

Jerry L. Storedahl, Owner



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ROCK PRODUCTS, GRADING & EXCAVATING

U.S. FISH & WILDLIFE SERVICE
WWFWS

January 25, 2011

Mr. Steve Landino
NOAA Fisheries
510 Desmond Drive, Suite 103
Lacey, WA 98503

FEB 22 2011

LACEY, WA
RECEIVED

Mr. Tim Romanski
U.S. Fish & Wildlife
510 Desmond Drive, Suite 102
Lacey, WA 98503

Re: Daybreak Habitat Conservation Plan (HCP) Annual Report

Gentlemen:

Attached is a brief summary of the conservation and monitoring activities at the Daybreak site over the past year. In addition to the summaries, we have included raw data and reports prepared by our consultants as prescribed in the HCP.

As noted in earlier conversations and correspondence, there have been some minor changes to the sequencing of the mining activities to avoid the Dean Creek riparian zone while our consultation continues. Specifically, we initiated mining in areas 1C and 1D, which is now complete with topsoil placement and grading on going. We anticipate completing the work in these areas with planting in the fall of 2011. We have moved the mining to the east end of area 4 in order to continue to avoid any potential effects to the Dean Creek riparian zone, until the ongoing consultation is completed.

If you have any questions or comments please feel free to call me or Randy Sweet at (360) 673-5397.

Respectfully,

A handwritten signature in blue ink, appearing to read 'Kimball', is written over a blue circular stamp.

Kimball Storedahl
Vice President

cc.

Clark County Building and Planning
Department of Ecology

Daybreak Conservation Measures Annual Report for 2010

CM-01	Washwater clarification process	Daybreak has been operating via dry processing only and will continue to do so until further notice. Therefore no raw data or summary thereof is warranted.
CM-02	Storm Water and Erosion Control Plan and Storm Water Pollution Prevention Plan	The stormwater plan has been approved by Clark County and has been and continues to be implemented. Turbidity levels at the Pond 5 outfall ranged from a high of 6.8 NTUs in April to a low of 3.6 NTUs in October. All TSS laboratory testing reported ND. Notably, there was no flow in Dean Creek from July 23 through September. Ecology discharge Monitoring Reports (DMRs) for the NPDES General Permit monitoring is attached.
CM-03	Donation of Water Rights	Transfer of the water rights has been delayed, pending the outcome of the ongoing consultation. In the interim, the water will be used to irrigate the native valley-bottom trees which have been planted under CM-06 to accelerate their growth and reduce the potential for die off.
CM-04	Water management plan	This measure is approximately 80% complete with the berm infill and reconfiguration of Pond 5 and construction of the controlled outlet and bottom-water pick up. The remaining work to complete includes the installation of the pumping system, irrigation lines in the Dean Creek terrace area, and the discharge points along Dean Creek. That work is on hold pending the resolution of the ongoing consultation
CM-05	Conservation and habitat enhancement endowment	This measure was initiated with the initial sale of processed aggregate. As of December 31, 2010, the fund has accrued \$19,510.06 and a full accounting of the fund is attached.

CM-06	Native valley-bottom forest revegetation	In March and April 2010, Storedahl plowed and disked, and planted 23 acres, or approximately 53% of the prescribed valley-bottom forest per the schedule in the HCP. Fall monitoring showed significant mortality in the planting and over 1,000 Douglas fir and Western Red Cedar were recently replanted.
CM-07	Floodplain reestablishment between Dean Creek and the created ponds	Invasive vegetation has been mechanically cleared, but terrace construction has not started. This near-stream measure is on hold, pending the outcome of the ongoing consultation.
CM-08	Mining and reclamation designs to reduce the risk of an avulsion	The initial infilling of Pond 2 is approximately 60% complete. As noted in the HCP, additional infill and reconfiguration will take place as "clean fill" becomes available.
CM-09	Contingency plan for potential avulsion of the East Fork Lewis River	The avulsion sill and overflow spillway were completed prior to any mining at the site. Since this measure is now complete, we have requested that the Services release the financial assurance required under this measure.
CM-10	Study of the Ridgefield Pits and East Fork Lewis River	R2 Resources completed the first phase of this work this Summer and a report of their findings is attached.
CM-11	Off-site floodplain enhancement	This measure is not scheduled to start until the third year of operation.
CM-12	Conservation easement and fee-simple transfer	Placement of the conservation easement and fee-simple transfer of property has been delayed, pending the outcome of the ongoing consultation.

CM-13	Riparian management zone on Dean Creek	This measure is on hold pending outcome of the ongoing consultation.
CM-14	In-channel habitat enhancement in select reaches of Dean Creek	No in-stream work is anticipated until resolution of the ongoing consultation.
CM-15	Shallow water and wetland habitat creation	Topsoil placement and grading is approximately 60% complete at Cells 1C & D. The balance of the topsoil placement and grading is scheduled for this summer. Planting will be completed in the Fall of 2011.
CM-16	Control of non-native predatory fishes	This measure is not scheduled for initiation until year five of the operation.
CM-17	Create habitat suitable for Oregon spotted frogs.	This is a contingency measure, dependent on the identification of Oregon spotted frogs in Clark County. To the best of our knowledge, none have been identified to date.
CM-18	Control public access	Fencing has been completed and signage is in place.

Daybreak Monitoring and Evaluation Measures Annual Report for 2010

MEM-01	Closed-loop Clarifier	Only dry processing is being used at the site and monitoring is proceeding per the NPDES permit below.
MEM-02	NPDES Monitoring	NPDES Monitoring is ongoing. A summary is included with the CM-02 report and raw data is attached.
MEM-03	Water Management Plan Monitoring	Temperatures at the Pond 5 outlet ranged from a low 15.9 degrees C, with a DO of 10.96 mg/l, in early May to a high of 20.6 degrees C, with a DO of 8.89 mg/l, in mid August. Temperatures at PZ-3 ranged from 11.7 degrees C in early June to a high of 17.2 degrees C in late June. Dean Creek temperatures ranged from 12.3 degrees C, with a DO of 10.19 mg/l, and 22.5 degrees C, with a DO of 9.11 mg/l. Notably, Dean Creek had no flow from late August through September. Since only dry processing, i.e., no dissolved chemicals or additives were discharged into the ponds, specific conductance was not monitored at PZ-3. Raw data for the summer monitoring of PZ-3, surface water and discharges from Pond 5 are attached.
MEM-04	Pond, Shallow Water, and Shoreline Physical Structure Monitoring	Pond 2 infill and reconfiguration is nearly complete and as-built plans will be completed within 6 months of that completion with bathymetric surveys completed in years 5, 10, 15, 20 and 25 per the HCP.
MEM-05	Vegetation Monitoring	Valley bottom forest mortality is noted under CM-06. Additional monitoring will be completed in the Spring of 2011, i.e., 1 year after initial planting, with subsequent monitoring per the HCP to follow.
MEM-06	Dean Creek Riparian and Channel Condition Monitoring	Not scheduled to begin until 1 year after planting.
MEM-07	East Fork Lewis River Critical Bank Stability Monitoring	WEST Consultants completed this survey after consultation with the Services and their report is attached.
MEM-08	Pond Fish Use and Limnological Monitoring	Habitat monitoring was completed by R2 Resources this summer and their report is attached. Monitoring of fish use is scheduled in years 5, 10 and 15, per CM-16.
MEM-09	Oregon Spotted Frog Monitoring	To the best of our knowledge, no Oregon spotted frogs have been identified in Clark County to date.
MEM-10	Financial Status of Conservation Endowment	A summary of the financial status of the endowment is included under CM-05 and detailed financial data, including deposits, income and/or interest, as well as the year end balance is attached.

