MEMORANDUM

STATE OF ALASKA
Department of Fish and Game

TO: Stan Senner
OSIAR
Oil Spill Restoration
Planning Office, Anchorage

DATE: November 9, 1990

FILE NO:

THRU:

TELEPHONE NO: 465-4160

SUBJECT: Expanded Descriptions for Habitat Rehabilitation Project

FROM: Brian Allee Ph. D.
Director
Division of FRED, Juneau

We have provided the more detailed descriptions of the projects under the Habitat Rehabilitation category that you requested. As you suggested, the Forest Service projects have not been detailed here. The prioritization for some projects (following the FRED project submission of November 9, 1990) have been changed slightly after further review by biologists. Also, some projects have been combined and one has been removed. The project priortiy may still change and should be considered preliminary.

Thank you for your interest and I look forward to meeting you on December 7, 1990. If you have additional questions please contact me.

cc:
Robert Burkett
Jeff Hartman
Johnny Holland
Tom Kron
Charles Meacham

Rebuilding of Pink Salmon Populations in Streams Impacted by the Exxon Valdez Oil Spill High Priority:

Principal Investigators: Larry Peltz, FRED Division, Hydrologist FRED Division, Engineer FRED Division, and USFS staff.

LINK TO NRDA DAMAGES: Intertidal spawning habitat in several streams have been severely oiled. The pink salmon populations which utilize these habitats may be severely impacted when incubating eggs and emergent fry are exposed to the oil. Several high impact stream systems and intertidal areas have been identified in the damage assessment, and any of these (or new streams of impact) could be included in the rehabilitation effort. Individual stocks of pink salmon may be reduced if few recruits are produced from the hydrocarbon exposure. Scientists, are uncertain over how long it would take the specific habitats, critical for incubation and early rearing to improve. By the time the oiled areas become suitable habitat, a full cycle of pink salmon and the corresponding genetically unique stock could be lost.

METHODS: Rehabilitation techniques, have been frequently used in North America to repair ecological, and habitat damage to small natural populations of salmon. The technology and facilities are fully in place to apply these techniques in areas affected by the EVOS. To rebuild pink salmon stocks, and prevent further reductions in populations, a portion of the existing returning adults would provide eggs for incubation in available hatchery space. Two candidate central incubation facilities could be used (Wally Noerenberg II and/or Valdez Fisheries Development Corporation). By utilizing indigenous stocks of fish and returning all fry to their streams the genetic diversity of the population can be maintained. It may also be necessary to further clean the impacted area. This would facilitate recovery. Another option would be to maintain use of the central incubation facility for several cycles until the natural recovery process restores the impacted spawning habitat.

COSTS: $25,000 to $50,000 per system per year, including evaluation. This project could commence on affected streams in FY91.

EXPECTED RESULTS: Where small populations of genetically discrete pink salmon populations exist (this technique could be applied to any species of salmon) productivity of a weak stock can be increased by 5 to 20 times over what would occur in a healthy the natural environment. This type of result is consistent with enhancement efforts currently applied on large stocks of salmon in PWS. In an oiled environment, or one with temporary or chronic habitat damage, affecting survivability of early life stages, this technique could literally avert the risk of loosing genetically unique stocks of salmon.

Lower Cook Inlet Pink Salmon Habitat Rehabilitation High Priority:

LEAD AGENCY:	Division of FRED
PRINCIPAL INVESTIGATOR:	Nick Dudiak, Division of FRED
COOPERATORS:	Division of Commercial Fisheries, Division of Sport Fish
	Port Graham, English Bay, and Seldovia
	Native Associations
	North Pacific Rim Corporation
	Alaska Division of State Parks

INTRODUCTION:

Background The area along the southern Kenai Peninsula has a significant number of estuarine and intertidal nursery areas important to salmon production. The harvest of pink and chum salmon returns to the area provides a significant contribution to the southern Kenai Peninsula economy. During the spring and summer of 1989, heavy concentrations of oil sheen, emulsified oil, and tar balls moderately to severely impacted these important areas. Many observations were made of juvenile salmonids residing, swimming, and feeding in the oiled areas. Moderate to intensive oil cleanup and remediation activities were conducted in only a small portion of the impacted area in 1989 and 1990.

