STREAM INVENTORY REPORT

Laguna Creek

WATERSHED OVERVIEW

Laguna Creek is a tributary to the Big River (Figure 1). Elevations range from 100 feet at the mouth of the creek to 600 feet in the headwater areas. Laguna Creek's legal description at the confluence with the Big River is T17N R16W Sec31. Its location is 39°17'15"N. latitude and 123°41'19"W. longitude according to the USGS Mathison Peak 7.5 minute quadrangle. Laguna Creek drains a watershed of approximately 3,245 acres.

HABITAT INVENTORY RESULTS

The habitat inventory of July 1, 1996 through July 8, 1996, was conducted by Diana Hines and Dave Wright. The total length of surveyed stream in Laguna Creek was 10,220 feet (1.9 miles, 3.0 KM) (Table 1). There were no side channels in this creek. Flow measured at the mouth of Laguna Creek in July 1996 was 0.144 cubic feet per second (cfs).

Laguna Creek consists of one reach: a C3 for the entire 10,220 feet of creek.

Table 1 summarizes the Level II Riffle, Flatwater and Pool Habitat Types. By percent occurrence Riffles comprised 9%, Flatwater 28% and Pools 63% of the habitat types (Graph 1). By percent total length, Riffles comprised 3%, Flatwater 28% and Pools 68% (Graph 2).

Twelve Level IV Habitat Types were identified and are summarized in Table 2. The most frequently occurring habitat types were Mid-Channel Pools 36%, Corner Pools 20% and Step Runs 10% (Graph 3). The most prevalent habitat types by percent total length were Mid Channel Pools at 39%, Corner Pools 21% and Step Runs 15% (Table 2).

Table 3 summarizes Main, Scour and Backwater pools which are Level III Pool Habitat Types. Main pools were most often encountered at 57% occurrence and comprised 57% of the total length of pools.

Table 4 is a summary of maximum pool depths by Level IV Pool Habitat Types. Pools with depths of three feet (.91 m) or greater are considered optimal for fish habitat. In Laguna Creek, 33 of the 176 pools (19%) had a depth of three feet or greater (Graph 4).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 1% had a value of 1, 0% had a value of 2, 3% had a value of 3 and 96% had a value of 4 (Graph 5).

Laguna Creek

Of the Level II Habitat Types, Pools had the highest mean shelter rating at 61 (Table 1). Of the Level III Pool Habitat Types, Scour Pools had the highest mean shelter rating at 97 (Table 3).

Of the 176 pools, 7% were formed by Large Woody Debris (LWD): 4% by logs and 3% by root wads (calculated from Table 4).

Table 6 summarizes dominant substrate by Level IV Habitat Types. Of the Low Gradient Riffles fully measured, 50% had gravel and 25% had small cobble as the dominant substrate (Graph 6).

Mean percent closed canopy was 87%: 57% coniferous trees and 30% deciduous trees. Mean percent open canopy was 13% (Graph 7, calculated from Table 7).

Table 7 summarizes the mean percent substrate/vegetation types found along the banks of the stream. Mean percent right bank vegetated was 78% while mean percent left bank vegetated was 79%. Coniferous trees were the dominant bank vegetation type in 41% of the units fully measured. The dominant substrate composing the structure of the stream banks was Sand/Silt/Clay, found in 97% of the units fully measured.

<u>DISCUSSION</u>

The information gathered in the process of habitat typing will provide Georgia-Pacific with baseline data on the current condition of this creek and the available habitat for salmonids. These data can be used to identify components of the habitat in need of enhancement so appropriate conditions for Laguna Creek can be obtained over time.

Level II habitat types by percent occurrence and length

Flatwater habitat types comprised a moderate percentage of the units by both percent occurrence and length at 28% each (Table 1 and Graph 1). These unit types usually do not provide optimal spawning or rearing habitat for salmonids. Riffle habitat units comprised a very low percentage of the river by both percent occurrence and length at 9% and 3% respectively. Pools, however, comprised a much higher percentage by both percent occurrence and length at 63% and 68% respectively. Riffles usually provide good spawning habitat while pools provide important rearing habitat. In addition, Mundie (1969) reported that invertebrate food production is maximized in riffles while pools provide an optimum feeding environment for coho. In fact, the most productive streams are those consisting of a pool to riffle ratio of approximately one to one (Ruggles 1966).

