SECTION 905(b) ANALYSIS

GENERAL INVESTIGATION RECONNAISSANCE STUDY

Chehalis River Basin, Washington

EXPEDITED RECONNAISSANCE STUDY

US Army Corps of Engineers®
Seattle District

Section 905(b) (WRDA 86) Analysis

Chehalis River Basin, WA

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1. **STUDY AUTHORITY**: The study of the Chehalis River Basin was initiated as a Corps of Engineers – Civil, Title I general investigation study under Public Law 106-60, dated September 29, 1999. This authority states: "The following appropriations shall be expended under the direction of the Secretary of Army and the supervision of the Chief of Engineers for authorized civil functions of the Department of Army pertaining to rivers and harbors, flood control, beach erosion, and related purposes."

   General Investigation funds are used for the collection and study of basic information pertaining to rivers and harbors, flood control, shore protection and related projects, restudy of authorized projects, miscellaneous investigations, and, when authorized by laws, surveys and detailed studies and plans and specifications of projects prior to construction.

   In fiscal year 2000, $100,000 was provided to complete a 905(b) Report and Project Study Plan.

2. **STUDY PURPOSE**: The purpose of this study is to determine if there is a Federal (Corps) interest in identifying flood problem areas and ecosystem restoration opportunities in the Chehalis River Basin, develop conceptual measures to address the identified problems and opportunities, and work with local governments to determine which measures and/or projects warrant further study effort in the feasibility phase. For those potential projects, a Project Study Plan (PSP) will be developed to conduct further feasibility level studies, and a Feasibility Cost Sharing Agreement (FCSA) will be coordinated with the local sponsor, Grays Harbor County. The primary area of consideration is to address local basin needs for flood damage reduction and environmental restoration projects.

3. **LOCATION OF PROJECT/CONGRESSIONAL DISTRICT**: The Chehalis River drainage basin is located in southwest Washington State and covers 2,114 square miles. It occupies major portions of Lewis, Thurston, Mason, and Grays Harbor Counties, and minor portions of Cowlitz, Pacific, and Lewis Counties. The estuary of Grays Harbor is not included within the study area. Major cities within the basin include Hoquiam, Aberdeen, Montesano, Satsop, Elma, Porter, Oaksville, Grand Mound, Bucoda, Centralia, Chehalis, and Doty (Figure 1). The project lies within the 3rd, 6th, and 9th Congressional Districts.

4. **DISCUSSION OF PRIOR STUDIES, REPORTS, AND EXISTING WATER RESOURCE PROJECTS**:

a. Prior studies and reports:

- The "Preliminary Examination and Survey of Chehalis River and Tributaries" was transmitted to Congress in 1943 and published as House document 494, 78th Congress, Second Session. Meskill, Bloody Run and Ruth dam sites and a system of levees and seawalls to protect the cities of Aberdeen, Hoquiam and Cosmopolis were studied. A project for the levees and sea walls were recommended.

- "Coffee Creek, Channel Excavation and Debris Removal" under Section 208 of 1954 Flood Control Act, 1965. This report examined floodway problems along Lum Road in Centralia and recommended clearing and snagging on 1,660 feet of Coffee Creek (completed March 1966).

- "Interim Feasibility Report and Environmental Impact Statement, Centralia, Washington, Flood Damage Reduction", 1982-3. Interim reports were prepared for a number of flood prone areas in the Chehalis Basin. In the final version (1983), two flood damage reduction alternatives were identified as economically justified: (1) A levee system along the Skookumchuck and Chehalis Rivers and Salzer Creek, and (2) Modification of the Skookumchuck Dam.

- "Centralia-Chehalis Flood Warning and Flood Response Study", 1990. This reconnaissance report indicated that substantial benefits would accrue from improved flood warning, public awareness, and an updated flood response plan for the area. The study produced three products: (l) A public brochure covering what to do before, during and after a flood, (2) a flood warning map, and (3) a flood warning checklist to assist local officials with public facilities threatened during flood events. No construction measure was identified for implementation.

- "Chehalis River at South Aberdeen and Cosmopolis, Washington – Flood Control Project", 1990. This project enabled construction of an earthen levee, high ground and a sheetpile floodwall within the cities of Cosmopolis and Aberdeen, and unincorporated Grays Harbor County.

- "Centralia Washington Pre-Construction Engineering and Design, General Re-evaluation Report and Environmental Impact Statement", 1999-on-going. Seattle District is presently preparing a General Re-evaluation Report and Environmental Impact Statement (GRR/EIS) in relation to efforts to reduce floodwater damages to the cities, highway system and metropolitan area of Centralia and Chehalis. The Centralia, WA GRR/EIS includes the investigation of ecosystem restoration components that compliment each flood damage reduction alternative. Present planning for the Centralia, WA GRR/EIS will produce restoration plans in conjunction with the project's flood control alternatives for the purpose of minimizing and mitigating adverse impacts associated with the implementation of flood

control alternatives as well as to provide appropriate habitat restoration above and beyond mitigation needs. Potential restoration measures anticipated include the reconnection of floodplains and wetlands, creation of off-channel and instream habitat, riparian revegetation, fish passage barrier removal, and direct and indirect benefits to water quality. Although the Centralia, WA GRR/EIS is within the Chehalis River basin, potential ecosystem restoration features associated the GRR/EIS will remain entirely separate from the Chehalis River Basin Study.

- "Floodplain Management Special Study, Floodplain Delineation, Chehalis River at the Chehalis Indian Reservation Near Oakville, WA", 1999. This study estimates and maps the 100-year floodplain of the Chehalis River in the vicinity of the Chehalis Indian Reservation. The purpose was to assist the tribe in identifying flood hazard areas.

