Limiting Factors Assessment and Restoration Plan

Little Lobster Creek

A Tributary to Lobster Creek in the Alsea Basin

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Introduction

This document provides watershed restoration actions proposed to enhance the Coho Salmon population within the Little Lobster Creek sub-watershed in Benton County, Oregon. Little Lobster Creek is a 4th order contributor to Lobster Creek within the Alsea River Basin.

The goal of the restoration effort is to identify the dominant processes and habitat characteristics that currently limit the production of Coho salmon smolts in the watershed, and to develop a prioritized list of actions ("prescriptions") for removing the limitations in ways that help normalize landscape and stream channel function.

Central to this goal is the identification of Coho "Core Areas" and "Anchor Sites", which are sections of the stream channel that support the Coho population. By Core Area we mean a contiguous section of stream channel or channel system where juveniles rear on a consistent (year to year) basis. The term Anchor Site is used to specify the portion of the Core Area which provides all essential habitat features necessary to support the complete Coho freshwater life history.

For a more detailed description of these concepts as well as the restoration, assessment, and prioritization protocols used in developing the plan, please refer to "*Midcoast Limiting Factors Analysis, A Method for Assessing 6th field subbasins for Restoration*". This document is available at www.midcoastwatershedscouncil.org/GIS or by contacting the Midcoast Watersheds Council.

The following questions exemplify the types of issues addressed in the assessment process.

- How well is the current system functioning for Coho production (what part does each of the habitat subdivisions play)
- What temperature problems are apparent?
- Where are temperature refugia located?
- Where are the barriers?
- What are the sediment issues in the system?
- Where are the spawning areas, and how are they integrated with the summer and winter rearing sites?
- What needs to be done to make the Core habitat function for all life phases, and to function at a higher level?
- What work should be done in each area to facilitate a more completely functional whole?
- What is the best upslope work that supports the instream work?
- How are the fish currently using the system?
- What problems are generated by the current habitat configuration (e.g., temperature dependant movements that expose juveniles to predation)
- How and when are the greatest losses generated to the population?
- Within the Core habitat, what are the dominant limiting factors?
- Within the 6th field, what are the dominant limiting factors?
- Within the 4th field, what are the dominant limiting factors?
- Does the presence or absence of adequate winter habitat outside the spatial boundaries of the 6th field suggest or preclude the need for expanding the quantity or quality of winter habitat?

Resources used in developing the plan

The following resources were used in preparing the restoration plan:

- Management reports: "Lobster/Five Rivers Watershed Analysis", U.S. Dept of Agriculture and U. S. Dept of Interior, January 1997.
- DEQ temperature database recorded by the USFS in 1998 by continuous data logger. Incidental point source data collected by Bio-Surveys and ODFW's AQHI survey crews from 1994 - 2002
- Aquatic habitat inventories: Habitat surveys were conducted in Little Lobster Creek by the Oregon Department of Fisheries and Wildlife in 1994, 1996, 1997, and 1999.

- Summer juvenile snorkel surveys: These "Rapid Bio Assay" fish inventories identify the species, age class, density and distribution of salmonids in pools based on fish counts made in randomly selected pools. Little Lobster Creek was surveyed by Bio-Surveys for five consecutive years between 1998 and 2002.
- Bio-Surveys Field assessments: This identifies the location and functionality of the sub-watershed's Core Area and Anchor Site(s) and tributary system. In addition, spawning gravels are quantified and given qualitative rating and riparian conditions are assessed. The field assessment of Little Lobster Creek was conducted on May 5 – 7, 2005.
- Oregon Department of Forestry slide risk assessment mapping: This procedure utilizes modified CLAMS data to evaluate failure-prone headwater slopes as potential sources of wood and substrate for the aquatic corridor. The evaluations help identify and rank Critical Recruitment Areas within the sub-watershed.
- Nickelson Model: This analytical model, also referred to as the Habitat Limiting Factor Model (Nickelson) model, utilizes estimates of spawning gravel, egg deposition rates, and abundance of aquatic habitat to identify which seasonal habitat, and thus which Coho life stage, currently limits smolt production within the sub-watershed. The model is described in ODFW Information Report 98-4.

Watershed overview

The Little Lobster Creek sub-watershed comprises 2,071 hectares within the Five Rivers/Lobster Creek watershed of the Alsea River basin. Flow originates at about 800 ft elevation in two steep headland branches on the north slopes of Prairie Mountain. Flow direction is initially northwest and then west to the stream's confluence with Lobster Creek at about RM 8.

The mainstem valley may be broadly described as several geomorphic sections (Appendices 1 and 2):

- At the upper end is the headwaters, with its steep, narrow valley.
- Below this, from Tributary J (RM 5.9) to Tributary I (RM 4.9, near the Alsea/Deadwood Highway crossing) is a transition zone where the gradient decreases below 6% and the valley begins to open up.
- The section between Tributary H and Briar Creek (RM 2.4) is characterized by a broad valley floor, alternating hillslope and terrace constraints and gradients near 2%.
- From Briar Creek to the mouth, the valley narrows and the gradient decreases below 1%. The valley becomes very narrow near Tributary B (RM 0.50), forming a "pinch point" that appears to have functioned historically as a debris flow barrier causing upstream terrace development.

The drainage pattern may be described as "unbalanced dendritic", with the large majority of the tributaries entering from the North (Appendix 2). The principle tributary is Briar Creek, which enters from the north as a major source of flow and habitat.

With the exception of Briar Creek and Tributary C (RM .87), tributary valleys are mostly small, steep, and narrow, individually providing only minor flow and habitat potential. Tributary C is slightly more significant than the remaining tributary corridors because it provides cold summer flows.

From the standpoint of salmonid habitat assessment, Appendices 1 and 2 focus our attention on mainstem Sections 1-9 up to approximately RM 4.8, lower Briar Creek, and a small portion of Tributary C. The mainstem valley floor above RM 4.8, like most of the tributary valleys, is too steep and too constrained to consistently generate significant Coho rearing habitat.

This region of the Oregon Coastal Range is characterized by surface formations dominated by sand and silt-stone deposits, creating a general tendency for hill slope instability and recruitment of soft substrates to the aquatic system. In the lower mainstem, most mobile substrates are soft, reducible sediments. Sand, gravel, and small cobble are abundant, while large cobble and boulders native to the system are rare here and do not function significantly in channel development.

Igneous intrusions are also abundant, and appear as exposed ridges such as Prairie Peak. These intrusions contribute durable substrates of all sizes to upper valley channels. However, the coarse components of this material are found almost exclusively in the headwater and transition zones, and are not evident in the depositional zones of the lower mainstem.

Exposed channel bedrock, another presentation of bedrock intrusion, is common throughout the system. In the lower mainstem, these exposures have resulted from debris flow scour and channel entrenchment.

A large portion of the mainstem flows through private lands, as do many of the tributaries. However, lands surrounding the mainstem from approximately RM 1.8 to 3.0, most of the Briar Creek drainage, and most of the headwaters are in public ownership (BLM). Rural residence and abandoned homesteads dominate the stream adjacent private lands ownership (73%), while stream adjacent industrial timber ownership accounts for 27% of private ownership.

Fire (primarily the 1868 Yaquina fire), "slash and burn" homesteading initiated during the late 1800's, and timber harvest reaching peak efforts in the 1970's removed most upland large wood resources as well as riparian canopies while generating large movements of labile soft sediments and woody debris to the valley floor in the form of torrent flows. During the 1980's and 1990's, harvest continued on private lands including harvest of re-growth, but diminished on public lands due to conservation measures.

From these events, a mixed aged patchwork of conifer re-growth has developed on the hill slopes. The riparian system is currently predominantly deciduous in the lower mainstem, while upstream conifers become a more significant riparian resource.

As indicated in Appendix 1, in-channel wood resources are very low throughout the system, a reflection of land use and fire events. The primary Coho producing areas of the system are therefore deficient in two primary stimulants to channel development, wood and large substrate.

In a 1994 survey, 24 beaver ponds were found in Section 10 above the Deadwood-Alsea Highway junction (RM 4.9). However, a 1997 survey found no ponds in this section. A 1996 survey found one pond in Section 9. It is probable that winter flood conditions in 1996 removed these ponds, and that they have not been rebuilt. Recent RBA surveys and the current assessment have identified only three ponds, located in Section 2.

Current status of Coho

The status of Oregon Coast Natural (OCN) Coho has been well documented in the Alsea basin by ODFW's Stratified Random Sampling Program for adult spawners and by the Midcoast Watershed Councils Rapid Bio-Assessment Inventory for estimates of the summer standing crop of juveniles. The adult data gives us a sense of the basin wide trends in abundance and the juvenile data gives us a purview of trends within specific 5th and 6th fields.

A 15 year review of basin wide trends in the Alsea indicate that adult escapement hovered at a very low level from 1990 to 1998 and only once during that period exceeded 1,700 adult Coho. This depressed status culminated in the 1998 cohort crashing to a total basin estimate of 213. From the period of 1999 to 2003 there has been a very significant and steady incline in spawner abundance in the basin that peaked at 8,957 in 2003. A 33% decline (from the 2003 level) was documented in the most recent adult inventory (2004), which may be an indicator of a shift in the basin wide trend towards another period of declining abundance.

There were two major variables that were altered during this 5 year period of increasing adult abundance that could have dramatically impacted Coho abundance on the basin scale.1) There was a quantifiable and radical increase in the ocean survival rates of Coho smolts to spawning adults. This increase was observed in ODFW's Life Cycle Monitoring sites with ocean survival rates exceeding 10% in multiple locations. 2) There was the cessation of hatchery Coho releases in the Alsea basin from the Fall Cr. Coho production facility, which resulted in the reduction of negative genetic interactions between hatchery and wild stocks within the watershed. "*The primary genetic risk is that matings in the wild involving one or more hatchery origin parents results in the production of offspring with reduced fitness*" (Monitoring and Evaluation of Supplementation Projects. ISRP and ISAB, 2005).

To focus our review of status more narrowly on the Little Lobster Cr. 6th field, a review of the Rapid Bio-Assessment data (juvenile snorkel surveys) indicates that during low abundance years, Little Lobster Cr. was not out performing other 6th fields in the basin when Coho production was utilized as a metric. In 1999, Little Lobster contained 6.8 % of the total basin mileage but only 4.4 % of the total basins Coho production. In a higher abundance year (2002), Preacher contained 2.7% of the basins total stream miles and still contributed only 2.3 % of the total summer Coho population. This basin wide comparison indicates that the Little Lobster Cr 6th field during higher abundance years still performs below the watershed median for Coho production. This suggests that there may be significant habitat limitations that are expressed during the early life history stages (before the onset of winter flow regimes) within the 6th field that are limiting the carrying capacity of the 6th field. Little Lobster was chosen in the Midcoast assessment process as a high priority 6th field for restoration because it exhibited the morphological characteristics of low gradient, hydric soils and interactive floodplains that suggested high production potential for Coho. This is essentially verification that the 6th field is well qualified to be a high priority for enhancement and restoration but that its current function is rated as very poor when compared to similar 6th fields (such as Preacher Cr).

Juvenile distribution and abundance data was collected for Little Lobster Cr for each of the five years from 1998-2002. During that period the highest summer production estimate for Coho was documented in 2002 at 8,870 (this was the result of an ODFW adult escapement estimate in the Alsea basin of 3,339). A review of summer juvenile Coho distribution in both extremely low and moderate adult abundance years (1999 and 2002) indicate that rearing densities consistently drop off below RM 2.7 which is just above the confluence of Briar Cr. (see Coho distribution histograms). Even when summer pool habitats are fully seeded between RM 4.0 and 5.0 (indicating the likelihood of density dependant downstream migration of fry) habitats below Briar Cr. appear to be extremely under utilized. Little Lobster has not been inventoried for juveniles during the most recent years of significant adult escapement (2003 brood @ 8,957 adults) but the possibility remains that greater escapement has not led to significant increases in juvenile production within the lower 3 miles of Little Lobster.

Limiting seasonal habitat analysis

Habitat and spawning gravel inventories were used to estimate the capacity of the watershed to generate and support the development of Coho salmon through the four stages of freshwater residence up to smoltification.

The Nickelson model helped determine whether spawning gravel or one of the seasonal rearing habitats constitutes the resource that most limits Coho smolt production. Information for this analysis came from two principle sources: 1) The Field Assessment phase of the project, which provided estimates of the amount and quality of spawning gravel; and 2) ODFW habitat inventories, which provided most but not all of the needed habitat data.

