APPENDIX A: REACH OBJECTIVES AND STRATEGIES

Overview

The reach-scale objectives and strategies provided in this appendix outline a comprehensive approach for the restoration and preservation of salmon and steelhead habitat in the lower East Fork Lewis River. Known constraints for achieving those objectives also are included. The objectives and strategies were developed by the EFWG and are based on existing information related to species recovery goals, fish usage, key life stages, watershed processes, and habitat conditions, and the local experience and knowledge of EFWG members.

The objectives focus on addressing the root causes of habitat degradation to ensure that restoration actions result in long-lasting benefits. Since many processes that create habitat operate on time-scales of decades or longer, it is also important to implement restoration actions that address both near-term needs (e.g. instream structures and LWD placement to increase habitat structure and complexity) and long-term needs, such as recovering riparian and floodplain forests. For each objective, multiple strategies are identified that support both short- and long-term habitat forming processes.

The objectives and strategies are organized according to the segments described below. The beginning of each segment contains a summary of existing information from the Recovery Plan, including fish use and timing, life stage limiting factors, species-specific reach priorities, and restoration vs. preservation value.

Segment 1 (EDT Reach 1A to 4C)

This segment extends from RM 0.0 to RM 5.7 in the mainstem EF Lewis River. The valley type is unconfined in this segment and is a tidally-influenced backwater of the Columbia River. The species with highest priority for recovery in this segment is chum (in 4C only). Recovery importance for all other species is low in all the reaches (Table 1).

Table 1. Summary of EDT results for segment including species and habitat limiting factor by lifestage, relevant months, the values for restoration or preservation, and the importance of the reach to population recovery. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Chum	Prespawn holding Egg incubation	Hab diversity/quantity Sediment	Oct-Jan Oct-Apr	69/31	High
Fall Chinook, Coho, Summer/Winter Steelhead					Low

Segment 1 Objectives:

1. **Preserve existing functioning habitat and allow no further degradation in order to preserve Chinook and chum (potential) habitat conditions.**

   Constraints:

   - *Private land ownership.*

   Strategies:

   - *Preserve quality habitat (paleochannels, high flow side-channels etc.) in the entire segment.*
   - *Work with willing landowners (public and private) to preserve quality riparian, floodplain, and off-channel habitat throughout this segment on both the north and south banks and at tributary junctions. Consider conservation easements, landowner education and other methods to ensure preservation.*
   - *Consider actions which would benefit other important fish and wildlife species in this segment.*
   - *Enforce the newly adopted Instream Flow Rule for WRIA's 27/28 which regulates withdrawals in streams and lists streams with protective closures and instream flow numbers (WDOE 2008a).*

2. **Reduce elevated summer and fall stream temperatures (to TMDL standard) in order to benefit fall Chinook, coho, and chum prespawn holding and migration.**

   Constraints:

   - *High temperatures are partially created by upstream conditions.*

   Strategies:

   - *Work with public and private landowners to plant native trees and shrubs in riparian areas and on streambanks on both the north and south banks of this segment.*
   - *Reduce width-to-depth ratios by placing LWD structures along stream margins experiencing rapid lateral erosion.*
   - *Promote rapid succession from hardwoods to conifers where conifers are climax species.*
   - *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*

3. **Reduce fine sediment input from upstream and local sources to reduce fine sediment impacts to egg incubation for chum. Reduce sediment to <10% fines and <20% embedded in non-backwatered reaches.**

   Constraints:

   - *Basin-scale and upland processes are contributing to fine sediment entering reach.*
   - *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*
   - *Reach is backwatered under certain flow conditions (Columbia flow and tidal flow conditions also have an impact).*

   Strategies:

   - *Reduce rapid erosion of streambanks through the addition of combination LWD and boulder structures that also provide habitat*

complexity and pool formation.
- *Livestock exclusion fencing on north bank between RM 2.0 and 3.0.*

4. **Enhance availability of off-channel and side-channel groundwater fed chum spawning habitat in order to benefit chum egg incubation.**

Constraints:
- *Substrate is highly embedded with fines in the tidally influenced area which may limit spawning success.*
- *Pair restoration actions with Lower Columbia Salmon Recovery and Fish & Wildlife Plan regarding chum. WDFW would need to develop or select a suitable chum salmon broodstock for the EFL in the absence of one.*

Strategies:
- *Improve access to existing off-channel habitat areas.*
- *Identify and enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide upwelling areas for chum spawning.*
- *Utilize existing meander scars and paleochannels that have been mapped along this segment.*
- *Look for opportunities near the mouths of tributaries and along the base of the hillslope on the north (east) side that may have cool upwelling conditions.*

5. **Increase the abundance (>50%) and quality (>1 meter residual depth) of mainstem pool habitat for coho rearing and chum pre-spawn holding.**

Constraints:
- *Avoid structures that will limit river recreation uses.*

Strategies:
- *Add structure that creates and maintains quality pool habitat. Focus on the type of structure that was historically present and can currently be supported given existing conditions.*

6. **Increase LWD quantities (mainstem and off-channel areas) to >57 pieces/100 m in order to increase pool abundance and habitat complexity for chum pre-spawning holding.**

Constraints:
- *There is little near-term potential LWD input from upstream reaches.*

Strategies:
- *Add LWD in the form of stable accumulations of multiple pieces (jams) with sufficient ballast to ensure they remain in place and functional up to the design flood. Add as much structure/cover to tidal area as is feasible given recreational constraints. Consider locating structures so they are activated at higher water such that they will not inhibit summer recreation use.*

7. **Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages.**

Constraints:
- *A plan to manage reed canary grass should be incorporated into*

riparian and floodplain planting plans.

Strategies:

- *Plant native trees and shrubs in riparian areas and on stream banks.*
- *Remove and control non-native invasive plant species particularly in the lower tidal area where cover is critical for estuary rearing.*
- *Preserve existing native ash groves along the south bank.*

8. **Restore channel migration zone (CMZ) where feasible to support long-term habitat forming processes that will support multiple species and life stages.**

Constraints:

- *There are private properties that use the river for recreation along this section.*
- *The large ponds/wetlands on the south bank between RM 3.0 and 5.0 are important waterfowl habitat.*

Strategies:

- *Assess the feasibility of removing the long levee perpendicular to the stream at RM 5.1.*
- *Consider adding structure to aggrade the channel bed and re-water floodplain and other off channel habitat.*

9. **Preserve and enhance existing cold water refugia in the channel, floodplain, off-channel, and side channel habitats for coho and steelhead rearing and Chum spawning.**

Constraints:

- *Cold water habitats are often associated with groundwater/hyporheic flow and may have low dissolved oxygen which may limit fish use.*
- *Cold water sources such as those identified at Mason Creek Spring have high iron content which may limit fish use.*

Strategies:

- *Identify existing cold water locations (daily max temperature meets TMDL requirements for season and life stage). Consider using volunteers to point sample during the summer to identify cold water habitat.*
- *Improve capacity/use of existing refugia by adding cover (substrate and wood).*
- *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*
- *Focus restoration actions for juvenile rearing at cold water sources to create cold water refugia.*
- *Enhance off-channel/side-channel habitat in areas with hyporheic/ groundwater flow input that will provide cool water refuge for rearing juveniles and/or chum spawning.*

Segment 2 (EDT Reach 5A, 5B, 6A)

This segment extends from RM 5.7 to RM 7.3 in the mainstem EF Lewis River. The valley type is unconfined in this segment and the channel type is pool-riffle. The species with highest priority for recovery in this segment are fall Chinook, coho, and chum (Table 2, Table 3). Summer and winter steelhead are a low priority for recovery in this segment. EDT results were the same for Reach 5A & 5B.

