



Shell Exploration & Production

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16 May 2008

Re: North Slope Borough Permit 08-195 – Shell Offshore Inc.
Harboring Plan, Beaufort and Chukchi Sea Operations - **Revised Copy**

Dear Mr. Aiken,

Enclosed is a revised and updated copy of the Shell Offshore Inc. (Shell) Harboring Plan for the Beaufort and Chukchi Seas operations. The plan was drafted in response to a recommendation by the North Slope Borough (NSB) Planning Department staff set forth in the NSB Permit 08-195, issued February 28, 2008.

If there are any questions or comments regarding this plan, please contact me or Walt Sandel at (907) 770-3700 or e-mail susan.childs@shell.com or walter.sandel@shell.com.

Sincerely,

Shell

A handwritten signature in cursive script that reads "Susan Childs".

Susan Childs
Regulatory Affairs Manager, Alaska Venture

cc: Gordon Brower, NSB
Roy Varner, NSB
Don Perrin, ADNRP/OPMP
Jeff Walker, MMS
Project Manager
Project File
Administrative Record

Enclosure: Harboring Plan

SS/CW/AH/KP

15267-01.03-08-004A/08-115A



Harboring Plan 2008 Beaufort and Chukchi Seas Operations

May 2008

REVISION 1

Prepared for

Shell
3601 C Street, Suite 1314
Anchorage, Alaska 99503

Prepared by



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Addendum 2008-1: Shell 2008 Beaufort and Chukchi Sea Operations

ACRONYMS

3D	three-dimensional
4MP	Marine Mammal Monitoring and Mitigation Plan
ARLIS	Alaska Resources Library and Information Services
BPXA	BP Exploration (Alaska), Inc.
Brice	Brice Marine, LLC
Com	Communications
CPT	cone penetrometer
Crowley	Crowley Maritime Corporation
ft	foot/feet
ft/sec	feet/second
Industry	oil and gas industry
Kilabuk	M/V <i>Jim Kilabuk</i>
kmph	kilometers per hour
m	meter(s)
MLC	mud line cellar
MMMMP	Marine Mammal Monitoring and Mitigation Plan
MMS	U.S. Department of the Interior, Minerals Management Service
mph	miles per hour
m/sec	meters/second
M/V	Marine Vessel
NSB	North Slope Borough
NTCL	Northern Transportation Company Limited
NWT	Northwest Territories
OBHs	Ocean Bottom Hydrophones
OCS	Outer Continental Shelf
Plan	Harboring Plan
R/V	Research Vessel
sq yd	square yard(s)
TK	Traditional Knowledge
UAF	University of Alaska Fairbanks
VHF	very high frequency

1.0 INTRODUCTION

The following Harboring Plan (Plan) identifies planned vessel harboring locations for Shell Offshore Inc.'s (Shell) 2008 operations. The Plan was developed to best ensure Shell's crew and vessel safety, while at the same time reflect Shell's commitment to avoid unreasonable conflicts with the subsistence whaling activities of local residents. Shell intends that this Plan will remain in effect for its future Beaufort and Chukchi Seas operations. Amendments and/or updates to the Plan will be provided as future operations might dictate.

The Plan identifies various harboring areas along the Chukchi and Beaufort coasts for the vessels of various drafts within Shell's fleet. These possible harboring areas may be used for various reasons whenever a vessel has to move off the project site. In addition, ports or docks are described that may be used for crew changes, resupply, maintenance, etc. Vessel harboring and docking procedures and protocols are examined with respect to timing of subsistence uses. Avoidance of unreasonable impact to subsistence resources and harvest activities is a primary objective of this Plan.

Accompanying the Plan is an addendum (Addendum 2008-1) to provide details regarding the planned programs for the 2008 exploration season. Shell intends that the Plan will remain effective for future operations in the Beaufort and Chukchi Seas. In the event future planned operations might require revisions to the Plan, appropriate amendments and/or updates will be provided prior to initiation of operations.

Shell plans to acquire harboring information from a wide range of sources, but most importantly from the residents and organizations of the North Slope. Through programs such as the Subsistence Advisor Program and the Marine Mammal Observer Program, as well as village public meetings and visits with elders, Shell will gain additional knowledge regarding harboring and subsistence issues.

2.0 GENERAL ARCTIC WEATHER PATTERNS

2.1 *Historical Data*

2.1.1 Wind Currents

Challenging weather conditions in the Chukchi and Beaufort Seas may affect exploration and subsequent development plans and activities. Both regions experience freezing temperatures for most of the year and are known for frequent and sustained stormy weather. There is high potential for sea-spray icing of superstructures, such as drilling units.

Counterclockwise winds centered over the Arctic Ocean alternate with shorter periods of five to seven years of clockwise winds. Wind direction also varies by season. In the winter, northerly winds prevail, while in the summer, winds alternate between north and south directions. On the coast between Point Lay and Barrow, winds tend to blow from the east and southeast.

Most of the year, the region has moderate winds of 9.84 to 16.4 feet/second (ft/sec) (3 to 5 meters/second [m/sec]). Winds greater than 32.8 ft/sec (10 m/s) are rare and usually occur between October and March. These strong winds typically occur along the coast.

In the Beaufort and Chukchi Seas, wind and ice conditions drive the severity of ocean waves. Lynch et al. (2001) examined high wind events in Barrow between the years 1960 to 2000. High-wind events are more common in the fall and winter than they are in the spring and summer.

Longer, ice-free periods, and more frequent storms could indicate a future increase in storm surge events. Although coastal winds range from 13.1 to 26.2 ft/sec (4 to 8 m/sec), winds as high as 95.1 ft/sec (29 m/sec) have been sustained. Storms have wind velocities greater than 49.2 ft/sec (15 m/sec) and are more common in the winter than in the summer.

The U.S. Department of the Interior, Minerals Management Service (MMS) Outer Continental Shelf Chukchi Sea Planning Area Sale 193 Environmental Impact Statement (MMS 2007) summarizes Chukchi conditions to include 6 to 10 storm-days per month with each storm lasting 6 to 24 hours, with any individual storm lasting from 8 to 14 days. Winds may gust 75 to 80 miles per hour (mph) (121 to 129 kilometers per hour [kmph]) and be sustained at 55 mph (89 kmph). This can result in significant wind-induced wave erosion along the coastline and quickly shifting ice pack in the open water.

2.1.2 Ocean Currents

The general direction of ocean water movement is northerly from the Bering Strait into the Arctic Ocean. Bering Strait water is warmer and nutrient-rich causing the Chukchi Sea to have limited or no ice cover for up to five months each year, potentially extending the open-water operational season into the fall (October/November). This northward water flow results in complex water movement and also results in variable water salinities and densities. It will be important to understand where the shifts in salinity and density occur as various marine surveys may be affected by these variables.

For oil spill contingency planning, currents and water densities will also be important variables in the identification of spill migration direction for accurate modeling. Polynyas, or open lead systems, are important because these systems are closely related to predator-prey interactions. Predators such as polar bear, as well as subsistence hunters, use these areas for hunting. Polynyas also serve as whale migration routes to and from feeding areas or wintering grounds. Thus, coastal villages use polynyas for whaling during the spring.

Data regarding ocean currents in the offshore Beaufort Sea has been collected using current meters deployed in early summer and recovered in late September. However, these data do not represent the largest storm-induced currents, which typically occur in late fall, particularly in October and November. Through correlation of wind speed, ice floe speed, and current speed off the coast near Prudhoe Bay, surface currents are believed to reach 5 to 7 percent of wind speed. Therefore, for storm-induced sustained wind speed of 60 knots (101 ft/second; 69 mph) (111 kmph), surface current would be approximately 4 knots (6.7 ft/second; 4.6 mph) (7.4 kmph) (BP Exploration [Alaska], Inc. [BPXA] 1996).

