STATE OF CALIFORNIA - BOARD OF FORESTRY
CUMULATIVE IMPACTS ASSESSMENT

(1) Do the assessment area(s) of resources that may be affected by the proposed project contain any past, present, or reasonably foreseeable probable future projects?

Yes X No ___

If the answer is yes, identify the project(s) and affected resource subject(s).

Past, present and future projects are described below within the specific assessment area discussions.

(2) Are there any continuing, significant adverse impacts from past land use activities that may add to the impacts of the proposed project?

Yes X No ___

If the answer is yes, identify the project(s) and affected resource subject(s).

Continuing, significant adverse impacts from past land use activities are described below within the specific assessment area discussions.

(3) Will the proposed project as presented, in combination with past, present, and reasonable foreseeable probable future projects identified in items (1) and (2) above, have a reasonable potential to cause or add to significant cumulative impacts in any of the following resource subjects?

	Yes after mitigation (a)	No after mitigation (b)	No reasonably potential significant effects (c)
1. Watershed		X	
2. Soil Productivity		X	
3. Biological		X	
4. Recreation			X
5. Visual			X
6. Traffic			X
7. Other			X

a) **Yes, means that potential significant adverse impacts are left after application of the forest practice rules and mitigations or alternatives proposed by the plan submitter.**
b) **No after mitigation means that any potential for the proposed timber operation to cause significant adverse impacts has been substantially reduced or avoided by mitigation measures or alternatives proposed in the THP and application of the forest practice rules.**
c) **No reasonable potential significant effects means that the operations proposed under the THP do not have a reasonable potential to join with the impacts of any other project to cause cumulative impacts.**

ASSESSMENT AREA DESCRIPTIONS:

1. Watershed: A majority of the conversion THP area is contained within the Annapolis CAL Watershed (#1113.840303). A small portion of the plan area (approximately 14 acres) lies within the Grasshopper Creek CAL Watershed (#1113.830003) and another very small portion (approximately 2 acres) lies within the Little Creek CAL Watershed (#1113.830004). Therefore, the Annapolis CAL Watershed will be the main focus of this assessment, however, both the Grasshopper Creek and the Little Creek CAL Watersheds will also be considered. The combined area of all three watersheds is approximately 19,202 acres. The boundary for this watershed was chosen under the guidelines offered in 14 CCR 912.9 Technical Addendum #2. The reasoning for choosing this area was to account for all effects from activities that could conceivably interact with effects from this conversion THP to cause significant cumulative adverse impacts on the watershed.

2. Soil Productivity: The Soil Productivity Assessment Area is that area within the conversion THP boundary and all roads and landing located outside the boundary that will be used as a part of harvest operations as suggested in the "Cumulative Impacts Guidelines, August 13, 1991", page 10. This area was chosen as it encompasses all areas within which timber operations will occur. Timber harvest operations will not take place outside of this area, therefore the potential for adverse impacts to soil productivity does not exist beyond the plan boundary and associated timber harvesting facilities.

3. Biological: Biological assessment areas will vary with the species being evaluated and its habitat requirements. The biological assessment area for this conversion THP is the area within 1.3 miles of the THP, as this area is large enough (approximately 7,140 acres) to provide a representative sample of the different habitat types found in the vicinity of the proposed plan area. This assessment area as described is large enough to account for effects, on any species, that may be caused by this THP. In addition, this assessment area was chosen because it coincides with the survey area for the Northern Spotted Owl set forth in the Forest Practice Rules and any potential adverse impacts to wildlife will be diminished beyond the Biological Assessment Area.

4. Recreation: The Recreational Assessment Area will follow the guidelines stated in the Appendix to Technical Rule Addendum #2, which is the conversion timber harvest plan area plus 300 feet beyond the boundary.

5. Visual: The visual assessment area will include viewpoints within a three mile radius of the timber operations, however emphasis shall be placed on the visual impacts from Annapolis Road. As stated in Technical Rule Addendum #2, activities are not easily discernible at distances greater than three miles and are less significant. As such, the proposed visual assessment area is large enough to assess all of the potential visual impacts.

6. Traffic: Timber from this plan will be hauled from the plan area on either of the two following routes 1) via a private road system to Annapolis Road (a county road) then west to Highway 1 or 2) a private road system off the plan area to Annapolis Road (a county road) then east on Annapolis Road to Skaggs Springs Road (a county road), then east on Skaggs Springs Road to Dry Creek Road, and east on Dry Creek Road to State Highway 101. This road system will be considered the assessment area. This is consistent with Technical Rule Addendum #2.

1. Watershed Resources:

Past and Present Projects

The assessment area has a long history of human habitation. The main activities that have contributed past adverse impacts to the Watershed Assessment Area are wildland burning, agriculture/grazing, rural subdivisions, road building, and timber harvesting.

Wildland Burning

Early landowners appear to have burned the slopes periodically following the initial logging in an attempt to enhance livestock carrying capacity. The wildland burning, which occurred from before the turn of the century until the 1950s, definitely had a negative impact on the beneficial uses of water across the assessment area. Annual burning was conducted to increase the amount of grazing habitat and improve the quality of the grazing habitat. Burning during this period was also used in conjunction with clear cutting in the watershed assessment area. This burning reduced protective ground cover exposing large areas of soil to increased erosion potential. Conifer shade canopy along the watercourses of the assessment area must have been reduced as a result of repeated burning, thus leading to higher summer water temperatures. Reduced canopy levels across the timbered portions of the assessment area would have resulted in reduced water use by vegetation and a potential for increased peak flows.

The practice of broadcast control burning is still practiced within the watershed to a certain degree to control fuel loads and vegetative cover and for site preparation activities. Fires are usually set in early winter when burning conditions are suitable for low intensity controlled burns. Wildland burning however is not conducted on the same scale as it was in the past and is not used to increase grazing habitat.

Agriculture/Grazing

The watershed assessment area has a long history of agricultural use. Orchards existed along Annapolis Road from approximately 1920 to 1960. These orchards were left largely untended until the early 1990s when they started to be converted to vineyards and other uses. Grape production has continued to increase in this area in the last ten years due to the "discovery" of the high quality grape that is produced in this area. An on site, ocular review of the watershed assessment area indicates that most of the vineyard development that has occurred within the last six years has taken place within areas that were previously orchards or grasslands. As discussed above, a majority of the burning and clearing conducted in the past was intended to increase grazing habitat and improve the quality of grazing habitat. The amount of grazing throughout the assessment area has been significantly reduced.

Rural Subdivisions

The human population levels of the area have fluctuated in the past. Whenever there is human activity, there is potential for adverse effects on the environment. Human population growth affects all resources, either directly or indirectly, and increased pressure upon rural settings is a manifestation of those impacts. Accelerated erosion can occur from access roads and homesites. Chemical and biological pollutants can enter waterways from septic systems, gardens and roads. The increasing human population reduces the inventory of productive soils and disrupts wildlife.

It reduces wildland recreational opportunities and disrupts the visual resources. The county/state controls almost all land use activities with regulations designed to prevent significant adverse impacts.