Prior to the 1989 oil spill most of the affected streams have demonstrated decreasing production trends, even prior to the 1989 Exxon Valdez oil spill. Any further sublethal effects from previous oil accumulation or other events could jeopardize long-term pink salmon production in some lower Cook Inlet systems.

Goals The goal of this project is to initiate pink salmon rehabilitation or restoration activities in areas which had previously been impacted by oiling. Various proven rehabilitation techniques would be immediately implemented in FY 91 in the identified impacted areas.

Objectives The objectives of this project include immediate implementation of rehabilitation techniques at several locations in order to prevent further decreasing trends of these pink salmon stocks. Objectives include:

1. Port Dick Head End Creek - initiate stream rehabilitation and spawning channel construction in FY 91-FY 92.
2. Island Creek - initiate stream rehabilitation in FY 91.
3. Tonsina Bay - initiate remote-site egg take for hatchery incubation and ultimate fry release in FY 91-FY 92.
4. Port Graham Bay - continue enhancement program already initiated in FY 91 by remote-site egg take, hatchery incubation, and saltwater rearing.
5. Windy Bay Right and Left Stream - initiate remote-site egg take for hatchery incubation and ultimate fry release in FY 91-FY 92.

Methods Techniques to be applied have been proven and considered routine operations within the FRED Division. The general methods used for each area was outlined under the various objectives. None of the proposed techniques are anticipated to interfere with future cleanup activities or ongoing oil spill-related studies.

Duration and Scope These rehabilitation projects would be initiated in FY 91 and, in most cases, would continue for 3-6 years.

Expected Results Due to the short (two-year) life cycle of pink salmon, near immediate increases in adult return numbers would be expected. In some cases, these increased population levels would provide for required escapement goals, as well as provide for commercial fisheries harvest. Previous pink salmon enhancement work in lower Cook Inlet has contributed as much as 90% of the entire annual commercial harvest of that species.

Project Costs Estimated cost by project includes:

1. Port Dick Head End Creek Clearance and Spawning Channel		$130.0
2. Island Creek Stream Clearance		35.0
3. Tonsina Bay Fry Stocking		50.0
4. Port Graham Bay Stocking		40.0
5. Windy Bay Stocking		50.0
TOTAL	FY 91	$275.0
	FY 92-FY 94/year	$140.0

Prince William Sound Fish Pass Projects High Priority:

Various Fish Pass projects in the Southwestern, and Eshamy Districts of Prince William Sound, including streams 500, 501, 510, 603, and 610.

Principal Investigators: Larry Peltz, FRED Division, Hydrologist FRED Division, Engineer FRED Division, and USFS staff.

LINK TO NRDA DAMAGES: Some Damage to pink salmon populations have occurred in the Southwest and Eshamy districts of Prince William Sound. At the time of this draft the authors have not been informed of which specific streams are damaged. The majority of stream systems in these two districts contain intertidal and non-intertidal populations of pink salmon. Barriers to passage exacerbate the low population numbers of some of the stocks of fish at these sites. Typically the sites are small and have less than 10,000 returning spawners, however at this time it is not known whether these habitat constraints at specific sites produce a less that optimal population size. Thus, population information would need to be obtained and projected with and without the proposed fish pass, as part of the project.

METHODS: Historical site reconnaissance information approximately 5 candidate site will be evaluated, including escapement information, and estimates of biological population size by species. Further verification of link to NRDA Damages to specific stream or statistical area will occur as part of the ranking for. An initial site visit will be used to evaluate hydrology, and some preliminary survey work will occur. After the best site is selected, final survey work and design work will be completed in FY 92. Construction would typically begin on the site in FY 93.

COSTS:

In FY 91: Approximately $103,000 Site reconnaissance, engineering, and hydrological analysis in FY 91 consisting of $30,000 in flight time, $25,000 for 6 mo. biologist, $18,000 for 4 mo. hydrologist, $18,000 for 4 mo. engineering.
FY 92: Complete design work and detailed survey work on one project $50,000
FY 93: Construction begins. Construction cost $50,000 to $100,000 for typical fish pass in a small stream system with an elevation gain of approximately 15 ft (slope 20%).