ODFW conducted habitat inventories in Little Lobster Creek during the summers of 1994, 1996, 1997 and 1999. However, these surveys omitted two sections of the mainstem and all of the tributaries. Some mainstem reaches overlapped those of other years in irregular fashion (variable start and end points), and identifying features are difficult to interpret in some of the survey maps. Based on these considerations, some of the existing data were excluded from the analysis.

Data from the most informative mainstem surveys were combined to create a non-overlapping sequence that identify the two missing sections. The resulting 13 surveyed and unsurveyed sections are listed in Appendix 1. Note that reach length and location data in this table are approximate and may not correspond exactly to map location.

Section 6 was not included in the ODFW surveys. We approximated habitat conditions in this section by averaging data from Sections 5 and 7.

Briar Creek was not included in ODFW surveys. The lower section of this tributary has a low gradient, wide valley morphology favorable to the development of habitats used by juvenile Coho. In the absence of a habitat inventory, we defined a single low gradient reach 1.1 miles in length. We then estimated the types and amounts of aquatic habitat in this reach based on pool dimension data from a recent Rapid Bioassay survey and non-pool data from the 1999 ODFW survey of mainstem Section 3. We assumed that this section was the best source of data to approximate habitat conditions in lower Briar Creek because Briar joins the mainstem in Section 3.

Habitat conditions and distribution are then compared to an overlay of summer juvenile salmonid distribution. These two data layers provide a real world display of interaction between populations and physical habitat variables. These distribution and abundance layers (fish and habitat) are then compared to the Nickelson modeling exercise that looks at hypothetical subbasin relationships utilizing only total seasonal habitat surface areas and their associated seasonal survival rates (the data available for the basin does not allow us to actually estimate the abundance of spring habitat and winter habitats are estimated utilizing a regression equation developed from existing summer habitat inventories) to identify a habitat bottleneck (limiting factor). It is important to clarify that the modeling exercise is not capable of evaluating the impacts of the density dependant issues that are present in every real world ecosystem on seasonal survival rates. Therefore, habitat quality, levels of sedimentation, temperature thresholds, intra and inter specific competition and every other potential variable are ignored by the modeling exercise. Because of this stark weakness inherent in the Nickelson model we also apply seasonal survival rates summarized from the Alsea Watershed Study that reflect the impacts of real world ecosystem variables. At this point we incorporate professional judgment into the process of identifying limiting factor issues. We are utilizing all of the information consolidated in the following assessment to tease out both the short term and long term issues of concern in the subbasin that will restore functional processes and result in boosting smolt production potential from the sub basin.

Field assessment

Migration barriers

There is a 4ft corrugated culvert on Trib B with a 4 inch perch that is a minor issue for potential upstream juvenile migrants. The culvert easily passes adult Cutthroat that are the primary users of any habitats in Trib A. The Trib is not a likely spawning location for large salmonids (Coho and Steelhead) because of its small flow and rapidly increasing gradient.

There is a natural full spanning log jam with a 3ft pour at a point 1.4 miles above the confluence of Briar Cr and below the confluence of Trib G. This is an old stable large wood jam and is currently an upstream barrier to juveniles conducting upstream temperature dependant migrations.

There is also a 2 ft bedrock cascade at the mouth of Trib A of Briar Cr that is a barrier to juvenile upstream migrants. This is not an issue for adults and adult Coho have typically spawned in this tributary.

Temperature issues

There has been a substantial amount of temperature data collected for the Little Lobster 6^{th} field from its confluence with Lobster Cr to the headwaters. The most reliable data comes from the USFS site just above the confluence with mainstem Lobster that was recorded with a continuous data logger in 1998. The peak 7 day average of daily maximums was 21.3 deg C (70.3 deg F). This value substantially exceeds the DEQ threshold for salmonids and was the source of its listing on their 303 (d) list. Other significant points documented in the basin were collected by Bio-Surveys and ODFW during habitat and juvenile inventories from 1994 to 2002. The mainstem of Little Lobster just above the confluence of Briar Cr exhibited a 9:45 temperature of 61 deg F on August 10, 1999 and Briar Cr exhibited a 15:00 temperature of 63 deg F on August 11, 1999. In addition, lower mainstem temperatures of 17 deg C were recorded as early as July 8 in 1994.
Fish distribution data indicates that aquatic habitats below the confluence of Briar Cr may be severely impacted by extended periods of instream summer temperatures that exceed juvenile salmonid thresholds.

You will note in the discussion on *Summer Distribution Profile* below that the highest quality and most abundant gravels occur in Anchor site #1 in the lower mainstem but that the lowest Coho densities are consistently observed there.
Also well documented is the extensive distribution and abundance of Dace within the mainstem of Little Lobster. They are consistently, year to year the most abundant fish species (number and biomass) from the mouth to the confluence of Briar Cr. This is a warm water tolerant species that is a direct competitor with juvenile salmonids for habitat and food resources.
There are several significant North Slope tributaries that do not provide significant levels of habitat for salmonids because of their gradients but that are critical for mitigating elevated mainstem temperatures (see Critical Contributing Area discussion).

Aquatic habitats overview

Core Area

Describe the Core Area and its location.

The Core area describes the current summer distribution of Coho within the 6th field. Coho utilize 6.1 miles of mainstem Little Lobster to a point 1.0 miles above the Alsea / Deadwood Hwy crossing. In addition Coho have been observed in 1.1 miles of Briar Cr and in 0.5 miles of Trib A of Briar Cr.

Spawning gravel

Describe the quantity, quality and location of spawning gravel.

237 sq. meters of functional spawning gravel was quantified for the entire 6th field by Bio-Surveys during a field inventory in May of 2005. The mainstem was divided into 3 functional segments that will be significant throughout this analysis process (see Spawning Gravel Count table in Appendix 3).
Segment 1: Extends from the mouth at the confluence with Lobster Cr to the confluence with Briar Cr.
Segment 2: Extends from the confluence with Briar Cr to the bridge crossing on Alsea / Deadwood Hwy.
Segment 3: Extends from the Alsea / Deadwood Hwy crossing to a point 1.1 miles upstream (end Coho).

Segment 1 contained 200 sq meters of spawning gravel located in sites appropriate for spawning. Only 114 sq. meters was classified as high quality. The actual functional gravel estimate utilized in the limiting factors run of the Nickelson model was 156 sq. meters of gravel for segment 1.

Segment 2 contained 116 sq. meters of spawning gravel. Only 5 sq. meters was classified as high quality. The actual functional gravel estimate utilized in the limiting factors run of the Nickelson model was 45 sq. meters.

Segment 3 contained 0 sq. meters of spawning gravel.

Briar Cr. contained 86 sq. meters of spawning gravel identified in the mainstem and its tributaries. Only 7 sq. meters of this gravel was classified as high quality. The actual functional gravel estimate utilized in the limiting factors run of the Nickelson model was 36 sq. meters.

Summer juvenile distribution

Describe the summer distribution of Coho juveniles. Include a description of the resources used.

Five consecutive years of juvenile distribution data from 1998 – 2002 during both low and moderate adult escapement years provide the baseline for the following discussion. Juvenile Coho have been consistently observed in extremely low numbers in habitats below the confluence of Briar Cr.(see distribution graphics for 1999 and 2002 in Appendix). These lower mainstem pools have never exhibited rearing densities above 0.3 fish/sq meter and have resulted in producing only 3-20 juveniles / pool in even good years. The average pool in this lower mainstem area, if fully seeded, should be rearing approximately 220 Coho juveniles. The upper basin (above the confluence of Briar Cr) has exhibited sections of fully seeded densities (RM 4 - 5) during moderate adult abundance years (2002). There does not appear to be any temperature dependant upstream migration of juvenile Coho from mainstem Lobster Cr into the lower reaches of Little Lobster. This is significant because it indicates that summer temperatures in lower Little Lobster are probably not significantly different than those observed in mainstem Lobster (which have been well documented as exceeding upper thresholds for rearing juvenile salmonids). The conundrum portrayed by the presence of the highest quantity and quality spawning gravel and the consistently low abundance of juvenile Coho in this lower 2.7 mile reach is a strong signal that there are habitat quality factors potentially limiting distribution.

Summer cover

Describe the character and distribution of summer cover. Note that this evaluation generally lacks quantitative measurement, and relies on professional judgment.

Summer cover for juvenile salmonids is often expressed in quantitative inventories as the abundance of large wood. From the mouth of Little Lobster to the confluence of Trib B there are 14 habitat improvement structures interacting with the channel that are comprised of 1-8 medium to large logs / structure. The structures have developed many mid channel bars and side channels, they have narrowed and deepened the active channel and at least 2 of the sites are ranked as providing exceptional complexity. They still have not exhibited significantly higher summer rearing densities during snorkel inventories.

The segment from the mouth to Briar Cr was quantified by a 1999 ODFW AQHI survey. There were 100 total pieces / mile of wood of all sizes associated with the aquatic corridor. 9.6 pieces / mile of this total was classified as key pieces of large wood >24" in diameter and at least 30 ft long. The majority of these key pieces (20 of 27) were observed below the confluence of Trib B and were the result of the habitat improvement project referred to above that was conducted on private industrial forest land by ODFW. This leaves the majority of segment 1 (mouth to the confluence of Briar Cr) without any significant abundance of large stable instream wood.

A wood inventory in the 2.68 mile reach from the confluence of Briar Cr to the Alsea / Deadwood Hwy crossing resulted in a total of 6 large key pieces /mile (> 24" diameter and 30 ft long), 64 pieces /mile of medium wood (12"- 24" diameter) and 80 pieces / mile of small wood (<12" diameter). The abundance of large key logs is the most significant deficiency observed which limits the systems ability to capture and retain (long term) the smaller transient wood components that are being recruited from the riparian corridor.

Given the above accounting of wood complexity it is clear that in segment 1 between the confluence of Trib B and Briar Cr, there is limited summer cover provided by large woody debris and that most of the cover and complexity is composed of transient materials migrating through the system.

Winter cover

Describe the character and distribution of winter cover. Note that this evaluation generally lacks quantitative measurement, and relies on professional judgment.

Winter cover and complexity is a combined review of the wood densities addressed above and the location and abundance of interactive floodplains that provide low velocity (off channel) habitat structure. Within Segment 1 there is only one site currently providing functional winter cover. The first and most significant has been classified as Anchor site #1 (see Anchor site discussion below) and exists between the confluence of Trib B and the confluence of Trib D. The second is in segment 2 (between the confluence of Briar Cr and the Alsea / Deadwood Hwy.). Both of these sites provide extensive floodplain interaction and exhibit premium winter cover characteristics for juvenile salmonids. The remainder of the active channel in the subbasin has been isolated from its floodplain by channel entrenchment as a result of low instream wood densities that function to trap and retain mobile substrates that eventually cause channel aggredation.

Channel form and floodplain interaction

Describe the channel form and degree of floodplain interaction..

The mainstem of Little Lobster Cr. has been formed on top of an underlying strata of sandstone. The most significant feature of this sandstone bedrock layer is that it is extremely flat. This feature combined with other attributes discussed in this analysis preordains Little Lobster Cr. to be temperature sensitive. The channel gradient in the 2.4 mile section from the mouth to the confluence of Briar Cr. has a gradient of 0.7%. The gradient in the 2.7 mile segment 2 from Briar Cr to the Alsea / Deadwood Hwy crossing is 1.8%. The gradient in Briar Cr., the systems only secondary branch habitat is only 1.9%. These gradients reduce pool turnover rates that directly impact summer temperature profiles. In addition, there are very long corridors of exposed bedrock (1,400 ft above the confluence of Trib D and in mainstem Briar Cr) with no accumulation of bed materials that exposes all of the summer flow to aeration and ambient air temperatures. The alternate state of proper function would observe subsurface flows locked into a contiguous depositional layer from headwaters to mouth protecting a percent of the mainstem flow from exposure.

There are two morphological pinch points along the mainstem of Little Lobster. Both occur in Segment 1. The first is at the confluence of Trib B and the other is 1,400 ft above the confluence of Trib D. There has been a historical debris torrent event within this section of channel that has left it severely impacted (scoured to bedrock). As a result of this event, a large volume of mobile substrate (gravels, sediments) were transported and deposited behind a jam at the confluence of Trib B. The jam has long since been removed but the deposition materials still exist. There has been no documentation of this event in any of our document review and therefore the initiation site is unknown. However, there is some evidence that this event may have originated in Briar Cr. (long contiguous stretches of channel scoured to bedrock).
Most of mainstem Little Lobster exhibits a condition of channel entrenchment and isolation from its floodplain. This is primarily a result of a long legacy of agricultural and upslope forestry practices that either removed riparian wood resources completely or extracted them from the stream corridor to reduce deposition and any potential interaction with homestead meadows that they were trying to drain and utilize. The majority of mainstem Little Lobster is still small private ownership and was converted to agrarian based homestead activities near the turn of the century. There are several locations that will be reviewed under the Anchor Habitats section of this document that exhibit the potential for restoring floodplain interaction, however most of these zones have been disconnected for so long that the recovery of function may take more than a single one time treatment of wood complexity.