J.L. Storedahl & Sons Inc.
Daybreak Mine
PZ-3 MEM-03 Monitoring Record

Year 2010

PZ3			
Month	Date	Ph	Temp C
June	3 RD	7.21	17.7°
	11 th	7.19	13.3°
	17 th	7.18	17.2°
	24 th	7.19	16.8°
July	6 th	7.19	16.7°
	14 th	7.20	16.8°
	20 th	7.23	16.7°
	28 th	7.21	16.3°
August	4 th	7.24	16.1°
	11 th	7.19	15.8°
	19 th	7.25	15.4°
	26 th	7.23	15.2°
September	7 th	7.18	15.1°
	14 th	7.17	15.0°
	22 ND	7.19	14.8°
	28 th	7.22	14.8°

Technical Memo

WEST Consultants, Inc.

2601 25th St. SE

Suite 450

Salem, OR 97302-1286

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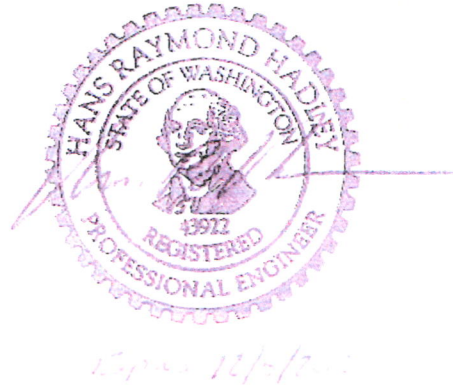
Name: Kimball Storedahl

Company: J.L. Storedahl & Sons, Inc.

Date: November 5, 2010

From: Hans R. Hadley, P.E.
Senior Hydraulic Engineer

Subject: MEM-07 Monitoring Report – October 20, 2010 Field Reconnaissance

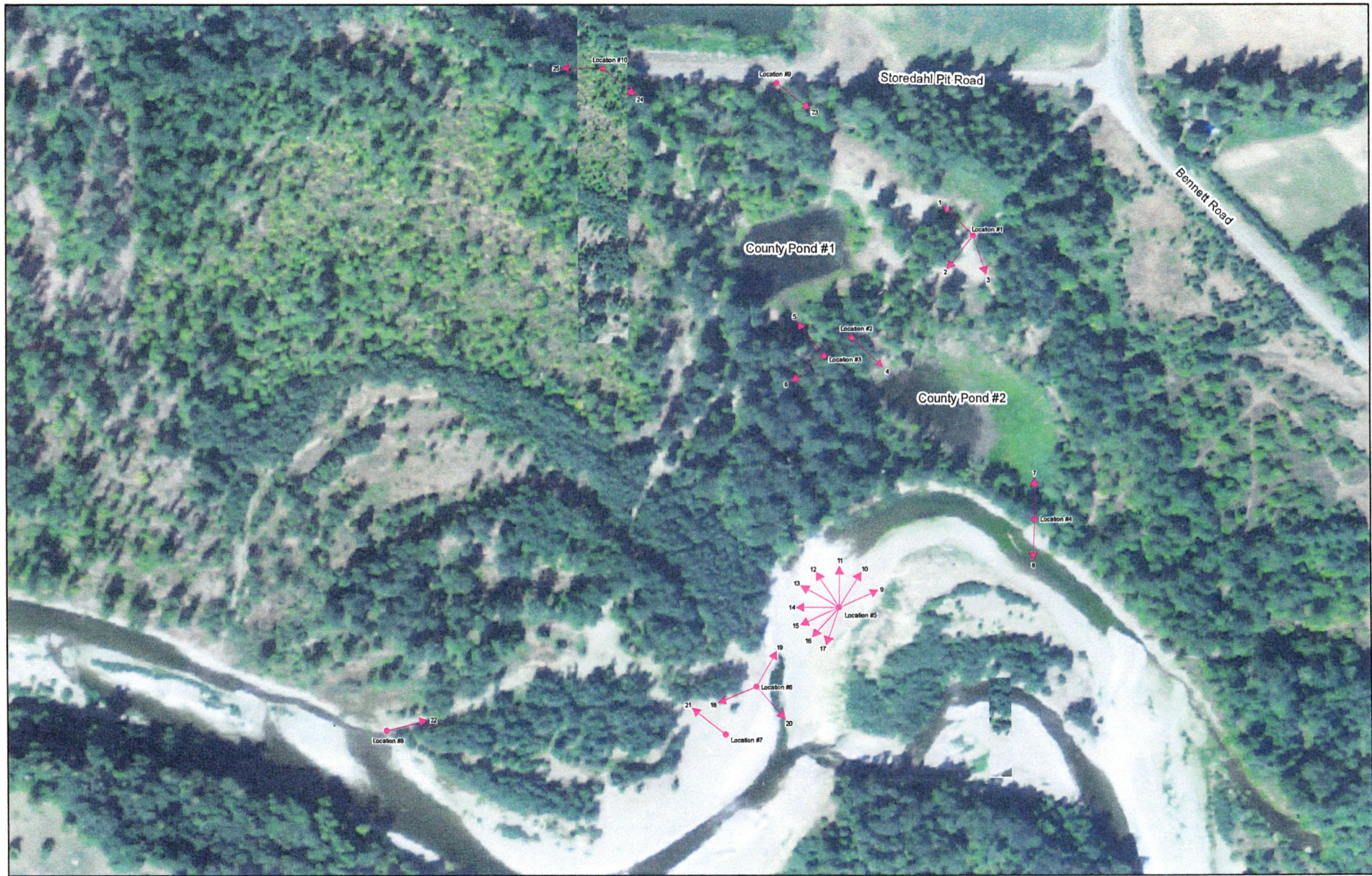


WEST Consultants conducted the initial field reconnaissance of the East Fork Lewis River in the vicinity of the Daybreak Mine as required under MEM-07 of the Habitat Conservation Plan. The reconnaissance was conducted by Thomas R. Grindeland, P.E. and Hans R. Hadley P.E. on October 20, 2010. Observations of the river and floodplain were made to determine the likelihood of the river avulsing into the existing Daybreak ponds. Photographs were taken at selected locations to form a baseline record of the channel and floodplain conditions. The photograph locations are shown on an aerial photo base map (Appendix A). Arrows are depicted on the map to indicate the direction in which each photo was taken. A corresponding photographic log is provided in Appendix B.