2.1.3 Ice Conditions

The following summary of ice conditions in the project area is derived from the BPXA Conceptual Engineering Report (BPXA 1996) and is based on site observations, interpretation of satellite imagery, and studies by various authors.

For about nine months of the year, typically November through July, the waters of the Alaskan Beaufort Sea are covered with ice. During winter, the sea ice is generally classified into three main zones: landfast, shear zone, and pack ice. A brief description of each zone, starting from shoreline, is presented below.

Landfast Ice Zone

Landfast ice is relatively undeformed ice that extends from the shoreline to about the 33- to 66-foot (ft) (10-meter [m] to 20-m) isobaths. Landfast ice achieves a maximum thickness of about 6 ft (1.8 m). The fast ice is usually further subdivided into bottomfast ice and floating fast ice. Bottomfast ice freezes all the way down to the seabed; consequently, there is no water beneath the ice. Bottomfast ice extends from the shoreline to about the 6-ft (1.8-m) isobath. Seaward of the 6-ft (1.8-m) isobath the fast ice floats. The landfast ice remains relatively undisturbed through the winter until it begins to melt in late June. Movement of the landfast ice during the winter period is primarily attributed to thermal contraction and expansion of the continuous ice sheet. Small movements related to storm fronts cause narrow leads and rubble fields in this zone. Generally, the landfast zone contains open-water conditions throughout the summer season. Seaward of the landfast ice is the shear zone.

Shear Zone

The shear zone is located between the landfast ice and the pack ice zone, generally in water depths of 33 to 66 ft (10 to 20 m). The shear zone is a transition between the relatively stationary landfast ice and highly mobile pack ice. Fragments of seasonal ice, multi-year ice, and ice ridges more than 30 ft (9.1 m) high are typically found in this zone. The outer edge of fast ice is deformed and broken by pressure from the polar ice pack forming ridges of ice blocks that eventually “ground” onto the sea floor. Shear zone ice forces are extremely dynamic and constantly produce open water (leads) that freeze and form new ice, which in turn are deformed by pressure.

The environment at water depths over 40 ft (12 m) is active, especially in the fall with first-year and multi-year ice and waves, both of which combine as significant forces and potential erosion.

Pack Ice Zone

The pack ice zone lies beyond the shear zone and consists predominantly of multi-year permanent ice floes from 6- to 12-ft (1.8- to 3.7-m) thick that are consistently in motion. In summer the floes are surrounded by open water, thin ice, or bits and fragments of ice, and in winter by first-year ice. The long-term ice movement is from east to west in response to the Beaufort Gyre. Often, the Beaufort Sea pack contains large ice floes or ice islands that originate from the Ellesmere Ice Shelf. These features vary in size from a few thousand square yards (sq yd) (1,000 sq yd; 836 square meters) to 300 square miles (777 square kilometers). During the summer, rate of ice movements in excess of 12 miles (19 kilometers) per day are common.

Nearshore Ice Season

Ice within (shoreward of) the barrier islands is classified as landfast ice. In these areas the ice cover is typically at about 50 percent during the first or second week of July. One to two weeks later the ice is essentially gone (zero percent cover). In the fall, seasonal ice begins to form in October. This new ice is relatively thin and arctic-class vessels would be able to break through. Winter through late spring, the landfast ice reaches its maximum thickness.

2.2 Local Traditional Knowledge

It is Shell’s intent is to gather local Traditional Knowledge (TK) regarding weather and marine conditions in the Beaufort and Chukchi Seas. Shell proposes acquiring this TK from Native elders, other North Slope residents, and North Slope-based organizations, among others, during various meeting venues (e.g.,

Plan of Cooperation meetings) and through various programs (e.g., Subsistence Advisor program). The following lists some of the sources that Shell may investigate:

- North Slope elders
- Other North Slope residents and groups
- Project Jukebox climate change <http://uaf-db.uaf.edu/Jukebox/ClimateChange/home.html>
- Project Jukebox dangerous ice workshop <http://uaf-db.uaf.edu/Jukebox/dangerice/start.htm>
- *Impacts of changes in sea ice and other environmental parameters in the Arctic: report of the Marine Mammal Commission Workshop*. Edited by Henry Huntington (ASRC Energy Services – Regulatory and Technical Services recently checked this out from the Alaska Resource Library and Information Services [ARLIS])
- Arctic Research Consortium of the United States
- University of Colorado Integrated Assessment of the Impacts of Climate Variability on the Alaskan North Slope Coastal Region <http://nome.colorado.edu/HARC/>

As TK is gathered it will be reported in appropriate amendments and/or updates to the Plan.

3.0 SUBSISTENCE RESOURCES - SOURCES AND ISSUES

3.1 Traditional Knowledge Sources

In order to create a comprehensive Harboring Plan that details vessel operations with respect to subsistence resources, Shell intends to reach out and gather TK from North Slope Borough (NSB) residents and entities, as well as other local and state entities. Village elders and residents and various NSB groups contain a wealth of TK in the form of oral histories, written documents, and maps. This information will be important in defining marine subsistence areas and time periods when subsistence activities occur. For general TK subsistence information, some of which would include harboring areas, the following list applies:

- North Slope elders
- North Slope Tribal Councils
- North Slope City Councils
- Communications (Com) and Call Center reports
- Inupiat Heritage and Language Center
- Barrow Arctic Science Consortium (Anne Jensen)
- University of Alaska Fairbanks (UAF) Project Jukebox website: (<http://uaf-db.uaf.edu/Jukebox/PJWeb/proguse.htm>)
- Alaska Native Knowledge Network website: <http://www.ankn.uaf.edu/>
- Alaska Native Science Commission websites: <http://www.nativescience.org/>;
http://www.nativescience.org/html/traditional_knowledge.html
- Traditional Land Use Inventory
- NSB Comprehensive Plan

- Traditional Stories (e.g. <http://www.nsbds.org/anep/public/index.cfm/18,431.html>)
- Far North Science website:
<http://www.farorthscience.com/2007/03/30/anthropology/tapping-arctic-native-science/>
- MMS Traditional Knowledge website:
http://www.mms.gov/alaska/native/tradknow/tk_mms2.htm
- Proceedings and publications from the Alaska Anthropological Association
- Alaska Traditional Knowledge and Native Foods Database website:
<http://www.nativeknowledge.org/start.htm>
- ARLIS
- Communities in vicinity/region
- Various anthropological, ethnographic, and historic literature – depending on location

For more subsistence based TK (i.e., information on the seasons for various species; migratory routes etc.) the following list is applicable:

- North Slope elders
- North Slope Tribal councils
- North Slope City Councils
- NSB Comprehensive Plan
- NSB Planning, Wildlife, and Geographic Information Systems Departments
- Kuukpikmiut Subsistence Oversight Panel
- Alaska Traditional Knowledge and Native Foods Database
<http://www.nativeknowledge.org/start.htm>
- UAF Project Jukebox North Slope <http://uaf-db.uaf.edu/Jukebox/PJWeb/progusenorth.htm>
- State of Alaska Division of Subsistence
- Alaska Department of Fish and Game
- Stephen Braund and Associates (have done subsistence studies) and various other consultants

