PRELIMINARY ENVIRONMENTAL ASSESSMENT OF PROPOSED HARBOUR SITES AT McKINLEY BAY AND BAILLIE ISLANDS, NORTHWEST TERRITORIES

VOLUME II:

POTENTIAL EFFECTS OF HARBOUR AND ASSOCIATED DEVELOPMENT ON WILDLIFE

by

D.J. Karasiuk[a/]
Canadian Wildlife Service
Yellowknife, N.W.T.

and

P.N. Boothroyd
Canadian Wildlife Service
Winnipeg, Manitoba

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[a/] Present address: Petro-Canada, Calgary, Alberta

CANADIAN WILDLIFE SERVICE

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ABSTRACT

Possible implications to wildlife of the development of harbour and marine terminal facilities at McKinley Bay and Baillie Islands, N.W.T., in conjunction with Beaufort Sea oil and gas production, are evaluated. Potential impacts are rated numerically assuming single company use (Dome Petroleum Limited) of each site. Measures for minimizing adverse environmental effects are recommended.

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1. INTRODUCTION

In Volume 1, the distribution of migratory birds at McKinley Bay and Baillie Islands, N.W.T., during the summer of 1980, was documented. Vegetation and landforms were classified and migratory bird habitat which could be affected by industrial development described.

In this volume, we have attempted to assess the potential effects of developing harbour and marine terminal facilities on migratory birds and other wildlife at McKinley Bay and Baillie Islands. Because site-specific data on wildlife use of the two areas is limited, and because detailed development plans were not available, our assessment must be viewed as preliminary.

Potential effects of development on migratory birds were assessed on the basis of the field data collected in 1980, knowledge of bird use obtained by other researchers, and available literature which documented effects of various human activities on birds. In addition, potential impacts on other wildlife, such as seals and caribou, were analyzed from limited observations made by the authors, information on wildlife use obtained from other researchers and studies, and current knowledge of human disturbance effects.

It should be noted that the scope of the impact assessment is limited to consideration of Dome's plans for harbour and marine terminal development known to the authors at the time this report was being written. Since that time, Dome's plans for McKinley Bay have enlarged and Gulf Canada Resources has also showed an interest in McKinley Bay to satisfy its harbour requirements. In addition, the bay has been considered by Esso Resources Canada as a base for some of their operations. Evaluation of the magnitude of

potential impacts in this report does not reflect the plans of either Gulf or Esso.

This volume concludes with a set of recommended measures for the protection of migratory birds, their marine and terrestrial habitats, and other wildlife, should further developments proceed at either McKinley Bay or Baillie Islands.

2. PROPOSED AND POSSIBLE FUTURE DEVELOPMENT SCENARIOS

2.1 Hydrocarbon Exploration and Development

The following generalized scenario has been extracted from Dome's document entitled "Projected Land Requirements for Beaufort Sea Development" (Dome 1979) with modifications, where appropriate, based on Volume 2 of the Beaufort Sea Environmental Impact Statement (Dome, Esso and Gulf 1982). Fore more detailed information on the Beaufort Sea development scenario, the reader is referred to this volume.

Dome expects to develop its first offshore oil field by late 1986. Development of the field and production of the oil will be accomplished using man-made production islands. The drilling and production islands would be totally self-contained and would include: living accommodations; production facilities for separating oil, water and gas; power generation, gas compression and oil pumping facilities; and other support facilities required for the drilling and production operation. The islands would probably also be equipped for crude oil storage. At present, the long-term mode of transporting the oil to southern markets is uncertain. Class 10 icebreaking tankers could load either directly at the islands or at a shore-based marine terminal. Alternatively, the oil may be transported by pipeline from a shore-based facility. In the case of discoveries closer to shore, underwater pipelines may be used to carry the production to a shore-based facility for separation of oil, water and gas. The processed oil could then be redelivered by pipeline to a tanker loading terminal at a deepwater port on the Beaufort Sea coast.

Variations of these schemes are being evaluated as well as other more elaborate production concepts. It remains to be seen which offshore oil development technology will ultimately be selected in developing the Beaufort Sea oil reserves.

2.2 General Harbour and Marine Terminal Requirements

To support their exploratory and anticipated oil production activities, Dome will require at least one suitably located 10 m, medium-draft harbour capable of supporting year-round drilling activities and a 17 m, deep-draft harbour to permit refueling, mooring and drydocking of vessels such as Class 6 ice-breakers (Dome 1980a). Because these two functions could potentially be combined into one harbour, the following discussion will consider the development of a single 17 m deepwater harbour and marine terminal. According to Dome (1980a), sites suitable for a deepwater harbour and marine terminal are restricted to the Yukon coast. However, in a preceding document (Dome 1979), it was indicated that King Point, McKinley Bay, Baillie Islands and Wise Bay were all candidate locations for a deepwater harbour. Because of frequent changes in development plans and recent development proposals for McKinley Bay (see section 2.3), it is probably reasonable to assume that a deepwater harbour and associated infrastructure could be established at either McKinley Bay or Baillie Islands.

A number of associated developments would occur at the selected harbour site to support harbour operations and exploration and production activity. Although the bulk of construction for offshore drilling and production facilities would take place in southern industrial centres, a staging area would be required in the north for assembly of major components. This

staging area would be located at the deepwater base and could ultimately occupy some 10,000 m^2 (Dome 1979). This would include camp accommodation and office facilities. It would be necessary to construct a light to medium aircraft runway approximately 1200 m long. Fuel required for aircraft, ship and marine terminal use will need to be stored on site. The deepwater harbour would have to incorporate a floating drydock for maintenance and repair of drillships, icebreakers and other vessels. The minimum size required to accommodate round drillships and Class 10 icebreakers is 215 m by 50 m with a draft of 20 m (Dome 1979). It is still uncertain whether processing of the recovered production would occur on offshore platforms or at a deepwater shore terminal. Whichever option is selected, the processing facility would accommodate production, separation, oil storage, water treatment, tanker loading and gas reinjection. In the case of a shore-based facility, the production would be brought from the oil fields to the processing facility by underwater pipelines buried beneath the ocean floor. The harbour/terminal may also include other facilities such as a power plant, breakwaters, docks, storage space for oil spill contingency equipment, warehouses and waste treatment facilities. The entire harbour and marine terminal could occupy an area of anywhere between 4 km^2, as in the case of the terminal at Valdez, Alaska, and the 12 km^2 occupied by the terminal at Sullum Voe, Scotland (Dome 1980a).

2.3 Site Specific Harbour and Marine Terminal Requirements

2.3.1 McKinley Bay

A number of developments have occurred since Canmar first dredged an approach channel and mooring basin at McKinley Bay in 1979. It was discovered during

the 1979-80 winter that the mooring basin was not as well-protected from ice movement as expected. Canmar decided to move the basin further into McKinley Bay, to dredge a protective berm or island adjacent to the basin (Figure 1), to dredge a deeper area in the new basin to accommodate a floating drydock and to install permanent moorings (Figure 2) (Canmar 1980). On September 11, 1980, Dome made application to utilize the island created during the summer of 1980:

(1) to provide temporary storage for materials such as vessel-mooring equipment, dredge pipe, winter breakout equipment and winter road-building equipment;

(2) to provide space for winter waste management operations including the storage of surplus containers and refuse, and possibly the incineration of combustibles;

(3) to provide a surface suitable for landing helicopters and fixed wing aircraft, such as Twin Otters, thereby facilitating crew transfers during the freeze-up and breakup periods when it is not possible to land aircraft on the ice; and

(4) to provide for refueling of these aircraft, employing a truck to transport fuel from a fuel barge to the island (Dome 1980b).

By 1982, Canmar had received permission to install more permanent facilities, such as pipe racks, fuel tanks, storage sites and warehouses, on the island. Over the next five years the mooring basin could be expanded to 1 km by 1 km (compared to the roughly 0.7 km by 0.4 km basin constructed in 1980) to accommodate the growing offshore fleet. During the period 1983-85, the facilities could be expanded using floating bases and/or increased island surface to support drilling construction operations.

