

Wildlife Resources Technical Data Report

LNG Canada Export Terminal

October 2014



LNG CANADA
Opportunity for British Columbia. Energy for the world

Joint venture companies



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EXECUTIVE SUMMARY

LNG Canada Development Inc. is proposing to construct and operate a liquefied natural gas facility (including an LNG processing and storage site and marine terminal) in the District of Kitimat, British Columbia, and to export LNG from the facility by shipping. This proposed project is called the LNG Canada Export Terminal (the Project). Construction and operation of the LNG facility have the potential to adversely affect wildlife and wildlife habitat through terrain alteration, vegetation clearing, and sensory disturbances from construction and operations. First Nations traditional harvest might also be affected. Wildlife resources has been selected as a valued component to assess potential effects of Project construction and operation. Legislation applicable to this assessment includes the BC *Wildlife Act*, the *Migratory Birds Convention Act*, and the *Species at Risk Act*.

Terrestrial Wildlife

To facilitate the assessment of effects on wildlife, baseline data was collected to study the diversity, abundance, distribution, and habitat use of terrestrial mammals, songbirds, raptors, waterfowl, and amphibians, with a focus on species of conservation concern, such as western toad, western screech-owl, and grizzly bear. Data collected during this study were used to supplement existing publically available information on abundance, distribution, and seasonal use of habitats in the Douglas Channel region by resident and migrating wildlife populations. Wildlife habitat suitability models were developed to help define existing habitat for six key species: grizzly bear, Pacific marten, harlequin duck, western sandpiper, western screech-owl, and western toad. These species were selected to assess potential environmental effects of the Project on terrestrial wildlife. An additional habitat suitability model was developed for marbled murrelet, which is key species assessed under marine birds (Section 3.0), but is known to breed within the terrestrial environment.

The broad expanse of the Kitimat River estuary and surrounding upland habitats support a relatively diverse faunal group that includes large and small mammals, songbirds, raptors, waterfowl, shorebirds, and amphibians. Several species of conservation concern are present seasonally. The importance of this habitat for First Nations is demonstrated in available literature. Most species recorded during large mammal, breeding bird, and amphibian surveys, as well as through incidental observations, are common to north coastal forests. Several wildlife species were detected frequently: American robin, ruby-crowned kinglet, song sparrow, warbling vireo, western tanager, yellow-rumped warbler, western toad, and grizzly bear. Raptor nests were present in the terrestrial wildlife LSA: one inactive and two active bald eagle nests, and one active and one inactive osprey nest. Surveys indicated that western screech-owl were potentially nesting in mature forest along the river, although follow-up surveys did not detect the occurrence of this species. Eight provincially and or federally listed species were identified during these surveys: grizzly bear, great blue heron, peregrine falcon, western screech-owl, California gull, barn swallow, coastal tailed frog, and western toad.

Wildlife habitat suitability modelling suggested that effective habitat for the key species comprised between 5.6% and 38.4% of the overall terrestrial wildlife LSA. Effective grizzly bear spring and fall feeding habitat comprised 26.4% and 38.4% of the terrestrial wildlife LSA, respectively. Effective Pacific

marten living habitat comprised 5.6% of the terrestrial wildlife LSA. Marbled murrelet effective breeding habitat accounted for 5.8%. The model results also showed effective habitat of 12.1% for western screech-owl breeding habitat, 6.0% for western sandpiper spring and fall foraging habitat, and 7.7% for Harlequin duck spring and fall foraging habitat. Effective western toad breeding habitat amounted to 3.9% of the terrestrial wildlife LSA.

Marine Birds

To facilitate the assessment of effects on marine birds, baseline data was collected to capture the diversity, abundance, and distribution of marine birds in the marine birds regional study area. The data collected during field studies was used to supplement existing publically available information on seasonal habitat use.

The marine birds regional study area supports a diverse and seasonally abundant marine bird community. Marine bird species recorded during vessel-based and stationary point surveys primarily included diving and dabbling ducks, gulls, geese, seabirds, shearwaters, and shorebirds. In total, 25 provincially and or federally listed species were identified: American golden-plover, ancient murrelet, Brandt's cormorant, Brant, cackling goose, California gull, Caspian tern, Cassin's auklet, common murre, double-crested cormorant, great blue heron, horned puffin, long-tailed duck, marbled murrelet, northern fulmar, pelagic cormorant, peregrine falcon, pink-footed shearwater, red-necked phalarope, surf scoter, tufted puffin, wandering tattler, western grebe, and yellow-billed loon.

The wildlife habitat suitability modeling suggested that effective breeding habitat for marbled murrelet comprises 1.3% (high suitability habitat) and 4.5% (moderate suitability habitat) within the terrestrial wildlife LSA. The model primarily identifies mature and old growth forest adjacent to the Kitimat River as effective suitable habitat for marbled murrelet.

ACRONYMS AND ABBREVIATIONS

%	percent
AV	audio/visual
BC	British Columbia
BCCDC	British Columbia Conservation Data Centre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWH	Coastal Western Hemlock
GBPU	Grizzly Bear Population Units
GPS	global positioning system
ha	hectares
IBA	Important Bird Area
KVN	Kitimat Valley Naturalists
km	kilometres
LNG	liquefied natural gas
LNG Canada	LNG Canada Development Inc.
LSA	local study area
MBCA	<i>Migratory Birds Convention Act</i>
MFLRNO	Ministry of Forests, Lands, and Natural Resource Operations
PNCIMA	Pacific North Coast Integrated Management Area
Project	LNG Canada Export Terminal
RIC	Resource Inventory Committee
RSA	regional study area
SARA	<i>Species at Risk Act</i>
spp.	species
TEM	terrestrial ecosystem mapping
Triton	Triton Environmental Consultants Ltd.
ZOI	zone of influence

TABLE OF CONTENTS

1	Introduction	1
1.1	Study Objectives	3
1.2	Terrestrial Wildlife.....	3
1.2.1	Terrestrial Wildlife Key Species.....	3
1.3	Marine Birds	4
1.3.1	Marine Bird Key Species	4
2	Terrestrial Wildlife.....	5
2.1	Study Areas.....	5
2.1.1	Regional Setting	5
2.1.2	Local Study Area	7
2.1.3	Regional Study Area.....	7
2.2	Review of Existing Data	10
2.2.1	Aboriginal Traditional Use	10
2.2.2	Literature and Electronic Resources	11
2.2.3	Previous Studies.....	12
2.3	Field Studies.....	17
2.3.1	Breeding Bird Point Counts	20
2.3.2	Raptor Surveys	22
2.3.3	Wetland Bird Call-Playback.....	23
2.3.4	Marbled Murrelet Dawn Audio-Visual Surveys.....	23
2.3.5	Marbled Murrelet Habitat Assessment Surveys	26
2.3.6	Amphibian Surveys.....	27
2.3.7	Large Mammal Transects.....	30
2.3.8	Incidental Observations	33
2.4	General Discussion	36
2.5	Habitat Suitability Modelling	37
2.5.1	Key Species.....	37
2.5.2	Grizzly Bear	42
2.5.3	Harlequin Duck	48
2.5.4	Marbled Murrelet.....	51
2.5.5	Pacific Marten	54
2.5.6	Western Screech-owl	58
2.5.7	Western Sandpiper	61
2.5.8	Western Toad	64
2.5.9	Model Verification	66

3	Marine Birds	69
3.1	Study Area.....	69
3.1.1	Regional Setting	69
3.1.2	Local Study Area	70
3.1.3	Regional Study Area.....	70
3.2	Review of Existing Data	73
3.2.1	Aboriginal Traditional Use	73
3.2.2	Literature and Electronic Resources	73
3.2.3	Key Species Selection.....	85
3.2.4	Discussion	89
3.3	Field Studies.....	90
3.3.1	Vessel-based Surveys.....	90
3.3.2	Stationary Point Surveys	102
3.3.3	Discussion	110
4	Conclusions.....	113
5	Closure.....	115
6	References.....	117

List of Tables

Table 2.2-1:	Wildlife Use as Identified by Haisla First Nation	10
Table 2.2-2:	Species of Conservation Concern Potentially Occurring in the Terrestrial Wildlife LSA	11
Table 2.2-3:	Seasonal Observations by KVN during Coastal Waterbird Surveys	13
Table 2.2-4:	Observations of Species of Conservation Concern during Christmas Bird Counts (2002 to 2012) and Coastal Waterbird Surveys (2004 to 2013)	13
Table 2.2-5	Amphibian Species Observed during June 2012 Surveys.....	15
Table 2.2-6:	Marine Bird Species Observed during June 2012 Surveys	16
Table 2.3-1:	Survey Effort by Group or Survey Type	18
Table 2.3-2:	Marbled Murrelet A/V Survey Results.....	25
Table 2.3-3:	Marbled Murrelet Habitat Plot Survey Results	26
Table 2.3-4:	Total Observations of Amphibian Egg Masses, Tadpoles, and Adults.....	29
Table 2.3-5:	Observations of Amphibian Egg Masses and Tadpoles by Site in May 2013	29
Table 2.3-6:	Observations of Amphibian Egg Masses and Tadpoles by Site in June 2013	29
Table 2.3-7:	Wildlife Observations by Transect and Species	30

Table 2.5-1:	Key Species, Conservation Status and Life Histories Modelled	39
Table 2.5-2:	Rating Scheme Used to Assess Habitat Suitability for Key Species	41
Table 2.5-3:	Example of Confusion Matrix for a Four-Class Model	41
Table 2.5-4:	Grizzly Bear Spring Feeding Habitat Ratings	43
Table 2.5-5:	Grizzly Bear Fall Feeding Habitat Ratings	44
Table 2.5-6:	Area of Grizzly Bear Spring Feeding Habitat in the Terrestrial Wildlife LSA	44
Table 2.5-7:	Area of Grizzly Bear Fall Feeding Habitat in the Terrestrial Wildlife LSA	45
Table 2.5-8:	Harlequin Duck Spring and Fall Foraging Habitat Ratings Assumptions	48
Table 2.5-9:	Area of Harlequin Duck Spring and Fall Foraging Habitat in the Terrestrial Wildlife LSA	49
Table 2.5-10:	Breeding Habitat Requirements for Marbled Murrelet	51
Table 2.5-11:	Marbled Murrelet Breeding Habitat Suitability Ratings	52
Table 2.5-12:	Marbled Murrelet Breeding Habitat in the Terrestrial Wildlife LSA	54
Table 2.5-13:	Marten Year-round Living Habitat Ratings	55
Table 2.5-14:	Area of Marten Year-round Living Habitat in the Terrestrial Wildlife LSA	56
Table 2.5-15:	Western Screech-owl Year-round Living Habitat Ratings Assumptions	59
Table 2.5-16:	Area of Western Screech-owl Year-round Living Habitat in the Terrestrial Wildlife LSA	59
Table 2.5-17:	Western Sandpiper Spring and Fall Foraging Habitat Rating Assumptions	61
Table 2.5-18:	Area of Western Sandpiper Spring and Fall Foraging Habitat in the Terrestrial Wildlife LSA	62
Table 2.5-19:	Area of Western Toad Breeding Habitat in the Terrestrial Wildlife LSA	66
Table 2.5-20:	Confusion Matrix Results	67
Table 3.2-1:	Identified Marine Bird Species Traditionally Used by First Nations	74
Table 3.2-2:	Summary of Conservation Areas in and adjacent to the Marine Bird RSA	77
Table 3.2-3:	Provincial Parks and Conservancies in and adjacent to the Marine Bird RSA	79
Table 3.2-4:	Historical Data on Marine Bird Diversity Documented in the Marine Bird RSA	79
Table 3.2-5:	Marine Bird Species of Conservation Concern in the Marine Bird RSA	83
Table 3.2-6:	Marine Bird Breeding Colonies in or at the Margins of the Marine Birds RSA	84
Table 3.2-7:	Ecological Information for Marine Bird Key Species	87
Table 3.3-1:	Survey Effort for Marine Bird Vessel Surveys in the Marine Birds RSA in 2013	92
Table 3.3-2:	Number of Marine Bird Species Observed During Vessel-based Surveys	93
Table 3.3-3:	All Species in All Observations	101
Table 3.3-4:	A Key Species and One Other Species is Present in All Observations	101

Table 3.3-5:	At Least One of the Key Species, or the Other Species, or Both Were Present in Observations	101
Table 3.3-6:	Number of Marine Bird Species Observed during Stationary Point Surveys.....	104
Table 3.3-7:	Incidental Observations of Marine Birds During Vessel-based and Stationary Point Surveys	107

List of Photos

Photo 2.1-1:	Marine Shoreline Habitat of the Kitimat River Estuary.....	5
Photo 2.1-2:	Typical Estuarine Upland Habitat of the Kitimat River Estuary.....	5
Photo 2.1-3:	Early Seral Forest in the Eastern Portion of the Estuary	6
Photo 2.1-4:	Mature Forest in the Northeastern Portion of the Estuary	6
Photo 2.1-5:	Minette Bay Estuarine Habitat with Grassy Banks, Mud Flats, and Intertidal Zones	6
Photo 2.1-6:	Cobbled Shoreline at the Edge of the Kitimat River	6
Photo 2.3-1:	Wetland Habitat of the Kitimat River Estuary.....	28
Photo 2.3-2:	Juvenile Western Toad Observed Crossing a Road in the Local Study Area	28
Photo 2.3-3:	Adult Northwestern Salamander	28
Photo 2.3-4:	Columbia Spotted Frog Egg Mass in Wetland Habitat in the Local Study Area	28
Photo 2.3-5:	Grizzly Bear Track in Mud on a Dyke Commonly Used as a Movement Corridor....	32
Photo 2.3-6:	Moose Antler Markings	32
Photo 2.3-7:	Ungulate Mineral Lick in Early Seral Habitat	32
Photo 2.3-8:	Grey Wolf Track in Early Spring Snow Cover.....	32
Photo 2.3-9:	Great Blue Heron on the shore of the Kitimat River	34
Photo 2.3-10:	Osprey Nest on a Light Standard at the RTA wharf “B”.....	34
Photo 3.3-1:	Ancient Murrelet Adult and Chicks Foraging	98
Photo 3.3-2:	Double-crested Cormorant Roosting on Islet.....	98
Photo 3.3-3:	Red-necked Phalarope Flying over Open Water	98
Photo 3.3-4:	Short-tailed Shearwater Taking Flight.....	98
Photo 3.3-5:	Bonaparte’s Gull Feeding on Small Fish.....	98
Photo 3.3-6:	Surf Scoter Flushing during Boat Survey.....	98

List of Figures

Figure 1.0–1:	Location of the LNG Canada Project Site	2
Figure 2.1-1:	Terrestrial Wildlife LSA.....	8
Figure 2.1-2:	Terrestrial Wildlife RSA	9
Figure 2.3-1:	Terrestrial Wildlife Survey Locations.....	19
Figure 2.3-2:	Breeding Bird Species Richness Accumulation Curve	21
Figure 2.3-3:	Marbled Murrelet Survey Locations	24
Figure 2.3-4:	Sensitive Wildlife Areas	35
Figure 2.5-1:	Grizzly Bear Spring Feeding Habitat at Baseline.....	46
Figure 2.5-2:	Grizzly Bear Fall Feeding Habitat at Baseline	47
Figure 2.5-3:	Harlequin Duck Spring and Fall Foraging Habitat at Baseline	50
Figure 2.5-4:	Marbled Murrelet Breeding Habitat at Baseline	53
Figure 2.5-5:	Marten Year-Round Living Habitat at Baseline.....	57
Figure 2.5-6:	Western Screech-Owl Year-round Living Habitat at Baseline	60
Figure 2.5-7:	Western Sandpiper Spring and Fall Foraging Habitat at Baseline	63
Figure 2.5-8:	Western Toad Breeding Habitat at Baseline.....	65
Figure 3.1-1:	Marine Birds LSA	71
Figure 3.1-2:	Marine Birds RSA.....	72
Figure 3.2-1:	Important Bird Areas, Conservancies, Ecological Reserves, Parks and Protected Areas in the Marine Bird RSA	78
Figure 3.3-1:	Starting Locations for Marine Bird Vessel Survey	91
Figure 3.3-2:	Survey Protocol for Vessel-based Marine Bird Surveys	92
Figure 3.3-3:	Key Species Observed in the Marine Birds RSA.....	97
Figure 3.3-4:	Species at Risk Observed in the Marine Birds RSA	99
Figure 3.3-5:	Marine Bird Species Richness Accumulation Curve.....	100
Figure 3.3-6:	Marine Bird Stationary Observation Points	103

List of Appendices

Appendix A:	.....	Kitimat Valley Naturalists BC Coastal Waterbird Survey Data
Appendix B:	.....	Kitimat Valley Naturalists BC Christmas Bird Count Data
Appendix C:	.....	Triton Bird Point Count Data 2012
Appendix D:	.....	Triton Wetland/Estuary Bird Migration Data 2012
Appendix E:	.....	Terrestrial Survey Habitat and Weather Data
Appendix F:	.....	Breeding Bird Survey Data
Appendix G:	.....	Incidental Wildlife Observations
Appendix H:	.....	Wildlife Habitat Suitability Rating Adjustments
Appendix I:	.....	Histograms
Appendix J:	.....	Bird Species Observed at Stationary Points

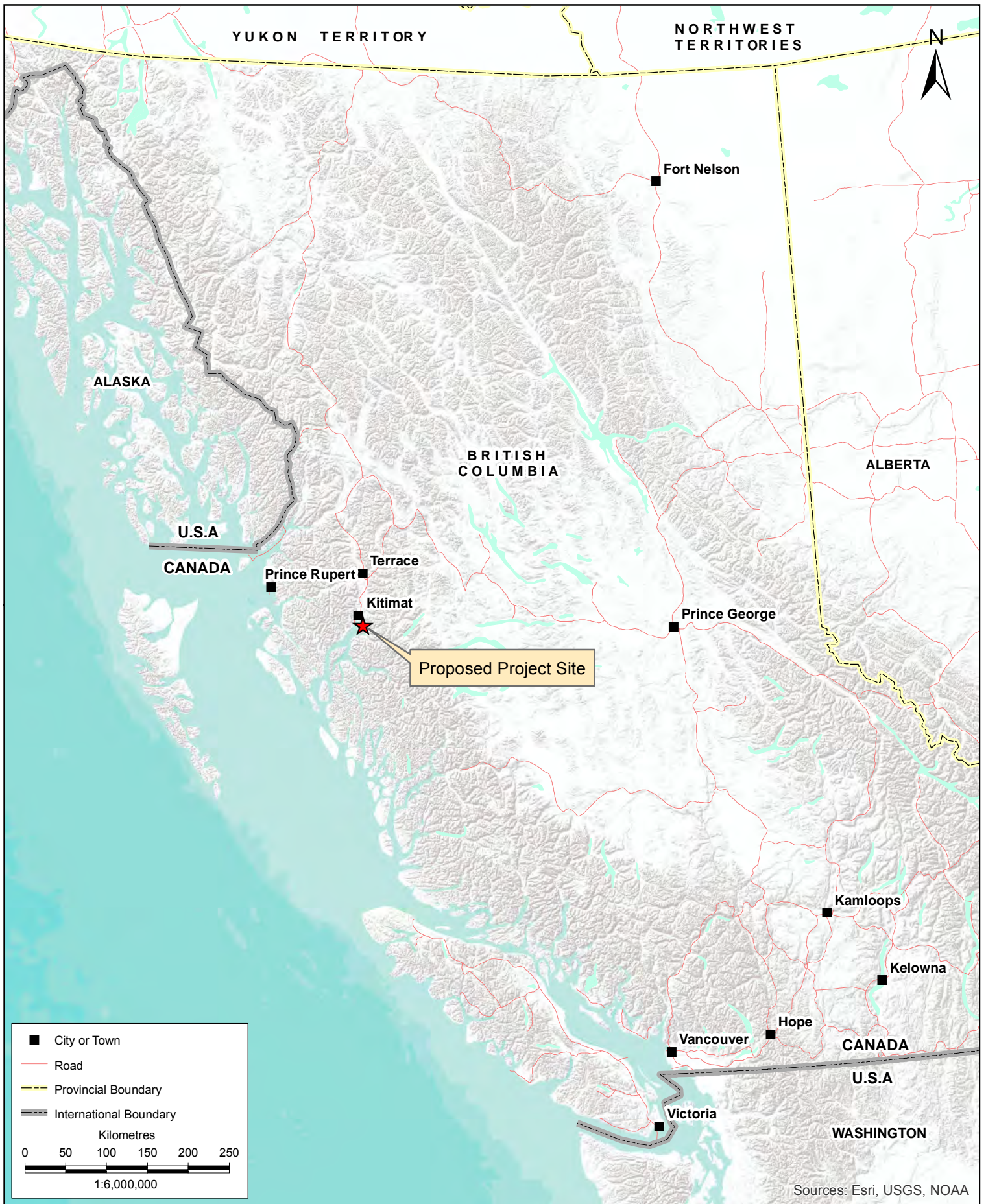
1 INTRODUCTION

LNG Canada Development Inc. (LNG Canada) is proposing to construct and operate a liquefied natural gas (LNG) facility (including an LNG processing and storage site and marine terminal) in the District of Kitimat, British Columbia (BC), and to export LNG from the facility by shipping. This proposed project is called the LNG Canada Export Terminal (the Project) (Figure 1.0–1). The Project encompasses both terrestrial and marine components; the terrestrial component extends from the head of Kitimat Arm and the old Moon Bay Marina north through the Kitimat River estuary. The marine component extends approximately 140 km from Kitimat Arm, southwest through Douglas Channel, Whale Channel, Squally Channel, Caamaño Sound, Estevan Sound, and north through Principe Channel, and Browning Entrance to Triple Island.

Wildlife resources has been selected as a valued component for the assessment of Project effects because:

- Site clearing before and during construction will disturb or alter wildlife habitats in the Project footprint and might constrain wildlife movement in established connectivity corridors.
- Site clearing and construction activities might result in direct injury or mortality to wildlife.
- LNG processing and storage and associated marine terminal operations might disturb terrestrial wildlife through air and noise emissions.
- Project vessels might affect marine birds through sensory disturbances (e.g., physical presence, noise).

The focus of the study was to collect information on the presence and habitat use by terrestrial wildlife and marine birds within the Terrestrial Wildlife Local Study Area (LSA) and the marine birds LSA and Regional Study Area (RSA). The scope and design of the study was guided by relevant experience and professional judgment of the study team and input from consultation with regulators, Aboriginal Groups, and the public. The study began with a review of existing available information (e.g., published scientific literature, electronic databases, and reports from government agencies, Aboriginal Groups, and environmental consultants). Field studies were designed and conducted to address information gaps, update existing information, and provide any additional wildlife baseline information required to support the environmental assessment.



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WILDLIFE TECHNICAL DATA REPORT

LOCATION OF THE LNG CANADA PROJECT SITE

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	BC Albers	DRAWN BY	NP
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	1.0-1

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1.1 Study Objectives

The specific objectives of the wildlife study are:

- to provide baseline data on the occurrence and distribution of terrestrial wildlife and marine birds, and
- to facilitate the assessment of potential effects of the Project on terrestrial wildlife and marine birds.

1.2 Terrestrial Wildlife

Baseline data was collected on the presence, distribution, and habitat use of terrestrial mammals, raptors, songbirds, waterfowl, and amphibians, with a focus on species of conservation concern, such as western toad (*Anaxyrus boreas*), western screech-owl (*Megascops kennicottii kennicottii*), and grizzly bear (*Ursus arctos*). The data collected during this study was used to supplement existing publically available information on abundance, distribution, and seasonal habitat use of resident and migrating wildlife populations in the Project study area.

1.2.1 Terrestrial Wildlife Key Species

It is not possible to assess effects on every wildlife species. Therefore, terrestrial wildlife key species were selected, whose presence, absence, or population wellbeing provides an indication of the overall health of ecosystem elements (Noss et al. 1996). These species are used to represent the broad range of resident and migrating species potentially affected by the Project (see Section 2.5 for more information). The six key species selected are:

- Harlequin duck (*Histrionicus histrionicus*)
- Pacific marten (*Martes caurina*)
- grizzly bear
- western sandpiper (*Calidris mauri*)
- western screech-owl
- western toad

Marbled murrelet (*Brachyramphus marmoratus*) is selected to represent marine birds (see Section 1.3.1); however, because this species nests in terrestrial habitats, it also represents terrestrial wildlife as outlined in Section 2.5. Its nesting habitat is characterized by old-growth forests that support a complex stand structure and nest-site specific attributes.

Wildlife habitat suitability models were developed for each key species to describe the existing conditions in the LSA, to identify available high-value or sensitive wildlife habitats, to identify potential wildlife movement corridors, and to quantify predicted potential Project effects on wildlife. Biological surveys supported these models through field validation of terrestrial ecosystem mapping of habitats with high and moderate wildlife suitability for these key species.

1.3 Marine Birds

Baseline information was collected on the presence, distribution, and habitat use of marine birds, with a focus on species of conservation concern, such as marbled murrelet, ancient murrelet (*Synthliboramphus antiquus*), pelagic cormorant (*Phalacrocorax pelagicus pelagicus* subspecies), and great blue heron (*Ardea herodias fannini* subspecies). The data collected during this study was used to supplement existing publically available information on abundance, distribution, and seasonal habitat use of resident and migratory marine birds in the Project study area.

1.3.1 Marine Bird Key Species

It is not practical to assess Project effects on every marine bird species; therefore, key species are used as a focus for the effects assessment. Key species presence, absence, or population well-being can provide a measure of potential Project effects on the full suite of marine birds that are likely to occur in the marine birds RSA. Five key species were selected to represent different marine bird groups and their associated habitat requirements or foraging strategies for the marine component of the Project: black oystercatcher (*Haematopus bachmani*), marbled murrelet, double-crested cormorant (*Phalacrocorax auritus*), common goldeneye (*Bucephala clangula*), and glaucous-winged gull (*Larus glaucescens*). Section 2.5 provides a comprehensive rationale for the selection of key species for the assessment. Selection criteria are the same for both terrestrial wildlife and marine bird key species apart from habitat type.

2 TERRESTRIAL WILDLIFE

2.1 Study Areas

2.1.1 Regional Setting

The Project occurs within the Coast Mountain range, which is characterized by dense forest, and along the rocky coastline of the Pacific Ocean (Demarchi 2011). More precipitation falls here than in any other region in BC. Summers are cool and winters are mild. The islands and other terrestrial and marine shoreline habitats are part of the Pacific Maritime Ecozone (Photo 2.1-1 to Photo 2.1-6). Most wildlife habitats occur in the Coastal Western Hemlock Very Wet Hypermaritime biogeoclimatic subzone (CWHvh2), with some habitats in the Coastal Western Hemlock Southern Very Wet Hypermaritime (CWHvh1) subzone in the Kitimat Arm (Pojar et al. 1991). In general, the Kitimat region is characterized by low to mid-elevation forests dominated by Douglas-fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*). The mature to old-growth vegetation communities provide important nesting habitat for a variety of birds including bald eagle (*Haliaeetus leucocephalus*), marbled murrelet, osprey, and a host of songbird species. These habitats are also important for a wide range of terrestrial wildlife including Pacific marten and grizzly bear.

The study area is relatively sparsely populated with largely undeveloped shorelines. It is near to the city of Kitimat, Kitamaat Village, and several industrial and port facilities. Industries in the region include commercial, recreational, Aboriginal traditional fishing and hunting, tourism, shipping, aluminum smelting, and forestry.



Photo 2.1-1: Marine Shoreline Habitat of the Kitimat River Estuary

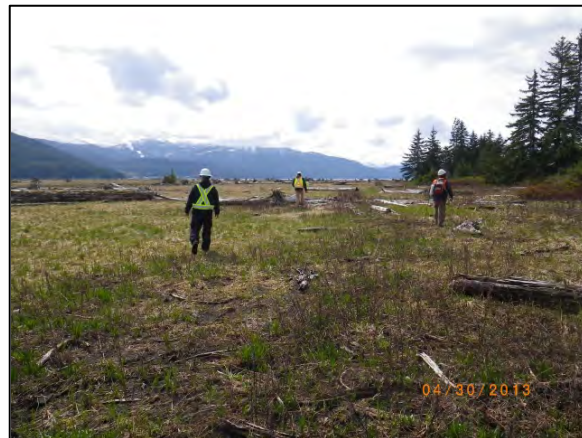


Photo 2.1-2: Typical Estuarine Upland Habitat of the Kitimat River Estuary



Photo 2.1-3: Early Seral Forest in the Eastern Portion of the Estuary

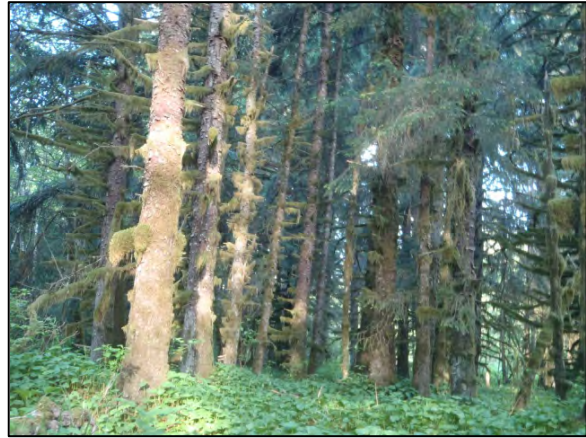


Photo 2.1-4: Mature Forest in the Northeastern Portion of the Estuary



Photo 2.1-5: Minette Bay Estuarine Habitat with Grassy Banks, Mud Flats, and Intertidal Zones



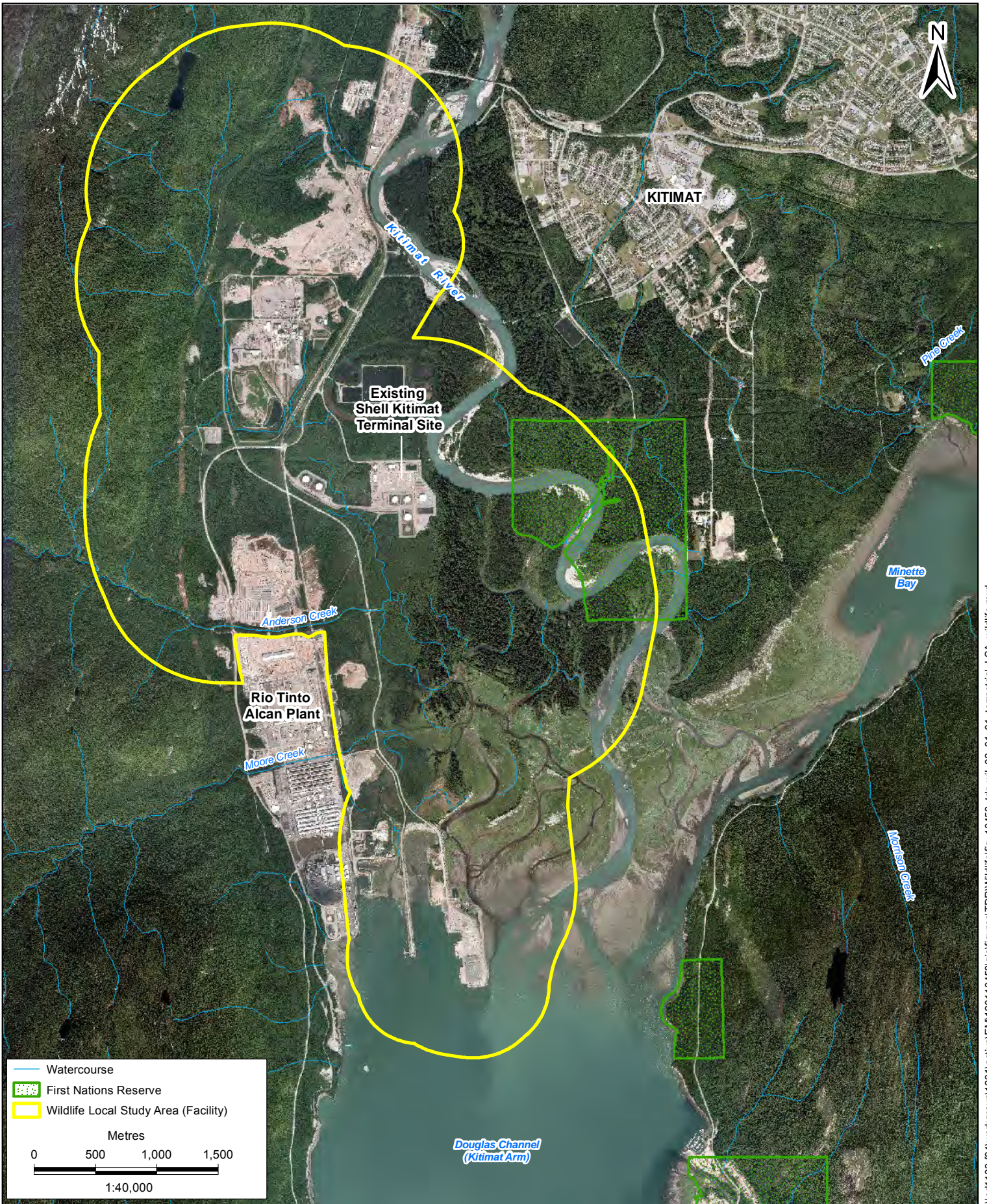
Photo 2.1-6: Cobbled Shoreline at the Edge of the Kitimat River

2.1.2 Local Study Area

The LSA for the terrestrial wildlife assessment encompasses the footprint of the LNG facility, (including the supporting infrastructure and marine terminal), plus a 1 km buffer to the east and west, and a 500 m buffer north and south of the LNG facility (Figure 2.1-1). The buffer areas are based on: 1) a 1 km zone of influence (ZOI) for potential disturbances to the largest-ranging wildlife species, the grizzly bear, with consideration for habitat connectivity requirements, sensitivity to access features, and potential disturbance from noise and activity, and 2) a 500 m ZOI that assumes decreased potential for disturbance effects from linear features (e.g., roads) and the marine terminal.

2.1.3 Regional Study Area

The RSA for terrestrial wildlife encompasses the area of land designated within the North Coast and Bulkley Lakes Grizzly Bear Population Units (GBPUs) extending from the lower Kitimat River estuary to high alpine habitat, and as such, acting as an umbrella area for other potentially vulnerable species. These two units were selected based on the presence of viable populations of grizzly bear (MFLNRO 2012), whose sustained presence is indicative of the occurrence of undisturbed expanses of natural forest, and as such represent habitat of other wildlife species that also depend on these habitats (Noss et al. 1996; Carroll et al. 2001) (Figure 2.1-2).



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WILDLIFE TECHNICAL DATA REPORT
TERRESTRIAL WILDLIFE LOCAL STUDY AREA
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	2.1-1

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WILDLIFE TECHNICAL DATA REPORT

**TERRESTRIAL WILDLIFE
REGIONAL STUDY AREA**

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	2.1-2

2.2 Review of Existing Data

2.2.1 Aboriginal Traditional Use

2.2.1.1 Methods

A background study was completed to compile available information on traditionally used wildlife resources in the terrestrial wildlife RSA. This review focused on government electronic resources, local First Nations consultant reports, and published scientific literature.

2.2.1.2 Results

First Nations cultural and traditional uses in the terrestrial wildlife RSA include the harvest of mallard (*Anas platyrhynchos*), goldeneye (*Bucephala* spp.), and merganser (*Mergus* spp.) ducks as sources of food and comfort (i.e., down feathers). Canada goose (*Branta canadensis*) and snow goose (*Chen caerulescens*) also provide food and down feathers. Traditional harvesting of gull eggs, primarily of glaucous-winged gull (Powell 2011), provides protein-rich supplements. Haisla First Nation has traditionally hunted and trapped several mammal and bird species for pelts, food, comfort, and other subsistence materials, such as quills, down feathers, bone, pelts, horns, antlers, and wool (Table 2.2-1). Historically important areas identified for securing these resources include the Kitimat River estuary, the mouth of the Kitimat River, Minette Bay, and Moore and Anderson creeks (Powell 2011; Power 2013).

Table 2.2-1: Wildlife Use as Identified by Haisla First Nation

Large Mammals	Importance	Small Mammals	Importance	Birds	Importance
Black bear	Pelt, food	Beaver	Pelt	Mallard	Food, down
Moose	Food, antler	Porcupine	Quills	Goldeneye	Food, down
Deer	Food, antler	Marmot	Pelt	Black duck	Food, down
Mountain goat	Food, horn, wool	Marten	Pelt	Merganser	Food, down
Wolf	Pelt	Fisher	Pelt	Canada goose	Food, down
Wolverine	Pelt	River otter	Pelt	Goslings	Down
Grizzly bear	Pelt	Mink	Pelt	Snow goose	Food, down
Lynx	Pelt	Weasel	Pelt	Goose eggs	Food
		Muskrat	Pelt	Grouse	Food, feathers

SOURCES: Powell (2011); Power (2013)

2.2.2 Literature and Electronic Resources

2.2.2.1 Methods

A comprehensive background review was completed to compile available information on wildlife and wildlife habitat use in the terrestrial wildlife LSA. This information focused on government electronic and published resources, local databases, consultant reports, and published scientific literature.

2.2.2.2 Setting

The Coastal Western Hemlock (CWH) forests in the terrestrial wildlife LSA support several large and small mammal species including grizzly bear, black bear (*Ursus americanus*), black-tailed deer (*Odocoileus hemionus*), moose (*Alces americanus*), Pacific marten, and snowshoe hare (*Lepus americanus*) (BC MOF 1991, 1999). The riparian, riverine, and salt marsh habitats support migrating and resident species of raptors, songbirds, waterfowl, and seabirds. The Kitimat River estuary is a regionally important staging and overwintering site for birds and supports large seasonal concentrations of shorebirds and waterfowl (KVN 2011). Amphibian species occurring in ponds and riparian zones of the upland habitats in the Kitimat River estuary include Columbia spotted frog (*Rana luteiventris*), northwestern salamander (*Ambystoma gracile*), and western toad (BC MOF 1991, 1999).

2.2.2.3 Species of Conservation Concern

Background research indicated that 15 species of conservation concern might occur in the terrestrial wildlife LSA (BCCDC 2014), including 14 species identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *endangered*, *special concern* or *threatened*, 10 species listed on Schedule 1 of SARA as *threatened* or of *special concern*; and 13 species on the provincial Red or Blue Lists (Table 2.2-2).

Table 2.2-2: Species of Conservation Concern Potentially Occurring in the Terrestrial Wildlife LSA

English Name	Scientific Name	Conservation Status ^a			
		BC List Status ^b	COSEWIC Status ^c	SARA - Schedule 1 Status ^d	CF Priority ^e
Mammals					
Grizzly bear	<i>Ursus arctos</i>	Blue	SC (May 2002)	–	2
Little brown myotis	<i>Myotis lucifugus</i>	Yellow	E (Nov 2013)	–	5
Amphibians					
Coastal tailed frog	<i>Ascaphus truei</i>	Blue	SC (Nov 2011)	SC (Jun 2003)	1
Western toad	<i>Anaxyrus boreas</i>	Blue	SC (Nov 2012)	SC (Jan 2005)	2
Birds					
Band-tailed pigeon	<i>Patagioenas fasciata</i>	Blue	SC (Nov 2008)	SC (Feb 2011)	2
Barn swallow	<i>Hirundo rustica</i>	Blue	T (May 2011)	–	2
Common nighthawk	<i>Chordeiles minor</i>	Yellow	T (Apr 2007)	T (Feb 2010)	2

English Name	Scientific Name	Conservation Status ^a			
		BC List Status ^b	COSEWIC Status ^c	SARA - Schedule 1 Status ^d	CF Priority ^e
Great blue heron	<i>Ardea herodias fannini</i>	Blue	SC (Mar 2008)	SC (Feb 2010)	1
Marbled murrelet	<i>Brachyramphus marmoratus</i>	Blue	T (May 2012)	T (Jun 2003)	1
Northern goshawk	<i>Accipiter gentilis laingi</i>	Red	T (Apr 2013)	T (Jun 2003)	1
Olive-sided flycatcher	<i>Contopus cooperi</i>	Blue	T (Nov 2007)	T (Feb 2010)	2
Rusty blackbird	<i>Euphagus carolinus</i>	Blue	SC (Apr 2006)	SC (Mar 2009)	2
Western screech-owl	<i>Megascops kennicottii kennicottii</i>	Blue	T (May 2012)	SC (Jan 2005)	1

NOTES:

^a Conservation status as of November, 2013 (BCCDC 2014)

^b BC List Status:

Red –extirpated, endangered, or threatened

Blue –special concern

Yellow – not at risk

^c COSEWIC Status:

SC –special concern: species sensitive to human activities or vulnerable to natural events

T – threatened: species likely to become endangered

E – endangered: species facing imminent extirpation or extinction

^d SARA Schedule:

Species at Risk Act schedule, status (definitions the same as COSEWIC) and date of last review

^e Conservation Framework (CF) Priority:

A rank applied to species of 1 (highest) to 6 (lowest) for a set of three goals: 1) contribute to global efforts for species and ecosystem conservation, 2) prevent species and ecosystems from becoming extinct, and 3) maintain the diversity of native species and ecosystems.

2.2.3 Previous Studies

2.2.3.1 Kitimat Valley Naturalists

The Kitimat Valley Naturalists (KVN) have been collecting data on the distribution of marine and terrestrial birds near Kitimat, BC, since 1996 (KVN 2011). Experienced local naturalists who volunteer with this group have documented the presence and distribution of a diversity of bird species through their involvement in the annual Christmas Bird Counts, BC Coastal Waterbird Surveys, and the Breeding Bird Atlas (Horwood 2013).

These data are valuable because they provide baseline data on the seasonal distribution of birds in the Kitimat area that are otherwise not available. In addition, these data include observations of species at risk and other uncommon or rare species that have not previously been observed. The most recent data (2002 to 2012 for Christmas Bird Counts; 2004 to 2013 for Coastal Waterbird Surveys) are summarized below.

Christmas Bird Counts are annual events that occur during a single observation day each December, with the exception of 2009 when counts occurred in December and January. During the period 2002 to 2012, KVN recorded 54,160 observations of 96 bird species during Christmas Bird Counts. Seven species—Canada goose, dark-eyed junco (*Junco hyemalis*), glaucous-winged gull, mallard, northwestern crow

(*Corvus caurina*), pine siskin (*Spinus pinus*), and greater scaup (*Aythya marila*)—were most commonly observed, respectively, accounting for 34.7% of observations.

From 2004 to 2013, 67,884 observations of 115 unique species of birds were recorded during Coastal Waterbird Surveys, which were completed on a monthly basis (97 total observation days) from three established survey points at the north end of Douglas Channel (Horwood 2013) (Table 2.2-3); Canada goose, glaucous-winged gull, unidentified gull species, and mallard—dominated these observations, accounting for 33.7% of observations. The seasonality of these data, not corrected for bias associated with observation effort (Table 2.2-3), highlight the importance of this area as a stop-over and overwintering site for many bird species. Species richness was highest during spring and fall observation periods.

Table 2.2-3: Seasonal Observations by KVN during Coastal Waterbird Surveys

Season	Effort (Observation Months)	Total No. of Observations	Total No. of Bird Species
Winter (Dec-Feb)	27	22,293	57
Spring (March-May)	25	25,989	92
Summer (June-Aug)	19	3,089	62
Fall (Sept-Nov)	30	16,513	71

During all survey types, 16 species of conservation concern were observed (Table 2.2-4) in the Kitimat area. This list includes species that were observed rarely (<10 observations), such as California gull (*Larus californicus*), Caspian tern (*Hydroprogne caspia*), northern goshawk, short-eared owl (*Asio flammeus*), and tundra swan (*Cygnus columbianus*). Species that were observed commonly included common murre (*Uria aalge*), great blue heron, marbled murrelet, and surf scoter (*Melanitta perspicillata*).

Table 2.2-4: Observations of Species of Conservation Concern during Christmas Bird Counts (2002 to 2012) and Coastal Waterbird Surveys (2004 to 2013)

English Name	Scientific Name	Conservation Status ^a			No. of Observations
		BC List Status ^b	COSEWIC Status ^c	SARA - Schedule 1 Status ^d	
Barn swallow	<i>Hirundo rustica</i>	Blue	T (May 2011)	–	13
Brant	<i>Branta bernicla</i>	Blue	–	–	44
California gull	<i>Larus californicus</i>	Blue	–	–	2
Caspian tern	<i>Hydroprogne caspia</i>	Blue	–	–	6
Common murre	<i>Uria aalge</i>	Red	–	–	1,067
Great blue heron	<i>Ardea herodias fannini</i>	Blue	SC (Mar 2008)	SC (Feb 2010)	499
Long-tailed duck	<i>Clangula hyemalis</i>	Blue	–	–	10
Marbled murrelet	<i>Brachyramphus marmoratus</i>	Blue	T (May 2012)	T (Jun 2003)	320
Northern goshawk	<i>Accipiter gentilis laingi</i>	Red	T (Apr 2013)	T (Jun 2003)	5
Pelagic cormorant	<i>Phalacrocorax pelagicus pelagicus</i>	Red	–	–	23
Peregrine falcon	<i>Falco peregrinus pealei</i>	Blue	SC (April 2007)	SC (June 2003)	1

English Name	Scientific Name	Conservation Status ^a			No. of Observations
		BC List Status ^b	COSEWIC Status ^c	SARA - Schedule 1 Status ^d	
Short-billed dowitcher	<i>Limnodromus griseus</i>	Blue	–	–	57
Short-eared owl	<i>Asio flammeus</i>	Blue	SC (April 2007)	SC (June 2003)	3
Surf scoter	<i>Melanitta perspicillata</i>	Blue	–	–	1,218
Tundra swan	<i>Cygnus columbianus</i>	Blue	–	–	2
Western grebe	<i>Aechmophorus occidentalis</i>	Red	C (July 2007)	–	130

NOTES:

^a Conservation status as of August, 2013 (BCCDC 2014)

^b BC List Status:

Red –extirpated, endangered, or threatened
Blue –special concern

^c COSEWIC Status:

SC –special concern: species sensitive to human activities or vulnerable to natural events
T – threatened: species likely to become endangered

^d SARA Schedule:

Species at Risk Act schedule, status (definitions the same as COSEWIC) and date of last review
– no status designation

During 2012, KVN participated in the Breeding Bird Atlas program and identified 28 bird species breeding within a defined 10 km² atlas area. These observations included two species of conservation concern: band-tailed pigeon (*Patagioenas fasciata*) and barn swallow (*Hirundo rustica*).

Discussion

Data from KVN provide valuable information on the seasonal distribution of birds in the Kitimat area including observations of 16 species of conservation concern. These data highlight the importance of this region as a migratory stop-over site for marine birds and breeding birds (seasonal observations noted in Appendices A and B).

2.2.3.2 Previous Project Surveys

Triton Environmental Consultants Ltd. (Triton) was contracted to complete baseline surveys in the terrestrial wildlife RSA during spring 2012 (Triton 2012). The intent of these surveys was to provide the initial year of baseline data for LNG Canada to support the environmental assessment process. As part of these studies, Triton conducted spring wildlife surveys within three broad habitat types (terrestrial, wetland/estuary, and marine) in the Kitimat River/Douglas Channel complex. These studies included stationary bird point-count surveys, wetland/estuary bird migration surveys, call-playback raptor and owl surveys, marine bird surveys, and time-constrained amphibian surveys.

Bird Point-Count Surveys

Triton completed six days of bird point-count surveys at 40 stations in the terrestrial wildlife LSA. Surveys documented 853 observations of 60 bird species. Five species accounted for 52.3% of these observations: American robin (*Turdus migratorius*), ruby-crowned kinglet (*Turdus migratorius*), yellow warbler (*Setophaga petechial*), varied thrush (*Ixoreus naevius*), and red-winged blackbird (*Agelaius*

phoeniceus) (Appendix C). Olive-sided flycatcher (*Contopus cooperi*), which is provincially blue-listed, was the only species of conservation concern noted during these surveys (Triton 2012).