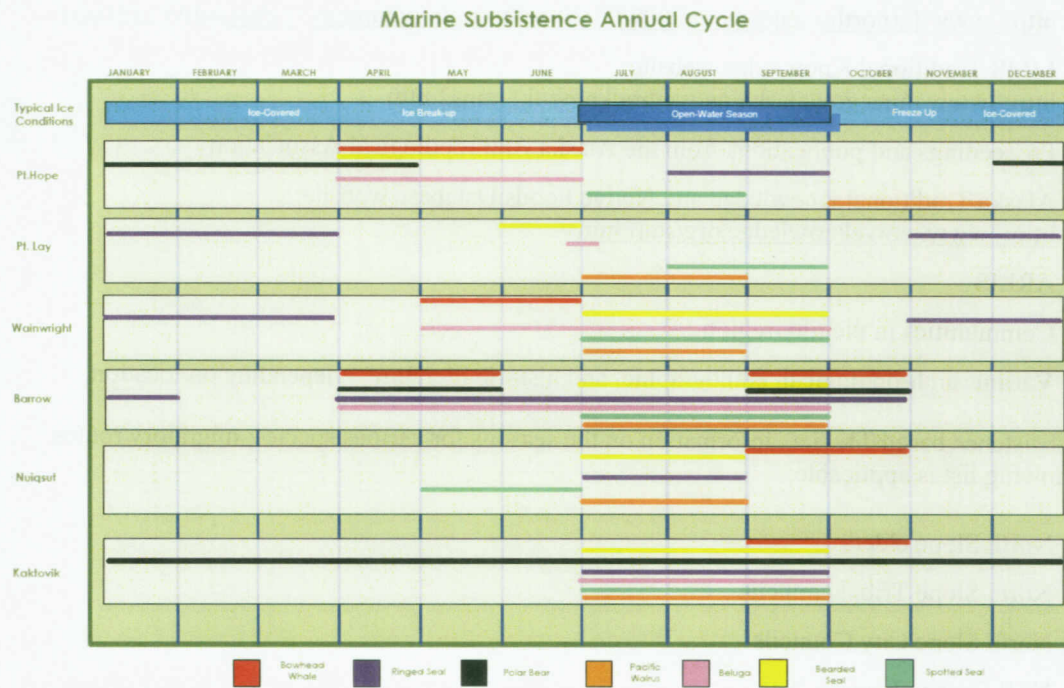
As subsistence TK is gathered it will be incorporated into the Plan and will be reported in appropriate amendments and/or updates.

3.2 Subsistence Issues

Table 3.2-1 displays a timeline for traditional time frames for various marine mammals for specific villages along the Chukchi and Beaufort Seas coasts.

All Shell vessels will operate under the various conditions and mitigation measures set forth by the permit authorizations acquired to complete the various programs. Permit authorizations such as an Incidental Harassment Authorization from the National Marine Fisheries Service or a Letter of Authorization from the U.S. Fish and Wildlife Service include such measures.

TABLE 3.2-1
Marine Subsistence Annual Cycle – Chukchi and Beaufort Sea Villages*



* Information compiled from Arctic Slope Regional Corporation Shareholder Arlene Thomas

In order to avoid conflicts between subsistence whaling and oil and gas industry (Industry) activities, Com and Call Centers (see Figure 1) have been established to facilitate communication between whalers/subsistence hunters and Industry vessels. The Com and Call Centers operators will track the locations and progress of Shell vessels and other involved Industry vessels, local whalers and other subsistence hunters, and other vessels operating in the area. Vessel traffic information will be relayed among all vessels in the vicinity in order to avoid potential conflicts.

Figure 1 Communications and Call Center Locations



All vessels and the Com and Call Centers shall monitor very-high-frequency (VHF) channel 16 for hailing, and communications then proceed on channel 7 or other village-specific channel. The VHF channels for each Com and Call Center are listed in Table 3.2-2.

TABLE 3.2-2
Communications and Call Center Channels

Com/Call Center Location	VHF Channel
Barrow	71
Deadhorse	68
Kaktovik	69
Point Hope	68
Point Lay	68
Wainwright	69
Industry	7

4.0 HARBORING AND LOGISTICAL AREAS

4.1 Commercial Sources of Information

General information regarding vessel harboring came from the following sources:

- Brice Marine, LLC (Brice)
- Northern Transportation Company Limited (NTCL)
- Crowley Maritime Corporation (Crowley)

Included in Appendix 1 are lists of locations along the Beaufort and Chukchi Seas that Brice and NTCL use when needed. Information from Crowley is pending.

4.2 Potential Resupply/Crew Transfer Sites

Along the Chukchi Sea coast, possible locations of potential resupply and/or crew change include the following (from south to north):

- Nome
- Port Clarence
- Kotzebue
- Wainwright
- Barrow

Within the Beaufort Sea the locations are:

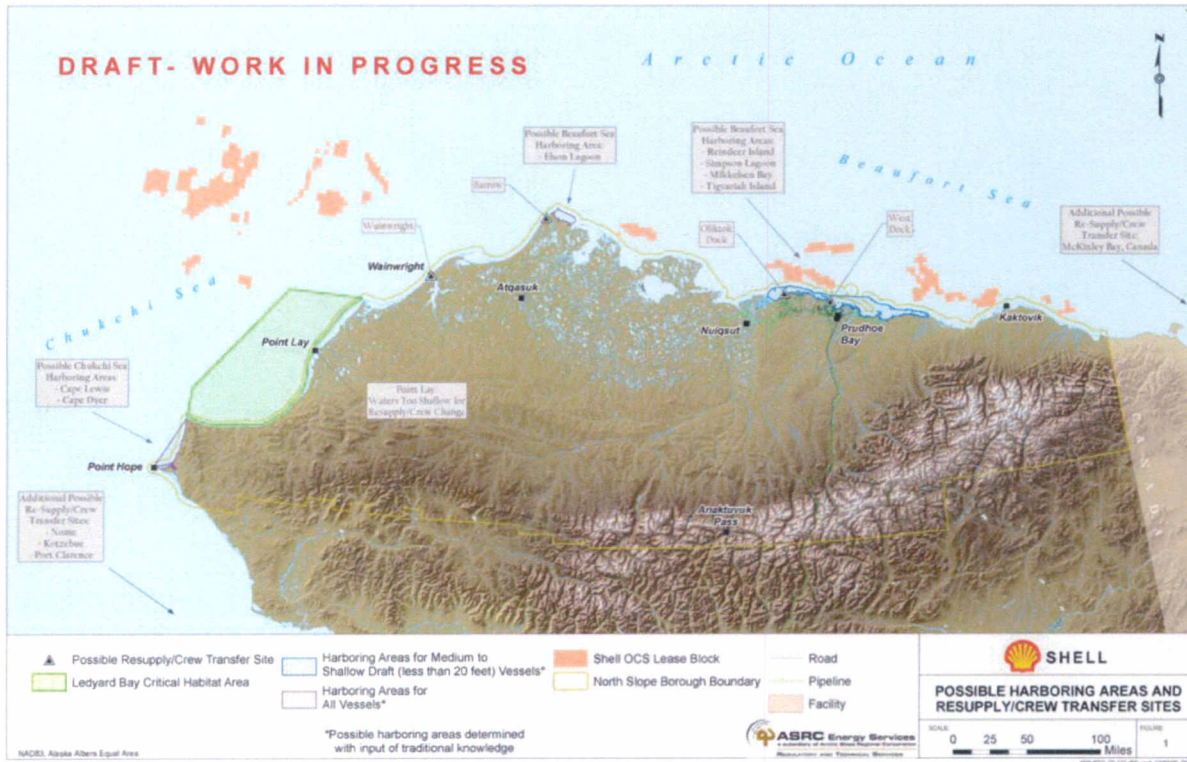
- Barrow
- Oliktok Dock
- West Dock

See Figure 2 for all these locations. The actual resupply and/or crew change locations are outlined in the attached 2008-1 Addendum.

4.3 Potential Harboring Areas

Deep-draft vessels, and therefore all vessels, have a limited number of locations where they may harbor close to land and under shelter. These areas, outlined on Figure 2, are Cape Dyer/Cape Lewis (north of Point Hope), Elson Lagoon (east of Point Barrow), and McKinley Bay (Northwest Territory, Canada). Cape Dyer/Cape Lewis and Elson Lagoon are appropriate for vessels working in the Chukchi Sea, whereas Elson Lagoon and McKinley Bay are appropriate for those vessels working in the Beaufort Sea.