Channel complexity potential

Assess the potential for the development of meander, braiding, side channel, alcove, backwater channel forms.

There are several sites that exhibit adequate floodplain width to encourage the development of sinuosity as a restoration goal. However, the majority of the Little Lobster mainstem is hillslope confined and does not offer any significant potential for increasing the abundance of off channel habitat characteristics. These areas have been identified as either functional or potential Anchor sites in the Anchor site discussion below.

Channel complexity limitations

List and rank the factors currently limiting the development of channel complexity.

1) Limited instream wood complexity capable of trapping gravels and mobile sediments
2) The apparent collapse of the resident beaver population (data available)
3) Deeply entrenched active channels through historical floodplain (currently isolated)
4) Long stretches of riparian logging impacts that have reduced natural recruitment potential
5) Exposed bedrock reaches that exacerbate high summer temperature profiles
6) Hillslope confinement as a morphological side board that discourages floodplain interaction

Addressing the limitations

Are these limitations addressable through restoration work? Explain for each limitation listed above.

1) Yes. Sites can be prioritized for wood placement that will accomplish a multitude of tasks (link floodplains, trap mobile substrates, provide roughness, cover and complexity)

2) Yes. Beaver could be transported back into the system and the planting of food resources to encourage their colonization could be part of a riparian planting strategy.

3) Yes. Wood placement designed to trap mobile substrates would begin to lift the channel back up to it's historic levels and enable it to interact with these isolated floodplains.

4) Yes. These harvest impacts have already been levied on the system and these sites have been replanted. However, for the short term, the reduction of similar impacts on other upslope sites that contain live Type N streams is paramount to reversing the trajectory of elevated summer stream temperatures.

5) Yes. This is the 3rd limiting issue that can be addressed with the placement of instream wood. Each complex log structure is capable of trapping and storing mobile bedload on top of the underlying bedrock strata. This will result in restoring subsurface flow that reduces solar and ambient air exposure.

6) No. Hillslope confinement definitively restricts the expansion of channel complexity beyond the borders of the active channel.

Anchor Site 1

Location and length

The anchor site is the largest in the 6th field and begins at the confluence of Trib B as a result of the confinement created by opposing hillslopes. It extends approximately 2,700 ft upstream to the confluence of Trib D. The floodplain within this Anchor site is currently highly interactive and is up to 250 ft wide at the widest point.

Sinuosity

Channel sinuosity is the highest in the 6th field within this Anchor Site (value not quantified). The channel works alternately back and forth within this floodplain. The sinuosity was created when the active channel developed a new route through the deposition plain that included buried wood from a historical debris torrent jam.

Terrace structure

Low terraces alternate from right to left and provide many opportunities for off channel back water habitats on inside corners during winter flow regimes. There is essentially only one terrace elevation as is typical of deposition plains created by a full spanning jam or beaver dam. The terraces are dominated by willow and a growing abundance of the invasive plant species *Deadly Night Shade(see photo #6).*

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

Anchor site #1 contains the majority of the high quality gravel observed in the 6th field (see photo #5). The site contains 19% of all of the spawning gravel observed in the entire basin and 44% of all of the spawning gravels classified as high quality. These are the gravels that exhibit low percentages of sand, silt and fines and that are well sorted for the provision of oxygenated water flow to incubating salmonids. Because the site contains a complex channel form and an interactive floodplain it is also providing the best off channel winter habitat in the 6th field. Wood complexity is currently low within the Anchor site and this fact certainly limits its carrying capacity during both summer and winter flow regimes.

There have been no winter abundance and distribution inventories in Little Lobster to assess how these variable habitats are performing in relation to rearing salmonid juveniles, but the potential is high. Summer inventories have observed consistently low abundances of Coho juveniles within the anchor that suggest that factors other than spawning or rearing habitat may be playing a significant role in limiting its production potential.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

The site is currently classified as exhibiting excellent function during all seasons of the year. However, if there was a single factor that could enhance its performance it would be the provision of cooler summer temperatures in this lower mainstem for addressing summer limitations and higher wood densities for addressing winter limitations.

Addressing the limitations

List and rank the restoration work at the site that would most effectively increase survival within the site and stabilize the core population at a higher base level.

1) The addition of wood complexes that are effective at impounding winter flows to improve floodplain interaction and provide cover for both summer and winter rearing juveniles.

Anchor Site 2

Location and length

The site begins at RM 1.6 and extends upstream 1,160 ft to the confluence of Trib E on the left. The Anchor is within the confines of a homestead parcel that has been cleared and drained for agriculture. Currently there is a modest cut flower (daffodils) operation on the site that remains active annually.

Sinuosity

Sinuosity improves over the reach average within this anchor but the amplitude of the meander bends (3 total) in this short 1,160 ft site are not short enough to significantly boost channel complexity. The active channel does however traverse the entire 250 ft wide floodplain from left to right twice suggesting that the placement of log complexes in a restoration prescription would likely be successful in creating interactive floodplain habitats during winter flow regimes.

Terrace structure

The current active channel is deeply entrenched (6 vertical ft) within its historical floodplain (see photo #8). There is only one terrace elevation indicating significant deposition has occurred here historically that has extended from hillslope to hillslope. The restoration of floodplain interaction at this site could likely involve two treatments of wood placement, 15 years apart. In addition, this site appears to have a historical beaver legacy that is completely missing. The reintroduction of Beaver could accelerate floodplain connectivity trajectories.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

There was a total of 25 sq. meters of spawning gravel observed within the Anchor Site. 18 sq meters was classified as high quality, representing 14 % of the basins total of high quality gravel. As discussed in the Anchor site #1 section, there is adequate gravel of significant quality here to fully seed large areas of summer rearing habitat. Summer snorkel inventories however have consistently observed very low abundances of summer parr in the mainstem below the confluence of Briar Cr. If the summer temperature profile were improved in the lower mainstem, it is likely that these habitats would represent high quality summer and winter rearing potential with the addition of the roughness and complexity delivered by instream wood placement.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

The site is currently classified as exhibiting very poor function during all seasons of the year except spawning and incubation. Three factors are clearly limiting the production potential of this Anchor site for salmonids.
1) Elevated summer temperatures above the threshold for juvenile salmonids
2) No floodplain interaction for the provision of off channel winter habitat
3) Full solar exposure from a total lack of riparian canopy

Addressing the limitations

List and rank the restoration work at the site that would most effectively increase survival within the site and stabilize the core population at a higher base level.

1) The addition of wood complexes that are effective at impounding winter flows to trap mobile substrates that will eventually lift the active channel vertically to improve floodplain interaction and provide cover for both summer and winter rearing juveniles.
2) Plant a riparian canopy to provide shade and reduce the amount of aquatic solar exposure. In addition, this canopy will provide the long term benefit of providing naturally recruited wood components.

Anchor Site 3

Location and length

The Anchor site is small and extends approximately 1,300 lineal ft. There has been a habitat improvement project in a portion of the anchor and it is currently dominated by two large beaver ponds with 4 ft dams that are the only active beaver sites observed in the Little Lobster 6^{th} field. The site is road accessible and exists in a corridor of recently harvested opposing slopes on Weyerhauser property.

Sinuosity

Channel sinuosity is excellent within the Anchor and a result of the channel braiding that is common. The level of sinuosity developed by channel braiding is a direct response of the high quality floodplain interaction created on these depositional plateaus by Beaver. Potential exists for improving this condition even further with the structures that are currently in place. The site is well positioned to increase channel meander with the next major winter flow event (this occurred during the winter of 2005 after completion of field inventories).

Terrace structure

Terraces are low and exhibit a long history of deposition from Beaver dam impoundment. There is significant evidence that this community has moved up and down within the anchor to take advantage of recovering food resources on depositional plains. The low terraces provide high quality floodplain interaction during winter flow regimes and provide what is typically absent in most other sections of Little Lobster.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

Spawning gravels are present within the Anchor (approximately 20 sq meters). All of the gravels were classified as poor and fair. Summer parr distributions indicate that spawning is occurring here and that the highest densities observed in the Little Lobster Cr 6th field are consistently observed just above the historical beaver flats observed in the anchor. In addition, the anchor provides some of the best winter refugia for juvenile salmonids in the two stable beaver pond complexes that have survived multiple winter flow events.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

The site is currently only limited by the condition of the spawning gravel resource that has been severely impacted by recent slope failures on adjacent upslope harvest units. Two slides originating within 1,000 ft of the anchor during the winter of 2005 have deposited large volumes of silt and sediment into the active channel.

There are other upslope factors at this site that result in impacts further down stream in the Lobster Cr 6th field. These factors probably do not directly impact habitats within the Anchor. This is a zone of substantial upslope harvest on both banks with a limited riparian buffer. Solar impacts here begin to develop the cumulative impacts observed downstream. These impacts are the systems primary limitation, summer temperatures that exceed survival thresholds for juvenile salmonids.

Addressing the limitations

List and rank the restoration work at the site that would most effectively increase survival within the site and stabilize the core population at a higher base level.

1) Inject additional wood complexity to maximize cover and complexity for boosting rearing capacity and sort low quality gravels impacted by recent slope failures

Anchor site rankings

Function

Rank the identified anchor sites in terms of current function (1= best).

1) Anchor Site #1
2) Anchor Site #3
3) Anchor Site #2

Restoration potential

Rank the identified anchor sites in terms of restoration potential.

1) Anchor Site #2
2) Anchor Site #1
3) Anchor Site #3

Secondary Branch 1

Location and length

There is only one secondary branch tributary in the Little Lobster Cr. 6th field, Briar Cr. Briar Cr. is within the confines of the Core area description for Little Lobster to a point 1.1 miles above its confluence with Little Lobster (this is the normal end of juvenile Coho distribution). In addition, Trib A of Briar Cr includes 0.5 mile of additional Coho habitat (Trib A enters on the left just above the start of Briar Cr.).

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

Briar Cr contains a total of 86 sq. meters of spawning gravel, 38 sq. meters of this total was observed in Trib A (44% of the Briar Cr total). This is 21% of the 6th fields total of all spawning gravels. Briar contains only 7 sq. meters of high quality gravel or 6% of the 6th fields total of high quality gravel. Most of the tributaries gravels are classified as poor or fair with a high percentage of fines, sand and silt. This reduces the gravels egg/fry survival rate during incubation which has been factored into the modeling exercise included in this analysis.

Historical habitat and juvenile inventories have always documented abundant beaver pond habitats in the surveyed reach of Briar and its Trib A. These beaver ponds have been the long term backbone of the rearing habitat profile in Briar Cr for both summer and winter residents. The recent inventory conducted by Bio-Surveys in May of 2005 observed no active beaver colonies in the entire tributary subbasin. No beaver ponds, no scent mounds or feeding stations. Our experience in Coast Range habitats considers this observation both disturbing and devastating for the short term production potential of the subbasin.

Briar Cr contributed a range from 0 percent to 21.9 percent of the entire 6th fields Coho production between the years of 1998 and 2002. These contribution rates are very similar to the spawning gravel contributions discussed above (21%). Briar Cr contains approximately 16% of the 6th fields available pool surface area during summer flow regimes.

Winter rearing potential historically has been very high in Briar Cr relative to the mainstem because of the presence of stable full spanning beaver ponds in both Briar and Trib A of Briar. This condition has been altered significantly with no intact beaver dams observed during the May 2005 inventory conducted by Bio-Surveys.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

Three key limitations appear to exist in Briar Cr:
1) The low abundance of high quality spawning gravel. Low recruitment potential from slide prone areas upslope (see ODF debris flow risk assessment, appendix). Limited wood abundance for trapping and sorting gravels.
2) Elevated summer stream temperatures that meet and may exceed juvenile salmonid thresholds for extended periods. Limited floodplain interaction to saturate low floodplain terraces for slow summer release. Open canopy and extensive solar exposure.
3) The lack of floodplain interaction and high quality rearing area historically provided by beaver pond habitats. Reduction in the abundance of active beaver colonies and the absence of full spanning dam structures.

Addressing the limitations

List and rank the restoration work at the site that would most effectively increase survival within the site and stabilize the core population at a higher base level.

1) Restore functional Beaver colonies in the subbasin to trap substrates and boost floodplain connectivity.
2) Place full spanning wood structures to mimic Beaver dam function.

Secondary branch site rankings

Function

Rank the identified branch sites in terms of current function (1= best).

1) Briar Cr

Restoration potential

Rank the identified branch sites in terms of restoration potential.