Wetland/Estuary Bird Migration Surveys

Wetland bird migration surveys were conducted at 14 stations on nine dates during May and June, 2012. These surveys documented 2,774 observations of 53 species. Nine species dominated these counts, comprising 77.4% of observations (Appendix D). Three provincially blue-listed species were identified: great blue heron, California gull, and barn swallow.

Raptor Call-Playback Surveys

Call-playback surveys were conducted on June 13, 2013, for northern goshawk in mature coniferous habitat. No responses were detected.

Owl Call-Playback Surveys

Triton completed owl call-playback surveys at 11 survey stations on May 19, 2012, for western screech-owl and detected a single owl species, barred owl (*Strix varia*), within mature alder (*Alnus* spp.) forest.

Time-constrained Amphibian Surveys

Amphibian surveys were conducted in the terrestrial wildlife LSA at 11 sites from June 11 to 22, 2012. Three amphibian species (Table 2.2-5) were recorded: western toad, Columbia spotted frog and northwestern salamander. Western toad is a provincially blue-listed species and is identified as *special concern* under COSEWIC and SARA. Four life stages (adult, juvenile, egg, and tadpole) were identified during these surveys in terrestrial and aquatic habitats.

Table 2.2-5 Amphibian Species Observed during June 2012 Surveys

English Name	Scientific Name	No. Observations	Life Stage
Columbia spotted frog	<i>Rana luteiventris</i>	7	Adult
Northwestern salamander	<i>Ambystoma gracile</i>	21	Egg mass
Western toad	<i>Anaxyrus boreas</i>	2	Adult
Western toad	<i>Anaxyrus boreas</i>	1	Juvenile
Western toad	<i>Anaxyrus boreas</i>	3	Tadpole

Marine Bird Surveys

Marine bird surveys were completed over a five-day period from June 14 to 18, 2012. These surveys followed a modified combination of procedures outlined by the Resource Inventory Committee (RIC 1997a, 1997b), Bodkin (2011), and Ronconi and Burger (2009). Marine birds were identified and recorded during boat transects (300 m fixed-width strip) along the shorelines and mid-channel of Kitimat Arm and Douglas Channel out to Kitkiata Inlet. Shoreline transects were positioned 150 m from shore. During these surveys, 1,420 observations of 24 marine bird species were recorded (Table 2.2-6).

Table 2.2-6: Marine Bird Species Observed during June 2012 Surveys

English Name	Scientific Name	Total No. Individuals
Ancient murrelet	<i>Synthliboramphus antiquus</i>	21
Barrow's goldeneye	<i>Bucephala islandica</i>	11
Black oystercatcher	<i>Haematopus bachmani</i>	1
Petrel spp.		1
Bonaparte's gull	<i>Chroicocephalus philadelphia</i>	8
Cassin's auklet	<i>Ptychoramphus aleuticus</i>	520
Common loon	<i>Gavia immer</i>	45
Common merganser	<i>Mergus merganser</i>	5
Common murre	<i>Uria aalge</i>	1
Glaucous-winged gull	<i>Larus glaucescens</i>	22
Harlequin duck	<i>Histrionicus histrionicus</i>	95
Mallard	<i>Anas platyrhynchos</i>	3
Marbled murrelet	<i>Brachyramphus marmoratus</i>	45
Mew gull	<i>Larus canus</i>	168
Pacific loon	<i>Gavia pacifica</i>	4
Pigeon guillemot	<i>Cepphus columba</i>	76
Red-necked grebe	<i>Podiceps grisegena</i>	2
Red-throated loon	<i>Gavia stellata</i>	1
Surf scoter	<i>Melanitta perspicillata</i>	153
Unknown alcid spp.		7
Unknown bird spp.		2
Unknown seabird spp.		1
Western grebe	<i>Aechmophorus occidentalis</i>	26
White-winged scoter	<i>Melanitta fusca</i>	202
Total		1,420

Wildlife Trail Monitoring

Triton (2012) identified four major wildlife trails in the terrestrial wildlife LSA. Movement of wildlife on these trails was monitored using two wildlife cameras strategically placed at a key point along each trail. These cameras were used for a total of 480 hours and documented habitat and trail use by red fox (*Vulpes vulpes*), moose, grizzly bear, porcupine (*Erethizon dorsatum*), and varied thrush. Grizzly bear is a species of conservation concern, red fox is uncommon, and moose is important to local hunting and Aboriginal Groups.

Discussion

Surveys conducted by Triton (2012) provided the first baseline year of wildlife information at the Project site and were used to design 2013 field studies conducted by Stantec Consulting Ltd. Some survey sites from 2012 were visited again in 2013 to provide a robust and standardized dataset to support potential future analyses. Highlights of these 2012 surveys included the detection of three raptor species, barred owl, merlin (*Falco columbarius*), and northern harrier (*Circus cyaneus*), not observed during 2013 surveys. Results of 2012 surveys are also consistent with 2013 observations of species at conservation concern, including olive-sided flycatcher, great blue heron, California gull, barn swallow, grizzly bear, and western toad.

All species detected during Triton's 2012 marine bird surveys were observed during the 2013 field surveys. The unusually large number of observations of Cassin's auklet (*Ptychoramphus aleuticus*) in 2012 has rarely occurred in protected waters in BC.

2.3 Field Studies

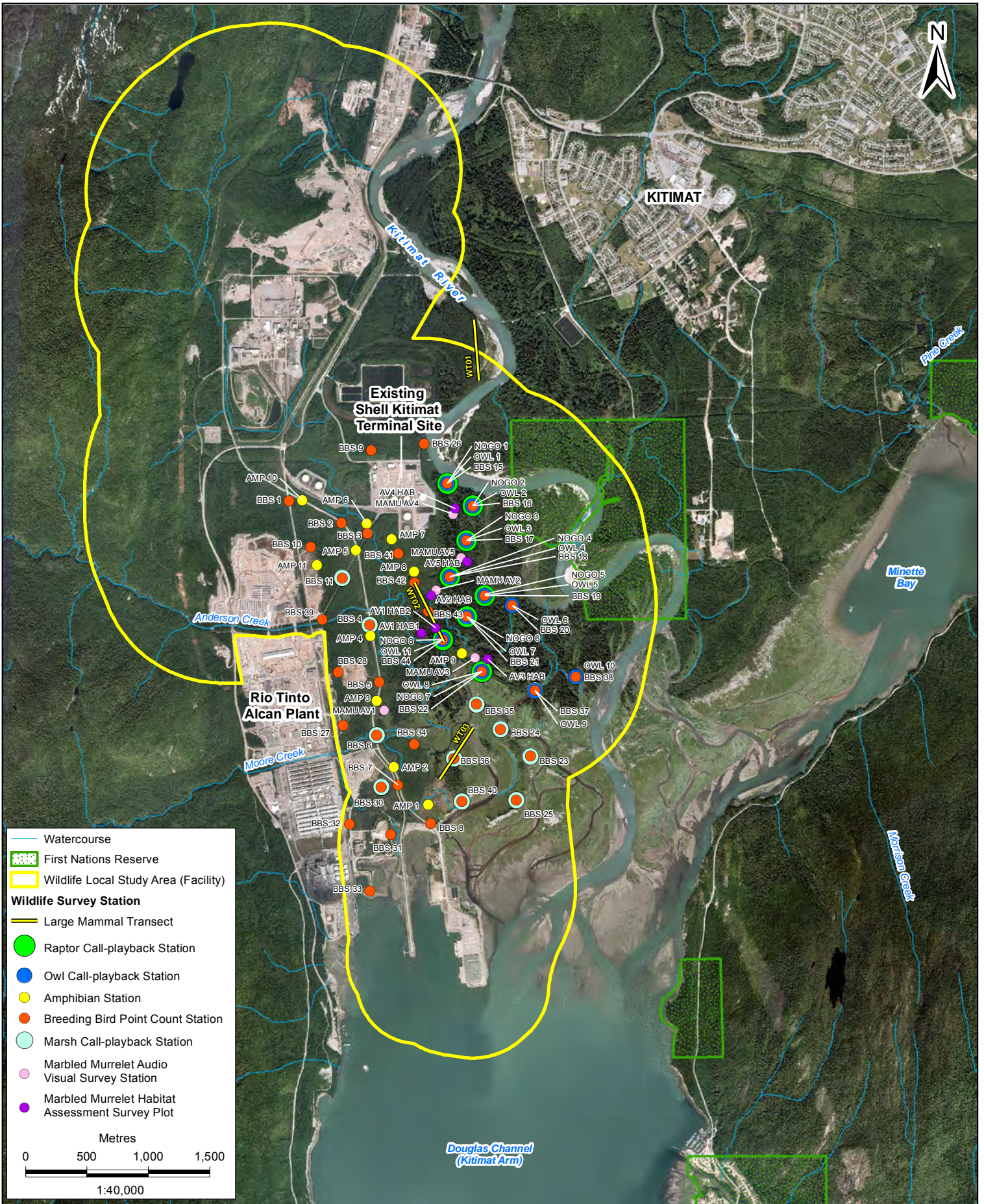
Field studies were designed to provide additional baseline data and address data gaps on presence and distribution of large mammals, raptors, breeding birds, and amphibians in the terrestrial wildlife LSA (Table 2.3-1). Incidental observations of wildlife sign were recorded to indicate presence and habitat use by species not observed during systematic surveys, primarily of large mammals. The following surveys were conducted to document wildlife and habitat use in the terrestrial wildlife LSA (Figure 2.3-1):

- Wildlife habitat: surveys were conducted as part of the terrestrial ecosystem mapping (TEM) verification program in August and September 2012, and September 2013. This information supports the wildlife habitat suitability ratings that inform the habitat suitability models.
- Breeding birds: stationary fixed-radius point-count surveys were completed for songbirds in May and June 2013.
- Raptors and wetland birds: call-playback surveys for wetland birds were completed in May and June 2013, and raptor call-playback surveys and nest surveys were completed in May 2013 and June 2014.
- Marbled murrelet: dawn audio-visual (A/V) surveys and habitat assessment surveys were completed in late May, early June, early July, and late July 2014.

- Amphibians: transect and intensive site surveys were conducted in wetland and riparian areas in conjunction with breeding bird surveys in May and June 2013.
- Large mammals: large mammal transect surveys were conducted in August, and September 2012 and May, June, August, and September 2013, primarily for large ungulates, black bear, grizzly bear, and wolf (*Canis lupus*).
- Incidental observations of wildlife or wildlife sign, important habitat features (e.g., wildlife trees), and wildlife movement corridors were recorded as detected opportunistically outside of systematic surveys.

Table 2.3-1: Survey Effort by Group or Survey Type

Group/Survey Type	Survey Dates	No. Survey Days	No. Sites Surveyed	Effort (min.)	Person-Hours
Wildlife habitat assessments	September 10–11, 2013 August 26–30 and September 1–2, 2012	9	61	3,600	61
Breeding bird point count	May 21–26 and June 21–26, 2013	12	41	200	6.6
Raptor call-playback	May 1, 2013	1	8	65	2.1
Owl call-playback	May 2, 2013 and June 9–11, 2014	4	3	114	4.0
Marsh call-playback	June 20–24, 2013	5	11	48	1.6
Marbled murrelet audio-visual	May 26–29, June 9–11, July 8–10, and July 29–31, 2014	12	5	2,580	86
Marbled murrelet habitat assessments	May 26–29, 2014	3	8	480	16
Amphibian surveys	May 21–24 and June 20–24, 2013	8	13	1,193	39.8
Large mammal transects	August 28–29 and September 1, 2012 May 24–25 and June 22, 2013	7	3	290	9.6
	Total	68	160	8,633	228.6



— Watercourse
 First Nations Reserve
 Wildlife Local Study Area (Facility)

Wildlife Survey Station

- Large Mammal Transect
- Raptor Call-playback Station
- Owl Call-playback Station
- Amphibian Station
- Breeding Bird Point Count Station
- Marsh Call-playback Station
- Marbled Murrelet Audio Visual Survey Station
- Marbled Murrelet Habitat Assessment Survey Plot

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WILDLIFE TECHNICAL DATA REPORT
TERRESTRIAL WILDLIFE SURVEY LOCATIONS
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	05-JUN-14	FIGURE NO.	2.3-1

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2.3.1 Breeding Bird Point Counts

Fixed-radius point-count surveys were conducted to determine presence, relative abundance, and distribution of breeding songbird species in the terrestrial wildlife LSA.

2.3.1.1 Methods

Breeding bird surveys were conducted following the protocols for point-count surveys provided in RIC (1999a). Stations were established throughout the terrestrial wildlife LSA at a minimum distance of 300 m from each other to reduce the probability of overlapping ranges and counting birds twice (Figure 2.3-1). Forty-one point-count stations were surveyed over 12 days during May 21 to 27, 2013, and June 21 to 26, 2013, during the songbird breeding period. Two observers surveyed each site for five minutes during peak bird activity (30 minutes before sunrise to four hours after sunrise). To prevent disturbance caused by their arrival at the station, observers were silent for one minute before initiating surveys. All birds detected within a 100 m radius of each survey point were identified and recorded. Birds were detected audio-visually and identified to species, age, and sex, where possible, and their behaviour was noted. Observers recorded the direction, quadrant, and estimated distance of detected birds within the 100 m radius. Each station was surveyed twice.

At each station, the time, location, and weather conditions (wind speed and direction, temperature, cloud cover, and precipitation) were recorded. Surveys were suspended during periods of heavy precipitation or winds greater than 12 km/h (Beaufort Scale 3). Habitat parameters included habitat type (wetland or forested), leading tree species, canopy cover, average tree height, coarse woody debris volume, presence of arboreal lichen, shrub and herb cover, and linear disturbances (Appendix E). Photographs were also taken at each station.

2.3.1.2 Results

A total of 1,237 observations of 58 species were made during May and June 2013 surveys (Appendix F). An average of 9 species and 17.8 observations were observed at each point-count station during May surveys, and 10 species and 13.1 observations at each point-count station during June surveys. In May, 48 bird species were detected overall. These observations were dominated by five species: American robin, ruby-crowned kinglet, song sparrow (*Melospiza melodia*), warbling vireo (*Vireo gilvus*), and yellow-rumped warbler (*Setophaga coronata*) (48.6% of observations). In June, 55 bird species were detected, and observations were dominated by the same five species (41.2% of observations).

The eight most common species accounted for 57.7% of observations: yellow-rumped warbler (10.3%), warbling vireo (9.6%), ruby-crowned kinglet (9.3%), American robin (7.9%), song sparrow (7.8%), common yellowthroat (*Geothlypis trichas*) (4.4%), golden-crowned kinglet (*Regulus satrapa*) (4.4%), and Pacific wren (*Troglodytes pacificus*) (4.0%). American robin (41 stations), yellow-rumped warbler (39 stations), and ruby-crowned kinglet (35 stations) were detected most often. Rare or uncommon species were black swift (*Cypseloides niger*), house finch (*Haemorhous mexicanus*), greater yellowlegs (*Tringa melanoleuca*), ruffed grouse (*Bonasa umbellus*), sandhill crane (*Grus canadensis*), and white-crowned sparrow (*Zonotrichia leucophrys*).

Species Richness

A species-richness curve represents a central measure of community species diversity (Gotelli and Colwell 2001; Ugland et al. 2003) where species richness is defined as the number of species within a defined geographic area. The basic approach is to graph the accumulation of new species over the extent of the sampling effort. The shape of the curve rises sharply at first as the initial surveys gather abundant numbers of common species, and then at a particular level of effort, the curve typically begins to level out as increasingly infrequent or rarer species are detected (Gotelli and Colwell 2001). The curve approaches an asymptote as continued sampling effort results in fewer detections of new species. At this point, it is assumed a sufficient level of sampling effort has been achieved to capture most of the species richness.

For the terrestrial wildlife LSA, a species-richness curve was used to determine whether sampling effort was sufficient to capture the species richness for breeding birds (Figure 2.3-2). The curve approaches an asymptote at approximately 32 surveys.

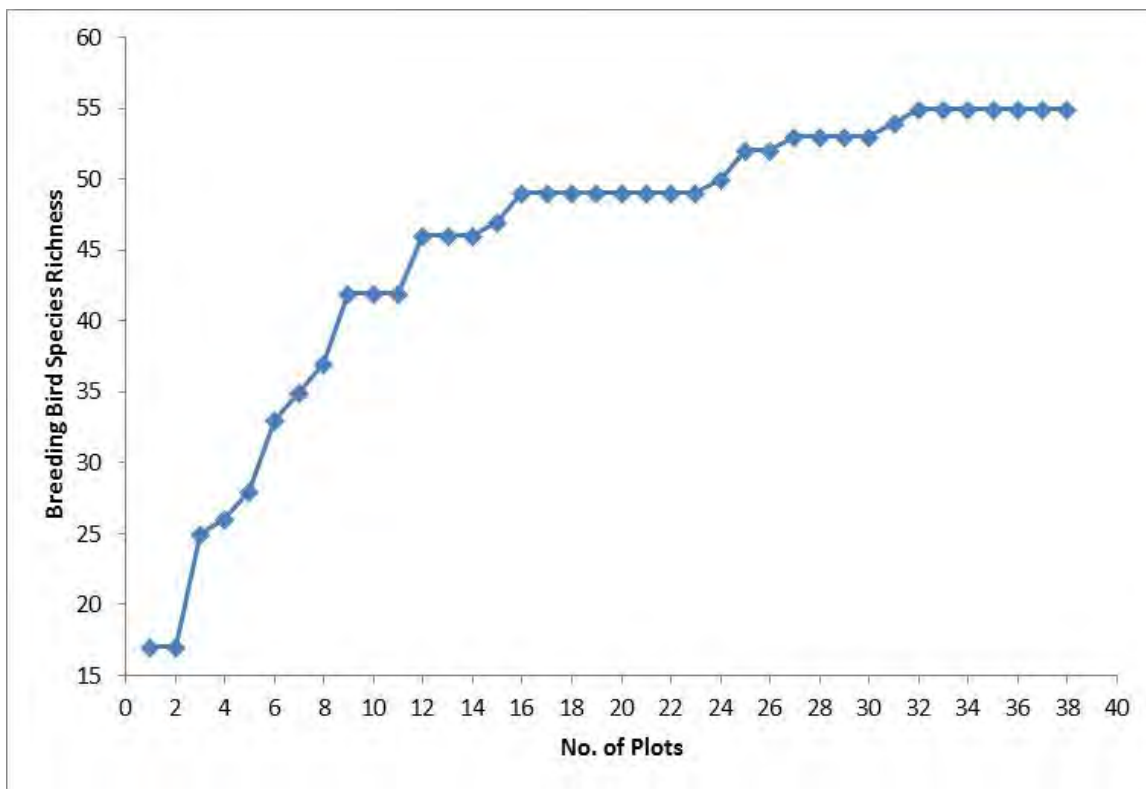


Figure 2.3-2: Breeding Bird Species Richness Accumulation Curve

2.3.2 Raptor Surveys

2.3.2.1 Methods

Raptor surveys were conducted following the methods for raptor call-playback surveys outlined in RIC (2001a). Two listed species potentially occurring in the area were targeted in the survey design: northern goshawk (*threatened* under COSEWIC and SARA, and provincially red-listed) and western screech-owl (*threatened* under COSEWIC and SARA, and provincially red-listed). Diurnal raptor surveys for northern goshawk were completed on May 2, 2013, at eight stations, and nocturnal raptor call-playback surveys for western screech-owl were completed on May 1, 2013, May 29, 2014, and June 9 to 11, 2014, at three stations (Figure 2.3-1).

Surveys were conducted by two observers during survey windows including 30 minutes after sunrise to 30 minutes before sunset for northern goshawk and from 30 minutes after sunset to 30 minutes before sunrise for western screech-owl. After arriving and before initiating call-playbacks at each station, observers were silent for two minutes to allow any birds present to recover from any effect of noise or physical disturbances caused by observers approaching the station. The call of each species was then broadcast during an interval of 20 seconds followed by 30 seconds of listening. This interval was repeated three times while rotating the direction of the broadcast 120° between each call-playback to cover a full 360° range at each station.

All bird species were detected by A/V responses and identified to species. Observers recorded the time, direction, and estimated distance of each response. Age and sex (if possible), and behaviour were recorded, along with any other wildlife signs present, such as pellets or nests. Location (GPS position) and weather (wind speed and direction, temperature, cloud cover, and precipitation) were recorded at each survey point. Surveys were not conducted in wind speeds greater than 12 km/h (Beaufort Scale 3) or in periods of moderate or heavy precipitation.

2.3.2.2 Results

Two owl species were detected during nocturnal surveys on May 1, 2013, western screech-owl and northern saw-whet owl (*Aegolius acadicus*). The western screech-owl was detected twice from station 'Owl2' and the saw-whet owl was detected once from station 'Owl1'. Once the second western screech-owl response was detected, the survey was immediately stopped to avoid the potential for predation by larger raptors or wildlife. This response indicated the possible presence of a western screech-owl nest site.

During follow-up nocturnal surveys completed on May 29, 2014, and June 9, 2014, no responses from western screech-owl were noted. On June 9, 2014, a barred owl was detected, but no other raptor species were detected during diurnal call-playback surveys.

2.3.3 Wetland Bird Call-Playback

2.3.3.1 Methods

Wetland bird surveys were conducted following the methods for call-playback surveys outlined in RIC (1998e). These surveys focused on Virginia rail (*Rallus limicola*) and American bittern (*Botaurus lentiginosus*) because these species are known to rely on wetland habitat for breeding and foraging. Surveys were completed at point-count stations in the terrestrial wildlife LSA that supported suitable habitat for these species (Figure 2.3-1; Photo 2.3-1). Wetland bird call-playback surveys were completed using the same methods described in Section 2.3.2.1 for raptor call-playback surveys. Eleven stations were surveyed in June 2013, twice per station, for a total effort of 1.6 person-hours.

2.3.3.2 Results

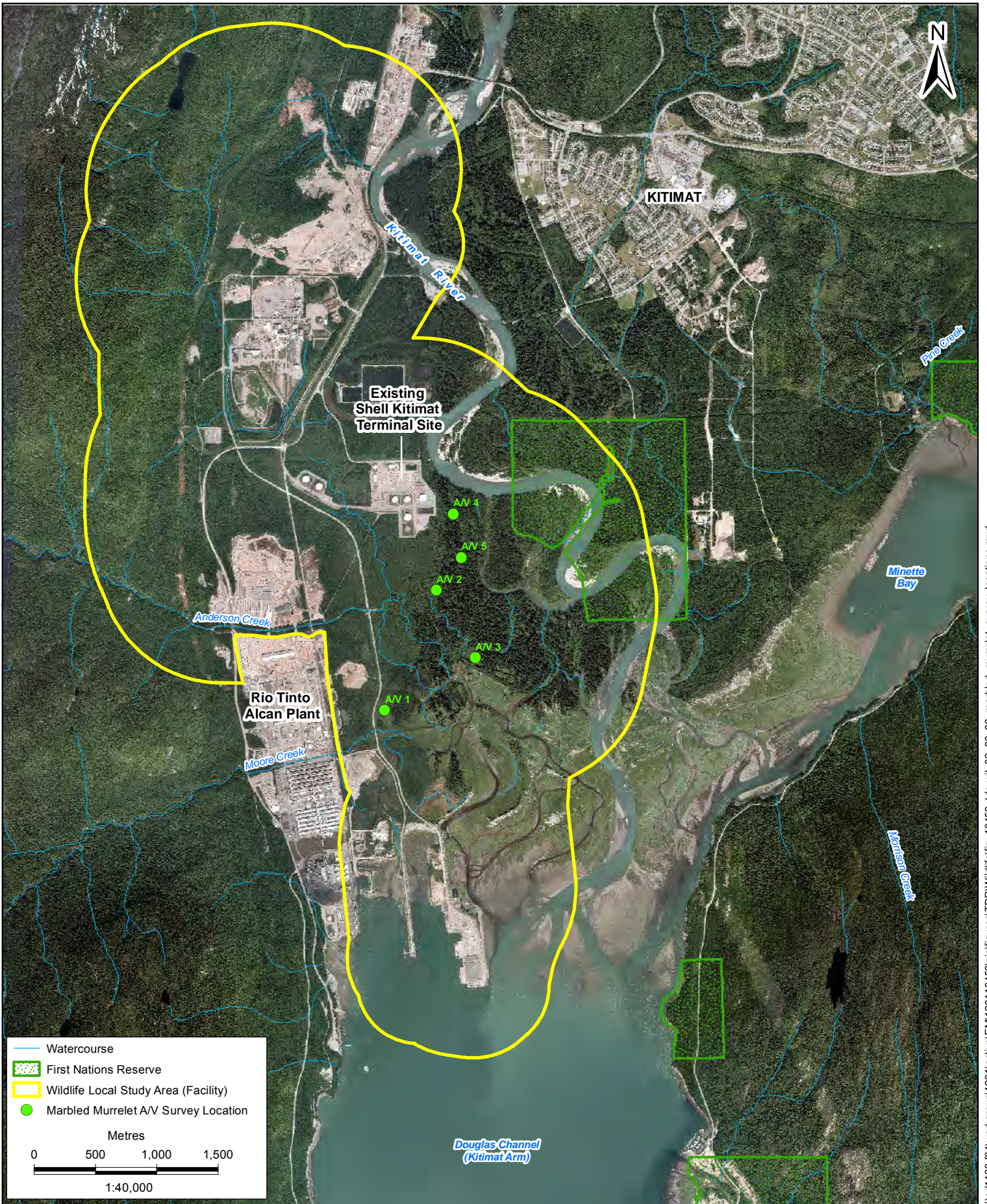
No responses from Virginia rail, American bittern, or any wetland birds were detected. American bittern and Virginia rail are generally cryptic in behaviour and display an affinity for marshy, inaccessible habitats with tall wetland herb and shrub security cover. These characteristics present challenges to detecting their occurrence.

2.3.4 Marbled Murrelet Dawn Audio-Visual Surveys

2.3.4.1 Methods

Marbled murrelet A/V surveys were conducted at systematically located points in the Project footprint along the edge of identified marbled murrelet breeding habitat. Dawn A/V surveys followed the protocol described in RIC (2001b). Surveys were scheduled to coincide with the predicted nesting period for marbled murrelet and occurred on May 26 to 29, June 9 to 11, July 8 to 10, and July 29 to 31, 2014.

Five survey stations were selected during daylight hours in advance of the survey to ensure the best selection of plot locations (Figure 2.3-3). Stations were located in canopy openings that provided a view of the canopy. Surveys began 75 minutes before sunrise and continued for a minimum of one hour after sunrise. Before the survey, observers recorded environmental conditions (cloud cover, precipitation, wind speed, and temperature), survey location (geographic coordinates), and time of survey. For each detection, observers recorded the type of detection (audio, visual, or both), type of call or sound heard, detection location, direction, and behaviour, and recorded the number of birds.



— Watercourse
 First Nations Reserve
 Wildlife Local Study Area (Facility)
● Marbled Murrelet AV Survey Location

Metres

0 500 1,000 1,500

1:40,000



WILDLIFE TECHNICAL DATA REPORT
MARBLED MURRELET SURVEY LOCATIONS
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	2.3-3

2.3.4.2 Results

Marbled murrelets were not detected during May and July 2014 surveys, but six detections were made during June surveys (Table 2.3-2). Birds detected in June were well above canopy height, which suggests that these were flybys and not occupancy observations (i.e., resident birds).

Table 2.3-2: Marbled Murrelet A/V Survey Results

Station	Survey Date	No. of Observations	Flyby (above canopy)	Occupancy
AV1	May 27-30, 2014	0	0	0
	June 9-11, 2014	1	1	0
	July 8-10, 2014	0	0	0
	July 9-11, 2014	0	0	0
AV2	May 27-30, 2014	0	0	0
	June 9-11, 2014	1	1	0
	July 8-10, 2014	0	0	0
	July 9-11, 2014	0	0	0
AV3	May 27-30, 2014	0	0	0
	June 9-11, 2014	0	0	0
	July 8-10, 2014	0	0	0
	July 9-11, 2014	0	0	0
AV4	May 27-30, 2014	0	0	0
	June 9-11, 2014	0	0	0
	July 8-10, 2014	0	0	0
	July 9-11, 2014	0	0	0
AV5	May 27-30, 2014	0	0	0
	June 9-11, 2014	4	4	0
	July 8-10, 2014	0	0	0
	July 9-11, 2014	0	0	0
Total		6	6	0

2.3.5 Marbled Murrelet Habitat Assessment Surveys

2.3.5.1 Methods

Marbled murrelet habitat assessment surveys were conducted following protocols outlined in RIC (2001b). Eight circular plots 25 m in radius were randomly located within 100 m surrounding the dawn A/V survey stations. General habitat data, including biogeoclimatic zone, slope, aspect, structural stage, and elevation, were recorded for the survey area. Forest cover, distance to saltwater, and distance to forest edge were recorded for the survey plots. Within each survey plot, tree characteristics, including species, layer, tree height, epiphyte cover, mistletoe infestation, and number of potential nest platforms, were recorded for all trees with a diameter at breast height greater than 10 cm.

2.3.5.2 Results

Potential breeding habitat for marbled murrelet was variable across the nine habitat plots surveyed (Table 2.3-3). All habitat plots were within structural stage 7 forests (old growth), were within 3.0 km of saltwater, and were at low elevations (3 metres above sea level). The mean number of large (greater than or equal to 18 cm) potential platforms per tree ranged from 0 to 7.7, whereas the mean number of smaller (12 cm to 18 cm) potential platforms ranged from 0.7 to 20.8 per tree. Mean tree height varied from 23.4 m to 44.7 m, and mean diameter at breast height varied from 72.6 cm to 112.0 cm.

Table 2.3-3: Marbled Murrelet Habitat Plot Survey Results

Habitat								Mean Potential Platforms (per tree)	
Plot No.	Canopy Closure (%)	Structural Stage	Distance from saltwater (km)	Elevation (m)	Tree Species Composition	Mean DBH (cm)	Mean Height (m)	≥18 cm; ≥15 m	12–18 cm; ≥10 m
1-1	80	7	2.0	3	Sitka spruce, western hemlock	93.1	26.1	0.1	0.7
1-2	70	7	2.0	3	Sitka spruce	88.0	26.3	0	1.7
1-8	60	7	2.0	3	Western hemlock, Sitka spruce, black cottonwood	100.0	26.8	7.7	8.1
1-7	70	7	2.0	3	Sitka spruce, red alder, black cottonwood	72.6	23.4	0.9	6.3
3-1	70	7	1.5	2	Sitka spruce	110.0	44.7	0.4	1.8
3-9	55	7	1.5	2	Sitka spruce	112.0	29.3	6.2	20.8
4-5	70	7	3.0	3	Sitka spruce, western hemlock	105.8	44.6	1.8	8.1
5-1	60	7	2.5	3	Western hemlock	86.8	29.5	4.0	1.2
5-10	40	7	3.0	3	Western hemlock, Sitka spruce	108.0	37.7	2.7	10.9

NOTE:

DBH – diameter at breast height

2.3.6 Amphibian Surveys

Amphibian surveys were conducted in wetlands, shallow water areas, and streams in the terrestrial wildlife LSA to determine potential amphibian species diversity and distribution, and to locate potentially important breeding areas, primarily for western toad.

2.3.6.1 Methods

Systematic surveys were conducted following the methods in RIC (1998d). Two surveys of wetlands with the potential to provide amphibian breeding habitat were conducted from May 21 to 24 and June 20 to 24, 2013 at 13 survey sites (Figure 2.3-1). Surveys were scheduled to coincide with predicted breeding and migration periods for amphibians likely to be present, such as western toad.

A single systematic search was conducted by two observers walking transects 10 m apart and parallel to each other along the shore and shallow water zones of each wetland. Observers visually searched for adults, juveniles, tadpoles, and egg masses. A dip net was used to investigate nearshore areas and inspect detections. Observers recorded the species, location (GPS position), life stage, number of individuals, sex (if possible), and behaviour. Weather conditions (wind direction and speed, cloud cover, temperature, and precipitation) were documented. Surveys were not carried out in weather that impaired A/V detections, including during periods of heavy rain or fog.

2.3.6.2 Results

During searches at 20 wetlands (Photo 2.3-1), three species were identified, including western toad (Photo 2.3-2), Columbia spotted frog, and northwestern salamander (Photo 2.3-3). Columbia spotted frog and western toad were most frequently observed (Table 2.3-4). All egg masses and larval amphibians observed in May were of Columbia spotted frog (Photo 2.3-4; Table 2.3-5). In June, western toad and Columbia spotted frog were frequently recorded (Table 2.3-6). Egg masses and larval amphibians were observed at 8 of the 20 sites.

Notable observations include 85 Columbia spotted frog egg masses at observation site AMP-10 and thousands of western toad tadpoles (blue-listed, *special concern* under SARA) at observation site AMP-1 (Figure 2.3-1) in June 2013 (Table 2.3-6).



Photo 2.3-1: Wetland Habitat of the Kitimat River Estuary



Photo 2.3-2: Juvenile Western Toad Observed Crossing a Road in the Local Study Area



Photo 2.3-3: Adult Northwestern Salamander



Photo 2.3-4: Columbia Spotted Frog Egg Mass in Wetland Habitat in the Local Study Area

Table 2.3-4: Total Observations of Amphibian Egg Masses, Tadpoles, and Adults

Species	Observations							
	May				June			
	Egg Mass	Tadpole	Adult	Total	Egg Mass	Tadpole	Adult/Juvenile	Total
Columbia spotted frog	6	50	3	59	130	12	6	148
Northwestern salamander	0	0	0	0	1	0	2	3
Western toad	4	0	24	28	0	1,000 ^a	124 ^b	1,124
Total	10	50	27	87	131	1,012	132	1,275

NOTE:

^a This is a conservative estimate of a large number of larval western toads observed.

^b This is a conservative estimate; hundreds to thousands of juveniles were observed June 20 during a dispersal event.

Table 2.3-5: Observations of Amphibian Egg Masses and Tadpoles by Site in May 2013

Species	Observations at Survey Sites			
	AMP-4		AMP-13	
	Egg Mass	Tadpole	Egg Mass	Tadpole
Columbia spotted frog	1	50	5	0
Northwestern salamander	0	0	0	0
Western toad	0	0	0	0
Total	1	50	5	0

Table 2.3-6: Observations of Amphibian Egg Masses and Tadpoles by Site in June 2013

Species	Observations at Survey Sites															
	AMP-4		AMP-13		AMP-1		AMP-2		AMP-5		AMP-8		AMP-9		AMP-10	
	E ^a	T ^b	E	T	E	T	E	T	E	T	E	T	E	T	E	T
Columbia spotted frog	1	50	5	0	0	0	36	0	3	12	0	0	6	0	85	0
Northwestern salamander	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Western toad	0	0	0	0	0	1,000	0	0	0	0	0	0	0	0	0	0
Total	1	50	5	0	0	1,000	36	0	3	12	1	0	6	0	85	0

NOTE:

^a E = egg mass observations

^b T = tadpole observations

2.3.7 Large Mammal Transects

Transects were surveyed to assess large mammal diversity, distribution, and habitat use in the terrestrial wildlife LSA. Wildlife of interest were primarily large ungulates and bears but also small and medium-sized mammals more difficult to detect. This work also provided opportunities to document incidental use of the terrestrial wildlife LSA by birds and amphibians not observed during structured surveys.

2.3.7.1 Methods

Transects were surveyed following protocols in RIC (1998a, 1998b). Three 500 m long transects were surveyed on August 28 and 29, and September 1, 2012, and on May 24 and 25, and June 22, 2013 (Figure 2.3-1). Transects were located to provide a representative sampling of habitats within the upland component of the terrestrial wildlife LSA. Two observers scanned each transect intensively for wildlife sign, such as scat, tracks, tree markings, browse, nests, and dens, that could be used to identify habitat use by various species. All A/V detections within 1 m of the centre line of the transect were recorded. The location (GPS position), species, number, age, and sex of individuals (if possible), and age of sign were recorded. Photographs were also taken of noteworthy sightings.

2.3.7.2 Results

During transect surveys, 6 mammal species, 21 bird species, and 3 amphibian species were detected (Table 2.3-7). The predominant type of wildlife sign recorded was scat (38.4%). Other visual observations (26.0%) included game and other trails, feeding sites, egg masses, resting or bedding sites, tree markings, mineral licks, and tracks (e.g., Photo 2.3-5 to Photo 2.3-8), and auditory detections were also made (19.2%). Transect WT03 (Figure 2.3-1) had the most observations ($n = 215$; Table 2.3-7), and Transect WT02 had the fewest observations ($n = 20$; Table 2.3-7). Of 215 observations in WT03, 151 (70%) were of western tanager (*Piranga ludoviciana*) (150 of these were in a single large flock). Grizzly bear were detected 20 times (Figure 2.3-1), primarily on Transect WT01; black bear was detected only once on the same transect. Moose were detected 12 times, primarily on Transect WT01. Western toad were also detected most often on this transect. Transect WT01 is located adjacent to the Kitimat River in the northern section of the terrestrial wildlife LSA in an area that is relatively isolated from previous disturbances. Overall, grizzly bear, western tanager, and western toad were most commonly detected and accounted for 76.6% of all observations. No signs of habitat use by deer were detected.

Table 2.3-7: Wildlife Observations by Transect and Species

		Transect			
Species Name	Scientific Name	WT01	WT02	WT03	Total
Mammals					
Bear species ^a		–	–	1	1
Black bear	<i>Ursus americanus</i>	1	–	–	1
Grey wolf	<i>Canis lupus</i>	1	1	–	2
Grizzly bear	<i>Ursus arctos</i>	13	6	1	20
Moose	<i>Alces americanus</i>	7	2	3	12

Species Name	Scientific Name	Transect			
		WT01	WT02	WT03	Total
Red fox	<i>Vulpes vulpes</i>	1	2	–	3
Red squirrel	<i>Tamiasciurus hudsonicus</i>	1	1	–	2
Birds					
American robin	<i>Turdus migratorius</i>	2	–	–	2
Bald eagle	<i>Haliaeetus leucocephalus</i>	2	–	2	4
Brown creeper	<i>Certhia americana</i>	–	–	1	1
Canada goose	<i>Branta canadensis</i>	–	–	10	10
Dowitcher species ^a		–	–	16	16
Hammond's flycatcher	<i>Empidonax hammondi</i>	–	1	–	1
Hooded merganser	<i>Lophodytes cucullatus</i>	–	–	3	3
Least sandpiper	<i>Calidris minutilla</i>	–	–	5	5
Lincoln's sparrow	<i>Melospiza lincolni</i>	–	–	1	1
Mew gull	<i>Larus canus</i>	1	–	–	1
Osprey	<i>Pandion haliaetus</i>	1	–	–	1
Pacific wren	<i>Troglodytes pacificus</i>	–	1	–	1
Pine siskin	<i>Spinus pinus</i>	–	–	0	0
Raptor species ^a		–	–	1	1
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>	–	1	–	1
Red-eyed vireo	<i>Vireo olivaceus</i>	–	1	–	1
Ruby-crowned kinglet	<i>Regulus calendula</i>	–	1	1	2
Savannah sparrow	<i>Passerculus sandwichensis</i>	–	–	1	1
Song sparrow	<i>Melospiza melodia</i>	–	–	1	1
Tree swallow	<i>Tachycineta bicolor</i>	–	–	5	5
Warbling vireo	<i>Vireo gilvus</i>	–	1	–	1
Western tanager	<i>Piranga ludoviciana</i>	–	1	150	151
Wilson's warbler	<i>Cardellina pusilla</i>	2	–	–	2
Amphibians					
Columbia spotted frog	<i>Rana luteiventris</i>	–	–	2	2
Northwestern salamander	<i>Ambystoma gracile</i>	–	–	1	1
Western toad	<i>Anaxyrus boreas</i>	101	1	10	112
Total		133	20	215	368

NOTES:

^a Individuals were not identified to species.
– species not observed



Photo 2.3-5: Grizzly Bear Track in Mud on a Dyke Commonly Used as a Movement Corridor



Photo 2.3-6: Moose Antler Markings



Photo 2.3-7: Ungulate Mineral Lick in Early Seral Habitat



Photo 2.3-8: Grey Wolf Track in Early Spring Snow Cover

2.3.8 Incidental Observations

2.3.8.1 Methods

Incidental observations provide supplemental data on species of conservation concern, the presence of elusive or cryptic species, locations of important wildlife features, and opportunistic sightings of wildlife or wildlife sign not detected during systematic surveys. These observations contribute to the assessment of overall diversity within the terrestrial wildlife LSA. Incidental observations were recorded during all seasons and field programs, all types of surveys (outside of formal intervals), at survey stations, and while travelling between stations.

2.3.8.2 Results

A total of 2,482 observations of 86 species and 11 unknown species were recorded, often during surveys focused on other species groups (Appendix G). Seven species listed provincially and/or federally were identified, including grizzly bear, great blue heron (Photo 2.3-9), California gull, peregrine falcon, barn swallow, coastal tailed frog (*Ascaphus truei*), and western toad. Incidental observations of moose, Canada goose, greater white-fronted goose (*Anser albifrons*), pectoral sandpiper (*Calidris melanotos*), an unidentified shorebird species, western toad, and harbour seal (*Phoca vitulina*) comprised 71.3% of the observations. Six species not documented during systematic surveys were identified: porcupine, long-tailed weasel (*Mustela frenata*), an unidentified shrew species, black turnstone (*Arenaria melanocephala*), pectoral sandpiper, and coastal tailed frog.

During late summer surveys, a black bear was observed taking refuge in a den within riparian forest near the Kitimat River (Figure 2.3-4). It is unknown whether this had been a natal den during the summer; however, it potentially provides shelter during other seasons for medium- to large-sized animals.

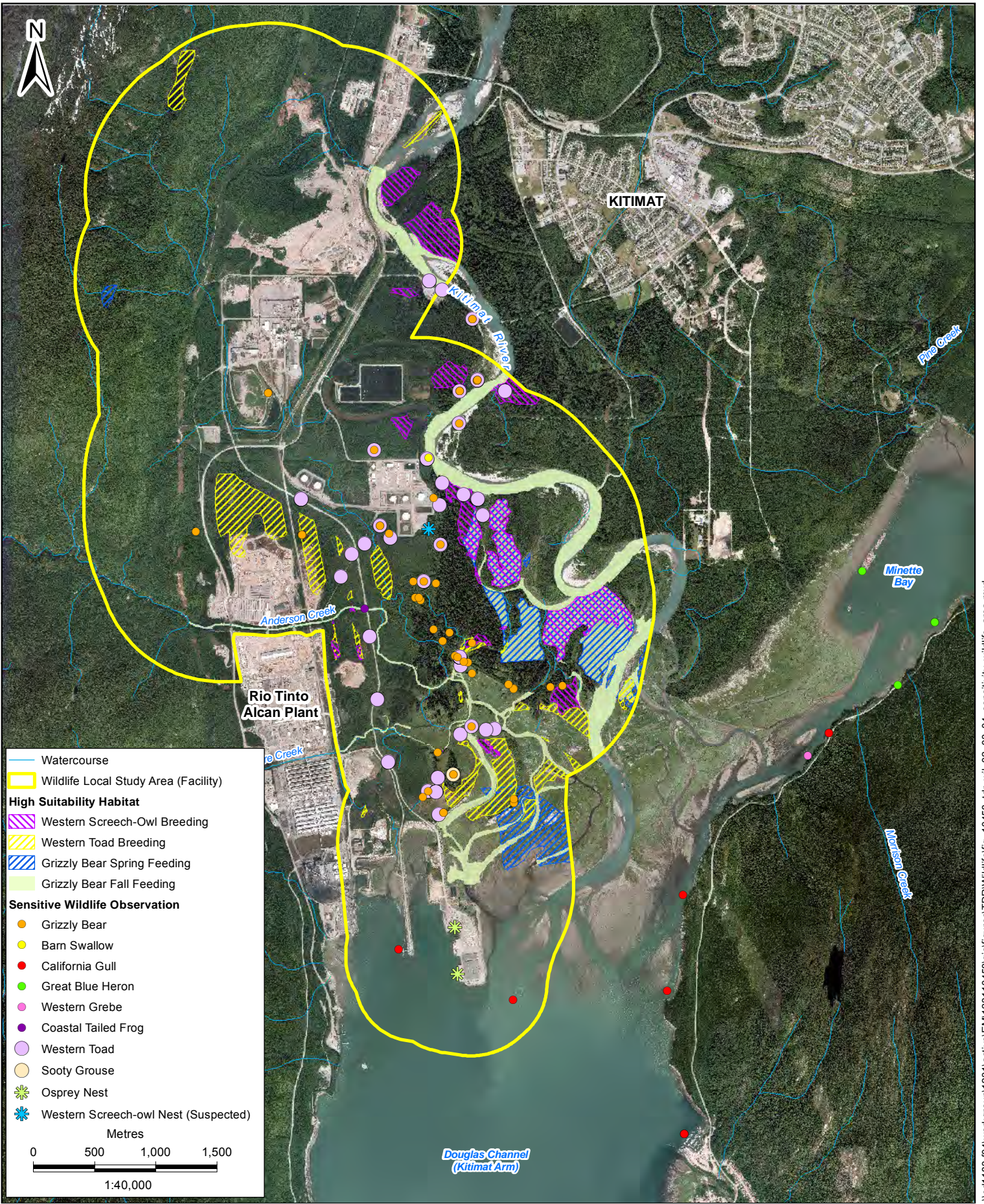
Large raptor nests were observed: one inactive and two active bald eagle nests in mature forest and one active osprey nest on a light standard on RTA wharf "B" (Photo 2.3-10). A second osprey nest was observed on a new pole erected in 2014 on RTA wharf "B". Surveys also indicated that western screech-owl could potentially nest in mature forest along the river based on the availability of wildlife trees with suitable nest cavities.



Photo 2.3-9: Great Blue Heron on the shore of the Kitimat River



Photo 2.3-10: Osprey Nest on a Light Standard at the RTA wharf "B"



Watercourse

Wildlife Local Study Area (Facility)

High Suitability Habitat

- Western Screech-Owl Breeding
- Western Toad Breeding
- Grizzly Bear Spring Feeding
- Grizzly Bear Fall Feeding

Sensitive Wildlife Observation

- Grizzly Bear
- Barn Swallow
- California Gull
- Great Blue Heron
- Western Grebe
- Coastal Tailed Frog
- Western Toad
- Sooty Grouse
- Osprey Nest
- Western Screech-owl Nest (Suspected)

Metres

0 500 1,000 1,500

1:40,000



WILDLIFE TECHNICAL DATA REPORT

SENSITIVE WILDLIFE AREAS

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	2.3-4

2.4 General Discussion

The Kitimat River estuary and surrounding upland habitats support a relatively diverse faunal group that includes small to large mammals, nocturnal and diurnal raptors, waterfowl, seabirds, shorebirds, songbirds, and amphibians. During field studies, 8 of the 15 species identified as likely to occur in the terrestrial wildlife LSA were detected: grizzly bear, great blue heron, barn swallow, marbled murrelet, rusty blackbird (*Euphagus carolinus*), western screech-owl, coastal tailed frog, and western toad. The cultural and traditional importance of this estuary for First Nations, as documented by available information for the region, has been supported by these investigations.

Most species recorded during breeding bird surveys and incidental observations were forest birds typical of the northern coastal forests of BC (Campbell et al. 1997; Campbell et al. 2001). Bird species diversity was relatively high during May and June as expected during the active breeding season. Overall bird species diversity was slightly higher in May (54 species) than June (47 species). In May, 10 species were recorded that were not observed in June. The relatively high bird species richness is consistent with previous studies of diversity in the area. Many of these species have important roles as predators, pollinators, scavengers, seed dispersers, seed consumers, and ecosystem engineers (Whelan et al. 2008).

