9 PROJECT EVALUATION

Projects were evaluated and placed into implementation tiers based on four criteria: expected biological response, consistency with natural processes, benefit-to-cost, and reach priority. Biologic and geomorphic criteria were assigned qualitative values of high, moderate, or low value and benefit-to-cost was given a qualitative ratio using high, moderate, or low values. Reaches were prioritized into three levels of relative importance. The following sections of this report describe the prioritization criteria and process. As projects are implemented, it may be appropriate to revisit projects and re-evaluate tier levels. This evaluation does not consider feasibility in terms of landowner willingness to participate. The information presented in this report is intended to provide an objective look at the conceptual projects that would most benefit target species based on biological benefit and physical effects.

9.1 Evaluation Criteria

9.1.1 Expected Biologic Response

The expected biological benefit was scored based on the expected magnitude of benefits and the likelihood that project objectives would be met. Those projects that most directly address limiting factors and critical life stages, while creating the greatest volume of quantifiable habitat, received the highest scoring. The diversity of existing habitat and the functionality of the existing and proposed habitat during target life stages were included in the evaluation. The juvenile life history stage (egg to parr) was identified as critical to improving spring Chinook populations in the Tucannon River. In particular, the persistent lack of adequate juvenile rearing habitat during winter and spring runoff (post-emergence to parr), bed scour during stochastic winter/spring flows, and summer water temperature have been identified as limiting to juvenile populations. Therefore, projects that improve the quality and quantity of juvenile habitat during these periods or create rearing habitat in areas where it does not currently exist received a higher rating.

The expected biologic response of each project was evaluated within the following categories:

- Provides immediate habitat benefits for critical life history stages

- Reconnects isolated habitats or improves existing habitats and promotes floodplain connectivity
- Provides diversity throughout the active channel and low-lying floodplain for all life history stages

9.1.2 Consistency with Natural Geomorphic Process

Natural geomorphic processes are the primary factor in creating and maintaining high-quality habitat in properly functioning rivers and streams. Designing for geomorphic process or removing inhibitors to geomorphic processes are important considerations in project prioritization. The sustainability and functionality of the project is highly dependent on consistency with geomorphic processes, and it is the restoration of these processes that will create and maintain habitat features in the long term. The projects that are expected to most effectively address the rehabilitation of natural processes will receive the highest qualitative rating.

For each project, consistency with natural geomorphic processes was evaluated within the following categories:

- Removes stressors that promote habitat degradation or inhibit natural channel and floodplain processes
- Promotes reach-scale geomorphic response consistent with natural processes
- Promotes the retention of LWD and sediment and forces pool-riffle morphology and complex channel planform

9.1.3 Benefit-to-Cost Ratio

A qualitative evaluation of the magnitude of biological and physical benefits of the project was determined, as was a rough opinion of the probable implementation cost. The result of this estimate is a qualitative ranking of the benefit-to-cost ratio. Those projects that achieve the greatest benefit for the least amount of money received the highest ratings. This criterion also considers whether the benefit is achieved on a short-term or long-term timeline.

9.1.4 Reach Priority

Reaches were prioritized using a variety of biologic and physical data (Table 9-1). High priority was given to reaches where existing fish use is high and the restoration potential has also been determined to be high. Physical characteristics included the area of low-lying floodplain, the amount of disconnected low-lying floodplain, and the percent of the reach that is a gaining reach versus a losing reach. Biological data included redd surveys (Gallinat and Ross 2010) and juvenile distribution (SRSRB 2006) that provide a relative density of spawning and juvenile presence in each reach.

Table 9-1
Summary of Physical Reach Characteristics, Reaches 6 to 10

Reach	Length (mi)	Low-lying Floodplain Area (acres)	Low Floodplain per River Mile (acres/mi)	Degree of Confinement (%)			Disconnected Low Floodplain (acres/RM)	Groundwater Input	
				Confined	Moderate	Unconfined		Gaining	Losing
10	6.2	135	22	24%	76%	0%	4.2	79%	21%
9	4	128	32	0%	51%	50%	1.3	8%	92%
8	7.9	247	31	11%	82%	8%	10.5	22%	78%
7	4.6	130	28	52%	48%	0%	12.2	0%	100%
6	7.5	454	61	5%	68%	28%	15.5	36%	64%

Table 9-2
Summary of Biological Reach Characteristics, Reaches 6 to 10

Reach	Length (mi)	Spawning Use (redds/RM)	Spawning Presence (qualitative)	Juvenile Density (per/100 m^2)	Juvenile Presence (qualitative)
10	6.2	7.7	Med	9.0/3.3	Med
9	4	7.7	High	9.0	High
8	7.9	5.2	High	11.9	High
7	4.6	2.7	Med	8.5	High
6	7.5	0.2	Low	8.5/3.3	Low-med

Sources: Spawning data from Gallinat and Ross (2010). Juvenile data from SRSRB (2006).