- "Post Flood Verification Report, February 1996 Floods, Upper Chehalis River Basin, Western Washington", 1999. FEMA requested that the Corps perform a verification study to compare the existing Flood Insurance Study (FIS) data for the upper Chehalis River Basin with the February 1996 flood data to see if criteria for significant change had been exceeded. The study determined that the Chehalis River in the Grays Harbor County FIS, Thurston County FIS, Lewis County FIS in the vicinity of Centralia and Chehalis, the city of Centralia, and the city of Chehalis need to be restudied. In addition, the Skookumchuck River in Centralia, and the Newaukum River in Chehalis also need to be restudied. Only the Lewis County FIS upstream of Chehalis to Pe Ell did not need to be restudied.

b. Existing water projects:

- The Chehalis River and Grays Harbor were dredged for navigation purposes in 1931.

- The Wynoochee Dam is located at River Mile (RM) 52 on the Wynoochee River and was constructed by the Corps of Engineers in 1974 for municipal and industrial water supply, and flood control for the city of Aberdeen, as well as water for irrigation, recreation, and fish and wildlife habitat. Tacoma City Light is responsible for the regulation of the dam except during flood events from 1 October to 24 March, when the Corps assumes control of the project.

- The Skookumchuck Dam and Bloody Run Dams are located on the Skookumchuck River. Both projects store water for the Centralia Steam-Electric Power Plant. In addition, Skookumchuck provides minimal flood control, and supplies hydroelectric power to a distribution center that contributes electricity to several western states.

- Numerous small diversion structures (up to 10 cfs) are located throughout the basin, which supply municipal and industrial water to the local jurisdictions in these areas.

- Major levee systems in the basin include the Skookumchuck levee, the Coffee Creek levee,

the Airport levee, the Salzer Creek fairgrounds levee and the Cosmopolis levee. The Airport, Salzer Creek, and Cosmopolis Levees are currently in the Corps program, whereas local authorities maintain the remaining levees (Skookumchuck and Coffee Creek).

5. PLAN FORMULATION:

(a) Identified problems: The proposed study would evaluate two significant problems in the Chehalis River Basin: (1) Flood control, on both a basin-wide and sub-watershed level, and (2) degraded ecosystem functions and processes necessary to support flood control, water quality, and fish and wildlife habitat throughout the basin.

1. **Flood Control -** Flood damage reduction techniques are needed in this basin to alleviate chronic flooding, sporadic means of notifying the public of impending floods, increased bank erosion, degradation of existing infrastructure, damage to agricultural properties, and degraded water quality. These techniques may include:

- Construction of bypass channel
- Upstream storage
- Basin-wide flood warning notification system
- Protection of municipal infrastructure (i.e., water supply, escape routes)
- Replacement or placement of structures to alleviate flooding (i.e., levees)
- Structural modifications
- Dredging of waterways

2. **Ecosystem Restoration**. Heavy logging, manipulation of watercourses, road and railroad building, persistent flooding, and land use practices have contributed to a degraded ecosystem in this basin. Several means of restoration will be considered during the development of the study:

- Fish and wildlife habitat restoration
- Streambank stabilization
- Land use modifications (i.e., buyouts, easements, fencing stream corridors, etc.)
- Assessment of instream structures (i.e., culverts, bridges)
- Water quality improvements
- Floodway modifications

Existing Conditions without Project:

Preface: The Chehalis River Basin encompasses approximately 2,114 square miles and includes portions of the Western Cascades, Willapa Hills, Black Hills and Olympic Mountains. The Chehalis River and its tributaries flow through seven Washington counties including Cowlitz, Grays Harbor, Lewis, Mason, Pacific, Thurston and Wahkiakum. The upper and middle basin has mild, rainy winters and dry warm summers while the lower basin's climate is characterized by more foggy conditions owing to its proximity to the Pacific coast.

Land uses in the basin are primarily commercial forestry and logging, agriculture, and residential. The basin is predominantly rural, but has centers of population in the twin cities of Centralia and Chehalis in the middle part of the basin and Aberdeen, Hoquiam and Cosmopolis at the mouth of the river near Gray's Harbor. Several smaller towns including Napavine, Elma, Pe Ell, Doty, Satsop, Bucoda, Porter, Dryad, Adna, Rochester, and Oakville also are within the basin. The primary area of concern for flooding problems lies within Lewis, Grays Harbor and Thurston Counties and includes the mainstem Chehalis downstream of the South Fork confluence, and the Skookumchuck and Newaukum Rivers. Some smaller tributaries also cause localized flooding in the study area. The cities of Centralia and Chehalis experience the most significant flooding and Interstate 5 has been closed at times due to flooding.

1. **Flooding Occurrence:** The Chehalis River originates in the Willapa Hills southeast of Aberdeen, and flows 125 miles before emptying into Grays Harbor estuary on the Pacific Coast. Major tributaries to the Chehalis River include the Wishkah, Newaukum, Skookumchuck, Wynoochee, and Satsop Rivers. Major flooding occurs during the winter season, from November through February, mainly as a result of heavy rainfall. Flooding may be widespread throughout the basin or localized in sub-basins, depending upon the areal extent and uniformity of the precipitation causing the runoff. Precipitation and timing of the main stem and tributary flows are the major factor in determining the magnitude of floods on the Chehalis River. There is a direct correlation between the amount of precipitation with ten of the largest floods on the Chehalis River. In most cases, the recent large floods of record have the greatest precipitation totals for all temporal duration.

