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A student in the Marine Resource Management program is encouraged to select course work in any school and department at Oregon State University. At the same time, the student selects and develops a personalized scientific orientation from the multi-disciplinary curriculum and faculty in the School of Oceanography. Recommended or required subjects ensure exposure to management philosophy and techniques. It is the opportunity for a new and different work experience-internship, however, that makes the classroom study truly educational. The usefulness of having taken diverse and demanding courses was very apparent to me during my internship involved with marine pollution. The following discussion and examples of my work may indicate this. At this time, though, I feel it is important to mention certain courses which were of special significance.

Estuarine physical systems were stressed in the 400-level oceanography classes. This background was an important factor as pollution constantly occurs in and seriously affects these sheltered and dynamic environments. In the Tillamook Bay Project and the Marine Extension Methods classes, the social and economic aspects common to coastal settings and all populated regions were emphasized. These aspects were taught from a problem-solution orientation which, since the problems and solutions were less than straight forward, prompted many considerations and required communications with many people. Awareness of personal appearance and public speaking techniques was also fostered. Regional Economics, Land Use Planning, and Ocean Engineering were introduced with a stand back, look, and then act manner or style. In all cases, the instructors stressed the importance of fairly correlating all of the variables inherent in the subject or question.

My experience with spill pollution, predominantly that of petroleum in Alaska, was sometimes bewildering and the task was infinitely complex. The frame of mind and the education I possessed, in my case made possible through MRM, was always helpful and seemingly essential.

I became acquainted with a variety of spill response organizations and scientific communities during my nine months with oil pollution work. I was most familiar with the Hazardous Materials Response Project (Project) of

the National Oceanic and Atmospheric Administration (NOAA). Project responsibilities originated in Congressional legislation. The subsequent development and the formation of methods by the Project are briefly reviewed below. My work with NOAA is then discussed. Typical activities and several specific experiences are introduced with references to several of my products which follow as appendices.

Federal Spill Pollution Response

The Federal Water Pollution Control Act of 1972 "declares that it is the policy of the United States that there should be no discharge of oil or hazardous substances into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone ...".[1] The Act initiated federal responsibility for ensuring an immediate and organized reaction to a spill situation. A fund was established to provide ready cash for response activities and for emergency relief payments to people and businesses strickened by a spill crisis. The government was to be reimbursed by the spiller for virtually all expenses. Amendments to the Act in 1977 clarified this important point so that such expenses would now include those "incurred ... in the restoration or replacement of natural resources damaged or destroyed as a result of a discharge of oil or a hazardous substance."[2]

The Act of 1972 recognized that many of the mechanisms and agency interactions set in motion were untested. In addition, critical ambiguities complicated one of the more basic objectives of the legislation. Questions that had to be answered were: What is damage?, and How can the natural resources be assessed for damage? According to the Act, the federal government was to:

> "determine ... those quantities of oil and any hazardous substance the discharge of which, at such times, locations, circumstances, and conditions, will be harmful to the public health or welfare of the United States, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches."[3]

Thus, even though an ignorance of environmental cause and effect relationships was acknowledged, the government must, as necessary, "act to mitigate the damage to the public health or welfare caused by such a discharge."[4]

In the National Oil and Hazardous Substances Pollution Contingency Plan prepared by the Council of Environmental Quality after the 1972 Act,

the detailed procedures and structure of spill response was introduced. The Plan is in a continual state of revision as agency organization and personnel are modified. Definitions of functional responsibilities and the assignment of these tasks to agencies has been established, however, and to date, these remain unchanged. The US Coast Guard commands absolutely the on-scene activity. During a spill, a Regional Response Team and, if necessary, the National Response Team, each composed of federal and state government agency representatives, convene to advise and support the Coast Guard on critical decisions, and otherwise reaffirm the federal government's action. A Scientific Support Coordinator (SSC) position serves as the point of contact between the science communities (government, academic, and private) and the Coast Guard. NOAA is responsible for the coastal and offshore waters, and the Environmental Protection Agency is charged with spillages in inland waters.

