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US Army Corps of Engineers

Seattle District
Regulatory Functions Branch
P. O. Box C-3755
Seattle, Washington 98124
(206) 764-3495
ATTN: Permit Processor

Public Notice of Application for Permit

1983

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OLYMPIA

Public Notice Date: 5 December 1983
Expiration Date: 4 January 1984
Reference: 071-OYB-4-009161
Name: Tacoma, Port of

x.6 7872-C

Interested parties are hereby notified that application has been received for Department of the Army permit in accordance with Section 404 of the Clean Water Act for certain work described below and shown on the inclosed prints.

APPLICANT - Port of Tacoma
Post Office Box 1837
Tacoma, Washington 98401
ATTN: Mr. Gary Kucinski
telephone (206) 383-5841

LOCATION - In wetlands adjacent to the Puyallup River at Tacoma, Washington.

WORK - Retain 1,000 cubic yards of fill material; place an additional 40,000 cubic yards of fill material.

PURPOSE (PER APPLICANT) - Construct a marine terminal.

ENDANGERED SPECIES - Preliminary determinations indicate that the activity will not affect endangered species, or their critical habitat, designated as endangered or threatened (Endangered Species Act of 1973). Formal consultation under Section 7 of the Act is not required.

CULTURAL RESOURCES - Presently unknown archeological, scientific, prehistorical or historical data may be lost or destroyed by work to be accomplished under the requested permit. The work is not located on a property registered in the National Register of Historic Places.

PUBLIC HEARING - Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

ADDITIONAL INFORMATION - The State of Washington is reviewing this work for consistency with the approved Washington Coastal Zone Management Program.

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12-28-83

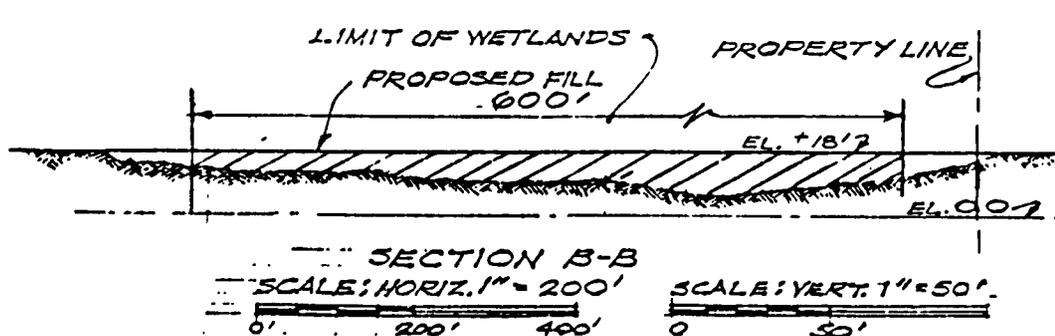
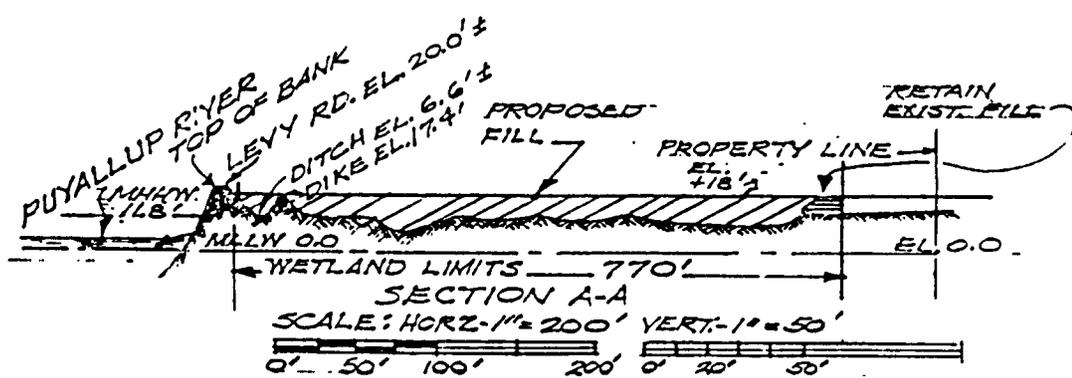
071-OYB-4-009161

The evaluation of the impact of the activity on the public interest will include application of the guidelines promulgated by the Administrator, EPA, under authority of Section 404(b) of the Clean Water Act.

EVALUATION - The decision whether to issue a permit will be based on an evaluation of the probable impact, including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food production and, in general, the needs and welfare of the people.

COMMENT AND REVIEW PERIOD - Comments on these factors will be accepted and made part of the record and will be considered in determining whether it would be in the best public interest to grant a permit. Comments should refer to the reference number shown above and reach this office, Attn: Regulatory Functions Branch, not later than the expiration date of this public notice to insure consideration.

1 Incl
Prints (2)



<p> PURPOSE: MARINE TERMINAL OPERATIONAL AREA DATUM: MLLW = 0.0' N.O.S. </p>	<p> PROPOSED: RETAIN FILL MATERIAL PLACE ADDITIONAL FILL MATERIAL IN WETLANDS ADJACENT TO THE PUYALLUP RIVER. AT: TACOMA, PIERCE COUNTY, WA. APPLICATION BY PORT OF TACOMA SHEET 2 OF 2 NOV, 1983 071-018-4-000-41 </p>
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WPSOP-RF
Application No. 071-OYB-4-U09161

Name of Applicant Port of Tacoma

Effective Date 26 MAR 1984

Expiration Date (If applicable) See condition "o"

DEPARTMENT OF THE ARMY
PERMIT

- Referring to written request dated 26 October 1983 for a permit to:
- () Perform work in or affecting navigable waters of the United States, upon the recommendation of the Chief of Engineers, pursuant to Section 10 of the Rivers and Harbors Act of March 3, 1899 (33 U.S.C. 403);
 - (x) Discharge dredged or fill material into waters of the United States upon the issuance of a permit from the Secretary of the Army acting through the Chief of Engineers pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344);
 - () Transport dredged material for the purpose of dumping it into ocean waters upon the issuance of a permit from the Secretary of the Army acting through the Chief of Engineers pursuant to Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (86 Stat. 1062; P.L. 92-532);

Port of Tacoma
P.O. Box 1837
Tacoma, Washington 98401

is hereby authorized by the Secretary of the Army:
to retain 1,000 cubic yards of fill material and place an additional 40,000 cubic yards of fill material (construct a marine terminal)

in wetlands adjacent to the Puyallup River

at Tacoma, Washington

in accordance with the plans and drawings attached hereto which are incorporated in and made a part of this permit (on drawings, give file number or other definite identification marks.) 071-OYB-4-009161, 2 sheets

subject to the following conditions:

I. General Conditions:

a. That all activities identified and authorized herein shall be consistent with the terms and conditions of this permit; and that any activities not specifically identified and authorized herein shall constitute a violation of the terms and conditions of this permit which may result in the modification, suspension or revocation of this permit, in whole or in part, as set forth more specifically in General Conditions j or k hereto, and in the institution of such legal proceedings as the United States Government may consider appropriate, whether or not this permit has been previously modified, suspended or revoked in whole or in part.