Table 2. Summary of EDT results for segment 2 (Reach 5A & 5B) including species and habitat limiting factor by lifestage, relevant months, the values for restoration or preservation, and the importance of the reach to population recovery For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Chum	Prespawn holding Egg incubation	Habitat div/quantity Sediment	Oct-Jan Oct-Apr	56/44	High
Fall Chinook	Egg incubation Spawning	Sediment Temperature	Nov-May Oct-Nov	43/57	High
Coho	Age-0 inactive Age-0 active rear	Key habitat quantity Temp/key hab quan.	Oct-Mar Mar-Oct	93/07	High
Summer & Winter Steelhead					Low

Table 3. Summary of EDT results for segment 2 (Reach 6A) including species and habitat limiting factor by lifestage, relevant months, the values for restoration or preservation, and the importance of the reach to population recovery. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Fall Chinook	Egg incubation Fry colonization	Sediment Key Habitat quantity	Nov-May Apr-May	41/59	High
Coho	Age-0 inactive Age-0 active	Key habitat quantity Temp/key habitat	Oct-Mar Mar-Oct	96/04	High
Chum	Prespawn hold Egg incubation	Habitat div/quantity Sediment	Oct-Jan Oct-Apr	56/44	High
Summer & Winter Steelhead					Low

Segment 2 Objectives:

1. **Preserve existing functioning riparian habitat and upland forest and allow no further degradation in order to preserve existing habitat conditions.**

   Constraints:

   - *Private land ownership.*

   Strategies:

   - *Preserve/acquire quality habitat (paleochannels, high flow side-channels etc) on north (east) bank through this segment.*

- *Work with willing landowners (public and private) to preserve quality riparian, floodplain, and off-channel habitat throughout this segment on both the north and south banks. Consider conservation easements, landowner education and other methods to ensure preservation.*
- *Consider actions which would benefit other fish and wildlife species in this segment.*

2. **Reduce fine sediment input from upstream and local sources to reduce fine sediment impacts to egg incubation for Chinook and chum. Reduce sediment to <10% fines and <20% embedded.**

   Constraints:
   - *Basin-scale and upland processes are contributing to fine sediment entering reach.*
   - *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*

   Strategies:
   - *Reduce rapid erosion of stream banks through the addition of combination LWD and boulder structures that also provide habitat complexity and pool formation.*

3. **Reduce elevated summer and fall stream temperatures (to TMDL standard) in order to benefit coho rearing and Chinook spawning.**

   Constraints:
   - *High temperatures are partially created by upstream conditions.*

   Strategies:
   - *Work with public and private land owners to plant native trees and shrubs in riparian areas and on stream banks on both the north and south banks of this segment.*
   - *Reduce width-to-depth ratios by placing LWD structures along stream margins experiencing rapid lateral erosion.*
   - *Promote rapid succession from hardwoods to conifers where conifers are climax species.*
   - *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*

4. **Preserve and enhance existing cold water refugia in the channel, floodplain, off-channel, and side channel habitats for coho and steelhead rearing and Chum spawning.**

   Constraints:
   - *Cold-water habitats are often associated with groundwater/hyporheic flow and may have low dissolved oxygen which may limit fish use.*
   - *High iron content in Mason Creek springs may limit fish use.*

   Strategies:
   - *Identify existing cold-water locations. Consider using volunteers to point sample during the summer to identify cold water habitat.*
   - *Improve capacity/use of existing refugia by adding cover (substrate and wood).*

- *Preserve/enhance existing cold-water spring habitat located on the north bank near RM 6.5 (chum spawning channel).*
- *Preserve/enhance existing cold-water springs located on the north bank near Mason Creek.*
- *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*
- *Focus restoration actions for juvenile rearing at cold water sources to create cold water refugia.*
- *Enhance off-channel/side-channel habitat in areas with hyporheic/ groundwater flow input that will provide cool water refugia for rearing juveniles and/or chum spawning.*

5. **Increase the abundance and quality of available off-channel rearing habitat to increase key habitat quantity and to provide summer temperature refugia for coho age-0 active rearing.**

Constraints:

- *Channel incision and lack of sediment supply due to upstream pits will limit ability to reconnect summer channels.*

Strategies:

- *Improve access to existing off-channel habitat areas.*
- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide cool water refugia.*
- *Enhance off-channel areas through excavation of off-channel ponds connected with the mainstem. Utilize existing meander scars and paleochannels that have been mapped along this segment.*
- *Enhance new and existing off-channel areas by adding LWD for cover and complexity.*
- *Opportunities for off-channel and side-channel restoration between RM 6 and 7 on public and private land.*

6. **Enhance availability of off-channel and side-channel groundwater fed chum spawning habitat in order to benefit chum egg incubation.**

Constraints:

- *Pair restoration actions with Lower Columbia Salmon Recovery and Fish & Wildlife Plan regarding chum. WDFW would need to develop or select a suitable chum salmon broodstock for the EFL in the absence of one.*

Strategies:

- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide upwelling areas for chum spawning.*
- *Enhance off-channel areas through excavation of off-channel ponds connected with the mainstem. Utilize existing meander scars and paleochannels that have been mapped along this segment.*
- *Opportunities for off channels and side channels between RM 6 and 7 on public and private land. Consider side channels to support chum rearing as part of long term chum recovery planning.*
- *Evaluate the feasibility of enhancing the chum channel on Swanson property.*
- *Consider creating chum spawning channels in nearby tributaries*

(Mason, Dean and Dyer).

- *Base of Mason Creek terrace may provide groundwater/chum spawning opportunity.*

7. **Increase the abundance (>50%) and quality (>1 meter residual depth) of mainstem pool habitat for coho rearing and chum pre-spawn holding.**

   Constraints:

   - *Avoid structures that will limit river recreation uses.*

   Strategies:

   - *Add structure that creates and maintains quality pool habitat. Focus on the type of structure that was historically present and what can currently be supported given existing conditions.*

8. **Increase LWD quantities (mainstem and off-channel areas) to >57 pieces/100 m in order to increase pool abundance and habitat complexity for coho rearing and chum pre-spawning holding.**

   Constraints:

   - *There is little near-term potential LWD input from adjacent riparian areas or upstream reaches.*

   Strategies:

   - *Add LWD in the form of stable accumulations of multiple pieces (jams) with sufficient ballast to ensure they remain in place and functional up to the design flood.*

9. **Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages.**

   Constraints:

   - *None identified.*

   Strategies:

   - *Plant native trees and shrubs in riparian areas and on stream banks*
   - *Remove and control non-native invasive plant species.*

10. **Enhance availability of main-stem and side-channel spawning habitat.**

    Constraints:

    - *Heavy use by boats and other recreation. Avoid structures that will limit river uses.*

    Strategies:

    - *Restore channel structure to capture substrate, increase bar formation, restore natural rates of channel migration, and increase hyporheic exchange.*
    - *Add LWD jams with boulder ballast to retain and sort substrate and to create diverse pool-riffle habitats that contain high quality spawning areas.*
    - *Increase the availability of secondary channels (i.e. active side-channels and groundwater fed off-channels) that provide quality spawning habitat for multiple species.*

11. **Restore CMZ where feasible to support long-term habitat forming processes that will support multiple species and life stages, and chum specifically.**

    Constraints:

    - *Some private properties, farm fields, and structures are within the historical CMZ and floodplain (including the airstrip).*
    - *Building grade will be costly and may not be feasible if it negatively impacts private land.*

    Strategies:

    - *Remove bank armoring on left (south) bank at RM 6.6 and 6.8 if feasible.*
    - *Evaluate the feasibility of adding channel structure in the mainstem to add grade to the river and reactive off-channel and side-channel habitat.*
    - *Work proactively with local landowners to prevent the use of additional rip-rap and bank armoring.*

12. **Increase habitat diversity where feasible at areas with bank armoring and actively eroding banks to benefit coho rearing, and pre-spawning holding.**

    Constraints:

    - *Some bank armoring is protecting the airstrip at RM 6.5.*

    Strategies:

    - *Incorporate vegetation and LWD into bank armoring in areas where armoring is necessary to protect private property.*

Segment 3 (EDT Reach 6B)

This segment extends from RM 7.3 to 8 in the mainstem EF Lewis River. The valley type is unconfined and the channel type is pool-riffle. This section is also known as the "Ridgfield Pits" avulsed reach. The species with highest priority for recovery in this segment are fall Chinook, coho, and chum (Table 4). Winter and summer steelhead are a low priority for recovery in this reach.

Table 4. Summary of EDT results for segment 3 (Reach 6B) including species and habitat limiting factor by lifstage, relevant months, the values for restoration or preservation, and the importance of the reach to population recovery. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Fall Chinook	Egg incubation Fry colonization	Sediment Key Habitat quantity	Nov-May Apr-May	38/62	High
Coho	Egg incubation Age-0 active rearing	Sediment Temp/key hab quant.	Oct-May Mar-Oct	86/14	High
Chum	Prespawn holding Egg incubation	Habitat div/quantity Sediment	Oct-Jan Oct-Apr	56/44	High
Summer & Winter Steelhead					Low

Segment 3 Objectives:

1. **Reduce fine sediment input from upstream and local sources to reduce fine sediment impacts to egg incubation for Chinook, coho, and chum. Reduce sediment to <10% fines and <20% embedded.**

   Constraints:

   - *Basin-scale and upland processes are contributing to fine sediment entering reach.*
   - *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*
   - *Pit avulsions have created backwatered conditions that collect fine sediment.*

   Strategies:

   - *There may be several approaches for addressing the avulsed reach. These include reactivating the abandoned channel, filling the pits with cobbles and boulders, or waiting for natural processes to fill the pits over time.*
   - *Any work in the abandoned pits should evaluate the costs vs. benefits as well as the potential for channel migration into and out of the pits.*

2. **Reduce elevated summer and fall stream temperatures (meet TMDL standard) in order to benefit coho rearing and Chinook spawning.**

   Constraints:

   - *High temperatures may result from stagnant water in the backwatered pits and from reduction in hyporheic exchange through river bed and bank alluvium.*
   - *High temperatures are partially created by upstream conditions.*
   - *Lack of reliable temperature and flow data in the pits. It is not known if the pits contribute to river warming or not.*
   - *BPA power line runs through the property (at least 3 towers) which may limit restoration opportunities. Work with BPA on this issue.*
   - *Area is overrun by invasive species including Himalayan blackberry, reed canary grass, scotch broom, and Japanese knotweed.*

   Strategies:

   - *Plant native trees and shrubs in riparian areas and on stream banks.*
   - *Reduce width-to-depth ratios through channel reconstruction and/or through isolation of backwatered pits from the main channel.*
   - *Evaluate the feasibility of pumping groundwater into pits/reach segment to reduce summer temperatures.*

3. **Restore CMZ where feasible to support long-term habitat forming processes that will support multiple species and life stages.**

   Constraints:

   - *The existing Storedahl mining operation is within the historic CMZ and floodplain and restricts channel migration and floodplain inundation.*
   - *The 1996 channel avulsion has served to lock the river in place within the avulsed pits until they fill with material and the river can*

resume lateral channel adjustment.

Strategies:

- *Evaluate the feasibility and cost vs. benefit of filling the pits with excess material (or floodplain material) available at the site.*
- *Evaluate the cost vs. benefit of any activity in the pit against natural process recovery.*

4. **Enhance channel structure and physical habitat conditions within the avulsed reach.**

Constraints:

- *High water temperatures in the pits.*
- *Invasive species may limit the benefit of habitat improvements.*

Strategies:

- *Evaluate the feasibility and cost vs. benefit of filling the pits with excess material available at the site, or use fill to further isolate the pits from the river during the summer (isolate warm water in the pools).*
- *Evaluate the cost vs. benefit of any activity in the pit against natural process recovery.*
- *Evaluate the feasibility of actions that would improve juvenile and adult migration through this segment.*
- *Evaluate the feasibility and cost vs. benefit of realigning the current channel into the historic channel.*

5. **Increase the abundance and quality of available off-channel rearing habitat to increase key habitat quantity and to provide summer temperature refuge for coho age-0 active rearing.**

Constraints:

- *The avulsed pits do not constitute quality off-channel habitat. They are overly deep, lack sufficient cover, and have disrupted natural hyporheic exchange processes.*

Strategies:

- *There may be the potential to reconstruct the main channel and develop portions of the avulsed ponds into off-channel habitat connected with the mainstem. Considerable restoration work would be needed to make the ponds into high quality off-channel habitats.*
- *Enhance new and existing off-channel areas by adding LWD for cover and complexity.*

6. **Enhance availability of off-channel and side-channel groundwater-fed chum spawning habitat in order to benefit chum egg incubation.**

Constraints:

- *The 1996 channel avulsion has served to lock the river in place within the avulsed pits and may be limiting potential off-channel connectivity.*
- *Pair restoration actions with Lower Columbia Salmon Recovery and Fish & Wildlife Plan regarding chum. WDFW would need to develop or select a suitable chum salmon broodstock for the EFL in the absence of one.*

Strategies:

- *Improve access to existing off-channel habitat areas.*
- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide upwelling areas for chum spawning.*

7. **Enhance pool habitat in the avulsed section for Chinook fry colonization, coho rearing, steelhead rearing, and chum pre-spawn holding.**

Constraints:

- *Current avulsed pools provide low quality habitat that support invasive, predatory species.*

Strategies:

- *There may be opportunities for reconstructing the main channel to create higher quality pool habitat.*

8. **Increase LWD quantities (mainstem and off-channel areas) to >57 pieces/100 m in order to increase pool quality and habitat complexity for coho rearing, steelhead rearing, and chum pre-spawning holding.**

Constraints:

- *There is little near-term potential LWD input from riparian areas or upstream reaches.*

Strategies:

- *Add LWD in the form of stable accumulations of multiple pieces (jams) with sufficient ballast to ensure they remain in place and functional up to the design flood.*

9. **Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages.**

Constraints:

- *The area is overrun with invasives, including Scotch broom, reed canary grass, and Japanese knotweed.*
- *Land around/adjacent to ponds is highly compacted and perched above the water table, extensive site preparation is necessary prior to planting.*

Strategies:

- *Plant native trees and shrubs in riparian areas and on stream banks.*
- *Remove and control non-native invasive plant species.*

Segment 4 (EDT Reach 6C, 7, 8A, 8B)

This segment extends from RM 8 to RM 13 in the mainstem EF Lewis River. The valley type is unconfined in this segment and the channel type is pool-riffle. The species with highest priority for recovery in this segment are fall Chinook, coho, and chum (Table 6,Table 7, Table 8, Table 8). Winter steelhead are a medium priority in Reach 7 and 8B and summer steelhead are a low priority for recovery in all the reaches.