EXPECTED RESULTS: Properly bio-engineered and designed fish passes exist in Alaska, that produce large sustained increases in harvest. The increase in sustained yield would be estimated for each of the candidate sites. It is impossible to estimate the change in harvest resulting from an individual site until further biological scoping work is completed.

PWS Stream Channelization Projects Medium Priority:

Principal Investigators: Larry Peltz, FRED Division, Hydrologist FRED Division, Engineer FRED Division, and USFS staff.

LINK TO NRDA DAMAGES: Some Damage to pink salmon populations have occurred in the Southwest and Eshamy districts of Prince William Sound. For obvious reasons the nature of the damages cannot be detailed in this document. The majority of stream systems in these two districts contain intertidal and non-intertidal populations of pink salmon. Hydrological barriers to passage during critical spawning migrations may exacerbate the restoration of weak pink stocks that have been exposed to hydrocarbons. This would result in reduced spawning potential of the pink salmon populations and other salmonids located at these sites. Typically the candidate stream systems that are being considered are small and have less than 10,000 returning pink salmon spawners. However, at this time it is not known whether these habitat constraints at specific sites produce a less that optimal population size. Thus, population information would be obtained as the first stage of this project and future population size and harvests would be projected with and without the proposed fish pass, as part of the project.

METHODS: Passage of adult salmon into stream habitat areas that are suitable for spawning may be limited through several types of physical and hydrological barriers. These barriers may consist of zones in streams with too high a water velocity or other areas with too low water flows, or depth. During low flow conditions stream flows can be largely inter-gravel. While the sites mentioned in this project proposal have been identified as having some type of passage problem, the nature of the problem, and whether it is periodic or chronic would need to be determined during initial site reconnaissance and by analysis of other fishery catch and escapement information.

The work on the site will consist of (1) background research on the site, such as a review of historical site reconnaissance information that may exist on the stream system, escapement information, and estimates of biological population size by species, (2) verification of link to NRDA Damages to specific stream or statistical area. Of the few candidate sites listed, the final project will consist of 1 or 2 actual sites. The project would focus on various stream channelization projects in the, Southwestern, and Coghill Districts of Prince William Sound, including streams 665, 681, and 698.

COSTS:

FY 91: Approximately $103,000 Site reconnaissance, engineering, and hydrological analysis in FY 91 consisting of $30,000 in flight time, , $25,000 for 6 mo. biologist, $18,000 for 4 mo. hydrologist, $18,000 for 4 mo. engineering.
FY 92: $50,000 for design and detailed survey work on one project.
FY 93: $40,000 to $100,000 for final stream work.

EXPECTED RESULTS: Stream channelization projects have been successfully applied to salmon systems in North America. However, in Alaska, they have not been widely used. This is primarily because the production potential from these actions (in terms of maximizing the size of the state harvest) are expected to be small compared to large scale production hatcheries and other enhancement activities. None-the-less, improvement of small localized stocks through stream channelization techniques represents a relatively unobtrusive approach to improving survival. It is impossible to estimate the change in harvest until a specific site for application has been chosen. The increase in sustained yield would be estimated for each of the candidate sites as part of this project.

Restoration of wild pink salmon through enhancement of marine survival Medium Priority:

Principal Investigator: Mark Willette, FRED Division; Larry Peltz, FRED Division; Jim Hasbrouck, FRED Division

LINK TO NRDA DAMAGES:

Intertidal spawning habitat in several streams have been severely oiled. The pink salmon populations which utilize these habitats may be severely impacted when incubating eggs and emergent fry are exposed to the oil. Individual stocks of pink salmon may be reduced if few recruits are produced from the hydrocarbon exposure. Scientists, are uncertain over how long it would take the specific habitats, critical for incubation and early rearing to improve. By the time the oiled areas become suitable habitat, a full cycle of pink salmon and the corresponding genetically unique stock could be lost.

Most traditional salmon enhancement techniques increase survival during the freshwater lifestage. In some years survival increases for these life stages may ge be offset by limitations in early marine survival. The marine survival of hatchery-reared pink salmon is strongly affected by the timing of fry releases in relation to the seasonal increase in zooplankton abundance and ocean temperatures. This proposal describes a well known hatchery practice that may provide a relatively unobtrusive means of restoring wild pink salmon populations damaged by the Exxon Valdez oil spill.

