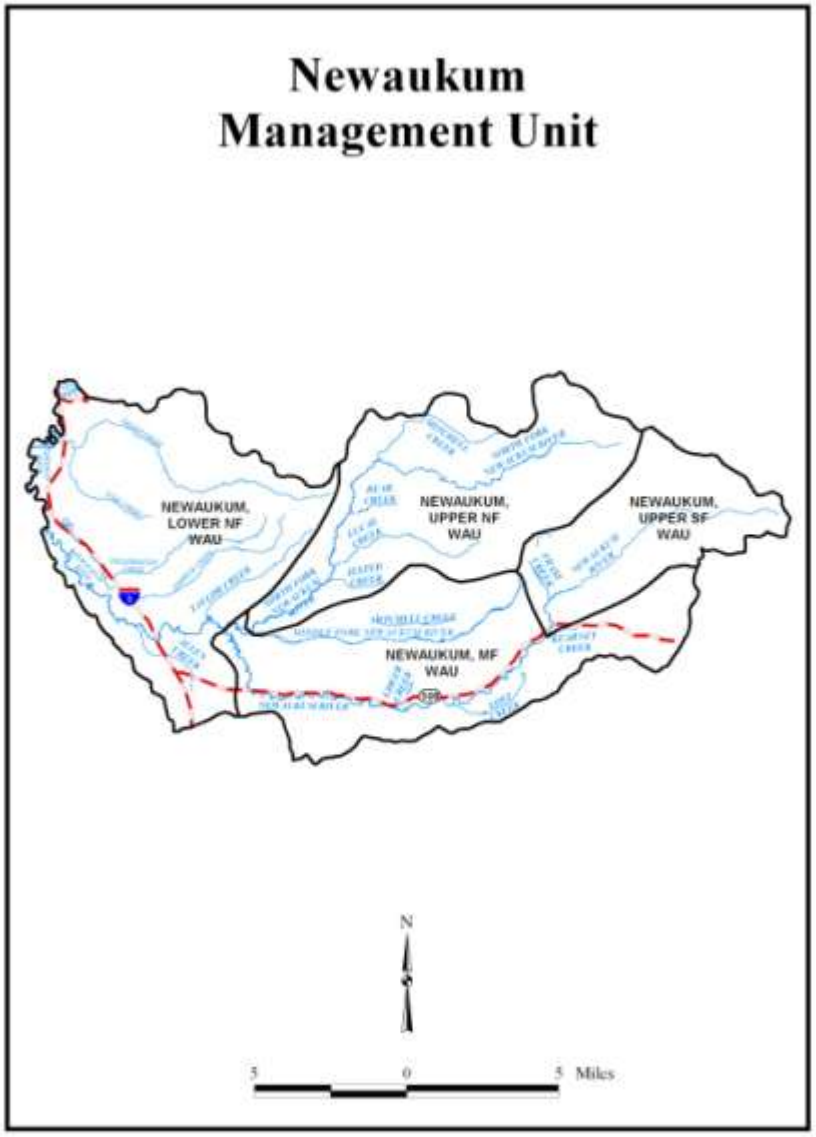
NEWAUKUM MANAGEMENT UNIT

NEWAUKUM RIVER

Description:

The Newaukum subbasin drains 158 square miles with an average annual discharge of 1,600 cfs. The mainstem Newaukum River enters the Chehalis River near RM 75.2 just south of the City of Chehalis. It has a low gradient and runs through farmland. Spring, summer, and fall Chinook salmon spawn, rear, and transport in the mainstem, while coho salmon and steelhead trout use the mainstem for rearing and transportation. Two small tributaries, Allen and Taylor Creeks, provide habitat for coho salmon and steelhead trout. Cutthroat trout use the entire system. The North Fork Newaukum River and the South Fork Newaukum River join at RM 10.8 to form the mainstem Newaukum River.



The North Fork Newaukum River originates in steep hills and then flows into a broad valley in its lower reaches. Stream gradient in the upper North Fork watershed is steep; it is moderate in the lower ten miles. Private timber management dominates the middle and upper watershed; land use in the lower ten miles is primarily agriculture. Spring and fall Chinook spawn up to RM 12.5, and coho and steelhead have been documented to RM 18.5. The larger tributaries to the North Fork Newaukum River include the Middle Fork Newaukum River, and Lucas, Bear, Mitchell, and Johns Fork Creeks. Coho salmon, cutthroat trout, and steelhead trout have been documented in each of these streams.

The South Fork Newaukum River is about 26.5 miles long. The upper watershed is in the steep terrain of the Cascade Mountain Range and the upper stream reaches have steep gradients. As the river heads in Newaukum Lake near RM 30, the terrain begins to broaden and the gradient moderates. The upper reaches are under private timber management, while farmland, rural residences, and small towns surround the lower reaches. Spring, summer, and fall Chinook salmon spawn up to RM 31 and coho salmon and steelhead and cutthroat trout have been documented to RM 32.2. In the upper South Fork watershed, Bernier, Beaver, Frase, and Kearney Creeks provide or have potential habitat for coho salmon, cutthroat trout, and steelhead trout. In the lower reaches, the coho, cutthroat trout, and steelhead producing tributaries include Gheer and Lost Creeks. Gheer Creek contains Carlisle Pond, which is used for coho salmon supplementation.