Road Building

Road building is associated with all of the other past land uses discussed here. The sedimentation of watercourses is perhaps the greatest past and continuing impact within the watershed and a major contributing factor to that would be the construction and use of forest and ranch roads. Several sources including the Handbook for Forest and Ranch Roads (Weaver and Hagens 1994) and the Klamath Resource Information System, KRIS indicate that road failures can contribute both fine and course sediment to streams, and accumulated road failures in large storm events can have catastrophic effects, such as filling in pools and reducing habitat complexity. Studies cited within KRIS show that roads can contribute 50 to 80% of the sediment that enters streams and the amount of sediment delivered from forests with roads can be more than 300 times greater than from undisturbed forest land. Roads on ranch lands and those leading to rural and suburban parcels also contribute to sediment problems in a watershed. Surface erosion from roads can produce chronic sources of fine sediment, which can diminish salmon and steelhead spawning success. Roads constructed next to streams are chronic contributors of fine sediment, particularly if they are used in winter months. Winter logging exacerbates this problem because the truck wheels pump fines from within the roadbed to the surface. Fine sediment from roads that enters streams fills interstitial spaces in gravel streambeds, reducing survival of salmon and steelhead eggs and aquatic insects.

Road construction in the past was not regulated as it is now and resources such as the Handbook for Forest and Ranch Roads were not available. Roads were constructed within and next to streams and were commonly used during wet winter periods. The roads altered the drainage patterns of the watershed assessment area and proper watercourse crossing were not installed. Recognition of road and erosion problems in the Gualala River basin has lead to a number of road improvement and erosion control projects in recent years. Two notable projects are the upgrading of Kelly Road and road erosion-proofing of the Fuller Creek basin. There are however many small rural landowners that continue to use road systems during wet periods and who conduct little or no upgrades to their road systems.

Timber Harvesting

Before the implementation of the Forest Practice Act of 1973, historic logging activities did not take into consideration, erosion, mass wasting or the watercourse protection issues that forest harvesting focuses on today. Early timber harvesting and the manufacturing of split products across the assessment area caused significant increases in the watershed effects described below and the beneficial uses of water were significantly adversely affected by these activities. Roads and skid trails were constructed either directly in or adjacent to watercourses resulting in sedimentation of the watercourses and reduction of shade canopy. Large increases in large woody debris and increased sediment inputs resulted in the storage of large amounts of sediment. As the woody debris begins to decay, stored sediment is moving through the watershed. Furthermore, lack of adequate erosion control on skidtrails, roads and watercourse crossings resulted in the deposition of large amounts of sediment and organic debris into the watercourse channels. Overall impacts from past timber management however, appear to have been beneficial. The lands remain forested with various levels of regeneration dependent upon location. Diversity is wide within stands and forested cover. Incidental adverse impacts to watershed resources are more likely associated with road maintenance or primary log transport using watercourses rather than harvesting per se.

Recently, timber harvesting operations have been conducted under the Z'berg Nejedly Forest Practices Act of 1973 and the rules of the Board of Forestry. Other agencies such as the Department of Fish and Game and Water Quality are also a part of the review process for proposed timber operations throughout the State of California. The education of timber operators and the development of new technologies have led to the significant improvement in road building, timber harvesting, and erosion control. These practices have led to continuing improvements in protecting environmental resources. Some improvements in the practice of forest management are in the following:

- The protection of watercourses by the use of buffer zones, protect beneficial uses of water and wildlife that depend on moisture and clean running water. These buffer strips maintain stream temperature and provide biomass to those organisms that feed on plant materials that are an essential part of the food chain within aquatic communities.

- Harvesting methods include skyline cable yarding and helicopters that keep tractors off of steep slopes and prevent logs from skidding on top soil that increases the potential for soil loss and/or erosion. These methods help protect watershed dynamics and sensitive geologic areas such as unstable soils and slopes.

- Wildlife monitoring and habitat identification is included in Timber Harvest Plans to help determine if federal or state listed endangered, threatened and/or species of concern are located within the proposed harvest area. If such species exist mitigations are required are to protect appropriate habitat types. Available resource inventories and databases are used to determine local habitat characteristics that help assess the proposed harvest area is suitable habitat for any such listed species; (i.e., Stream Surveys from DFG, Higher Plants of California, California Native Plant Society, etc.).

- A Number of different harvesting prescriptions are used to create more diversity and watercourse protection that benefits stand dynamics and wildlife. Reforestation efforts are increasing to assure future inventory of harvest trees. Many small land owners and non-industrial timber lands are encouraged to increase that inventory of coniferous trees through such programs as the California Forest Improvement Program created by the Department of Forestry and Fire Protection.

These improvements have shown that a steady supply of forest products can be maintained while protecting forest resources.

Other than the proposed THP, no past, present or future timber harvesting projects occur on land owned or controlled by the timberland owner within the assessment area.

The following table includes a summary of the THPs filed within the assessment area within the past 10 years:

Silvicultural Methods:

SEL - Selection
TRN- Transition
SWR - Shelterwood Removal
STSS- Seed Tree Seed Step
REH - Rehabilitation
ALT – Alternative Prescription
STR – Seed Tree Removal
CT- Commercial Thin
CC- Clearcut
VAR – Variable Retention
SS- Sanitation Salvage
GS-Group Selection

Logging Method:

C – Cable
T – Tractor
FB – Feller Buncher
H – Helicopter

Comments:

1- Completed
2- Approved not yet completed
3 - Submitted Not Approved

THP#	Acres*	Silvicultural Method	Yarding Method	Comments	Location
Annapolis WAA					
1-08-124 SON	126	STR, SEL	T	2	T10N R14W Sec. 14
1-08-121 SON	206	VAR	C	3	T10N R14W Sec. 25
1-08-093 SON	112	VAR	T, C	3	T10N R13W Sec. 29 & 30
1-07-028 SON	185	ALT, REH	T, C	2	T10N R14W Sec. 24 T10N R13W Sec. 18 & 19
1-06-192 SON	200	ALT	T,C,H	2	T10N R13W Sec. 20, 28 & 29
1-06-110 SON	135	ALT, REH	T, C	2	T10N R14W Sec. 23,25,26&30
1-06-072 SON	110	STR, SEL	T,C	2	T10N R14W Sec. 25,26 & 35
1-05NTMP-017	120	SEL,GS,TRN,REH	T,C	2	T10N R14W Sec. 11 & 14
1-04-275 SON	50	SEL	T	2	T10N R14W Sec. 9, 15, 16 & 22
1-04-201 SON	35	CC,SEL,STR,SWR	T	2	T10N R14W Sec. 23 & 27
1-04-045 SON	296	TRN,ALT,REH,VAR,STR	T,C	2	T10N R13W Sec. 18, 19 & 20
1-04NTMP-001	62	SEL	T	2	T10N R14W Sec. 22, 23 & 26
1-03-008 SON	70	CC	T	1	T10N R14W Sec. 15, 16 & 22
1-02-174 SON	20	SEL	T	1	T10N R14W Sec. 10
1-01-202 SON	5	Conversion	T	1	T10N R13W Sec. 17
1-01-034 SON	50	STR	T	1	T11N R14N Sec. 25
1-00-468 SON	487	ALT,TRN,STR	T,C	1	T10N R13W Sec. 30, 31 & 32
1-00-129 SON	237	STR, ALT, REH	T, FB, C	1	T10N R14W Sec. 13, 24 T10N R13W Sec. 19
1-00NTMP-073	85	SEL	T	2	T10N R14W Sec. 11, 12, 13, 14
1-00NTMP-041	13	SEL	T	2	T10N R14W Sec. 10
1-99-390 SON	20	SEL	T	1	T10N R14W Sec. 18
1-99-354 SON	134	STR, CC, SWR	T, C	1	T10N R14W Sec. 9, 10, 15, 16
1-99-052 SON	197	STR, SS, REH	T	1	T10N R14W Sec. 25; T10N R3W Sec. 30, 31
1-99NTMP-021	38	SEL	T	2	T10N R14W Sec. 13
1-98-269 SON	82	CC	T, C	1	T10N R14W Sec. 14, 15, 22
Little Creek WAA					
1-08-078 SON	40	TRN	T, C	2	T10N R14W Sec. 11
1-06NTMP-009	210	GS	T, C	2	T10N R13W Sec. 7 T10N R14W Sec. 11&12
1-05NTMP-013	160	SEL	T,C	2	T10N R14W Sec. 4 & 5
1-04-059 SON	25	Conversion	T	1	T10N R13W Sec. 12
1-04-055 SON	8	Conversion	T	1	T10N R13W Sec. 12
1-04-030 SON	16	Conversion	T	1	T10N R14W Sec. 2
1-02-019 SON	18	Conversion	T	1	T10N R14W Sec. 2
1-01-243 SON	38	ALT	T	1	T10N R14W Sec. 10
1-01-178 SON	30	ALT	T,C	1	T10N R14W Sec. 10
1-00-328 SON	63	STR	T	1	T10N R14W Sec. 12
1-99-445 SON	70	SEL	T	1	T10N R14W Sec. 4, 5 & 6

1-99-426 SON	35	STR	T	1	T10N R14W Sec. 35
1-99-258 SON	161	CC	T,C	1	T10N R14W Sec. 4, 5, 9 & 10
1-98-336 SON	70	CC	T,C	1	T10N R14W Sec. 5 T11N R14W Sec. 32
1-97-036 SON	174	STR	T,C	1	T10N R14W Sec. 3
Grasshopper Creek WAA					
1-06-157 SON	46	STR,SWS,SEL	T, C	2	T10N R13W Sec. 6 T11N R13W Sec. 31
1-06NTMP-001	628	SEL, GS	T, C	2	T10N R13W Sec. 6, 7 & 8
1-00-147 SON	90	Conversion	T	1	T10N R13W Sec. 7
1-98-236 SON	74	CC	T, FB, C	1	T10N R13W Sec. 3, 9, 10
1-97-070 SON	445	ALT	T	1	T10N R13W Sec. 4 & 5 T11N R13W Sec. 31,32&33
1-97-034 SON	59	STR	T, FB, C	1	T11N R14W Sec. 25, 26
Total	**5535**				

***Acres within the assessment area – not total plan acres.**

As indicated in the table above, approximately 28.8% of the 19,202 acre watershed assessment area has had a timber harvest plan filed on it within the last 10 years. The majority of these past projects have been completed and are currently fully stocked. The more recent plans or those filed within the last 5 years, are considered to have a low to moderate impact on the watershed depending on the amount of time that has past since the completion of timber operations, yarding method utilized and the vegetative cover remaining post harvest.

Additional past activities
Powerline maintenance- Maintenance of the right-of-way dictates that all vegetation which could touch the lines under any conditions be cut, as well as any vegetation which might grow to become a problem in the next decade or so. Biological resources may be affected by these practices.

LWD Removal- Stream clearance activities were initiated by the California Department of Fish and Game within the assessment area in the 1960's. Active removal of the logjams began in the late 1960s and continued into the 1980's. Current views of this activity are less favorable as it may be seen as resulting in a loss of large woody debris (LWD). Watershed resources would have been affected. In stream habitat was adversely affected and impacts continue presently.

Sonoma County Landfill- Sonoma County operates a refuse disposal site transfer station south of the project area. The landfill is located within the Patchett Creek drainage and may contribute to the cumulative effects of the watershed and biological assessment areas.

Future Projects:

As described above, the main activities that have been conducted within the Watershed Assessment Area are wildland burning, agriculture/grazing, rural subdivisions, road building, and timber harvesting. It is anticipated that these activities will continue into the future.

Wildland burning is expected to be conducted in the future, to a certain degree, to control fuel loads and vegetative cover and for site preparation activities. The amount of burning conducted is expected to be minimal and should not result any adverse impacts.

In the past 10 years a small portion of the assessment areas have been developed into vineyards. Development has occurred in areas of gentle terrain (ridgetops), high quality soils, and relatively frost-free environments. A recent proposal has been made by Premier Pacific Vineyards to develop approximately 1,861 acres of vineyard in the area. Approximately 750 of the 1,861 acres fall within the assessment area of this THP and should be considered as a future project. The proposed 1,861 acre vineyard, referred to as the Preservation Ranch Project is part of an integrated land use plan that would establish the following: (1) 1,861 acres of sustainable vineyards; (2) 14,868 acres of Sustainable Timber Management Area; (3) 2,702 acres of core wildlife habitat called Windy Gap Preserve; (4) a 221-acre expansion of the Soda Springs Reserve; (5) a 5-mile public trail easement; and (6) extinguishment of 97 legal parcels via voluntary merger. The integrated land use plan maximizes forest resource protections and environmental benefits while integrating agriculture and wildlife conservation with a large working forest, over the entire landscape.

Large forested land holdings have been and will likely continue to be sub-divided into "ranchettes" and vacation home properties. Rural residential development will continue to have impacts upon the management of large tracts of industrial and small private timberland.

Road building is not expect to result in adverse impacts to the assessment area in the future as a majority of the assessment area is currently roaded and any new roads constructed will utilize proper planning, design and construction techniques.

Industrial timber companies and small landowners own a large majority of this assessment area and have conducted timber management activities in the past. These activities are expected to continue into the future. These future activities will be conducted with the knowledge gained from past practices and will result in fewer adverse impacts and improved forest health and diversity.

Watershed Effects:

Timber harvesting can degrade the beneficial uses of water through increases in **sediment**, **water temperature**, **organic debris**, **chemical contamination** and **peak flows**. Additional discussion of these effects is included in Chapter 3.7 of the project EIR.

Sediment Effects

Runoff from the proposed vineyard site flows to the Gualala River, which is currently on the federal Clean Water Act (CWA) Section 303(d) list due to impairment and/or threat of impairment to water quality by temperature and sediment.