Neither wetland birds nor northern goshawk were detected during call-playback surveys. Two western screech-owl responses were detected from the same station in the mid-east portion of the terrestrial wildlife LSA. The low number of call-playback detections may reflect naturally low population densities in the terrestrial wildlife LSA as would be expected for both species. The screech-owl is a rare and sensitive raptor and typically does not respond to call-playbacks. The northern goshawk has a very large home range and the probability of detection in the terrestrial wildlife LSA during surveys is low. In addition, western screech-owl and northern goshawk typically require substantial patches of mature riparian and older coniferous forests, respectively. Only a small proportion of mature to old habitat is available in the central and northeast portions of the terrestrial wildlife LSA. The active bald eagle and osprey nests observed are protected year round under the BC *Wildlife Act*. Their occurrence might constrain Project development unless they are managed under a provincially approved Raptor Management Plan that includes protective buffers to avoid disturbance or harm to the nest, birds, and eggs or young, an environmental monitoring program during construction and operation, or a permit to relocate.

Both western toad and Columbia spotted frog were commonly detected during the May and June breeding season, with abundant adult and juvenile western toad, and Columbia spotted frog egg masses. Observations peaked in June, related to an increase in breeding activity and the higher probability of detection of western toad juveniles and tadpoles compared to egg masses. Areas of larger concentration were not evenly distributed across the terrestrial wildlife LSA but rather occurred within three wetland sites (i.e., AMP-1, AMP-4, and AMP-10) located adjacent to the main road and in the central portion of the terrestrial wildlife LSA to the east of the existing industrial site disturbance.

Grizzly bear and moose were frequently observed during the large mammal transect surveys. Moderately heavy use of transect WT01 by grizzly bear, moose, and dispersing western toad suggests that it is part of an important wildlife movement corridor.

During incidental observations, seven species that were not noted during other surveys were identified: porcupine, long-tailed weasel, an unidentified shrew species, pectoral sandpiper, black turnstone, and Coastal tailed frog. Thus, incidental observations were useful in further documenting wildlife diversity present in the terrestrial wildlife LSA. Incidental observations were also made of commonly occurring species such as grizzly bear, moose, American robin, and western toad.

Studies indicate sensitive wildlife areas (Figure 2.3-4) include remnant patches of old-growth coniferous forests, known western toad breeding locations, and habitats associated with the Kitimat River estuary. These areas are primarily located in association with the Kitimat River and estuary habitat.

2.5 Habitat Suitability Modelling

2.5.1 Key Species

Wildlife habitat suitability models were created for seven key species: grizzly bear, Pacific marten, western screech-owl, harlequin duck, marbled murrelet, western sandpiper, and western toad. Marbled murrelet is designated as a key marine bird species (see Section 3.2.3); however, marbled murrelet nest in terrestrial habitats. This nesting habitat is critical for marbled murrelet because they require structure associated with mature to old-growth forests. As such, marbled murrelet breeding habitat suitability modelling is presented here.

Table 2.5-1 lists the key species that were selected to represent groups of foraging guilds or ecological niches and to assess potential effects of the Project on wildlife. These key species were selected based on the following criteria:

- occurrence and use of habitats in the terrestrial wildlife LSA and RSA
- potential sensitivity to Project effects and the ability to measure the effects
- species conservation status
- ecological importance (including value as an indicator of environmental effects for related resources)
- established base of information, knowledge, or data, and
- First Nations cultural and traditional value.

These models were used to inform the assessment of potential Project effects on key species by identifying the availability of species-specific requirements for wildlife habitat. Wildlife habitat suitability models were developed using *British Columbia Wildlife Habitat Rating Standards* (RIC 1999b) and integrated ecosystem mapping units from TEM developed for the Project (RIC 1998c). Models were based on species life requisites, seasonality of habitat use in the terrestrial wildlife LSA, critical periods and vulnerabilities for each species, and First Nations cultural or traditional use.

Habitat suitability modeling is an expert opinion-based modelling process where knowledgeable biologists and experts assign ratings to mapped ecological units for key species (RIC 1999a). Suitability ratings reflect the relative value of habitat units to the key species under current habitat conditions and

are based on the potential or expected use of these habitats relative to the best available habitat ranked by the province (RIC 1999b). Habitat suitability models consider the detailed life histories for each species in order to evaluate whether a four- or six-class rating scheme should be used. Table 2.5-2 lists the rating scheme used for the six key species based on the most sensitive and relevant life history requisites of each species in the terrestrial wildlife LSA.

A field component (ground-truthing) is part of model development and is used to compare field-based ratings of ecosystem units with those based on an independent literature review and the professional opinions of qualified biologists and species experts. In the field, species life requisites of interest (e.g., Pacific marten year-round living habitat) are assessed relative to site-specific conditions and existing information available from in or near the terrestrial wildlife LSA. The model predictions are also supported by additional factors that can affect suitability (e.g., snow accumulation, precipitation, slope, aspect, or canopy closure). To quantify and compare the availability of species-specific suitable habitat in the terrestrial wildlife LSA, “effective habitat”—habitat with a suitability rating of moderate or higher—was defined for each species.

Table 2.5-1: Key Species, Conservation Status and Life Histories Modelled

Key Species	Modeled Life History	Broad Habitat Use	BC List Status ^{a,b}	COSEWIC Status ^c	SARA Schedule 1 Status ^d	Justification
Grizzly bear	Spring and fall foraging	Mature forest, steep shrub slopes, fish-bearing creeks	Blue	SC (2012)	–	Species at risk (BC, COSEWIC, SARA) Culturally important to First Nations Umbrella, keystone, and flagship species Wide ranging but present in low numbers Represents quality of salmon-bearing watercourses Indicates wilderness quality for other large carnivores Sensitive to human access and disturbance
Harlequin duck	Spring and fall foraging	Marine nearshore	Yellow	–	–	Represents migratory species Represents other waterfowl species Requires habitat quality in staging/stopover areas
Pacific marten	Year-round living	Old-growth, mature forest	Yellow	–	–	Keystone predator of small mammals Indicates habitat quality for rare fisher (<i>Pekania pennanti</i>) and other small carnivores Represents old-growth forest and landscape connectivity
Marbled murrelet	Breeding	Old-growth, mature forest	Blue	T (2012)	T (2003)	Species at Risk (BC, COSEWIC, SARA) Culturally important to First Nations (Bahn and Newsome 1999) Represents intact old-growth habitats Represents sensitive alcid seabirds
Western sandpiper	Spring and fall foraging	Intertidal habitats, marine foreshore	Yellow	–	–	Represents migratory species Represents other sensitive shorebird species Represents marine foreshore habitats including mudflats and estuaries Requires habitat quality in stopover areas

Key Species	Modeled Life History	Broad Habitat Use	BC List Status ^{a,b}	COSEWIC Status ^c	SARA Schedule 1 Status ^d	Justification
Western screech-owl	Breeding	Mature mixed and riparian forest, edge habitat	Yellow	–	–	Species at risk (BC) Represents other owls and cavity nesters Sensitive to disturbance and present in low numbers Indicator of quality riparian forest habitats and presence of significant wildlife trees
Western toad	Breeding	Shallow ponds, wetlands, riparian forest	Blue	SC (2012)	SC (2005)	Species at risk (BC, COSEWIC, SARA) Represents shallow and vernal pond-dwelling amphibians Indicator of habitat quality in wetlands and ephemeral pond habitats

NOTES:

^a Conservation status as of August 2013 (BCCDC 2014)

^b BC List Status:

Red – extirpated, endangered, or threatened

Blue – special concern

Yellow – not at risk

^c COSEWIC Status:

SC – *special concern*: species sensitive to human activities or vulnerable to natural events

T – *threatened*: species likely to become endangered

^d SARA Schedule:

Species at Risk Act schedule, status (definitions the same as COSEWIC) and date of last review

– no status designated

Table 2.5-2: Rating Scheme Used to Assess Habitat Suitability for Key Species

Species	Class	Habitat Suitability	Percent Suitability	Suitability Midpoint
Grizzly bear	1	High	100%–76%	88%
	2	Moderately high	75%–51%	63%
	3	Moderate	50%–26%	38%
	4	Low	25%–6%	15%
	5	Very low	5%–1%	3%
	6	Nil (habitat absent)	0%	0%
Harlequin duck	1	High	100%–76%	88%
Marbled murrelet	2	Moderate	75%–26%	50%
Pacific marten	3	Low	25%–1%	16%
Western sandpiper	4	Nil (habitat absent)	0%	3%
Western screech-owl				
Western toad				

2.5.1.1 Model Verification

Model accuracy and confidence analysis for habitat suitability models was completed using a confusion matrix as well as histograms. Confusion matrices have been used by researchers to evaluate the ability of habitat suitability models to predict species presence (e.g., Hirzel et al. 2006). The primary advantages of the confusion matrix approach are its simplicity and its ability to identify bias as well as accuracy. For example, the analysis might show that the field ratings are biased high relative to the model outputs (Fielding and Bell 1997). This information can be useful in determining whether the field ratings are inflated or the model outputs are undervalued.

The matrix provides the distribution of agreement and non-agreement between the model and the field ratings (Table 2.5-3). The white diagonal cells in Table 2.5-3 represent agreement; the green cells represent “false positives” (i.e., the model outputs were numerically higher [lower suitability] than the field ratings); and, the blue cells represent “false negatives” (i.e., the model outputs were numerically lower [higher suitability] than the field ratings). Accuracy is determined as the sum of the white diagonal cells as a proportion of the total number of comparisons. The false positive rate is the sum of the green cells and the false negative rate is the sum of the blue cells—both as proportions of the total number of comparisons. Accuracy, false positive rate, and false negative rate were calculated for each model.

Table 2.5-3: Example of Confusion Matrix for a Four-Class Model

		Model output				Sum
		1	2	3	4	
Field rating	1	4	11	7	6	28
	2	6	22	24	18	70
	3	9	27	27	36	99
	4	3	6	18	71	98
	Sum	22	66	76	131	295

Histograms of the difference between the field ratings and the model ratings were developed to illustrate the distribution of the difference. Confidence in the models was determined, in part, by the shape of the histogram:

- high confidence – tall bell-shaped curve centred on zero (>40%)
- moderate confidence – most differences occurred within was one class (± 1) (>60%), and
- low confidence – bell-shaped curve centred off zero or if conditions for moderate confidence are not met.

2.5.2 Grizzly Bear

2.5.2.1 Status, Population Trends, and Distribution

Grizzly bear is provincially blue-listed (BCCDC 2014) and federally listed as *special concern* by COSEWIC (SRPR 2013). The primary reasons for its listing include extensive range and population reductions associated with urban development, habitat fragmentation, human conflicts, and mortality (COSEWIC 2002a). The BC population is estimated at a minimum of 15,000 individuals (MFLNRO 2012). The province is divided into 56 GBPUs. The terrestrial wildlife RSA overlaps two GBPUs, the North Coast and Bulkley-Lakes GBPUs, with population estimates of 190 and 493 individuals, respectively (MFLNRO 2012).

2.5.2.2 Habitat Use and Life Requisites

Grizzly bears use a diversity of habitat types in their home ranges for travel, seclusion, feeding, and denning. The productivity of populations is primarily influenced by the availability of high-quality food resources (Gyug et al. 2004). For this assessment, spring and fall feeding habitat were considered the most limiting.

Spring Feeding Habitat

Grizzly bears emerge from winter dens (late March to early April) in relatively poor condition because of weight loss during hibernation. They maximize their forage intake in the spring by concentrating feeding activities in areas where early snowmelt and early vegetation green-up occur. These are typically south-facing slopes, floodplains, sedge meadows, low-elevation riparian areas, meadows and wetlands, cutblocks, and avalanche chutes, which support a variety of newly emergent grasses, sedges, and roots (Mace 1985; Hamer and Herrero 1987; MacHutchon et al. 1993; Ramcharita 2000; Milakovic et al. 2012). Wet, rich areas with an open forest canopy produce a greater abundance and diversity of forage plants than dry, nutrient-poor areas with a closed forest canopy (Schoonmaker and McKee 1988; Meidinger et al. 2002; Tressler et al. 2003).

Fall Feeding Habitat

Fall has been identified as a critical period for grizzly bear because weight gain in the fall is critical for winter denning preparation and survival (Servheen 1983; Zager and Jonkel 1983). Fall feeding habitat is reduced at higher elevations with winter onset forcing bears to move to mid to low elevations (Zager and

Jonkel 1983; Milakovic et al. 2012). Foraging is split between low-elevation salmon spawning and mid- to low-elevation berry-producing shrubs (*Vaccinium* spp. and *Shepherdia* spp.) (Gyug et al. 2004).

2.5.2.3 Model Development

Spring Feeding Habitat

A six-class rating scheme was used to rank suitability of grizzly bear spring feeding habitat. The following assumptions were used to model habitat suitability (Table 2.5-4):

- Wet, nutrient-rich areas with open forest canopy (<60% cover), structural stage 6 and 7 (mature and old-growth forest), or structural stages 2 and 3, were rated higher than dry, nutrient-poor areas with closed forest canopy or younger structural stages 4 and 5.
- Sedge-dominated and low-elevation wetlands, meadows, and riparian open forests were rated high (1).
- Transmission line RoWs were rated moderate (3).
- Non-vegetated units (rocky outcrops, road surface, gravel bars) were rated nil (6).

Table 2.5-4: Grizzly Bear Spring Feeding Habitat Ratings

Structural Stage	Wet (hygric-subhydric)	Forest	Moist (mesic-submesic)	Forest	Dry (xeric- subxeric)	Forest
1	3		4		5	
2-3	2		3		4	
4-5	4		5		5	
6-7	1		2		3	

Fall Feeding Habitat

A six-class rating scheme was used to rate suitability of grizzly bear fall feeding habitat. Habitat suitability was ranked using the following model assumptions (Table 2.5-5):

- Mid- to low-elevation habitats, such as river floodplains, shrub fields, and older forest with berry-producing shrubs (e.g., *Vaccinium* spp.) were rated as high (1).
- Known salmon bearing streams were rated high (1).
- Wet, nutrient-rich areas with an open forest canopy (<60% cover), structural stages 6 and 7 (mature and old-growth forest), or structural stages 2 and 3 were rated higher (1-2) than dry, nutrient-poor areas with closed forest canopy or units within structural stages 4 and 5.
- Sedge-dominated habitats were rated moderate (3).
- Transmission line RoWs were rated low (4).
- Forests with structural stages 2 and 4 were rated low (4) to very low (5).
- Non-vegetated sites were rated nil (6).

Table 2.5-5: Grizzly Bear Fall Feeding Habitat Ratings

Structural Stage	Wet Forest (hygric-subhydryc)	Moist Forest (mesic-submesic)	Dry Forest (xeric-subxeric)
1	2	5	5
2 – 3	1	3	5
4 – 5	3	4	6
6 – 7	1	3	5

2.5.2.4 Habitat Rating Adjustments

Appendix H outlines rating adjustments made for disturbed areas located within the terrestrial wildlife LSA. Rating adjustments address the influence of anthropogenic structures (i.e., roads and existing structures) on the suitability of habitat because grizzly bear are known to be sensitive to these influences and will avoid them.

2.5.2.5 Results

Model results indicate the effective (herein defined as moderate to high suitability habitat) spring feeding habitat for grizzly bear covers 627.5 ha (26.4%) of the terrestrial wildlife LSA (Table 2.5-6; Figure 2.5-1). Most of this habitat is located within the southeast portion near the mouth of the Kitimat River. Effective fall feeding habitat for grizzly bear covers 680.0 ha (28.6%) of the terrestrial wildlife LSA (Table 2.5-7; Figure 2.5-2). Most of this habitat is located on the east side near the Kitimat River.

Table 2.5-6: Area of Grizzly Bear Spring Feeding Habitat in the Terrestrial Wildlife LSA

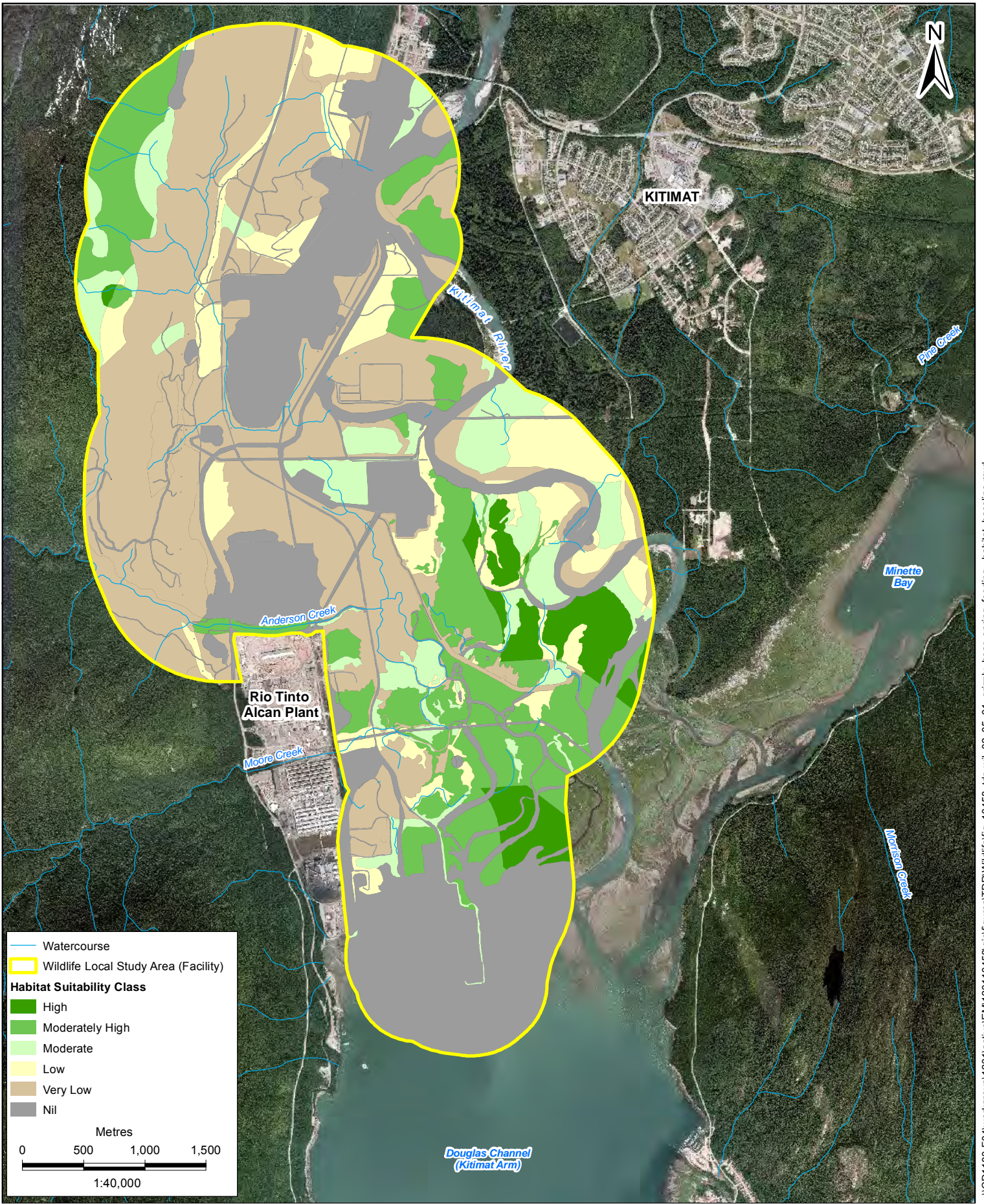
Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	93.6	3.9
Moderately high	340.5	14.3
Moderate	193.4	8.1
Low	214.6	9.0
Very low	807.9	34.0
Nil	725.6	30.5
Total	2,375.6	100

Table 2.5-7: Area of Grizzly Bear Fall Feeding Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	165.6	7.0
Moderately high	210.6	8.9
Moderate	303.8	12.8
Low	537.7	22.6
Very low	548.8	23.1
Nil	609.1	25.6
Total	2,375.6	100

2.5.2.6 Discussion

Effective grizzly bear spring and fall feeding habitat is relatively abundant in the terrestrial wildlife LSA and is primarily associated with the Kitimat River and sedge-dominated, low-elevation wetlands and riparian forest habitats in the estuary.



— Watercourse
 Wildlife Local Study Area (Facility)

Habitat Suitability Class

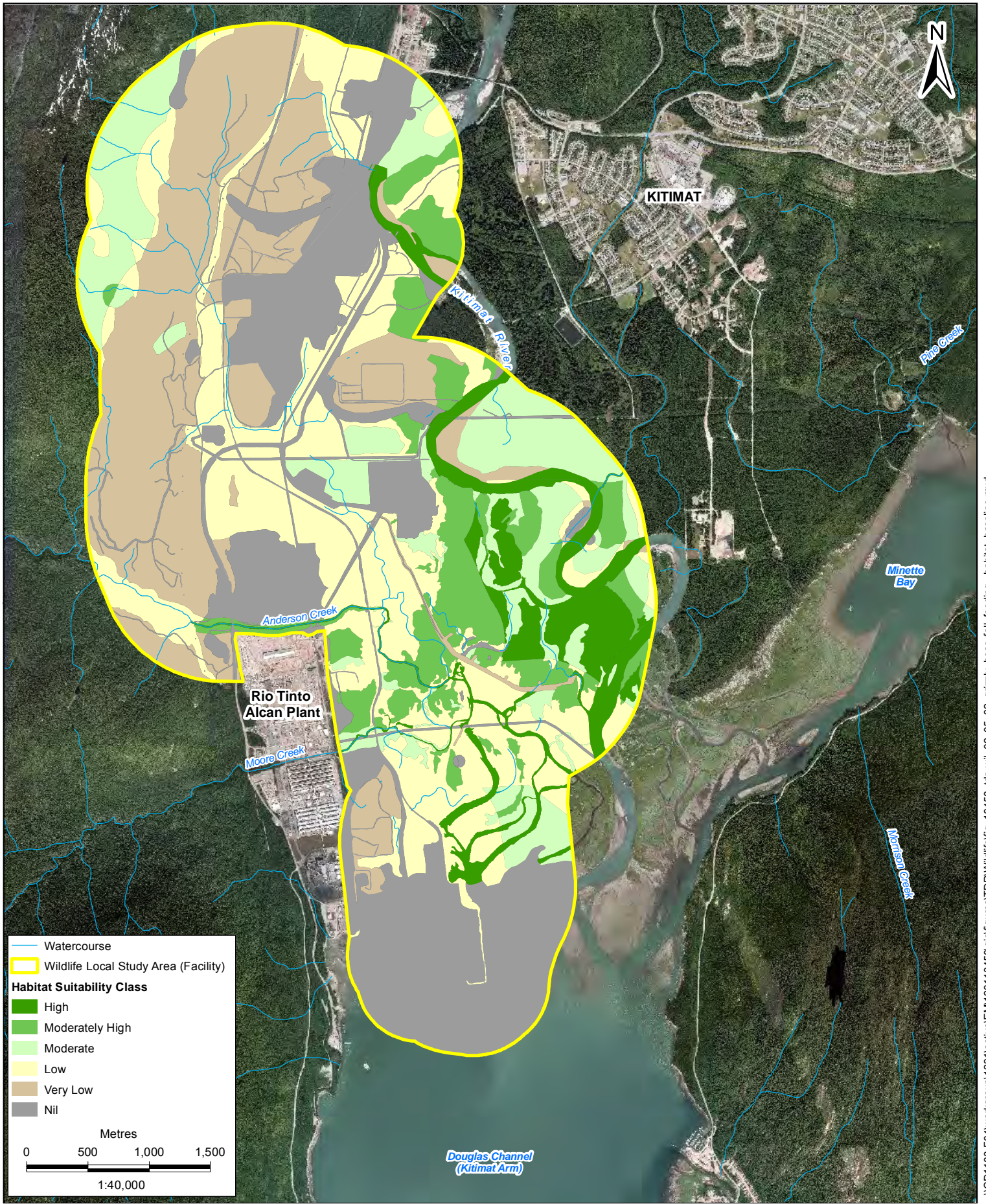
- High
- Moderately High
- Moderate
- Low
- Very Low
- Nil

Metres
 0 500 1,000 1,500
 1:40,000



WILDLIFE TECHNICAL DATA REPORT
GRIZZLY BEAR SPRING FEEDING HABITAT AT BASELINE
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	16-JUL-14	FIGURE NO.	2.5-1



— Watercourse
 Wildlife Local Study Area (Facility)

Habitat Suitability Class

- High
- Moderately High
- Moderate
- Low
- Very Low
- Nil

Metres
 0 500 1,000 1,500
 1:40,000



WILDLIFE TECHNICAL DATA REPORT
GRIZZLY BEAR FALL FEEDING HABITAT AT BASELINE
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	16-JUL-14	FIGURE NO.	2.5-2

2.5.3 Harlequin Duck

2.5.3.1 Status, Population Trends, and Distribution

Harlequin duck is not a species of conservation concern in BC. Harlequin duck are known to breed in inland areas and to winter in sheltered marine areas of the Pacific coast, such as bays and inlets (BCCDC 2014). Little information is available on the regional population trends of Harlequin duck.

2.5.3.2 Habitat Use and Life Requisites

Harlequin ducks migrate from inland summer breeding grounds during the spring and fall (NatureServe 2013). They forage almost exclusively on benthic aquatic invertebrates (NatureServe 2013) while overwintering along the coast. The Kitimat River estuary has been identified as a staging area for Harlequin duck to rest and acquire resources during migration events (KVN 2011). Breeding habitat does not occur in the terrestrial wildlife LSA. Consequently, spring and fall foraging habitats used during stop-over events were modelled for this species.

2.5.3.3 Model Development

A four-class rating scheme was used to rank Harlequin duck spring and fall foraging habitat suitability. Model rating assumptions used to define habitat suitability are summarized in Table 2.5-8:

Table 2.5-8: Harlequin Duck Spring and Fall Foraging Habitat Ratings Assumptions

Habitat Type	Ranking
River	3
Ocean (within 100 m of shoreline)	1
Pond	3
Wetland fen	3
Wetland marsh	3
Estuary shrub	3
Wetland swamp	3
All other habitats	4

2.5.3.4 Ratings Adjustments

Ocean habitat within 100 m of the shoreline retained a high ranking and all other ocean habitats outside of this were reduced to moderate. Ratings adjustment for disturbed areas in Harlequin duck spring and fall foraging habitat are included in Appendix D.

2.5.3.5 Results

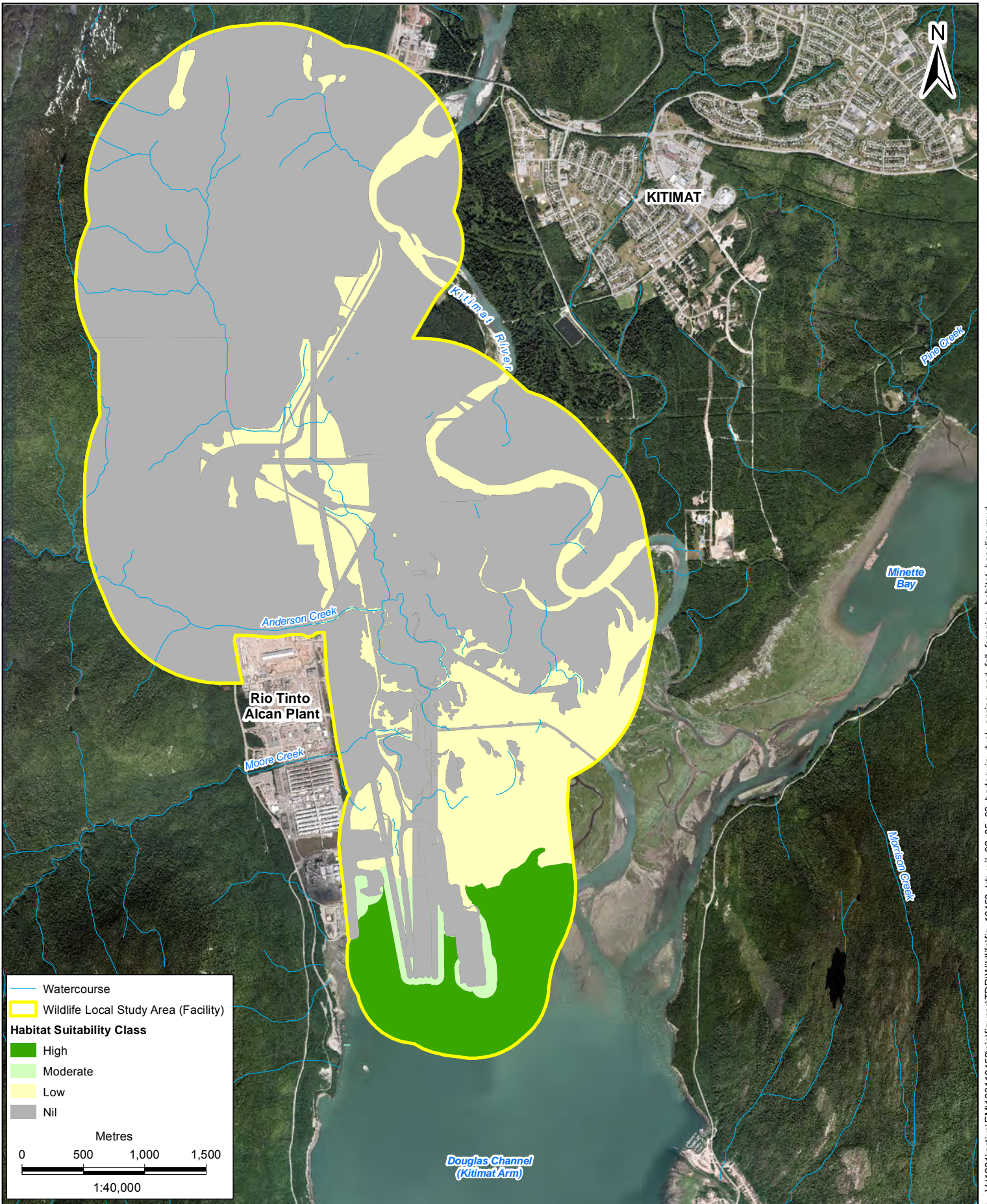
The models indicated there are 182.0 ha (7.7%) of effective Harlequin duck spring and fall foraging habitat (high to moderate; Table 2.5-9; Figure 2.5-3) available in the terrestrial wildlife LSA. Most of this habitat in the terrestrial wildlife LSA is located in the nearshore channel and upstream aquatic habitats, and the Kitimat River estuary.

Table 2.5-9: Area of Harlequin Duck Spring and Fall Foraging Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	159.4	6.7
Moderate	22.6	1.0
Low	399.6	16.8
Nil	1,794.0	75.5
Total	2,375.6	100

2.5.3.6 Discussion

The Kitimat River estuary, marine nearshore areas, and the river have previously been identified as important staging areas for Harlequin duck (KVN 2011).



— Watercourse

▭ Wildlife Local Study Area (Facility)

Habitat Suitability Class

- High
- Moderate
- Low
- Nil

Metres

0 500 1,000 1,500

1:40,000



WILDLIFE TECHNICAL DATA REPORT

**HARLEQUIN DUCK
SPRING AND FALL FORAGING HABITAT
AT BASELINE**

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	15-OCT-14	FIGURE NO.	2.5-3

2.5.4 Marbled Murrelet

2.5.4.1 Status, Population Trends, and Distribution

The marbled murrelet is federally listed as *threatened* on Schedule 1 of SARA and is provincially blue-listed. Marbled murrelet have been recorded in most inshore marine areas of BC (RIC 2001b), often no more than 0.5 km offshore. They use inland old-growth forests for nesting habitat (Burger 1995). They seasonally shift their distribution from northern and outer coasts in winter to southern and inland waters in summer (Fraser et al. 1999; RIC 2001b; CMMRT 2003). They are common in the marine birds RSA during spring and winter and are uncommon during the breeding season (Horwood 1992).

2.5.4.2 Habitat Use and Life Requisites

Murrelets typically forage in waters less than 0.5 km from shore and less than 40 m deep, primarily in protected areas (Burger 1995). Nesting occurs in coniferous forests with large, old trees (greater than 140 years old) (DeGange 1996) within 50 km of the coastline, with only rare occurrences further inland (i.e., up to 80 km) (Burger 2004). Nests are in Douglas-fir, Sitka spruce, western hemlock, western redcedar, and yellow-cedar (*Chamaecyparis nootkatensis*) trees with suitable large mossy branches that serve as nest platforms (Table 2.5-10).

Table 2.5-10: Breeding Habitat Requirements for Marbled Murrelet

Requirement	Key Attribute
Sufficient nest height to allow stall-landings and jump-off departures	Nest trees are typically >40 m tall (15 to 80 m); nest heights are typically >30 m (11 to 54 m); nest trees are larger than the stand average.
Openings in the canopy for unobstructed flight access to nest	Small gaps are typically next to nest trees. Vertical complexity of the canopy is higher in stands with nests.
Sufficient branch platform diameter to provide a nest site and landing pad	Nests are typically on large or deformed branches (15 to 74 cm in diameter), with moss cover and within 1 m of the trunk.
Soft substrate to provide a nest cup	Moss and other epiphytes provide thick pads at moist nest sites; duff and leaf litter are used in drier areas.
Overhead cover to provide shelter and reduce predation	Nests are overhung by branches.

SOURCE: Adapted from Nelson 1997 and Burger et al. 2000

Ratings Assumptions

A four-class rating scheme was used to rate marbled murrelet breeding habitat suitability. Habitat suitability was ranked using the following model assumptions (Table 2.5-11):

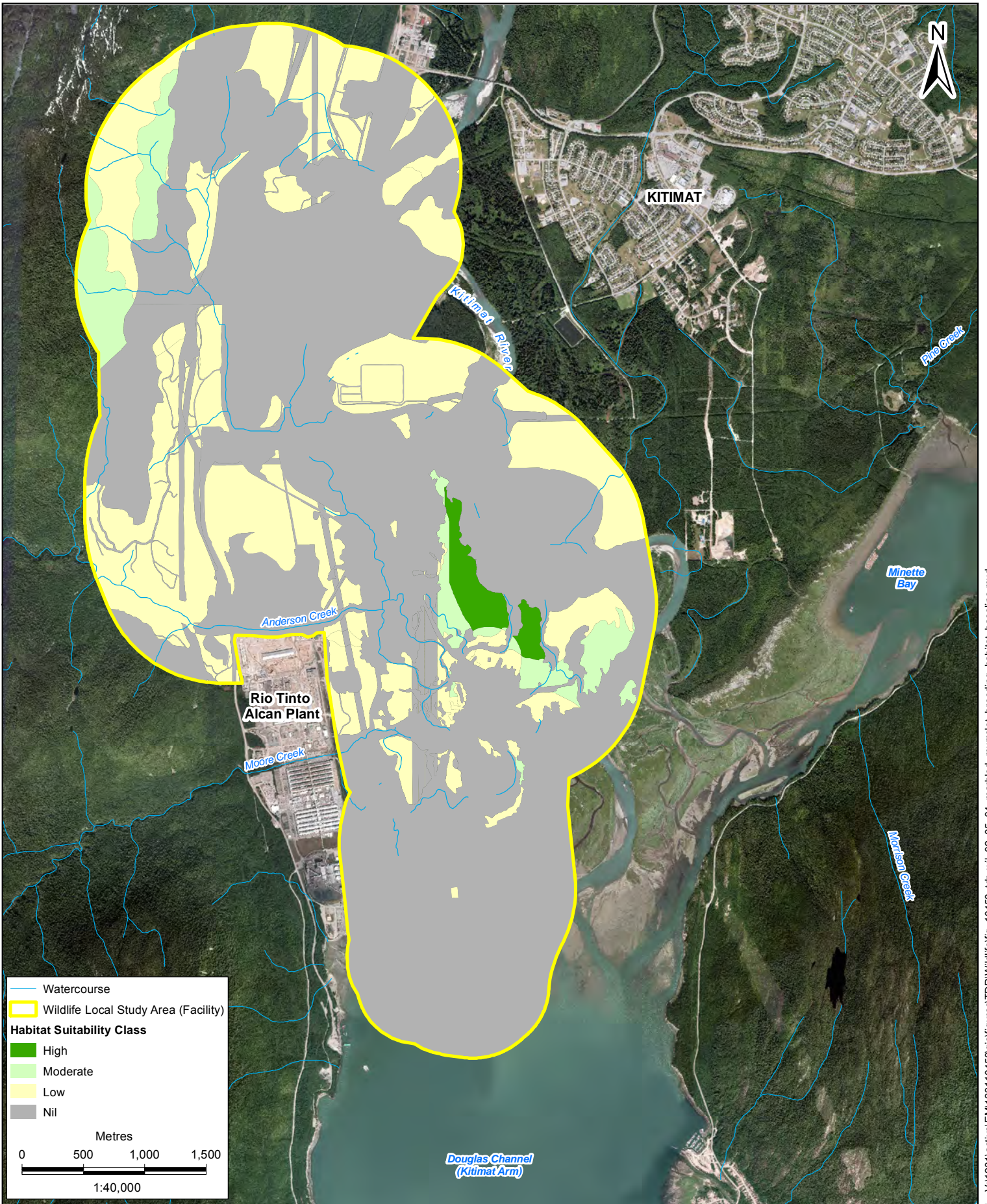
- Ecosystems with coniferous old-growth forests were rated higher than younger forests stands. Structural stages 7 (greater than 250 years) and 6 (greater than 140 years old) were rated higher than structural stage 5 and under (3 or 4).
- Ecosystems with the best potential tree height were rated higher than less potential (e.g., drier and scrubby ecosystems).
- Ecosystems with conifers of sufficient tree diameter to provide limb diameters (15 cm to 74 cm) were rated higher.
- Ecosystems with potentially higher canopy closure were rated higher than units with lower crown closure.
- Ecosystems with complex tree canopies, including trees with large crown size, were rated higher than smaller tree canopies.

Table 2.5-11: Marbled Murrelet Breeding Habitat Suitability Ratings

Structural Stage	Conifer-Dominated	Mixedwood	Deciduous-Dominated
1-4	4	4	4
5	3	3	4
6	2	3	4
7 (xeric forest)	2	3	4
7 (mesic forest)	1	3	4

2.5.4.3 Results

The habitat suitability model indicated that there is a moderate amount of effective marbled murrelet breeding habitat (137.3 ha, 5.8%) in the terrestrial wildlife LSA (Figure 2.5-4; Table 2.5-12). These habitats are located in the central portion of the terrestrial wildlife LSA near the Kitimat River within mature and old-growth coniferous forests.



— Watercourse

▭ Wildlife Local Study Area (Facility)

Habitat Suitability Class

- High
- Moderate
- Low
- Nil

Metres

0 500 1,000 1,500

1:40,000



WILDLIFE TECHNICAL DATA REPORT

MARBLED MURRELET BREEDING HABITAT AT BASELINE

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	15-OCT-14	FIGURE NO.	2.5-4

Table 2.5-12: Marbled Murrelet Breeding Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	31.0	1.3
Moderate	106.3	4.5
Low	590.1	24.8
Nil	1,648.2	69.4
Total	2,375.6	100

2.5.4.4 Discussion

A relatively limited amount of high suitability marbled murrelet breeding habitat and a higher amount of moderate suitability habitat occur in the terrestrial wildlife LSA. Old-growth forest is limited in the terrestrial wildlife LSA given the history of human disturbance.

2.5.5 Pacific Marten

2.5.5.1 Status, Population Trends, and Distribution

Pacific marten is not a species of conservation concern in BC and is managed as a furbearer. This species is widespread, with greatest densities of martens found in coastal old-growth forests (Stevens 1995; BCCDC 2014). Population trends for marten are unknown but are thought to fluctuate widely, especially in the north (Hatler et al. 2003). They are strongly dependent on prey availability and may demonstrate cyclic behaviour in response to primary prey populations of voles and hares (Fryxell et al. 1999).

2.5.5.2 Habitat Use and Life Requisites

Martens are old-growth dependent; however, they also occur in second-growth forest (Buskirk and Powell 1994; Bowman and Robitaille 1997), including deciduous stands (Poole et al. 2004). Open areas and young seral-stage forests are low-quality habitats (Buskirk and Ruggiero 1994; Poole et al. 2004). Refuges include ground burrows, rock piles and crevices, downed logs, stumps, snags, brush piles, and squirrel middens (Steventon and Major 1982; Ruggiero et al. 1994). Marten prey opportunistically on red-backed vole (*Clethrionomys rutilus*) and other microtines (Buskirk and Powell 1994; Buskirk and Ruggiero 1994; Paragi et al. 1996). Snowshoe hare, mice, squirrels, carrion, birds and eggs, insects, and berries are also consumed (Nagorsen et al. 1989; Thompson and Colgan 1994; Poole and Graf 1996; Bull and Heater 2000).

Although winter requirements may be limiting and are the most critical for individuals and populations (Steventon and Major 1982; Hargis and McCullough 1984; Buskirk and Powell 1994; Sherburne and Bissonette 1994), similar habitat is required throughout the year. Therefore, year-round living habitat was the life requisite modelled.

Year-round Living Habitat

Mature and old-growth coniferous forests with 30% canopy closure support the highest densities of marten, because it has high structural diversity (i.e., standing and downed woody material) and provides security cover from avian predators (Koehler and Hornocker 1977; Hargis and McCullough 1984; Buskirk and Ruggerio 1994; Thompson and Colgan 1994; Thompson and Harestad 1994). Moist or mesic productive forest types are preferred (Buskirk and Powell 1994), but young seral-stage forests (less than 40 years old) and deciduous-dominated forests (Poole et al. 2004) are also used. Coarse woody debris is an important ecological element for denning, thermal insulation, security cover, and access to subnivean prey in winter (Buskirk and Powell 1994; Buskirk and Ruggiero 1994; Sherburne and Bissonette 1994; Taylor and Buskirk 1994; Thompson and Colgan 1994; Thompson and Harestad 1994). It is relatively abundant in CWH stands (Feller 2003) of recently cut forests, rare in intermediate-aged forests (approximately 50 years old), and highly abundant in stands greater than 80 years old (Feller 2003).

2.5.5.3 Model Development

A four-class rating scheme was used to model Pacific marten year-round living habitat available for foraging, security, and thermal cover during all seasons. Habitat suitability was rated using the following model assumptions (Table 2.5-13):

- Moist, open-canopy, conifer-dominated forests in structural stages 6 and 7 were rated high (1).
- Moist units were rated higher than dry or very wet units because they typically have higher canopy closure and denser shrub and herb layers.
- High ground cover was rated higher than sparse ground cover. Suitability was decreased by one class for units with a sparse cover (less than 30%) of low shrubs.
- Conifer-dominated stands were rated higher than deciduous-dominated or mixedwood stands.
- Ecosystem units and ecosite phases of structural stage 6 and 7 were rated higher than structural stage 5.
- Stands supporting closed canopies are rated higher than stands supporting open canopies.
- Non-vegetated units (e.g., rock outcrops, gravel bars, and young forest) were rated nil (4).

Table 2.5-13: Marten Year-round Living Habitat Ratings

Structural Stage	Conifer-dominated	Mixedwood	Deciduous-dominated
1-4	4	4	4
5 (open canopy/dry)	3	3	3
5 (closed canopy/moist)	2	3	3
6-7 (open canopy/dry)	2	2	3
6-7 (closed canopy/moist)	1	2	3

2.5.5.4 Model Ratings Adjustments

Marten generally occur in habitat patches greater than or equal to 15 ha (Synder and Bissonette 1987; Takats et al. 1999). Patches of suitable habitat (i.e., contiguous ratings of 1, 2, or 3) less than 15 ha were downgraded to nil, and patches greater than or equal to 15 ha retained rating values. Appendix D outlines model rating adjustments made for disturbed areas in the terrestrial wildlife LSA.

2.5.5.5 Results

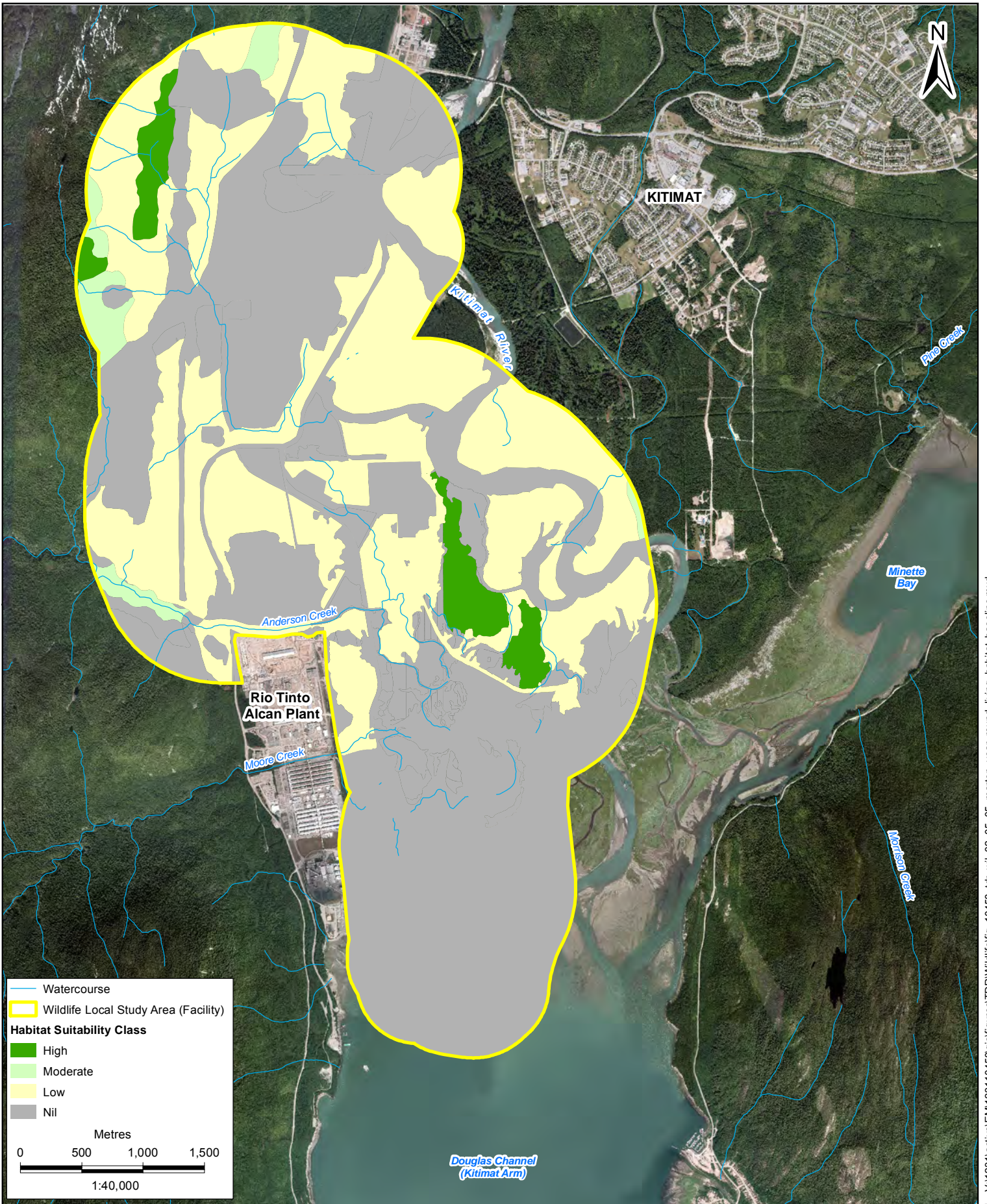
The models indicate there are 132.7 ha (5.6%) of effective (moderate to high suitability) marten year-round living habitat in the terrestrial wildlife LSA (Figure 2.5-5; Table 2.5-14). Most of this habitat is located on the west and east sides in mature coniferous forests.

Table 2.5-14: Area of Marten Year-round Living Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	81.0	3.4
Moderate	51.7	2.2
Low	843.0	35.5
Nil	1,399.9	58.9
Total	2,375.6	100

2.5.5.6 Discussion

Marten depend on structurally diverse mature and old-growth coniferous forests that support cover from avian predators, an abundance of subnivean burrows, and access to prey. Mature and old-growth forests in the terrestrial wildlife LSA are limited by previous disturbances and natural fluctuations in the high-water mark or floodplain of large aquatic features: rivers, estuary, creeks, and ocean.



