4.5.3 *Treatment Cell Infiltration Process*

4.5.3.1 Infiltration Well Design

The infiltration wells will consist of 75 mm Schedule 40 PVC slotted well pipe installed to a depth of approximately 3 m below grade. Wells will be installed with a backhoe or excavator. The wells will be installed in an open hole and backfilled with soil from the site. The well will be constructed with a stick-up consisting of solid schedule 40 PVC pipe to allow application of variable head pressure to the infiltration point by varying the amount of stick-up and head pressure of water present in the stand pipe.

The purpose of this well modification is to increase the Hydraulic Head Pressure to increase the rate of water injection within the contaminated zone. Higher rates of water injection will increase remediation performance.

4.5.3.2 Shallow Surface Infiltration Lines

Surface infiltration lines will be applied to areas of the site located between re-circulation wells. These infiltration lines will be laid on surface or slightly buried below the significant surface vegetation layer to allow downward percolation of nutrient and hydrocarbon degrading bacteria rich solution. The lines will consist of 25 mm diameter perforated pipe to allow seepage at select intervals along the line.

4.5.4 *Groundwater Containment Process*

The groundwater containment design is essential to allow complete recovery, treatment, and eventual re-circulation of recovered groundwater. The following design has been used successfully at many sites to ensure groundwater is both contained and recovered on the perimeter of the treatment area.

4.5.4.1 Trench and Recovery Well Design and Construction

Drawing 3 depicts a typical groundwater recovery trench design that will be implemented on this site. The trench will be created by excavating a 0.5 m wide and 2 m deep area at the locations shown on Drawing 2. The trench layout has been designed to provide complete hydrogeologic control around each bio-circulation cell. Continuous 200 mm diameter perforated pipe will be laid along the trench bottom.

Each trench will be serviced by 2, 3, or 4 vertical water recovery riser pipes constructed of 100 mm schedule 40 PVC. Inside the riser pipe a 25 mm recovery line attached to a float controlled water pump will control the depth to groundwater as determined by the site engineer as the project evolves.

The groundwater will be maintained at specific levels throughout the project in order to maintain hydrogeologic control.

4.5.4.2 Groundwater Extraction Pump Systems

A surface groundwater extraction pump will be dedicated to service each extraction trench. Water levels will be maintained at a level to continually provide a recovery gradient to the internal cell. As the project progresses it is anticipated the area inside the IBCC will become saturated to near-ground surface. This is desired as the contaminants have been noted to be concentrated between 0 and 1 m below grade. Maintenance of high water levels within the cell will be controlled by maintaining a water level in the recovery trench at approximately 1 m below grade or slightly below the static water level within the IBCC adjacent to the trench.

4.5.5 Portable Multi-Phase Extraction System

The portable multi-phase extraction system will be utilized to enhance groundwater and soil vapour recovery in areas deemed to be affected by lighter volatile hydrocarbon concentrations. Vacuum treatment for vapour-extraction and drying of individual extraction/recirculation wells may be applied to target specific hotspots containing volatile hydrocarbons at the site.

In addition, the application of vacuum treatment to a low flow or stagnant area of the site undergoing IBCC treatment will significantly enhance groundwater movement rates to the recovery well and therefore accelerate movement and improve contact times of inoculated bio-solution with the contaminated soil in a given area. Vacuum conditions can easily increase groundwater pumping rates by 2 to 3 times.

4.5.6 Water Distribution and Recovery Piping Layout

Delivery and recovery of groundwater will be accomplished through surface piping. All connections, piping fittings and layout will be at grade to minimize surface disturbance. Where necessary, to allow movement of pumps and equipment over the treatment area, lines may be laid in shallow surface trenches a few inches deep. A schematic of the layout is depicted in Drawing 4.

4.5.7 Treatment Process Area Layout and Description

A schematic of the treatment process is depicted in Drawing 5. Water will be recovered from the recovery/containment trenches and wells and will be processed through a series of tanks as described below. Make-up water will be pumped from the Mackenzie River as needed to allow the system to operate at full infiltration capacity. It is anticipated that more water from the Mackenzie River will be utilized at the start of the process to increase soil water saturation levels. As the process advances, less water from the river will be necessary to maintain the system.

Excess water that builds up in the treatment system with rainfall events will slow infiltration rates due to soil saturation. Excess water in the system will be bled off and filtered through carbon adsorption beds (if necessary) to meet river discharge criteria. Sections 4.5.7.1 through 4.5.7.5 outline the tanks to be utilized in the treatment process.

4.5.7.1 Sedimentation Tank

The initial tank in the process stream will serve to remove sediment and suspended solids from the influent water originating from the wells or the river.

4.5.7.2 GLR Bioreactor Tank

The GLR Bioreactor tank will contain/receive water from the sedimentation tank. The water within the bioreactor will be circulated through a Gas Liquid Reactor (GLR). The GLR process super oxygenates water through introduction of air micro-bubbles which dissolve into the water within the tank. Other nutrients and amendments may be added to this tank as required to ensure micro-organism population growth.

4.5.7.3 Aeration/Retention Tanks

The aeration tanks will provide a continued source of oxygen for the bioreaction to take place under ideal aerobic conditions. Hydrocarbons present in the recovered water will, by this point in the system, have been degraded significantly if not eliminated completely from the treatment stream. The water will be returned from the retention tanks to the subsurface within the IBCC through the re-circulation wells and infiltration lines.

4.5.7.4 Clay/Carbon Treatment Vessel

Excess groundwater will be processed through granular activated clay/carbon (GAC) as needed. Prior to discharge, the water will be stored within an above ground storage tank, sampled, and

submitted for laboratory analyses. This will ensure all discharged water complies GNWT and CCME criteria.

4.5.7.5 Storage/Discharge Tank

The storage discharge tank will be utilized to hold treated water prior to discharge to the environment. The water can be sampled and analyzed and can be checked for headspace prior to allowing discharge.

4.6 Effluent Sampling Process and Frequency

Due to the reliability of GAC in removing petroleum constituents from groundwater while anticipating that little excess water will require disposal, it is proposed that an influent groundwater sample be collected immediately upon system activation. The groundwater sample will be submitted for laboratory analyses for TPH and BTEX. If the hydrochemical results are less than the allowable discharge criteria, then the groundwater will be passed through the GAC, and then discharged directly to the Mackenzie River. In the case where the groundwater concentrations in the influent sample exceed the allowable criteria, the water will be passed through the GAC vessel and into an above ground storage tank. The water within this tank will be re-sampled and submitted for laboratory analyses for TPH and BTEX. When the results are available, and the effectiveness of the treatment process has been sufficiently proven, the criterion for future discharge will be based on headspace vapour concentration measurements. On other projects of this nature a headspace vapour concentration measurement of 100 ppm has been utilized. In addition, a flow totalizer will be installed on the system to track exactly how much groundwater will be discharged into the Mackenzie River.

4.7 Progress/Confirmatory Soil Sampling

Towards the latter part of the operational season soil samples will be collected by Dutch auger to assess remediation progress. Samples will be collected using acceptable protocols. Select samples will be submitted for analysis for contaminants of concern.

Results from the analysis will be reviewed prior to shut down at the end of the season to determine if remediation goals, being GNWT and CCME criteria, have been met within the first operational season.

Laboratory data will determine if goals have been met and if equipment will be demobilized or winterized. The possibility exists that a second operational season will be needed to achieve site remediation goals.

4.8 Groundwater Monitoring Wells and Program

Groundwater monitoring wells will be installed between each of the recovery trenches to determine the effectiveness of the groundwater recovery and circulation program, and to determine if the groundwater within the IBCC is being captured and treated as designed.

It is proposed that the depth to groundwater and dissolved oxygen levels will be recorded immediately after installation of the wells and immediately prior to the initiation of the circulation activities. Once the system is operational, the depth to groundwater and dissolved oxygen levels will be measured within these wells on a periodic basis for the duration of the operational activities. The effectiveness of the in-situ bioremediation program can be evaluated by the change in groundwater levels and dissolved oxygen concentrations in the areas of the monitoring wells.

4.9 Personnel Required

For approximately the first three weeks, 3 technicians will be required to be on site. After the installation of equipment is complete and the program begins, only two technicians will be required to operate the system. A camp cook, environmental monitor and wildlife monitor will be present for the duration of the remedial program.

4.10 Equipment Required

8 - Centrifugal electric pumps
1 - Diesel-Powered 20 kw Genset generator
2 - Gasoline-powered 2" trash pumps
1 – 15 hp skid-mounted electric multi-phase extraction system
1 – 20' X 8' Sea Canister (Filled with hoses, PVC piping, and fittings)
1 – Track Hoe
1 – Heavy Duty Quad
Assorted electrical fittings and cable
6 – 4,000 L Poly Tanks
2 – 25 gpm GLR systems
1 – 900 kg Carbon vessel with carbon
1 – 16' Aluminium Boat

4.11 Fuel Storage

It is estimated that the generator will operate on approximately 4 gallons of diesel per hour on full load when operational. It should be noted that it is not expected to operate under full load, nor is it expected the generator will operate all the time. If personnel were to be onsite for 90 days, it is expected that fuel consumption for the program would consist of approximately 4,000 gallons of diesel and 2 drums of gasoline. All fuel storage tanks will have secondary containment systems. Fuel tanks will be transported to the program site pre-filled, and if the program extends to a second field season, will be re-filled at that time by barge.

4.12 Camps

Tendering documents are currently being drafted for contracting the camp services at West Channel. The camp will include:

- tent housing for 6-personnel (3 site workers, 1 wildlife monitor, 1 environmental monitor, 1 cook)
- 5 tents and bedding
- toilet and wash basin
- hot water shower
- plywood for tent floors
- kerosene heaters
- all weather kitchen
- cook and cooking equipment
- fridge
- deep freezer
- weekly food and equipment re-supply
- diesel generator
- re-supply as required for fuels (diesel)
- fire extinguishers and CO2 detectors

Waste generated at the site will be disposed of by the following methods: honey bucket system for septic sewage, incineration of burnable solid wastes, off site disposal of non-burnable solid wastes, and septic system or field (if volumes and quality permit) for gray-water. Additional camp equipment will include an ATV with heavy-duty equipment trailer, 16+ foot aluminum fishing boat with 40 – 70 hp engine, and a track hoe for system installation, maintenance and winter shut down.

5.0 ALTERNATIVES

An overall review of proven and available technologies normally utilized for fuel hydrocarbon remediation was completed during preparation of this remedial action plan. During the evaluation the following elements were included for consideration:

- soil type (generally fine-grained soil types consisting of silt, sandy silt, and occasional silty sands);
- contaminant characteristics and spatial distribution;
- site location and logistics;
- climate and geographical characteristics;
- regulatory acceptability;
- environmental impact and community acceptability;
- time required to attain remedial objectives; and
- cost effectiveness.

The following technologies were reviewed for applicability:

- vapour extraction;
- multiphase extraction;
- excavation and offsite disposal;
- excavation and onsite biocell construction/operation followed by site restoration and grading;
- in-situ bioremediation; and
- natural attenuation.

Additional remedial alternatives not listed above are available; however, none of the other potential options including in-situ thermal or chemical oxidation methods were given serious consideration for this site due to the sensitivity regarding the permafrost layer typically present below 2 m during summer months. Any desorption/volatilization/oxidation methods generating excessive heat in the subsurface could potentially cause long term alteration to the permafrost layer.

The listed remedial technologies were considered in relation to the site-specific parameters listed above and ranked for applicability in achieving site remediation goals. A summary of the applicability of each listed technology to the site is summarized below.

5.1 Vapour/Multi-phase Extraction Options

Based on the soil types at the site and the character of the residual fuel hydrocarbons, vapour extraction and multi-phase extraction were determined to have limited applicability on select areas of the site. Factors that influence the successful vapour and/or multiphase extraction of contaminants are the permeability of the soil and the volatility of the contaminant.

On this site the soil types have been logged as silts with some sand, sandy silt, and occasional silty sands. With the exception of sandy intervals, these soil types typically exhibit a low permeability to air. These conditions usually result in low effective radius of influence and a generally low capacity to transmit or move vapour through the soil. Some air movement in the subsurface can always be achieved by applying higher vacuum systems (10-20 inch Hg wellhead vacuums) which will allow extraction of air through existing soil fractures and small sand stringers.

Contaminant volatility plays a significant role in the effectiveness of vapour/multi-phase extraction operations to remove contaminants. This site exhibits several boreholes with hydrocarbon concentrations in the range that are generally conducive to vapour/multi-phase extraction. Hydrocarbons in the range C6 to C10 (specifically benzene) are extractable by these methods. Boreholes BH8, BH-9, BH-15, BH16, BH18 and BH20 have volatile components conducive to extraction methods.

5.2 Excavation Options

Excavation options are commonly viable on contaminants of this type where proximity to approved landfill or contaminated soil disposal facilities can be considered and/or onsite bio-remediation piles can be utilized. In addition, on a site of this nature, several other factors must be considered when evaluating excavation as an option including; the volume of impacted soil, the environmental impact of the disturbance, the overall community acceptability of the visual impact, and the logistics and cost effectiveness of the process of excavating and handling large volumes of soil at a remote site.

When all factors are considered, the aerial distribution of the contamination would indicate stripping and removal of soil to depths of at least 1 meter over an area in excess of 10,000 m^2 (1 ha). The visual impact to the peninsula, the disturbance to vegetation, the potential for excessive soil erosion while the site is stripped, and the increased cost factor due to site remoteness all contribute to make excavation a poor remedial option. In addition, periodic seasonal flooding of the contaminated area has been documented and could result in unexpected inundation of the disturbed/excavated treatment area during ongoing remedial operations.
Offsite disposal is not a viable option due to logistical and cost implications for such a large excavation and the need to provide backfill for the excavation.

5.3 In-situ Bioremediation

Enhanced bioremediation is a proven technology for the remediation of fuel hydrocarbons. It has broad application over the entire range of fuel hydrocarbons and can be applied under extremely diverse conditions. The term insitu indicates that the reduction in contamination concentrations takes place in the subsurface without causing excessive disturbance to the native soil column. The remedial process is designed to achieve the clean-up goal without having to remove the soil through excavation processes.

Bioremediation applications generally involve enhancement and acceleration of processes already naturally occurring in the contaminated soil and groundwater at a given site. Hydrocarbons are naturally degraded over time by indigenous microorganisms in the subsurface. These microorganisms utilize the residual hydrocarbon as an energy/food source when other conditions including the presence of various micro-nutrients and other chemical conditions are satisfied.

In this case, a hybrid of the technology was designed, evaluated, and reviewed for several key factors to determine the applicability to the site. Factors considered included the ability to promote conditions conducive to accelerated/enhanced bioremediation, the ability to apply and transmit a water based solution laden with the necessary micro-nutrients to the contaminated mass, and the ability to contain and recover/circulate groundwater from the entire treatment area.

The type of contaminant present at the site is conducive to bioremediation. The process has been successfully applied to remediate hydrocarbons of the type present at West Channel at other sites since the early 1970s. The carbon chains present in the soil at the site and concentrations documented by site assessment are in the range considered viable for remediation through these processes.

Because the soil types at the site exhibit low-to-moderate groundwater permeability and the contaminant is dispersed over a rather large area. A number of engineered systems were evaluated. It has been determined by consideration of the site conditions, including soil types and the relatively shallow dispersion of the contaminant, that an insitu bioremediation program is technically feasible for this site.

Other factors that were considered include: site disturbance during construction, short and long term environmental/ecological impacts, visual aesthetic impacts to the site and surrounding area, time constraints, and logistical considerations. Consideration of the above information with site-specific adjustments indicates that the approach is both technologically sound and cost effective.

5.4 Natural Attenuation

Natural attenuation is the process of allowing a contaminant concentration to be reduced in concentration to an acceptable level over time by natural processes. Typically, no external amendments are added to the soil or groundwater and simple long term monitoring of the site is continued in order to verify that remediation is occurring.

Generally, the time necessary to complete remediation by natural attenuation of fuel hydrocarbons at the concentrations currently present at West Channel would be considered excessively long (>15 to 20 years). As a result, natural attenuation was eliminated as being a feasible remedial strategy.

6.0 CUMULATIVE EFFECTS

Cumulative effects refer to the impacts on the environment that result from a combination of past, existing, and imminent projects and activities. Causal agents of cumulative effects can include multiple causes; multiple effects; effects of activities in more than one locale; and recurring events.

The study area for cumulative effects is based on the sub-regional extent of the proposed remediation program, which is approximately 4.5 hectares. The significance, extent, duration, magnitude, and residual effects criteria used in this section are defined in Section 12.0, Proposed Mitigation and Anticipated Environmental Impacts.

Recent activities within the vicinity of the proposed remediation program includes seismic and drilling exploration from winter 2000/2001 (Table 2).