Throughout the Newaukum subbasin, private land ownership dominates (over 95%). Another major land use issue is a dam constructed on the NF Newaukum at RM 12.5 to allow water to be diverted for Centralia and Chehalis. This dam blocked all passage to salmon until 1970. The City of Chehalis continues to use this facility as part of their water supply.

Major Tributaries: Taylor, Allen, Gheer, Lucas, Kearney, Mitchell, and Johns Fork Creeks

Land Uses: Private forestlands, agriculture, and rural residential

Anadromous Fish Stocks: Spring Chinook, fall Chinook, coho, winter steelhead, and cutthroat

Newaukum River (Mainstem and Tributaries) Tier 1 Concerns

Newaukum River (Mainstem and Tributaries) Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ Poor riparian quality along the mainstem reach consisting of little to no riparian vegetation (Smith Wenger 2001). ➡ In the Mainstem Newaukum approximately 90% of the riparian corridor is considered 'open/hardwood' or 'non-forested' (Smith Wenger 2001).	➡ Impacts to riparian corridors along the mainstem are mostly attributed to the conversion from forestland to agriculture and rural residences. Bank vegetation loss is the largest impact in the whole Newaukum subbasin. (Smith Wenger 2001)	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Protect by fee simple or easement key properties ➡ Revegetate open riparian areas with native plants (Use Wampler et al. 1993 document to identify restoration sites)

Newaukum River (Mainstem and Tributaries) Tier 1	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ The mainstem Newaukum is on the 303d List for high temperatures and fecal coliform.	➡ The high temperatures are likely a result of poor riparian canopy conditions (Jennings and Pickett 2000). ➡ High fecal coliform: livestock access, failing septic systems	➡ Implement TMDL recommendations ➡ See Riparian actions ➡ Work with landowners to correct failing septic systems

Newaukum River (Mainstem and Tributaries) Tier 1	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Base flows are not being met for an average of 59 days per year at the gauging station near Chehalis (Smith Wenger 2001). There has also been an increase in peak flows and water volume within the Newaukum subbasin (Clark 1999)	➡ Likely contributors to the water quantity problems in the Newaukum subbasin are water withdrawals, changes in land coverage, and loss of wetlands (Smith Wenger 2001).	➡ Determine if water withdrawals are being followed in accordance with current water rights ➡ Implement activities that lead to natural recharge of aquifers ➡ Reduce water withdrawals from surface sources

Newaukum River (Mainstem and Tributaries) Tier 2 Concerns

Newaukum River (Mainstem and Tributaries) Tier 2	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access to spawning / rearing habitat is restricted	➡ Many culverts at road crossings on tributaries to the MS are undersized and do not allow adequate fish passage upstream due to high water velocity or perched outfall. These undersized structures also inhibit the movement of streambed material and LWD downstream and usually contribute to channel scour directly downstream.	➡ Correct barrier culverts. See Section 4.

Newaukum River (Mainstem and Tributaries) Tier 2	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ Mainstem Newaukum floodplain conditions have not been quantified but are likely impacted based on the information noted by Wampler et al. 1993. ➡ Data Need ➡ In areas, the floodplain is restricted	➡ Past gravel removal operations from the Newaukum River to construct the I-5 freeway may have contributed to channel incision. I-5 also acts as a dike in the lower reach of the Newaukum. (Andy Carlson personal communication) ➡ The placement of riprap along the banks of the river has restricted its ability to meander within the floodplain. The construction of dikes and roads within the floodplain and the loss of stream adjacent wetlands restricts the flood water storage capacity. There has also been a noted decline in beaver activity (dams), which aid in connecting the river and streams with its floodplain.	➡ Assess floodplain conditions and identify impacts ➡ Reconnect, enhance, and/or restore potential off-channel, floodplain, and wetland habitat ➡ Remove hard armoring (riprap) or implement bioengineering techniques in place of hard armoring

Newaukum River (Mainstem and Tributaries) Tier 3 Concerns

Newaukum River (Mainstem and Tributaries) Tier 3	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Estimated high levels of sediment input in the mainstem Newaukum. ➡ Data need	➡ The high amount of sediment is likely due to the high road densities, landslides caused by roads, and high amounts of bank erosion. (Smith Wenger 2001)	➡ Abandon roads on steep geologically sensitive areas ➡ Correct cross drains that may trigger mass wasting on geologically sensitive slopes ➡ Identify sources that are contributing to sediment loading ➡ Reduce sediment loading by reducing low densities ➡ Implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Revegetate stream/river banks for added erosion protection ➡ Upgrade logging roads to comply with Forest and Fish Agreement (1999)