Evaluation of on-site activities:

The project has been designed to avoid initiating soil loss by minimizing the overall extent of bare mineral soil, employing erosion control techniques that focus upon dispersing water rather than concentrating it, directing flows away from at-risk areas and by maintaining an adequate buffer away from watercourses. Elements of the project erosion control plan are likely to minimize risk of sediment delivery. Watershed resources within the plan area are then, expected to be protected from sediment effects by current forest practice regulations, and by the proposed mitigation measures proposed within the THP and EIR including the Erosion Control Plan.

At first, one must consider the location of the project and whether or not the location presents inherent risk of erosion and whether those risks are high or not. In this instance, the risk is low because the location is at the top of a gentle ridge and because the slopes of the project area average about 12%, with a maximum of approximately 40%. Aside from the basic physiography of the site, the forest practice rules require that structures (roads, skid trails and landings) used during harvesting be fitted with drainage structures to prevent the accumulation of water and its attendant erosive capacity.

Within the project boundaries no unstable areas have been identified nor is there evidence of ancient landslide features apparent. No operations are proposed as part of the proposed project on or near unstable soils, so the likelihood of adversely affecting the slopes is low to nonexistent.

The project proposes no harvesting practices near watercourses. Trees that stabilize streamside banks, since there are no watercourses in the plan area, are not proposed for removal.

Broadcast burning is not proposed as part of the project. Rather, piling and burning of the specifically generated debris is. Therefore, within the areas outside the project boundary, the duff layer and the soil protection that it provides should be maintained. This measure should also reduce impacts from rainfall and overland flow and should maintain filter properties of the surrounding buffer area. Yet the possible mitigation effect comes at the risk of losing the positive benefits to watercourses and the riparian zone that fire could provide, such as nutrient cycling, and natural succession of fire dependent riparian species.

Evaluation of off-site activities:
The Gualala River Total Maximum Daily Load for Sediment (U.S. EPA, 2001), The Gualala River Watershed Assessment Report (North Coast Watershed Assessment Program, 2002) and the KRIS Gualala Project (Klamath Resource Information System, 2003) all describe in detail off-site activities that have contributed to the sedimentation of the watershed.

As required by the CWA, a total maximum daily load (TMDL) assessment for sediment was completed for the Gualala River watershed in late 2002. The information in the TMDL document was developed based on the North Coast Regional Water Quality Control Board (Regional Board) *Gualala River Watershed Technical Support Document for Sediment* (TSD). To date, the Regional Board has not adopted an implementation plan for the prescribed TMDL program.

Although land use practices such as agriculture, grazing, and rural residential development have been implicated as sediment sources in the project area, both the TSD and the TMDL documents identify road construction associated with logging as the primary cause of sediment problems in the Gualala River Watershed. In general, the studies determined that natural sediment sources currently account for approximately one-third of the total sediment delivered to the Gualala River, while two-thirds of the sediment is human-caused. Furthermore, the analysis showed that road-related erosion is the major portion of the human-caused erosion, and that higher road density in a given area results in greater sediment loading from roads.

The Regional Board TSD also addressed the potential for sedimentation due to viticulture. Viticulture was determined to not be a major contributing factor to sediment loads in the Gualala River watershed; however, viticulture and the associated clearing of vegetation are likely to increase surface erosion through exposure of bare earth to rainfall and runoff. Observations made by Regional Water Board staff in conjunction with the TSD development show that conservation practices used in viticulture (cover cropping, buffer strips, terracing, etc.) have variable effects on erosion prevention.

After identifying the major contributors to sediment water quality impairments in the Gualala River watershed, the TSD and TMDL documents outline proposed load allocations from each major contributing sources that would be necessary to reduce the total loading to meet the loading capacity. Based on the information presented in these documents, the loading capacity estimate is 125 percent of the natural load. This corresponds to a natural load of 380 tons/mi^2/yr and an anthropogenic load of 95 tons/mi^2/yr when applied to the estimated sediment load. The allocated anthropogenic sediment load (95 tons/mi^2/yr) is equivalent to an 88 percent reduction of the current estimated anthropogenic sediment load (810 tons/mi^2/yr).

Water Temperature Effects

The following discussion of the importance of water temperature is taken from KRIS Gualala: California chinook salmon, coho salmon, steelhead trout and coastal cutthroat trout are all Pacific salmon species (genus Oncorhynchus), and all require cold water. Water temperature tolerance varies somewhat between species and also between life stages. Warm temperatures can reduce fecundity, decrease egg survival, retard growth of fry and smolts, reduce rearing densities, increase susceptibility to disease, decrease the ability of young salmon and trout to compete with other species for food and to avoid predation. Two recent studies conducted in northern California found that coho salmon were at extremely low abundance or absent in streams where the floating weekly average water temperature (MWAT) exceeded 16.8° Celsius (62.3° F) one or more times during the season (Welsh et al., 2001; Hines and Ambrose, 1998). While steelhead are more tolerant of high water temperatures than coho, they too become sub-dominant to warm water species when stream temperatures are elevated (Reeves, 1985). Armor (1990) notes that all salmonids cease growth over 20° C.

According to the Regional Water Quality Control Board (RWQCB) steelhead trout are found in the lower reaches of Patchett Creek commencing about 4,800 feet downstream of the project area. Steelhead trout are not able to migrate above this point as there is an impassable area to further upstream reaches. Water temperature is an important habitat characteristic when considering habitat quality for steelhead trout downstream of the project site. Steelhead trout optimal egg and fry incubation temperatures range from 48°F to 52°F (Moyle, 2002). Optimal temperatures for fry and juvenile rearing range from 45°F to the mid-60s. Thermal stress in juvenile steelhead trout occurs at temperatures exceeding this range, which can promote disease and reduce growth.

Water temperature data analyzed for the NCWAP (2002) indicate that the Gualala River has major water temperature problems for cold water fish species such as steelhead trout. Few tributaries have cooler temperatures where steelhead trout can survive during the summer months. Water temperature data for Patchett Creek was not available for this review although Higgins (2003) states "it is likely that Patchett Creek flow provide potential islands of cool water near their mouths for juvenile steelhead trout in their lower reaches."

Evaluation of on-site activities:

Since harvesting is not proposed along watercourses, shade canopy levels are expected to be maintained and increase over time and thus, solar effect on water temperature is not expected to increase. Solar influences on the watercourses are expected to decrease over time as timber stands grow. Water drafting from fish bearing streams is not proposed, and thus the risk of impacts from this practice is eliminated. No surface water leaves the project area during the summer months. Water flowing from the project area does so via groundwater. However, because the conversion area is far removed from watercourses that flow on the surface during the warm dry season there should be little or no impact on downstream water temperature.

The Erosion Control Plan and the Hydrological Analysis Report prepared for this plan provide detailed discussions of the effects of the proposed operations on water availability, demand and temperatures and provide mitigation measures intended to protect the beneficial uses of the watershed.