TABLE 2

OTHER LAND USE ACTIVITIES WITHIN THE PROJECT VICINITY

Proponent	Activity	Distance from Proposed Program*	Duration	Aerial Extent	Magnitude
Shell Canada Ltd.	2D Seismic Program	11 km	Winter 2000/2001 Short-term	Subregional	Low
Explor Data	2D Seismic Program	9 km	Winter 2000/2001 Short-term	Subregional	Low
Shell Canada Ltd.	3D Seismic Program	27 km	Winter 2000/2001 Short-term	Subregional	Low
Petro-Canada	3D Seismic Program	29 km	Winter 2000/2001 Short-term	Subregional	Low

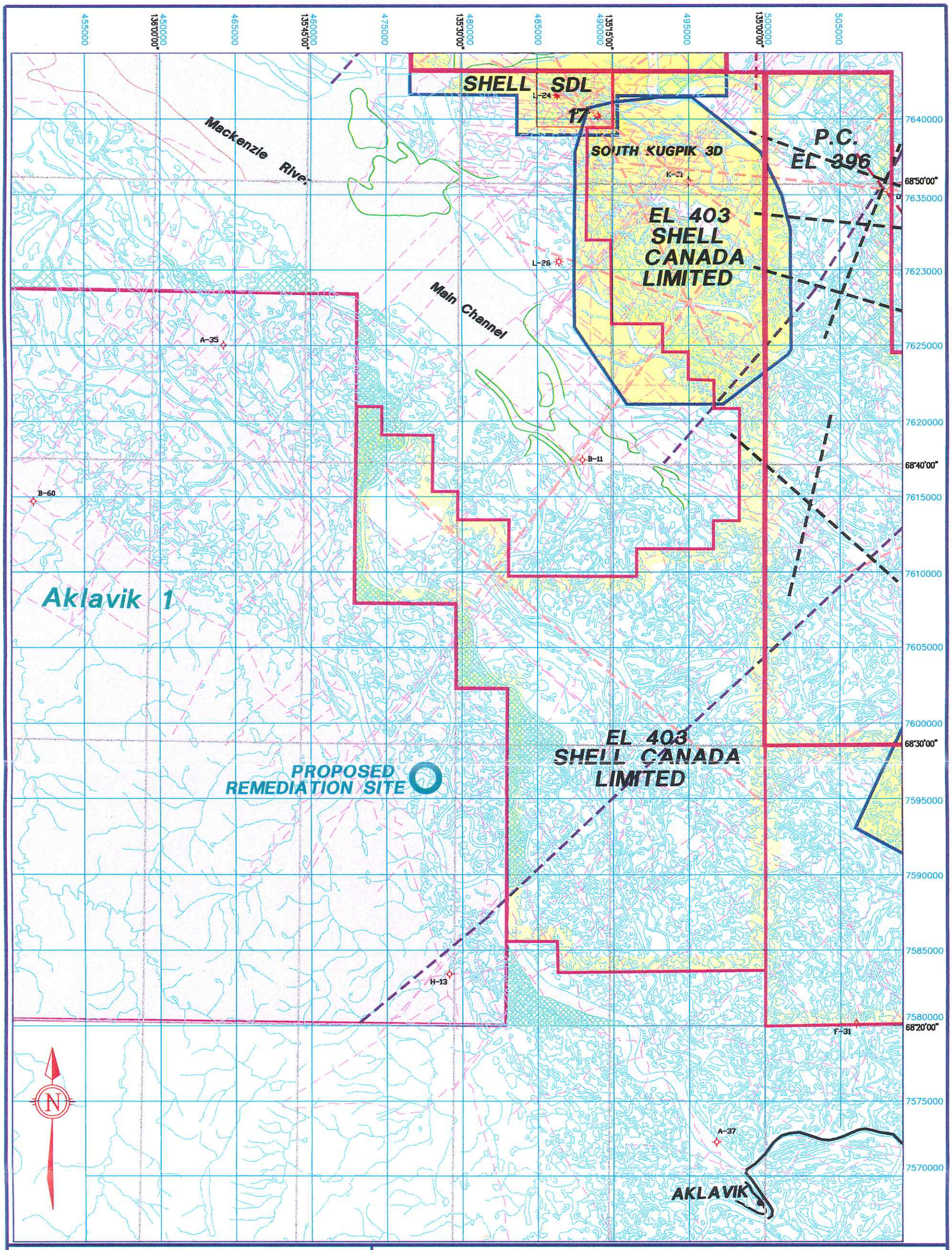
* Distance from project area at nearest point.

The incremental increase of impacts from the proposed remediation program, in combination with other projects in the study area, will likely be restricted to a temporary change in vegetation cover, which is local and short-term in nature, and vegetation disturbance, which will be local and short-term due to natural re-vegetation. Impacts to wildlife are anticipated to be short-term and low based on an assessment of Valued Ecosystem Components (VECs) (Table 7).

VECs of the project area, during the period of operation, have been identified as the Bluenose-west/Cape Bathurst caribou herd and grizzly bears. These are large mammals identified as species of Special Concern, either by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or by the Inuvialuit as published in Community Conservation Plans.

Grizzly bears can be found in the general region surrounding the remediation program area, although at low densities. Grizzly bears may forage in the area during non-denning seasons. Residual impacts to grizzly bears and grizzly bear dens are subregional, low in magnitude, limited to medium-term disturbance, accidental in frequency and not significant. A wildlife monitor will be present during the operational phases of the program.

Disturbance to other species in the area will be restricted to the remediation area and the operational area. The disturbance from the regional activities listed in Table 2 will occur over a 4 month period and will be medium-term. Cumulative effects of this project on other species over time are considered not significant.



LEGEND

- PROPOSED REMEDIATION SITE
- PROPOSED 3D SEISMIC PROGRAMS
- WINTER 2001 ONSHORE 2D SEISMIC PROGRAMS
- SEISMIC PROGRAMS 1965 – 1992
- EXPLORATION LEASE (EL) BOUNDARY SHOWN THUS
- EXISTING WELLSITE SHOWN THUS

SHELL CANADA LIMITED

FIGURE 3

CUMULATIVE EFFECTS OF OIL AND GAS ACTIVITIES IN THE VICINITY OF THE PROPOSED PROJECT

MACKENZIE DELTA, N.W.T.

SCALE : 1 : 250 000

Inuvialuit Environmental & Geotechnical Inc.

INUKSHUK Geomatics Inc.

CALGARY–EDMONTON–REGINA

DRAWN : B.T.	JOB NO. : 00–12929 12215MAP1–FIG3–R	
DATE : APRIL 16, 2001		REV NO: 0

7.0 LOCATION

The West Channel site is located on a vegetated peninsula adjacent to the west channel of the Mackenzie River on Inuvialuit private 7(1)(a) lands at 68°28'33" N latitude and 135°33'25" W longitude, approximately 37 kilometres northwest of Aklavik, NT (Figure 1).

8.0 TRADITIONAL AND OTHER LAND USES

Land use in the region includes subsistence trapping, hunting and fishing, as well as tourism related recreation. Traditional land and continuing subsistence use by the Inuvialuit of the region is documented within Community Conservation Plans for each community in the Inuvialuit Settlement Region (ISR). The proposed project falls within the Tuktoyaktuk, Inuvik and Aklavik Conservation Planning Areas as defined by the respective Community Conservation Plans (AICCP, IICCP, and TCCP 2000). The community conservation plans identify four management categories of land (B through E). The project directly affects lands within categories C and D. The descriptions are as follows:

Category C: Lands and waters where cultural or renewable resources are of particular significance and sensitivity during specific times of year. These areas shall be managed so as to guarantee the conservation of the resources.

Category D: Lands and waters where cultural or renewable resources are of particular significance and sensitivity throughout the year. As with Category C areas, these lands and waters shall be managed so as to guarantee the conservation of resources.

The proposed remediation program lies within two areas defined as Special Management Areas, where the Inuvialuit outline recommended land use practices, and where time of the program must be considered in relation to local harvesting of natural resources. Special Management Areas within or near the project area are listed in Table 3, illustrated in Figure 4 and described in relation to the proposed project.

TABLE 3

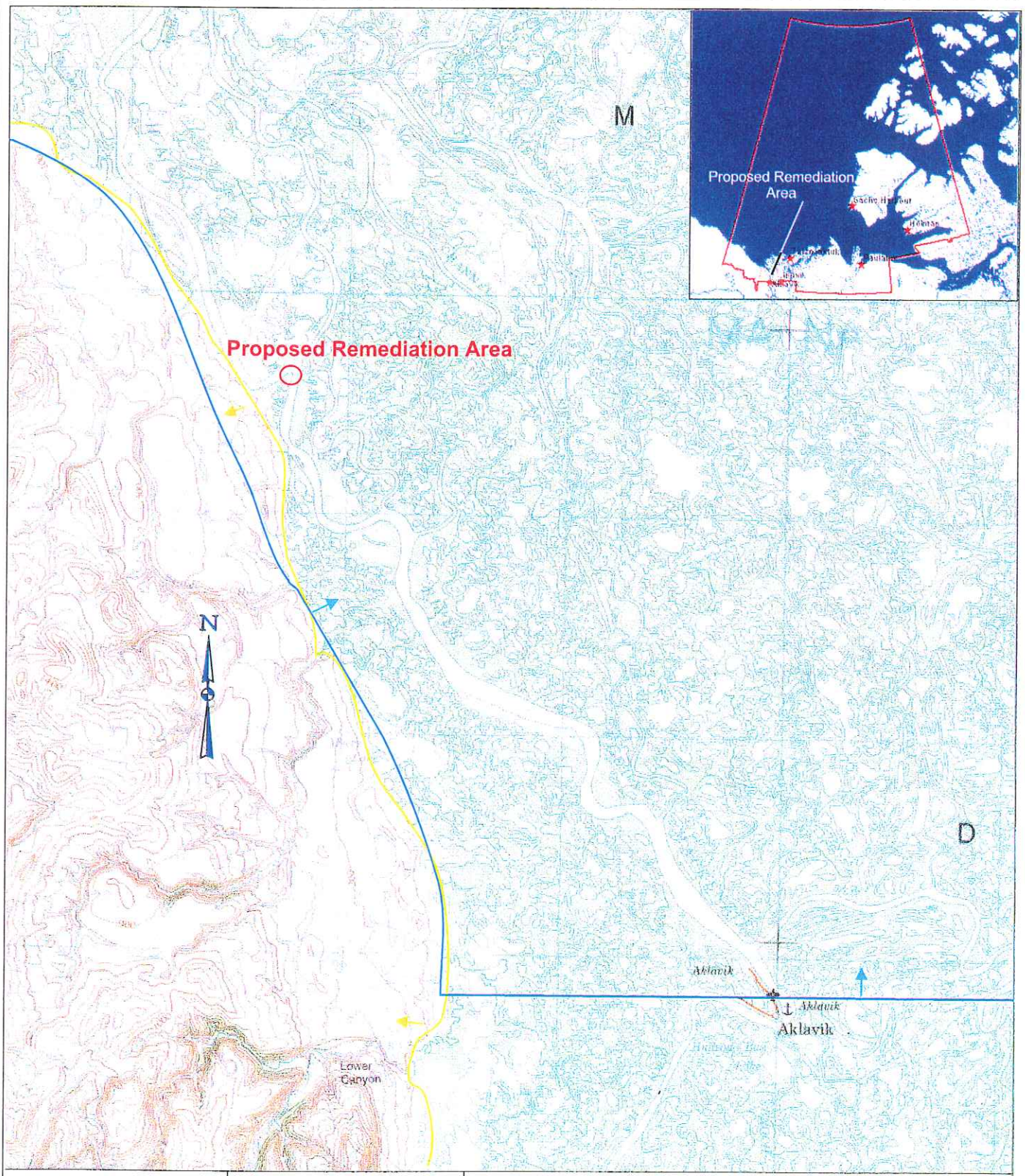
SPECIAL MANAGEMENT AREAS WITHIN OR NEAR THE PROJECT AREA*

Site Number And Protective Status Category	Name	Location Description	Location In Relation To Project
719C	Inner Mackenzie Delta	Includes the area between the West and East Channels, Reindeer Channel to the south and the ISR boundary to the north.	Management Area encompasses the program area.
725D	North Slope, East of Babbage River	Land base lying between the eastern border of Ivvavik National Park (with the exception of the fish hole at the top of the Babbage River, inside the park) and the west side of the Mackenzie Delta, the southern boundary of the ISR and the Beaufort Sea.	Management Area is located within 5 km of project area.

* AICCP, IICCP and TCCP, 2000

Site No. 719C – Inner Mackenzie Delta is located on private 7(1)(a) and Crown lands within the ISR. The site is important due to its habitat for fish, waterfowl, moose and furbearers. It is also used by the people of Aklavik for trapping and hunting muskrats during the spring, and setting fish nets at all times of the year. In order to mitigate any potential effects, wildlife monitors and environmental monitors will be employed to assess potential wildlife conflicts in the project area. Found within this Special Management Area are many historical, cultural and archaeological sites (IICCP 2000), however, within the immediate project area, the only archaeological site consists of an isolated chert flake, and it is located approximately 8.5 km to the northwest (FMA 2000).

Site 725D – Eastern North Slope, east of Babbage River is located on Private 7(1)(a) lands and Crown lands within the ISR and is located within 5 km of the project area. This site is important habitat for the Porcupine caribou herd, which is harvested year-round in this area. It is also important habitat wolves (spring and summer denning areas), polar bears (winter denning), moose and musk oxen (year round) (see Table 7 for mitigation measures) (IICCP 2000). Several raptors (such as golden eagle, bald eagle, rough-legged hawk, peregrine falcon, and gyrfalcon) also use the site for summer nesting. Geese use the site for fall staging and swans use the site for summer moulting and nesting (IICCP 2000). As indicated above, monitoring will help to ensure that migrating birds are not affected by this program.



Inuvialuit Environmental & Geotechnical Inc.

Legend:

- 719C Inner Mackenzie Delta
- 725D - Eastern North Slope, East of Babbage River

Special Management Areas within the Vicinity of the Proposed Remediation Site

April 2001	5015-01	Scale: 1: 250,000	Figure 4

9.0 DEVELOPMENT TIMETABLE

The remediation program will occur from July 2001 until approximately September 15, 2001. Should an additional season be required to complete the program, it will continue from June to September 2002. The installation of the remediation equipment will take approximately 15 days. Once the equipment is in place, the program will be operational for 75 days. The overall development schedule will depend on factors such as the timing of the barge arrival at the site.

10.0 NEW TECHNOLOGY

Due to the proximity of the Mackenzie River, the depth of permafrost, and the sensitivity of the geographic location, any new technologies for site remediation have not been evaluated. However, although in-situ bioremediation is not considered new technology, the proposed version, the IBCC, is a new application of existing technology. As stated, this technology combines proven principles of bioremediation with novel advancements in fluid aeration with a site-specific engineered fluid distribution, infiltration, containment, and treatment process. The fluid aeration, or GLR, utilizes groundwater circulation and venturi vacuum chambers to super oxygenate the groundwater (dissolved oxygen levels >15 to 20 mg/L at 10°C). The micro-bubbles generated by the GLR increases the dissolved oxygen (DO) readings for extended periods of time. When injected into the formation, the DO front disseminates into the saturated soil thereby creating an aerobic environment in the contaminated zone. When coupling this technology with the re-circulation and recovery techniques described in this report, complete mineralization of the petroleum hydrocarbons can occur in relatively short periods of time.

11.0 ENVIRONMENTAL OVERVIEW

11.1 Methods

The baseline information provided in this report was synthesized from existing literature, Phase I and II Environmental Site Assessments conducted for the project area during the Year 2000. Literature was collected from community reports obtained from the Joint Secretariat located in Inuvik, and from the Arctic Institute of North America library, located at the University of Calgary. Archaeological information was obtained from the Canadian Museum of Civilization accessed through a database maintained by the Prince of Wales Northern Heritage Centre.

11.2 Physiography and Bedrock Geology

The project area lies within the Mackenzie Delta Ecoregion within the Taiga Plains Ecozone (ESWG 1995). This ecozone features typically subdued relief consisting of broad lowlands and plateaus incised by major rivers, the largest of which can show elevational differences of several hundred metres (ESWG 1995). Underlain by horizontal sedimentary rock, limestone, shale and sandstone, the nearly level to gently rolling plain is covered with organic deposits and to a lesser degree, with undulating to hummocky morainal and lacustrine deposits (ESWG 1995). Alluvial deposits are common along the major river systems, including braided networks of abandoned channels.

The Mackenzie Delta Ecoregion is composed of the southern two-thirds of the distinctive Mackenzie River Delta. The delta is a complex area of peat-covered deltas and fluvial marine deposits. The present delta is remarkable for its multitude of lakes and channels. Wetlands extend over 50% of the ecoregion, and are characteristically polygonal peat plateau bogs with ribbed fens (ESWG 1995).

11.3 Soils

The dominant soils of the Mackenzie Delta ecoregion include Regosolic Static and Gleysolic Static Cryosols with Organic Cryosols developed on level fluvioglacial, organic, and marine deposits (ESWG 1995). A discontinuous layer of permafrost underlies these soils with low to medium ice content. The organic soils found on the eskers of this ecozone are generally shallow, highly acidic, and nutrient-poor. The mineral soils are also poorly developed and often frozen (ESWG 1995). Sensitive terrain areas encountered within the project area include the eroded backs of the Mackenzie River.

11.4 Climate

The ecoregion traversed by the proposed project experiences very cold winters and cool summers. The mean annual temperature is approximately –9.5°C with a mean summer temperature of 8.5 C and a mean winter temperature of –26.5 C (ESWG 1995). Winters in this area tend to be quite long as there is an approximate period of one month in which the sun does not rise above the horizon. In this dark period the ground radiates heat into space, the air grows colder and denser, and the atmospheric pressure begins to build. Very cold conditions prevail and may last for several weeks at a time. When temperatures reach such lows the ability of the air to contain moisture is limited and very precipitation falls. The mean annual precipitation ranges from 200-275 mm (ESWG 1995).

11.5 Permafrost

Permafrost occurs discontinuously throughout the project area and has low to medium ice content. This layer often lies just a few centimeters below the surface and acts as a barrier that stops the downward flow of water. Consequently, even though there is little precipitation here, the soils are often waterlogged or frozen. Vegetation provides thermal protection against permafrost degradation. Vehicle and equipment traffic, and soil disturbance can degrade the permafrost (UMA 1999), however mitigative measures will be taken in order to minimize disturbance (see Table 7).

Repeated freezing and thawing of these soils creates features on the surface that include cell-like polygons, bulging hummocks, and bare mud boils where the soil is so active that no plants can take root. Intense frost heaving often splits apart the underlying bedrock and forces large angular "boulders" to the surface.

11.6 Vegetation

Permafrost detracts from soil productivity by chilling the soil and creating waterlogged conditions in the thawed active layer near the soil surface. Plant communities found in the vicinity are relatively simple and are dominated by a few species that are well adapted to poor soil conditions and the harsh climate.