Four of the above characteristics were chosen to collectively represent the relative restoration potential of the reaches and achieve watershed-scale restoration objectives:

- **Available low-lying floodplain:** The total amount of low-lying floodplain within the reach represents the maximum habitat that could be available if a "full build-out" condition with respect to restoration actions were realized. Hence, those reaches with naturally wider low-lying floodplain areas were scored higher than reaches with floodplains that are higher and naturally confined. Low-lying floodplain was calculated by determining an average height of the 5-year flood elevation within each reach using the basin-scale hydraulic model (Anchor QEA 2011). This elevation value was projected out across the LiDAR surface to create a floodplain polygon. These areas were then calculated for each reach and compared to the length of the reach in RM. The low-lying floodplain area was refined and updated from the values presented in the *Geomorphic Assessment* (Anchor QEA 2011).
- **Disconnected low-lying floodplain:** The potential for additional floodplain connection is represented by the relative amount of disconnected low-lying floodplain in a reach. The channel alignment was broken out into sections that are disconnected from the low-lying floodplain by infrastructure and sections that are not influenced by infrastructure. A percent length within each category was calculated and compared to acres of available low-lying floodplain per RM as described above. These values were refined and updated from the values presented in the *Geomorphic Assessment* (Anchor QEA 2011); revisions were based on field observations and refined spatial analysis.
- **Distribution of spring Chinook spawning areas:** Redd distribution for spring Chinook, as presented in Gallinat and Ross (2010), was compared to the Tucannon River geomorphic reaches. A relative weight was assigned to each reach to represent the density of existing spawning.
- **Distribution of spring Chinook juveniles:** Estimates of juvenile Chinook distribution for spring Chinook, as presented in the *Snake River Salmon Recovery Plan* (2006), was compared to the Tucannon River geomorphic reaches. A relative weight was assigned to each reach to represent the density of existing juvenile use.

Based on the quantitative values shown in Tables 9-1 and 9-2, the reaches were assigned a relative value between 1 and 5 for each of the four criteria above. The higher values

represent a greater potential for restoration benefit. Low-lying floodplain was assumed to be slightly less beneficial in the near-term relative to the presence of spring Chinook in a reach. Therefore, the physical and biological values were weighted at 40 percent and 60 percent, respectively; Table 9-3 summarizes these values and provides the reach priorities. This methodology resulted in Reaches 8 and 9 having the highest priority. These reaches have high fish use and a large area of low-lying floodplain per mile. Reaches 6 and 7 are in the second priority category, primarily because of a lower fish presence. Reach 10 had a lower priority value primarily because there are fewer juvenile fish and less low-lying floodplain.

Table 9-3
Ranked Reach Characteristic Values to Determine Reach Priority, Reaches 6 to 10

Reach	Physical Characteristics *weight = 40%*		Biological Characteristics *weight = 60%*		Total	Weighted Total	Reach Priority
	Low-lying Floodplain	Disconnected Low-lying Floodplain	Relative Spring Chinook Spawning Use	Relative Spring Chinook Juvenile Rearing Use			
10	1	1	5	3	**10**	**5.6**	**P3**
9	3	1	5	4	**13**	**7.0**	**P1**
8	3	3	4	5	**15**	**7.8**	**P1**
7	2	4	3	4	**13**	**6.6**	**P2**
6	5	5	1	3	**14**	**6.4**	**P2**

Note: Relative values between 1 and 5 are based on the quantities provided in Tables 9-1 and 9-2

9.2 Project Prioritization

Table 9-4 summarizes the ratings assigned to each project within the four evaluation criteria categories: Expected Biologic Response, Consistency with Natural Geomorphic Processes, Benefit-to-Cost Ratio, and Reach Priority. Table 9-5 provides the relevant quantities of reconnected floodplain area, levee removals, and other project actions that were considered in developing the qualitative ranking for each project. This information was used to place each project within one of three tier levels that reflect the relative priority of project implementation. The following sections describe the general attributes of each tier level and how the tier levels should be considered within the overall restoration planning process, as well as providing the tier level of the 28 conceptual projects.