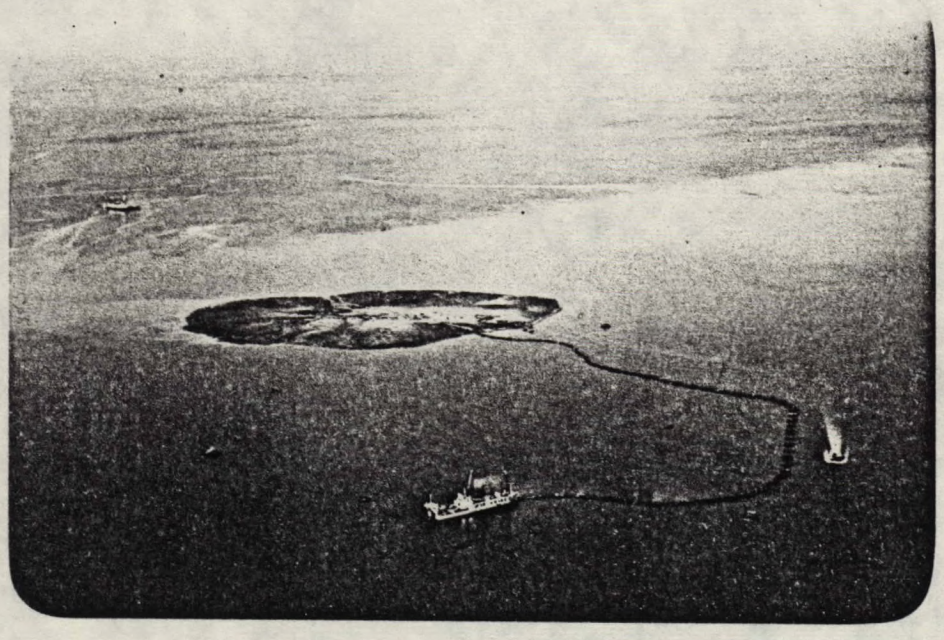

Figure 1. Construction of an artificial island in McKinley Bay, August 1980.

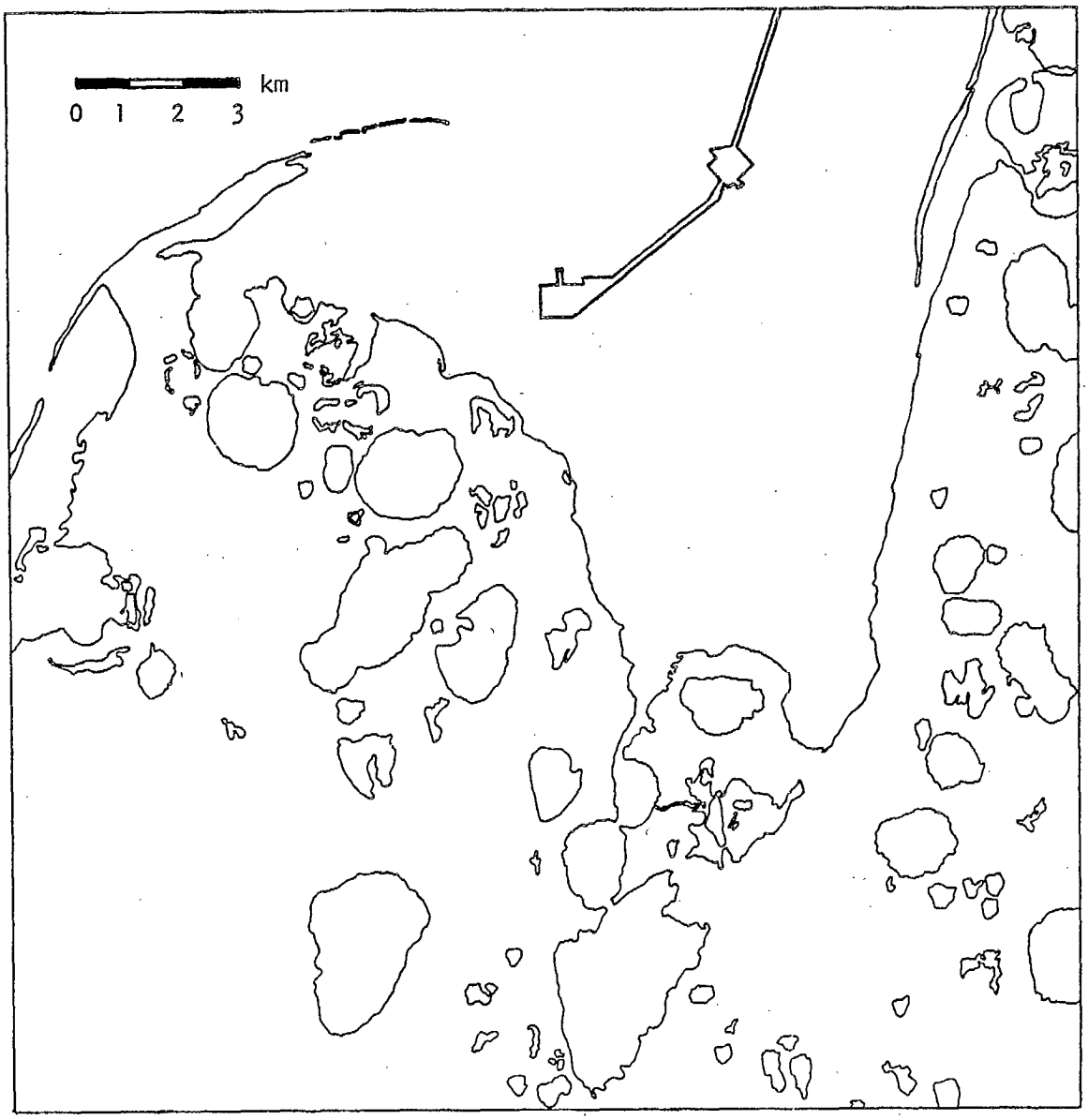

Figure 2. Generalized location of approach channel and vessel mooring basin dredged at McKinley Bay during 1979 and 1980.

Source: Dome Petroleum Limited.

These plans must still be considered tentative and will depend on several factors including the success of Dome's current hydrocarbon exploration program, the location and timing of development, the choice of hydrocarbon transportation systems, and the results of ongoing environmental and engineering feasibility studies (Canmar 1980). It should also be noted that during and after preparation of this report, several modified scenarios were produced regarding the role of McKinley Bay as a support base for Beaufort Sea exploration and development activities (e.g. Dome 1980c, 1980d, 1981. Dome, Esso and Gulf. 1982).

2.3.2 Baillie Islands

Although it appears that Dome is seriously considering McKinley Bay to meet their deepwater harbour requirements, plans are by no means definite. Such a facility could possibly be constructed at Baillie Islands, although this now appears to be very unlikely.

Preliminary evaluations of the suitability of Baillie Islands have been made (Dome 1979). Two possible vessel anchorage locations have been identified (Figure 3). For the western anchorage proposal, a shore base would probably be located at the southwestern tip of the larger island. The best location for a shore base for the eastern anchorage case appears to be at the base of the peninsula extending north from Cape Bathurst (Dome 1979).