   The Corps has data on nine of the largest floods that have occurred on the Chehalis River for several representative streamgages since 1971. Three of the largest floods occurred since publication of the most recent FEMA FIS reports in the basin, the latest being in 1982. The number of large recent events has caused a significant increase in the frequency curves at most of the streamgaging stations.

   The flows for set flood frequencies for the Upper Chehalis River Basin have increased dramatically in the last 30 years due to the many large events hitting the basin since 1972. In 1969, the Chehalis River at Grand Mound had an expected 100-year flow of 54,000 cfs. The latest frequency curve for this gage (through WY1998) has an expected 100-year flow of 74,100 cfs. This is an increase of 37 percent.

   For the Lower Chehalis River Basin, the peak flows have also increased. In 1990, the

Wynoochee River at Black Creek had an expected 100-year flow of 35,500 cfs. In a frequency curve updated to 2000, the expected 100-year is 40,800 cfs. This is an increase of 15 percent.

In the Upper Chehalis River Basin, there have been at least thirty-one flood events on the Chehalis River at the Centralia gage (Mellen St.) since 1971. Of those events, nine have resulted in river crests of greater than 70 feet. Of the nine flood events, two (January 1990 and February 1996) have resulted in the closure of Interstate 5 for several days. These flood events also resulted in the two highest readings on the Skookumchuck River at Centralia in the last 25 years.

2. **Ecosystem Restoration**: Coupled with the serious flooding problems in the basin, the natural aquatic ecosystem has been degraded and populations of many species of fish and wildlife are in decline. Habitat conditions in the basin were significantly altered during the 1920's, 1930's and 1940's when logging activities were most active. Railroads, roads and residential development also contributed to the decline of ecosystem health in the basin. The diversion, channeling and straightening of streams within the watershed and clearing of riparian corridors mainly for agricultural uses has increased flooding danger in the basin and has contributed to degraded aquatic and riparian ecosystems. Degradation of aquatic ecosystem health and many of the flooding problems in the Chehalis River basin are the result of altered natural functions in the basin.

   Incidences of flooding in the basin have steadily risen over time while aquatic ecosystem health has declined. Basin-wide flooding problems and declining aquatic ecosystem health appear directly related. Merging efforts for both flood damage reduction and aquatic ecosystem restoration would likely diminish both problems.

   The primary limiting factors to aquatic ecosystem health in the Chehalis River basin are physical barriers, floodplain connectivity, streambed/sediment conditions, riparian conditions and water quality. Flooding problems in the basin are usually tied directly with these limiting factors.

   Physical Barriers. Physical barriers include flowage barriers or constrictors and fish passage barriers. The Skookumchuck Dam is the largest barrier in the Chehalis River basin. It currently blocks passage to all anadromous fish in the headwaters of the basin and has altered historic flows and gravel replenishment in the lower reach. Road culverts make up the majority of the remaining barriers. Fish passage barriers also include velocity impediments, degraded water quality conditions such as high temperatures, or low dissolved oxygen barriers. Other barriers and constrictors include railroad and highway bridges, small agricultural diversions, dams, and road and highway embankments near or next to streams. While some of these structures are not necessarily a full blockage for fish, they serve as an impediment to natural flows and can exacerbate flooding problems, upsetting the equilibrium of natural flows and the river's hydrology.

Floodplain Connectivity. Floodplain connectivity refers to conditions affecting overall flows of a watercourse through a floodplain. Floodplains with open connectivity are connected directly to the river at many points, allowing wetlands and other off channel areas to store flood water and later discharge this storage back to the river during lower flows. In floodplains with constrained connectivity, flood flows rise and fall quickly, such as in a canyon. Historic conditions of the Chehalis River included large, broad floodplains with very open conditions. Floodplain connectivity in the Chehalis basin has been altered from natural conditions resulting in peak flows well above historic flows, thereby increasing the frequency of flooding. Elders of the Federated Tribes of the Chehalis contrast historic conditions with today's condition, reporting that during and following heavy rains, the Chehalis River in the middle basin rose and fell slowly, whereas now it quickly rises much higher and then falls; they also report that the river used to be clear and deep green during high flows and that now it is like "latte" (murky brown). Examples of alterations include bank hardening using riprap or dikes, channel realignments, and the existence of a high number of roads, railroads and levees. The conversion of active channels to inaccessible ponds has occurred in several areas because of agricultural ditching and pond construction for settlement of mine tailings. Residential, commercial and industrial development has also filled in floodplains.

Altered and degraded floodplain connectivity in the Chehalis basin has contributed significantly to degraded aquatic ecosystems, increased flow velocities, greater bank erosion and sediment deposition, and channel incision. During high flows, salmonids will normally take refuge in off-channel areas, but riprap and channeled watercourses have prevented development and perpetuation of off-channel habitats. Channelization has contributed to increased bed scour, which destroys spawning areas and these degraded habitat functions have further reduced floodplain interactions by severe channel incision. Overall floodplain connectivity alterations in the Chehalis River basin have exacerbated flooding and degraded aquatic ecosystem health.

Streambed/Sediment Conditions. The causes of degraded sediment and streambed conditions in the Chehalis River basin include the Skookumchuck Dam, a lack of large woody material to maintain coarse sediment, bank and surface erosion, channelization of the river, and landslides. Bank erosion is a source of fine sediments into basin streams, which can suffocate salmonid eggs and decrease size and availability of interstitial spaces used by small juveniles for rearing. Debris torrents and dam-break floods have scoured channels and contributed to a decrease in large woody material. Most non-natural surface erosion (including landslides) comes from dirt and gravel roads and forestry/agricultural lands. Increased river velocities and volumes from altered floodplain connectivity in the upper basin has also caused high levels of deposition in the middle and lower basin, displacing flows outside of historical channels and causing increased flooding.