Table 9-4
Project Prioritization

Project	Reach	Expected Biologic Response			Consistency with Natural Geomorphic Processes			Benefit-to-Cost Ratio		Reach Priority
		Provides immediate benefit for critical life history stages	Reconnects or enhances off-channel habitat; promotes floodplain connectivity	Promotes diversity throughout the active channel and low-lying floodplain	Removes stressors that promote degradation or inhibit natural channel processes	Promotes reach-scale geomorphic response consistent with natural process	Promotes retention of LWD and sediment; forces pool-riffle morphology and complex planform	Magnitude of benefit vs. cost of implementation	Timeline for achieving benefit	Long-term potential value for restoration in the reach
1	10	H	M	M	L	H	H	M/M	H	P3
2	10	H	H	M	L	L	L	H/L	H	P3
3	10	H	L	M	L	H	H	M/M	H	P3
4	10	M	M	M	H	M	L	M/M	H	P3
5	10	L	H	H	M	M	L	M/H	M	P3
6	10	L	M	M	M	M	L	M/H	M	P3
7	10	H	L	M	M	M	H	M/H	M	P3
8	10	M	M	M	M	M	M	M/L	H	P3
9	10	M	L	M	L	L	H	M/M	M	P3
10	9	H	M	H	L	H	H	M/M	M	P1
11	9	H	M	M	L	M	H	M/M	H	P1
12	9	H	L	L	L	L	L	L/L	H	P1
13	8	H	M	H	H	H	H	H/M	H	P1
14	8	H	M	M	L	M	H	M/M	M	P1
15	8	H	M	M	M	M	H	M/L	H	P1
16	8	L	M	M	L	L	L	L/L	H	P1
17	8	H	M	M	H	M	H	M/H	H	P1
18	8	M	M	M	L	L	M	M/L	M	P1
19	7	M	M	M	M	M	M	M/H	H	P2
20	7	L	L	M	L	L	L	L/L	L	P2
21	7	H	L	M	L	M	M	M/M	M	P2
22	7	H	M	M	M	M	M	M/M	H	P2
23	7	H	M	M	M	M	M	M/M	H	P2

Project	Reach	Expected Biologic Response			Consistency with Natural Geomorphic Processes			Benefit-to-Cost Ratio		Reach Priority
		Provides immediate benefit for critical life history stages	Reconnects or enhances off-channel habitat; promotes floodplain connectivity	Promotes diversity throughout the active channel and low-lying floodplain	Removes stressors that promote degradation or inhibit natural channel processes	Promotes reach-scale geomorphic response consistent with natural process	Promotes retention of LWD and sediment; forces pool-riffle morphology and complex planform	Magnitude of benefit vs. cost of implementation	Timeline for achieving benefit	Long-term potential value for restoration in the reach
24	7	H	M	M	H	H	H	M/M	H	P2
25	6	L	L	M	L	L	M	L/L	H	P2
26	6	H	H	H	H	H	H	H/H	H	P2
27	6	M	M	M	L	M	M	M/L	H	P2
28	6	L	M	L	M	M	L	M/L	H	P2