Table 5. Summary of EDT results for segment 4 (Reach 6C) including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recover. For low priority species, limiting factor information is not included.

Priority Species	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Fall Chinook	Egg incubation Fry colonization	Sediment Key habitat quantity	Nov-May Apr-May	42/58	High
Coho	Age-0 active rearing Egg incubation	Temp/Key hab. quant. Sediment	Mar-Oct Oct-May	91/09	High
Chum	Egg incubation Prespawn holding	Sediment Hab. diversity/quantity	Oct-Apr Oct-Jan	56/44	High
Summer & Winter Steelhead					Low

Table 6. Summary of EDT results for segment 4 (Reach 7) including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recover. For low priority species, limiting factor information is not included.

Priority Species	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Fall Chinook	Egg incubation Spawning	Sediment Temperature	Nov-May Oct-Nov	34/66	High
Coho	Age-0 active rear Egg incubation	Temp/key hab quant. Sediment	Mar-Oct Oct-May	82/18	High
Chum	Egg incubation Prespawn holding	Sediment Key habitat quantity	Oct-Apr Oct-Jan	45/55	High
Winter Steelhead	Egg incubation Age-0 active rear	Sediment/temp Temp/predation	Mar-Jul May-Oct	46/64	Medium
Summer Steelhead					Low

Table 7. Summary of EDT results for segment 4 (Reach 8A) including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recover. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Fall Chinook	Egg incubation Spawning	Sediment Temp./Key habitat	Nov-May Oct-Nov	33/67	High
Coho	Egg incubation Age-0 active rearing	Sediment Temp/key hab quant.	Oct-May Mar-Oct	83/17	High
Chum	Egg incubation Prespawn holding	Sediment/Key Hab. Habitat Diversity	Oct-Apr Oct-Jan	52/48	High
Winter Steelhead	Egg incubation Age-0 active rearing	Sediment/temp. Temp./predation	Mar-Jul May-Oct	68/32	Medium
Summer Steelhead					Low

Table 8. Summary of EDT results for segment 4 (Reach 8B) including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recover. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Chum	Egg incubation Prespawn holding	Sediment/key hab. Habitat diversity	Oct-Apr Oct-Jan	52/48	High
Fall Chinook	Egg incubation Spawning	Sediment/key hab. Temp./key hab.	Nov-May Oct-Nov	38/62	Medium
Coho	Egg incubation Age-0 active rearing	Sediment Temp/key hab. quan.	Oct-May Mar-Oct	83/17	Medium
Winter Steelhead	Egg incubation Age-0 active rearing	Sediment/temp. Temp./predation	Mar-Jul May-Oct	66/34	Medium
Summer Steelhead					Low

Segment 4 Objectives:

1. **Preserve existing functioning riparian habitat and upland forest and allow no further degradation in order to preserve existing habitat conditions.**

   Constraints:

   - *Private land ownership in this section is fragmented into small parcels.*

   Strategies:

   - *Preserve/acquire quality habitat (paleochannels, high-flow side channels etc) along south bank between RM 11.5 and 12.3.*
   - *Conservation easement along south bank near RM 10.8.*
   - *Work with landowners (public and private) to preserve quality riparian and floodplain habitat in the following areas: large intact riparian and floodplain located on both sides of the river near RM 12.0; intact riparian corridor and floodplain located on the north side near RM 11.0; intact riparian corridor located on the south side near RM 10.5. Consider conservation easements, landowner education and other methods to ensure preservation.*

2. **Reduce fine sediment input from upstream and local sources to reduce fine sediment impacts to egg incubation for Chinook, coho, steelhead, and chum. Reduce sediment to <10% fines and <20% embedded.**

   Constraints:

   - *Basin-scale and upland processes are contributing to fine sediment entering reach.*
   - *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*
   - *Lack of reliable sediment data. Unclear about the scope of the sediment problem in this reach.*

   Strategies:

   - *Reduce rapid erosion of low terraces through the addition of*

combination LWD and boulder structures that also provide habitat complexity and pool formation.

3. **Reduce elevated summer and fall stream temperatures (to TMDL standard) in order to benefit coho rearing and Chinook spawning.**

   Constraints:

   - *High temperatures are partially created by upstream conditions.*

   Strategies:

   - *Work with public and private landowners to plant native trees and shrubs in riparian areas and on streambanks in the following areas: along the south bank from RM 9.3 to 10 and RM 10.8 to 11.8.*
   - *Reduce width-to-depth ratios by placing LWD structures along stream margins experiencing rapid lateral erosion.*
   - *Promote rapid succession from hardwoods to conifers where conifers are climax species.*
   - *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*

4. **Preserve and enhance existing cold water refugia in the channel, floodplain, off-channel and side channel habitats for coho and steelhead rearing and Chinook spawning.**

   Constraints:

   - *Cold-water habitats are often associated with groundwater/ hyporheic flow and may have low dissolved oxygen which may limit fish use.*

   Strategies:

   - *Identify existing cold-water locations. Consider using volunteers to point sample during the summer to identify cold-water habitat.*
   - *Improve capacity/use of existing refugia by adding cover (substrate and wood).*
   - *Preserve/enhance existing cold-water spring habitat located on the north bank near the confluence of Manly and Mill Creeks (RM 9.3).*
   - *Preserve/enhance existing cold water springs located on the south bank side below Manly Creek (RM 9.0 to 9.3).*
   - *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange*
   - *Focus restoration actions for juvenile rearing at cold water sources to create cold water refugia.*
   - *Enhance off-channel/side-channel habitat in areas with hyporheic/ groundwater flow input that will provide cool water refuge for rearing juveniles and/or chum spawning (north bank near the confluence of Manly and Mill Creeks (RM 9.3) and south bank side below Manly Creek (RM 9.0 to 9.3).*

5. **Increase the abundance and quality of available off-channel rearing habitat to increase key habitat quantity and to provide summer temperature refuge for coho age-0 active rearing.**

   Constraints:

   - *Private land ownership.*

- *May not be feasible to relocate the County Shop.*
- *Summer temperatures in off-channel/side channel habitat may be too warm for salmon and trout.*

Strategies:

- *Improve access to existing off-channel habitat areas.*
- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide cool water refuge.*
- *Enhance off-channel areas through excavation of off-channel ponds connected with the mainstem. Utilize existing meander scars and paleochannels that have been mapped along this segment.*
- *Enhance new and existing off-channel areas by adding LWD and boulder substrate for cover and complexity.*
- *Focus on confluence areas of tributaries.*
- *Restore existing off-channel/side-channel areas on north side of RM 9.5 (near Manley) and below County Shop.*
- *Evaluate the feasibility of relocating the County Shop outside of the floodplain/CMZ to improve off channel habitat and CMZ processes. Approach adjacent landowners about removing levees and improving off channel habitat.*

6. **Enhance availability of off-channel and side-channel groundwater fed chum spawning habitat in order to benefit chum egg incubation.**

Constraints:

- *Channel incision from pit avulsion may be limiting potential off-channel connectivity near RM 9.0.*
- *Pair restoration actions with Lower Columbia Salmon Recovery and Fish & Wildlife Plan regarding chum. WDFW would need to develop or select a suitable chum salmon broodstock for the EFL in the absence of one.*

Strategies:

- *Improve access to existing off-channel habitat areas.*
- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide upwelling areas for chum spawning.*
- *Enhance off-channel areas through excavation of off-channel ponds connected with the mainstem. Utilize existing meander scars and paleochannels that have been mapped along this segment.*

7. **Increase the abundance (>50%) and quality (>1 meter residual depth) of mainstem pool habitat for Chinook fry colonization, coho rearing, steelhead rearing, and chum pre-spawn holding.**

Constraints:

- *River recreation use, avoid channel structures that would impair river uses.*

Strategies:

- *Add structure that creates and maintains quality pool habitat. Focus on the type of structure that was historically present and what can currently be supported given existing conditions.*

8. **Increase LWD quantities (mainstem and off-channel areas) to >57 pieces/100 m in order to increase pool abundance and habitat complexity for coho rearing, steelhead rearing, and chum pre-spawning holding.**

Constraints:

- *There is little near-term potential LWD input from upstream reaches*
- *Avoid channel structures that would impair river uses.*

Strategies:

- *Add LWD in the form of stable accumulations of multiple pieces (jams) with sufficient ballast to ensure they remain in place and functional up to the design flood.*
- *Add LWD in areas to divert flow into off-channel/side-channel habitat.*

9. Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages

Constraints:

- *None identified.*

Strategies:

- *Plant native trees and shrubs in riparian areas and on streambanks*
- *Enhance new and existing off-channel areas by adding LWD and boulder substrate for cover and complexity*

10. Enhance availability of main-stem and side-channel spawning habitat.

Constraints:

- *Heavy use by boats and other recreation. Avoid structures that will limit river uses.*

Strategies:

- *Restore channel structure to capture substrate, increase bar formation, restore natural rates of channel migration, and increase hyporheic exchange.*
- *Add LWD jams with boulder ballast to retain and sort substrate and to create diverse pool-riffle habitats that contain high quality spawning areas.*
- *Increase the availability of secondary channels (i.e. active side-channels and groundwater fed off-channels) that provide quality spawning habitat for multiple species.*

11. Restore CMZ where feasible to support long-term habitat forming processes that will support multiple species and life stages.

Constraints:

- *Daybreak Bridge and associated road fill constricts CMZ.*
- *There are houses, roads, businesses, and farms within the historical CMZ and floodplain.*
- *Will need to protect existing infrastructure (e.g. access roads on Storedahl property).*
- *Gravel pits will continue to affect channel migration for the short term (decades).*

Strategies:

- *Remove remnant levees near RM 8.1, 8.2, 8.7, 8.9, 9.4, and 10.7 if it can be determined they are no longer serving any flood protection function.*
- *Assess where bank armoring could be removed.*

- *Evaluate the feasibility of relocating the County Shop outside of the floodplain to improve off channel habitat. Approach adjacent landowners about removing levees and improving off channel habitat (RM 8 to 9).*

12. **Increase habitat diversity where feasible at areas with bank armoring and actively eroding banks to benefit coho rearing, steelhead rearing, and pre-spawning holding.**

    Constraints

    - *Some bank armoring is protecting private property from erosion (RM 10 and 11.5).*

    Strategies

    - *Incorporate vegetation and LWD into bank armoring in areas where armoring is necessary to protect private property.*
    - *Evaluate the feasibility of removing, or incorporating vegetation and wood into the armored bank near RM 11.5 (south side).*

Segment 5 (EDT 8B)

This segment extends from RM 13 to RM 15 in the mainstem EF Lewis River. The valley is moderately confined in this segment and the channel type is pool-riffle. The species with highest priority for recovery in this reach are chum (Table 9). Recovery priorities for Fall Chinook, coho, and winter steelhead are medium in this reach and low for summer steelhead.

Table 9. Summary of EDT results for segment 5 including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recover. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Chum	Egg incubation Prespawn holding	Sediment/key habitat Habitat diversity	Oct-Apr Oct-Jan	52/48	High
Fall Chinook	Egg incubation Spawning	Sediment/key habitat Temperature/key hab.	NovMay Oct-Nov	38/62	Medium
Coho	Egg incubation Age-0 active rearing	Sediment Temp/key hab quan.	Oct-May Mar-Oct	83/17	Medium
Winter Steelhead	Egg incubation Age-0 active rearing	Sediment/temperature Temperature/predation	Mar-Jul May-Oct	66/34	Medium
Summer Steelhead					Low

Segment 5 Objectives:

1. **Preserve existing functioning riparian habitat and upland forest and allow no further degradation in order to preserve existing habitat conditions.**

    Constraints:

    - *Private land ownership.*

    Strategies:

    - *Work with landowners (public and private) to preserve quality*

riparian and upland forest habitat. Consider conservation easements, landowner education and other methods to ensure preservation. There may specific opportunities in the following areas: large intact riparian and upland forest located on the north side near RM 15.0; intact riparian corridor and floodplain located on the south side between RM 14.5-14.0; intact riparian corridor located on both sides of the river between RM 13.0-13.5.

2. **Reduce fine sediment input from upstream and local sources to reduce fine sediment impacts to egg incubation for Chinook, coho, and chum. Reduce sediment to <10% fines and <20% embedded.**

   Constraints:

   - *Basin-scale and upland processes are contributing to fine sediment entering reach.*
   - *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*
   - *There are few actively eroding streambanks along this section.*

   Strategies:

   - *Restore actively eroding banks within Lewisville Park near RM 13.7. Work proactively with Vancouver/Clark County Parks to develop a long term strategy for bank stabilization to prevent continued use of emergency rip-rapping.*
   - *Control fine sediment at areas in Lewisville Park where recreational access points contribute to bank erosion.*

3. **Reduce elevated summer and fall stream temperatures (to TMDL standard) in order to benefit coho rearing and Chinook spawning.**

   Constraints:

   - *High temperatures are partially created by upstream conditions*
   - *The riparian canopy in this reach is largely intact. There are few opportunities for planting to offset existing temperature.*

   Strategies:

   - *Plant native trees and shrubs in riparian areas and on stream banks in the following areas: along south bank near RM 13.0; along north bank in Lewisville Park (RM 13.5 to 14.2).*
   - *Promote rapid succession from hardwoods to conifers where conifers are climax species.*
   - *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*

4. **Preserve and enhance existing cold water refugia in the channel, floodplain, off-channel and side-channel habitats for coho and steelhead rearing and Chinook spawning.**

   Constraints:

   - *Cold water habitats are often associated with groundwater/hyporheic flow and may have low dissolved oxygen which may limit fish use.*

   Strategies:

   - *Identify and preserve existing cold water habitat.*

- *Improve capacity/use of existing refugia by adding cover (substrate and wood).*
- *Restore channel structure to capture substrate, increase bar formation, active channel migration, and increase hyporheic exchange.*
- *Focus restoration actions for juvenile rearing at cold water sources to create cold water refugia.*
- *Enhance off-channel/side-channel habitat in areas with hyporheic/groundwater flow input that will provide cool-water refugia for rearing juveniles and/or chum spawning habitat.*

5. **Increase the abundance and quality of available off-channel/side-channel active rearing and winter refugia where feasible to increase key habitat quantity for rearing coho and steelhead.**

Constraints:

- *Private land ownership.*
- *Summer recreational use.*
- *Limited opportunities for active summer side-channels in this reach.*
- *Summer temperatures in off-channel/side-channel habitat may be too warm for salmon and trout.*

Strategies:

- *Improve access to existing off-channel/side-channel habitat areas.*
- *Enhance off-channel areas through excavation of off-channel ponds connected with the mainstem. Utilize existing meander scars and paleochannels along this segment.*
- *Enhance new and existing off-channel areas by adding LWD and substrate for cover and complexity.*
- *Enhance existing high-flow channel on north side at RM 13.5 in Lewisville Park. Remove armoring at the head of the channel.*
- *Enhance existing side-channel on south side at RM 14-14.5.*

6. **Enhance availability of off-channel and side-channel groundwater fed chum spawning habitat in order to benefit chum egg incubation**

Constraints:

- *Pair restoration actions with Lower Columbia Salmon Recovery and Fish & Wildlife Plan regarding chum. WDFW would need to develop or select a suitable chum salmon broodstock for the EFL in the absence of one.*

Strategies:

- *Improve access to existing off-channel habitat areas.*
- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide upwelling areas for chum spawning.*
- *Enhance off-channel and side-channel areas using existing meander scars and paleochannels that are present along this segment.*

7. **Increase the abundance (>50%) and quality (>1 meter residual depth) of mainstem pool habitat for coho rearing and chum pre-spawn holding.**

Constraints:

- *Heavy use through the park area by boats, swimmers and other recreation. Avoid structures that will limit river uses.*

Strategies:

- *Add structure that creates and maintains quality pool habitat. Focus on the types of structures that were historically present and what can currently be supported given existing conditions.*

8. **Increase LWD quantities (mainstem and off-channel areas) to >57 pieces/100 m in order to increase pool abundance and habitat complexity for coho rearing, steelhead rearing, and chum pre-spawning holding.**

Constraints:

- *There is little near-term potential LWD input from riparian areas or upstream reaches. Heavy use through the park area by boats, swimmers and other recreation.*

Strategies:

- *Add LWD in the form of stable accumulations of multiple pieces (jams) with sufficient ballast to ensure they remain in place and functional up to the design flood.*
- *Avoid structures that will limit river uses.*

9. **Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages.**

Constraints:

- *None identified.*

Strategies:

- *Plant native trees and shrubs in riparian areas and on stream banks.*
- *Remove and control non-native invasive plant species*
- *Camp Juliana planting.*

10. **Enhance availability of main-stem and side-channel spawning habitat.**

Constraints:

- *Heavy use by boats and other recreation. Avoid structures that will limit river uses.*

Strategies:

- *Restore channel structure to capture substrate, increase bar formation, restore natural rates of channel migration, and increase hyporheic exchange.*
- *Add LWD jams with boulder ballast to retain and sort substrate and to create diverse pool-riffle habitats that contain high quality spawning areas.*
- *Increase the availability of secondary channels (i.e. active side-channels and groundwater fed off-channels) that provide quality spawning habitat for multiple species.*

11. **Restore CMZ where feasible to support long-term habitat forming processes that will support multiple species and life stages.**

Constraints:

- *Residences, roads, and parts of Lewisville Park are within the historical CMZ and 100-year floodplain.*
- *Lewisville Bridge and associated road fill constrict the CMZ.*

- *There are few opportunities to restore the historical CMZ without land acquisitions, major reconfiguration of the HWY 503 Bridge and fill, or incorporation of Lewisville Park into the CMZ.*

Strategies:

- *Land acquisition.*
- *Incorporate portions of Lewisville Park into the CMZ where feasible.*
- *Work proactively with local landowners to prevent the use of rip-rap along banks.*

12. **Increase habitat diversity where feasible at areas with bank armoring and actively eroding banks to benefit coho rearing, steelhead rearing, and pre-spawning holding.**

Constraints:

- *Some bank armoring is protecting portions of Lewisville Park*

Strategies:

- *Incorporate vegetation and LWD into bank armoring in areas where armoring is necessary to protect property*

Segment 6 (Lower Valley Tributary Reaches):

These are tributary reaches that occur within the CMZ of the EF Lewis River. Valley types vary from unconfined to marginally unconfined. Channel type varies by tributary as doe the species of highest priority. Reach tiers included in Segment 6 are: Tier 1 (Brezee Cr 2, Dean Cr 1A, Dyer Cr 1, Manley Cr 1A, D, E, F and G). Tier 2 (Dyer Cr 2, Lockwood Cr 1, Manley Cr 1B-C, McCormick 1A, Mason Cr 1, Swanson Cr). Tier 4 (Brezee Cr 1, Beasley Cr 1 & 2, Mason Cr 2, Stoughton Cr 1). The species with highest priority for recovery in this segment are coho, the segment is of medium to low importance for steelhead and chum recovery, and low importance for fall Chinook and summer steelhead (Table 10).

Table 10. Summary of EDT results for segment 6 (see above) including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recovery. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Population Recovery
Coho	Egg incubation, Fry Colonization, Age-0 active/inactive rearing	Sediment, Key habitat quantity, Channel stability, Temperature, Habitat diversity	Oct-May Mar-Oct	varies by reach	High to Medium
Winter Steelhead	Spawning, Egg Incubation, Fry Colonization , Age-0/1 active/inactive rearing	Sediment, Temperature, Habitat diversity, Oxygen, Pathogens, Flow	Mar-Jul May-Oct	varies by reach	Medium to Low
Chum	Egg incubation Prespawn holding	Habitat diversity, key habitat quantity, sediment, channel stability	Oct-Apr Oct-Jan	varies by reach	Medium to Low
Fall Chinook, Summer Steelhead					Low

Segment 6 Objectives:

1. **Preserve existing functioning headwater, floodplain, wetland, and riparian habitat and allow no further degradation in order to preserve existing coho, steelhead, and chum habitat conditions.**

   Constraints:

   - *There are houses, roads, businesses, and farms within the headwaters, riparian and floodplain of most of the tributaries.*

   Strategies:

   - *Work with willing landowners to preserve existing functioning habitat.*
   - *Identify potential land acquisition opportunities.*
   - *Preserve instream flows.*

2. **Reduce elevated summer and fall stream temperatures (to TMDL standard) in order to benefit coho and steelhead rearing and chum migration.**

   Constraints:

   - *High temperatures are partially created by headwater conditions which are primarily held in private ownership.*
   - *Headwater springs/tributaries have been converted into small ponds and reservoirs for private use.*