1) Briar Cr

Lower mainstem area

Winter habitat potential

The lower mainstem outside of identified Anchor sites exhibits extremely poor potential for the provision of winter habitat. This is a result of the 6^{th} fields general morphology that is expressed in low sinuosity and consistently narrow floodplain terraces within confining hillslopes. In addition, a low instream wood density exacerbates this lack of floodplain potential by not providing low velocity cover within the active channel. The single significant exception to this condition is the segment of mainstem Little Lobster Cr on Weyerhauser property from the confluence with Lobster Cr to the confluence of Trib B. In this section there are large full spanning wood complexes that are providing exceptional potential for winter habitat.

Summer habitat potential

The lower mainstem of Little Lobster is severely limited by summer temperatures well above the threshold for juvenile salmonids. This condition is significant and functioning as a seasonal bottleneck for juvenile salmonid production.

Lowland habitats

Describe lowland habitats and locations outside the 6th field.

There are no lowland habitats immediately accessible downstream of the 6^{th} field that exhibit an obvious direct relationship to the 6^{th} field as potential sources of fully functional winter habitat. Juvenile salmonids migrating to the estuary in search of potential winter habitat are faced with a 27 mile traverse of mainstem habitats to reach the head of tidal influence. We are certain of two conditions for these migrants, 1) Unique and diverse winter habitats are available in these lowlands and 2) Juveniles making this journey are exposed to much higher predation rates than those retained in 6^{th} field habitats.

Riparian corridor

Dimensions and location

Describe the lineal dimensions and location of deciduous, coniferous, and open canopy.

The riparian corridor from the confluence with mainstem Lobster Cr to the confluence of Trib E at RM 1.9 is dominated by a deciduous canopy that exhibits significant historical and contemporary impacts. This is also the corridor that is 100 percent private ownership. Specifically, within this segment there is only one short 800 ft segment from the mouth upstream that maintains a riparian stand of late successional Douglas fir (13 trees total) that are well poised to be future recruits to the active aquatic corridor. The remainder of the segment to Trib E has only occasional conifer present. Twenty nine percent of this segment is currently exposed to solar impacts. 1,800 ft as a result of clearcut logging that begins at RM 1.3 and 1,100 ft as a result of homestead meadows on the Glade property (see photo #8). The remainder of the riparian in this segment is well canopied on the south slope and exhibits a narrow one tree canopy on the north slope where the stream parallels old homestead meadows.

The riparian corridor from the confluence of Trib E to a point slightly above the confluence of Briar Cr (RM 1.9 – RM 2.5) is contained in BLM ownership and exhibits a mixed coniferous deciduous canopy with excellent potential for the long term recruitment of Large woody debris from the riparian (see photo #9).

The riparian corridor from RM 2.5 to RM 5.1 at the Alsea / Deadwood Hwy crossing exhibits a mixed ownership of primarily private with some riparian north slopes within BLM jurisdiction. The segment is dominated by a deciduous canopy with limited recruitment potential from riparian conifers. Fifty one percent of this 2.6 mile segment is exposed to solar impacts during summer low flow conditions. Approximately half of this exposure is from historical homestead meadows that persist in the riparian and the remainder is from recent (2003) clear cut activity above the Little Lobster Cr road crossing.

The remainder of the riparian corridor from the Alsea / Deadwood Hwy crossing to the end of Coho distribution is dominated by a coniferous canopy in a steep hillslope confined canyon that is the result of dense stands of young Douglas fir reproduction (15 years).

The Briar Cr corridor exhibits a significant riparian conifer component to a point 2,200 ft from its confluence with mainstem Little Lobster. The riparian then transitions into broad terraces with extensive conifer reproduction on the periphery.

Recruitment potential

What is the recruitment potential and time frame for delivery to the channel?

Excellent conifer recruitment potential exists in 3 primary locations, the lower 800 ft of mainstem Little Lobster, the 0.6 mile section of the mainstem above the confluence of Trib E and the lower 0.4 miles of Briar Cr. At these locations, large conifers are present in the riparian and will be key components of future long term wood recruitment. The remainder of the riparian is either currently in a very early seral stage for conifers or dominated by a deciduous species mix that plays a less significant long term role in channel formation.

Thermal problems

Describe the relationship between riparian condition and thermal problems in the aquatic system. Include locations and causes.

There are several factors that cumulatively affect the elevated temperature profiles documented in Little Lobster Cr. We have discussed the lack of floodplain interaction for maintaining late season water storage and the exposed bedrock from channel scour that exposes potentially subsurface flows. There are two other variables that factor into these cumulative impacts. The first is the east / west aspect of mainstem Little Lobster that extends the duration of daily solar exposure. Second is the upslope condition of the riparian that we have observed as exhibiting impacts from solar exposure (lack of a stream adjacent canopy) on historical homestead meadows and recent clear cut harvest units. This solar exposure impacts approximately 33% of the entire mainstem corridor and approximately 43% of the Briar Cr sub basin to the end of Coho distribution.

Critical Contributing Areas (CCA)

Description and relation to core site

Identify the CCA's and describe the spatial relationship between each CCA and the Core Area and Anchor Site(s). Identify CCA's that contribute directly to specific Anchor Sites.

The primary Critical contributing areas are tributaries emanating from the north slope of mainstem Little Lobster. They are responsible for delivering cold water to the mainstem during summer low flows that mitigate the cumulative temperature impacts documented in this analysis. In addition, some of these tributaries also exhibit the steep headwalls that indicate they are important potential sources of organic resources for the mainstem (wood and substrate).

Tributaries A,B,C,E of Little Lobster Cr. are significant players in maintaining proper long term function within the subbasin through resource contribution. In addition, Trib A of Briar Cr. provides a similar significant function.

Trib A enters below any of the identified anchor sites within the Core area and therefore interacts at a lower rate with the mainstem than other CCA's. Trib A has been rated by ODF as the 2nd most likely CCA to contribute resources to the mainstem through slope failure.

Trib B enters exactly at the downstream terminus of anchor site #1 and is therefore extremely significant as a source of wood that could potentially influence salmonid incubation and rearing greatly. The Tributary canyon was ranked by ODF as the 3rd most likely CCA in the basin to be impacted by slope failure that could deliver directly to the mainstem.

Trib C enters directly into Anchor site #1 (approximately ¾ of the way up). The Trib is currently providing domestic water and is rated by ODF as not exhibiting the potential for delivering resources directly to the mainstem in a debris torrent event.

Trib E enters the mainstem within Anchor site #2 (near the top end) and therefore exhibits excellent potential for resource recruitment into 2 of 3 mainstem anchor sites. ODF ranks the CCA as the most likely source of slope failure activity with the potential of impacting mainstem habitats.

Trib A of Briar also exhibits an abundance of slope failure initiation sites but the likely hood of delivery to the mainstem is much lower than observed in previously discussed CCA's. Impacts to mainstem anchor sites would be limited.

Ranking

Rank the CCA's in order of importance to the Core/Anchor Site system. This ranking should consider the contribution of substrate, wood, flow, and temperature maintenance to the Anchor Site system.

1) Trib E (slope failure potential and flow)
2) Trib C (flow)
3) Trib B (flow and slope failure potential)
4) Trib A Briar (flow)
5) Trib A (flow and slope failure potential)

Restoration analysis

The purpose of this section is to create a list that ranks the factors currently limiting Coho production. This ranking should be based on the information and conclusions developed in this report, as well as the output from the Nickelson model which estimates seasonal smolt potential using rearing habitat data. The analysis requires an integrated view of the Coho rearing system which up to this point has been assessed as individual components. The process necessarily utilizes professional judgment in weighing the importance of diverse information resources.

Nickelson Model results

The Limiting Habitat Analysis Worksheet (see Appendix 4) displays a final comparison of the two modeling efforts in tables F1 and F2. The differential seasonal survival rates represented by each of these models in the case of Little Lobster Cr develop extremely different conclusions when attempting to identify the seasonal limitation. The Nicholson Model concludes that winter habitat is the dominant limiting factor. The Alsea Watershed Study method concludes that the abundance of spawning gravel is limiting. It is interesting to note that the Alsea Watershed Studies smolt production predictions are the most realistic estimates based on what we know of actual summer parr abundances observed between the years of 1998 and 2002. For the year 2002 the Little Lobster 6th field retained an estimated 8,870 summer Coho parr. This would normally result in the production of approximately2,661 smolts if the habitat was rated as high quality. The Alsea Watershed study predicts 5,265 after factoring in all seasonal limitations. Greater adult escapement to the subbasin could easily bring the system up from the 2002 level to the predicted level.

The primary limiting factor appears to be the abundance of high quality gravel. This limitation is exacerbated by the fact that the best gravels in the 6th field are located low in the system in a stream segment that is temperature limited during mid summer flow regimes. This condition actually alters the limiting season from spring incubation (projected in the Alsea Watershed Study) to summer. A large percentage of the accessible gravels are located in a zone that becomes uninhabitable to high densities of juvenile salmonids by mid July. Temperature limitations in the lower reaches must be addressed to improve the production capacity of lower mainstem gravels.

Defining the production bottleneck

Does the seasonal bottleneck identified by the Nickelson Model remain the primary limiting habitat when each of the other issues identified in the assessment process are factored in? Explain.

The modeling effort by necessity is based on quantitative assessments of unique habitat components. The Alsea Watershed Study additionally integrates density dependant relationships to this data to generate seasonal survival rates that the Nickelson Model does not. However, neither of these efforts are capable of incorporating the qualitative evaluations that in the case of Little Lobster appear to dramatically influence the outcome of this limiting factors analysis. There are obvious aquatic complexity issues within the 6th field that can be addressed with standard restoration prescriptions but the most significant long term issue of watershed function is the streams summer temperature profile that is a result of basin wide cumulative impacts. Some of these impacts have been within the active channel (these are channel and riparian interactions that have resulted in floodplain isolation and the inability of the floodplain to store and retain water for slow release late into the summer). But just as important are the upslope impacts that have not adequately protected critical sources of cold water during summer flow regimes. Consequently, habitat improvement projects that focus exclusively on solving floodplain interaction issues will have a lower likelihood of success in producing and retaining juvenile salmonids throughout their entire life history to the smolt stage.

There are many unknowns here that still limit our ability to understand the systems potential. For example, adult Coho returning to Little Lobster to spawn are undoubtedly utilizing the high quality gravels observed in the lower mainstem. Fry emerging from this reach however do not appear to be present as parr during mid summer and may have migrated out of the system as mainstem temperatures accelerate to seek optimum habitats in other parts of the Alsea basin. These parr may or may not be successful utilizing this survival strategy. The Alsea Watershed Study identifies these out migrants as nomads and their fate as well as their eventual contribution to basin wide smolt production is still largely unknown.

Potential for lowlands contribution

If the abundance of winter habitat has been determined as the primary factor limiting Coho production, discuss how lowland habitats existing outside the boundaries of the 6th field might function to provide winter habitat for smolts produced in the 6th field.

If and when the limitation of elevated summer temperatures is addressed the importance of additional winter habitat will become significant as 6th field function is slowly restored. At this juncture the goal of increasing floodplain connectivity with the use of full spanning logs and the reintroduction of Beaver will improve the floodplain retention of summer flows. This shift in run off profiles will mitigate elevated mainstem summer temperatures and also provide much higher abundances of off channel low velocity winter habitat.

Ownership issues

To what degree would land use and ownership allow restoration work?

There are a broad range of ownership types within the 6th field. There are substantial blocks of BLM ownership that suggest the development of a partnership with the BLM would be key in providing a structure log source and for developing management strategies for Trib E and Briar Cr. There are also large blocks of industrial forest ownership that are key to the development of long term upslope strategies that address ecosystem function. Industrial owners have a long track record of participating in watershed restoration and would be obvious partners for the development of a long term strategy to address the need to provide connectivity to upslope wood resources. In addition, there are several small private landowners (Carr, Glade and Abendroth) that have expressed an interest in cooperating with a restoration strategy. There are also other small private owners adjacent to the Abendroth property that have not been contacted for participation.

Channel complexity potential

What is the potential to increase channel complexity in the long term through natural recruitment processes, with and without restoration?

The long term potential for the natural recruitment of conifers from the riparian is extremely poor in the Little Lobster subbasin because of current and historical agricultural and upslope harvest practices that have removed this component from the riparian. Without adopting a long term restoration strategy that attempts to secure those resources from both the riparian corridor and from slide prone slopes, the system will maintain it's trajectory towards channel simplification. The placement of wood in the channel through restoration addresses the short term needs of restoring function but is only a band aide approach to buy time. This is the fundamental reason that in the following prescriptions, the restoration of Beaver populations has been proposed as a restoration tool. Short rotations on private industrial forest lands will never provide the late successional component required to restore proper function in the aquatic corridor.