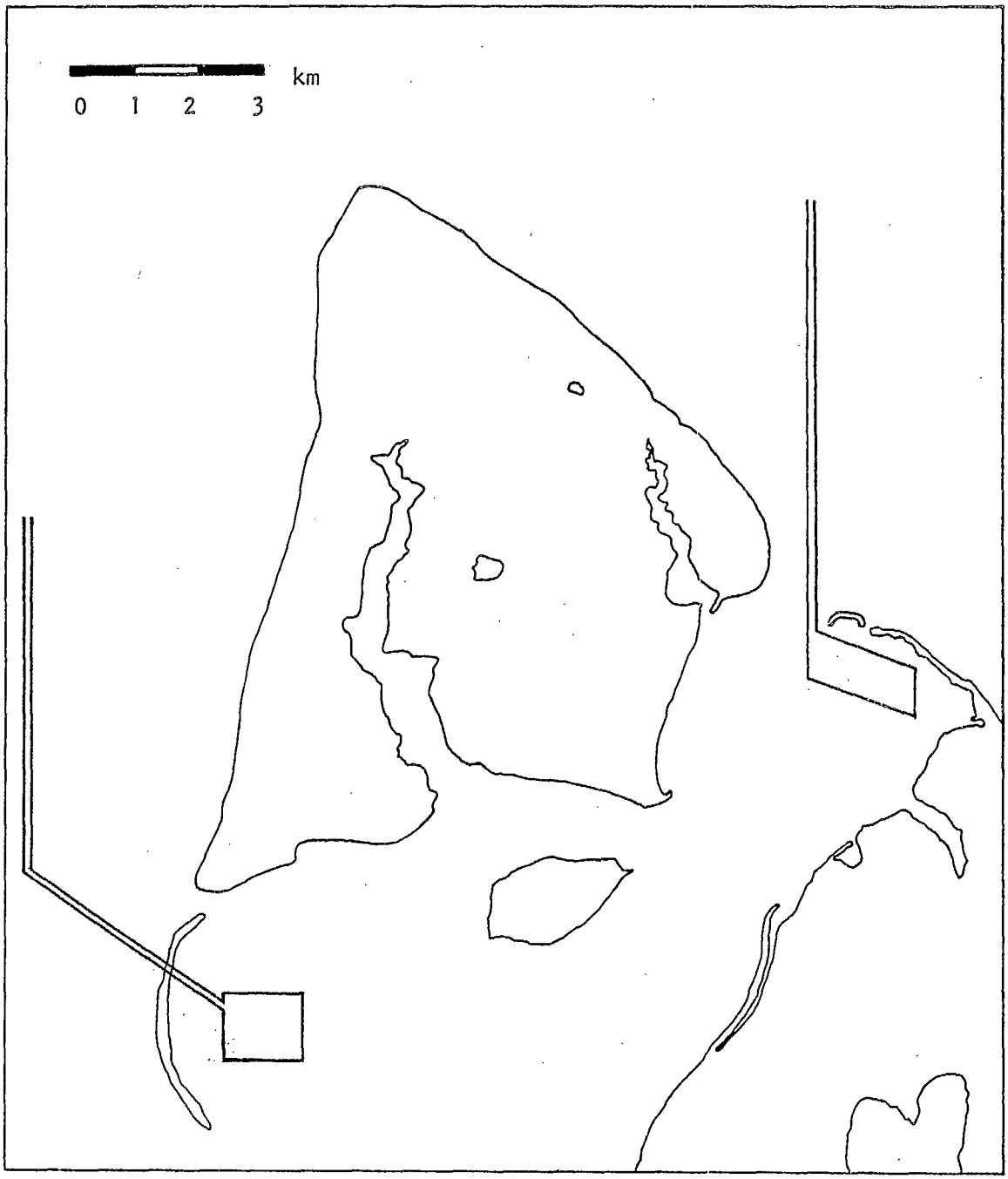

Figure 3. Possible alternative locations for vessel mooring basin and approach channel at Baillie Islands.

Source: Dome (1979).

3. ANALYSIS OF IMPACTS

3.1 Methodology

Tables 1 and 2 are matrices illustrating predicted impacts of harbour and marine terminal developments on wildlife at McKinley Bay and Baillie Islands respectively.

Dome's scenarios for harbour and possible marine terminal development at each of these locations have been discussed earlier (section 2). To develop the impact matrices, we analyzed the effect that each component of development is likely to have on each taxon. The interaction between impact and a target species may be either favourable (+) or unfavourable (-), and may affect a variety of aspects of the species' life cycle such as nesting, moulting, feeding or post-calving movements. Within the matrix the severity of impact is rated as follows:

0 - no measurable impact (left blank in matrices)

1 - slight impact. One to several hundred individuals may have short-term disruption of activity, but the disruption will not result in increased mortality or decreased natality.

2 - moderate impact. The anticipated impact is such that a small proportion of the local population (up to 10 percent) may die, fail to breed, or have reduced breeding success if no mitigation of the impact occurs.

3 - severe impact. The anticipated impact is such that 10 to 100 percent of the local population may die, fail to breed, have reduced breeding success, or abandon the study area if no mitigation occurs.

Key to Environmental Impact Matrices

(a) severity of impact

( ) - no impact (left blank)

1 - slight impact

2 - moderate impact

3 - severe impact

(b) life cycle activity affected, birds

F - feeding

N - nesting

M - moulting

S - staging during migration

L - loafing

(c) life cycle activity affected, mammals

F - feeding

C - calving, whelping

P - post-calving, post-whelping

W - wintering activities

L - loafing, haul-out

(d) vector of impact

( ) - negative impact (left blank)

+ - positive impact

Table 1. Environmental impact matrix for development of a harbour and marine terminal at McKinley Bay.

Components of impact	Target species													Remarks
	loons	swans	brant	other geese	sea ducks	dabbling ducks	shorebirds	gulls, terns, jaegers	raptors	songbirds	carnivores	seals	caribou, reindeer	
1. Dredging of mooring basins														
1.1 Noise and physical presence	1F				1F,M			1F				1F		No mitigation required.
1.2 Disposal of dredge spoils					+1L			+1L						No mitigation requried.
1.3 Presence of dredge plume	1F				1F			+1F				1F		No mitigation required.
1.4 Maintenance dredging	1F				1F, M,L			+1L, F				1F		No mitigation required.
2. Harbouring of vessels and craft														
2.1 Physical presence of vessels			1S	1S	1S		1S			1S				Sporadic collisions of birds with vessels may occur.
2.2 Noise												1C		Possible slight impact on nursing ringed seals.
2.3 Icebreaking activity												1C		Possible mortality from destruction of birth lairs.
3. Aircraft activity[a/]														
3.1 Low-elevation flights	1N	1N	1N	1N	1F,M	1N,M	1N	1N		1N		1L	2P	Aircraft may reduce attentiveness of brooding and incubating birds; reindeer may suffer physiological stress.
3.2 Airstrip construction (on mainland)			1F	1N	1N,S									Impacts relate to loss of habitat.
4. Fuel spills														
4.1 On open water	2F		2S		3F,M			2F,N				1W,C		Apply existing oil spill contingency plans.
4.2 On ice-infested water	2F				3F,M			2F,M				1W,C		Ice edge is critical habitat. No effective mitigation available.
4.3 On shore		1N	2F	1F,N	1L	1N	1N	1L,F		1N		1F		Tidal marshes should be protected from oil contamination.
5. Camps and personnel														
5.1 Accommodation, warehousing and other support facilities (on mainland)		1N		1N		1N	1N	1N		1N				Impacts relate to slight loss of habitat.
5.2 Sewage disposal at sea														No impact anticipated.
5.3 Sewage disposal on land	1N	1N		1N		1N	1N	1N		1N	1F		1N	Impacts relate to slight loss of habitat.
5.4 Solid waste disposal								+1F			2F,W			Scavenging bears and foxes may be safety hazard to people.
5.6 Recreational activities	1F		1F		1F,L			1F			1W	1W,C	2P	Avoid snowmobile and boat harassment of reindeer. Restrict use of ATV's for emergencies only.
6. Surface transport and linear facilities														
6.1 Winter roads											1F	1C,L		No mitigation required.
6.2 All-weather roads	1N	2N,M	1N	2N,M		2N,M	2N,S	2N,M	1N	2N,N	2C, P,W		2C, P,W	Initial environmental evaluation required before road approved.
6.3 Transmission lines		1N,S		1N,S		1N,S	1N,S	1N,S	+1N	1N				Impacts relate to collision with wires and pylons.
6.4 Pipelines	1N	2N,M		2N,M		1N,S	1N,S	1N,S		1N	1F, C,W		1F, P,W	Impacts relate to terrain disturbance and loss of habitat; initial environmental evaluation required.
7. Navigation aids														
7.1 Range markers									+1N					Markers may provide nest sites for rough-legged hawks.
7.2 Beacons							1S			1S				Beacons may cause tower mortalities among nocturnal migrants over land.
8. Hydrocarbon processing	2F	1N	2F	1F,N	3F,M	1N	1N	2F,M		1N	1W,C	1F		Tentative assessment only. Impact cannnt be assessed with present data; initial environmental evaluation required.

[a/] impact ratings do not consider jet aircraft use of the airstrip.

Table 2. Environmental impact matrix for development of a harbour and marine terminal at Baillie Islands.