The Plan outlines three objectives and tasks for the SSC. The functions of the SSC are:

1. To provide the (Coast Guard) On-Scene Coordinator with highly qualified scientific advice in mitigating environmental impact.

2. To assess the environmental damage and socioeconomic impact resulting from spills, and

3. To maximize the research advantage offered by a spill situation, especially with respect to improving the capability for future response.[5]

The three tasks are quite distinct yet for a spill, all three must be initiated immediately to provide consistent documentation throughout the spill. The tasks are listed in order of urgency. The SSC must first advise on the appropriateness of possible actions in terms of the actual or potential dangers to environmental resources. Ideally, clean-up crews will be directed to the most critical areas and proper protection, clean-up, and restoration techniques will be used.

The second task refers to the questions raised above, i.e. What is damage?, and How do we measure it? Socioeconomic impacts can be quantified by recording Marina clean-up costs and, less directly, lost fishing days. Environmental damage, however, is direct destruction of life as well as indirect repercussions in productivity for food web members and human amenity and business persuits. The means to the mitigation of these damages

and, most significantly, the extrapolation to the total cost of such damages to be paid for by the spiller is still unclear. Each spill situation is different. If the spill attracts enough attention, tasks 2 and 3 combine to produce masses of data and scientific interpretations which, in turn, must be interpretated in a judicial setting. If the spill is of a lesser consequence or if interest is lacking, the acting SSC will generally make an educated value judgement based upon observations. This, then, is a very brief summary of the role I helped maintain in Alaska for nine months.

Review of My Internship Experience

For six months, the NOAA Hazardous Materials Response Project's personnel were Dr. Nancy Maynard, a marine biologist, and myself. In January of 1979, we were joined by a secretary and a NOAA Corps officer LCDR. Burl Wescott who was to relieve Dr. Maynard. Dr. Maynard had become the first SSC in Alaska only a month or two before my arrival. This was coincident with an identical position being filled in the Southeastern region of the United States. Within several weeks, and continuing intermittently throughout my internship, I was left with the role and office responsibilities of the SSC while Dr. Maynard travelled for job and personal reasons. I eventually became accommodated to the beeper pager apparatus which I inherited whenever my boss was away.

That summer in Alaska passed without a significant spill of any kind. During that period, I read extensively and began collecting pertinent references. I also compiled and organized names of scientific and agency personnel for use in notification telephone calls. In addition, I travelled to and sometimes directly participated in several regional and national response planning meetings and workshops. I prepared what was the first overlay series of physical process and resource information for two particularly susceptible areas, Kachemak Bay in Lower Cook Inlet and, on a much larger scale, Prince William Sound. Months later, I assisted private contractors in the preparation of a more complete and polished version of a resource overlay for the Lower Cook Inlet region.

This work with overlays is shown circled as the Alaskan Sensitivity Guide in the flowchart displayed in Appendix I. I created that flowchart as a result of having the time to do so and due to my interest in depicting the necessary interactions of the SSC role. At that time, the flowchart

image was in the minds of only a small number of individuals. I felt that, judging by the difficulty people were having in understanding the SSC position, such a picture was necessary. The flow chart was a mental exercise with what I knew to be relatively few applications. It was enough for me to hear that it was accurate and that over time, it remained accurate and thorough.

Formation of the Alaska Spill Index (Appendix II) was done in coordination with a reporting format being prepared in the Southeastern SSC office. If maintained, the Index would be the only complete record for the state of significant spills thereby providing a history of such pollution from pristine conditions to conditions perhaps revealing local increases in stress on the environment. This information would be useful for planning purposes and for long range impact assessment.

Spill Experience

Appendix III is a report I prepared concerning the activities of the SSC office during the sinking and salvage of the MV Glacier Queen from November 1978 to January 1979. While in Seldovia, I participated in or conducted a variety of sampling and observation programs. These programs included current surveys; intertidal substrate, water column, oil, benthose, and dungeoness crab samplings; plankton trawls; and daily monitoring of oil plume transport. The reason for the extension of my internship from six to nine months was, in part, to permit me to prepare this document. The incident had attracted considerable attention due to its very high cost per oil spilled ratio. For me, writing that report is the most useful experience I will retain from the internship.