Figure 2 Possible Harboring Areas and Resupply/Crew Transfer Sites



Shallow-draft vessels have the above harboring options; however, the Chukchi coast offers no other shelter from Point Hope northeast to Point Barrow. Within the Beaufort Sea, shallow-draft vessels may shelter landward of many of the barrier islands that parallel the coast from near Oliktok Dock to Brownlow Point in the Point Thomson area.

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APPENDIX 1

HARBOR LOCATION USED BY BRICE MARINE, LLC (BRICE) AND NORTHERN TRANSPORTATION COMPANY LIMITED

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Northern Transportation Company Limited*		
Safe Harbor Areas for Shallow Draft Vessels		
Destination	Miles from Tuktoyaktuk	
	Nautical	Statute
Tuktoyaktuk	0	0
Pullen Island Marker	45	52
Pelly Island Bluff	68	78
Garry Island West Point	82	94
Shingle Point (Bar 2)	130	150
Stokes Point (Bar B)	140	161
Hershel Island (Collinson Head)	140	161
Hershel Island (Osborn Point)	148	170
Hershel Island (Avadlek Spit Inside)	153	176
Hershel Island (Avadlek Spit Outside)	167	192
Komakuk Beach (Bar 1) Outside Herschel	173	199
Komakuk Beach (Bar 1) Inside Herschel	173	199
Demarcation Point	196	225
BARTER ISLAND (Bar Main)	256	294
Collinson Point (Simpson Cove)	285	327
Brownlow Point	305	351
Flaxman Island (West End)	313	360
Mary Sachs Entrance (Maguire Isl. Est End)	324	378
Bullen Point (Pow 3. Sav. Point)	328	377
Foggy Island	348	400
Prudhoe Bay Anchorage (Stump Island)	367	422
Prudhoe Bay Dock (ConocoPhillips)	374	430
Beechy Point (via East Entrance)	381	438
Beechy Point (via West Entrance)	417	480
Oliktok Point (Pow2)	403	463
Pitt Point (Pow1)	478	550
Elsion Lagoon	550	633
Point Barrow	553	636
BARROW	562	646
Point Franklin (Pearl Bay)	610	702
WAINRIGHT	648	745
Point Marsh	651	749
Wainright Inlet	654	752
Pingorarok Pass	673	774
Akoliakalat Pass	682	784
Icy Cape	692	796
Icy Cape Pass	695	799
Utukok Pass	713	820
Akunik Pass	726	835
Pukpowruk Pass	742	853
POINT LAY	747	859
Naokok Pass S.	758	872
Cape Lisburne	826	950
Maryatt Inlet	854	982
Point Hope	862	991
POINT HOPE	864	994

*NTCL uses Canadian Ice Services, Enfotec and NOAA for ice reports; Environment Canada and Inuvik Coast Guard (1-867-874-2667) for weather reports;

Brice Marine LLC, Safe Harbor Locations						
SAFE HARBOR	LATITUDE	LONGITUDE	WIND DIRECTION	DRAFT RESTRICTION	DATES OF USE	NOTES
Dutch Harbor			ALL	25'	ALL	Main Harbor
False Pass - Bechevin Bay	54-53.068N	163-24.083W	SW - NW	16'	ALL	Anchorage
False Pass - Bechevin Bay	54-52.731N	163-20.0W	SW - S - NE	12'	ALL	Anchorage
Ikitan Bay	54-48.246N	163-20.022W	N	10'	ALL	Anchorage
Nelson Lagoon	56-00.367N	161-08.736W	ALL	7'	MAY - OCTOBER	Dock - Need Waypoints to get behind island
Naknek	58-42.955N	157-01.923W	ALL	12'	MAY - OCTOBER	Anchorage - Need waypoints to get in on tide
Clarks Point	58-50.045N	158-35.772W	EAST & WEST	12'	JUNE - OCTOBER	Anchorage - Need waypoints to get in on tide
Bradford Point	58-59.899N	158-31.307W	EAST & WEST	12'	JUNE - OCTOBER	Anchorage - Need waypoints to get in on tide
Dillingham	59-02.531N	158-25.480W	ALL	12'	JUNE - OCTOBER	Anchorage - Need waypoints to get in on tide
Togiak - Anchor Point	58-57.396N	160-20.775W	SE - N - NNW	12'	MAY - OCTOBER	Anchorage
Hagemeister Strait	VARIOUS	VARIOUS	ALL	12'	MAY - OCTOBER	Anchorage
Pyrite Point	58-36.274N	161-32.308W	N - W	16'	MAY - OCTOBER	Anchorage
Security Cove	58-40.324N	161-53.323W	NE - E - SSW	16'	JUNE - OCTOBER	Anchorage
Good News Bay	59-04.141N	161-48.868W	ALL	10'	JUNE - OCTOBER	Anchorage
Helmik Point	60-16.344N	162-26.927W	ALL	22'	JUNE - OCTOBER	Anchorage - Need waypoints to get in on tide
Bethel			ALL	12'	JUNE - OCTOBER	Dock & anchorage - Need Waypoints to get up river on tide
Nunivak Island					JUNE - OCTOBER	Anchorage
Cape Corwin	60-00.101N	165-35.140W	NW - W - SW	16'	JUNE - OCTOBER	Anchorage
Cape Mendenhall	VARIOUS		NW - N - NE	16'	JUNE - OCTOBER	Anchorage
Etolin Anchorage	60-25.838N	166-08.202	NW - W - SW	16'	JUNE - OCTOBER	Anchorage
Nash Harbor	60-12.555	166-54.864	SW - S - SE	16'	JUNE - OCTOBER	Anchorage
Toksook Bay	60-29.771N	165-08.803W	NW - N - S	16'	JUNE - OCTOBER	Anchorage - Need waypoints to get to Anchorage
Hooper Bay	61-29.511N	166-07.850W	NW - N - E	10'	JUNE - OCTOBER	Anchorage - Need waypoints to get to Anchorage
South Mouth Yukon River	62-32.0N	165-09.781W	ALL EXCEPT SW	10'	JUNE - OCTOBER	Anchorage - Need waypoints to get in mouth
Emmonak	Don't have lat/long		ALL	10'	JUNE - OCTOBER	Push beach or anchor - Need local knowledge to get up river
Stebbins/ Stewart Island	63-31.470N	162-22.287W	NW - N - SE	10'	JUNE - OCTOBER	Anchorage
St Michael Bay	63-28.292N	162-00.952	SE - S - NW	12'	JUNE - OCTOBER	Anchorage
Golovin Bay	64-31.877N	163-03.115	ALL	12'	JUNE - OCTOBER	Anchorage
Nome			ALL EXCEPT S'LY	16'	JUNE - OCTOBER	Dock
St Lawrence Island						
Murhpy Bay	63-18.957N	171-29.601	WNW - N - ENE	12'	JUNE - OCTOBER	Anchorage
Apavawook Cape	VARIOUS		W - N - NE	12'	JUNE - OCTOBER	Anchorage
Taphook Point	63-38.254N	171-07.103W	SW - S - E	12'	JUNE - OCTOBER	Anchorage
Port Clarence	VARIOUS		ALL	20'	MID JUNE - OCTOBER	Anchorage
Grantley Harbor	65-16.094N	166-18.917W	ALL	10'	MID JUNE - OCTOBER	Anchorage
Shishmaref - South Side	66-12.949N	166-09.155W	ALL	8'	JULY - OCTOBER	Anchorage - Need waypoints to get in
Kotzebue Sound	VARIOUS		ALL	22'	JULY - OCTOBER	Anchorage
Kotzebue			ALL	7'	JULY - OCTOBER	Anchorage or dock - need waypoints to get in

Addendum 2008-1

Shell 2008 Beaufort and Chukchi Seas Operations

1.0 OVERVIEW OF 2008 PROGRAMS

Shell is planning a variety of programs in the Beaufort and Chukchi Seas during the 2008 open water season. The planned activities for 2008-2009 include:

- Exploration Drilling – Tophole Sections (Beaufort Sea)
- Geotechnical Program (Beaufort Sea)
- Deep Three-Dimensional (3D) Seismic Surveys (Beaufort and Chukchi Seas); and
- Marine Surveys (Beaufort and Chukchi Seas) – this includes three activities:
 1. Site Clearance and Shallow Hazards (Beaufort and Chukchi Seas)
 2. Ice Gouge Survey (Beaufort Sea)
 3. Strudel Scour Survey (Beaufort Sea)

All of these individual activities will require marine vessels to accomplish the work. All but two of the vessels listed in Table 1 are either under contract to Shell or a contractor to Shell. In all programs shown in Table 1, a vessel similar to each vessel listed could be substituted in cases where for whatever reason a vessel, or vessels, becomes unavailable to perform.