ENG FORM 1721, Sep 82

EDITION OF 1 JUL 77 IS OBSOLETE

(ER 1146-2-303)

5-10-1-12

b. That all activities authorized herein shall, if they involve, during their construction or operation, any discharge of pollutants into waters of the United States or ocean waters, be at all times consistent with applicable water quality standards, effluent limitations and standards of performance, prohibitions, pretreatment standards and management practices established pursuant to the Clean Water Act (33 U.S.C. 1344), the Marine Protection, Research and Sanctuaries Act of 1972 (P.L. 92-532, 86 Stat. 1052), or pursuant to applicable State and local law.

c. That when the activity authorized herein involves a discharge during its construction or operation, or any pollutant (including dredged or fill material), into waters of the United States, the authorized activity shall, if applicable water quality standards are revised or modified during the term of this permit, be modified, if necessary, to conform with such revised or modified water quality standards within 6 months of the effective date of any revision or modification of water quality standards, or as directed by an implementation plan contained in such revised or modified standards, or within such longer period of time as the District Engineer, in consultation with the Regional Administrator of the Environmental Protection Agency, may determine to be reasonable under the circumstances.

d. That the discharge will not destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species.

e. That the permittee agrees to make every reasonable effort to prosecute the construction or operation of the work authorized herein in a manner so as to minimize any adverse impact on fish, wildlife, and natural environmental values.

f. That the permittee agrees that he will prosecute the construction or work authorized herein in a manner so as to minimize any degradation of water quality.

g. That the permittee shall allow the District Engineer or his authorized representative(s) or designee(s) to make periodic inspections at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

h. That the permittee shall maintain the structure or work authorized herein in good condition and in reasonable accordance with the plans and drawings attached hereto.

i. That this permit does not convey any property rights, either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to property or invasion of rights or any infringement of Federal, State, or local laws or regulations.

j. That this permit does not obviate the requirement to obtain state or local assent required by law for the activity authorized herein.

k. That this permit may be either modified, suspended or revoked in whole or in part pursuant to the policies and procedures of 33 CFR 325.7.

l. That in issuing this permit, the Government has relied on the information and data which the permittee has provided in connection with his permit application. If, subsequent to the issuance of this permit, such information and data prove to be materially false, materially incomplete or inaccurate, this permit may be modified, suspended or revoked, in whole or in part, and/or the Government may, in addition, institute appropriate legal proceedings.

m. That any modification, suspension, or revocation of this permit shall not be the basis for any claim for damages against the United States.

n. That the permittee shall notify the District Engineer at what time the activity authorized herein will be commenced, as far in advance of the time of commencement as the District Engineer may specify, and of any suspension of work, if for a period of more than one week, resumption of work and its completion.

o. That if the activity authorized herein is not completed on or before 26th day of March, 19 87, (three years from the date of issuance of this permit unless otherwise specified) this permit, if not previously revoked or specifically extended, shall automatically expire.

p. That this permit does not authorize or approve the construction of particular structures, the authorization or approval of which may require authorization by the Congress or other agencies of the Federal Government.

q. That if and when the permittee desires to abandon the activity authorized herein, unless such abandonment is part of a transfer procedure by which the permittee is transferring his interests herein to a third party pursuant to General Condition t hereof, he must restore the area to a condition satisfactory to the District Engineer.

r. That if the recording of this permit is possible under applicable State or local law, the permittee shall take such action as may be necessary to record this permit with the Register of Deeds or other appropriate official charged with the responsibility for maintaining records of title to and interests in real property.

00210

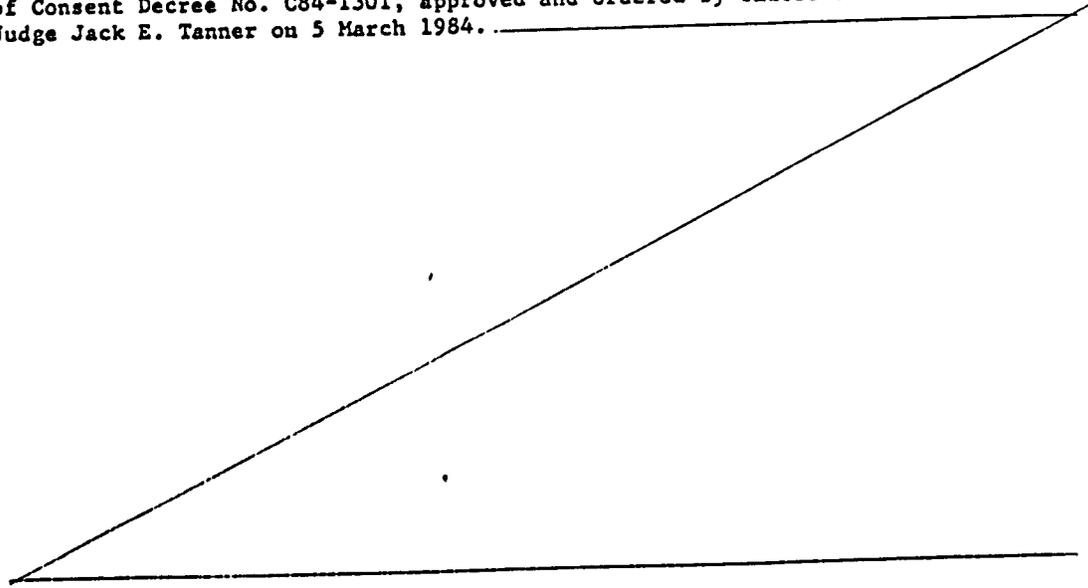
a. That there shall be no unreasonable interference with navigation by the existence or use of the activity authorized herein.

t. That this permit may not be transferred to a third party without prior written notice to the District Engineer, either by the transferee's written agreement to comply with all terms and conditions of this permit or by the transferee subscribing to this permit in the space provided below and thereby agreeing to comply with all terms and conditions of this permit. In addition, if the permittee transfers the interests authorized herein by conveyance of realty, the deed shall reference this permit and the terms and conditions specified herein and this permit shall be recorded along with the deed with the Register of Deeds or other appropriate official.

u. That if the permittee during prosecution of the work authorized herein, encounters a previously unidentified archeological or other cultural resource within the area subject to Department of the Army jurisdiction that might be eligible for listing in the National Register of Historic Places, he shall immediately notify the district engineer.

ii. Special Conditions: (Here list conditions relating specifically to the proposed structure or work authorized by this permit):

1. Permittee shall carry out the mitigation plan to create a freshwater tidal wetland on a 12-acre parcel of uplands adjacent to the Puyallup River. Permittee shall submit final topographic contours, planned plant community locations, and other specific details of the plan to the Seattle District of the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.
2. Permittee shall initiate the process of obtaining all required Federal, state, and local authorizations for the completed mitigation concept within 30 days of the issuance of this permit.
3. If the chosen mitigation site proves unsuitable for wetland creation, permittee shall develop an alternate mitigation plan in consultation with the Seattle District of the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the Washington State Department of Ecology.
4. Permittee shall complete all mitigation work within 15 months of the issuance of this permit.
5. Nothing in these conditions shall supersede or overrule the provisions of Consent Decree No. C84-130T, approved and ordered by United States District Judge Jack E. Tanner on 5 March 1984.



The following Special Conditions will be applicable when appropriate:

STRUCTURES IN OR AFFECTING NAVIGABLE WATERS OF THE UNITED STATES:

a. That this permit does not authorize the interference with any existing or proposed Federal project and that the permittee shall not be entitled to compensation for damage or injury to the structures or work authorized herein which may be caused by or result from existing or future operations undertaken by the United States in the public interest.

b. That no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized by this permit.

c. That if the display of lights and signals on any structure or work authorized herein is not otherwise provided for by law, such lights and signals as may be prescribed by the United States Coast Guard shall be installed and maintained by and at the expense of the permittee.

d. That the permittee, upon receipt of a notice of revocation of this permit or upon its expiration before completion of the authorized structure or work, shall, without expense to the United States and in such time and manner as the Secretary of the Army or his authorized representative may direct, restore the waterway to its former conditions. If the permittee fails to comply with the direction of the Secretary of the Army or his authorized representative, the Secretary or his designee may restore the waterway to its former condition, by contract or otherwise, and recover the cost thereof from the permittee.

e. Structures for Small Boats: That permittee hereby recognizes the possibility that the structure permitted herein may be subject to damage by wave wash from passing vessels. The issuance of this permit does not relieve the permittee from taking all proper steps to insure the integrity of the structure permitted herein and the safety of boats moored thereto from damage by wave wash and the permittee shall not hold the United States liable for any such damage.

MAINTENANCE DREDGING:

a. That when the work authorized herein includes periodic maintenance dredging, it may be performed under this permit for _____ years from the date of issuance of this permit (ten years unless otherwise indicated);

b. That the permittee will advise the District Engineer in writing at least two weeks before he intends to undertake any maintenance dredging.

DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES:

a. That the discharge will be carried out in conformity with the goals and objectives of the EPA Guidelines established pursuant to Section 404(b) of the Clean Water Act and published in 40 CFR 230;

b. That the discharge will consist of suitable material free from toxic pollutants in toxic amounts.

c. That the fill created by the discharge will be properly maintained to prevent erosion and other non-point sources of pollution.