In another spill, an oil storage tank belonging to a large pulp mill in Ketchikan, Alaska, was vandalized and approximately 800 barrels were spilled. Three-fourths of this amount entered a one square kilometer cove which served as a log storage area while providing a habitat for sea otters, seabirds, and salmon. Appendix IV, a report on this incident, is another example of the SSC involvement at a spill. The Ketchikan spill can be considered a more typical event than that of the Seldovia Glacier Queen.

Conclusions

I am fortunate to have participated in an internship which demanded both bureaucratic and crisis level interactions with federal, state, and local governmental personnel, with scientists of many varied persuasions, and with private contractors and assorted local residents. The common denominator, spill pollution, continues to be an infinitely complex problem at every stage of interest and work. My fascination with the subject, and in particular, with the SSC approach to oil spill response, compels me to choose similar work with marine pollution in the future.

References Cited

1) Federal Water Pollution Control Act (P.L. 92-500), Section 311(b)(1).

2) Clean Water Act (P.L. 95-217), Section 311(f)(4).

3) F.W.P.C.A. (P.L. 92-500), Section 311(b)(4).

4) C.W.A. (P.L. 95-217), Section 311(b)(v).

5) United States Coast Guard Western Alaska Pollution Response Plan, from the National Oil and Hazardous Substances Pollution Contingency Plan, Draft 1978.

APPENDIX I

APPENDIX II

March 1979

ALASKA SPILL INDEX FILE REPORT FORMAT

Report Number: AK- { AC-(Arctic Coast) / SA-(Southwest/Aleutians) / CI-(Cook Inlet) / GOA-(Gulf of Alaska) / SE-(Southwest) / PWS-(Prince William Sound) } - Numbers for: Month - day - year

Title:.....Spill

Location:...(Local name relative to a city or known name)

Type of Material Spilled:...

Approximate Quantity Spilled:...

NOAA SSC Notified:...(date, time, by whom)

Dates of SSC On-Scene Response:...

NOAA SSC Representative(s):...

Government/Private Industry Representative:...

NOAA SSC General Conclusions:...

Report by:

Other sections are necessary:

Situation Description

Map/Chartlet

Environmental Setting

Response Log

Agency Reports in Appendix

Spill Index

Reference Bibliography

Spills with SSC response

Other spills

REPORT NUMBER: AK-SA-10-31-78

TITLE: Adak Navy Jet Fuel Spill.

LOCATION: Sweeper Creek, Adak Island, Aleutian Chain, Alaska.

TYPE OF MATERIAL SPILLED: JP-5.

APPROXIMATE QUANTITY SPILLED: 8000 gallons total, 4000 gallons into Sweeper Creek.

NOAA SSC NOTIFIED: November 2, 1978 by US Coast Guard, Juneau, AK.

DATES OF NOAA SSC ON-SCENE RESPONSE: The incident did not require on-scene response.

NOAA SSC REPRESENTATIVE: Will Ernst.

GENERAL CONCLUSION: It was determined largely from observations by a Fish and Wildlife Service Aleutian Wildlife Refuge manager at Adak that longterm damage to the environment was minimal. Several fish were killed immediately, however, no other life forms were reported damaged. Salmon spawning upstream was not visibly affected. The Creek was altered by human construction activity and no longer served as major anadromous stream.

Although impact was eventually considered slight, governmental response revealed the need for stricter notification guidelines and more rapid agency interaction.

APPENDIX III

APPENDIX IV

REPORT NUMBER: AK-SE-1-26-79

TITLE: Louisiana Pacific Ketchikan Pulp Mill Spill.

LOCATION: On Ward Cove, Northwest of Ketchikan, Alaska.

TYPE OF MATERIAL SPILLED: No. 6 Bunker, Trace of Diesel.

QUANTITY SPILLED: 800 barrels (33,600 gal.) from source
600 barrels (25,200 gal.) introduced onto water.