On a regional basis, the predominant vegetation in the project area consists of stunted stands of black spruce and tamarack with secondary quantities of white spruce, and a ground cover of dwarf-birch, willow, ericaceous shrubs, cottongrass, lichen and moss (ESWG 1995). Poorly drained sites usually support sedge, cottongrass and sphagnum moss and low shrub tundra (usually dwarf birch and willow) is also common (ESWG 1995).

Eleven plant species of national significance are found in the Mackenzie River delta region (McJannet et al. 1995). These species are listed in Table 4.

TABLE 4

VEGETATIVE SPECIES OF SIGNIFICANCE FOUND IN THE VICINITY OF THE PROPOSED PROJECT

Common Name	Latin Name	Phytogeography	Habitat	NCR[1]
Pussytoes	*Antennaria friesiana*	Arctic-alpine	Alpine ridges and snowbeds.	N3T1
Mustard	*Braya pilosa*	Arctic	Sandy seashores.	NX
Fescue	*Festuca lenensis*	Arctic-alpine	Dry tundra.	N1
Junegrass	*Koeleria asiatica*	Arctic-alpine	Shale scree slopes and dry tundra.	N1
Pondweed	*Potamogeton subsibiricus*	Aquatic	Still waters.	N2
Goose grass	*Puccinellia poacea*	Arctic	Riverbanks, flood plains and tidal flats.	N1
Buttercup	*Ranunculus pallasii*	Arctic-alpine	Coasts and estuaries	N2
Buttercup	*Ranunculus turneri*	Arctic-alpine	Subalpine meadows.	N2
Willow	*Salix chamissonis*	Arctic-alpine	Tundra	N2
Willow	*Salix ovalifolia* var. *arctolitoralis*	Arctic	Sand beaches and terraces.	N2T2
Mustard	*Smelowski calycina* var. *media*	Arctic-alpine	Stony slopes and lakeshores.	N3T2

Notes:
1. The Nature Conservancy Ranks
   - Canada Rank (N): national status
   - Taxon Subrank (T): applied if a taxon is a subspecies or variety
   - The degree to which a species is imperiled is rated on a scale of 1 – 5 (from extremely rare to abundant), with X indicating the species is extirpated or extinct.

11.7 Wildlife

The habitats that include and surround the Mackenzie River Delta, support a wide variety of wildlife species. Species in the project area include grizzly, black bear, and polar bear, caribou, moose, muskrat, wolf, fox, snowshoe hare, beaver, mink, ermine, and arctic ground squirrel. Vertebrate species of concern potentially found in the general vicinity of project area are listed in Table 5.

A number of species that are important to local subsistence harvesters as well as recreational users are found in the area. Inuvialuit wildlife and environmental monitors will be present during the program to help manage potential wildlife conflicts as the project progresses.

11.7.1 Terrestrial Mammals

Grizzly bears reside year round in vicinity of the project, although at low density. They have been designated the status of "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The major causes of decline of grizzly populations have been hunting and degradation of habitat (CWS 2000a). Between the years of 1973 to 1978

approximately four bears per 1000 km^2 were observed in the Richards Island region (WMAC 1998) and the current population is estimated at 4000-5000 in the Northwest Territories (CWS 2000a).

Den site selection was found to vary among grizzly bear populations in the tundra of the northern Yukon (Linnell, et al., 2000). Generally, dens were selected on slopes of 40°, (with a range of 20 to 80°). 96% of dens were excavated, and 4% were snow dens. Linnell, et al. (2000) identified the chronology of denning for brown bears in northwestern Alaska at 68° latitude. It was determined that the average den entry and emergence dates being the 4th week October and 2nd week May, respectively. All bears were denning between the 1st week of December and the 2nd week of April.

Generally, bears select dens 1 – 2 km from human activity and seem to tolerate most activities that occur more than one km from the den (Linnell, et al., 2000). Activity in closer proximity to denning bears has been shown to cause variable responses (Jalkotzy et al. 1997, Harding and Nagy 1977, Reynolds et al 1983). Some bears tolerate disturbance even inside the den, but bears may abandon dens in response to activity within this zone, especially early in the denning period.

Black bears also reside year round in the project area. Although found in a variety of habitats, black bears prefer wooded areas and dense bush land (CWS 2000b). Black bears will begin to seek out their den with the first frosts in September, are generally in hibernation in October and emerge from their den in April (NWT 1985).

The project area is located approximately 5 km east of the edge of the Porcupine caribou herd habitat. This caribou herd is harvested in the Eastern North Slope Special Management Area year round (IICCP 2000). Calving usually occurs in the Arctic National Wildlife Refuge along the Alaska coast of the Beaufort Sea located north of the project area, in June (Environment Canada 1996). Currently the population of the Porcupine herd is approximately 129,000 (PCMB 2000).

A wolf research program was undertaken by RWED in the Western Arctic from 1987-1993. These studies indicate that wolves may occur throughout the project area, but are more common in the Caribou Hills located approximately 62 km east of the project area (Clarkson and Liepins 1989).

Beaver, mink, ermine and muskrat are found in habitat associated with the channels and watercourses of the delta. Foxes may also occur in the area. Ground squirrels inhabit dry upland ridges, while lemmings and voles occupy more heavily vegetated tundra and delta habitats.

11.7.2 Birds/Waterfowl

Common bird species include the common redpoll, gray jay, common raven, parasitic jaegers, longtailed jaegers, red-throated loon, northern shrike, and fox sparrow. Raptors include the bald eagle, peregrine falcon and osprey. The Mackenzie Valley forms one of North America's most traveled migratory corridors for waterfowl (ducks, geese, and swans) breeding along the Arctic coast. The delta is important as a spring and fall staging area for migrating waterfowl. In spring, the largest concentrations occur along the Middle Channel during mid to late May (TCCP 2000). An area of high use for breeding by geese and other waterfowl during the spring and summer is the Kendall Island Bird Sanctuary, located north of the project area.

TABLE 5

VERTEBRATE SPECIES FOUND IN THE VICINITY OF THE PROPOSED PROJECT

Species [1]	Latin Name	Habitat	COSEWIC [2]
MAMMALS			
Grizzly bear	*Ursus arctos*	Prefers open areas of alpine tundra, subalpine mountains or subarctic tundra. Richards Island, Kugaluk River, delta.	Special Concern
Polar bear	*Ursus maritimus*	Southern broken edge of the arctic ice pack. Less use of delta region during summer and fall.	Special Concern
Wolf	*Canis lupus arctos*	Treeline-tundra transition zone. Bluenose caribou wintering range. Caribou Hills.	Indeterminate
Wolverine	*Gulo gulo*	On tundra between treeline and arctic coasts. North Slope, Cache Creek, Sheep Creek, Big Fish River, Foothills west of Aklavik. Relatively few in delta.	Special Concern
BIRDS			
Yellow billed loon[3]	*Gavia adamsii*	Arctic tundra on large lakes or in backwater areas of flooded rivers. Winter in the Gulf of Alaska.	Not listed
Red-throated loon[3]	*Gavia stellata*	Coastal and tundra ponds during summer; large lakes, bays, estuaries, and ocean during migration and winter.	Not listed
Bald eagle[3]	*Haliaeetus leucocephalus*	Lakes, rivers, marches, seacoasts. Willow River, Fish Creek, First Creek, Mackenzie delta.	Not listed
Golden eagle[3]	*Aquila chrysaetos*	Mountain forests and open grasslands; can be found in any habitat during migration. Willow River, Fish Creek, First Creek, Mackenzie delta.	Not listed
Peregrine falcon	*Falco peregrinus tundrius*	Nests on cliffs or buildings, and hunts over open tundra habitats.	Special Concern
Gyrfalcon[3]	*Falco rusticolus*	Arctic tundra and rocky cliffs near water. Nests in cliffs and occasionally trees.	Not listed
Eskimo curlew[4]	*Numenuis borealis*	Formerly bred in the tundra and woodland transition zones of the Mackenzie District. Present day habitat is unknown.	Endangered
Short-eared owl	*Asio flammeus*	The owl prefers extensive stretches of relatively open habitat. It is primarily a bird of marshland and deep grass fields. It likes to hunt and roost in abandoned pastures, fields, hay meadows, grain stubble, airports, young conifer plantations and marshes in the winter. It frequents prairies, grassy plains or tundra in the summer.	Special Concern

Notes:

1. Bird species are included only if they are known to be confirmed, possible or probable breeders within a particular subregion that the proposed excavation impacts.

2. Committee on the Status of Endangered Wildlife in Canada 2000.

   Endangered = A species facing imminent extirpation or extinction.
   Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural events.
   Indeterminate = A species for which there is insufficient scientific data to support status designation.

3. Species are included due to their listing in Community Conservation Plans as species of interest or declining in population.

4. Species not observed for approximately 100 years. Thought to be extinct.

11.8 Hydrology and Fish

The Mackenzie River Delta is a dynamic complex of lakes, islands, braided channels and oxbows. The hydrological regime is the primary factor controlling vegetation and wildlife habitat in the area. It is an estuarine delta with poorly developed levees, formed largely from sediments transported by the Mackenzie River over the last 13,000 years. The southwest sector also receives sediment from the Peel and Rat rivers. The present delta is flat and dotted with numerous lakes, ponds and river channels, but also contains land varying from stable forested areas to tidal flats (MRBC 1981).

The southwest portion of the delta is greatly influenced by the Peel River, which enters the delta directly. However, the dominant influence is the Mackenzie River that asserts itself across the delta further downstream. Ice covers the waters of the delta for approximately eight months of the year and can be up to 2.5 m thick in the main stem of the Mackenzie River. Ice break-up usually begins in April, and ice movement occurs before peak spring water levels. Water levels fall during late summer and into fall. The basic hydrology of the delta is a complex interaction of aggrading and degrading forces, with spring break-up being the major hydrological event each year (MRBC 1981).

A large number of fish species occur within the freshwater and marine environments of the mainland western Arctic. The impacts of oil and gas development activities are of particular concern to these aquatic environments and their inhabitants. Fish species of concern are listed in Table 6 along with their spawning habitats and spawning times.

Several studies have been conducted on fish and fish habitat with the Mackenzie River Delta. Research indicates that the delta provides overwintering habitat for a variety of fish species. In general, large, deep lakes with connections to river channels are used more extensively for wintering than are small channels. Overwintering data is found primarily in research conducted by Mann (1975) during three winter surveys in October and November 1974 and April 1975 at locations between Moose Channel and Shallow Bay. Fisheries resource information from scientific reports and land use map data were compiled by Sekerak et al. (1992) in order to describe overwintering habitats and to note the occurrence of each of the major fish species in different habitat types of the near shore Beaufort Sea and Mackenzie River delta area. DFO has indicated that any water body with greater than 0.5 m of non-frozen water under ice may provide over wintering habitat for delta fish species (Wright Pers. Comm.).

TABLE 6

FISH SPECIES FOUND IN THE VICINITY OF THE PROPOSED PROJECT

Species [1]	Latin Name	Habitat	Spawning Period	COSEWIC [2]
FRESHWATER				
Burbot	*Lota lota*	Mouths of creeks. Winter and spring may be abundant in fresh or brackish waters of Kugmallit Bay's coastal embayment.	January – March	Not listed
Arctic char	*Salvelinus alpinus*	Fish Hole, Rat River, Big Fish River, Fish Creek, Babbage River, Peel River, Shingle Point, occasionally travel the Mackenzie near Inuvik and Aklavik.	August, early September	Not listed
Flathead chub	*Platygobio gracilis*	Shallow sandy bars in smaller tributary streams, survives well in turbid water.	Summer	Not listed
Lake chub	*Couesius plumbeus*	Most of Canada west of Hudson Bay. Cool streams, lakes, ponds. Moves into deeper water during the summer.	Late March – early May	Not listed
Arctic cisco	*Coregonus autumnalis*	Mackenzie River and estuary, tributaries to the Mackenzie (spawning habitat - inland lakes).	Fall	Not listed
Least cisco	*Coregonus sardinella*	Mackenzie River and estuary, tributaries to the Mackenzie (spawning habitat), inland lakes. Inner Shallow Bay / Niakunak Bay and Kugmallit Bay are important overwintering and nursery areas.	Early October	Not listed
Finescale dace	*Chrosomus neogaeus*	Bog ponds, streams, and lakes. Mackenzie River drainage.	April to June	Not listed
Longnose dace	*Rhinichthys cataractae*	Prefers small streams, generally in riffles of gravel and boulders. Often found in turbulent waters. Also the wave lashed shores of very large lakes and often found in trout streams.	April and May	Not listed
Inconnu	*Stenodus leucichthys*	Mackenzie River and estuary (rearing habitat). Turbid lakes on Richard Island throughout summer, Mallik and Mason Bays.	Late September – early October	Not listed
Arctic grayling	*Thymallus arcticus*	Kugalak River, coastal rivers of North Slope. Occasionally Richards Island.	Spring	Not listed
Lake trout	*Salvelinus namaycush*	Outer delta lakes (including minor channels) with high oxygen levels, a good connection to adjacent water bodies, small to moderate volumes available and poor to moderate water quality.	Fall	Not listed
Northern pike	*Esox lucius*	Tributaries, creeks and shallow lakes in Mackenzie delta.	Early spring	Not listed
Deepwater sculpin	*Myoxocephalus thompsoni*	Habitat preferences are not known. Spawning areas are not known.	May and June	Threatened
Slimy sculpin	*Cottus cognatus*	Coldwater streams. Stream bottom.	Late April and May	Not listed
Spoonhead sculpin	*Cottus ricei*	Turbid rivers or deep areas of lakes.	Fall	Not listed
Pond smelt	*Hypomesus olidus*	Arctic and Pacific drainages from Rae River (Coronation Gulf) and Great Bear Lake in Northwest Territories, Canada to Copper River in Alaska Seines of Shallow Bay near mouth of west channel.	Late spring – early summer.	Not listed

Species [1]	Latin Name	Habitat	Spawning Period	COSEWIC [2]
Rainbow smelt	*Osmerus mordax*	Found only along mainland coast from Bathurst Inlet westward.	Spring	Not listed
Ninespine stickleback	*Pungitius pungitius*	Shallow vegetated areas of lakes, ponds, and pools of sluggish streams. Sometimes in open water over sand. Seining locations Shallow Bay, Kendall Island, Swan Channel and East Channel.	Spring	Not listed
Longnose sucker	*Catostomus catostomus*	Arctic mainland in lakes and occasionally in the brackish water of estuaries.	Spring	Not listed
White sucker	*Catostomus commersoni*	Lakes, small rivers and streams.	Late April to June	Not listed
Trout-perch	*Percopsis omiscomaycus*	Stream habitats with high water quality, deep pools and bottoms consisting of sand and gravel. Lake populations avoid mud-filled bays.	May through August	Not listed
Walleye	*Stizostedion vitreum*	Intermediate to large cool lakes, rivers, and streams. Prefers large shallow lakes with high turbidity.	April to late June	Not listed
Broad whitefish	*Coregonus nasus*	Several overwintering areas in East Channel and Whitefish Bay. Tuktoyaktuk Harbour, Mason Bay, Mallik Bay, Shallow Bay, streams of Tuktoyaktuk Peninsula, spawning throughout the Mackenzie system.	October, November	Not listed
Round whitefish	*Prosopium cylindraceum*	Inhabits shallow areas of lakes and clear streams, rarely entering brackish water. Most often found in clear fast flowing water. Outer Mackenzie delta.		Not listed
SALTWATER				
Arctic char	*Salvelinus alpinus*	Fish Hole, Rat River, Big Fish River, Fish Creek, Babbage River, Peel River, Shingle Point, occasionally travel the Mackenzie near Inuvik and Aklavik.	Fall	Not listed

Notes:

1. Fish species are included only if they are known to be confirmed, possible or probable breeders within a particular subregion that the proposed excavation impacts.

2. Committee on the Status of Endangered Wildlife in Canada 2000.

   Threatened = A species likely to become endangered if limiting factors are not reversed.
   Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural event

11.9 Cultural and Historic Resources

Cultural and historic resources include the physical traces of culture and societies as well as the current resources utilized by local people. Heritage sites recognized by Federal agencies are also considered. These sites include: archaeological sites, historic structure sites, traditional trails, campsites, berry picking areas, sacred or medicinal plant picking areas, burial sites, ceremonial sites, traditional hunting grounds, and places associated with traditional names or legends.

The project is situated within the Mackenzie River Delta, portions of which have seen previous historical resource survey efforts. A records search was completed for mapped locations of heritage resource sites on file at the Canadian Museum of Civilization for locations of known archaeological and historical resource sites in the project area. Palaeontological finds of Quaternary age have also been recorded in the delta and are not on file with the Canadian Museum of Civilization but are considered heritage resources (FMA 2000).

One archaeological site with Borden designation of NdTx-1, is located approximately 8.5 km northwest of the project area. This site, which is located on a ridge on the east side of elongate, north-south trending lake which drains into Cache Creek, just west of the Mackenzie Delta in the northern Richardson Mountains, consists of an isolated find of a chert flake. This site has the geographic coordinates of latitude 68°30'08" N and a longitude of 135°49" W.

12.0 PROPOSED MITIGATION AND ANTICIPATED ENVIRONMENTAL IMPACTS

Shell's West Channel Remediation Program has been designed to remediate hydrocarbon contaminated soil while mitigating impacts on the environment and land users. Potential environmental impacts were identified through a review of existing literature and maps, and a general knowledge of the project area developed through work on other projects in the region.

Without adequate mitigation, potential environmental impacts resulting from the remedial operation may include: disturbance to terrain, soils and permafrost, vegetation, terrestrial wildlife, and other land uses.

The following section and Table 7 identify: how these potential environmental and socio-economic impacts could arise during the excavation program; recommended measures to prevent or mitigate the potential impacts; and significance of the residual impacts. The assessment criteria and definitions used in assessing the significance of each potential impact are provided below.

It is predicted that the use of the proposed mitigative measures by Shell and its contractors will ensure that no significant residual impacts will occur as a result of the project. Remediation program activities will follow all applicable legislation and guidelines.