Riparian Conditions. Degraded riparian conditions currently exist in the Chehalis River basin as a result of riparian harvest, dam break floods, fires, agriculture, and development. Areas with no vegetation, little vegetation, or vegetation that is composed primarily of young deciduous trees characterize the degraded riparian conditions. Areas with little or no vegetation do not provide adequate shade and those areas may experience increased water temperatures, which limit fish survival and reproduction. They also do not provide large woody material recruitment, or cover to the streams and do not provide a buffer for stormwater runoff or other human activities. Remnant riparian forests in the basin are unable to provide adequate large woody material recruitment (especially since most of these forests are also young), which leads to increased sediment transport, decreased pool habitat, and increased scour.

Water Quality. The primary water quality problem in the Chehalis River basin is high water temperatures, although pH and fecal coliform are also an issue in some areas of the watershed. Cleared or degraded riparian forests no longer provide shade along stream banks and calving and eroding banks have made low flow channels wider and shallower, thereby exposing more water to direct sunlight. Longtime residents of the middle basin frequently report that the river is much shallower and wider than in the past. Animal waste from pastures, dairies and farms has affected water quality, adding nutrients to the water and increasing coliform.

Anadromous salmonid species including spring and fall chinook, coho, chum, winter and summer steelhead and coastal cutthroat trout occur in the basin. Runs of all of these species have declined significantly from historic levels. There are eleven Federal listed threatened or endangered species in the basin including four birds (bald eagle, marbled murrelet, spotted owl, and western snowy plover) one fish (bull trout), three mammals (gray wolf, Canada lynx, and grizzly bear), two plants (golden paintbrush and Kincaid's lupine) and one invertebrate (Oregon silverspot butterfly). Coastal cutthroat trout are proposed for listing under the Endangered Species Act and exist in the basin. In addition, there are two candidate species and twenty species of concern in the basin. The US Fish and Wildlife Service estimates that 95 percent of the spawning habitat for the proposed coastal cutthroat trout was eliminated in the Skookumchuck River drainage following construction of Skookumchuck Dam.

Existing Restoration and Flood Damage Reduction in the Basin. Local, Tribal and state governments are individually conducting some aquatic ecosystem restoration in the Chehalis River basin, but on a limited basis. Except for ongoing flood damage reduction efforts in the Centralia-Chehalis area (Centralia, WA GRR/EIS and Long Road Section 205 Project), local state and Tribal governments are inactive in their efforts to ameliorate current and future flooding problems. Past, present and planned restoration activities include limited side channel construction (summer and winter), some fish barrier removals, large woody material placement for bank protection, riparian area planting, and some limited land use regulations. Revegetation and bank stabilization efforts in the basin have also been conducted to reduce sediment loading and to provide needed shade and cover. Current and past restoration efforts, while praiseworthy,

need augmentation and coordination, and need to be synchronized with one another so that they are fully beneficial to the entire basin. Conditions and problems in the basin are such that it is possible to integrate flood damage reduction measures and aquatic ecosystem restoration, gaining respective benefits and advantages of each simultaneously and to a greater degree.

Because of these conditions, problems and opportunities, the Corps and the County are seeking to develop a joint flood hazard reduction plan and habitat restoration plan. The Corps strongly believes that basin-wide flooding problems and declining aquatic ecosystem health in the Chehalis River watershed are directly related. Combining and balancing flood damage reduction efforts with aquatic ecosystem restoration will diminish both problems.

Expected Future Conditions.

1. Future without project. The Chehalis River basin in the future without a Corps project would likely experience increased incidences of flooding and a continued decline in the health of aquatic and riparian ecosystems. Non-participation by the Corps in numerous state and local restoration efforts would likely result in a reduced amount of net habitat gain for the basin, and several proposed restoration and flood damage reduction efforts would be passed over. It is anticipated that without restorative intervention to slow, stop or reverse the present decline in the ecosystem health of the Chehalis River basin, current salmonid runs in the basin may become threatened or endangered.

2. With Project Condition. The anticipated with project condition for the Chehalis River basin include reduced incidences of localized flooding and a positive change in the health of the basin's aquatic ecosystems. By implementing sound flood damage reduction and ecosystem restoration measures both flood damages and ecosystem degradation can be significantly reduced. It is likely that if an aggressive aquatic ecosystem restoration strategy is followed through, the decline of fisheries resources in the basin can be stopped. Implementation of a basin-wide restoration and flood management plan could suspend one or more future listings of Chehalis River salmon runs.

3. Advantages and Benefits of the With Project Plan:

- Increased survival and productivity of salmonid species
- Potential avoidance of threatened or endangered listing of additional Chehalis River salmonid species
- Improved water quality
- Improved ecosystem health
- Decreases in flood damages

- Increased data on flooding and ecosystem problems for local, state and Tribal planning purposes
- Decreased sediment loading into middle and lower basins
- Reduced water temperatures in critical areas
- Increases in large woody material recruitment
- Coordination and synchronization of related basin projects

Planning Constraints

The following are suggested criteria to screen alternative and select potential projects. These criteria will be finalized in the feasibility study:

1) The project study area will encompass Water Resource Inventory Areas (WRIA) 21 and 22, with the exception of the drainage's that flow directly into Grays Harbor (Humptulips, Hoquiam, and Johns Rivers), and the Grays Harbor estuary.