DISPOSAL OF DREDGED MATERIAL INTO OCEAN WATERS:

a. That the disposal will be carried out in conformity with the goals, objectives, and requirements of the EPA criteria established pursuant to Section 102 of the Marine Protection, Research and Sanctuaries Act of 1972, published in 40 CFR 220-228.

b. That the permittee shall place a copy of this permit in a conspicuous place in the vessel to be used for the transportation and/or disposal of the dredged material as authorized herein.

This permit shall become effective on the date of the District Engineer's signature.

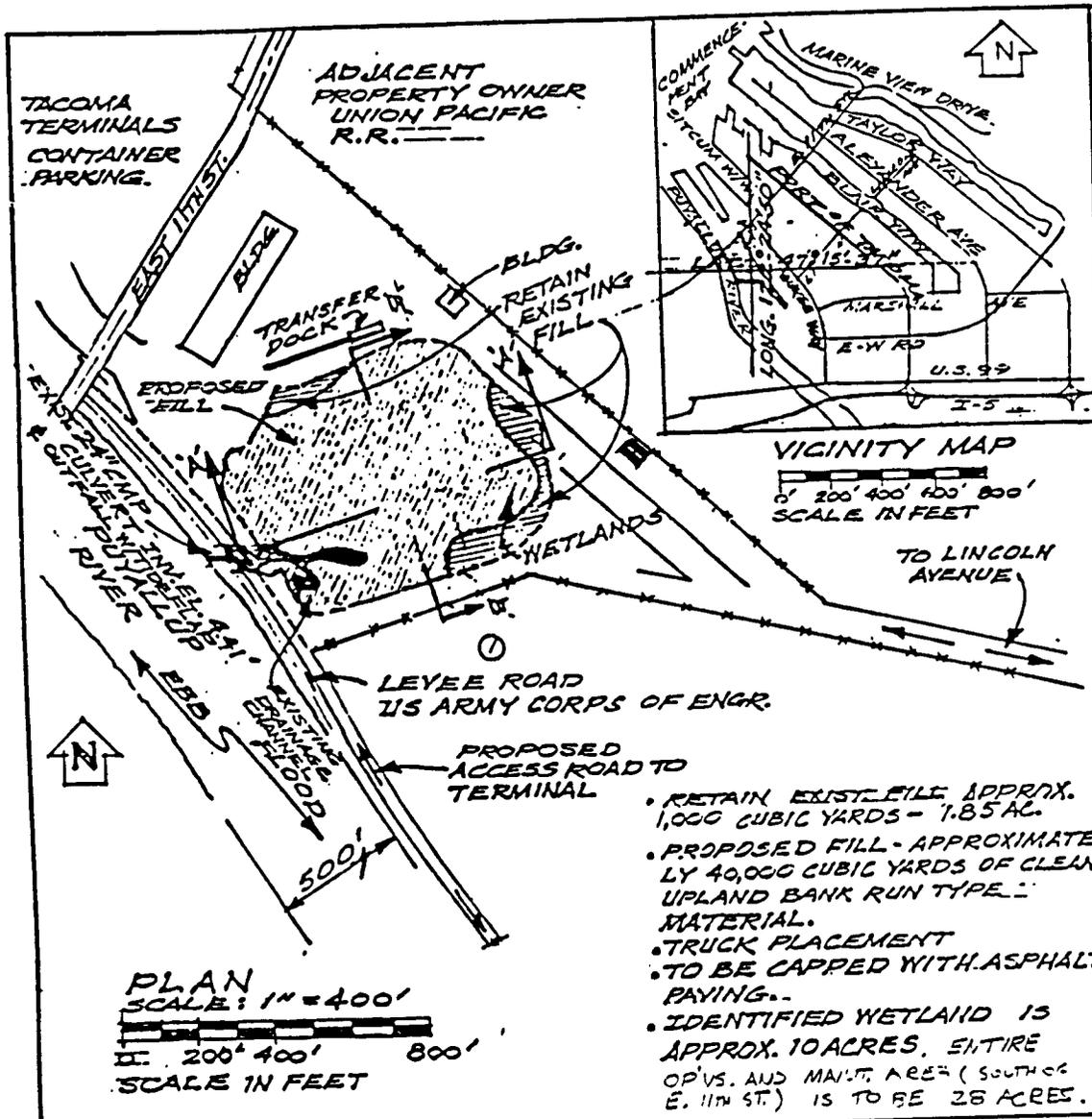
Permittee hereby accepts and agrees to comply with the terms and conditions of this permit.

1 Gary S. Kucinski March 26, 1984
PERMITTEE DATE

Port of Tacoma
BY AUTHORITY OF THE SECRETARY OF THE ARMY:
for Stephen A. Wright 26 March 1984
NORMAN C. HINTZ DATE
Colonel
DISTRICT ENGINEER,
U.S. ARMY, CORPS OF ENGINEERS

Transferee hereby agrees to comply with the terms and conditions of this permit.

TRANSFEEE DATE



- RETAIN EXIST. FILL APPROX. 1,000 CUBIC YARDS - 1.85 AC.
- PROPOSED FILL - APPROXIMATELY 40,000 CUBIC YARDS OF CLEAN UPLAND BANK RUN TYPE MATERIAL.
- TRUCK PLACEMENT
- TO BE CAPPED WITH ASPHALT PAVING.
- IDENTIFIED WETLAND IS APPROX. 10 ACRES. ENTIRE OPVS. AND MAINT. AREA (SOUTH OF E. 11th ST.) IS TO BE 28 ACRES.

PURPOSE: MARINE TERMINAL OPERATIONS AND MAINTENANCE AREA.

DATUM: MLLW. = 0.0' N.O.S.

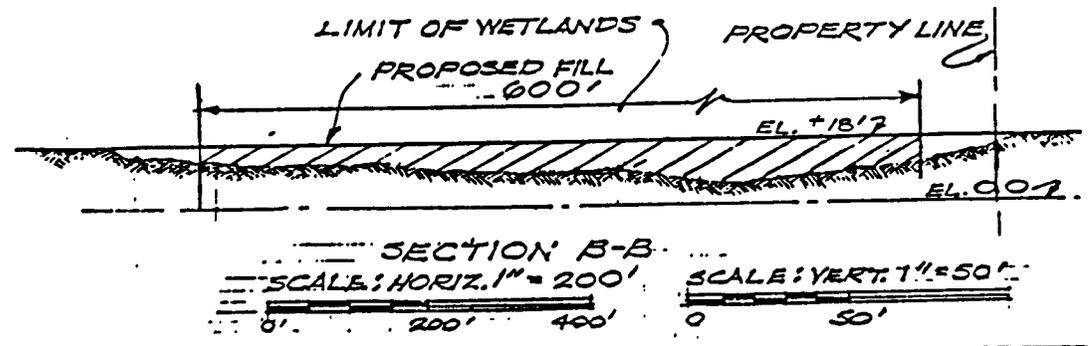
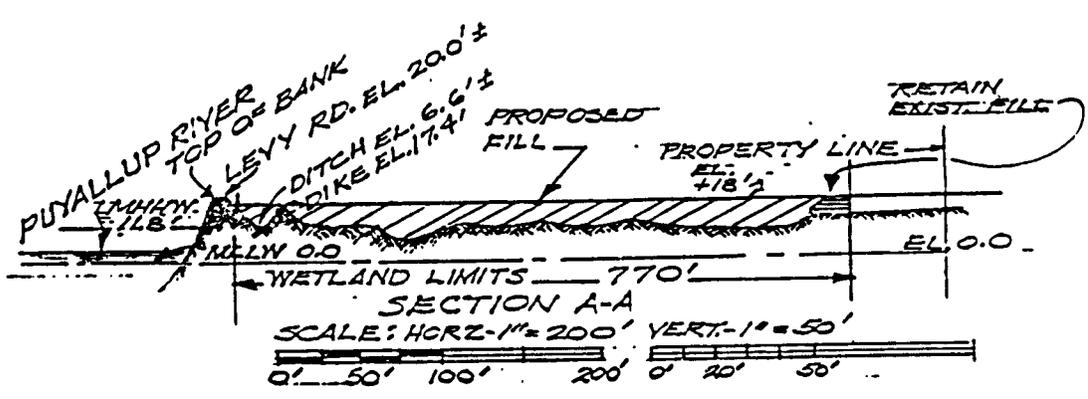
ADJACENT OWNERS:

① M^o FARLAND CASCADE.

