Gray Creek (South) is also considered to be fairly sensitive environmentally. Fish-bearing creeks empty into Crawford Bay and there are several boating and camping areas in the vicinity. It is anticipated that there would be strong local objection to construction of a ferry terminal at this site.

At this stage there are no real benefits in relocating the terminal at Gray Creek. This site will not therefore be considered further in this report, although further evaluation may be required as part of an overall transportation plan.

- **Gray Creek (North)**

This site is located approximately 2 km north of the Gray Creek (South) site on the east side of Crawford Bay.

Similar site conditions exist and the same arguments apply for both Gray Creek sites.

In fact Gray Creek (North) is probably more environmentally sensitive and is further still from the ferry terminal on west side of the lake.

This site is not therefore considered feasible for the location of the ferry terminal and will not be considered in detail in this report.

- **East of Procter Light**

Another site on the west side of the lake which was considered is the area east of Procter Light. This site falls into the category of sites which could form part of a long term planning scheme for the area.

The obvious disadvantage of this site is that it is located on the Procter side of the lake. In order for this site to be feasible, it would be necessary to provide a bridge crossing over the west arm of Kootenay Lake somewhere west of Balfour. Since this would be a major structure, it is not within the scope of this report to discuss the feasibility of such a crossing.

At this stage, a ferry terminal located in the Procter area is not considered feasible, however, should the possibility of a bridge crossing become evident, it may be worthwhile to evaluate a terminal site east of the Procter Light.

- **Balfour**

Located on the west side of Kootenay Lake, Balfour is the site of the existing ferry terminal.

As at Kootenay Bay, the advantages of keeping the terminal at Balfour relate to the existing transportation infrastructure and the requirements for limited additional land acquisition which would reflect on the cost of the terminal upgrade.

The main disadvantage of keeping the terminal at Balfour is that ferry capacity will always be limited and restricted because of the length of the crossing.

There are some other important issues which must be considered at the Balfour site. Modifications to the M.V. Balfour to increase carrying capacity would result in a bigger and possibly faster ferry. This vessel is likely to cause considerable local concern in terms of wave action during ferry operation. This problem may also be accentuated if the terminal on the east side of the lake is moved and ferry crossings become more frequent.

Another serious concern relates to safety. During the summer months many small boats use recreational marina facilities in the Balfour area. Fishing is also very popular near the west arm of Kootenay Lake. Although fishing is currently restricted due to reduced stocks, this is seen as only

PROVINCE OF BRITISH COLUMBIA

Ministry of
Transportation
and Highways

EVALUATION OF ALTERNATIVE SITES

FACTORS	ALTERNATIVE SITES								
	COFFEE CREEK	KOOTENAY BAY	PILOT POINT	QUEENS BAY (North)	QUEENS BAY (South)	SOUTH OF GRAY CREEK	GRAY CREEK	EAST OF PROCTER LIGHT	BALFOUR
LENGTH OF ROUTE	●	○	●	●	○	○	○	●	○
ENVIRONMENTAL	○	◐	◐	◐	◐	○	○	◐	◐
SOCIO-ECONOMIC	○	◐	◐	○	◐	◐	○	◐	◐
LAND ACQUISITION	○	●	◐	○	◐	○	○	◐	●
HIGHWAY ACCESS	○	●	○	◐	◐	◐	◐	○	●
SITE TOPOGRAPHY	○	●	●	◐	●	●	●	○	◐
SITE EXPOSURE	○	◐	●	○	●	◐	◐	○	●
COST	○	●	◐	◐	◐	◐	◐	○	●

● ⟷ ○

BETTER WORSE

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KOOTENAY LAKE FERRY STUDY

FIGURE 6

a temporary situation and boaters will return in large numbers. Moving the ferry terminal away from Balfour would certainly reduce the risk of an accident involving a small boat.

Local issues are another important concern. Businesses have built up as a result of the location of the ferry terminal and would be affected if it were to move. This is certainly true, but may not be such a serious concern in view of other recreational developments in the area, such as a new golf course.

Indeed moving the terminal out of Balfour may make way for other uses of the area such as recreational/marina facilities. The same arguments apply at Balfour, as at Kootenay Bay.

Although it appears initially that a new ferry terminal would be detrimental to the environment, moving the terminal to a less sensitive area and giving up prime waterfront property may in fact be a benefit environmentally.

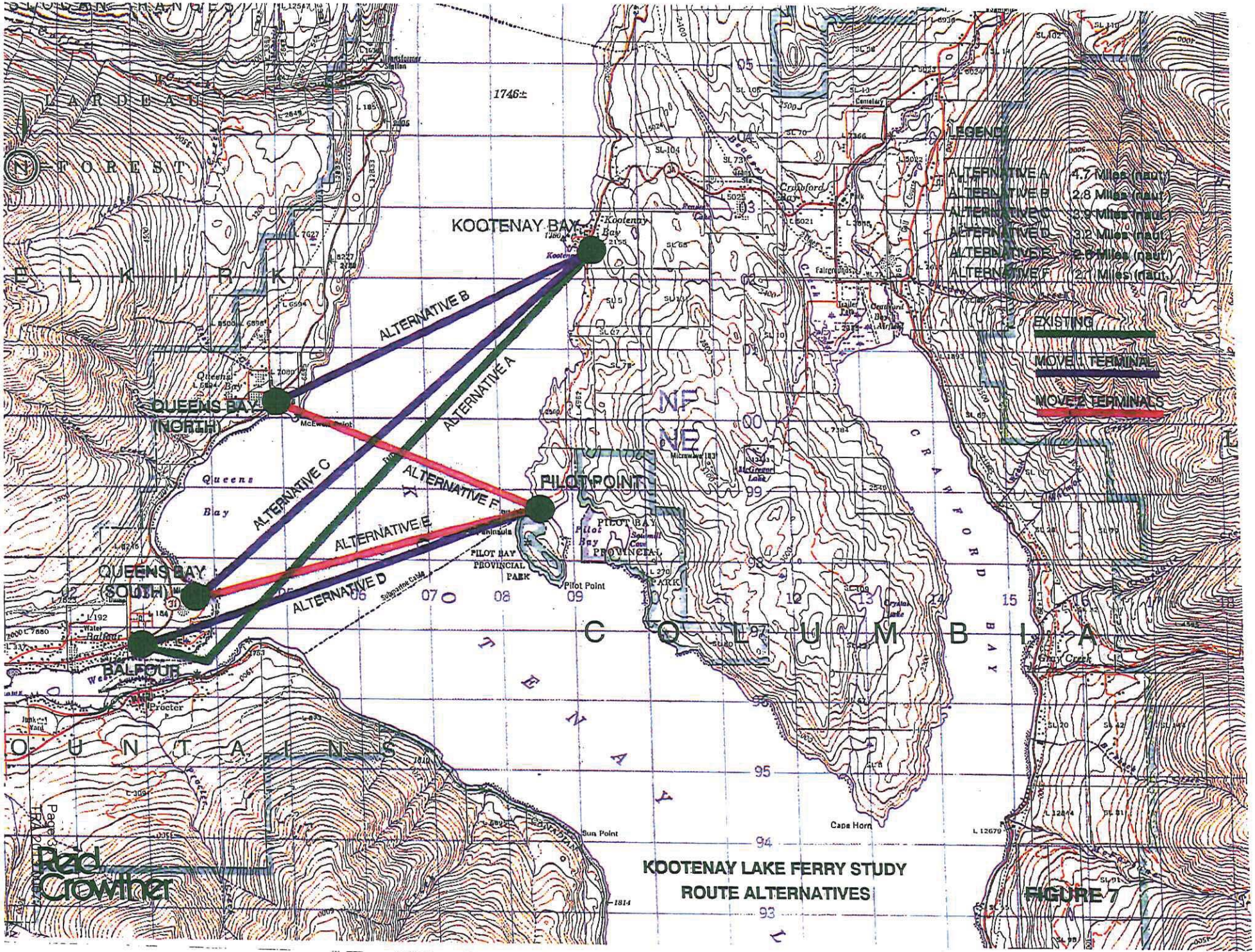
It may therefore be possible to justify moving out of Balfour in terms of capacity and other factors. The main disadvantages of course relate to cost and finding a suitable alternative site.