Components of Impact	Target species												Remarks
	loons	swans	geese	sea ducks	dabbling ducks	shorebirds	gulls, terns, jaegers	raptors	songbirds	carnivores	seals	caribou	
1. Dredging of mooring basins													
1.1 Noise and physical presence	1F			1F,M			1F				1F,L		No mitigation required.
1.2 Disposal of dredge spoils				+1L			+1L						No mitigation required.
1.3 Presence of dredge plume	1F			1F			1F				1F		No mitigation required.
1.4 Maintenance dredging	1F			1F, M,L			1F,L				1F,L		No mitigation required.
2. Harbouring of vessels and craft													
2.1 Physical presence of vessels			1S	1S		1S			1S				Sporadic collisions of migrating birds with vessels may occur.
2.2 Noise				1F						1F	1C,F		Noise may cause marine mammals and birds to use alternate areas.
2.3 Icebreaking activity				1F						1F	2C		Icebreaking may destroy birth lairs of ringed seals.
3. Aircraft activity													
3.1 Low-elevation flights	1N	1N	1S	1M,S		1N	1N	1N	1N	1F	1C,L	2C,P	Aircraft disturbance may reduce attentiveness of brooding and incubating birds; caribou calving area may be affected.
3.2 Airstrip construction		1N				1N			1N			1F	Impacts relate to loss of habitat.
4. Fuel spills													
4.1 Spills on open water	2F			3F,M			2F,L			2F	2P		Apply existing oil spill contingency plans.
4.2 Spills on ice-infested water	3F,S			3F,S						2F,W	3C,W		No effective mitigation for spills in shifting ice of polynya.
4.3 Spills on shore			1F	2L			2L,F						Generally muddy coastline difficult to clean.
5. Camps and personnel													
5.1 Accommodation, wharehousing and other facilities					1N	1N	1N		1N				Impacts relate to loss of habitat.
5.2 Sewage disposal at sea													No impact anticipated.
5.3 Sewage disposal on land				1N		1N	1N		1N		1F		Slight impact related to loss of habitat.
5.4 Solid waste disposal							+1F			2F,W			Scavenging carnivores may be a safety hazard to personnel.
5.6 Recreational activities	1F			1F,L			1F			1F,W	1C,L	2C	Avoid snowmobile and boat harassment of wildlife. Restrict use of ATV's for emergencies only.
6. Surface transport and linear facilities													
6.1 Winter roads													Baillie Islands unlikely to be served by ice roads. See text.
6.2 All weather roads													Baillie Islands unlikely to be served by all-weather roads. Initial environmental evaluation required before roads constructed.
6.3 Transmission lines													Initial environmental evaluation required. Beyond scope of study.
6.4 Pipelines													Initial environmental evaluation required. Beyond scope of study.
7. Navigation aids													
7.1 Range markers								+1N					Markers may provide nest sites for rough-legged hawks.
7.2 Beacons							1S		1S				Beacons may cause tower mortalities among nocturnal migrants over land.
8. Hydrocarbon processing	1F	1N	2S	2S,M		1N	1N	1N		1F	2W,C	1F	Tentative assessment only. Impacts cannot be properly assessed with present data.

Our rating of the severity of impact is subjective, because there are few detailed analyses of the interactions of wildlife and the kinds of impacts we anticipate at either McKinley Bay or Baillie Islands. The following sections expand the impact analysis matrices in Tables 1 and 2. Where applicable mitigative measures are suggested. No relationship exists between the order in which the potential impacts are evaluated and the severity of each impact.

3.2 Interactions Between Impacts and Wildlife Species

3.2.1 Dredging of the Mooring Basins

Figures 2 and 3 show the locations of the mooring basins to be dredged at McKinley Bay and at Baillie Islands East and West, respectively. Sources of impacts directly associated with dredging include the physical presence and noise created by the dredge, disposal of dredge spoils, and creation of dredge plumes.

3.2.1.1 Physical Presence and Noise Created by the Dredge

At Baillie Islands and McKinley Bay, the target species of this impact source are marine mammals and birds that feed in shallow water. These include loons, scoters, oldsquaws, eiders, gulls, terns, jaegers and seals (*Phoca hispida* and *Erignathus barbatus*). The physical presence and noise of the dredge will, at worst, cause avoidance in the immediate vicinity of the dredge (perhaps a 1 to 2 km radius) and relocation to alternative feeding areas. Renewable Resources (1978) conducted studies to determine whether diving ducks and dabbling ducks avoided dredging activities in the Mackenzie River near Fort Providence, N.W.T. Their results showed that any avoidance was slight or minor in extent. We

believe, therefore, that there should be either no impact or only a slight impact and that no mitigation is required.

3.2.1.2 Disposal of Dredge Spoils and Creation of Dredge Plumes

Cutter suction dredging will result in the burial of infaunal and epifaunal benthic organisms, and depending on future dredging plans, the creation of one or more artificial islands. A dredge plume of a few hundred meters' radius will have turbid water in which feeding animals would experience diminished visibility. The target species would be the marine mammals and birds listed in section 3.2.1.1. Burial of benthic organisms by dredge spoils would cause a short-term reduction in food for marine vertebrates, until the dredging basins and spoil banks were recolonized. We do not know how long recolonization might take to occur.

Reports by Dr. J. Ward of Dome Petroleum indicate that a few species such as glaucous gulls would experience short term benefits, because dredging brings benthic organisms and other food items to the water surface. The dredge plume is a short-lived phenomenon that will disappear within a few days after dredging ceases, depending on the texture of bottom sediments and on dispersion of the plume by winds and currents.

The creation of artificial islands near mooring basins could create new loafing sites for oldsquaws, eiders, scoters, gulls, terns and jaegers. However, such loafing birds could suffer mortality should the shorelines of the island become coated with oily substances resulting from a spill in the bay (see section 3.2.4.3). Because human activity near these islands would be intense during the times of pair formation, nesting and incubation,

we do not believe that additional nesting sites would be created. At worst, disposal of dredge spoils would have a slight negative impact on marine vertebrates that feed on the benthos. Significant expansion of Dome's harbour facilities, resulting in an increase in the area requiring maintenance dredging, and/or development of harbour facilties by Gulf and Esso, would of course significantly increase the level of impact. At best, a slight positive impact may result because dredging casts food to the water surface for certain seabirds. No mitigation is foreseen.

3.2.1.3 Maintenance Dredging

The requirement for maintenance dredging at McKinley Bay or at Baillie Islands cannot be assessed, because long-term data on storm surges, currents and tides are lacking, and because future requirements for deeper-draft vessels cannot be predicted.

The impacts of maintenance dredging, and the target species, are likely to be the same as discussed in earlier paragraphs. No mitigation for maintenance dredging is foreseen.

3.2.2 Harbouring of Vessels

During the winter of 1979-80, four drillships, eight supply vessels, one icebreaker, one dredge and two barges were moored in McKinley Bay. By 1985, it is anticipated that the fleet moored at McKinley Bay will be augmented by several additional drillships, supply vessels, icebreakers, and barges.

The impacts that arise from harbouring vessels include physical presence of tall vessels, the noise of compressors, generators and ships' engines, and impacts associated with icebreaking activities. Small fuel spills will

also occur from the vessels while in harbour. Possible impacts of fuel spills are assessed in section 3.2.4.

3.2.2.1 Physical Presence of Vessels

Overall, the impact arising from presence of the vessels should have a slight impact on the wildlife at McKinley Bay. An extensive bibliography documenting bird mortalities at various man-made structures was compiled by Avery et al. (1980). Included in the bibliography, are several reports of mortalities resulting from collision with ships (e.g. Green and Perkins 1964, Jones 1976, Dick and Donaldson 1978). Dr. J. Ward (pers. comm.) has anecdotal evidence of instances when a thick-billed murre and black guillemots changed their course to investigate vessels moored in McKinley Bay, and when common eiders collided with a supply ship at sea. There may be occasional mortalities when flying birds collide with vessels, especially tall drillships, during times of poor visibility; target species may include shorebirds, waterfowl, and songbirds. For want of definitive information, we anticipate a slight impact during spring and fall migration: there may be a few such mortalities annually. There is probably no way that "freak" collisions of flying birds with stationary vessels can be mitigated. Probably, the local wildlife will become habituated to the presence of stationary vessels.

3.2.2.2 Noise

While vessels are moored in their winter berths, and during spring preparations for the drilling season, there will likely be considerable noise caused by the operation of compressors, generators, and ships' engines. At McKinley Bay, the disturbance source would be in fast ice several kilometres from the nearest shore, so that terrestrial species are unlikely to be affected. Marine birds

require open water to rest and feed. With the exception of a few small leads, the only open water in June 1980 was a 100 to 150 m wide band adjacent to shore, to which marine birds were restricted. If this is the usual pattern of open water during spring breakup, noise should have no impact on feeding or resting marine birds. At Baillie Islands East and West, the mooring basins are located in solidly shorefast ice that has few leads or pressure ridges. Migrating loons, common eiders and king eiders concentrate northeast of Baillie Islands at the floe ice near the Cape Bathurst polynya — these are unlikely to be affected by noise. Several hundred oldsquaws and scoters were seen concentrating at the northern tip of Cape Bathurst in the same location as the Baillie Islands East harbour alternative. Development of a harbour at this location would preclude its use by these waterfowl populations. We do not know whether this location is a preferred loafing and feeding area for these individuals. It is more likely that the birds would simply be displaced to other feeding areas in the vicinity of the larger island or to the extensive Cape Bathurst polynya a short distance away. In the absence of definitive information on the value of the Cape Bathurst promontory to waterfowl, the impact is judged as slight.