TABLE 1
Shell 2008 Proposed Vessel Inventory – Beaufort and Chukchi Seas Programs for 2008

Program	Vessel	General Location	Proposed Operations Time Frame	Vessel Draft (ft)
Exploration Drilling	Drill Unit <i>Kulluk</i>	Beaufort Sea	Mid-September – end of October	41
	<i>M/V Vladimir Ignatjuk</i>	Beaufort Sea	Mid-September – end of October	27.2
	<i>M/V Kapitan Dranitsyn</i>	Beaufort Sea	Mid-September – end of October	
3D Seismic	<i>M/V Jim Kilabuk</i>	Beaufort Sea	Mid-September – end of October	14.2
	<i>M/V Gilavar</i>	Beaufort Sea	Mid-September – end of October	17.4
		Chukchi Sea	July 20 –mid-September; end of October – mid-November	
	<i>M/V Gulf Provider</i>	Beaufort Sea	Mid-September – end of October	14.1
		Chukchi Sea	Mid-July – mid-September; end of October – mid-November	
	<i>M/V Theresa Marie</i>	Beaufort Sea	Mid-September – end of October	14.4
		Chukchi Sea	Mid-July – mid-September; end of October – mid-November	
	<i>M/V Torsvik</i>	Beaufort Sea	Mid-September – end of October	12.3
		Chukchi Sea	Mid-July – mid-	

TABLE 1
Shell 2008 Proposed Vessel Inventory – Beaufort and Chukchi Seas Programs for 2008

Program	Vessel	General Location	Proposed Operations Time Frame	Vessel Draft (ft)
			September; end of October – mid-November	
	<i>M/V Maxime</i>	Beaufort Sea	Mid September – end of October	2
		Chukchi Sea	Mid-July – mid-September; end of October – mid-November	
Marine Surveys	<i>M/V Henry Christoffersen</i>	Beaufort Sea	Early July – end of October	4
	<i>R/V Annika Marie*</i>	Beaufort Sea	Late July – early August (approximately 5 days)	3.5
	<i>R/V Alpha Helix</i>	Beaufort Sea	Early July – end of October	13.6
Geotechnical Survey	TBD	Beaufort Sea	Early July – mid-August	TBD
4MP Support	<i>R/V Norseman II</i>	Beaufort Sea	Mid-July - end of October	13
		Chukchi Sea	Mid-July – mid-September; end of Oct – mid-November	
General Support	<i>M/V West Dock Shuttle</i>	Beaufort Sea	Mid-September – end of October	~ 4
	<i>M/V Point Barrow Tug</i>	Beaufort Sea	Mid-September – end of October	8
	<i>M/V Endeavor Barge</i>	Beaufort Sea	Mid-September – end of October	12.5

*also to be used for resupply for the *R/V Norseman II*

4MP = Marine Mammal Monitoring and Mitigation Plan

M/V = Marine Vessel

R/V = Research Vessel

Figures 1 through 5 depict the areas where Shell expects each vessel or fleet of vessels to operate during the open water season, July through November. Mitigation measures taken by Shell regarding subsistence hunting of bowhead whales include postponing, or suspension of some programs that are in proximity to areas that have active subsistence hunting.

Figures 1 – 5 Planned Shell Vessel Locations, July through November 2008

Figure 1 2008 Vessel Locations: July



Figure 2 2008 Vessel Locations: August



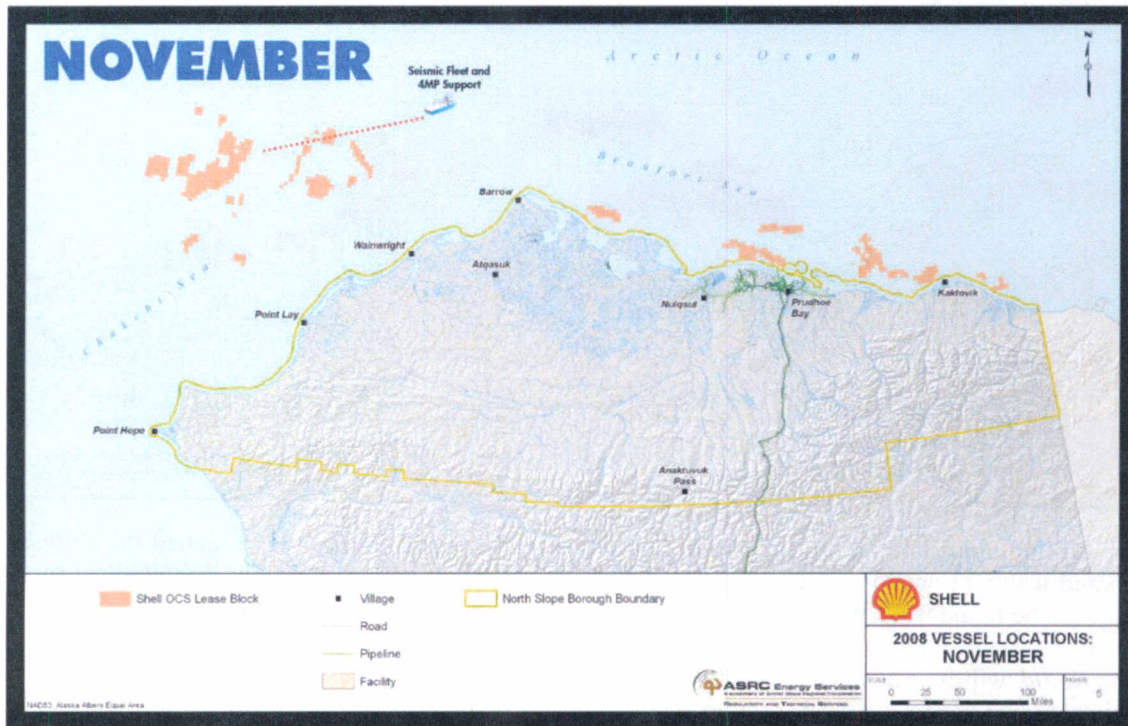
Figure 3 2008 Vessel Locations: September