WILDLIFE TECHNICAL DATA REPORT
MARTEN YEAR-ROUND LIVING HABITAT AT BASELINE
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	15-OCT-14	FIGURE NO.	2.5-5

2.5.6 Western Screech-owl

2.5.6.1 Status, Population Trends, and Distribution

The *kennicottii* subspecies of western screech-owl is provincially red-listed (BCCDC 2014). Federally, it is designated as a species of *special concern* under Schedule 1 of SARA (SRPR 2013). The screech-owl is a cavity nester that occurs in low-elevation forests and woodlands below 600 m (Campbell et al. 1990b; Canning and Angell 2001; COSEWIC 2012). In habitats west of the Coast Mountains, abundance estimates are approximately 870 breeding pairs (COSEWIC 2012). Although there are no data from the north coast, BC-Yukon Nocturnal Owl Surveys on the central and south coasts indicate a steep decline in western screech-owl detections from 2000 to 2009 (COSEWIC 2012).

2.5.6.2 Habitat Use and Life Requisites

Year-round Living Habitat

The western screech-owl prefers mixedwood forests, riparian woodlands, and deciduous trees (AXYS 1988; Campbell et al. 1990b; Canning and Angell 2001; Kissling and Lewis 2009). Western screech-owl nest within 300 m of rivers, creeks, marshes, and large ponds with home ranges focused on larger streams (Class 1 or 2) (Campbell et al 1990b). Nest cavities are typically made by northern flicker (*Colaptes auratus*) or pileated woodpecker (*Dryocopus pileatus*) in deciduous (greater than 25 cm diameter at breast height), and Douglas-fir, western redcedar, and western hemlock trees (38 to 65 cm diameter at breast height) (Kissling and Lewis 2009). Although breeding habitat is critical for western screech-owl (COSEWIC 2012), similar habitat is required throughout the year. Consequently, year-round living habitat was assessed for this species.

2.5.6.3 Model Development

Year-round Living Habitat

A four-class rating scheme was used to rank suitability of western screech-owl year-round habitat using the following model assumptions (Table 2.5-15):

- Riparian forest in structural stages 6 and 7 were rated high (1).
- Structural stages 6 and 7 were rated higher than structural stage 5.
- Mixedwood and open-canopy deciduous-dominated forests were rated highest. Coniferous-dominated and closed-canopy deciduous-dominated forests were rated lower.
- Non-forested habitats were assumed to have no value and were rated nil (4).

Table 2.5-15: Western Screech-owl Year-round Living Habitat Ratings Assumptions

Structural Stage	Mixedwood Forest	Deciduous Forest	Coniferous Forest
1-4	4	4	4
5 (open canopy)	2	2	3
5 (closed canopy)	2	3	3
6-7 (open canopy)	1	1	2
6-7 (closed canopy)	1	2	3

2.5.6.4 Ratings Adjustments

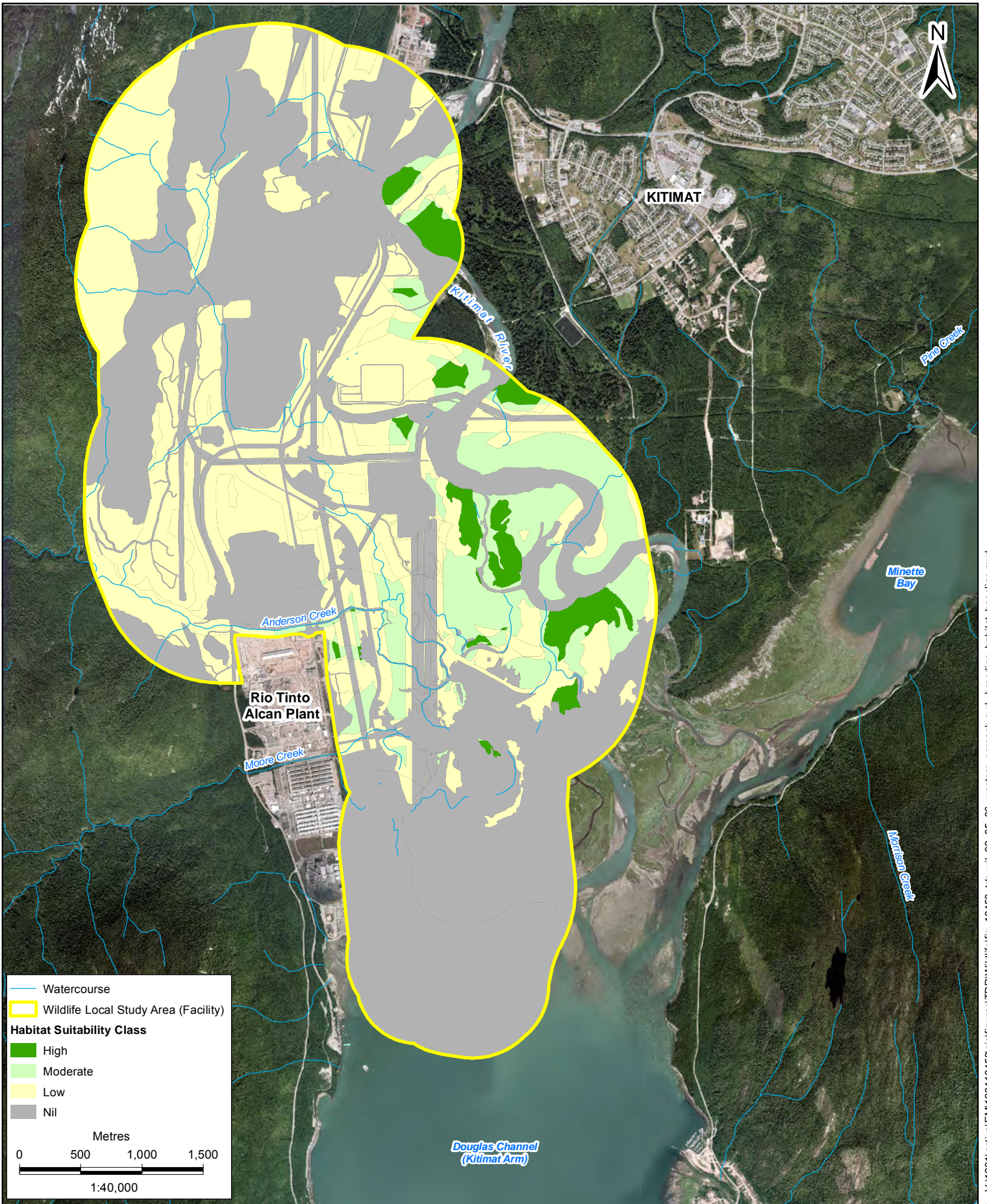
Habitat ratings were reduced by one class for habitat greater than 300 m from water (e.g., streams and wetlands). Adjustments for disturbances in western screech-owl habitat are detailed in Appendix D.

2.5.6.5 Results

Model results indicate that effective year-round living habitat (high to moderate) for western screech-owl covers 288.1 ha (12.1%) of the terrestrial wildlife LSA (Table 2.5-16; Figure 2.5-6). Most of this habitat is located adjacent to the Kitimat River on the northeast side of the terrestrial wildlife LSA.

Table 2.5-16: Area of Western Screech-owl Year-round Living Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	75.3	3.2
Moderate	212.8	9.0
Low	730.1	30.7
Nil	1,357.4	57.1
Total	2,375.6	100



— Watercourse
 Wildlife Local Study Area (Facility)

Habitat Suitability Class

- High
- Moderate
- Low
- Nil

Metres
 0 500 1,000 1,500
 1:40,000



WILDLIFE TECHNICAL DATA REPORT
**WESTERN SCREECH-OWL BREEDING HABITAT
 AT BASELINE**
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	15-OCT-14	FIGURE NO.	2.5-6

2.5.6.6 Discussion

Most effective year-round living habitat for western screech-owl in the terrestrial wildlife LSA is located in relatively abundant riparian and deciduous forests. Marshes and large ponds are also present. Wildlife trees with cavities have been documented during field studies in these areas and may be used for breeding.

2.5.7 Western Sandpiper

2.5.7.1 Status, Population Trends, and Distribution

The western sandpiper is not a species of conservation concern in BC. Western sandpipers are known to breed on islands in the Bering Sea and along the coasts of western and northern Alaska. The Kitimat River estuary is known to serve as a migratory stop-over point during the spring and fall (Horwood 1992). They overwinter along the Pacific coast (NatureServe 2013). The global population is estimated at 3.5 million birds (Morrison et al. 2006).

2.5.7.2 Habitat Use and Life Requisites

Western sandpipers occur along flat or gently sloping muddy, sandy, or gravelly shores (Stiles and Skutch 1989). They forage in mudflats, beaches, and shores of ponds. Breeding habitat does not occur in the terrestrial wildlife LSA.

Western sandpipers migrate during spring and fall (Iverson et al. 1996), using intertidal wetlands and shorelines as staging habitat. Staging habitat has been identified within the Kitimat River estuary (KVN 2011). Consequently, spring and fall foraging habitat was modelled for this species.

2.5.7.3 Model Development

A four-class rating scheme was used to rank suitability of spring and fall foraging habitat (Table 2.5-17).

Table 2.5-17: Western Sandpiper Spring and Fall Foraging Habitat Rating Assumptions

Habitat Type	Ranking
Mudflats and shorelines	1
Rivers and creeks	3
Pond	2
Wetland fen, no standing water	2
Wetland marsh, standing water	1
Estuary shrub	3
Lake	2
Wetland swamp	1

2.5.7.4 Ratings Adjustments

Adjustments for disturbed areas in western sandpiper spring and fall foraging habitat are detailed in Appendix D.

2.5.7.5 Results

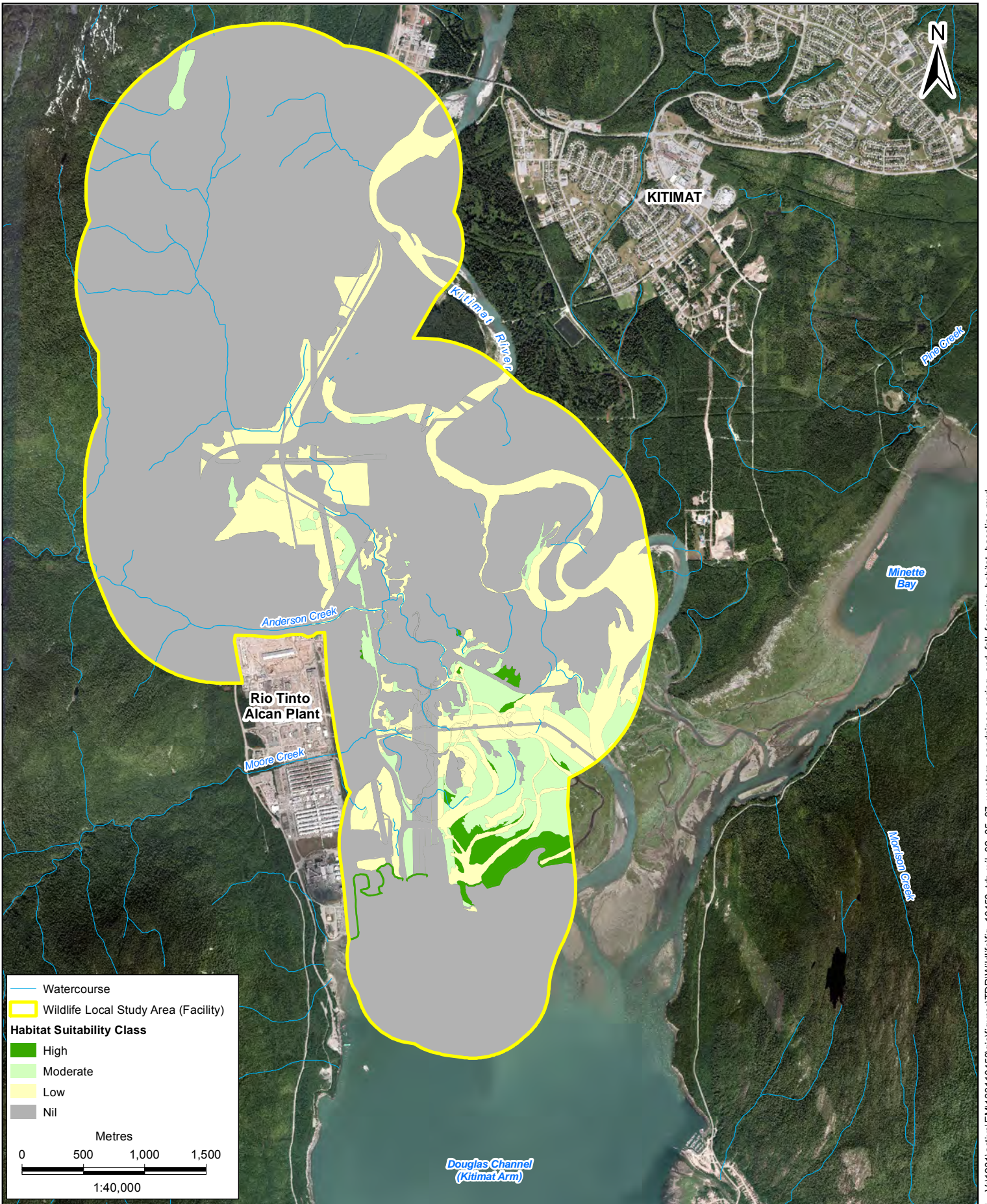
The models indicated there are 142.1 ha (6.0%) of effective western sandpiper spring and fall foraging habitat (high to moderate; Table 2.5-18; Figure 2.5-7) available in the terrestrial wildlife LSA. Most of this habitat is located along the ocean shoreline and mudflats in the Kitimat River estuary.

Table 2.5-18: Area of Western Sandpiper Spring and Fall Foraging Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	32.4	1.4
Moderate	109.7	4.6
Low	294.7	12.4
Nil	1,938.8	81.6
Total	2,375.6	100

2.5.7.6 Discussion

Western sandpiper spring and fall foraging habitat is limited to mudflats, shores of wetlands, and along the ocean shoreline. The Kitimat River estuary has previously been identified as an important staging area for western sandpiper.



— Watercourse
 Wildlife Local Study Area (Facility)

Habitat Suitability Class

- High
- Moderate
- Low
- Nil

Metres
 0 500 1,000 1,500
 1:40,000



WILDLIFE TECHNICAL DATA REPORT
WESTERN SANDPIPER
SPRING AND FALL FORAGING HABITAT
AT BASELINE
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	15-OCT-14	FIGURE NO.	2.5-7

2.5.8 Western Toad

2.5.8.1 Status, Population Trends, and Distribution

The western toad is blue-listed in BC (BCCDC 2014) and is designated as a species of *special concern* under Schedule 1 of SARA (SRPR 2013). It occurs from the Rocky Mountains to the Pacific Coast at elevations from sea level to 3,660 m. Western toad is widespread and common in a variety of habitats; however, no long-term datasets or abundance estimates are available for this species (COSEWIC 2002b). Local declines are attributed to habitat degradation or loss, pollutants, predation, competition with non-native species, road mortality, and disease (COSEWIC 2002b).

2.5.8.2 Habitat Use and Life Requisites

Western toads spend most of their life history in terrestrial habitats but breed in calm, open waters of ponds, stream edges, and roadside ditches (COSEWIC 2002b). They prefer shallow water, with sufficient water permanence, where water temperatures are relatively high, thereby accelerating growth of eggs and tadpoles (Davis 2002; Zevit and Wind 2010). Sites with a pH balance neutral to basic are preferred (Hogrefe et al. 2005; Dulisse and Hausleitner 2009). They exhibit strong annual breeding site fidelity, even when other potential sites are available, and return in successive years (COSEWIC 2002b). Consequently, breeding habitat was modelled for western toad.

2.5.8.3 Model Development

A four-class rating scheme was used to rank western toad breeding habitat suitability. The following assumptions were used to model habitat suitability:

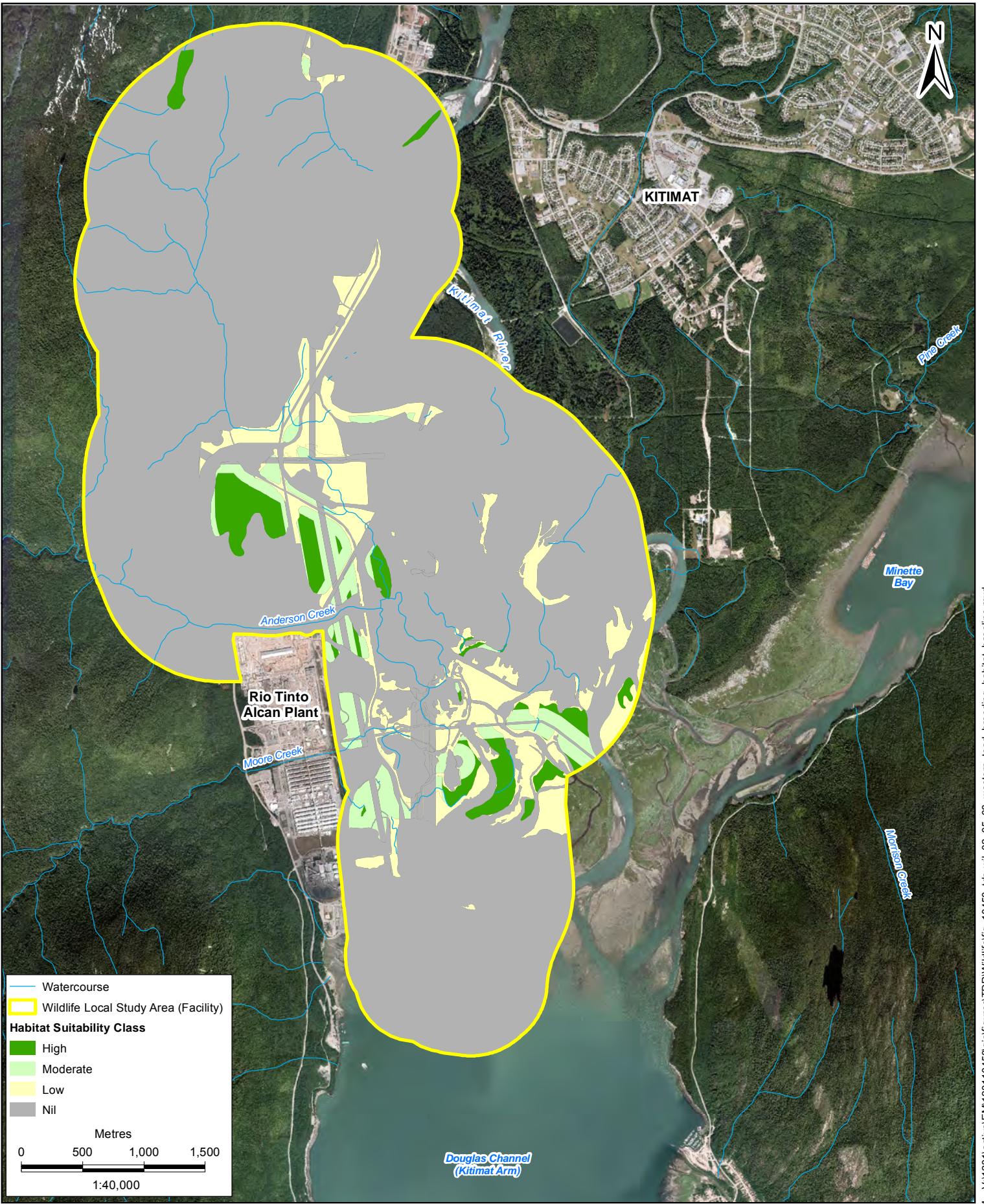
- Permanent wetlands with calm, open water were rated high (1).
- All Terrestrial Resource Inventory Mapping wetlands were ranked high (1).
- All pond, marsh, or bog units were ranked high (1).
- All units where breeding was confirmed were rated as high (1).
- Shrub, swamp, estuary, and fen units were ranked low (3).
- Non-vegetated terrestrial units, such as rocky outcrops, were rated nil (4).
- All other ecosystem units were rated nil (4).

2.5.8.4 Ratings Adjustments

Ratings adjustments for disturbed areas of western toad breeding habitat are provided in Appendix D.

2.5.8.5 Results

Models indicate there are 143.6 ha (6.0%) of effective western toad breeding habitat (high to moderate; Figure 2.5-8; Table 2.5-19) available in the terrestrial wildlife LSA. Most of this habitat is located in the central portion of the terrestrial wildlife LSA, associated with wetlands.



— Watercourse
 Wildlife Local Study Area (Facility)

Habitat Suitability Class

- High
- Moderate
- Low
- Nil

Metres
 0 500 1,000 1,500
 1:40,000



WILDLIFE TECHNICAL DATA REPORT
WESTERN TOAD BREEDING HABITAT AT BASELINE
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	15-OCT-14	FIGURE NO.	2.5-8

Table 2.5-19: Area of Western Toad Breeding Habitat in the Terrestrial Wildlife LSA

Habitat Suitability	Area of Suitable Habitat (ha)	Proportion of LSA (%)
High	69.6	2.9
Moderate	74.0	3.1
Low	171.8	7.2
Nil	2,060.2	86.7
Total	2,375.6	100

2.5.8.6 Discussion

The relatively limited amount of effective western toad breeding habitat in the terrestrial wildlife LSA is an important wildlife consideration given that western toads exhibit strong breeding site fidelity. Existing wetlands were identified as high and moderate suitability habitats that support breeding for western toad and other amphibian species, such as Columbia spotted frog. Despite limited habitat in the terrestrial wildlife LSA, western toad is an explosive breeder and can be locally common.

2.5.9 Model Verification

The results of the confusion matrix suggest low to high model accuracy (i.e., agreement between model and field ratings), with accuracy ranging from 24% to 84% (Table 2.5-20). Harlequin duck, western sandpiper, marbled murrelet, Pacific marten and western toad had the highest agreement between model and field ratings (40% to 84%). For grizzly bear spring foraging habitat and western screech-owl breeding habitat, accuracy ranged from 20% to 24% with high false negative proportions (field ratings higher than model ratings). This suggested that the models underestimated the potential amount of habitat for these species. For grizzly bear fall foraging habitat, accuracy was 34% with nearly equal false-negative and false-positive proportions. Some of the reduced accuracy of the models can be attributed to site-specific variation in certain habitat elements (e.g., coarse woody debris, snag density, shrub cover, density and height, canopy cover) that are assumed in the TEM descriptions to have certain “average” values.

The distribution in the difference between model and field ratings included tall bell-shaped curves centred on zero as well as off-centred distributions with false positives and false negatives (Appendix I); therefore, confidence in the models is considered low to high (Table 2.5-20). Where the distribution in the difference between model and field ratings showed a unimodal distribution centred on 0 and with accuracy greater than or equal to 50% (harlequin duck, marbled murrelet, Pacific marten, and western sandpiper) confidence was considered high. Where the distribution in the difference between model and field ratings showed a skewed distribution but with most differences in one class (± 1), confidence was moderate (grizzly bear spring foraging, western screech-owl, and western toad). Confidence in the grizzly bear fall foraging model was considered low given the skewed distribution of the differences of field and model ratings.

Table 2.5-20: Confusion Matrix Results

Key Species	Modeled Life History	Accuracy	False Negative	False Positive	Reliability
Grizzly bear	Spring foraging	24%	23%	53%	Low
	Fall foraging	34%	35%	31%	Moderate
Harlequin duck	Spring and fall foraging	84%	7%	7%	High
Pacific marten	Year-round living	53%	38%	9%	Moderate
Marbled murrelet	Breeding	56%	35%	9%	High
Western sandpiper	Spring and fall foraging	80%	12%	8%	High
Western screech-owl	Breeding	20%	29%	51%	Moderate
Western toad	Breeding	40%	30%	30%	Moderate

3 MARINE BIRDS

3.1 Study Area

The study areas for marine birds were determined by the spatial extent within the regional setting in which the potential for Project effects can be measured and where there is a reasonable expectation that effects could be significant. The delineation of areas relevant for study was considered with reference to Aboriginal traditional use, technical or scientific information (e.g., marine bird habitat use), the interaction of other discipline studies (marine fish and mammals), the locations where marine birds were likely to interact with the Project activities, and the professional experience of the study team.

3.1.1 Regional Setting

The landscape of the Pacific Maritime Ecozone extending along the BC coastline is generally characterized by rocky shores and steep fjords. Douglas Channel is in the North Coast Fjords Ecodistrict of the Pacific Shelf Ecoregion (Environment Canada 1997). Fjords are characterized by deep troughs bounded by sills, turbid surface layers with slow tidal currents and low productivity, deep hypoxic waters, and considerable freshwater input mixed with irregular intervals of inflowing seawater (Environment Canada 1997; Lucas et al. 2007). Water temperature and salinity are strongly influenced by the seasonal input of freshwater from rivers (Pickard 1961). The average water surface temperature in Kitimat Arm is approximately 14°C in the summer and 6°C in the winter (Lucas et al. 2007). Wind- and tide-generated currents influence circulation in Douglas Channel and its interface with the open waters of Hecate Strait (MacDonald and Shepherd 1983).

The Kitimat Arm of Douglas Channel is approximately 3 km wide and 20 km long. The Kitimat River, which flows south approximately 75 km from the southwestern slope of Mount Davies, discharges into the Kitimat Arm from the north at the Kitimat River estuary. The Kitimat River estuary is a large, flat, tidal delta that is provincially recognized as an important migratory staging and overwintering area for marine birds, waterfowl, and shorebirds (Horwood 1992).

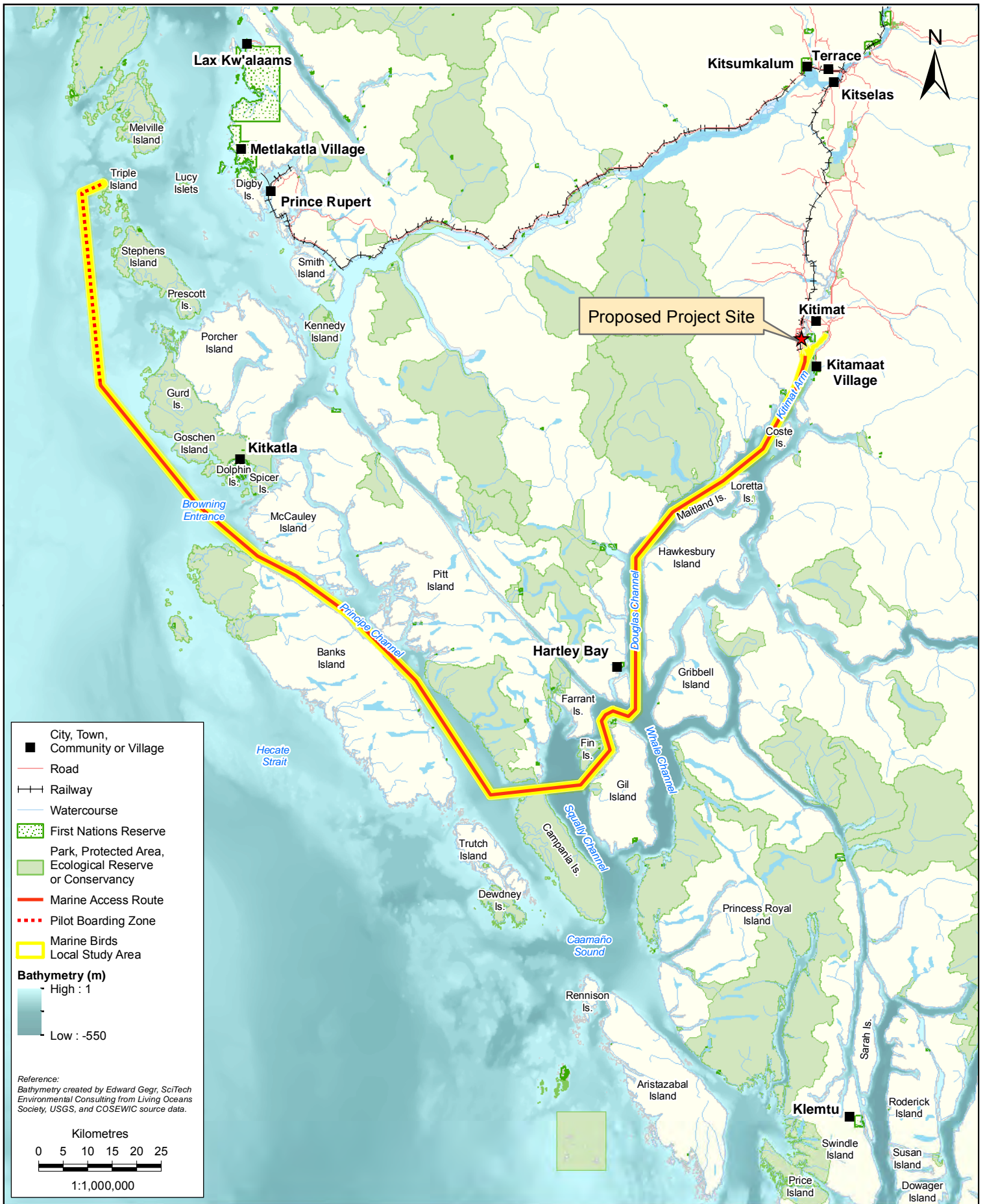
The marine study area contains several small settlements, including Hartley Bay, Kitkatla, and Kitamaat Village. There are several First Nations that depend on natural resources for their daily culture, spiritual needs, food, and livelihood (see Section 3.2.1). Commercial fishing is an important industry in the region. Fishery species include Pacific salmon (e.g., Chinook, coho, chum, spring, and sockeye), halibut, herring, sea urchin, crab, and shellfish. Vessel traffic includes commercial, recreational, and fishing fleets. In the Pacific North Coast Integrated Management Area (PNCIMA), an estimated 40% of the vessel traffic consists of towboats and tugboats and 26% consists of carrier vessels. The remaining traffic is made up of 18% passenger vessels (e.g., cruise ships and ferries), 15% fishing vessels (greater than 24 m), and 1% oil tankers (PNCIMA 2011).

3.1.2 Local Study Area

The LSA for marine birds encompasses the nearshore waters of the northern end of Kitimat Arm of Douglas Channel, including Minette Bay and extending through the confined channels with a buffer of 1 km on either side of the marine access route between the terminal and the Triple Island Pilot Boarding Station. The marine birds LSA is the marine environment with potential for direct and indirect Project effects from the marine terminal and infrastructure, vessel berthing, and vessel operations (Figure 3.1-1). This area is where there is the potential for direct sensory disturbance to sensitive seabirds from the vessel visual presence, activity, or noise during vessel operations. A 1,000 m buffer, or ZOI, is a reasonable estimate of the threshold of response to vessel disturbance by the more sensitive marine bird species groups, such as alcids (Gladwin et al. 1988; Smith 2000; Hentze 2006; Ruddock and Whitfield 2007; Stillman et al. 2007).

3.1.3 Regional Study Area

The RSA for marine birds includes the extent of the marine waters and associated shoreline habitats along the marine access route from the Triple Island Pilot Boarding Station through Principe and Douglas channels to the terminal. Where the marine access route is not confined by geography in the north end, a buffer of approximately 10 km is used. The marine birds RSA includes the extent of vessel activities where Project effects may interact with other marine activities within the confined channels and delineated open water areas (Figure 3.1-2) to cause cumulative effects. It encompasses marine bird seasonal habitats, including breeding colonies, and staging and overwintering areas, with a focus on the marine waters and associated shorelines in Principe and Douglas channels, Caamaño Sound, and Squally Channel. Potential Project effects in the marine birds LSA are considered in the broader context of the marine birds RSA.



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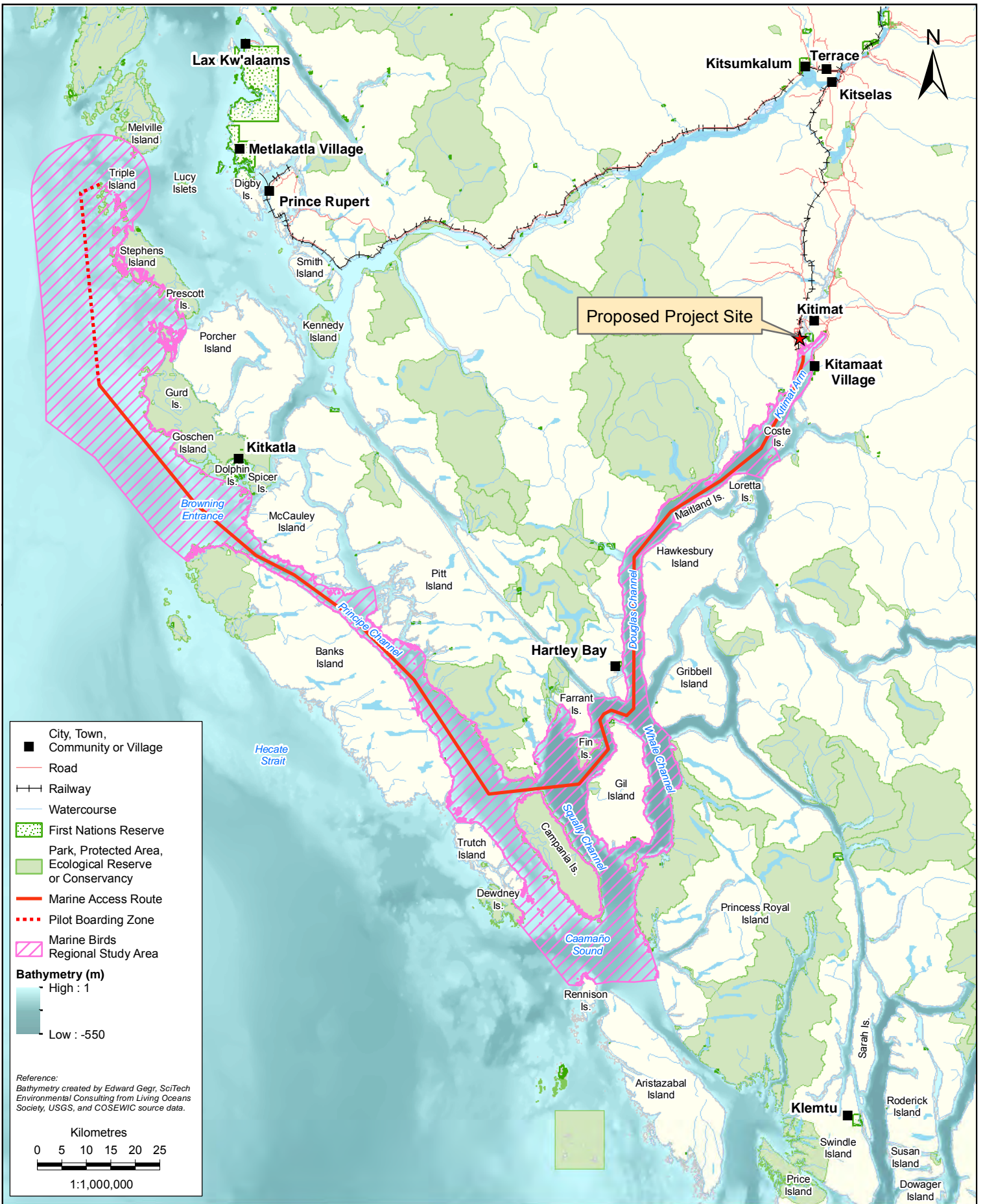


WILDLIFE TECHNICAL DATA REPORT

**MARINE BIRDS
LOCAL STUDY AREA**

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	3.1-1



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WILDLIFE TECHNICAL DATA REPORT

**MARINE BIRDS
REGIONAL STUDY AREA**

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	3.1-2

3.2 Review of Existing Data

A review of background information available for the marine birds RSA included traditional use studies, relevant published literature, local industry environmental assessments, electronic databases from research and government websites, and local historical data.

3.2.1 Aboriginal Traditional Use

3.2.1.1 Methods

Information on the use and importance of marine birds to coastal First Nations groups in the marine birds RSA was gathered from a variety of reports (Marsden 2011; Menzies 2011; Metlakatla Governing Council 2011; Powell 2011; Marsden 2012). These studies describe the cultural, spiritual, and traditional uses of marine resources important to the continued practice of treaty and claimed Aboriginal rights for groups including Haisla, Gitga'at, Gitxaala, and Metlakatla First Nations. Information from Lax Kw'alaams, Kitsumkalum, and Kitselas First Nations was not publicly available at the time of writing.

3.2.1.2 Results

The historical and current uses of marine birds by First Nations include harvest for food; provisions for cultural, spiritual, and traditional feasting activities; and material resources, such as the collection of feather down for warmth and comfort (Table 3.2-1). Several bird species have historically had cultural, spiritual, or traditional importance to First Nations groups that may occur in the marine birds RSA (Table 3.2-1).

Haisla First Nation collects ducks, such as mallard, goldeneye and merganser species, for food and down feathers (Barbette and Powell 2005; Powell 2011). Canada goose and snow goose also provide food and down. Traditional harvesting of gull eggs is practiced. Gitga'at First Nation harvests many marine bird species, including black oystercatcher and glaucous-winged gull, for food and cultural, spiritual, and feasting activities (Marsden 2012). Gitxaala First Nation harvests geese, ducks, scoters, and swans (Marsden 2011; Menzies 2011) for food and other traditional uses. Metlakatla First Nation harvests eggs at the traditional site of Lucy Island (traditional name: Lax Sinna) (Metlakatla Governing Council 2011). Egg harvesting likely involves a variety of marine bird species, such as glaucous-winged gull, black oystercatcher, and possibly alcids. Traditional use was incorporated into the study design and effects assessment through the selection of appropriate key species with which to focus the assessment of the Project's potential effects on marine birds. For example, black oystercatcher, glaucous-winged gull, and marbled murrelet were selected, in part, because they are species of importance to Aboriginal peoples (Section 3.2.2).

3.2.2 Literature and Electronic Resources

A literature review was conducted to identify the full complement of marine bird species and their distribution and abundance in the marine birds RSA.

Table 3.2-1: Identified Marine Bird Species Traditionally Used by First Nations

First Nations Group	Species	Site Name	Geographic Description	First Nations Use	Reference
Haisla	Duck (e.g., mallard, goldeneye species, black duck, and merganser species)	Simgas and Zagwis (Wa'wais)	The lower courses, estuary, and mouth of the Kitimat River and Minette Bay	Hunting	Powell (2006)
		Minette Bay and the flats around Zagwis	Minette Bay and the flats around Zagwis	Hunting	Powell (2006)
		Qelxat'sinuxw	Yaksda Wa'wais between Moore Creek and Anderson Creek	Hunting	Powell (2011)
		Yaksda (Wa'wais) – a traditional territory of a specific Haisla household group	Lower reaches of the Kitimat River (west side) and the Alcan site, along Moore and Anderson creeks south to "Frog Falls" or Kwengad	Hunting	Powell (2006)
		C'imoca and Wohlstu Wa'wais – a traditional territory of a specific Haisla household group	Kitamaat Village area along the Wolh River and Wohlstu Creek, draining into Robinson Lake and including the highlands behind the village	Hunting	Powell (2006)
		Around Kitamaat Village	Kitamaat Village area	Hunting	Powell (2011)
	Goose (e.g., Canada goose and snow goose)	Simgas and Zagwis (Wa'wais)	The lower courses, estuary, and mouth of the Kitimat River and Minette Bay	Hunting	Powell (2006)
		Minette Bay and the flats around Zagwis	Minette Bay and the flats around Zagwis	Hunting	Powell (2006)
		Minette Bay	Minette Bay	Hunting	Powell (2006)
		Yaksda (Wa'wais) – a traditional territory of a specific Haisla household group	Lower reaches of the Kitimat River (west side) and the Alcan site, along Moore and Anderson creeks south to "Frog Falls" or Kwengad	Hunting	Powell (2006)
		Qelxat'sinuxw	Yaksda Wa'wais between Moore Creek and Anderson Creek	Hunting	Powell (2011)
		Lower Yaksda area	Yaksda (Wa'wais)	Historical goose rearing ponds	Powell (2011)
		C'imoca and Wohlstu Wa'wais – a traditional territory of a specific Haisla household group	Kitamaat Village area along the Wolh River and Wohlstu Creek, draining into Robinson Lake and including the highlands behind the village	Hunting	Powell (2006)
Around Kitamaat Village	Kitamaat Village area	Hunting	Powell (2011)		

First Nations Group	Species	Site Name	Geographic Description	First Nations Use	Reference
Gitga'at	Black oystercatcher murrelet species	–	–	Hunting	Marsden (2012)
	Duck (e.g., goldeneye species., loon species, mallard, scoter species, and Harlequin duck)	K'k'a'at	Douglas Channel (west side), Kitkiata River, and Kitkiata Inlet	Hunting	Marsden (2012)
	Goose (e.g., Canada goose and snow goose)	K'k'a'at	Douglas Channel (west side), Kitkiata River, and Kitkiata Inlet	Hunting	Marsden (2012)
		K'tiskos	Douglas Channel (west side) on north side of Kiskosh Inlet	Hunting	Marsden (2012)
	Gull species (e.g., glaucous-winged gull)	Kagaas and K'ak'Aas Territory	Campania Island (east side)	Egg harvesting	Marsden (2012)
		K'k'a'at	Douglas Channel (west side), Kitkiata River, and Kitkiata Inlet	Hunting	Marsden (2012)
Gitxaala	Duck species. (e.g., mallard)	–	Gurd, Goschen, Spicer, and Dolphin islands, and Banks Island (northwest side)	Hunting	Marsden (2011); Menzies (2011)
	Goose species	–	Gurd, Goschen and Dolphin islands, Banks Island (northwest side), and Pitt Island (southwest side)	Hunting	Marsden (2011); Menzies (2011)
	Scoter species	–	Rennison Island and Aristazabal Island (northwest end)	Hunting	Marsden (2011); Menzies (2011)
	Waterfowl (e.g., swans)	–	Gurd, Goschen, Spicer, and Dolphin islands, Mink Trap Bay, Otter Passage, and the smaller western coastal islands	Various	Marsden (2011); Menzies (2011)
Metlakatla	Marine bird colony, especially rhinoceros auklets	–	Lucy Islands	Various	Metlakatla Governing Council (2011)

NOTE:

- ^a Names of species, or species groups, are listed as provided in the available literature.
- No information reported

3.2.2.1 Methods

A summary of available baseline information was compiled from existing data and information resources in published literature (e.g., Campbell et al. 1990a; Horwood 1992), provincial and federal government reports and initiatives (e.g., PNCIMA 2011), and publications by or in partnership with First Nations (e.g., Metlakatla Governing Council 2011). Additional information was collated from the BC Breeding Bird Atlas (Bird Studies Canada 2013), eBird Canada (2013), and local environmental consultant reports (e.g., Morrison 2012). These sources informed the selection of key species.

3.2.2.2 Results

Important Bird Areas, Conservancies, Ecological Reserves, and Parks and Protected Areas

Marine birds extensively use coastal wetlands, and nearshore and offshore habitats, including islands, islets, estuaries, and cliffs. There are two Important Bird Areas (IBA) and one ecological reserve in and adjacent to the marine birds RSA, which have been established to help conserve and manage marine species (Table 3.2-2; Figure 3.2-1).

Provincial Parks and Conservancies

Marine and terrestrial provincial parks provide habitat for shorebirds, wading birds, waterfowl, and seabird species. Four provincial parks and 14 conservancies are located in and near the marine birds RSA (Table 3.2-3; Figure 3.2-1).

Marine Birds

Marine birds require marine and coastal habitats during a portion or all of their lifecycles (Croxall et al. 2012). They represent an important component of coastal ecosystems because of their relatively high diversity and abundance (Milko et al. 2003) and, therefore, are used as indicators of marine ecosystem health (Environment Canada 2004). Overall, 127 marine bird species have been documented among regional and local datasets within the marine birds RSA (Table 3.2-4). Presence has been confirmed for all species.

An initial marine bird survey was conducted in the marine birds RSA by Triton in June 2012. Surveys were conducted for five days, over 248.9 km along the shorelines and mid-channel of the Kitimat Arm and Douglas Channel out to Kitkiata Inlet (Morrison 2012). A total of 22 species were observed, including Leach's storm-petrel (*Oceanadroma leucorhoa*) and black oystercatcher. Black oystercatcher was observed foraging along the southern tip of Loretta Island.