NOTIFICATION: 0730, 29 January 1979, Office of Scientific Support Coordinator (SSC) requested by U.S. Coast Guard, CDR. Spoltman, Federal On Scene Coordinator (OSC), to report on scene for damage assessment considerations.

NOAA SSC REPRESENTATIVES: LCDR Burl L. Wescott.

William D. Ernst

DATES OF NOAA SSC ON SCENE RESPONSE: 30 January 1979, 1500 - 1 February 1979, 1725.

SITUATION DESCRIPTION:

The source of the oil was a 55,000 barrel storage tank. Inside the containment dike which encircles the storage tank is a small pump house which contains two steam driven duplex pumps with suction strainers. Sometime between 1500 and 220 on Friday, January 26th, the bolt on the "stiff back" of the strainer cover on the suction side of one pump was loosened.

During a routine check, the shift utility man discovered oil spraying throughout the pump house. By this time, it had accumulated a level of approximately two feet inside the containment dike. The utility man contacted the shift engineer and the shift superintendant who constructed a bridge to the roof of the pump house from the top of the containment dike. They chopped a hole in the roof of the pump house in order to secure the valve inside. (See Photo #1, Appendix A).

By 2245, 26 January 1979, the oil leak at the pump house had been stopped. At this time, it was discovered that oil was flowing through an opening in the dike wall into a stream which emptied into Ward Cove. (See Photo #2, Appendix A). A flood tide held most of the oil close to the spill site until containment booms were set in place. Oil subsequently reached a depth of 8 -10 inches on the water inside the containment booms.

DESCRIPTION OF SPILL ENVIRONMENT

Ward Cove, about 0.7 mile N. of Penninsula Point, is on the N. side

of Tongass Narrows, about 5 miles N.W. of Ketchikan. The cove, which narrows to approximately 0.3 miles wide at the entrance, is characterized by steeply sloping shores. A log boom extends from the N.E. end of the pulp mill to Bolles Ledge, which is near the head of the cove and about 250 yards off the East shore. At times, the North side of the entrance and the entire cove may become blocked by logs that are normally stored along both sides of the cove.

A cannery is on the S.E. shore 0.7 mile from the head of the cove and the Louisiana Pacific Ketchikan (LPK) Pulp mill is on the N.W. side of Ward Cove. Most of the N.W. shore is highly developed by the pulp mill with associated industrial activity. (See Map. Appendix B).

Weather conditions were calm with clear or partly cloudy skies. The air temperature remained near freezing. Thin sheets of ice formed on the water at night and generally melted during the day.

The maximum tidal range during the spill, was from a high of 19.1 ft. to a low of -4.0 ft. The oil was introduced into the cove on a flood tide, which ranged from -2.5 ft. to 15.4 ft. Tidal currents are estimated not to have exceeded ½ knot in the area where the oil was contained by booms. Wave height was negligible.

At the head of Ward Cove is Ward Creek. Trout and steelhead as well as pink, chum, coho, and red salmon are present during spawning season. The watershed lies within the Tongass National Forest. An access road to the creek area provides for camping and fishing. Its proximity to Ketchikan makes it a popular outdoor recreational area.

Ward Cove has been used by the LPK Pulpmill since 1954 for log storage, docking facilities, and as a wastewater out-fall area. Some shellfish are present but are thought to be limited due to the industrialization. This area is used by diving ducks during the spring migration. Herring, otters and sea lions were present in Ward Cove when the spill occurred. They avoided the oiled area and seemed to be otherwise unaffected. A sea lion was seen eating a salmon inside the cove while clean-up operations were under way.

ACTIVITIES / OBSERVATIONS

LPK attempted to heat the oil remaining inside the containment dike so that it could be pumped out and reclaimed. This was done on Saturday, 27 January, and, as soon as the oil warmed, it began to seep under the containment dike wall and into the adjacent stream. An additional 50 to 75 barrels of oil were lost before it could be dammed with sandbags and cooled to where it stopped flowing. (See Photo #3, Appendix A).