Table 9-5

Approximate Physical and Habitat Quantities for Conceptual Projects

Reach	Project Area	RM		Project Actions (in ft)								Reconnected Low Floodplain (in acres)	Riparian Enhancement (in acres)	Protection Area
					Levees/Riprap		Side Channels			Roads				
		From	To	LWD Addition	Remove	Set Back	Enhance	New	Reconnect	Remove	Realign			
10	1	50	48.9	6713.64	-	-	-	-	-	-	-	-	-	-
	2	49.1	48.65	1097.31	-	-	1412.08	202.79	-	-	-	-	-	-
	3	48.65	46.8	6907.95	377.11	-	-	-	-	-	-	0.59	-	-
	4	46.8	46.4	2385.57	1190.66	1028.47[a]	1968.88	256.37	821.86	-	-	1.63	-	-
	5	46.4	45.95	2459.74	988.02	95.05	-	-	-	2326.92	-	10.73	-	-
	6	45.95	45.3	1134.14	144.86	-	-	-	-	-	-	-	-	RM 45.3-45.7
	7	45.3	44.85	2443.23	337.29	-	-	-	-	2706.46	2467.63	-	-	-
	8	44.85	44.4	1504.17	684.07	329.13	445.28	-	545.71	-	-	1.01	-	-
	9	44.4	44	2969.59	2563.46	-	-	-	-	-	-	-	-	-
9	10	44	42.4	8173.62	1304.93	-	-	-	-	-	-	5.83	39.37	-
	11	42.3	40.7	9716.34	1108.07	-	-	-	-	1539.64	652.09	1.43	39.79	-
	12	40.7	40	1965.14	-	-	-	-	-	-	-	-	17.81	RM 40.0-40.7
8	13	40	39.2	3555.66	3191.74	758.96	-	-	-	-	-	3.91	-	-
	14	39.2	37.15	10309.25	162.26	-	-	-	-	-	-	17.77	-	-
	15	37.15	36.35	4027.30	864.80	-	-	-	-	-	-	-	-	-
	16	36.35	34.9	1708.14	524.03	-	-	1118.20	-	-	-	4.59	-	-
	17	34.9	34.3	2935.69	706.19	-	1614.14	-	-	663.92	724.17	2.25	17.26	-
	18	34.3	32.1	3558.36	-	-	-	-	-	-	-	-	-	RM 33.65-34.3, 32.1-33.1
7	19	32.1	31.8	1432.45	639.32	-	-	-	-	-	-	-	-	-
	20	31.8	31.5	-	-	-	-	-	-	-	-	-	-	RM 31.5-31.8
	21	31.5	30.3	5976.68	1742.74	2551.07	-	-	-	-	-	0.59	-	-
	22	30.3	29.3	5338.39	2945.17	193.14	-	-	-	-	-	2.45	-	-
	23	29.3	28.25	5059.00	2159.49	888.67	-	-	-	-	-	9.48	-	-
	24	28.25	27.5	3972.34	2532.41	2924.26	-	-	-	-	-	1.32	-	-
6	25	27.5	26.9	1177.05	-	-	-	-	-	-	-	-	-	RM 27.15-27.5
	26	26.9	23.65	9578.38	8304.91	12217.65	-	-	-	-	-	29.26	-	-
	27	23.65	22.85	1256.78	265.91	2819.50	-	-	-	-	-	-	-	-
	28	22.85	20	1037.01	657.03	-	-	-	-	-	-	22.12	-	RM 20.5-21.7, 22.1-22.8

[a] The levee set back calculation includes the road realignment; this section of road is located on top of the levee embankment

9.2.1 Tier 1 Projects

Tier 1 projects are those projects that should be considered for early implementation within basin restoration planning. In general, the actions recommended in these projects are expected to provide an immediate biological response for the identified critical life history stages within a relatively large area of impact. Nine Tier 1 projects were identified, with six of the projects in the high-priority reaches (Table 9-6).

Table 9-6
Tier 1 Projects

Project	Reach	River Miles	Description
2	10	49.1 to 48.65	The minor amount of earthwork required to achieve enhanced flow to a significant length of off-channel habitat results in a substantial benefit-to-cost ratio.
10	9	44.0 to 42.4	Adding LWD through the incised and simplified channel in this project area results in a high benefit to both instream habitat and physical processes long term.
11	9	42.3 to 40.7	This project removes important stressors and adds LWD to a confined portion of the channel that lacks complexity and cover, resulting in a high expected benefit within one of the high-priority reaches.
13	8	40.0 to 39.2	This project is expected to provide a high biological benefit for a moderate cost in a section of a P1 reach where the river is tightly confined and simplified by infrastructure and channel modification.
14	8	39.2 to 37.15	This project adds LWD and increases floodplain connectivity for a moderate cost.
15	8	37.15 to 36.35	The cost of implementing this project is relatively low and would increase channel complexity and floodplain connectivity within a high-priority reach.
17	8	34.9 to 34.3	Although the cost of this project is relatively high, biological and physical benefits are expected in a degraded section of the river within a high-priority reach.
24	7	28.25 to 27.5	This project will significantly increase the width of the floodplain corridor and promote increased channel complexity for a moderate implementation cost.
26	6	26.9 to 23.65	Removing the levees that confine much of this project area is expected to have a high biological and physical benefit.

