STREAM INVENTORY REPORT

Chadbourne Gulch

WATERSHED OVERVIEW

Chadbourne Gulch is a tributary to the Pacific Ocean (Figure 1). Elevations range from 0 feet at the mouth of the creek to 600 feet in the headwater areas. Chadbourne Gulch's legal description at the confluence with the Pacific Ocean is T20N R17W S08. Its location is 39°36'47"N. latitude and 123°46'50"W. longitude according to the USGS Inglenook 7.5 minute quadrangle.

HABITAT INVENTORY RESULTS

The habitat inventory of November 15, 1996, was conducted by Dave Lundby. The total length of surveyed stream in Chadbourne Gulch was 7,538 feet (1.4 miles, 2.3 KM) (Table 1). There were no side channels in this creek.

Chadbourne Gulch consists of two reaches: A C4 for the first 6,106 feet and a G3 for the remaining 1,432 feet.

Table 1 summarizes the Level II riffle, flatwater and pool habitat types. By percent occurrence, riffles comprised 22%, flatwater 32% and pools 44% of the habitat types (Graph 1). By percent total length, riffles comprised 8%, flatwater 69% and pools 20% (Graph 2).

Thirteen Level IV habitat types were identified and are summarized in Table 2. The most frequently occurring habitat types were step runs 30%, low gradient riffles 19% and lateral scour log pools 12 % (Graph 3). The most prevalent habitat types by percent total length were step runs at 66%, low gradient riffles at 8% and lateral scour log pools 5% (Table 2).

Table 3 summarizes main, scour and backwater pools which are Level III pool habitat types. Scour pools were most often encountered at 72% occurrence and comprised 72% of the total length of pools.

Table 4 is a summary of maximum pool depths by Level IV pool habitat types. In second order streams, pools with depths of two feet (0.61 m) or greater are considered optimal for fish habitat. In Chadbourne Gulch, 12 of the 57 pools (21%) had a depth of two feet or greater (Graph 4).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 0% had a value of 1, 0% had a value of 2, 54% had a value of 3 and 46% had a value of 4 (Graph 5).

Of the Level II habitat types, riffles had the highest mean shelter rating at 80 (Table 1). Of the Level III pool habitat types, scour pools had the highest mean shelter rating at 27 (Table 3).

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Of the 57 pools, 47% were formed by large woody debris (LWD): 26% by logs and 21% by root wads (calculated from Table 4).

Table 6 summarizes dominant substrate by Level IV habitat types. Of the low gradient riffles fully measured, 100% had gravel as the dominant substrate (Graph 6).

Mean percent closed canopy was 50%: 12% coniferous trees and 38% deciduous trees. Mean percent open canopy was 50% (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 82% while mean percent left bank vegetated was also 82%. Brush was the dominant bank vegetation type in 35% of the units fully measured. The dominant substrate composing the structure of the stream banks was silt/clay, found in 63% of the units fully measured.

DISCUSSION

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 Chadbourne Gulch 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 percent occurrence and a high percentage by length at 32% and 69% respectively (Table 1 and Graph 1). These unit types usually do not provide optimal spawning or rearing habitat for salmonids. Riffle habitat units comprised a moderate percentage of the stream by percent occurrence and a low percentage by length at 22% and 8% respectively. Pools comprised a high percentage by percent occurrence and a low percentage by length at 44% and 20% 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

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. Chadbourne Gulch, a second order stream, is comprised mainly of shallow pools with 21% of the pools having a maximum depth of two feet or greater.

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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, small woody debris, boulders, root wads, terrestrial vegetation, aquatic vegetation, bedrock ledges and undercut banks. Of the Level II habitat types, riffles had the highest shelter rating at 80. Of the Level III habitat types, scour pools had the highest shelter rating at 27. The first value is high and the second low as shelter values of 80 or higher are considered optimal 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 Chadbourne Gulch was 47%. 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 salmon 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-rootwad enhanced, backwater pool-log formed and backwater pool-rootwad 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 Chadbourne Gulch.