On the afternoon of 30 January, the SSC team arrived on scene. The LPK clean-up supervisor, Mr. Higgins, took the SSCs and Mr. Hoffman of D.E.C. and Mr. Kelly of A.D.F.&G. through the oiled area. U.S. Coast

Guard members from Ketchikan, Misters Ensley & Nance, were present for the OSC and overseeing clean-up activities. Clean-up of spilled oil was into the fourth day and over 300 barrels had been recovered. Most of this oil had been shoveled off the water into barrels or picked up by sorbent material. (See Photos #4 & 5, Appendix A). No oiled birds or mammals had been reported and there were no dead fish reported along the beaches or on the water.

Mr. Hansen, a commercial diver hired by LPK, dove under the area where oil had most heavily accumulated on the water. The purpose of the dive was to look for oil which might have sunk to the bottom. No evidence of sunken oil was discovered by Mr. Hansen on 30 January.

After initial recovery of the first 300 barrels of oil by LPK personnel, what was remaining were large blebs of oil with a heavy sheen. (See Photo #6, Appendix A). The only heavy concentrations of oil left were adhering to the log floats and structures, dock piles, and dolphins, etc. (See Photo #7, Appendix A).

The majority of blebs and sheen remaining were confined inside the log and sorbent booms shown on the map in Appendix B and on photos 8 and 9 in Appendix A. Some oil was transported beyond this area near the mill and had collected on the log rafts anchored in Ward Cove. That oil which reached the log rafts was largly on the first ebb tide after the spill. As long as it remained on the logs, it was a continual source of sheen on the water.

A large boom was placed across the mouth of Ward Cove to contain any sheen which escaped from the booms around the immediate mill area and that sheen coming from the log rafts. Initial placement of the boom was on Saturday, January 27th. Some sheen was observed seaward of the big boom so it was subsequently moved out toward Tongass Narrows. Sorbent material was placed at the log ends to effect better containment of the sheen on Ward Cove. (See Photo #10, Appendix A).

The tidal area upstream from the highway bridge on Ward Creek was walked by the SSC team on the morning of January 31st. Infrequent patches of sheen on the rocks or on ice in the tidal zone were noticed. Two pea sized blebs of oil were also seen. This did not stick to one's fingers and the amount of oil present was light in concentration and its source could not conclusively be determined.

At 1000 hrs., January 31st, a meeting of mill personnel and the state and federal people on scene was called by the OSC, CDR. Spoltman, USCG. This was the first time all interested parties had been together. (See List of Attendees, Appendix C).

Clean-up procedures by the mill were explained and the progress of the clean-up was illustrated by Mr. Fisher of LPK. Agreement to the clean-up progress was expressed by the OSC. None of the scientific community in attendance presented any problems concerning LPK clean-up procedures.

It was the general consensus of all in attendance that life systems impact would be lessened with the most expeditious removal of the oil contaminant. It was further agreed that LPK was addressing the clean-up in a timely and conscientious manner.

The SSC contacted the U.S. Fish & Wildlife Service and arrangements were made for Mr. Chuck Osborn of USFWS, Ketchikan, and Mr. Bob Larson of ADF&G to do a second dive in the area where the oil had been most heavily concentrated. They were again to look for any sunken oil and also to take bottom samples in this area.

On this dive no oil was visible below 15 cm. from the surface. There were some masses of the bunker oil in this 15 cm. layer of water at the surface. The amount of oil below the surface was minimal and that which was there was probably mixed with sediment or weathered to a point where its specific gravity was altered. A bottom sample was taken and, upon inspection, there appeared to be no oil present in the bottom sediments. The content of the bottom sample was high sulfur sludge identified by the mill as a carbon ash residue from the mill outfall. This sample is being maintained by the SSC Office, Anchorage, in compliance with chain of custody requirements.

After the bulk of the oil was shoveled off the water, that which remained was being cleaned off the structures with high pressure water and steam. (See Photo #11, Appendix A). Sorbent booms were placed around local sites where the steam or high pressure water cleaning was being done. This helped to contain the oil for easy removal from the water surface. (See Photo #12, Appendix A).