Currently, there are no indications to suggest that the East Fork Lewis River poses an avulsion threat to the Daybreak ponds. The main channel is generally located along the southern portion of the valley with large areas of floodplain separating the channel from the Daybreak ponds. However, observations suggest that several small secondary channels are continuing to develop in the floodplain between the main channel and Storedahl Pit Road. The secondary channels could pose an avulsion threat in the future and will be monitored for changes in size and extent during subsequent field reconnaissance work.

If you have any questions, please feel free to contact me at 503-485-5490 or hhadley@westconsultants.com.

Appendix A: Base Map



0 100 200 400 Feet





0 100 200 400 Feet



Photographic Log Base Map

Sheet 2 of 3



0 100 200 400 Feet



Photographic Log Base Map
Sheet 3 of 3

Appendix B. Photographic Log



Photo 1. Looking northwest from Location #1 along secondary floodplain channel.



Photo 2. Looking southwest from Location #1 at headcut nick point located at upstream end of secondary floodplain channel.



Photo 3. Looking south southeast from Location #1 toward County Pond #2.



Photo 4. Looking southeast from Location #2 at overflow path from County Pond #2.



Photo 5. Looking northwest from Location #3 at overflow channel into County Pond #1.



Photo 6. Looking southwest from Location #3 at headcut nick point located at upstream end of overflow channel into County Pond #1.



Photo 7. Looking north from Location #4 at overflow channel from E.F. Lewis River into County Pond #2.



Photo 8. Looking south from Location #4 at upstream end of overflow channel from E.F. Lewis River into County Pond #2. Recently abandoned E.F. Lewis River channel in background.



Photo 9. Looking east northeast from Location #5 at right bank of recently abandoned section of E.F. Lewis River at location of overflow channel that leads to County Pond #2.



Photo 10. Looking northeast from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 11. Looking north from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 12. Looking north northwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 13. Looking northwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 14. Looking west from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 15. Looking west southwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 16. Looking southwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 15. Looking west southwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 16. Looking southwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River.



Photo 17. Looking south southwest from Location #5 at right bank of recently abandoned section of E.F. Lewis River and high bluff along left bank of E.F. Lewis River.



Photo 18. Looking west southwest from Location #6 at upstream end of secondary floodplain channel.



Photo 19. Looking north northeast from Location #6 at rock vane located along the right bank of recently abandoned section of E.F. Lewis River.



Photo 20. Looking southeast from Location #6 at downstream end of recently abandoned section of E.F. Lewis River. Note new channel at left side of photo.



Photo 21. Looking northwest from Location #7 at upstream end of secondary floodplain channel.



Photo 22. Looking east northeast from Location #8 at downstream end of secondary floodplain channel.



Photo 23. Looking southeast from Location #9 in direction of floodplain overflow channel shown in Photo 1.



Photo 24. Looking southeast from Location #10 at floodplain adjacent to Storedahl Pit Road. Historic location of E.F. Lewis River channel.



Photo 25. Looking west from Location #10 at floodplain adjacent to Storedahl Pit Road. Historic location of E.F. Lewis River channel.



Photo 26. Looking southeast from Location #11 at floodplain adjacent to Storedahl Pit Road. Historic location of E.F. Lewis River channel.



Photo 27. Looking south from Location #11 at floodplain adjacent to Storedahl Pit Road. Historic location of E.F. Lewis River channel.



Photo 28. Looking west southwest from Location #11 at floodplain adjacent to Storedahl Pit Road. Historic location of E.F. Lewis River channel.



Photo 29. Looking northwest from Location #12 at Daybreak Pond #5 overflow into E.F. Lewis River floodplain.



Photo 30. Looking northeast from Location # 12 at Daybreak Pond #5.



Photo 31. Looking west northwest from Location #12 at E.F. Lewis River floodplain.



Photo 32. Looking west from Location #13 at E.F. Lewis River floodplain.



Photo 33. Looking southeast from Location #13 at E.F. Lewis River floodplain.



Photo 34. Looking south southeast from Location #14 at historic E.F. Lewis River channel.



Photo 35. Looking west from Location #14 at historic E.F. Lewis River channel.



Photo 36. Looking north northeast from Location # 15 along alignment of historic E.F. Lewis River channel.



Photo 37. Looking south southwest from Location #15 along alignment of historic E.F. Lewis River channel.



Photo 38. Looking east southeast from Location #16 at E. F. Lewis River floodplain. Historic location of E.F. Lewis River channel.



Photo 39. Looking west southwest from Location #16 at E.F. Lewis River floodplain. Historic location of E.F. Lewis River channel.

Technical Memorandum

Date: January 24, 2011

Project Number: 1844.01/MM101

To: Kimball Storedahl

From: Tim Sullivan/Dudley Reiser – R2 Resource Consultants

Subject: East Fork Lewis River Habitat Survey

cc: Randy Sweet

Background

This Technical Memorandum (TM) summarizes the results of the field effort conducted by R2 Resource Consultants (R2) on the East Fork Lewis River on October 18-19, 2010. This effort was conducted in partial fulfillment of Conservation Measure 10 (CM-10) of the Storedahl Daybreak Mine Habitat Conservation Plan (HCP) (Sweet et al. 2003). CM-10 stipulates that “a study will be initiated to assess the conditions within a recent channel avulsion through the Ridgefield Pits (located south of the Daybreak site) on salmonid habitat in the East Fork Lewis River” and includes the following study components:

1. Fish habitat survey of the East Fork Lewis river between river kilometer (RKm) 9.7 (river-mile (RM) 6) and RKm 20.9 (RM 13);
2. Observations of fish use in the East Fork Lewis River between (RKm) 9.7 (RM) 6) and RKm 20.9 (RM 13);
3. Monitoring of temperature and dissolved oxygen (DO) in the avulsed reach;
4. Assessment of channel shape, pool volume, and sediment infill rates; and
5. Participation in and assessment of planned habitat restoration efforts.

The fish habitat survey representing the first study component was conducted during the October, 2010 field effort and is the focus of this TM. The second (fish observations) and third (temperature and DO) study components were not completed during this effort because the prevailing cold water temperatures (<6° C) would likely have resulted in fish distributions, water temperatures, and DO levels that were not representative of the period of interest (i.e., spring and summer). Geomorphic surveys were likewise not completed since seasonal flows in the East Fork Lewis River increased above target levels conducive to measurement (summer low flows).