Evaluation of off-site activities:
As is the case in the discussion of sedimentation, the Gualala River Watershed Assessment Report (North Coast Watershed Assessment Program, 2002) and the KRIS Gualala Project (Klamath Resource Information System, 2003) describe in detail off-site activities that have effected the water temperature of the watershed.

The KRIS Gualala Project states, "There is a wealth of temperature data available for the Gualala River, thanks to inexpensive automated temperature sensing probes. These devices make it possible to collect hourly data for months with a limited number of site visits. The large amount of regional temperature information is a powerful tool for analyzing salmonid stream conditions. The Forest Science Project (Lewis, 1999) has provided protocols for water temperature data collection. Gualala Redwoods Inc. (GRI) has monitored water temperatures of streams within its holdings with automated temperature sensing devices since 1992. The Gualala River Watershed Council also has collected data in recent years. The KRIS IFR staff received summary data, rather than raw data, from the North Coast Regional Water Quality Control Board (NCRWQCB). Floating weekly average water temperatures exceeded 16.8° C (62.3^0 F) in mainstem locations of all Gualala sub-basins measured. This indicates that temperature would be limiting to coho salmon production in these streams."

The Gualala River Watershed Assessment Report indicates that the main factors effecting water temperature within the Gualala River are lack of deepwater habitats (pools) and streamside vegetation (canopy cover). These factors are addressed within the Forest Practice Rules as they relate to timber harvesting. The Forest Practice Rules requires a buffer zone along watercourses that protects the streamside vegetation as well as provides for large woody debris recruitment, which aids in the creation of pool habitat.

Organic debris effects:
Organic debris in a watercourse can have either positive or negative effects depending on the size and stability of the material. Large woody debris is an important component of a healthy functioning watershed, while an excessive amount of small fine organic debris will have a negative impact. The Department of Fish and Game (DFG) engaged in stream clearance work for

over 20 years. The amount of large wood which has been removed from the Gualala River by stream clearance projects aimed at fish passage has not been quantified. According to Higgins (1997): "Numerous California Department of Fish and Game stream surveys in the 1960's and 1970's called for clearance of debris jams as well as riparian restoration. A great many stream clearance projects were carried out, while riparian recovery occurred mainly as a result of natural processes. Logjam removal was thought to benefit fish passage and continued until about 1985." LWD provides in stream habitat for salmonid species as well as storage and metering of sediment within the stream itself. A lack of LWD in Class I waters has been identified as a limit on salmonid habitat function.

Evaluation of on-site activities:
A moderate amount of large woody debris is present in watercourse channels adjacent to the plan area from historic logging 30+ years ago and from windfalls and fallen snags. This material is containing sediments, and acting to check potential downcutting of the channel. It shall not be disturbed. There shall be no timber harvesting within the WLPZs adjacent to these watercourses therefore, an increase in the small fine organic debris content of the Class II and III watercourses is not expected to occur. Timber to be harvested within the conversion areas adjacent to WLPZs will be removed from the site or piled for burning well away from WLPZs. Trees to be felled are expected to be directed away from the watercourses, wet areas and their buffer zones. Any logging slash accidentally introduced to those areas during current operations shall be immediately removed. As such, an increase in the existing organic debris content of the watercourses on or adjacent to the plan area will not result from the proposed timber harvesting operation.

The watercourses in the vicinity of the plan area exhibit little evidence of capacity to move large woody debris (LWD) to higher order waters. Stream channels have gentle gradients and do not experience flows sufficient to transport large woody debris. Large woody debris is more prone to serve as a natural bank stabilization mechanism than as future, downstream dependent species habitat. Field evidence within similar watersheds observed by the RPF showed that about 2500 feet of length and 620 feet of vertical fall within the watercourse channel are required to create the necessary head (or force) to move LWD downstream. Field evidence showed that LWD is not, for the most part, being transported within the Class III or Class II waters.

Evaluation of off-site activities:
Although no harvest of trees along any watercourse is proposed within the context of the project, the Forest Practice Rules require a minimum 150 ft. wide Watercourse and Lake Protection Zone around Class I waters (fish streams). The Forest Practice Rules require that along each 330 ft. length of Class I watercourse, at least 10 of the largest diameter trees present that have the capacity to fall into the watercourse be retained permanently. The Rules require that within the first 75 ft. (as measured from the watercourse) of the WLPZ, 85% overstory shade canopy be retained and within the next 75 ft. of the WLPZ 65% overstory canopy be retained. These two requirements translate to a very high level of tree retention along Class I waters, approaching a "no harvest" level.

In addition, the Forest Practice Rules require that the LTO not do either of the following during timber operations:

(1) Place, discharge, or dispose of or deposit in such a manner as to permit to pass into the waters of the state, any substance or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, beneficial functions of riparian zones, or the quality and beneficial uses of water;
(2) Remove water, trees or large woody debris from a watercourse or lake, the adjacent riparian area, or the adjacent flood plain in quantities deleterious to fish, wildlife, beneficial functions of riparian zones, or the quality and beneficial uses of water.

Chemical contamination effects:
As noted in Chapter 3.8 of the project EIR, known chemical contaminants have not been identified on the project site, either in association with past agricultural practices, or from other practices typically involving high chemical usage. The project site currently contains the remnants of an apple orchard, which was probably last actively maintained in the 1950s or early 1960s and no chemical treatments have been conducted since that time.

The California Department of Pesticide Regulation (DPR) regulates chemical applications. All applicable laws, regulations and labels shall be adhered to if employed. The regulations are in part designed to reduce the risk of adverse impacts to water bodies. The submitter at this time does not plan to use chemical agents as part of the timber harvest operations.

Evaluation of on-site activities:
Chemical contamination of the watershed will not result from operations proposed in the conversion THP. Fuels and oils are usually stored temporarily and in small quantities at or near landings. Any fuel stored on site will be stored away from all WLPZs in approved storage containers. Used oil from on site equipment will be disposed of in accordance with state laws. There are no plans to use chemicals to remove vegetation from the site as a part of conversion timber harvesting operations. All vegetation proposed for removal under this conversion THP will be removed via mechanical means as outlined in the THP. Due to the use of mechanical treatment of vegetation on the plan area and proper storage and disposal of fuel and oil on the plan area, the proposed timber operations will not result in chemical contamination of the watershed.