   Strategies:

   - *Focus on restoration and preservation of headwater tributaries and springs.*
   - *Work with willing landowners to convert headwater diversions such as ponds/small reservoirs back into functioning cold water stream channel/spring habitat.*
   - *Plant native trees and shrubs in riparian areas and on stream banks.*
   - *Remove non-native invasive plants.*
   - *Reduce width-to-depth ratios by placing LWD structures along stream margins experiencing rapid lateral erosion.*
   - *Control and rebuild grade in incised channels in order to restore more frequent floodplain inundation, channel migration, and increase groundwater and surface water interactions.*
   - *Place in-stream structures to capture and retain substrate to improve hyporheic exchange through the substrate.*
   - *Restore instream flows (surface and groundwater) by working with willing landowners to purchase or lease existing water rights or relinquish existing unused water rights.*

3. **Restore instream habitat complexity on tributaries within the valley floor of the EF Lewis to enhance summer rearing and winter refugia for coho and steelhead.**

   Constraints:

   - *Channel incision within the EF Lewis limits the ability to restore tributary connectivity with its floodplain.*
   - *Basin-scale hydrologic impacts potentially increase flood risk and*

energy for erosion/incision.

Strategies:

- *Reduce rapid erosion of streambanks through the addition of combination LWD and boulder structures that also provide habitat complexity and pool scour.*
- *Add LWD structures that create and maintain quality pool formation, cover, bank stability and sediment sorting. Focus on the types of accumulations that were historically present and can currently be supported given existing conditions.*
- *Control and rebuild grade in incised channels in order to restore more frequent floodplain inundation, channel migration, and increase groundwater and surface water interactions.*
- *Identify sites where channel relocation is necessary to restore channel structure and habitat.*

4. **Reduce fine sediment input from upstream and local sources by protecting and restoring natural sediment supply processes to reduce fine sediment impacts to egg incubation for coho, steelhead, and chum.**

Constraints:

- *Basin-wide private agriculture and development are contributing to fine sediment entering reach.*
- *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*
- *Private fords/culverts exist on almost every tributary.*

Strategies:

- *Reduce rapid erosion of streambanks through the addition of combination LWD and boulder structures that also provide habitat complexity and pool scour.*
- *Livestock exclusion fencing.*
- *Restore streambank stability by restoring eroding stream banks and addressing mass wasting (e.g. landslides).*
- *Address road-related sediment sources by disconnecting ditch lines from stream channels.*
- *Work with willing landowners to reduce sediment impacts at stream fords.*
- *Work with willing landowners to increase riparian buffer size, plant native trees and shrubs, and remove non-native invasive plants.*

5. **Remove fish barriers to expand adult and juvenile passage.**

Constraints:

- *Private culverts/fords exist in every tributary.*
- *Private ponds/reservoirs exist in a couple of lower valley tributaries.*
- *Lack of data on fish barriers.*

Strategies:

- *Remove/replace culverts or other structures that create full or partial barriers and replace with passable culvert or bridge on all the tributaries.*
- *Work with willing landowners on privately-owned culvert replacement.*
- *Work with willing landowners to remove barriers caused by*

damming streams/springs for ponds and reservoirs

- *Address the sources of thermal, low flow, or channel morphology barriers*

6. **Increase the abundance and quality of available off-channel rearing habitat to increase key habitat quantity and to provide summer temperature refuge for coho age-0 active rearing.**

Constraints:

- *There are houses, roads, businesses, and farms within the riparian and floodplain of most of the tributaries.*
- *Artificial channel confinement on private lands.*
- *Cold water refugia habitat created by groundwater/hyporheic flow is often low in dissolved oxygen.*

Strategies:

- *Work with willing landowners to set back, breach or remove artificial channel confinement structures.*
- *Improve access to existing off-channel habitat areas.*
- *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide cool-water refugia, while maintaining DO levels.*
- *Create and enhance new and existing off-channel areas by adding LWD for cover and complexity.*

7. **Enhance availability of groundwater fed chum spawning habitat in order to benefit chum egg incubation.**

Constraints:

- *May be limited availability of suitable upwelling sites.*

Strategies:

- *Identify/preserve/enhance stream channel areas with hyporheic/groundwater flow input that will provide upwelling areas for chum spawning.*
- *Place in-stream structures to capture and retain substrate to improve hyporheic exchange through the substrate.*
- *Control and rebuild grade in incised channels in order to restore more frequent floodplain inundation, channel migration, and increase groundwater and surface water interactions.*

8. **Increase the abundance and quality of pool habitat for coho and steelhead fry colonization, rearing, and chum pre-spawn holding.**

Constraints:

- *None identified.*

Strategies:

- *Add LWD structure that creates and maintains quality pool habitat. Focus on the types of accumulations that were historically present and can currently be supported given existing conditions.*

9. **Increase LWD quantities to >3 pieces/channel width in order to increase pool abundance and habitat complexity for coho rearing, steelhead rearing, and chum pre-spawning holding.**

Constraints:

- *There is little near-term potential LWD input from most riparian areas or upstream contributing reaches.*

Strategies:

- *Add LWD that creates and maintains quality pool formation, cover, bank stability and sediment sorting. Focus on individual log placements and on the types of accumulations that were historically present and can currently be supported given existing conditions.*

10. Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages.

Constraints:

- *There are houses, roads, businesses, and farms within the riparian and floodplain of most of the tributaries.*

Strategies:

- *Work with willing landowners to increase riparian buffer size and plant native trees and shrubs.*
- *Remove and control invasive plant species.*

11. Restore CMZ where feasible to support long-term habitat forming processes that will support multiple species and life stages

Constraints:

- *Existing infrastructure such as bridges, culverts, and levees*
- *There are houses, roads, businesses, and farms within the historical CMZ and floodplain.*

Strategies:

- *Assess where bank armoring could be removed and work with willing landowners.*
- *Control and rebuild grade in incised channels in order to restore more frequent floodplain inundation, channel migration, and increase groundwater and surface water interactions.*
- *Remove or set-back levees where feasible.*

12. Improve water quality conditions by restoring runoff processes.

Constraints:

- *Private agriculture and development contribute chemical contaminants, turbidity, stormwater runoff, and farm waste.*

Strategies:

- *Livestock exclusion fencing.*
- *Work with commercial nurseries and tree farms to increase riparian buffers and reduce runoff by disconnecting ditch lines from stream channels.*
- *Work with willing landowners to increase riparian buffer size and plant native trees and shrubs.*
- *Restore wetlands.*

Segment 7 (Upper Valley Tributary Reaches)

These reaches include upper tributary reaches that occur upstream of the East Fork Lewis River valley floor. Valley types vary from confined to marginally unconfined. Channel type varies by tributary as does the species of highest priority. Reach tiers included in Segment 6 are: Tier 1 (McCormick Cr 1 D, G-H, Mason Cr RB Trib 1A, Mill Cr 1C). Tier 2 (McCormick Cr 1C & 1I, Dean Cr 3, Dyer Cr 4, Mason Cr 3 & 8, Mill Cr 1A). Tier 4 (All others). The species with highest priority for recovery in this segment are coho, with medium to low priority for steelhead. These are the only species present in the upper reaches (Table 11).