Table 3.2-2: Summary of Conservation Areas in and adjacent to the Marine Bird RSA

Conservation Area	Name	Description	Size (km ²)	Marine Bird Species	Reference
IBA BC119	Kitkatla Channel, Goschen Island North to Porcher Island	Includes salt and brackish marshes, tidal rivers and estuaries, mud and sand saline flats, open sea, inlets and coastal marine features, coastal cliffs and rocky shores; assessed to be globally significant for large congregations of colonial marine birds	1,583.99	High concentrations of surf scoter and waterfowl during spring migrations	IBA Canada 2012
IBA BC122	Lucy Islands, Chatham Sound	Encompasses coniferous forest (boreal and alpine), open sea, coastal cliffs, and rocky shores; assessed to be globally significant for large congregations of colonial marine birds.	73.95	Breeding colonies of rhinoceros auklet, pigeon guillemot, black oystercatcher, and glaucous-winged gull	IBA Canada 2012
Ecological Reserve	Dewdney and Glide Islands Ecological Reserve	Several low-lying islands, islets, and reefs, rocky headlands, coves, muddy lagoons, and beaches with sand, boulder and shingle substrate	36.96	Breeding colony of Cassin's auklet and breeding site of sandhill crane; use of reserve confirmed for Canada goose, common and red-throated loon, red-breasted merganser and great blue heron	BCMOE 2003



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Table 3.2-3: Provincial Parks and Conservancies in and adjacent to the Marine Bird RSA

Conservation Area	Name
Provincial Parks	Coste Rocks Park
	Eagle Bay Provincial Park
	Foch-Gilttoyees Provincial Park
	Jesse Falls Protected Area
Conservancies	Banks Nii Luutiksm Conservancy
	Gitxaala Nii Luutiksm Kitkatla Conservancy
	K'distsausk/Turtle Point Conservancy
	K'nabiyaaxl/Ashdown Conservancy
	Ksgaxi/Stephens Island Group Conservancy
	Ktisgaldz/MacDonald Bay Conservancy
	Lax Ka'Gass/Campania Conservancy
	Lax Kwaxl/Dundas-Melville Islands Conservancy
	Lax Kwil Dziidz/Fin Conservancy
	Lucy Island Conservancy
	Maxtaksm'aa/Union Passage Conservancy
	Moksgm'ol/Chapple-Cornwall Conservancy
	Monckton Nii Luutiksm Conservancy
Stair Creek Conservancy	

Table 3.2-4: Historical Data on Marine Bird Diversity Documented in the Marine Bird RSA

Species	Marine Bird Data (No. of individuals)				
	Morrison (2012) ^a	BC Breeding Bird Atlas	eBird Canada	KVN ^b (2002–2013)	Triton (2012) ^c
Alcid species ^e	–	–	4,453	–	198
American golden-plover	–	–	–	–	3
American wigeon	–	–	137	342	–
Ancient murrelet	21	–	10	–	102
Arctic tern	–	–	–	–	2
Auklet species ^e	–	–	–	–	1
Bald eagle	31	28	49	2,888	12
Barrow's goldeneye	–	1	44	256	26
Belted kingfisher	–	2	5	115	2
Black oystercatcher	–	2	2	–	4
Black scoter	–	–	–	–	12
Black turnstone	–	–	386	–	1
Black-bellied plover	–	–	–	35	–
Black-legged kittiwake	–	–	141	–	12
Blue-winged teal	–	–	15	–	–
Bonaparte's gull	8	1	161	23	8

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 Wildlife Resources Technical Data Report
 Section 3: Marine Birds

Species	Marine Bird Data (No. of individuals)				
	Morrison (2012) ^a	BC Breeding Bird Atlas	eBird Canada	KVN ^b (2002–2013)	Triton (2012) ^c
Brandt's cormorant	–	–	2	–	10
Brant	–	–	25	44	15
Bufflehead	–	–	14	2,339	6
Buller's shearwater	–	–	4	–	–
Cackling goose	–	–	–	–	17
Californian gull	–	–	37	2	62
Canada goose	–	3	6	17,380	17
Canvasback	–	–	–	2	–
Caspian tern	–	–	1	6	3
Cassin's auklet	527	–	20	–	6
Common goldeneye	–	2	3	993	3
Common loon	47	8	98	146	123
Common merganser	5	8	76	986	19
Common murre	1	–	1,088	1,067	125
Common raven	5	9	2	1,158	2
Common tern	–	–	–	–	1
Cormorant species ^e	–	–	8	–	49
Corvid species ^e	–	5	–	–	–
Double-crested cormorant	–	–	15	–	19
Dunlin	–	–	–	276	–
Flesh-footed shearwater	–	–	1	–	1
Fork-tailed storm-petrel	–	–	109	–	21
Gadwall	–	–	–	23	–
Glaucous gull	–	–	1	–	16
Glaucous-winged gull	24	2	550	24,506	102
Great blue heron	–	5	3	499	2
Greater scaup	–	–	4	1,979	1
Greater white-fronted goose	–	–	1	1,348	–
Greater yellowlegs	–	–	1	–	–
Green-winged teal	–	–	–	966	–
Gull species ^e	27	–	4,925	–	273
Harlequin duck	161	5	53	106	27
Herring gull	–	–	298	101	114
Hooded merganser	–	1	1	81	–
Horned grebe	–	–	1	12	–
Horned puffin	–	–	–	–	1
Killdeer	–	–	–	63	–
Leach's storm-petrel	–	–	6	–	1

Species	Marine Bird Data (No. of individuals)				
	Morrison (2012) ^a	BC Breeding Bird Atlas	eBird Canada	KVN ^b (2002–2013)	Triton (2012) ^c
Least sandpiper	–	–	–	12	–
Lesser scaup	–	–	–	6	–
Lesser yellowlegs	–	–	–	18	–
Long-billed dowitcher	–	–	3	–	–
Long-tailed duck	–	–	2	10	48
Long-tailed jaeger	–	–	2	–	–
Loon species ^e	2	–	483	–	91
Mallard	2	4	9	14,153	6
Manx shearwater	–	–	1	–	–
Marbled murrelet	42	23	4,453	320	228
Mew gull	241	8	548	2,931	110
Murrelet species ^e	–	–	–	–	11
Northern fulmar	–	–	24	–	1
Northern pintail	–	–	71	976	–
Northern shoveler	–	–	–	247	1
Northwestern crow	61	9	21	4,573	13
Osprey	–	2	1	30	–
Pacific loon	5	–	587	47	59
Parasitic jaeger	–	–	2	–	1
Pectoral sandpiper	–	–	–	–	1
Pelagic cormorant	–	–	75	23	124
Peregrine falcon	–	–	1	1	–
Phalarope species ^e	–	–	308	–	–
Pied-billed grebe	–	–	1	1	–
Pigeon guillemot	76	10	45	8	72
Pink-footed shearwater	–	–	213	–	–
Pomarine jaeger	–	–	6	–	–
Red phalarope	–	–	161	–	–
Red-breasted merganser	–	–	26	18	3
Red-necked grebe	2	–	50	372	6
Red-necked phalarope	–	–	2,670	–	2
Red-throated loon	–	3	165	9	22
Rhinoceros auklet	–	1	3,769	–	226
Ring-billed gull	–	–	1	1	4
Ring-necked duck	–	–	–	469	–
Sabine's gull	–	–	–	–	3
Sanderling	–	–	1	–	1
Sandhill crane	–	2	22	1	–

Species	Marine Bird Data (No. of individuals)				
	Morrison (2012) ^a	BC Breeding Bird Atlas	eBird Canada	KVN ^b (2002–2013)	Triton (2012) ^c
Scoter species ^e	–	–	172	–	18
Semipalmated plover	–	–	–	15	–
Shearwater species ^e	–	–	–	–	49
Shorebird species ^e	–	–	8	–	7
Short-billed dowitcher	–	–	1	–	–
Short-tailed shearwater	–	–	2	–	14
Snow goose	–	–	–	908	1
Sooty shearwater	–	–	670	–	70
Spotted sandpiper	–	3	4	1	–
Surf scoter	151	–	672	34	152
Surfbird	–	–	2	–	2
Thayer's gull	–	–	54	6	21
Trumpeter swan	–	–	–	476	–
Tufted puffin	–	–	–	–	2
Tundra swan	–	–	–	257	–
Western grebe	28	–	281	130	38
Western gull	–	–	20	–	–
Western sandpiper	–	–	–	469	1
Whimbrel	–	–	9	–	–
White-fronted goose	–	–	–	–	1
White-winged scoter	202	–	60	5	66
Wilson's phalarope	–	–	–	–	2
Wilson's snipe	–	–	–	1	–
Wilson's warbler	–	–	1	–	–
Yellow-billed loon	–	–	4	–	2

NOTES:

- ^a A baseline survey of marine birds within the marine birds RSA (i.e., Kitimat Arm) conducted in spring 2012 by Triton Environmental Consultants (Morrison 2012).
- ^b Combined Christmas Bird Count and Coastal Waterbird Survey data collected by KVN.
- ^c Marine bird information gathered by Triton Environmental Consultants for LNG Canada from vessel surveys and incidental observations in eastern end of Douglas Channel.
- ^d Data sources: BC Bird Atlas (Bird Studies Canada 2013); eBird (2013); Important Bird Areas Canada [IBA: BC119 (Kitkatla Channel, Goschen Island North to Porcher Island, Prince Rupert), BC122 (Lucy Islands), BC124 (Big Bay south to Delusion Bay)]; Campbell et al. (1990a, 1990b); Horwood (1992); National Geographic (2006); McFarlane Tranquilla et al. (2007).
- ^e Individuals not identified to species
- No data reported

Species of Conservation Concern

In total, 36 species of conservation concern, with provincial or federal designations, have been documented in the marine birds RSA (Table 3.2-5). These birds include eight species protected under Schedule 1 of SARA.

Marine Bird Breeding Colonies

Numerous marine bird species use a complex of marine habitats on the BC north coast to breed. Individuals from breeding colonies in the marine birds RSA interact with populations breeding in the PNCIMA at Scott Islands, Haida Gwaii, Queen Charlotte Sound, Quatsino Sound, and Brooks Peninsula (McFarlane Tranquilla et al. 2007). At least eight colonies occur in or at the margins of the marine birds RSA (Figure 3.2-1). Breeding species include black oystercatcher, fork-tailed storm-petrel (*Oceanodroma furcata*), glaucous-winged gull, pigeon guillemot (*Cepphus columba*), Leach's storm-petrel, and other petrel species (Table 3.2-6). The rhinoceros auklet (*Cerorhinca monocerata*) and tufted puffin (*Fratercula cirrhata*) use breeding habitat adjacent to the marine birds RSA.

Table 3.2-5: Marine Bird Species of Conservation Concern in the Marine Bird RSA

Common Name	Scientific Name	Conservation Status ^a			
		BC List Status ^b	COSEWIC Status ^c	SARA Schedule ^d	CF Priority ^e
American bittern	<i>Botaurus lentiginosus</i>	Blue	–	–	2
American golden-plover	<i>Pluvialis dominica</i>	Blue	–	–	4
Ancient murrelet	<i>Synthliboramphus antiquus</i>	Blue	SC (2004)	1-SC (2006)	1
Black-footed albatross	<i>Phoebastria nigripes</i>	Blue	SC (2007)	1-SC (2009)	2
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>	Red	–	–	1
Brant	<i>Branta bernicla</i>	Blue	–	–	2
Buller's shearwater	<i>Puffinus bulleri</i>	Blue	–	–	4
Cackling goose	<i>Branta hutchinsii</i>	Blue	–	–	4
California gull	<i>Larus californicus</i>	Blue	–	–	4
Canada goose	<i>Branta canadensis occidentalis</i>	Red	–	–	2
Caspian tern	<i>Hydroprogne caspia</i>	Blue	NAR (1999)	–	2
Cassin's auklet	<i>Ptychoramphus aleuticus</i>	Blue	C (2011)	–	2
Common murre	<i>Uria aalge</i>	Red	–	–	2
Double-crested cormorant	<i>Phalacrocorax auritus</i>	Blue	NAR (1978)	–	2
Flesh-footed shearwater	<i>Puffinus carneipes</i>	Blue	–	–	4
Great blue heron	<i>Ardea herodias fannini</i>	Blue	SC (2008)	1-SC (2010)	1
Horned puffin	<i>Fratercula corniculata</i>	Red	–	–	2
Laysan albatross	<i>Phoebastria immutabilis</i>	Red	–	–	1
Long-tailed duck	<i>Clangula hyemalis</i>	Blue	–	–	2
Marbled murrelet	<i>Brachyramphus marmoratus</i>	Blue	T (2000)	1-T (2003)	1
Northern fulmar	<i>Fulmarus glacialis</i>	Red	–	–	2
Pelagic cormorant	<i>Phalacrocorax pelagicus pelagicus</i>	Red	–	–	2

Common Name	Scientific Name	Conservation Status ^a			
		BC List Status ^b	COSEWIC Status ^c	SARA Schedule ^d	CF Priority ^e
Peregrine falcon	Falco peregrinus pealie	Blue	SC (2007)	1-SC (2003)	1
Pink-footed shearwater	Puffinus creatopus	Blue	T (2004)	1-T (2005)	2
Red knot	Calidris canutus	Red	E/T (2007)	1-T (2007)	1
Red-necked phalarope	Phalaropus lobatus	Blue	C (2011)	–	2
Semipalmated sandpiper	Calidris pusilla	No Status	–	–	2
Short-billed dowitcher	Limnodromus griseus	Blue	–	–	3
Short-tailed albatross	Phoebastria albatrus	Red	T (2003)	1-T (2005)	1
Surf scoter	Melanitta perspicillata	Blue	–	–	4
Thick-billed murre	Uria lomvia	Red	–	–	2
Tufted puffin	Fratercula cirrhata	Blue	–	–	2
Tundra swan	Cygnus columbianus	Blue	–	–	4
Wandering tattler	Tringa incana	Blue	–	–	4
Western grebe	Aechmophorus occidentalis	Red	C (2011)	–	1
Yellow-billed loon	Gavia adamsii	Blue	NAR (1997)	–	3

NOTES:

^a Conservation status as of August, 2013 (BCCDC 2014)

^b BC List Status:

Red –extirpated, endangered, or threatened,

Blue –special concern

Yellow – not at risk

^c COSEWIC Status:

NAR – *not at risk*

SC –*special concern*: species sensitive to human activities or vulnerable to natural events

T – *threatened*: species likely to become endangered

E – *endangered*: species faces imminent extinction or extirpation.

C – *candidate*: species short-listed for future assessment.

^d SARA Schedule:

Species at Risk Act schedule, status (definitions the same as COSEWIC) and date of last review

^e Conservation Framework (CF) Priority:

A rank applied to species of 1 (highest) to 6 (lowest) for a set of 3 goals: 1) contribute to global efforts for species and ecosystem conservation, 2) prevent species and ecosystems from becoming extinct, and 3) maintain the diversity of native species and ecosystems

Table 3.2-6: Marine Bird Breeding Colonies in or at the Margins of the Marine Birds RSA

Island, IBA, or Location	Colony-Breeding Species
Triple Island*	glaucous-winged gull, pelagic cormorant, pigeon guillemot, cormorant species, gull species
Stephens Island*	glaucous-winged gull, pigeon guillemot, gull species
Dewdney Island (south)*	glaucous-winged gull, gull species
Dewdney Island (west)*	black oystercatcher, glaucous-winged gull, pigeon guillemot, gull species
South Estevan Sound	black oystercatcher, glaucous-winged gull, pigeon guillemot, gull species,
North Caamaño Sound	black oystercatcher, fork-tailed storm-petrel, least storm-petrel, petrel species
Rennison Island (west)*	black oystercatcher, rhinoceros auklet
Rennison Island (southwest)*	black oystercatcher

NOTES:

* Breeding colonies located adjacent (at the margins) of the marine birds RSA.

3.2.3 Key Species Selection

It is not practical to assess Project effects on every marine bird species; thus, key species are used as a focus for effects assessment. Key species presence, absence, or population well-being can provide a measure of potential Project effects on the full suite of marine birds present in the marine birds RSA. Five key species were selected to represent different marine bird groups and their associated habitat requirements or foraging strategies for the marine component of the Project (Table 3.2-7): black oystercatcher, marbled murrelet, double-crested cormorant, common goldeneye, and glaucous-winged gull. These species were selected based on the following criteria:

- presence and use of marine habitats in the marine birds LSA and RSA
- sensitivity to potential Project effects and the ability to measure the effect
- traditional and cultural importance to First Nations
- species of conservation concern
- ecological importance (e.g., value as an indicator of environmental effects for related resources or umbrella species), and
- established base of information, knowledge, or data in the region.

Black Oystercatcher

The black oystercatcher is a resident shorebird that breeds on offshore forested islands (Campbell et al. 1990b) with rocky shores and barren patches. Pairs nest singularly or in loose colonies. Rocky intertidal ecosystems throughout the marine birds RSA represent potential breeding habitats. Nest sites are confirmed on Triangle Island, the entrance to Queen Charlotte Strait, and islets near Aristazabal Island (Jacqueline Booth and Associates et al. 1998; McFarlane Tranquilla et al. 2007). Black oystercatcher have also been observed on the southern portion of Loretta Island (Morrison 2012). The BC breeding population of black oystercatcher is estimated at 1,000 pairs (Campbell et al. 1990b). They have historically been indicators of nearshore ecosystem health (Andres and Falxa 1995; McFarlane Tranquilla et al. 2007).

Marbled Murrelet

Marbled murrelet are year-round residents in the marine birds RSA. Unlike other alcids that nest colonially, marbled murrelet nest inland in mature to old-growth stands of coniferous forest. Nests have been documented primarily near sheltered inlets within 500 m of shore; however, distances of a few kilometres are more common. Marbled murrelet is listed federally as *threatened* and is provincially blue-listed. The estimated population on the BC coast is 55,000 to 78,000 individuals (McFarlane Tranquilla et al. 2007).

Double-crested Cormorant

Double-crested cormorant are common inhabitants of coastal BC. Gregarious in nature, they often roost in groups, on logs, pilings, rocks, and trees (Hatch and Weseloh 1999). The double-crested cormorant is provincially blue-listed. There are 4,000 breeding pairs in BC; however, they are unlikely to nest in the marine birds RSA (McFarlane Tranquilla et al. 2007).

Table 3.2-7: Ecological Information for Marine Bird Key Species

Species Name	Scientific Name	Regional Breeder	Abundance ^a	Seasonal presence ^b				Primary Habitat	Key Species Validation
				Spring	Summer	Fall	Winter		
Black oystercatcher	Haematopus bachmani	Yes	Y	x	x	x	x	Rocky reefs, islets, spits, lagoons, mud and gravel flats, rocky and cobble beaches, sand bars, and inlets	Breeding resident Indicator of intertidal and shoreline habitat quality Culturally important to First Nations Sensitive; obligate foraging and nesting in intertidal zones Represents other shorebirds and great blue heron foraging habitats
Marbled murrelet	Brachyramphus marmoratus	Yes, inland	Y	x	x	x	x	Exposed coastal waters, bays, inlets, lagoons, harbours, coves, inlet mouths, and shallow banks	Breeding resident Species at risk Documented sensitivity to disturbances Culturally important to First Nations Represents shallow marine foraging requisites for other seabirds, especially alcids
Double-crested cormorant	Phalacrocorax auritus	Yes	Y	x	x	x	x	Bays, inlets, harbours, estuaries, lagoons; known to roost on islets, logs, wharves, and pilings.	Breeding resident Provincial species of conservation concern Similar requirements to littoral zone, deep foraging piscivores: grebes, loons, and cormorants
Common goldeneye	Bucephala clangula	Occasionally	sWM	x	x	x	x	Wintering adults and possible sub-adult moulting population. Uses bays, harbours, estuaries, lagoons, lakes, shallow waters adjacent to beaches and spits; occasionally ponds, rivers and creeks.	Resides in shallow coastal bays, estuaries (e.g., Kitimat River estuary) and harbours Traditional use by coastal First Nations Spring and fall migrant, and winter resident Similar requirement to other foragers of nearshore benthic invertebrates
Glaucous-	Larus	Yes	Y	x	x	x	x	Present in bays, estuaries, harbours, rivers, sheltered	Breeding resident

Species Name	Scientific Name	Regional Breeder	Abundance ^a	Seasonal presence ^{b*}				Primary Habitat	Key Species Validation
				Spring	Summer	Fall	Winter		
winged gull	glaucescens							waters, urban developments, and roosts in a variety of coastal habitats including small offshore islands	Traditionally important (i.e., egg harvesting) for coastal First Nations Abundant; a generalist in natural and disturbed environments Established baseline of biology, population abundance, and distribution Similar requirements to a wide range of marine birds including other gulls, jaegers and terns

NOTES:

^aAbundance: uppercase letter = common, very common, or abundant; lowercase letter = rare, scarce, uncommon, scattered, and sporadic

Y = present all year
 s = Summer = June 1 to Aug. 31
 W = Winter = Dec. 1 to Feb. 28
 M = Migratory:
 Spring = Mar. 1 to May 31
 Fall = Sept. 1 to Nov. 30

^bx = present

Common Goldeneye

Common goldeneye are abundant migrants and overwinter in large mixed-species flocks of Barrow's goldeneye (*Bucephala islandica*) and scoters that forage together in large rafts in nearshore areas. They primarily breed inland, although they have occasionally been observed breeding on the coast (Campbell et al. 1990a). The estimated population in BC varies between 2,400 and 5,000 individuals (Campbell et al. 1990a). Horwood (1992) notes common goldeneye is very common in the local area.

Glaucous-winged Gull

Glaucous-winged gull are abundant colonial breeders and are ubiquitous in the region. An estimated 25,000 breeding pairs occur in BC (Campbell et al. 1990b), and the PNCIMA supports an estimated 31% of the Canadian population (McFarlane Tranquilla et al. 2007). Breeding sites in the region include Kingsway Rock, and Low, East Skedans, Cumshewa, and Lost islands (McFarlane Tranquilla et al. 2007). Generally a coastal or inshore species, glaucous-winged gull has been observed offshore near fishing vessels (Hayward and Verbeek 2008). This species is an important resource for traditional egg harvesting (Section 3.1.2).

3.2.4 Discussion

A variety of habitats in the marine birds RSA are recognized as important foraging, nesting, and molting habitat for a diversity of marine bird species (Campbell et al. 1990a), such as Kitimat River estuary, and Lucy and Triple islands. Historically, at least 130 marine bird species have been confirmed using the marine birds RSA, including 8 species listed under SARA as *threatened* or of *special concern*, and 36 species are red- or blue-listed in BC.

Marine birds are important traditional resources for coastal First Nations residing in the marine birds RSA. Traditional uses are for food, cultural, spiritual, and feasting, as well as for comfort (e.g., the collection of down feathers and other materials).

Five key species were selected to assess the potential effects of the Project on marine birds: black oystercatcher, marbled murrelet, double-crested cormorant, common goldeneye, and glaucous-winged gull. These species represent ecological guilds within the broad range of marine bird groups and associated habitats in the marine birds RSA. Criteria to select the species included presence and use of habitats in the marine birds RSA, sensitivity to disturbance, importance to First Nations, conservation status, ecological importance, and availability of baseline information.

Information on marine bird distribution and abundance was limited; for example, data were available for Kitimat and Prince Rupert areas (Bird Studies Canada 2013) and the IBAs in or adjacent to the marine birds RSA, but were very limited for Principe, Squally, and Whale channels. Additional field-based survey programs were required to address information gaps on the current status of marine bird diversity, distribution, and abundance in the marine birds RSA.

3.3 Field Studies

A field program was conducted to supplement existing baseline on diversity, distribution, and abundance of marine birds in the marine birds LSA and RSA. Surveys were conducted from January to August and October of 2013.

3.3.1 Vessel-based Surveys

Vessel-based surveys conducted in the marine birds RSA were based on the survey design and protocol provided in regulatory inventory standards (see Gjerdrum et al. 2012; RIC 1997a, 1997b).

3.3.1.1 Methods

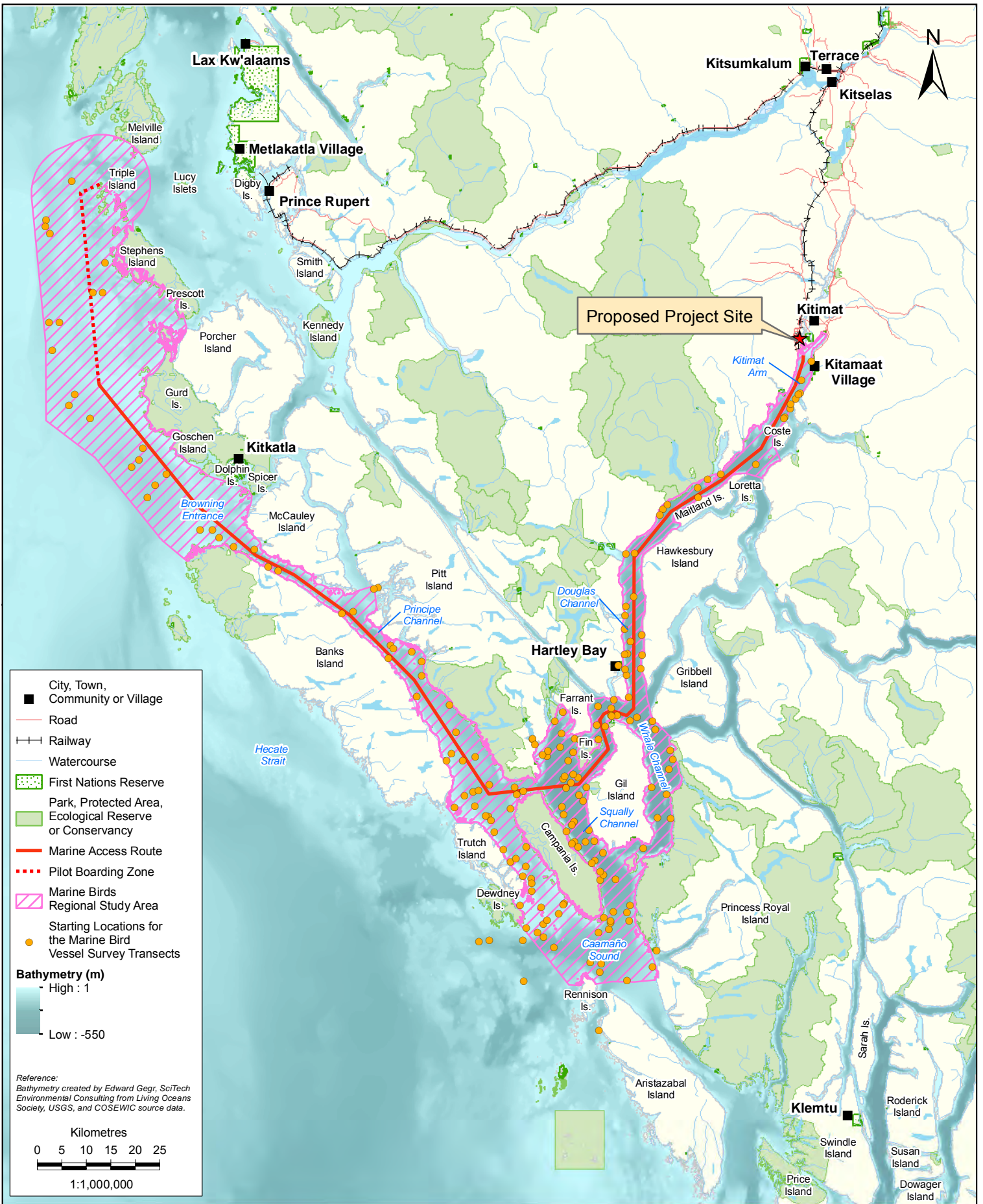
Marine bird surveys were conducted as a component of the marine mammal survey program that began in January 2013. Eleven vessel-based surveys, each lasting 10 to 14 days, were conducted during 2013: one in winter, two in spring, six in summer, and two in fall. The surveys were timed to document seasonal variation in marine bird distribution and abundance, including key species. The size of the area covered was considered sufficient to increase the likelihood of detection. Observation intervals were scheduled daily during three periods: morning (0930), midday (1130), and afternoon (1430), consisting of one transect survey of 9 to 30 minutes in duration, depending on weather, marine mammal activity, and visibility. Intervals per day totaled approximately 60 minutes, depending on weather conditions.

The survey area included Kitimat Arm, Douglas Channel, Whale Channel, Squally Channel, Caamaño Sound, Estevan Sound, Principe Channel, and Browning Entrance north to Triple Island (Figure 3.1-2). The surveys were completed along a transect during which efforts focused on identifying and recording birds at sea. Transect start locations were geo-referenced (Figure 3.3-1) and random, given the position of the vessel in the marine birds RSA at the time of day the scheduled survey was to take place and the direction the vessel was moving at that time. In this way, there was a representative sampling of marine habitat in the marine birds RSA.

During each transect, the trained observers faced forward, continuously scanning within an 180° arc from port (left) to starboard (right) side (Figure 3.3-2). The transect width was approximately 300 m, extending 150 m from each side of the vessel. Binoculars were used to identify birds to species and to document plumage status, sex, and behaviour, when possible. Seabird plumage varies with age and seasons so observers are trained to identify species adults and fledglings, or by breeding or alternate plumage. A digital data logger (GETAC) was used to record all observations, which were later transcribed to spatial data and electronic spreadsheets.

Bird Observations

Transects were continuously scanned by eye, with birds recorded in the air and on the water. Regular scans ahead of the boat were undertaken to observe birds diving or flushing as the vessel approached. Birds that dove, or were flushed from the surface, were recorded as “on water” with the direction of flight. The snapshot method was used to estimate large groups both in flight and on the water.



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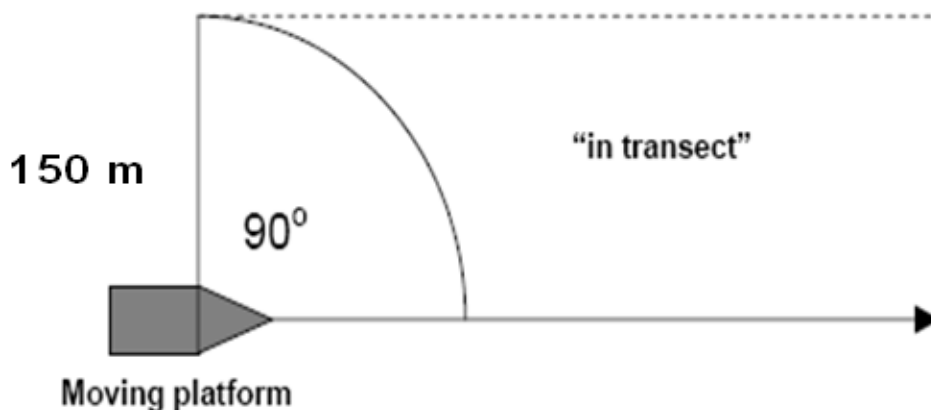
WILDLIFE TECHNICAL DATA REPORT

STARTING LOCATIONS FOR MARINE BIRD VESSEL SURVEY

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	3.3-1

8/8/2014 - 10:02:06 AM



NOTE: Observers scanned 90° from each side of a moving vessel out to 150 m

Figure 3.3-2: Survey Protocol for Vessel-based Marine Bird Surveys

Weather

Weather conditions were recorded in 30-minute intervals throughout the day, or when there was a marked change in conditions. Weather variables included date, time, location, air temperature, wind speed, wind direction, sea state, visibility, cloud cover, and precipitation. Marine bird surveys were not conducted during periods of poor visibility (i.e., entire 300 m scan width was not visible), dense fog, heavy precipitation, sea state greater than 3 on the Beaufort Scale (wind speeds 20 km/h to 28 km/h or more, moderate waves, possible spray), or acute sun glare. The Beaufort Scale is an empirical measure relating wind speed to observed conditions at sea or on land (Environment Canada 2011).

3.3.1.2 Results

Vessel-based surveys occurred during 118 days and covered 15,258 km (Table 3.3-1) travelled over all four seasons: January 31 to February 20 (2,140km), March 26 to April 24 (3,069 km), June 1 to August 27 (7,483 km), and October 2 to 29 (2,566 km), 2013.

Table 3.3-1: Survey Effort for Marine Bird Vessel Surveys in the Marine Birds RSA in 2013

Season*	Date	Distance (km)	No. Days	Survey time (min)	Comments
Winter	Jan. 31 to Feb. 11	1,187	8	254	Incidental data only
	Feb. 10 to 20	953	8	240	
Spring	Mar. 26 to Apr. 4	1,369	7	488	
	Apr. 8 to 24	1,700	11	290	
Summer	June 1 to 13	1,226	10	702	
	June 14 to 25	1,345	10	–	Incidental data only
	July 2 to 12	1,256	11	304	
	July 17 to 27	1,381	11	506	

Season*	Date	Distance (km)	No. Days	Survey time (min)	Comments
	Aug. 2 to 10	943	9	440	
	Aug. 16 to 27	1,332	12	736	
Fall	Oct. 2 to 13	1,199	10	462	
	Oct. 18 to 29	1,367	11	775	
Total		15,258	118	5,197	

NOTE:

* Season: winter (December 1 – February 28), spring (March 1 – May 31), summer (June 1 – August 31), fall (September 1 – November 30 (Campbell et al. 1990b)).
– Formal survey not completed; incidental data collected

Weather conditions during the marine bird surveys were typically fair to good. The sea state was frequently a light breeze with small wavelets (Beaufort Scale 2). Precipitation was rare and visibility was generally greater than 10 km. Lower wind speeds and calmer seas were typical in the sheltered and confined waterways of Douglas, Whale, Squally, and Principe channels. Larger, rougher seas were encountered in the more open waters of Caamaño Sound, Hecate Strait, and Browning Entrance.

A total of 9,401 individuals of at least 50 species were detected during the vessel surveys (Table 3.3-2). The four most common species accounted for 41% of observations including rhinoceros auklet (12%), sooty shearwater (*Puffinus griseus*) (12%), surf scoter (10%), and ancient murrelet (7%). Less common species detected (only observed once) were black scoter (*Melanitta americana*), Brant (*Branta bernicla*), tufted puffin, flesh-footed shearwater (*Puffinus carneipess*), yellow-billed loon (*Gavia adamsii*), and pomarine jaeger (*Stercorarius pomarinus*).

Table 3.3-2: Number of Marine Bird Species Observed During Vessel-based Surveys

Species	Jan. 31–Feb. 11, 2013	Feb. 10–20, 2013	Mar. 26–Apr. 4, 2013	Apr. 8–24, 2013	June 2–12, 2013	June 15–25, 2013	Jul. 2–12, 2013	Jul. 17–27, 2013	Aug. 2–10, 2013	Aug. 16–27, 2013	Oct. 2–13, 2013	Oct. 18–29, 2013	Total
Alcid species ^a	9	–	–	–	1	43	–	1	–	3	–	2	59
Ancient murrelet	–	5	501	30	53	2	23	2	–	4	–	–	620
Bald eagle	2	13	2	2	8	20	1	2	1	2	–	2	55
Barrow's goldeneye	–	30	–	16	–	–	–	–	–	–	–	–	46
Belted kingfisher	–	–	9	–	–	–	–	–	–	–	–	–	9
Black oystercatcher	–	–	–	–	–	2	1	–	–	–	–	–	3
Black scoter	–	–	–	–	–	1	–	–	–	–	–	–	1
Black turnstone	–	–	–	–	–	–	–	–	–	118	–	–	118
Bonaparte's gull	–	–	–	–	–	–	–	1	–	1	8	–	10
Brant	–	–	–	1	–	–	–	–	–	–	–	–	1
Bufflehead	–	2	–	–	–	–	–	–	–	–	–	–	2

LNG Canada Export Terminal
Wildlife Resources Technical Data Report
Section 3: Marine Birds

Species	Jan. 31–Feb. 11, 2013	Feb. 10–20, 2013	Mar. 26–Apr. 4, 2013	Apr. 8–24, 2013	June 2–12, 2013	June 15–25, 2013	Jul. 2–12, 2013	Jul. 17–27, 2013	Aug. 2–10, 2013	Aug. 16–27, 2013	Oct. 2–13, 2013	Oct. 18–29, 2013	Total
Cackling goose	–	–	–	50	–	–	–	–	–	–	–	–	50
California gull	–	–	–	–	–	2	2	13	12	45	–	5	79
Canada goose	–	–	–	–	–	–	–	–	–	–	–	225	225
Cassin's auklet	–	1	–	–	–	–	4	1	–	6	–	–	12
Common loon	–	13	91	13	9	9	–	–	–	2	1	2	140
Common merganser	–	33	3	–	–	–	–	–	–	5	–	–	41
Common murre	8	20	5	7	4	2	6	10	8	11	149	376	606
Common raven	–	–	–	–	–	2	–	–	–	–	–	–	2
Cormorant species ^a	7	2	–	–	–	2	–	–	–	–	5	–	16
Double-crested cormorant	1	1	2	2	–	–	–	–	–	1	8	2	17
Duck species ^a	–	–	4	–	–	3	–	–	–	–	–	15	22
Flesh-footed shearwater	–	–	–	1	–	–	–	–	–	–	–	–	1
Fork-tailed storm-petrel	–	–	–	–	2	1	182	3	1	13	7	–	209
Glaucous gull	–	–	7	1	–	–	3	–	–	–	–	24	35
Glaucous-winged gull	2	73	–	3	2	1	9	4	36	9	–	7	146
Goldeneye species ^a	–	–	–	–	–	–	–	–	–	–	–	5	5
Goose species ^a	–	–	–	–	5	–	–	–	–	–	–	–	5
Gull species ^a	88	22	236	1	3	45	–	93	–	44	120	491	1,143
Harlequin duck	–	9	–	–	–	–	–	–	–	–	–	–	9
Herring gull	38	2	26	7	2	–	1	–	85	12	1	41	215
Leach's storm-petrel	–	–	–	–	–	–	2	–	–	–	–	–	2
Long-tailed duck	1	6	–	130	–	–	–	–	–	–	–	–	137
Loon species ^a	–	1	–	–	–	7	–	–	–	2	2	22	34
Mallard	–	–	–	–	–	2	–	–	–	–	–	–	2
Marbled murrelet	–	18	12	27	9	58	21	10	7	5	37	18	222
Mew gull	–	29	–	6	1	7	–	1	–	2	–	–	46
Murrelet species ^a	–	–	2	–	–	4	–	–	1	–	–	–	7
Northern fulmar	–	–	–	–	–	–	2	–	–	–	3	–	5
Northwestern crow	–	29	–	–	1	6	1	–	–	–	–	–	37

Species	Jan. 31–Feb. 11, 2013	Feb. 10–20, 2013	Mar. 26–Apr. 4, 2013	Apr. 8–24, 2013	June 2–12, 2013	June 15–25, 2013	Jul. 2–12, 2013	Jul. 17–27, 2013	Aug. 2–10, 2013	Aug. 16–27, 2013	Oct. 2–13, 2013	Oct. 18–29, 2013	Total
Pacific loon	–	–	–	–	15	3	6	7	3	2	42	140	218
Pelagic cormorant	15	17	12	3	–	–	–	–	–	–	1	37	85
Phalarope species ^a	–	–	–	–	–	–	–	–	10	–	–	–	10
Pigeon guillemot	16	–	–	11	4	4	3	2	1	–	–	–	41
Pomarine jaeger	–	–	–	–	–	–	1	–	–	–	–	–	1
Red phalarope	–	–	–	1	6	–	–	–	–	–	–	–	7
Red-necked grebe	–	–	2	–	4	–	–	–	–	–	–	7	13
Red-necked phalarope	–	–	–	–	–	–	174	136	20	224	3	1	558
Rhinoceros auklet	–	1	5	14	37	34	29	423	29	601	–	–	1,173
Sanderling	–	–	–	–	–	–	–	25	–	–	–	–	25
Scoter species ^a	–	–	–	–	–	8	–	–	–	–	10	–	18
Shearwater species ^a	–	–	–	–	–	5	–	–	–	–	–	–	5
Shorebird species ^a	–	–	–	–	–	–	–	154	–	–	–	5	159
Short-tailed shearwater	–	–	–	205	–	–	–	–	–	–	–	–	205
Sooty shearwater	–	–	–	–	9	53	697	135	–	38	48	152	1,132
Storm-petrel species ^a	–	–	–	–	–	–	–	–	–	–	–	1	1
Surf scoter	84	578	115	97	9	–	1	–	–	4	23	27	938
Surfbird	–	70	–	–	–	–	–	–	–	–	–	–	70
Thayer's gull	–	1	–	1	–	–	1	–	–	1	–	–	4
Tufted puffin	–	–	–	1	–	–	–	–	–	–	–	–	1
Western grebe	–	–	2	266	1	–	–	–	–	–	1	5	275
White-winged scoter	–	6	3	8	27	–	–	12	–	4	3	4	67
Yellow-billed loon	–	–	–	1	–	–	–	–	–	–	–	–	1
Total	271	982	1,037	907	212	326	1,170	1,035	214	1,159	472	1,616	9,401

NOTES:

Marine bird data were collected by trained observers during structured observation periods within 150 m radius of the vessel.

^a Individuals not identified to species

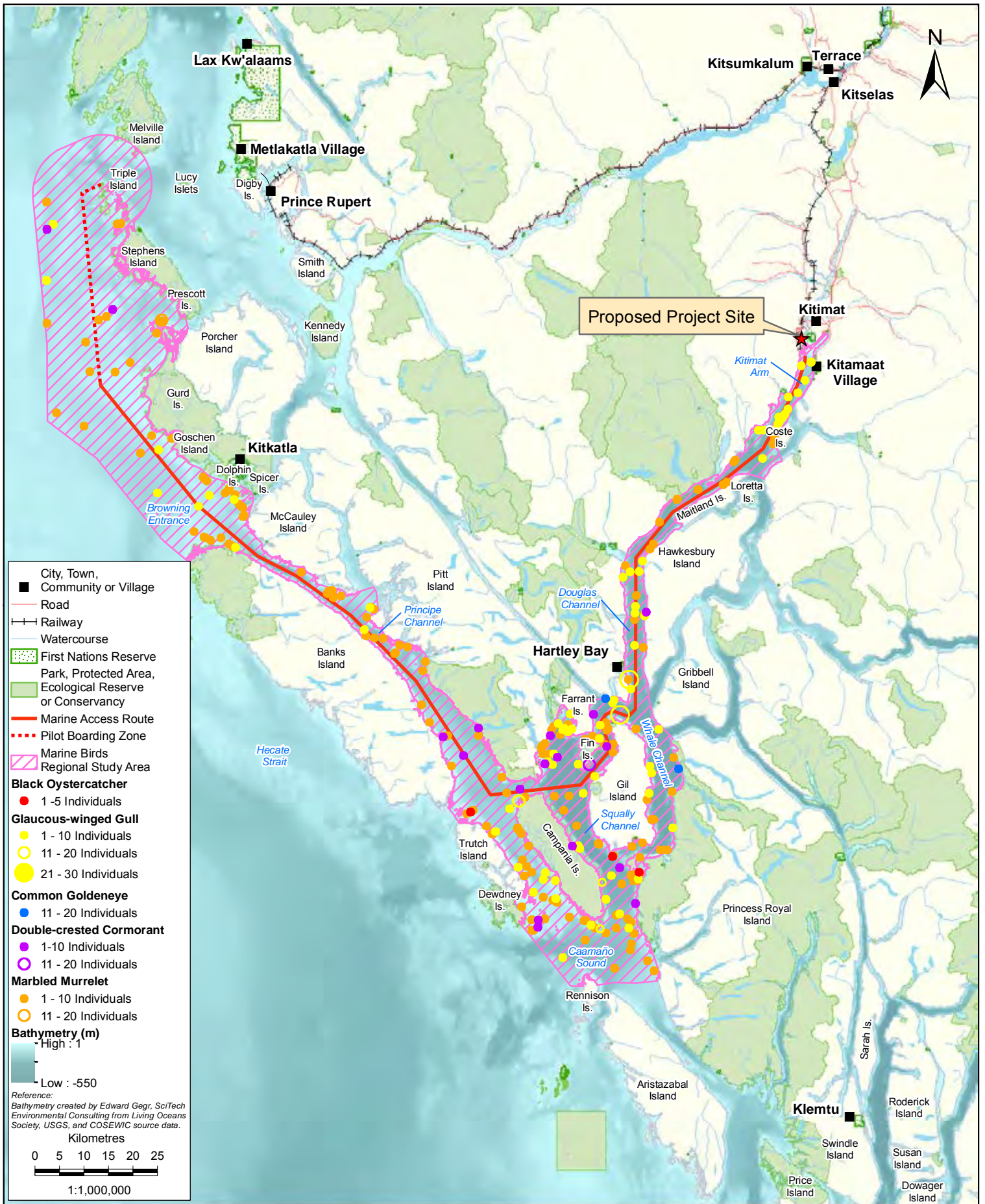
– species not recorded

Four of the five key species were recorded during vessel-based surveys (Figure 3.3-3): black oystercatcher, marbled murrelet, double-crested cormorant, and glaucous-winged gull. Common goldeneye was not detected. Examples of other bird species observed are provided in Photo 3.3-1 to Photo 3.3-6.

Of the 50 species observed, 2 were SARA-listed (ancient murrelet and marbled murrelet; Figure 3.3-4), 4 were provincially red-listed (common murre, northern fulmar [*Fulmarus glacialis*], pelagic cormorant, and western grebe [*Aechmophorus occidentalis*]; possibly a fifth [Canada goose, *occidentalis* subspecies] although a clear identification could not be confirmed), and 13 were provincially blue-listed:

- ancient murrelet (Photo 3.3-1)
- Brant
- cackling goose (*Branta hutchinsii*)
- California gull
- Cassin's auklet
- double-crested cormorant (Photo 3.3-2)
- flesh-footed shearwater
- long-tailed duck (*Clangula hyemalis*)
- marbled murrelet
- red-necked phalarope (*Phalaropus lobatus*) (Photo 3.3-3)
- surf scoter (Photo 3.3-6)
- tufted puffin, and
- yellow-billed loon.

The distribution of ancient murrelet and marbled murrelet (SARA, Schedule 1) observed is shown in Figure 3.3-3.



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WILDLIFE TECHNICAL DATA REPORT
**KEY SPECIES OBSERVED
 IIN THE MARINE BIRDS RSA**
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	3.3-3

8/8/2014 - 10:06:59 AM



Photo 3.3-1: Ancient Murrelet Adult and Chicks Foraging



Photo 3.3-2: Double-crested Cormorant Roosting on Islet



Photo 3.3-3: Red-necked Phalarope Flying over Open Water



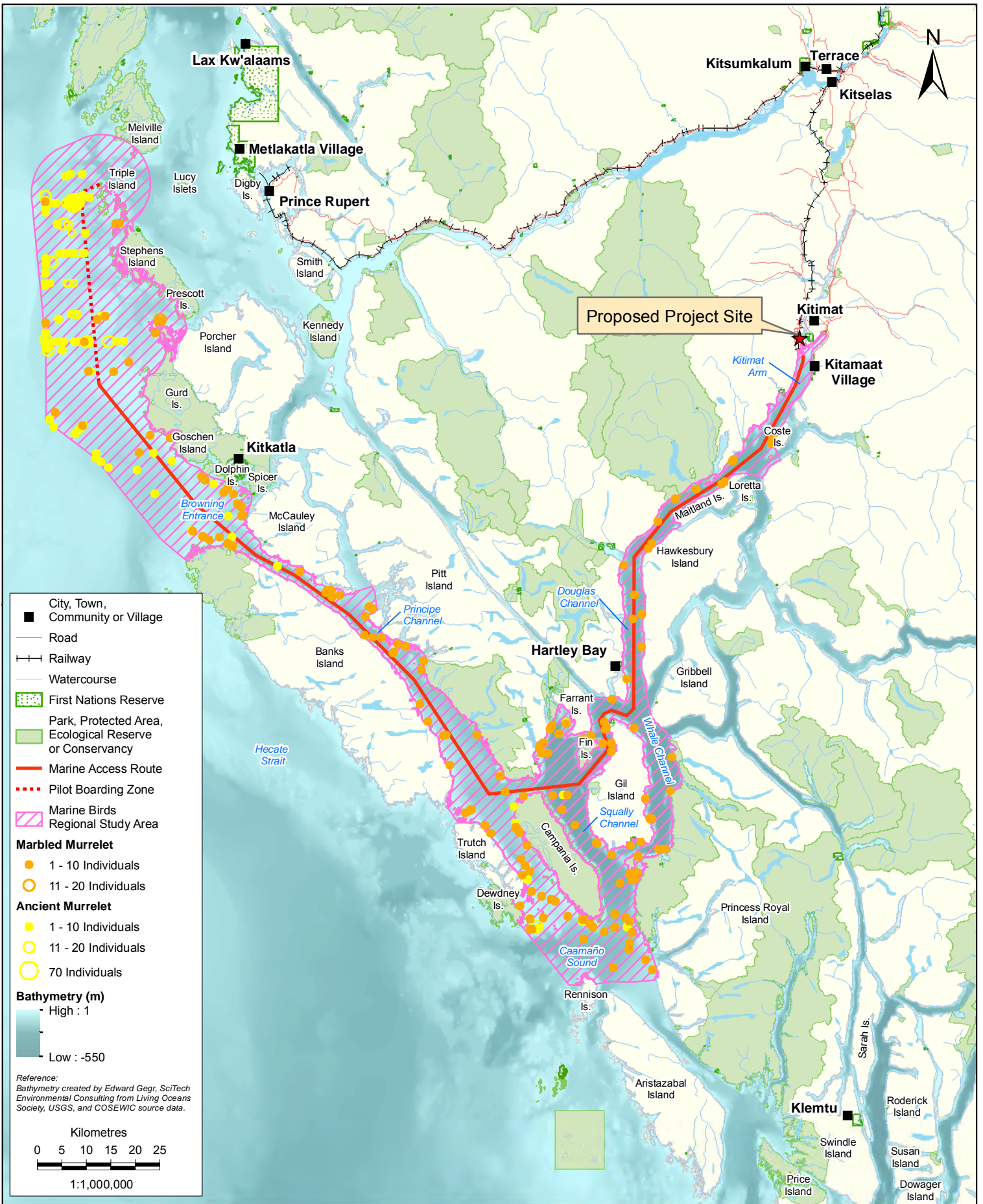
Photo 3.3-4: Short-tailed Shearwater Taking Flight



Photo 3.3-5: Bonaparte's Gull Feeding on Small Fish



Photo 3.3-6: Surf Scoter Flushing during Boat Survey



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WILDLIFE TECHNICAL DATA REPORT

SPECIES AT RISK OBSERVED IN THE MARINE BIRD RSA

LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SHS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-AUG-14	FIGURE NO.	3.3-4

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3.3.1.3 Species Richness

The species richness curve (Figure 3.3-5) represents the cumulative number of species observed over the total vessel sampling effort, including incidental sightings; shown are total survey days across four seasons (128 days). The curve approaches an asymptote at approximately 90 days, indicating sampling effort is sufficient to assess total species richness in the marine birds RSA.