Newaukum River (Mainstem and Tributaries) Tier 3	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ Likely poor LWD quantities in the Newaukum mainstem. The mainstem Newaukum has not been inventoried for LWD and additional data are needed to quantify its condition.	➡ Low quantities of LWD in the mainstem Newaukum are likely due to past practices of instream wood removal and the low LWD recruitment potential from the existing riparian corridor.	➡ Determine LWD quantities ➡ Develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity; install LWD pieces in conjunction with other restoration projects ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Revegetate open areas with native plants

Newaukum River (North Fork and Tributaries) Tier 1 Concerns

Newaukum River (North Fork and Tributaries) Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ The upper NF Newaukum has good riparian conditions while the middle and lower NF contain poor riparian conditions. The lower and middle NF reaches contain open and hardwood dominant riparian corridors. Lucas Creek contains riparian corridors with good and fair conditions. ➡ In the upper NF, approximately 70% of the riparian corridor is considered 'open/hardwood' or 'non-forested' and in the lower North Fork it is about 90% (Smith Wenger 2001).	➡ Impacts to riparian corridors along the NF are mostly attributed to the conversion from forestland to agriculture and rural residences. Bank vegetation loss is the largest impact in the entire Newaukum subbasin. (Smith Wenger 2001) ➡ Some areas in the Lower NF and Lucas Creek have naturally open riparian areas of prairie and wetland coupled with degraded riparian conditions (Smith Wenger 2001)	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Protect by fee simple or easement key properties of riparian ➡ Revegetate open riparian areas with native plants (Use Wampler et al. 1993 to identify potential restoration sites)

Newaukum River (North Fork and Tributaries) Tier 1	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access to spawning / rearing habitat is restricted	➡ Many culverts at road crossings on tributaries to the MS are undersized and do not allow adequate fish passage upstream due to high water velocity or perched outfall. These undersized structures also inhibit the movement of streambed material and LWD downstream and usually contribute to channel scour directly downstream.	➡ Correct barrier culverts. See Section 4 for guidelines. ➡ Improve fish passage at fishways and add a fishway to those structures that do not have them ➡ Remove dams where feasible

Newaukum River (North Fork and Tributaries) Tier 1	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Estimated high levels of sediment input in the NF Newaukum. Good gravel quality was measured in the upper reaches and no measurement was done in the lower reach where the sediment would likely settle out (Smith Wenger 2001). More data is needed to quantify the impacts of sediment in the NF Newaukum.	➡ The high amount of sediment is likely due to the livestock access, high road densities, landslides caused by roads, and high amounts of bank erosion (Smith Wenger 2001).	➡ Abandon roads on steep geologically sensitive areas ➡ Correct cross drains that may trigger mass wasting ➡ Identify sources that are contributing to sediment loading ➡ Implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Install riparian fencing to exclude or reduce livestock access ➡ Reduce sediment loading by reducing low densities (abandon/decommission) ➡ Revegetate stream/river banks for added erosion protection ➡ Upgrade logging roads to comply with Forest and Fish Agreement (1999)

Newaukum River (North Fork and Tributaries) Tier 2 Concerns

Newaukum River (North Fork and Tributaries) Tier 2	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ High summer water temperatures and high turbidity exist in the NF Newaukum (Pickett 1992).	➡ The high water temperature is likely a result of poor riparian canopy conditions coupled with low summer flows. Turbidity is likely caused by the same problems identified in the Sediment section.	➡ Determine if water withdrawals are being followed in accordance with current water rights ➡ Identify specific degraded riparian areas for restoration ➡ Implement approved nutrient enhancement efforts ➡ Implement TMDL recommendations ➡ Interplant conifers in deciduous dominant areas ➡ Protect by fee simple or easement key properties of riparian ➡ See Sediment actions

Newaukum River (North Fork and Tributaries) Tier 2	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Base flows are not being met for an average of 59 days per year in the Newaukum River at the gauging station near Chehalis (Smith Wenger 2001). There has also been an increase in peak flows and water volume within the Newaukum subbasin (Clark 1999)	➡ Contributors to water quantity problems in the Newaukum subbasin are water withdrawals, changes in land coverage, and some loss of wetlands (Smith Wenger 2001). ➡ The lower NF has greatly altered land cover and the upper NF has good hydrologic maturity (Smith Wenger 2001).	➡ Determine if water withdrawals are being followed in accordance with current water rights ➡ Reduce water withdrawals from surface sources ➡ Restore wetlands for water storage ➡ See Riparian actions

Newaukum River (North Fork and Tributaries) Tier 3 Concerns

Newaukum River (North Fork and Tributaries) Tier 3	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ Parts of NF have poor quantities of LWD. Lucas Creek also has poor levels of LWD. Upper reaches in the NF have good quantities of LWD. (Smith Wenger 2001, and Weyerhaeuser 1998)	➡ Low quantities of LWD in the NF Newaukum are likely due to past practices of instream wood removal and the limited LWD recruitment potential from the existing riparian corridor.	➡ Determine LWD quantities ➡ Develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity ➡ Identify specific degraded riparian areas for restoration ➡ Install LWD pieces in conjunction with other projects ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas where appropriate ➡ Revegetate open and areas with native plants