PROPOSED: RETAIN FILL MATERIAL, PLACE ADDITIONAL FILL MATERIAL IN WETLAND ADJACENT TO THE PUYALLUP RIVER.

J. TACOMA, PERCE COUNTY, WA

APPLICATION BY PORT OF TACOMA



<p> PURPOSE: MARINE TERMINAL OPERATIONS & MAINTENANCE AREA DATUM: MLLW = 0.0' N.G.S. </p>	<p> PROPOSED: RETAIN FILL MATERIAL PLACE ADDITIONAL FILL MATERIAL IN WETLANDS ADJACENT TO THE PUYALLUP RIVER. AT: TACOMA, PIERCE COUNTY, WA. APPLICATION BY PORT OF TACOMA SHEET 2 OF 2 NOV, 1983 . 071-048-A-009161 </p>
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FRI-UW-9108
December 1991

WETLAND ECOSYSTEM TEAM
Fisheries Research Institute
School of Fisheries WH-10
University of Washington
Seattle, WA 98195

**THE GOG-LI-HI-TE WETLAND SYSTEM IN THE
PUYALLUP RIVER ESTUARY, WASHINGTON**

**Phase V Report: Year Five Monitoring,
January-December 1990**

RONALD M. THOM, CHARLES A. SIMENSTAD,
JEFFERY R. CORDELL AND LAURA HAMILTON

FINAL REPORT
to
PORT OF TACOMA



INTRODUCTION

As mitigation for filling a 9.6-acre parcel of land (Parcel 5; Fig. 1) containing wetland and upland habitats, the Port of Tacoma constructed a similarly sized wetland system. Construction included establishment of a sedge (*Carex lyngbyei*) marsh through initial transplantings. The new wetland system, located at the intersection of the Lincoln Avenue bridge and the Puyallup River (Fig. 1), was connected to the Puyallup River estuary via a breach in the river dike in February, 1986. Earlier reports (Thom et al. 1987, 1990; Shreffler et al. 1990) on the project detail the construction and monitoring results through 1989. This monitoring work has shown that transplanted sedge continues to dominate the vegetation in the system and that other species, especially cattails, have vigorously colonized the system. In addition, target resources including juvenile salmonids, shorebirds, and waterfowl occupied and utilized the system. On the basis of these findings, it was concluded that the wetland system satisfied ecological performance criteria established as part of the mitigation agreement (Thom et al. 1987, 1990; Shreffler et al. 1990). However, the system was in an early stage of development and, similar to any new ecological system, changes were expected in subsequent years.

The work in 1990, which was the fifth and final year of U.S. Army Corps of Engineers permit-required monitoring, included continued systematic sampling of sedimentation, vegetation, fish, and birds. In contrast to previous years, infauna and epibenthic zooplankton were not sampled in 1990. Very little change in the taxa composition of these assemblages was seen following the initial dramatic changes that occurred during the first year following construction. Thom et al. (1990) concluded that, although the density of infauna and epibenthic zooplankton probably will exhibit large fluctuations over time, the species in this assemblage appear to have stabilized very shortly after construction. In addition, infauna and epibenthic zooplankton were not a major part of the diet of juvenile salmonids in the system (Shreffler et al. 1990). Insects that either emerged from the marsh or were imported from the river were found to be much more important to the diet of the young salmon.

STUDY SITES

The wetland system contains an upland area with a grassland, cattail marsh, and swamp, and an intertidal area consisting of mudflats and channels (Fig. 2). In 1990, sampling of vegetation and fish was carried out in the intertidal area. Birds were sampled in all habitats. All flats except flat 5 were planted in 1986-1987 with *Carex*, and flat 5 served as an unplanted reference area.

Puget Sound Notes

Lincoln Avenue (1st St) Wetland
Article p. 2

CE: Don
Naren

Summer/Autumn, 1989

Editor: Jacques Faigenblum, Ecology
Contributors: Mike Rylko, EPA
Ron Thom, University of Washington
Pam Crocker-Davis, Ecology
Andrea Copping, PSWQA
Roberta Feins, PSWQA
Jack Gakstatter, EPA

Puget Sound Participation in "Coastal Zone '89"

"Coastal Zone '89" was the sixth in a series of biennial, multidisciplinary meetings on comprehensive coastal and ocean management. Professionals, citizens and decision makers met for four days, July 11-14, in Charleston, South Carolina to exchange information and views on matters ranging from regional to international in scope and interest. It was attended by more than 1,000 people from the United States and many other countries. Several hundred papers were presented, in more than 75 sessions, on topics covering engineering and science; data gathering and monitoring; law and politics; planning, conservation and development; regulation and citizen participation and social science, among others.

Puget Sound was well represented at "Coastal Zone '89": county, state, federal and tribal agency staff-members attended and presented the following papers:

"Boater Environmental Education in Puget Sound" by Nina Carter and Nancy Richardson Hansen

"Wetlands Mitigation Banking Prospects for the State of Washington" by Kittie Ford and Karen Glatzel

"Net-Pen Aquaculture and Resource Management" by Jeffrey Dickison

"Nonpoint Pollution Planning in Thurston County, Washington" by Jeanne Koenings and Neil Aaland

"The Politics of Nonpoint Pollution Management" by Nancy Richardson Hansen and Roslyn Glasser

"Developing Sediment Quality Criteria and Standards - Comprehensive Sediment Management in Puget Sound" by Catherine Krueger and Robert Barrick

"Environmental Problems and Solutions in Puget Sound" by Kirvil Skinnarland and Jack Gakstatter

"A Screening-Level Approach to Estimating Natural Resource Damages from Contaminated Marine Sediments" by Pieter Booth, Scott Becker, Robert Barrick and Gardner Brown Jr.

"Comparing the Regional Puget Sound Marine Monitoring Program with the NOAA National Status and Trends Program" by John Armstrong and Andrea Copping

"Decreased Fluxes of Pb, Cu and Zn from Elliott Bay" by Anthony Paulson, Thomas Hubbard, Herbert Curl Jr., Richard Feely, Timothy Sample and Robert Swartz

"Mortality of Amphipods in Toxicity Tests Conducted Using Different Flow Regimes" by Jack Word, Jeffrey Ward, Betsy Brown, Brian Walls, Sandy Lemlich and Mike Carlin

The proceedings of the conference were published immediately in five volumes totalling to some 5,000 pages. Copies are available to the public at the Environmental Protection Agency Region 10 Library and at the Puget Sound Water Quality Authority Office in Seattle.

GIS Development

In the fall of 1989, the Puget Sound Water Quality Authority (PSWQA), under a cooperative agreement with Environmental Protection Agency Region 10 (EPA), will begin to create a computerized Geographic Information System (GIS) for Puget Sound. The GIS will allow the production of maps that show the locations of and interrelationships between resources (e.g., kelp beds, fish spawning areas), environmental conditions (e.g., point pollution sources, shellfish harvesting area closures), and environmental data (e.g., sediment chemistry, bioassay results). This information will be used to analyze data from the Puget Sound Ambient Monitoring Program, update the Puget Sound Environmental Atlas, and support programs in the Puget Sound Water Quality Management Plan.

Since development of a GIS is very expensive and time-consuming, the first year's efforts will be devoted to mapping high priority data and combining it with existing information. This information will be usable by the EPA, the Authority, and other state agencies. For more information, contact **Roberta Feins**, PSWQA, telephone number: (206) 464-7945.

GIS Pilot Project

A number of federal, state and local agencies are currently working on a pilot project to use small-scale mapping and geographic analysis in non-point pollution source monitoring in Puget Sound. The project, a cooperative effort which includes the Puget Sound Water Quality Authority, the Puget Sound River Basin Team, the State Departments of Ecology and Natural Resources, the Tulalip Tribes, the Snohomish County Conservation District, and the Stillaguamish Watershed Management Committee, is taking place in the Portage Creek areas of the Stillaguamish River watershed.

Different organizations are doing surveys of land ownership, land-uses and farm management practices, fisheries habitat, and water quality. This information will be analyzed, integrated and modelled using a computerized geographic information system (GIS). A final report for the project is due to be published in spring of 1990. For more information, contact **Roberta Feins**, PSWQA, telephone number: (206) 464-7945.

