Appendix L
Well Control Plan

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Well Control Plan Outline
Revised Camden Bay Exploration Plan

Well control is the process of maintaining pressure inside the drilled wellbore in a manner that prevents gas or fluids from underground reservoirs flowing into the wellbore and escaping at the surface in an uncontrolled manner.

Shell Offshore Inc. (Shell) believes that no single operational error or equipment failure should lead to loss of well control. Therefore, Shell will apply the following layers of prevention and response to avoid well control issues:

- Layer I - includes proper well construction, risk identification, training, scheduled tests and drills on the rig (e.g., blowout preventer [BOP] tests, pit drills, and trip drills), all of which build a strong foundation for well control incident avoidance.
- Layer II - includes early kick detection and timely implementation of kick response procedures. Continuous monitoring including the use of computerized pit volume monitoring, return flow detection, returned drilling fluid analysis and data sharing with Shell's Real Time Operations Center provide early kick detection. When a kick is detected, the general response is to immediately shut down the pumps, perform a flow check, shut in the well, and kill the flow using one of several methods that prevent the situation from escalating into a blowout (an uncontrolled flow at the surface).
- Layer III - involves the use of mechanical barriers, including but not limited to subsea wellheads with tested seal assemblies, casing, dual floats (i.e., check valves), cement, weighted drilling fluid and tested BOPs. Testing and inspections of all mechanical barriers are performed to ensure competency.
- Layer IV – incorporates detailed relief well planning and drilling, blowout kill operations, subsea capping equipment and containment capabilities that would be implemented if all other kick control methods fail.

In the unlikely event that well control is lost despite these precautions, Shell will immediately mobilize specialized emergency response personnel and equipment, including Shell's capping equipment and Arctic Containment System, to the site. Shell will also consult a well control specialist, such as Wild Well Control, for the intervention and prompt action to resolve the emergency.

Surface Control Options

If well control is lost, every effort will be made to regain well control using dynamic surface control measures. Dynamic pressure control involves pumping weighted fluid at rates sufficient to create fluid friction in the annulus of the blowout well to match or exceed reservoir pressure. Once this condition is achieved, flow from the reservoir ceases and control is regained. Historically, these measures of regaining control have been rapid and effective. However, uncontrolled flow at the surface presents a safety hazard. Safety procedures are employed to protect personnel, the environment, and equipment. These procedures can involve rapid disconnection from the well and escape from the drill site.

Although the specific surface control methods used will depend on the situation, potential mechanical surface control methods include the following:

- Induced natural bridging (or plugging) of the well
- Pumping mud, plugging material, and/or special fluids down the well to kill it
- Replacing failed equipment if control was lost due to equipment malfunction
- Capping (attaching a device to the well to stop the flow)

Relief Well

In the scenario developed for a blowout, the primary drilling vessel (either the *Kulluk* or *Discoverer*) will attempt to stop the blowout by pumping mud and/or some other specially formulated fluid down the hole. Should these efforts fail, the drilling vessel will disconnect and pull away to a site upwind and upcurrent from the blowout location and initiate relief well drilling operations. As a precautionary measure, relief well preparation operations are initiated in parallel with surface capping/intervention methods being employed on the blowout well. Unless it is damaged, the original drilling vessel can commence relief well drilling if intervention measures prove to be unsuccessful. It is noted that throughout capping/intervention efforts and relief well drilling, Shell's Oil Spill Response (OSR) fleet will still be on site collecting and storing oil from the surface of the sea.

The general strategy for killing a blowout using a relief well is to drill a specially designed well to intersect the blowout well at some point along its path, usually near the top of the source reservoir. Then, kill weight fluid is pumped from the relief well into the original wellbore at sufficient rates to stop formation fluids from flowing, bringing the blowout well under control. Finally, both wells are properly plugged and abandoned using procedures approved by BOEMRE.

In the event that the *Kulluk* is drilling in Camden Bay and becomes disabled and not capable of drilling the relief well for any reason, the *Discoverer* will cease drilling in the Chukchi Sea, Burger Prospect, suspend the well so that it cannot flow, recover its BOP stack and moorings, and transit to the relief well drill site in Camden Bay. The *Discoverer* will initiate relief well drilling operations upon arrival and mooring, and will remain at the site through plugging operations on both the relief well and the blowout well before returning to the Burger Prospect in the Chukchi Sea to resume drilling operations on the suspended well.