As indicated in the Conversion Application, the landowner intends to use integrated pest management (IPM) instead of chemical alternatives in the maintenance of the vineyard. IPM focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment or non-target organisms. As a part of the proposed vineyard development and maintenance, chemicals will only be used when a feasible alternative does not exist. In the event that pesticide or herbicide use is deemed necessary during the development and operation of the vineyard, the applicant would strictly adhere to federal, State, and local regulations pertaining to the use of permitted chemicals. Only low-toxicity, high-LD50 materials with minimal biological hazard would be applied, and these materials would be applied at low, safe, and least-cost agronomic rates, according to label direction. The following is a list of potential chemicals and the active ingredient in parenthesis that may be utilized: Abound ™ *(Azoxystrobin),* Admire™, Provado™ *(Imidacloprid),* Agri-Mek™ *(Abamectin),* CSC Dusting Sulfur, ™ Kumulus ,™ Special Electric ™ *(Sulfur),* CMR Silicone Surfactant *(Organo-Modified Siloxane),* Dithane *(Mancozeb),* Tripline Foam-Away, Kaligreen *(Potassium hydrogencarbonate),* Latron ™ *(Phthalic/glycerol alkyl resin),* Nexter ™ *(Pyridazinone),* uintec™ *(Quinoxyfen),* Roundup™ *(Potassium salt of Glyphosate),* Serenade™ (dried *Bacillus subtilis),* Sovran ™ *(Kresoxim-methyl),* Stylet Oil *(Hydrotreated parafinnic distillate),* Vangard™ *(4-Cyclopropyl-6-methyl-2-phenylamino-pyrimidine).* These chemicals are fungicides, herbicides, miticides, and insecticides. The target diseases/pests of these treatments are: Powdery Mildew, Botrytis Bunch Rot, Grape Phylloxera, Spider Mites, Grape leafhopper, Weeds, Pierce' s Disease and Sharpshooters. Only personnel with the proper license and/or certification would be permitted to handle potentially hazardous materials, and chemical applications would take place under the supervision of a qualified vineyard manager. IPM will be used in the development and maintenance of the vineyard in order to minimize chemical use in the vineyard to the extent feasible. A complete discussion of chemical use may be found within Chapter 3.8 of the Environmental Impact Report.

Since most of the roads within or appurtenant to the plan are located away from watercourses, and since the filter strip between roads and watercourses is usually dense, the risk of contamination is minimized should chemical dust abatement methods be employed.

In addition to the use of IMP and adhering to all applicable laws, regulations and labels the following mitigation measure would provide for a proper response to potential chemical spills, which would protect water quality from any accident occurring during the transport or use of agricultural chemicals: *Prior to the issuance of grading permits, the applicant shall provide the Department of Forestry and the Sonoma County Permit and Resource Management Department with an Agricultural Chemical Use and Storage Contingency Plan. The Plan shall include the measures that will be taken in the occasion that a spill occurs. Potential measures include: the deployment of straw wattles or other barriers stored on-site, instructions for diverting any overland flow away from onsite drainages, the on-site storage of absorbent materials to clean up any spills, and a prominent listing of accident and hazard responding agencies, including: the Sonoma County Department of Emergency Services and the Sonoma County Hazardous Materials Response Team. The Plan shall be made available to all workers handling pesticides and shall be posted on the corporation yard building.*

Evaluation of off-site activities:
Use of pesticides on surrounding vineyards, oil and fuel spills, leaking underground tanks including septic tanks, are all potential hazards. However, many of the local vineyards, including the one proposed are organic. In addition, most vineyards and other development are not near watercourses.

Peak Flow Effects
The conversion of forest vegetation and grassland to vineyard potentially could impact downstream beneficial uses by affecting runoff, peak flows and groundwater recharge. Groundwater pumping for irrigation would have an adverse effect on neighboring wells only if an irrigation-type of well were located along the property boundary very close to a neighboring well. The project does not propose to use existing deep wells for irrigation.

The timberland conversion may likely result in an increase in runoff because of surface soil compaction (tractor rows), a less pronounced litter depth (organic matter that covers the surface of soil), and since less evapo-transpiration may occur than under a complete forest canopy. Typically, the net result is a decrease in deep percolation, and a slight, yet measurable per acre increase in runoff. The expected response can fluctuate from year to year based on rainfall. Conversely however, soil tillage practices tend to loosen the soil and thereby the percolation rates of the soil increase so as to offset some of the increased overland flow effect. The amount of runoff captured by the collection system and used for irrigation in the summer, should also offset some of the increased runoff.

Evaluation of on-site activities:
Changes in topography and runoff management in the proposed vineyard are expected to change surface flow paths relative to existing site conditions. Furthermore, removal of forest vegetation is expected to result in increased run-off rates. As a result, increases in winter peak flows could occur. In order to assess the effects of the project on peak flow, and all aspects of the hydrology of the area, a complete hydrological assessment was conducted. Please refer to Chapter 3.7 of the Project EIR and the Erosion Control Plan for further discussion and mitigation measures relating to these issues.

Evaluation of off-site activities:
All development activities that reduce the natural cover contribute to increased runoff and thus may impact peak flows. However, in this rural area the scope of these development activities is too small to have a measurable impact on peak flows.

Watercourse Conditions:

In accordance with Section 303(d) of the Clean Water Act, the State of California periodically identifies waters where water quality standards are not being met. In its latest Section 303(d) list, adopted through Resolution 98-45 on 23 April 1998, the Regional Water Board identified the Gualala River as impaired due to elevated temperature and sedimentation. All of the watercourses within the watershed assessment area are part of the larger Gualala River Watershed.

Considering the impaired nature of the watershed, there have been many studies and surveys conducted that address this situation. These studies/surveys include the following:

- California Regional Water Quality Control Board (CRWQCB). 2001. Gualala River Watershed TMDL Technical Support Document for Sediment. CRWQCB, Region 1. Santa Rosa, CA. 147 pp.
- Higgins, P.T. 1997. Gualala River Watershed Literature Search and Assimilation. Funded by the Coastal Conservancy under contract to Redwood Coast Land Conservancy. Gualala, CA. 59 pp.
- Klamath Resource Information System, 2003. KRIS Gualala Project
- Klamt, Robert R., C. LeDoux-Bloom, J. Clements, M. Fuller , D. Morse, and M. Scruggs (multi-disciplinary team leads). 2002. Gualala River Watershed Assessment Report. North Coast Watershed Assessment Program, 367pp plus Appendices. California Resources Agency, and California Environmental Protection Agency, Sacramento, California.
- U.S. Environmental Protection Agency, 2001. The Gualala River Total Maximum Daily Load for Sediment

The description of the watercourse conditions that follows is taken from the above listed studies as well as on site and off site observations conducted by the RPF who prepared the plan.

STREAM CHANNEL CHARACTERISTICS

Embeddedness and substrate
Excess fine sediment can cause gravels in the water body to become embedded (i.e., the fine sediment surrounds and packs-in against the gravels), which effectively cements them into the channel bottom. Embeddedness can prevent the spawning salmon from building their redds. Pool tail embeddedness is a simple but subjective means of evaluating salmonid spawning habitat quality in the field. Pools tail crests are measured visually to determine to what degree potential spawning gravels might be embedded (partially buried). The California Department of Fish and Game (1998) rates the level of embeddedness on the percentage that the gravel is embedded. A one rating means that cobbles are embedded O to 25%, a two rating 25% to 50%, a three rating 50% to 75% and a four rating 75% to 100%. Cobble embeddedness measured at a one rating is

considered best for steelhead and salmon spawning. The majority of pool tail crests in the watercourses within the assessment area were measured at an embeddedness rating of two (25% to 50%). Embeddedness estimates are visual and involve some subjectivity. The method is somewhat reliable for showing differences in habitat conditions among streams surveyed by the same observers, and much less reliable for strictly classifying habitat conditions or showing differences among streams surveyed by different observers. By contrast, bulk gravel (McNeil) or permeability samples are much more rigorous in describing spawning and incubation habitat conditions.