2) The expected benefits will extend over a long period of time (i.e., 50 years or more).

3) The proposed work will be compatible with other ongoing efforts by Federal, State, and local agencies.

4) Public health, safety, and well being will be protected.

5) The project should be designed to mimic the natural processes that will minimize the amount of maintenance required.

6) Proposed work will implement the local sponsors' priority projects.

7) Proposed work will enhance habitat for threatened and endangered species that occur within the basin.

8) The proposed work will ameliorate the effects of flooding to the greatest extent possible.

9) The proposed work will significantly restore natural hydrologic functions within the basin.

10) Real estate is reasonably available and cost effective.

11) The proposed project will have positive net benefits to existing or degraded ecosystems.

12) The non-Federal sponsor is willing to operate and maintain the project after construction.

(b) Alternative Plans: Multiple alternative strategies were considered and evaluated at the concept level to reduce the flood damages on both a basin-wide and sub-watershed level, and to restore degraded ecosystem functions and processes necessary to support flood control, water quality, and fish and wildlife habitat throughout the basin. A sample list of potential projects is provided in Appendix A. The list of potential projects is not a comprehensive list, but rather a cursory outline used to demonstrate that many opportunities exist in the basin. The local sponsor has indicated that many other projects exist in this area.

1) **Flood Control Alternatives**:

No Action – The no action alternative will not meet the needs of alleviating flooding in the basin.

Bypass Channels – Construction of bypass channels along the main stem Chehalis River originating above flood prone population centers such as Elma, Satsop, Cosmopolis, Adna and Montesano. The bypasses would be configured appropriately to carry additional floodwaters around flood prone areas. Improvements to existing or historical oxbows that can be utilized for added flow will be evaluated. Fish and wildlife habitat restoration in bypass areas would be an added benefit.

Upstream Storage – Construction of small upstream flow restriction structures on tributary streams to delay floodwaters. This alternative would investigate the strategic placement of small flow restriction structures on selected tributaries of the Chehalis River to synchronize the timing of high river flows so that peak flows are reduced. The flow restriction structures also offer opportunities for wetland and fish habitat creation, without presenting a barrier for passage.

Levee Systems – Construction of a new setback levee on the north (right bank) of the Chehalis River at Elma to contain flood events caused by high flows of the Chehalis River. Lower Macdonald Creek and Lower Cloquallum Creek join the Chehalis River at Elma. During peak flows of the Chehalis River, flows from these two tributaries are prevented from entering the river and flow through residential and commercial areas.

Basin-wide Flood Warning System – Facilitate real time communication to residents in danger of flooding. Substantial benefits could accrue from improved flood warning, public awareness, and an updated flood response plan for the basin.

Protection of Existing Infrastructure – The feasibility of placing bank protection along the left (south) bank of the Chehalis River at Satsop to protect existing public water supply and measures to minimize migrating river meanders would be investigated.

Structural Modifications – Raise structures and roads above the 100-year flood level. The economic benefits of raising commercial and residential structures and transportation systems above the 100-year would be investigated.

Dredging – Clearing, snagging, and dredging the Chehalis River channel to increase capacity. The feasibility of dredging accumulated deposits at select location within the river would be investigated.

2) Ecosystem Restoration Alternatives

No Action – The no action alternative will not meet the needs of providing improved fish passage, hydrologic functions, and overall restoration of the Chehalis basin ecosystem for fish and wildlife, particularly those listed as threatened or endangered.

Fish and Wildlife Habitat Areas – Construct off-channel habitat areas to provide overwinter rearing and refuge habitat for juvenile salmonids. These habitats, and their associated riparian zones, are also valuable for many species of waterfowl, migratory birds and mammals. More natural river meanders, increased sinuosity, and natural creation of off-channel habitat could be possible if bank-hardening structures were removed (riprap) and connections made to existing isolated off-channel habitats. Placement of large woody debris would introduce in-stream cover and in-channel structure, increase channel complexity, and increase sediment storage, particularly spawning gravel retention. Construction of off channel areas can serve as small detention basins for floodwaters.

Streambank Stabilization – Plant riparian vegetation, incorporate vegetation into areas currently dominated by rip-rap, and place large woody material or engineered log jams in areas in the basin with increased bank erosion. Severe bank erosion in numerous locations along the main stem Chehalis River and on tributary streams has caused great increases in suspended sediment loads, decreasing fish habitat quality and increasing flood damage potential in downstream area. The USFWS has identified the South Fork Satsop River as having such severe bank erosion that curtailment of this problem could be the single most effective restoration effort in the watershed. There are also bank stabilization needs in other areas of the watershed that exist in conjunction with recreational use. Unconfined and overused recreation sites along the river and tributaries is causing severe increases in sediment loading to the river system.

Land Use Modifications – Facilitate or encourage changes in land use practices detrimental to water quality and fish habitat quality. Creation of fish and wildlife habitat easements and buyouts of industrial or commercial zoned properties with high habitat restoration potential.

Assessment of Instream Structures – Removal or upgrade of culverts would allow fish passage for all species during all flow conditions. This would result in access to many miles of tributaries that may be inaccessible because of culverts, generally improving production of fish by increasing total area available for spawning, rearing or refuge. Improving culvert passages will also reduce localized flooding associated with insufficiently sized culverts during high flows.