Summary of Alternate Sites

Figure 6 shows a summary of some of the important factors and a rating for each of the sites that were visited.

In terms of further evaluation and routes to be considered, the following sites are recommended.

Kootenay Bay	Existing Site
Pilot Point	Smelter Bay Area
Balfour	Existing Site
Queens Bay (North)	West of McEwen Point
Queens Bay (South)	Site of Temporary Terminal Facility


KOOTENAY BAY
QUEENS BAY (NORTH)
QUEENS BAY (SOUTH)
PILOT POINT
BALFOUR
ALTERNATIVE A
ALTERNATIVE B
ALTERNATIVE C
ALTERNATIVE D
ALTERNATIVE E
ALTERNATIVE F
LEGEND
ALTERNATIVE A 4.7 Miles (naut.)
ALTERNATIVE B 2.8 Miles (naut.)
ALTERNATIVE C 3.9 Miles (naut.)
ALTERNATIVE D 3.2 Miles (naut.)
ALTERNATIVE E 2.9 Miles (naut.)
ALTERNATIVE F 2.1 Miles (naut.)
EXISTING
MOVE 1 TERMINAL
MOVE 2 TERMINALS
KOOTENAY LAKE FERRY STUDY
ROUTE ALTERNATIVES
FIGURE 7

4.2 Alternative Routes

Figure 7 shows the alternative routes that are possible with the sites recommended in Section 4.1.

The following is a brief overview of each of the routes, with projected ferry capacity, length of route and other important factors considered.

The construction required to establish these routes varies from modifications to the existing ferry berths, relocation of 1 terminal, to relocation of 2 terminals.

A summary of some of the important factors is also shown in Figure 8. The factors are listed in order of importance, as determined by discussions during the study and workshop held for the project. Each alternative route is also rated to give an idea of which routes are the most favorable and why.

Route A: Balfour - Kootenay Bay (Existing Route)

Alternative A involves staying at the existing terminals and modifying the ferry berths to accommodate an upgraded ferry (the M.V. Balfour).

The main advantages of this option are minimum capital cost and the existing facilities can be utilized.

Although this route is listed here as an "alternative", it will probably be necessary to carryout the work required for this option in order to meet the schedule for operation of the modified ferry M.V. Balfour.

It will thus be necessary to operate this route for a further 1-2 years after the modification, as this would be the minimum amount of time required to effect the move of one or both of the terminal locations. Schedules for modifications to the existing berths and construction of new terminals are given in Section 5.0.

In terms of ferry capacity, the Balfour-Kootenay Bay option is the longest route and therefore restricts the ultimate capacity of the ferry to approximately 60 cars per hour. Current capacity with the existing ferries is 45 cars per hour.

Ferry capacities are summarized in Figure 8A. The capacities given are based on 2-ferry operation with the appropriate schedule time.

Other considerations are environmental, socio-economic and safety.

Initially, the environmental impact of staying with the existing route would appear to have the least effect. However, considering that the sites at Balfour and Kootenay Bay could be given up to other recreational/social uses, moving out of Balfour and/or Kootenay Bay may in fact be a benefit environmentally.

Local, people issues are also an important consideration, especially on the Balfour side. It is difficult to properly assess the reaction of local residents at this stage. Full public participation should be sought during the functional design stage of the project by holding an open house and carrying out full public relations measures.

The safety issue at Balfour has been discussed in Section 4.1. Staying at Balfour and operating a bigger, faster ferry would only increase the risk of an accident involving a small boat. The same argument is probably true for the Kootenay Bay side, with the increase in small boat activity on the east side of the lake.

The following three alternative routes B, C. and D involve moving one ferry terminal and operating from the other existing site.

Route B: Queens Bay North - Kootenay Bay

The main advantage of this route is that it shortens the crossing distance considerably and therefore increases capacity of the ferry. Initial estimates indicate a maximum capacity of 85 cars per hour, compared with 60 for the modified ferry. Capacities are summarized in Figure 8A.

In terms of site access and service reliability, Queens Bay North is not perfect because of its exposure to the southerly wind and swells. There may well be considerable local objection to construction of a terminal at Queens Bay North and land acquisition for the new terminal and access would be necessary.

However, in view of the substantial benefits in terms of increased ferry capacity, combined with moderate cost of moving one terminal, this route is certainly worth further consideration.

Route C: Queens Bay South - Kootenay Bay

This route shortens the crossing distance, but not by as much as Alternate B. A maximum ferry capacity of approximately 65 cars per hour could probably be achieved on this route.

Queens Bay South does, however, offer other advantages over Queens Bay North, especially in the area where a temporary facility was operated in 1984. The terminal site is favorable, highway access is reasonable and the site is well-sheltered from an operational standpoint.

If the need to move away from the existing terminal at Balfour is strong enough and can be justified in terms of factors other than ferry capacity, Queens Bay South to Kootenay Bay is a viable alternative which should be considered.

Route D: Balfour - Pilot Point

Route D from Balfour to Pilot Point shortens the crossing distance considerably. A maximum ferry capacity of approximately 75 cars per hour could probably be achieved.