Newaukum River (North Fork and Tributaries) Tier 3	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ The NF Newaukum is moderately restricted from fully utilizing its floodplain for channel meandering and floodwater storage (Smith Wenger 2001).	➡ The placement of riprap along the banks of the river has restricted its ability to meander within the floodplain. The construction of stream adjacent parallel roads within the floodplain (N. Fork Rd and Lucas Creek Rd) and the loss of wetlands restricts the flood water storage capacity. There has also been a noted decline in beaver activity (dams), which aid in floodplain connectivity. (Smith Wenger 2001).	➡ Reconnect, enhance, and/or restore potential off-channel, floodplain, and wetland habitat ➡ Remove hard armoring (riprap) or implement bioengineering techniques in place of hard armoring

Newaukum River (Middle Fork and Tributaries) Tier 1 Concerns

Newaukum River (Middle Fork and Tributaries) Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ Poor riparian conditions along the lower reach and fair riparian conditions in the middle and upper reaches. Riparian corridor is predominately (approximately 90%) 'open/hardwood' and 'non-forested' (Smith Wenger 2001)	➡ Impacts to riparian corridors along the MF are mostly attributed to the conversion from forestland to agriculture and rural residences. Bank vegetation loss is the largest impact in the entire Newaukum subbasin. (Smith Wenger 2001)	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas where appropriate ➡ Revegetate open riparian areas with native plants (Use Wampler et al. 1993 document to identify potential restoration sites)

Newaukum River (Middle Fork and Tributaries) Tier 1	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access to spawning / rearing habitat is restricted	➡ Many culverts at road crossings on tributaries to the MS are undersized and do not allow adequate fish passage upstream due to high water velocity or perched outfall. These undersized structures also inhibit the movement of streambed material and LWD downstream and usually contribute to channel scour directly downstream.	➡ Correct barrier culverts. See Section 4.

Newaukum River (Middle Fork and Tributaries) Tier 1	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Estimated high levels of sediment input in the MF Newaukum based on information from Wampler et al. 1993.	➡ The high amount of sediment is likely due to the livestock access, high road densities, landslides caused by roads, vehicle activity, and high amounts of bank erosion (Smith Wenger 2001).	➡ Abandon roads on steep geologically sensitive areas ➡ Correct cross drains that may trigger mass wasting on geologically sensitive slopes ➡ Identify sources that are contributing to sediment loading ➡ Implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Reduce sediment loading by reducing low densities (abandon/decommission) ➡ Revegetate stream/river banks for added erosion protection ➡ Upgrade logging roads to comply with Forest and Fish Agreement (1999)

Newaukum River (Middle Fork and Tributaries) Tier 2 Concerns

Newaukum River (Middle Fork and Tributaries) Tier 2	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ Estimated to have high summer water temperatures ➡ Data need	➡ This assumption is based on the poor riparian conditions within the MF Newaukum. More information should be obtained to verify water quality issues.	➡ Determine water quality conditions ➡ Implement TMDL recommendations ➡ See Riparian actions

Newaukum River (Middle Fork and Tributaries) Tier 2	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Base flows are not being met for an average of 59 days per year in the Newaukum River at the gauging station near Chehalis (Smith Wenger 2001). There has also been an increase in peak flows and water volume within the Newaukum subbasin (Clark 1999). ➡ The lower reach of the MF often turns to isolated pools during the late summer (Smith Wenger 2001).	➡ Likely contributors to the water quantity problems in the Newaukum subbasin are water withdrawals, changes in land coverage, and loss of wetlands (Smith Wenger 2001).	➡ Determine if water withdrawals are being followed in accordance with current water rights ➡ Reduce water withdrawals from surface sources ➡ Restore wetlands for water storage

Newaukum River (Middle Fork and Tributaries) Tier 3 Concerns

Newaukum River (Middle Fork and Tributaries) Tier 3	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ Data Need	➡ Data Need	➡ Determine LWD quantities ➡ Develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity ➡ Install LWD pieces in conjunction with other restoration projects

Newaukum River (Middle Fork and Tributaries) Tier 3	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ Symptom	➡ Cause	➡ General Actions
➡ Data Need	➡ Data Need	➡ Assess floodplain conditions and identify impacts

Salzer Creek

Description:

Salzer Creek drains into the Chehalis River at RM 69.4 just south of the Centralia city limits. Salzer Creek originates in the low-lying hills east of Centralia and Chehalis and drains and area of 24.5 Square miles. The watershed has a maximum elevation of approximately 800 feet. Coal Creek drains into Salzer at RM 0.8.

Major Tributaries: Coal Creek

Land Uses: Highly developed for residential and commercial uses in the lower third of its length. Primarily forestlands and agriculture.