Water Quality Improvement: –Revegetation of riparian areas that have been cleared to increase shading and reduce temperatures that do not currently meet Class A standards, particularly in the tributary streams. Restore degraded riparian zones to provide cover, and nutrient and detrital input into the aquatic ecosystem. Plant riparian areas with conifer species to increase large woody debris recruitment. Riparian revegetation would also result in reduced surface and bank erosion and improved filtration of runoff from the floodplain and uplands. Riparian zones are important corridors for wildlife movements and are also extensively utilized by many species as primary foraging and nesting sites.

Floodway Modification – Setting levees back or removing unnecessary or non-functioning levees to reconnect the watercourses to their floodplain in specific locations. Currently, the mainstem Chehalis River is highly incised and channelized and does not flood over its banks except in infrequent events, greatly diminishing groundwater recharge in the floodplain. Sloping back non-leveed banks and creating excavated floodplains or wetlands would allow more frequent inundation of the floodplain in selected locations and improve bank stability. Floodplains provide habitat for a variety of fish and wildlife species and are especially effective at reducing water velocities, trapping sediment, and providing winter rearing habitat for juvenile salmon. Road re-routing would also be conducive to increased floodplain connectivity. Revegetation of floodplain areas would further improve the sediment trapping and groundwater recharge functions. Wetlands can be restored or created in floodplain areas to further allow groundwater recharge and provide seasonal fish habitat during high flows.

3) **Combination Plan**

This alternative recognizes that a combination of methodologies may be necessary to address all the problems in the Chehalis basin. It is highly unlikely that just one alternative will solve the problems that are being experienced in this area. This combination is thought to best represent what is needed to restore the existing environment and provide ancillary flood relief. These means will be considered during the development of the study and include, but are not limited to:

a) **Bypass Channels**-Construction of bypass channel within the Chehalis basin to carry floodwaters around flood prone areas and create side channels that provide habitat for fish and wildlife during high flows.

b) **Upstream Storage** – Construction of small flow diversion (i.e., creation of wetlands) on selected tributaries in upper watershed areas intended to detain flows and provide habitat for fish and wildlife.

c) **Basin-wide Flood Warning Notification System**-Develop real time system to alert residents within the Chehalis Basin of impending floods. Assess existing system and determine where most needed flood warning is necessary and implement a system to warn citizens of flooding.

d) **Protection of Existing Infrastructure**-Identify existing infrastructure that is repeatedly threatened by flooding and develop a means to protect these structures using bank protection methodologies that do not limit habitat access or use by fish and wildlife species.

e) **Fish and Wildlife Habitat Areas** – Construct, create or re-establish sidechannels to provide refuge for fish and wildlife during flooding and to help contain high flows (i.e., reconnection of oxbows to river).

f) **Streambank Stabilization** – Identify and prioritize streambanks prone to calving or severe erosion which can be rehabilitated using bioengineering techniques. May include regrading and/or revegetating eroding slopes, constructing engineered logjams and/or placement of boulders and large woody debris within rivers and tributaries within Chehalis basin.

g) **Assessment of Instream Structures**- Identify and characterize how existing instream structures affect flooding within the basin or sub-basin. Areas with inadequately sized culverts that both block assess for fish and wildlife and restrict flows could be replaced with adequately sized culverts, bridges or potentially "daylighting" of stream can be done so it flows naturally.

h) **Floodway Modifications**. Assess current levee system and determine the viability of existing system. Reconnect the floodplain to the river wherever possible to increase flood capacity and improve conditions for fish and wildlife. May include installation of setback levees, buyouts or revegetation of cleared areas.

© **Preliminary Evaluation of Alternatives**: At this level of study, it is apparent that the alternatives would result in net environmental benefits through ecosystem restoration. Additional ancillary benefits may be derived from flood control through restoration efforts and visa versa. Of particular importance is that all of the alternatives would provide an increased habitat diversity necessary for threatened and endangered species, such as bull trout. The Project Study Plan will be based on refinement and analysis of the combined alternatives. Based on the limited evaluations to date, it appears that the alternatives would be technically feasible, environmentally sound and could be justified for implementation.

6. FEDERAL INTEREST: The preliminary assessment of flood damage reduction and ecosystem restoration of the Chehalis River basin indicates that measures exist that are most likely economically justified, environmentally acceptable, supported by the local sponsor,

and consistent with Army policies, costs, and benefits. Ecosystem restoration is a high priority budget output, and a primary output of the alternatives to be considered. Flood control benefits can either be derived through ecosystem restoration, or independently. Therefore, there is a strong Federal interest in conducting the feasibility study.

7. **PRELIMINARY FINANCIAL ANALYSIS**: A letter of intent from Grays Harbor County is included as enclosure 1. This letter indicates the strong interest of the local government in working with the Corps to prepare a Project Study Plan and to cost share in a feasibility study and project implementation. Grays Harbor County has indicated that they are willing and able to sign a FCSA. Grays Harbor County will act as the principal local sponsor and represent other local flood control districts, adjacent counties, and individual groups that may provide monetary assistance to the overall planning effort. Monies from the other interested parties will be paid to Grays Harbor County for proposed projects outside the jurisdiction of Grays Harbor and distributed to the Corps. In addition, funds from tax revenues, grants from Washington State, and performance of in-kind services will be used too meet the county's local cost share.