SIGNIFICANCE CRITERIA

AREAL EXTENT

Local:	Impacts are limited to the remedial, fuel storage, and camp areas
Subregional:	Impacts may extend beyond the limits of the remedial, fuel storage, and camp areas, but are limited to within 1 km of the remedial, fuel storage, and camp areas
Regional:	Impacts may extend beyond 1 km of the remedial, fuel storage, and camp areas

MAGNITUDE

Negligible:	No discernible impact.
Low:	Impacts would be restricted to a few individuals or only slightly affect the resource or parties involved; factors related to species' population levels would not be affected.
Moderate:	Impacts would affect many individuals or noticeably affect the resource or parties involved; factors related to a species' population levels would be affected to a degree that a change within natural limits of variability will occur; impacts would be socially tolerated.
High:	Impacts would affect numerous individuals or affect the resources or parties involved in a significant manner; factors affecting species' population levels would be altered to a degree that a change beyond natural limits of variability will occur.

DURATION

Immediate:	Impact duration is limited to less than two days.
Short-term:	Impact duration is longer than two days but less than one year.
Medium-term:	Impact duration is one year or longer but less than ten years.
Long-term:	Impact duration extends ten years or longer.

FREQUENCY OF OCCURRENCE

Isolated:	Occurrence confined to specified period.
Accidental:	Occurs rarely over assessment period (*i.e.*, life of the project).
Occasional:	Occurs intermittently and sporadically over assessment period.
Periodic:	Occurs intermittently but repeatedly over assessment period.
Continuous:	Occurs continually over assessment period.

PROBABILITY OF OCCURRENCE

Low:	Unlikely.
High:	Likely.

LEVEL OF CONFIDENCE

Low:	Based on incomplete understanding of cause-effect relationships and incomplete data pertinent to remediation area.
Moderate:	Based on good understanding of cause-effect relationships using data from elsewhere or incompletely understood cause-effect relationships using data pertinent to remediation area.
High:	Based on good understanding of cause-effect relationships and data pertinent to remediation area.

PERMANENCE OR REVERSABILITY

Reversible in short-term:	Impact can be reversed in less than one year.
Reversible in medium-term:	Impact can be reversed in 1 year or more, but less than 10 years.
Reversible in long-term:	Impact can be reversed in 10 years or more.
Irreversible:	Impact is permanent.

RESIDUAL IMPACT BALANCE

Positive:	Net benefit or gain to the resource or affected party.
Neutral:	Neither a positive nor negative impact; or positive and negative impacts are balanced.
Negative:	Net loss to the resource or detriment to the affected party.

RESIDUAL IMPACT SIGNIFICANCE

Significant Adverse Effect:	High probability of permanent or long-term residual effect of high magnitude on ecological, social, or economic sustainability that cannot be technically or economically mitigated or compensated.
Significant Positive Effect:	High probability of permanent or long-term positive residual effect of high magnitude on ecological, biological, social, or economic sustainability.
Unknown:	Potential significance cannot be defined with existing information or knowledge.
Not Significant Adverse Effect:	All other negative effects.
Not Significant Positive Effect:	All other positive effects.

TABLE 7

POTENTIAL ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS, MITIGATION AND RESIDUAL IMPACTS

Concern/Impact	Mitigative Measures	Areal Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
1. Permafrost and Permafrost Features										
1.1 Disturbance of permafrost	.1 Personnel and equipment will be transported to and removed from the site by boat, thereby minimizing effects on permafrost soils. .2 On-land movement will be restricted to all terrain vehicles (ATVs) and foot traffic. .3 Environmental and Wildlife Monitors will be present during operations to identify sensitive areas and assist in mitigation, on the advice of the ILA. .4 Remediation techniques do not generate excessive heat and therefore will not cause long-term alteration to the permafrost layer.	Local	Low	Short-term to medium term	Accidental	Low	High	Reversible in medium-term	Negative	Not significant
2. Soils										
2.1 Disturbance to the soil profile (i.e. soil loss, compaction, admixing)	.1 Any soil or organic material displaced during remediation operations will be replaced and compacted. .2 Any inadvertent surface disturbance created outside the main remediation site will be repaired immediately.	Local	Low	Medium-term	Accidental	Low	High	Reversible in medium-term	Neutral	Not significant
2.2 Disturbance to erosion prone banks and slopes	.1 If surfaces are disturbed in an area where drainage or erosion is a possibility, erosion control measures may include utilizing salvaged slash as rollback.	Local	Low	Short-term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
2.2 Disturbance to drainage	.1 Clearings will be recontoured to restore natural cross drainages. .2 Drainages will be left free of debris. .3 Equipment will not be used instream, nor will crossing structures be erected on watercourses.	Local	Low	Short-term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
3. Vegetation										
3.1 Loss of vegetation communities	.1 Vegetation clearing will be minimal, but if necessary, will be restricted to the remediation site. .2 Natural revegetation will be encouraged to minimize the opportunities for non-native species introduction.	Local	Low	Medium-term	Continuous	Low	High	Reversible in short-term	Neutral	Not significant
	.3 An Inuvialuit Environmental Monitor will be employed to observe ground cover for rare or unusual plant species.									

TABLE 7 Cont'd

Concern/Impact	Mitigative Measures	Areal Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
4. Wildlife										
4.1 Disturbance to wildlife	.1 The remediation program will occur within a four month time period, thereby minimizing the disturbance to wildlife. .2 If the project continues into a second field season, any equipment left in place over winter will be secured together and covered with tarps. .3 All activity will be restricted to the reclamation site. .4 An Inuvialuit Wildlife Monitor will be employed to assess potential wildlife conflicts in the area of operations as directed by the ILA. .5 Movement by contractors on land will be minimized to the extent possible. .6 Large groups of nesting waterfowl will be avoided by 500 m.	Sub regional	Low	Short-term	Accidental	Low	HIgh	Reversible in short-term	Neutral	Not significant
4.2 Attraction of nuisance animals	.1 Garbage will be continuously collected and incinerated or disposed of at approved facilities. .2 Wildlife will not be harassed or fed.	Local	Low	Short-term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
4.3 Encroachment on endangered species or important wildlife habitats	.1 Local RWED biologists and officers will be notified if a bear is encountered. Excavation will avoid bear dens. .2 An Inuvialuit Widlife Monitor will locate ground and tree nest sites, and these sites will be avoided. .3 An Inuvialuit Wildlife Monitor will be employed to watch for and help the contractor to avoid species of concern within the vicinity of the remediation operations.	Loeal	Low	Short-term	Aecidental	Low	High	Reversible in short-term	Neutral	Not significant
5. Aquatic Resources										
5.1 Introduction of pollutants to waterbodies	.1 Special measures will be employed to refuel or service equipment and ATVs. .2 Refueling will occur a minimum of 30 m from the nearest waterbody. .3 In the event of a spill, the Fuel Spill Contingency Plan will be followed (Appendix A). .4 Spills will immediately be reported to Shell's Environmental, Health and Safety Coordinator and ILA. All accidental spills will be reported to the NWT Emergency Spill response Line (867.920.8130). .5 Personnel will be trained in spill response procedures and equipment use. .6 A closed loop system will be used during in-situ remediation that will limit both removal from and discharge back to the Mackenzie River.	Local	Low	Short-term	Isolated	Low	High	Reversible in short-term	Neutral	Not significant

TABLE 7 Cont'd

Concern/Impact	Mitigative Measures	Areal Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
	.7 All discharged water will meet or exceed GNWT water discharge criteria.									
5.2 Disturbance to Fish or Fish Habitat	.1 Intakes used for withdrawing water will be screened to prevent damage to streams or lake bottoms and to avoid impingement or entrainment of fish. .2 Withdrawal rate and volume will not exceed 10% of the flow rate of the watercourse or of the volume of a natural body of water.	Local	Low	Short-term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
6. Interference with Other Land Uses										
6.1 Possible conflict with wildlife harvesting in the area	.1 Public consultation with local communities will be ongoing to notify communities of reclamation operatins and timing.	Local	Low	Short-term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
6.2 Fishing Camps	.1 Local harvesters will be notified of excavation operations and timing. .2 The borders of the reclamation area will be clearly staked and flagged, and visible to local travellers.	Local	Low	Short-term	Accidental	Low	High	N/A	Neutral	Not significant
7. Future Land Use										
	.1 The project is not anticipated to negatively affect land use by local and/or recreational users of the region.	Local	Negligible	Short-term	Isolated	Low	High	N/A	Neutral	Not significant
8. Archaeological, Historical or Palaeontological Sites										
	.1 Should any archaeological, paleontological or historical sites be discovered during operations, work will be stopped, and notification of site discovery will be provided in writing to Inuvialuit organizations and the Prince of Wales Northern Heritage Centre within 2 days.	Local	Low	Long-term	Accidental	Low	High	Irreversible	Neutral	Not significant
9. Health or Environmentally Threatening Emergency										
	.1 In the event of an emergency, Shell's Emergency Response Plan will be implemented (Appendix A).	N/A	N/A	N/A	Isolated	Low	High	N/A	Neutral	N/A

TABLE 7 Cont'd

Concern/Impact	Mitigative Measures	Areal Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
10. Abandonment and Restoration										
	.1 Should the project be completed in one season, all equipment and materials will be removed from the area immediately following project completion. .2 If the project continues into a second field season, winterization will consist of draining all lines and pumps of residual water and removal of all equipment off the point bar and back onto high ground out of the potential zone of flood impacts. Any equipment left in place over winter will be secured together and covered with tarps. .3 All garbage will be incinerated. Non combustibles will be transported to Inuvik for proper disposal. .4 Once remediation goals have been achieved all equipment and surface piping will be removed from the site and any remaining significant surface disturbances will be restored to minimize evidence of the onsite activity. .5 Below grade recovery trenches and piping buried at depths of more than 1 m below grade will be left in place. Redisturbance of the ground to remove these structures will result in greater damage to the environment that leaving them in place.	Local	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Not significant

13.0 EMERGENCY RESPONSE PLANS

In the event of an emergency, Shell's Emergency Response Plan will be followed (Appendix A) and the Inuvialuit Land Administration will be contacted immediately. In the event of a fuel spill, Shell's Spill Response Plan (Appendix A) will be followed and the NWT Spill Response Line will be contacted immediately as outlined in Appendix A.

14.0 CLEANUP, RECLAMATION, DISPOSAL, AND/OR DECOMMISSIONING PLAN

Remediation progress will be assessed on a continual basis throughout the operational season based on soil vapour and soil sample laboratory results. A determination as to the necessity for winterization, and use of the IBCC in the following field season will be made based on the progress sampling results.

Winterization will consist of draining all lines and pumps of residual water and removal of all equipment off the point bar and back onto high ground out of the potential zone of flood impacts. Any equipment to be left over the winter will be secured together and covered with tarps.

Once remediation goals have been achieved all equipment and surface piping will be removed from the site and any remaining significant surface disturbances will be restored to minimize evidence of the onsite activity.

Below grade recovery trenches and piping buried at depths of more than 1 meter below grade will be left in place through approved regulatory methods. Re-disturbance of the ground to remove these structures will result in greater damage to the environment than leaving them in place.

15.0 OTHER ENVIRONMENTAL ASSESSMENT

A Phase 1 ESA at West Channel, a former staging point for Shell Canada's northern operations, was conducted by Shell in July 2000. Seven sub-sites underwent intrusive soil investigation by Dutch Auger from discrete depth intervals to determine the presence and extent of subsurface contamination. In addition, three plants were collected on-site and sent for laboratory analysis. Elevated concentrations of BTEX and metal were encountered in four of the collected soil samples, when compared to CCME Remediation Criteria. Shell personnel encountered elevated

hydrocarbon vapour readings while field screening subsurface soil. Shell determined that the site required further investigation through a Phase II Environmental Site Assessment (ESA).

Inuvialuit Environmental Inc. was contracted by Shell to conduct a Phase II Environmental Site Assessment of the site for their exclusive use. The results were submitted to Shell in November 2000. The program was designed to meet client requests and the objectives of a Phase II site characterization with generally accepted practices to meet the GNWT Industrial Remediation Criteria for Soil and the Canadian Council of Ministers of the Environment (CCME) Interim Canadian Environmental Quality Criteria for Contaminated Sites. The Phase II ESA on-site inspection and subsurface soil collection at the West Channel site was performed on September 22 and 24, 2000. The objectives of the project were to test any previously identified areas for potential contamination; to identify the extent of contamination and the potential for further contamination; to report any further contamination not previously identified; and to recommend remediation plans for contaminated areas. The scope of the investigation was to assess the subsoil for possible subsurface contamination resulting from the operation of a staging point for Shell Canada Limited northern operations. The project activities included site reconnaissance for indications of surface contamination and areas of stressed vegetation, discrete subsurface soil sampling at 25 borehole excavations, and laboratory analysis of sampled soil for Total Petroleum Hydrocarbons (TPH) including Benzene – Toluene – Ethyl-Benzene – Xylene (BTEX), CCME listed metals, landfill prohibition scan (solvents, PAH).

The subsurface soils at the subject property were found to consist primarily of silt with some sand that was moist, soft and brown in colour. The Phase II ESA found evidence of hydrocarbon contamination in connection with the West Channel site. CCME list metals except for Barium in BH-8 were either below the acceptable criteria, or are currently regulated. Barium concentrations found in BH-8 were slightly elevated compared to GNWT and CCME Remediation Criteria. All other borehole samples analyzed indicated this Barium exceedance was localized to BH-8.

The conclusions and recommendations of the Phase II ESA identified concentrations of TPH, Benzene, Toluene, Xylene, and Barium were elevated compared to GNWT and CCME remediation criteria. All other analyzed parameters were below applicable territorial and federal criteria or are not currently regulated.

Numerous other environmental assessments have been conducted within the Mackenzie Delta region in support of various exploration programs in 2000 and 2001.

16.0 COMMUNITY CONSULTATION

Shell initiated public consultation with the communities and regional organizations potentially affected by the proposed remediation program in April 2001. Government representatives were informed of the proposed remediation program, operational schedule, and details of the remediation program. On April 6, 2001, IEG, on behalf of Shell, sent an initial project notification along with a request for comments to all pertinent territorial, federal and Inuvialuit agencies with jurisdiction in the project area. The purpose of the notification was to provide agency representatives with an overview of the project prior to consultation meetings with Shell representatives and to offer the opportunity for early comments or identification of concerns and to provide any information that might influence the project. A summary of the individuals who received project notification is provided in Table 8.

TABLE 8

GOVERNMENT AND NON-GOVERNMENT NOTIFICATION

Name	Agency	Date	Method
GOVERNMENT			
Rudy Cockney District Manager North Mackenzie District	Indian and Northern Affairs Canada, Inuvik, NWT	April 6, 2001	Email sent
Pete Cott Kelly Withers Area habitat Biologist NWT	Fisheries and Oceans Canada, Yellowknife, NWT	April 6, 2001	Email sent
John Nagy Marsha Branigan Wildlife Biologist	Resources, Wildlife and Economic Development	April 6, 2001	Email sent
Stephen Harbicht Head, Assessment and Monitoring	Environment Canada, Environmental Protection Branch, Yellowknife, NWT	April 6, 2001	Email sent
Meighan Wilson Coordinator, Inuvialuit Region	Indian Affairs and Northern Development, Water Resources Division, Yellowknife, NWT	April 6, 2001	Email sent
Gordon Wray Chair	NWT Water Board	April 6, 2001	Facsimile sent
Hans Arends Land Administrator	Inuvialuit Land Administration, Tuktoyaktuk, NWT	April 6, 2001	Email sent
NON-GOVERNMENT			
Duane Smith, Chair	Inuvialuit Game Council	April 6, 2001	Email sent
Frank Pokiak, Chair	Tuktoyaktuk Hunters and Trappers Committee	April 6, 2001	Email/Facsimile sent
Richard Binder, Chair	Inuvik Hunters and Trappers Committee	April 6, 2001	Email/Facsimile sent
Danny C. Gordon, Chair	Aklavik Hunters and Trappers Committee	April 6, 2001	Email/Facsimile sent
Patrick Gruben, Chair	Tuktoyaktuk Community Corporation	April 6, 2001	Facsimile sent
Donna Kisoun, Chair	Inuvik Community Corporation	April 6, 2001	Facsimile sent
Alex Illasiak, Chair	Aklavik Community Corporation	April 6, 2001	Facsimile sent
Linda Graf, Secretary	Environmental Impact Screening Committee	April 6, 2001	Email sent

In response, IEG received written notification from both the Inuvik Community Corporation, and the Tuktoyaktuk Hunters and Trappers Committee, that a meeting in regards to the project was unnecessary. The Tuktoyaktuk Community Corporation requested a conference call in lieu of a meeting to discuss the project and their concerns.

Meetings were held on April 18th and 19th, 2001 in the communities of Inuvik and Aklavik, and by conference call on April 20, 2001 with Community Corporation representatives in Tuktoyaktuk, to discuss issues of concern and mitigative measures to be adhered to during the project. At the meetings, project information was presented to the various individuals and groups and input related to issues, concerns or questions were invited. A schedule of meetings is provided in Table 9. The issues raised during community consultation meetings are listed below in Table 10.

TABLE 9

COMMUNITY CONSULTATION MEETINGS

Consultation Group	Date	Location
Indian and Northern Affairs Canada	April 18, 2001	Inuvik
Aklavik HTC, Community Corporation, and Public	April 18, 2001	Aklavik
Inuvik Hunters and Trappers Committee	April 19, 2001	Inuvik
Inuvialuit Land Administration	April 19, 2001	Inuvik
Tuktoyaktuk Community Corporation	April 20, 2001	Conference call

TABLE 10

COMMUNITY CONSULTATION ISSUES AND RESPONSES

Issue	Response
Did the Phase II sampling include testing for DDT?	Yes, and no evidence of DDT was found in the soil samples.
How deep was the original soil sampling?	3 metres; contamination was found between surface and 1 metre depth, and in one case at 1 – 2 metres depth. No contamination was found below 2 metres depth.
How can you ensure that the water in the remediation plan is moving in the desired manner?	In 3 ways: 1) by creating a hydraulic gradient through the use of recovery trenches to force the water to move in the desired manner, 2) by utilizing injection wells to create a pressure gradient, and 3) monitoring wells for quality control
Will the circulated water in the system be pumped off?	There will be apparatus onsite to treat the circulated water. Tanks of a sufficient capacity will be used to store the water for testing before release.
Is there groundwater at the site?	Some, but not much.
How will the soil be treated?	Explained.
The majority of hydrocarbons detected were between C3 and C25?	Yes. C32 is the cutoff point for what was detected during Phase II studies.
Where is the main contaminated area?	(Referred to Drawing 6) Where the red outline is on the map.