Finally, actions related to the fifth element, restoration, have not commenced, and therefore no restoration activities were completed as part of this effort.

Study Area and Methods

The habitat survey was conducted in a downstream direction extending from Rkm 20.9 (RM 13) at the Lewisville Bridge (Highway 503) to Rkm 9.7 (RM 6) at the confluence with Mason Creek (Figure 1). This effort took place over two days (October 18-19, 2010) and was conducted by boat. As stipulated in CM-10 of the HCP (Sweet et al. 2003), we used survey protocols modified from the USFS stream inventory handbook (USFS 1998). As feasible, we also used survey protocols and subsequent data analysis approaches that were similar to the most recent known habitat survey of the East Fork Lewis River conducted in 2004 for the Lower Columbia Fish Recovery Board (SP Cramer & Associates 2005). The use of similar protocols and analyses were intended to facilitate the comparison of habitat conditions over time. To that end, we also present results here in terms of reaches that are analogous to the reaches designated by SP Cramer & Associates (2005) (Table 1). To more directly describe habitat conditions in relation to the Ridgefield Pits, the reaches used by SP Cramer & Associates (2005) upstream of the Ridgefield Pits were grouped into a single Upstream Reach.

Each habitat (Natural Sequence Order (NSO)) unit was classified as a cascade, boulder/large-cobble (BLD/LC) riffle, gravel/small-cobble (GR/SC) riffle, glide, or pool. For each unit, the length and average wetted width were measured using a laser range finder and average and maximum depths were estimated using a stadia rod. For each pool unit, the pool crest depth was measured and the tail-out area was estimated as a percentage of the total unit area. Substrate composition was estimated for each unit as the percentage of sand (<2 mm), gravel (2-64 mm), cobble (64-256 mm), boulder (256-4,096 mm), or bedrock (>4,096 mm). The degree to which substrate was embedded in fines was estimated as a percentage for each unit. For deep pools, the entirety of the substrate was not visible and estimates were based only on visible substrate. The maximum depth in some of the pools comprising the Ridgefield Pits was too deep to measure and was instead estimated based on water clarity relative to the maximum measurable depth. The number of individual large woody debris (LWD) pieces and LWD jams were counted in each unit (see Table 3 for LWD definitions). The percentage of the left and right stream banks that were unstable was also estimated for each unit.

More detailed assessments were also made at a subsampling of habitat units. These "Nth" units were randomly selected as every 3rd pool unit and every 7th fastwater (cascade, riffle, or glide) unit. At each Nth unit, available cover was quantified as a percentage of the unit area. Cover

types included LWD, undercut banks, overhanging vegetation, depth, and substrate. Where feasible, bankfull width was measured using a laser range finder and bankfull depth was surveyed at one-quarter, one-half, and three-quarters of the bankfull width using a handlevel and stadia rod. Maximum bankfull depth was similarly surveyed. Inner and outer riparian vegetation composition and riparian disturbance were also estimated at each Nth unit. Because of the reduced frequency of Nth unit observations, the parameters described above could not be summarized on a reach-specific basis.

Mean daily flow in the East Fork Lewis River, as measured at USGS Gage 14222500 near Heisson, WA, was between 146 and 156 cfs during the survey (Figure 2). This flow was somewhat greater than base-flow conditions, but allowed for the survey to be conducted by boat.

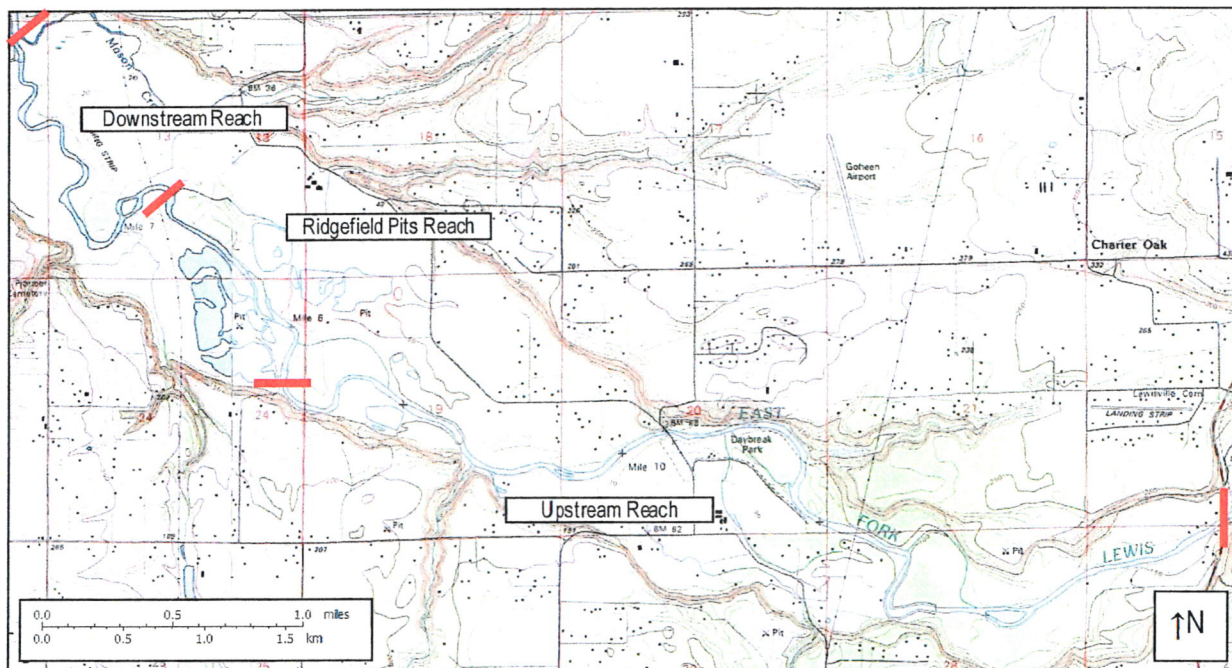


Figure 1. Study area of the East Fork Lewis River where the habitat survey was conducted, from RKm 20.9 (RM 13) downstream to RKm 9.7 (RM 6). Also shown are reach designations relative to the Ridgefield Pits.