Anadromous Fish Stocks: Coho and cutthroat

Salzer Creek Tier 1 Concerns

Salzer Creek Tier 1	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Ecosystem Diagnosis and Treatment (EDT) model demonstrates sedimentation is a major problem in Salzer Creek	➡ Adjacent land use practices are the major contributor to sedimentation in the Salzer Creek subbasin. ➡ Sedimentation is likely the product of bank erosion, roads, and livestock access to the creek. (Wampler et al. 1993).	➡ Correct cross drains that may trigger mass wasting on geologically sensitive slopes ➡ Implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Install riparian fencing to exclude or reduce livestock access ➡ Reduce sediment loading by reducing road densities (abandon/decommission) ➡ Revegetate stream/river banks for added protection from erosion ➡ Upgrade logging roads to comply with Forest and Fish Agreement (1999)

Salzer Creek Tier 1	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access to the habitat restricted	➡ High percentage of forestland and logging roads, many with undersized culverts and road crossings	➡ Correct barrier culverts. See Section 4 for guidelines.

Salzer Creek Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ The riparian condition in the Salzer Creek subbasin is poor. The riparian corridor along Salzer Creek is sparsely vegetated with deciduous vegetation (Smith Wenger 2001).	➡ Conversion of land use from forestry to agriculture or rural residential has contributed to degraded riparian corridors (primarily lower Salzer Creek subbasin reaches). ➡ Past timber harvesting practices have impacted riparian corridors reducing vegetation (primarily upper Salzer Creek subbasin reaches)	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Revegetate open riparian areas with native plants

Salzer Creek Tier 2 Concerns

Salzer Creek Tier 2	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ Channelization; loss of side channel, off-channel and pool habitat	➡ Logjams have been removed from Salzer Creek according to the Phinney and Bucknell (1975). ➡ Levee at airport impedes natural channel migration.	➡ Assess floodplain conditions and identify impacts ➡ Reconnect, enhance, and/or restore potential off-channel, floodplain, and wetland habitat

Salzer Creek Tier 2	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ Salzer Creek is on the 303(d) list for temperature and low DO (Smith Wenger 2001). ➡ Low DO and fecal coliform levels were observed as the main water quality problems.	➡ The causes cited were: ➡ Poor farm management practices and leachate infiltration from the Centralia Municipal landfill. "...heavily affected by several sources, including stormwater runoff from a drainage sump" (SW WA fairgrounds) ➡ Urban and residential sources ➡ Livestock activities and possibly other unidentified sources	➡ Currently undergoing corrective action as a federal Superfund site ➡ Implement TMDL recommendations ➡ See Riparian actions ➡ Work with landowners to correct failing septic systems.

Salzer Creek Tier 3 Concerns

Salzer Creek Tier 3	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ No logjams present. ➡ Observations suggest that LWD availability and presence is extremely limited.	➡ Recorded historic settlement activities included land clearing and removal of jams and large wood from channel.	➡ Develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity ➡ Identify specific degraded riparian areas for restoration ➡ Install LWD pieces in conjunction with other restoration projects ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas where appropriate ➡ Revegetate open riparian areas with native plants

Salzer Creek Tier 3	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Low summer flows were noted as a limiting factor in Salzer Creek (Phinney and Bucknell 1975). ➡ Salzer Creek is closed to further water appropriations (Smith Wenger 2001). ➡ Increased peak flows, i.e., bank erosion and riverbed scour	➡ Low flows are a problem and many of the withdrawals are for agricultural purposes. ➡ The loss or change of vegetative cover contributes to an increase in peak flows, resulting in increased bank erosion and riverbed scour.	➡ Determine if water withdrawals are being followed in accordance with current water rights. ➡ Reduce water withdrawals from surface sources

Coal Creek

Description:

Coal Creek (WRIA-23-0872) is a short stream that flows from the east, just north of Chehalis, and enters Salzer Creek between Chehalis and Centralia. The lower reaches of Coal Creek are heavily developed with commercial enterprises. The stream bed is low gradient and primarily silt and sand. The upper reaches are in a narrow valley bordered by rural home sites, with adjacent slopes in timber production.

Major Tributaries: None named

Land Uses: Forestry, agriculture, and rural residences

Anadromous Fish Stocks: Coho and cutthroat

Coal Creek Tier 1 Concerns

Coal Creek Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ Reduced canopy and riparian vegetation ➡ The riparian corridor is in poor condition (Chehalis River Council)	➡ Agriculture, rural residences and past logging are primary causes for reduced riparian vegetation and canopy (Chehalis River Council). ➡ Channel stability is documented as high for reduced conditions by the Ecosystem Diagnosis and Treatment (EDT) model (2003)	➡ Control invasive species. See Section 5. ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Protect, fee simple/easement key properties of riparian ➡ Revegetate open riparian areas with native plants

Coal Creek Tier 1	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Extensive bank erosion was documented in the middle reaches of Coal Creek and two of its tributaries (23.0705 & 23.0712 (Smith Wenger 2001)).	➡ Sedimentation is likely the product of both bank erosion and roads. ➡ Livestock access is an issue in the lower reaches of Coal Creek (Smith Wenger 2001).	➡ Abandon roads on steep geologically sensitive areas; correct cross drains that may trigger mass wasting; identify sources that are contributing to sediment loading; implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Revegetate stream and riverbanks ➡ Upgrade logging roads - Forest and Fish Agreement (1999)