9.2.2 Tier 2 Projects

Tier 2 projects are moderate- to high-priority projects that should be considered for strategic implementation as funding and other opportunities arise. These projects are expected to achieve relatively high biologic and physical benefits for target life stages; however, it may take time for the benefits to be fully realized or achieving the results may be contingent upon other actions or have potential challenges that have been identified by local stakeholders. Ten Tier 2 projects were identified that are primarily located within the second and third priority reaches (Table 9-7).

Table 9-7
Tier 2 Projects

Project	Reach	River Miles	Description
1	10	50.0 to 48.9	This project will add LWD throughout an area that lacks cover and hydraulic complexity.
3	10	48.65 to 46.8	This project will add LWD and remove unnecessary bank armoring through this project area, creating instream complexity and promoting natural processes.
4	10	46.8 to 46.4	This project will significantly reduce channel confinement for a moderate cost of implementation.
5	10	46.4 to 45.95	Removing the road through the floodplain will approximately double the width of the floodplain corridor for a relatively high cost.
7	10	45.3 to 44.85	Adding LWD to the channel will provide immediate benefits to critical life stages and, with road relocation, would promote natural processes to reverse the incised channel conditions over time. However, the cost of implementation would be high.
8	10	44.4 to 44.0	The cost of this project is relatively low and will approximately double the floodplain width and create instream complexity.
18	8	34.3 to 32.1	This relatively small project is expected to have moderate biological benefits for a low cost of implementation and is located in a priority reach.
21	7	31.5 to 30.3	This project will add LWD and remove stressors within this incised and plane-bed section of the channel that lacks cover and complexity.
22	7	30.3 to 29.3	This project will reduce channel confinement and promote channel complexity and wood retention in a second priority reach.
23	7	29.3 to 28.75	This project will promote natural processes by significantly increasing floodplain connectivity, and will create immediate instream habitat by adding LWD to the channel.

9.2.3 Tier 3 Projects

The Tier 3 group represents those projects that are appropriate for long-term strategic implementation. The biological and physical response may have less impact or be less certain, or the expected benefit of the project is low compared to the relative cost. Achieving the full benefits of a Tier 3 project may depend on implementing other actions, or it may take place on a relatively long time scale. Nine Tier 3 projects were identified throughout the area of study (Table 9-8). Four of the projects are expected to have a low biological benefit. However, the proposed restoration actions would require a low implementation cost. Alternately, those areas where protection (no action) is proposed received lower ranking than active restoration projects and were ranked as Tier 3 projects. These naturally recovering areas currently provide good biological and physical benefits, but this was not necessary reflected in the prioritization process.

Table 9-8
Tier 3 Projects

Project	Reach	River Miles	Description
6	10	45.95 to 45.3	Although removing the campground is expected to have an overall moderate benefit, the implementation cost may be high and immediate biological benefit is low.
9	10	44.4 to 44.0	Existing habitat and physical conditions in this section of the river are moderate. Lake removal is not expected to have significant impact to existing floodplain processes or critical life stages.
12	9	40.7 to 40.0	This project involves a small amount of active restoration (LWD placement) and is not expected to result in significant benefits or geomorphic response.
16	8	36.35 to 34.9	The high concentration of private homes through this project area greatly limits the possibilities for restoration without incurring risk. The proposed restoration actions are not extensive enough to have significant impacts to natural processes, but they would provide some amount of biologic benefit.
19	7	32.1 to 31.8	This project is expected to have moderate benefit in a second priority reach. However, replacing the bridge will likely involve a long-term effort.
20	7	31.8 to 31.5	This project involves passive restoration efforts and did not rank high in the prioritization process. However, some biological benefit to water quality and the riparian vegetation can be achieved with little effort and low cost.

Project	Reach	River Miles	Description
25	6	27.5 to 26.9	This project involves a small amount of active restoration (LWD placement) and is not expected to result in significant benefits or geomorphic response.
27	6	23.65 to 22.85	Existing habitat conditions are moderate or actively recovering throughout much of the project area. The small amount of proposed restoration actions is expected to have a moderate benefit and low cost.
28	6	22.85 to 20.0	The recommendation for a majority of this project area is protection of recovering sections of the channel. The small amount of active restoration will have a moderate biological response for a relatively low cost of implementation.