Pool Depth

Laguna Creek

According to Flosi and Reynolds (1994), a stream with at least 50% of its total habitat comprised of primary pools is generally desirable. Primary pools are at least two feet deep in first and second order streams and at least three feet deep in third order streams. The information from Graph 4 on maximum depth in pools was used to determine percent of primary pools. Laguna Creek, a fourth order stream, is comprised of relatively shallow pools with 19% of the pools having a maximum depth of three feet or greater.

Instream Shelter

Instream shelter ratings are derived from two measurements: instream shelter complexity and instream shelter percent cover. The first is a value rating which provides a relative measure of the quality and composition of the shelter and the second is a measure of the area of a habitat unit covered by shelter. The various types of instream shelter include LWD, SWD, boulders, root wads, terrestrial vegetation, aquatic vegetation, bedrock ledges and undercut banks. Of the Level II habitat types Pools had the highest shelter rating at 61. Of the Level III habitat types Scour Pools had the highest shelter rating at 97. The first value is considered low while the second is high, as shelter values of 80 or higher are considered optimum for good rearing habitat (Flosi and Reynolds 1994).

Large Woody Debris

The presence of Large Woody Debris in streams is a significant component of fish habitat. Woody debris creates areas of low flow, providing a refuge for fish during periods of high flow (Robison and Beschta, 1990). Woody debris also provides cover for fish, lowering the risk of predation. The percent of pools formed by LWD in Laguna Creek was 7%. Whether these numbers are high or low, relative to the needs of salmonids is difficult to ascertain since the optimum amount of woody debris in streams has not been specified (Robison and Beschta 1990). However, based on data from Georgia-Pacific's 1995 Aquatic Vertebrate Study, the only coho found in the Ten Mile River Basin were in stream reaches where approximately 50% of pools were formed by large woody debris. Those reaches that did not support coho had a significantly lower percentage of pools formed by large woody debris (Ambrose et al, 1996). This suggests that a low percentage of LWD formed pools could adversely affect juvenile Coho Populations (C.S. Shirvel 1990) .

The above LWD analysis pertains only to pools formed by logs or root wads as described in Flosi and Reynolds (1994)**:** Lateral Scour Pool Log Enhanced, Lateral Scour Pool Root Wad Enhanced, Backwater Pool Log Formed and Backwater Pool Root Wad Formed. Other pools containing LWD as a component were not included in the calculation. For example, plunge pools may be formed by boulders, bedrock or LWD but are not described as such by habitat unit types. Therefore, the LWD formed pool calculation is limited to four pool types and does not quantify the total amount of LWD in Laguna Creek.

Laguna Creek

Canopy

There are two important benefits of canopy cover in coastal streams. Canopy keeps stream temperatures cool as well as providing nutrients in the form of leaf litter and organic material (Bilby 1988). This leaf litter, organic material, and their associated nutrients are utilized as a food source by benthic macroinvertebrates (aquatic insects). The macroinvertebrates, in turn, are major food sources for most fish species in forested areas (Gregory et al., 1987). Mean percent canopy cover for the Laguna Creek was 87%. This is relatively high since a canopy cover of 80% or higher is considered optimum, Flosi and Reynolds (1994).

Coniferous trees occupied a larger portion of the canopy than did deciduous trees. Coniferous trees comprised 57% and deciduous trees 30% of the canopy. Wood from coniferous trees does not deteriorate as rapidly as wood from alder and most other deciduous species (Sedell, *et al*. 1988). Therefore, more LWD would be available in the future for fish cover and LWD formed pools in this creek and others dominated by coniferous species.

Embeddedness

High embeddedness values (silt levels), such as those found in Laguna Creek, have been associated with many negative impacts to salmonids. These negative impacts can be observed in important environmental components of salmonid habitat such as pool habitats, dissolved oxygen levels and water temperatures.

High silt levels impact pool habitats by filling in and eventually eliminating pools. As already mentioned, pools provide important feeding and rearing habitat for salmonids.

High silt levels also impact dissolved oxygen levels. They do so by reducing water circulation within the substrate, thus lowering the oxygen levels needed by salmonid eggs (Sandercock, 1991). This can hinder the survival of the eggs deposited in the redds.