Another Look at Wetland Mitigation

Introduction and Background

For centuries they were viewed as problem areas to be diked and filled. But in 1989, both resource agencies and the general public are becoming aware that wetlands function as extremely important fish and wildlife habitats and as important natural environments that trap nutrients and sediments and attenuate flooding. Natural wetland communities are now commonly regarded as valuable resources. Growing awareness among scientists, regulators, and the public regarding the critical ecological role of wetlands and nearshore systems in Puget Sound may have slowed the loss rate of some wetland types, but important losses are still occurring, especially in the fast growing semi-rural areas of the Puget Sound basin.

The geology of Puget Sound is such that many wetlands occupy areas that are considered highly suitable for development. Because of their proximity to the water and often desirable location, wetlands are frequently lost to residential, commercial, industrial and agricultural development. In fact, approximately 70% of the tidally-influenced emergent wetlands in Puget Sound have been lost due to diking, dredging, and filling (Bortelson, 1980). In the case of freshwater wetlands, we do not have a reliable estimate of the proportion of resource that has already been lost, but ongoing losses associated with population growth and land conversion are considered to be significant. Furthermore, continuing degradation of the quality of remaining wetland systems is impairing their ecological functioning.

In the midst of these continuing pressures on our wetland resources, most state and federal resource agencies have adopted a permitting strategy that includes the use of wetland replacement, known as compensatory mitigation. The goal of this strategy is to offset and reverse the continuing trend in the loss of critical fish and wildlife habitats and other wetland functions. This is done by requiring the replacement of wetlands lost to the impacts of shoreline development. Such mitigation can consist of either wetland creation or restoration and enhancement of wetland systems already severely degraded by human activities.

It is important to note that mitigation is only considered after the development application has met permitting requirements. That is, compensatory mitigation is not used to determine if a project permit is to be granted, but rather as a requirement to offset the losses associated with projects that are likely to be approved on their own merits and that are acknowledged to have an unavoidable and adverse impact.

Overview of the Problem

Most resource agencies have adopted a policy goal of "no net loss of wetland functions and values" to maintain the area, variety, and function of specific wetland environments. In practice, however, one-to-one wetland replacement is seldom achieved with respect to area, diversity, or function. There are at least two important reasons for this. First, it is technically very difficult to reproduce the complexity of natural wetland ecosystems. The degree of complexity varies between different types of wetlands. There are some types of wetland systems which simply cannot be 'rebuilt' within our political or regulatory timeframes: freshwater bogs and forested wetlands are good examples of this. The advance of wetland restoration technology should improve the general effectiveness of compensation efforts, but some mitigation projects or components of such projects will continue to fail. This has to be expected with any experimental science. But also, no two wetlands are exactly alike, and occasional failures should be expected because of the subjective design considerations that are necessary within the field of ecological restoration.

The second major reason why one-to-one replacement is seldom achieved is attributed to the resource agencies' failure to require sufficient mitigation. Between 1980 and 1986, only 2% of all Section 404 wetland development permits issued in Washington required compensatory mitigation. For those 2%, replacement of only two-thirds of the area, diversity, and function of the lost wetlands was required (Kunz *et al.*, 1988), and these figures do not take into account project failures or defaults. A number of studies have concluded that in order to achieve one-to-one compensation for wetland losses, some amount in excess of one-to-one must be required (Race, 1985; Eliot, 1985; Baker, 1984).

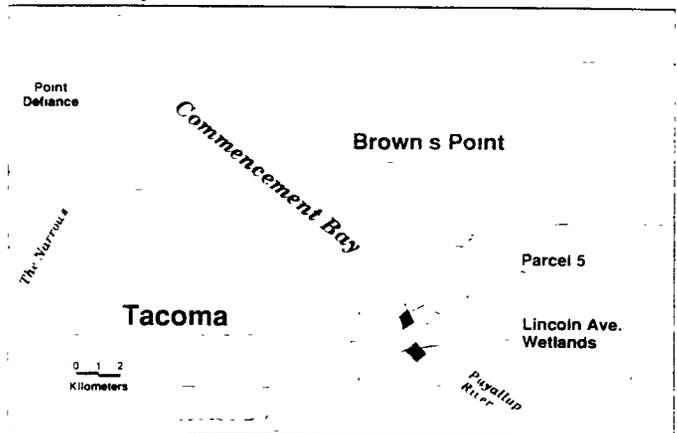
For these reasons, local officials have been extremely conservative in using compensatory mitigation to resolve development/preservation conflicts. Instead, there has been a general effort to avoid the adverse impacts in the first place. However, a more balanced, effective, and predictable wetland mitigation process has the potential to better serve both the resource and development interests alike. The following case study of one of the more comprehensive wetland restoration projects illustrates such potential.

Case Study; the Lincoln Avenue Wetland System in Tacoma

Historical background.

In spring of 1984, the Port of Tacoma filled a 9.6 acre wetland known as Parcel 5, located adjacent to the Puyallup River near the 11th St. Bridge (Figure 1). The Section 404 permit allowing the fill was granted provided the following conditions were met: (1) the environmental impacts of the fill be mitigated through construction of a comparably sized or larger wetland; (2) the wetland must be functional within one year; (3) the ecological "performance" of the wetland must be maintained in perpetuity; and 4) to evaluate the performance of the system, monitoring was required.

Figure 1.
Location of Parcel 5 and the Lincoln Avenue Wetland System.



Parcel 5 and the mitigation site are located on the Puyallup River delta. During the last 100 years, this delta has seen dramatic wetland losses due to filling and dredging, and now contains 14 acres of the original 1,900 acres of wetland present in 1880 (Bortelson 1980). Construction of a river dike in the late 1940's resulted in loss of direct connection of Parcel 5 and other wetlands to the river. Filling of much of the wetlands adjacent to the river subsequently took place in this area. A faulty tide gate in the dike maintained a small connection between Parcel 5 and the Puyallup River. Parcel 5 was described by Boule and

Dybdahl (1981) as a freshwater tidal wetland with cattails, spike rush, bulrush, reedtop, and occasional saltgrass. Fish, in particular juvenile salmon, were essentially excluded from Parcel 5 due to the dike and tide gate. However, export of organic matter produced in the wetland were likely to have been of benefit to the estuarine ecosystem. The Puyallup Tribe has a historical interest in the site from the standpoint of wildlife and fisheries support. Tribal biologists had observed a variety of wildlife in the area including marsh hawks, Canada geese, great blue heron and California quail.

The Lincoln Avenue mitigation site was chosen primarily because of its proximity to Parcel 5 and the Puyallup River estuary, and because it was also owned by the Port of Tacoma. Much of the Lincoln Avenue site had been used as a refuse landfill which had subsequently been covered with a layer of fill dirt. A small portion contained a cattail marsh surrounded by cottonwood trees. The remainder was occupied primarily by shrubby vegetation.

Discussions among resource agencies, the Port of Tacoma, Corps of Engineers, Dr. Ernest Salo of the University of Washington and the Puyallup Indian Tribe resulted in a list of general objectives that were to be accommodated by the restoration effort. The working group specified that 50% of the site would be designed to benefit juvenile salmon, 20% waterfowl, 10% shorebirds, 10% raptors and 10% small mammals. Considerable habitat overlap occurs among the target indicator species, a fact that minimized the problem of assuring that the areal cover criteria were met. There was no