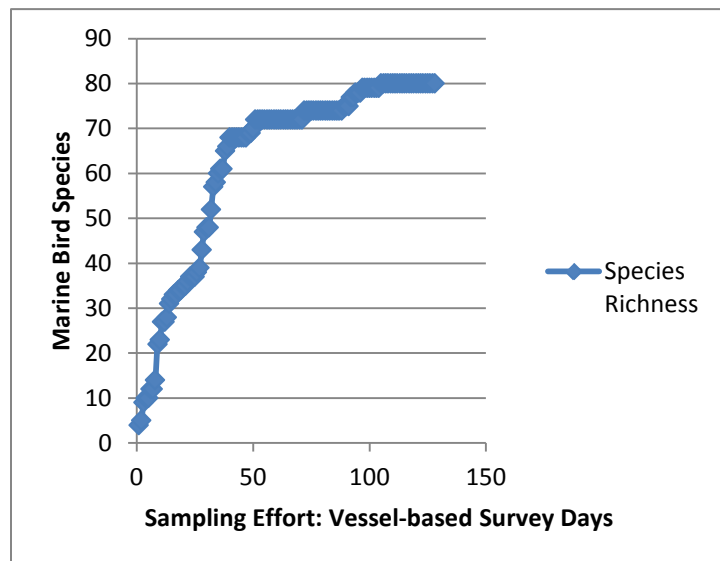


Figure 3.3-5: Marine Bird Species Richness Accumulation Curve

3.3.1.4 Key Species Correlation Analysis

Correlation analyses were conducted on marine bird observations that were recorded “on transect” or within 150 m of the vessel during survey intervals. This statistical technique, using Spearman’s rank with adjusted p values for multiple testing), shows whether, and how strongly pairs of variables are related. In other words, this statistical technique determines the extent to which changes in the value of an attribute (e.g., the number of observations of one species) are associated with changes in another attribute (e.g., number of observations of another species). This analysis can lead to a better understanding of the dataset and local bird populations.

The objective of the key species correlation analyses was to investigate the associations between selected key species and other marine bird species that they represent, and that were observed during surveys throughout the marine birds RSA. The results of a preliminary analysis showed that very few correlations among species were identified and all identified correlations were positive (Table 3.3-3). In the first correlation analysis, there were repeated tests (across all species) of relationships between a key species and one other species. The second analysis tested observations where at least one key species or other species was seen; that is, transects were excluded where neither species were observed

(Table 3.3-4). This analysis produced many results where one species was seen and the other was not. In the third analysis, only cases where the key species were observed were included (Table 3.3-5). Relationships were observed only for black oystercatcher.

Table 3.3-3: All Species in All Observations

Key Species	N species correlated	N species not correlated	N positive	N negative
Black oystercatcher	11	78	11	0
Marbled murrelet	0	89	0	0
Double-crested cormorant	2	87	2	0
Common goldeneye	4	85	4	0
Glaucous-winged gull	1	88	1	0

Table 3.3-4: A Key Species and One Other Species is Present in All Observations

Key Species	N species correlated	N species not correlated	N positive	N negative
Black oystercatcher	54	35	0	54
Marbled murrelet	36	53	0	36
Double-crested cormorant	85	4	4	81
Common goldeneye	85	4	1	84
Glaucous-winged gull	83	6	0	83

Table 3.3-5: At Least One of the Key Species, or the Other Species, or Both Were Present in Observations

Key Species	N species correlated	N species not correlated	N positive	N negative
Black oystercatcher	7	82	7	0
Marbled murrelet	0	89	0	0
Double-crested cormorant	0	89	0	0
Common goldeneye	0	89	0	0
Glaucous-winged gull	0	89	0	0

These preliminary results should not be taken to indicate a broad lack of association between key species and other species. They only indicate a lack of relationship among these species within this dataset. The lack of association is largely because the survey was not designed explicitly to test for relationships between individual key species and other species.

3.3.2 Stationary Point Surveys

Stationary point surveys were conducted to document use of the marine terminal area and Kitimat River estuary by migrating and overwintering waterbirds (i.e., marine birds, waterfowl, wading birds, and shorebirds).

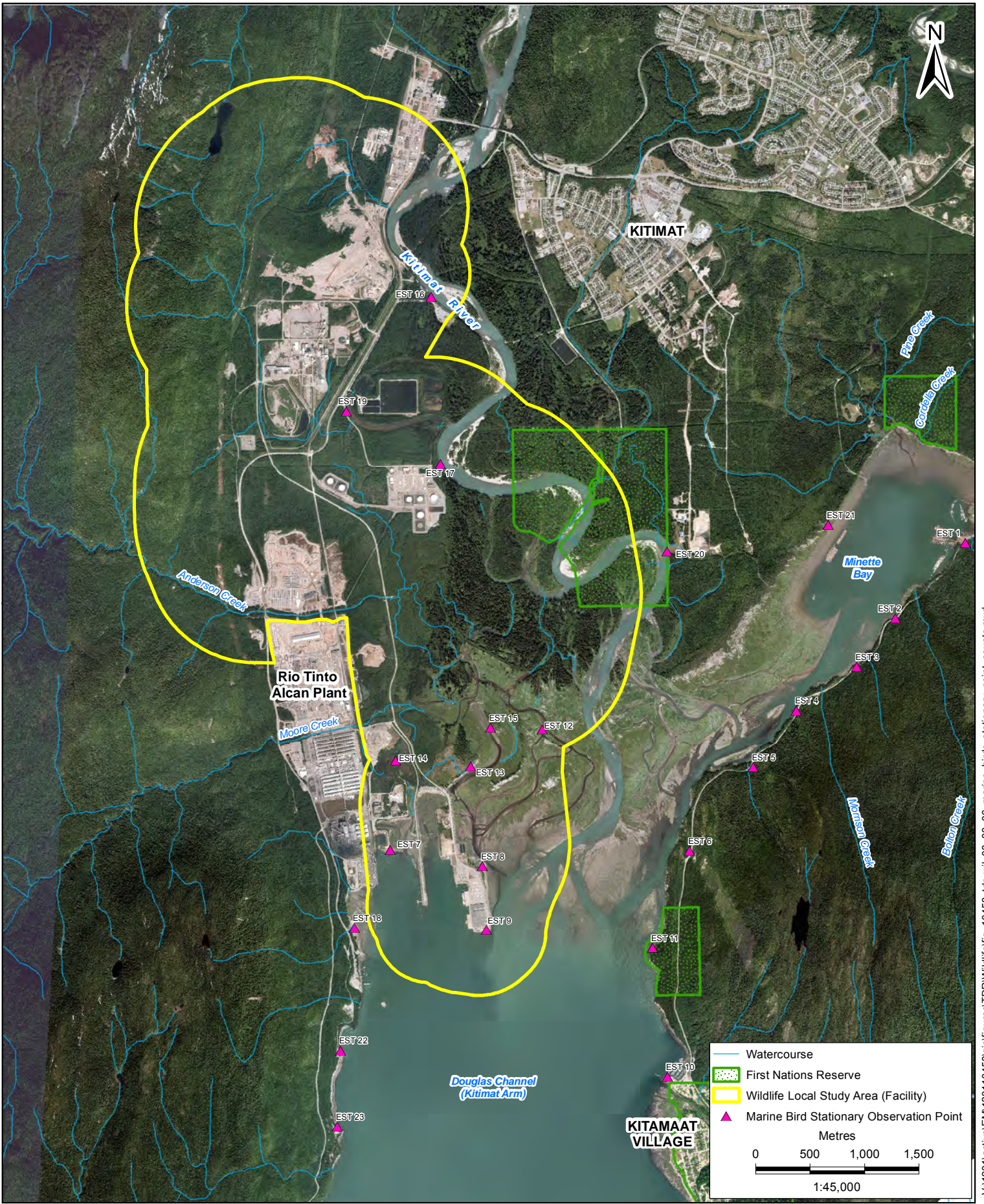
3.3.2.1 Methods

The stationary point survey methods were developed based on RIC (1997a, 1997b), where applicable. There were 23 stations located throughout the Kitimat River estuary, including in the terrestrial wildlife LSA, at sites that afforded an unobstructed view of suitable coastal habitat (Figure 3.3-6). In addition, vessel surveys were conducted in Kitimat River and Minette Bay to capture intertidal and near shore species.

Stationary surveys were conducted during daylight hours. Time, location (GPS coordinates), and weather (temperature, wind [Beaufort Scale], cloud cover, cloud ceiling, and precipitation) were recorded. Surveys were not conducted during high winds (greater than 15 km/h) or moderate to heavy precipitation. Four observers, including two First Nations field assistants, conducted 20-minute surveys at each station, identifying birds using binoculars, a spotting scope, and unaided visual scans. Observers recorded the estimated distance of each bird from the station, flight direction, and sex and maturity of the bird(s), where possible.

3.3.2.2 Results

Surveys, accumulating 1,718 minutes, were conducted in 2012 and 2013 at stationary points (Figure 3.3-6). Twenty-one stations were surveyed in the fall during August and September 2012 for a total of 735 minutes; 22 stations were surveyed in winter during January 2013 for a total of 406 minutes; and 18 stations were surveyed in spring during April and May 2013 for a total of 577 minutes of survey effort.



	Watercourse
	First Nations Reserve
	Wildlife Local Study Area (Facility)
	Marine Bird Stationary Observation Point

Metres

0 500 1,000 1,500

1:45,000



WILDLIFE TECHNICAL DATA REPORT

MARINE BIRD STATIONARY OBSERVATION POINTS

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	28-MAY-14	FIGURE NO.	3.3-6

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In total, 5,178 individuals of 53 species were observed during stationary counts (Table 3.3-6). The three most common species accounted for 30% of observations: Canada goose (11%), western sandpiper (10%), and mallard (9%). Less-common species included merlin, least sandpiper (*Calidris minutilla*), Pacific loon (*Gavia pacifica*), peregrine falcon, pigeon guillemot, rock sandpiper (*Calidris pilocnemis*), western grebe, and Wilson's snipe (*Gallinago delicata*). The highest diversity of species was observed in the fall and spring (38 species), while the lowest was observed in winter (24 species).

The highest numbers were detected in spring (3,331 individuals), followed by fall (1,401 individuals), and winter (446 individuals). The higher abundance observed in spring and fall is likely attributable to seasonal migration. The highest observations in spring were of Canada goose (14%), western sandpiper (14%), greater white-fronted goose (9%), and mallard (8%). In winter, the highest numbers were of mallard (33%), Canada goose (16%), mew gull (*Larus canus*) (13%), and greater white-fronted goose (13%). The most observations in fall were of herring gull (19%), California gull (18%), mew gull (9%), and common merganser (*Mergus merganser*) (8%).

Table 3.3-6: Number of Marine Bird Species Observed during Stationary Point Surveys

Species	Fall	Winter	Spring	Total No. of Individuals
	Aug. 31–Sept. 3, 2012	Jan. 28–Jan. 30, 2013	Apr. 29–May 2, 2013	
American wigeon	73	1	132	206
Bald eagle	17	14	41	72
Barrow's goldeneye	–	1	64	65
Belted kingfisher	4	1	1	6
Black turnstone	13	–	–	13
Bonaparte's gull	–	2	34	36
Bufflehead	–	19	27	46
California gull	70	187	132	389
Canada goose	2	70	472	544
Common goldeneye	6	1	–	7
Common loon	2	1	7	10
Common merganser	112	8	9	129
Common raven	2	8	7	17
Cormorant species ^a	1	–	–	1
Dowitcher species ^a	–	–	15	15
Duck species ^a	49	–	–	49
Dunlin	–	–	204	204
Gadwall	37	–	–	37
Glaucous-winged gull	2	43	2	47
Goldeneye species ^a	–	–	4	4
Goose species ^a	50	–	–	50
Great blue heron	10	–	4	14
Greater scaup	–	–	24	24
Greater white-fronted goose	–	–	282	282

Species	Fall	Winter	Spring	Total No. of Individuals
	Aug. 31–Sept. 3, 2012	Jan. 28–Jan. 30, 2013	Apr. 29–May 2, 2013	
Green-winged teal	9	1	236	246
Gull species ^a	20	18	162	200
Harlequin duck	–	–	6	6
Herring gull	263	6	178	447
Hooded merganser	4	1	–	5
Least sandpiper	2	–	–	2
Mallard	89	145	254	488
Marbled murrelet	3	1	26	30
Merlin	1	–	–	1
Mew gull	128	59	12	199
Northern harrier	1	–	5	6
Northern pintail	42	–	23	65
Northern shoveler	1	–	46	47
Northwestern crow	15	35	31	81
Osprey	4	–	2	6
Pacific golden-plover	–	–	11	11
Pacific loon	1	–	–	1
Peregrine falcon	1	–	–	1
Pigeon guillemot	–	–	2	2
Red-breasted merganser	–	4	–	4
Red-necked grebe	13	–	2	15
Ring-billed gull	3	–	–	3
Rock sandpiper	–	–	1	1
Sanderling	7	–	20	27
Scaup species ^a	8	–	6	14
Scoter species ^a	25	–	–	25
Shorebird species ^a	3	–	120	123
Short-billed dowitcher	3	–	1	4
Snow goose	–	–	84	84
Spotted sandpiper	9	–	–	9
Surf scoter	47	–	50	97
Thayer's gull	1	3	–	4
Trumpeter swan	–	6	101	107
Wandering tattler	–	–	20	20
Western grebe	1	–	–	1
Western sandpiper	54	–	470	524
White-winged scoter	4	–	–	4

Species	Fall	Winter	Spring	Total No. of Individuals
	Aug. 31–Sept. 3, 2012	Jan. 28–Jan. 30, 2013	Apr. 29–May 2, 2013	
Wilson's snipe	–	–	1	1
Total	1,403	446	3,331	5,178

NOTE:

– Species not recorded.

^a Individuals were not identified to species.

In general, the most individuals and highest species richness were recorded at stations located on the eastern shore at the south entrance to Minette Bay (e.g., EST 3 and EST 4), and the Rio Tinto Alcan terminal (EST 8) (Appendix J). The highest numbers of individuals were recorded at stations EST3, EST8, EST4, and EST21, whereas species richness was highest at EST18, EST4, EST15, and EST10.

Of the 53 species observed, three are SARA-listed (great blue heron, marbled murrelet, and peregrine falcon), two are provincially red-listed (Canada goose, *occidentalis* subspecies, and western grebe), and seven are provincially blue-listed (California gull, great blue heron, marbled murrelet, peregrine falcon, short-billed dowitcher [*Limnodromus griseus*], surf scoter, and wandering tattler [*Tringa incana*]).

Incidental marine bird observations were recorded throughout the marine birds RSA outside of structured vessel-based and stationary point surveys, or while traveling between stations. A total of 83,692 individuals from 83 species were recorded (Table 3.3-7).

Seventeen species were detected incidentally that were not recorded during formal surveys:

- American golden-plover (*Pluvialis dominica*)
- Arctic tern
- black-legged kittiwake
- Brandt's cormorant (*Phalacrocorax penicillatus*)
- canvasback
- Caspian tern
- common tern
- horned grebe
- horned puffin (*Fratercula corniculata*)
- killdeer
- parasitic jaeger
- pectoral sandpiper
- Pink-footed shearwater (*Puffinus creatopus*)
- red-throated loon
- Sabine's gull
- sandhill crane
- Wilson's phalarope

Of the 83 species observed, 4 are SARA-listed species (ancient murrelet, great blue heron, marbled murrelet, and pink-footed shearwater); 7 are provincially red-listed (Brandt's cormorant, Canada goose [*B. c. occidentalis*], common murre, horned puffin, northern fulmar, pelagic cormorant, and western grebe); and 16 are provincially blue-listed (American golden-plover, ancient murrelet, Brant, cackling goose, California gull, Caspian tern, Cassin's auklet, double-crested cormorant, great blue heron, long-tailed duck, marbled murrelet, pink-footed shearwater, red-necked phalarope, surf scoter, tufted puffin, and yellow-billed loon).

Table 3.3-7: Incidental Observations of Marine Birds During Vessel-based and Stationary Point Surveys

Species	Vessel-based Surveys ^a	Shore-based Survey ^b
Alcid species ^c	703	–
American golden-plover	4	–
American wigeon	–	17
Ancient murrelet	1,651	–
Arctic tern	13	–
Auklet species ^c	2	–
Bald eagle	1,103	21
Barrow's goldeneye	248	1
Belted kingfisher	5	–
Black oystercatcher	28	–
Black scoter	42	–
Black turnstone	51	1
Black-legged kittiwake	33	–
Bonaparte's gull	118	3
Brandt's cormorant	40	–
Brant	143	–
Bufflehead	33	–
Cackling goose	292	7
California gull	615	–
Canada goose	1,577	462
Canvasback	–	2
Caspian tern	29	–
Cassin's auklet	94	–
Common goldeneye	48	–
Common loon	275	1
Common merganser	56	10
Common murre	2,164	–
Common raven	6	2
Common tern	2	–
Cormorant species ^c	343	–

Species	Vessel-based Surveys ^a	Shore-based Survey ^b
Double-crested cormorant	197	–
Dowitcher species ^c	8	–
Duck species ^c	245	52
Dunlin	6	10
Fork-tailed storm-petrel	621	–
Gadwall	45	–
Glaucous gull	134	–
Glaucous-winged gull	1,151	–
Goldeneye species ^c	55	–
Goose species ^c	308	–
Great blue heron	6	4
Greater scaup	15	–
Greater white-fronted goose	52	200
Grebe species ^c	151	–
Green-winged teal	–	3
Gull species ^c	9,637	2
Harlequin duck	158	–
Herring gull	2,080	40
Horned grebe	3	–
Horned puffin	5	–
Killdeer	–	3
Leach's storm-petrel	3	–
Least sandpiper	–	41
Long-tailed duck	655	–
Loon species ^c	435	–
Mallard	47	5
Marbled murrelet	1,511	–
Merganser species ^c	5	–
Mew gull	459	–
Murre species ^c	30	–
Murrelet species ^c	22	–
Northern fulmar	45	–
Northern pintail	7	8
Northern shoveler	4	8
Northwestern crow	103	1
Osprey	1	–
Pacific loon	752	–
Parasitic jaeger	2	–
Pectoral sandpiper	1	–
Pelagic cormorant	692	–

Species	Vessel-based Surveys ^a	Shore-based Survey ^b
Phalarope species ^c	9	–
Pigeon guillemot	239	–
Pink-footed shearwater	6	–
Pomarine jaeger	15	–
Puffin species ^c	2	–
Raptor species ^c	–	5
Red-breasted merganser	44	–
Red-necked grebe	64	–
Red-necked phalarope	17,005	–
Red-throated loon	479	–
Rhinoceros auklet	7,505	–
Ring-billed gull	9	–
Sabine's gull	22	–
Sanderling	471	–
Sandhill crane	2	–
Sandpiper species ^c	66	–
Scaup species ^c	22	–
Scoter species ^c	1,350	–
Shearwater species ^c	1,462	–
Shorebird species ^c	375	120
Short-tailed shearwater	39	–
Snow goose	30	–
Sooty shearwater	16,247	–
Spotted sandpiper	3	–
Storm-petrel species ^c	4	–
Surf scoter	6,136	–
Surfbird	2	–
Tern species ^c	3	–
Thayer's gull	67	–
Trumpeter Swan	3	30
Tufted puffin	4	–
Western grebe	739	–
Western sandpiper	174	39
White-winged scoter	616	–
Wilson's phalarope	9	–

Species	Vessel-based Surveys ^a	Shore-based Survey ^b
Yellow-billed loon	2	–
Total	82,594	1,098

NOTES:

^a Information incorporates marine bird survey data collected outside of structured observation periods, as well as data collected within structured observation periods, if the sighting was beyond 150 m radius from the boat.

^b Information includes incidental data of marine bird species from the stationary point counts.

^c Individuals were not identified to species.

– no data collected

3.3.3 Discussion

Extensive vessel-based surveys were conducted in all seasons throughout the marine birds RSA as a component of the marine mammal survey program to provide a more comprehensive overview of marine bird diversity, distribution, and abundance. Systematic and incidental observations resulted in observations of 95 species, including 2 species listed under SARA, 5 provincially red-listed species, and 13 provincially blue-listed species. Of the 127 marine bird species known historically to use the marine birds RSA, 75% were observed either on the vessel or at stationary points, including during structured and incidental observations.

Most pelagic birds known to occur occasionally in the marine birds RSA, such as albatross species, were not observed, likely because of the proximity of the marine birds RSA to shoreline habitats. In addition, more exposed open-water areas, such as Caamaño Sound and Browning Entrance north to Triple Island, were sampled less often because of safety concerns (i.e., extreme weather conditions).

Species richness for vessel surveys was evaluated using a species-richness curve to determine whether sampling effort captured the actual species richness for marine birds in the marine birds RSA. The curve approached an asymptote at approximately 90 days of surveys (out of a total of 128 days), indicating sampling effort was sufficient to assess total marine bird species richness in the marine birds RSA.

Of the five key species selected for the marine bird component of the wildlife resources valued component, one species, common goldeneye, was not observed during structured vessel surveys. This result is likely due to this species' preference for protected waters (e.g., bays, estuaries and harbours), which were habitats difficult to observe from the vessel. Common goldeneye is also seasonally present, nesting in wetlands, lakes, and rivers, migrating along coastal and freshwater areas, and overwintering within shallow coastal bays, estuaries, and harbours (Eadie et al. 1995).

Stationary surveys were conducted in fall 2012, and winter and spring 2013, for overwintering and migratory marine bird species in the marine terminal area, in the Kitimat River and in Minette Bay. A total of 53 species were observed, including three species listed under SARA (great blue heron, marbled murrelet, and peregrine falcon), one provincially red-listed species (Canada goose *occidentalis* subspecies), and five blue-listed species (California gull, great blue heron, marbled murrelet, peregrine falcon, and wandering tattler). Diversity of species was highest in fall and lowest in winter. Abundance was highest in spring and lowest in winter. Abundance and species richness were highest on the eastern

shore at the southern entrance to Minette Bay (EST 3 and EST 4) and near the Rio Tinto Alcan terminal (EST 8). These stations also had superior vantage points, which might have increased the probability of detections. Two of the five key species were observed; common goldeneye observed primarily in fall (6 individuals), marbled murrelet observed primarily in spring (26 individuals).

Incidental observations documented 83,692 individuals of 83 species during vessel-based and estuary-based stationary point surveys. Seventeen of these species were not recorded during structured surveys. Therefore, incidental observations provided a more comprehensive overview of species diversity in the marine birds RSA. Observations confirmed the presence of 27 species of conservation concern documented during vessel and stationary surveys, and incidentally.

4 CONCLUSIONS

During field studies, 8 of the 15 wildlife species of conservation concern considered likely to occur in the terrestrial wildlife LSA were detected: grizzly bear, great blue heron, marbled murrelet, rusty blackbird, barn swallow, western screech-owl, Coastal tailed frog, and western toad. Grizzly bear and western toad were most prevalent.

During nocturnal owl surveys, western screech-owl responses suggested there was a potential nest location in a patch of highly suitable forest habitat east of the northern edge of the terrestrial wildlife LSA (Figure 2.3-4). This potential western screech-owl breeding site is regionally important given the relatively limited distribution of highly suitable habitat there (4.9%). Western screech-owl requires patches of mixedwood or deciduous forest and riparian woodlands that support large diameter trees with existing cavities suitable for nesting and roosting (Artemis Wildlife Consultants 2008). Northern goshawk was not detected during call-playback surveys; however, the lack of large expanses of mature riparian and older coniferous forests available in the eastern portion of the terrestrial wildlife LSA would be consistent with a low probability of habitat use and detection.

Three bald eagle nests and one osprey nest were detected in the terrestrial wildlife LSA. The active osprey nest is a long-term breeding site located on a light standard at the end of the RTA wharf "B". The wharf is currently proposed for reconstruction by LNG Canada. Two active and one inactive bald eagle nests are located in the central portion of the terrestrial wildlife LSA. One active nest is at the northernmost boundary of the Project footprint proposed for clearing during site construction. These raptor nests are constraints to Project development because the nests, eggs or young, and nest trees are protected year round from disturbance, harm, or destruction under the BC *Wildlife Act*. A provincially approved Raptor Management Plan, to include strategies to mitigate disturbance or harm, and which might also include consideration of legally permitted nest relocations, needs to be developed in advance of any site work.

Western toad were abundant in the terrestrial wildlife LSA. Large breeding concentrations occurred in three wetland sites located adjacent to the main central road to the east of existing industrial site disturbances. Western toad have high breeding site fidelity in successive years; therefore, breeding ponds and upland dispersal areas are valuable resources and need to be considered for protection in future road and access design plans. Development plans should include an amphibian capture and relocation program before any site preparation or clearing activities during the breeding and dispersal period (March 1 to August 15), which will require that a wildlife permit be obtained from the MFLNRO.

Grizzly bear use a diversity of habitat types in their home ranges for travel, thermal cover, seclusion, feeding, and denning. Wildlife movement corridors include large patches of trees or shrubs for security cover (Ciarnello et al. 2007). A black bear den was observed in mature riparian forest near Kitimat River. Particularly in highly fragmented landscapes, connectivity corridors between upland foraging habitat and

salmon-bearing watercourses have been identified as important landscape components (Proctor 2003; Proctor et al. 2005) and should be maintained or reconstructed.

Habitat suitability models indicated highly suitable grizzly bear spring and fall feeding habitats in the terrestrial wildlife LSA were primarily associated with the Kitimat River, the riparian zones, and sedge-dominated habitats in the estuary. Suitable western screech-owl breeding habitat was located adjacent to the Kitimat River in riparian and deciduous stands. Suitable western toad breeding habitat was associated with mapped waterbodies in the terrestrial wildlife LSA, the area to the southeast of the proposed LNG facility, and the estuary. The associated upland forest and riparian areas also support year-round habitat for western screech-owl breeding and grizzly bear spring and fall feeding. The results highlight the local importance of the Kitimat River, the estuary, and associated upland habitats to local wildlife species.

Data collected during previous studies in the spring of 2012 documented 60 bird species. Most common species detected were American robin, ruby-crowned kinglet, song sparrow, yellow warbler, red-winged blackbird, mew gull, and varied thrush. This was consistent with the results of surveys by Stantec Consulting Ltd. in the spring of 2013. Notable differences include observations of golden-crowned kinglet, yellow-rumped warbler, common yellowthroat, and Pacific wren in 2013. These species are all common forest-dwelling songbirds, so the differences between the studies were likely associated with the location of point-count stations. The KVN provided historical evidence of the importance of the Kitimat area, in particular the Kitimat River estuary, for a diversity of migratory and overwintering birds.

Marine birds are important to First Nations' traditional harvest as food; as provisions for cultural, spiritual, and feasting activities; and as sources of material (e.g., down feathers). Abundant numbers and species of marine birds make extensive use of habitats in the marine birds RSA, including coastal features (e.g., islands, estuaries, and cliffs), nearshore waters, and offshore open-water habitats. Many conservation areas, specifically IBAs, provide important breeding sites in and adjacent to the marine birds RSA.

Thirty-six species of conservation concern have been recorded historically in the marine birds RSA, 25 of these (69%) were detected during field surveys. This includes 4 species designated federally under Schedule 1 of SARA and 24 species provincially red or blue-listed. A wildlife habitat suitability model for one of these species, marbled murrelet, suggested that effective breeding habitat comprised 3.9% high suitability habitat and 20.7% moderate suitability habitat in mature forest stands of the terrestrial wildlife LSA.

The results of the Project surveys are consistent with historical data collected during previous studies conducted in the region. In general, the terrestrial wildlife and marine birds LSA is used by wildlife species that are common along the north coast of BC. Many of the species at risk considered likely to occur were documented during Project field surveys. Project constraints are primarily focused on raptor nests, bear dens and movement corridors, and western toad breeding and dispersal habitats. Field programs in 2012 and 2013 contributed to a comprehensive account of terrestrial wildlife and marine bird diversity, distribution, and abundance in the terrestrial wildlife and marine birds LSA, the marine birds RSA, and the region, by supplementing the desktop review of existing data. The extensive field data will facilitate the assessment of potential Project effects on terrestrial wildlife and marine birds.

5 CLOSURE

This Wildlife Resources Technical Data Report presents the results of a review of existing baseline information, supplemented by field studies (including terrestrial and marine wildlife surveys and habitat suitability models) to support the assessment of potential Project effects on wildlife. We trust the information provided in this report meets your requirements. Please do not hesitate to contact us if you have any questions or comments.

Respectfully submitted,

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6 REFERENCES

- Andres, B.A. and G.A. Falxa. 1995. Black oystercatcher (*Haematopus bachmani*). In A. Poole and F. Gill (ed.). *The Birds of North America*. The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologists' Union, Washington, DC.
- Artemis Wildlife Consultants. 2008. *Western Screech-Owl Conservation along the Shuswap River*. Final Report BCRP Project # 7.W.SHU.01.
- AXYS Environmental Consulting Ltd (AXYS). 1988. *Owl Abundance and Habitat in the Nimpkish Valley, Vancouver Island*. Prepared for Canadian Forest Products Ltd. Woss, BC.
- Bahn, V. and D. Newsom. 1999. Marbled Murrelet as target species for land management in coastal British Columbia. In *Proceedings of a Conference on the Biology and Management of Species and Habitats At Risk, Kamloops, BC* Volume 2. 735–740.
- Barbette, L. and J. Powell. 2005. *Haisla! We Are Our History: Our Lands, Nuyem and Stories as Told by Our Chiefs and Elders*. Prepared for the Kitimat Village Council. Available at: <https://www.neb-one.gc.ca/ll-eng/livlink.exe?func=ll&objId=774474&objAction=browse> Accessed: April 2013.
- Bird Studies Canada. 2013. *British Columbia Breeding Bird Atlas 2008–2012 Raw Breeding Data*. Available at: <http://www.birdatlas.bc.ca/english/index.jsp>. Accessed: July 12, 2013.
- Bodkin, J.L. 2011. SOP for conducting marine bird and mammal surveys - Version 4.1: Southwest Alaska Inventory and Monitoring Network. Natural Resource Report NPS/SWAN/NRR—2011/392. National Park Service, Fort Collins, Colorado. NPS 953.
- Bowman, J.C. and J.F. Robitaille. 1997. Winter habitat use of American martens *Martes americana* within second-growth forest in Ontario, Canada. *Wildlife Biology* 3(2): 97–105.
- British Columbia Conservation Data Centre (BCCDC). 2014. *BC Species and Ecosystems Explorer*. Available at: <http://a100.gov.bc.ca/pub/eswp/>. Accessed: July 2014.
- British Columbia Ministry of Environment (BCMOE). 2003. *Management Direction Statement for Dewdney and Glide Ecological Reserve*. Available at: http://www.env.gov.bc.ca/bcparks/eco_reserve/dewgld_er/dewdney.pdf. Accessed July 22, 2013.
- British Columbia Ministry of Forests (BC MOF). 1991. *Ecosystems of British Columbia*. Available at: <http://www.for.gov.bc.ca/hfd/pubs/Docs/Srs/Srs06/front.pdf>. Accessed: November 25, 2013.
- British Columbia Ministry of Forests (BC MOF). 1999. Available at: <http://www.for.gov.bc.ca/hfd/pubs/Docs/Bro/BRO31.PDF>. Accessed November 25, 2013.

- British Columbia Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). 2012. British Columbia Grizzly Bear Population Estimate for 2012. Available at:
http://www.env.gov.bc.ca/fw/wildlife/docs/Grizzly_Bear_Pop_Est_Report_Final_2012.pdf.
Accessed: November 15, 2013.
- Bull, E.L. and T.W. Heater. 2000. Resting and denning sites of American martens in northeastern Oregon. *Northwest Science* 74(3): 179–185.
- Burger, A.E. 1995. *Marine Distribution, Abundance and Habitats of Marbled Murrelets in British Columbia*. USDA Forest Service Gen. Tech. Rep. PSW-152. Albany, CA. US Department of Agriculture, Forest Service, Pacific Southwest Research Station.
- Burger, A.E., V. Bahn, and A.R. Tillmanns. 2000. Comparison of coastal fringe and interior forest as reserves for Marbled Murrelets on Vancouver Island. *Condor* 102: 915–920.
- Burger, A.E. 2004. *Standard Methods for Identifying and Ranking Nesting Habitat of Marbled Murrelets (Brachyramphus marmoratus) in British Columbia Using Air Photo Interpretation and Low-level Aerial Surveys*. Ministry of Environment Lands and Parks, Biodiversity Inventory Branch. Victoria, BC.
- Buskirk, S.W. and L.F. Ruggiero. 1994. American marten. In L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon and W.J. Zielinski (ed.). *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States*. General Technical Report RM-254, Rocky Mountain Forest and Range Experiment Station, United States Forest Service, Fort Collins, CO.
- Buskirk, S.W. and R.A. Powell. 1994. Habitat ecology of fishers and American martens. In S.W. Buskirk, A.S. Harestad, M.G. Raphael and R.A. Powell (ed.). *Martens, Sables, and Fishers: Biology and Conservation*. Ithaca, NY: Cornell University Press. 283–296.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart and M.C.E. McNall. 1990a. *The Birds of British Columbia: Nonpasserines – Introduction and Loons through Waterfowl. Volume 1*. UBC Press. Vancouver, BC.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart and M.C.E. McNall. 1990b. *The Birds of British Columbia: Nonpasserines – Diurnal Birds of Prey through Woodpeckers. Volume 2*. UBC Press. Vancouver, BC.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, M.C.E. McNall and G.E.J. Smith. 1997. *The Birds of British Columbia: Passerines, Flycatchers through Vireos. Volume 3*. UBC Press, Vancouver, BC.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart and M.C.E. McNall. 2001. *The Birds of British Columbia: Passerines, Wood Warblers through Old World Sparrows. Volume 4*. University of British Columbia Press, Vancouver, BC.

- Canadian Marbled Murrelet Recovery Team (CMMRT). 2003. *Marbled Murrelet Conservation Assessment 2003, Part B: Marbled Murrelet Recovery Team Advisory Document on Conservation and Management*. Canadian Marbled Murrelet Recovery Team Working Document No. 1.
- Canning, R.J. and T. Angell. 2001. *Western screech owl (Megascops kennicottii)*. Available at: <http://bna.birds.cornell.edu/bna/species/597/articles/introduction>. Accessed: April 2013.
- Carroll, C., R.F. Noss., and P.C. Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain region. *Ecological Applications* 11(4): 961–980.
- Ciarniello, L.M., M.S. Boyce, D.R. Seip and D.C. Heard. 2007. Grizzly bear habitat selection is scale dependent. *Ecological Applications* 17(5): 1424–1440.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002a. *COSEWIC Assessment and Update Status Report on the Grizzly Bear Ursus arctos in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002b. *COSEWIC Assessment and Status Report on the Western Toad Bufo boreas in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2012. *COSEWIC Assessment and Status Report on the Western Screech-owl kennicottii subspecies Megascops kennicottii kennicottii and the Western Screech-owl macfarlanei subspecies Megascops kennicottii macfarlanei in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.
- Croxall, J.P., S.H.M. Butchart, B. Lascelles, A.J. Stattersfield, B. Sullivan, A. Symes and P. Taylor. 2012. Seabird conservation status, threats and priority actions: a global assessment. *Bird Conservation International* 22: 1–34.
- Davis, T.M. 2002. *Research Priorities for the Management of the Western Toad, Bufo boreas, in British Columbia*. Wildlife Working Report No. WR-106. British Columbia Ministry of Water, Land and Air Protection, Biodiversity Branch. Victoria, BC.
- DeGange, A. 1996. *The Marbled Murrelet: A Conservation Assessment*. Gen. Tech. Rep. PNW-GTR-388. Portland, OR. US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Demarchi, D.A. 2011. The British Columbia Ecoregion Classification. Available at: <http://www.env.gov.bc.ca/ecology/ecoregions/index.html>. Accessed: November 25, 2013.
- Dulisse, J. and D. Hausleitner. 2009. *2008 West Kootenay Amphibian Survey*. Prepared for the Fish and Wildlife Compensation Program. Nelson, BC.
- Eadie, J.M., M.L. Mallory and H.G. Lumsden. 1995. *Common Goldeneye (Bucephala clangula)*. Available at: <http://bna.birds.cornell.edu/bna/species/170/articles/habitat>. Accessed: August 2013.

- Environment Canada. 1997. *A Marine Ecological Classification System for Canada*. Environment Canada. L.E. Harding (ed.). Marine Environment Quality Advisory Group.
- eBird Canada. 2013. *eBird: An Online Database of Bird Distribution and Abundance* [web application]. Available at: <http://ebird.org/ebird/eBirdReports?cmd=Start>. Accessed: July 12, 2013.
- Environment Canada. 2004. *Species at Risk. Marbled Murrelet (Brachyramphus marmoratus)*. Government of Canada. Available at: http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=39. Accessed: November 2004.
- Environment Canada. 2011. *Beaufort Wind Scale Table*. Available at: <http://www.ec.gc.ca/meteorology/default.asp?lang=En&n=80C039A3-1>. Accessed: August 2013.
- Feller, M.C. 2003. Coarse woody debris in the old-growth forests of British Columbia. *Environmental Reviews* 11(S1): S135–S157.
- Fielding, A.H. and J.F. Bell. 1997. A review of methods for the assessment of prediction errors in conservation presence/absence models. *Environmental Conservation* 24: 38–49.
- Fraser, D.F., W.L. Harper, S.G. Cannings and J.M. Cooper. 1999. *Rare Birds of British Columbia*. Wildlife Branch and Resource Inventory Branch, BC Ministry of Environment, Lands and Parks, Victoria, BC.
- Fryxell, J.M., J.B. Falls, E.A. Brooks, R.J. Dix and M.A. Strickland. 1999. Density dependence, prey dependence, and population dynamics of martens in Ontario. *Ecology* 80(4): 1311–1321.
- Gjerdrum, C., D.A. Fifield and S.I. Wilhelm. 2012. *Eastern Canada Seabirds at Sea (ECSAS) Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms*. Canadian Wildlife Service Technical Report Series Number 515.
- Gladwin, D.N., D.A. Asherin and K.M. Mancini. 1988. *Effects of Aircraft Noise and Sonic Booms on Fish and Wildlife: Results of a Survey of U.S. Fish and Wildlife Service Endangered Species and Ecological Services Field Offices, Refuges, Hatcheries, and Research Centers*. NERC-88/30. USFWS, National Ecology Research Center, Fort Collins, CO.
- Gotelli, N.J. and R.K. Colwell. 2001. Quantifying biodiversity: procedures and pitfalls in measurement and comparison of species richness. *Ecology Letters* 4: 379–391. Available at: <http://onlinelibrary.wiley.com/doi/10.1046/j.1461-0248.2001.00230.x/pdf>. Accessed: July 29, 2013.
- Gyug, L., T. Hamilton and M. Austin. 2004. *Grizzly Bear Ursus arctos. Accounts and Measures for Managing Identified Wildlife*. British Columbia Ministry of Water, Land and Air Protection, Biodiversity Branch, Victoria, BC.
- Hamer, D. and S. Herrero. 1987. Grizzly bear food and habitat in the Front Ranges of Banff National Park, Alberta. *International Conference on Bear Research and Management* 7: 199–213.

- Hargis, C.D. and D.R. McCullough. 1984. Winter habitat and diet selection of marten in Yosemite National Park. *Journal of Wildlife Management* 48: 140–146.
- Hatler, D.F., D.A. Blood and A.M. Beal. 2003. *Furbearer Management Guidelines Marten *Martes americana**. BC Ministry of Water, Land and Air Protection. Victoria, BC.
- Hatch, J.J. and D.V. Weseloh. 1999. Double-crested cormorant (*Phalacrocorax auritus*). Available at: <http://bna.birds.cornell.edu/bna/species/441> Accessed: July 30, 2012.
- Hayward, J.L. and N.A. Verbeek. 2008. Glaucous-winged gull (*Larus glaucescens*). Available at: <http://bna.birds.cornell.edu/bna/species/059doi:10.2173/bna.59> Accessed: July 30, 2012.
- Hentze, N.T. 2006. *The Effects of Boat Disturbance on Seabirds off Southwestern Vancouver Island*, British Columbia. MSc Thesis. University of Victoria. Victoria, BC.
- Hirzel, A.H., G. LeLay, V. Helfer, C. Randin and A. Guisan. 2006. Evaluating the ability of habitat suitability models to predict species presences. *Ecological Modelling* 199: 142–152.
- Hogrefe, T.C., C.L. Bailey, P.D. Thompson and B. Nadolski. 2005. *Boreal Toad (*Bufo boreas boreas*) Conservation Plan in the State of Utah*. Publication No. 05-37. Utah Department of Natural Resources, Division of Wildlife Resources. Salt Lake City, UT.
- Horwood, D. 1992. *Birds of the Kitimat Valley*. Kitimat Centennial Museum: Canada.
- Horwood Environmental Ltd. (Horwood) 2013. Marine Birds of the Kitimat Harbour and Estuary Areas: 2003-2013. Report Prepared for Stantec Consultants Ltd. 45 pp.
- IBA Canada. 2012. *Important Bird Areas of Canada*. Available at: <http://www.ibacanada.com>. Accessed: July 2013.
- Iverson, G.C., S.A. Warnock., R.W. Butler, M.A. Bishop and N. Warnock. 1996. Spring migration of western sandpipers along the Pacific Coast of North America: A telemetry study. *The Condor* 98: 10–21.
- Jacqueline Booth and Associates, Coastal and Ocean Resources Inc., and Clover Point Cartographics. 1998. *Study to Identify Preliminary Representative Marine Areas in the Queen Charlotte Sound Marine Region*. National Parks, Parks Canada.
- Kissling, M.L. and S.B. Lewis. 2009. *Distribution, Abundance, and Ecology of Forest Owls in Southeast Alaska*. US Fish and Wildlife Service, Juneau Field Office, Alaska and Alaska Department of Fish and Game, Division of Wildlife Conservations, Douglas, AK.
- Koehler, G.M. and M.G. Hornocker. 1977. Fire effects on marten habitat in the Selway-Bitterroot Wilderness. *Journal of Wildlife Management* 41(3): 500–505.
- Kitimat Valley Naturalists (KVN). 2011. *Kitimat Valley Naturalists Review of Enbridge Project Documents: Marine Birds, Mammals and Kitimat Estuary*. Available at: <http://www.ceaa-acee.gc.ca/050/documents/54521/54521E.pdf>. Accessed: July 2013.

- Lucas, B.G., S. Verrin and R. Brown. 2007. *Ecosystem Overview: Pacific North Coast Integrated Management Area (PNCIMA)*. Canadian Technical Report of Fisheries and Aquatic Sciences 2667:xii + 104 pp.
- MacDonald, D.D. and B.G. Shepherd. 1983. *A Review of the Kitimat River Watershed*. Fisheries and Oceans Canada. Vancouver, BC.
- Mace, R.D. 1985. Analysis of grizzly bear habitat in the Bob Marshall Wilderness, Montana. In G.P. Contreras and K.E. Evans (ed.). *Proceedings of the Grizzly Bear Habitat Symposium*. General Technical Report INT-207. USDA Forest Service, Intermountain Research Station, Ogden, UT. 136–149
- MacHutchon, A.G., S. Himmer and C.A. Bryden. 1993. *Khutzeymateen Valley Grizzly Bear Study, Final Report*. Report to BC Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, BC.
- Marsden, S. 2011. *Written Evidence of the Intervenors Metlakatla First Nation*. Prepared for the National Energy Board, Northern Gateway Pipelines Project, Hearings Process 2013. Available at: <http://www.ceaa-acee.gc.ca/050/documents/54576/54576E.pdf>. Accessed: August 2013.
- Marsden, S. 2012. *The Gitk'a'ata, Their History, and Their Territories: Report Submitted to the Gitk'a'ata*. Prepared for the National Energy Board, Northern Gateway Pipelines Project, Hearings Process 2013. Available at: <http://www.ceaa-acee.gc.ca/050/documents/57088/57088E.pdf>. Accessed: August 2013.
- McFarlane Tranquilla, L., K. Truman, D. Johannessen and T. Hooper. 2007. Appendix K: Marine birds. In B.G. Lucas, S. Verrin and R. Brown (ed.) *Ecosystem Overview: Pacific North Coast Integrated Management Area (PNCIMA)*. Canadian Technical Report of Fisheries and Aquatic Sciences 2667: vi + 68 pp.
- Meidinger, D., T. Lee, G.W. Douglas, G. Britton, W. MacKenzie and H. Qian. 2002. *British Columbia Plant Species Codes and Selected Attributes*. Version 4 Database. Research Branch of BC Ministry of Forests, Victoria, BC.
- Menzies, C.R. 2011. *Gitxaala Use and Occupancy in the Area of the Proposed Northern Gateway Pipeline Tanker Routes*. Prepared on behalf of Gitxaala Nation.
- Metlakatla Governing Council. 2011. *In the Matter of Enbridge Northern Gateway Project Joint Review Panel, OH-4-2011*. Written evidence of the Intervenors Metlakatla First Nation ("Metlakatla).
- Milakovic, B., K.L. Parker, D.D. Gustine, R.J. Lay, A.B.D. Walker and M.P. Gillingham. 2012. Seasonal habitat use and selection by grizzly bears in northern British Columbia. *Journal of Wildlife Management* 76: 170–180.
- Milko, R., L. Dickson, R. Eliot and G. Donaldson. 2003. *Wings Over Water. Canada's Water Bird Conservation Plan*. Canadian Wildlife Service. Ottawa, ON.

- Morrison, R. 2012. *LNG Canada Wildlife and Wildlife Habitat Spring Baseline Studies*. Triton Environmental Consultants; Haisla Business Operations. Prepared for Shell Canada Ltd.
- Morrison, R.I.G., B.J. McCaffery, R.E. Gill, S.K. Skagen, S.L. Jones, G.W. Page, C.L. Gratto-Trevor and B.A. Andres. 2006. Population estimates of North American shorebirds, 2006. *Wader Study Group Bulletin* 111: 66–84.
- Nagorsen, D.W., Morrison, K.F., and Forsberg, J.E. 1989. Winter diet of Vancouver Island marten (*Martes americana*). *Canadian Journal of Zoology* 67: 1394–1400.
- National Geographic. 2006. Field Guide to the Birds of North America. J. Dunn and J. Alderfer (ed.). National Geographic. Washington, D.C.
- NatureServe. 2013. NatureServe Explorer: An Online Encyclopedia of Life. Version 7.1. Available at: <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Histrionicus+histrionicus>. Accessed: July 2013.
- Nelson, S.K. 1997. Marbled Murrelet (*Brachyramphus marmoratus*). In A. Poole and F. Gill (eds.). *The Birds of North America Online*. Cornell Lab of Ornithology. Ithaca, NY. Available at: <http://bna.birds.cornell.edu/bna/species/276/articles/introduction>. Accessed: March 28, 2013
- Newton, I. 2006. Can conditions experienced during migration limit the population levels of birds? *Journal of Ornithology* 147(2): 146–166.
- Noss, R. F., H. B. Quigley, M. G. Hornocker, T. Merrill, and P. C. Paquet. 1996. Conservation biology and carnivore conservation in the Rocky Mountains. *Conservation Biology* 10: 949–963.
- Pacific North Coast Integrated Management Initiative (PNCIMA). 2011. *Atlas of the Pacific North Coast Integrated Management Area*. Available at www.pncima.org.
- Paragi, T.F., W.N. Johnson, D.D. Katnik and A.J. Magoun. 1996. Marten selection of postfire seres in the Alaskan taiga. *Canadian Journal of Zoology* 74: 2226–2237.
- Pickard, G.L. 1961. Oceanographic features of inlets in the British Columbia mainland coast. *Journal of Fisheries Research Board of Canada* 18: 907–982.
- Pojar, J., K. Klinka and D.A. Demarchi. 1991. Chapter 6: Coastal Western Hemlock Zone. In D. Meidinger and J. Pojar (ed.). *Ecosystems of British Columbia*. BC Ministry of Forests. Victoria, BC.
- Poole, K.G. and R.P. Graf. 1996. Winter diet of marten during a snowshoe hare decline. *Canadian Journal of Zoology* 74: 456–466.
- Poole, K.G., A.D. Porter, A. de Vries, C. Maundrell, S.D. Grindal and C.C. St. Clair. 2004. Suitability of a young deciduous-dominated forest for American marten and the effects of forest removal. *Canadian Journal of Zoology* 82: 423–435.
- Powell, J. 2006. *Traditional Haisla Ownership, Use and Occupancy of the Stewardship Areas Along the Alcan and BC Hydro Transmission Lines in Haisla Traditional Territory*. A report prepared for the Kitamaat Village Council Environment Department. Submission of the Intervenor, Haisla Nation, in regards to BC Hydro & Power Authority Application for Revenue Requirements BCH-F2007108

- RRA - Project No. 3698416.
- Powell, J. 2011. *Stewards of the Land... Haisla Ownership and Use of Their Traditional Territory, and Their Concerns regarding the Northern Gateway Project and Proposed Tanker Traffic in the Douglas Channel and Kitimat Arm*. Prepared for the Haisla Nation for submission to Enbridge Northern Gateway Project Joint Review Panel. Available at: <http://www.ceaa-acee.gc.ca/050/documents/p21799/80479E.pdf>. Accessed: July 2013.
- Power, H. 2013. *Risk of Enbridge Northern Gateway Pipeline Project to Eulachon (Thaleichthys pacificus)*. MES thesis. Queen's University. Kingston, ON.
- Proctor, M. 2003. *Genetic Analysis of Movement, Dispersal and Population Fragmentation of Grizzly Bears in Southwestern Canada*. PhD Thesis. Department of Biological Sciences, University of Calgary. Calgary, AB.
- Proctor, M.F., B.N. McLellan, C. Strobeck and R.M.R. Barclay. 2005. Genetic analysis reveals demographic fragmentation of grizzly bears yielding vulnerably small populations. *Proceedings of the Royal Society B* 272: 2409–2416.
- Ramcharita, R.K. 2000. *Grizzly Bear Use of Avalanche Chutes in the Columbia Mountains, British Columbia*. MSc thesis. Faculty of Forestry, University of British Columbia. Vancouver, BC.
- Resource Inventory Committee (RIC). 1997a. *Inventory Methods for Seabirds: Cormorants, Gulls, Murres, Stormpetrels, Ancient Murrelet, Auklets, Puffins, and Pigeon Guillemot*. Version 0.0. Ministry of Environment, Lands and Parks. Province of British Columbia. Victoria, BC.
- Resource Inventory Committee (RIC). 1997b. *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Shorebirds: Plovers, Oystercatchers, Stilts, Avocets, Sandpipers, Phalaropes and Allies*. Ministry of Environment, Lands and Parks. Province of British Columbia. Victoria, BC.
- Resource Inventory Committee (RIC). 1998a. *Ground-based Inventory Methods for Selected Ungulates: Moose, Elk and Deer*. Standards for Components of British Columbia's Biodiversity No. 33. BC Ministry of Environment, Lands and Parks. Victoria, BC.
- Resource Inventory Committee (RIC). 1998b. *Ground-based Inventory Methods for Bears*. Standards for Components of British Columbia's Biodiversity No. 21. BC Ministry of Environment, Lands and Parks. Victoria, BC.
- Resources Inventory Committee (RIC). 1998c. *Standard for Terrestrial Ecosystem Mapping in British Columbia*. BC Ministry of Environment, Lands and Parks. Victoria, BC.
- Resources Inventory Committee (RIC). 1998d. *Inventory Methods for Pond-breeding Amphibians and Painted Turtle*. Standards for Components of British Columbia's Biodiversity No. 37. BC Ministry of Environment, Lands and Parks. Victoria, BC.