Ringed (*Phoca hispida*) and bearded (*Erignathus barbatus*) seals are fairly common in the pressure-ridged, shifting ice that occurs to the east, north and west of Baillie Islands. The seals are probably rare, according to our observations, in the stable ice of Snow Goose Passage where the Baillie Islands East and West harbour alternatives are located. Ringed seals bear their pups solitarily in late March and April and wean them within two months. Bearded seals have pups in late April and wean them 12 to 18 days later (Smith and Stirling 1975). Small numbers of both ringed and bearded seals may cease to

use Snow Goose Passage near Baillie Islands East and West because of vessel movements and noises and other spring-time activity. However, because much more favorable ice habitat exists nearby the impact is rated slight.

We saw no seals during aerial surveys of McKinley Bay. However, seal monitoring studies conducted for Dome showed that seal population densities in the McKinley Bay area were comparable to, or perhaps greater than, those reported in other parts of the Beaufort Sea (LGL 1980). Therefore, there could be a slight impact on nursing seals at McKinley Bay.

3.2.2.3 Icebreaking Activity

Dome's icebreaker Kigoriak makes it possible for the drilling fleet to leave its winter moorage and to move to open water through the shorefast ice during June and early July. The route created by the Kigoriak through the shorefast ice is a channel of moderately to tightly-packed ice chunks and crushed ice, which, as spring melt proceeds, tends to become a slurry of broken ice chunks and slush (Figure 4).

It has been suggested that icebreakers moving through ice may create artificial leads that could entrap migrating seabirds and whales. Because the Kigoriak leaves a track of crushed and broken ice, rather than open water, we do not believe that entrapment is a likely occurrence. If ambient temperatures are less than 0°C, the icebreaker track would freeze over rapidly in any event. Impact is therefore judged to be nil or slight and no mitigation is required at either McKinley Bay or Baillie Islands.

Icebreaking activity may destroy the birth lairs of a few ringed seals. The whelping and nursing period (April to June) corresponds to the time when ice-

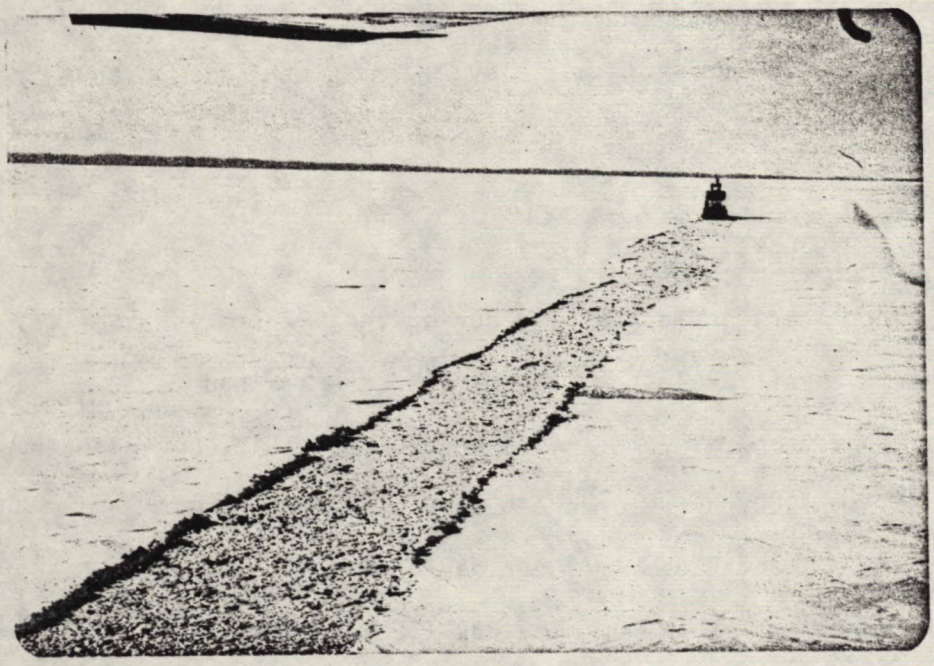

Figure 4. Channel created through shorefast ice at McKinley Bay by the Kigoriak, June 4, 1980.

breaking activity is most intense. Bearded seals, which wean their pups precociously are likely to be less vulnerable. Whether or not seals would be adversely affected by noise created during icebreaking is not known.

The impact of icebreaking on ringed seals would thus be moderate, because disturbance and mortality of nursing pups may occur. Mortality can be reduced by using a single icebreaker track for breakout, instead of many. Impacts may occur at either McKinley Bay or at Baillie Islands East and West.

3.2.3 Aircraft Activity

During the winter, and especially during the preparations for spring breakout, aircraft are essential for crew changes and for transporting materials and supplies from Inuvik and Tuktoyaktuk. During breakout activities in 1980, between June 8 and July 2, there were over 430 helicopter movements (about 17 per day) to or from McKinley Bay or between locations within McKinley Bay (Table 3). Dredging began on July 3 when breakout was being completed; the last drillship, Explorer 2, departed McKinley Bay on July 7 (J. Ward, pers. comm.). In support of dredging in July, there were 279 individual helicopter movements or about 9 per day. In August, helicopter support amounted to 132 flights or approximately four per day. There is presently a sand-surfaced airstrip at McKinley Bay, suitable for small aircraft such as a Cessna 185 and aircraft of the Twin Otter class. Between July 3 and July 31, eight round trips were made to the strip by a Dome Twin Otter (J. Ward, pers. comm.). Should McKinley Bay be developed into a major marine terminal, aircraft activity would increase.

Table 3. Number of helicopter movements at McKinley Bay during spring breakout and dredging in 1980.

Period	No. of helicopter flights[a/]						
	S61	S76	B204	B206 Long distance[a/]	B206 Local[b/]	B212	Total helicopters
June 8-July 2 (breakout)	186 (7.4)[d/]	222 (8.9)	2 (0.1)	24 (1.0)	--	--	434 (17.4)
July 3-July 31 (dredging)[c/]	24 (0.8)	46 (1.6)	--	90 (3.1)	117 (4.0)	2 (0.1)	279 (9.6)
Aug. 1-Aug. 31 (dredging)	14 (0.5)	54 (1.7)	--	--	--	64 (2.1)	132 (4.3)

[a/] individual flights to or from McKinley Bay

[b/] within McKinley Bay area (approximate)

[c/] the period July 3-7 includes final breakout activities

[d/] average number of flights per day

Source: Dome Petroleum Limited

Various authors have documented the effects of aircraft overflights on birds. Aircraft movements at low elevation are believed to reduce breeding success in raptors, because eggs are kicked out of nests when the parents are frightened, and because chicks may become chilled or overheated when parents are absent from the nest (Fyfe and Olendorff 1976). Gollop et al. (1974) observed that aircraft disturbance affected the normal incubating behaviour of brant, glaucous gulls and arctic terns, although the observers conducting the study also had a pronounced effect on the birds. Geese can sometimes be very sensitive to aircraft; a flock of spring staging Canada geese in the Mackenzie River valley flushed when a fixed-wing aircraft approached within 0.8 km at 1500 m elevation (Campbell and Shepard 1973). Snow geese left their nests at the approach of a helicopter flying at an altitude of 90 m (Barry and Spencer 1976). However, the same helicopter had to reduce altitude to 10 m before a whistling swan would leave its nest. Disturbance that causes adult geese to be off the nest for excessive periods facilitates nest predation by gulls and jaegers (Barry and Spencer 1976). T. Barry (pers. comm.) notes that human disturbance (as well as disturbance from natural predators) in nesting glaucous gulls may permit adults to cannibalize the nests and chicks of other parents. Robert and Ralph (1975) documented the effects of human disturbance on western gulls (*Larus occidentalis*). Low-level helicopter flights may induce panic reactions in caribou, and may subject these animals to sublethal physiological stresses (Miller and Gunn 1979).