Figure 4 2008 Vessel Locations: October



Figure 5 2008 Vessel Locations: November

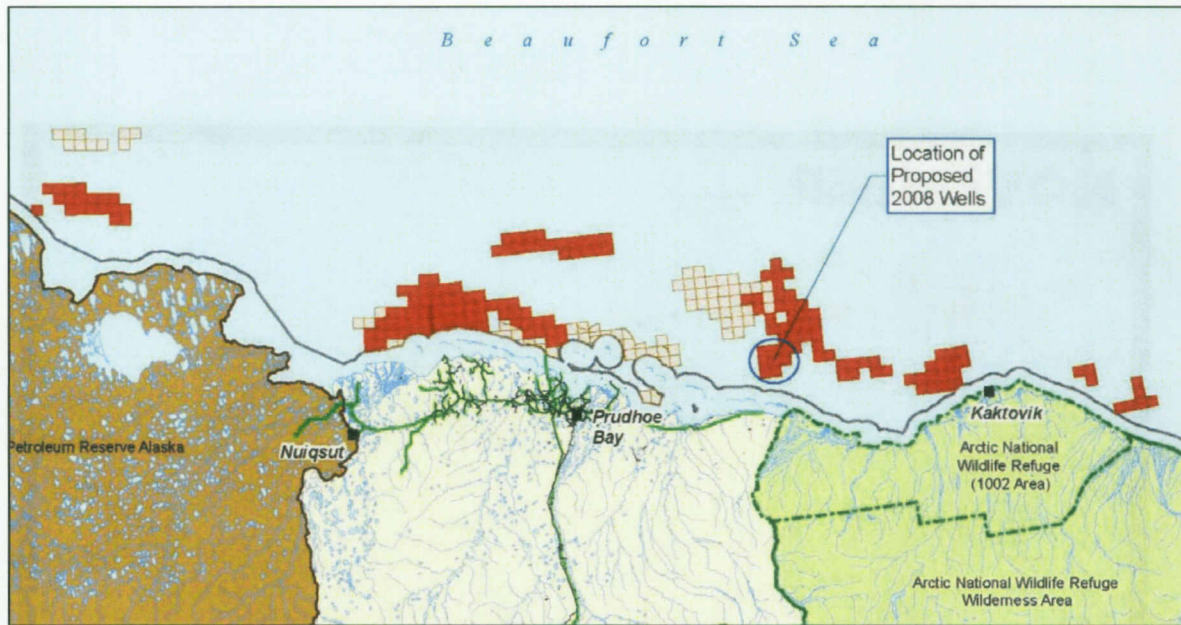


2.0 EXPLORATION DRILLING – TOPHOLE SECTIONS

Planned Activities

Shell is planning to utilize one drilling unit during the 2008 open water season to drill tophole sections for priority exploration targets on its U.S. Minerals Management Services (MMS) Outer Continental Shelf (OCS) leases in the Beaufort Sea. Shell's highest priority exploratory targets for the 2008 season are encircled in Figure 6 and this is collectively known as Sivulliq. Sivulliq is located offshore of Point Thomson and Flaxman Island in Camden Bay.

Figure 6 2008 Open Water Exploration Drilling Program – Tophole Sections



The drilling unit to be used during 2008 is the floating, portable marine vessel, called the *Kulluk*. It is moored using 12 anchor cables, each connected to a 15 or 20-ton anchor. The *Kulluk* dimensions and draft can be found in Table 1.

The *Kulluk* will be accompanied by two ice management vessels or arctic class anchor handlers, and an estimated two support vessels. One of the arctic class supply vessels may make periodic re-supply trips from Tuktoyaktuk, Northwest Territories (NWT), Canada to the rig. The ice management vessels or arctic class anchor handlers which likely will be used are: M/Vs *Vladimir Ignatjuk* and *Kapitan Dranitsyn*. If one or more of these specific vessels are not used, then similar vessel(s) will be substituted. The re-supply effort will be undertaken by the M/V *Jim Kilabuk* (*Kilabuk*) of the Northern Transportation Company Limited, and an additional multipurpose support vessel similar to the *Kilabuk*.

Other vessels in addition to the *Kulluk*, ice management/anchor handling vessels, and drilling support vessels may include the arctic-class barge called the “Endeavor” of Crowley (or similar vessel), pulled by the Point Barrow tug, and the West Dock Shuttle, used for crew change and re-supply. The Research Vessel (R/V) *Norseman II* (or similar vessel), will support the marine mammal monitoring and mitigation program in the Beaufort and Chukchi Seas during the 2008 open water season.

Shell's Beaufort Sea open water exploration drilling program includes plans to excavate/drill only the tophole sections for three exploratory well locations. A tophole section typically includes excavation and completion of the mudline cellar (MLC) and drilling and setting of one or two deeper well sections. The MLC and the next one or two deeper well sections collectively extend to approximately 1,000 ft (305 m) below the seafloor, and are referred to collectively as a “tophole” section, which is thousands of feet above any prospective liquid hydrocarbon-bearing strata. There is no measurable risk of encountering liquid hydrocarbons during the drilling of these topholes.

During the non-drilling season (approximately from November 2008 to July 2009), the *Kulluk* will be overwintered either near Hershel Island, Yukon Territory, Canada or in McKinley Bay, NWT, Canada. It may be attended at its overwinter location by one, or two ice management vessels.

Dates and Duration

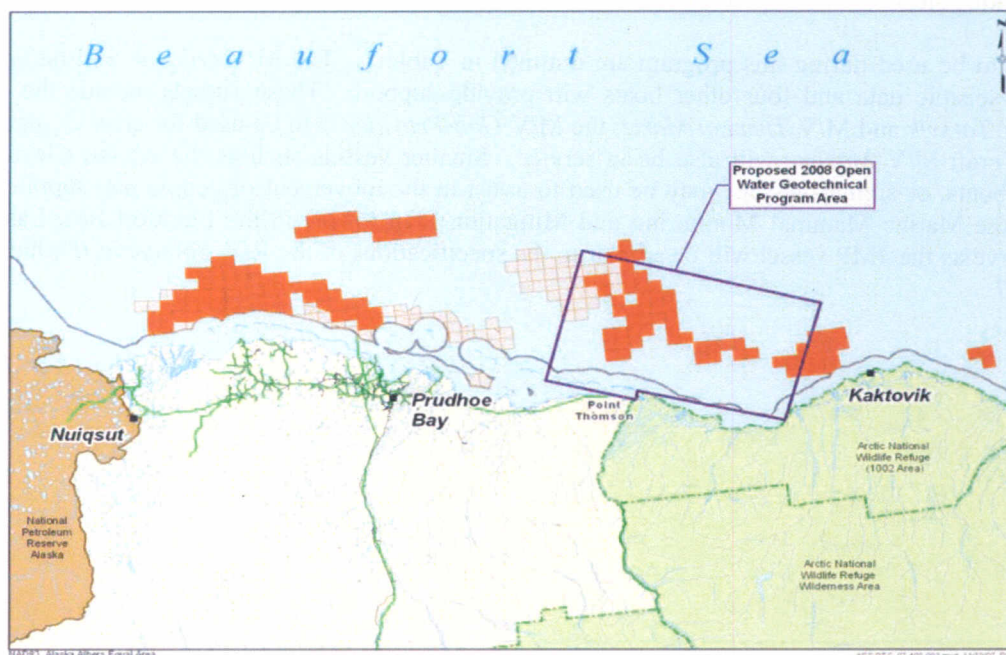
As planned, it is anticipated that the *Kulluk* will excavate and drill tophole sections for three exploratory wells during the 2008 open water season. For its 2008 tophole section drilling program, Shell will not operate the *Kulluk* and associated vessels in Camden Bay until after the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests are completed, approximately mid-September. Anticipated demobilization of the *Kulluk* from the Alaskan Beaufort Sea will be in November 2008. In total, it is anticipated by Shell that the tophole section drilling program will require approximately 60 days, excluding weather or other operational delays, beginning with mobilization from the Tuktoyaktuk Buoy and ending with return of the *Kulluk* to the Canadian Beaufort Sea near Tuktoyaktuk. Shell assumes approximately 50 of the 60 days of this program will include drilling, while the remaining days include rig mobilization, rig moves between locations, and rig demobilization.

3.0 OPEN WATER GEOTECHNICAL PROGRAM

Planned Activities

Up to 20 boreholes, each up to 500 ft (152 m) in depth will be bored to obtain geotechnical data for feasibility analyses of shallow sub-sea sediments. The boreholes will be completed to depths well above any liquid hydrocarbon-bearing strata. Approximately three potential locations will be investigated at Sivulliq, as well as locations along a prospective pipeline access corridor through Mary Sachs Entrance to landfall in the vicinity of Point Thomson (Figure 7).