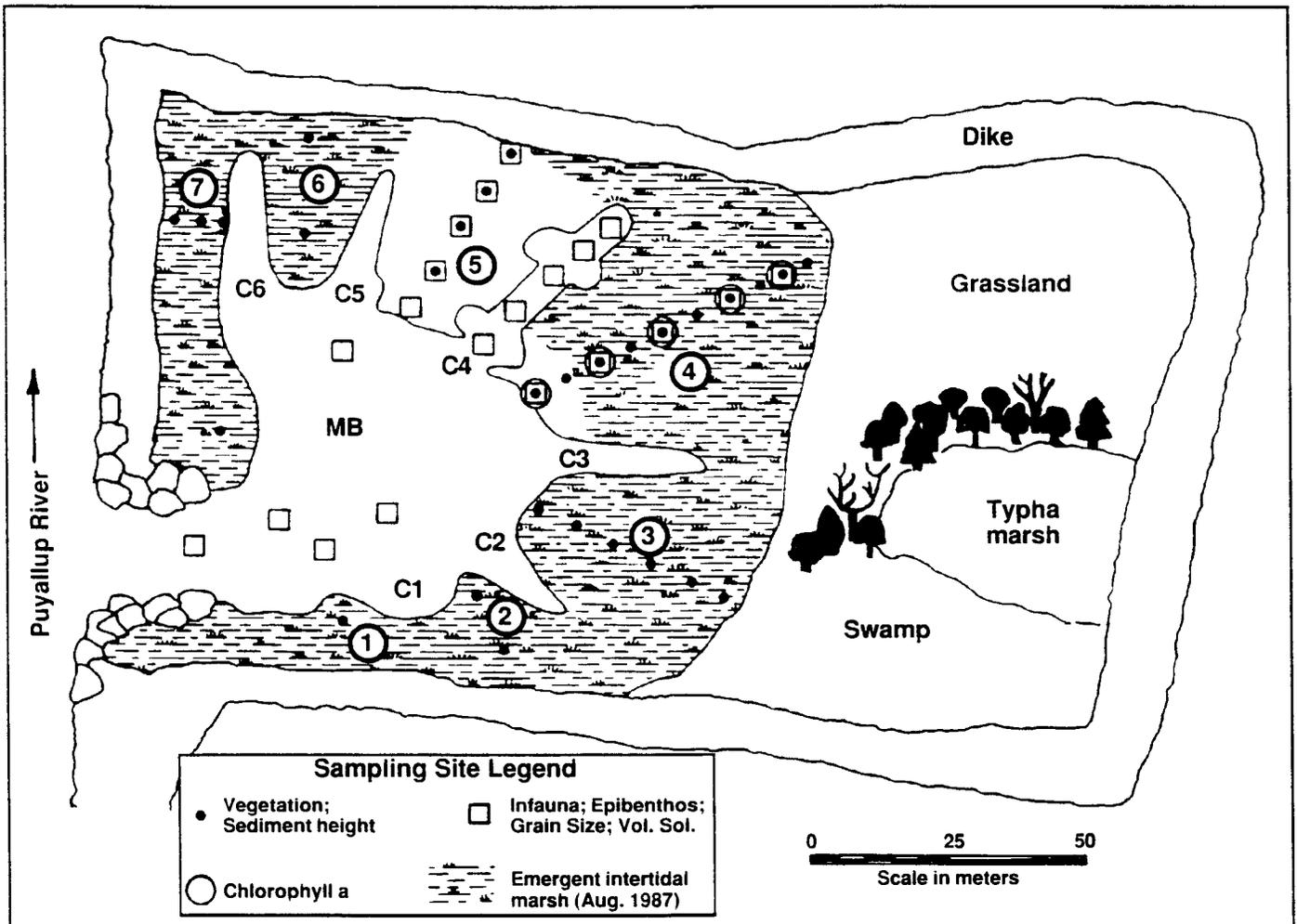
specific contingency plan other than that the Port was required to maintain the functional performance in perpetuity. This meant that the Port needed to identify and solve problems as they arose.

Construction

Groundbreaking took place on 9 July 1985. Excavation, construction of a new river dike to surround the system, removal of a small pocket of soil contaminated with PCB's, and rerouting of a buried oil pipeline took 7 months. The dike was breached on February 20th, 1986, connecting the River to the intertidal portion of the system. A storm two days later deposited extensive amounts of logs and wood debris onto the flats covering approximately 60% of the intertidal portion of the system. This material was largely removed by tidal action within a week.

Transplanting of the wetland sedge *Carex lyngbyei* commenced in April of 1986 and continued into July. Transplanting consisted of placing 2-3 shoots of sedge in holes spaced approximately 2.5 ft apart on all but one of the flats (Figure 2). This latter flat was to be used as a control for assessing natural colonization. A total of 37,150 shoots were planted by hand in 1986. Monitoring showed that areas planted latest (i.e., in late June and July) had poor plant survival. These areas were replanted with an additional 12,000 shoots in spring 1987. *Carex* was chosen because: (1) it occurred commonly in similar systems; (2) it is highly productive; (3) use by juvenile salmon is documented; (4) success in transplanting the species is documented on a limited basis in the northwest; and,

Figure 2. Details of Wetland System with Sampling Sites for Monitoring Programs. Intertidal Flats Are Numbered 1-7, Channels are Numbered C1-C6, and MB = Mid Bay.

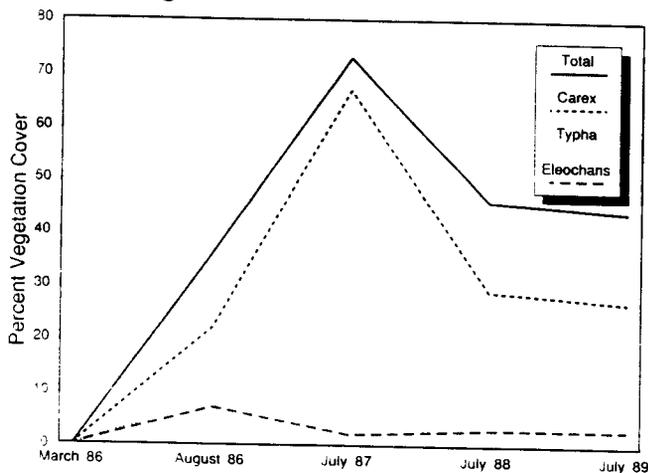


(5) shoots of this species were readily available from nursery stock. Although reliance on a single plant species was not optimal, it was thought that other species would naturally colonize the flats and fill areas where *Carex* did not survive. Ecological studies had demonstrated the importance of unvegetated sand and mudflats to juvenile salmon in the region (Simenstad and Wissmar 1985, Thom et al. 1989). So, even if no plants colonized the flats, fish and shorebirds would still benefit from sediment-associated algal and invertebrate production. This latter fact essentially provided one component of the contingency plan for ensuring improved ecological function at the site.

Performance.

In the first five months of the Lincoln Avenue wetland, between March and July 1986, 11 species of freshwater and estuarine fish were collected by beach seines of the wetland. Four of the five species of salmon were collected in the beach seine between mid-March and mid-June. The number of species of fish caught in the wetland has steadily increased since 1986 (Table 1). However, the University of Washington's Wetland Ecosystem Team (WET) knew that the presence in the system did not verify utilization and, therefore, the functional performance of the system had not been proven. Hence, WET conducted a series of experimental studies on salmon utilization in 1987 and 1988 to assess the number of fish accessing the system from the river, the residence time of juvenile salmon in

Figure 3.
The Percentage of Intertidal Flat Covered by Emergent Vegetation.



the system and the predation on resident invertebrates by the juvenile salmon (Shreffler, 1989). Shreffler found that 2.80% of the total chum outmigrant population and 0.38% of the total chinook outmigrant population in the river entered the wetland. Average residence time for chums was 2 days, and 5 days for chinook. The salmon fed primarily on insect larvae that were either produced in the wetland or were being imported from the river and concentrated in the wetland. Juvenile salmon showed significant increases in weight while resident in the wetland. Thus, the function of the wetland for feeding and refuge of juvenile salmon does appear to be developing.

The vegetation on the planted intertidal flats has undergone dramatic changes since transplanting. *Carex* abundance rose from an initial density of 37,150 plants to roughly 151,180 plants by the end of the first growing season in 1986. Approximately 280,000 *Carex* shoots were present in the system in August of 1987. By the end of the growing season in 1988, abundance had declined to about 60,000 shoots. The decline in *Carex* is probably in direct response to a vigorous colonization by cattails especially on the landward edges of the flats, a die-off of *Carex* transplanted at the wrong tidal elevation, and the increased size

Table 1

Species of fish taken in beach seine samples (+) from the tidal channels and inlet fyke net samples (x) from the mouth of the Lincoln Avenue wetland, 1986-1988.