Other advantages of this crossing are that both sites are well-sheltered from an operational standpoint and the Smelter Bay area of Pilot Point is currently in need of improvement.

Pilot Point offers the only real viable alternative site on the east site of Kootenay Lake. The main drawback of this route is the need for a major highway upgrade from Kootenay Bay down to the proposed terminal site at Pilot Point.

The cost of this highway could also be considered in terms of other additional benefits such as improving road access to the properties in the area and providing better access to the Provincial Park to the south of the proposed terminal area.

Although moving the ferry terminal to Pilot Point would probably arouse substantial local interest, moving away from the site at Kootenay Bay could offer benefits to the community.

Balfour to Pilot Point is a feasible route for the ferry crossing which should be considered in terms of additional ferry capacity and other local issues.

Two further crossings are possible, both involve construction of 2 new facilities.

Route E: Queens Bay South - Pilot Point

This route would shorten the crossing distance substantially and could increase ferry capacity to approximately 85 cars per hour.

Both locations at Queens Bay South and at Pilot Point are reasonably well-sheltered sites for a ferry terminal.

From an environmental standpoint, Queens Bay South and Pilot Point do not have any obvious drawbacks. However, during the functional design stage of this project, a detailed environmental impact study should be carried out to confirm this view.

Other benefits from adopting this route would be that the existing terminals at Balfour and Kootenay Bay could be removed and these sites could then be used for more recreation type activities, such as boating, camping and fishing. Moving away from the existing terminals could also improve the safety aspect of the ferry operation.

The main disadvantages of this route are cost and people related.

The Queens Bay - Pilot Point route would require significant capital cost and would involve construction of the new terminals and a new road from Kootenay Bay to Pilot Point.

One could also anticipate much local interest as this new construction would require land acquisition which may affect a number of residences causing considerable local objection.

However, in view of the long term needs to improve ferry capacity and other benefits which could be derived, Queens Bay South to Pilot Point is seen as a viable route for the ferry crossing.

Route F: Queens Bay (North) - Pilot Point

Route F from Queens Bay (North) to Pilot Point would provide the shortest crossing distance and therefore the maximum ferry capacity (approximately 100 cars per hour).

Most of the same arguments applied to Route E apply to the Queens Bay North to Pilot Point route.

The area at Queens Bay North is probably not as desirable in terms of highway access and wind and wave exposure, but this has to be weighed against the benefits of operating on the shortest route.

Costs of construction for routes E and F would be of the same order of magnitude. Route F is a little more sensitive from a socio-economic viewpoint.

Strictly in terms of maximum ferry capacity, Queens Bay North to Pilot Point is the most attractive crossing.

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COMPARISON OF ALTERNATIVE ROUTES

FACTORS	ALTERNATIVE ROUTES					
	A. Balfour - Kootenay Bay (Existing)	B. Queens Bay North - Kootenay Bay	C. Queens Bay South - Kootenay Bay	D. Balfour - Pilot Point	E. Queens Bay South - Pilot Point	F. Queens Bay North - Pilot Point
CROSSING DISTANCE (Nautical Miles)	4.7	2.8	3.9	3.2	2.6	2.1
- Ferry Capacity	○	◐	○	◐	●	●
- Socio-Economic	●	◐	●	◐	○	○
- Environmental	◐	●	●	◐	○	○
- Political	●	◐	●	◐	○	○
- Economic	●	◐	●	◐	○	○
- Long Term Planning	○	○	◐	◐	●	●
- Site Access	●	◐	●	◐	○	○
- Service Reliability	●	○	○	●	◐	◐
- Safety/Risk	○	◐	◐	○	●	●
- Tourism	○	○	◐	◐	●	●

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BETTER WORSE

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KOOTENAY LAKE FERRY STUDY

FIGURE 8

COMPARISON OF FERRY SERVICE CAPACITY (CARS/HOUR)

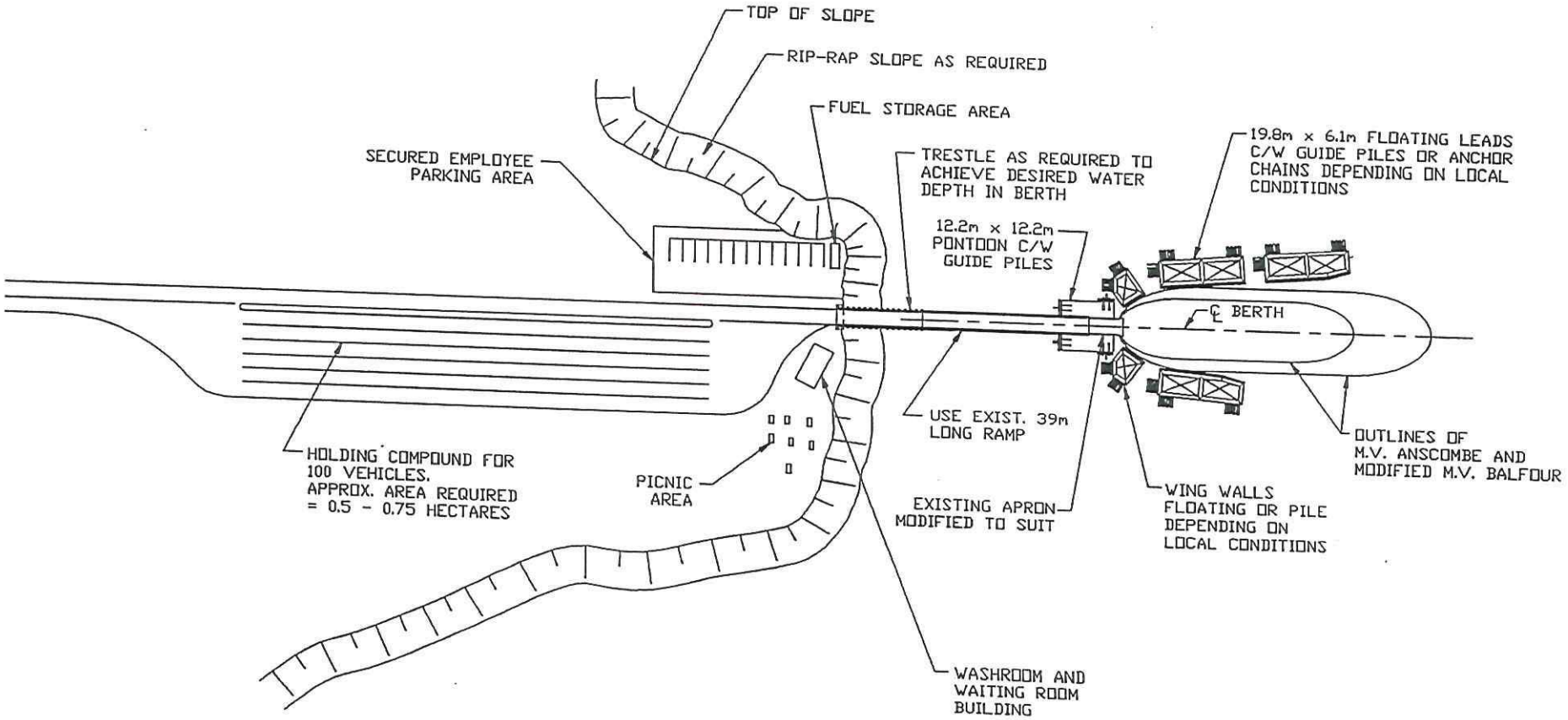
	ALTERNATIVE ROUTES					
	A BALFOUR TO KOOTENAY BAY (EXISTING)	B QUEENS BAY NORTH TO KOOTENAY BAY	C QUEENS BAY SOUTH TO KOOTENAY BAY	D BALFOUR TO PILOT POINT	E QUEENS BAY SOUTH TO PILOT POINT	F QUEENS BAY NORTH TO PILOT POINT
CROSSING DISTANCE (NAUTICAL MILES)	4.7	2.8	3.9	3.2	2.6	2.1
APPROXIMATE SCHEDULE (MINUTES)	50	35	45	40	35	30
MAX. AVERAGE CAPACITY (CARS/HOUR)						
• EXISTING ROUTE & FERRY	45	–	–	–	–	–
• SHORTEN ROUTE & MAINTAIN EXISTING FERRY	–	65	50	57	65	75
• SHORTEN ROUTE & MODIFY M.V. BALFOUR	60	85	65	75	85	100