Restoration prescriptions

Potential restoration sites

1) Anchor site #1
2) Anchor site #2
3) Anchor site #3
4) 1,400 ft of sluiced and simplified stream corridor above the confluence of Trib D
5) 1st mile of sluiced and simplified stream corridor in Briar Cr
6) Trib A corridor
7) Trib B corridor
8) Trib E corridor
9) Riparian corridor surrounding current rural residential home site
10) Entire Little Lobster Cr sub basin

Location

1) Anchor site #1 extends from the confluence of Trib B on the left 2,700 ft upstream to the confluence of Trib D on the right
2) Anchor site # 2 begins at the confluence of Trib E at RM 1.8 and extends downstream approximately 1,160 ft.
3) Anchor site #3 begins at RM 4.5 and extends upstream approximately 1,500 ft.
4) Simple stream corridor from the confluence of Trib D on the right to a point approximately 1,400 ft upstream
5) Briar Cr mainstem from the mouth at it's confluence with Little Lobster to a point 1.0 miles upstream
6) Trib A enters the mainstem of Little Lobster under a private road at RM 0.3
7) Trib B enters the mainstem of Little Lobster under a private road at RM 0.5
8) Trib E enters the mainstem of Little Lobster under a private road at RM 1.8 (0.5 miles below the confluence of Briar Cr.)
9) Inner riparian corridor from the mouth of Little Lobster to the confluence of Trib E at RM 1.9
10) Entire Little Lobster Cr subbasin

Issue

1) Anchor site # 1 is currently rated as exhibiting excellent morphological function. It contains a highly sinuous channel, excellent floodplain connectivity and a high frequency of high quality spawning gravel. It is limited first by the upstream cumulative impacts that result in elevated summer temperatures beyond the accepted threshold for rearing juvenile salmonids. Secondarily it lacks high densities of complex wood for cover and the development of additional floodplain interaction during winter flow regimes.

2) Anchor site # 2 currently exhibits a deeply incised active channel within a historically interactive floodplain. Full solar exposure exacerbates elevated stream temperatures in this section. The exposure is a result of the historical agricultural activities on the parcel that removed most of the riparian canopy. The Anchor exhibits much higher potential for restoration than Anchor site #1 because its current function is rated as extremely poor.

3) Anchor site # 3 is currently rated as exhibiting excellent morphological function. It contains two active beaver ponds that appear stable and are 4ft high. There has been an instream log placement project conducted in and adjacent to this anchor site. The site is still limited by complex woody structure for the provision of both summer and winter cover.

4) The 1,400 ft section of stream channel above the confluence of Trib D was scoured to bedrock during the debris torrent event that created the interactive deposition plain identified as Anchor site #1. The channel here is straight, contains virtually no mobile substrate component, no wood complexity to trap and store mobile aggregates and therefore provides no spawning sites, no winter habitat and extremely limited summer habitat because there is no potential for pool scour (depth) on top of torrented bedrock. Because the lower reaches of Little Lobster are primarily limited by elevated summer water temperatures, this section of total bedrock exposure is a primary factor in amplifying the severity of the thermal problem. Flows that have been protected upstream by the deposition of aggregate on top of bedrock are exposed for 1,400 ft in this section to ambient air temperatures and additional solar impacts.

5) Briar Cr is the largest contributor of tributary flow in the 6^{th} field. The summer stream temperatures have been documented at DEQ thresholds for salmonids. Large segments of the lower mainstem exhibit impacts from historic debris torrent activity (channel scoured to bedrock). The absence of wood complexity exacerbates the problem of elevated summer temperatures because flows are exposed to ambient air and solar impacts.

6) The Trib A sub basin is ranked #2 in the ODF analysis of probable sources of wood and substrate from land slide activity that could reach the mainstem of Little Lobster (see ODF risk analysis in Appendix). The primary problem is the runout of a debris torrent event would likely be truncated by the undersized culvert crossing on the private road that parallels the lower mainstem of Little Lobster.

7) The Trib B sub basin is ranked #3 in the ODF analysis of probable sources of wood and substrate from land slide activity that could reach the mainstem of Little Lobster (see ODF risk analysis in Appendix). The primary problem is the runout of a debris torrent event would likely be truncated by the undersized culvert crossing on the private road that parallels the lower mainstem of Little Lobster.

8) The Trib E sub basin is ranked #1 in the ODF analysis of probable sources of wood and substrate from land slide activity that could reach the mainstem of Little Lobster (see ODF risk analysis in Appendix). The problem is simply the retention of these wood resources in the Trib E riparian and initiation sites as a long term method of maintaining ecosystem function within the 6^{th} field.

9) The inner riparian corridor of mainstem little Lobster from the mouth to a point approximately 1.9 miles upstream to the confluence of Trib E exhibits a rapidly expanding community of Deadly Night Shade (Solanum dulcamara). The epi-center of the invasion is the homestead property and current residence at the confluence of Trib C. The invasive vine is growing within the active stream channel and is therefore poised for transport downstream and out of the Little Lobster 6^{th} field on any significant high water event.

Currently there are no documented sites within the Alsea basin that exhibit a proliferation of this species. Treatment at this juncture has a high likelihood of success.

10) The entire 6th field supported a substantial and interactive beaver population as late as 2002 that resulted in stable dam structures that functioned to trap and store spawning gravels, nutrients and sediments. In addition, these stable dam sites provided extensive floodplain connectivity that stored water in saturated terraces for slow release during the summer. The impoundments provided vast rearing surface areas during both summer and winter for juvenile salmonids. The 2005 survey conducted by Bio-Surveys observed no functional dam structures in place and very little indication of live beaver within the 6th field (scent mounds, feeding stations, etc.).

Goal

1) Boost instream wood complexity to build summer and winter capacity in the event that thermal factors currently limiting summer production are addressed and improved.

2) Boost instream wood complexity with full spanning log complexes designed to aggrade the currently incised channel with the deposition of mobile substrates. The final desired condition would be extensive improvement in floodplain connectivity during both summer and winter flows resulting in the retention of sub surface flow from the floodplain to mitigate elevated mainstem temperatures during summer flow regimes. In addition, restoring the riparian canopy in this stretch would assist in the mitigation of elevated stream temperatures to address a primary limiting factor.

3) Boost instream wood complexity to build summer and winter capacity. This is a section of mainstem Little Lobster where all of the habitat variables are properly aligned for Coho production and summer temperatures do not limit production capacity.

4) The primary goal is to address the limiting factor of the current thermal threshold by rebuilding a contiguous layer of aggregate on top of exposed bedrock to protect and insulate subsurface flows from exposure.

5) The primary goal is to address the limiting factor of the current thermal threshold by rebuilding a contiguous layer of aggregate on top of exposed bedrock to protect and insulate subsurface flows from exposure. A secondary goal would be to improve aquatic complexity and cover for juvenile salmonids and enhance floodplain interaction.

6) Design a road crossing that would allow unimpeded passage of a torrent event and protect the upslope resources (wood) from being removed from both potential initiation sites and the riparian corridor during future harvest activities.

7) Design a road crossing that would allow unimpeded passage of a torrent event and protect the upslope resources (wood) from being removed from both potential initiation sites and the riparian corridor during future harvest activities.

8) Maintain upslope wood resources on potential initiation sites and within the entire riparian corridor as a long term natural source of woody debris and mobile substrate.

9) Terminate the existence of this invasive plant species before it is transported more extensively outside of the 6th field.

10) Restore beaver populations within the 6th field to a level that is self sustaining and broadly distributed.

Method

1) Log placement in Anchor site #1 could be accomplished by either excavator or helicopter. The site is road accessible and log delivery would be feasible. The site does not need the full spanning complexes required in other upstream sites because floodplain interaction is already rated as excellent. Edge oriented

deflector structures would accomplish the goal of boosting channel roughness and providing cover and complexity.

2) Log placement in Anchor site #2 could be accomplished by either excavator or helicopter. The site is road accessible and log delivery would be feasible. The site requires full spanning log complexes with a high frequency of limbs and small wood components to accomplish the stated goal of building up the incised active channel with deposition. A riparian planting prescription for the segment would incorporate a two tiered strategy that provided shade and future wood recruitment (Doug Fir, Cedar, Maple) as well as a viable food source (willow) to stimulate the colonization of Beaver.

3) Log placement in Anchor site #3 could be easily accomplished by excavator. The site is road accessible and log delivery would be feasible. The site requires full spanning log complexes with a high frequency of limbs and small wood components

4) To rebuild the aggregate layer within this section of scoured channel, log placement would be necessary that incorporated large volumes of limbs and small woody debris in addition to the key log components that provide stability. The structures would need to be full spanning complexes and spaced at least 150 ft apart to allow for diverse habitats to develop between structure sites. The placements could be accomplished with either an excavator or a helicopter and the site is road accessible if road upgrades (gravel) are condoned by the owners of the private parcel at the mouth of Trib C.

5) The retention of mobile substrates in Briar Cr could be addressed with the placement of full spanning log structures. The placement would by necessity need to be accomplished by helicopter because there is no road access above the confluence of Trib A at the 1,150 ft mark. The subbasin is small and thus length and girth requirements of the LWD could be substantially less than prescriptions for the mainstem. This factor suggests that a helicopter with a smaller lift capacity could be utilized for this site that would be more cost effective (any helicopter prescription for the 6th field should consider the benefits of a single rotor helicopter with a smaller lift capacity).

6) An unimpeded road crossing (significantly oversized squash pipe) to more closely match the Trib A valley form. Upslope retention of wood resources could be negotiated with the current private landowner (Weyerhauser) with the use of a long term conservation easement.

7) An unimpeded road crossing (significantly oversized squash pipe) to more closely match the Trib B valley form. Upslope retention of wood resources could be negotiated with the current private landowner (Weyerhauser) with the use of a long term conservation easement.

8) Upslope retention of wood resources could be negotiated with the current private landowner (Weyerhauser) with the use of a long term conservation easement.

9) Invasive Night Shade could be eradicated by manual removal (all roots and vegetation need to be removed from the site and desiccated or burned). Herbicide treatment (Glyphosate) has been utilized successfully at other sites but is not recommended for this application because of the plants close association with the active aquatic corridor.

10) Beaver could be reintroduced with live trapped adults from a 5th field mainstem location. This would require a partnership with ODFW biologists and restoration funds to contract the live trapping. Release locations should be high in both the Briar Cr and Little Lobster subbasins because relocated Beaver are known to recolonize an average of 8 miles from the site of relocation.

Potential complications

1) The site does not offer high quality anchor points for placing stable deflector log structures. Initial contacts have been made with the single property owners (Bob Abendroth) and they are interested in a restoration partnership.

2) Anchor site #2 exists solely on the property of a single property owner (Steve and Mary Glade). Initial contacts have been made that indicate they may be receptive to a restoration strategy. Because the site exhibits a limited riparian canopy, the success of full spanning wood structures is more problematic (no anchor points for structure logs). Excavator placement would be more appropriate at this site because of the need to key in log structures with excavation. There is also a stream adjacent blanket of Reed Canary Grass that would require extended maintenance to reduce the competition for riparian seedlings. Seedling caging would also be a necessary component of the planting strategy which elevates the planting costs for the site.

3) Anchor site #3 at the time of this analysis (1-1-06) has been heavily impacted by two recent slope failures emanating from upslope harvest units on both the south and north slopes. The access may have been compromised by recent slope failures. In addition, Weyerhauser would need to be contacted to develop a restoration partnership.

4) The stream corridor above the confluence of Trib D proposed for treatment is contained on multiple small private parcels. Contact has not been made with owners to assess willingness to participate in a restoration partnership. No complications to the restoration prescription are anticipated.

5) The proposed treatment area of Briar Cr is completely within the confines of BLM ownership. Log structure placement should not be complicated by issues of access or ownership.

6) The Trib A upslope is large industrial forest ownership and the prescription calls for retaining timber within the riparian and potential slope failure initiation sites. This is a restoration strategy that steps well outside the current comfort level of large industrial timber owners. However, current alterations in State forest practice guidelines suggest that prescriptions for riparian leave strips may be a future harvest requirement in areas identified as exhibiting the potential for torrent activity. The road crossing alterations would impact a private residence that utilizes the Weyerhauser easement to access their property.

7) The Trib B upslope is also large industrial forest ownership and the prescription calls for retaining timber within the riparian and potential slope failure initiation sites. This is a restoration strategy that steps well outside the current comfort level of large industrial timber owners. However, current alterations in State forest practice guidelines suggest that prescriptions for riparian leave strips may be a future harvest requirement in areas identified as exhibiting the potential for torrent activity. The road crossing alterations would impact a private residence that utilizes the Weyerhauser easement to access their property.