At McKinley Bay, target species for aircraft harassment are nesting loons, swans, brant, ducks, shorebirds, gulls and songbirds, and reindeer

(*Rangifer tarandus tarandus*) during the postcalving period. Some of the nesting birds may have become partly habituated to helicopters used in the annual reindeer roundup which takes place over a two week period in June. We noted a snow goose incubating eggs within 50 m of the airstrip adjacent to our camp. The strip had been used by both fixed-wing aircraft and helicopters prior to discovery of the goose nest on July 1. We do not know whether the nest was successful. However, L. Allen (pers. comm.) made repeated observations of white-fronted geese flushing when a helicopter passed overhead. For nesting birds, we have rated the impact of aircraft disturbance as slight, because the species affected are common and have a wide geographic distribution, and because there are no major nesting colonies of snow geese, brant, glaucous gulls or arctic terns. Again, this impact rating would have to elevated should further facilities be developed by Gulf and Esso in the bay. We believe that aircraft harassment may have a moderate impact on reindeer survival. We noted fewer than ten dead calves and fewer than ten crippled adults and subadults in late June 1980. However, we ascribe these injuries and deaths to rough treatment during the annual reindeer roundup rather than to industrial activity. During their spring migration, snow geese may also be vulnerable to aircraft disturbance, because they are accumulating protein reserves sufficient to lay eggs and fat reserves for incubation. Because nearly 200,000 snow geese migrate along Tuktoyaktuk Peninsula in the spring (T. Barry, pers. comm.), aircraft disturbance could have a moderate impact on these birds by reducing natality. Although large numbers of moulting scoters and oldsquaws congregate on McKinley Bay, these were almost entirely males in 1980; because no lethal effects are anticipated, the impact of aircraft disturbance is rated slight.

At Baillie Islands, there are few nesting gulls and waterfowl and low to medium densities of nesting songbirds, and shorebirds. The impact of

aircraft disturbance would thus be slight. There are moderate concentrations of moulting oldsquaws and low concentrations of scoters, most of which were males in 1980. The polynya north of Baillie Islands is used by large concentrations of migrating eiders, oldsquaws, and other seabirds. However, aircraft disturbance is not expected to have a more than slight impact on these birds. The northeast coast of Cape Bathurst Peninsula is a minor calving area for the Bluenose caribou herd (Hawley, Poll and Brown 1976), and low-level aircraft flights could have a moderate impact on calving success there.

Dome Petroleum Ltd. has proposed constructing a Twin-Otter airstrip on one of the artificial islands created from dredge spoil in McKinley Bay (Dome 1980b). The airstrip has the advantages of taking no existing land out of production and of minimizing the disturbance to terrestrial wildlife. The company finds this location advantageous because it reduces the time and effort required to move materials from supply bases such as Inuvik and Tuktoyaktuk to the drilling fleet. This proposal would entail slight (disturbance-related) impacts on marine birds and seals during the spring breakout period and the summer ice-free season.

Use of the artificial island as an airstrip would probably entail the construction of storage depots for petroleum, oil and lubricants. There is a hazard that these products could be washed into McKinley Bay by ice ridging, storm surges, or waves, resulting in subsequent shoreline contamination. Solutions to this would include ensuring that the island was stable and of sufficient elevation above sea level and installing adequate dyking.

Alternatively, the existing airstrip at Atkinson Point could be upgraded. Approaches and exits from this strip extend over the open sea and over Louth Bay. Use of this strip to service the drilling fleet would entail only slight impacts to nesting birds, because there are no major nesting concentrations of birds within 2 km of the airstrip, though passerine and shorebird densities are high. Louth Bay has important concentrations of migrating oldsquaws, scoters and is used by grazing brant in the fall. Because Louth Bay opens earlier than the main part of McKinley Bay, it is particularly important to birds in spring, at the time when industrial preparations for spring breakout are most intense. Mitigation of aircraft disturbance to wildlife at McKinley Bay would entail minimizing the number of approaches and departures, and using a strip that has departures and approaches over water instead of over land. The risk of hazardous product spills complicates the choice of an airstrip on an artificial island versus the existing airstrip at McKinley Bay (see section 3.2.4).

Mitigation of disturbance to wildlife at Baillie Islands entails avoiding low flights over the polynya area north and east of Baillie Island, and over the caribou calving area on the Cape Bathurst Peninsula. Baillie Islands themselves have no terrestrial areas that are especially important to wildlife.

3.2.4 Fuel Spills

More than 20 small fuel spills (less than 100 gallons or 455 litres) were reported by Canmar during the 1979 drilling season. In winter 1979-80, there was a large fuel spill in McKinley Bay when a supply vessel was forced against a fuel barge. In 1980, at least 14 spills occurred in

McKinley Bay in connection with Dome/Canmar activities (D. Tilden, pers. comm.). Dome (1980c) estimates that of the 442 to 605 gallons of oil spilled in McKinley Bay, 313 to 407 gallons (69 percent) were recovered. The remaining 129 to 197 gallons were lost. Most fuel spills reported by Canmar were small. Dome/Canmar has an eight-man oil spill cleanup team, and Dome's contingency planning for hydrocarbon spills is generally acknowledged to better than that of other arctic petroleum operators (Arctic Waters Advisory Committee 1980). Nevertheless, there are still serious concerns related to fuel spills at both McKinley Bay and Baillie Islands. Chronic, low-level pollution resulting from small spills may reduce the productivity of both phytoplankton, zooplankton and benthic invertebrates (Hsiao 1975) and could also affect birds, indreasing their mortality or lowering their reproductive success. In fact, judging from the extent of grease balls distributed along the McKinley Bay shoreline (L. Allen, pers. comm.), chronic pollution may be the most serious spill-related impact. To date, there have been no baseline data on plankton and invertebrates collected for either study area (P. Wainwright, pers. comm.).

Spills from either tank farms or fuel barges may become encapsulated in sea ice during fall and winter. Present technology for cleanup entails waiting until sea ice begins to melt in spring, then burning the hydrocarbons that migrate to the ice surface. Burning of residual hydrocarbons is not complete.

Storm surges and waves may carry spilled fuels ashore. In exceptional situations, storm surges may affect tundra areas several hundred meters inland, as can be seen by the stranded wrack of tree-trunks that are prominent at McKinley Bay (see Figure 6, Volume I). Some shoreline types are relatively easy to clean up manually and mechanically -- these include unvegetated sands and gravels that comprise much of the shoreline at McKinley Bay.

However, cleanup of goose grass tidal flats, or of the sedge-heath or sedge subtypes, which occur within the storm surge limit, is not feasible without destroying the vegetative cover. Worbets (1979) provides a small-scale atlas with a cleanup manual for both McKinley Bay and Baillie Islands.

There is no technology for removing oil from shifting ice or water with considerable floe ice cover. This is especially a concern at Baillie Islands, because active shifting ice is favoured habitat for seals and polar bears (Smith and Stirling 1975, Stirling et al. 1975). Floe ice and the ice edge generally is a favoured feeding and loafing area for large numbers of common eiders, king eiders, and oldsquaws migrating past Baillie Islands (Barry 1976, Searing et al. 1975).

Dome Petroleum has a comprehensive contingency plan for fuel spills on open water, on ice, and on land. A response team dedicated to oil spill cleanup tests its contingency plan annually. Presently, materials and equipment are located in Tuktoyaktuk, where the Canadian Coast Guard also has oil spill cleanup equipment.

3.2.4.1 Oil Spills on Open Water

Because large numbers of moulting sea ducks use McKinley Bay, spilled fuel should be contained as rapidly as sea state conditions allow. All of McKinley Bay should be considered sensitive; Louth Bay and the lagoon system south of McKinley Bay should be considered critical. Target species for spilled oil at McKinley Bay are staging brant, white-winged scoter, surf scoter, oldsquaw, yellow-billed loon, arctic loon and red-

throated loon. As many as 8,000 individuals may be affected. Most of the ducks would be males.

At Baillie Islands, the target species are eiders, oldsquaws and yellow-billed and arctic loons using Snow Goose Passage. In nearby Franklin Bay and Liverpool Bay, common eider, king eider and lesser numbers of gulls, jaegers and terns would also be affected. Bird use of marine waters around Baillie Islands is diffuse, and we do not have enough information to identify critical areas. If an oil spill occurred in Snow Goose Passage, the area should be boomed off to prevent escape of spilled oil to the adjacent marine waters.

3.2.4.2 Oil Spills in Ice-Infested Waters

The ice at McKinley Bay is relatively stable, and develops relatively few leads and pressure ridges. Until spring breakup, the only target species is the ringed seal. Dome's contingency plan for oil spills under ice should be implemented, but burn-off of oil should be complete before ice breaks up naturally. There is little or no bird use of the melt pools that form on decaying sea ice in spring. However, the ice edge is a critical loafing and feeding area in spring, so that cleanup must be complete before open water encroaches on oil contaminated ice.