Water temperature is impacted by high silt levels in several ways. Hagans et al (1986) reported the following impacts to water temperatures: 1) the loss of a reflective bottom; 2) darker sediment (as opposed to clean gravels) storing heat from direct solar radiation which is then transferred to the water column; and 3) a reduction in the flow of water through the substrate interstitial spaces thereby exposing more of the water column to direct solar radiation.

Another means by which water temperatures are impacted is through the widening of stream channels: over time, high silt levels increase the substrate surface level of the creek, resulting in a wider, shallower stream channel (Flosi and Reynolds 1994). In shallow streams more surface area is exposed to the sun relative to the volume of water, leading to an increase in solar heating which in turn leads to higher water temperatures.

Laguna Creek

Substrate embedded with silt in varying degrees were given corresponding values as follows: 0-25%= value 1, 26 - 50% = value 2, 51 - 75% = value 3 and 76 - 100% = value 4. According to Flosi and Reynolds (1994), creeks with embeddedness values of two or higher are considered to have poor quality fish habitat. In the Laguna Creek, 99% of the pool tail-outs measured had embeddedness values of two or more.

It is important to consider, however, that the above embeddedness values were obtained in the summer during low flow conditions. In winter and spring, flows are usually higher due to the rainy season and the lowered evapotranspiration of the trees. This higher flow can carry away some of the silt previously deposited to sites further downstream. Therefore, embeddedness values may fluctuate throughout the year along different section of the stream.

Substrate

In Laguna Creek, 50% of the Low Gradient Riffles had gravel and 25% had small cobble as the dominant substrate. Collectively, the relatively high presence of gravel and small cobble in riffles indicates that there is a sufficient amount of substrate available as potential spawning habitat in this creek. While this creek had sufficient substrate for spawning in the riffles surveyed, the overall percentage of riffles in the surveyed portions of the creek was low at 9% (Table 1). Subsequently, there may be a lack of sufficient spawning habitat. Another point to consider is that regardless of the amount of substrate or spawning habitat available, this habitat may not be suitable for salmonids if it is highly embedded.

Overall, Laguna Creek appears to provide marginally suitable habitat for salmonids. Though this creek has sufficient canopy, it also has high embeddedness values and a relatively low percentage of primary and LWD formed pools. In addition, while there was sufficient substrate for spawning, habitat for spawning appeared to be limited. Shelter values were low for Level II habitat types but high for Scour Pools, a Level III habitat type.

Georgia-Pacific recognizes that there are areas of Laguna Creek in need of enhancement, and where feasible will attempt to restore those areas over time as part of its long term management plan. The company will also attempt to facilitate a healthy environment for salmonids in this creek through sound management practices.

RECOMMENDATIONS

1) Laguna Creek should be managed as an anadromous, natural production watershed.

2) Where feasible, design and engineer pool enhancement structures to increase the depth of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

Laguna Creek

3) Sources of stream bank erosion should be mapped and prioritized according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediment entering the stream. In addition, sediment sources related to road systems need to be identified, mapped and treated according to their potential for sediment yield to the watershed.

4) Shelter values throughout Laguna Creek could be increased by addition of large logs and root wads, boulder clusters, log and boulder wiers and log and boulder deflectors. These need to be placed carefully to prevent washing out in high flows. The Stream Habitat Restoration Manual, by Flosi and Reynolds, 1994, provides detailed descriptions for restoration efforts.

5) Log debris accumulations retaining large quantities of fine sediment should be modified if necessary, over time, to avoid excessive sediment loading in downstream reaches.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