Coal Creek Tier 1	WATER QUANTITY	
➡ Data gap. Some evidence of low summer flows.	➡ Water withdrawals worsen the low flow conditions during summer low flow periods (Smith Wenger 2001).	➡ Determine if water withdrawals are being followed in accordance with current water rights ➡ Restore wetlands for water storage

Coal Creek Tier 2 Concerns

Coal Creek Tier 2	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Restricted fish passage ➡ Limited materials transport	➡ Placement of undersized culverts under roads at stream crossings	➡ Correct barrier culverts. See Section 4 for guidelines.

Coal Creek Tier 2	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ Water quality problems have been documented in Coal Creek. Rates "poor" for water quality based on warm water temperatures and low DO.	➡ Elevated water temperatures (intermediate concern); dissolved oxygen levels, reduced benthos, toxicants (intermediate concern)	➡ Implement TMDL recommendations ➡ See riparian actions

Coal Creek Tier 3 Concerns

Coal Creek Tier 3	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ LWD levels are observed as low. ➡ The Chehalis EDT model indicates this reach needs improved habitat diversity	➡ LWD levels are likely low since riparian conditions are rated poor for the Salzer Creek and past practices have likely removed LWD from Coal Creek. (C. Stussy, professional opinion).	➡ Determine LWD quantities; develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity; install LWD pieces in conjunction with other projects ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Revegetate open riparian areas with native plants

Dillenbaugh Creek

Description:

Dillenbaugh Creek enters the Chehalis River from the east at Centralia. It originates in the steep foothills southeast of Chehalis, and drains an area of approximately 15 square miles. The gradient of Dillenbaugh Creek in its upper reaches is steep, falling about 70 feet per mile. After the stream flows out onto the Newaukum River floodplain, the gradient drops as Dillenbaugh Creek parallels the Newaukum for nearly 3 miles before entering the Chehalis River. The lower reaches of Dillenbaugh Creek collect much of the storm drainage from the City of Chehalis.

Major Tributaries: Berwick Creek

Land Uses: Agriculture, industry, and urban development

Anadromous Fish Stocks: Coho and cutthroat

Dillenbaugh Creek Tier 1 Concerns

Dillenbaugh Creek Tier 1	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Erosion and multiple sediment sources are identified in the Dillenbaugh subbasin (Wampler et al. 1993). ➡ According to the Ecosystem Diagnosis and Treatment (EDT) model channel stability is a major problem in the reach containing Dillenbaugh Creek.	➡ Livestock access is noted in sections of Dillenbaugh Creek (Wampler et al. 1993). ➡ Stream reach erosion is primarily a concern in the middle reaches of the Dillenbaugh Creek subbasin (Wampler et al. 1993; Envirovision, 2000)	➡ Identify sources that are contributing to sediment loading ➡ Implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Install riparian fencing to exclude or reduce livestock access ➡ Revegetate stream/riverbanks for added erosion protection

Dillenbaugh Creek Tier 1	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access to rearing and spawning habitat is restricted	➡ Placement of undersized stream crossing structures restricts fish passage and natural processes (streambed material and LWD transport).	➡ Correct barrier culverts. See Section 4 for guidelines.

Dillenbaugh Creek Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ The riparian condition in the Dillenbaugh Creek subbasin is poor. The riparian corridor along Dillenbaugh Creek is sparsely vegetated with minimal deciduous vegetation (Smith Wenger 2001). ➡ Loss of riparian vegetation through development has also altered ecological function of the creek (HDR internal memo, 2005).	➡ Conversion of land-use from forestry to agriculture or rural residential has contributed to degraded riparian corridors. ➡ Past timber harvesting practices have impacted riparian corridors.	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Protect, fee simple/easement, key properties of riparian, revegetate open riparian areas with native plants

Dillenbaugh Creek Tier 2 Concerns

Dillenbaugh Creek Tier 2	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ "Poor" based on the extensive 303(d) listing of mainstem reaches for warm water temperatures and low DO. This is priority segment for dissolved oxygen impacts.	➡ Causes of low DO come from a wide variety of sources: farming activities, a dairy feedlot, failing septic systems adjacent to the creek and industries in the Chehalis Industrial Park that contributed to increased temperatures 303(d) listed for FC, DO and Temp. ➡ Septic and agricultural inputs contribute to elevated nitrates and poor water quality.	➡ Implement TMDL recommendations ➡ Protect by fee simple or easement key properties of riparian habitat ➡ See Riparian actions ➡ Work with landowners to correct failing septic systems

Dillenbaugh Creek Tier 2	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ LWD levels are observed low.	➡ Recorded historic settlement activities included land clearing and removal of jams and large wood from channel. ➡ LWD levels are likely low since riparian conditions are rated poor for the Dillenbaugh Creek subbasin and past practices have removed LWD from the Creek.	➡ Determine LWD quantities ➡ Develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity ➡ Identify specific degraded riparian areas for restoration ➡ Install LWD pieces in conjunction with other restoration projects ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Revegetate open riparian areas with native plants