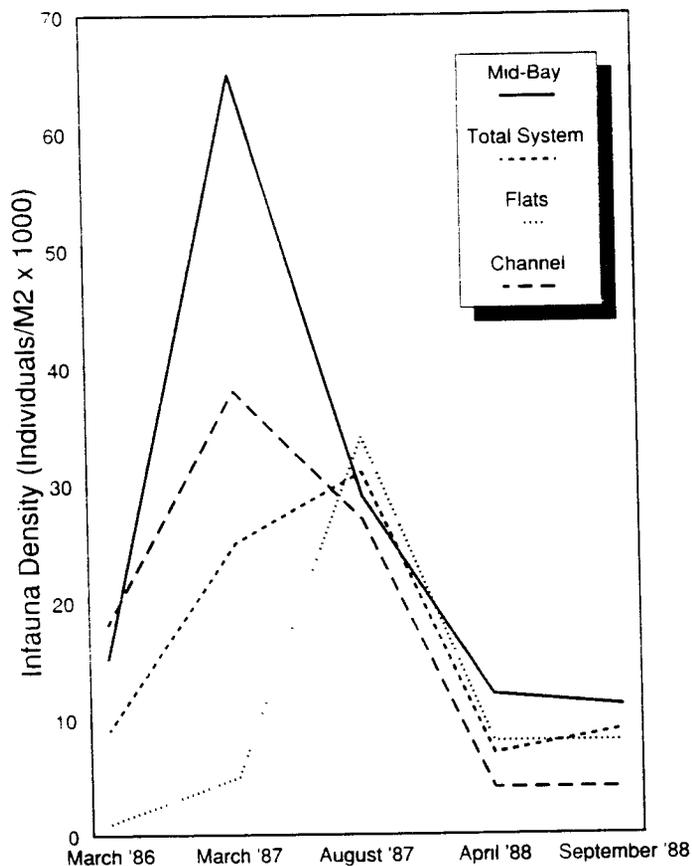
Family	Species/Common Name	1986	1987	1988
Petromyzontidae	<i>Lampetra richardsoni</i> (brook lamprey)*		x	x
	<i>L. ayresi</i> (river lamprey)*		x	
Salmonidae	<i>Prosopium williamsoni</i> (mountain whitefish)	+	+x	+x
	<i>P. coulteri</i> (pygmy whitefish)*		+	
	<i>Oncorhynchus gorbuscha</i> (pink salmon)	+		+x
	<i>O. keta</i> (chum salmon)	+	+x	+x
	<i>O. kisutch</i> (coho salmon)	+		
	<i>O. mykiss</i> (steelhead)*			x
	<i>O. tshawytscha</i> (chinook salmon)	+	+x	+x
Osmeridae	<i>O. clarki</i> (cutthroat trout)			x
	<i>Thaleichthys pacificus</i> (eulachon)		x	x
Cyprinidae	<i>Rhinichthys cataractae</i> (longnose dace)		+x	+x
	<i>Richardsonius balteatus</i> (redside shiner)	+	+x	+x
Ictaluridae	<i>Ictalurus nebulosus</i> (brown bullhead)*	+	+x	+x
Catostomidae	<i>Catostomus macrocheilus</i> (largescale sucker)	+	+x	+x
Gasterosteidae	<i>Gasterosteus aculeatus</i> (three-spine stickleback)	+	+x	+x
	<i>Pomoxis nigromaculatus</i> (black crappie)*			x
Centrarchidae	<i>Lepomis macrochirus</i> (bluegill sunfish)*		x	x
	<i>Ambloplites rupestris</i>			x
Cottidae	<i>Cottus asper</i> (prickly sculpin)	+	+x	+x
	<i>Leptocottus armatus</i> (Pacific staghorn sculpin)	+	+x	+x
Pleuronectidae	<i>Platichthys stellatus</i> (starry flounder)	+	+x	+x

* uncommon; fewer than 5 individuals collected.

of individual *Carex* shoots. Cattail shoots on the order of 9 ft high are common in late summer in the system. *Carex* has also been lost from the seaward ends of the flats, perhaps due to physical processes (i.e., currents, sedimentation) and grazing by birds. *Carex* persists in dense stands primarily along the southern and eastern edges of the system, reminiscent of stands commonly seen along stream banks. The unplanted control area still remains largely unvegetated except for a dense band of *Eleocharis* at the base of the surrounding dike. Between 1988 and 1989, vegetation cover appeared to have stabilized (Figure 3).

Sediment-associated microalgae (e.g., diatoms and bluegreens) are evident on the flats, and analysis of sediment chlorophyll-a content documented their high standing stock (150- 800 mg/m²). Infaunal invertebrates also showed a marked increase in density between 1986 and 1987 (Figure 4). By 1988, densities declined in a manner similar to the trends observed with vegetation cover. Infauna taxa composition remained similar between 1987 and 1988. Other invertebrate fauna, as typified by small epibenthic crustaceans (meiofauna)

Figure 4.
Mean Infauna Densities in the System.



has shifted from a freshwater type to one typical of brackish water systems between 1986 and 1987 (Table 2).

Over 90 species of birds have been observed in the system. Although baseline information on bird presence in the Lincoln Avenue parcel prior to construction and Parcel 5 prior to filling was incomplete, bird abundances and species richness are probably much higher in the new intertidal portion of the Lincoln Avenue system. Birds appear to be feeding in the system, and nesting of green-backed herons and mallards has been observed. The interspersed and adjacency of the different habitat types also appears to contribute to this increased utilization. For example, swallows that are generally found in the upland portion of the system, are commonly observed feeding on insects in the intertidal portion of the system. A marsh hawk (northern harrier) has been observed hunting in the system, although sightings have been rare. Waterfowl are common and persistent residents of the system. Observations indicate that grazing by Canada geese and other waterfowl may crop significant amounts of new *Carex* growth each spring and summer, and may have been responsible for uprooting clumps of shoots shortly after transplanting. Pheasant inhabit the vegetation on the steep slopes of the dike wall. Red-winged blackbirds are abundant in the upland cattail marsh.

No monitoring work has been done on the small mammals in the system. The habitats that existed prior to construction appear to be healthy, and small mammal populations probably inhabit these areas.

Threats to the system.

Sediments from the heavily sediment-laden Puyallup River have been accumulating in the channels and mid-bay portion of the wetland. Sedimentation has also occurred on the flats, although to a lesser extent. As of the spring of 1989, river

Table 2
Relative abundance of taxa collected in infauna samples. Values are the percentage of total number of individuals collected each date.

Taxon	March 1986	March 1987	August 1987	April 1988	September 1988
Insect	78%	1%	<1%	4%	2%
Harpacticoid	9%	3%	0%	<1%	0%
Oligochaete	8%	89%	99%	92%	95%
Nematode	4%	6%	6%	<1%	1%
Ostracod	1%	0%	0%	0%	0%
Corophium	0%	2%	0%	0%	0%
Gammarid	0%	<1%	<1%	<1%	0%
Polychaete (nereid)	0%	0%	<1%	0%	<1%
Mysid	0%	0%	<1%	0%	0%
Gastropod (juv.)	0%	0%	<1%	0%	0%

heights were adequate for fish to use the system. During low flow periods of late summer, little water is retained in the channels at low tide. If adequate water remains in the system during the critical period of salmon outmigration in spring, no action need be taken. If filling prevents or significantly impedes salmonid use, dredging may be required to open up the deeper portions of the system. Dredging would destroy the existing benthic community and alter the system in other ways, and is therefore viewed as a last resort. It is hoped that the system will reach a dynamic equilibrium, where open water is maintained by natural tidal flushing and erosion over the annual cycle. It is very difficult to predict when and at what elevation this equilibrium may occur. However, the rate of sedimentation appears to have slowed.

Trash, either dumped directly into the system or imported from the river, significantly degrades the aesthetic quality of the area. Because the area was used as a public dump for many years, the perception lingers that the area is appropriate for continued dumping. More significantly, because of the highly industrial nature of the surrounding area, there is the potential for toxic releases to affect the ecology of the wetland. The wetland is scheduled for improvements, including interpretive signs, more tree planting to provide buffers from noise and traffic, and access to motor vehicles will be limited. Hopefully, these actions will reduce the threat from continued dumping and other types of disturbance. Of note is that people utilize the dike surrounding the wetland for lunching and birding activities. The Tacoma Chapter of the Audubon Society has taken a keen interest in the site.

Conclusions

Based on post-construction monitoring, the Lincoln Avenue wetland appears to be developing the functions for which it was designed and these functions were evident within one year of its physical completion; wetland scientists believe that it will take a number of years before the wetland becomes functionally mature. Mature vegetation and invertebrate communities appear to be developing. Sedimentation and trash threaten to alter the original design of the system, but contingency plans are being developed to deal with the threats. The Port of Tacoma is committed to maintaining a functional system. Monitoring of the functional performance has been critical to advancing our understanding of the early development of a constructed system of this type, and will be critical in providing needed information to help maintain future functional performance.