8. SUMMARY OF FEASIBILITY STUDY ASSUMPTIONS:

a) The project study plan and FCSA will be developed to identify the specific studies and issues for the feasibility study. Upon approval of the plan by all parties, the FCSA will be signed;

b) The proposed feasibility study will use as much existing information as possible to gain a clear understanding of flooding and ecosystem restoration issues within this basin and the potential solutions already studied to determine the best means of proceeding;

c) The document will be a combined Programmatic EIS and Feasibility Report;

d) The document will incorporate local efforts targeted for restoration and flood damage reduction as integral parts of the overall action in the Chehalis River basin, including the Centralia GRR study;

e) The Corps or Corps contractor will perform the Real Estate and Economic Analysis functions for this project;

f) The Feasibility Report will be based upon existing information, revised or updated information provided by the local sponsor, and new studies. The Corps, local sponsor, or contract resources will perform new studies. The decision as to which entity will conduct the studies will be based upon whom is the most logical and practical party to complete the task.

9. **FEASIBILITY PHASE MILESTONES:** The feasibility study schedule is highly dependent upon the negotiation of the PSP with the local sponsor. As the PSP is developed, the scheduled will be revised and refined.

Table 1
Feasibility Phase Milestones

Milestone	Description	Target Dates
054	Submit draft PSP	March 2001
100	Execute FCSA	July 2001
105	Initiate Feasibility Study	August 2001
111	PSP In-Progress Review	November 2001
112	Without Project Conditions Complete	March 2002
113	Preliminary Design Complete	May 2002
114	Plan Selection	August 2002
124	Feasibility Design Complete	November 2002
145	AFB	November 2002
165	Public Review Complete	January 2003
170	Feas. Report w/NEPA Complete	March 2003
290	MSC Public Notice	May 2003
330	PED Agreement Executed	July 2003
340	President Sign Authorization	WRDA 2004
350	Chief's Report to ASA(CW)	August 2003

10. **FEASIBILITY PHASE COST ESTIMATE:** This estimate is a preliminary estimate of feasibility costs based on the alternatives, delineating the estimated costs for studies of the Corps and potential local sponsor. This estimate will be modified pending the formulation and negotiation of the PSP.

Table 2
Preliminary Cost Estimates

MAJOR WORK ITEMS	STUDY COST
COST SHARING FOR FEASIBILITY STUDY	
TOTAL STUDY COSTS	**$ 1,000,000**
50 % FEDERAL SHARE (Note: This is only funding estimates, local sponsor cash will increase these figures	
Public Involvement	$ 50,000
Environmental Studies	$ 100,000

Economic Studies	$ 50,000
Project Management	$ 100,000
Engineering	$ 50,000
Real Estate Studies	$ 50,000
Model Studies	$ 50,000
Review Contingency	$ 50,000
TOTAL FEDERAL SHARE	**$ 500,000**
50% SPONSOR SHARE	
Public Involvement	$ 50,000
Environmental Studies	$ 100,000
Economic Studies	NA
Project Management	$ 50,000
Engineering	$ 50,000
Real Estate Studies	NA
Model Studies	NA
Review Contingency	NA
TOTAL IN-KIND SERVICES	$ 250,000
CASH FUNDS	$ 250,000
TOTAL SPONSOR SHARE	**$ 500,000**

11. **RECOMMENDATIONS:** On the basis of the above findings, I recommend that this 905(b) analysis be certified as being in accordance with current policy and that a feasibility study should be conducted. The preliminary cost study estimate is $1.0 million. This estimate will be revised as the PSP is developed. The feasibility study is currently scheduled for completion in August 2003.

    This recommendation indicates that ecosystem restoration and flood damage reduction measures in the Chehalis River basin warrant federal participation in a cost-shared feasibility study. The identified planning objectives are in the federal interest, are in accord with Administration policy and budgetary priorities, and are strongly supported by the local sponsor. Recommend approval of this 905(b) analysis as a basis to complete development and negotiations of the Project Study Plan and to enter into a Feasibility Cost Sharing Agreement with Grays Harbor County to conduct the feasibility study.

    I recommend the Chehalis River Basin Flood Damage Reduction and Ecosystem Restoration Project proceed to feasibility phase.

12. **POTENTIAL ISSUES EFFECTING INITIATION OF FEASIBILITY PHASE:** The major issue effecting feasibility is the on-going Centralia GRR study. The implementation of projects recommended during this study may have an effect on the projects undertaken in the Centralia GRR study and visa versa. Careful consideration and coordination will be

undertaken to ensure that each study complements and is beneficial to the other.

13. VIEWS OF OTHER RESOURCE AGENCIES: Resource agencies are generally in favor of restoration efforts using a watershed approach. Concern for threatened and endangered species is of paramount importance to the resource agencies within Washington State. It is anticipated the resource agencies will review restoration in this basin in a very favorable light.

14. PROJECT AREA MAP: A map of the region and study area is attached as Figure 1.

/s/

Date_____

RALPH H. GRAVES
Colonel, Corps of Engineers
District Engineer

Insert Figure 1-Watershed map

Insert Enclosure 1 – Letter from Grays Harbor County

APPENDIX A

SAMPLE PROJECTS, CHEHALIS RIVER BASIN SECTION 905(b)

	PROJECT NAME	TYPE	AGENCY
1	Phase I Newaukum River	Ecosystem restoration and flood control	Chehalis Indian Tribe
2	South Fork Chehalis River	Ecosystem restoration and flood control	Chehalis Indian Tribe
3	South Chehalis Drainage Basin Mitigation Project	Flood control	City of Chehalis
4	Chehalis Drainage Evaluation	Flood control	City of Chehalis
5	Mill Creek Flood Control	Flood control	City of Cosmopolis
6	Lower Cloquallum Creek Area	Flood control	City of Elma
7	Lower Vance Creek Area	Flood control	City of Elma
8	Lower Macdonald Creek	Ecosystem restoration and flood control	City of Elma
9	Chehalis River Bank Stabilization	Flood control	City of Montesano
10	Montesano Stormwater Improvements	Flood control and water quality	City of Montesano
11	Sylvia Creek Water Quality Improvement	Ecosystem restoration	City of Montesano
12	Gaddis Creek	Ecosystem restoration and flood control	Columbia Pacific RC&D
13	Creamer Creek	Ecosystem restoration and flood control	Columbia Pacific RC&D
14	Canyon River	Ecosystem restoration and flood control	Columbia Pacific RC&D
15	East Fork Wishkah River	Ecosystem restoration and flood control	Columbia Pacific RC&D
16	Singer Creek	Ecosystem restoration and flood control	Columbia Pacific RC&D