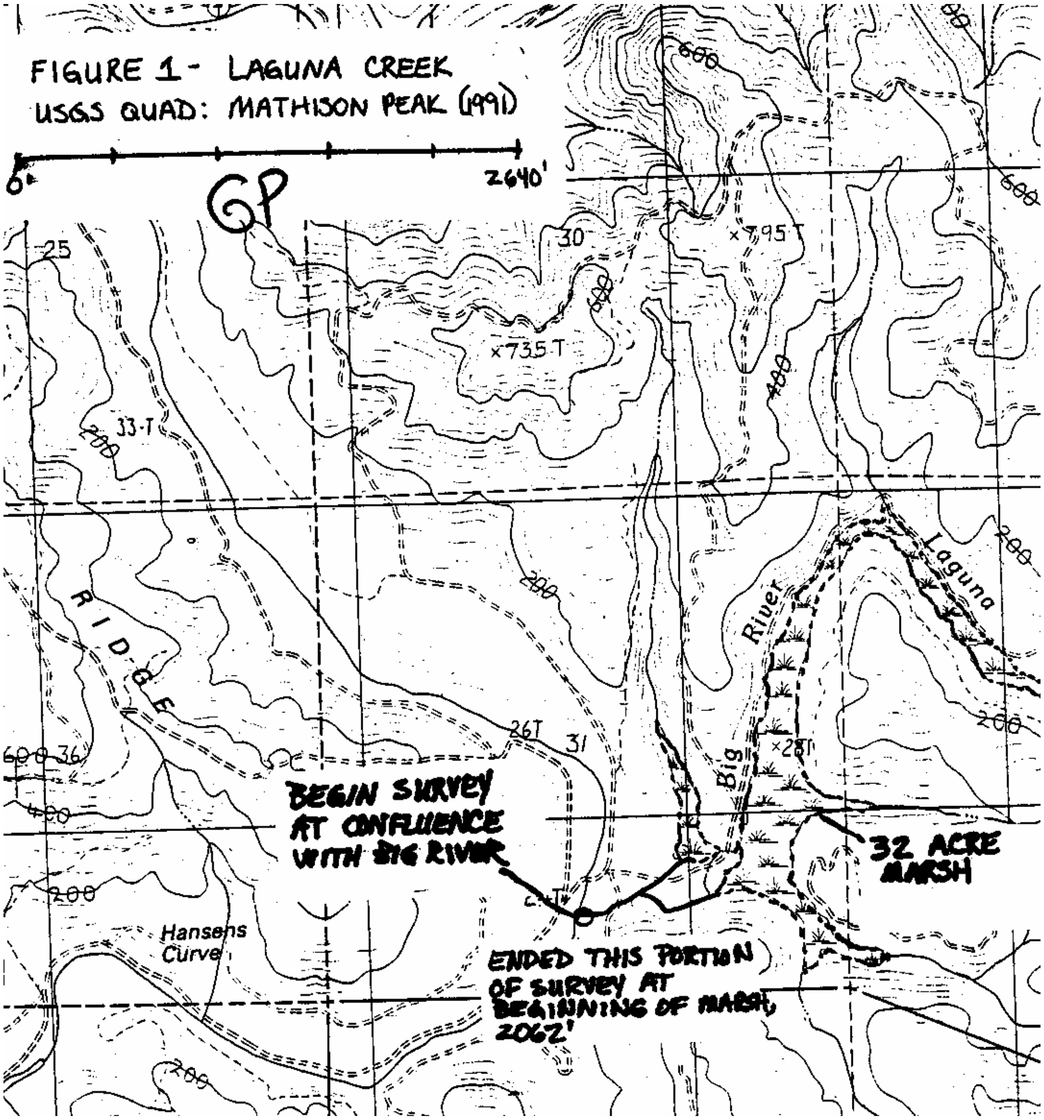
Position (ft):	Comment:
159’	One young of year (yoy) observed
350’	LWD over pool 20'l x 15'w x 2'h
721’	Tributary entering right bank at end of unit
1001’	LWD over pool 60' x 15' x 3'h
1229’	Yoy observed
1800’	One yoy observed
2062’	Creek turns into 32 acre marsh, no spawning habitat below marsh, no fish observed for last 200'.
2095’	Re-entered creek above marsh just below bridge
2706’	Bridge at beginning of pool at 12'

Laguna Creek

4109’	One yoy
4268’	No fish observed (NFO)
4329’	Red legged frog
4506’	Three inch salmonid
5224’	Red legged frog
5330’	Three inch salmonid
6378’	Two 4 inch salmonids observed
6594’	Log jam over creek at 80'. 10'h x 20'w x 8'l
6679’	One yoy observed
6907’	NFO
7098’	LWD over creek 30'l x 10'w x 2'h
7473’	One yoy
7602’	One yoy
7633’	One 4 inch salmonid
7784’	LWD over pool 6'h x 12'w x 4'l
8079’	NFO
8820’	Yoy observed
10220’	End of survey. End of G.P. property line

DIH

Laguna Creek



Laguna Creek