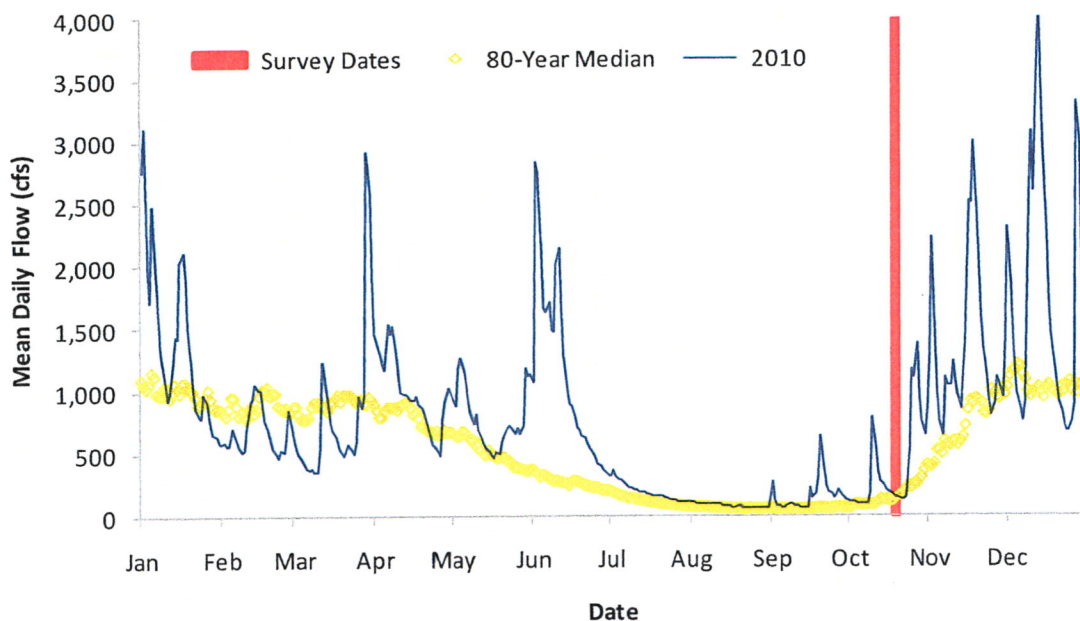


Figure 2: Historic (80-year median) and 2010 mean daily flow in the East Fork Lewis River (from USGS Gage 14222500 near Heisson, WA) showing the timing of the 2010 habitat survey.

Table 1. Reach designations used for 2010 (R2) and 2004 (SP Cramer & Associates 2005) surveys. Approximate river kilometers (RKm) derived from USGS topographic maps are also provided with river miles (RM) in parentheses.

2010 (R2)	2004 (SP Cramer & Associates 2005)	Upstream Boundary	Downstream Boundary
Upstream Reach	Reach 8A	Lewisville Bridge: RKm 20.9 (RM 13.0)	Mill Creek: RKm 15.1 (RM 9.4)
	Reach 6B	Mill Creek: RKm 15.1 (RM 9.4)	Head of Abandoned Channel: RKm 13.4 (RM 8.3)
Ridgefield Pits Reach	Reach 6A	Head of Abandoned Channel: RKm 13.4 (RM 8.3)	Dean Creek: RKm 11.6 (RM 7.2)
Downstream Reach	Reach 5	Dean Creek: RKm 11.6 (RM 7.2)	Mason Creek: RKm 9.7 (RM 6.0)

Habitat Type and Channel Morphology

A summary of attributes by habitat type is provided below in Table 2 for each of the three reaches. High gradient habitat types (i.e., cascades and boulder/large cobble riffles) were only found in the Upstream Reach (Figure 3). In terms of habitat area, pools dominated the Ridgefield Pits Reach. These pools were generally associated with the Ridgefield Pits themselves and are very deep with maximum depths often greater than 6 m (20 ft). In both the Upstream Reach and Downstream Reach, habitat composition was similarly divided among pool, glide, and riffle (including cascade) habitat types. However, glide habitat was more abundant in the downstream reach.

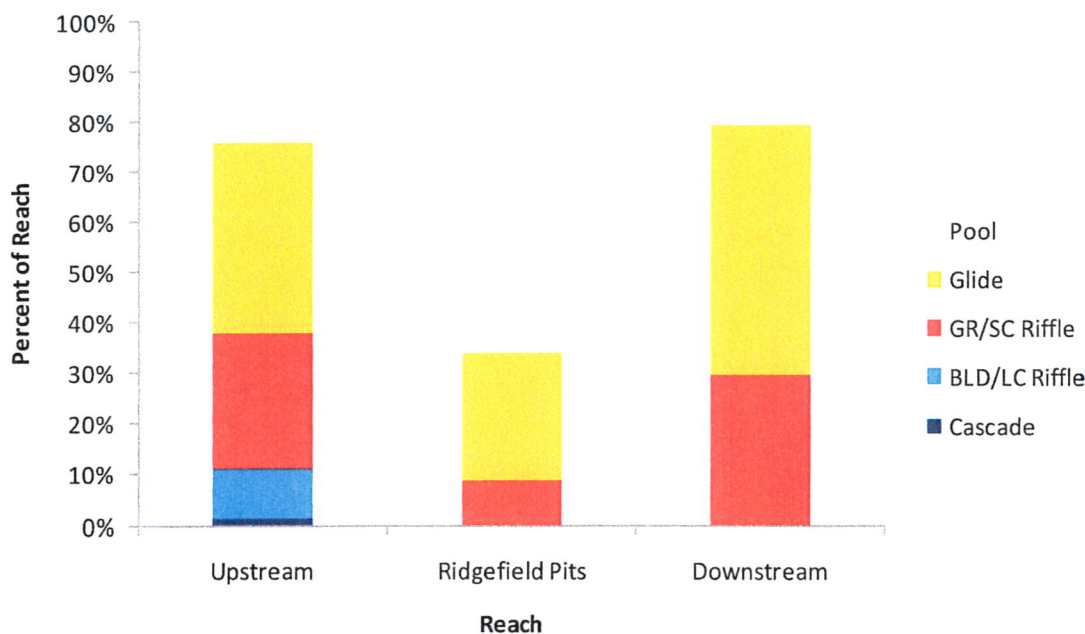


Figure 3. Area-based habitat composition by reach in the study area of the East Fork Lewis River. Percentages include both mainstem and side channel habitat units.

Table 2. Summary of habitat attributes by habitat type and reach as measured in the East Fork Lewis River, Washington, October 18-19, 2010.