NOTES

EXISTING VESSEL CAPACITIES: M.V. ANSCOMBE 40 CARS
M.V. BALFOUR 36 CARS

MODIFIED VESSEL CAPACITY: M.V. BALFOUR 60 CARS

KOOTENAY LAKE FERRY STUDY
FIGURE 8A



CONCEPTUAL LAYOUT OF NEW FERRY TERMINAL

(1 : 1000)

FIGURE 9

4.3 New Terminal Facility

Figure 9 shows the conceptual layout for a new terminal facility.

Where practical, structures which will be in use at the existing terminals have been reused in their new location. This would apply to the loading ramp, the pontoon, floating leads and floating wingwalls.

It may also be possible to salvage steel pipe guide piles for anchoring the floating wingwalls, depending on local site conditions - particularly water depths. Otherwise, floating leads can be anchored by stud-link chain and concrete anchor blocks.

The terminal layout is shown in conceptual form only. More site specific data should be obtained during the functional design stage. This would refer particularly to survey, geotechnical and hydrographical data.

A holding compound for 100 cars together with parking, picnic and washroom area is also shown. This is considered to be the minimum requirement for a new terminal facility and would occupy in the region of 0.5 - 0.75 hectares (approximately 2 acres of land).

Highway access is also required and this is dependant on terminal site and local conditions.

The cost of constructing new terminals at the three alternative sites which are considered feasible are discussed in Section 5 of this report.

Preliminary estimates in 1990 dollars indicate costs of approximately $4.2M - $4.4M for the Queens Bay sites and $6.9M for the Pilot Point site. The extra cost at Pilot Point is due to road upgrade which would be necessary from Kootenay Bay to Pilot Point.

A preliminary schedule is also included in Section 5, which indicates between 2 and 3 years to complete the project.

5.0 SCHEDULE AND COST ESTIMATES

SCHEDULE FOR RECONSTRUCTION OF EXISTING FACILITIES

TO ACCOMODATE M.V ANSCOMBE & ENLARGED M.V. BALFOUR

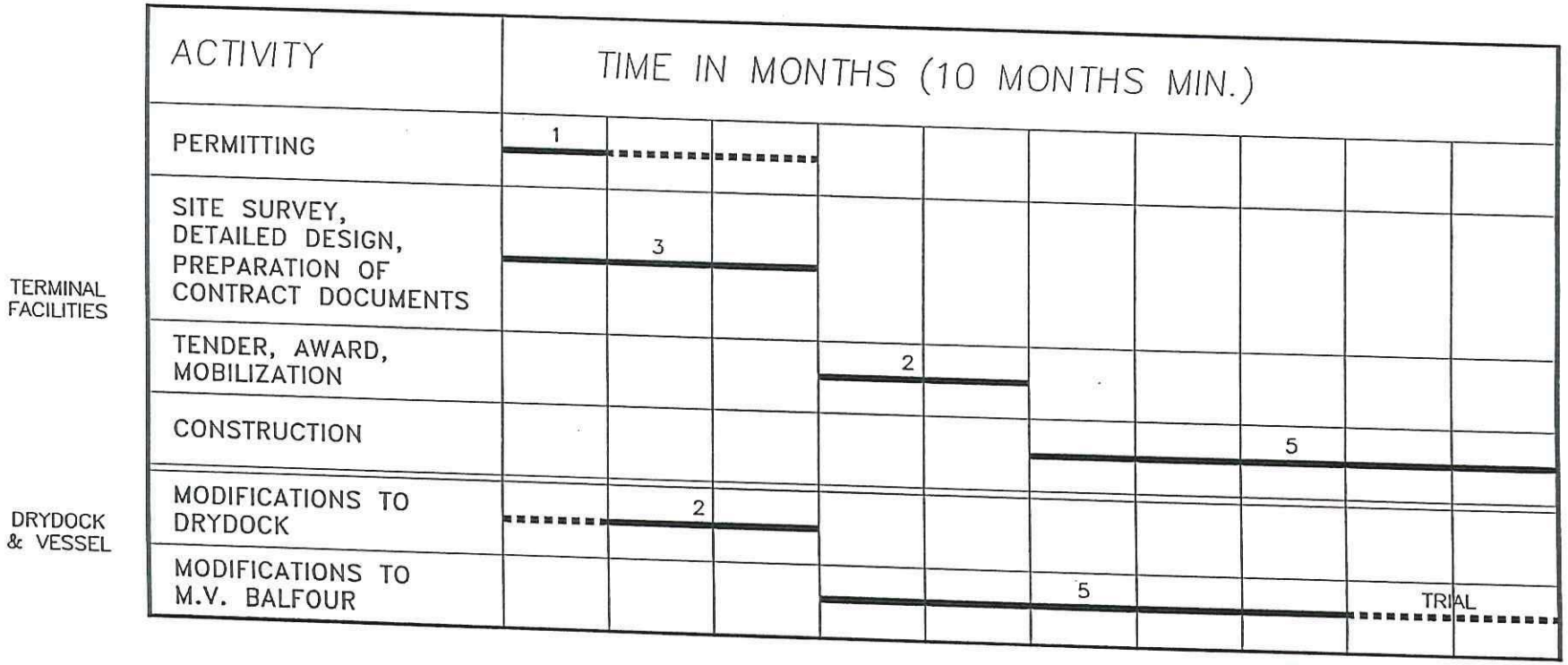


FIGURE 10

5.0 SCHEDULE AND COST ESTIMATES

5.1 Schedule

In view of the priority which has been given to the Kootenay Lake Ferry Project, schedules have been prepared which show the time required to bring the project to completion, i.e. with the modified ferry operating at either the existing terminals or at new terminal sites.