The Gualala River Watershed Technical Support Document for Sediment provided the following relating to Embeddedness, "A thin to non-existent armor layer (surface layer that is more coarse than the subsurface sediments) underlain and embedded with fine sediment typified observed riffles. The absence of an armor layer is indicative of an oversupply of sediment (Dietrich et al., 1989). Sand is the dominant substrate in many of the observed reaches. Spawning size gravels are overlain and embedded with fine sediment in observed riffles of the North Fork, Rockpile Creek, Wheatfield Fork, and the South Fork while Buckeye Creek was characterized by relatively more embeddedness and fine sediment without an armoring layer. Francini Creek, a tributary to Buckeye Creek, has fine sediment almost completely burying cobble."

The Gualala River Watershed Assessment Report states, "In 1984, roughly 300 of 750 miles of stream channel appeared in a disturbed condition as a result of excess sediment. By 2000, this improved by almost 50 percent with only 156 miles of the channels appearing disturbed. The distribution of the excess sediment within the stream channels is controlled by the location of sediment input and by the effectiveness of the streams to transport the sediment. Higher gradient reaches are more effective in sediment transport. The distribution of the excess sediment observed in 2000 aerial photos was mainly in low gradient reaches. Comparison of the distribution of instream sediment between 1984 and 1999/2000 shows a general watershed-wide reduction in excess instream sediment. This indicates that sediment transport exceeded sediment input over this period and may indicate progressive recovery from past disturbances."

Observation of the watercourses adjacent to the project area revealed that the level of embeddedness was relatively lower in those portions of the streams as compared to those watercourses elsewhere in the assessment area. Overall, the level of embeddedness throughout the assessment area should be considered high. However, as indicated in the Gualala River Watershed Assessment Report the amount of fine sediment seems to be improving and the mitigation measures listed below will ensure that the operation of this plan will not have an adverse impact.

Pools

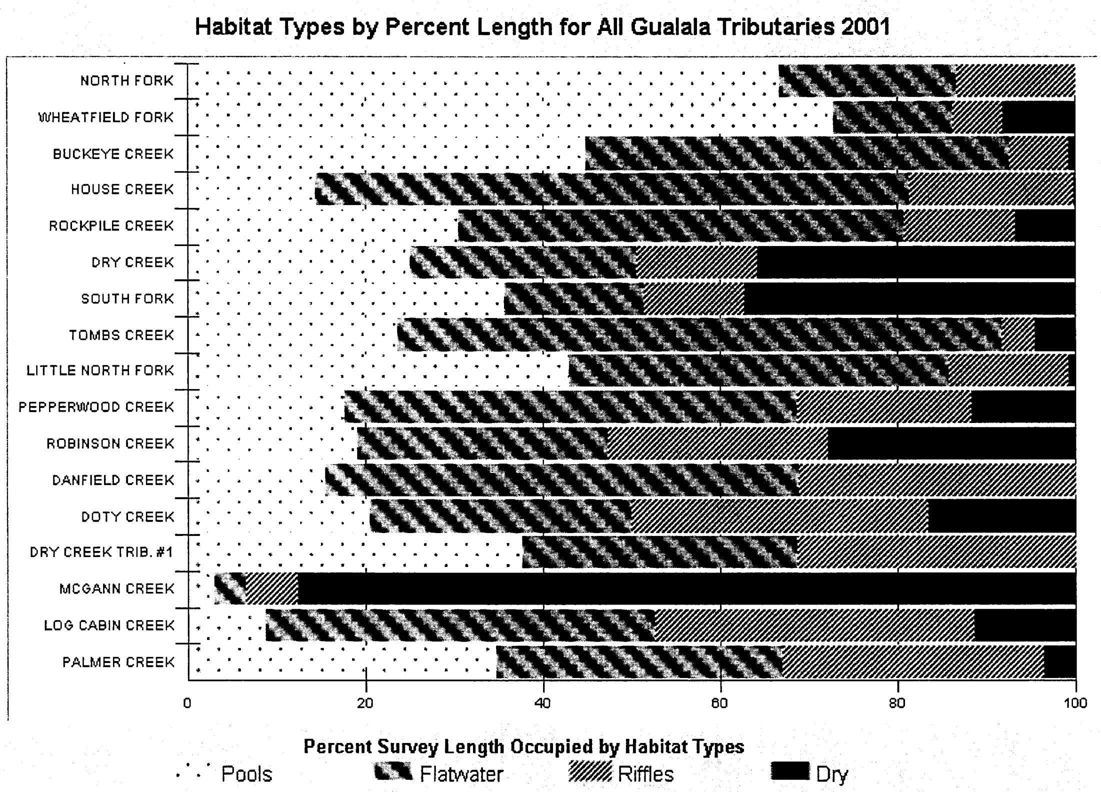
The KRIS Gualala project contains habitat typing data from stream surveys conducted by California Department of Fish and Game (CDFG) following protocols described in CDFG (1998).CDFG habitat typed approximately 100 miles of Gualala River tributaries in 2001 and that data provides a adequate insight into fish habitat conditions (CA RA, In Review). All surveys in the basin in 2001 were conducted by the same crew.

Larger streams generally have more open canopy and deeper pools than small streams. This is a function, at least in part, of wider stream channels and greater stream energy due to higher discharge during storms. KRIS charts list streams on the vertical axis in descending order by Strahler stream order to allow some resolution on this size factor. By such a presentation, one would expect a trend in canopy cover and pool depth values. Deviations from the expected trend in canopy or pool depth may indicate streams with more suitable or unsuitable canopy or pool depth conditions relative to other streams of that subbasin. For substantive discussions on analysis of habitat typing data from streams in the Mendocino coast hydrologic unit (Gualala River to Ten Mile River), see (CRWQCB, 2001).

Habitat frequency can be used to roughly gauge problems of cumulative watershed effects on streams. When substantial erosion occurs in a watershed, pool habitats diminish by aggradation (filling in) (Madej, 1984). Subsequent habitat surveys will find the stream dominated by riffles or flatwater units (shallow glides and runs). Flatwater habitats may still be suitable for young of the year steelhead, but young coho salmon require pools, preferably with large wood.

Habitat typing summaries in KRIS combine the 22 total habitat types into four simpler categories: pools, riffles, flat water habitats and dry areas. These are consistent with CDFG level II habitat types. Habitat frequency by length is used instead of percent occurrence because the latter has less relevance to habitat availability and is less sensitive to cumulative effects. For example, streams that are aggraded may still have numerous, shallow pools of short length and a few very long runs and riffles.