Habitat Type	Parameter	Upstream Reach	Ridgefield Pits	Downstream Reach	Total
Cascade	Mainstem Units	2			2
	Side Channel Units	0			0
	Mainstem Total Length (m)	118			118
	Mainstem Average Wetted Width (m)	32.0			32.0
	Mainstem Average Depth (m)	0.46			0.46
	Mainstem Average Max Depth (m)	0.61			0.61
	Total Area (m ²)	3,746			3,746
	Total Volume (m ³)	1,852			1,852
BLD/LC Riffle	Mainstem Units	5			5
	Side Channel Units	0			0
	Mainstem Total Length (m)	588			588
	Mainstem Average Wetted Width (m)	37.5			37.5
	Mainstem Average Depth (m)	0.36			0.36
	Mainstem Average Max Depth (m)	0.66			0.66
	Total Area (m ²)	23,241			23,241
	Total Volume (m ³)	8,285			8,285
GR/SC Riffle	Mainstem Units	19	7	8	34
	Side Channel Units	7	2	0	9
	Mainstem Total Length (m)	2,120	337	657	3,114
	Mainstem Average Wetted Width (m)	26.5	15.7	24.2	23.7
	Mainstem Average Depth (m)	0.36	0.37	0.41	0.37
	Mainstem Average Max Depth (m)	0.62	0.55	0.65	0.62
	Total Area (m ²)	65,476	5,499	16,049	87,025
	Total Volume (m ³)	21,912	1,931	6,004	29,847
Glide	Mainstem Units	21	4	9	34
	Side Channel Units	3	5	0	8
	Mainstem Total Length (m)	3,049	511	1,116	4,675
	Mainstem Average Wetted Width (m)	25.3	24.2	23.5	24.7
	Mainstem Average Depth (m)	0.74	0.84	0.94	0.81
	Mainstem Average Max Depth (m)	1.10	1.17	1.32	1.16
	Total Area (m ²)	93,838	16,390	27,208	137,435
	Total Volume (m ³)	73,677	14,943	25,194	113,815
Pool	Mainstem Units	14	4	4	22
	Side Channel Units	3	1	0	4
	Mainstem Total Length (m)	1,843	828	531	3,201
	Mainstem Average Wetted Width (m)	27.6	44.4	24.5	30.1
	Mainstem Average Depth (m)	1.40	3.05	1.87	1.78
	Mainstem Average Max Depth (m)	2.38	4.38	3.28	2.91
	Total Area (m ²)	58,844	43,073	11,493	113,410
	Total Volume (m ³)	78,897	145,339	21,314	245,550
	Total Pool Tail-out area (m ²)	6,382	1,007	635	8,024
Total	Mainstem Average Residual Pool Depth (m)	1.94	4.00	2.80	2.47
	Mainstem Units	61	15	21	97
	Side Channel Units	13	8	0	21
	Mainstem Total Length (m)	7,718	1,676	2,303	11,697
	Mainstem Average Wetted Width (m)	27.4	25.6	23.9	26.4
	Mainstem Average Depth (m)	0.73	1.21	0.92	0.85
	Mainstem Average Max Depth (m)	1.19	1.74	1.44	1.33
	Total Area (m ²)	245,145	64,962	54,750	364,856
	Total Volume (m ³)	184,624	162,212	52,512	399,349

Substrate

Because substrate composition is related to the habitat type in which it is observed, and because the frequency of habitat types varied by reach, substrate composition is shown separately by habitat type in Figure 4 (riffles), Figure 5 (glides), and Figure 6 (pools). This approach provides a more valid comparison of substrate composition across reaches. Substrate composition in both riffles (Figure 4) and glides (Figure 5) generally decreased in coarseness from upstream to downstream. For example, while cobble and gravel dominated riffles (including BLD/LC riffles, GR/SC riffles, and cascades) in all three reaches, cobble made up a greater percentage in the Upstream Reach. A different trend was observed in pools (Figure 6). Dominated by gravel and cobble, substrate composition was similar in the Upstream Reach and the Downstream Reach. In contrast, pool substrate in the Ridgefield Pits Reach was dominated by sand.

Average substrate embeddedness was generally similar across reaches in GR/SC riffles (6.4-7.5 percent) and glides (12.5-13.6 percent). However, average embeddedness in pools was slightly greater in the Ridgefield Pits Reach (20.0 percent) and Downstream Reach (18.8 percent) compared to the Upstream Reach (16.1 percent).

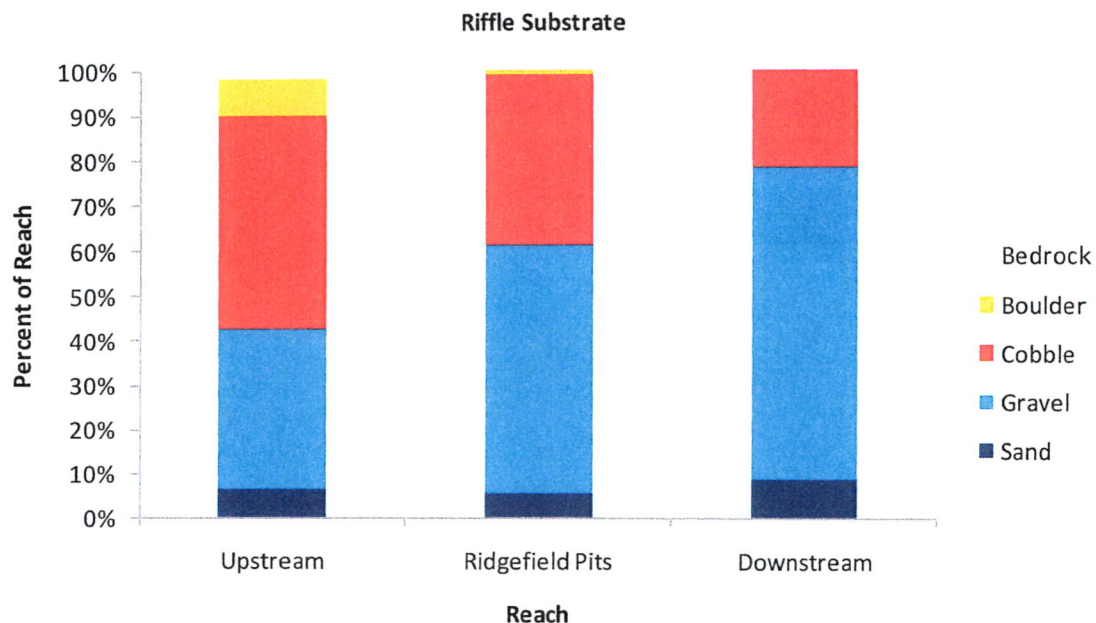


Figure 4. Substrate composition in riffle habitats (including cascades, boulder/large cobble riffles, and gravel/small cobble riffles) in the East Fork Lewis River study area by reach, October 18-19, 2010. Percentages include both mainstem and side channel habitat units.