Figure 7 Planned 2008 Open Water Geotechnical Program Area



The open water geotechnical program will use borehole excavating equipment mounted on a marine vessel (geotechnical vessel) to advance boreholes through a moonpool located approximately at mid-ship

of the geotechnical vessel. The geotechnical vessel also will have an electronic cone penetrometer (CPT) mounted on it. If used, the CPT unit will collect in-situ soil/sediment sub-sea samples to approximately 150 ft (46 m) below the mudline. The contractor to conduct this work has been chosen but the geotechnical vessel has not yet been detailed.

Shallow sub-sea bottom sampling for geotechnical analyses at the Sivulliq Prospect and along the access corridor will use a seabed frame to either push a sample tube or a cone penetration test into the seafloor. Other bottom sediment sampling proposed includes piston coring to a maximum depth of 10 ft (3 m) sub-sea bottom, and box coring to a maximum depth of 1-ft (0.3 m) sub-sea bottom.

Dates and Duration

The open water geotechnical program is expected to begin in July 2008. Including operational delays, it is anticipated that geotechnical borings, CPT sampling, piston and box coring sampling may be completed in approximately 50 days of work. Shell plans to complete the geotechnical program prior to the fall bowhead whale subsistence harvests of the communities of Kaktovik and Nuiqsut. Shell will not operate the geotechnical program in Camden Bay during the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests. If Shell is unable to complete the planned geotechnical program before the onset of fall whaling for Kaktovik and Nuiqsut (mid- to late August), Shell would return to Sivulliq, and/or prospective pipeline corridor after the conclusion of the harvest to complete the program.

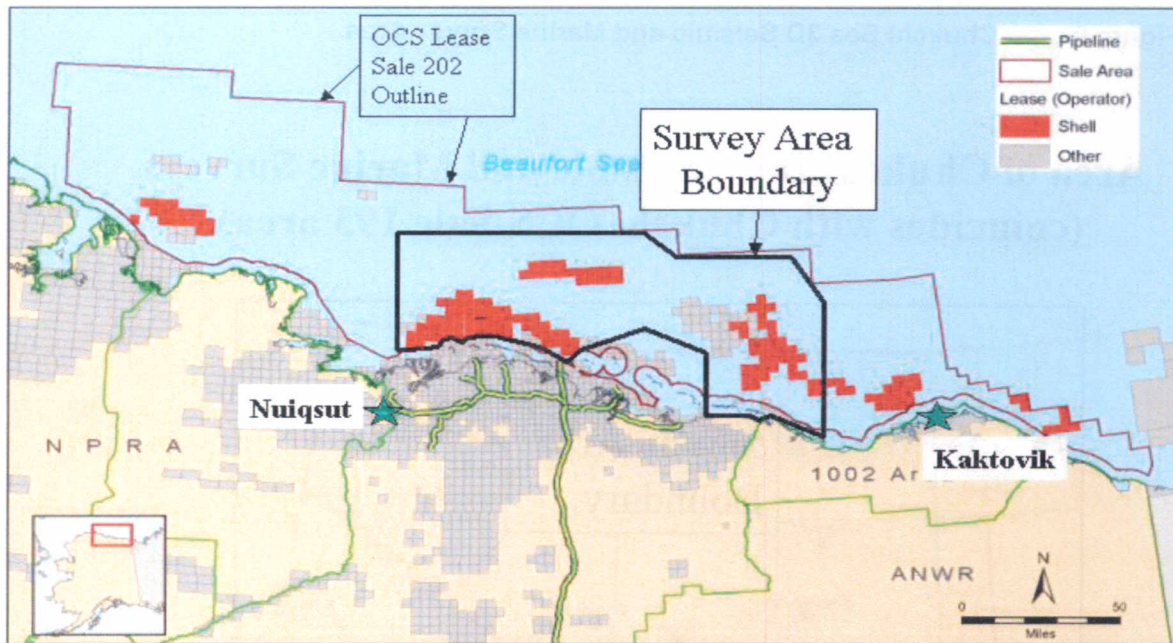
4.0 3D SEISMIC BEAUFORT SEA

Shell and its geophysical (seismic) contractor WesternGeco plan to conduct a marine geophysical (3D seismic) survey program in the central and eastern Beaufort Sea (Figure 8). The focus of this activity will be on Shell's existing leases, but some activity in the Beaufort Sea may occur outside of Shell's existing leases. Support vessels transporting personnel and supplies will most likely use West Dock or Oliktok Dock as docking sites.

The vessels to be used during this program are outlined in Table 1. The M/V *Gilavar* will be used to acquire the seismic data and four other boats will provide support. These vessels include the chase vessels M/V *Torsvik* and M/V *Theresa Marie*; the M/V *Gulf Provider* is to be used for crew change; and the landing craft M/V *Maxime* will also be in service. Smaller vessels such as the Alaska Clean Seas (ACS) bay boats, or similar vessels, may be used to assist in the movement of people and supplies and support of the Marine Mammal Monitoring and Mitigation Plan (4MP) in the Beaufort Sea. Lastly, a vessel to serve as the 4MP vessel will be similar to the specifications of the R/V *Norseman II* which was used in 2007.

Figure 8 Beaufort Sea 3D Seismic and Marine Survey Area

Area of Beaufort Deep Seismic and Marine Surveys



Dates and Duration

The program is proposed to occur in open water from mid-September to the end of October. As proposed, this program will last a maximum of 60 days of active data acquisition (excluding downtime due to weather and other unforeseen delays).

5.0 3D SEISMIC CHUKCHI SEA

Proposed Activities

In the Chukchi Sea, Shell proposes to conduct 3D seismic on leases obtained in Lease Sale 193 (Figure 9). The exact locations where seismic operations will occur are not known at this time. However, in general seismic data acquisition will occur at least 25 miles (40 kilometers) offshore of the coast and in waters averaging depths greater than 131 ft (40 m). The vessels to be used are the same that will be used in the Beaufort Sea.