Dillenbaugh Creek Tier 3 Concerns

Dillenbaugh Creek Tier 3	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ The lower reaches flow through urbanized areas, while residences and farmland surround the upper reaches. Lower Dillenbaugh flows through marsh habitat.	➡ Logjams have been removed from Dillenbaugh Creek according to Phinney and Bucknell (1975). ➡ Levees placed on portions of Dillenbaugh Creek have affected water storage in off-channel habitat (Smith and Wegner, 2001; USACE, 2003).	➡ Assess floodplain conditions and identify impacts ➡ Reconnect, enhance, and/or restore potential off-channel, floodplain, and wetland habitat ➡ Remove hard armoring (riprap) or implement bioengineering techniques in place of hard armoring

Dillenbaugh Creek Tier 3	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Low flows are a problem and many of the withdrawals are for agricultural purposes. ➡ Increase in peak flows result in increased bank erosion and riverbed scour. ➡ Assessments reveal that the Chehalis River is not meeting base flow standard	➡ Phinney and Bucknell (1975) note that water withdrawals may have a significant impact on the water quantity in Dillenbaugh Creek. ➡ Agricultural withdrawal ➡ Loss or change of vegetative cover ➡ Water rights/claims exceed natural stream flow in many instances during the summer months	➡ Determine if water withdrawals are being followed in accordance with current water rights ➡ Restore wetlands for water storage

Berwick Creek

Description:

Berwick Creek is located in Lewis County approximately two miles southeast of the town of Chehalis in the upper Chehalis Basin. This 7.1 mile long creek is a tributary to Dillenbaugh Creek, which drains to the Chehalis River. Primary land uses in the area include industry in the lower basin, and agriculture, rural residential, and forestry in the in the upper basin. A number of dairies are adjacent to Berwick Creek as well as livestock rearing operations.

Major Tributaries: None named

Land Uses: Forestry, agriculture, and rural residences

Anadromous Fish Stocks: Coho and cutthroat

Watershed Analysis: Newaukum Management Unit, Berwick Creek

Berwick Creek Tier 1 Concerns

Berwick Creek Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ Stream canopy reduced by agriculture in lower Berwick Creek. ➡ Dillenbaugh and its tributary Berwick Creek have gravel bottoms except in their low gradient areas. Dillenbaugh and Berwick have adequate streamside vegetation (Stream Catalog).	➡ Agriculture, rural residences and past logging are primary causes for reduced riparian vegetation and canopy loss.	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Revegetate open riparian areas with native plants

Berwick Creek Tier 1	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access spawning and rearing habitat is restricted	➡ Placement of undersized stream crossing structures restrict fish passage and natural processes (streambed material and LWD transport).	➡ Correct barrier culverts. See Section 4 for guidelines.

Berwick Creek Tier 1	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ Septic and agricultural inputs contribute to elevated nitrates and poor water quality. ➡ Kills of coho in Dillenbaugh and Berwick Creeks. ➡ 303(d) listed for fecal coliform.	➡ The suspected cause of low dissolved oxygen and high fecal coliform in Berwick Creek is livestock and septic (Smith Wenger 2001) ➡ Agricultural pollution linked to coho kills	➡ See riparian actions ➡ Work with landowners to correct failing septic systems

Berwick Creek Tier 2 Concerns

Berwick Creek Tier 2	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ LWD levels are considered very low.	➡ Recorded historic settlement activities included land clearing and the removal of jams and large wood from the channel.	➡ Develop LWD supplementation plan to install logjams in key places to improve instream channel structure and habitat diversity ➡ Install LWD in conjunction with other restoration projects

Berwick Creek Tier 2	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Low flows are a problem and many of the withdrawals are for agricultural purposes. ➡ Increase in peak flows result in increased bank erosion and riverbed scour.	➡ Water withdrawals worsen the low flow conditions during summer low flow periods (Smith Wenger 2001) ➡ The loss or change of vegetative cover	➡ Determine if water withdrawals are being followed in accordance with current water rights. ➡ Implement activities that lead to natural recharge of aquifers ➡ Protect by fee simple or easement key properties of riparian habitat ➡ See riparian actions

Berwick Creek Tier 3 Concerns

Berwick Creek Tier 3	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ The lower reaches flow through urbanized areas, while residences and farmland surround the upper reaches. ➡ Alteration of natural water storage processes	➡ Levees placed on portions of Berwick Creek have affected water storage in the subbasin (Smith and Wegner, 2001; USACE, 2003).	➡ Assess floodplain conditions and identify impacts ➡ Reconnect, enhance, and/or restore potential off-channel, floodplain, and wetland habitat