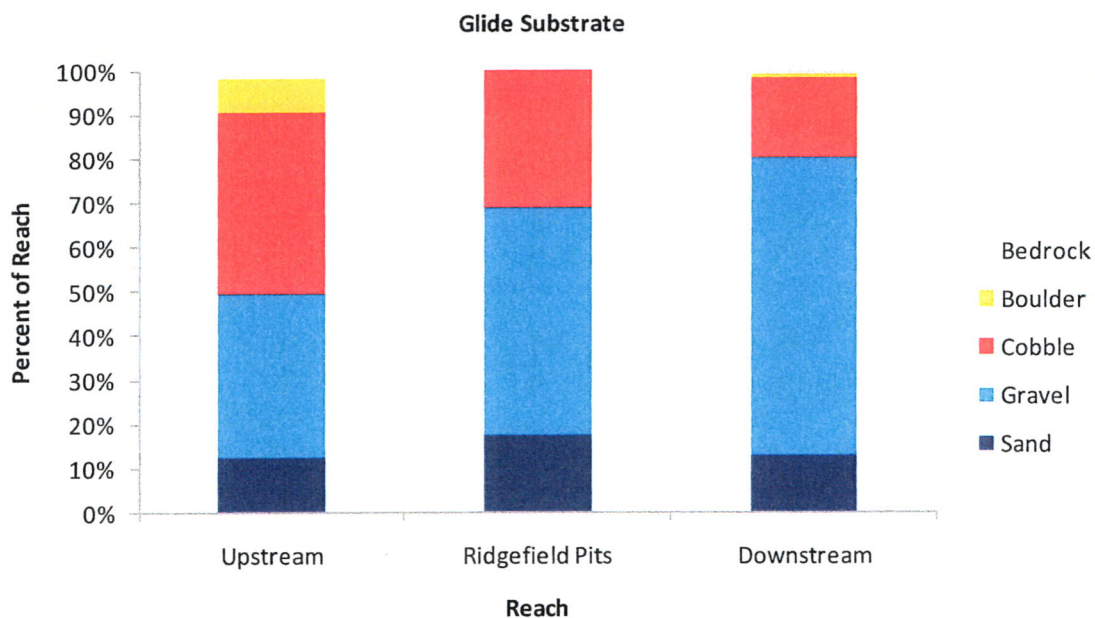


Figure 5. Substrate composition in glide habitat in the East Fork Lewis River study area by reach, October 18-19, 2010. Percentages include both mainstem and side channel habitat units.

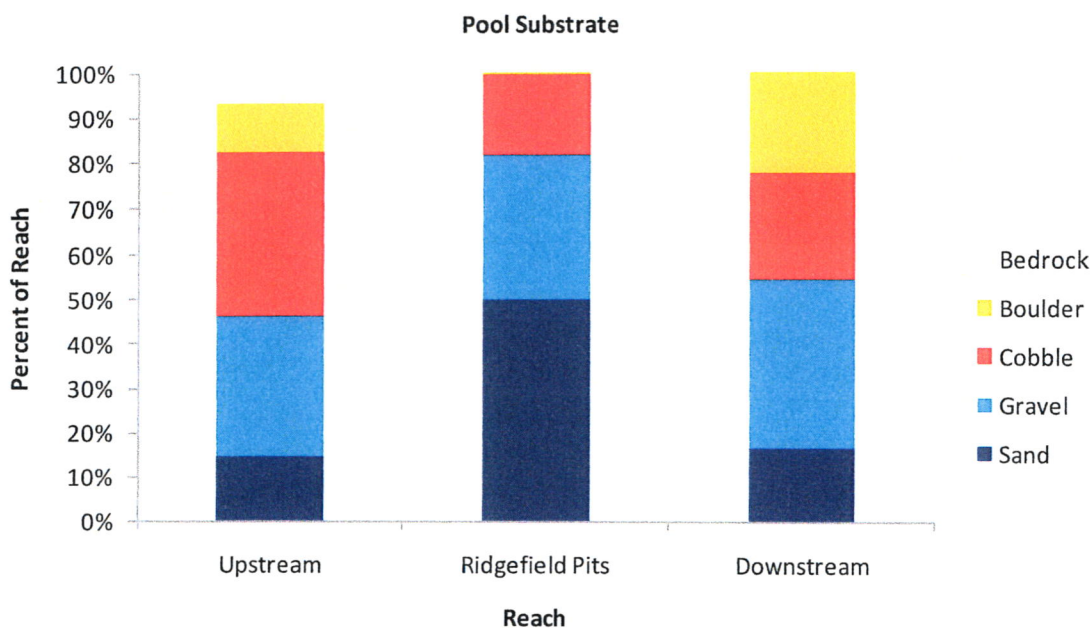


Figure 6. Substrate composition in pool habitat in the East Fork Lewis River study area by reach, October 18-19, 2010. Percentages include both mainstem and side channel habitat units.

Large Woody Debris

The amounts of large woody debris enumerated during the habitat survey are summarized below in Table 3. A total of 248 LWD pieces were counted over the entire survey and included mostly small and medium pieces. A total of 17 small or medium jams were counted, though no large jams were observed. In general, the densities of individual LWD pieces and LWD jams were greatest in the Ridgefield Pits reach, which may be explained by the lower energy and more depositional nature of this reach.

Table 3 Summary of large woody debris observed in the surveyed section of the East Fork Lewis River by reach.

LWD Category	Upstream Reach	Ridgefield Pits	Downstream Reach	Total
Small LWD (#)	66	29	15	110
Medium LWD (#)	65	25	17	107
Large LWD (#)	24	4	3	31
Total LWD (#)	155	58	35	248
Small Jam (#)	2	4	3	9
Medium Jam (#)	3	3	2	8
Root Wads (#)	20	6	3	29
Small LWD (per km)	8.6	17.3	6.5	9.4
Medium LWD (per km)	8.4	14.9	7.4	9.1
Large LWD (per km)	3.1	2.4	1.3	2.7
Total LWD (per km)	20.1	34.6	15.2	21.2
Small Jam (per km)	0.3	2.4	1.3	0.8
Medium Jam (per km)	0.4	1.8	0.9	0.7
Root Wads (per km)	2.6	3.6	1.3	2.5

Small LWD: 10-20 cm diameter & >2 m long; Medium LWD: 20-50 cm diameter & >2 m long; Large LWD: >50 cm diameter & >2 m long; Rootwads: Diameter >1 m; Small Jam: accumulation of 10-50 pieces; Medium Jam: accumulation of 50-100 pieces; Large Jam: accumulation of >100 pieces.

Bank and Riparian Condition

Bank instability was evaluated at all habitat units. Overall, 16 percent of banks were classified as unstable (Table 4). The extent of bank instability was generally between 12 and 16 percent throughout the surveyed area. The exception was the left bank in the Downstream Reach where 31 percent of the bank was classified as unstable. Overall, riparian vegetation was comprised mostly of small trees, shrubs/seedlings, and grasses/forbs (Figure 7). The outer riparian zone was dominated by small trees while the inner riparian zone was primarily shrubs/seedlings and grasses/forbs. Riparian disturbance, as estimated during Nth habitat unit surveys, was 57 percent on the left bank, 23 percent on the right bank, and 40 percent overall. Riparian disturbance was due to residential development, erosion, riprap (for erosion control), and power line right-of-ways.

Table 4. Bank instability as measured in three reaches of the East Fork Lewis River, October 181-9, 2011.