METHODS:

Coded wire-tags will be applied to pink salmon fry emigrating from three (or more) streams as was done in NRDA study #3. The three immediate streams that could be rehabilitated are Loomis Cr. (oiled in the Eshamy District), Herring Bay (oiled in the Southwest District), and Haden Creek (oiled in the Southwest District). Control streams are Cathead Bay (Southwest District), Totem Off Creek (Southwest District), O'brien Creek (Southwest District). If these are not the most appropriate streams to apply this technique to, because of the continuation of damage assessment, then other affected streams could be easily substituted.

Fry accumulating in traps will be transferred to netpens moored near the stream mouth and fed commercial food, if necessary, to maintain weight. Zooplankton abundance and water temperature in nearby marine rearing habitats will be monitored. Fry will be released from netpens after the seasonal increase in zooplankton abundance and water temperature is detected. The survival of fry held and released into the zooplankton bloom will be compared to the survival of fry emigrating directly into the ocean from nearby streams with similar coded-wire tagging programs.

This project will involve 4 streams: two with fry holding and two without fry holding. Sites where fry are held will be in areas where sea conditions permit mooring of net pens near stream mouths.

COSTS:

FY 91: $150,000 (4 streams w/ CWT tagging, new equipment)
FY 92: $120,000 (4 streams w/ CWT tagging, w/o equipment)
FY 93 or 94:$ 20,000 (per stream w/o CWT tagging, new equipment)
FY 94 or 95:$ 15,000 (per stream w/o tagging, w/o equipment)

EXPECTED RESULTS: Extensive culture experience with pink salmon in PWS demonstrates that survival will be improved by proper release timing. Typical enhancement projects with optimal release timing capabilities range from a 100% to 200% increase in returning adults over those with volitional release. This study will focus on applying these techniques to wild fish. A net environmental benefit will result because only damaged populations will be targeted, manipulation of damaged populations will be minimal, and there will be no permanent alteration of the environment. Economic feasibility can be determined in 2 years or less.

Miscellaneous PWS stream stocking projects Medium Priority: Various chum salmon stream stocking projects including stream 702, 707, 710, 711, 739, 745, 746, 747, 770, and 775.

PRINCIPAL INVESTIGATORS: Larry Peltz, Bruce Suzumoto, PWSAC; or Jason Wells Valdez DA, Bruce McCurtin

LINK TO NRDA DAMAGES: Stream spawning habitat and intertidal rearing habitat in several streams in Prince William Sound have been severely oiled. Chum salmon, using many of the same habitats as pink salmon may be impacted when incubating eggs and early rearing fry are exposed to the oil. Further study could reveal damage to chum salmon populations. Restoration of chum salmon in PWS and other affected areas could be applied to neighboring statistical areas that have a high potential for rehabilitation. One such area is Montegue Island.

The 1964 earthquake caused numerous streams to be depleted of chum salmon. A pilot project initiated in 1986 on Chalmers River has been successful with over 1,000 adult chum salmon returning to the stream in 1990. We will not know whether spawning was more successful until fry emerge next spring.

METHODS: It may be feasible to reestablish chum salmon by stocking fry in the following streams: Stream 701 Trap Creak, Stream 702 Point Creek, Stream 707 McCleod Creek, Stream 710 Hanning Creek, Stream 711 Quadra Creek, Stream 739 Swamp Creek, Stream 745 Wild Creek, Stream 746 Schuman Creek, Stream 747 Cabin Creek, Stream 770 Udall Creek, and Stream 775 Pautzke Creek. This technique could be applied to other oil affected areas of Prince William Sound, Lower Cook Inlet, and Kodiak Island. Two candidate central incubation facilities could be used (Wally Noerenberg II and/or Valdez Fisheries Development Corporation). Chum stocks could either come from remote egg takes or from one of the established chum stocks used for enhancement in PWS.

COSTS: $50,000 for the initial site reconnaissance and survey work that would be started in FY91. $10,000 per year for each site (starting in FY 92 to conduct stocking and evaluate success.

EXPECTED RESULTS: Populations of chum salmon could be re-established in systems that they formerly were found, with a net increase in the size of the chum harvest in the PWS.