As a result of discussions among the OSC, USFWS, EPA, ADEC and LPK personnel, it was decided to test Shell Oil Herder to see if it would be of use in the clean-up of the remaining oil sheen. Two plastic spray bottles of Shell Oil Herder were used for the test. One of the spray bottles clogged from freezing on the first spray and the other worked for about 30 seconds. The air temperature at the time of the test was about 32° F and the freezing point of the Shell Oil Herder is 34° F. However, that herder which did get sprayed onto the water still worked. As the herder spread, it actually moved oil counter to a slight tidal current flow in the test area. When the sprayer froze, the cap was taken off and some additional herder was poured from the bottle. This froze and formed white frosty globs in the water and appeared to be totally ineffectual. The consensus was that Shell Oil Herder would not be used to aid in this clean-up because of the limiting cold weather.

At 1630 on 31 January, the OSC, CDR Spoltman, gave the SSC team permission to depart the spill scene at their disgression. It was obvious at this time that LPK was adquately conducting clean-up operations and that the expedient removal and localization of the spilled oil will yield little impact other than to the mill area itself.

On the morning of February 1st, Will Ernst, SSC team member, took part in an overflight of the Ward Cove area. Only patches of light sheen were seen beyond the booms in the immediate mill area. No evidence of oil on the beach could be discerned.

Four "source" samples of oil were taken by the SSC team inside the containment dike. Four "weathered" samples were also taken off the water in the clean-up area. One set of source and weathered samples was transfered to Mr. Bob Higgins of the LPK pulpmill and a second set was transfered to Mr. Bruce Hoffman of ADEC, Ketchikan. Chain of custody forms were prepared for transfer of both sets of samples. The bottom sample taken by the divers and the two remaining sets of source and weathered samples are being held by the SSC, Anchorage.