Bank	Upstream Reach	Ridgefield Pits	Downstream Reach	Total
Unstable LB (m)	1,254	196	717	2,167
Unstable RB (m)	1,097	243	334	1,674
Survey Length (m)	7,718	1,676	2,303	11,697
Unstable LB (%)	16%	12%	31%	19%
Unstable RB (%)	14%	14%	15%	14%
Unstable Total (%)	15%	13%	23%	16%

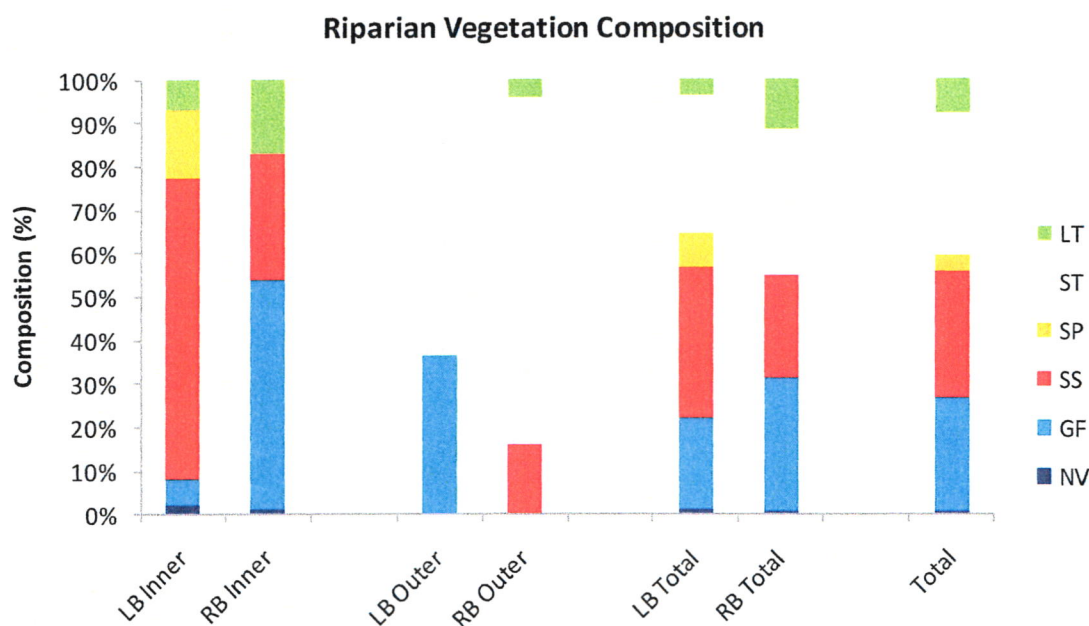


Figure 7. Riparian vegetation composition as measured in the East Fork Lewis River, October 181-9, 2011, at Nth habitat units. NV: no vegetation; GF: grass/forb; SS: shrub/seedling (1-5 in); SP: sapling/pole (5-9 in); ST: small trees (9-21 in); LT: large trees (21-32 in). No riparian areas were dominated by mature trees (>32 in).

Cover

Based on Nth unit subsampling, available cover comprised 22 percent of the surveyed habitat area. The most abundant cover available was associated with depth (>0.9 m), which comprised 17 percent of the surveyed habitat area (Table 5). Cover provided by all other types each represented 2.1 percent or less of the surveyed habitat area.

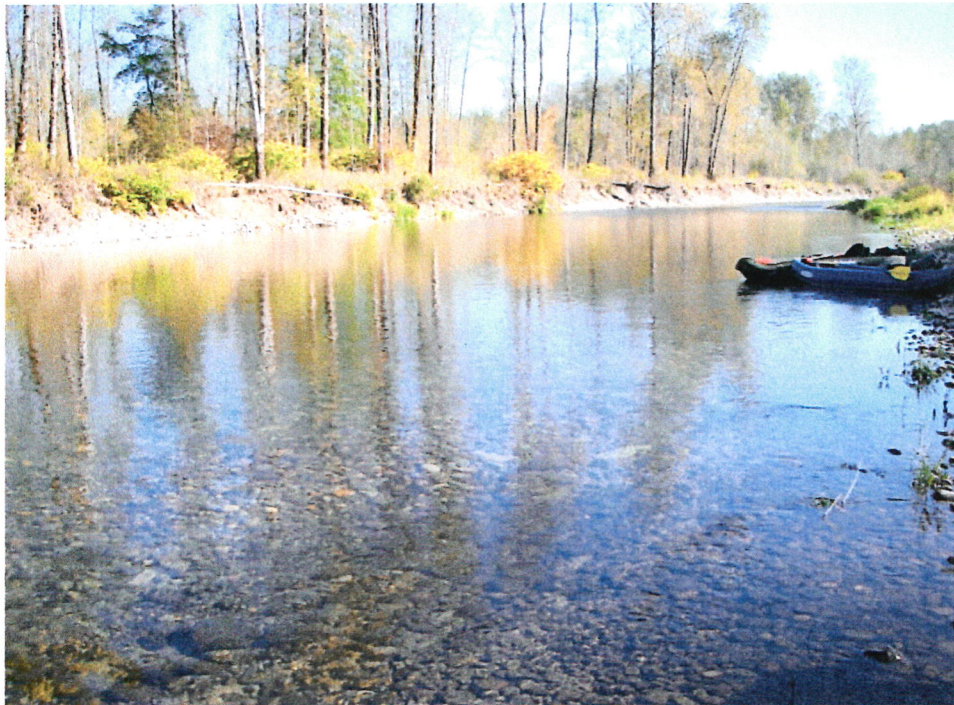
Table 5. Summary of available cover by type as measured in three reaches of the East Fork Lewis River, October 181-9, 2011
based on Nth unit observations.

Cover Type	Area (m ²)	Percent of Area
Large Woody Debris	541	1.2%
Undercut Bank	211	0.5%
Overhanging Vegetation	956	2.1%
Depth	7,702	17.0%
Substrate	675	1.5%
Total N th Unit Wetted Habitat	45,367	100.0%

Photographs



Photograph 1. View of head of pool (NSO # 6) in Upstream Reach of the East Fork Lewis River, looking downstream.



Photograph 2. Glide (NSO # 60) in Upstream Reach of the East Fork Lewis River, looking upstream.



Photograph 3. Ridgefield Pit # 1 in the East Fork Lewis River, looking upstream.



Photograph 4. Ridgefield Pit # 3.in the East Fork Lewis River.



Photograph 5. Gravel/Small-cobble riffle (NSO # 88) in Downstream Reach of the East Fork Lewis River, looking upstream.

References

- SP Cramer & Associates, Inc. 2005. Chapter 4: East Fork Lewis River Basin – Habitat Assessment. Prepared for: Lower Columbia Fish Recovery Board.
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