Berwick Creek Tier 3	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Livestock access to stream considered most important habitat problem (Envirovision, 2001).	➡ Livestock access is noted in sections of Berwick Creek (Wampler et al. 1993). ➡ Stream canopy reduced by agriculture, forest practices, and other causes. ➡ Bank vegetation destruction by livestock: lower Berwick Creek.	➡ Correct cross drains that may trigger mass wasting on geologically sensitive slopes ➡ Identify sources that are contributing to sediment loading ➡ Install riparian fencing to exclude or reduce livestock access ➡ Revegetate stream and riverbanks for added protection from erosion ➡ Upgrade logging roads to comply with Forest and Fish Agreement (1999)

China Creek

Description:

China Creek is a short, small watershed that flows through Centralia and empties into the Chehalis River just upstream of the Skookumchuck River at RM 67.3. Its surrounding floodplain is heavily modified. Its watershed encompasses approximately 6 square miles. Most of the channel consists of pipes and culverts where the stream runs through Centralia. Much of the watershed is moderately steep.

Major Tributaries: None

Land Uses: Industrial, forestry, agriculture, and rural residences

Anadromous Fish Stocks: Coho and cutthroat

China Creek Tier 1 Concerns

China Creek Tier 1	WATER QUALITY	
Symptom	**Cause**	**General Actions**
➡ Poor; warm water temperatures, high turbidity. (Smith Wenger 2001).	➡ High riparian loss, sedimentation, reduced canopy (Smith Wenger 2001).	➡ Implement TMDL recommendations ➡ See riparian actions

China Creek Tier 1	WATER QUANTITY	
Symptom	**Cause**	**General Actions**
➡ Low flows are a problem and many of the withdrawals are for agricultural purposes. ➡ Increase in peak flows result in increased bank erosion and riverbed scour (Smith Wenger 2001).	➡ Water withdrawals worsen the low flow conditions during summer low flow periods (Smith Wenger 2001) ➡ The loss or change of vegetative cover	➡ Determine if water withdrawals are being followed in accordance with current water rights. ➡ Implement activities that lead to natural recharge of aquifers ➡ Protect and preserve wetlands and springs. ➡ See riparian actions

China Creek Tier 1	RIPARIAN	
Symptom	**Cause**	**General Actions**
➡ 93% vegetation loss; 36% reduced tree canopy (Smith Wenger 2001).	➡ Agriculture, rural residences and past logging are primary causes for reduced riparian vegetation and canopy loss.	➡ Control invasive species. See Section 5. ➡ Identify specific degraded riparian areas for restoration ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas ➡ Revegetate open riparian areas with native plants

China Creek Tier 2 Concerns

China Creek Tier 2	SEDIMENT	
Symptom	**Cause**	**General Actions**
➡ Excessive sediment in stream bed in upper China Creek, identified by Wampler and Knudsen (1993).	➡ Sedimentation is likely the product of both bank erosion and roads. 93% vegetation loss; 36% reduced tree canopy (Smith Wenger 2001).	➡ Correct cross drains that may trigger mass wasting ➡ Identify sources that are contributing to sediment loading ➡ Implement alternative methods of bank stabilization (bioengineering) in locations of excessive erosion ➡ Install riparian fencing to exclude or reduce livestock access ➡ Reduce sediment loading by reducing road densities (abandon/decommission); upgrade logging roads to comply with Forest and Fish Agreement (1999) ➡ Revegetate stream /river banks for added erosion protection

China Creek Tier 2	FISH PASSAGE	
Symptom	**Cause**	**General Actions**
➡ Fish access to spawning and rearing habitat is restricted	➡ Heavily urbanized along the banks as it bisects Centralia (Terrain Navigator). ➡ The lower 2 miles of China Creek consist mostly of long culverts and concrete and rock line channels	➡ Correct barrier culverts. See Section 4.

China Creek Tier 3 Concerns

sChina Creek Tier 3	FLOODPLAIN	
Symptom	**Cause**	**General Actions**
➡ Floodplain connectivity is restricted	➡ Nearly 2 miles are entirely surrounded by the city of Centralia; impervious surfaces and hardened channels. ➡ Lower China Creek has riprap in lower reaches and is heavily channelized through the city of Centralia.	➡ Reconnect, enhance, and restore potential off-channel, floodplain, and wetland habitat ➡ Remove hard armoring (riprap) or implement bioengineering techniques in place of hard armoring

China Creek Tier 3	LARGE WOODY DEBRIS (LWD)	
Symptom	**Cause**	**General Actions**
➡ LWD levels are low	➡ LWD levels are likely low since riparian conditions are rated poor for the China Creek subbasin and past practices have removed LWD from the creek. ➡ Recorded historic settlement activities included land clearing and the removal of jams and large wood from the channel.	➡ Develop LWD supplementation plan that will install logjams in key places to improve instream channel structure and habitat diversity ➡ Identify specific degraded riparian areas for restoration needs ➡ Install LWD pieces in conjunction with other restoration projects ➡ Install riparian fencing to exclude or reduce livestock access ➡ Interplant conifers in deciduous dominant areas where appropriate ➡ Revegetate open riparian areas with native plants