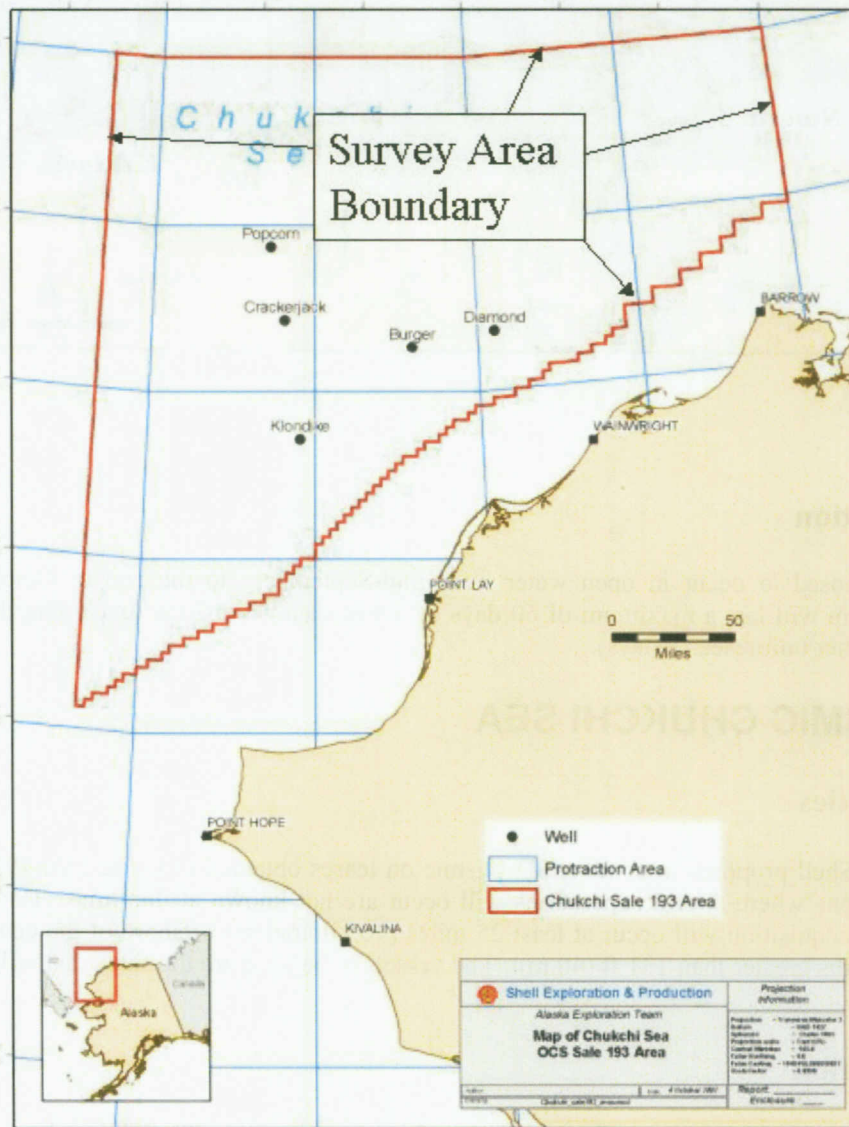
Dates and Duration

The proposed 3D seismic survey in the Chukchi Sea could commence July 20, 2008 and conclude by mid-November 2008. As proposed, this survey will last a maximum of 100 days of active data acquisition (excluding downtime due to weather and other unforeseen delays). If ice conditions allow, the

seismic and associated vessels may transit to the Beaufort Sea to conduct seismic operation for part of the this time which would shorten the duration of the proposed Chukchi Sea program from the 100 day maximum.

Figure 9 Chukchi Sea 3D Seismic and Marine Survey Area

Area of Chukchi Deep Seismic and Marine Surveys (coincides with Chukchi OCS Sale 193 area).



6.0 MARINE SURVEYS BEAUFORT SEA

Three marine survey activities are proposed for the Beaufort Sea: (1) Site Clearance and Shallow Hazards (2) Ice Gouge Surveys, and (3) Strudel Scour Surveys. Marine surveys for site clearance and shallow hazards, ice gouge, or strudel scour can be accomplished by one vessel with acoustic sources. No other vessels, such as chase boats, are necessary to accomplish the proposed work. Any necessary crew changes or 4MP coordinated activities under this activity will utilize the same crew change, landing craft, or 4MP vessel mentioned under the Beaufort Sea Deep 3D Seismic survey.

Planned Activities

Site Clearance and Shallow Hazards

Marine surveys will include site clearance and shallow hazards surveys of potential exploratory drilling locations. These surveys gather data on:

- bathymetry;
- seabed topography and other seabed characteristics (e.g., boulder patches);
- potential geohazards (e.g., shallow faults and shallow gas zones); and
- the presence of any archeological features (e.g., shipwrecks).

The focus of this activity will be on Shell's existing leases in the central and eastern Beaufort Sea, but some activity may occur outside of these existing leases. Actual locations of site clearance and shallow hazard surveys will occur within the area outlined in Figure 3. Before the commencement of operations, survey location information will be supplied to the National Marine Fisheries Service, MMS, and other affected agencies as it becomes available.

This program will use the M/V *Henry Christoffersen*, or a similar vessel. The M/V *Henry Christoffersen* is the same vessel used during Shell's 2006 and 2007 site clearance and shallow hazard surveys in the Beaufort Sea.

Ice Gouge Survey

Ice Gouge surveys are a type of marine survey to determine the depth and distribution of ice gouges in the sea bed. Ice gouge is created by ice keels which project from the bottom of moving ice that gouge into seafloor sediment. Remnant ice gouge features are mapped to aid in predicting the prospect of, orientation, depth, and frequency of future ice gouge. These surveys will focus on the potential, prospective pipeline corridor between the Sivulliq Prospect in Camden Bay and the nearshore Point Thomson area. The Sivulliq area will be surveyed to gather geotechnical and seafloor hazard information as well as data on ice gouges.

The vessel to be used will be the R/V *Alpha Helix*, or a similar vessel. Actual locations of the ice gouge surveys will occur within the area outlined in Figure 3.

Strudel Scour Survey

During the early melt on the North Slope, the rivers begin to flow and discharge water over the coastal sea ice near the river deltas. That water rushes down holes in the ice ("strudels") and scours the seafloor. These erosional areas are called "strudel scours". Information on these features is required for prospective pipeline planning. Two proposed activities are required to gather this information: aerial survey via helicopter overflights during the melt to locate the strudels; and strudel scour marine surveys to

gather bathymetric data. The overflights investigate possible sources of overflow water and will survey local streams that discharge in the vicinity of Point Thomson. Areas that have strudel scour identified during the aerial survey will be verified and surveyed with a marine vessel after the breakup of nearshore ice. The operation is conducted in the shallow water areas near the coast in the vicinity of Point Thomson.

It is anticipated that the strudel scour program will be carried out by R/V *Annika Marie*, or a similar vessel.

Dates and Duration

Site Clearance and Shallow Hazard Surveys

This program is proposed to commence as soon as the ice clears substantially in the Beaufort Sea, approximately mid-July. The program will end when the ice starts to reappear, generally early October. As proposed, this program will last a maximum of 70 days of active data acquisition (excluding downtime due to weather and other unforeseen delays).

Ice Gouge Surveys

This proposed activity is proposed to be conducted sometime between late July and early October. The total program will last a maximum of 40 days (excluding downtime due to weather and other reasons).

Strudel Scour Survey

This proposed activity is anticipated to take no more than 5 days to conduct (excluding downtime due to weather and other unforeseen delays). It is anticipated to occur in late July or August.

7.0 MARINE SURVEYS CHUKCHI SEA

Planned Activities

Marine surveys will include site clearance and shallow hazards surveys of potential exploratory drilling locations as required by MMS regulations. These surveys gather data on:

- bathymetry;
- seabed topography and other seabed characteristics (e.g., boulder patches);
- potential geohazards (e.g., shallow faults and shallow gas zones); and
- the presence of any archeological features (e.g., shipwrecks).

Any necessary crew changes or 4MP coordinated activities under this activity will utilize the same crew change, landing craft, or 4MP vessel mentioned under the Chukchi Sea deep 3D seismic.

The Chukchi Sea Marine Surveys will be conducted on leases acquired during the February 2008 Lease Sale 193. Site clearance surveys are confined to small specific areas within OCS blocks. Actual locations of site clearance and shallow hazard surveys will occur within the area outlined in Figure 4.

The vessel which will be conducting these marine surveys may also be involved in the deployment and retrieval of Ocean Bottom Hydrophones (OBHs). These OBHs are anchored sonabuys that record mammal vocalizations and seismic sounds.

The vessel which will be conducting this activity has not yet been defined. The vessel will be similar to a vessel contracted during 2007, the R/V *Norseman II*.

Dates and Duration

This proposed program will probably occur in August and September, and as proposed the total program will last a maximum of 45 days of active data acquisition (excluding downtime due to weather and other unforeseen delays). This vessel also may be used to perform other activities such as deploying and retrieving the OBHs. Time for deploying and retrieving OBHs is not included in the 45-day estimate.

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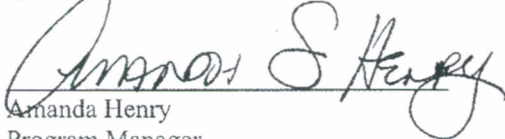
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