- Resource Inventory Committee (RIC). 1998e. *Inventory Methods for Marsh Birds: Bitterns and Rails*. Standards for Components of British Columbia's Biodiversity No. 7. BC Ministry of Environment, Lands and Parks. Victoria, BC.
- Resource Inventory Committee (RIC). 1999a. *British Columbia Wildlife Habitat Rating Standards*. Version 2.0. Ministry of Environment, Lands and Parks. Province of British Columbia. Victoria, BC.
- Resource Inventory Committee (RIC). 1999b. *Inventory Methods for Forest and Grassland Songbirds*. Version 2.0. Ministry of Environment, Lands and Parks. Province of British Columbia. Victoria, BC, Canada.
- Resources Information Committee (RIC). 2001a. *Inventory Methods for Raptors*. Standards for Components of British Columbia's Biodiversity No. 11. BC Ministry of Environment, Lands and Parks. Victoria, BC.
- Resource Inventory Committee (RIC). 2001b. *Inventory Methods for Marbled Murrelets in Marine and Terrestrial Habitats*. Standards for components of British Columbia's biodiversity No.10. Version 2.0. Ministry of Environment, Lands and Parks, Resources Inventory Branch. Victoria, BC.
- Ronconi, R.A., and A.E. Burger. 2009. Estimating seabird densities from vessel transects: distance sampling and implications for strip transects. *Aquatic Biology* 4: 297–309.
- Ruddock, M. and D.P. Whitfield. 2007. *A Review of Disturbance in Selected Birds Species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.
- Ruggerio, L.F., K.B. Aubrey, S.W. Buskirk, L.J. Lyon and W.J. Zielinski. 1994. *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States*. General Technical Report RM-254. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
- Schoonmaker, P. and A. McKee. 1988. Species composition and diversity during secondary succession of coniferous forests in the western Cascades Mountains of Oregon. *Forest Science* 34: 960–979.
- Servheen, C. 1983. Grizzly bear food habits, movements and habitat selection in the Mission Mountains, Montana. *Journal of Wildlife Management* 47: 1026–1035.
- Sherburne, S.S. and J.A. Bissonette. 1994. Marten subnivean access point use: response to subnivean prey levels. *The Journal of Wildlife Management* 58: 400-405.
- Smith, J. 2000. *Marine Bird: Monitoring at Race Rocks Ecological Reserve*. Prepared for Lester B. Pearson College and the Department of Fisheries and Oceans with support from the Department of the Environment, Canadian Wildlife Service.
- Snyder, J.E. and J.A. Bissonette. 1987. Marten use of clearcuttings and residual forest stands in western Newfoundland. *Canadian Journal of Zoology* 65: 169–174.
- Species at Risk Public Registry (SRPR). 2013. *Species at Risk Public Registry A to Z Species Index*. Available at: http://www.sararegistry.gc.ca/sar/index/default_e.cfm. Accessed: January 2013.

- Stevens, V. 1995. *Wildlife Diversity in British Columbia: Distribution and Habitat Use of Amphibians, Reptiles, Birds, and Mammals in Biogeoclimatic Zones*. Work Paper 04/1995. BC Ministry of Environment, Lands and Parks, Victoria, BC.
- Steventon, J.D. and J.T. Major. 1982. Marten use of habitat in commercially clear-cut forest. *Journal of Wildlife Management* 46: 175–182.
- Stiles, F.G. and A.F. Skutch. 1989. *A Guide to the Birds of Costa Rica*. Cornell University Press, Ithaca, NY.
- Stillman, R.A., A.D. West, R.W.G. Caldow and S.E.A. le V. dit Durrell. 2007. Predicting the effect of disturbance on coastal birds. *Ibis* 149: 9–14.
- Takats, L., R. Stewart, M. Todd, R. Bonar, J. Beck, B. Beck and R. Quinlan. 1999. *American Marten Winter Habitat*. Habitat Suitability Index Model, Version 5. Prepared for Foothills Model Forest. Hinton, AB.
- Taylor, S.L. and S.W. Buskirk. 1994. Forest Microenvironments and Resting Energetics of the American marten *Martes americana*, *Ecography* 17: 249–256.
- Thompson, I.D. and A.S. Harestad. 1994. Effects of logging on American martens, and models for habitat management. Pp 355 – 367 In *Martens, Sables and Fishers: Biology and Conservation*. Cornell University Press, Ithaca, New York, USA. Thompson, I.D. and P.W. Colgan. 1994. Marten activity in uncut and logged boreal forests in Ontario. *Journal of Wildlife Management* 58: 280–288.
- Tressler, R., T.I. Mohagen, J. Zabolotney and P.S. Energy. 2003. *Baker River Relicensing Project Grizzly Bear Spring Foraging Habitat Study Final Report*. Prepared for Puget Sound Energy, Inc.
- Triton Environmental Consultants (Triton). 2012. *LNG Canada Wildlife and Wildlife Habitat Spring Baseline Studies*. Prepared for Shell Canada Ltd.
- Ugland, K.I., J.S. Gray and K.E. Ellingsen. 2003. The species-accumulation curve and estimation of species richness. *Journal of Animal Ecology* 72: 888–897. Available at: <http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2656.2003.00748.x/pdf>. Accessed: July 29, 2013.
- Whelan, C.J., D.G. Wenny and R.J. Marquis. 2008. Ecosystem services provided by birds. *Annals of the New York Academy of Sciences* 1134: 25–60.
- Zager, P.E. and C.J. Jonkel. 1983. Managing grizzly bear habitat in the northern Rocky Mountains. *Journal of Forestry* 81: 524–536.
- Zevit, P. and E. Wind. 2010. *BC's Coast Region: Species and Ecosystems of Conservation Concern. Western Toad (Anaxyrus boreas). Factsheet*. Available at: www.geog.ubc.ca/biodiversity. Accessed: February 2011.

APPENDIX A

Kitimat Valley Naturalists BC Coastal Waterbird Survey Data

Table A-1: Kitimat Valley Naturalists BC Coastal Waterbird Survey Data

Species	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
American dipper	-	-	-	2	-	2	3	7	-	-	14
American kestrel	-	-	-	2	-	-	1	-	-	1	4
American redstart	-	-	-	-	-	-	-	-	-	1	1
American robin	-	-	-	-	10	-	56	7	3	34	110
American wigeon	-	-	1	34	-	32	46	103	27	46	289
Bald eagle	25	22	34	45	78	120	150	105	67	87	733
Barn swallow	-	-	-	-	-	-	5	-	5	3	13
Barrow's goldeneye	-	-	-	-	5	116	30	73	20	4	248
Belted kingfisher	3	4	9	4	4	7	10	9	7	13	70
Black-bellied plover	-	-	-	10	3	-	-	-	-	22	35
Black-capped chickadee	-	-	-	-	-	2	-	-	5	-	7
Blue-winged teal	-	-	-	2	2	2	-	-	-	8	14
Bonaparte's gull	-	-	-	-	-	-	2	-	14	7	23
Brown-headed cowbird	-	-	-	-	-	1	-	-	-	-	1
Bufflehead	31	85	116	89	267	187	324	171	178	124	1,572
California gull	-	-	-	-	-	-	-	-	-	2	2
Canada goose	154	312	825	1,231	958	1,031	1,141	1,649	2,689	687	10,677
Caspian tern	-	-	-	-	-	-	-	6	-	-	6
Cedar waxwing	-	-	-	-	-	-	-	-	1	30	31
Chestnut-backed chickadee	-	-	-	-	-	5	-	2	-	3	10
Cinnamon teal	-	-	-	2	-	2	-	-	-	6	10
Common goldeneye	4	15	7	15	21	154	34	139	116	16	521
Common loon	-	-	-	6	13	12	22	25	31	11	120
Common merganser	45	24	22	64	99	120	64	147	49	45	679
Common murre	-	-	-	-	47	8	3	210	750	-	1,018
Common raven	-	-	7	6	12	20	19	11	19	19	113
Dark-eyed junco	-	-	-	-	-	-	6	-	36	27	69
Dowitcher spp.	-	-	-	-	80	-	4	22	-	15	121
Downy woodpecker	-	-	-	-	-	-	1	-	-	-	1
Dunlin	-	6	6	80	120	-	6	-	-	40	258
Empidonax sp.	-	-	-	-	-	-	-	-	-	1	1
Eurasian collared-dove	-	-	-	-	-	-	-	-	-	2	2
European starling	-	-	-	-	20	-	27	11	-	-	58
Fox sparrow	-	-	-	-	-	1	-	-	2	2	5

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Species	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Gadwall	-	-	-	-	-	-	18	-	-	2	20
Glaucous-winged gull	-	200	-	275	605	892	1,157	1,593	1,197	43	5,962
Golden-crowned kinglet	-	-	-	-	-	-	-	-	1	10	11
Golden-crowned sparrow	-	-	-	-	-	-	-	-	-	4	4
Goldeneye sp.	-	-	-	-	-	-	-	3	6	2	11
Great blue heron	3	25	16	48	19	30	29	22	38	27	257
Great gray owl	-	1	-	-	-	-	-	-	-	-	1
Greater scaup	-	-	-	-	8	-	-	85	5	10	108
Greater white-fronted goose	-	-	-	35	237	250	293	24	-	509	1,348
Green-winged teal	19	36	77	53	53	62	42	168	-	232	742
Gull sp.	160	5,972	2,195	1,803	2,688	2,121	1,520	2,537	1,527	2,600	23,123
Hairy woodpecker	-	-	-	-	-	-	-	-	-	1	1
Harlequin duck	-	-	-	-	13	4	20	27	30	11	105
Hermit thrush	-	-	-	-	-	-	1	-	-	-	1
Herring gull	-	-	-	-	-	12	-	6	5	10	33
Hooded merganser	-	-	4	-	9	2	-	-	-	2	17
Horned grebe	-	-	-	1	-	-	5	-	4	-	10
Horned lark	-	-	-	20	-	-	-	-	-	-	20
Killdeer	-	2	12	-	5	6	4	-	-	3	32
Least sandpiper	-	-	-	-	-	-	-	-	-	12	12
Lesser scaup	-	-	-	-	-	-	-	-	-	6	6
Lesser yellowlegs	-	-	-	4	2	-	-	6	-	6	18
Lincoln's sparrow	-	-	-	-	-	-	-	-	-	1	1
Long-tailed duck	-	-	-	2	-	4	-	1	3	-	10
Mallard	118	393	572	1,022	633	1,621	1,342	1,403	1,370	1,675	10,149
Marbled murrelet	-	-	-	2	11	34	17	35	124	51	274
Merlin	-	-	1	1	-	-	-	-	2	3	7
Mew gull	-	10	40	33	178	92	198	198	608	471	1,828
Mountain bluebird	-	-	-	-	-	-	-	-	-	2	2
Northern flicker	-	-	-	-	1	-	-	-	-	3	4
Northern goshawk	-	-	-	-	-	-	-	-	-	1	1
Northern harrier	-	2	1	-	3	1	2	1	-	3	13
Northern pintail	4	51	62	83	71	89	186	89	75	259	969
Northern rough-winged swallow	-	-	-	-	-	-	-	-	1	1	2
Northern shoveler	-	-	-	19	14	23	16	22	5	60	159
Northern shrike	-	-	-	-	-	-	-	1	-	-	1

Species	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Northwestern crow	-	-	62	80	132	223	544	226	194	229	1,690
Orange-crowned warbler	-	-	-	-	-	-	-	-	-	1	1
Osprey	-	-	-	1	3	6	2	2	6	10	30
Pacific loon	-	-	-	2	-	-	2	5	28	-	37
Pacific wren	-	-	-	2	2	3	2	7	5	9	30
Peeps	1	16	-	24	21	-	7	1	2	200	272
Pelagic cormorant	-	-	-	-	1	8	6	6	-	2	23
Pigeon guillemot	-	-	-	-	-	-	-	7	-	1	8
Pine grosbeak	-	-	-	-	15	-	-	-	-	-	15
Pine siskin	-	-	-	30	140	-	40	20	-	75	305
Red crossbill	-	-	-	-	205	-	-	-	-	98	303
Red-breasted merganser	-	-	3	-	3	1	-	-	-	-	7
Red-necked grebe	-	4	-	4	27	61	27	83	32	60	298
Red-tailed hawk	1	-	1	2	-	1	2	-	-	-	7
Red-throated loon	-	-	-	3	-	-	-	1	1	-	5
Red-winged blackbird	-	-	-	-	1	-	-	-	1	9	11
Ring-necked duck	-	-	-	5	2	-	-	-	-	-	7
Ruby-crowned kinglet	-	-	-	-	-	1	-	-	-	3	4
Rufous hummingbird	-	-	-	-	-	-	-	-	2	1	3
Savannah sparrow	-	-	-	-	10	-	1	-	-	39	50
Scaup sp.	-	-	-	-	-	10	-	-	-	-	10
Scaup sp.	-	-	-	-	32	74	-	-	67	5	178
Semipalmated plover	-	-	-	2	-	9	-	3	1	-	15
Sharp-shinned hawk	-	-	-	-	1	-	-	-	-	-	1
Short-billed dowitcher	-	-	-	30	-	12	-	15	-	-	57
Short-eared owl	-	2	-	-	2	1	-	-	-	-	5
Snow bunting	-	-	10	-	-	-	-	-	-	-	10
Snow goose	7	-	-	3	402	5	33	3	-	455	908
Song sparrow	-	-	-	2	1	-	-	1	3	8	15
Spotted sandpiper	-	-	-	-	-	-	-	-	-	1	1
Steller's jay	-	-	-	-	-	-	1	3	2	1	7
Surf scoter	-	-	-	-	-	306	1	756	119	9	1,191
Townsend's warbler	-	-	-	-	-	-	-	-	1	1	2
Tree swallow	-	-	-	-	50	-	20	-	2	12	84
Trumpeter swan	-	10	10	-	24	43	21	29	86	33	256
Tundra swan	-	-	-	-	-	-	-	-	-	1	1

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Wildlife Resources Technical Data Report

Appendix A: Kitimat Valley Naturalists BC Coastal Waterbird Survey Data

Species	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Varied thrush	-	-	-	24	5	9	10	7	6	8	69
Warbling vireo	-	-	-	-	-	-	-	1	2	1	4
Water pipit	-	-	-	-	-	-	-	-	-	18	18
Western grebe	-	-	-	6	8	-	21	11	16	4	66
Western sandpiper	15	-	7	100	210	61	30	40	-	6	469
Western tanager	-	-	-	-	-	-	-	-	-	1	1
White-winged scoter	-	-	-	-	-	-	5	-	-	-	5
Yellow warbler	-	-	-	-	-	-	-	-	-	2	2
Yellow-rumped warbler	-	-	-	-	-	-	-	2	1	3	6
Grand total	590	7,192	4,100	5,313	7,586	7,899	7,579	10,147	9,596	8,582	67,884

NOTE:

- No observations noted

APPENDIX B

Kitimat Valley Naturalists BC Christmas Bird Count Data

Table B-1: Kitimat Valley Naturalists BC Christmas Bird Count Data

Species	Year										Total
	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	
American coot	4	1	2	1	-	-	-	-	-	-	8
American dipper	1	2	-	1	3	3	5	3	1	3	22
American kestrel	-	-	-	-	-	2	1	-	-	-	3
American robin	38	7	62	1	-	7	49	35	4	31	234
American tree sparrow	-	-	-	-	-	1	-	-	-	-	1
American wigeon	2	25	-	5	4	2	1	9	1	4	53
Anna's hummingbird	-	2	-	-	-	-	-	-	-	-	2
Bald eagle	49	166	132	115	208	287	510	202	325	161	2,155
Barred owl	-	-	-	-	-	-	-	-	-	1	1
Barrow's goldeneye	4	1	-	1	2	-	-	-	-	-	8
Belted kingfisher	5	10	4	4	5	1	5	4	3	4	45
Black-capped chickadee	20	2	-	-	-	7	9	-	2	-	40
Bohemian waxwing	-	-	41	-	-	-	22	100	-	-	163
Brant	-	-	-	-	-	44	-	-	-	-	44
Brewer's blackbird	15	16	4	2	10	34	40	20	6	20	167
Bufflehead	47	116	61	59	203	72	88	40	25	56	767
Canada goose	588	470	591	202	632	285	1,558	916	350	1,111	6,703
Canvasback	-	-	-	1	-	-	-	1	-	-	2
Chestnut-backed chickadee	18	24	41	16	34	11	44	27	29	38	282
Common goldeneye	50	124	19	41	60	17	41	8	35	77	472
Common loon	1	-	1	-	5	6	5	4	-	4	26
Common merganser	15	35	9	40	136	8	38	5	15	6	307
Common murre	-	3	-	-	-	-	3	3	40	-	49
Common raven	125	82	53	11	73	53	294	133	119	102	1,045
Common redpoll	-	-	-	-	-	-	-	-	-	4	4
Dark-eyed junco	236	416	304	443	248	638	805	184	54	431	3,759
Dowitcher sp.	-	-	-	-	-	1	-	-	-	-	1
Downy woodpecker	1	-	-	1	1	-	2	2	3	1	11
Dunlin	-	-	-	-	-	-	-	-	-	18	18
Eurasian collared-dove	-	-	-	-	-	-	-	7	4	14	25
European starling	175	166	20	100	36	63	254	98	21	20	953
Fox sparrow	1	5	9	-	10	12	22	14	4	16	93
Gadwall	2	1	-	-	-	-	-	-	-	-	3
Glaucous-winged gull	2,158	2,020	1,580	3,853	1,800	1,142	520	1,672	769	3,300	18,814
Golden-crowned kinglet	-	-	-	-	-	-	-	1	-	2	3
Golden-crowned sparrow	-	-	1	2	3	1	7	7	2	5	28
Great blue heron	29	34	14	40	18	13	29	21	20	24	242

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Appendix B: Kitimat Valley Naturalists BC Christmas Bird Count Data

Species	Year										Total
	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	
Great horned owl	-	-	-	-	2	-	1	-	-	-	3
Greater scaup	198	231	313	-	401	212	116	200	200	-	1,871
Green-winged teal	31	55	14	6	16	46	12	24	-	20	224
Hairy woodpecker	-	1	-	-	1	-	1	1	-	-	4
Harlequin duck	-	-	1	-	-	-	-	-	-	-	1
Harris' sparrow	-	-	-	-	-	1	-	-	-	-	1
Herring gull	-	2	1	25	7	3	18	5	5	2	68
Hooded merganser	2	8	6	7	14	4	11	8	2	2	64
Horned grebe	2	-	-	-	-	-	-	-	-	-	2
House sparrow	30	40	33	17	14	-	14	21	8	13	190
Killdeer	-	10	-	-	2	12	2	3	2	-	31
Mallard	518	394	692	249	195	310	720	487	277	162	4,004
Marbled murrelet	-	-	-	26	11	2	5	2	-	-	46
Merlin	3	1	-	-	1	2	1	3	-	2	13
Mew gull	123	87	150	202	63	158	145	82	80	13	1,103
Northern flicker	3	1	3	2	2	4	10	5	2	5	37
Northern goshawk	-	-	-	1	-	1	1	1	-	-	4
Northern harrier	-	-	-	1	1	-	-	-	-	-	2
Northern pintail	1	-	-	-	2	-	3	1	-	-	7
Northern pygmy-owl	2	-	-	-	2	-	2	-	1	-	7
Northern shoveler	3	30	46	-	2	5	1	1	-	-	88
Northern shrike	2	5	2	-	3	1	6	1	-	3	23
Northwestern crow	303	331	243	380	540	95	622	130	103	136	2,883
Pacific loon	-	-	-	-	-	1	1	1	2	5	10
Pacific wren	2	2	-	-	3	-	2	1	-	-	10
Peregrine falcon	-	-	-	1	-	-	-	-	-	-	1
Pied-billed grebe	-	-	1	-	-	-	-	-	-	-	1
Pine grosbeak	-	-	24	-	6	-	17	-	-	15	62
Pine siskin	600	62	240	-	254	345	216	171	210	1,979	4,077
Purple finch	-	5	13	-	13	5	26	1	8	9	80
Red-breasted merganser	-	-	-	11	-	-	-	-	-	-	11
Red-breasted nuthatch	3	1	1	-	1	-	4	-	-	12	22
Red-breasted sapsucker	-	-	2	-	-	-	-	-	-	-	2
Red-necked grebe	-	2	-	39	10	6	3	5	7	2	74
Red-tailed hawk	1	-	-	2	4	1	2	1	3	-	14
Red-throated loon	-	-	-	-	-	2	1	1	-	-	4
Red-winged blackbird	46	53	38	47	35	64	84	42	35	2	446
Ring-billed gull	1	-	-	-	-	-	-	-	-	-	1
Ring-necked duck	2	31	40	75	50	57	56	50	61	40	462

Species	Year										Total
	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	
Ruffed grouse	-	3	-	-	1	-	-	-	-	-	4
Rusty blackbird	-	3	-	-	1	-	1	-	-	4	9
Sandhill crane	1	-	-	-	-	-	-	-	-	-	1
Scaup sp.	-	50	-	206	-	-	49	-	-	200	505
Sharp-shinned hawk	1	2	-	1	1	8	6	2	-	3	24
Short-eared owl	-	-	-	-	1	-	-	1	-	1	3
Snow bunting	-	-	-	1	-	-	-	-	-	-	1
Song sparrow	3	10	8	3	11	10	19	6	9	9	88
Spotted towhee	-	-	1	-	-	-	-	1	-	-	2
Steller's jay	13	46	63	28	80	25	93	56	24	9	437
Surf scoter	-	-	-	-	27	-	-	-	-	-	27
Thayer's gull	-	3	1	-	1	-	-	-	1	-	6
Trumpeter swan	33	24	12	14	18	14	51	8	20	26	220
Tundra swan	-	-	-	-	-	-	-	-	1	-	1
Varied thrush	5	31	20	1	2	21	92	10	14	45	241
Western grebe	-	-	-	47	3	7	5	1	-	1	64
White-crowned sparrow	-	-	-	-	-	2	2	4	1	3	12
White-throated sparrow	-	-	-	-	1	1	-	1	-	-	3
White-winged scoter	-	-	-	-	-	-	-	5	-	-	5
Wilson's snipe	-	-	-	-	-	-	-	1	-	-	1
Grand total	5,516	5,252	4,916	6,331	5,293	4,135	6,773	4,860	2,908	8,176	54,160

NOTE:

- No observations noted

APPENDIX C

Triton Bird Point Count Data 2012

Table C-1: Triton Bird Point Count Data 2012

English Name	Date (2012)							Total
	May 21	May 22	May 23	May 24	June 13	June 18	June 19	
Alder flycatcher	-	-	-	-	6	6	3	15
American robin	25	15	13	39	26	21	20	159
Bald eagle	2	5	-	4	-	1	2	14
Barrow's goldeneye	1	-	-	-	-	-	-	1
Barred owl	-	-	-	1	-	-	-	1
Belted kingfisher	-	-	1	-	-	-	1	2
Brown-headed cowbird	-	-	-	-	-	1	-	1
Brewer's blackbird	-	-	-	1	-	-	1	2
Cedar waxwing	-	-	-	-	2	4	2	8
Chipping sparrow	-	-	-	-	-	5	2	7
Common raven	1	-	-	-	2	1	-	4
Common yellowthroat	1	-	-	5	1	4	1	12
Dark-eyed junco	-	-	-	-	-	3	1	4
Duck spp.	-	-	-	1	-	-	-	1
European starling	-	-	-	-	1	-	-	1
Fox sparrow	-	-	-	1	-	-	-	1
Golden-crowned kinglet	-	-	1	-	1	-	-	2
Greater scaup	-	-	-	13	-	-	-	13
Glaucous-winged gull	-	-	-	1	-	-	-	1
Hammond's flycatcher	-	1	1	1	3	-	2	8
Hairy woodpecker	-	-	2	2	2	-	-	6
Least flycatcher	-	-	-	-	2	-	-	2
Lincoln's sparrow	1	-	-	-	-	-	-	1
Mallard	2	1	-	1	-	20	-	24
Mew gull	4	-	-	30	-	3	-	37
Merlin	1	-	-	-	-	-	-	1
MacGillivray's warbler	-	-	-	-	2	-	-	2
Nashville warbler	1	-	-	-	-	-	-	1
Northwestern crow	4	1	1	7	-	2	3	18
Northern flicker	1	1	-	2	-	-	1	5
Northern harrier	-	1	-	-	-	-	-	1
Northern shoveler	-	-	-	-	-	1	-	1
Orange-crowned warbler	3	3	1	9	1	3	-	20
Olive-sided flycatcher	2	-	-	-	-	-	-	2

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 Appendix C: Triton Bird Point Count Data 2012

English Name	Date (2012)							Total
	May 21	May 22	May 23	May 24	June 13	June 18	June 19	
Pine siskin	1	3	-	4	1	1	3	13
Pacific-slope flycatcher	1	1	-	-	1	-	-	3
Red-breasted nuthatch	-	-	1	-	-	-	-	1
Ruby-crowned kinglet	11	18	18	16	15	4	8	90
Red-eyed vireo	-	1	2	-	1	1	-	5
Red-naped sapsucker	-	-	-	-	1	-	-	1
Rufous hummingbird	-	-	-	-	2	1	1	4
Red-winged blackbird	14	-	-	15	2	12	3	46
Savannah sparrow	-	-	-	-	-	-	3	3
Solitary sandpiper	-	2	-	-	-	-	-	2
Song sparrow	8	4	-	6	2	8	5	33
Spotted sandpiper	-	-	-	1	-	-	-	1
Swainson's thrush	-	1	-	-	14	1	3	19
Townsend's warbler	-	1	4	-	-	-	2	7
Tree swallow	2	1	-	3	-	4	-	10
Unknown	-	-	-	1	-	-	-	1
Varied thrush	13	9	8	8	7	2	4	51
Veery	-	-	-	-	1	-	-	1
Vesper sparrow	-	6	-	2	-	6	2	16
Warbling vireo	2	3	-	11	5	5	1	27
Western tanager	-	1	2	-	8	-	1	12
Wilson's warbler	7	5	1	-	6	-	1	20
Winter wren	-	-	3	-	4	-	-	7
Wood Pewee	-	-	-	1	-	1	-	2
Yellow warbler	23	9	6	16	13	16	6	89
Yellow-rumped warbler	-	3	-	4	2	1	1	11
Grand Total	131	96	65	206	134	138	83	853

NOTE:

- No observations noted

APPENDIX D

Triton Wetland/Estuary Bird Migration Data 2012

Table D-1: Triton Wetland/Estuary Bird Migration Data 2012

English Name	Date (2012)									Total
	May 17	May 18	May 22	May 23	May 24	May 25	Jun 12	Jun 18	Jun 19	
American robin	1	-	-	-	-	3	-	-	-	4
American wigeon	-	20	-	-	-	-	-	-	-	20
Bald eagle	1	16	13	14	9	13	8	-	2	76
Barrow's goldeneye	4	18	-	4	-	6	4	-	-	36
Barn swallow	200	-	-	-	10	-	-	-	-	210
Black-bellied plover	7	-	-	-	-	-	-	-	-	7
Belted kingfisher	-	-	1	-	-	-	-	-	-	1
Black swift	-	-	-	-	-	10	-	-	-	10
Bohemian gull	-	-	38	18	4	-	-	-	-	60
Blue-winged teal	-	-	-	10	-	15	-	-	-	25
Canada goose	87	44	-	-	-	-	-	-	-	131
California gull	-	2	-	-	-	-	-	-	-	2
Cinnamon teal	-	2	-	-	-	-	-	-	-	2
Common goldeneye	-	-	-	-	-	21	-	-	-	22
Common loon	-	1	-	1	-	1	-	-	-	3
Common merganser	-	-	11	-	-	2	-	-	-	13
Common raven	-	1	-	-	-	-	-	-	-	1
Dunlin	-	40	-	-	-	-	-	-	-	40
Great blue heron	-	2	-	-	-	2	-	-	-	4
Glaucous gull	-	-	-	-	-	59	-	-	-	59
Greater scaup	7	9	-	-	-	34	-	-	-	50
Greater yellowlegs	-	1	-	-	-	-	-	-	-	1
Glaucous-winged gull	-	1	-	-	-	1	1	-	-	3
Harlequin duck	-	-	1	-	-	9	-	-	-	10
Least sandpiper	-	-	-	3	-	1	-	-	-	4
Mallard	44	61	-	-	1	10	-	-	-	116
Mew gull	150	145	28	42	-	34	203	14	-	616
Northwestern crow	4	12	18	1	-	15	9	1	2	62
Northern harrier	1	-	-	-	-	-	-	-	-	1
Northern pintail	3	3	-	2	-	-	-	-	-	8
Northern shoveler	1	-	-	111	26	150	-	-	-	288
Osprey	1	2	-	-	-	1	-	-	-	4
Pacific wren	-	-	1	-	-	-	-	-	-	1
Pectoral sandpiper	33	-	-	-	-	-	-	-	-	33
Pine siskin	-	-	-	110	-	-	-	-	-	110
Red-necked grebe	-	-	-	-	-	2	-	-	-	2
Ring-necked duck	2	-	-	-	-	-	-	-	-	2
Ruby-crowned kinglet	-	-	1	-	-	-	-	-	-	1
Sandhill crane	-	3	-	-	-	-	-	-	-	3
Semipalmated plover	32	-	-	-	1	-	-	-	-	33
Sharp-shinned hawk	1	-	-	-	-	-	-	-	-	1
Song sparrow	-	-	-	-	1	1	-	-	-	2
Spotted sandpiper	1	-	-	-	-	-	-	-	-	1
Steller's jay	-	-	-	-	-	-	1	-	-	1

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Wildlife Resources Technical Data Report

Appendix D: Triton Wetland/Estuary Bird Migration Data 2012

English Name	Date (2012)									Total
	May 17	May 18	May 22	May 23	May 24	May 25	Jun 12	Jun 18	Jun 19	
Tree swallow	500	-	-	-	-	-	-	-	-	500
Unidentified gull	-	20	-	-	-	23	-	-	-	43
Unidentified swallow	-	-	-	-	-	1	-	-	-	1
Unknown	-	-	-	-	-	9	3	-	-	8
Varied thrush	3	-	-	-	-	2	-	-	-	5
Vesper sparrow	1	-	-	7	-	-	-	-	-	8
Violet-green swallow	100	-	-	-	-	-	-	-	-	100
Whimbrel	25	-	-	-	-	-	-	-	-	25
Yellow warbler	-	-	-	-	-	1	-	-	-	1
Total	1,209	403	112	323	52	426	229	15	4	2,774

NOTE:

- No observations noted

APPENDIX E

Terrestrial Survey Habitat and Weather Data

Table E-1: Breeding Bird Habitat and Weather Data (A)

Date	Station	Elevation (m)	Cloud Cover	Temp (°C)	Precip	Wind	Habitat	Wetland Type	Forested	Forest Type	Tree Species	Canopy Cover (%)	Average tree ht (m)
21/05/2013	BBS 1	16	30	10.3	N	0	Forested	-	Young	Deciduous	Willow sp.	Sparse	3.5
21/05/2013	BBS 10	16	25	9	N	0	Forested	-	-	Coniferous	-	Closed	5.5
21/05/2013	BBS 11	11	40	11	N	0	Forested	-	Young	Mixedwood	Alder (70%)	Sparse	8
25/05/2013	BBS 15	9	45	11	N	0	Forested	-	Mature	Mixedwood	-	-	13
25/05/2013	BBS 16	22	45	10.8	N	0	Forested	-	Mature	Mixedwood	-	-	13
25/05/2013	BBS 17	22	40	12.6	N	0	Forested	-	Mature	Mixedwood	-	Sparse	12
23/05/2013	BBS 18	19	30	13.3	N	0	Forested	-	Mature	Coniferous	-	Sparse	12
23/05/2013	BBS 19	15	20	12.4	N	0	Forested	-	Mature	Coniferous	-	Sparse	10
21/05/2013	BBS 2	16	35	9.1	N	0	Forested	-	Mature	Mixedwood	-	Sparse	7
26/05/2013	BBS 20	21	40	13.1	N	0	Forested	-	Mature	Mixedwood	-	-	12
23/05/2013	BBS 21	13	20	11.1	N	0	Forested	-	Mature	Coniferous	-	Sparse	13
23/05/2013	BBS 22	11	20	11.6	N	0	Forested	-	Mature	Mixedwood	-	Sparse	10
22/05/2013	BBS 23	11	55	15.6	N	0	Range	-	-	-	-	-	-
22/05/2013	BBS 24	10	55	14.9	N	0	Range	-	-	-	-	-	-
22/05/2013	BBS 25	7	50	13.9	N	0	Forested/Range	-	-	Coniferous	-	Sparse	10
25/05/2013	BBS 26	9	50	11.2	N	0	Forested	-	Mature	Deciduous	-	Sparse	13
21/05/2013	BBS 3	16	40	11	n	0	Forested	-	Mature	Deciduous	Act	Sparse	10
21/05/2013	BBS 30	14	40	14	N	0	Wetland	Marsh	-	-	-	-	-
21/05/2013	BBS 31	15	40	14.5	N	1	Wetland	Marsh	-	-	-	-	-
25/05/2013	BBS 32	9	60	13	N	0	Shrubland/developed	-	-	-	-	-	-
21/05/2013	BBS 33	14	40		N	2	Developed	-	Regen.	Mixedwood	-	Open	1
22/05/2013	BBS 34	12	40	20.8	N	0	Forested/Shrubland	-	Mature	Mixedwood	-	Closed	12
22/05/2013	BBS 35	9	45	14.9	N	0	Forested/Range	-	Mature	Coniferous	-	Sparse	12
23/05/2013	BBS 37	11	25	10.5	N	0	Forested	-	Mature	Mixedwood	-	Sparse	12

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 Wildlife Resources Technical Data Report
 Appendix E: Terrestrial Survey Habitat and Weather Data

Date	Station	Elevation (m)	Cloud Cover	Temp (°C)	Precip	Wind	Habitat	Wetland Type	Forested	Forest Type	Tree Species	Canopy Cover (%)	Average tree ht (m)
23/05/2013	BBS 38	11	25	11.5	N	0	Forested	-	Mature	Mixedwood	-	Sparse	12
21/05/2013	BBS 39	16	30	9.4	N	0	Forested	-	Young	Mixedwood	Act	Sparse	6.5
21/05/2013	BBS 4	16	30	11.1	N	0	Forested	-	Mature	Deciduous	-	Sparse	8.5
22/05/2013	BBS 40	11	55	12.9	N	0	Range	-	-	-	-	-	-
22/05/2013	BBS 41	16	45	12.9	N	0	Forested	-	Mature	Mixedwood	-	Sparse	9
22/02/2013	BBS 42	16	40	12	N	0	Forested	-	Mature	Deciduous	-	Sparse	11
23/05/2013	BBS 43	11	20	10.2	N	0	Forested	-	Mature	Mixedwood	-	Sparse	12
23/05/2013	BBS 44	20	20	10.3	N	0	Forested	-	-	Mixedwood	-	Sparse	12
21/05/2013	BBS 5	12	35	10.1	N	0	Forested	-	Mature	Mixedwood	-	Sparse	8
25/05/2013	BBS 59	9	60	11.1	N	0	Forested	-	Mature	Mixedwood	-	Sparse	13
21/05/2013	BBS 6	16	35	11.2	N		Forested	-	Mature	Mixedwood	-	Sparse	10
21/05/2013	BBS 7	10	35	11.2	N	0	Forested	-	Young	Coniferous	-	Closed	8.5
21/05/2013	BSS 8	2	35	12.9	N	1	Range	-	-	-	-	-	-
22/05/2013	BBS	14	55	13.3	N	0	Forested	-	Mature	Coniferous	-	Closed	9
21/05/2013	BBS 1	16	30	10.3	N	0	Forested	-	Young	Deciduous	Willow sp.	Sparse	3.5
21/05/2013	BBS 10	16	25	9	N	0	Forested	-	-	Coniferous	-	Closed	5.5
21/05/2013	BBS 11	11	40	11	N	0	Forested	-	Young	Mixedwood	Alder (70%)	Sparse	8

NOTE:
 – No data available

Table E-2: Breeding Bird Habitat and Weather Data (B)

Date	Station	CWD	Lichen (%)	Shrubs: Short (%)	Shrubs: Med (%)	Shrubs: Tall (%)	Herbs	Road/RoW/Trail/ Seismic line	Distance to (m)	Width (m)	Level of Use
21/05/2013	BBS 1	Moderate	0	5	10	85	35	-	-	-	-
21/05/2013	BBS 10	Low	0	25	10	65	20	Road	-	10	Moderate
21/05/2013	BBS 11	Low	0	20	5	75	30	Road	-	4	Low
25/05/2013	BBS 15	Low	0	10	10	80	50	Road	-	4	Moderate
25/05/2013	BBS 16	Moderate	0	5	30	5	35	Trail	20	0.25	Low
25/05/2013	BBS 17	-	0	10	30	3	70	Trail	-	0.25	Low
23/05/2013	BBS 18	Moderate	0	10	30	5	20	-	-	-	-
23/05/2013	BBS 19	Moderate	0	35	2	5	70	-	-	-	-
21/05/2013	BBS 2	-	0	30	0	0	65	-	-	-	-
26/05/2013	BBS 20	Low	0	30	10	60	30	Road	10	10	Moderate
23/05/2013	BBS 21	-	0	10	10	5	30	-	-	-	-
23/05/2013	BBS 22	-	0	30	5	0	50	-	-	-	-
22/05/2013	BBS 23	Moderate	0	5	20	5	5	Trail	-	5	Low
22/05/2013	BBS 24	-	-	-	-	-	-	-	-	-	-
22/05/2013	BBS 25	-	-	-	-	-	-	-	-	-	-
25/05/2013	BBS 26	-	0	5	5	90	85	-	-	-	-
21/05/2013	BBS 3	-	0	20	30	10	40	Trail	10	3	Moderate
21/05/2013	BBS 30	Low	0	20	5	75	75	RoW and Trail	30	15	Low
21/05/2013	BBS 31	-	-	-	-	-	-	RoW	15	10	Low
25/05/2013	BBS 32	-	-	-	-	-	-	Road	5	10	Low
21/05/2013	BBS 33	-	-	10	10	30	20	Road	-	10	Moderate
22/05/2013	BBS 34	Low	0	5	-	2	30	Road	-	15	Moderate
22/05/2013	BBS 35	-	-	10	20	-	80	-	-	-	-
23/05/2013	BBS 37	-	0	0	5	20	40	-	-	-	-
23/05/2013	BBS 38	Moderate	0	15	5	5	10	Trail	-	5	-

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 Wildlife Resources Technical Data Report
 Appendix E: Terrestrial Survey Habitat and Weather Data

Date	Station	CWD	Lichen (%)	Shrubs: Short (%)	Shrubs: Med (%)	Shrubs: Tall (%)	Herbs	Road/RoW/Trail/ Seismic line	Distance to (m)	Width (m)	Level of Use
21/05/2013	BBS 39	-	0	5	2	2	75	Trail	35	5	-
21/05/2013	BBS 4	Moderate	0	10	10	80	35	Trail	-	4	Low
22/05/2013	BBS 40	Low	0	60	10	30	30	Road and RoW	10 and 2	10 and 10	Moderate
22/05/2013	BBS 41	-	-	-	-	-	-	Trail	-	0.5	Moderate
22/02/2013	BBS 42	Moderate	0	20	10	70	20	RoW	15	15	Low
23/05/2013	BBS 43	Low	0	10	20	70	30	RoW	25	10	Low
23/05/2013	BBS 44	Moderate	-	5	15	20	50	Trail	-	5	Moderate
21/05/2013	BBS 5	Low	0	5	15	20	50	Trail	-	5	Moderate
25/05/2013	BBS 59	Moderate	0	10	25	65	35	-	15	15	Moderate/ High
21/05/2013	BBS 6	Moderate	0	10	30	-	30	Road	90	10	Moderate
21/05/2013	BBS 7	Low	0	5	15	80	60	RoW	-	50	Low
21/05/2013	BSS 8	High	0	0	10	90	10	Road	15	20	Moderate

NOTE:

CWD – coarse woody debris
 – No data available

Table E-3: Raptor Call Playback Habitat and Weather Data

Date	Call Type	Call Station	Start Time	End Time	Time Period	Survey Effort (min)	Temp (°C)	Avg. Wind Speed (km/h)	Precip.	CC (%)
5/1/2013	Western screech-owl	OWL 1	0356	0405	Nocturnal	8	5.8	0	none	50
5/1/2013	Western screech-owl	OWL 2	0437	0445	Nocturnal	8	4.6	0	none	100
5/1/2013	Western screech-owl	OWL 3	0504	0512	Nocturnal	8	7	0	none	100
5/1/2013	Western screech-owl	OWL 2	0530	0538	Nocturnal	8	7.4	0	none	100
5/2/2013	Northern goshawk	NOGO6	0953	1002	Diurnal	9	8.1	0	light	100
5/2/2013	Northern goshawk	NOGO5	1009	1017	Diurnal	8	8	0	light	100
5/2/2013	Northern goshawk	NOGO4	1039	1047	Diurnal	8	8.5	0	light	100
5/2/2013	Northern goshawk	NOGO3	1105	1113	Diurnal	8	8.9	0	light	100
5/2/2013	Northern goshawk	NOGO2	1123	1131	Diurnal	8	9.1	0	light	100
5/2/2013	Northern goshawk	NOGO1	1141	1149	Diurnal	8	8.8	0	light	100
5/2/2013	Northern goshawk	NOGO8	0935	0944	Diurnal	8	7.4	0	light	100
5/2/2013	Northern goshawk	NOGO7	0920	0928	Diurnal	8	7.5	0	light	100

NOTE:
CC – cloud cover

Table E-4: Amphibian Survey Habitat and Weather Data

Month	Site #	Wetland Size 1 (m)	Wetland Size 2 (m)	Search Time (min)	Wetland Size	Start time	Start: Ceiling	Start: Cloud Cover	Start: Wind	Start: Precip	Start: Temp	End Time	End: Ceiling	End: Cloud Cover	End: Wind	End: Precip	End: Temp
May	AMP 1	10	10	20	Small	1115	HIGH	97	6	0	15.6	1135	HIGH	97	6	0	15.8
May	AMP 10	70	100	40	Large	1052	LOW	100	3.1	0	11.5	1112	LOW	100	3.1	0	11.5
May	AMP 11	4	1.5	15	Small	1103	HIGH	97	7.9	0	15.4	1118	HIGH	97	7.9	0	15.4
May	AMP 12	60	5	40	Small	1150	VH	10	0	0	24.1	1210	VH	10	0	0	24
May	AMP 13	200	70	80	Large	1040	VH	40	2	0	18.5	1120	VH	40	2.2	0	20.7
May	AMP 2	100	100	20	Small	1150	VH	100	4.5	0	16.1	1220	VH	100	4	0	16
May	AMP 3	75	75	61	Small	1201	VH	40	3.9	0	18.7	1232	VH	20	1.6	0	21.4
May	AMP 4	100	100	45	Small	1245	VH	5	0.2	0	21	1330	VH	5	1.1	0	23
May	AMP 5	400	400	40	Large	1008	LOW	100	0	0	11.5	1028	LOW	100	2	0	11.5
May	AMP 6	60	60	40	Small	1240	VH	0	0	0	25.8	1300	VH	0	0	0	25.8
May	AMP 7	40	5	40	Small	1215	VH	1	0	0	24.3	1235	VH	0	0	0	24.3
June	AMP1	300	50	95	Small	0905	MID	100	3.4	Light rain	13.1	1020	LOW	100	3.6	rain	13.1
June	AMP10	60	60	60	Small	1040	HIGH	60	8.3	none	18.2	1110	HIGH	50	2.2	none	21
June	AMP2	90	100	120	Small	1055	MID	100	2.1	none	17.4	1155	MID	100	12	none	16.4
June	AMP3	75	50	60	Small	1215	MID	100	3	none	17.8	1245	MID	100	3	none	17.7
June	AMP4	50	100	60	Small	1027	HIGH	45	0	none	23	1057	HIGH	50	5.4	none	23
June	AMP5	100	100	63	Large	1121	HIGH	25	1	none	23.1	1154	HIGH	30	1.2	none	20.5
June	AMP6	75	100	50	Small	1010	LOW	100	0	none	17.2	1035	LOW	100	0	none	18.2
June	AMP7	50	50	70	Small	0925	LOW	100	0	none	17.1	1000	LOW	100	0	none	17.1
June	AMP8	50	50	54	-	1243	LOW	100	0	0	15.2	1310	LOW	100	0	0	16.6
June	AMP9	200	50	120	-	1130	LOW	100	0	none	14.9	1230	LOW	100	1.1	none	15

NOTE:
 – No data available

Table E-5: Large Mammal Transect Habitat and Weather Data

Date	Transect Label	Start time	End time	Effort (min)	Temperature (°C)	Wind Speed (km/h)	Precipitation	Transect Segment (m)
28-Aug-12	WT01	1045	1130	45	15	0	none	350–375
29-Aug-12	WT02	1645	1720	35	15	0	drizzle	375–400
24-May-13	WT02	0800	0830	30	12.8	0	light rain	225–250
24-May-13	WT03	0900	0940	40	10.6	5.6	light rain	400–425
25-May-13	WT01	1046	1115	29	13.2	0	none	350–375
1-Sep-12	WT03	1330	1354	24	15.3	18.2	none	225–250
24-Jun-13	WT03	0715	0745	30	15.1	0	none	350–375
22-Jun-13	WT01	1045	1112	27	19.3	0	none	125–150
22-Jun-13	WT02	0925	0955	30	14.4	0	none	475–500