Elements of Successful Plans

The above case study illustrates the development of what is considered to be a successful mitigation project. However, both Cooper (1987) and Kunz et al (1988) have since recommended a specific suite of mitigation design elements to enhance the likelihood of project success. To ensure better projects, agencies are now requiring developers to document the technical feasibility of their proposed compensation techniques.

It is presumed that a questionable methodology is not likely to be approved for mitigation. In fact, many developers already have recognized that good design is in their own interests, and that each well-executed project makes it more likely that other mitigation proposals will be accepted within the permitting process. The specific elements of a successful mitigation plan include:

- baseline data identifying and characterizing the extent and value of wetland functions and values including the abundance and distribution of important species and community assemblages at both the proposed project and mitigation sites;
- specific goals and objectives of the mitigation actions;
- detailed work plans describing and specifying mitigation techniques, including maintenance requirements and relevant timelines;
- an adequate replacement ratio to ensure that there is no net loss of resource area (this ratio will usually be dependent on the complexity of the habitats under consideration). This replacement ratio should also reflect the time component of ecological loss which usually consists of at least several growing seasons;
- inclusion of landscape criteria including buffer strips and site connection or adjacency to hydrologic and ecological corridors;
- performance standards to be used to measure whether mitigation goals are being met;
- monitoring plans describing schedules and types of data to track mitigation progress;
- contingency plans describing corrective actions if proposed mitigation techniques don't meet minimum expectations; and
- performance bonds ensuring commitment to fulfill mitigation actions, monitoring, and contingency measures.

Lessons Learned

To date, resource agencies have not been effective in offsetting wetland losses through the use of mitigation. Furthermore, the effectiveness of most mitigation projects has been clouded by the lack of clear environmental goals, performance standards, and monitoring criteria. Objective evaluations depend on these three elements being clearly defined. It is often these elements that are found missing from proposed mitigation plans (Kunz et al. 1988). In addition, the lack of standardized monitoring protocols has hindered both the interpretation and subsequent use of collected data. Instead of learning from our previous successes and mistakes, we tend to approach each successive project anew, missing important opportunities to be more cost and resource efficient.

Mitigation projects typically involve multiple agencies, each concerned with slightly different issues. Unless there is clear agreement at the outset on the specific goals and objectives of a given mitigation, project oversight may become fragmented and important issues may be overlooked or forgotten. In these instances, agency "memory" can be surprisingly short, especially when there is staff turnover.

These findings reflect the problems that agencies within the region have experienced in measuring the success of mitigation projects. These problems are being worked on. The Puget Sound Estuary Program, in conjunction with EPA's Wetlands Program, state resource agencies, the Puget Sound Water Quality Authority, the Ports of Seattle and Tacoma, local tribes, and the University of Washington's Wetlands Ecosystem Team have been working to develop mitigation monitoring protocols in an effort to improve interagency coordination and overall mitigation effectiveness. These initial monitoring protocols are directed at estuarine wetland systems and will focus only on fish and wildlife habitat criteria, but it is hoped that the process will be applied in the development of other needed wetland monitoring criteria. Similarly, the Washington State Department of Transportation is working on parallel protocols

for monitoring water quality, productivity, and habitat use within freshwater wetlands.

But, perhaps the most important lesson is that compensatory mitigation is not a panacea. Functional replacement of wetland ecosystems is extremely difficult to achieve, and most mitigation plans seek simply to maintain habitat for a very limited number of fish and wildlife habitat, rather than to replace the full spectrum of wetland values and functions. Compensatory mitigation is being relied upon as an important tool in easing conflict between development and protecting critical wetland resources, but the success of many mitigation techniques and the effectiveness of resource agencies in using mitigation to achieve resource management objectives, particularly with respect to preventing a net loss of our wetland resources, have yet to be established.

Acknowledgements

Dr. Ernest Salo and several resource agency representatives were instrumental in the development of the mitigation plan for Parcel 5 and for the scientifically based objective monitoring program. R. Albright, C. Simenstad, J. Cordell, D. Shreffler, J. Hampel, and R. Thom formed the core of Dr. Salo's wetland group at the University of Washington. The Port of Tacoma, especially Leslie Sacha and Gary Kucinski, have provided needed support for the monitoring work. The Puyallup Tribe and the Tacoma Audubon Society have provided broad and comprehensive observations on resources in the system.

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CC: Dave G...
Bob ...

February 29, 1984

Mr. Frank R. Lockard, Director
Washington State Department of Game
600 N. Capitol Way, M/S GJ-11
Olympia, WA 98504

Subject: Public Notice No. 071-OYB-4-009161, Tacoma, Port of

Dear Mr. Lockard:

The Port of Tacoma has requested a permit to place fill in wetlands adjacent to the Puyallup River for construction of a marine terminal. Based upon a well-coordinated and carefully prepared mitigation plan, the United States Department of Interior Fish & Wildlife Service and other resource agencies have responded to the Corps of Engineers that they do not object to the issuance of the permit for this project provided the following conditions are made part of the permit.

1. The Port of Tacoma will adhere to designs and concepts contained in two documents:
 - a. The Potential For Development of a River Tidal Marsh and Juvenile Salmonid Artificial Rearing Facility on the Puyallup River Delta by Douglas J. Martin and Ernest O. Salo dated August 1983.
 - b. A follow-up to that report titled, Summary of Wetland Concept by Ron Thom and Ernest O. Salo bearing no date.
2. The Port of Tacoma will take whatever measures are necessary to ensure the viability of the wetland. If creation of the wetlands at the chosen site is infeasible, another site will be used and/or other mitigation acceptable to the resource agencies will be accomplished.
3. Plant growth and benthic productivity will be monitored for five years following completion of construction of the wetland.
4. Construction of the mitigation site will begin during the summer of 1984 and be completed within one year.

The Port of Tacoma agrees with these conditions and will abide by them.

Yours very truly,

Gary Kucinski
GARY KUCINSKI
Director of Planning
and Research

GK:kg

cc: Mr. Ted Muller
Game Program Manager, Regional Habitat
Region #4



COMMISSIONERS: ROBERT C. EARLEY, JACK A. PABST, JOHN R. TRICK, CHRISTOPHER L. RICHARD DALE SMITH
EXECUTIVE DIRECTOR

February 3, 1984

Mr. Jack Kennedy
Regulatory Functions
U.S. Army Corps of Engineers
P.O. Box C-3755
Seattle, WA 98124

FEB 6 1984

Subject: Public Notice #071-OYR-4-009161-Tacoma, Port of

Dear Jack:

With reference to the letter I wrote to you and all the agencies dated January 24, 1984, regarding the above, Carl Kassebaum of EPA has requested some further information which is provided below.

Carl felt it was important to address three items:

- (a) Timing of mitigation work;
- (b) DOE's position; and
- (c) What happens if, for some reason, the selected wetland creation site seems infeasible.

Following is the best available information:

- (a) The Port proposes to begin excavation of the mitigation site in August 1984. A permit application to breach the levee along the Puyallup River will be made within 90 days of receipt of approval to fill Parcel 5. The levee will be breached either just prior to March 15, 1985, or, more likely, just after June 15, 1985.
- (b) I cannot speak for the Department of Ecology, however, we expect them to take a cautiously cooperative position. I have written a letter to Tom Eaton requesting a subsurface sampling and testing procedure of the wetland creation site so that we may proceed with such an effort.
- (c) It is the Port of Tacoma's position that, if, for some unforeseen reason, the creation of the wetlands at the chosen site becomes infeasible, another site will be selected with agencies' assistance; and/or other mitigation which the agencies feel is appropriate will be pursued.



COMMISSIONER
EXECUTIVE DIR.
BERT G. EARLEY, JACK A. FABULICH, PATRICK O'MALLEY
RICHARD DALE SMITH

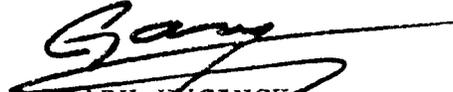
- 2 -

Mr. Jack Kennedy

February 3, 1984

I trust that this information helps clarify the situation. If there are any questions, please call at your earliest convenience.

Yours very truly,


GARY KUCINSKI
Director of Planning
and Research

GK/im

cc: USFWS
EPA
NMFS
PUYA TRIBE
WDOE
WDF
WDG ✓