Issue	Response
If excavation were considered as a remedial option, what quantity of soil would be excavated?	Between 4,000 – 10,000 m^3, which would also involve the removal of some clean soil.
What materials will be left as residue?	The belowground piping in the trenches will be left in place. The solids in the bioreactor will be hauled out and reused. The carbon will be hauled out, regenerated, and reused.
How many litres of diesel are in the soil?	The hydrocarbons at the site are not free-phase. We don't know how much was originally spilled at the site. Based on the one borehole log indicating the highest level of contamination, it would be the equivalent of 0.02 litres of gas per kilogram of soil if you were able to squeeze it out of the soil.
Is the contamination seeping into the river?	There is no evidence of migration into the river because: the contaminant is not free phase, the contaminated area is restricted to about 2 m depth, and if it was migrating into the river higher contaminant concentrations would have been found in that area. The Phase II delineation clearly defined the horizontal and vertical boundaries of soil contamination which show that the hydrocarbons have not left the site.
What if flooding occurred?	The timing of the project does not occur during the peak flood season.
The annual spring flood encroaches on the southwest part of the site.	Based on the timing, the flood period should have passed by the time the project begins in July.
What quantity of water are you anticipating for withdrawal?	Less than 100 m^3/day, although an exact quantity is still being determined, based on the outcome of benchscale tests currently underway.
How long will it take to clean up the site?	Hopefully, the clean up will be completed this year (by mid-September), but if another season is required, we will return during the same time period next year.
Were any lab results received for the vegetation samples taken at the site?	The plant samples showed no elevations related to metals or hydrocarbons, and no concentrations differences were noted between plants in the contaminated and non-contaminated zone.
What was the site used for in the past?	It was a staging area for Shell's operations in the 1970s.
Was there a gravel pad at the site when it was a staging area?	No, just a silt base.
Should you put a curtain wall around the area like at Shingle Point in case it seeps?	The recovery trenches serve the same purpose of liquid containment that the curtain walls on the DEW Line landfill achieve therefore further containment is not required. Monitoring wells will be in place behind the trenches, to detect any sort of contamination migration.
How deep will the wells be?	Most wells will be 2 metres deep.
Will you hit permafrost?	The wells will be seated into the permafrost, but not too deep.
How deep is it to permafrost at the site?	The borehole logs show it to be from about 2-3 m depth.
Is that why the contamination isn't spreading?	It does act as a barrier, but the contamination isn't spreading because it's not in free phase.
Will monitoring wells be left in place to monitor groundwater?	The contamination at the site is in soil, not groundwater. The soil will be tested to meet or exceed GNWT criteria. Long term groundwater monitoring is not necessary.
Could you explain the role of the bacteria at the site?	No bacteria will be brought to the site for this program. We will be enhancing naturally occurring bacteria with oxygen and nutrients to help speed up the remediation process.
Shouldn't the bugs in the soil have already cleaned the contamination up?	They likely would with time, but natural attenuation is a very long term process.
Once the system is done, will the bugs in the soil continue to degrade the residual left?	Yes, the elevated oxygen and nutrient levels will allow a higher rate of natural attenuation for likely another 2 years.
Has this method been used in the arctic before?	The method itself has a proven track record. For arctic applications, several aspects of this method were used in the clean up at the Bar-1 DEW Line site (Komakuk Beach).
How deep will the trenches be?	2 - 3 metres deep.
Is there peat at the site?	No, it is not a peat zone.
How big are the tanks you are using in this process?	4000 litre tanks.

Issue	Response
What if you get heavy rains while you are there?	It is essential that the site be saturated anyway, so rain would not be harmful. However, if there was a lot of rain the tanks and pumps would have to work harder to pump the excess water out of the trenches.
With more water moving in the trenches, could it increase the possibility of going into the non-contaminated zone?	The probability is very low, because the water level in the trenches is kept low and the water flow is directed where we want it to be. Monitoring wells will also be in place to monitor concentrations.
Where was the first sampling analysis taken?	From the tank farm area.
Were any liquids found?	No, the contamination is not free phase.
Is there oil contamination?	No, testing shows concentrations of diesel and gas.
Will you be adding heat to the remediation system?	No, we don't want to cause permafrost degradation. The system can work well without adding heat.
How long will the site be drained for and how long will the site be saturated after?	The system will be continuously drained when the program is complete, with saturation lasting for likely one week after.
Will the trenches be filled when you are done?	Yes, with the belowground pipes left in place.
How will the surface pipes (stick-ups) be winterized if the program goes for 2 seasons?	They will be left in place and flagged.
Are you using steel pipes?	No, PVC pipes will be used.
How do you know when the site will be clean?	Soil will be augered out for testing.
Will the site be 100% clean when you are done?	Not 100% clean, but the soil quality will meet the GNWT criteria for safe levels.
There is a local barge contractor that may be an alternative to NTCL.	They will be contacted. Cost would be a deciding factor.
Will you need a Cat?	No, a track hoe will be used.
Where is the equipment coming from?	The specialized remediation equipment will be coming from Calgary. Local contractors will be used to supply other equipment wherever possible.
Can updates on the operations be faxed to the HTC's and Community Corporations?	Yes, written updates will be provided.
Moose come down to this area in the fall.	The project will be completed in September, so the timing should not conflict with the arrival of moose in the area.
Will the wildlife monitor be from Aklavik?	The monitor will be decided with the ILA and HTC.
How many personnel are required?	1 wildlife monitor, 1 environmental monitor, 1 camp cook, 3 technicians (2 senior technicians, 1 junior technician) for the first two or three weeks during set-up then only 2 (1 senior technician, 1 junior technician) once the system is operational.
Which of these positions can be filled by Inuvialuit?	The camp cook, both monitors, and the junior technician will be filled by Inuvialuit beneficiaries.
What kind of skills does the technician need?	The skills we would require include someone who is technically inclined, good with their hands, good with machinery, careful and responsible.
How many hours a day will you be working?	The system will be running 24 hours a day. Personnel will be on an 11 or 12 hour shift. The first couple of weeks will be intensive during set-up and troubleshooting. There may be periodic shifts at night or trading off between 2 people.
How long will the workers be on the site?	There will be about three 21 day shifts this summer.
How will you ensure that locals are used as much as possible?	Shell will be abiding by its Cooperation and Benefits Agreement.
Who will be handling the logistics regarding employment and contractors, etc?	Contact Doug Lee at the Calgary office.
There are 2 camps nearby.	(Comment).
Are you using a tent for the camp?	Yes.
Can members from the HTC or community members go out to the site to see the operation?	Yes. The site is not dangerous, so one of the technicians can show you around.
Will they have radios?	Yes.
Will a medic be on site?	At least one person on site will have First Aid training. Additionally, Shell's Emergency Response Plan will be followed.

17.0 PERSONAL COMMUNICATIONS

Inuvialuit Environmental & Geotechnical Inc. wishes to acknowledge the following people for their assistance in supplying information and comments incorporated into this report.

Wright, Dennis. Coordinator, Environmental Affairs, Fisheries and Oceans Canada, Winnipeg, MB.

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APPENDIX A

SHELL CANADA LIMITED EMERGENCY RESPONSE PLAN FOR MACKENZIE DELTA WEST CHANNEL PROJECT

EMERGENCY CONTACTS

CONTACT	LOCATION	PHONE NUMBER
RCMP	Inuvik	(867) 777-2935
AMBULANCE	Inuvik	(867) 777-4444
HOSPITAL	Inuvik	(867) 777-2955
FOREST FIRE	Inuvik	(867) 777-3333 or (24 hr) 1-800-661-0800
NWT EMERGENCY SPILL RESPONSE LINE	Yellowknife	(867) 920-8130
CANADIAN HELICOPTERS LTD.	Inuvik	(867) 777-2424
SHELL CORPORATE CONTACT	Calgary	(403) 691-2521 (403) 691-3111

SHELL CANADA LIMITED

EMERGENCY RESPONSE PLAN (ERP)

FOR

MACKENZIE DELTA WEST CHANNEL REMEDIATION PROGRAM

THIS IS A CONTROLLED DOCUMENT

Date	Revision	Signature
April 16, 2001	00	rhh

CONTROLLED DOCUMENT DISTRIBUTION:

Copy 1	Randy Hetman, Shell Canada
Copy 2	Stacey Kelley, Shell Canada
Copy 3	Doug Lee, Inuvialuit Environmental & Geotechnical Inc.
Copy 4	Kevin Keenan, Sequoia Environmental Remediation Inc.

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1.0 EMERGENCY PREPAREDNESS

1.1 SCOPE

This Emergency Response Plan (ERP) addresses a Mackenzie Delta Operations Emergency. The ERP is a bridged version of the Resources Standard / Model Emergency Response Plan (ERP) intended for use by individuals trained and familiar with that ERP. For complete details regarding Emergency Activation, Action Plans, Organization, Responsibilities and Communication, consult the Resources Standard / Model ERP.

The ERP will be supplied to the controlled document distribution list and updated as required. This document will be located in the WC&GO ERP Manual under a tab called "Regional Data – Miscellaneous Area".

1.2 PURPOSE

An Emergency is any sudden, abnormal or unplanned incident that requires immediate attention and has the potential to endanger human life, the environment or have an adverse effect on Shell/public assets.

Criteria utilized to classify an Emergency Incident includes:

- Risk to life/public safety
- Environmental damage
- Physical site situation

The purpose of the ERP is to have controls and methods of recovery in place to minimize the impact of an emergency, which results in injury to crew, damage to property or the environment.

The ERP covers all possible emergencies and relies on the resources of the crew and the crew's equipment for the most part. However additional assistance may be required from other sources and or the Rescue Coordination Center.

1.3 OBJECTIVE

The objective of the ERP is to develop, implement and maintain a system, including drills and procedures, which when activated in an emergency situation will minimize the effects on:

- Injury or health to persons
- The environment
- Contractor and or third party property
- Image or reputation

Emergency planning began with identifying and assessing the hazards associated with the business activities of the crew. Hazards were then considered in terms of their potential for loss and severity. The Safety Management System activities establish the means of recovery and control of these hazards.

1.4 REFERENCES:

Shell Canada Limited:

- Resources Standard / Model Emergency Response Plan [ERP].
- Well Construction & Geophysical Operations Site Specific Emergency Response Plan - ***this document***.

2.0 INCIDENT COMMAND SYSTEM (ICS]

2.1 INCIDENT COMMAND SYSTEM

ICS is an all-risk system that is flexible and adaptable to all Emergencies.

To define the specific situations, events have been grouped into three levels in order of their risk or potential risk to personnel, public, environment, property, media and/or public attention or corporate business/reputation impacts.

Circumstances or the perception of a particular stakeholder could cause the incident to be defined at a higher or lower level.

Always consider the "actual" and/or "perceived" risks/health impacts when responding to the public needs.

No two (2) incidents are the same. The response and resources need to be evaluated and assessed on every emergency. THE LEVELS ARE A MINIMUM GUIDE.

This Section 2.0 is ICS and Support Information summarized from Resources Standard / Model ERP.

Emergency situations where personnel, environment or equipment could be at risk and external support is required:

- Field Based Command Post shall be the West Channel Camp or some accommodation / office in Inuvik
- Field Based Command Post Incident Commander shall be Shell Representative on Site.
- Local EOC shall be the Calgary office.

2.2 CLASSIFICATION (LEVELS) OF EMERGENCIES

RESPONSE LEVEL	RESPONSIBILITY	DESCRIPTION OF INCIDENT	EXAMPLES
LEVEL 1 **FIELD INCIDENT** **LOW IMMEDIATE** **IMPACT OR** **UNCONFIRMED**	• Local emergency response team(s)	• An incident has occurred • The incident can be managed by the local emergency response team(s) • The incident is contained onsite • Report after the fact • Note. A Level 1 Emergency may have the potential to escalate to a Level 2 or a Level 3 Emergency • Some characteristics of a Level 1 incident are: ✓ Immediate control of the hazard/source ✓ No threat to public safety ✓ Negligible environmental impacts ✓ No reputation impacts ✓ No business impacts ✓ No media interest ✓ No supporting government actions required	• Small, contained, controllable fire/explosion. • Small, contained, controllable hazardous material spill. • Single person medevac. • Overdue aircraft with which communication cannot be established • Severe weather that could result in process shutdown or the isolation of personnel (ie personnel required to remain in camp). • Any threat of criminal or hazardous act. • Damage equipment. • Wildlife encounters.

RESPONSE LEVEL	RESPONSIBILITY	DESCRIPTION OF INCIDENT	EXAMPLES
LEVEL 2 **EMERGENCY INCIDENT** **SIGNIFICANT IMPACT** **OR POTENTIAL**	• Local emergency response team(s) with assistance from the Calgary office	• An incident with serious to significant impact to the safety of persons, environment, property or production • The incident cannot be managed by the local emergency response team(s) alone • The incident has the potential for escalation or to continue for an extended period of time • Some characteristics of a Level 2 incident are: ✓ Imminent control of the hazard ✓ Some threat to public safety ✓ Moderate environmental impacts ✓ Local reputation impacts ✓ Local/Regional media interest ✓ Beyond the capability of local resources ✓ Minor government involvement	• Fire and/or explosion as a result of a hazardous material spill. • A hazardous spill occurs and overflows onto / into the Mackenzie River. • An incident where 2 or more persons have been seriously injured requiring medevac • Any serious injury where treatment is required above first aid equivalent and where medevac is not likely (ie. severe weather) • A helicopter crash where there may be injuries but no fatalities • A helicopter landing in open water • Overdue aircraft with which communication cannot be established after an unreasonably long period of time • Camp fire • Adverse weather that jeopardizes the safety of personnel in the field (i.e. whiteout conditions) • Ice Rescue • Any criminal action • Personal injury / equipment damage causes by shallow gas.

RESPONSE LEVEL	RESPONSIBILITY	DESCRIPTION OF INCIDENT	EXAMPLES
LEVEL 3 **CRISIS INCIDENT** **MAJOR IMPACT OR HAZARD TO PUBLIC**	• Local emergency response team(s) with assistance from the Calgary office.	• An incident where control of the situation has been lost presenting a definite hazard for the people or environment • An incident with extreme impact or the impact requires full Corporate response to control, mitigate and bring to conclusion • Some characteristics of a Level 3 incident are: ✓ Uncontrolled hazard ✓ Public safety jeopardized ✓ Significant and ongoing environmental impacts ✓ Corporate reputation impacts ✓ Corporate business impacts ✓ National/International media interest ✓ Immediate multi-agency government involvement ✓ Assistance from outside parties	• Major fire or explosion • Uncontrolled spill of hydrocarbon or hazardous product/chemical. • Death of a worker • Crash and destruction of a helicopter • Terrorist acts

EMERGENCY RESPONSE PLAN

SUBJECT: **ICS POSITION SUMMARY**

REFERENCE: **503 (5.3)**

0

COMMAND STAFF

INCIDENT COMMANDER (IC)
- Person in Charge

SAFETY
- Overall Safety

LIAISON
- Government Agencies

PUBLIC INFO OFFICER (PIO)
- Media

LOGISTICS
- Orders Resources (both Manpower and Equipment)

OPERATIONS
- Actual Working Operations

STAGING
- Pre-deployment Area

RECORDER
- Records All Events

RECON
- Eyes of the Command Staff

PLANNING
- Involved in/prepares Planning aspects

FINANCE
- Procurement, Time and Costs

OPERATIONS

AIR OPERATIONS
- Air activities, Supervision and Coordination

PIPELINE REPAIR
- Responsible for all Pipeline Repair

FIRE ATTACK
- Provide Fire Attack

SPILL GROUP
- Spill Containment and Clean-Up

OPERATIONS (cont'd)

HAZARDOUS MATERIALS GROUP
- Define and Manage all activities in the
- Hot and Warm Zones