8) The Trib E headwall is large industrial forest ownership and the prescription calls for retaining standing timber within the entire riparian corridor and potential slope failure initiation sites. This is a restoration strategy that steps well outside the current comfort level of large industrial timber owners. The riparian corridor of Trib E (the predicted runout corridor) and some high risk initiation sites are managed by the BLM and should be identified in their planning process as a high priority zone for limiting impacts related to harvest.

9) Invasive plant species treatment will occur on strictly small private property ownership. Access and cooperation from 4 separate landowners would be required for effective treatment.

10) Beaver reintroduction for the purpose of restoring ecosystem function would require support from ODFW in establishing a trapping ban pilot project within the 6th field. In addition, a damage response plan would have to be developed to assist private landowners within the 6th field in dealing with any potential drainage problems (roads & culverts) resulting from beaver impacts.

Expected results

1) Restoration efforts in Anchor site #1 are intended to increase the juvenile salmonid production capacity of a site already ranked as exhibiting excellent function. Immediate benefits are expected during winter flow regimes and summer benefits can be expected when the critical limiting factor of elevated summer temperatures has been addressed in the 6th field.

2) Restoration efforts in Anchor site #2 are intended to lift the active stream channel with deposition to facilitate an improvement in floodplain connectivity. An improvement of floodplain interaction is designed to address the primary limiting factor of elevated summer stream temperatures by storing late spring flows in shallow floodplain aquifers for extended summer release to the mainstem. In addition, the prescribed riparian planting prescription at this site expects to address elevated summer temperatures in the mainstem.

3) Restoration efforts in Anchor site #3 are intended to boost juvenile salmonid production capacity immediately upon the provision of addition cover and complexity. Stream temperatures here are capable of rearing summer densities to capacity and the additional floodplain interaction will provide additional winter habitat support.

4) Restoration efforts in the mainstem from the confluence of Trib D to a point 1,400 ft upstream will retain mobile aggregates on top of an active channel scoured to bedrock. The resultant bedload will protect low summer flows from 100% ambient air exposure by allowing contiguous subsurface flows to exist. The goal is to address mainstem temperature limitations.

5) Restoration efforts in Briar Cr. will retain mobile aggregates on top of an active channel scoured to bedrock. The resultant bedload will protect low summer flows from 100% ambient air exposure by allowing contiguous subsurface flows to exist. The goal is to decrease the cumulative impacts of elevated tributary temperatures on the mainstem.

6) The expected result of activities prescribed for the Trib A corridor is to facilitate long term natural function within the 6th field. This is a high risk site for slope failure. The restoration of the linkage between the upslope resources in this tributary and the mainstem of Little Lobster addresses the stated goal of restoring long term function.

7) The expected result of activities prescribed for the Trib B corridor is to facilitate long term natural function within the 6th field. This is a high risk site for slope failure. The restoration of the linkage between the upslope resources in this tributary and the mainstem of Little Lobster addresses the stated goal of restoring long term function.

8) The expected result of activities prescribed for the Trib E corridor is to facilitate long term natural function within the 6th field. This is a high risk site for slope failure. The restoration of the linkage between the upslope resources in this tributary and the mainstem of Little Lobster addresses the stated goal of restoring long term function.

9) The treatment of the invasive night shade attempts to eliminate the source population of this species for the large portion of the Alsea basin that exists downstream of Little Lobster. The site is closely associated with the active stream channel and the risk is high for downstream transport.

10) The reintroduction of Beaver is critical for the long term restoration of ecosystem function. The presence of beaver pond habitats addresses the seasonal limitation of elevated summer temperatures by developing an interactive relationship between the active summer channel and its floodplain. The retention of cool subsurface flow from these interactive floodplains is the primary goal. The secondary goal is the capture and retention of mobile substrates during large winter flow events that can be sorted to provide spawning sites for adult salmonids. The tertiary goal is the provision of large surface areas of high quality summer and winter habitat for boosting the smolt production capacity of the 6th field.

Restoration rankings

From the recommendations listed above, list and rank the restoration work that most effectively stabilizes the population at a higher base level and prioritizes the recovery of ecosystem function.

Short term

10
4
2
3
5
1
8
6
7
9

Long term

10
4
2
3
5
8
6
7
1
9

Combined

10
4
2
3
5
1
8
6
7
9

APPENDICES

Appendix 1. Little Lobster Creek mainstem survey reaches

Valley morphology and aquatic habitat descriptions are based primarily on ODFW aquatic habitat inventories.

Section	Survey		River Mile			Valley Morphology			Aquatic Habitats		
	Year	Reach #	Len	Beg	End	Gradient (%)	Width (VWI)	Constraint	Pools (%)	Beaver Ponds (#)	Wood (pcs/mile)
1	1999	1	0.57	0.00	0.57	0.6	2.8	Hillslope	53	0	0.7
2	2005	2	1.26	0.57	1.83			Hillslope/Terrace	85	3	
3	1999	3	0.59	1.83	2.42	1.4	2.7	Hillslope/Terrace	60	0	0.7
4	1999	4	0.26	2.42	2.68	1.0	4.3	Hillslope/Terrace	54	0	0.8
5	1999	5	0.22	2.68	2.91	1.0	8.0	Terrace	47	0	0.5
6	Not surveyed		1.39	2.91	4.29						
7	1996	1	0.35	4.29	4.64	2.4	10.1	Hillslope/Terrace	54	0	0.5
8	1996	2	0.04	4.64	4.68	2.9	6.0	Terrace	45	0	0.2
9	1996	3	0.25	4.68	4.93	2.8	4.8	Hillslope/Terrace	31	0	0.2
10	1997	1	0.79	4.93	5.72	5.8	1.3	Hillslope	22	0	0.9
11	1997	2	0.19	5.72	5.92	10.3	1.0	Hillslope	25	0	3.0
12	1997	3	0.27	5.92	6.19	12.5	1.0	Hillslope	25	0	2.4
13	1997	4	0.25	6.19	6.44	18.2	1.0	Hillslope	16	0	0.9

Section 2: Defined in 1999 as Reach 2, but not surveyed until 2005.

Appendix 2. Little Lobster Creek tributaries

Distance data and valley descriptions are from the topographic mapping program *Terrain Navigator* by Maptech. Topographic maps often ignore some channel sinuosity, and thus tend to underestimate channel length compared to field measurements.

Tributary	River Mile	Enters from	Slope faces	Relative drainage size	Valley description	Comments
A	0.3	Left	South	Small	Steep, narrow	
B	0.5	Left	South	Small	Steep, narrow	
C	0.9	Left	Southwest	Medium	Steep upper valley, moderate gradient 1st 400ft, generally narrow valley	Cool water contributor
D	1.0	Right	Northwest	Very small	Steep, narrow	
E	1.8	Left	South	Small	Steep, narrow	
Briar Creek	2.4	Left	Southwest	Large	Lower 1 mile is low gradient, moderate valley width.	Most significant contributor of flow and habitat, warm
F	2.8	Left	Southwest	Very small	Steep, narrow	
G	4.0	Left	South	Very small	Steep, narrow	
H	4.3	Left	Southwest	Very small	Moderate gradient and width in upper valley, steep and narrow in lower valley	Channel entering Little Lobster is confined by road bed and deeply entrenched
I	4.9	Left	West	Small	Steep, narrow	
J	5.9	Right	Northwest	Small	Steep, narrow	

Appendix 3. Little Lobster Creek spawning gravel estimates

Spawning gravel	Poor	Fair	Good	Total
Amount (m2)	109	167	126	
Effectiveness rating	0.25	0.50	1.00	
Effective gravel (m2)	27.3	83.5	126.0	**237**

Appendix 4. Little Lobster Creek limiting habitat analysis based on the Nickelson model

WORKSHEET FUNCTION

This sheet evaluates spawning gravel estimates, summer rearing areas, and winter smolt capacity developed in previous sheets to identify which seasonal habitat is the rearing bottleneck.

Ideally, this evaluation would rank Spawning gravel smolt capacity, Spring smolt capacity, Winter smolt capacity, and Summer smolt capacity.

However, Winter surveys are not available. The work-around for this is to use the regression relationship between summer conditions and winter capacity developed in the Winter Smolt Capacity worksheet.

No such work-around exists for estimating Spring capacity, and it is not estimated.

Therefore, the current evaluation aims at determining whether Spawning Gravel, Summer conditions, or Winter conditions are most limiting in the rearing system.

The calculation model used is "Version 5.0. Coho Salmon Carrying Capacity Model", provided by Tom Nickelson of ODFW Research Division.

Two sets of survival rates are available and have been entered into Table B1 and B2. Each set of survival rates generates different seasonal smolt capacities that are output in Tables F1 and F2.

NOTE: Currently non-functioning parts of the worksheet are shaded gray.

SECTION 1. SMOLT CAPACITY AND SURVIVAL RATES

Table A. Coho salmon rearing density for each habitat type in each season.

HABITAT TYPE	SEASON		
	SPRING	SUMMER	WINTER
Cascades	0	0.24	0
Rapids	0.6	0.14	0.01
Riffles	1.2	0.12	0.01
Glides	1.81	0.77	0.12
Trench Pools	0.99	1.79	0.15
Plunge Pools	0.84	1.51	0.28
Lateral Scour Pools	1.29	1.74	0.35
Mid Chan Scour Pools	1.29	1.74	0.35
Dam Pools	2.56	1.84	0.56
Alcoves	5.75	0.92	1.84
Beaver Ponds	2.56	1.84	1.84
Backwaters	5.75	1.18	0.58

Data of Tom Nickelson based on ODFW research.

Tables B1 and B2. Survival rates to smolt

Table B1. ODFW research data.

Life stage	Survival rate
Egg to smolt	0.3200
Spring to smolt	0.4600
Summer to smolt	0.7200
Winter to smolt	0.9000

Rates used by Tom Nickelson (ODFW)

Table B2. Alsea study data.

Life stage	Survival rate
Egg to smolt	0.0270
June to Smolt	0.0644
Fall to smolt	0.1110
Winter to smolt	0.2870

Data provided by Jim Hall, OSU Dept of F & W

Table C. Egg and maximum rearing densities

Life stage	#/m2
Spawning (eggs)	833
Spring	5.75
Summer	1.84
Winter	1.84

Data of Tom Nickelson based on ODFW research.
Egg density is based on 2500 eggs/redd & 3 m2/redd
Spring, Summer, and Winter values are maximums from Table A.
These data currently do not contribute directly to spreadsheet calculations.

SECTION 2. DATA INPUT

Table D. Data entry

1) Enter length of reach or group of reaches analyzed (km).	
2) Effective Spawning Gravel referenced from the Spawning Gravel worksheet)	236.75

3) Enter summer habitat area totals below from the Summer Hab Areas worksheet.

Habitat Type	Season	
	Summer	Winter
Cascades	1,119	
Rapids	5,264	
Riffles	14,391	
Glides	1,068	
Trench Pools	0	
Plunge Pools	793	
Lateral Scour Pools	21,011	
Mid Chan Scour Pools	4,215	
Dam Pools	964	
Alcoves	30	
Beaver Ponds	1,897	
Backwaters	317	
Total	51,068	0
Pool Area	29,226	0
Percent Pools	57%	#DIV/0!

Table E. Calculation of seasonal rearing capacities for each habitat type.

Habitat Type	Season		
	Spring	Summer	Winter
Cascades	0	269	0
Rapids	0	737	0
Riffles	0	1,727	0
Glides	0	823	0
Trench Pools	0	0	0
Plunge Pools	0	1,198	0
Lateral Scour Pools	0	36,559	0
Mid Chan Scour Pools	0	7,334	0
Dam Pools	0	1,773	0
Alcoves	0	27	0
Beaver Ponds	0	3,490	0
Backwaters	0	374	0
Total	0	54,310	0

No winter data are available. Therefore the spring rearing capacity could not be calculated by this method. Winter rearing capacity was calculated using a separate methodology (see "Winter Smolt Capacity" sheet") and entered by reference below.

Calculation of egg deposition and smolt production depending on which seasonal habitat is limiting.

Table F1. Results using ODFW research survival rates.

Life Stage	Potential Seasonal Capacity	Potential Smolts Produced
Spawning (# eggs)	195,000	62,400
Spring (# fish)	0	0
Summer (# fish)	54,310	39,100
Winter (# fish)	*36,493*	32,800

Table F2. Results using Alsea study survival rates.