APPENDIX F

Breeding Bird Survey Data

Table F-1: Breeding Bird Survey Data

		May Breeding Bird Survey Data – Stations 1 to 11 and 15 to 22																			
Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	
American redstart	<i>Setophaga ruticilla</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
American robin	<i>Turdus migratorius</i>	2	1	1	-	1	4	-	3	2	3	1	1	3	1	1	2	2	2	2	
Bald eagle	<i>Haliaeetus leucocephalus</i>	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
Black swift	<i>Cypseloides niger</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
Black-capped chickadee	<i>Poecile atricapillus</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	
Brown creeper	<i>Certhia americana</i>	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	-	
Cedar waxwing	<i>Bombcilla garrulous</i>	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
Chestnut-backed chickadee	<i>Poecile rufescens</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chipping sparrow	<i>Spizella passerina</i>	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Common yellowthroat	<i>Geothlypis trichas</i>	2	-	1	1	-	1	-	1	-	-	2	-	-	-	-	-	-	-	1	
Dark-eyed junco	<i>Junco hyemalis</i>	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	
Downy woodpecker	<i>Picoides pubescens</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-	2	1	
Fox sparrow	<i>Passerella iliaca</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	
Golden-crowned kinglet	<i>Regulus satrapa</i>	-	-	-	-	-	1	-	-	-	-	-	1	2	1	2	1	1	2	4	
Hammond's flycatcher	<i>Empidonax hammondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-	1	-	-	
Hermit thrush	<i>Catharus guttatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	
Lincoln's sparrow	<i>Melospiza lincolnii</i>	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	
MacGillivray's warbler	<i>Geothlypis tolmiei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Northern flicker	<i>Colaptes auratus</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	
Northern waterthrush	<i>Parkesia noveboracensis</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Northwestern crow	<i>Corvus caurina</i>	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
Orange-crowned warbler	<i>Oreothlypis celata</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
Pacific wren	<i>Troglodytes pacificus</i>	-	-	-	-	-	-	-	-	-	-	-	2	2	-	2	2	-	1	-	
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3	-	

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 Wildlife Resources Technical Data Report
 Appendix F: Breeding Bird Survey Data

		May Breeding Bird Survey Data – Stations 1 to 11 and 15 to 22																			
Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	
Pileated woodpecker	<i>Dryocopus pileatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	
Pine siskin	<i>Spinus pinus</i>	-	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	-	-	
Purple finch	<i>Haemorhous purpureus</i>	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	
Red-eyed vireo	<i>Vireo olivaceus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
Red-tailed hawk	<i>Buteo jamaicensis</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Red-winged blackbird	<i>Agelaius phoeniceus</i>	1	-	-	-	-	1	-	1	-	-	1	-	-	-	-	-	-	-	1	
Ruby-crowned kinglet	<i>Regulus calendula</i>	1	2	-	-	2	3	1	1	1	2	1	4	3	2	4	2	3	4	5	
Ruffed grouse	<i>Bonasa umbellus</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
Rufous hummingbird	<i>Selasphorus rufus</i>	1	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	
Savannah sparrow	<i>Passerculus sandwichensis</i>	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
Song sparrow	<i>Melospiza melodia</i>	1	1	5	5	2	-	-	3	-	-	3	-	-	-	-	-	1	-	1	
Swainson's thrush	<i>Catharus ustulatus</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	
Townsend's warbler	<i>Setophaga townsendi</i>	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-	
Tree swallow	<i>Tachycineta bicolor</i>	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	
Varied thrush	<i>Ixoreus naevius</i>	-	-	-	1	1	-	-	1	-	1	-	-	-	1	-	1	-	2	1	
Veery	<i>Catharus fuscens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
Warbling vireo	<i>Vireo gilvus</i>	3	1	3	2	-	2	1	-	4	-	3	-	3	-	-	2	1	-	2	
Western tanager	<i>Piranga ludoviciana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
Western wood-pewee	<i>Contopus sordidulus</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
Wilson's warbler	<i>Cardellina pusilla</i>	1	-	3	-	-	1	-	-	1	1	-	-	1	1	-	-	-	-	2	
Yellow warbler	<i>Setophaga petechial</i>	1	-	-	3	-	2	-	-	1	-	1	-	-	-	-	-	-	-	1	
Yellow-rumped warbler	<i>Setophaga coronata</i>	-	2	1	5	-	4	2	3	4	-	6	4	3	1	3	1	-	4	5	
Total		17	8	18	17	6	23	6	26	19	7	22	17	18	9	20	15	14	26	29	

NOTE:
 – No observations made

		May Breeding Bird Survey Data – Stations 23 to 26 and 30 to 44																		
Common Name	Scientific Name	23	24	25	26	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Alder flycatcher	Empidonax alnorum	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
American robin	Turdus migratorius	1	4	1	1	-	1	1	-	-	2	-	-	1	2	3	1	1	1	1
Bald eagle	Haliaeetus leucocephalus	-	-	-	-	-	1	2	-	-	-	-	-	1	-	2	-	-	-	-
Chipping sparrow	Spizella passerina	1	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-
Common raven	Corvus corax	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common yellowthroat	Geothlypis trichas	-	1	-	-	-	-	5	-	1	-	-	-	-	-	4	-	-	-	-
Dark-eyed Junco	Junco hyemalis	-	2	-	-	-	-	-	1	-	1	1	-	-	2	-	-	-	-	-
Downy woodpecker	Picoides pubescens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Dusky flycatcher	Empidonax oberholseri	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
Fox sparrow	Passerella iliaca	-	1	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-
Golden-crowned kinglet	Regulus satrapa	1	-	-	-	-	-	-	-	-	1	1	2	2	-	1	-	-	-	-
Gray jay	Perisoreus canadensis	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
Hammond's flycatcher	Empidonax hammondii	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	2	1	1
Hermit thrush	Catharus guttatus	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	1	-	1	-
Lincoln's sparrow	Melospiza lincolni	2	9	1	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	2
MacGillivray's warbler	Geothlypis tolmiei	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Northern flicker	Colaptes auratus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern waterthrush	Parkesia noveboracensis	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-
Northwestern crow	Corvus caurina	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orange-crowned warbler	Oreothlypis celata	-	1	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
Pacific wren	Troglodytes pacificus	-	-	-	-	-	-	-	-	1	-	1	-	2	2	-	3	1	4	-
Pacific-slope flycatcher	Empidonax difficilis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Purple finch	Haemorhous purpureus	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	-	1	-	-
Red-breasted nuthatch	Sitta canadensis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Red-eyed vireo	Vireo olivaceus	-	-	-	1	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-

LNG Canada Export Terminal
 Wildlife Resources Technical Data Report
 Appendix F: Breeding Bird Survey Data

		May Breeding Bird Survey Data – Stations 23 to 26 and 30 to 44																		
Common Name	Scientific Name	23	24	25	26	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Red-winged blackbird	<i>Agelaius phoeniceus</i>	1	2	-	-	5	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Ring-necked duck	<i>Aythya collaris</i>	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ruby-crowned kinglet	<i>Regulus calendula</i>	1	4	1	-	1	1	-	-	-	2	2	2	4	-	1	1	-	3	3
Rufous hummingbird	<i>Selasphorus rufus</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Savannah sparrow	<i>Passerculus sandwichensis</i>	2	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Song sparrow	<i>Melospiza melodia</i>	-	3	2	-	2	1	4	2	1	1	-	-	1	-	2	-	2	-	-
Spotted sandpiper	<i>Actitis macularius</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Swainson's thrush	<i>Catharus ustulatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Townsend's warbler	<i>Setophaga townsendi</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tree swallow	<i>Tachycineta bicolor</i>	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Varied thrush	<i>Ixoreus naevius</i>	1	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	2	1
Veery	<i>Catharus fuscens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Warbling vireo	<i>Vireo gilvus</i>	-	-	-	3	3	-	3	-	-	-	-	-	1	4	-	6	5	4	4
Western tanager	<i>Piranga ludoviciana</i>	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-
Western wood-pewee	<i>Contopus sordidulus</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Wilson's warbler	<i>Cardellina pusilla</i>	1	-	-	4	1	-	-	-	-	1	-	-	1	-	-	1	4	-	1
Yellow warbler	<i>Setophaga petechial</i>	-	-	-	2	-	-	1	-	-	-	-	1	-	1	-	-	-	-	-
Yellow-rumped warbler	<i>Setophaga coronata</i>	2	2	-	4	1	-	1	-	1	3	2	2	1	2	1	1	2	1	2
Total		15	35	8	18	19	7	22	4	11	13	11	11	19	15	17	18	20	19	16

		June Breeding Bird Survey Data – Stations 1 to 11 and 15 to 23																			
Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	23
Alder flycatcher	<i>Empidonax alhorum</i>	1	2	-	1	2	1	1	2	-	1	-	-	-	-	-	1	1	-	1	-
American redstart	<i>Setophaga ruticilla</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
American robin	<i>Turdus migratorius</i>	-	1	-	-	2	-	4	1	5	2	-	-	-	2	1	4	1	2	1	-
Black-capped chickadee	<i>Poecile atricapillus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Brown creeper	<i>Certhia americana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-
Cedar waxwing	<i>Bombycilla garrulus</i>	-	-	1	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-
Chestnut-backed chickadee	<i>Poecile rufescens</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chipping sparrow	<i>Spizella passerina</i>	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common yellowthroat	<i>Geothlypis trichas</i>	1	1	-	1	2	-	3	-	-	-	1	-	-	-	-	-	-	-	2	3
Dark-eyed junco	<i>Junco hyemalis</i>	1	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	1
Downy woodpecker	<i>Picoides pubescens</i>	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden-crowned kinglet	<i>Regulus satrapa</i>	-	-	-	-	-	-	-	-	2	1	1	1	1	1	1	5	1	2	-	-
Hammond's flycatcher	<i>Empidonax hammondii</i>	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	-	-	-	-
Hermit thrush	<i>Catharus guttatus</i>	-	1	-	-	2	-	-	-	1	-	-	-	-	-	1	-	-	-	1	-
Lincoln's sparrow	<i>Melospiza lincolnii</i>	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	1	-
MacGillivray's warbler	<i>Geothlypis tolmiei</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern flicker	<i>Colaptes auratus</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern waterthrush	<i>Parkesia noveboracensis</i>	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Northwestern crow	<i>Corvus caurina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Orange-crowned warbler	<i>Oreothlypis celata</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific wren	<i>Troglodytes pacificus</i>	-	-	1	-	-	1	2	-	-	2	-	1	-	2	2	4	-	1	-	-
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	-	-	1	-	-	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Red-breasted nuthatch	<i>Sitta canadensis</i>	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	1	1	-	-	-
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Red-eyed vireo	<i>Vireo olivaceus</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Red-winged blackbird	<i>Buteo jamaicensis</i>	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-

LNG Canada Export Terminal
 Wildlife Resources Technical Data Report
 Appendix F: Breeding Bird Survey Data

		June Breeding Bird Survey Data – Stations 1 to 11 and 15 to 23																			
Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	23
Ruby-crowned kinglet	<i>Agelaius phoeniceus</i>	1	2	-	-	1	2	-	1	2	1	-	1	3	2	2	2	2	2	1	-
Rufous hummingbird	<i>Regulus calendula</i>	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Sandhill crane	<i>Passerculus sandwichensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Savannah sparrow	<i>Passerculus sandwichensis</i>	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	1
Song sparrow	<i>Melospiza melodia</i>	1	1	1	1	3	1	4	3	3	-	3	-	-	-	-	1	1	-	1	3
Swainson's thrush	<i>Catharus ustulatus</i>	-	1	2	1	4	-	2	1	1	-	-	1	-	2	3	1	-	1	1	1
Townsend's warbler	<i>Setophaga townsendi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Tree swallow	<i>Tachycineta bicolor</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Varied thrush	<i>Ixoreus naevius</i>	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	4	2	-	-	-
Veery	<i>Catharus fuscens</i>	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Warbling vireo	<i>Vireo gilvus</i>	2	5	-	2	3	1	3	-	2	6	3	-	1	4	1	2	2	2	1	-
Western tanager	<i>Piranga ludoviciana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	1
Western wood-pewee	<i>Contopus sordidulus</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wilson's warbler	<i>Cardellina pusilla</i>	1	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Yellow warbler	<i>Setophaga petechial</i>	2	1	-	3	4	-	2	-	2	1	-	-	3	-	-	1	-	-	-	-
Yellow-rumped warbler	<i>Setophaga coronata</i>	1	6	-	-	-	2	1	-	2	1	1	2	1	3	2	4	3	3	1	-
Total		13	24	12	9	28	12	28	13	24	18	10	10	11	20	16	35	15	16	12	15

		June Breeding Bird Survey Data – Stations 24 to 26, 30 to 44, and 50																		
Common Name	Scientific Name	24	25	26	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	50
Alder flycatcher	<i>Empidonax alnorum</i>	-	1	2	-	-	1	1	1	2	-	1	-	-	-	-	-	-	-	-
American redstart	<i>Setophaga ruticilla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
American robin	<i>Turdus migratorius</i>	1	1	-	-	-	2	-	3	5	1	3	-	1	1	-	1	-	-	-
Bald eagle	<i>Haliaeetus leucocephalus</i>	-	1	-	-	1	-	1	-	3	-	-	-	-	-	-	-	-	-	-
Brown creeper	<i>Certhia americana</i>	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	-	-
Cedar waxwing	<i>Bombycilla garrulous</i>	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-
Chipping sparrow	<i>Spizella passerina</i>	1	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-
Common raven	<i>Corvus corax</i>	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common yellowthroat	<i>Geothlypis trichas</i>	1	5	-	3	1	-	-	2	5	1	2	1	-	-	-	-	-	-	-
Dark-eyed junco	<i>Junco hyemalis</i>	-	-	-	-	-	1	-	1	-	1	-	-	2	-	-	-	-	-	-
Golden-crowned kinglet	<i>Regulus satrapa</i>	-	-	1	-	-	-	-	1	1	2	4	1	-	-	1	-	2	1	1
Greater yellowlegs	<i>Tringa melanoleuca</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Hammond's flycatcher	<i>Empidonax hammondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Hermit thrush	<i>Catharus guttatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
House finch	<i>Haemorhous mexicanus</i>	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lincoln's sparrow	<i>Melospiza lincolnii</i>	2	3	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-
MacGillivray's warbler	<i>Geothlypis tolmiei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern flicker	<i>Colaptes auratus</i>	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Northern waterthrush	<i>Parkesia noveboracensis</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Northwestern crow	<i>Corvus caurina</i>	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific wren	<i>Troglodytes pacificus</i>	-	-	-	1	-	-	-	2	-	1	1	-	-	-	1	-	2	1	1
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Purple finch	<i>Haemorhous purpureus</i>	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-
Red-breasted nuthatch	<i>Sitta canadensis</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-

LNG Canada Export Terminal
 Wildlife Resources Technical Data Report
 Appendix F: Breeding Bird Survey Data

		June Breeding Bird Survey Data – Stations 24 to 26, 30 to 44, and 50																		
Common Name	Scientific Name	24	25	26	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	50
Red-eyed vireo	<i>Vireo olivaceus</i>	-	-	1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-
Red-winged blackbird	<i>Agelaius phoeniceus</i>	-	2	-	2	-	1	-	-	1	-	1	-	-	1	-	-	-	-	-
Ruby-crowned kinglet	<i>Regulus calendula</i>	2	1	-	2	-	-	1	1	4	1	3	2	-	1	1	1	1	2	-
Rufous hummingbird	<i>Selasphorus rufus</i>	1	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Savannah sparrow	<i>Passerculus sandwichensis</i>	1	1	-	-	-	-	-	2	1	-	-	-	-	1	-	-	-	-	-
Song sparrow	<i>Melospiza melodia</i>	2	4	-	2	1	3	1	1	4	-	1	1	-	5	-	2	-	-	-
Spotted sandpiper	<i>Actitis macularia</i>	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-
Swainson's thrush	<i>Catharus ustulatus</i>	-	-	1	-	-	1	-	-	1	1	2	-	-	1	-	2	1	2	3
Tree swallow	<i>Tachycineta bicolor</i>	-	1	-	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Varied thrush	<i>Ixoreus naevius</i>	2	-	-	-	-	-	-	1	1	-	2	1	-	-	-	-	2	1	-
Warbling vireo	<i>Vireo gilvus</i>	-	-	2	1	-	5	-	1	-	-	-	2	3	-	-	1	1	2	1
Western tanager	<i>Piranga ludoviciana</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-
Western wood-pewee	<i>Contopus sordidulus</i>	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Wilson's warbler	<i>Cardellina pusilla</i>	-	-	1	1	-	1	1	-	-	-	-	-	1	-	-	-	-	-	-
Yellow warbler	<i>Setophaga petechial</i>	-	-	2	1	-	1	-	2	1	-	-	-	-	-	1	1	-	-	-
Yellow-rumped warbler	<i>Setophaga coronata</i>	-	2	2	3	2	-	-	2	1	2	2	-	1	-	1	-	-	-	-
Total		14	26	12	22	5	17	9	31	37	11	24	10	9	11	6	12	10	9	6

NOTE:

- No observations made

APPENDIX G

Incidental Wildlife Observations

Table G-1: Incidental Bird Observations

Common Name	Scientific Name	No. observations
American robin	<i>Turdus migratorius</i>	14
American redstart	<i>Setophaga ruticilla</i>	1
American wigeon	<i>Anas americana</i>	17
Bald eagle	<i>Haliaeetus leucocephalus</i>	31
Barn swallow	<i>Hirundo rustica</i>	6
Barrow's goldeneye	<i>Bucephala islandica</i>	1
Belted kingfisher	<i>Megaceryle alcyon</i>	1
Black turnstone	<i>Arenaria melanocephala</i>	1
Black-capped chickadee	<i>Poecile atricapillus</i>	2
Bonaparte's gull	<i>Chroicocephalus philadelphia</i>	3
California gull	<i>Larus californicus</i>	7
Canada goose	<i>Branta canadensis</i>	462
Canvasback	<i>Aythya valisineria</i>	2
Chipping sparrow	<i>Spizella passerina</i>	2
Common loon	<i>Gavia immer</i>	1
Common merganser	<i>Mergus merganser</i>	10
Common raven	<i>Corvus corax</i>	5
Common yellowthroat	<i>Geothlypis trichas</i>	1
Dark-eyed junco	<i>Junco hyemalis</i>	6
Downy woodpecker	<i>Picoides pubescens</i>	4
Duck species	-	52
Dunlin	<i>Calidris alpina</i>	10
Great blue heron	<i>Ardea herodias fannini</i>	4
Great horned owl	<i>Bubo virginianus</i>	1
Greater white-fronted goose	<i>Anser albifrons</i>	200
Green-winged teal	<i>Anas crecca</i>	11
Gull species	-	2
Hammond's flycatcher	<i>Empidonax hammondii</i>	2
Herring gull	<i>Larus argentatus</i>	40
Killdeer	<i>Charadrius vociferus</i>	3
Least flycatcher	<i>Empidonax minimus</i>	1
Least sandpiper	<i>Calidris minutilla</i>	42
MacGillivray's warbler	<i>Geothlypis tolmiei</i>	1
Mallard	<i>Anas platyrhynchos</i>	15
Mourning dove	<i>Zenaida macroura</i>	15
Northern harrier	<i>Circus cyaneus</i>	1
Northern flicker	<i>Colaptes auratus</i>	3
Northern pintail	<i>Anas acuta</i>	8
Northern shoveler	<i>Anas clypeata</i>	17

LNG Canada Export Terminal
 Wildlife Resources Technical Data Report
 Appendix G: Incidental Wildlife Observations

Common Name	Scientific Name	No. observations
Northern waterthrush	<i>Parkesia noveboracensis</i>	2
Northwestern crow	<i>Corvus caurina</i>	1
Osprey	<i>Pandion haliaetus</i>	5
Owl species	-	1
Pacific wren	<i>Troglodytes pacificus</i>	1
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	1
Pectoral sandpiper	<i>Calidris melanotos</i>	330
Peregrine falcon	<i>Falco peregrinus pealei</i>	1
Pine siskin	<i>Spinus pinus</i>	27
Purple finch	<i>Haemorhous purpureus</i>	2
Raptor species	-	5
Red crossbill	<i>Loxia curvirostra</i>	5
Red-breasted nuthatch	<i>Sitta canadensis</i>	3
Red-eyed vireo	<i>Vireo olivaceus</i>	1
Red-tailed hawk	<i>Buteo jamaicensis</i>	3
Ruby-crowned kinglet	<i>Regulus calendula</i>	7
Rufous hummingbird	<i>Selasphorus rufus</i>	5
Rusty blackbird	<i>Euphagus carolinus</i>	1
Sanderling	<i>Calidris alba</i>	5
Shorebird species	-	120
Song sparrow	<i>Melospiza melodia</i>	21
Songbird species	-	1
Sooty grouse	<i>Dendragapus fuliginosus</i>	1
Townsend's warbler	<i>Setophaga townsendi</i>	3
Trumpeter swan	<i>Cygnus buccinator</i>	30
Varied thrush	<i>Ixoreus naevius</i>	18
Violet-green swallow	<i>Tachycineta thalassina</i>	4
Warbling vireo	<i>Vireo gilvus</i>	3
Western sandpiper	<i>Calidris mauri</i>	39
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	1
Yellow warbler	<i>Setophaga petechial</i>	2
Yellow-rumped warbler	<i>Setophaga coronata</i>	10
Total		1,665

Table G-2: Incidental Mammal Observations

Common Name	Scientific Name	No. Observations
American beaver	<i>Castor canadensis</i>	9
Bear species	-	7
Black bear	<i>Ursus americanus</i>	4
Grey wolf	<i>Canis lupus</i>	11
Grizzly bear	<i>Ursus arctos</i>	49
Harbour seal	<i>Phoca vitulina</i>	83
Mink	<i>Neovision vison</i>	1
Moose	<i>Alces americanus</i>	80
Mule deer	<i>Odocoileus hemionus</i>	3
Mustelidae	-	2
Porcupine	<i>Erethizon dorsatum</i>	3
Red fox	<i>Vulpes vulpes</i>	2
Red squirrel	<i>Tamiasciurus hudsonicus</i>	16
River otter	<i>Lontra canadensis</i>	10
Long-tailed weasel	<i>Mustela frenata</i>	1
Shrew species	-	1
Steller sea lion	<i>Eumetopias jubatus</i>	5
Ungulate species	-	5
Total		292

Table G-3: Incidental Amphibian Observations

Common Name	Scientific Name	No. Observations
Coastal tailed frog	<i>Ascaphus truei</i>	1
Columbia spotted frog	<i>Rana luteiventris</i>	2
Northwestern salamander	<i>Ambystoma gracile</i>	2
Western toad	<i>Anaxyrus boreas</i>	495
Total		500

Table G-4: Incidental Other Observations

Common Name	Scientific Name	No. Observations
Arthropod, unknown species	-	25
Total		25

APPENDIX H

Wildlife Habitat Suitability Rating Adjustments

Table H-1: Wildlife Habitat Suitability Disturbance Rating Adjustments

Species	Description	ZOI Buffer	ZOI Adjustment	Footprint Ranking
Grizzly bear – summer foraging	Bridge	50	1	6
	Building	50	1	6
	Clearing	50	1	6
	Clearing – industrial	50	1	6
	Dirt Road	50	1	0
	Electric substation complex	500	1	6
	Industrial	500	1	6
	Major road	500	1	6
	Pier/wharf	50	1	6
	Recreation	50	1	6
	Sand pit	50	1	6
	Settling pond	50	1	6
	Sewage treatment facility	500	1	6
	Train tracks	50	1	6
	Transmission line corridor	0	0	0
	Cut block – regenerating 2004	0	0	0
Grizzly bear – fall foraging	Bridge	50	1	6
	Building	50	1	6
	Clearing	50	1	6
	Clearing – industrial	50	1	6
	Dirt Road	50	1	0
	Electric substation complex	500	1	6
	Industrial	500	1	6
	Major road	500	1	6
	Pier/wharf	50	1	6
	Recreation	50	1	6
	Sand pit	50	1	6
	Settling pond	50	1	6
	Sewage treatment facility	500	1	6
	Train tracks	50	1	6
	Transmission line corridor	0	0	0
	Cut block – regenerating 2004	0	0	0
Harlequin duck – spring and fall foraging	Bridge	50	1	4
	Building	100	1	4
	Clearing	50	1	4
	Clearing – industrial	100	1	4
	Dirt road	50	1	4
	Electric substation complex	100	1	4

LNG Canada Export Terminal
 Wildlife Resources Technical Data Report
 Appendix H: Wildlife Habitat Suitability Rating Adjustments

Species	Description	ZOI Buffer	ZOI Adjustment	Footprint Ranking
	Industrial	100	1	4
	Major road	100	1	4
	Pier/wharf	50	1	4
	Recreation	50	1	4
	Sand pit	50	1	4
	Settling pond	50	1	4
	Sewage treatment facility	100	1	4
	Train tracks	50	1	4
	Transmission line corridor	50	1	4
	Cut Block – regenerating 2004	0	0	0
Marbled murrelet – breeding	Bridge	100	1	4
	Building	250	1	4
	Clearing	250	1	4
	Clearing – industrial	250	1	4
	Dirt road	100	1	4
	Electric substation complex	250	1	4
	Industrial	250	1	4
	Major road	250	1	4
	Pier/wharf	100	1	4
	Recreation	100	1	4
	Sand pit	100	1	4
	Settling pond	250	1	4
	Sewage treatment facility	250	1	4
	Train tracks	100	1	4
	Transmission line corridor	100	1	4
Cut block – regenerating 2004	100	1	4	
Pacific marten – year-round living	Bridge	50	1	4
	Building	100	1	4
	Clearing	50	1	4
	Clearing – industrial	100	1	4
	Dirt road	50	1	4
	Electric substation complex	100	1	4
	Industrial	100	1	4
	Major road	100	1	4
	Pier/wharf	50	1	4
	Recreation	50	1	4
	Sand pit	50	1	4
	Settling pond	50	1	4
	Sewage treatment facility	100	1	4
	Train tracks	50	1	4

Species	Description	ZOI Buffer	ZOI Adjustment	Footprint Ranking	
Western sandpiper – spring and fall foraging	Transmission line corridor	50	1	4	
	Cut Block – regenerating 2004	0	0	0	
	Bridge	50	1	4	
	Building	100	1	4	
	Clearing	50	1	3	
	Clearing – industrial	100	1	4	
	Dirt road	50	1	4	
	Electric substation complex	100	1	4	
	Industrial	100	1	4	
	Major road	100	1	4	
	Pier/wharf	50	1	4	
	Recreation	50	1	4	
	Sand pit	50	1	4	
	Settling pond	50	1	4	
	Sewage treatment facility	100	1	4	
	Train tracks	50	1	4	
	Transmission line corridor	50	1	4	
	Cut block – regenerating 2004	0	0	0	
Western screech-owl – year-round living	Bridge	50	1	4	
	Building	100	1	4	
	Clearing	50	1	4	
	Clearing – industrial	100	1	4	
	Dirt road	50	1	4	
	Electric substation complex	100	1	4	
	Industrial	100	1	4	
	Major road	100	1	4	
	Pier/wharf	50	1	4	
	Recreation	50	1	4	
	Sand pit	50	1	4	
	Settling pond	50	1	4	
	Sewage treatment facility	100	1	4	
	Train tracks	50	1	4	
	Transmission line corridor	50	1	4	
	Cut block – regenerating 2004	0	0	0	
	Western toad – breeding	Bridge	0	0	0
		Building	100	1	4
Clearing		50	1	4	
Clearing – industrial		100	1	4	
Dirt road		50	1	4	
Electric substation complex		100	1	4	

Species	Description	ZOI Buffer	ZOI Adjustment	Footprint Ranking
	Industrial	100	1	4
	Major road	100	1	4
	Pier/wharf	50	1	4
	Recreation	50	1	4
	Sand pit	50	1	4
	Settling pond	50	1	3
	Sewage treatment facility	100	1	4
	Train tracks	50	1	4
	Transmission line corridor	50	1	4
	Cut Block – regenerating 2004	0	0	0

APPENDIX I

Histograms

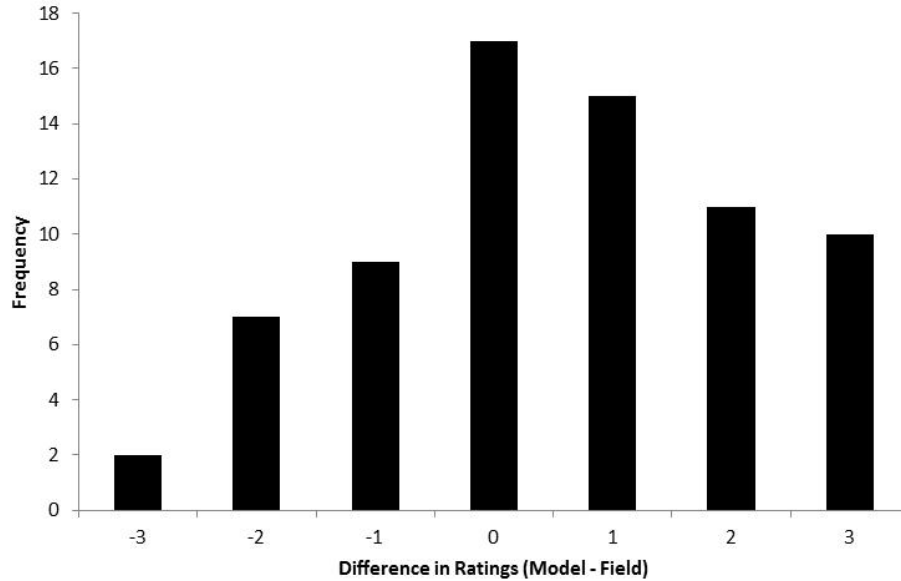


Figure I-1: Grizzly Bear Fall Foraging Habitat Suitability Model Distribution of the Difference in Habitat Ratings

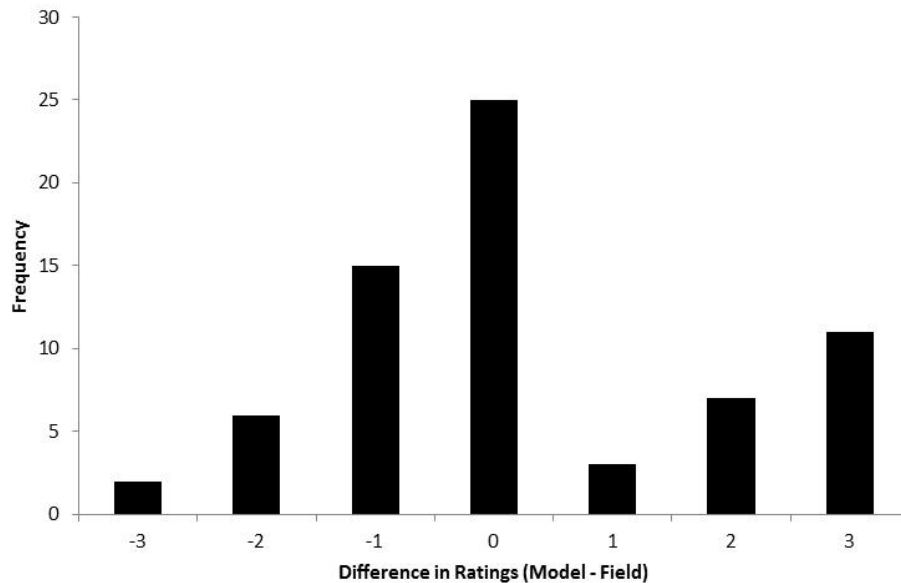


Figure I-2: Grizzly Bear Spring Foraging Habitat Suitability Model Distribution of the Difference in Habitat Ratings

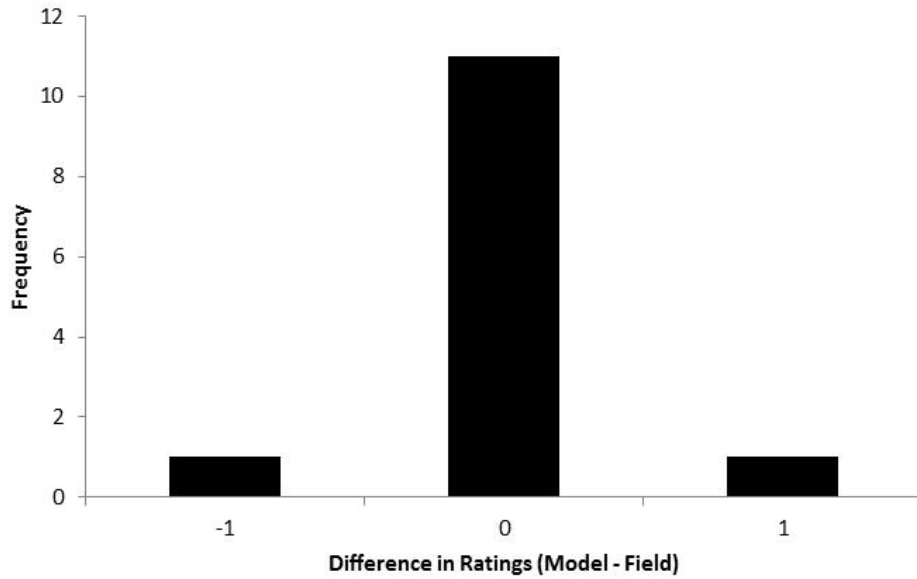


Figure I-3: Harlequin Duck Spring and Fall Foraging Habitat Suitability Model Distribution of the Difference in Habitat Ratings

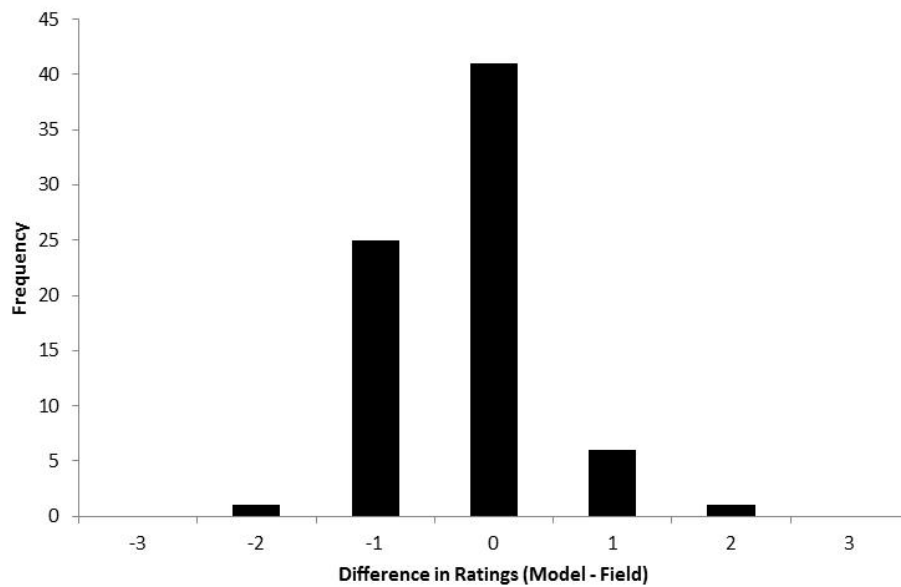


Figure I-4: Marbled Murrelet Breeding Habitat Suitability Model Distribution of the Difference in Habitat Ratings

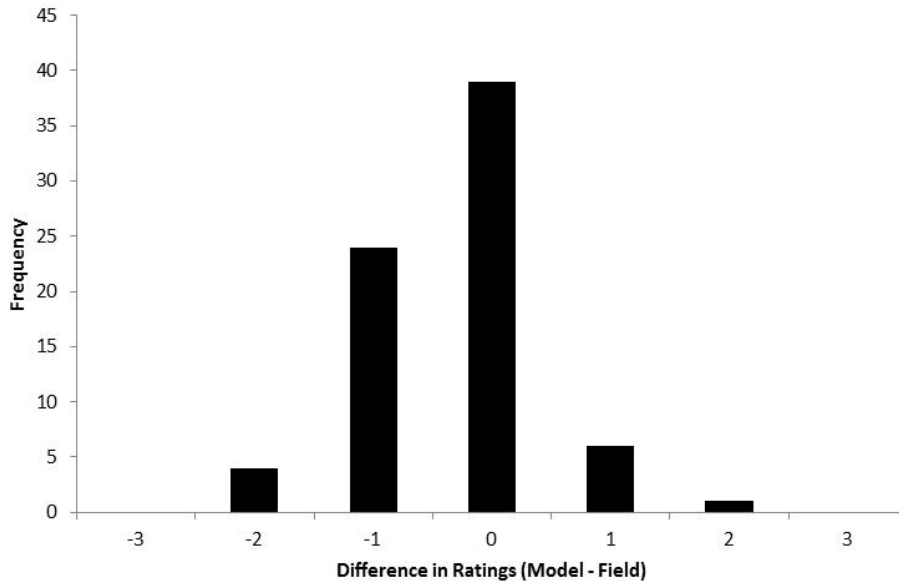


Figure I-5: Pacific Marten Year-Round Living Habitat Suitability Model Distribution of the Difference in Habitat Ratings

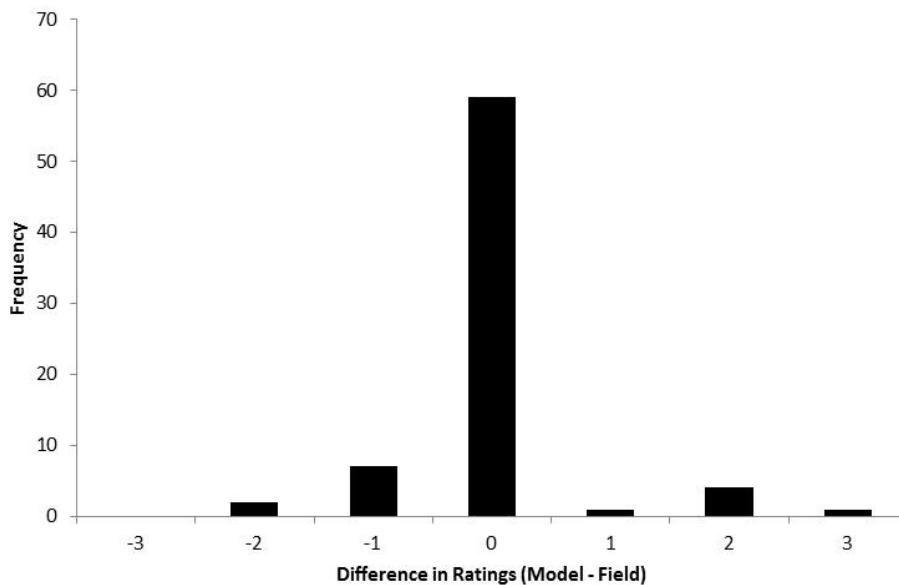


Figure I-6: Western Sandpiper Spring and Fall Foraging Habitat Suitability Model Distribution of the Difference in Habitat Ratings

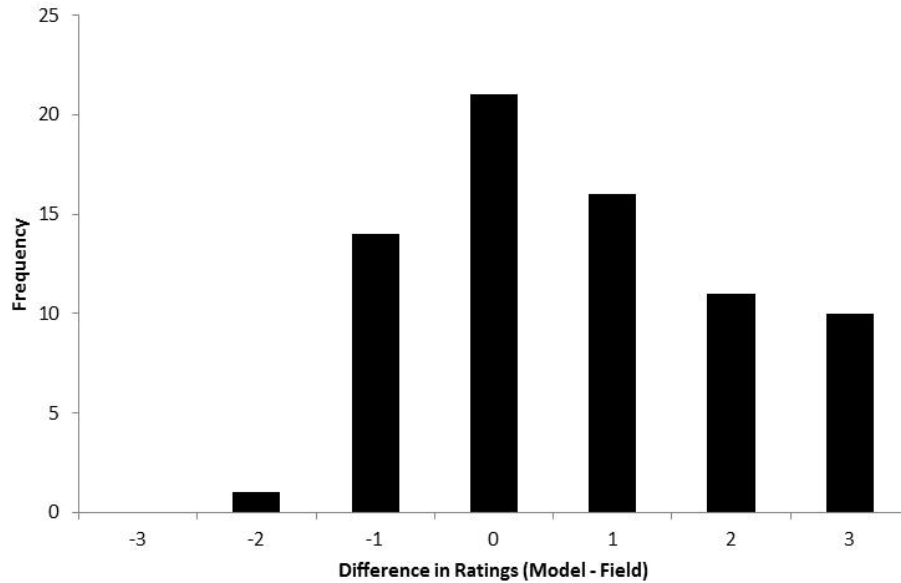


Figure I-7: Western Screech Owl Breeding Habitat Suitability Model Distribution of the Difference in Habitat Ratings

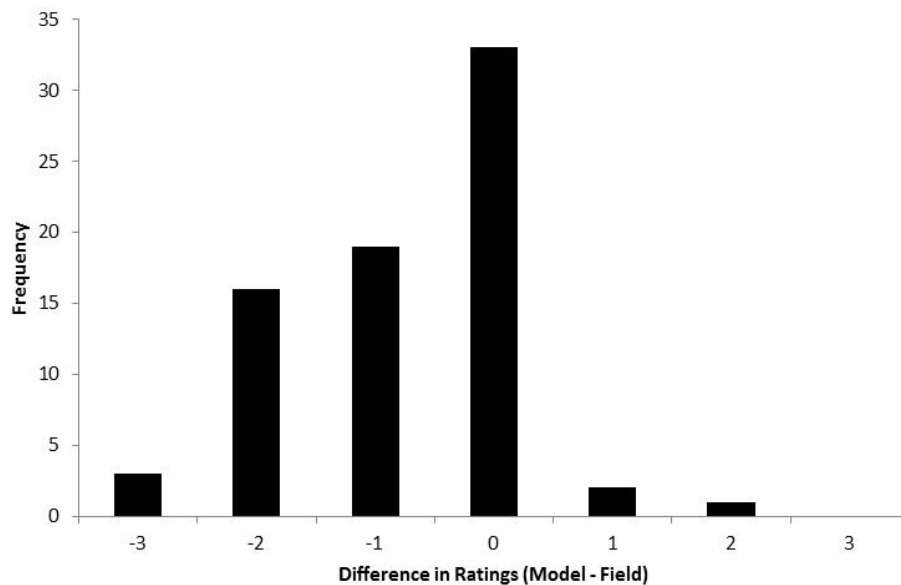


Figure I-8: Western Toad Foraging Habitat Suitability Model Distribution of the Difference in Habitat Ratings

APPENDIX J

Bird Species Observed at Stationary Points

Table J-1: Number of Individuals by Species Observed at Each Stationary Point

Species	EST1	EST2	EST3	EST4	EST5	EST6	EST7	EST8	EST9	EST10	EST11	EST12	EST13	EST14	EST15	EST16	EST17	EST18	EST19	EST20	EST21	EST22	EST23	Vessel Surveys ^a	Total
American wigeon	-	-	-	20	8	2	-	-	-	-	-	-	3	-	67	-	-	-	1	-	5	-	-	100	206
Bald eagle	-	1	6	5	1	2	1	3	1	3	3	6	3	-	6	-	4	3	1	2	1	2	3	15	72
Barrow's goldeneye	-	-	-	1	15	-	-	-	-	1	-	-	2	-	-	1	-	-	-	-	18	-	-	27	65
Belted kingfisher	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	6
Black turnstone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	0
Bonaparte's gull	-	-	3	1	-	-	-	-	-	10	10	-	-	-	-	-	-	-	-	-	-	-	-	12	36
Bufflehead	-	-	-	1	-	-	8	27	-	-	-	-	4	-	-	-	-	6	-	-	-	-	-	-	46
California gull	-	-	-	112	-	-	69	-	1	118	16	-	-	-	-	1	1	1	-	-	3	1	-	66	389
Canada goose	-	-	300	46	-	-	-	5	-	-	-	-	17	1	17	-	-	-	-	-	-	-	-	158	544
Common goldeneye	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	7
Common loon	-	-	-	4	2	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	10
Common merganser	-	1	-	8	5	-	-	49	-	3	-	-	-	5	-	3	4	2	-	-	-	-	-	49	129
Common raven	-	-	1	-	-	1	-	4	-	-	1	-	1	-	2	-	2	1	-	4	-	-	-	-	17
Cormorant species ^b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Dowitcher species ^b	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Duck species ^b	-	-	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	49
Dunlin	-	-	10	4	-	-	-	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	204
Gadwall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	6	-	-	19	37
Glaucous-winged gull	-	-	1	-	1	-	22	-	5	1	-	2	-	-	-	-	5	5	-	-	-	2	2	1	47
Goldeneye species ^b	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	-	-	4
Goose species ^b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50
Great blue heron	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	10	14
Greater scaup	-	-	-	2	-	-	-	20	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	24
Greater white-fronted goose	-	-	200	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	80	-	-	-	282
Green-winged teal	-	-	3	-	13	25	1	104	-	-	7	-	1	-	35	-	-	-	1	-	-	-	-	56	246
Gull species ^b	-	-	3	150	-	-	10	1	-	-	-	25	-	-	-	-	-	2	-	-	-	2	2	5	200
Harlequin duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	6
Herring gull	-	3	56	6	-	1	2	16	63	17	10	6	-	1	1	60	17	6	-	5	7	1	1	168	447
Hooded merganser	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3	-	-	-	-	-	5
Least sandpiper	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Mallard	7	8	4	9	36	18	21	35	-	7	12	13	24	-	41	-	-	-	19	1	85	-	1	147	488
Marbled murrelet	-	-	-	5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-	20	30
Merlin	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Mew gull	11	62	27	1	-	-	2	-	3	5	9	-	-	-	-	3	10	-	-	2	11	-	2	51	199
Northern harrier	-	-	-	1	-	-	-	1	-	-	1	-	-	-	1	-	-	-	-	-	1	-	1	-	6
Northern pintail	-	-	-	-	-	4	2	11	-	-	-	20	6	-	3	-	-	-	-	-	-	-	-	19	65
Northern shoveler	-	-	-	4	-	7	-	22	-	-	2	-	4	-	1	-	4	-	-	-	-	-	-	3	47
Northwestern crow	-	-	-	3	-	5	-	23	-	11	3	1	-	4	1	-	-	-	-	1	6	2	-	21	81

Species	EST1	EST2	EST3	EST4	EST5	EST6	EST7	EST8	EST9	EST10	EST11	EST12	EST13	EST14	EST15	EST16	EST17	EST18	EST19	EST20	EST21	EST22	EST23	Vessel Surveys ^a	Total
Osprey	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	5	6
Pacific golden-plover	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Pacific loon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Peregrine falcon	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Pigeon guillemot	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Red-breasted merganser	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	4
Red-necked grebe	2	1	-	-	-	1	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	8	15
Ring-billed gull	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3
Rock sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Sanderling	-	-	-	-	-	-	-	20	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	3	27
Scaup species ^b	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	14
Scoter species ^b	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
Shorebird species ^b	-	-	120	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	123
Short-billed dowitcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4
Snow goose	-	-	-	-	-	60	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84
Spotted sandpiper	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-	-	-	5	9
Surf scoter	-	-	-	-	-	15	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	50	-	30	97
Thayer's gull	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	4
Trumpeter swan	-	-	-	5	-	-	-	-	-	-	-	100	2	-	-	-	-	-	-	-	-	-	-	-	107
Wandering tattler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	20
Western grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Western sandpiper	30	-	-	-	-	-	-	36	-	-	-	15	2	-	-	-	-	-	-	11	-	-	150	280	524
White-winged scoter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4
Wilson's snipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Grand total	53	77	738	422	83	168	138	550	77	176	83	188	91	11	189	70	56	27	26	26	228	63	163	1,476	5,178

NOTE:
^a Additional vessel surveys were conducted within the Kitimat River and Minette Bay to capture intertidal and near shore species.
^b Individuals were not identified to species.
 - Species not recorded.