MONITORING
- Assist donning of PPE
- Walking Dictionary/Resource Material

HazMat REFERENCE
- Ensure Safety of Responders within Zones

HazMat SAFETY
- Ensure Safety of Responders within Zones

DECON
- Decontaminate Victims and Responders

SITE ENTRY
- Safe Entry, Search and Rescue

SOURCE CONTROL
- Perform Tactical Control

IGNITION UNIT
- Ignition of Releases

ROADBLOCK
- Establish Roadblocks

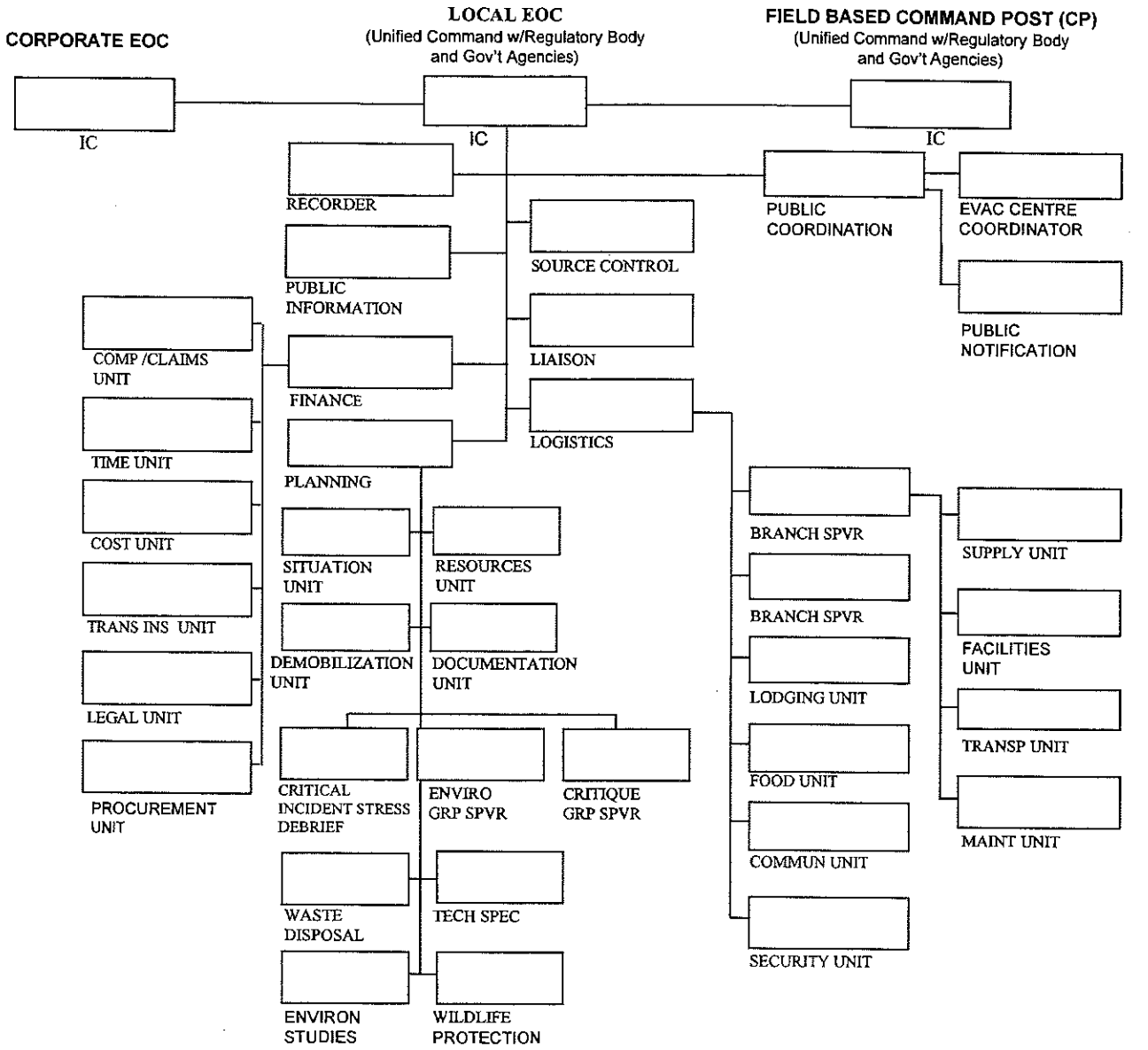
EVAC /SEARCH
- Co-ordinate Evacuation/Search

MEDICAL
- Medical Services and Equipment

TRIAGE
- Prioritize Treatment of Patients

TRANSPORT
- Medical Transportation Needs

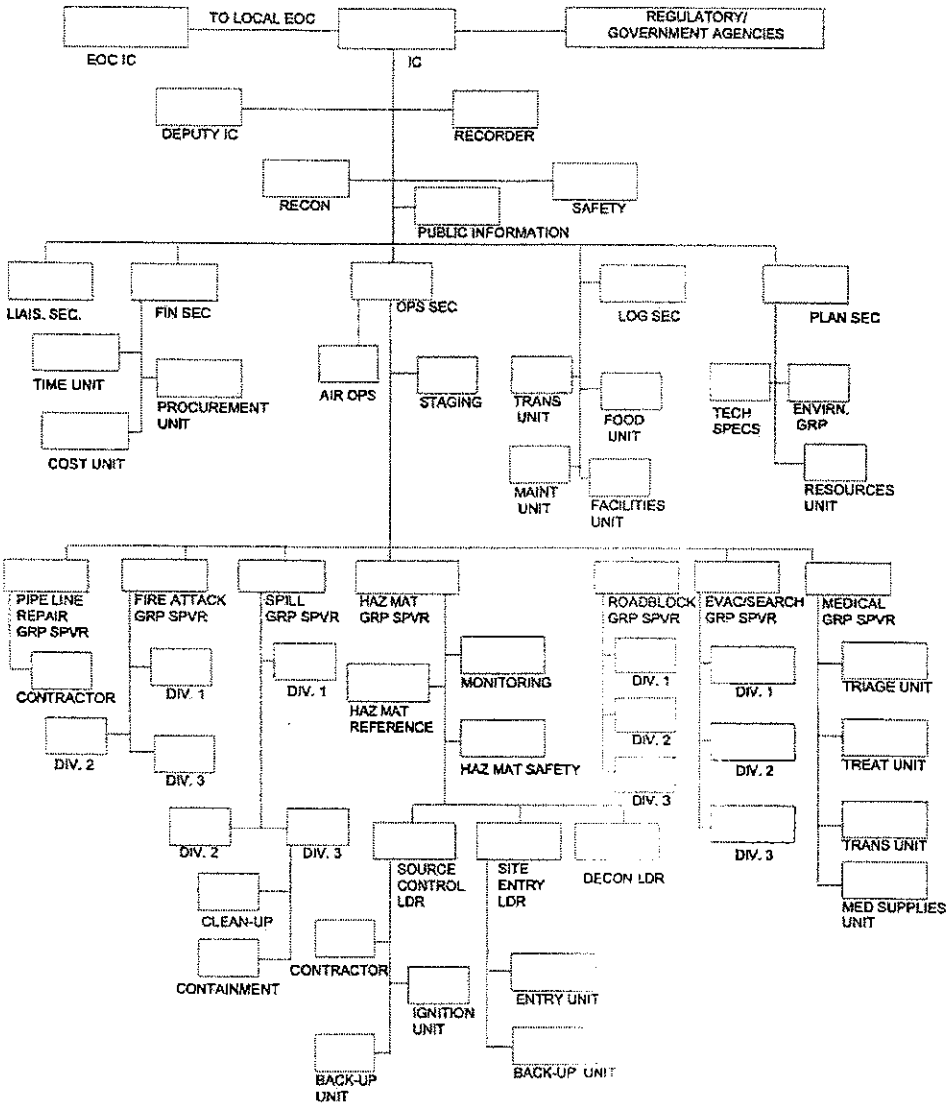
MEDICAL SUPPLIES
- Maintain Supplies


CORPORATE EOC
IC
LOCAL EOC
(Unified Command w/Regulatory Body and Gov't Agencies)
IC
FIELD BASED COMMAND POST (CP)
(Unified Command w/Regulatory Body and Gov't Agencies)
IC
RECORDER
PUBLIC INFORMATION
SOURCE CONTROL
LIAISON
LOGISTICS
PUBLIC COORDINATION
EVAC CENTRE COORDINATOR
PUBLIC NOTIFICATION
COMP /CLAIMS UNIT
TIME UNIT
COST UNIT
TRANS INS UNIT
LEGAL UNIT
PROCUREMENT UNIT
FINANCE
PLANNING
SITUATION UNIT
RESOURCES UNIT
DEMOBILIZATION UNIT
DOCUMENTATION UNIT
CRITICAL INCIDENT STRESS DEBRIEF
ENVIRO GRP SPVR
CRITIQUE GRP SPVR
WASTE DISPOSAL
TECH SPEC
ENVIRON STUDIES
WILDLIFE PROTECTION
BRANCH SPVR
BRANCH SPVR
LODGING UNIT
FOOD UNIT
COMMUN UNIT
SECURITY UNIT
SUPPLY UNIT
FACILITIES UNIT
TRANSP UNIT
MAINT UNIT

EMERGENCY RESPONSE PLAN

SUBJECT: #98, FIELD BASED COMMAND POST (CP)

REFERENCE: 801



KEY
- Dotted lines represent communications/support information
- Solid lines represent organizational authority

SEC = Section
GRP SPVR = Group Supervisor
LDR = Leader

Note:
- It is not mandatory to assign all positions.
- Assign positions only as necessary.
- Some positions may not require activation depending on the actual emergency.

2.6 GLOSSARY

CORPORATE EMERGENCY OPERATIONS CENTRE [EOC]:
Provides support to the Local EOC. This includes logistical, planning, liaison, financial, business impact, legal, and public information support. Additionally, serves as the liaison link between coordination of Corporate Business impact needs and Local EOC activities.

The Corporate Emergency Operations Centre [EOC] is activated upon request of the Local EOC Incident Commander [IC] or the Crisis Evaluation Group [CEG].

- Corporate EOC / CMT, Classroom 5 Shell Centre, Calgary.
- Public Affairs Room, Classroom 4 Shell Centre, Calgary.

EMERGENCY:
A situation that has the potential to result in serious adverse effects on the health and /or safety of employees, the community or the environment. An emergency may be the result of process upsets, uncontrolled reactions, fires, explosions, threats, and unplanned releases of hazardous materials, including third party, natural disasters such as tornadoes, hurricanes, earthquakes, floods and winter storms.

EMERGENCY PLANNING ZONE [EPZ]:
Pre-defined area surrounding a potential source of sour gas from which the Public may be evacuated if there is a sour gas release.

EVACUATION CENTRE:
Primary control point for the initial reception of evacuees. Personnel will provide registration, first aid, accommodation and information for evacuees.

FIELD BASED COMMAND POST [CP]:
Location from which direct Command and Control of the Emergency is carried out.

INCIDENT COMMANDER [IC]:
Individual responsible for the overall management of all incident activities including the development and implementation of strategy and for approving the ordering and release of resources.

LOCAL EMERGENCY OPERATIONS CENTRE [EOC]:
Activated to provide initial and on-going source control, public notification, monitoring, reconnaissance, safety and support services for the Field Based Emergency. This includes operational, logistical, planning, liaison, financial, safety and public information support resources.

THE LOCAL EOC PROVIDES SUPPORT TO THE FIELD BASED COMMAND POST [CP].

PUBLIC:
Are people within a defined area [EPZ] for emergency response planning that are generally referred to by industry in the following categories:

- **Resident** - an individual who lives at a fixed location and maintains occupancy on a full time basis.
- **Transient** - individuals who frequents an area (hunters, trappers)
- **Industry** - operators of trade, business, production, or manufacturing.

3.0 NOTIFICATIONS

Introduction

These notification procedures must be followed for Shell field operations in the event of the following emergencies:

- Serious injury or fatality
- Explosive mishap
- Dangerous goods mishap
- Natural disaster
- High potential incident/accident
- Group II incidents according to the Potential Risk Matrix

The following information must be provided to the person(s) being notified:

- Location of incident/accident
- Type of incident/accident
- Person(s) involved
- Time of occurrence
- Action already taken
- Further action planned
- Assistance required

INCIDENT COMMANDER (IE. FIELD SUPERVISORY STAFF) RESPONSIBILITIES

RCMP

In the event of the previously mentioned emergencies, the RCMP must be notified immediately. The RCMP will, if asked, notify the following:

- Local fire chief
- Local hospital and ambulance service
- Local wrecker

DANGEROUS GOODS EMERGENCY

In the event of a dangerous goods occurrence, the following agencies must be notified immediately:

- Alberta Public Safety Services, or
- B.C. Provincial Emergency Program, or
- N.W.T. Emergency Measures Organization, or
- Saskatchewan Spill Response Centre

These agencies will, if asked, notify the following government agencies:

- Department of Environment
- Forestry, Lands and Wildlife
- Canadian Transport Commission

These agencies will also provide assistance in notifying, evacuating and finding temporary shelter for people.

ELECTRICAL INSPECTION BRANCH

In the event of a serious electrical injury or fatality, the Supervisor of Electrical Inspection must be notified immediately.

MEDIA

When emergencies occur, it is Shell Canada Limited's Policy to assist the press by providing full, honest and prompt answers to their questions, within the bounds of reason, safety and practicality. Any lack of cooperation will only mean that newspapers, radio and T.V. will be forced to substitute rumor and speculation for fact, which cannot be in the Company's best interests.

The senior person in charge at the time of an accident is fully responsible for ensuring that this policy is carried out. With the public's acute interest in the environmental effects of accidents such as gas leaks, explosions, etc., the implementation of this policy has become all the more essential.

TRANSIENTS

If an evacuation of nearby residents is necessary, then a check for transients (i.e. hunters, trappers, etc.) in the vicinity of the affected area is a must.

INVESTIGATION

In the event of the previously mentioned emergencies, an incident/accident investigation must be initiated immediately. Support from Contractor's and Shell's Management will arrive to assist in the investigation. Refer to page 4 for additional information on incident/accident reporting.

SHELL REPORTING PROCEDURES

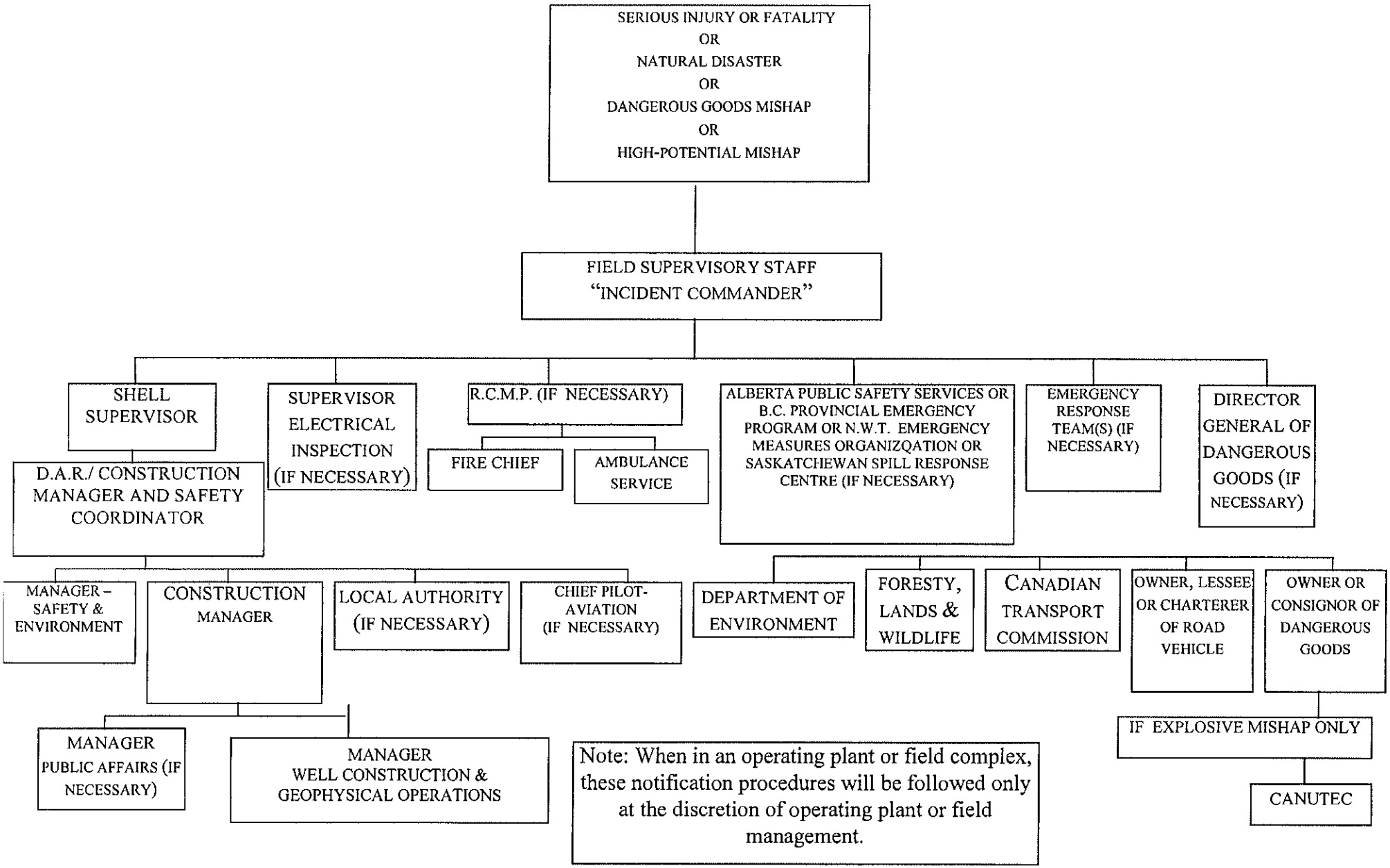
D.A.R./Construction Manager

In the event of a fatality or serious injury, the Department of Occupational Health & Safety must be notified immediately.
In the event of a helicopter incident/accident, the Manager - Aviation must be notified immediately.

D.A.R./Construction Manager

In the event of a fatality, serious injury, potentially catastrophic mishap or any incident/accident with third party involvement, the Manager - Public Affairs must be notified and any press statements coordinated with him or her.

NOTIFICATION PROCEDURES



4.0 TELEPHONE NUMBERS / CONTACTS *(all telephone numbers to be confirmed before program start)*

SHELL CANADA LTD.