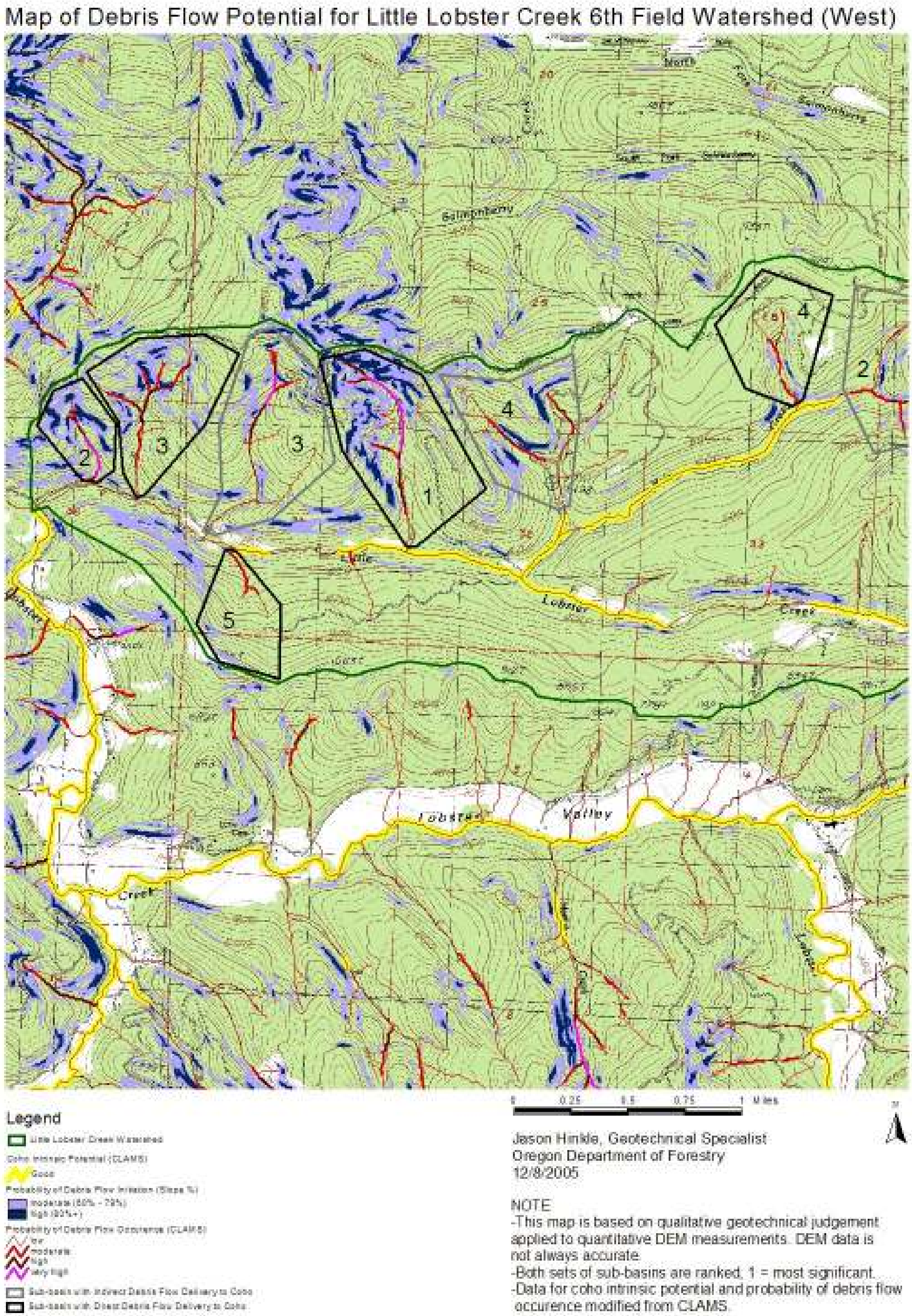
Life Stage	Potential Seasonal Capacity	Potential Smolts Produced
Spawning (# eggs)	195,000	5,265
June (# fish)	0	0
Fall (# fish)	54,310	6,000
Winter (# fish)	*36,493*	10,500

*Winter capacity is entered by **cell reference** to the "Winter Smolt Capacity" worksheet*

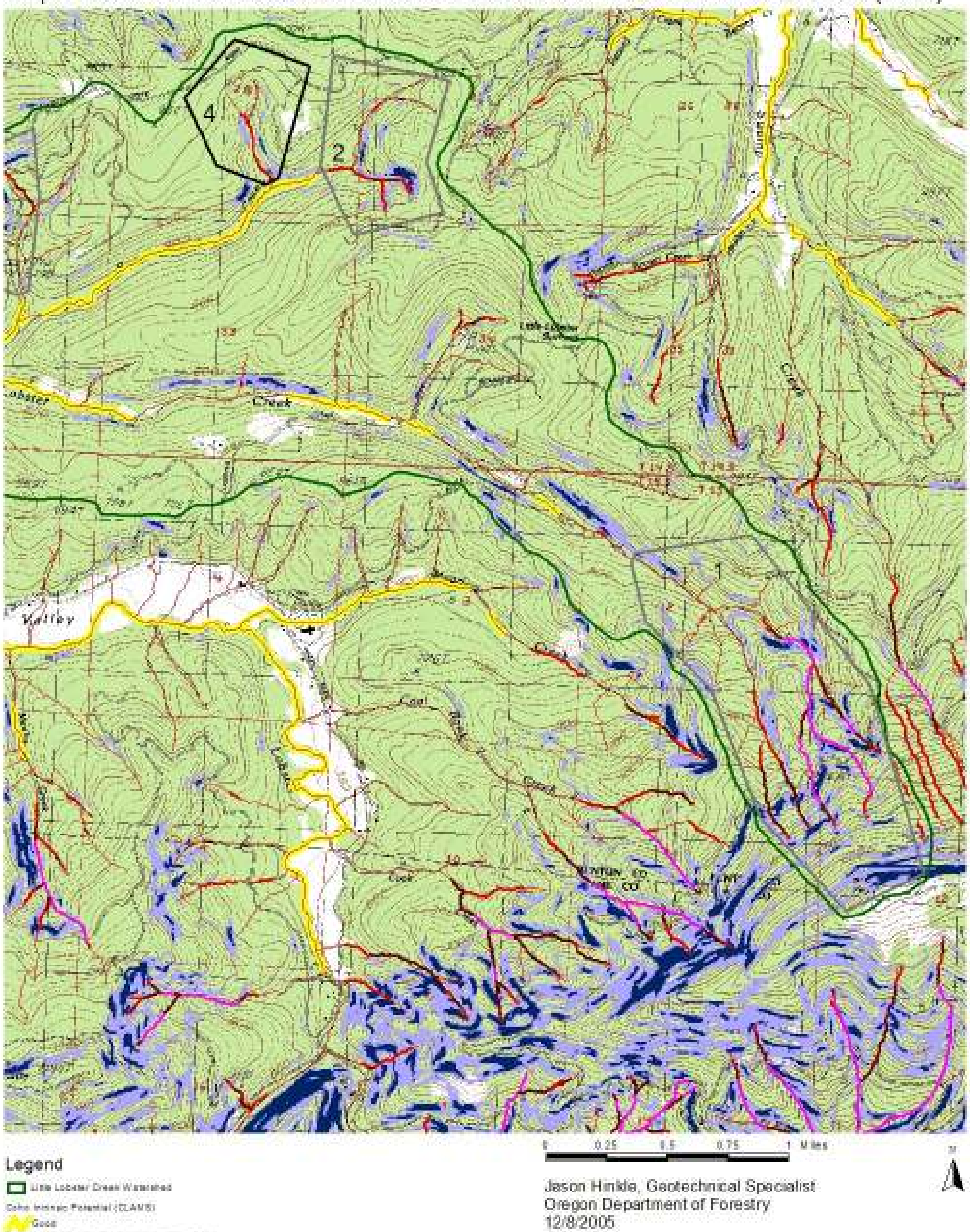
No estimate of spring capacity or potential smolts produced is possible with current data.

Calculation of Spawning (# eggs) is based on the assumptions of 2500 eggs/redd and 3 m2/redd

Appendix 5. Little Lobster Creek ODF slope risk analysis map



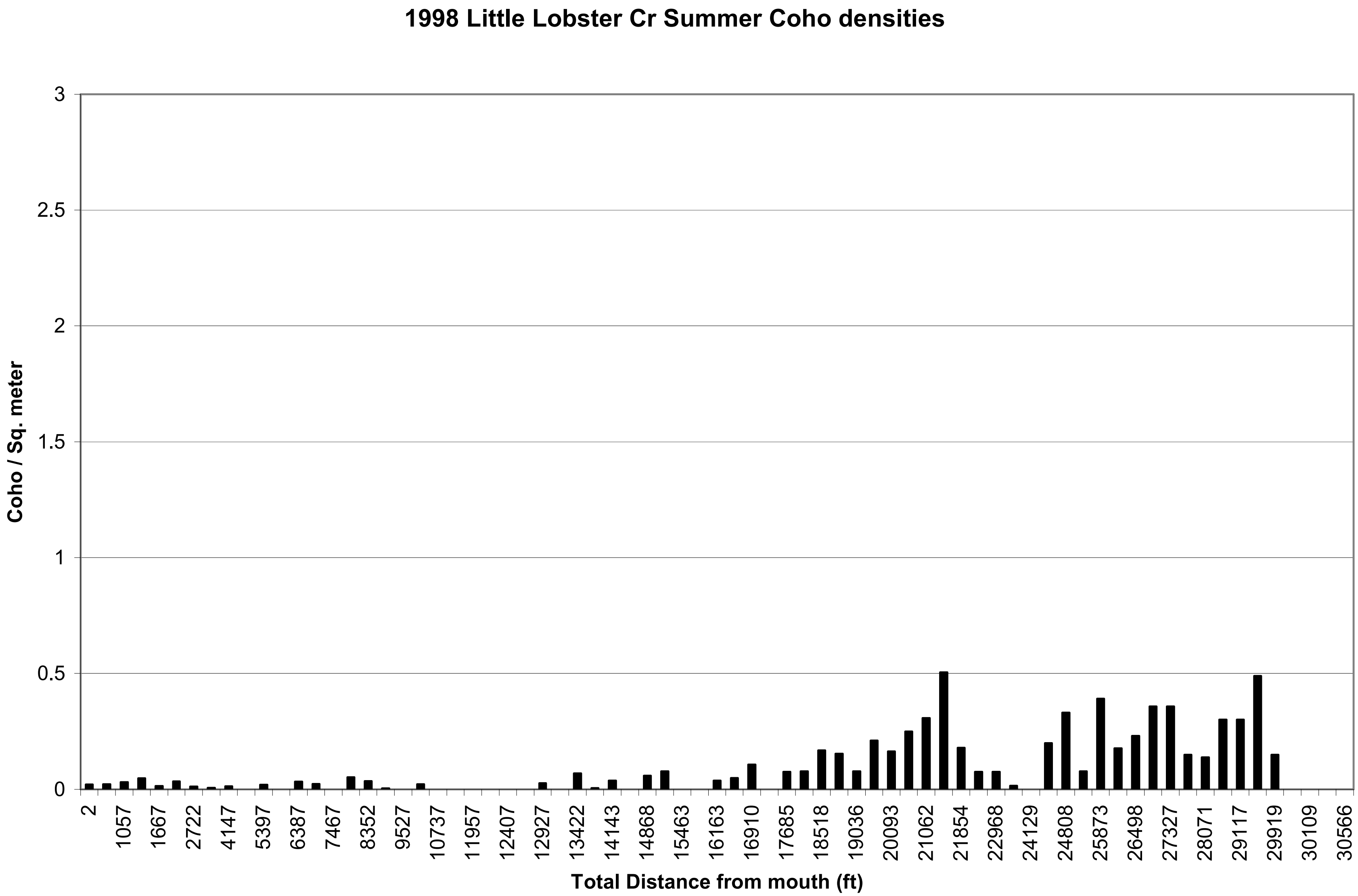
Map of Debris Flow Potential for Little Lobster Creek 6th Field Watershed (East)