At Snow Goose Passage adjacent to Baillie Islands, sea ice conditions are similar to those in McKinley Bay, and the same mitigation measures should be employed.

There is no effective mitigation for spills that occur in the shifting transition ice north and east of Baillie Islands in Franklin Bay. Oil spills in ice are likely to be fragmented into several bodies, and to gather in open water leads. The leads are often used as breathing holes and haul-out locations by ringed and bearded seals, and as hunting areas by polar bears (Smith and Stirling 1975). They are also important to migrating seabirds (Stirling and Cleator 1981).

3.2.4.3 Oil Spills on Shorelines

We disagree with some of the shore zone cleanup measures recommended by Worbets (1979) for Baillie Islands and McKinley Bay.

Much of McKinley Bay has sandy to pebbly shorelines that are not covered by vegetation. Mechanical cleanup with bulldozers is feasible on these shores, and the contaminated sediments can be incinerated to remove spilled hydrocarbons, then replaced *in situ* (Worbets 1979).

However, goose grass tidal flats cannot be cleaned mechanically without destroying the low, lawn-like vegetation. Goose grass is an important food for brant and snow geese. Mitigation could possibly be provided by booms placed to prevent spilled oil from contaminating Louth Bay ecotypes (see Figure 4, Volume 1). However, the lengths of boom required might make this measure unfeasible.

The shorelines at Baillie Islands are comprised of fine-textured marine silts and clays, except for the sandspits extending north from Cape Bathurst and south from the larger Baillie Island. Unvegetated coastal

bluffs are a prominent feature of Baillie Islands. Tidal flat vegetation (goose grass) is present, but it is discontinuous. Effective cleaning of the muddy shorelines at Baillie Islands may not be possible, because the texture of these sediments makes walking difficult, and, when thawed, they are likely impassable to tracked vehicles. However mechanical scraping of oiled beaches may be possible when the soil has frozen, and the contaminated muds could be buried.

If storm surges were to carry spilled oil ashore onto *Dryas* subtype, sedge-heath subtype, sedge subtype, or raised center polygon subtype vegetation, there would probably be no effective mitigation.

If spilled oil is carried ashore to lyme grass-covered dunes, the most effective mitigation may be to remove the vegetative mat mechanically, and incinerate the sediments. Lyme grass appears to be adapted to constant soil shifting, so that recolonization may proceed rapidly. However, the feasibility of this suggestion remains untested.

3.2.5 Camps and Personnel

In the winter of 1979-80, up to 600 personnel were housed at McKinley Bay. Should a major marine terminal be sited at McKinley Bay, the accommodation requirements would be somewhat greater.

Environmental concerns associated with camps are: sewage disposal on land or at sea; solid waste disposal by ocean dumping or burial on land; removal of land from natural conditions; and recreational activities such as boating, artifact hunting, use of all-terrain vehicles (ATV's) and snowmobiling.

Sewage disposal at sea would probably have no impact on marine birds and mammals, except to provide extra nutrients to the food chain. Sewage disposal on land would probably require the removal of a few hectares of land, or fresh water if a pond was used, to construct a sewage lagoon. We consider that the impact of this activity on terrestrial species would be slight.

Garbage and other solid waste disposal is usually achieved by a combination of incineration and burial in northern Canada. Species such as glaucous gulls, jaegers, arctic fox, grizzly bear, and polar bear would probably be attracted to these landfills. There could be a safety hazard to personnel from "garbage bears". Mitigation of wildlife problems can be achieved by incinerating solid waste daily followed by burial or ocean dumping of the burned residue. On artificial islands in the Beaufort Sea, Esso Resources Canada employs Inuit polar bear monitors. However, the monitors usually end up shooting troublesome bears. In areas where polar bears may be numerous, such as Baillie Islands, the harvest of "trouble bears" may be excessive. At McKinley Bay, fewer polar bears but more grizzly bears are likely to be killed by bear monitors.

Recreational use of boats would likely have a slight impact on most marine birds and mammals but could have a moderate impact on reindeer at McKinley Bay and caribou at Cape Bathurst during the post-calving and calving periods respectively. Since use of ATV's could have a serious impact on tundra vegetation, they should be restricted to emergency use only. Archaeological sites and historic sites at Baillie Islands and McKinley Bay should be identified and declared off-limits to all personnel, both government and industry, with the exception of individuals holding N.W.T. permits for archaeological work.

3.2.6 Surface Transport and Linear Facilities

Possible surface access to McKinley Bay includes winter or all-weather roads over ice or over land, pipelines for natural gas or oil, and transmission lines. Ice roads serving McKinley Bay would probably follow the shore from Tuktoyaktuk, and cross shorefast ice. There would probably be no impact on wildlife, except for temporary disturbance of a few seals and arctic foxes. Baillie Islands are probably too distant from existing supply bases such as Inuvik and Tuktoyaktuk to make maintenance and construction of ice roads worthwhile. A harbour facility at Baillie Islands would likely be serviced by aircraft during the winter months and by ship and aircraft during the summer.

All-weather roads crossing land between Tuktoyaktuk and McKinley Bay would likely impact all terrestrial species to some degree. A comprehensive evaluation of the environmental impacts associated with road construction and use is beyond the scope of this study. However, the impacts on terrain and wildlife could be significant. Should such a road be considered, an Initial Environmental Evaluation should be performed as a minimum. More properly, the possible requirement for all-weather roads on the Tuktoyaktuk Peninsula and their environmental implications should be addressed in the Environmental Impact Statement concerned with hydrocarbon development in the Beaufort Sea (see Section 1, Volume I). In considering the possible impact, evaluators should be aware that the landscape of the Tuktoyaktuk Peninsula is unique since it has the highest density of pingos in the world. Parks Canada (1978) has identified the pingos south of Tuktoyaktuk as a Natural Site of Canadian Significance. The possibility that increased hunting would

occur in McKinley Bay and other areas along the Tuktoyaktuk Peninsula, as a result of access provided by the road, should certainly be considered.

A review of environmental impacts associated with other linear facilities such as transmission lines and pipelines, are likewise beyond the scope of this study. Proposals to construct these linear facilities should also be subject to a rigorous Initial Environmental Evaluation or included in the EARP Panel review of hydrocarbon development in the Beaufort Sea.

3.2.7 Navigation Aids

Navigation aids include range markers, light beacons, and radio beacons for ships at sea. Placement, installation, and servicing of navigation aids fall within the jurisdiction of Transport Canada.

At both McKinley Bay and Baillie Islands, flying birds may collide with navigation aids, particularly if these are placed on tall towers. Birds that migrate over water, such as common and king eiders, are less likely to be affected than birds that migrate over land, such as snow geese and songbirds. Numerous instances of collisions of birds with towers and similar structures have been documented in the literature (see Avery et al. 1980). However, because there do not appear to be any detailed reports on the impact of tall structures on migrating birds in the Canadian Arctic, our assessment is subjective. Navigation aids will probably have a slight impact on migrating songbirds, shorebirds, snow geese, brant, other geese, and ducks. The extent of mortality resulting from collisions is uncertain. Mitigation includes placing high towers and beacons away from prominent headlands and capes, and minimizing the height of tall towers as much as is feasible.

Raptors such as rough-legged hawks, ospreys, and bald eagles use tall towers as nesting platforms. A gyrfalcon is also reported to have nested on one of the tower structures at the Tuktoyaktuk DEW site (J. Ward, pers. comm.). Such structures may, therefore, benefit raptors.

3.2.8 Hydrocarbon Processing

Should the Beaufort Sea prove to have reserves of crude oil or natural gas in sufficient quantities to make their recovery economically viable, these hydrocarbons would require processing to separate the oil, water and gas mixture. Presently, it is not known whether such facilities would be located at sea or on land. In the case of shorebased facilities, underwater pipelines would be required to carry the production from the offshore production sites (Dome 1979).

Assessment of the environmental risks of such facilities at either McKinley Bay or Baillie Islands is difficult without design and siting specifications. A tentative assessment of potential impact is provided in Tables 1 and 2. Consideration of these risks should be included in the Environmental Impact Statement referred to in Section 1, Volume I. At the very least, an Initial Environmental Evaluation would be required before any decision on construction of processing facilities could be made.

In general, concerns include: (1) the risk of oil spills; (2) disposal of unwanted byproducts such as sulphur and heavy fractions; (3) the incidence and severity of convection or radiation fogs produced by the facilities; (4) the impact of compressor station and power generation plant noise; and (5) the disturbance of terrain during installation of facilities.