Shell Canada Resources	1-800-661-7378
Crisis Evaluation Group (CEG) Leader (Pager #44204) Crisis Evaluation Group (CEG) (Cellular)	403-245-9900 403-607-6667
Crisis Evaluation Group (CEG) (Pager #44298)	403-245-9900
Pim van de Pypekamp (Cellular)	403-818-7091
Pim van de Pypekamp (Office)	403-691-3128
Pim van de Pypekamp (Pager #44218)	403-245-9900
Pim van de Pypekamp (Residence)	403-241-2649
Randy Hetman (Office) DAR/Construction Manager	403-691-2521
Randy Hetman (Cellular)	403-813-0408
Randy Hetman (Residence)	403-275-0730
Mike Read (Office) Manager – WC&GO	403-691-3323
Mike Read (Pager) or his delegate	403-245-9900 Pager 44202
Mike Read (Residence)	403-243-0153
Stacey Kelley (Office) Staff Safety Specialist	403-691-2240
Stacey Kelley (Cellular)	403-815-5136
Stacey Kelley (Residence)	403-288-5443

CAMP COMMUNICATIONS:

	To be Updated when active	

GOVERNMENT

24-Hour Spill Report Line	Voice 867-920-8130	Fax 867-873-6924
GNWT Pollution Control Division- Yellowknife	Voice 867-873-7654	Fax 867-873-0221
Indian & Northern Affairs Canada- Inuvik	867-777-3361	
Environment Canada – Yellowknife	867-669-4725	
NEB (N.W.T.)	(403) 299-3868	
Local Police (N.W.T.)	Dial "O", Ask for Zenith 50000	

OTHER SERVICES

Canadian Transport Commission	(819) 997-7707
CANUTEC	(613) 996-6666
Edmonton Poison (24 Hour)	1-800-332-1414
Energy, Mines and Resources – Ottawa	(613) 995-3065
Rescue Co-ordination Centre	1-800-661-5631

CONTACT PHONE NUMBERS (TO BE COMPLETED ON LOCATION)

Hospital Emergency Number	Inuvik	(867) 777-2955
Ambulance Number:	Inuvik	(867) 777-4444
Local Helicopter Charter Number:	Inuvik	(867) 777-2424
Local R.C.M.P. Detachment Number:	Inuvik	(867) 777-2935
Local Fire Emergency Number:	Inuvik	(867) 777-3333 or (24hrs) 1-800-661-0800
NWT Emergency Spill Response Line:	Yellowknife	(867) 920-8130
Shell Corporate Contact Number:	Calgary	(403) 691-2521
Shell 24hr Emergency Number:	Calgary	(403) 691-3111 1-800-661-7378

NOTE: These phones are to be maintained in an updated status at all times.

5.0 Training Exercises

The success of any emergency response plan depends on adequately trained personnel. The level of training has to be tailored to the functions to be performed and the skill levels of the individual.

Training in the areas of SCL Incident Command System is provided to the individuals who are responsible for implementing this plan.

Exercises are equally important to the success of any ERP implementation. The purpose of the Exercises is to reinforce the formal training through tabletop exercises and mock drills. They are intended to evaluate the ability of supervisor to carryout key roles within the Incident Command System and identify additional training requirements.

Appendix 1 - MEDEVAC PROCEDURES

INTRODUCTION

The hazards and the potential for high severity injury to our employees and contractors at this location requires that, as far as is practical, the training and resources to treat and transport the sick or injured are provided.

Furthermore, the Occupational Health and Safety Act states that "An employer must ensure that emergency conveyance is readily available to any work site where his workers are engaged

SELECTION OF SERVICE

To aid in the decision about what type of service or combination of services would be adequate, the following points will dictate when a Medic and/or Industrial First Aid Attendant with an emergency conveyance vehicle are required.

- Hazard Assessment
- Distance from a hospital

In the instance of most serious injuries (i.e. major respiratory distress, severe burns or bleeding, etc.) it is imperative that response time to medical treatment is kept to a minimum and proper first aid be administered to prevent patient condition from becoming worse and to promote recovery.

Upon startup of a project, contact must be made with the local authorities and services to obtain phone numbers for Emergency Response. The following medevac procedures must be posted in the office and made readily available to all supervisory personnel.

Medevacs

First Aid attendant to administer medical treatment and assess if casualty requires off-site treatment. If further medical treatment is required off-site, then a helicopter should be ordered for the evacuation. When a helicopter is required for evacuations, the first aid attendant must also bring a stretcher with blankets and pillows.

The helicopter is to remain with the casualty until transportation is required. Only the pilot, first aid attendant and casualty are permitted in the helicopter during transport.

Note: During medevac all operations serviced by the first aid attendant and/or helicopter are to cease and radio silence enforced.

MEDIVAC PROCEDURES

CITY/TOWN:_____
PROSPECT: _____

FOR AIR EVACUATION, FIXED WING OR HELICOPTER, CALL:
CHARTER:_____
CHARTER:_____

TELL THEM:

- MEDEVAC REQUIRED
- YOUR LOCATION – INCLUDE LANDING AREA OR AIRSTRIP CO-ORDINATES

LATITUDE:_____
LONGITUDE:_____

- LANDING AREA OR AIRSTRIP CONDITION – INCLUDE LIGHTING, WIND SPEED AND DIRECTION
- ANY OBSTRUCTION OR HAZARDS TO BE AWARE OF ON LANDING
- LOCAL WEATHER CONDITIONS
- YOUR PHONE NUMBER RADIO FREQUENCY:

PHONE NUMBER: _____
RADIO FREQUENCY:_____

UPON CONTACT TO FIXED WING OR HELICOPTER CHARTER, MEDICAL CONTACT IS MANDATORY TO ENSURE THAT PROPER FACILITIES AND ATTENTION IS GIVEN TO PATIENT. IF AVAILABLE AND POSSIBLE, THE FIRST AID ATTENDANT SHALL CALL THE LOCAL HOSPITAL.

FOR MEDICAL ATTENTION AND SERVICE CALL:
HOSPITAL EMERGENCY:_____
24 – HOUR HOSPITAL EMERGENCY:_____
AMBULANCE SERVICE:_____

TELL THEM:

- MEDEVAC IN PROGRESS
- TYPE OF ASSISTANCE REQUIRED
  - HELIPAD OR AIRSTRIP LOCATION
  - AMBULANCE TO TRANSPORT PATIENT FROM AIRCRAFT TO HOSPITAL

*NOTE: **GET DIRECTIONS TO HOSPITAL AND/OR HELIPAD/AIRSTRIP LOCATIONS.**

- NATURE OF INJURY OR ILLNESS, INCLUDING
  - AGE AND SEX OF PATIENT
  - BRIEF DESCRIPTION OF ACCIDENT
  - DESCRIPTION OF INJURIES OR ILLNESS
- YOUR POSITION AND QUALIFICATIONS
- TYPE OF MEDICAL AID ALREADY ADMINISTERED
- YOUR PHONE NUMBER
- ESTIMATED TIME OF ARRIVAL

Appendix 2 – AIRCRAFT

Introduction
The safe and efficient movement of helicopters within operations require the presence of a reliable network of communication, both in the air and on the ground. The size, location and terrain of the operations area can cause problems in the establishment and maintenance of an effective communication network.

The helicopter must not be parked in a communications "blind spot" so as to avoid delays in the helicopter responding to any emergencies that may occur during operations. Also, this rule should help avoid needless activation of the Aircraft Accident Response Plan.

FLIGHTWATCH PERSON
A person with sufficient training and knowledge must be designated to assume responsibility for the tracking and coordination of all helicopters and passenger movements during the day, maintaining required radio contact with the helicopter and all applicable field personnel, and to initiate the Aircraft Accident Response Plan when required.

The flightwatch person is responsible for the completion of the flightwatch control/manifest form.

Note: A separate flightwatch control/manifest form is to be used for each helicopter, and retained until job completion.

The flightwatch person or a designated substitute person, must be on duty continuously during helicopter operations.

The flightwatch person or designated substitute person must initiate the Aircraft Accident Response Plan when:

- There is reasonable indication of a helicopter accident (i.e. observations by field personnel) or distress radio messages from the helicopter.

OR

- The helicopter is overdue and communication cannot be established using all available sources.

OR

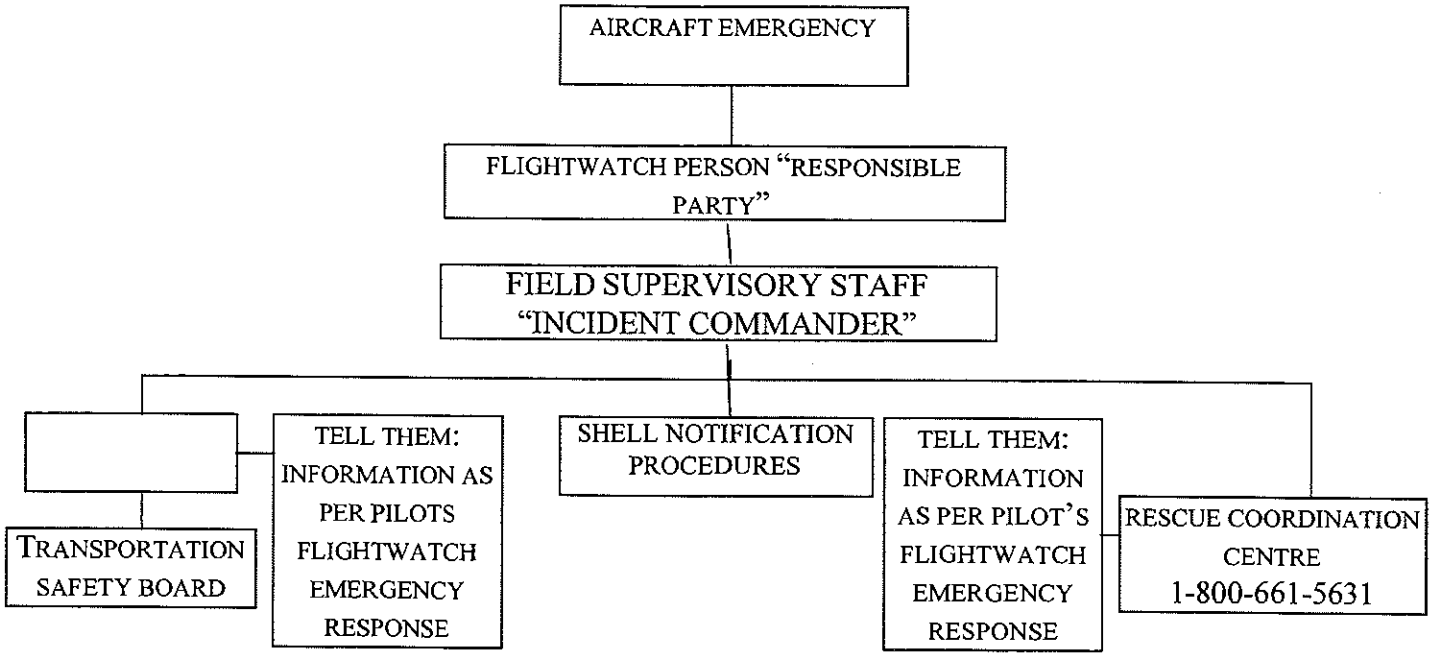
- More than sixty minutes has elapsed since the last communication has been received from the helicopter.

HELICOPTER PILOT
The helicopter pilot must provide the flightwatch person with the pilot's flightwatch emergency response information as shown on the following page.

The helicopter pilot must ensure that the flightwatch person, at all times, knows who is on board the helicopter.

The helicopter pilot must not operate within the operations area for more than one hour without communication with the appropriate flightwatch person.

RESPONSE FLOW CHART



PILOT'S FLIGHTWATCH

EMERGENCY RESPONSE INFORMATION

AIRCRAFT COMPANY	AIRCRAFT REGISTRATION	AIRCRAFT TYPE	AIRCRAFT COLORS
_____	_____	_____	_____

TYPE OF EMERGENCY LOCATOR TRANSMITTER	COMMUNICATION EQUIPMENT			NAVIGATION AIDS		
_____	_____ VHF	_____ HF	_____ OTHER	_____ ADF	_____ VOR	_____ OTHER

TRUE AIRSPEED	PILOT NAME AND LICENSE NUMBER	PILOT SIGNATURE
_____ KNOTS	_____ _____	_____

Appeudix 3 - FIRE AND OR EXPLOSION

Introduction

Fires can spread and destroy an entire trailer camp in minutes due to trailer composition and spacing. Fire assessment, control and extinguishment must be prompt. In the event of a campfire, certain procedures must be followed. It is vital that personnel under your supervision are aware of these procedures and of their responsibilities for the Emergency Response Plan to work effectively.

- An incident commander (i.e. field supervisory staff) must be designated to administer and initiate the Emergency Response Plan.
- Muster Area must be designated. Document area in Fire Procedures Form.
- Emergency Response Team(s) must be designated by the incident commander to respond to and assist in emergency situation(s). Document Team members on Fire Procedures Form.
- Incidents/Accidents involving dangerous goods are to be reported to the incident commander immediately.

JOB RESPONSIBILITIES

All Personnel Including Visitors

- Report to the incident commander upon arrival to and departure from camp.
- Familiarize yourself with the location of pull stations, fire extinguishers, exits, helipad and muster area.
- No unauthorized personnel in camp.

Medic

- Always ensure that the emergency conveyance vehicle (ECV) is ready for transportation of patient(s) at all times.
- Familiarize yourself with the operation of a hand-held radio.
- Treat injuries according to severity.
- After determining that an air medevac is necessary, co-ordinate the air medevac using medevac procedures.

Incident Commander (i.e. field supervisory staff)

- Conduct at least one fire drill per month.
- Do a visual check of all fire equipment weekly.
- Familiarize yourself with the operation of a hand-held radio.
- In the event of an alarm, notify the Emergency Response Team(s).
- If required, assist in fire fighting and search and rescue.

Emergency Response Team (i.e. Camp Attendant)

- Be familiar with and know the location of fire equipment, breakers and power plant generator.
- Familiarize yourself with the operation of a hand-held radio.
- Respond to emergencies at the request of the incident commander only.

Appendix 4 – DANGEROUS GOODS

INCIDENT/ACCIDENT PROCEDURES

An incident/accident involving dangerous goods is anything that represents a danger to health and safety, property or the environment. In the event of an incident/accident involving dangerous goods, certain procedures must be followed. It is vital that personnel under your supervision are aware of these procedures and of their responsibilities for the Emergency Response Plan to work effectively.

- An incident commander (i.e. field supervisory staff) must be designated to administer and initiate the Emergency Response Plan.
- Emergency Response Team(s) must be designated by the incident commander to respond to and assist in emergency situation(s). For serious large spills, the Shell Emergency Response Team can be activated. (see Map page 13)
- Incidents/Accidents involving dangerous goods are to be reported to the incident commander immediately.
- The incident commander must put the Emergency Response Plan into effect (refer to attachments for Emergency Response Plans for various products starting on page 18).
- Incidents/Accidents involving explosives or injuries due to a release of dangerous goods must be reported to the Director General of Dangerous Goods in Ottawa within 30 days of the incident/accident. Information must be present on Schedule IX, Form 2 (refer to page 14-16) Located in the Geophysical Operations Safety Manual.

  Director General
  344 Slater Street
  14th Floor
  Ottawa, Ontario
  K1A ON5

  The CAGC explosives emergency response number is: **ERP2-0150-091**
  (403) 245-5883 (24 hours)

INCIDENT/ACCIDENT RESPONSIBILITIES

Employee

- Notify the incident commander immediately.
- Barricade the hazardous area and await the incident commander and/or Emergency Response Team(s).
- Evacuate to pre-determined area of safety as defined by the Emergency Response Plan.

Incident Commander

- Evacuate to pre-determined area of safety as defined by the Emergency Response Plan.
- Notify the appropriate Emergency Response Team(s) to respond to the particular emergency situation(s).
- Notify the appropriate dangerous goods emergency contact number for the province or territory you are in. Numbers are listed in this module under Other Emergency Contact Numbers. (pages 28-30)
- Notify the RCMP.
- Notify your supervisor and/or a Shell Supervisor.
- When a railway vehicle is involved, notify the Canadian Transport Commission.
- When an aircraft is involved or the occurrence takes place at an airport, notify the Canadian Air Transportation Administration of the Department of Transport.
- Notify the owner, lessee or charterer of a road vehicle when a road vehicle is involved.
- Notify the owner or the consignor of the consignment of dangerous goods.

Emergency Response Team(s)

- Must be familiar with potential hazards that may occur involving dangerous goods and the emergency action required for these hazards.
- Each member must have a valid first aid ticket.
- Respond to and assist in emergency situations at the request of the incident commander.

Appendix 5- Fuel / Oil Spill Contingency Plan

9.0 West Channel Camp:

All fuel on site will have secondary containment that can contain 100% of the volume of the tanks.. Volumes of fuel to be stored on site are estimated to be 4,000 gallons of diesel fuel and two 45 gallon drums of gasoline.

Transportation

Liquid fuels and oils will be stored in a closed system during transportation. Access routes will be channels of the Mackenzie River.

10.0 Maintenance And Control

This contingency plan is project specific and will be reviewed:

- As changes to applicable environmental legislation come into effect
- During any on-site training exercises; and
- After each and every fuel / oil spill incident.

Changes to phone numbers and names of those individuals identified in this contingency plan will be made on an as and when required basis.

11.0 Notification

Spills will be immediately be reported to the following organizations:

- Shell's Environmental, Health and Safety Coordinator,
- Inuvialuit Land Administration
- Indian Northern Affairs Canada
- Northwest Territory Emergency Spill Response Line

12.0 Spill Response

- Receive or make the initial assessment
- Assess the spill area and eliminate all sources of ignition
- Keep the public away from the area.
- Initiate the emergency plan at the assessed level as per section 2.2, classification of emergency's
- Establish and maintain contact with appropriate emergency services and external agencies
- Deliver 'stand-down' instructions to all external services when they are no longer required to support the emergency situation.

13.0 Containment

- deploy the on-site spill containment equipment as required
- notify and request assistance if required from external NWT Emergency Spill Response line.
- erect barriers to minimize the migration of the spill

14.0 Recovery

The goal of recovering the spilled fuel is to ensure that as much as possible is recovered as soon as possible therefore minimizing the impact on the environment.

- ensure that the spill has been adequately contained before starting recovery procedures
- depending on the characteristics of the spill, containment and recovery may be done simultaneously
- if required, set up a decontamination site so that individuals involved with containment/recovery operation don't spread the material beyond its contained limits.

- assess which recovery method is most suitable/efficient for the circumstances, taking into account the amount of fuel to be recovered, where the spill has occurred and the anticipated dangers to human life and the natural environment.

15.0 Recovery Methods

DIRECT SUCTION TECHNIQUES
The direct suction technique will be utilized as part of the initial response to the spill.