Table 11. Summary of EDT results for segment 7 (see above) including species and habitat limiting factor by life stage, relevant months, the values for restoration or preservation, and the importance of the reach to population recovery. For low priority species, limiting factor information is not included.

Species Present	Life Stage (primary limiting)	Limiting Factor (primary)	Relevant Months	Restoration v. Preservation Value	Reach Importance to Pop. Recovery
Coho	Egg incubation, Fry Colonization, Age-0 active/inactive rearing	Sediment, Key habitat quantity, Temperature	Oct-May Mar-Oct	varies by reach	High to Medium
Winter Steelhead	Spawning, Egg Incubation, Fry Colonization	Sediment, Temperature, Key habitat quantity	Mar-Jul May-Oct	varies by reach	Medium to Low

Segment 7 Objectives:

1. **Preserve existing functioning headwater, floodplain, wetland, and riparian habitat and allow no further degradation in order to preserve existing coho and steelhead habitat conditions.**

   Constraints:

   - *There are houses, roads, businesses, and farms within the headwaters, riparian and floodplain of most of the tributaries.*

   Strategies:

   - *Work with willing landowners to preserve existing functioning habitat.*
   - *Identify potential land acquisition opportunities.*
   - *Enforce newly adopted Instream Flow Rule for WRIA's 27/28 which regulates withdrawals in streams and lists streams with protective closures (WDOE 2008a).*

2. **Reduce elevated summer stream temperatures in order to benefit coho and steelhead rearing.**

   Constraints:

   - *High temperatures are partially created by headwater conditions which are primarily held in private ownership.*
   - *Headwater springs/tributaries have been converted into small ponds and reservoirs for private use.*

   Strategies:

   - *Focus on restoration and preservation of headwater tributaries and springs.*

- *Work with willing landowners to convert headwater diversions such as ponds/small reservoirs back into functioning cold water stream channel/spring habitat.*
- *Plant native trees and shrubs in riparian areas and on streambanks.*
- *Remove non-native invasive plants.*
- *Reduce width-to-depth ratios by placing LWD structures along stream margins experiencing rapid lateral erosion.*
- *Control and rebuild grade in incised channels in order to restore more frequent floodplain inundation, channel migration, and increase groundwater and surface water interactions.*
- *Place in-stream structures to capture and retain substrate and improve hyporheic exchange through the substrate.*
- *Restore instream flows (surface and groundwater) by working with willing landowners to purchase or lease existing water rights or relinquish existing unused water rights.*

3. **Reduce fine sediment input from upstream and local sources by protecting and restoring natural sediment supply processes to reduce fine sediment impacts to egg incubation for coho and steelhead.**

Constraints

- *Private agriculture and development are contributing to fine sediment entering reach.*
- *Basin-scale hydrologic impacts potentially increase flood risk and energy for erosion/incision.*
- *Private fords/culverts exist on almost every tributary.*

Strategies

- *Reduce rapid erosion of streambanks through the addition of combination LWD and boulder structures that also provide habitat complexity and pool scour.*
- *Livestock exclusion fencing.*
- *Restore streambank stability by restoring eroding stream banks and mass wasting (landslides, debris flows).*
- *Address road related sediment sources by disconnecting ditch lines from stream channels.*
- *Work with willing landowners to reduce sediment impact at stream fords.*
- *Work with willing landowners to increase riparian buffer size, plant native trees and shrubs, and remove non-native invasive plants.*

4. **Remove fish barriers to expand coho and steelhead fry colonization and summer and winter rearing habitat.**

Constraints:

- *Private culverts/fords exist on almost every tributary.*
- *Private ponds/reservoirs exist on almost every tributary.*

Strategies:

- *Remove/replace culverts or other structures that create full or partial barriers and replace with passable culvert or bridge.*
- *Work with willing landowners on privately owned culvert replacement.*
- *Work with willing landowners to remove barriers caused by*

damming streams/springs for ponds and reservoirs.

- *Address the sources of thermal, low flow, or channel morphology barriers.*

5. **Increase the abundance and quality of available off-channel rearing habitat to increase key habitat quantity and to provide summer temperature refuge for coho age-0 active rearing.**

   Constraints:

   - *There are houses, roads, businesses, and farms within the riparian and floodplain of most of the tributaries.*
   - *Artificial channel confinement on private lands.*
   - *Cold water refugia habitat created by groundwater/hyporheic flow is often low in dissolved oxygen.*

   Strategies:

   - *Work with willing landowners to set back, breach or remove artificial channel confinement structures.*
   - *Improve access to existing off-channel habitat areas.*
   - *Enhance off-channel habitat in areas with hyporheic/groundwater flow input that will provide cool-water refugia, while maintaining DO levels.*
   - *Create and enhance new and existing off-channel areas by adding LWD for cover and complexity.*

6. **Increase the abundance and quality of pool habitat for coho and steelhead fry colonization, rearing, and adult holding.**

   Constraints:

   - *None identified.*

   Strategies:

   - *Add LWD structures that create and maintain quality pool habitat. Focus on the types of accumulations that were historically present and can currently be supported given existing conditions.*

7. **Increase LWD quantities to >3 pieces/channel width in order to increase pool abundance and habitat complexity for coho rearing, steelhead rearing, and adult pre-spawn holding.**

   Constraints:

   - *There is little near-term potential LWD input from most riparian areas or upstream contributing reaches.*

   Strategies:

   - *Add LWD for pool formation, cover, bank stability and sediment sorting. Focus on the types of accumulations that were historically present and can currently be supported given existing conditions.*

8. **Restore native riparian forest communities to increase long-term bank stability, shade, and LWD recruitment to benefit multiple species and life stages.**

   Constraints:

   - *There are houses, roads, businesses, and farms within the riparian and floodplain of most of the tributaries.*

Strategies:

- *Work with willing landowners to increase riparian buffer size and plant native trees and shrubs.*
- *Remove and control invasive plant species.*

9. Restore CMZ where feasible to support long-term habitat forming processes that will support multiple species and life stages.

Constraints:

- *Existing infrastructure such as bridges, culverts, and levees*
- *There are houses, roads, businesses, and farms within the historical CMZ and floodplain.*

Strategies:

- *Assess where bank armoring could be removed and work with willing landowners.*
- *Remove levees or other confining structures.*
- *Control and rebuild grade in incised channels in order to restore more frequent floodplain inundation, channel migration, and increase groundwater and surface water interactions.*

10. Improve water quality conditions by restoring runoff processes.

Constraints:

- *Private agriculture and development contribute chemical contaminants, turbidity, stormwater runoff, and farm waste*

Strategies:

- *Livestock exclusion fencing.*
- *Work with commercial nurseries and tree farms to increase riparian buffers.*
- *Reduce runoff by disconnecting ditch lines with stream channels.*
- *Work with willing landowners to increase riparian buffer size and plant native trees and shrubs.*
- *Restore wetlands.*

11. Restore habitat complexity in channel and off-channel to increase pool quality and habitat complexity for coho and steelhead rearing.

Constraints:

- *There is little near-term potential LWD input from riparian areas or upstream reaches.*

Strategies:

- *Add LWD in the form of stable accumulations of multiple pieces (jams) with sufficient ballast to ensure they remain in place and functional up to the design flood.*
- *Add structure to mainstem channel.*