Cold Creek Pink Salmon Stream Clearance Medium Priority: Afognak Island (252-331)

PRINCIPAL INVESTIGATOR: Lorne E. White, FRED Division;

LINK TO NRDA DAMAGES AND INTRODUCTION: Cold Creek (252-331) of Danger Bay (Kazakof), has been under investigation for stream clearance and fish passage improvement since 1985. Kodiak and Afognak Island pink Salmon fishery were closed in 1989 due to the Exxon Valdez oil spill. This resulted in over-escapement damages to many systems in the area. Improvement of fish passage in Cold Creek is a method of mitigating damages from the closed fishery and over-escapement.

METHODS: Placement of gabion steep pools and cutting into rocks creating resting pools for pink salmon will improve fish passage and increase the size of the run in Danger Bay.

COST ESTIMATE: $15,000 FY 91

RESULTS: Fish passage improvement should result in an increase from the present escapement of 4,000 pinks to 12,000 (i.e. a gain of 8,000 spawners). The Afognak Island area has a return to spawner ratio of 3.6:1. Therefore, 20,800 will be available for harvest, in the future less requirements for escapement.

Horse Marine, Olga Bay fishpass for pink and sockeye salmon Medium Priority: Kodiak Island

PRINCIPAL INVESTIGATOR: Lorne E. White, FRED Division

LINK TO NRDA DAMAGES AND INTRODUCTION: Horse Marine Creek (257-402) of Olga Bay Kodiak Island has been investigated for fish passage improvements since 1978. The site is in need of a 70 ft. to 80 ft. steeppass/ladder to improve passage over a 25 ft. high falls. The fish ladder would expand spawning area of an additional 11,000 pink salmon and improve passage for 20,000 sockeye salmon currently using the system. Kodiak and Afognak Island pink salmon fisheries were closed in 1989 due to the Exxon Valdez oil spill. This resulted in over-escapement damages to many systems in the ares. Improvement of fish passage in Horse Marine Creek is a method of restoring the damages in a nearby statistical area, from the closed fishery and over-escapement.

METHODS: Construction of 70 to 80 foot aluminum fish ladder at base of falls.

COST ESTIMATE: $60,000

EXPECTED RESULTS: The fish ladder should generate spawning area for 11,000 pink salmon. At a return per spawner ratio of 3.6:1, a total of 28,600 pink salmon for the harvest, less escapement. An additional 2,000 sockeye salmon will be available for spawning in Horse Marine Lake due to less exposure to predation by bears. At a return per spawner ratio of 3.0:1, a total of 4,000 sockeye would be available for harvest, less escapement.

Enriching Near-shore Environments with Either Organic or Inorganic Fertilizer to Optimize Survival of Rearing Salmonids Low Priority:

Principal Investigator: Dr. Jeff Koenings (FRED Division, Soldotna) and University of Alaska-Southeast.

Injury Documentation;link to NRDA

Pink salmon populations in oil impacted areas of coastal Alaska demonstrate signs of physical exposure to oil, and populations of some small stocks may have been damaged. As such, these natural stocks may respond to rehabilitation. Local esturine rearing conditions may prove to be a limiting factor to pink salmon stock rebuilding efforts through management or intensive rehabilitation, in that food abundance can be ecologically constrained. These constraints in food production may handicap efforts of managers to increase stocks of pink salmon or other near - shore rearing salmonids through allowing for larger escapement.

Estuaries typically receive energy inputs from terrestrial detritus and from phytoplankton which supports production of zooplankton. A lack of terrestrial decomposition in Alaska may limit the amount of detritus exported from watersheds into the near-shore environment. Enrichment of estuaries with a combination of inorganic and organic fertilizers may stimulate the seasonal production of zooplankton (as has been shown for freshwater zooplankton), the principal forage item for juvenile pink and chum salmon.

This study could also be a low cost approach for replacing services lost to fishermen related to environmental damage that have affected other areas of the salmon fishery.

METHODS: Restoration in this case would be aimed at replacing lost pink salmon production or production of specific stocks known to rear in the near-shore areas receiving treatment.

This study would compare the effects of both controlled additions of nitrogen and phosphorous inorganic fertilizers, with organic fertilizers to designated nearshore areas. Tagging studies would be initiated to evaluate the comparative success of the two options. Several potential areas in Prince William Sound and in Cook Inlet would be investigated to conduct the trials.