USE OF ABSORBENT MATERIAL
Absorbents are materials that soak up fuel either by absorption or adsorption. They are commonly used for final cleanup and recovery of small amounts of fuel. They are effective in recovering thin layers of fuel. The West Channel camp will have sorbent pads on location to be used for soaking up the small spills or residue. The saturated sorbent pads will be placed in open drums. When a drum is full, it will be closed up and sent to Hay River for furtherance to Alberta for final disposition.

APPENDIX B

LICENCE APPLICATIONS

ILA Application # _____

INUVIALUIT LAND ADMINISTRATION
APPLICATION FORM

All rights applied for are subject to the IFA, ILA Rules and Procedures and the laws of General Application.

LOCATION NAME/LOCAL NAME West Channel (Former Shell Staging Site)

Coordinates 68°28'33" N 135°33'25" W

UTM _____ N _____ E

If a heading does not apply to your application, please indicate N/A. If insufficient space, please attach a separate sheet(s).

1. **Name and mailing address of Head Office of Applicant:**
Shell Canada Limited
400-4th Avenue S.W.
Calgary, AB
T2P 2H5

Responsible officer or manager of Applicant:

Randy Hetman

DAR/ Construction Manager

Telephone and Fax:

403-691-2521

403-269-9748 (fax)

2. **Type of Right(s) applied for: (Note: If a Right-of-Way forms part of the general activity applied for, make a separate application for the Right-of-Way.)**

Land Use Permit

3. **Type of Operation(s) to be carried out:**

In-situ remediation of contaminated soil at the former Shell Canada Limited West Channel Staging Site.

4. **Planned duration of activities:**

One to two years (depending on progress of remediation)

Please attach a detailed Schedule of Operation.

See Project Description

5. **Total Number of Personnel / Manpower requirements:**

Three technicians plus wildlife monitor, environmental monitor and camp cook.

6. **Total Number of Inuvialuit employed:**

One Inuvialuit technician, wildlife monitor, environmental monitor, and camp cook.

7. **Names, addresses and functions of Inuvialuit contractors and sub-contractors:**

Camp contractor not determined.

8. **Names, addresses and functions of non-Inuvialuit contractors and sub-contractors:**
Inuvialuit Environmental & Geotechnical Inc. (IEG) (Environmental Consultant)

Sequoia Environmental Remediation Inc. (subcontractor to IEG)

9. **Attach a concluded or proposed Participation Agreement or Access Agreement.**
To be negotiated with ILA.

10. **Planned surface requirements for land use / occupancy in hectares (ha):**

4.5 ha

Attach a 1:50,000 NTS map showing the location and a preliminary plan showing area, measurements and location of all buildings, work areas, etc.
See Project Description

11. **Planned length of Right-of Way in kilometers (km):**
N/A- Access by boat and barge.

12. **Waste and/or drilling fluid disposal arrangement (fuel fired forced air incinerator or specify other method):**

N/A

Garbage:
Forced air incinerator

Sewage (Sanitary & Grey Water):
Honey buckets to be transported by boat to Aklavik for disposal. Grey water

13. **Equipment, vehicles, and facilities to be used (type, number, size, purpose, weight, etc.):**
See Project Description (Section 4.9)

14. **Fuels to be used (type, number of containers, capacity, etc.):**

Diesel: 4,000 gallons (aboveground storage tank with secondary containment)

Gasoline: 90 gallons (two 45 gallon drums with secondary containment)

Aviation Fuel: N/A

Propane: N/A

15. **Method of emptying and filling fuel containers:**

Diesel tank to be filled prior to shipment to site. If operations continue into a second year, tank to be refilled by barge. Gasoline drums to be used for fuelling light equipment. Refuelling will take place over a drip pan to contain any spillage.

16. **Please attach FUEL/OIL SPILL CONTINGENCY PLAN.**

See Project Description (Appendix A)

17. **Radio Equipment to be utilized with identification #:**

To be determined

18. **Emergency First Aid Facilities:**

See Project Description (Appendix A)

19. **Potable Water Requirements:**

Bottled water for six personnel.

20. **Attach a detailed project description expanding on the information given above and including any additional relevant information.**
See Attached

21 **Where the applicant applies for a Right pursuant to Subsection 7(18) of the Agreement, attach copy of the right or interest granted by Canada on the basis of which this application is being made.**
N/A

22. **Fee calculations (based on ha and/or km as per current ILA Fee Schedules(s):**
Application fees to be calculated by ILA.

Randy Hetman DAR/Construction Manager	Shell Canada Limited
Name of Representative and Title	Company Name
Signature of Representative	Date
Signature of Land Administrator	Date
Location	

Issuing ILA Office: Inuvialuit Land Administration
P.O. Box 290
Tuktoyaktuk, NT
X0E 1C0
Telephone: (867) 977-2202 or (867) 977-2466
Fax: (867) 977-2467

Schedule III
(Subsection 6(1))

APPLICATION FOR LICENCE, AMENDMENT OF LICENCE, OR RENEWAL OF LICENCE

APPLICATION/LICENCE NO:
(amendment or renewal only)

1. Name and Mailing Address of Applicant

Shell Canada Limited
400-4th Avenue S.W.
Calgary, AB
T2P 2H5

Telephone: 403-691-2521 Fax: 403-269-7948

2. Address of Head office in Canada if incorporated

Telephone: Fax:

3. Location of Undertaking (describe and attach a map, indicating watercourses and location of any proposed waste deposits)
See Project Description

Latitude 68°28'33" N Longitude 135°33'25" W

4. Description of Undertaking (describe and attach plans)
In-situ remediation of contaminated soil at Shell Canada Limited former staging area on the West Channel of the Mackenzie River.

5. Type of Undertaking

1. Industrial		4. Power		6. Conservation	
2. Mining and milling		5. Agriculture		7. Recreation	
3. Municipal					
	Remediation				

8. Miscellaneous (describe)

6. Water Use

To obtain water	X	Flood Control	
To cross a watercourse		To divert water	
To modify the bed or bank of a watercourse		To alter the flow of, or store, water	

Other (describe) To discharge treated wastewater

7. Quantity of Water Involved (litres per second, litres per day or cubic metres per year, including both quantity to be used and quality to be returned to source)
<100m^3/ day to be pumped into the in-situ remediation area unitl such time as the area is saturated. Quality of wastewater to be returned to source will comply with Guideline for Industrial Waste Discharges in the NWT- Schedule II Standards for Non-Point Source Discharges and CCME Water Quality Guidelines.

SCHEDULE III – *Concluded*

APPLICATION FOR LICENCE, AMENDMENT OF LICENCE, OR RENEWAL OF LICENCE - *Concluded*

8. Waste Deposited (quantity, quality, treatment and disposal)

See Project Description (Section 4)

9. Other Persons or Properties Affected By This Undertaking (give name, mailing address and location; attach list if necessary)

N/A

10. Predicted Environmental Impacts of Undertaking and Proposed Mitigation

See Project Description (Section 12)

11. Contractor and Sub-Contractors (names, addresses and functions)

Inuvialuit Environmental & Geotechnical (IEG) (Environmental Consultant)

1338R – 36th Avenue N.E.

Calgary, AB

T2E 6T6

Sequoia Environmental Remediation Inc. (Subcontractor to IEG)

135 Sierra Nevada Close S.W.

Calgary, AB

T3H 3H7

12. Studies Undertaken to Date (attach list if necessary)

Phase I Environmental Site Assessment (conducted by Shell Canada Limited)

Phase II Environmental Site Assessment (conducted by IEG)

13. Proposed Time Schedule

See attached project description.

Start date July, 2001 Completion date September, 2002

NAME	TITLE	SIGNATURE	DATE

FOR OFFICE USE ONLY

APPLICATION FEE	Amount:	$ 30.00	Receipt No.:	
WATER USE DEPOSIT	Amount:	$	Receipt No.:	

NORTHWEST TERRITORIES WATER BOARD

ONSHORE OIL AND GAS EXPLORATION DRILLING QUESTIONNAIRE

FOR

WATER LICENCE APPLICATIONS

Prepared by:
Department of Indian Affairs and Northern Development
Water Resources Division
August 1999
Version 5.07

Introduction

The purpose of this questionnaire is to solicit supplemental information from an applicant to support their application for a water licence (or renewal). It is anticipated that the completion of this questionnaire will reduce delays arising from the Northwest Territories Water Board having to solicit additional information after an application has already been submitted. This information will also be useful during the environmental assessment and screening of your application, which must be undertaken prior to development and approval of a water licence.

The applicant should complete the questionnaire to the best of his/her ability, recognizing that some questions may not be relevant to the project under consideration. For questions that do not relate to his/her operation, the applicant is requested to indicate "N/A" (Not Applicable).

If any questions arise while completing the questionnaire, the applicant may wish to contact the Northwest Territories Water Board at (867) 669-2772. If your question is that of a technical nature please contact the Regulatory Approvals Section of the Water Resources Division, Department of Indian Affairs and Northern Development (INAC), at (867) 669-2651.

Chairman,
Northwest Territories Water Board

TABLE OF CONTENTS

If space is insufficient for any of the responses on this questionnaire, use the back of the sheet or attachments.

List attachments in Appendix 1.

Print or type your responses.

SECTION 1:

PRELIMINARY SITE ASSESSMENT

DATE: **April 30, 2001**

1.1 APPLICANT **Shell Canada Limited**

COMPANY NAME: **Shell Canada Limited**

ADDRESS: **400-4th Avenue S.W.**

Calgary, AB

T2P 2H5

PROPERTY NAME/EXPLORATION LIC. #: N/A

CLOSEST COMMUNITY: Aklavik

LATITUDE/LONGITUDE OF WELL CENTRE (SITE) (Degrees, minutes, seconds):
68° 28' 33"N 135° 33' 25"W

1.2 PRIMARY COMPANY CONTACT:

NAME: Randy Hetman

TITLE: DAR/Construction Manager

CONTACT NUMBER: 403-691-2521

ALTERNATE CONTACT NUMBERS:

1.3 FIELD CONTACT: Not yet determined

NAME (If known):

TITLE (If known):

CONTACT NUMBER:

1.4 INDICATE THE STATUS OF THIS APPLICATION:

NEW APPLICATION [X] RENEWAL [ ]

IF RENEWAL, INCLUDE LICENCE NUMBER:

1.5 SITE HISTORY

INDICATE IF THIS SITE CONTAINS ANY KNOWN:

FORMER WELL SITES	No
WASTE DUMPS	No
FUEL AND CHEMICAL STORAGE AREAS	Yes
SUMP AREAS	No
WASTE WATER DISCHARGE LOCTIONS	No

DESCRIBE SITES AND REFERENCE THEM ON THE MAP IN QUESTION 1.6

*See attached Phase II Site Assessment as an appendix to the Project Description.

1.6 ATTACH MAPS DRAWN TO SCALE SHOWING LOCATIONS OF EXISTING AND PROPOSED: see Project Description

CAMP FACILITIES,	N/A
WELL SITE(S),	N/A
SUMPS,	N/A
WATER SOURCES,	X
FUEL AND CHEMICAL STORAGE FACILITIES,	X
DRILLING MUD STORAGE FACILITIES,	N/A
DRAINAGE CONTROLS,	X
TRANSPORTATION ROUTES (SEASONAL AND ALL WEATHER)*	
ELEVATION CONTOURS,	X
LOCATIONS OF WATERBODIES	X
DRAINAGE PATTERNS FOR WELL (REMEDIATION SITE) (Contour map of site provided)	X

* **Clearly identify crossings over water courses greater than 5 m at ordinary high water mark.**

1.7 DESCRIBE THE PROPOSED OR CURRENT METHOD OF FRESHWATER WITHDRAWAL, THE TYPE AND OPERATING CAPACITY OF THE PUMPS USED AND THE INTAKE SCREEN SIZE.

See Project Description-(screen size 0.5 cm)

1.8 **ESTIMATE MAXIMUM DRAW DOWN AND RECHARGE CAPABILITY OF THE RIVER OR LAKE FROM WHICH FRESH WATER WILL BE DRAWN. QUOTE DRAW DOWN IN CENTIMETRES, OR, STATE PERCENTAGE OF FLOW WITHDRAWN.**

Less than 1% of flow to be withdrawn

1.9 **INDICATE IF PERMAFROST IS EXPECTED TO BE ENCOUNTERED UNDER:**

CAMP FACILITIES	X
WELL SITE	N/A
ACCESS ROUTES	
SUMPS	N/A
OTHER	

1.10 **INDICATE ANY POTENTIAL FOR ENCOUNTERING ARTESIAN AQUIFERS OR LOST CIRCULATION WITHIN THE SURFACE HOLE (TO CASING DEPTH)**

N/A

1.11 **ATTACH A DESCRIPTION OF THE SURFICIAL GEOLOGIC AND HYDRO-GEOLOGIC CONDITIONS IN THE IMMEDIATE VICINITY OF THE WELLSITE**

N/A

SECTION 2:

WATER USE AND WASTE DISPOSAL

2.1 OUTLINE ALL WATER USAGE IN THE DRILL PROGRAM, CAMP FACILITIES, AND ROAD CONSTRUCTION. INDICATE THE SOURCE AND VOLUME OF WATER FOR EACH USE.

	Source	Use	Average Volume (m^3/day)
1.	Mackenzie River	In-situ remediation	<100m^3
2.	Mackenzie River	Camp facilities	<100m^3
3.			
4.			
		TOTAL:	<100m^3

2.2 WILL DRILLING WASTES CONTAIN DETRIMENTAL SUBSTANCES INCLUDING, BUT NOT LIMITED TO, OIL BASED OR INVERT MUDS AND HIGH SALINITY FLUIDS? N/A

YES ____ **NO** ____

IF YES, INDICATE SUBSTANCES:

N/A

2.3 INDICATE THE TOTAL ESTIMATED VOLUME OF DRILLING WASTES
N/A

CUBIC METRES

2.4 INDICATE METHODS FOR DISPOSAL OF DRILLING WASTES.

N/A SUMP

DOWN HOLE (REQUIRES NEB APPROVAL)

ON-SITE TREATMENT (PROVIDE PLAN)

OFF-SITE (GIVE LOCATION ANDMETHOD OF DISPOSAL)

2.5 IF A SUMP IS BEING USED, ATTACH THE FOLLOWING INFORMATION

SCALE DRAWINGS AND DESIGN OF SUMPS,
CAPACTIY IN CUBIC METRES,
BERM EROSION PROTECTION,
SOIL PERMEABILITY AND TYPE
RECYCLING/RECLAIMING WATERS,
SURFACE DRAINAGE CONTROLS,
ABANDONMENT PROCEDURES.

2.6 WILL A CAMP BE PROVIDED?

YES x NO ☐

2.7 IF YES, THEN INDICATE THE CAPACITY AND THE EXPECTED MAXIMUM NUMBER OF PERSONS THAT WILL BE ACCOMMODATED.

CAPACITY 6 PERSONS

MAXIMUM ACCOMMODATED 6 PERSONS

SECTION 3:

CONTINGENCY, ABANDONMENT AND RESTORATION PLANNING

3.1 **ATTACH THE PROPOSED OR EXISTING CONTINGENCY PLAN WHICH DESCRIBES COURSE OF ACTION, MITIGATIVE MEASURES AND EQUIPMENT AVAILABLE FOR USE IN THE EVENT OF SYSTEM FAILURES AND SPILLS OF HAZARDOUS MATERIALS (IN COMPLIANCE WITH NWT WATER BOARD GUIDELINES FOR CONTINGENCY PLANNING, 1987).**
See Project Description- ERP and Oil Pollution Emergency Plan is provided in Appendix A

3.2 **ATTACH AN INVENTORY OF HAZARDOUS MATERIALS ON THE PROPERTY (AS DEFINED UNDER TRANSPORTATION OF DANGEROUS GOOD REGULATIONS).**
See Project Description- fuel storage (Section 4.10)

3.3 **ATTACH AN OUTLINE OF PLANNED ABANDONMENT AND RESTORATION PROCEDURES. See Project Description- (Section 14)**

SECTION 4:

ENVIRONMENTAL ASSESSMENT AND SCREENING

Your application and other project details, such as this questionnaire, will be sent out for review by local aboriginal and public groups as well as territorial and federal government agencies. Their comments regarding the significance of project impacts are considered before a decision is made to allow the project to proceed. Because formal assessment and screening of water licences was only initiated in about 1989, applicants will find that this process may be required even if the project has been built and in operation for several years. However, if your project has been previously screened a further assessment may not be required, or a more limited process may be used. This will depend on individual circumstances, including the stage of the project. Some projects may need a higher level of review or submission of more information before being screened.

4.1 HAS THIS PROJECT EVER UNDERGONE AN INITIAL ENVIRONMENTAL ASSESSMENT, INCLUDING PREVIOUS OWNERS?

YES X **NO** ☐

IF YES, BY WHOM / WHEN: **Inuvialuit Environmental Inc.**
Fall 2000

4.2 HAS BASELINE DATA BEEN COLLECTED FOR THE MAIN WATER BODIES IN THE AREA?

YES ☐ **NO** X

IF YES, ATTACH DATA.

4.3 HAS BASELINE DATA BEEN COLLECTED AND EVALUATED WITH RESPECT TO THE BIOPHYSICAL COMPONENTS OF THE ENVIRONMENT POTENTIALLY AFFECTED BY THE PROJECT (WILDLIFE, SOILS, AIR QUALITY).

YES X **NO** ☐

IF YES, ATTACH DATA.
See Project Description

4.4 ATTACH A DESCRIPTION OF ALL PROPOSED AND EXISTING ENVIRONMENTAL MONITORING PROGRAMS.
See Project Description

4.5 HAS A COMMUNITY CONSULTATION PROGRAM BEEN INITIATED?

YES X **NO** ☐

IF YES, PROVIDE DETAILS OF THE PROGRAM.- See Project Description

SECTION 5:

LIST OF ATTACHMENTS

Reference to Question #	Title	Number of pages
	Project Description for the Proposed Shell Canada Limited West Channel Remediation Plan	29 plus appendices