The chart below shows the relative length, by basic habitat type, of surveys in the Gualala basin in 2001 by the California Department of Fish and Game. Pool habitat predominates in the higher order streams at the top of the chart, except that House Creek has less than 20% of its habitat occurring as pools. Pool frequency of many lower order streams is low with Doty, Danfield, Robinson and Pepperwood all having values less than 20% by length. Although 2001 was a dry year, extensive dry reaches are consistent with a hypothesis of aggradation in the Gualala basin.



Brown et al. (1994) suggested that pools of one meter (approximately 3 feet) in depth or greater were necessary for successful rearing of coho salmon juveniles. Older age steelhead also rely on pool habitat. Chen (1992) based cumulative effects models for the Elk River, Oregon on whether three-foot-deep pools were being maintained. His hypothesis was that if pools were greater than three feet they would support yearling steelhead.

Maximum pool depth is a discrete attribute with minimally subjective criteria for evaluation in the field. Summary charts in KRIS Gualala display pool depth categories to discern how many pools deeper than three feet exist in surveyed areas. The ranking of streams by size enables the viewer to account for the fact that larger streams naturally have deeper pools due greater flow and energy.

California Department of Fish and Game surveys of the Gualala River in 2001 measured maximum depth for every pool surveyed. Results of the surveys showed that pool depth is restricted. Fifth Order streams like the North Fork and Wheatfield had few pools deeper than four feet. Smaller streams were dominated by pools less than three feet and a high occurrence of pools measuring less than two feet deep.

The predominance of pools less than two feet deep in the Little North Fork, Doty Creek, Dry Creek, and Robinson Creeks (located in upper Robinson Calwater) represents unsuitable rearing habitat for coho and older age steelhead, and is consistent with the hypothesis of aggradation. Despite its large size, the North Fork has many pools less than two feet deep.

The watercourses adjacent to the project area were surveyed by the RPF preparing the plan and pool frequency and depth were measured. These watercourses are located at or near the top of the watershed and as could be expected, the pools were relatively small when compared to higher order steams. Pools made up approximately 20% of the habitat by length and the average depth was 1-2 feet. Overall, the level of pool filling should be considered high throughout the watershed. However, as indicated in the Gualala River Watershed Assessment Report the amount of fine sediment seems to be improving and the mitigation measures listed below will ensure that the operation of this plan will not have an adverse impact.

Stream Aggradation

As described above, the Gualala River has been identified in accordance with Section 303(d) of the Clean Water Act as impaired due to elevated temperature and sedimentation. As a result of this elevated sedimentation, or as an example of it, stream aggradation is evident throughout the watershed. As described above in the discussion of pools, pool depth and frequency have been reduced as a result of the elevated sedimentation levels and resulting aggradation.

CDFG 2001 habitat surveys found that extensive reaches of the Gualala River and its tributaries lacked surface flow. Many of these reaches formerly supported salmonid juveniles in summer, but high sediment yield has buried these productive reaches. When sediment supply is so high that streams lose surface flow, it diminishes carrying capacity for salmonid juveniles. Measurement of dry stream reaches is also robust since there is no chance for introduction of observer bias. It is estimated that the Wheatfield Fork of the Gualala River has aggraded approximately 25 feet in recent decades. Both the Wheatfield and upper South Fork Gualala run underground in places during late summer in dry years because of severe aggradation. This condition indicates that stored sediment in low gradient reaches of the mainstem Gualala River remain high, however, there are no studies on the rate of gravel supply from tributaries. It is likely that supply from tributaries such as Fuller Creek is decreasing as indicated by down-cutting of that stream channel (Cox, 1995).

Low to moderate levels of aggradation has occurred within the streams adjacent to the project area. These streams generally have gentle gradients and are therefore more susceptible to aggradation. The streams adjacent to the plan that have higher gradients show less aggradation, as these streams are more capable of flushing the sediment downstream.

Bank cutting/Down cutting

Bank cutting is indicated by areas of fresh, unvegetated soil or alluvium exposed along the stream banks, usually above the low-flow channel and often with a vertical or undercut face. Severe bank cutting is often associated with channels that are down cutting, which can lead to over-steepened banks. As described above, high levels of sedimentation within the watershed has lead to or is evidenced by stream aggradation. Also described above, is the fact that more recently, sedimentation levels have been decreasing and the watercourses are now flushing the sediment downstream and are down cutting through the stored sediment.

Within the watershed there are areas where down cutting is evident, however, adjacent to the project area where sedimentation levels and aggradation levels are lower there are very few areas where bank cutting or down cutting is occurring.

Bank mass wasting

The Gualala River watershed is transected by the San Andreas Fault and the Tombs Creek Fault zones along northwest-oriented lines. The latter separates highly unstable mélange on the east from relatively more stable terrain on the west. The South Fork and the Little North Fork of the Gualala River flow within a linear valley presumably formed by the San Andreas Fault near the coast.

The Gualala River system and surrounding topography evolved in response to rapid geologic changes along the west coast of North America over the past 30 million years, and especially in the last five million years. The drainage networks evolved along with the changing landscape. The drainage network of the Gualala River is bedrock controlled and records the major geologic changes that took place. The landscape continues to change, most notably by mass wasting. Mass wasting and erosion affect fluvial geomorphic conditions, which in turn affect aquatic habitat conditions.

Woodland and grassland areas have the largest proportion of historically active landslides in the watershed, approximately 11,000 acres (6 percent) of the entire Gualala watershed, which is consistent with the underlying geology. These areas are in the finer-grained and less competent melange of the Franciscan Complex that typically fail as large earthflows. Conifer forests generally do not grow well on the mélange. Approximately 1,100 acres (less than one percent) of the entire watershed are areas of historically active landslides within THP areas between 1991-2000. Approximately 5,500 acres (~3 percent) of the watershed area have historically active landslides within timberlands that are not included in THPs since 1991. With respect to roads, approximately 80 miles or 5 percent of the current roads in the watershed cross areas of mapped historically active landslides. The largest portions of roads that are located in historically active landslides occur in the Wheatfield Subbasin with approximately 37 miles.

The causes of mass wasting are varied. A large percentage of mass wasting is a result of natural geologic processes. Grazing cattle on unstable grasslands and timber harvesting on unstable soils can also result in mass wasting. CDF's studies of the implementation and effectiveness of the Forest Practice Rules indicate that mass wasting failures associated with current timber operations have been mostly related to roads. Roads produced the highest sediment delivery to watercourse channels when compared to other erosion processes (Monitoring Study Group 1999). The majority of the road related mass failures were associated with fill slope problems, indicating that proper road construction techniques are critical for protecting instream resources.

Within the Buckeye Creek watershed mass wasting is associated with the "Kelley Road" which runs the length of Buckeye Creek from its confluence with Flatridge Creek. The road was built in the late 1950's and early '60's. Much of the overburden was simply sidecast into the creek. On steeper slopes there have been numerous bank and fill failures over the years although for the most part the roadbed and slopes have stabilized over time. Nonetheless, as can be seen on aerial photos there are several areas of bare soil from past mass wasting which may still be unraveling.

As it relates specifically to this project, the potential for mass wasting occurring is low. The project area is located along a ridge top with fairly gentle slopes. An erosion control plan has