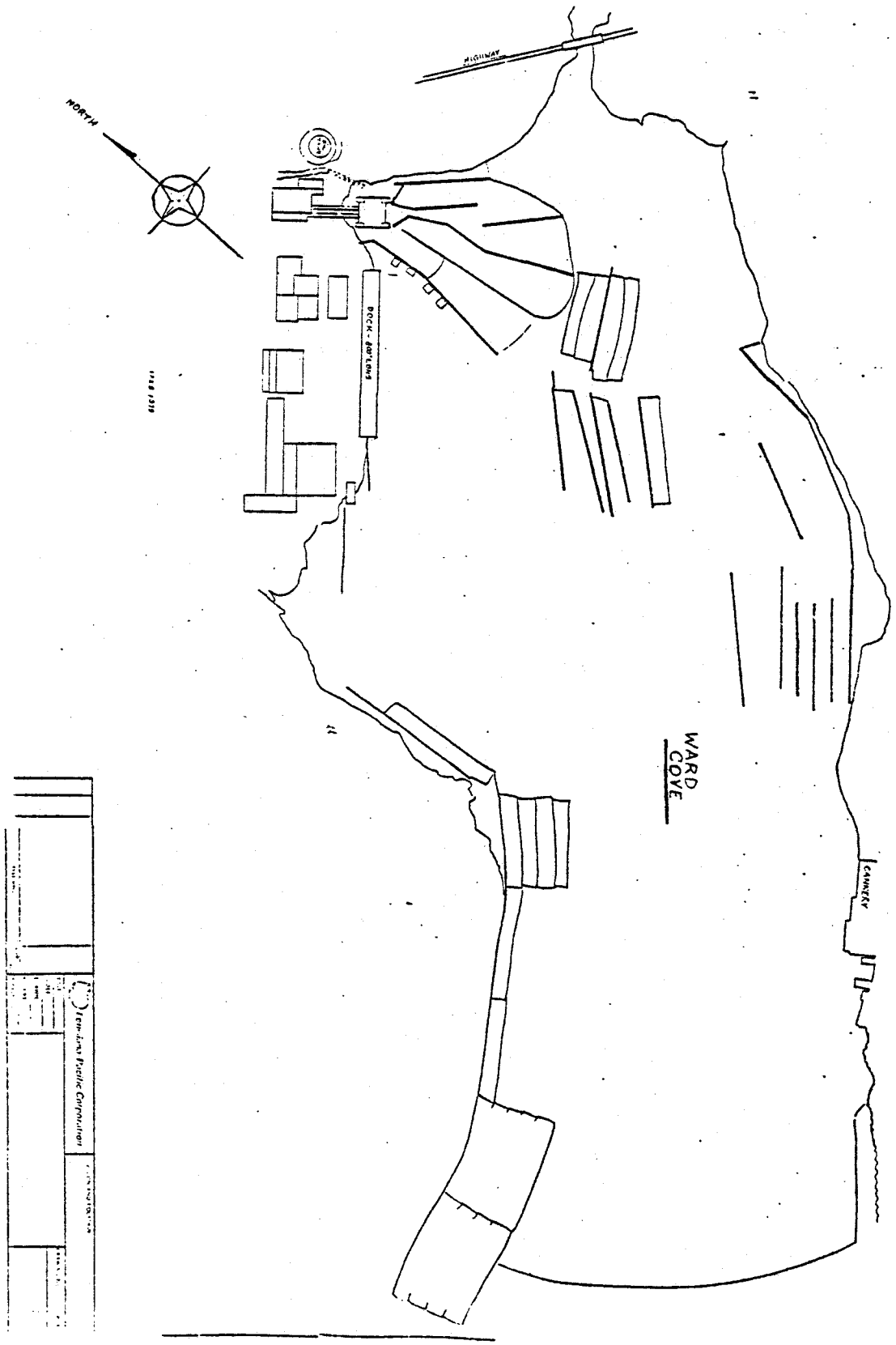
SSC team members met with Mr. Kelly, ADF&G and Mr. Hoffman, ADEC, to discuss the resources in the Ward Cove area and the possible impact of this oil spill. Quick containment and clean-up response by LPK prevented what could have been a severe impact to Ward Cove and possibly parts of Tongass Narrows. Migratory birds and spawning fish were not present this time of year. Beach oiling only occurred at the already heavily industrialized mill area. That sheen which escaped the containment booms was minimal and will be naturally dissipated. The spawning beds in Ward Creek were not oiled and thus pose no threat to salmon returning this year. It was, therfore, deemed unnecessary to perform a comprehensive damage assessment study.

The ADEC and ADF&G representatives in Ketchikan agreed to continue to monitor for oil impact in this area after the departure of the SSC team. Communications would be maintained between Ketchikan and the SSC Office in Anchorage and notification of any future oil damage relative to this spill would be relayed.

The LPK Pulpmill drafted a chartlet of Ward Cove from an aerial photograph for use by the SSC team. A reduced version of the chartlet appears as Map, Appendix B. Copies of the map were also furnished to ADEC and ADF&G in Ketchikan. This served as a common reference for interagency communications.

The SSC team departed Ketchikan at 1925, 1 February 1979.

Appendix B



Appendix C

KETCHIKAN PULP MILL OIL SPILL
MEETING ATTENDEES

31 January 1979

Name	Organization Representing
LCDR Burl L. Wescott	Anchorage, NOAA Scientific Support Coordinator
William D. Ernst	Anchorage, NOAA Scientific Office of Marine Pollution
Chuck Osborn	Ketchikan, USFWS Division of Ecological Services
Jerry A Cegelske	Ketchikan, USFWS Division of Law Enforcement
Lt. Terry L. Rich	Ketchikan, USCG
Lt. A.D. Ensley	Ketchikan, USCG
CDR R.H. Spoltman	Juneau, OSC
W.E. Fisher	Ketchikan, LPK
Don Kelly	Ketchikan, ADF&G
Carl Kitz	Seattle, EPA
Bob Higgins	Ketchikan, LPK
Merle A. Mosar	Ketchikan, LPK
Alan Kegler	Juneau, ADEC
Ron Flinn	Juneau, ADEC
Bruce H. Hoffman	Ketchikan, ADEC