	PROJECT NAME	TYPE	AGENCY
17	Still Creek - Large Woody Debris	Ecosystem restoration and flood control	Columbia Pacific RC&D
18	Still Creek - Riparian Planting	Ecosystem restoration	Columbia Pacific RC&D
19	Unnamed Creek Culvert Replacement	Ecosystem restoration and flood control	Columbia Pacific RC&D
20	Wishkah River Fencing	Ecosystem restoration and flood control	Columbia Pacific RC&D
21	Alder Creek	Ecosystem restoration and flood control	Grays Harbor Conservation District
22	Chehalis River Bank Restoration near Oakville	Flood control and bank stabilization	Grays Harbor County
23	Flood/All Hazard Warning System	Flood control warning	Grays Harbor County
24	River Gauge Stations	Flood control warning	Grays Harbor County
25	Warning Notification System	Flood control warning	Grays Harbor County
26	Chehalis River Bank Restoration near Porter	Flood control and bank stabilization	Grays Harbor County
27	Satsop River Bank Stabilization near Satsop	Flood control and bank stabilization	Grays Harbor County
28	Satsop River Bank Stabilization near Satsop Rivera	Flood control and bank stabilization	Grays Harbor County
29	Keys Road Chehalis River Bank at Boat Launch near Satsop River	Flood control and bank stabilization	Grays Harbor County
30	West Satsop River Bank Restoration At Boat Launch	Flood control and bank stabilization	Grays Harbor County
	PROJECT NAME	**TYPE**	**AGENCY**

31	Ranney Well Field	Flood control and bank stabilization	Grays Harbor Public Development Authority
32	Neatherly Well Field	Ecosystem restoration and bank stabilization	Grays Harbor
33	Barge Unloading Facility	Flood control and bank stabilization	Grays Harbor Public Development Authority
34	Raw Water Well Field	Flood control and bank stabilization	Grays Harbor Public Development Authority
35	Water Quality Monitoring	Water quality monitoring	Lewis County
36	Aquifer Recharge Areas Study	Data collection	Lewis County
37	Flood Storage and Critical Areas Acquisition	Flood control	Lewis County
38	Flood/Channel Migration Mapping	Data collection	Lewis County
39	Headwater Measures	Flood control	Lewis County
40	Basin-wide Flood Warning System	Flood control warning	Lewis County
41	Local Cooperative Livestock Platforms	Flood mitigation	Lewis County
42	Carlisle Lake Spillway	Flood control	Lewis County
43	River Bank Stabilization at Galvin	Flood control and bank stabilization	Lewis County
44	Drainage Improvements near Adna	Flood control	Lewis County
45	China Creek Bypass Channel	Flood control	Lewis County
	PROJECT NAME	**TYPE**	**AGENCY**
46	Salzer Creek Detention	Flood control	Lewis County

	Facilities		
47	Flood Storage at Steam Plant	Flood control	Lewis County
48	Coal Creek & Other Streams Enhancement Study	Flood control and Ecosystem restoration	Lewis County
49	Skookumchuck Bypass by the Rotary Riverside Park in Centralia	Flood control	Lewis County
50	Fish Passage Barrier Culvert Replacement	Ecosystem restoration	Lewis County
51	Northpark Drive Culvert	Flood control	Lewis County
52	Coal Creek		Lewis County Conservation District
53	Wishkah River Oxbow/Wetlands fish access	Ecosystem restoration	None identified (cited by Mike Kelly, USFWS)
54	West Fork of the Satsop River sediment transport reduction	Ecosystem restoration	None identified (cited by Mike Kelly, USFWS)
55	Fish Passage Barrier Culvert Replacement	Ecosystem restoration	Thurston County
56	Bank Erosion Stabilization	Flood control and bank stabilization	Thurston County
57	Anderson Road improvements	Flood control	Thurston County
58	Black/Chehalis River Floodplain Modifications	Flood control	Thurston County
59	Ecosystem restoration	Ecosystem restoration	Thurston County
60	Hydraulic connections	Flood control	Thurston County
	PROJECT NAME	**TYPE**	**AGENCY**
61	Flood proofing	Flood control	Thurston County

62	Bank Erosion Stabilization	Flood control and bank stabilization	Thurston County
63	Bank Erosion	Flood control and bank stabilization at Bucoda	Thurston County
64	Flood warning system	Flood control warning	Thurston County
65	Tenino/Scatter Creek/Culvert Replacements/Beaver Dams	Ecosystem Restoration and Flood Control	Thurston County
66	Road passage study	Flood control	Thurston County
67	Hobson Road	Ecosystem restoration and flood control	Thurston County
68	Scatter Creek	Ecosystem restoration and flood control	Thurston County Conservation District
69	Humptulips River Acquisition	Ecosystem restoration and flood control	WDFW
70	Fish Pond Creek	Ecosystem restoration and flood control	WDFW
71	Lincoln Creek	Ecosystem restoration and flood control	WDFW