5.1.1 Reconstruction of Existing Facilities

Figure 10 shows the minimum time required to carry out modifications to the existing terminals as ten months, with a breakdown of the time required for each activity.

The detailed design phase, which would include site survey, permitting and preparation of contract documents is estimated to take approximately 3 months.

Tender, award and mobilization should take 2 months. Construction has been estimated as 5 months, although it may be possible to make up some time during this phase.

If the modified facility is required sooner than the 10 month completion period would allow, it may be advantageous to pre-tender some of the floating wingwall and other marine structures. Detailed design of these structures early in the design phase and pre-fabrication could likely save valuable time during the construction period.

Construction of the marine structures can generally be carried out with little disruption to the existing ferry service and should not effect modifications being carried out to the M.V. Balfour.

There will be a phase during the end of the construction period, where apron modifications, demolition of existing and installation of new structures will be necessary. There will be some disruption to existing services during this period.

Included in Figure 10 is a general schedule for modifications to the dry dock and the vessel. The main constraint for this work is the availability of the M.V. Balfour. The winter schedule for ferry operation runs from October to the end of March. It is therefore a pre-requisite that the modifications are complete by March.

SCHEDULE FOR CONSTRUCTION OF NEW FACILITY

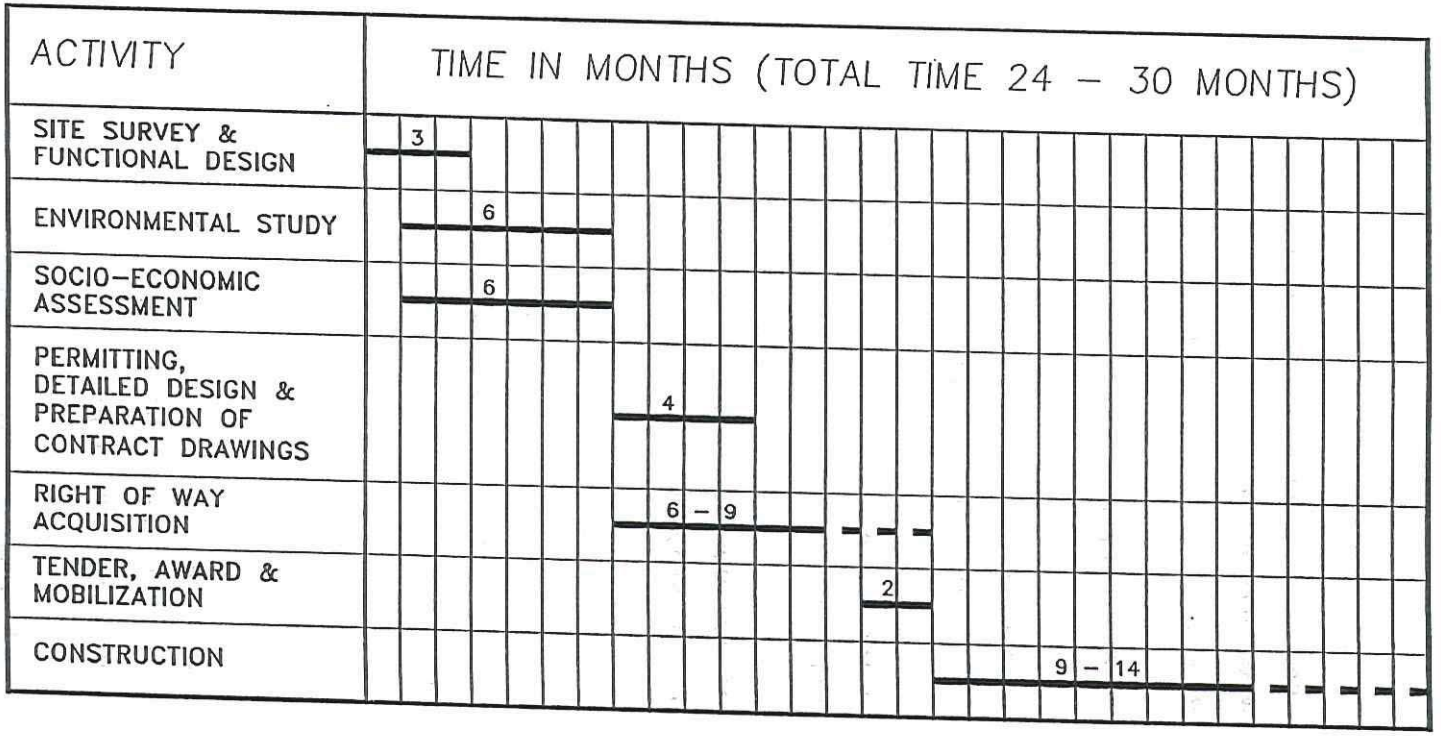


FIGURE 11

5.1.2 Construction of New Facilities

Figure 11 shows the estimated time required to complete construction of a new facility or facilities at the prospective sites which were discussed in Section 4.1.

The time required is estimated as a minimum of 2 years, but is more likely to extend to 3 years.

There are several unknowns which would become apparent during the functional and detailed design phases of the project.

Time to complete the project is also dependant on which sites are chosen and how quickly right-of-way acquisition can be effected.

During the construction phase of the project, installation of the marine structures is not considered to be a problem as the floating structures designed for the modified exiting facilities would be reused. The critical path items for a new terminal would likely be the construction of the highway from Kootenay Bay if Pilot Point is selected and provision of highway access and terminal facilities at the various sites.

5.2 Cost Estimates

The degree of accuracy of cost estimates is dependant on the amount of detailed information available and the stage to which the design has progressed.

In order to clarify the cost estimates which have been prepared, a brief description of each class of cost estimate is presented here together with their relevance to this project.