4. SUMMARY AND CONCLUSIONS

We have analyzed the potential impacts, which may be associated with harbour and marine terminal development and operation, on migratory birds and other wildlife species at McKinley Bay and Baillie Islands. We conclude that the physical act of dredging vessel mooring basins and maintenance dredging by Dome at either McKinley Bay or at Baillie Islands would have only a slight impact on local wildlife, and that no mitigation would be required. Should Gulf and Esso establish mooring facilities in the bay, however, this impact could become moderate to severe. We conclude that the presence of vessels and craft, and associated icebreaking activity will generally have a slight impact on local wildlife. An exception to this generalization is that icebreaking activity in late winter may cause mortality of ringed seals in the birth lairs. Because seals appear to be more common at Baillie Islands than at McKinley Bay, the impact would be greater at the former locality. Mitigation would entail using one icebreaker track, instead of many.

Generally, aircraft movements will have a slight impact on local wildlife at both McKinley Bay and Baillie Islands. Should Dome decide to provide runway facilities on the artificial island at McKinley Bay for summer use of their Boeing 737, or should Gulf and Esso also become established in the bay, this impact could become moderate to severe. Low flights over the caribou calving area at Cape Bathurst Peninsula should be avoided; over this area, a flight elevation of at least 600 m above ground level should be maintained. Low flights over the reindeer herds that frequent McKinley Bay should also be avoided. Possible mitigation measures for reducing wildlife disturbance resulting from aircraft use include:

(1) where feasible, orienting airstrips so that approaches and departures are over marine areas rather than over land;

(2) placing the airstrip at McKinley Bay on an artificial island instead of using the existing airstrip;

(3) using heavy-capacity fixed-wing aircraft rather than helicopter transport of materials; and

(4) using marine rather than air transport.

Fuel spills may have a moderate to severe impact on wildlife at both McKinley Bay and Baillie islands. Generally, the target species are marine birds and mammals which feed and rest on water, and coastal species such as brant which require halophytic vegetation for feeding. Existing contingency plans for cleanup of oil in open water and in stable shorefast ice are not totally adequate. There are serious concerns about spills in shifting transition ice and at the ice edge — both these ice types are very important to marine birds and mammals, but presently an effective method of containment does not exist. If oil is carried by storm surges onto certain terrestrial habitats, it is unlikely that the spilled oil could be cleaned up successfully.

Developing major winter harbours at McKinley Bay or Baillie Islands would entail hundreds of personnel, and camps would be required to accommodate them. Recreational use of boats may have slight impacts to marine birds and may cause moderate impacts to calving caribou at Cape Bathurst and post-calving reindeer at McKinley Bay.

At McKinley Bay, there may be requirements for linear facilities such as roads, transmission lines and perhaps pipelines. However, it would be premature to comment on the environmental impact of these facilities prior

to scrutiny of routing plans and design standards. Baillie Islands are probably too distant from existing supply bases for the installation of linear facilities to be economically feasible.

Navigation aids will probably have a slight impact on the local wildlife. Tall radio or light beacons may cause tower mortalities among migrating birds. Impacts can be minimized by careful placement of towers away from areas of high migratory bird use and by constructing towers as low as possible.

The possibility of placing hydrocarbon processing facilities at either McKinley Bay or Baillie Islands cannot be properly addressed at present. Design specifications for such facilities are presently not available.

It is our judgment that neither McKinley Bay nor Baillie Islands are so unique or so critical to wildlife to justify prevention of harbour and marine terminal development at either location. However, both areas receive significant use by various wildlife species and wildlife populations and their habitats should be protected as much as possible. Recommended measures for mitigating impacts on wildlife appear in section 5.

McKinley Bay is a sensitive wildlife area because it has large concentrations of moulting oldsquaws, surf scoters and white-winged scoters. The area is important for breeding and staging brant, non-breeding white-fronted geese and staging snow geese. The lagoon system is important for moulting swans and the brackish lakes and ponds for breeding swans. In common with other parts of the Tuktoyaktuk Peninsula, there are high densities of nesting

songbirds, shorebirds and ducks. McKinley Bay is an important site for Inuit reindeer herding activities, and industry must be sensitive to the land requirements of the local herders. We believe that the reindeer have become partly habituated to low flights by fixed-wing aircraft, and to humans on foot. Some habituation to human activity may also have occurred by resident waterfowl species.

Baillie Islands and nearby Cape Bathurst, are generally of little importance to terrestrial wildlife, with the exception of calving caribou use of Cape Bathurst. Snow Goose Passage is of minor importance as a moulting area for several hundred oldsquaws, and to some extent eiders. However, the nearby ice edge of the Cape Bathurst polynya, and the moving ice of the polynya itself, is an important area for migrating eiders, oldsquaws, and other marine birds. This area is also very important for breeding ringed and bearded seals, and polar bears.

Although McKinley Bay is probably more important than Baillie Islands from a wildlife standpoint, the mitigation of anticipated environmental impacts is probably more easily achieved at McKinley Bay.

5. RECOMMENDATIONS

5.1 In the opinion of the authors, establishment of a marine terminal for Dome's drilling fleet and support vessels at either McKinley Bay or Baillie Islands could proceed with only minor impacts to wildlife. Development of similar facilities in the bay by Gulf and Esso would augment the level of these impacts. However, we recommend that harbour and marine terminal facilities supporting offshore hydrocarbon exploration be concentrated at McKinley Bay rather than be distributed along the Tuktoyaktuk Peninsula.

5.2 In the opinion of the authors, industry should produce Initial Environmental Evaluations for any of the following proposals for McKinley Bay before permission to proceed is granted:

(1) all-season roads between these locations;

(2) transmission lines serving McKinley Bay;

(3) hydrocarbon processing facilities; and

(4) pipelines connecting McKinley Bay to other locations.

In our opinion, these and other ancillary facilities would be more properly addressed in the Environmental Impact Statement to be produced for Panel review of hydrocarbon production in the Beaufort Sea.

5.3 Roads, transmission lines, and processing plants are less likely to be situated in the Baillie Islands area. However, the potential impacts of such facilities should similarly be assessed through preparation of Initial Environmental Evaluations, in our opinion.

5.4 Detailed oil spill contingency plans should be developed by industry for McKinley Bay. Sufficient manpower and materials must be present at all times at winter harbour sites to enable such oil spill contingency plans to be promptly implemented.

5.5 Oil spill cleanup and containment measures should be developed for land and ice habitats for which no adequate technology exists. These include:

(1) spills in shifting transition ice in the Cape Bathurst polynya, and,

(2) spills on vegetated coastal habitats, such as those of Atkinson Point, Louth Bay and Pingo ecosections.

5.6 At McKinley Bay, aircraft interference with wildlife is likely to be more harmful to terrestrial wildlife than to marine wildlife. Therefore, aircraft approaches and departures should be routed over marine habitats rather than terrestrial habitats, where feasible. Flights that do cross terrestrial habitats should be limited to elevations of 300 m or more above ground level. There is no objection to creating an airstrip on an artificial island in McKinley Bay. However, bulk storage on the island of aircraft fuel, lubricants and other hazardous materials should not occur unless it can be demonstrated that the island can structurally withstand peak storm surges and adequate dyking is installed to prevent these materials from entering the bay.

5.7 At Baillie Islands, marine wildlife are more likely to be affected by low aircraft flights than are terrestrial wildlife.

Therefore, aircraft approaches and departures should be routed over land or over the stable shorefast ice of Liverpool Bay, where feasible. Aircraft approaches from the southeast and south, which would pass over sensitive caribou calving areas, should be prohibited during May through July.

5.8 To avoid attracting polar bears and grizzly bears to the vicinity of camps, all domestic garbage should be incinerated daily, and the residue should either be buried, dumped at sea, or returned to Tuktoyaktuk for disposal.

5.9 Recreational use of snowmobiles and all-terrain vehicles should be excluded from areas critical to reindeer (as defined by native reindeer herders) and from the caribou calving area on the Cape Bathurst Peninsula. Boating should be excluded from areas receiving intensive use by moulting or staging waterfowl.

5.10 Islands, lakes and coastline areas that are used as nesting areas by swans, brant and other geese, glaucous gulls, oldsquaws, and Sabine's gulls should be declared "off-limits" to all personnel.

5.11 Archaeological and historical sites, especially burial grounds and house ruins, should be declared "off-limits" to all personnel, both government and industry, except where valid N.W.T. permits have been obtained for archaeological work.

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