In the event the *Discoverer* is the primary drilling vessel and the *Kulluk* is standing by in Dutch Harbor and the *Discoverer* is disabled, the *Kulluk* will immediately rig for towing and mobilize and transit to Camden Bay. Because the *Kulluk* would not be drilling in this scenario, it would not be necessary to suspend a well, recover moorings, pull the riser and BOP stack.

A relief well in this situation will not have a mudline cellar (MLC). Relief well drilling is rapid and the relief well drilling vessel will only be on the site temporarily. The relief well will intercept the blowout and perform the kill even if extreme ice management efforts are required. All materials, equipment and supplies including wellhead housings, casing, drillpipe, mud materials, and cement in sufficient quantities to at least start the relief well will be available at the relief well drill site. Additional materials and supplies will be mobilized quickly to ensure that there are no delays in drilling the relief well and killing the blowout. A detailed Relief Well Plan will be submitted to BOEMRE as part of the Application for Permit to Drill for each planned exploration well.

Relief Well Location and Timing

The optimum location for a relief well depends on several factors, including the depth and direction of the intercept point, personnel safety, and weather conditions. The location of the relief well is selected so that it can be drilled in the most efficient manner practicable.

The estimated total duration from the start of a blowout to well killing through a relief well would be approximately 25 days for a Torpedo well (20 days for a Sivulliq well) from initial mooring through kill pumping. It is expected that a total of 9 days will be required for the *Discoverer* to suspend the Burger well, recover its moorings, pull the BOP stack and riser and make way under her own power then transit to the Camden Bay relief well drill site. If the *Discoverer* is the primary drilling vessel in Camden Bay and becomes disabled the *Kulluk* would require approximately 18 days to reach the relief well drill site in Camden Bay.

Often, relief wells intercept a deep blowout at some point above the total vertical depth depending on flowrates, reservoir pressures, and fluid types (oil, gas or salt water), so the relief well intercept could occur in less time than these estimates.

In general, all available resources are quickly accessed and funneled into drilling the relief well and killing the blowout as quickly as possible. Resupply of critical supplies and equipment, mobilization of specialized equipment and assignment of drilling personnel and well control specialists occurs rapidly in this emergency situation. Normal time requirements for planning and scheduling activities are compressed and deliveries are expedited. All reasonable and safe measures are employed to kill the blowout as quickly as possible.

Blowout Well Ignition

The decision to ignite a blowout will be made only after assessing the probability of implementing successful surface control (i.e., capping), reviewing potential safety hazards, addressing pertinent environmental considerations and obtaining necessary agency approvals. Placing human safety as the highest priority, Shell will consider the feasibility and benefits of igniting the blowout after all personnel, equipment, and vessels have been located at a safe distance from the surfacing oil and gas. The decision to ignite will be made in conjunction with BOEMRE. Ignition and sustained combustion of vapors from the surfacing gas and oil would likely result in a safer working environment for relief well operators and for responders attempting to contain and/or recover oil downstream of the blowout. This decision may or may not result in the loss of the drilling vessel; most shallow water subsea blowouts have been allowed to burn on the ocean's surface to consume dangerous vapors in the area when these vapors could threaten capping and containment work and relief well drilling operations.

Blowout Well Intervention

Many wells bridge over naturally within 24-48 hours of blowing out. The flowrate from other wells may drop over a few days, due to near wellbore depletion or formation subsidence. In these situations, it may be possible to re-enter the blowout well and use conventional well kill methods to regain control and secure the well against further flows. If this is possible, the *Discoverer* (or *Kulluk*, as appropriate) will move over the blowout well when it is safe to do so, re-attach the Lower Marine Riser Package (LMRP) and riser to the BOP remaining on the well, test all equipment to ensure integrity, and run tools and equipment into the blowout wellbore to affect a final kill.

Often, the wellbore is damaged by the blowout to the extent that it is no longer usable and permanent abandonment is indicated. The decision to continue drilling operations or plug the well after such an intervention will be made in conjunction with BOEMRE. Drilling may proceed only if doing so would not introduce the risk of a subsequent blowout from the damaged wellbore.