Class D Estimate - New Sites

Class D estimates are based on conceptual design only without detailed survey, geotechnical survey or environmental impact study.

Class D estimates are only normally used to determine the feasibility of the project.

Class C Estimate - Existing Sites

Class C estimates are based on functional design which includes detailed survey, geotechnical survey and have dealt with environmental issues.

Class C estimates can be used for budget purposes. Approximate degree of accuracy is 25% - 35%.

Class B Estimate

Class B estimates are developed after the detailed design has been completed and are produced prior to tender call and are normally referred to as the "Ministry's Estimate" or the "Consultant's Estimate".

Degree of accuracy for Class B estimates is 10% - 20%.

Class A Estimate

Class A estimates are produced after the tenders are in. The degree of accuracy is usually within 10% of the actual cost.

For the Kootenay Lake Ferry Project, the cost of providing new terminals is based on Class D estimates.

Modifications to existing sites are based on Class C estimates - although detailed design has not yet been carried out, it is known that certain types of structure are feasible at these sites.

5.2.1 Cost Estimate for Modifications to Existing Berths (Class C Estimates) 1990 Dollars

Balfour

Floating Leads (including guide piles)	$ 900,000
Demolition of existing structures	20,000
Steel work (apron modification)	30,000
Contingency (15%)	150,000
	$1,100,000

Kootenay Bay

Floating Leads (including guide piles)	$ 900,000
Floating wing walls	400,000
Demolition of existing structures	50,000
Steelwork (apron modifications)	30,000
Contingency (15%)	220,000
	$1,600,000

5.2.2 Cost Estimates for New Sites (Class D Estimates) 1990 Dollars

Pilot Point

Right of Way acquisition		$ 500,000
Approach highway upgrade to required standard		3,000,000
Ferry Compound (100 cars)		500,000
Site Services (water, electrical, etc.)		250,000
Marine Structures	- Trestle Approach	1,500,000
	- Relocation of Existing Structures	
Contingency (20%)		1,150,000
		$6,900,000

Queens Bay (North)

Right of Way acquisition	$ 350,000
Approach highway construction	1,100,000
Ferry compound (100 cars)	500,000
Site Services	250,000
Marine Structures	1,500,000
Contingency (20%)	700,000
	$4,400,000

Queens Bay (South)

Right of Way acquisition	$ 350,000
Approach highway construction	900,000
Ferry compound	500,000
Site Services	250,000
Marine Structures	1,500,000
Contingency (20%)	700,000
	$4,200,000

6.0 SUMMARY AND RECOMMENDATIONS

6.0 SUMMARY AND RECOMMENDATIONS

6.1 Ferry Capacity

Increasing the capacity of the Kootenay Lake Ferry can be achieved in two ways.

- By increasing the size of the ferry, thereby improving the car-carrying capacity of the vessel.

- By relocating the existing ferry terminal/terminals to shorten the route and reduce the crossing time.

6.2 Increasing the Size of the Ferry

The M.V. Balfour, which is currently operating on the Kootenay Lake Ferry route can be modified to increase its car-carrying capacity from 36 cars to 60 cars. Conceptual designs of the modifications to this vessel have been carried out by Marine Design Associates, Victoria, B.C.

The existing marine structures at Balfour and Kootenay Bay can be modified to accommodate the newly converted M.V. Balfour and the existing M.V. Anscombe.

Recent survey data shows that the wingwall layout at Kootenay Bay is different from the wingwall layout at Balfour. With the current information which is available regarding the size and shape of the modified M.V. Balfour, the following measures would be required at the existing terminals to operate the new ferry.

Balfour

- Remove existing dolphin structures
- Modify existing apron
- Construct new floating leads, anchored by steel pipe piles and or chain and anchor system
- Existing wingwalls can be retained

Kootenay Bay

- Remove existing wingwall structures
- Remove existing dolphin structures
- Modify existing apron
- Construct new floating wingwalls, anchored by steel pipe piles
- Construct new floating leads anchored by steel pipe piles

The use of floating structures for modifications to the two existing terminals is recommended for the following reasons:

- Structures can be used at other sites if it is decided to move the location of the ferry terminal, thereby reducing costs and improving schedule.

- Modifications to the terminals can be implemented with least disruption to the ferry operation and structures can be pre-fabricated to improve construction schedule.

Modifications to the existing compound and car parking facilities have not been addressed at this stage of the study.

Class "C" cost estimates for the modifications to the marine structures are:

- Balfour Terminal $1.1 M
- Kootenay Bay Terminal $1.6 M

Minimum schedule for design and construction of these modifications is estimated at 10 months.

6.3 Shortening the Route

Alternative Sites

Nine sites including the existing sites at Balfour and Kootenay Bay were evaluated as potential ferry terminal sites.

As a result of site visits, discussion and the workshop which was held during the study, the following sites are considered to be feasible for ferry terminal location and should be evaluated further during the functional design stage of the project.

- Balfour) Existing Terminals
- Kootenay Bay)

- Queens Bay (North) - West of McEwen Point
- Queens Bay (South) - In the area of the temporary ferry dock
- Pilot Point - Smelter Bay area

It is recommended that during the functional design stage, additional information is collected which should include:

- Detailed Survey Information
- Geotechnical Report
- Hydrographic Data ... Soundings, etc.
- Environmental and Socio-economic Studies

It is also recommended that public participation in the project is implemented at this stage, which should include an open house where alternative schemes can be presented to the public.

Class "D" cost estimates for new terminals at the above sites are as follows:

Pilot Point	$6.9 M
Queens Bay (North)	$4.4 M
Queens Bay (South)	$4.2 M

Schedule to completion of the project is estimated at 24 - 30 months.

Alternative Routes

Based on the sites that are considered to be feasible for location of the ferry terminals, 6 alternative routes (including the existing) are possible.

Each of these routes is worth evaluation as each offers some merit, depending on the priorities given to the relevant issues.

Some of these issues may become more apparent during the next phases of the project and after input from the public.

- **Kootenay Bay - Balfour (existing route)**

  Offers the easiest solution from cost and implementation standpoint. Limits the capacity of the ferry due to length of crossing.

- **Queens Bay (North) - Kootenay Bay**

  Achieves considerable increase in ferry capacity with moderate relative costs. Local issues may be a problem and the site is not ideal.

- **Queens Bay (South) - Kootenay Bay**

  Does not achieve big increase in ferry capacity, but may be a good compromise if the need to move away from Balfour is justified. Good site for a terminal.

- **Balfour - Pilot Point**

  Offers reasonable increase in ferry capacity and is the only real alternative to Kootenay Bay on the east side of the lake. Would require construction of highway from Kootenay Bay to Pilot Point.