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 Chadbourne Gulch was only 50%. This is low since a canopy cover of 80% or higher is considered optimum(Flosi and Reynolds, 1994).

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Deciduous trees occupied a larger portion of the canopy than did coniferous trees. Coniferous trees comprised only 12% of the canopy. The significance of this is that wood from alder and most other deciduous species deteriorates more rapidly than wood from coniferous species (Sedell, *et al*. 1988). Therefore, less LWD would be available in the future for fish cover and LWD formed pools in this creek and others dominated by deciduous species. Since the channel is dominated by deciduous trees and the survey was conducted after the leaf abscission period, it must be noted that canopy levels recorded were probably lower than when the trees were in foliage.

Embeddedness

High embeddedness values (silt levels), such as those found in Chadbourne Gulch, 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.

The impact high silt levels have on pool habitat is that they fill in and eventually eliminate pools. As already mentioned, pools provide important habitat for rearing salmonids.

High silt levels also impact oxygen levels in the water. 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 redds, as well as the survival of juvenile salmonids.

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 increased 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.

Substrates 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 Chadbourne Gulch, 100% 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 previously deposited silt to sites further downstream. Therefore, embeddedness values may fluctuate throughout the year along different sections of the stream.

Substrate

In Chadbourne Gulch, 100% of the low gradient riffles had gravel as the dominant substrate. The high concentration of gravel in riffles indicates that there is a sufficient amount of substrate available as potential spawning habitat in this creek. It is important to consider 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, Chadbourne Gulch appears to have a relatively low percentage of primary pools, insufficient canopy and high embeddedness values. However, this creek appears to have sufficient LWD formed pools as well as sufficient substrate for spawning.

Georgia-Pacific recognizes that there are areas of Chadbourne Gulch 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) Chadbourne Gulch 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.

3) Increase the canopy in Chadbourne Gulch by planting willow, alder, redwood and Douglas-fir along the watercourses where shade canopies are not at acceptable levels. Planting efforts need to be coordinated to follow bank stabilization or upslope erosion control projects. A proportion of trees already present along the creek should also be allowed to grow and left to maintain a functional overstory canopy.

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

5) 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.

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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):	Comments:
7	Channel type.
109	Large debris accumulation (LDA) consists of six pieces of LWD.
288	Fish observed, 3+.
365	LDA consists of two pieces of LWD.
443	Culvert 3’ x 3’, Highway One crossing: 4' baffled culvert.
610	LDA consists of eight pieces of LWD.
885	LDA consists of six pieces of LWD.
1759	LDA consists of three pieces of LWD.
1991	Confluence with Walters Gulch.
2211	LDA consists of four pieces of LWD.
2513	LDA consists of four pieces of LWD.
3235	Right bank failure measures 40' long x 50' high; contributing fines to the channel.
3289	Right bank failure measures, 20' long x 20' high. Another right bank failure measures 40' long x 60' high.
3321	LDA consists of eight pieces of LWD.
4944	Right bank tributary.
5239	LDA consists of two pieces of LWD.
5707	LDA consists of eight pieces of LWD.
6028	Channel becoming more entrenched, substrate increasing in size.
6068	Log jam, possible barrier.

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6106	LDA consists of five pieces of LWD.
6153	LDA consists of five pieces of LWD.
6165	Channel type here.
6187	LDA consists of two pieces of LWD. No fish observed.
6337	LDA consists of six pieces of LWD.
6406	Pool created by transverse logs. LDA consists of seven pieces of LWD.
6555	Right bank tributary. Young-of-the-year (YOY) salmonids were observed in the tributary. Habitat minimal in tributary-possible thermal refuge.
6603	LDA consists of two pieces of LWD.
6773	LDA consists of five pieces of LWD. Creek choked with limbs, recent cut. Left bank failure measures 80' long x 40' high, It is about to contribute more trees, but contributing fines now.
7411	Still no fish observed.
7419	Eight foot vertical plunge, no jump pool or landing pool, possible barrier.
7449	Dry 6’ high plunge, no fish observed.
7538	End of survey. Channel choked with debris, very narrow, no spawning substrate for salmonids.

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