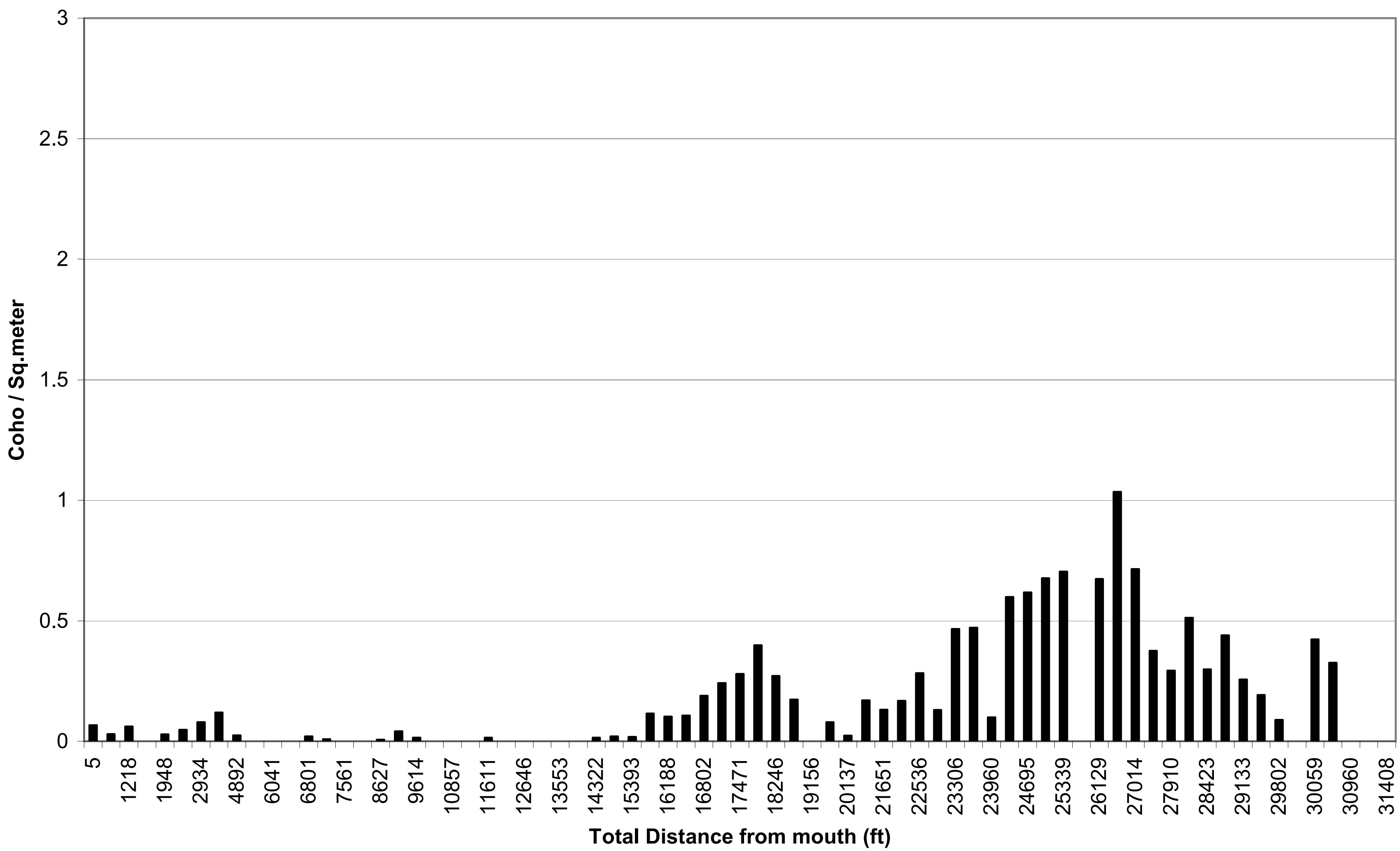
Jason Hinkle, Geotechnical Specialist
Oregon Department of Forestry
12/8/2005

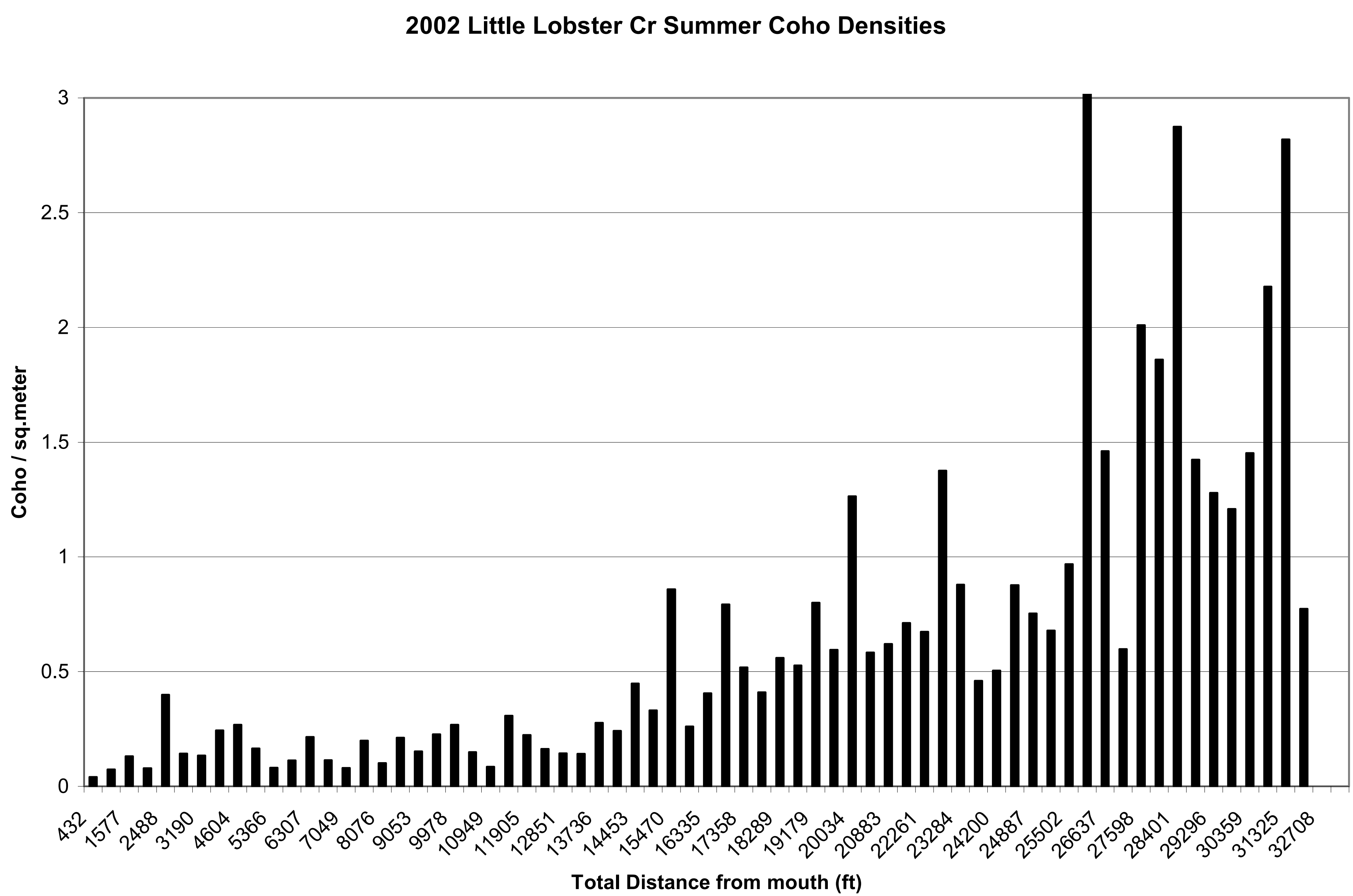
NOTE
-This map is based on qualitative geotechnical judgement applied to quantitative DEM measurements. DEM data is not always accurate.
-Both sets of sub-basins are ranked, 1 = most significant.
-Data for coho intrinsic potential and probability of debris flow occurence modified from CLAMS.

Appendix 6. Little Lobster Creek summer Coho distribution chart

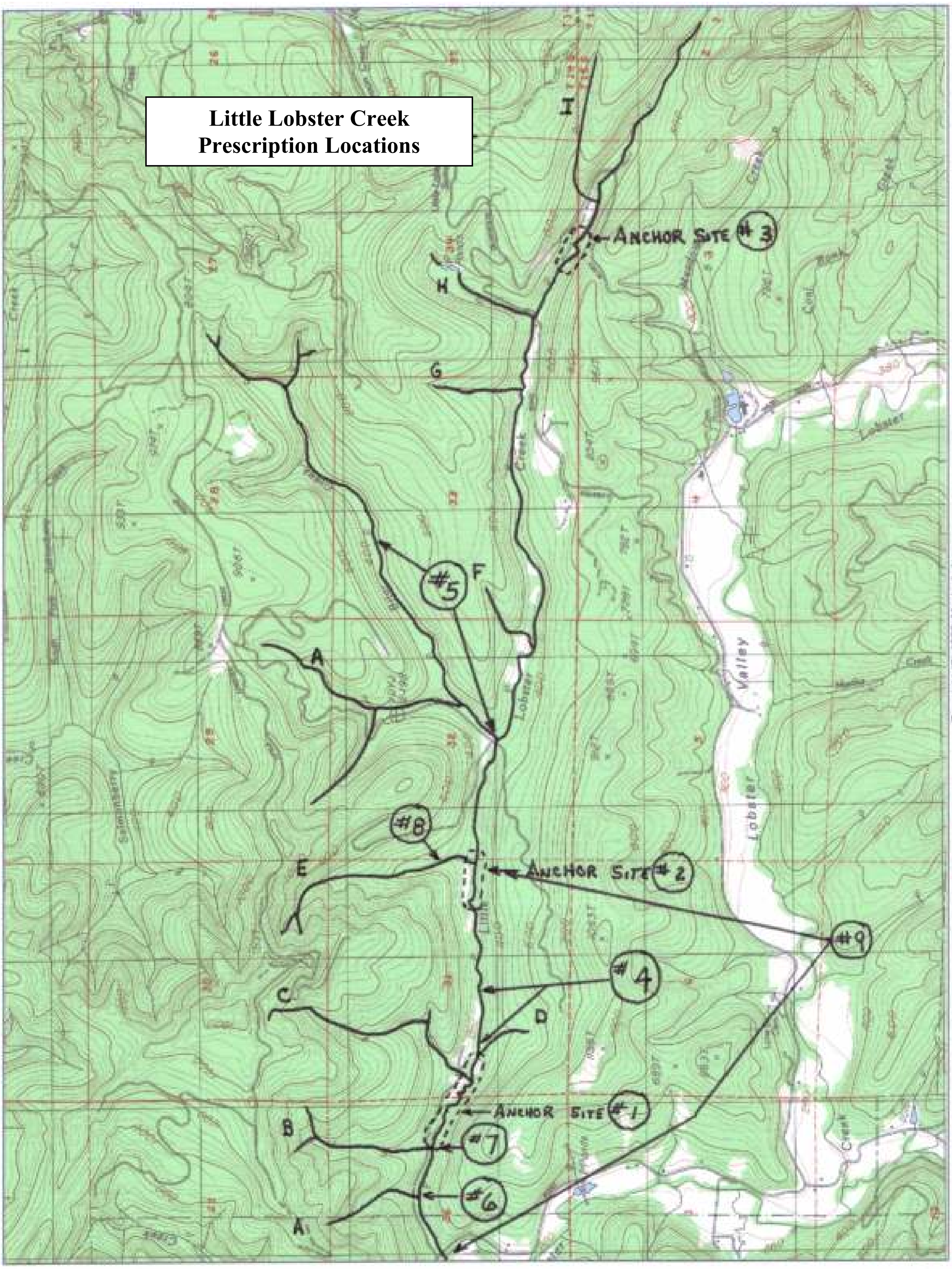


1999 Little Lobster Summer Coho Densities




2002 Little Lobster Cr Summer Coho Densities
Coho / sq.meter
3
2.5
2
1.5
1
0.5
0
432
1577
2488
3190
4604
5366
6307
7049
8076
9053
9978
10949
11905
12851
13736
14453
15470
16335
17358
18289
19179
20034
20883
22261
23284
24200
24887
25502
26637
27598
28401
29296
30359
31325
32708
Total Distance from mouth (ft)

Appendix 7. Little Lobster Creek prescription location map.



Appendix 8. Little Lobster Creek photos

Photo 1. Typical riparian wood recruitment (Alder dominated).

Photo 2. Midchannel bar development associated with structure logs.

Photo 3. Typical log structure in segment 1 and associated substrate deposition.

Photo 4. Confluence of Tributary A at start of Anchor Site #1.


Photo 5. High quality spawning gravel in Anchor Site #1.

Photo 6. Profuse growth of invasive night shade (common and extensive).

Photo 7. A 1400 foot bedrock corridor begins just above Trib B (high priority for restoration).

Photo 8. Deposition plain in Anchor site #2. Note channel development.

Photo 9.Typical large key log component (old growth Douglas Fir) sparse.

Photo 10. Boulder weir placements just below Briar Creek. Most have been breached.

Photo. 11.Only intact boulder weir, exhibiting limited channel modification.