- **Queens Bay (South) - Pilot Point**

  Substantial increase in ferry capacity. Both sites are reasonable for ferry terminals from operational standpoint. High cost, as two new terminals and access road are required.

- **Queens Bay (North) - Pilot Point**

  Highest capacity route due to shortest crossing distance. Reasonable sites for terminals, although Queens Bay North is probably a little more sensitive to local issues than Queens Bay South. Similar cost to Queens Bay (South) - Pilot Point route.

6.4 Phased Construction

In order to achieve the long term goal of increased ferry capacity, within the constraints of limited schedule and budget, a phased approach to the project should be considered.

This may have certain advantages and provide the flexibility required if a change in direction becomes necessary.

The following outline may meet these requirements:

Phase 1 - Modification of Existing Ferry and Sites

- Conversion of M.V. Balfour and drydock facility
- Modifications to existing structures
- Functional design and planning of new sites
- Public participation and input

Phase 2 - Alternative Design

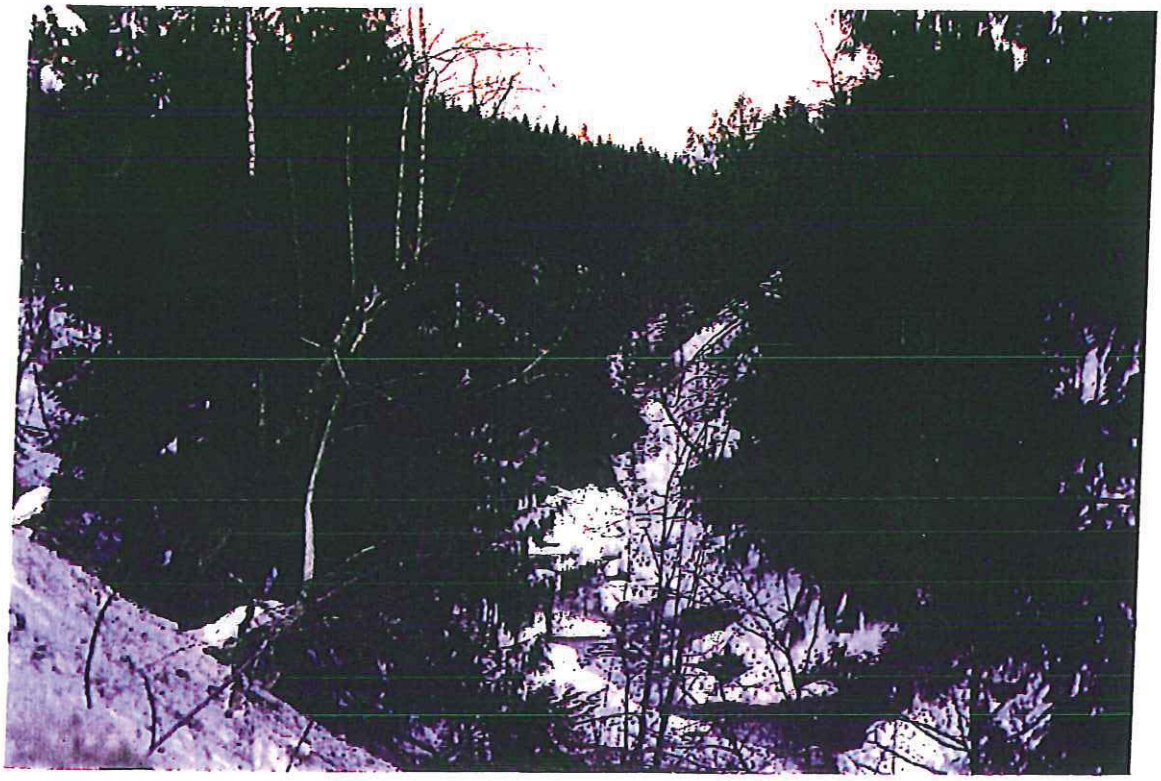
- Modified ferry is operational on existing routes
- Construction of terminal access road
- Detailed design of new terminals

Phase 3 - Implementation

- Construction of new terminals
- Operation of ferry on new route

APPENDIX A

Photographs of Alternate Sites



COFFEE CREEK (SHORE SIDE)