COST: Approximately $150,000 in FY 91.

Sockeye Rehabilitation through fertilization of lake systems in Prince William Sound and Cook Inlet Low Priority.

Principal Investigators: Dr. Jeff Koenings (FRED Division, Soldotna), Nick Dudiak (FRED Division, Homer)

Injury Documentation;link to NRDA

NRDA Studies are underway to determine if fishery closures following the Exxon Valdez Oil Spill resulted in higher than desired escapement of sockeye salmon into spawning areas. High densities of fish in certain sensitive spawning streams may lead to reduced survival of eggs or fry, and a net loss in outmigration. If these studies reveal reduced population sizes of important stocks of sockeye, restoration may be desired. If studies do not confirm that reductions of sockeye salmon have occurred in the area's studied this study may still be a least cost approach for replacing lost services related to environmental damage that have affected salmon fishermen.

METHODS: Restoration in this case would be aimed at replacing lost sockeye production by rehabilitating systems that are nutrient limited, and capable of sustaining greater numbers of spawners.
The controlled additions of nitrogen and phosphorous to the surface of sockeye (O. nerka) nursery lakes has substantially enhanced the survival of rearing juveniles, in Alaska. Sixteen lakes throughout the State have received nutrient additions to increase the production of sockeye and coho smolts. The increased numbers of smolts have in-turn increased numbers of adults either for spawning or harvest by the common property fishery.

Several potential sites exist in Prince William Sound and in Cook Inlet where these methods could be applied. Since the technical feasibility of this approach is known this project could begin in 1991, and should be carried out for 3 or more years.

EXPECTED RESULTS Models for estimating the change in the size of each stock of salmon must be applied to specific systems and projects. Typical a typical fertilization project on a single lake system may increase harvest from 10,000 to 100,000 salmon.

Cost of implementation

Costs of nutrient modification projects depend on many variables. Some may include additional stocking. Costs of investigations, and applications for each lake vary between $15,000 and $50,000 annually.

PWS Fish Pass Projects Low Priority:

Various Fish Pass projects in the Districts of Prince William Sound for systems that no current NRDA damages are verified, but reasonable probability of damage exists. Note: that this would be similar to Prince William Sound Fish Pass Projects High Priority:, but without current injury link. In particular these projects would be consentrated in the Eastern District, Northern District, Northwest District, and Southeastern District.

Principal Investigators: Larry Peltz, FRED Division, Hydrologist FRED Division, Engineer FRED Division, and USFS staff.

COSTS: In FY 91: Approximately $103,000 Site reconnaissance, engineering, and hydrological analysis in FY 91 consisting of $30,000 in flight time, $25,000 for 6 mo. biologist, $18,000 for 4 mo. hydrologist, $18,000 for 4 mo. engineering. FY 92: Complete design work and detailed survey work on one project $50,000. FY 93: Construction begins. Construction cost $50,000 to $100,000 for typical fish pass in a small stream system with an elevation gain of approximately 15 ft (slope 20%).

PWS Stream Channelization Projects Low Priority:

Various stream channelization projects in Districts of Prince William Sound that no current NRDA damages are verified. Note: that this would be similar to PWS Stream Channelization Projects Medium Priority:, but without current injury link. In particular these projects would be consentrated in the Eastern District, Northern District, Northwest District, and Southeastern District.

Principal Investigators: Larry Peltz, FRED Division, Hydrologist FRED Division, Engineer FRED Division, and USFS staff.

COST: FY91: Approximately $103,000 Site reconnaissance, engineering, and hydrological analysis in FY 91 consisting of $30,000 in flight time, , $25,000 for 6 mo. biologist, $18,000 for 4 mo. hydrologist, $18,000 for 4 mo. engineering.
FY 92: $50,000 for design and detailed survey work on one project.
FY 93: $40,000 to $100,000 for final stream work.

Red Lake, Sockeye rehabilitation in adjacent statistical area Low Priority: Kodiak Island
Cost: $60,000
Principal Investigator: Lorne E. White, FRED Division
Detailed project proposal not available at this time.

Forest Service Habitat Rehabilitation Projects

Piggot Bay Spawning Channel
Harrison Creek Diversion
Chalmers river chum reintroduction (underway now)
Coho habitat improvement