QUEENS BAY (SOUTH) - SHORE SIDE

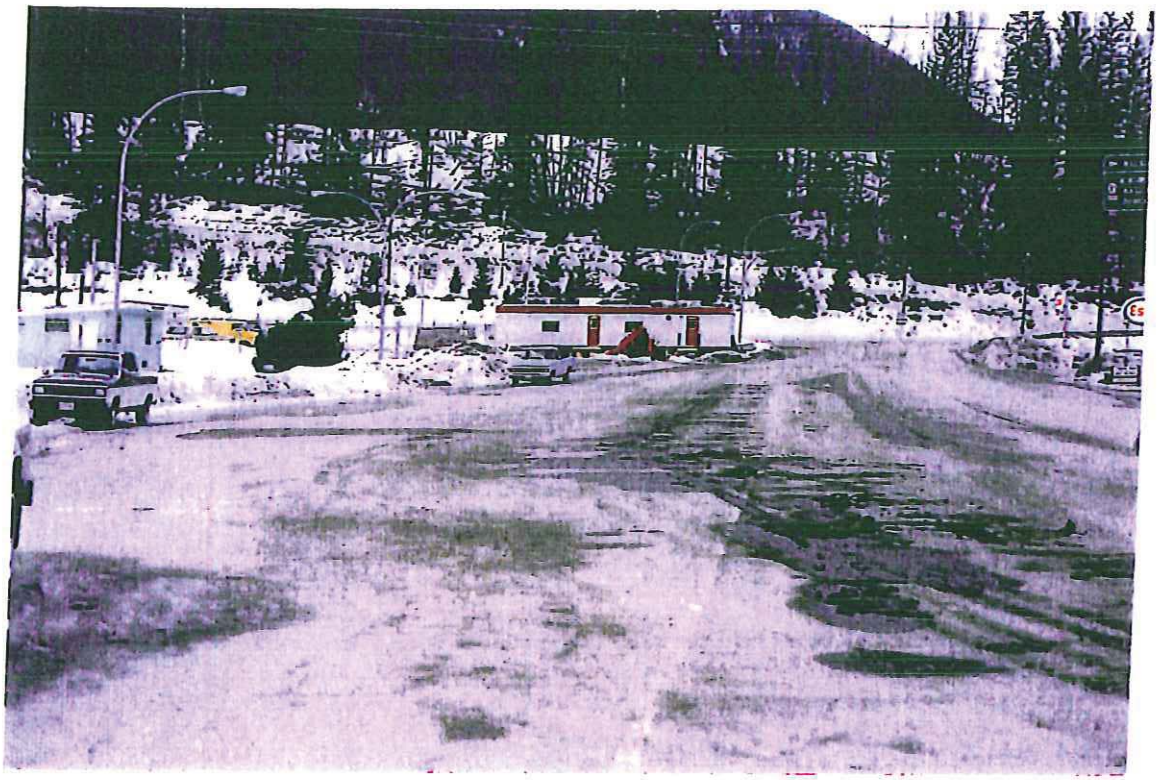
EAST OF PROCTER LIGHT

PILOT POINT - SMELTER BAY AREA

KOOTENAY BAY TERMINAL

COFFEE CREEK

KOOTENAY BAY



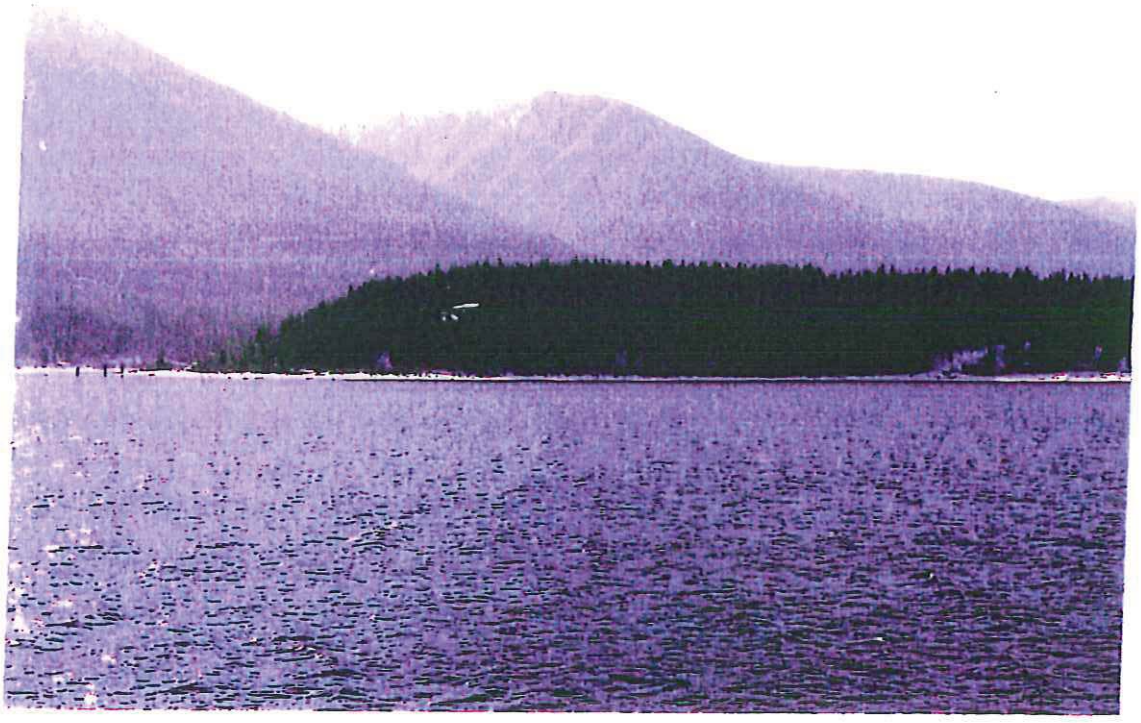
BALFOUR TERMINAL AREA

BALFOUR TERMINAL

GRAY CREEK

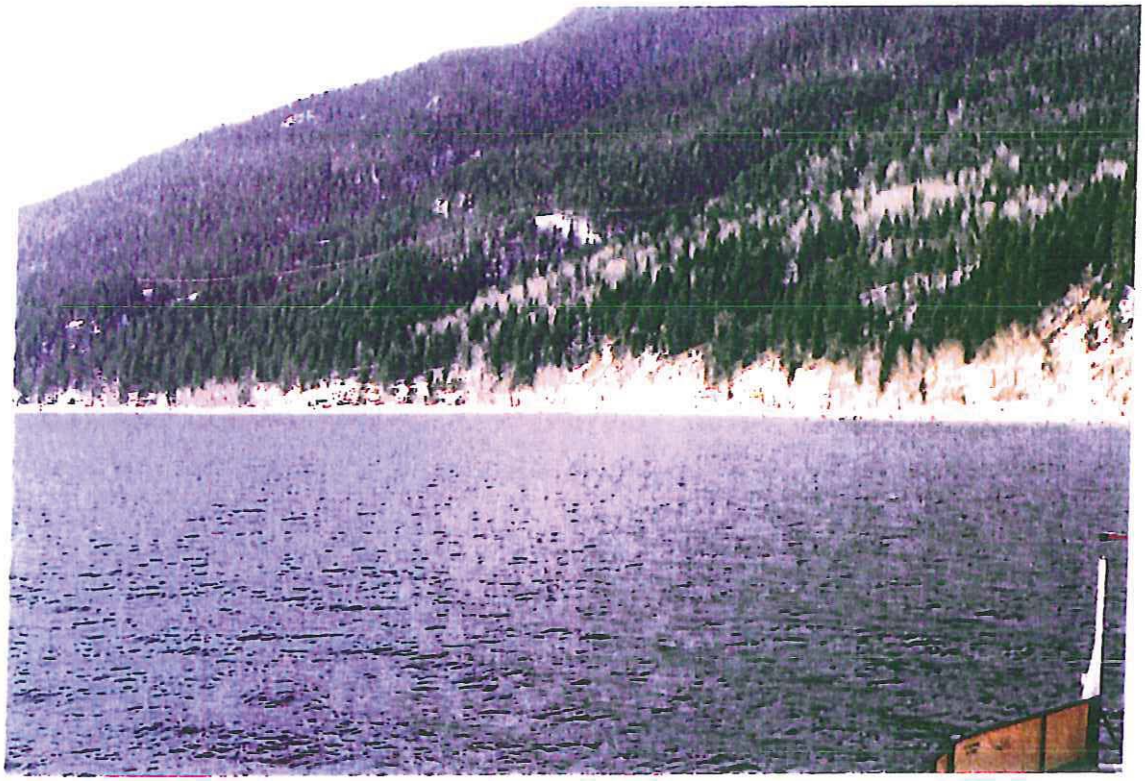
GRAY CREEK (SOUTH)

QUEENS BAY



QUEENS BAY (SOUTH)

QUEENS BAY (McEWEN POINT)



QUEENS BAY